



Merlin 4100 Management Guide

Table of Contents

1. Introduction	11
1.1. Using this Documentation	11
1.2. Information Tables	11
1.3. Diagnostics, Definitions and UCI Commands	12
1.4. Warning Levels	12
2. Product Overview	14
2.1. Product Description	14
2.2. Available Models	14
3. Installation	15
3.1. Mounting the Router	15
3.2. Cooling	15
3.3. Connecting Cables	15
3.4. Connecting the Antenna	15
3.5. Inserting SIM Cards	15
3.5.1. Inserting SIM 1 Card	16
3.5.2. Inserting SIM 2 Card	16
3.6. Powering Up	16
4. Hardware Specification	17
4.1. Hardware Overview	17
4.2. Dimensions and Weight	17
4.3. Compliance Information	18
4.3.1. Agency Approvals and Standards Compliance	18
4.4. Specifications	18
4.4.1. Interface Specifications	19
4.4.2. Type Tests and Environmental Conditions	20
4.5. Connector Information	21
4.5.1. Power Input	21
4.5.2. Serial Port	21
4.5.3. Digital input	22
4.5.4. Antennas	22
4.5.5. SFP Transceivers	22
4.5.6. Reset Button	22
4.6. LED Indicators	23
4.7. Ethernet Port LED Behaviour	24
5. Factory Configuration Extraction from SIM Card	25
6. Accessing the Router	26
6.1. Accessing the Router over Ethernet using the Web Interface	26
6.2. Accessing the Router over Ethernet using an SSH Client	26
6.3. Accessing the Router over Ethernet using a Telnet Client	27
6.4. Configuring the Password	28
6.4.1. Configuring the Password using UCI	29
6.4.2. Configuring the Password using Package Options	29
6.5. Accessing the Device Using RADIUS Authentication	29
6.6. Accessing the Device Using TACACS+ Authentication	31
6.7. SSH	34
6.8. Package Dropbear using UCI	37
6.9. Certs and Private Keys	37
6.10. Configuring a Router's Web Server	38
6.10.1. Main Settings	39
6.11. Basic Authentication (httpd conf)	43
6.12. Securing uhttpd	43
6.13. Displaying Custom Information via Login Screen	44
7. Router File Structure	46

7.1. System Information	46
7.2. Identify Your Software Version	46
7.3. Image Files	47
7.4. Directory Locations for UCI Configuration Files	47
7.5. Viewing and Changing Current Configuration	48
7.6. Configuration File Syntax	48
7.7. Exporting a Configuration File	49
7.7.1. Exporting a Configuration File using the Web Interface for Software Versions pre- 72.002	49
7.7.2. Exporting a Configuration File using the Web Interface for Software Version 72.002 and Above	50
7.7.3. Exporting a Configuration File using UCI	50
7.8. Importing a Configuration File	51
7.8.1. Importing a Configuration File using the Web Interface for Software Versions pre- 72.002	51
7.8.2. Importing a Configuration File using the Web Interface for Software Version 72.002 and Above	52
7.8.3. Importing a Configuration File using UCI	53
8. Using the Command Line Interface	54
8.1. Overview of Some Common Commands	54
8.2. Using Unified Configuration Interface (UCI)	56
8.3. Export a Configuration	58
8.4. Show a Configuration Tree	58
8.5. Display Just the Value of an Option	59
8.6. High Level Image Commands	60
8.7. Format of Multiple Rules	60
8.8. Configuration Files	62
8.9. Configuration File Syntax	62
9. Upgrading Router Firmware	64
9.1. Software Versions	64
9.2. Identify your Software Version	64
9.3. Upgrading Router Firmware For Software Version 72.002 and Above	65
9.4. Upgrading Router Firmware for Software Versions pre-72.002	66
9.5. Flash Image and Do Not Reboot Option	68
9.6. Update Flash Image and Reboot using New Image Immediately Option	68
9.7. Possible File Corruption	69
9.8. Verify the Firmware Has Been Upgraded Successfully	69
9.9. Upgrading Firmware using CLI	69
9.9.1. Flashing	70
9.9.2. Flash Verification after Flashing	70
9.9.3. Set up an Alternative Image	71
10. System Settings	72
10.1. Syslog Overview	72
10.2. Configuring System Properties	72
10.2.1. General Settings	73
10.2.2. Logging	74
10.2.3. Language and Style	77
10.2.4. Audit Configuration	77
10.2.5. Time Synchronization	78
10.2.6. Console Login Banner	80
10.2.7. System Reboot	81
10.3. System Settings Using Command Line	81
10.3.1. System Settings using UCI	82
10.4. System Diagnostics	83
10.4.1. System Log Messages in RAM	84

10.4.2. System Log Messages in Flash	84
10.4.3. Kernel Messages	85
10.4.4. Syslog Process	86
10.4.5. NTP Process	86
10.5. Advanced Filtering of Syslog Messages	86
10.5.1. Advanced Filtering Using Command Line	86
10.5.2. Filter Definitions	87
11. Configuring an Ethernet Interface	90
11.1. Configuring an Ethernet Interface using the Web Interface	90
11.1.1. Interface Overview: Editing an Existing Interface	91
11.1.2. Interface Overview: Creating a New Interface	91
11.1.3. Interface Overview: Common Configuration	92
11.2. Interface Overview: IP-aliases	99
11.2.1. IP-alias using the Web	99
11.2.2. IP-aliases: General Setup	100
11.2.3. IP-aliases: Advanced Settings	101
11.3. Interface Overview: DHCP Server	101
11.3.1. DHCP Server: General Setup	102
11.3.2. DHCP Server: Advanced Settings	104
11.4. Interface Configuration using Command Line	104
11.4.1. Interface Configuration using Package Options	106
11.4.2. Loopback Interfaces UCI	107
11.5. Configuring Port Maps using the Web Interface	107
11.6. Configuring Port Maps using UCI	108
11.7. Configuring Port Map using Package Options	109
11.8. Interface Diagnostics	109
11.9. Route Status	111
11.10. ARP Table Status	111
12. Configuring VLAN	112
12.1. Configuring VLAN using the Web Interface	112
12.2. General Setup: VLAN	114
12.3. Firewall Settings: VLAN	115
12.4. Viewing VLAN Interface Settings	116
12.5. Configuring VLAN using UCI	116
13. Configuring Mobile Manager	118
13.1. Configuring Mobile Manager using the Web Interface	118
13.1.1. Mobile Manager: Basic Settings	118
13.1.2. Mobile Manager: Advanced Settings	119
13.1.3. Mobile Manager: LTE Settings	121
13.1.4. Mobile Manager: CDMA Settings	123
13.1.5. Mobile Manager: Callers	126
13.2. Configuring Mobile Manager using UCI	126
13.3. Monitoring SMS	128
13.3.1. Sending SMS from the Router	129
13.3.2. Sending SMS to the Router	129
14. Configuring multi-APNs for Mobile Interfaces	130
14.1. Multi-APN Overview	130
14.2. Configuring multi-APN using the Web Interface	130
14.3. Configuring multi-APN using the Command Line	132
14.3.1. Configuring Multi-APN using UCI	132
14.4. Multi-APN Diagnostics	134
14.4.1. Routing table	135
15. Configuring a GRE Interface	137
15.1. Creating a GRE Connection using the Web Interface	137
15.1.1. GRE Connection: Common Configuration: General Setup	139

15.1.2. Configuring IPv6 Routes using the Web Interface	140
15.1.3. GRE Connection: Common Configuration-advanced Settings	141
15.1.4. GRE Connection: Firewall Settings	142
15.1.5. GRE Connection: Adding a Static Route	143
15.2. Configuring GRE using UCI	143
15.3. GRE Diagnostics	145
16. Configuring VRF (Virtual Router Forwarding)	148
16.1. Configuring VRF using the Web Interface	148
16.1.1. Configuring a VRF on a Static Route	150
16.2. Configuring the VRFs using the Command Line	150
16.2.1. VRF using UCI	151
16.3. VRF Diagnostics	151
17. Configuring Static Routes	153
17.1. Configuring Static Routes using the Web Interface	153
17.2. Configuring Routes using Command Line	154
17.3. IPv4 Routes using UCI	155
17.4. IPv6 Routes using UCI	155
17.5. Static Routes Diagnostics	156
17.6. Configuring IPv6 Routes using the Web Interface	156
18. Configuring BGP (Border Gateway Protocol)	158
18.1. Configuring BGP using the Web Interface	158
18.2. Optionally Configure a BGP Route Map	160
18.3. Configure BGP Neighbours	162
18.4. Configuring BGP using Command Line	163
18.5. View Routes Statistics	165
19. Configuring OSPF	167
19.1. OSPF Areas	167
19.2. OSPF Neighbours	168
19.3. OSPF Designated Routers	168
19.4. OSPF Neighbour States	169
19.5. OSPF Network Types	169
19.6. The OSPF Hierarchy	170
19.7. OSPF Router Types	171
19.8. Configuring OSPF using the Web Interface	171
19.8.1. Global Settings	172
19.8.2. Topology Configuration	173
19.8.3. Interfaces Configuration	174
19.9. Configuring OSPF using the Command Line	177
19.10. Configuring OSPF using UCI	178
19.11. OSPF Diagnostics	179
19.11.1. Quagga/Zebra Console OSPF	180
19.11.2. OSPF Debug Console	181
20. Configuring VRRP	186
20.1. Configuring Static Routes using the Web Interface	186
20.2. Configuring VRRP using the Web Interface	187
20.3. VRRP Global Settings	187
20.4. VRRP Group Configuration Settings	188
20.5. Configuring VRRP using Command Line	191
20.5.1. VRRP using UCI	192
20.6. VRRP Diagnostics	193
21. Configuring RIP	194
21.1. RIP characteristics	194
21.2. RIP Versions	194
21.3. Configuring RIP using the Web Interface	195
21.3.1. RIP Interfaces Configuration	198

21.3.2. Offset Configuration	199
21.3.3. MD5 authentication key chains	200
21.4. Configuring RIP using Command Line	200
21.4.1. RIP using UCI	202
21.4.2. RIP using Package Options	203
21.5. RIP Diagnostics	204
21.5.1. Tracing RIP Packets	205
21.5.2. Quagga/Zebra console RIP	205
21.5.3. RIP Debug Console	206
22. Configuring PIM and IGMP Interfaces	208
22.1. Configuring PIM and IGMP using the Web Interface	208
22.1.1. Global Settings	209
22.1.2. Interfaces Configuration	209
22.2. Configuring PIM and IGMP using UCI	209
23. Configuring Multi-WAN	211
23.1. Configuring Multi-WAN using the Web Interface	211
23.2. Configuring Multi-WAN using UCI	216
23.3. Multi-WAN Diagnostics	218
24. Automatic Operator Selection	221
24.1. Configuring Automatic Selection via the Web Interface	221
24.1.1. Scenario 1: PMP + Roaming: Pre-empt Enabled	221
24.2. Mobile Manager: Basic Settings	231
24.3. Mobile Manager: Advanced Settings	232
24.4. Mobile Manager: CDMA Settings	233
24.5. Mobile Manager: Callers	236
24.6. Roaming Interface Template: Web Interface	238
24.7. Scenario 2: PMP + Roaming: Pre-empt Disabled	241
24.7.1. Set Multi-WAN Options for Pre-empt Disabled	242
24.8. Scenario 3: No PMP + Roaming	242
24.8.1. Set Options for Automatically Created Interfaces (failover)	243
24.8.2. Basic Settings	243
24.8.3. Caller Settings	244
24.8.4. Configuring no PMP + Roaming using UCI	244
24.8.5. Roaming Interface Template: Web Interface	247
24.8.6. Set Multi-WAN Options for Primary Predefined Interface	250
24.9. Configuring Automatic Operator Selection via UCI	255
24.9.1. PMP + Roaming: Pre-empt & Disabled using UCI	255
24.9.2. Configuring no PMP + Roaming using UCI	261
24.9.3. Automatic Operator Selection Diagnostics via the Web Interface	264
24.10. Automatic Operator Selection Diagnostics via UCI	265
24.10.1. Check Roaming Interfaces Discovered	265
24.10.2. Check Interfaces created in multiwan Package	266
24.10.3. Check Interfaces Created in Network Package	267
24.10.4. Check Current Interface	268
25. Configuring Connection Watch (cwatch)	270
25.1. Configuring Connection Watch using the Web Interface	270
25.2. Configuring cwatch using Command Line	273
25.2.1. cwatch using UCI	274
25.3. cwatch Diagnostics	274
26. Configuring DHCP Server and DNS (Dnsmasq)	276
26.1. Configuring IPv6 Routes using the Web Interface	276
26.2. Configuring DHCP and DNS using the Web Interface	277
26.2.1. Dnsmasq: General Settings	278
26.2.2. Dnsmasq: Resolv and Host Files	279
26.2.3. Dnsmasq: TFTP Settings	280

26.2.4. Dnsmasq: Advanced Settings	281
26.2.5. Active Leases	283
26.2.6. Static Leases: DHCP Server and DNS	283
26.2.7. Configuring DHCP Pools using the Web Interface	284
26.3. Configuring DHCP and DNS using Command Line	286
26.3.1. Configuring Static Leases using Command Line	287
26.3.2. Configuring DHCP Pools using Command Line	287
27. Configuring DHCP Client	289
27.1. Configuring DHCP Client using the Web Interface	289
27.1.1. Creating a New Interface for DHCP Client	290
27.2. Common Configuration	291
27.2.1. Common Configuration: General Setup	292
27.2.2. Common Configuration: Advanced Settings	294
27.3. Configuring DHCP Client using Command Line	296
27.4. DHCP Client Diagnostics	297
28. Configuring DHCP Forwarding	299
28.1. Configuring DHCP using the Web Interface	299
28.2. Configuring DHCP Forwarding using Command Line	300
28.3. DHCP Forwarding over IPSec	301
28.3.1. Configuring Source NAT for DHCP Forwarding over IPSec	301
28.4. Configuring Source NAT for DHCP Forwarding over IPSec	303
28.5. Configuring Source NAT for DHCP Forwarding over IPSec using Command Line ..	306
28.6. DHCP Forwarding Diagnostics	307
29. Configuring Dynamic DNS	309
29.1. Configuring Dynamic DNS using the Web Interface	309
29.2. Dynamic DNS using UCI	312
30. Configuring Host Names	314
30.1. Configuring Local Host Files Entries using the Web Interface	314
30.2. Local Host Records using Command Line	315
30.3. Local Host Records Diagnostics	316
30.4. Configuring PTR Records using the Web Interface	316
30.5. PTR Records using Command Line	317
30.6. PTR Records Diagnostics	317
30.7. Configuring Static Leases using the Web Interface	318
30.8. Configuring Static Leases using Command Line	319
31. Configuring Firewall	321
31.1. Scenario 3: No PMP + Roaming	321
31.2. Configuring Firewall using the Web Interface	321
31.2.1. Firewall - Zone Settings - General Settings page	322
31.2.2. Firewall Port Forwards Page	328
31.2.3. Firewall Traffic Rules Page	332
31.3. Configuring Firewall using UCI	336
31.3.1. Implications of DROP vs. REJECT	340
31.3.2. Connection Tracking	340
31.3.3. Firewall Rule Examples	341
32. Configuring IPSec	348
32.1. Configuring IPSec using the Web Interface	348
32.1.1. Configure Common Settings using the Web Interface	349
32.1.2. Common Settings: Configure Connection using Web Interface	350
32.1.3. Common Settings: IP Addressing using the Web Interface	351
32.2. Common Settings: IPSec Settings using the Web Interface	353
32.3. Configure Secret Settings using the Web Interface	356
32.4. Configuring an IPSec Template for DMVPN via the Web Interface	357
32.5. Configuring IPSec using UCI	357
32.6. Shunt Connection using UCI	360

32.7. Secret Settings using UCI	361
32.8. Configuring an IPSec Template to use with DMVPN using UCI	362
32.9. IPSec Diagnostics	364
33. Configuring SCEP (Simple Certificate Enrolment Protocol)	366
33.1. Configuring SCEP using the Web Interface	366
33.2. Configuring SCEP Certificate using the Command Line	369
33.3. SCEP Diagnostics	372
33.4. Strongswan Process using UCI	373
34. Dynamic Multipoint Virtual Private Network (DMVPN)	374
34.1. Configuring DMVPN using the Web Interface	374
34.2. DMVPN Scenarios	376
34.3. Configuring DMVPN using the Web Interface	378
34.4. DMVPN Diagnostics	380
35. Configuring QoS: VLAN PCP Tagging	384
36. Management Configuration Settings	387
36.1. Autoload: Boot up Activation	387
36.2. Autoload using UCI	390
36.3. HTTP Client: Configuring Activation using the Web Interface	391
36.4. Httpclient: Activator Configuration using UCI	395
36.5. User management using UCI	396
36.6. Configuring Management User Password using UCI	398
36.7. Configuring User Access to Specific Web Pages	399
37. Configuring Monitor	400
37.1. Reporting Device Status to Monitor	400
37.2. Configuring Keepalive Heartbeat using the Web Interface	400
37.3. Configuring keepalive heartbeat using command line	403
37.4. Enabling Interface Status in Keepalive Heartbeat via Web Interface	405
37.5. Enable Interface Status using UCI	406
37.6. Reporting GPS Location to Monitor	406
37.7. GPS Diagnostics	407
37.8. Reporting Syslog to Monitor	408
37.9. Configuring Syslog Events to Monitor using Command Line	409
37.10. Configuring ISAD	410
37.11. ISAD Diagnostics	412
37.12. Speedtest Reporting	413
38. Configuring SNMP	415
38.1. Configuring SNMP using the Web Interface	415
38.1.1. Com2Sec Settings	416
38.1.2. Group Settings using the Web Interface	417
38.1.3. View Settings	417
38.1.4. Access Settings using the Web Interface	418
38.1.5. Trap Receiver	419
38.1.6. Inform Receiver using the Web Interface	420
38.1.7. USM user using Web Interface	420
38.2. Configuring SNMP using Command Line	421
38.2.1. Com2sec using UCI	422
38.2.2. Group Settings using Command Line	423
38.2.3. View Settings using UCI	425
38.2.4. Access Settings Using Command Line	426
38.2.5. SNMP Traps Settings using Command Line	427
38.2.6. SNMP Inform Receiver Settings using Command Line	428
38.2.7. SNMP USM User Settings	429
38.3. Configuring SNMP Interface Alias with Static SNMP Index	430
38.4. Automatic SNMP Traps	431
38.5. SNMP diagnostics	431

39. Event System	434
39.1. Implementation of the Event System	434
39.2. Configuring the Event System using the Web Interface	435
39.3. Connection Tester	435
39.4. Event Destination	436
39.4.1. Syslog Target	437
39.4.2. Email Target	438
39.4.3. SNMP Target	441
39.4.4. Exec Target	443
39.4.5. SMS Target	444
39.4.6. File Target	445
39.5. Event Filters	446
39.6. Configuring the Event System using Command Line	447
39.6.1. Event System using UCI	449
39.7. Event System Diagnostics	456
40. Configuring Data usage Monitor	460
40.1. Configuring Data using the Web Interface	460
40.2. Configuring Data using Command line	462
40.3. Data Usage Diagnostics	463
41. Configuring Terminal Server	465
41.1. Configuring Terminal Server using the Web Interface	465
41.1.1. Configuring Port Settings	466
41.2. Configuring Terminal Server using UCI	480
41.3. Configuring Terminal Server DSR Signal Management Network	480
41.4. Serial Mode GPIO Control	482
41.5. Terminal server diagnostics	482
42. Configuring Terminal Package	485
42.1. Configuring Terminal Package using UCI	485
42.2. Terminal Diagnostics	486
43. Configuring RTUD	487
43.1. Configuring RTUD using the Web Interface	487
43.1.1. Configuring RTUD General Options	489
43.1.2. Configure RTUD Advanced Options	490
43.1.3. Configuring RTUD IEC104 Options	491
43.1.4. Configure RTUD DNP3 Options	493
43.1.5. Configure RTUD Modbus Options	494
43.2. Controlling the RTUD Application Manually using the Web Interface	494
43.3. Configuring RTUD using Command Line	495
43.4. RTUD Diagnostics	497
44. SCADA IEC 104 Gateway	499
44.1. IEC 104 Gateway Configuration using the Web Interface	500
44.1.1. Main Settings	501
44.1.2. Port Settings	501
44.1.3. Port Settings: General	502
44.1.4. Port settings: IEC 104	502
44.1.5. Port Settings: IEC 101	505
44.1.6. Port Settings: DNP3	508
44.1.7. Port Settings: Modbus	511
44.1.8. Port Settings: Advanced	512
44.2. IEC 101 Links	514
44.3. Point Mappings	514
44.4. IEC 104 Gateway Configuration using Command Line	518
44.5. IEC 104 to IEC 101 Conversion (Balanced or Unbalanced)	519
44.6. IEC104 to Modbus Conversion	523
44.6.1. IEC104 to Modbus using UCI	525

44.7. Configuring the Terminal Server	528
44.7.1. Configuring the Terminal Server for IEC104 to DNP3	533
44.7.2. Configuring the Terminal Server for IEC 104 to Modbus over Serial	533
44.8. Configuring IEC61850 to IEC101 Conversion	539
44.8.1. IEC 61850 to IEC 101 Conversion using UCI	542
44.9. SCADA IEC 104 Gateway Diagnostics	546
45. DNP3 Outstation Application	549
45.1. Configuring DNP3 Outstation using the Web Interface	549
45.2. Configuring DNP3 Outstation using Command Line	550
45.3. DNP3 Outstation Diagnostics	551
46. Configuring the dual use serial/digital input port	553
46.1. RJ45 pin numbering	553
46.2. Configuring the dual use port for RS-232	553
46.2.1. Configuration package used	553
46.2.2. Configuring the dual use port for RS-232 using the web UI	553
46.2.3. Configuring the dual use port for RS-232 using UCI	555
46.2.4. Configuring the dual use port for RS-232 using package options	555
46.3. Configuring the dual use port for digital input	555
46.3.1. Configuring the dual use port for digital input using the web UI	555
46.3.2. Configuring the dual use port for digital input using UCI	556
46.3.3. Configuring the dual use port for digital input using package options	556

1. Introduction

This document covers models in the Merlin 4100 Series. For general references, we refer to the Merlin Series throughout.

1.1. Using This Documentation

You can configure your router using either the router's web interface or via the command line using UCI commands. Each chapter explains first the web interface settings, followed by how to configure the router using UCI. The web interface screens are shown along with a path to the screen for example, 'In the top menu, select **Service -> SNMP**.' followed by a screen grab.

After the screen grab there is an information table that describes each of the screen's fields.

1.2. Information Tables

We use information tables to show the different ways to configure the router using the router's web and command line. The left-hand column shows three options:

- **Web:** refers the command on the router's web page,
- **UCI:** shows the specific UCI command, and
- **Opt:** shows the package option.

The right-hand column shows a description field that describes the feature's field or command and shows any options for that feature.

Some features have a drop-down menu and the options are described in a table within the description column.

Values for enabling and disabling a feature are varied throughout the web interface, for example, 1/0; Yes/No; True/False; check/uncheck a radio button. In the table descriptions, we use **0** to denote Disable and **1** to denote Enable.

Some configuration sections can be defined more than once. An example of this is the routing table where multiple routes can exist and all are named 'route'. For these sections, the UCI command will have a code value **[0]** or **[x]** (where x is the section number) to identify the section.

Web Field/UCI/Package Option	Description
Web: Metric	Specifies the route metric to use.
UCI: network.@route[0].metric	
Opt: metric	



NOTE

These sections can be given a label for identification when using UCI or package options.

```
network.@route[0]=route
network.@route[0].metric=0
```

can be written as:

```
network.routename=route
network.routename.metric=0
```

However, the documentation usually assumes that a section label is not configured.

The table below shows fields from a variety of chapters to illustrate the explanations above.

Web Field/UCI/Package Option	Description																
Web: Enable UCI: cesop.main.enable Opt: enable	Enables CESoPSN services. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																
Web: Syslog Severity UCI: cesop.main.severity Opt: log_severity	Selects the severity used for logging events CESoPSN in syslog. The following levels are available: <table><tr><td>0</td><td>Emergency</td></tr><tr><td>1</td><td>Alert</td></tr><tr><td>2</td><td>Critical</td></tr><tr><td>3</td><td>Error</td></tr><tr><td>4</td><td>Warning</td></tr><tr><td>5</td><td>Notice</td></tr><tr><td>6</td><td>Informational</td></tr><tr><td>7</td><td>Debug</td></tr></table>	0	Emergency	1	Alert	2	Critical	3	Error	4	Warning	5	Notice	6	Informational	7	Debug
0	Emergency																
1	Alert																
2	Critical																
3	Error																
4	Warning																
5	Notice																
6	Informational																
7	Debug																
Web: Agent Address UCI: snmpd.agent[0].agentaddress Opt: agentaddress	Specifies the address(es) and port(s) on which the agent should listen. [(udp tcp):]port[@address][.##]																

1.3. Diagnostics, Definitions And UCI Commands

Diagnostics

Diagnostics are explained at the end of each feature's chapter.

Definitions

Throughout the document, we use the host name 'VA_router' to cover all router models.

UCI Commands

UCI commands and package option examples are shown using the following format:

```
root@VA_Router:~# vacmd show current config
```

For detailed information on using UCI commands, read chapters 'Router File Structure', and Using Command Line Interface'.

1.4. Warning Levels

Warning signs are provided to prevent personal injuries and/or damages to the product. The following levels are used:

Level of warning	Description	Consequence personal injury	Consequence material damage
 WARNING	Indicates a potentially hazardous situation	Possible death or major injury	Major damage to the product
 CAUTION	Indicates a potentially hazardous situation	Minor or moderate injury	Moderate damage to the product
 NOTICE	Provides information in order to avoid misuse of the product, confusion or misunderstanding	No personal injury	Minor damage to the product
 NOTE	Used for highlighting general, but important information	No personal injury	Minor damage to the product

Table 1. Warning levels

2. Product Overview

2.1. Product Description



The Merlin 4100 Series router

The Merlin 4100 router is a versatile LTE cellular router suited to a variety of industrial deployments. The compact and rugged design makes it ready for harsh environments that require remote access such as SCADA, CCTV, telemetry, smart grid, digital signage and intelligent traffic systems.

The Merlin series is designed from the ground up to achieve best-in-class Cybersecurity. High security VPNs, stateful inspection firewall, user authentication and 802.1x are just a few of the features available to keep the device secure both locally and when transmitting data over the internet or private network.

The Merlin 4100 is compatible with the Activator Zero-Touch Deployment software. Activator ensures that configurations are generated and deployed from a central server, reducing configuration mistakes and increasing efficiency during the installation phase of a project.

A dual-use port is software-configurable to act either as a RS-232 serial port or as a dry contact digital input. The serial port facilitates applications where it is necessary to migrate from modems to an IP infrastructure. The industrial protocol gateway feature enables several devices using different protocols to be accessed via a common protocol interface.

This compact unit is suited to tight spaces. Its high MTBF, wide temperature range and voltage supply ensure the Merlin 4100 can deal with the demands of industrial and utility applications.

2.2. Available Models

See datasheet for full list of models available

3. Installation

3.1. Mounting The Router

The router is fitted with a DIN-rail clip by default. To attach the router to a DIN-rail:

1. Position the router so that the top hook of the DIN-clip rests on top of the DIN-rail.
2. Push the lower half of the router towards the DIN-rail until the bottom part of the DIN-clip snaps into place, indicating that the unit is clamped to the DIN-rail.

To remove the router from the DIN-rail, hold the unit firmly on both sides with one hand and firmly push the unit in an upward then outward direction, so lifting and releasing the unit clear of the DIN-rail.



MOUNTING HEIGHT

To reduce the risk of personal injury and damage to the device, the unit must not be mounted at a height greater than two metres above the ground beneath it.

3.2. Cooling

This product uses convection cooling. Spacing is recommended for the use of the product in full operating temperature range and service life. To avoid obstructing the airflow around the product, use the following spacing rules.

Minimum spacing of 25 mm (1 inch) above/below and 10 mm (0.4 inches) left/right of the product is recommended.



REDUCE THE RISK OF FIRE

To reduce the risk of fire, use only telecommunication line cords with a cable diameter of AWG 26 or larger. Regarding power cable dimensions, see chapter Interface Specifications.

3.3. Connecting Cables

Connect one end of the Ethernet cable into port A and the other end to your PC or switch.

3.4. Connecting The Antenna

If only connecting one LTE antenna, screw the antenna into the MAIN SMA connector. If you are using more than one LTE antenna, screw the main antenna into the MAIN SMA connector and the secondary antenna into the WAN-AUX SMA connector.

3.5. Inserting SIM Cards

On the rear side of the router there are two SIM slots. To access the SIM cards, first remove the SIM cover using a suitable screwdriver (not supplied). Only the proper driver can drive a specific head size without risk of damaging the driver or screw.

3.5.1. Inserting SIM 1 Card

Ensure the router is powered off.

- Remove the SIM cover using a suitable screwdriver.
- Hold the SIM 1 card with the chip side facing down and the cut corner facing away from you, to the left.
- Gently push the SIM card into the upper SIM slot 1 until it clicks in.
- Screw the SIM cover back on with the screwdriver.

3.5.2. Inserting SIM 2 Card

- If you are using a second SIM, hold the SIM 2 card with the chip side facing up and the cut corner front right facing away from you.
- Gently push the SIM card into the lower SIM slot 2 until it clicks in.
- Screw the SIM cover back on with the screwdriver.

3.6. Powering Up

Plug the power cable first into the device and then to a suitable power source. The router takes less than a minute to boot up. During this time, the power LED flashes.

Other LEDs display different diagnostic patterns during boot up. Booting is complete when the power LED stops flashing and stays on steady.

4. Hardware Specification

4.1. Hardware Overview

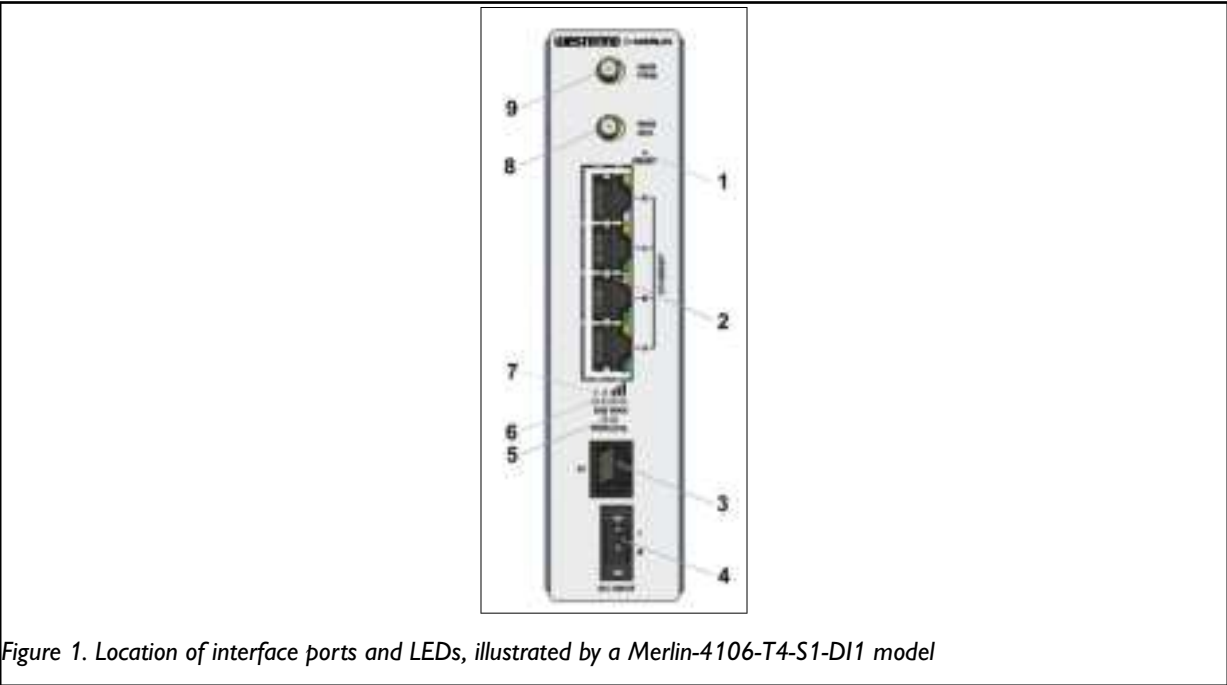
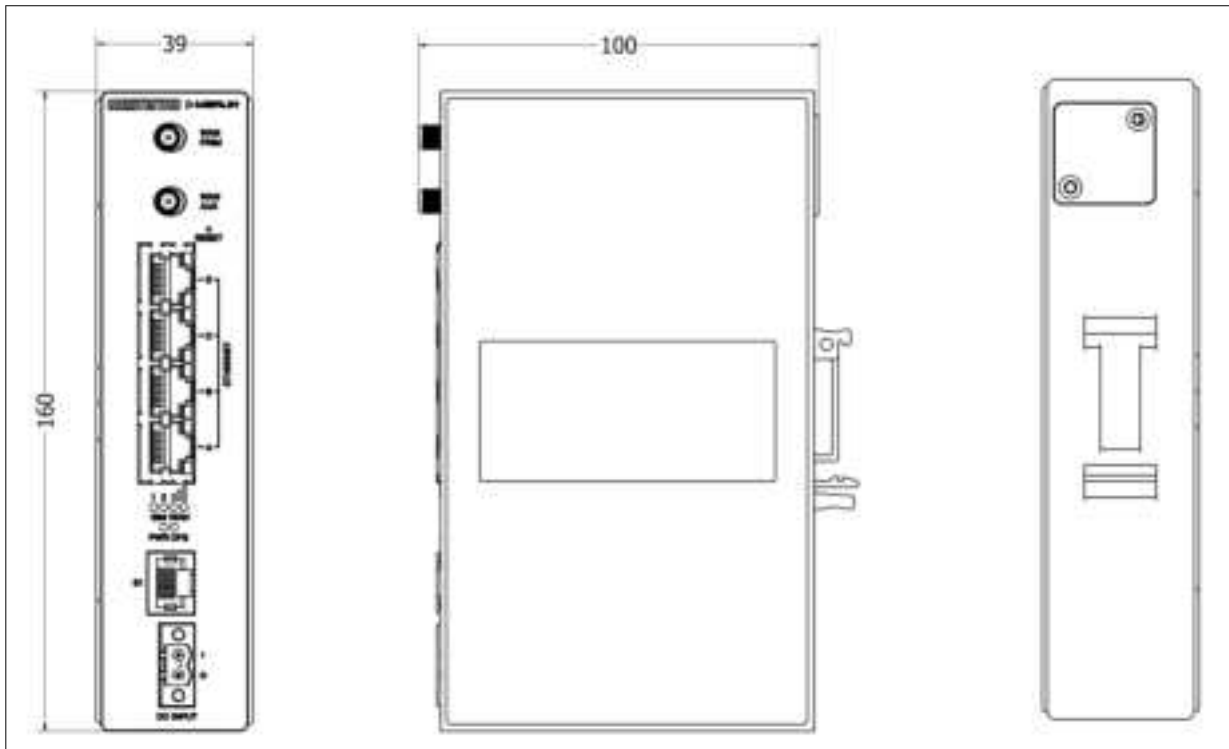


Figure 1. Location of interface ports and LEDs, illustrated by a Merlin-4106-T4-S1-DI1 model

No.	Description	No.	Description
1	Reset button	2	Ethernet RJ45 ports
3	Serial / Digital Input port	4	Power connection
5	Power and configuration LEDs	6	SIM LEDs
7	WAN signal strength	8	WAN auxiliary SMA connector
9	WAN primary SMA connector		

4.2. Dimensions And Weight

Unit size:	39W 100D 160H mm
Unit weight:	280g



4.3. Compliance Information

4.3.1. Agency Approvals And Standards Compliance

Type	Approval/Compliance
EMC	• EN/IEC 61000-6-2, Immunity industrial environments • EN/IEC 61000-6-4, Emission industrial environments
Safety	• EN 62368-1, Safety Communication Technology

Table 2. Agency approvals and standards compliance

4.4. Specifications

4.4.1. Interface Specifications

DC, Power port	
Operating voltage	9.6 to 60 VDC isolated
Rated current	320 mA at 12 VDC 200 mA at 24 VDC
Rated frequency	DC
Inrush current	$2.74 \times 10^{-3} \text{ A}^2\text{s}$ at 12 VDC
Polarity	Reverse polarity protected
Redundant power input	No
Connector	Push-in spring connectors
Conductor cross section	0.2-2.5 mm ² (AWG 24-12)
Stripping length cable	7 mm
Tightening torque, screw flange	0.3 Nm
Shielded cable	Not required

Ethernet TX	
Electrical specification	IEEE std 802.3
Data rate	10 Mbit/s, 100 Mbit/s, manual or auto
Duplex	Full or half, manual or auto
Circuit type	TNV-1
Transmission range	Up to 150 m with CAT5e cable or better
Isolation	All other ports
Connection	RJ-45, auto MDI/MDI-X
Cabling	Shielded CAT5e or better is recommended
Number of ports	4

RS-232	
Electrical specification	EIA RS-232
Data rate	RS-232: 50 bit/s - 1 Mbit/s
Data format	7 or 8 data bits, odd, even or none parity, 1 or 2 stop bits (2 stop bits only when no parity is set)
Circuit type	TNV-1
Transmission range	RS-232: 15 m/49 ft
Number of ports	1
Connection	RJ-45 according to EIA-561 RJ-45 shielded cable

Digital input	
Mode of operation	Dry contact only
Connection	RJ-45 shielded cable

4.4.2. Type Tests And Environmental Conditions

Environmental phenomena	Basic standard	Description	Test levels
ESD	EN 61000-4-2	Enclosure	Contact: ± 4 kV Air: ± 8 kV
Radiated RF immunity	EN 61000-4-3	Enclosure	10 V/m at (80 - 1000) MHz 3 V/m at (1 - 6) GHz 1 kHz sine, 80% AM
Fast transients	EN 61000-4-4	Power port	± 0.5 kV, ± 1 kV & ± 2 kV DC
		Ethernet ports	± 0.5 kV & ± 1 kV, capacitive coupling clamp
		RS-232	
Surge	EN 61000-4-5	Power port	L-E: ± 1 kV, 12 Ω , 9 μ F, 1.2/50 μ s L-E: ± 1 kV, 42 Ω , 0.5 μ F, 1.2/50 μ s L-L: ± 0.5 kV, 2 Ω , 18 μ F, 1.2/50 μ s L-L: ± 0.5 kV, 42 Ω , 0.5 μ F, 1.2/50 μ s
		Ethernet ports	L-E: ± 1 kV, 2 Ω , direct on shield, 1.2/50 μ s
Conducted RF immunity	EN 61000-4-6	Power port	10 Vrms, 0.15 - 80 MHz
		Ethernet	
		Digital input	
		RS-232	
Power frequency magnetic field	EN 61000-4-8	Enclosure	30 A/m; 50 Hz
Radiated RF emission	EN 301 489-1 EN 301 489-52 EN 61000-6-4	Enclosure	Class A (Residential), 30 MHz to 12.75 GHz
Conducted RF emission	EN 301 489-1	Power port	Class A
	EN 301 489-52	Ethernet	
	EN 61000-6-4	Digital input	
	EN 61000-6-4	RS-232	
Dielectric strength	IEC 62368-1	Power port to Ethernet ports	1.5 kVrms, 50 Hz, 1 min
		Ethernet TX to all other ports	

Table 3. EMC and electrical conditions

Environmental phenomena	Basic standard	Description	Test levels
Temperatures	EN 60068-2-1 EN 60068-2-2	Operational	-20 to +70°C ^a
Humidity	EN 60068-2-30	Operational	5-95 % relative humidity
MTBF	Telcordia	Ground benign, 25°C	1,700,000 hours
Enclosure	EN 62368-1	ABS	Fire enclosure
Weight			Approx 280 g
Cooling			Convection

^aRefer to "Safety Information" chapter regarding touch temperature

Table 4. Environmental and mechanical conditions

4.5. Connector Information

4.5.1. Power Input

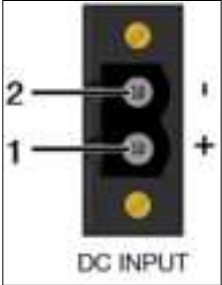
Illustration	Position	Product marking	Direction	Description
	1	DC+	Input	Supply voltage
	2	DC-	Input	Supply voltage

Table 5. Power input

The positive input is marked with a plus sign, "+". The negative input is marked with a minus sign, "-". Connect the voltage to the + pin and the return to the - pin on the power input.



NOTICE - POWER SUPPLY
Where an AC/DC-adaptor has not been supplied, a power supply of no greater than 100 W should be used, with a current limit of 1 Amp.

4.5.2. Serial Port

Merlin 4100 has a dual-use legacy port that is configurable in software to act either as an RS232 port or as a digital input. The serial port is named as follows, also the identifier for use within the terminal server configuration when the port is configured to operate as RS-232:

Label	tservd.port.serialPortName
S1	serial1



RS-232 Ports

When you configure a serial port to operate as an RS-232 interface, it supports the following signals:

- Transmit Data
- Receive Data
- CTS
- RTS
- DSR
- DTR

The pin numbering of the RJ45 socket, when viewed from the front of the unit, is as shown below. The RS-232 interface is wired as a DCE.

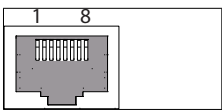
Illustration	Pin no.	Signal	Direction	Description
	1	DSR	Out	Data Set Ready
	2	DCD	Out	Data Carrier Detect
	3	DTR	In	Data Terminal Ready
	4	SG	-	Signal Ground, not chassis ground
	5	RD	Out	Receive Data
	6	TD	In	Transmit Data
	7	CTS	Out	Clear To Send
	8	RTS	In	Request To Send

Table 6. RS-232 connection

4.5.3. Digital Input

When you configure the port to operate as a digital input, it operates as a dry contact only.

The pin numbering of the RJ45 socket, when viewed from the front of the unit, is as shown below.

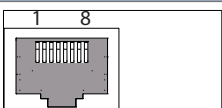
Illustration	Pin no.	Signal	Direction	Description
	2	+ve	Out	Input
	3	-ve	In	Input. Default value is zero when nothing is fitted to port
	4	Ground	-	Signal Ground, not chassis ground

Table 7. Digital input port

4.5.4. Antennas

The router has two SMA connectors for mobile radio LTE antennas, one for MAIN and the other for AUXiliary.

4.5.5. SFP Transceivers

This section applies only to products which support SFP transceivers.

Each SFP slot can hold one SFP transceiver. See "Transceiver User Guide 6100-0000" for transceiver handling instructions, which also can be downloaded from the product support pages at www.westermo.com/support/product-support.

In the event of contamination, the optical connectors in the SFP transceivers should only be cleaned by the use of forced nitrogen and some kind of cleaning stick. Recommended cleaning fluids are methyl-, ethyl-, isopropyl- or isobutyl alcohol, hexane or naphtha.



HANDLING OF SFP TRANSCEIVERS

SFP transceivers are supplied with plugs to avoid contamination inside the optical port. They are very sensitive to dust and dirt. If the fibre optic cable is disconnected from the product, a protective plug must be used on the transmitter/receiver. The protective plug must be kept on during transportation. The fibre optic cable must be handled the same way.

4.5.6. Reset Button

Use the reset button to request a system reset. When pressing the reset button, all LEDs turn on simultaneously. The length of time holding the reset button will determine its behaviour.

Press duration	PWR/CONFIG LED behaviour	Router behaviour on depress
0-3 seconds	Solid on	Normal reset to running config. No special LED activity.
3-15 seconds	Flashing fast	Releasing 3-15 seconds switches the router back to factory configuration. Note: this will wipe the configurations, both config1 and config2.
15-20 seconds	Solid on	Releasing 15-20 seconds performs a normal reset to running config.
20-30 seconds	Flashing slowly	Releasing 20-30 seconds reboots the router to recovery mode. Only to be done in case of emergency and under the guidance of Westermo support staff. Note: this may wipe the configurations, both config1 and config2.
> 30 seconds	Solid on	Releasing after 30 seconds performs a normal reset.

Table 8. Merlin series router reset behaviour

4.6. LED Indicators

The LED indicators described in this section are all single colour LEDs. When the router is powered on, the power LED is green.

The possible LED states are:

- Off
- Flashing slowly
- Flashing quickly
- On

LED	Status	Description
Booting up		The router takes less than a minute to boot up. During this time, the power LED flashes. Other LEDs display different diagnostic patterns during boot up. Booting is complete when the power LED stops flashing and stays on steady.
Power	On	Power is present
	Off	No power. Boot loader does not exist.
	Flashing	Booting
Config	On	The router is running a valid configuration file.
	Flashing slowly	The router is running in recovery mode (2.5 flashes/second)
	Flashing quickly	The router is running in factory configuration (5 flashes/second)
SIM	On	SIM selected and registered on the 3G/4G network
	Off	Not selected or SIM not inserted
	Flashing	SIM selected and not registered on the network
3G/LTE cellular signal strength LED	Both LEDs off	Data link not connected or signal strength ≤ -113 dBm
	Left LED on	Data link connected and signal strength ≤ -89 dBm
	Right LED off	
	Left LED off	Data link connected and signal strength is between -89 to -69 dBm
	Right LED on	
	Both LEDs on	Data link connected and signal strength > -69 dBm

Table 9. LED indicators

4.7. Ethernet Port LED Behaviour

There are four Ethernet ports and each has a pair of LEDs: a LINK LED (green) and a SPEED LED (amber). When looking at the port, the LED on the top is the LINK LED, and the SPEED LED is on the bottom.



Figure 3. Merlin Ethernet ports

LINK LED (green)	On	Physical Ethernet link detected
	Off	No physical Ethernet link detected
	Flashing	Data is being transmitted or received over the link
SPEED LED (amber)	On	Link operating at 100 Mbps
	Off	Link operating at 10 Mbps

Table 10. Ethernet LED behaviour and descriptions

5. Factory Configuration Extraction From SIM Card

Merlin Series routers have a feature to update the factory configuration from a SIM card. This allows you to change the factory configuration of a router when installing the SIM.

1. Make sure the SIM card you are inserting has the required configuration written on it.
2. Ensure the router is powered off.
3. Insert the SIM card into SIM slot 1 following the instructions detailed in the Installation chapter.
4. Power up the router.

Depending on the model, the power LED and/or the configuration LED flash as usual.

The SIM LED starts flashing. This indicates the application responsible for LTE and configuration extraction management is running. It also means the update of the configuration is happening.

When the update is finished, depending on the model, the power LED and/or the configuration LED blink alternatively and very fast for 20 seconds.



NOTE

Factory configuration extraction is only supported on mobile modules that support phone book operations.

6. Accessing The Router

Access the router through the web interface or by using SSH. By default, Telnet is disabled.

Configuration Packages Used

Package	Sections
dropbear	dropbear
system	main
uhttpd	main
	cert

6.1. Accessing The Router Over Ethernet Using The Web Interface

DHCP is disabled by default, so if you do not receive an IP address via DHCP, assign a static IP to the PC that will be connected to the router.

PC IP address	192.168.100.100
Network mask	255.255.255.0
Default gateway	192.168.100.1

Assuming that the PC is connected to Port A on the router, in your internet browser, type in the default local IP address 192.168.100.1, and press **Enter**. The Authorization page appears.



The login page

The password may vary depending on the factory configuration the router has been shipped with. The default settings are shown below. The username and password are case sensitive.

In the username field, type **root**. In the Password field, type **admin**.

Click **Login**. The Status page appears.

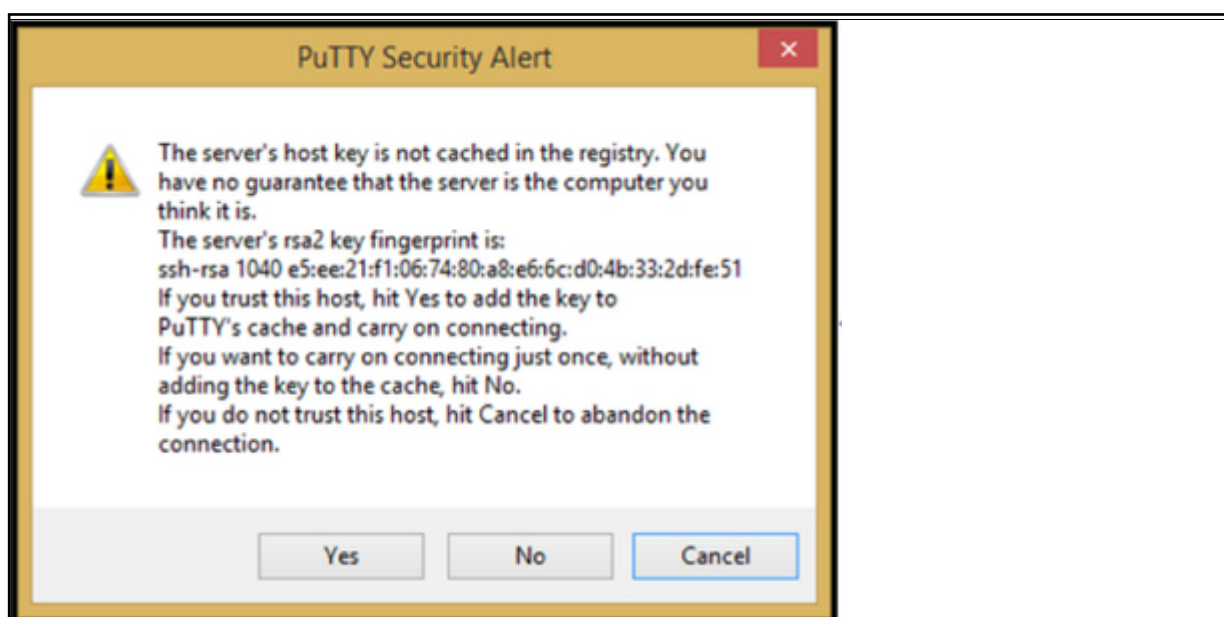
6.2. Accessing The Router Over Ethernet Using An SSH Client

You can also access the router over Ethernet, using Secure Shell (SSH) and optionally over Telnet.

To access CLI over Ethernet start an SSH client and connect to the router's management

IP address, on port **22**: **192.168.100.1/24**.

On the first connection, you may be asked to confirm that you trust the host.



Confirming trust of the router's public key over SSH



SSH CLI login screen

In the SSH CLI login screen, enter the default username and password.

Username: **root**

Password: **admin**

SCP (Secure Copy Protocol)

As part of accessing the router over SSH, you can also use SCP protocol. Use the same user authentication credentials as for SSH access. You can use SCP protocol to securely, manually transfer files from and to the router's SCP server.

No dedicated SPC client is supported; select the SCP client software of your own choice.

6.3. Accessing The Router Over Ethernet Using A Telnet Client

Telnet is disabled by default, when you enable Telnet, SSH is disabled.

To enable Telnet, enter:

```
root@VA_router: ~# /etc/init.d/dropbear disable
root@VA_router: ~# reboot
```

To re-enable SSH, enter:

```
root@VA_router: ~# /etc/init.d/dropbear enable
root@VA_router: ~# reboot
```



NOTE

As SSH is enabled by default, initial connection to the router to enable Telnet must be established over SSH.

6.4. Configuring The Password

Configuration packages used

Packages	Sections
system	main

To change your password, in the top menu click **System -> Administration**. The Administration page appears.



In the Router Password section, type your new password in the password field and then retype the password in the confirmation field.

Scroll down the page and click **Save & Apply**.



NOTE

The username 'root' cannot be changed.

Web Field/UCI/Package Option	Description
Web: Password	Defines the root password. The password is displayed encrypted
UCI: system.main.password	via the CLI using the 'hashpassword' option.
Opt: password	UCI: system.main.hashpassword
	Opt: hashpassword

6.4.1. Configuring The Password Using UCI

The root password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci show system

system.main=system

system.main.hostname=VA_router

system.main.hashpassword=$1$jRX/x8A/$U5kLCMpi9dcahRhOl7eZV1
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
root@VA_router:~# uci system.main.password=newpassword

root@VA_router:~# uci commit
```

The new password will take effect after a reboot and will now be displayed in encrypted format via the hashpassword option.

6.4.2. Configuring The Password Using Package Options

The root password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci export system

package system

config system 'main'

option hostname 'VA_router'

option hashpassword '$1$wRYYijOz$EeHN.GQcxXhRgNPVbqxVw
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
package system

config system 'main'

option hostname 'VA_router'

option hashpassword '$1$wRYYijOz$EeHN.GQcxXhRgNPVbqxVw

option password 'newpassword'
```

The new password will take effect after reboot and will now be displayed in encrypted format via the hashpassword option.

6.5. Accessing The Device Using RADIUS Authentication

You can configure RADIUS authentication to access the router over SSH, web or local console interface.

```
package system
config system 'main'
option hostname 'VirtualAccess'
option timezone 'UTC'

config pam_auth
option enabled 'yes'
option pamservice 'login'
option pammodule 'auth'
option pamcontrol 'sufficient'
option type 'radius'
option servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'

config pam_auth
option enabled 'yes'
option pamservice 'sshd'
option pammodule 'auth'
option pamcontrol 'sufficient' ...it checks package management_users
option type 'radius'
option servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'

config 'pam_auth'
option enabled 'yes'
option pamservice 'luci'
option pammodule 'auth'
option pamcontrol 'sufficient'
option type 'radius'
servers '192.168.0.1:3333|test|20 192.168.2.5|secret|10'
```

UCI/Package Option	Description						
UCI: system.@pam_auth[0].enabled=yes Opt: enabled	Enables and disables RADIUS configuration sections. <table> <tr> <td>Yes:</td><td>enables the following RADIUS configuration section</td></tr> <tr> <td>No:</td><td>disables the following RADIUS configuration section</td></tr> </table>	Yes:	enables the following RADIUS configuration section	No:	disables the following RADIUS configuration section		
Yes:	enables the following RADIUS configuration section						
No:	disables the following RADIUS configuration section						
UCI: system.@pam_auth[0].pamservice Opt: pamservice	Selects the method which users should be authenticated by. <table> <tr> <td>login:</td><td>User connecting over console cable</td></tr> <tr> <td>sshd:</td><td>User connecting over SSH</td></tr> <tr> <td>luci:</td><td>User connecting over web</td></tr> </table>	login:	User connecting over console cable	sshd:	User connecting over SSH	luci:	User connecting over web
login:	User connecting over console cable						
sshd:	User connecting over SSH						
luci:	User connecting over web						
UCI: system.@pam_auth[0].pamcontrol Opt: pamcontrol	Specifies authentication behaviour after authentication fails or connection to RADIUS server is broken. <table> <tr> <td>Sufficient</td><td>First authenticates against remote RADIUS if password authentication fails then it tries the local database (user defined in package management_users).</td></tr> <tr> <td>Required:</td><td>If either authentication fails of the RADIUS server is not reachable then the user is not allowed to access the router.</td></tr> <tr> <td>[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die]:</td><td>Local database is only checked if the RADIUS server is not reachable.</td></tr> </table>	Sufficient	First authenticates against remote RADIUS if password authentication fails then it tries the local database (user defined in package management_users).	Required:	If either authentication fails of the RADIUS server is not reachable then the user is not allowed to access the router.	[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die]:	Local database is only checked if the RADIUS server is not reachable.
Sufficient	First authenticates against remote RADIUS if password authentication fails then it tries the local database (user defined in package management_users).						
Required:	If either authentication fails of the RADIUS server is not reachable then the user is not allowed to access the router.						
[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die]:	Local database is only checked if the RADIUS server is not reachable.						
UCI: system.@pam_auth[0].pammodule.auth Opt: pammodule	Enables user authentication.						
UCI: system.@pam_auth[0].type.radius Opt: type	Specifies the authentication method.						
UCI: system.@pam_auth[0].servers Opt: servers	Specifies the RADIUS server along with port number, password and timeout in seconds. Port and timeout are optional. The default port for RADIUS is 1812; default timeout is 10 seconds. Multiple servers are entered using a space separator. Syntax: <server ip address>[:<port>]<secret>[[timeout] Examples: option servers `192.168.0.1test` option servers `192.168.0.1 test 192.168.2.5:1234 secret 10`						
UCI: system.@pam_auth[1].args=service=ppp Opt: args	Additional arguments to pass to TACACS server.						

Information table for RADIUS authentication

6.6. Accessing The Device Using TACACS+ Authentication

You can configure TACACS+ authentication to access the router over SSH, web or local console interface.

```
package system

config system 'main'

option hostname 'VirtualAccess'

option timezone 'UTC'


config pam_auth

option enabled 'yes'

option pamservice 'sshd'

option pammodule 'auth'

option pamcontrol 'sufficient'

option type 'tacplus'

option servers '192.168.0.1:49|secret'


config pam_auth

option enabled 'yes'

option pamservice 'sshd'

option pammodule 'account'

option pamcontrol 'sufficient'

option type 'tacplus'

option servers '192.168.0.1:49|secret'


config 'pam_auth'

option enabled 'yes'

option pamservice 'sshd'

option pammodule 'session'

option pamcontrol 'sufficient'

option type 'tacplus'

servers '192.168.0.1:49|secret'

option args 'service=ppp'


config pam_auth

option enabled 'yes#'

option pamservice 'luci'

option pammodule 'auth'

option pammodule 'sufficient'

option type 'tacplus'

option servers '192.168.0.1:49|secret'

option args 'service=ppp'
```



```
config pam_auth
option enabled 'yes'
option pamservice 'luci'
option pammodule 'session'
option pamcontrol 'sufficient'
option type 'tacplus'
option servers '192.168.0.1:49|secret'
option args 'service=ppp'

config pam_auth
option enabled 'yes'
option pamservice 'login'
option pammodule 'account'
option pamcontrol 'sufficient'
option type 'tacplus'
option servers '192.168.0.1:49|secret'
option args 'service=ppp'

config pam_auth
option enabled 'yes'
option pamservice 'login'
option pammodule 'session'
option pamcontrol 'sufficient'
option type 'tacplus'
option servers '192.168.0.1:49|secret'
option args 'service=ppp'
```

UCI/Package Option	Description						
UCI: system.@pam_auth[0].enabled=yes Opt: enabled	Enables and disables TACACS configuration sections. <table> <tr> <td>Yes:</td><td>enables the following TACACS configuration section</td></tr> <tr> <td>No:</td><td>disables the following TACACS configuration section</td></tr> </table>	Yes:	enables the following TACACS configuration section	No:	disables the following TACACS configuration section		
Yes:	enables the following TACACS configuration section						
No:	disables the following TACACS configuration section						
UCI: system.@pam_auth[0].pamservice Opt: pamservice	Selects the method which users should be authenticated by. <table> <tr> <td>login:</td><td>User connecting over console cable</td></tr> <tr> <td>sshd:</td><td>User connecting over SSH</td></tr> <tr> <td>luci:</td><td>User connecting over web</td></tr> </table>	login:	User connecting over console cable	sshd:	User connecting over SSH	luci:	User connecting over web
login:	User connecting over console cable						
sshd:	User connecting over SSH						
luci:	User connecting over web						
UCI: system.@pam_auth[0].pamcontrol Opt: pamcontrol	Specifies authentication behaviour after authentication fails or connection to TACACS server is broken. <table> <tr> <td>Sufficient</td><td>First authenticates against remote TACACS if password authentication fails then it tries the local database (user defined in package management_users).</td></tr> <tr> <td>Required:</td><td>If either authentication fails of the TACACS server is not reachable then the user is not allowed to access the router.</td></tr> <tr> <td>[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die];</td><td>Local database is only checked if the TACACS server is not reachable.</td></tr> </table>	Sufficient	First authenticates against remote TACACS if password authentication fails then it tries the local database (user defined in package management_users).	Required:	If either authentication fails of the TACACS server is not reachable then the user is not allowed to access the router.	[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die];	Local database is only checked if the TACACS server is not reachable.
Sufficient	First authenticates against remote TACACS if password authentication fails then it tries the local database (user defined in package management_users).						
Required:	If either authentication fails of the TACACS server is not reachable then the user is not allowed to access the router.						
[success=done new_authtok_reqd=done authinfo_unavail=ignore default=die];	Local database is only checked if the TACACS server is not reachable.						
UCI: system.@pam_auth[0].pammodule.auth Opt: pammodule	Enables user authentication.						
UCI: system.@pam_auth[0].type.radius Opt: type	Specifies the authentication method.						
UCI: system.@pam_auth[0].servers Opt: servers	Specifies the TACACS server along with port number, password and timeout in seconds. Port and timeout are optional. The default port for TACACS is 49. Multiple servers are entered using a space separator. Syntax: <server ip address>[:<port>]]<secret> Examples: option servers `192.168.0.1test` option servers `192.168.0.1 test 192.168.2.5:1234 secret 10`						
UCI: system.@pam_auth[1].args=service=ppp Opt: args	Additional arguments to pass to TACACS server.						

6.7. SSH

SSH allows you to access remote machines over text-based shell sessions. SSH uses public key cryptography to create a secure connection. These connections allow you to issue commands remotely via a command line.

The router uses a package called Dropbear to configure the SSH server on the box. You can configure Dropbear using the web interface or through an SSH connection by editing the file stored on: /etc/config_name/dropbear.

Configuration packages used

Package	Sections
dropbear	dropbear

SSH access using the web interface

In the top menu, click **System -> Administration**. The Administration page appears.

Scroll down to the SSH Access section.

SSH Access

Dropbear offers SSH network shell access and an integrated SCP server

Dropbear Instance

Interface

☐ LAN (no interfaces attached)

☐ LAN1

☐ MOBILE1

☐ ETHVDSL

☐ Ethernet

☒ unspecified

Listen only on the given interface or, if unspecified, on all

Port

Specifies the listening port of this Dropbear instance

Password authentication

☒

Allow SSH password authentication

Allow root login with password

☒

Allow the root user to login with password

Gateway ports

☐

Allow remote hosts to connect to local SSH forwarded ports

Idle Session Timeout (seconds)

Remote session will be closed after this many seconds of inactivity

Maximum login attempts

SSH connection is dropped once this limit is reached

Add

The SSH access section

Web Field/UCI/Package Options	Description				
Web: Interface UCI: dropbear:@dropbear[0].Interface Opt: Interface	Listens only on the selected interface. If you check unspecified, it listens on all interfaces. All configured interfaces will be displayed via the web GUI. <table> <tr> <td>(unspecified)</td><td>Listend on all interfaces.</td></tr> <tr> <td>Range</td><td>Configured interface names.</td></tr> </table>	(unspecified)	Listend on all interfaces.	Range	Configured interface names.
(unspecified)	Listend on all interfaces.				
Range	Configured interface names.				
Web: Port UCI: dropbear:@dropbear[0].Port Opt: port	Specifies the listening port of the Dropbear instance. <table> <tr> <td>22</td><td>Disabled</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	22	Disabled	Range	0-65535
22	Disabled				
Range	0-65535				
Web: Password authentication UCI: dropbear:@dropbear[0].PasswordAuth Opt: PasswordAuth	If enabled, allows SSH password authentication. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Allow root logins with password UCI: dropbear:@dropbear[0].RootPasswordAuth Opt: RootPasswordAuth	Allows the root user to login with password. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Gateway ports UCI: dropbear:@dropbear[0].GatewayPorts Opt: GatewayPorts	Allows remote hosts to connect to local SSH forwarded ports. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Idle Session Timeout UCI: dropbear:@dropbear[0].IdleTimeout Opt: IdleTimeout	Defines the idle period where the remote session will be closed after the allocated number of seconds of inactivity. <table> <tr> <td>30</td><td>30 seconds.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	30	30 seconds.	Range	
30	30 seconds.				
Range					
Web: n/a UCI: dropbear:@dropbear[0]. BannerFile Opt: BannerFile	Defines a banner file to be displayed during login. <table> <tr> <td>/etc/banner</td><td></td></tr> <tr> <td>Range</td><td></td></tr> </table>	/etc/banner		Range	
/etc/banner					
Range					
Web: Maximum login attempts UCI: dropbear:@dropbear[0].MaxLoginAttempts Opt: MaxLoginAttempts	Specifies maximum login failures before session terminates. <table> <tr> <td>10</td><td></td></tr> <tr> <td>0-infinite</td><td></td></tr> </table>	10		0-infinite	
10					
0-infinite					

6.8. Package Dropbear Using UCI

```
root@VA_router:~# uci show dropbear
dropbear.@dropbear[0]=dropbear
dropbear.@dropbear[0].PasswordAuth=on
dropbear.@dropbear[0].RootPasswordAuth=on
dropbear.@dropbear[0].GatewayPorts=0
dropbear.@dropbear[0].IdleTimeout=30
dropbear.@dropbear[0].Port=22
dropbear.@dropbear[0].MaxLoginAttempts=3

Package dropbear using package options
root@VA_router:~# uci export dropbear
package dropbear
config dropbear'
option PasswordAuth 'on'
option RootPasswordAuth 'on'
option Port '22'
option GatewayPorts '0'
option IdleTimeout '30'
option MaxLoginAttempts '3'
```

6.9. Certs And Private Keys

Certificates are used to prove ownership of a public key. They contain information about the key, its owner's ID, and the digital signature of an individual that has verified the content of the certificate.

In asymmetric cryptography, public keys are announced to the public, and a different private key is kept by the receiver. The public key is used to encrypt the message and the private key is used to decrypt it.

To access certs and private keys, in the top menu, click **System -> Administration**. The Administration page appears. Scroll down to the Certs & Private Keys section.

Certificates & Private Keys

Certificates and private keys used for various services could be uploaded here.

IPsec Certificates and Keys

Choose File

No file chosen

Upload a *.tar.gz file containing certificate and/or private keys. All the previous certs previously uploaded will be deleted when new ones uploaded. Archive structure should match this of directory of folder. Every file should be in one of 8 subfolders according to its purpose:

- private (private keys) certs (cert) certs
- certs (certificate files)
- ca-certs (CA certs)
- integrity (OCSP agent certs)
- ca-certs (Authorization Authority certs)
- ca-certs (certificates certs)
- keys (PKCS#10 cert requests)

More info

OpenVPN Certificates and Keys

Choose File

No file chosen

Upload a *.tar.gz file containing certificate and/or private keys. All the previous certs previously uploaded will be deleted when new ones uploaded. OpenVPN requires its special folder structure. Hence files will be installed into the openvpn folder as they are in archive.

VPN Certificates and Keys

Choose File

No file chosen

Upload a *.tar.gz file containing certificate and/or private keys. All the previous certs previously uploaded will be deleted when new ones uploaded. Archive structure should match this of directory folder which is similar to directory of folder.

Save & Apply

Cancel

Reset

The certificates and private keys section

This section allows you to upload any certificates and keys that you may have stored. There is support for IPsec, OpenVPN and VA certificates and keys.

If you have generated your own SSH public keys, you can input them in the SSH Keys section, for SSH public key authentication.

SSH-Keys

Here you can paste public SSH Keys (one per line) for SSH public key authentication.

The SSH-keys box

6.10. Configuring A Router’s Web Server

The router’s web server is configured in package uhttpd. This file defines the behaviour of the server and default values for certificates generated for SSL operation. uhttpd supports multiple instances, that is, multiple listen ports, each with its own document root and other features, as well as cgi and lua. There are two sections defined:

Main: this uHTTPd section contains general server settings.

Cert: this section defines the default values for SSL certificates.

Configuration Packages Used

Package	Sections
uhttpd	main
	cert

To configure the router's HTTPS server parameters, in the top menu, select **Services -> HTTP Server**. The HTTP Server page has two sections:

Main Settings	Server Configurations
Certificate Settings	SSL certifications

6.10.1. Main Settings

HTTP Server

Configuration of the Http Server used for management of the device

Main Settings

Basic configuration of the Http Server

Listen Address and Port

0.0.0.0:80

Specifies the ports and addresses to listen on for plain HTTP access. If only a port number is given, the server will attempt to serve both IPv4 and IPv6 requests. Use 0.0.0.0 to bind at port 80 only on IPv4 interfaces or :::80 to serve only IPv6.

Secure Listen Address and Port

0.0.0.0:443

Specifies the ports and addresses to listen on for encrypted HTTPS access.

Home path

/www

Defines the server document root.

Cert file

/etc/ssl/cert.pem

PEM certificate used to serve HTTPS connections.

Key file

/etc/ssl/private.key

PEM private key used to serve HTTPS connections.

CGI path

/cgi-bin

Defines the path for CGI scripts, relative to the document root. CGI support is disabled if this option is missing.

Script timeout (s)

60

Maximum wait time for CGI or jsn requests in seconds. Requested connections are terminated if no output was generated until the timeout expired.

Network timeout (s)

30

Maximum wait time for network activity. Requested connections are terminated and connection is shut down if no network activity occurred for the specified number of seconds.

HTTPS time

5

TLS protocol version

1.3

Min supported TLS version, versions below this will not be supported by the https server.

HTTP server main settings

Web Field/UCI/Package Option	Description						
Web: Listen Address and Port UCI: uhttpd.main.listen_http Opt: list listen_http	Specifies the ports and addresses to listen on for plain HTTP access. If only a port number is given, the server will attempt to serve both IPv4 and IPv6 requests. <table><tr><td>0.0.0.0:80</td><td>Bind at port 80 only on IPv4 interfaces.</td></tr><tr><td>:::80</td><td>Bind at port 80 only on IPv6 interfaces.</td></tr><tr><td>Range</td><td>IP address and/or port</td></tr></table>	0.0.0.0:80	Bind at port 80 only on IPv4 interfaces.	:::80	Bind at port 80 only on IPv6 interfaces.	Range	IP address and/or port
0.0.0.0:80	Bind at port 80 only on IPv4 interfaces.						
:::80	Bind at port 80 only on IPv6 interfaces.						
Range	IP address and/or port						
Web: Secure Listen Address and Port UCI: uhttpd.main.listen_https Opt: list listen_https	Specifies the ports and address to listen on for encrypted HTTPS access. The format is the same as listen_http. <table><tr><td>0.0.0.0:443</td><td>Bind at port 443 only.</td></tr><tr><td>:::443</td><td></td></tr><tr><td>Range</td><td>IP address and/or port.</td></tr></table>	0.0.0.0:443	Bind at port 443 only.	:::443		Range	IP address and/or port.
0.0.0.0:443	Bind at port 443 only.						
:::443							
Range	IP address and/or port.						
Web: Home path UCI: uhttpd.main.home Opt: home	Defines the server document root <table><tr><td>/www</td><td></td></tr><tr><td>Range</td><td></td></tr></table>	/www		Range			
/www							
Range							

Web: Cert file UCI: uhttpd.main.cert Opt: cert	ASN.1/DER certificate used to serve HTTPS connections. If no listen_https options are given the key options are ignored. <table border="1"> <tr><td>/etc/uhttpd.crt</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	/etc/uhttpd.crt		Range			
/etc/uhttpd.crt							
Range							
Web: Key file UCI: uhttpd.main.key Opt: key	ASN.1/DER private key used to serve HTTPS connections. If no listen_https options are given the key options are ignored. <table border="1"> <tr><td>/etc/uhttpd.key</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	/etc/uhttpd.key		Range			
/etc/uhttpd.key							
Range							
Web: CGI profile UCI: uhttpd.main.cgi_prefix Opt: cgi_prefix	Defines the prefix for CGI scripts, relative to the document root. CGI support is disabled if this option is missing. <table border="1"> <tr><td>/cgi-bin</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	/cgi-bin		Range			
/cgi-bin							
Range							
Web: N/A UCI: uhttpd.main.lua_prefix Opt: lua_prefix	Defines the prefix for dispatching requests to the embedded lua interpreter, relative to the document root. Lua support is disabled if this option is missing. <table border="1"> <tr><td>/luci</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	/luci		Range			
/luci							
Range							
Web: N/A UCI: uhttpd.main.lua_handler Opt: lua_handler	Specifies the lua handler script used to initialise the lua runtime on server start. <table border="1"> <tr><td>/usr/lib/lua/luci/cgi/uhttpd.lua</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	/usr/lib/lua/luci/cgi/uhttpd.lua		Range			
/usr/lib/lua/luci/cgi/uhttpd.lua							
Range							
Web: Script timeout UCI: uhttpd.main.script_timeout Opt: script_timeout	Sets the maximum wait time for CGI or lua requests in seconds. Requested executables are terminated if no output was generated. <table border="1"> <tr><td>60</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	60		Range			
60							
Range							
Web: Network timeout UCI: uhttpd.main.network_timeout Opt: network_timeout	Maximum wait time for network activity. Requested executables are terminated and the connection is shut down if no network activity occurred for the specified number of seconds. <table border="1"> <tr><td>30</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	30		Range			
30							
Range							
Web: rfc 1918 filter UCI: uhttpd.main.rfc1918_filter Opt: rfc1918_filter	Enables option to reject requests from RFC1918 IPs to public server IPs (DNS rebinding counter measure). <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled		
0	Disabled						
1	Enabled						
Web: TLS protocol version UCI: uhttpd.main.tls_version Opt: tls_version	Defines the minimum supported TLS version for the https server. <table border="1"> <tr><td>1.0</td><td></td></tr> <tr><td>1.1</td><td></td></tr> <tr><td>1.2</td><td></td></tr> </table>	1.0		1.1		1.2	
1.0							
1.1							
1.2							
Web: N/A UCI: uhttpd.main.realm Opt: realm	Defines basic authentication realm when prompting the client for credentials (HTTP 400). <table border="1"> <tr><td>OpdenWrt</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	OpdenWrt		Range			
OpdenWrt							
Range							

Web: N/A UCI: uhttpd.main.config Opt: config	Config file in Busybox httpd format for additional settings. Currently only used to specify basic auth areas. <table border="1"> <tr> <td>/etc/http.conf</td><td></td></tr> <tr> <td>Range</td><td></td></tr> </table>	/etc/http.conf		Range	
/etc/http.conf					
Range					
Web: N/A UCI: uhttpd.main.index_page Opt: index_page	Index file to use for directories, for example, add index.php when using php.				
Web: N/A UCI: httpd.main.error_page Opt: error_page	Virtual URL of file of CGI script to handle 404 requests. Must begin with '/' (forward slash).				
Web: N/A UCI: uhttpd.main.no_symlinks Opt: no_symlinks	Does not follow symbolic links if enabled. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: N/A UCI: uhttpd.main.no_dirlists Opt: no_symlinks	Does not generate directory listings if enabled. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				

HTTP Server Using Command Line

Multiple sections of the type uhttpd may exist. The init script will launch one webserver instance per section.

A standard uhttpd configuration is shown below.

HTTPs Server Certificate Settings

To configure HTTPs server certificate settings, in the top menu, select **Services -> HTTP Server**. Scroll down to the Certificate Settings section.

Certificate Settings

Get parameters for valid certificate generation

Days

365

Validity time of the generated certificate in days

Key

2048

Size of the generated RSA key in bits

Country

US

ISO country code of the certificate issuer

State

California

State of the certificate issuer

Locality

San Jose

Locality of the certificate issuer

Common Name

192.168.1.100

Common name contained by the certificate

Generate

HTTP server certificate settings

Web Field/UCI/Package Option	Description				
Web: Days UCI: uhttpd.px5g.days Opt: days	Validity time of the generated certificates in days. <table border="1"> <tr><td>730</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	730		Range	
730					
Range					
Web: Bits UCI: uhttpd.px5g.bits Opt: bits	Size of the generated RSA key in bits. <table border="1"> <tr><td>1024</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	1024		Range	
1024					
Range					
Web: Country UCI: uhttpd.px5g.country Opt: country	ISO code of the certificate issuer.				
Web: State UCI: uhttpd.px5g.state Opt: state	State of the certificate issuer.				
Web: Location UCI: uhttpd.px5g.location Opt: location	Location or city of the certificate user.				
Web: Commonname UCI: uhttpd.commonname Opt: commonname	Common name covered by the certificate. For the purposes of secure activation, this must be set to the serial number (Eth0 MAC address) of the device.				

HTTP Server Using UCI

```

root@VA_router:~# uci show uhttpd
uhttpd.main=uhttpd
uhttpd.main.listen_http=0.0.0.0:80
uhttpd.main.listen_https=0.0.0.0:443
uhttpd.main.home=/www uhttpd.main.rfc1918_filter=1
uhttpd.main.cert=/etc/uhttpd.crt
uhttpd.main.key=/etc/uhttpd.key
uhttpd.main.cgi_prefix=/cgi-bin
uhttpd.main.script_timeout=60
uhttpd.main.network_timeout=30
uhttpd.main.config=/etc/http.conf
uhttpd.main.tls_version=1.0

```

HTTP Server using Package Options

```
root@VA_router:~# uci export uhttpd

config uhttpd 'main'

list listen_http '0.0.0.0:80'

list listen_https '0.0.0.0:443'

option home '/www'

option rfc1918_filter '1'

option cert '/etc/uhttpd.crt'

option key '/etc/uhttpd.key'

option cgi_prefix '/cgi-bin'

option script_timeout '60'

option network_timeout '30'

option config '/etc/http.conf'

option tls_version '1.0'
```

6.11. Basic Authentication (Httpd Conf)

For backward compatibility reasons, uhttpd uses the file `/etc/httpd.conf` to define authentication areas and the associated usernames and passwords. This configuration file is not in UCI format.

Authentication realms are defined in the format `prefix:username:password` with one entry and a line break.

Prefix is the URL part covered by the realm, for example, `cgi-bin` to request basic auth for any CGI program.

Username specifies the username a client has to login with.

Password defines the secret password required to authenticate.

The password can be either in plain text format, MD5 encoded or in the form `$p$user` where the user refers to an account in `/etc/shadow` or `/etc/passwd`.

If you use `$p$...` format, uhttpd will compare the client provided password against the one stored in the shadow or passwd database.

6.12. Securing Uhttpd

By default, uhttpd binds to 0.0.0.0 which also includes the WAN port of your router. To bind uhttpd to the LAN port only you have to change the `listen_http` and `listen_https` options to your LAN IP address.

To get your current LAN IP address, enter:

```
uci get network.lan.ipaddr
```

Then modify the configuration appropriately:

```
uci set uhttpd.main.listen_http='192.168.1.1:80'

uci set uhttpd.main.listen_https='192.168.1.1:443'

config 'uhttpd' 'main'

list listen_http 192.168.1.1:80

list listen_https 192.168.1.1:443
```

6.13. Displaying Custom Information Via Login Screen

The login screen, by default, shows the hostname of the router in addition to the username and password prompt. However, the router can be configured to show some other basic information if required using a UDS script.

Note: this can only be configured via the command line.

Configuration Packages Used

Package	Sections
luci	main
uds	script

Configuring Login Screen Customer Information

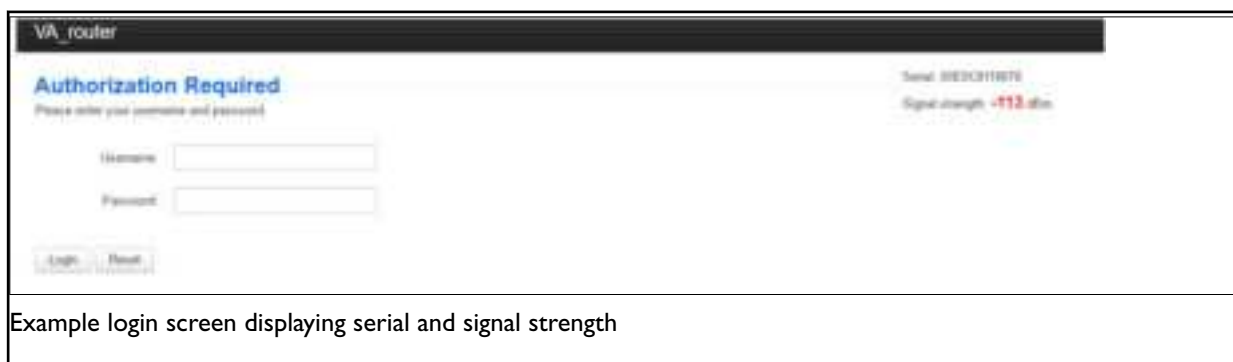
The luci package option `login_page_info_template` is configured with the path to a UDS script that would render the required information on the right side of the login page.

The following example shows how to display serial number and mobile signal strength.



NOTE

This can only be configured via the command line.



Example login screen displaying serial and signal strength

Login Screen Customer Information using UCI

```

root@VA_router:~# uci show luci
luci.main=core
luci.main.login_page_info_template=/tmp/uds/sysauth_template
root@VA_router:~# uci show uds
uds.sysauth_template=script
uds.sysauth_template.enabled=1
uds.sysauth_template.exec_type=none
uds.sysauth_template.fname=sysauth_template.htm
uds.sysauth_template.type=none
uds.sysauth_template.text=Serial: <=pcdata(luci.version.serial)%><br><% local sig =luci.dispatcher.uci.cursor_state():get("mobile",
"3g_1_1",
"sig_dbm") or -113 sig = tonumber(sig) local hue = (sig + 113) * 2 local hue = math.min(math.max(hue, 0), 120) > Signal strength:
<h3 style="color:hsl(<%=hue%>, 90%, 50%);display:inline;"><%=sig%></h>dBm

```

7. Router File Structure

This section describes the file structure and location of essential directories and files on the router.

Throughout this document, we use information tables to show the different ways to configure the router using the router's web interface and command line interface (CLI).

When showing examples of the command line interface we use the host name 'VA_router' to indicate the system prompt. For example, the table below displays what the user should see when entering the command to show the current configuration in use on the router:

```
root@VA_router:~# va_config.sh
```

7.1. System Information

General information about software and configuration used by the router is displayed on the Status page. To view the running configuration file status on the web interface, in the top menu, select **Status -> Overview**. This page also appears immediately after you have logged in.

Status	
System	
Router Name	GW0000
Router Model	Virtual Access GW000100-AA0179E
Firmware Version	VIE-16.00.55
Current Image/Config	image2 / config2
Kernel Version	3.2.12
Local Time	Fri Aug 5 11:43:52 2016
Uptime	0h 10m 8s
Load Average	0.27, 0.35, 0.31

Example of the status page

System information is also available from the CLI if you enter the following command:

```
root@VA_router:~# va_vars.sh
```

The example below shows the output from the above command.

```
VA_SERIAL: 00E0C8121215
VA_MODEL: GW0000
VA_ACTIVEIMAGE: image2
VA_ACTIVECONFIG: config1
VA_IMAGE1VER: VIE-16.00.44
VA_IMAGE2VER: VIE-16.00.44
```

7.2. Identify Your Software Version

To check which software version your router is running, in the top menu, browse to: **Status - > Overview**.

Status
System
Services
Network
Logout

Status

System

Router Name	GW0000
Router Model	Virtual Access GW0001R-AD179E
Firmware Version	V15-15.00.55
Current Image/Config	image2 / config2
Kernel Version	3.2.12
Local Time	Fri Aug 5 11:43:52 2016
Uptime	0h 10m 8s
Load Average	0.27, 0.35, 0.31

The status page showing a software version prior to 72.002

Status

Status

System

Router Name	dmvpn
Router Model	GW2028
Firmware Version	LIS-15.00.72.002rc4
Current Image/Config	image1 / config1
Kernel Version	3.2.12
Local Time	Thu Jan 26 14:46:03 2017
Uptime	0h 39m 37s
Load Average	1.02, 0.53, 0.48

The status page showing software version 72.002

In the Firmware Version row, the first two digits of the firmware version identify the hardware platform, for example LIS-15; while the remaining digits: .00.72.002, show the software version.

7.3. Image Files

The system allows for two firmware image files:

- image1, and
- image2

Two firmware images are supported to enable the system to rollback to a previous firmware version if the upgrade of one image fails.

The image names (image1, image2) themselves are symbols that point to different partitions in the overall file system. A special image name “altimage” exists which always points to the image that is not running.

The firmware upgrade system always downloads firmware to “altimage”.

7.4. Directory Locations For UCI Configuration Files

Router configurations files are stored in folders on:

- /etc/factconf,
- /etc/config1, and
- /etc/config2

Multiple configuration files exist in each folder. Each configuration file contains configuration parameters for different areas of functionality in the system.

A symbolic link exists at /etc/config, which always points to one of factconf, config1 or config2 is the active configuration file.

Files that appear to be in /etc/config are actually in /etc/factconf|config1|config2 depending on which configuration is active.

If /etc/config is missing on start-up, for example on first boot, the links and directories are created with configuration files copied from /rom/etc/config/.

At any given time, only one of the configurations is the active configuration. The UCI system tool (Unified Configuration Interface) only acts upon the currently active configuration.

7.5. Viewing And Changing Current Configuration

To show the configuration currently running, enter:

```
root@VA_router:~# va_config.sh
```

To show the configuration to run after the next reboot, enter:

```
root@VA_router:~# va_config.sh next
```

To set the configuration to run after the next reboot, enter:

```
root@VA_router:~# va_config.sh -s [factconf|config1|config2|altconfig]
```

7.6. Configuration File Syntax

The configuration files consist of sections – or packages - that contain one or more config statements. These optional statements define actual values.

Below is an example of a simple configuration file.

```
package 'example'

config 'example' 'test'

option 'string' 'some value'

option 'boolean' '1'

list 'collection' 'first item'

list 'collection' 'second item'
```

The config 'example' 'test' statement defines the start of a section with the type example and the name test.

Command	Target	Description
export	[<config>]	Exports the configuration in a machine readable format. It is used internally to evaluate configuration files as shell scripts.
import	[<config>]	Imports configuration files in UCI syntax.
add	<config> <section-type>	Adds an anonymous section of type-section type to the given configuration.
add_list	<config>.<section>.<option>=<string>	Adds the given string to an existing list option.
show	[<config>[.<section>[.<option>]]]	Shows the given option, section or configuration in compressed notation.
get	<config>.<section>[.<option>]	Gets the value of the given option or the type of the given section.
Set	<config>.<section>[.<option>]=<value>	Sets the value of the given option, or adds a new section with the type set to the given value.
delete	<config>[.<section>[.<option>]]	Deletes the given section or option.

Managing Sets of Configuration Files using Directory Manipulation

Configurations can also be managed using directory manipulation. To remove the contents of the current folder, enter:

```
root@VA_router:/etc/config1# rm -f *
```



WARNING

The above command makes irreversible changes

To remove the contents of a specific folder regardless of the current folder (config2), enter:

```
root@VA_router:/ # rm -f /etc/config1/*
```



WARNING

The above command makes irreversible changes

To copy the contents of one folder into another (config2 into config1), enter:

```
root@VA_router:/etc/config1# cp /etc/config2/* /etc/config1
```

7.7. Exporting A Configuration File

If you have software versions prior to 72.002, go to 'Exporting a configuration file using the web interface for software versions prior to 72.002'

If you have software version 72.002 or above, go to 'Exporting a configuration file using the web interface for software versions 72.002 and above.'

To export a configuration file using UCI, for any software version, go to 'Exporting a configuration file using UCI.'

7.7.1. Exporting A Configuration File Using The Web Interface For Software Versions Pre- 72.002

The current running configuration file may be exported using the web interface.

In the top menu, select **System -> Backup/Flash Firmware**. The Flash operations page appears.



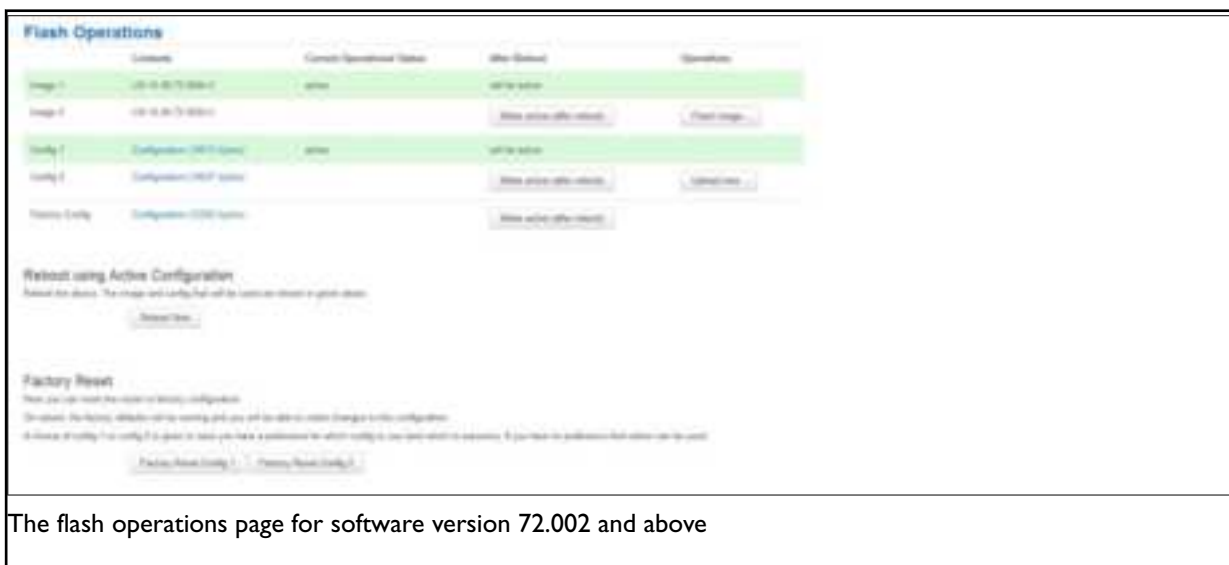
The flash operations page

In the Backup/Restore section, select **Generate Archive**.

7.7.2. Exporting A Configuration File Using The Web Interface For Software Version 72.002 And Above

The current running configuration file may be exported using the web interface.

In the top menu, select **System -> Flash Operations**. The Flash operations page appears.



The flash operations page for software version 72.002 and above

In the **Flash Operation** section, click the configuration file in the Contents column to download it.

7.7.3. Exporting A Configuration File Using UCI

You can view any configuration file segment using UCI. To export the running configuration file, enter:

```
root@VA_router:~# uci export
```

To export the factory configuration file, enter:

```
root@VA_router:~# uci -c /etc/factconf/ export
```

To export config1 or config2 configuration file, enter:

```
root@VA_router:~# uci -c /etc/config1/ export
```

```
root@VA_router:~# uci -c /etc/config2/ export
```

7.8. Importing A Configuration File

If you have software versions prior to 72.002, go to section 'Importing a configuration file using the web interface for software versions pre-72.002

If you have software version 72.002 or above, go to section 'Importing a configuration file using the web interface for software version 72.002 and above.

To import a configuration file using UCI, for any software version, go to section 'Importing a configuration file using UCI.

7.8.1. Importing A Configuration File Using The Web Interface For Software Versions Pre- 72.002

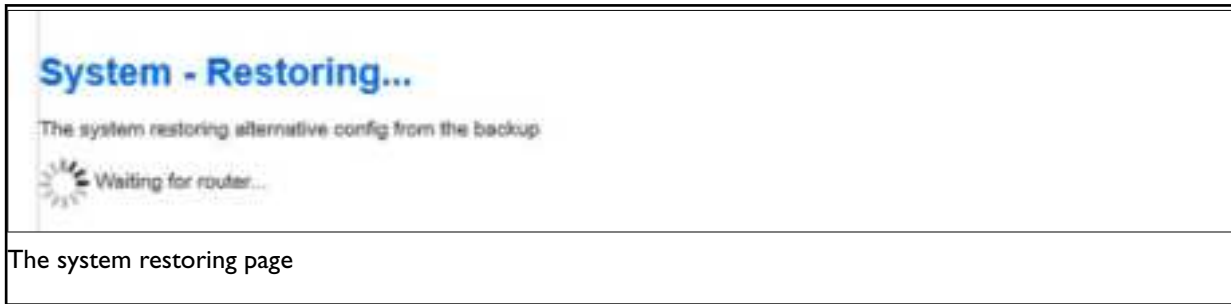
You can import a configuration file to the alternate configuration segment using the web interface. This will automatically reboot the router into this configuration file.

In the top menu, select **System -> Backup/Flash Firmware**. The Flash operations page appears.



The flash operations page

Under Backup/Restore, choose **Restore Backup: Choose file**. Select the appropriate file and then click **Upload archive**.

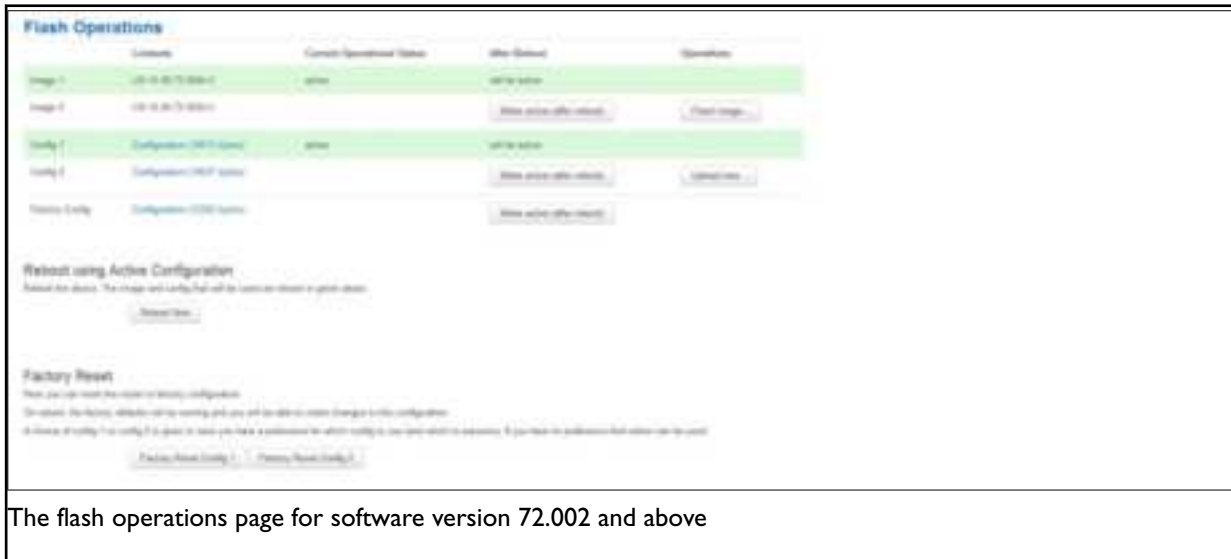


When the 'waiting for router' icon disappears, the upgrade is complete, and the login homepage appears.

7.8.2. Importing A Configuration File Using The Web Interface For Software Version 72.002 And Above

You can import a configuration file to the alternate configuration segment using the web interface.

In the top menu, select **System -> Flash Operations**. The Flash operations page appears.



In the Operations column, click **Upload new**. Select the appropriate file.

Flash Operations

Imported uploaded file to config2

	Contents	Flash Operations/ Status	After Reboot	Operations
Image 1	2018-01-01 10:00:00		Make active after reboot	Flash image
Image 2	2018-01-01 10:00:00	active	active active	
Config 1	Configuration (2018-01-01)	active	active active	
Config 2	Configuration (2018-01-01)		Make active after reboot	Upload file
Factory Config	Configuration (2018-01-01)		Make active after reboot	

Reboot using Active Configuration
Reboot the device. The image will verify that all the used the device is given above.
Reboot Now

Factory Reset
Make you can reset the router to factory configuration.
(Warning): The factory defaults will be restored and you will be able to make changes to the configuration.
It shows all config 1 or config 2 is given to user (you have a preference for which config to use, you will be given). If you have no preference then either will be good.
Factory Reset Config 1 Factory Reset Config 2

The flash operations succeed upload configuration page

If you select 'Flash image and do not reboot', the router will only run this configuration if you click **OK** to return to the Flash Operations page. There you can manually select **Made Active (after reboot)**. Then click **Reboot Now** in the 'Reboot using Active Configuration' section.

7.8.3. Importing A Configuration File Using UCI

You can import a configuration file to any file segment using UCI. To import to config1, enter:

```
root@VA_router:~# uci -c /etc/config/1/ import
<paste in config file>
<CTRL-D>
```


NOTE

It is very important that the config file is in the correct format otherwise it will not import correctly.

8. Using The Command Line Interface

This chapter explains how to view the router log files and edit configuration files using a Command Line Interface (CLI) and the Unified Configuration Interface (UCI) system. Some commands may vary between router models.

8.1. Overview Of Some Common Commands

The router has an SSH server typically running on port 22.

The factconf default password for the root user is **admin**. To change the factconf default password, enter:

```
root@VA_router:/# uci set system.main.password='*****'  
root@VA_router:/# uci commit system
```

To reboot the system, enter:

```
root@VA_router:/# reboot
```

The system provides a Unix-like command line. Common Unix commands are available such as ls, cd, cat, top, grep, tail, head, more and less.

Typical pipe and redirect operators are also available, such as: >, >>, <, |

The system log can be viewed using any of the following commands:

```
root@VA_router:/# logread  
root@VA_router:/# logread | tail  
root@VA_router:/# logread -f
```

These commands will show the full log, end of the log (tail) and continuously (-f). Enter

Ctrl-C to stop the continuous output from logread -f.

To view and edit configuration files, the system uses the Unified Configuration Interface (UCI) which is described further on in this chapter. This is the preferred method of editing configuration files. However, you can also view and edit these files using some of the standard Unix tools.

For example, to view a text or configuration file in the system, enter:

```
root@VA_router:/# cat /etc/passwd
```

The command output information shows the following, or similar output.

```
root:x:0:0:root:/root:/bin/ash
daemon:*:1:1:daemon:/var:/bin/false
ftp:*:55:55:ftp:/home/ftp:/bin/false
sftp:*:56:56:sftp:/var:/usr/lib/sftp-server
network:*:101:101:network:/var:/bin/false
nobody:*:65534:65534:nobody:/var:/bin/false
```

To view files in the current folder, enter:

```
root@VA_router:/# ls
bin etc lib opt sbin usr
bkrepos home linuxrc proc sys var
dev init mnt root tmp www
```

For more details add the **-l** argument:

```
root@VA_router:/# ls -l
drwxrwxr-x 2 root root 642 Jul 16 2012 bin
drwxr-xr-x 5 root root 1020 Jul 4 01:27 dev
drwxrwxr-x 1 root root 0 Jul 3 18:41 etc
drwxr-xr-x 1 root root 0 Jul 9 2012 lib
drwxr-xr-x 2 root root 3 Jul 16 2012 mnt
drwxr-xr-x 7 root root 0 Jan 1 1970 overlay
dr-xr-xr-x 58 root root 0 Jan 1 1970 proc
drwxr-xr-x 16 root root 223 Jul 16 2012 rom
drwxr-xr-x 1 root root 0 Jul 3 22:53 root
drwxrwxr-x 2 root root 612 Jul 16 2012 sbin
drwxr-xr-x 11 root root 0 Jan 1 1970 sys
drwxrwxrwt 10 root root 300 Jul 4 01:27 tmp
drwxr-xr-x 1 root root 0 Jul 3 11:37 usr
lrwxrwxrwx 1 root root 4 Jul 16 2012 var -> /tmp
drwxr-xr-x 4 root root 67 Jul 16 2012 www
```

To change the current folder, enter **cd** followed by the desired path:

```
root@VA_router:/# cd /etc/config1
root@VA_router:/etc/config1#
```



NOTE

If the specified directory is actually a link to a directory, the real directory will be shown in the prompt.

To view scheduled jobs, enter:

```
root@VA_router:/# crontab -l

0 * * * * slupload 00FF5FF92752 TFTP 1 172.16.250.100 69
```

To view currently running processes, enter:

```
root@VA_router:/# ps
```

PID	Uid	Vmsize	stat	Command
1	root	356	S	init
2	root	-	DW	[keventd]
3	root	-	RWN	[ksoftirqd_CPU0]
4	root	-	SW	[kswapd]
5	root	-	SW	[bdflush]
6	root	-	SW	[kupdated]
8	root	-	SW	[mtdblockd]
89	root	344	S	logger -s -p 6 -t
92	root	356	S	init
93	root	348	S	syslogd -C 16
94	root	300	S	klogd
424	root	320	S	wifi up
549	root	364	S	httpd -p 80 -h /www -r VA_router
563	root	336	S	crond -c /etc/crontabs
6712	root	392	S	/usr/sbin/dropbear
6824	root	588	S	/usr/sbin/dropbear
7296	root	444	S	-ash
374	root	344	R	ps ax
375	root	400	S	/bin/sh /sbin/hotplug button
384	root	396	R	/bin/sh /sbin/hotplug button
385	root	-	RW	[keventd]

To search for a process, enter: `pgrep -fl '<process name or part of name>'`:

```
root@VA_router:/# pgrep -fl 'wifi'

424 root 320 S wifi up
```

To kill a process, enter the PID:

```
root@VA_router:~# kill 424
```

8.2. Using Unified Configuration Interface (UCI)

The system uses Unified Configuration Interface (UCI) for central configuration management. Most common and useful configuration settings can be accessed and configured using the UCI system.

UCI consists of a Command Line Utility (CLI), the files containing the actual configuration data, and scripts that take the configuration data and apply it to the proper parts of the system, such as the networking interfaces. Entering the command 'uci' on its own will display the list of valid arguments for the command and their format.

```
root@VA_router:/lib/config# uci
```

Usage: uci [<options>] <command> [<arguments>]

Commands:

```

export [<config>]

import [<config>] changes [<config>] commit [<config>]

add <config> <section-type>

add_list <config>.<section>.<option>=<string> show [<config>[.<section>[.<option>]]] get <config>.<section>[.<option>]

set <config>.<section>[.<option>]=<value> delete <config>[.<section>[.<option>]]

rename <config>.<section>[.<option>]=<name> revert <config>[.<section>[.<option>]] Options:

-c <path> set the search path for config files (default: /etc/config)

-d <str> set the delimiter for list values in uci show

-f <file> use <file> as input instead of stdin

-m when importing, merge data into an existing package

-n name unnamed sections on export (default)

-N don't name unnamed sections

-p <path> add a search path for config change files

-P <path> add a search path for config change files and use as default

-q quiet mode (don't print error messages)

-s force strict mode (stop on parser errors, default)

-S disable strict mode

-X do not use extended syntax on 'show'

```

The table below describes commands for the UCI command line and some further examples of how to use this utility.

Command	Target	Description
commit	[<config>]	Writes changes of the given configuration file, or if none is given, all configuration files, to the filesystem. All "uci set", "uci add", "uci rename" and "uci delete" commands are staged into a temporary location and written to flash at once with "uci commit". This is not needed after editing configuration files with a text editor; but for scripts, GUIs and other programs working directly with UCI files.
export	[<config>]	Exports the configuration in a UCI syntax and does validation.
import	[<config>]	Imports configuration files in UCI syntax.
changes	[<config>]	Lists staged changes to the given configuration file or if none given, all configuration files.
add	<config> <section-type>	Adds an anonymous section of type section- type to the given configuration.
add_list	<config>.<section>.<option>=<string>	Adds the given string to an existing list option.
show	[<config>[.<section>[.<option>]]]	Shows the given option, section or configuration in compressed notation.
get	<config>.<section>[.<option>]	Gets the value of the given option or the type of the given section.
set	<config>.<section>[.<option>]=<value>	Sets the value of the given option, or add a new section with the type set to the given value.
delete	<config>[.<section>[.<option>]]	Deletes the given section or option.
rename	<config>.<section>[.<option>]=<name>	Renames the given option or section to the given name.
revert	<config>[.<section>[.<option>]]	Deletes staged changes to the given option, section or configuration file.



NOTE

All operations do not act directly on the configuration files. A commit command is required after you have finished your configuration.

```
root@VA_router:~# uci commit
```

Using uci commit to avoid router reboot

After changing the port, uhttpd listens on from 80 to 8080 in the file `/etc/config/uhttpd`; save it, then enter:

```
root@VA_router:~# uci commit uhttpd
```

Then enter:

```
root@VA_router:~# /etc/init.d/uhttpd restart
```

For this example, the router does not need to reboot as the changes take effect when the specified process is restarted.

8.3. Export A Configuration

Using the `uci export` command it is possible to view the entire configuration of the router or a specific package. Using this method to view configurations does not show comments that are present in the configuration file:

```
root@VA_router:~# uci export httpd  
  
package 'httpd'  
  
config 'httpd'  
  
option 'port' '80'  
  
option 'home' '/www'
```

8.4. Show A Configuration Tree

The configuration tree format displays the full path to each option. This path can then be used to edit a specific option using the `uci set` command.

To show the configuration 'tree' for a given config, enter:

```
root@VA_router:/# uci show network
network.loopback=interface
network.loopback.ifname=lo
network.loopback.proto=static
network.loopback.ipaddr=127.0.0.1
network.loopback.netmask=255.0.0.0
network.lan=interface
network.lan.ifname=eth0
network.lan.proto=dhcp
network.wan=interface
network.wan.username=foo
network.wan.password=bar
network.wan.proto=3g
network.wan.device=/dev/ttyACM0
network.wan.service=umts
network.wan.auto=0
network.wan.apn=arkessa.com
network.@va_switch[0]=va_switch
network.@va_switch[0].eth0=A B C
network.@va_switch[0].eth1=D
```

It is also possible to display a limited subset of a configuration:

```
root@VA_router:/# uci show network.wan
network.wan=interface
network.wan.username=foo
network.wan.password=bar
network.wan.proto=3g
network.wan.device=/dev/ttyACM0
network.wan.service=umts
network.wan.auto=0
network.wan.apn=hs.vodafone.ie
```

8.5. Display Just The Value Of An Option

To display a specific value of an individual option within a package, enter:

```
root@VA_router:~# uci get httpd.@httpd[0].port
80
root@VA_router:~#
```

8.6. High Level Image Commands

To show the image running currently, enter:

```
root@VA_router:~# vacmd show current image
```

To set the image to run on next reboot, enter:

```
root@VA_router:~# vacmd set next image [image1|image2|altimage]
```

```
root@VA_router:~# reboot
```

8.7. Format Of Multiple Rules

When there are multiple rules next to each other, UCI uses array-like references for them. For example, if there are 8 NTP servers, UCI will let you reference their sections as `timeserver.@timeserver[0]` for the first section; or `timeserver.@timeserver[7]` for the last section.

You can also use negative indexes, such as `timeserver.@timeserver[-1]` '-1' means the last one, and '-2' means the second-to-last one. This is useful when appending new rules to the end of a list.

```
root@VA_router:/# uci show va_eventd

va_eventd.main=va_eventd
va_eventd.main.enabled=yes
va_eventd.main.event_queue_file=/tmp/event_buffer
va_eventd.main.event_queue_size=128K
va_eventd.@conn_tester[0]=conn_tester
va_eventd.@conn_tester[0].name=Pinger
va_eventd.@conn_tester[0].enabled=yes
va_eventd.@conn_tester[0].type=ping
va_eventd.@conn_tester[0].ping_dest_addr=192.168.250.100
va_eventd.@conn_tester[0].ping_success_duration_sec=5
va_eventd.@target[0]=target
va_eventd.@target[0].name=MonitorSyslog
va_eventd.@target[0].enabled=yes
va_eventd.@target[0].type=syslog
va_eventd.@target[0].target_addr=192.168.250.100
va_eventd.@target[0].conn_tester=Pinger
va_eventd.@target[0].suppress_duplicate_forwardings=no
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=yes
va_eventd.@forwarding[0].className=ethernet
va_eventd.@forwarding[0].target=MonitorSyslog
va_eventd.@forwarding[1]=forwarding
va_eventd.@forwarding[1].enabled=yes
va_eventd.@forwarding[1].className=auth
va_eventd.@forwarding[1].target=MonitorSyslog
va_eventd.@forwarding[2]=forwarding
va_eventd.@forwarding[2].enabled=yes
va_eventd.@forwarding[2].className=adsl
va_eventd.@forwarding[2].target=MonitorSyslog
va_eventd.@forwarding[3]=forwarding
va_eventd.@forwarding[3].enabled=yes
va_eventd.@forwarding[3].className=ppp
va_eventd.@forwarding[3].target=MonitorSyslog
```

8.8. Configuration Files

The table below lists common package configuration files that can be edited using uci commands. Other configuration files may also be present depending on the specific options available on the router.

File	Description
Management	
/etc/config/autoload	Boot up Activation behaviour (typically used in factconf)
/etc/config/httpclient	Activator addresses and urls
/etc/config/monitor	Monitor details
Basic	
/etc/config/dropbear	SSH server options
/etc/config/dhcp	Dnsmasq configuration and DHCP settings
/etc/config/firewall	NAT, packet filter, port forwarding, etc.
/etc/config/network	Switch, interface, L2TP and route configuration
/etc/config/system	Misc. system settings including syslog
Other	
/etc/config/snmpd	SNMPd settings
/etc/config/uhttpd	Web server options (uHTTPd)
/etc/config/strongswan	IPSec settings

8.9. Configuration File Syntax

The configuration files usually consist of one or more config statements, so-called sections with one or more option statements defining the actual values.

Below is an example of a simple configuration file.

```
package 'example'

config 'example' 'test'

option 'string' 'some value'

option 'boolean' '1'

list 'collection' 'first item'

list 'collection' 'second item'
```

The config 'example' 'test' statement defines the start of a section with the type example and the name test. There can also be so-called anonymous sections with only a type, but no name identifier. The type is important for the processing programs to decide how to treat the enclosed options.

The option 'string' 'some value' and option 'boolean' '1' lines define simple values within the section.



NOTE

There are no syntactical differences between text and boolean options. Per convention, boolean options may have one of the values '0', 'no', 'off' or 'false' to specify a false value or '1', 'yes', 'on' or 'true' to specify a true value.

In the lines starting with a list keyword, an option with multiple values is defined. All list statements that share the same name collection in our example will be combined into a single list of values with the same order as in the configuration file.

The indentation of the option and list statements is a convention to improve the readability of the configuration file but it is not syntactically required.

Usually you do not need to enclose identifiers or values in quotes. Quotes are only required if the enclosed value contains spaces or tabs. Also it is legal to use double-quotes instead of single-quotes when typing configuration options.

All of the examples below are valid syntax.

```
option example value
option 'example' value
option example "value"
option "example" 'value'
option 'example' "value"
```

In contrast, the following examples are not valid syntax.

```
option 'example' "value'
```

Quotes are unbalanced.

```
option example some value with space
```

Missing quotes around the value.

It is important to note that identifiers and config file names may only contain the characters a-z, A-Z, 0-9 and `_`. However, option values may contain any character, as long they are properly quoted.

9. Upgrading Router Firmware

This chapter describes how to upgrade router firmware. The upgrade process is as follows:

- Firmware is transferred to the device.
- Firmware is checked to ensure there are no corruptions.
- Firmware is saved to persistent storage.
- Data in persistent storage is validated.

To avoid any unrecoverable errors during the process, you must follow several safety steps described in this chapter.

On successful completion of the process, you can restart the device running the new firmware.

9.1. Software Versions

If you have software versions prior to 72.002, go to 'Upgrading router firmware for software versions pre-72.002'.

If you have software version 72.002 or above, go to 'Upgrading router firmware for software versions 72.002 and above'.

To upgrade firmware using CLI, for any software version, go to 'Upgrading firmware using CLI'.

9.2. Identify Your Software Version

To check which software version your router is running, in the top menu, browse to **Status -> Overview**

Status

System

Router Name	GW0000
Router Model	Virtual Access GW0001WF-AA0179E
Firmware Version	VSE-18.05.55
Current Image/Config	image2 / config2
Kernel Version	3.2.12
Local Time	Fri Aug 3 11:43:52 2018
Uptime	5h 10m 4s
Load Average	0.27, 0.35, 0.31

The status page showing a software version prior to 72.002

Status

System

Router Name	
Router Model	
Firmware Version	V7E-76.00.06
Current Image/Config	image0 / config2
Kernel Version	3.2.12
Local Time	Fri Aug 5 11:43:52 20
Uptime	5h 10m 3s
Load Average	0.27, 0.33, 0.31

The status page showing software version 72.002

In the Firmware Version row, the first two digits of the firmware version identify the hardware platform, for example LIS-15; while the remaining digits: .00.72.002, show the software version.

9.3. Upgrading Router Firmware For Software Version 72.002 And Above

Copy the new firmware issued by Westermo to a PC connected to the router.

Flash Operations

Contents	Current Operational Status	After Reload	Operations
Image 1 LIS-15-40-75-0000-0	active	active	
Image 2 LIS-15-40-75-0000-0		active when after reload	Flash Image
Config 1 Configuration: 00-00-00-00-00-00	active	active	
Config 2 Configuration: 00-00-00-00-00-00		active when after reload	Upload Config
Factory Config Configuration: 00-00-00-00-00-00		active when after reload	

Reboot using Active Configuration

Reboot the device. The image and config that will be active are shown in green above.

Reboot Now

Factory Reset

When you click reset the router will return to factory configuration.

On reboot, the device will return to the factory default state and will be able to return to the configuration.

It is recommended to backup the configuration before resetting the device. If you have the configuration file, you can upload it after the reset.

Factory Reset Config 1

Factory Reset Config 2

The flash operations page

In the top menu, select **System tab -> Flash operations**. The Flash operations page appears.

Under Flash Operations, click **Flash Image**. Only the inactive image is available to flash. Select the appropriate image and then wait until image has loaded.



NOTE

This process may take a while depending on the available connection speed. When the image has loaded, the Update Firmware page appears.



Click either: **Flash image and do not reboot**, or **Flash image and reboot using new image immediately**. The 'Firmware update is being applied' message appears.

When the firmware update is complete, the Update Firmware page appears. There are various messages, depending on which option you selected, or if any corruptions have occurred.

9.4. Upgrading Router Firmware For Software Versions Pre-72.002

Copy the new firmware issued by Westermo to a PC connected to the router.

In the top menu, select **System tab -> Backup/Flash Firmware**. The Flash operations page appears.



Under Flash new firmware image, click **Choose File** or **Browse**.



NOTE

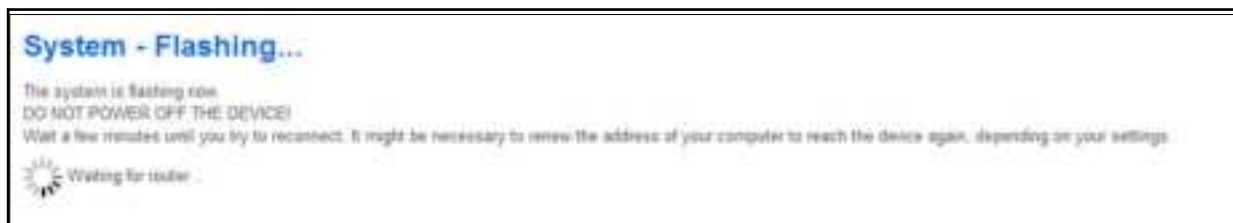
The button will vary depending on the browser you are using.

Select the appropriate image and then click **Flash Image**. The Flash Firmware – Verify page appears.



The flash firmware - verify page

Click **Proceed**. The System – Flashing page appears.



The system flashing page

When the 'waiting for router' icon disappears, the upgrade is complete, and the login homepage appears.

To verify that the router has been upgraded successfully, click **Status** in the top menu. The Firmware Version shows in the system list.



The system status list page

9.5. Flash Image And Do Not Reboot Option

Update Firmware

The flash image was uploaded.

Click on the "Flash Image" button below to start the flash procedure.

[a 100% download of the flash image](#)
[a 100% download of the flash image](#)

L15-16.00.72.002rc1

Firmware update is being applied. Do not power cycle the device or leave this page.
Progress can be monitored below.

Ready for imaging	Checked
Image file is valid	100%
Ready to flash image	Checked

Firmware update is complete

The updated firmware has been applied to the device.

The update will only run the firmware P-4 firmware. "Flash Image" in the flash operations page.

Click on the "Flash" button in the flash operations page.

The firmware update page after 'do not reboot' option selected

If you select 'Flash image and do not reboot', the router will only run the firmware if you click **OK** to return to the Flash Operations page. There you can manually select **Made Active (after reboot)**. Then click **Reboot Now** in the 'Reboot using Active Configuration' section.

9.6. Update Flash Image And Reboot Using New Image Immediately Option

Update Firmware

The flash image was uploaded.
Click and write "Flash Image" button below to start the flash procedure.

• [Firmware Download](#) [Firmware Upload](#)
• [FAQ](#) • [Contact Us](#) • [Privacy Policy](#)

LIS-16.00.72.002rc1

Firmware update is being applied. Do not power cycle the device or leave this page.
Progress can be monitored below.

Ready for imaging:	Checked	
Write file to flash:		
Verify flash integrity:	Checked	

Firmware update is complete

The updated firmware has been applied to memory.
The system will reboot the firmware P-01 hardware. "Flash finished" in the flash operation page.

Click OK to return to the flash operation page.

[OK](#)

The firmware update page after 'update flash image an reboot' option selected

If you select 'Update flash image and reboot using new image immediately' and the overall validation and flashing process has succeeded, the router will reboot immediately. To regain access to the router you must login again. If any part of the processes encounters an error the reboot does **not** occur and a report is given.

9.7. Possible File Corruption



The firmware update failure page

In the unfortunate event that the firmware upgrade fails, the 'Failed verification File is most likely corrupt' or similar message will appear in the Verify file integrity row. No changes will be made to the system and the general message **File verification failed** appears.

9.8. Verify The Firmware Has Been Upgraded Successfully

To check the firmware version, in the top menu, browse to **System -> Flash Operations**, or after router reboots, in the top menu, click **Status**. The Firmware Version shows in the system list and also in the right top corner of the menu bar.



The system status list showing current firmware version

9.9. Upgrading Firmware Using CLI

Transfer File to Router

To upgrade firmware using CLI, you will need a TFTP server on a connected PC or SCP available.

Open up an SSH session to the router.

Enter in the relevant username and password.

To access the temp folder, enter **cd /tmp**

The output shows the available application:

TFTP using curl

Enter the following command:

```
curl tftp://x.x.x.x/LIS-15.00.72.002.image -o /tmp/LIS-15.00.72.002.image
```

where x.x.x.x is the IP of your PC, **-o** is local file name to store.

SCP

Secure Copy (SCP) is a part of Secure Shell (SSH) and enables file transfers to the router using authentication and encryption. It is different to TFTP, which uses UDP, while SCP uses a TCP connection. On Unix machines, SCP is a standard part of the system; on Windows it requires an additional application. The usage example below is for a Unix machine and therefore assumes the image file is in the current folder.

```
scp LIS-15.00.72.002.image root@x.x.x.x:/tmp/LIS-15.00.72.002.image
```

Where the first argument 'LIS-15.00.72.002.image' in SCP is the source and the second argument 'tmp/LIS-15.00.72.002.image' is the destination path, enter root as the username to connect to x.x.x.x IP address. After you execute the above command you will be asked to provide a root password. At this stage the output shows the process of copying the software file into destination directory.

```
root@192.168.100.1's password:
LIS-15.00.72.000.image    100% 6812KB  2.2MB/s 00:03
```

9.9.1. Flashing

When downloaded firmware verification succeeds, the new image can be written to flash. To write the image into the alternative image, enter:

```
mtm write LIS-15.00.72.002.image altimage
```



NOTE

This is an example, substitute the correct file name.

9.9.2. Flash Verification After Flashing

After the write process has finished, you must complete a post verification of the firmware.

To verify the checksum of downloaded firmware, enter:

```
va_image_csum.sh /tmp/LIS-15.00.72.002.image
```

The checksum of the downloaded binary is shown:

```
08761cd03e33c569873bcc24cf2b7389 7006920 LIS-15.00.72.002 This MD5
```

To verify the checksum of written firmware, enter:

```
va_image_csum.sh alt
```

After a while the checksum will be calculated:

```
Calculating checksum.....
```

```
08761cd03e33c569873bcc24cf2b7389 7006920 LIS-15.00.72.002 This MD5
```

Verify and compare the checksum with the MD5 sum of the downloaded image.

If the checksum of the written firmware in altimage matches the one from the downloaded image in /tmp, the new firmware has been programmed successfully.

9.9.3. Set Up An Alternative Image

Provided the programming has succeeded, you can set it as the next image to use after reboot; enter:

```
vacmd set next image altimage
```

To reboot using the new firmware, enter:

```
reboot
```

10. System Settings

The system section contains settings that apply to the most basic operation of the system, such as the host name, time zone, logging details, NTP server, language and style.

The host name appears in the top left-hand corner of the interface menu bar. It also appears when you open a Telnet or SSH session.

Note: this document shows no host name in screen shots. Throughout the document we use the host name 'VA_router'.

The system configuration contains a logging section for the configuration of a syslog client.

10.1. Syslog Overview

Most syslog settings appear in the main System Configuration page.

Syslog messages have a timestamp, source facility, priority, and message section. Often the message section begins with an optional tag identifying the usermode program name and process ID responsible for the message.

Messages can be stored locally and also forwarded remotely. Separate filter options apply to each case. At a broad level, you can set the minimum severity level for local and remote targets; only messages with a priority more severe than the configured level will be recorded.

Kernel messages are recorded separately in their own buffer. However, for convenience, these are copied to the system log automatically so that a unified system log is available.

In addition, you can also define filter rules to determine how particular log messages are handled. For example, you may decide that certain debug messages are directed into their own log file, to avoid cluttering up the main system log, and to save bandwidth if delivering to a remote syslog server. You can define filters to be applied to local and remote targets, or both. A filter matches specific log messages and then determines an action for them.

Configuration Package Used

Package	Sections
System	main
	syslog_filter
	timeserver
luci	main

10.2. Configuring System Properties

To set your system properties, select **System -> System**. There are five sections in the System page.

Section	Description
General settings	Configure host name, local time and time zone.
Logging	Configure a router to log to a server. You can configure a syslog client in this section.
Language and style	Configure the router's web language and style.
Time synchronization	Configure the NTP server in this section.
Audit configuration	Configures auditing of configuration changes and shell execution.

10.2.1. General Settings



General settings in system properties

Web Field/UCI/Package Option	Description
Web: Local Time	Sets the local time and syncs with browser. You can manually configure on CLI, using: date -s YYYY.MM.DD-hh:mm:ss
Web: hostname UCI: system.main.hostname Opt: hostname	Specifies the hostname for this system.
Web: Timezone UCI: system.main.timezone Opt: timezone	Specifies the time zone that the date and time should be rendered in by default.
Web: n/a UCI: system.main.timezone Opt: time_save_interval_min	Defines the interval in minutes to store the local time for use on next reboot.

10.2.2. Logging

System Properties

General Settings

Logging

Language and Style

Log Storage

File

System log buffer size

4096

edit

System log buffer size for RUM

64

edit

External system log server

10.0.0.0

External system log server port

414

External system backup log server

10.0.0.0

External system backup log server port

414

Log file location

root\syslog messages

Rotated log file to keep

3

Max Age of rotated log file

0

Reset

Custom log hostname

Log output level

Info

edit

Remote log output level

Debug

edit

The logging section in system properties

Web Field/UCI/Package Option	Description									
Web: Log storage UCI: system.main.log_type Opt: log_type	Defines the system log storage type. Messages stored in RAM can be seen using logread. Note: system log stored in RAM will be lost on reboot. <table><tr><th>Web value</th><th>Description</th><th>UCI</th></tr><tr><td>RAM</td><td>Store system log in RAM. Lost on reboot. Viewed using logread.</td><td>circular</td></tr><tr><td>File</td><td>Store system log in flash. Maintained through reboot. Viewed using cat/log</td><td>file</td></tr></table>	Web value	Description	UCI	RAM	Store system log in RAM. Lost on reboot. Viewed using logread.	circular	File	Store system log in flash. Maintained through reboot. Viewed using cat/log	file
Web value	Description	UCI								
RAM	Store system log in RAM. Lost on reboot. Viewed using logread.	circular								
File	Store system log in flash. Maintained through reboot. Viewed using cat/log	file								
Web: System log buffer size UCI: system.main.log_size Opt: log_size	File log buffer size in KB. Note: when the file reaches the configured size it is copied to the archive file (log_file_name.0). <table><tr><td>Range</td><td></td></tr><tr><td>16</td><td>16KB</td></tr></table>	Range		16	16KB					
Range										
16	16KB									
Web: System log buffer size for RAM UCI: system.main.log_size_ram Opt: log_size_ram	RAM log buffer size in KB. <table><tr><td>Range</td><td></td></tr><tr><td>16</td><td>16K</td></tr></table>	Range		16	16K					
Range										
16	16K									
Web: External system log server UCI: system.main.log_ip Opt: log_ip	External syslog server IP address. If defined, syslog messages will be sent in addition to local storage.									
Web: External system log server port UCI: system.main.log_port Opt: log_port	External syslog server port number. <table><tr><td>Range</td><td></td></tr><tr><td>514</td><td></td></tr></table>	Range		514						
Range										
514										
Web: External system backup log server UCI: system.main.log_ip_backup Opt: log_ip_backup	Backup external syslog server IP address. If defined, syslog messages will be sent here in addition to the main log server. <table><tr><td>Range</td><td>IP or FQDN</td></tr><tr><td>0.0.0.0</td><td></td></tr></table>	Range	IP or FQDN	0.0.0.0						
Range	IP or FQDN									
0.0.0.0										
Web: External system backup log server port UCI: system.main.log_port_backup Opt: log_port_backup	External syslog server port number for use with backup server <table><tr><td>Range</td><td></td></tr><tr><td>51</td><td></td></tr></table>	Range		51						
Range										
51										
Web: Log file location UCI: system.main.log_file Opt: log_file	Defines the file path for log storage when log storage is set to 'file'. Note: when the file reaches the configured size it is copied to the archive file (log_file_name.0). Set to: root/syslog.messages <table><tr><td>Range</td><td></td></tr><tr><td>/root/syslog</td><td></td></tr></table>	Range		/root/syslog						
Range										
/root/syslog										
Web: Rotated log files to keep UCI: system.main.log_file_count Opt: log_file_count	Defines the file number of archive files for storage in flash when Log Storage is set to 'file'. When the system log file reaches the configured size it is copied to the archive file (log_file_name.0). Existing archive files are copied to log_file_name.(x+1). <table><tr><td>Range</td><td></td></tr></table>	Range								
Range										

Web Field/UCI/Package Option	Description																											
	<table><tr><td>1</td><td>Store 1 archive log file in flash</td></tr></table>	1	Store 1 archive log file in flash																									
1	Store 1 archive log file in flash																											
Web: Max Age of rotated log files UCI: system.main.log_age Opt: log_age	Defines the maximum duration in hours before archive syslog files are deleted. Set to 0 to define no age limit. <table><tr><td>Range</td><td></td></tr><tr><td>0</td><td>No age limit</td></tr></table>	Range		0	No age limit																							
Range																												
0	No age limit																											
Web: Custom log hostname UCI: system.main.log_hostname Opt: log_hostname	Defines a custom host name for syslog messages. Magic values %hostname (system hostname), %ser (serial), and%mon (Monitor dev_reference) are also recognised. <table><tr><td>Range</td><td></td></tr><tr><td>Empty</td><td>User router hostname for syslog messages.</td></tr></table>	Range		Empty	User router hostname for syslog messages.																							
Range																												
Empty	User router hostname for syslog messages.																											
Web: Log output level UCI: system.main.conloglevel Opt: conloglevel	Sets the maximum log output level severity for system events. System events are written to the system log. Messages with a lower level or level equal to the configured level are displayed on the console using the logread command, or alternatively written to a flash file, if configured to do so. <table><tr><th>Web value</th><th>Description</th><th>UCI</th></tr><tr><td>Debug</td><td>Information useful to developers for debugging the application</td><td>8</td></tr><tr><td>Info</td><td>Normal operational messages that require no action</td><td>7</td></tr><tr><td>Notice</td><td>Events that are unusual, but not error conditions</td><td>6</td></tr><tr><td>Warning</td><td>May indicate that an error will occur if action is not taken</td><td>5</td></tr><tr><td>Error</td><td>Error conditions</td><td>4</td></tr><tr><td>Critical</td><td>Critical conditions</td><td>3</td></tr><tr><td>Alert</td><td>Should be addressed immediately</td><td>2</td></tr><tr><td>Emergency</td><td>System is unusable</td><td>1</td></tr></table>	Web value	Description	UCI	Debug	Information useful to developers for debugging the application	8	Info	Normal operational messages that require no action	7	Notice	Events that are unusual, but not error conditions	6	Warning	May indicate that an error will occur if action is not taken	5	Error	Error conditions	4	Critical	Critical conditions	3	Alert	Should be addressed immediately	2	Emergency	System is unusable	1
Web value	Description	UCI																										
Debug	Information useful to developers for debugging the application	8																										
Info	Normal operational messages that require no action	7																										
Notice	Events that are unusual, but not error conditions	6																										
Warning	May indicate that an error will occur if action is not taken	5																										
Error	Error conditions	4																										
Critical	Critical conditions	3																										
Alert	Should be addressed immediately	2																										
Emergency	System is unusable	1																										
Web: Remote log output level UCI: system.main. remoteloglevel Opt: remoteloglevel	Sets the maximum log output level severity for system events sent to remote syslog server. <table><tr><th>Web value</th><th>Description</th><th>UCI</th></tr><tr><td>Debug</td><td>Information useful to developers for debugging the application</td><td>8</td></tr><tr><td>Info</td><td>Normal operational messages that require no action</td><td>7</td></tr><tr><td>Notice</td><td>Events that are unusual, but not error conditions</td><td>6</td></tr><tr><td>Warning</td><td>May indicate that an error will occur if action is not taken</td><td>5</td></tr><tr><td>Error</td><td>Error conditions</td><td>4</td></tr><tr><td>Critical</td><td>Critical conditions</td><td>3</td></tr><tr><td>Alert</td><td>Should be addressed immediately</td><td>2</td></tr><tr><td>Emergency</td><td>System is unusable</td><td>1</td></tr></table>	Web value	Description	UCI	Debug	Information useful to developers for debugging the application	8	Info	Normal operational messages that require no action	7	Notice	Events that are unusual, but not error conditions	6	Warning	May indicate that an error will occur if action is not taken	5	Error	Error conditions	4	Critical	Critical conditions	3	Alert	Should be addressed immediately	2	Emergency	System is unusable	1
Web value	Description	UCI																										
Debug	Information useful to developers for debugging the application	8																										
Info	Normal operational messages that require no action	7																										
Notice	Events that are unusual, but not error conditions	6																										
Warning	May indicate that an error will occur if action is not taken	5																										
Error	Error conditions	4																										
Critical	Critical conditions	3																										
Alert	Should be addressed immediately	2																										
Emergency	System is unusable	1																										
Web: n/a UCI: system.main.audit_shell Opt: audit_shell	Log every command executed in shell. <table><tr><td>1</td><td>Enable</td></tr><tr><td>0</td><td>Disable</td></tr></table>	1	Enable	0	Disable																							
1	Enable																											
0	Disable																											
Web: n/a UCI: system.main.audit_cfg Opt: audit_cfg	Log changes made to configuration file through any interface. <table><tr><td>1</td><td>Enable</td></tr><tr><td>0</td><td>Disable</td></tr></table>	1	Enable	0	Disable																							
1	Enable																											
0	Disable																											
Web: n/a UCI: system.main.audit_cfg_hul_interval_h ours Opt: audit_cfg_hul_interval_hours	Defines the interval, in hours, at which configuration changes are uploaded to Activator. Set to 0 to disable. <table><tr><td>Range</td><td></td></tr></table>	Range																										
Range																												

Web Field/UCI/Package Option	Description	
	6	6 hours
Web: n/a UCI: system.main.audit_cfg_max_size_kb Opt: audit_cfg_max_size_kb	Defines the maximum size audit data can take in flash in 1024 byte units.	
	Range	
	1024	6 hours

10.2.3. Language And Style

The language and style section in system properties

Web Field	Description	
Language	Sets the language to 'auto' or 'English'.	
	Auto	
	English	
Design	Sets the router's style.	

10.2.4. Audit Configuration

The audit configuration section in system properties

Web Field/UCI/Package Option	Description															
Web: Track Config Changes UCI: system.main.audit_cfg Opt: audit_cfg	Any changes made to configuration file through any interface are logged to syslog.															
Web: Changelog File Location UCI: system.main.audit_cfg_log_file Opt: audit_cfg_log_file	Defines the location of the configuration change log. <table><tr><td>Range</td><td></td></tr><tr><td>/root/changelog</td><td></td></tr></table>	Range		/root/changelog												
Range																
/root/changelog																
Web: Logfile Size (kB) UCI: system.main.audit_cfg_log_size Opt: audit_cfg_log_size	Defines the maximum size of the configuration change log file in KB. <table><tr><td>Range</td><td></td></tr><tr><td>200</td><td>200KB</td></tr></table>	Range		200	200KB											
Range																
200	200KB															
Web: Rotated Changelog Files to Keep UCI: system.main.audit_cfg_log_count Opt: audit_cfg_log_count	Defines the maximum number of configuration change log files to store. <table><tr><td>Range</td><td></td></tr><tr><td>4</td><td>Stoer 4 changelog files before rotating.</td></tr></table>	Range		4	Stoer 4 changelog files before rotating.											
Range																
4	Stoer 4 changelog files before rotating.															
Web: Audit Data Max Size (kB) UCI: system.main.audit_cfg_max_size_kb Opt: audit_cfg_max_size_kb	Defines the maximum size audit data can take in flash in KB. <table><tr><td>Range</td><td></td></tr><tr><td>1024</td><td></td></tr></table>	Range		1024												
Range																
1024																
Web: Config Changes Upload Interval UCI: system.main.audit_cfg_hul_interval_hours Opt: audit_cfg_hul_interval_hours	Defines the interval, in hours, at which configuration change messages are uploaded to Activator: Set to 0 to disable. <table><tr><td>Range</td><td></td></tr><tr><td>6</td><td>6 hours</td></tr></table>	Range		6	6 hours											
Range																
6	6 hours															
Web: Shell Audit UCI: system.main.audit_shell Opt: audit_shell	Every command executed in shell is logged to syslog. <table><tr><td>1</td><td>Enabled</td></tr><tr><td>0</td><td>Disabled</td></tr></table>	1	Enabled	0	Disabled											
1	Enabled															
0	Disabled															
Web: Web Audit UCI: luci.main.audit_req Opt: audit_req	Enables logging management web access to syslog. <table><tr><td>1</td><td>Enabled</td></tr><tr><td>0</td><td>Disabled</td></tr></table>	1	Enabled	0	Disabled											
1	Enabled															
0	Disabled															
Web: Web Audit Level UCI: luci.main.audit_shell Opt: audit_level	Defines the type of web operation to be logged to syslog. <table><tr><th>Web value</th><th>Description</th><th>UCI</th></tr><tr><td>1</td><td>Actions invoked via web page</td><td>1</td></tr><tr><td>2</td><td>Config and status pages</td><td>2</td></tr><tr><td>3</td><td>config , status and polled pages</td><td>3</td></tr><tr><td>4</td><td>comprehensive URL logging</td><td>4</td></tr></table>	Web value	Description	UCI	1	Actions invoked via web page	1	2	Config and status pages	2	3	config , status and polled pages	3	4	comprehensive URL logging	4
Web value	Description	UCI														
1	Actions invoked via web page	1														
2	Config and status pages	2														
3	config , status and polled pages	3														
4	comprehensive URL logging	4														

10.2.5. Time Synchronization

The router time must be synchronized using NTP. The router can act as both an NTP client and an NTP server. It is enabled as an NTP client by default and individual interfaces can be configured to respond to NTP requests.

Time Synchronization

NTP update interval

1

NTP server candidates

0 openntp.pool.ntp.org

1 openntp.pool.ntp.org

2 openntp.pool.ntp.org

3 openntp.pool.ntp.org

Max Round Trip Time (sec)

3

ⓘ

If NTP round-trip would take longer than this, it won't be regarded for calculation.

NTP Server Interface

WAN/ETH

NTP Server Stratum

0

NTP Server Customize List

0

The time synchronization section in system properties

Web Field/UCI/Package Option	Description				
Web: NTP update interval UCI: system.ntp.interval_hours Opt: interval_hours	Specifies interval of NTP requests in hours. Default value set to auto. <table border="1"> <tr> <td>Auto</td><td></td></tr> <tr> <td>Range</td><td>auto; 1-23</td></tr> </table>	Auto		Range	auto; 1-23
Auto					
Range	auto; 1-23				
Web: NTP server candidates UCI: system.ntp.server Opt: list server	Defines the list of NTP servers to poll the time from. If the list is empty, the built-in NTP daemon is not started. Multiple servers can be configured and are separated by a space if using UCI. By default all fields are set to 0.0.0.0.				
Web: Max Round-Trip Time (secs) UCI: system.ntp.max_ntp_roundtrip_sec Opt: max_ntp_roundtrip_sec	Defines the maximum time in seconds for an NTP poll. Any polls that take longer than this will be not be used for NTP calculation. <table border="1"> <tr> <td>2</td><td>Two seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	2	Two seconds	Range	
2	Two seconds				
Range					
Web: NTP Server Interface UCI: system.ntp.listen Opt: listen	Defines a list of interfaces that respond to NTP requests. Interfaces should be delimited using space. Example: option listen 'LAN1 LAN2' <table border="1"> <tr> <td>Blank</td><td>Do not respond to NTP requests</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Blank	Do not respond to NTP requests	Range	
Blank	Do not respond to NTP requests				
Range					
Web: NTP Server Stratum UCI: system.ntp.stratum Opt: stratum	Defines how far this NTP server is from the reference clock. For example, an NTP server getting time directly from the reference clock will have a stratum of 1. In general, this should be left blank, which means that the router NTP server will derive the stratum from the NTP dialogue. <table border="1"> <tr> <td>Blank</td><td>NTP derive stratum</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Blank	NTP derive stratum	Range	
Blank	NTP derive stratum				
Range					
Web: NTP Source Combine Limit UCI: system.ntp.combinelimit Opt: combinelimit	Defines whether to limit sources included in the combining algorithm. When <code>chronyd</code> has multiple sources available for synchronization, it has to select one source as the synchronization source. The measured offsets and frequencies of the system clock relative to the other sources, however, can be combined with the selected source to improve the accuracy of the system clock. The <code>combinelimit</code> directive limits which sources are included in the combining algorithm. Their synchronization distance has to be shorter than the distance of the selected source multiplied by the value of the limit. Also, their measured frequencies have to be close to the frequency of the selected source. <table border="1"> <tr> <td>3</td><td></td></tr> <tr> <td>Range</td><td></td></tr> </table>	3		Range	
3					
Range					

10.2.6. Console Login Banner

To configure a message that is displayed after login via SSH, telnet or console, in the top menu, select **System -> Administration**. Navigate to the Console login banner section.

Console login banner

Here you can specify the banner that is shown prior to logins

This is a test banner

The console login banner in system section

Web Field/UCI/Package Option	Description
Web: Console login banner	Defines a login banner that is displayed after log in via SSH, telnet or console
UCI: system.main.banner list: banner	

10.2.7. System Reboot

The router can be configured to reboot immediately, or scheduled to reboot a configured time in the future.

In the top menu, select **System -> Reboot**. The System page appears. Ensure you have saved all your configuration changes before you reboot.



The system settings reboot page

Check the **Reboot now** check box and then click **Reboot**.

10.3. System Settings Using Command Line

System settings are configured under the system package `/etc/config/system`. There are several configuration sections.

Section	Description
system	General system configuration options
timeserver	Router time and NTP configuration options
syslog_filter	Advanced filter rules (see Advanced filter section)

10.3.1. System Settings Using UCI

```
root@VA_router:~# uci show system

system.main=system

system.main.hostname=VA_router

system.main.timezone=UTC

system.main.log_ip=1.1.1.1

system.main.log_port=514

system.main.remoteloglevel=8

system.main.log_file=/root/syslog.messages

system.main.log_size=400

system.main.log_type=file

system.main.log_file_count=3

system.main.conloglevel=8

system.main.cronloglevel=8

system.main.banner=This is a test banner system.ntp.interval_hours=auto

system.ntp.server=0.VA_router.pool.ntp.org 10.10.10.10

system.ntp.combinelimit=3
```

System Settings Using Package Options

```
root@VA_router:~# uci export system package 'system'

config 'system' 'main'

option 'hostname' "VA_router"

option 'timezone' "UTC"

option 'log_ip' "1.1.1.1"

option 'log_port' "514"

option remoteloglevel '8'

option log_file '/root/syslog.messages'

option log_size '400'

option log_type 'file'

option log_file_count '3'

option time_save_interval_min "10"

option conloglevel '8'

option cronloglevel '8'

list banner `This is a test banner`

config 'timeserver' 'ntp'

option interval_hours 'auto'

list server "0.VA_router.pool.ntp.org"

list server '10.10.10.10'

option listen 'LAN1 LAN2' option combinelimit '3'
```

10.4. System Diagnostics

System log messages

System log messages comprise of a date, source facility, hostname, severity and message description in the form tag: message.

Facility	Description
auth	Authorisation/security
authpriv	Authorisation (private)
cron	Scheduled jobs
daemon	Background daemons
kern	Kernel messages
local0	hotplug scripts
security	Same as auth
syslog	Internal syslog events
user	General user-mode application messages

Event severity list

Level	Name	Description
0	emerg	System is unusable
1	alert	Immediate action required
2	crit	Critical conditions
3	error	Error conditions
4	warning	Warning conditions
5	notice	Normal but significant
6	info	Informational
7	debug	Debug-level messages
-	none	No priority

10.4.1. System Log Messages In RAM

By default, system log messages are stored in the system log in RAM. To view the system log in RAM, enter:

```
root@VA_router:~# logread
```

Shows the log.

```
root@VA_router:~# logread |tail
```

Shows end of the log.

```
root@VA_router:~# logread | more
```

Shows the log page by page.

```
root@VA_router:~# logread -f
```

Shows the log on an ongoing basis. To stop this option, press **ctrl-c**.

```
root@VA_router:~# logread -f &
```

Shows the log on an ongoing basis while in the background. This allows you to run other commands while still tracing the event logs. To stop this option, type **fg** to view the current jobs, then press **ctrl-c** to kill those jobs.

10.4.2. System Log Messages In Flash

Since logread is limited by memory size and does not survive a reset, it is beneficial to write system messages to flash memory. To do this, modify the system config under the system package.

Set the options '**log_file**', '**log_size**', '**log_type**' and '**log_file_count**' as shown below:

```
root@VA_router:~# uci export system package system
config system 'main'
option hostname 'VA_router' option zonename 'UTC' option timezone 'GMT0' option conloglevel '8'
option cronloglevel '8'
option time_save_interval_hour '10' option log_hostname '%serial' option log_ip '1.1.1.1'
option log_port '514'
option log_file '/root/syslog.messages' option log_size '400'
option log_type 'file'
option log_file_count '3'
```

The above commands will take effect after a reboot, or by running the console command:

```
root@VA_router:~# /etc/init.d/syslogd restart
```

```
root@VA_router:~# cat /root/syslog.messages
```

Shows all the system events stored in flash.

```
root@VA_router:~# tail /root/syslog.messages
```

Shows end of the events stored flash.

```
root@VA_router:~# tail -f /root/syslog.messages &
```

Shows the log on an ongoing basis. To stop this option, press **ctrl-c**.

10.4.3. Kernel Messages

To view kernel messages, enter `dmesg`

```
root@VA_router:~# dmesg
[ 0.000000] Linux version 3.10.12 (info@virtualaccess.com) (gcc version 4.8.1 20130401 (prerelease) (Linaro GCC 4.8-2013.04) )
#130 PREEMPT 1970-
01-01T00:00:00Z
```

```
[ 0.000000] SoC: xRX330 rev 1.1
[ 0.000000] bootconsole [early0] enabled
[ 0.000000] CPU0 revision is: 00019556 (MIPS 34Kc)
[ 0.000000] adding memory size:267386880 from DT
[ 0.000000] MIPS: machine is Virtual Access GW6600V series [ 0.000000] Determined physical RAM map:
[ 0.000000] memory: 0ff00000 @ 00000000 (usable) [ 0.000000] User-defined physical RAM map:
[ 0.000000] memory: 07200000 @ 00000000 (usable)
```



NOTE

Kernel messages are also copied to the main system log by default.

10.4.4. Syslog Process

To check the syslog process is running correctly, enter `pgrep -fl syslogd`

```
root@VA_router:~# pgrep -fl syslogd
5409 /sbin/syslogd -h VARouter -L -R 192.168.14.202:514 -l 7 -r 8 -s 400 -O
/root/syslog.messages -b 3 -C64 -R localhost:2048
```

Changes to the syslog configuration will take effect with a restart of syslogd

```
root@VA_router:~# /etc/init.d/syslogd restart
```

10.4.5. NTP Process

To check the NTP process is running correctly, enter `pgrep -fl chrony`

```
root@VA_router:~# pgrep -fl chrony
2553 /usr/sbin/chronyd -f /etc/chrony.conf
```

Changes to the NTP configuration will take effect with a restart of chrony

```
root@VA_router:~# /etc/init.d/chrony restart
```

10.5. Advanced Filtering Of Syslog Messages

Syslog messages can be filtered against a series of rules that are checked for each message generated. If a match is found, then the specified action is taken. If no match occurs, then the default action is taken, as defined in the main system logging settings.

A message may match multiple filters. They are processed in the order listed. For example, you may wish to record authorisation messages in the main system log, but also make a copy in a separate authorisation log which can span a much longer period of time.

By default, all matching filters will be applied to each message. However, you can mark a filter to indicate that after it matches, no further filter processing should take place.

The filter rules are defined in a free-form text list in the `syslog_filter` configuration section. There are two section types, one for messages to be stored locally, and one for messages delivered remotely.

Configuring advanced filters on the web interface is not currently supported; they must be edited using the command line interface.

10.5.1. Advanced Filtering Using Command Line

Filters are defined in the `syslog_filter` configuration section of the system package. A set of filters can be either local or remote.

- All messages are matched against both local and remote filter rules, if configured.
- Each local filter matched is executed; if there is no match, then the default local logging action applies.
- Any remote filter matched is executed; if there is no match, then the default remote logging action applies.

```
root@VA_router:~# uci export system
package system

config syslog_filter 'local'
list text "...line 1..."
list text "...line 2..."
list text "...line 3..."

config syslog_filter 'remote'
list text "...line 1..."
list text "...line 2..."
list text "...line 3..."
```

Lines defined here are copied to the router runtime file **/var/conf/syslog.conf** which may be reviewed to determine current rules in use.

10.5.2. Filter Definitions

Each filter ruleset is a series of lines. Each line can be:

- A filter pattern, of the form facility.[op]severity(pattern) target [~]
- A blank line, or comment line, starting with hash (#).

If a message does not match any of the filter lines for a destination, local or remote, the default action for that destination is taken.

The sections of a filter pattern break down as shown in the following table.

Section	Description																		
facility	Any keyword or comma-separated list of keywords from the source facility list. See the Source Facilities table in section 6.5.1.1. Use the wildcard '*' to match all facilities.																		
severity	Any keyword from the event severity list (see Event Severity table above). The rule will match all severities more urgent if the message severity level is at least as urgent as this. Use the wildcard '*' to match all facilities.																		
op	Defines an optional severity condition. <table border="1"> <tr> <td>(empty)</td><td>match listed severity, and also anything more severe</td></tr> <tr> <td>!</td><td>match on less urgent severities than that listed</td></tr> <tr> <td>=</td><td>severity must match exactly</td></tr> <tr> <td>!=</td><td>match any severity other than the listed severity</td></tr> </table> Examples: *.debug matches all messages of debug severity and greater (i.e. debug, info, warning, etc *.=debug matches all debug messages.	(empty)	match listed severity, and also anything more severe	!	match on less urgent severities than that listed	=	severity must match exactly	!=	match any severity other than the listed severity										
(empty)	match listed severity, and also anything more severe																		
!	match on less urgent severities than that listed																		
=	severity must match exactly																		
!=	match any severity other than the listed severity																		
pattern	Defines an optional pattern to match against the message text. The pattern is used to restrict the number of log messages matching this filter. The pattern syntax is a simple case-insensitive regular expression, using these characters: <table border="1"> <tr> <td>*</td><td>Matches zero or more characters.</td></tr> <tr> <td>?</td><td>Matches any single character (use this for spaces).</td></tr> <tr> <td>!</td><td>Matches anything not matching the following pattern.</td></tr> <tr> <td>^</td><td>Matches the start of a message.</td></tr> <tr> <td>\$</td><td>Matches the end of a message.</td></tr> </table> Examples: <table border="1"> <tr> <td>(firewall:)</td><td>Match any message containing the string 'firewall:'</td></tr> <tr> <td>(up*eth1)</td><td>Match any UP message referencing eth1</td></tr> <tr> <td>(!mobile)</td><td>Match only messages that do not include the string 'mobile'</td></tr> <tr> <td>(^mobile)</td><td>Match only messages beginning with the string 'mobile'</td></tr> </table>	*	Matches zero or more characters.	?	Matches any single character (use this for spaces).	!	Matches anything not matching the following pattern.	^	Matches the start of a message.	\$	Matches the end of a message.	(firewall:)	Match any message containing the string 'firewall:'	(up*eth1)	Match any UP message referencing eth1	(!mobile)	Match only messages that do not include the string 'mobile'	(^mobile)	Match only messages beginning with the string 'mobile'
*	Matches zero or more characters.																		
?	Matches any single character (use this for spaces).																		
!	Matches anything not matching the following pattern.																		
^	Matches the start of a message.																		
\$	Matches the end of a message.																		
(firewall:)	Match any message containing the string 'firewall:'																		
(up*eth1)	Match any UP message referencing eth1																		
(!mobile)	Match only messages that do not include the string 'mobile'																		
(^mobile)	Match only messages beginning with the string 'mobile'																		
target	Defines what to do with the log message when a match occurs. It is optional for remote filters. It can be the name of a disk file, or one of the special target keywords listed below. <table border="1"> <tr> <td>default</td><td>Do whatever the default action is, as if not the filter rule is matched.</td></tr> <tr> <td>ignore</td><td>Never log this message (useful for remote filtering).</td></tr> <tr> <td>console</td><td>Log this message to the console. To view the console use cat/proc/conlog</td></tr> <tr> <td>mem</td><td>Log this message to the memory buffer (logread), if configured.</td></tr> </table> Note: logread is not stored through reboot.	default	Do whatever the default action is, as if not the filter rule is matched.	ignore	Never log this message (useful for remote filtering).	console	Log this message to the console. To view the console use cat/proc/conlog	mem	Log this message to the memory buffer (logread), if configured.										
default	Do whatever the default action is, as if not the filter rule is matched.																		
ignore	Never log this message (useful for remote filtering).																		
console	Log this message to the console. To view the console use cat/proc/conlog																		
mem	Log this message to the memory buffer (logread), if configured.																		
~	Optional flag to indicate no further filters should be checked, if this filter matches. This prevents later filters from acting on the same message. For convenience this is automatically implied when a target of ignore is used. A space must be present before the ~ character. <table border="1"> <tr> <td>~</td><td>No further filters should be checked after a match.</td></tr> <tr> <td>(empty)</td><td>Continue checking other filters after a match.</td></tr> </table>	~	No further filters should be checked after a match.	(empty)	Continue checking other filters after a match.														
~	No further filters should be checked after a match.																		
(empty)	Continue checking other filters after a match.																		

Filter Examples

Example 1

Log all debug messages to memory buffer. Do not log anywhere else locally.

Log all authorisation facility messages to filepath 'var/log/auth'. Do not log anywhere else locally.

Log all ipsec messages to filepath 'va/log/ipsec'. Do not log anywhere else locally.

For everything else, apply default local logging.

No remote filter rules defined, so apply default remote logging to all messages.

```
config syslog_filter 'local'

list text '.*=debug mem ~'

list text 'auth,authpriv.* /var/log/auth ~'

list text '.*.*(ipsec:) /var/log/ipsec ~'
```

Example 2

As Example 1 but in addition to specified local files, copy auth, authpriv and ipsec to local default log.

```
config syslog_filter 'local'

list text '.*=debug mem ~'

list text 'auth,authpriv.* /var/log/auth'

list text '.*.*(ipsec:) /var/log/ipsec'

list text '.*.* default'
```

Example 3

As in Example 2, except **do not** send any auth or auth priv messages remotely.

```
config syslog_filter 'local'

list text '.*=debug mem ~'

list text 'auth,authpriv.* /var/log/auth'

list text '.*.*(ipsec:) /var/log/ipsec'

list text '.*.* default' config syslog_filter 'remote'
```

Example 4

As in Example 3, except only send auth or auth priv messages remotely.

```
config syslog_filter 'local'

list text '.*=debug mem ~'

list text 'auth,authpriv.* /var/log/auth'

list text '.*.*(ipsec:) /var/log/ipsec'

list text '.*.* default' config syslog_filter 'remote'

list text 'auth,authpriv.* ~'

list text '.*.* ignore'
```

11. Configuring An Ethernet Interface

This chapter describes how to configure an Ethernet interface including configuring the interface as a DHCP server, adding the interface to a firewall zone, mapping the physical switch ports and defining loopback interface.

Configuration Packages Used

Package	Sections
Network	interface
	route
	va_switch
	alias
firewall	zone
dhcp	dhcp

11.1. Configuring An Ethernet Interface Using The Web Interface

To create and edit interfaces via the web interface, in the top menu, click **Network -> Interfaces**. The Interfaces overview page appears.



The interfaces overview page

There are three sections in the Interfaces page.

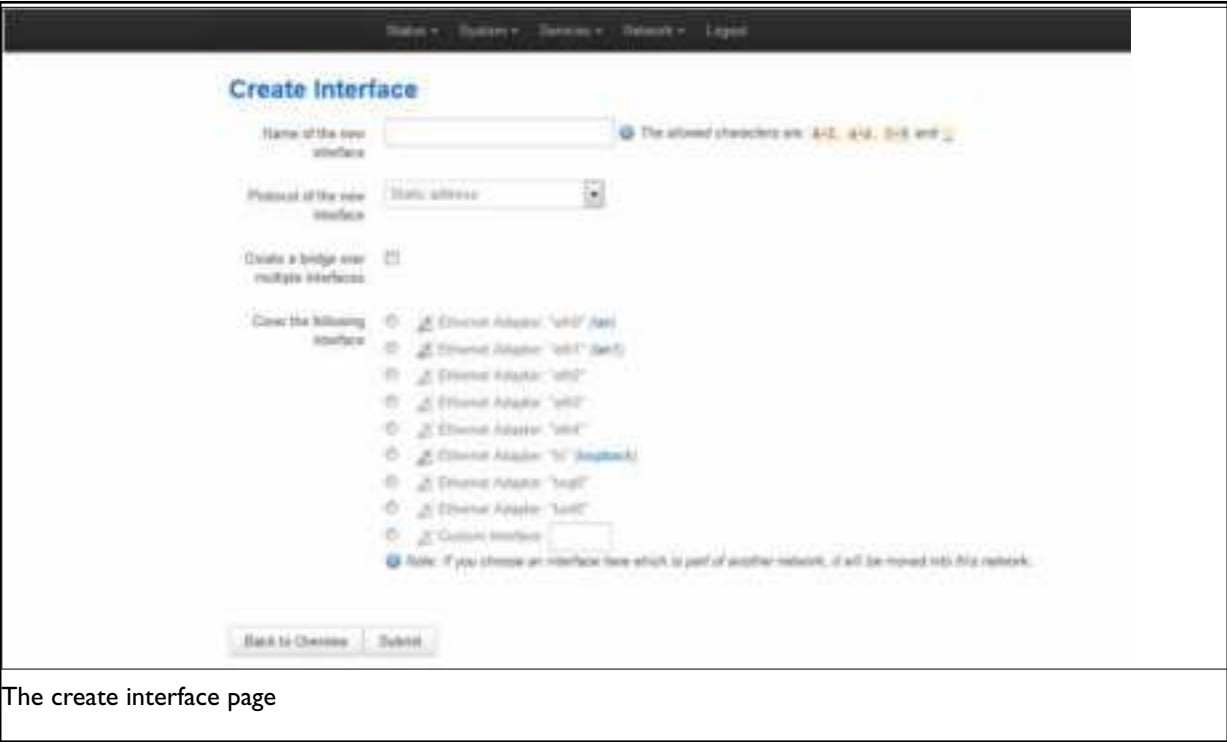
Section	Description
Interface Overview	Shows existing interfaces and their status. You can create new, and edit existing interfaces here.
Port Map	In this section you can map device ports to Ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space-separated port character in the port map fields.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

11.1.1. Interface Overview: Editing An Existing Interface

To edit an existing interface, from the interface tabs at the top of the page, select the interface you wish to configure. Alternatively, click **Edit** in the interface's row.

11.1.2. Interface Overview: Creating A New Interface

To create a new interface, in the Interface Overview section, click **Add new interface**. The Create Interface page appears.



The create interface page

Web Field/UCI/Package Option	Description																																										
Web: Name of the new interface UCI: network.<if name> Opt: config interface	Assigns a logical name to the interface. The network interface section will assign this name (<if name>). Type the name of the new interface. Allowed characters are A-Z, a-z, 0-9 and _																																										
Web: Protocol of the new interface UCI: network.<if name>.proto Opt: proto	Specifies what protocol the interface will operate on. Select Static . <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Static</td><td>Static configuration with fixed address and netmask</td><td>static</td></tr><tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr><tr><td>Unmanaged</td><td>Unspecified</td><td>none</td></tr><tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr><tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td>gre</td></tr><tr><td>IOT</td><td>IOT</td><td>iot</td></tr><tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td>i2tp</td></tr><tr><td>L2TPv3</td><td>L2TPv3 Tunnelling Protocol</td><td>i2tpv3</td></tr><tr><td>PPP</td><td>Point to Point Tunnelling protocol</td><td>ppp</td></tr><tr><td>PPPoE</td><td>PPP over Ethernet</td><td>pppoe</td></tr><tr><td>PPPoATM</td><td>PPP over ATM</td><td>pppoa</td></tr><tr><td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS, or GPRS connection using an AT-style 3G modem</td><td>3g</td></tr><tr><td>PPP (PSTN-Modem)</td><td>PPP v90 modem</td><td>pppmodem</td></tr></table>	Web	Description	UCI	Static	Static configuration with fixed address and netmask	static	DHCP Client	Address and netmask are assigned by DHCP.	dhcp	Unmanaged	Unspecified	none	IPv6-in-IPv4 (RFC4213)	Used with tunnel brokers.		GRE	Generic Routing Encapsulation protocol	gre	IOT	IOT	iot	L2TP	Layer 2 Tunnelling Protocol	i2tp	L2TPv3	L2TPv3 Tunnelling Protocol	i2tpv3	PPP	Point to Point Tunnelling protocol	ppp	PPPoE	PPP over Ethernet	pppoe	PPPoATM	PPP over ATM	pppoa	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3G modem	3g	PPP (PSTN-Modem)	PPP v90 modem	pppmodem
Web	Description	UCI																																									
Static	Static configuration with fixed address and netmask	static																																									
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Unmanaged	Unspecified	none																																									
IPv6-in-IPv4 (RFC4213)	Used with tunnel brokers.																																										
GRE	Generic Routing Encapsulation protocol	gre																																									
IOT	IOT	iot																																									
L2TP	Layer 2 Tunnelling Protocol	i2tp																																									
L2TPv3	L2TPv3 Tunnelling Protocol	i2tpv3																																									
PPP	Point to Point Tunnelling protocol	ppp																																									
PPPoE	PPP over Ethernet	pppoe																																									
PPPoATM	PPP over ATM	pppoa																																									
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3G modem	3g																																									
PPP (PSTN-Modem)	PPP v90 modem	pppmodem																																									
Web: Create a bridge over multiple interfaces UCI: network.<if name>.type Opt: type	If you select this option, then the new logical interface created will act as a bridging interface between the chosen existing physical interfaces. <table><tr><td>Empty</td><td></td></tr><tr><td>Bridge</td><td>Configures a bridge over multiple interfaces</td></tr></table>	Empty		Bridge	Configures a bridge over multiple interfaces																																						
Empty																																											
Bridge	Configures a bridge over multiple interfaces																																										
Web: Cover the following interface UCI: network.<if name>.ifname Opt: ifname	Physical interface name to assign to this logical interface. If creating a bridge over multiple interfaces select two interfaces to bridge. When using UCI the interface names should be separated by a space e.g. option ifname 'eth2 eth3'																																										

Click **Submit**. The Interface configuration page appears. There are three sections:

Section	Description
Common Configuration	Configure the interface settings such as protocol, IP address, gateway, netmask, custom DNS servers, MTU and firewall configuration.
IP-Aliases	Assigning multiple IP addresses to the interface.
DHCP Server	Configuring DHCP server settings for this interface.

11.1.3. Interface Overview: Common Configuration

The common configuration section has four sub-sections:

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, gateway, netmask, custom DNS servers.
Advanced Settings	'Bring up on boot', 'Monitor interface state', Override MAC address, Override MTU and 'Use gateway metric'.
Physical Settings	Bridge interfaces, VLAN PCP to SKB priority mapping.
Firewall settings	Assign a firewall zone to the interface.

Common Configuration: General Setup

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Status

eth3

MAC Address: 00:E0:C8:D3:18:20
RX: 0.00 B (0 Pkts.)
TX: 0.00 B (0 Pkts.)

Protocol

Static address

IPv4 address

IPv4 netmask

IPv4 gateway

IPv4 broadcast

Use custom DNS servers



Accept router advertisements

☐

Send router solicitations

☒

IPv6 address

IPv6 gateway

The Ethernet connection common configuration settings page

Web Field/UCI/Package Option	Description																																																
Web: Status	Shows the current status of the interface.																																																
Web: Protocol UCI: network.<if name>.proto Opt: proto	Protocol type. The interface protocol may be one of the options shown below. The protocol selected in the previous step will be displayed as default but can be changed if required. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Static</td><td>Static configuration with fixed address and netmask.</td><td>static</td></tr><tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td><td>dhcp</td></tr><tr><td>Unmanaged</td><td>Unspecified</td><td>none</td></tr><tr><td>IPv6-in-IPv4 (RFC4213)</td><td>Used with tunnel brokers.</td><td></td></tr><tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport.</td><td></td></tr><tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td>gre</td></tr><tr><td>IOT</td><td>IOT</td><td>iot</td></tr><tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td>i2tp</td></tr><tr><td>L2TPv3</td><td>L2TPv3 Tunnelling Protocol</td><td>i2tpv3</td></tr><tr><td>PPP</td><td>Point to Point protocol</td><td>ppp</td></tr><tr><td>PPTP</td><td>Point to Point Tunnelling protocol</td><td>pptp</td></tr><tr><td>PPPoE</td><td>PPP over Ethernet</td><td>pppoe</td></tr><tr><td>PPPoATM</td><td>PPP over ATM</td><td>pppoa</td></tr><tr><td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem</td><td>3g</td></tr><tr><td>PPP(PSTN-Modem)</td><td>PPP v90 modem</td><td>pppmodem</td></tr></table>	Web	Description	UCI	Static	Static configuration with fixed address and netmask.	static	DHCP Client	Address and netmask are assigned by DHCP.	dhcp	Unmanaged	Unspecified	none	IPv6-in-IPv4 (RFC4213)	Used with tunnel brokers.		IPv6-over-IPv4	Stateless IPv6 over IPv4 transport.		GRE	Generic Routing Encapsulation protocol	gre	IOT	IOT	iot	L2TP	Layer 2 Tunnelling Protocol	i2tp	L2TPv3	L2TPv3 Tunnelling Protocol	i2tpv3	PPP	Point to Point protocol	ppp	PPTP	Point to Point Tunnelling protocol	pptp	PPPoE	PPP over Ethernet	pppoe	PPPoATM	PPP over ATM	pppoa	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem	3g	PPP(PSTN-Modem)	PPP v90 modem	pppmodem
Web	Description	UCI																																															
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IPv6-in-IPv4 (RFC4213)	Used with tunnel brokers.																																																
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport.																																																
GRE	Generic Routing Encapsulation protocol	gre																																															
IOT	IOT	iot																																															
L2TP	Layer 2 Tunnelling Protocol	i2tp																																															
L2TPv3	L2TPv3 Tunnelling Protocol	i2tpv3																																															
PPP	Point to Point protocol	ppp																																															
PPTP	Point to Point Tunnelling protocol	pptp																																															
PPPoE	PPP over Ethernet	pppoe																																															
PPPoATM	PPP over ATM	pppoa																																															
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem	3g																																															
PPP(PSTN-Modem)	PPP v90 modem	pppmodem																																															
Web: IPv4 address UCI: network.<if name>.ipaddr Opt: ipaddr	The IPv4 address of the interface. This is optional if an IPv6 address is provided.																																																
Web: IPv4 netmask UCI: network.<if name>.netmask Opt: netmask	Subnet mask to be applied to the IP address of this interface.																																																
Web: IPv4 gateway UCI: network.<if name>.gateway Opt: gateway	IPv4 default gateway to assign to this interface (optional).																																																
Web: IPv4 broadcast UCI: network.<if name>.broadcast Opt: broadcast	Broadcast address. This is automatically generated if no broadcast address is specified.																																																
Web: Use custom DNS servers UCI: network.<if name>.dns Opt: list dns	List of DNS server IP addresses (optional). Multiple DNS Servers are separated by a space if using UCI.																																																
Web: Accept router advertisements UCI: network.<if name>.accept_ra Opt: accept_ra	Specifies whether to accept IPv6 Router Advertisements on this interface (optional). Note: default is 1 if protocol is set to DHCP, otherwise defaults to 0.																																																
Web: Send router solicitations UCI: network.<if name>.send_rs Opt: send_rs	Specifies whether to send Router Solicitations on this interface (optional). Note: defaults to 1 for static protocol, otherwise defaults to 0.																																																
Web: IPv6 address UCI: network.<if name>.ip6addr	The IPv6 IP address of the interface. Optional if an IPv4 address is provided. CIDR notation for the IPv6 address is required.																																																

Web Field/UCI/Package Option	Description
Opt: ip6addr	
Web: IPv6 gateway	Assign given IPv6 default gateway to this interface (optional).
UCI: network.<if name>.ip6gw	
Opt: ip6gw	

Common Configuration: Advanced Settings

Status + System + Services + Network + Logout

Common Configuration

General Setup
Advanced Settings
Physical Settings
Firewall Settings

Bring up on boot ☒

Monitor interface state ☐ ⓘ This interface state would be reported to VA Monitor via [keep-alive](#)

Use broadcast flag ☐ ⓘ Required for certain ISPs, e.g. Charter with DOCSIS 3

Use default gateway ☒ ⓘ If unchecked, no default route is configured

Use DNS servers advertised by peer ☒ ⓘ If unchecked, the advertised DNS server addresses are ignored

Use gateway metric

Client ID to send when requesting DHCP

Vendor Class to send when requesting DHCP

Override MAC address

Override MTU

The Ethernet connection advanced settings page

Web Field/UCI/Package Option	Description										
Web: Bring up on boot UCI: network.<if name>.auto Opt: auto	Enables the interface to connect automatically on boot up. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled						
0	Disabled										
1	Enabled										
Web: Monitor interface state UCI: network.<if name>.monitored Opt: monitored	Enabled if status of interface is presented on Monitoring platform. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled						
0	Disabled										
1	Enabled										
Web: Override MAC address UCI: network.<if name>.macaddr Opt: macaddr	Override the MAC address assigned to this interface. Must be in the form: hh:hh:hh:hh:hh:hh, where h is a hexadecimal number.										
Web: Override MTU UCI: network.<if name>.mtu Opt: mtu	Defines the value to override the default MTU on this interface. <table border="1"> <tr> <td>1500</td><td>1500 bytes</td></tr> </table>	1500	1500 bytes								
1500	1500 bytes										
Web: Use gateway metric UCI: network.<if name>.metric Opt: metric	Specifies the default route metric to use for this interface (optional). <table border="1"> <tr> <td>0</td><td></td></tr> <tr> <td>Range</td><td></td></tr> </table>	0		Range							
0											
Range											
Web: Dependant Interfaces UCI: network.[..x..].dependants Opt: dependants	Lists interfaces that are dependant on this parent interface. Dependant interfaces will go down when parent interface is down and will start or restart when parent interface starts. Separate multiple interfaces by a space when using UCI Example: options dependants 'PPPADSL MOBILE' This replaces the following previous options in child interfaces. <table border="1"> <tr> <td>gre</td><td>option local_interface</td></tr> <tr> <td>lt2p</td><td>option src_ipaddr</td></tr> <tr> <td>iot</td><td>option wan1 wan2</td></tr> <tr> <td>6in4</td><td>option ipaddr</td></tr> <tr> <td>6t04</td><td>option ipaddr</td></tr> </table>	gre	option local_interface	lt2p	option src_ipaddr	iot	option wan1 wan2	6in4	option ipaddr	6t04	option ipaddr
gre	option local_interface										
lt2p	option src_ipaddr										
iot	option wan1 wan2										
6in4	option ipaddr										
6t04	option ipaddr										
Web: SNMP Alias ifindex UCI: network.[..x..].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface, that can be polled via the SNMP interface index (snmp_alias_ifindex+1000). See 'Configuring SNMP' section for more information. <table border="1"> <tr> <td>Blank</td><td>No SNMP interface alias index</td></tr> <tr> <td>Range</td><td>0 - 4294966295</td></tr> </table>	Blank	No SNMP interface alias index	Range	0 - 4294966295						
Blank	No SNMP interface alias index										
Range	0 - 4294966295										

Common Configuration: Physical Settings

StatusSystemServicesNetworkLogout

Common Configuration

General SetupAdvanced SettingsPhysical SettingsFirewall Settings

Bridge interfaces

creates a bridge over specified interface(s)

VLAN PCP to skb->priority mapping

Space separated list of <pcp>-<priority>

skb->priority to VLAN PCP mapping

Interface

Ethernet Adapter: "3G" (3G)

Ethernet Adapter: "ADSL" (ADSL)

Ethernet Adapter: "eth0"

Ethernet Adapter: "eth1" (lan1)

Ethernet Adapter: "eth2"

Ethernet Adapter: "eth3"

Ethernet Adapter: "lo" (loopback)

Ethernet Adapter: "teql0"

Ethernet Adapter: "tunl0"

Ethernet Adapter: "usb0"

Wireless Network: Master "GW6530W_VA" (lan)

Custom interface:

The common configuration physical settings page

Web Field/UCI/Package Option	Description				
Web: Bridge interfaces UCI: network.<if name>.type Opt: type	Sets the interface to bridge over a specified interface(s). The physical interfaces can be selected from the list and are defined in network.<if name>.ifname. <table border="1"> <tr> <td>Empty</td><td></td></tr> <tr> <td>Bridge</td><td>Configures a bridge over multiple interfaces.</td></tr> </table>	Empty		Bridge	Configures a bridge over multiple interfaces.
Empty					
Bridge	Configures a bridge over multiple interfaces.				
Web: Enable STP UCI: network.<if name>.stp Opt: stp	Enable Spanning Tree Protocol. This option is only available when the Bridge Interfaces option is selected. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: VLAN PCP to skb>priority mapping UCI: network.<if name>.vlan_qos_map_ingress Opt: list vlan_qos_map_ingress	VLAN priority code point to socket buffer mapping. Multiple priority mappings are entered with a space between them when using UCI. Example: network.<if name>. vlan_qos_map_ingress =1:2 2:1				
Web: skb priority to >VLAN PCP mapping UCI: network.<if name>.vlan_qos_map_egress Opt: list vlan_qos_map_egress	Socket buffer to VLAN priority code point mapping. Multiple priority mappings are entered with a space between them when using UCI. Example: network.<if name>. vlan_qos_map_egress =1:2 2:1				
Web: Interface UCI: network.<if name>.ifname Opt: ifname	Physical interface to assign the logical interface to. If mapping multiple interfaces for bridging the interface names are separated by a space when using UCI and package options. Example: option ifname 'eth2 eth3' or network.<if name>.ifname=eth2 eth 3				

Loopback Interfaces

Loopback interfaces are defined in exactly the same way as Ethernet interfaces. For more information, read the section above.



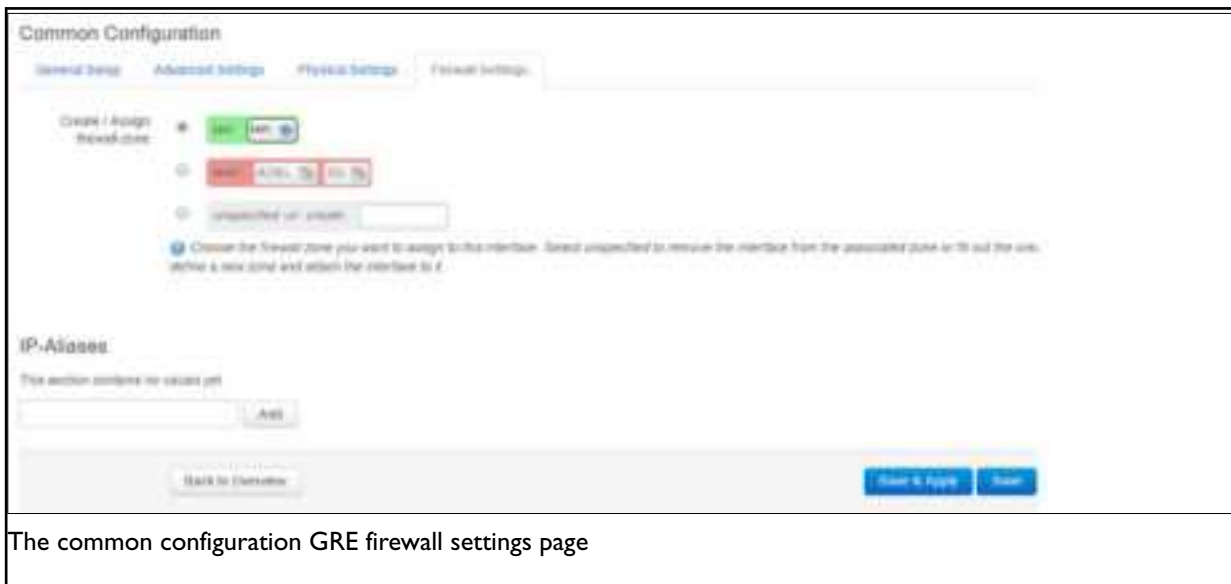
NOTE

There is no software limitation as to how many loopback interfaces can exist on the router.

Common Configuration: Firewall Settings

Use this section to select the firewall zone you want to assign to this interface.

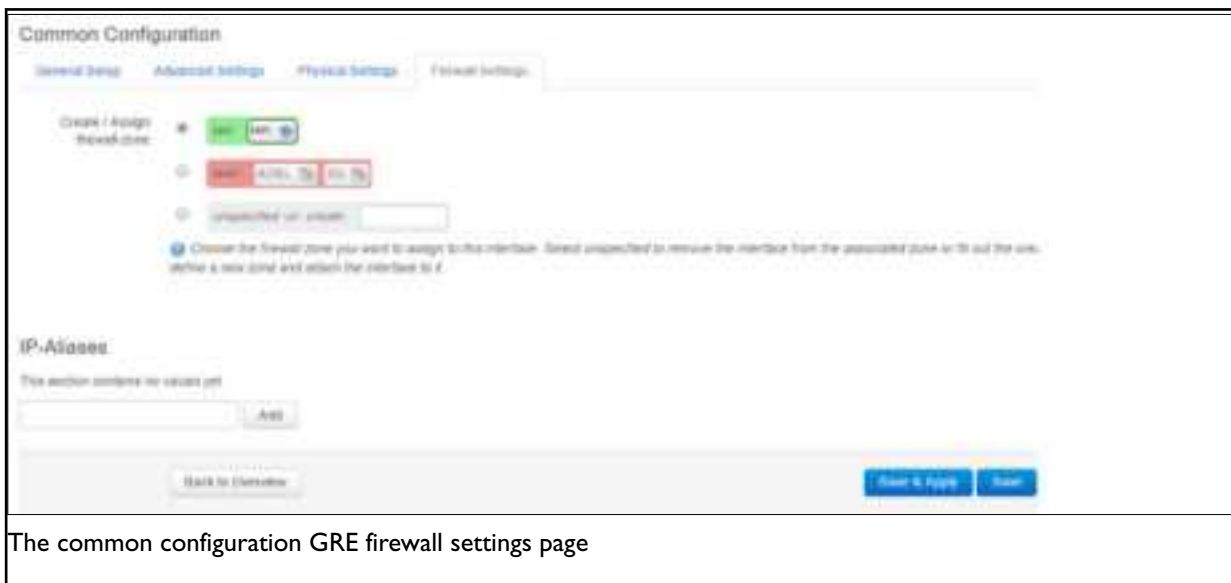
Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.



Common Configuration: Firewall Settings

Use this section to select the firewall zone you want to assign to this interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.



11.2. Interface Overview: IP-Aliases

IP-aliasing means associating more than one IP address to a network interface. You can assign multiple aliases.

IP-alias Packages

Package	Section
Network	alias

11.2.1. IP-Alias Using The Web

To use IP-aliases, enter a name for the alias and click **Add**. This name will be assigned to the alias section for this IP-alias. In this example, we use the name 'ethalias1'.

The IP-Aliases section

Web Field/UCI/Package Option	Description
UCI: network.<alias name>=ifname Opt: config interface 'aliasname'	Assigns the alias name.
UCI: network.<alias name>.interface Opt: interface	This maps the IP-Alias to the interface.
UCI: network.<alias name>.proto Opt: proto	This maps the interface protocol to the alias.

After you have clicked **Add**, the IP-Aliases configuration options page appears.

The IP- Alias page is divided into two sub sections: general setup and advanced.

11.2.2. IP-Aliases: General Setup

The IP-Aliases general setup page

Web Field/UCI/Package Option	Description
Web: IPv4-Address UCI: network.<alias name>.ipaddr Opt: ipaddr	Defines the IP address for the IP-alias.
Web: IPv4-Netmask UCI: network.<alias name>.netmask Opt: netmask	Defines the netmask for the IP-alias.
Web: IPv4-Gateway UCI: network.<alias name>.gateway Opt: gateway	Defines the gateway for the IP-alias.

11.2.3. IP-Aliases: Advanced Settings



The IP-Aliases advanced settings section

Web Field/UCI/Package Option	Description
Web: IPv4-Broadcast UCI: network.<alias name>.bcast Opt: bcast	Defines the IP broadcast address for the IP-alias.
Web: DNS-Server UCI: network.<alias name>.dns Opt: dns	Defines the DNS server for the IP-alias.

11.3. Interface Overview: DHCP Server



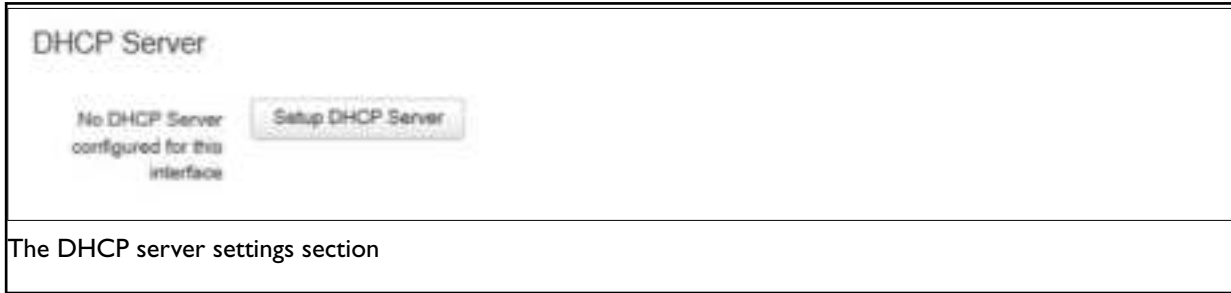
NOTE

This option is only available for interfaces with a static IP address.

DHCP Server: Packages

Package	Sections
dhcp	dhcp

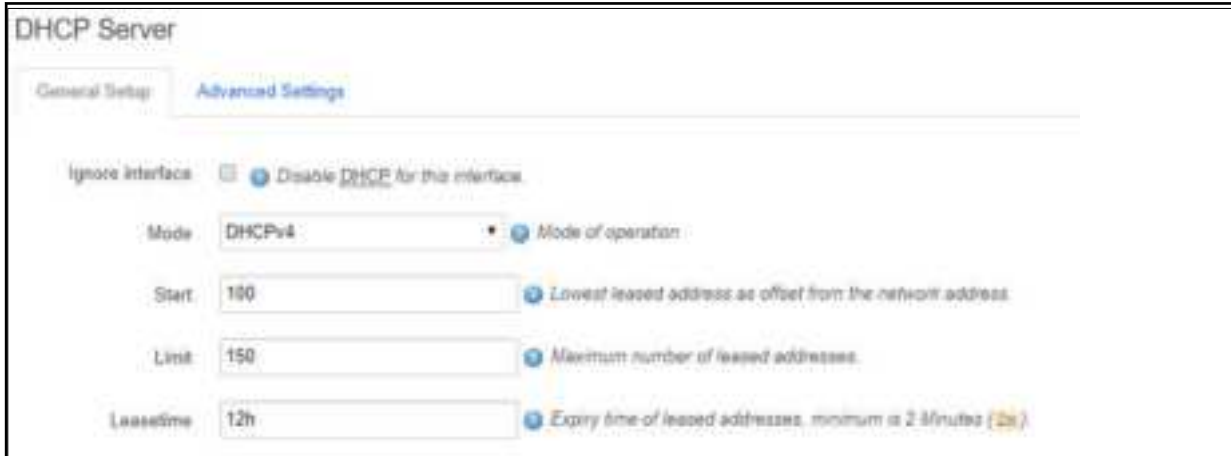
To assign a DHCP server to the interface, click **Setup DHCP Server**.



The DHCP server settings section

The DHCP Server configuration options appear. The DHCP Server is divided into two sub-sections: General Setup and Advanced Settings.

11.3.1. DHCP Server: General Setup



The DHCP server general setup section

Web Field/UCI/Package Option	Description															
Web: Ignore interface UCI: dhcp.@dhcp[x].ignore Opt: ignore	Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then default is disabled i.e. dhcp pool enabled. <table><tr><td>0</td><td>Disabled.</td></tr><tr><td>1</td><td>Enabled.</td></tr></table>	0	Disabled.	1	Enabled.											
0	Disabled.															
1	Enabled.															
Web: Mode UCI: dhcp.@dhcp[x].mode Opt: mode	Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then default is disabled i.e. dhcp pool enabled. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>DHCPv4</td><td>DHCP for IPv4</td><td>ipv4</td></tr><tr><td>DHCPv6</td><td>DHCP for IPv6</td><td>ipv6_dhcp</td></tr><tr><td>IPv6 Router Advertisements</td><td>IPv6 RA</td><td>ipv6_ra</td></tr><tr><td>DHCPv6 Prefix Delegation</td><td>DHCPv6 prefix delegation</td><td>ipv6_pd</td></tr></table>	Web	Description	UCI	DHCPv4	DHCP for IPv4	ipv4	DHCPv6	DHCP for IPv6	ipv6_dhcp	IPv6 Router Advertisements	IPv6 RA	ipv6_ra	DHCPv6 Prefix Delegation	DHCPv6 prefix delegation	ipv6_pd
Web	Description	UCI														
DHCPv4	DHCP for IPv4	ipv4														
DHCPv6	DHCP for IPv6	ipv6_dhcp														
IPv6 Router Advertisements	IPv6 RA	ipv6_ra														
DHCPv6 Prefix Delegation	DHCPv6 prefix delegation	ipv6_pd														
Web: Start UCI: dhcp.@dhcp[x].start Opt: start	Defines the offset from the network address for the start of the DHCP pool. Example: for network address 192.168.100.10/24, start=100, DHCP allocation pool will start at 192.168.100.100. For subnets greater than /24, it may be greater than 255 to span subnets. Alternatively, specify in IP address notation using the wildcard '0' where the octet is required to inherit bits from the interface IP address. Example: to define a DHCP scope starting from 10.1.20.0 on an interface with 10.1.0.0/16 address, set start to 0.0.20.1100 <table><tr><td>100</td><td></td></tr><tr><td>Range</td><td></td></tr></table>	100		Range												
100																
Range																
Web: Limit UCI: dhcp.@dhcp[x].limit Opt: limit	Defines the size of the address pool. Example: for network address 192.168.100.10/24, start=100, limit=150, DHCP allocation pool will be .100 to .249 <table><tr><td>150</td><td></td></tr><tr><td>Range</td><td>0 - 255</td></tr></table>	150		Range	0 - 255											
150																
Range	0 - 255															
Web: Leasetime UCI: dhcp.@dhcp[x].leasetime Opt: leasetime	Defines the lease time of addresses handed out to clients, for example 12h or 30m. <table><tr><td>12h</td><td>12 hours</td></tr><tr><td>Range</td><td></td></tr></table>	12h	12 hours	Range												
12h	12 hours															
Range																
Web: n/a UCI: dhcp.@dhcp[x].interface Opt: interface	Defines the interface that is served by this DHCP pool. This must be one of the configured interfaces. When configured through the web UI this will be automatically populated with the interface name															

11.3.2. DHCP Server: Advanced Settings

The DHCP server advanced settings section

Web Field/UCI/Package Option	Description				
Web: Dynamic DHCP UCI: dhcp.@dhcp[x].dynamicdhcp Opt: dynamicdhcp	Defines whether to dynamically allocate DHCP leases. <table border="1"> <tr> <td>1</td><td>Dynamically allocate leases.</td></tr> <tr> <td>0</td><td>Use /etc/ethers file for serving DHCP leases.</td></tr> </table>	1	Dynamically allocate leases.	0	Use /etc/ethers file for serving DHCP leases.
1	Dynamically allocate leases.				
0	Use /etc/ethers file for serving DHCP leases.				
Web: Force UCI: dhcp.@dhcp[x].force Opt: force	Forces DHCP serving on the specified interface even if another DHCP server is detected on the same network segment. <table border="1"> <tr> <td>0</td><td>Disabled.</td></tr> <tr> <td>1</td><td>Enabled.</td></tr> </table>	0	Disabled.	1	Enabled.
0	Disabled.				
1	Enabled.				
Web: IPv4-Netmask UCI: dhcp.@dhcp[x].netmask Opt: netmask	Defines a netmask sent to clients that overrides the netmask as calculated from the interface subnet.				
Web: DHCP-Options UCI: dhcp.@dhcp[x].dhcp_option Opt: list dhcp_option	Defines additional options to be added for this dhcp pool. For example with 'list dhcp_option 26,1470' or 'list dhcp_option mtu, 1470' you can assign a specific MTU per DHCP pool. Your client must accept the MTU option for this to work. Options that contain multiple values should be separated by a comma. Example: list dhcp_option 6,192.168.2.1,192.168.2.2 <table border="1"> <tr> <td></td><td>No options defined.</td></tr> <tr> <td>Syntax</td><td>option_number, option_value</td></tr> </table>		No options defined.	Syntax	option_number, option_value
	No options defined.				
Syntax	option_number, option_value				
Web: n/a UCI: dhcp.@dhcp[x].networkid Opt: networkid	Assigns a network-id to all clients that obtain an IP address from this pool. <table border="1"> <tr> <td></td><td>Use network from interface subnet.</td></tr> <tr> <td>Range</td><td></td></tr> </table>		Use network from interface subnet.	Range	
	Use network from interface subnet.				
Range					

For more advanced configuration on the DHCP server, read 'DHCP server and DNS configuration section.

11.4. Interface Configuration Using Command Line

The configuration files are stored at `/etc/config/network`, `/etc/config/firewall` and `/etc/config/dhcp`.

Interface Configuration using UCI


```

root@VA_router:~# uci show network

### network.newinterface=interface
network.newinterface.proto=static
network.newinterface.ifname=eth0
network.newinterface.monitored=0
network.newinterface.ipaddr=2.2.2.2
network.newinterface.netmask=255.255.255.0
network.newinterface.gateway=2.2.2.10
network.newinterface.broadcast=2.2.2.255
network.newinterface.vlan_qos_map_ingress=1:2 2:1
network.ethalias1=alias
network.ethalias1.proto=static
network.ethalias1.interface=newinterface
network.ethalias1.ipaddr=10.10.10.1
network.ethalias1.netmask=255.255.255.0
network.ethalias1.gateway=10.10.10.10
network.ethalias1.bcast=10.10.10.255
network.ethalias1.dns=8.8.8.8

root@VA_router:~# uci show firewall

### firewall.@zone[0]=zone
firewall.@zone[0].name=lan
firewall.@zone[0].input=ACCEPT
firewall.@zone[0].output=ACCEPT
firewall.@zone[0].forward=ACCEPT
firewall.@zone[0].network=lan newinterface

root@VA_router:~# uci show dhcp

dhcp.@dhcp[0]=dhcp
dhcp.@dhcp[0].interface=newinterface
dhcp.@dhcp[0].mode=ipv4
dhcp.@dhcp[0].start=100
dhcp.@dhcp[0].limit=150
dhcp.@dhcp[0].leasetime=12h

```

To change any of the above values use **uci set** command.

11.4.1. Interface Configuration Using Package Options

```
root@VA_router:~# uci export network package network

config interface 'newinterface'

option proto 'static'

option ifname 'eth0'

option monitored '0'

option ipaddr '2.2.2.2'

option netmask '255.255.255.0'

option gateway '2.2.2.10'

option broadcast '2.2.2.255'

list vlan_qos_map_ingress '1:2'

list vlan_qos_map_ingress '2:1'

config alias 'ethalias1'

option proto 'static'

option interface 'newinterface'

option ipaddr '10.10.10.1'

option netmask '255.255.255.0'

option gateway '10.10.10.10'

option bcast '10.10.10.255'

option dns '8.8.8.8'

root@VA_router:~# uci export firewall package firewall

config zone

option name 'lan'

option input 'ACCEPT'

option output 'ACCEPT'

option output 'ACCEPT'

option forward 'ACCEPT'

option network 'lan newinterface'

root@VA_router:~# uci export dhcp package dhcp

config dhcp

option interface 'newinterface'

option mode 'ipv4'

option start '100'

option leasetime '12h'

option limit '150'
```

To change any of the above values use **uci set** command.

11.4.2. Loopback Interfaces UCI

Loopback interfaces are defined in exactly the same way as Ethernet interfaces.



NOTE

There is no software limitation as to how many loopback interfaces can exist on the router.

An example showing a partial uci export of a loopback interface configuration is shown below.

```
root@VA_router:~# uci export network
###
config interface 'loopback' option proto 'static' option ifname 'lo'
option ipaddr '127.0.0.1'
option netmask '255.0.0.0'
```



NOTE

We highly recommend you **do not** un-assign the 127.0.0.1 IP address from the loopback interface as this action will cause issues with the syslog mechanism and all internal logs will be routed outside the router.

If you must assign an alternative IP address to a loopback interface then you should create the alias of the loopback interface as shown below.

```
Config alias 'loopback_alt'
option interface 'loopback' option proto 'static'

option ipaddr '10.1.1.10'
option netmask '255.255.255.0'
```

11.5. Configuring Port Maps Using The Web Interface

Port Map Packages

Package	Sections
Network	va_switch

The new logical Ethernet interface needs to be mapped to a physical switch port. To configure the Ethernet switch physical port to logical interface mappings, go to the Port Map section at **Network -> Interfaces**.

Port Map

Map device ports to ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space separated port numbers in fields below

eth0

A

eth1

B

eth2

C

eth3

D

The interface port map section

Web Field/UCI/Package Option	Description								
Web: eth0 UCI: network.@va_switch[0].eth0 Opt: eth0	Defines eth0 physical switch port mapping. Must be entered in upper case. <table> <tr><td>A</td><td>Eth0 assigned to switch port A</td></tr> <tr><td>B</td><td>Eth0 assigned to switch port B</td></tr> <tr><td>C</td><td>Eth0 assigned to switch port C</td></tr> <tr><td>D</td><td>Eth0 assigned to switch port D</td></tr> </table>	A	Eth0 assigned to switch port A	B	Eth0 assigned to switch port B	C	Eth0 assigned to switch port C	D	Eth0 assigned to switch port D
A	Eth0 assigned to switch port A								
B	Eth0 assigned to switch port B								
C	Eth0 assigned to switch port C								
D	Eth0 assigned to switch port D								
Web: eth1 UCI: network.@va_switch[0].eth1 Opt: eth1	Defines eth1 physical switch port mapping. Must be entered in upper case. <table> <tr><td>A</td><td>Eth1 assigned to switch port A</td></tr> <tr><td>B</td><td>Eth1 assigned to switch port B</td></tr> <tr><td>C</td><td>Eth1 assigned to switch port C</td></tr> <tr><td>D</td><td>Eth1 assigned to switch port D</td></tr> </table>	A	Eth1 assigned to switch port A	B	Eth1 assigned to switch port B	C	Eth1 assigned to switch port C	D	Eth1 assigned to switch port D
A	Eth1 assigned to switch port A								
B	Eth1 assigned to switch port B								
C	Eth1 assigned to switch port C								
D	Eth1 assigned to switch port D								
Web: eth2 UCI: network.@va_switch[0].eth2 Opt: eth2	Defines eth0 physical switch port mapping. Must be entered in upper case. <table> <tr><td>A</td><td>Eth2 assigned to switch port A</td></tr> <tr><td>B</td><td>Eth2 assigned to switch port B</td></tr> <tr><td>C</td><td>Eth2 assigned to switch port C</td></tr> <tr><td>D</td><td>Eth2 assigned to switch port D</td></tr> </table>	A	Eth2 assigned to switch port A	B	Eth2 assigned to switch port B	C	Eth2 assigned to switch port C	D	Eth2 assigned to switch port D
A	Eth2 assigned to switch port A								
B	Eth2 assigned to switch port B								
C	Eth2 assigned to switch port C								
D	Eth2 assigned to switch port D								
Web: eth3 UCI: network.@va_switch[0].eth3 Opt: eth3	Defines eth0 physical switch port mapping. Must be entered in upper case. <table> <tr><td>A</td><td>Eth3 assigned to switch port A</td></tr> <tr><td>B</td><td>Eth3 assigned to switch port B</td></tr> <tr><td>C</td><td>Eth3 assigned to switch port C</td></tr> <tr><td>D</td><td>Eth3 assigned to switch port D</td></tr> </table>	A	Eth3 assigned to switch port A	B	Eth3 assigned to switch port B	C	Eth3 assigned to switch port C	D	Eth3 assigned to switch port D
A	Eth3 assigned to switch port A								
B	Eth3 assigned to switch port B								
C	Eth3 assigned to switch port C								
D	Eth3 assigned to switch port D								

11.6. Configuring Port Maps Using UCI

The configuration files are stored on /etc/config/network

```
root@VA_router:~# uci show network
network.@va_switch[0]=va_switch
network.@va_switch[0].eth0=A
network.@va_switch[0].eth1=B
network.@va_switch[0].eth2=C
network.@va_switch[0].eth3=D
```

To change any of the above values use **uci set** command.

11.7. Configuring Port Map Using Package Options

The configuration files are stored on `/etc/config/network`

```
root@VA_router:~# uci export network

config va_switch

option eth0 'A'

option eth1 'B'

option eth2 'C'

option eth3 'D'
```

To change any of the above values use **uci set** command.

ATM Bridges

The ATM bridges section is not used when configuring an Ethernet interface.

11.8. Interface Diagnostics



NOTE

The information presented on screen and data output using UCI depends on the actual mobile hardware being used. Therefore, the interfaces or output you see may differ from the samples shown here.

Interface Status

```
root@VA_router:~# ifconfig

3g-CDMA Link encap:Point-to-Point Protocol

inet addr:10.33.152.100 P-t-P:178.72.0.237 Mask:255.255.255.255

UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1400 Metric:1

RX packets:6 errors:0 dropped:0 overruns:0 frame:0

TX packets:23 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:3

RX bytes:428 (428.0 B) TX bytes:2986 (2.9 KiB)

eth0 Link encap:Ethernet HWaddr 00:E0:C8:12:12:15

inet addr:192.168.100.1 Bcast:192.168.100.255

Mask:255.255.255.0

inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1

RX packets:6645 errors:0 dropped:0 overruns:0 frame:0

TX packets:523 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1000

RX bytes:569453 (556.1 KiB) TX bytes:77306 (75.4 KiB)

lo Link encap:Local Loopback

inet addr:127.0.0.1 Mask:255.0.0.0

inet6 addr: ::1/128 Scope:Host

UP LOOPBACK RUNNING MTU:16436 Metric:1

RX packets:385585 errors:0 dropped:0 overruns:0 frame:0

TX packets:385585 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:0

RX bytes:43205140 (41.2 MiB) TX bytes:43205140 (41.2 MiB)
```

To display a specific interface, enter:

```
root@VA_router:~# ifconfig eth0

eth0 Link encap:Ethernet HWaddr 00:E0:C8:12:12:15

inet addr:192.168.100.1 Bcast:192.168.100.255

Mask:255.255.255.0

inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1

RX packets:7710 errors:0 dropped:0 overruns:0 frame:0

TX packets:535 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:1000

RX bytes:647933 (632.7 KiB) TX bytes:80978 (79.0 KiB)
```

11.9. Route Status

To show the current routing status, enter:

```
root@VA_router:~# route -n Kernel IP routing table
```

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
192.168.100.0	*	255.255.255.0	U	0	0	0	eth



NOTE

A route will only be displayed in the routing table when the interface is up.

11.10. ARP Table Status

To show the current ARP table of the router, enter:

```
root@va_router:~# arp
? (10.67.253.141) at 30:30:41:30:43:36 [ether] on eth8
? (10.47.48.1) at 0a:44:b2:06 [ether] on gre-gre1
```

12. Configuring VLAN

Maximum number of VLANS supported

Merlin routers support up to 4095 VLANs.

Package	Sections
Network	

12.1. Configuring VLAN Using The Web Interface

To create and configure a VLAN interface using the web interface, in the top menu, select **Network -> Interfaces**.

Click **Add new interface**. The Create Interface page appears.

The Create interface page

Web Field/UCI/Package Option	Description																										
Web: Name of the new interface UCI: network.vlan1=interface Opt: interface	Type the name of the new interface. For example, VLAN1																										
Web: Protocol of the new interface UCI: network.vlan_tets.proto Opt: proto	Protocol type. Select Static . <table border="1"> <thead> <tr> <th>Option</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Static</td><td>Static configuration with fixed address and netmask.</td></tr> <tr> <td>DHCP Client</td><td>Address and netmask are assigned by DHCP</td></tr> <tr> <td>Unmanaged</td><td>Unspecified</td></tr> <tr> <td>IPv6-inIPv4 (RFC4213)</td><td>Used with tunnel brokers</td></tr> <tr> <td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport</td></tr> <tr> <td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr> <tr> <td>IOT</td><td></td></tr> <tr> <td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr> <tr> <td>PPP</td><td>Point to Point Protocol</td></tr> <tr> <td>PPPoE</td><td>PPP over Ethernet</td></tr> <tr> <td>PPPoATM</td><td>PPP over ATM</td></tr> <tr> <td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS, or GPRS connection using an AT-style 3g modem</td></tr> </tbody> </table>	Option	Description	Static	Static configuration with fixed address and netmask.	DHCP Client	Address and netmask are assigned by DHCP	Unmanaged	Unspecified	IPv6-inIPv4 (RFC4213)	Used with tunnel brokers	IPv6-over-IPv4	Stateless IPv6 over IPv4 transport	GRE	Generic Routing Encapsulation protocol	IOT		L2TP	Layer 2 Tunnelling Protocol	PPP	Point to Point Protocol	PPPoE	PPP over Ethernet	PPPoATM	PPP over ATM	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem
Option	Description																										
Static	Static configuration with fixed address and netmask.																										
DHCP Client	Address and netmask are assigned by DHCP																										
Unmanaged	Unspecified																										
IPv6-inIPv4 (RFC4213)	Used with tunnel brokers																										
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport																										
GRE	Generic Routing Encapsulation protocol																										
IOT																											
L2TP	Layer 2 Tunnelling Protocol																										
PPP	Point to Point Protocol																										
PPPoE	PPP over Ethernet																										
PPPoATM	PPP over ATM																										
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem																										
Web: Create a bridge over multiple interfaces UCI: network.vlan1.type Opt: ifname	Create a bridge over multiple interfaces.																										
Web: Cover the following interface UCI: network.vlan1.ifname Opt: ifname	Check the Custom Interface radio button. Enter a name, for example, eth0.100. this will assign VLAN 100 to the eth0 interface.																										

Click **Submit**. The Interfaces page for VLAN1 appears.

12.2. General Setup: VLAN

WAN

VLAN1

VLAN2

LAN

Interfaces - VLAN1

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANID (e.g. eth0.1).

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Status

eth0.1

Uptime: 5h 4m 41s
MAC Address: 00:00:00:10:10:10
RX: 0.00 B (0 Pkts.)
TX: 252.00 B (0 Pkts.)
IPv4: 172.16.100.1/24

Protocol

Static address

IPv4 address

172.16.100.1

IPv4 netmask

255.255.255.0

IPv4 gateway

IPv4 broadcast

Use custom DNS

advertis

The common configuration general setup page

Web Field/UCI/Package Option	Description																										
Web: Protocol UCI: network.VLAN1.proto Opt: proto	Protocol type. <table> <tr> <th>Option</th><th>Description</th></tr> <tr> <td>Static</td><td>Static configuration with fixed address and netmask.</td></tr> <tr> <td>DHCP Client</td><td>Address and netmask are assigned by DHCP</td></tr> <tr> <td>Unmanaged</td><td>Unspecified</td></tr> <tr> <td>IPv6-inIPv4 (RFC4213)</td><td>Used with tunnel brokers</td></tr> <tr> <td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport</td></tr> <tr> <td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr> <tr> <td>IOT</td><td></td></tr> <tr> <td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr> <tr> <td>PPP</td><td>Point to Point Protocol</td></tr> <tr> <td>PPPoE</td><td>PPP over Ethernet</td></tr> <tr> <td>PPPoATM</td><td>PPP over ATM</td></tr> <tr> <td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS, or GPRS connection using an AT-style 3g modem</td></tr> </table>	Option	Description	Static	Static configuration with fixed address and netmask.	DHCP Client	Address and netmask are assigned by DHCP	Unmanaged	Unspecified	IPv6-inIPv4 (RFC4213)	Used with tunnel brokers	IPv6-over-IPv4	Stateless IPv6 over IPv4 transport	GRE	Generic Routing Encapsulation protocol	IOT		L2TP	Layer 2 Tunnelling Protocol	PPP	Point to Point Protocol	PPPoE	PPP over Ethernet	PPPoATM	PPP over ATM	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem
Option	Description																										
Static	Static configuration with fixed address and netmask.																										
DHCP Client	Address and netmask are assigned by DHCP																										
Unmanaged	Unspecified																										
IPv6-inIPv4 (RFC4213)	Used with tunnel brokers																										
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport																										
GRE	Generic Routing Encapsulation protocol																										
IOT																											
L2TP	Layer 2 Tunnelling Protocol																										
PPP	Point to Point Protocol																										
PPPoE	PPP over Ethernet																										
PPPoATM	PPP over ATM																										
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem																										
Web: IPv4 address UCI: network.VLAN1.ipaddr Opt: ipaddr	The IPv4 address of the interface. This is optional if an IPv6 address is provided.																										
Web: IPv4 netmask UCI: network.VLAN1.netmask Opt: netmask	Subnet mask to be applied to the IP address of this interface.																										
Web: IPv4 gateway UCI: network.VLAN1.gateway Opt: gateway	IPv4 default gateway to assign to this interface (optional).																										
Web: Use custom DNS servers UCI: network.VLAN1.dns Opt: dns	List of DNS server IP addresses (optional).																										

12.3. Firewall Settings: VLAN

Use this section to select the firewall zone you want to assign to the VLAN interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

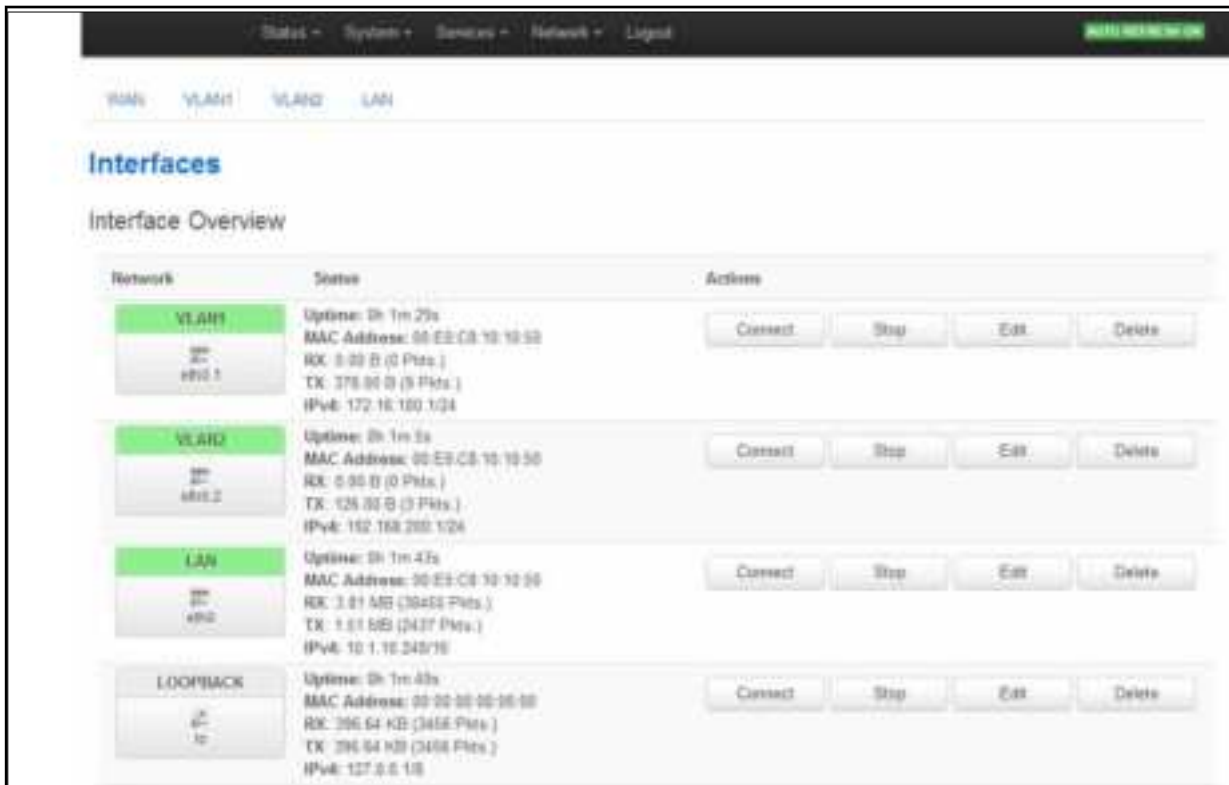
The common configuration firewall settings page

When you have added all the VLAN interfaces you require, click **Save & Apply**.

12.4. Viewing VLAN Interface Settings

To view the new VLAN interface settings, in the top menu, select **Network -> Interfaces**. The Interfaces Overview page appears.

The example below shows two VLAN interfaces configured.



The interface overview page showing two VLAN interfaces

12.5. Configuring VLAN Using UCI

You can configure VLANs through CLI. The VLAN configuration file is stored on: **/etc/config/network**

```
# uci export network
package network
config interface 'vlan100'
option proto 'static'
option ifname 'eth0.100'
option monitored '0'
option ipaddr '192.168.100.1'
option netmask '255.255.255.0'
option gateway '192.168.100.10'
option broadcast '192.168.100.255'
option dns '8.8.8.8'
```

Modify these settings by running **uci set <parameter>** command.

When specifying the ifname ensure that it is written in dotted mode, that is, eth1.100 where eth1 is the physical interface assigned to VLAN tag 100.

**NOTE**

VLAN1 is, by default, the native VLAN and will not be tagged.

13. Configuring Mobile Manager

The Mobile Manager feature allows you to configure SIM settings.

Configuration Package Used

Package	Sections
mobile	main
	callers
	roaming_template

13.1. Configuring Mobile Manager Using The Web Interface

Select **Services -> Mobile Manager**. The Mobile Manager page appears. There are four sections in the mobile manager page:

Section	Description
Basic	Enable SMS, configure SIM pin code and select roaming SIM.
Advanced	Configure advanced options such as collect ICCIDs and temperature polling interval.
LTE	LTE-specific settings
CDMA*	CDMA configuration.
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure Preferred Roaming List options.
*Option available only for CDMA modules.	

13.1.1. Mobile Manager: Basic Settings

MAIN

Basic

Advanced

LTE

CDMA

SMS Enable

☒

PIN-code for SIM1

PIN-code for SIM2

The mobile manager basic settings page

Web Field/UCI/Package Option	Description				
Web: SMS Enable UCI: mobile.main.sms Opt: sms	Enables or disables SMS functionality. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled
Default: 1	Enabled				
0	Disabled				
Web: PIN code for SIM1 UCI: mobile.main.sim1pin Opt: sim1pin	Depending on the SIM card specify the pin code for SIM 1. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>Depends on the SIM provider</td></tr> </table>	Default	Blank	Range	Depends on the SIM provider
Default	Blank				
Range	Depends on the SIM provider				
Web: PIN code for SIM2 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 2. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>Depends on the SIM provider</td></tr> </table>	Default	Blank	Range	Depends on the SIM provider
Default	Blank				
Range	Depends on the SIM provider				

13.1.2. Mobile Manager: Advanced Settings

MAIN

Basic

Advanced

LTE

CDMA

Collect ICCIDs

☐ Collect ICCIDs on startup

Force Mode

Automatic

Select network interface mode

Temperature Polling Interval (Seconds)

30

Automatic Firmware Selection

☐ Select firmware based on network operator - only supported on some radio modules

Allow USB Power Cycle

☒ Power cycle usb bus if modem disappeared from the USB bus for more than 40 seconds

The mobile manager advanced settings page

Web Field/UCI/Package Option	Description									
Web: Collect ICCIDs UCI: mobile.main.init_get_iccids Opt: init_get_iccids	Enables or disables integrated circuit card identifier ICCIDs collection functionality. If enabled, then both SIM 1 and SIM 2 ICCIDs will be collected; otherwise it will default to SIM 1. This will be displayed under mobile stats. <table><tr><td>Default: 1</td><td>Enabled</td></tr><tr><td>0</td><td>Disabled</td></tr></table>	Default: 1	Enabled	0	Disabled					
Default: 1	Enabled									
0	Disabled									
Web: Force Mode UCI: mobile.main.force_mode Opt: force_mode	Defines whether to operate mobile modem in PPP or Ethernet mode. The mode will be dependent on the service provided by the mobile provider. In general, this is Ethernet mode (default). Note: It should not be necessary to force PPP mode – contact your support representative for advice. <table><tr><th>Web</th><th>UCI</th><th>Description</th></tr><tr><td>Automatic</td><td></td><td>Ethernet mode (option not present)</td></tr><tr><td>PPP</td><td>tty</td><td>Enable PPP mode</td></tr></table>	Web	UCI	Description	Automatic		Ethernet mode (option not present)	PPP	tty	Enable PPP mode
Web	UCI	Description								
Automatic		Ethernet mode (option not present)								
PPP	tty	Enable PPP mode								
Web: Temperature Polling Interval UCI: mobile.main.temp_poll_interval_sec Opt: temp_poll_interval_sec	Defines the time in seconds to poll the mobile module for temperature. Set to 0 to disable.									
Web: Automatic Firmware Selection UCI: mobile.main.enable_firmware_autoselect Opt: enable_firmware_autoselect	Enables the selection of an operator-specific firmware in the radio module. The selection is based on the ICCID of the used SIM. At module initialisation the IMSI is checked and if necessary, the correct firmware image in the module will be activated. Note: activation of the firmware will lead to a delayed startup of the network interface associated with the radio module. Note: this feature is currently only supported for the Telit LE910NA V2 module. Here Verizon-specific firmware will be selected if the ICCID starts with “891480”. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled					
Default: 0	Disabled									
1	Enabled									
Web: Allow USB Power Cycle UCI: mobile.main.allow_usb_powercycle Opt: allow_usb_powercycle	Defines whether to automatically power cycle the USB modem if a mobile module is not detected for 40 seconds. <table><tr><td>Default: 1</td><td>Enabled</td></tr><tr><td>0</td><td>Disabled</td></tr></table>	Default: 1	Enabled	0	Disabled					
Default: 1	Enabled									
0	Disabled									

13.1.3. Mobile Manager: LTE Settings

MAIN

Basic

Advanced

LTE

CDMA

SIM1 LTE Bands

Comma-separated list of LTE bands to use with SIM1

SIM2 LTE Bands

Comma-separated list of LTE bands to use with SIM2

SIM 1: Default bearer

APN enabled

SIM1: Default bearer

APN

SIM1: Default bearer

APN username

SIM1: Default bearer

APN password

SIM1: Default bearer

APN authentication type

CHAP

Select APN authentication type

SIM 1: Default bearer

IPv4 enabled

SIM 1: Default bearer

IPv6 enabled

SIM 2: Default bearer

APN enabled

The mobile manager LTE settings page

Web Field/UCI/Package Option	Description									
Web: SIM1: LTE bands UCI: mobile.main.sim1_lte_bands Opt: sim1_lte_bands	Depending on the SIM card, specify the LTE bands for SIM 1. Comma delimiter. Example: option sim1_lte_bands `3,20` Limits LTE bands to 3 and 20 Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200, Asiatel and Quectel radio modules. <table><tr><td>Default:</td><td>Blank</td></tr><tr><td>Range</td><td>LTE bands range from 1 to 70.</td></tr></table>	Default:	Blank	Range	LTE bands range from 1 to 70.					
Default:	Blank									
Range	LTE bands range from 1 to 70.									
Web: SIM2: LTE bands UCI: mobile.main.sim2_lte_bands Opt:sim2_lte_bands	Depending on the SIM card, specify the LTE bands for SIM 2. Comma delimiter. Example: option sim2_lte_bands `3,20` Limits LTE bands to 3 and 20 Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200, Asiatel and Quectel radio modules. <table><tr><td>Default:</td><td>Blank</td></tr><tr><td>Range</td><td>LTE bands range from 1 to 70.</td></tr></table>	Default:	Blank	Range	LTE bands range from 1 to 70.					
Default:	Blank									
Range	LTE bands range from 1 to 70.									
Web: SIM1: Default bearer APN enabled UCI: mobile.main.sim1_lte_default_apn_enabled Opt: sim1_lte_default_apn_enabled	Enables the use of a specific LTE attach bearer. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled					
Default: 0	Disabled									
1	Enabled									
Web: SIM1: Default bearer APN UCI: mobile.main.sim1_lte_default_apn Opt: sim1_lte_default_apn	Specifies the LTE attach bearer APN.									
Web: SIM1: Default bearer APN username UCI: mobile.main.sim1_lte_default_apn_username Opt: sim1_lte_default_apn_username	Username for authentication with attach bearer APN.									
Web: SIM1: Default bearer APN password UCI: mobile.main.sim1_lte_default_apn_password Opt: sim1_lte_default_apn_password	Password for authentication with attach bearer APN. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>CHAP</td><td>CHAP authentication</td><td>2</td></tr><tr><td>PAP</td><td>PAP authentication</td><td>1</td></tr></table>	Web	Description	UCI	CHAP	CHAP authentication	2	PAP	PAP authentication	1
Web	Description	UCI								
CHAP	CHAP authentication	2								
PAP	PAP authentication	1								
Web: SIM1: Default bearer IPv4 enabled UCI: mobile.main.sim1_lte_default_apn_ipv4 Opt: sim1_lte_default_apn_ipv4	Enables IPv4 for the attach bearer <table><tr><td>Default: 0</td><td>IPv4 disabled</td></tr><tr><td>1</td><td>IPv4 enabled</td></tr></table>	Default: 0	IPv4 disabled	1	IPv4 enabled					
Default: 0	IPv4 disabled									
1	IPv4 enabled									
Web: SIM1: Default bearer IPv6 enabled UCI: mobile.main.sim1_lte_default_apn_ipv6 Opt: sim1_lte_default_apn_ipv6	Enables IPv6 for the attach bearer. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled					
Default: 0	Disabled									
1	Enabled									
Web: SIM2: Default bearer APN UCI: mobile.main.sim2_lte_default_apn Opt: sim2_lte_default_apn	Specifies the LTE attach bearer APN.									
Web: SIM2: Default bearer APN username UCI: mobile.main.sim2_lte_default_apn_username	Username for authentication with attach bearer APN.									

Web Field/UCI/Package Option	Description									
Opt: sim2_lte_default_apn_username										
Web: SIM2: Default bearer APN password UCI: mobile.main.sim2_lte_default_apn_password Opt: sim2_lte_default_apn_password	Password for authentication with attach bearer APN.									
Web: SIM2: Default bearer APN authentication type UCI: mobile.main.sim2_lte_default_apn_password Opt: sim2_lte_default_apn_password	Selects the APN authentication mechanism. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>CHAP</td><td>CHAP authentication</td><td>2</td></tr><tr><td>PAP</td><td>PAP authentication</td><td>1</td></tr></table>	Web	Description	UCI	CHAP	CHAP authentication	2	PAP	PAP authentication	1
Web	Description	UCI								
CHAP	CHAP authentication	2								
PAP	PAP authentication	1								
Web: SIM2: Default bearer IPv4 enabled UCI: mobile.main.sim2_lte_default_apn_ipv4 Opt: sim2_lte_default_apn_ipv4	Enables IPv4 for the attach bearer <table><tr><td>Default: 0</td><td>IPv4 disabled</td></tr><tr><td>1</td><td>IPv4 enabled</td></tr></table>	Default: 0	IPv4 disabled	1	IPv4 enabled					
Default: 0	IPv4 disabled									
1	IPv4 enabled									
Web: SIM2: Default bearer IPv6 enabled UCI: mobile.main.sim2_lte_default_apn_ipv6 Opt: sim2_lte_default_apn_ipv6	Enables IPv6 for the attach bearer <table><tr><td>Default: 0</td><td>IPv6 disabled</td></tr><tr><td>Range</td><td>IPv6 enabled</td></tr></table>	Default: 0	IPv6 disabled	Range	IPv6 enabled					
Default: 0	IPv6 disabled									
Range	IPv6 enabled									

13.1.4. Mobile Manager: CDMA Settings

This configuration page is only supported for CDMA modules.

MAIN

Basic

Advanced

LTE

CDMA

IMSI

if specified over-rides IMSI stored in radio module

HDR Auth User ID

AN-PPP user id. Supported on Cellent module only

HDR Auth Password

AN-PPP password. Supported on Cellent module only

Ordered Registration triggers module reboot

☐

Station Class Mark

Slot Cycle Index

Slot Mode

Mobile Directory Number

MOB_TERM_HOME registration flag

☐

MOB_TERM_FOR_SID registration flag

☐

MOB_TERM_FOR_NID registration flag

☐

The mobile manager CDMA page

Web Field/UCI/Package Option	Description				
Web: IMSI UCI: mobile.main.imsi Opt: imsi	Allows the IMSI (International Mobile Subscriber Identity) to be changed. <table border="1"> <tr> <td>Default:</td><td>Programmed in module.</td></tr> <tr> <td>Range</td><td>Up to 15 digits</td></tr> </table>	Default:	Programmed in module.	Range	Up to 15 digits
Default:	Programmed in module.				
Range	Up to 15 digits				
Web: HDR Auth User ID UCI: mobile.main.hdr_userid Opt: hdr_userid	AN-PPP user ID. Supported on Cellient CDMA modem only. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>Depends on the CDMA provider.</td></tr> </table>	Default:	Blank	Range	Depends on the CDMA provider.
Default:	Blank				
Range	Depends on the CDMA provider.				
Web: HDR Auth User Password UCI: mobile.main.hdr_password Opt: hdr_password	AN-PPP password. Supported on Cellient CDMA modem only. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>Depends on the CDMA provider.</td></tr> </table>	Default:	Blank	Range	Depends on the CDMA provider.
Default:	Blank				
Range	Depends on the CDMA provider.				
Web: Ordered Registration triggers module reboot UCI: mobile.main. mobile.main.cdma_ordered_registration_reboot_enabled Opt: cdma_ordered_registration_reboot_enabled	Enables or disables rebooting the module after the order registration command is received from a network. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Station Class Mark UCI: mobile.main.cdma_station_class_mark Opt: cdma_station_class_mark	Allows the station class mark for the MS to be changed. <table border="1"> <tr> <td>Default:</td><td>58</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default:	58	Range	0-255
Default:	58				
Range	0-255				
Web: Slot Cycle Index UCI: mobile.main.cdma_slot_cycle_index Opt: cdma_slot_cycle_index	Defines the desired slot cycle index if different from the default. <table border="1"> <tr> <td>Default:</td><td>2</td></tr> <tr> <td>Range</td><td>0-7</td></tr> </table>	Default:	2	Range	0-7
Default:	2				
Range	0-7				
Web: Slot Mode UCI: mobile.main.cdma_slot_mode Opt: cdma_slot_mode	Specifies the slot mode. <table border="1"> <tr> <td>Default:</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default:	0	Range	
Default:	0				
Range					
Web: Mobile Directory Number UCI: mobile.main.cdma_mobile_directory_number Opt: cdma_mobile_directory_number	Allows the mobile directory number (MDN) to be changed. <table border="1"> <tr> <td>Default:</td><td>Programmed in module.</td></tr> <tr> <td>Range</td><td>Up to 15 digits</td></tr> </table>	Default:	Programmed in module.	Range	Up to 15 digits
Default:	Programmed in module.				
Range	Up to 15 digits				
Web: MOB_TERM_HOME registration flag UCI: mobile.main. cdma_mob_term_home_registration_flag Opt: cdma_mob_term_home_registration_flag	The MOB_TERM_HOME registration flag. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled
Default: 1	Enabled				
0	Disabled				
Web: MOB_TERM_FOR_SID registration flag UCI: mobile.main. cdma_mob_term_for_sid_registration_flag Opt: cdma_mob_term_for_sid_registration_flag	The MOB_TERM_FOR_SID registration flag. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled
Default: 1	Enabled				
0	Disabled				
Web: MOB_TERM_FOR_NID registration flag UCI: mobile.main. cdma_mob_term_for_nid_registration_flag Opt: cdma_mob_term_for_sid_registration_flag	The MOB_TERM_FOR_NID registration flag. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled
Default: 1	Enabled				
0	Disabled				
Web: Access Overload Control UCI: mobile.main.cdma_access_overload_control	Allows the access overload class to be changed. <table border="1"> <tr> <td>Default:</td><td>Programmed into module as part of IMSI</td></tr> </table>	Default:	Programmed into module as part of IMSI		
Default:	Programmed into module as part of IMSI				

Web Field/UCI/Package Option	Description
Opt: cdma_access_overload_control	1 Enabled
Web: Preferred Serving System UCI: mobile.main.cdma_preferred_serving_system Opt: cdma_preferred_serving_system	The CDMA Preferred Serving System(A/B). Default: 5
Web: Digital Analog Mode Preference UCI: cdma_digital_analog_mode_preference Opt: cdma_digital_analog_mode_preference	Digital/analog mode preference. Default: 4
Web: Primary Channel A UCI: mobile.main.cdma_primary_channel_a Opt: cdma_primary_channel_a.	Allows the primary channel (A) to be changed. Default: 283 Range: 1-2016. Any band class 5 channel number.
Web: Primary Channel B UCI: mobile.main.cdma_primary_channel_b Opt: cdma_primary_channel_b	Allows the primary channel (B) to be changed. Default: 384 Range: 1-2016. Any band class 5 channel number.
Web: Secondary Channel A UCI: mobile.main.cdma_secondary_channel_a Opt: cdma_secondary_channel_a	Allows the secondary channel (A) to be changed. Default: 691 Range: 1-2016. Any band class 5 channel number.
Web: Secondary Channel B UCI: mobile.main.cdma_secondary_channel_b Opt: cdma_secondary_channel_b	Allows the secondary channel (B) to be changed. Default: 777 Range: 1-2016. Any band class 5 channel number.
Web: Preferred Forward & Reverse RC UCI: mobile.main.cdma_preferred_forward_and_reverse_rc Opt: cdma_preferred_forward_and_reverse_rc	The preferred forward & reverse RC value, this takes the form "forward_rc,reverse_rc" Default: 0,0 Format: forward radio channel, reverse radio channel
Web: SID-NID pairs UCI: mobile.main.cdma_sid_nid_pairs Opt: cdma_sid_nid_pairs	Allows specification of SID:NID pairs, this takes the form "SID1,NID1,SID2,NID2, Default: 0,0 Format: SID1 (0-65535),NID (0-65535)

Mobile manager: roaming interface template

For more information on Roaming Interface Template configuration, read the chapter, 'Automatic Operator Selection'.

13.1.5. Mobile Manager: Callers

Callers

Configure caller numbers that may use the SMS service

Name: Name of the caller

Number: Number of the caller. Use * for wildcard matching

Enable: ☐

Respond: ☐

The mobile manager CDMA page

Web Field/UCI/Package Option	Description				
Web: Name UCI: mobile.@caller[0].name Opt:name	Name assigned to the caller. <table><tr><td>Default:</td><td>Blank</td></tr><tr><td>Range</td><td>No limit</td></tr></table>	Default:	Blank	Range	No limit
Default:	Blank				
Range	No limit				
Web: Number UCI: mobile.@caller[0].number Opt:number	Number of the caller allowed to SMS the router. Add in specific caller numbers, or use the * wildcard symbol. <table><tr><td>Default:</td><td>Blank</td></tr><tr><td>Range</td><td>No limit</td></tr></table>	Default:	Blank	Range	No limit
Default:	Blank				
Range	No limit				
Web: Enable UCI: mobile.@caller[0].enabled Opt:enabled	Enables or disables incoming caller ID. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Respond UCI: mobile.@caller[0].respond Opt: respond	If checked, the router will return an SMS. Select Respond if you want the router to reply. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

13.2. Configuring Mobile Manager Using UCI

The configuration files for mobile manager are stored on `/etc/config/mobile`

The following example shows how to enable the SMS functionality to receive and respond from certain caller ID numbers.

```
root@VA_router:~# uci show mobile

uci set mobile.main=mobile

uci set mobile.main.sim1pin=0000

uci set mobile.main.sim2pin=0000

uci set mobile.main.sim1_lte_bands='3,20'

uci set mobile.main.sim2_lte_bands='4,5'

uci set mobile.main.temp_poll_interval_sec=61

uci set mobile.main.enable_firmware_autoselect=0

uci set mobile.main.allow_usb_powercycle=1

uci set mobile.main.roaming_sim=none

uci set mobile.main.sms=1

uci set mobile.main.hdr_password=5678

uci set mobile.main.hdr_userid=1234

uci set mobile.main.init_get_iccids=1

uci set mobile.@caller[0]=caller

uci set mobile.@caller[0].name=user1

uci set mobile.@caller[0].number=3538712345678

uci set mobile.@caller[0].enabled=1

uci set mobile.@caller[0].respond=1

uci set mobile.@caller[1]=caller

uci set mobile.@caller[1].name=user2

uci set mobile.@caller[1].number=3538723456789

uci set mobile.@caller[1].enabled=1

uci set mobile.@caller[1].respond=1
```

Mobile manager using package options

```
root@VA_router:~# uci export mobile

package mobile

config mobile 'main'

option sim1pin '0000'

option sim2pin '0000'

option roaming_sim 'none' option sms '1'

option hdr_password '5678'

option hdr_userid '1234'

option init_get_iccids '1'

option sim1_lte_bands '3,20'

option sim2_lte_bands '4,5'

option temp_poll_interval_sec '61'

option enable_firmware_autoselect '0'

option allow_usb_powercycle '1'

config caller

option name 'vasupport' option number '353871234567'

option enabled '1'

option respond '1'

config caller

option name 'vasupport1' option number '353872345678'

option enabled '1'

option respond '1'
```

13.3. Monitoring SMS

You can monitor inbound SMS messages using the router's web browser or via an SSH session

To monitor SMS using the web browser, login and select **Status > system log**. Scroll to the bottom of the log to view the SMS message.

Status - System - Services - Network - Logout

System Log

Aug 10 09:24:52 user.err GW0000 mobile[4016]: SIM 1 is not inserted
Aug 10 09:24:52 user.notice GW0000 3g: Failed to establish connection
Aug 10 09:25:54 user.notice GW0000 mobile[4016]: Already on SIM1
Aug 10 09:25:54 user.err GW0000 mobile[4016]: SIM 1 is not inserted

Example of output from system log

To monitor using SSH, login and enter:

```
logread -f &
```


Or, when logging system messages to a flash file at /root/syslog.messages

```
tail -f /root/syslog.messages &
```

13.3.1. Sending SMS From The Router

You can send an outgoing message via the command line using the following syntax:

```
sendsms 353879876543 'hello'  
root@VirtualAccess:~# Aug 10 16:29:1 user:notice VirtualAccess  
mobile[1737]: Queue sms to 353879876543 "hello"
```

13.3.2. Sending SMS To The Router

The router can accept UCI show and set commands via SMS if the caller is enabled.



NOTE

Commands are case sensitive.

An example would be to SMS the SIM card number by typing the following command on the phone and checking the SMS received from the router.

```
uci show mobile.@caller[0].number
```

Multiple commands can be sent in a single SMS using a semicolon (;) separator; for example, to set the router to factory config and then reboot.

```
vacmd set next config factconf;reboot
```

14. Configuring Multi-APNs For Mobile Interfaces

Some of our routers, including the Merlin Series, support simultaneous multiple APN connections to be connected using a single SIM card. Up to two APNs per SIM are currently supported.

Support for this feature is limited to specific mobile modules.

Supported Mobile Modules

Vendor	Module
Quectel	Quectel EC25
SIMCOM	SIMCOM7600E-H

Configuration Package Used

Package	Sections
network	interface

14.1. Multi-APN Overview

A PDP (Packet Data Protocol) context is a data structure that exists within the mobile service provider's network that contains a subscriber's session information when the subscriber has an active session. The PDP context data structure contains:

- the subscriber's IP address,
- IMSI (International Mobile Subscriber Identity), and
- APN (Access Point Name)

It is sometimes required to connect to two different APNs at the same time. This can be achieved with a single SIM card using separate PDP contexts.



NOTE

The SIM card must allow connection to each of the APNs. Also, two PDP contexts from the same SIM card cannot use the same APN.

You can use routing and VRF support for each PDP context by referring to the unique interface name that the APN is configured under. Routing and VRF support can be utilised for each PDP context. For more information on these features, read chapters 'Configuring Static Routes' and 'VRF: Virtual Router Forwarding'.

Multi-WAN can control routing to each PDP context in the same way it can control routing to other interfaces. However, in package multiwan option `manage_state`, set to `no` for both multiwan interface configurations. Multiwan will then control routing through each PDP context by altering the interface metric to '-1' when it determines the interface has failed its health check.

14.2. Configuring Multi-APN Using The Web Interface

To configure Multi-APN, select **Network -> Interface**. A unique PDP context needs to be configured on each mobile interface. For more information on how to configure a mobile interface, read the chapter 'Configuring a mobile connection'.



NOTE

On each mobile interface set **option sim** to the same number and not to **any**.

Name	Status	Actions
MOBILE1	Up	Connect Stop Edit Delete
MOBILE2	Up	Connect Stop Edit Delete
LAN	Up	Connect Stop Edit Delete
LOOPBACK	Up	Connect Stop Edit Delete
WLAN	Up	Connect Stop Edit Delete

The network interface page

On the the desired mobile interface, select **Edit** and then select **Advanced Settings**.

Interfaces - MOBILE1

Common Configuration

Authentication type: Click to select authentication type

PDP context: Click to select PDP context

Enable IPsec negotiation on the PDP link: ☐

Session timeout: Maximum amount of seconds to wait for the mobile to become ready

Use default gateway: ☐ If unchecked, no default route is configured

Use gateway metric:

IPsec Mode:

IPsec Mode:

The mobile interface advanced settings page

Web Field/UCI/Package Option	Description				
Web: PDP context	Defines the PDP context ID. Should multiple active PDP contexts be supported, you must configure interfaces with different PDP context IDs.				
UCI: network.[interface].pdp_context					
Opt:pdp_context					
	<table border="1"> <tr> <td>1</td><td></td></tr> <tr> <td>Range</td><td>1-4</td></tr> </table>	1		Range	1-4
1					
Range	1-4				

14.3. Configuring Multi-APN Using The Command Line

You can configure multi-APN using the interface configuration section in the network package `/etc/config/network` using the option `pdp_context`. The option value should be an integer that is unique to each APN configuration.

14.3.1. Configuring Multi-APN Using UCI

```
root@VA_router:~# uci show network
package network

network.Mobile1=interface
network.Mobile1.proto=3g
network.Mobile1.apn=open.internet
network.Mobile1.username=gprs
network.Mobile1.password=gprs
network.Mobile1.sim=1
network.Mobile1.service=auto
network.Mobile1.metric=1
```

```
network.Mobile1.pdp_context=1
network.Mobile2=interface
network.Mobile2.proto=3g
network.Mobile2.apn=3ireland.ie
network.Mobile2.sim=1
network.Mobile2.service=auto
network.Mobile2.metric=1
network.Mobile2.pdp_context=2
```

Configuring multi-APN using package options

```
root@VA_router:~# uci export
network package network

#####

config interface 'Mobile1'
option proto '3g'
option apn 'open.internet'
option username 'gprs'
option password 'gprs'
option sim '1'
option service 'auto'
option metric '1'
option pdp_context '1'
config interface 'Mobile2'
option proto '3g'
option apn '3ireland.ie'
option sim '1'
option service 'auto'
option metric '1'
option pdp_context '2'
```

Example of simple routing over multi-APN using UCI

```
root@VA_router:~# uci show network

package network

network.Mobile1=interface
network.Mobile1.proto=3g
network.Mobile1.apn=open.internet
network.Mobile1.username=gprs
network.Mobile1.password=gprs
network.Mobile1.sim=1
network.Mobile1.service=auto
network.Mobile1.metric=1
network.Mobile1.pdp_context=1
network.Mobile1.defaultroute=0

network.Mobile2=interface
network.Mobile2.proto=3g
network.Mobile2.apn=3ireland.ie
network.Mobile2.sim=1
network.Mobile2.service=auto
network.Mobile2.metric=1
network.Mobile2.pdp_context=2
network.Mobile1.defaultroute=0

#####

network.8888=route
network.8888.interface=Mobile1
network.8888.target=8.8.8.8
network.8888.netmask=255.255.255.255

network.8844=route
network.8844.interface=Mobile1
network.8844.target=8.8.4.4
network.8844.netmask=255.255.255.255
```

14.4. Multi-APN Diagnostics

Interface Status

When active, to see the status of interfaces with multiple APNs, enter:

```
root@VA_router:~# ifconfig

#####

qmimux0 Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00
inet addr:10.205.77.223 P-t-P:10.205.77.223 Mask:255.255.255.192
inet6 addr: fe80::9bb3:25f7:278ca8f1/64 Scope:Link
```

```
UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1500 Metric:1

RX packets:5 errors:0 dropped:0 overruns:0 frame:0 TX packets:23 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1

RX bytes:1540 (1.5 KiB) TX bytes:3976 (3.8 KiB)

qmimux1 Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00
inet addr:10.209.38.182 P-t-P:10.209.38.182 Mask:255.255.255.252
inet6 addr: fe80::89f2:b5d5:f017:ae91/64 Scope:Link

UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1500 Metric:1

RX packets:94 errors:0 dropped:0 overruns:0 frame:0 TX packets:293 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1

RX bytes:9032 (8.8 KiB) TX bytes:20860 (20.3 KiB)
```

To check which mobile interface corresponds to the output from the ifconfig command shown above, enter:

```
root@VA_router:~# network_status -a

Interface: Mobile1

Status: Up

Uptime: 00h 05m 30s

IPv4 addresses: 10.202.187.228/29 MAC address: 00:00:00:00:00:00

Device name: "qmimux0"

Interface: Mobile2

Status: Up

Uptime: 00h 05m 27s

IPv4 addresses: 10.201.206.252/29 MAC address: 00:00:00:00:00:00

Device name: "qmimux1"
```

14.4.1. Routing Table

To check the routing table, enter:

```
root@VA_router:~# ip route  
8.8.4.4 via 10.204.5.101 dev qmimux0  
8.8.8.8 via 10.204.5.101 dev qmimux0  
10.204.5.100/30 dev qmimux0 proto kernel scope link src 10.204.5.102  
10.209.38.180/30 dev qmimux1 proto kernel scope link src 10.209.38.182  
192.168.100.0/24 dev eth0 proto kernel scope link src 192.168.100.1  
192.168.101.0/24 dev wlan0 proto kernel scope link src 192.168.101.1  
192.168.101.0/24 dev wlan1 proto kernel scope link src 192.168.101.1
```


15. Configuring A GRE Interface

General Routing Encapsulation (GRE) is a tunnelling protocol used for encapsulation of other communication protocols inside point to point links over IP.

Configuration Packages Used

Package	Sections
network	interface

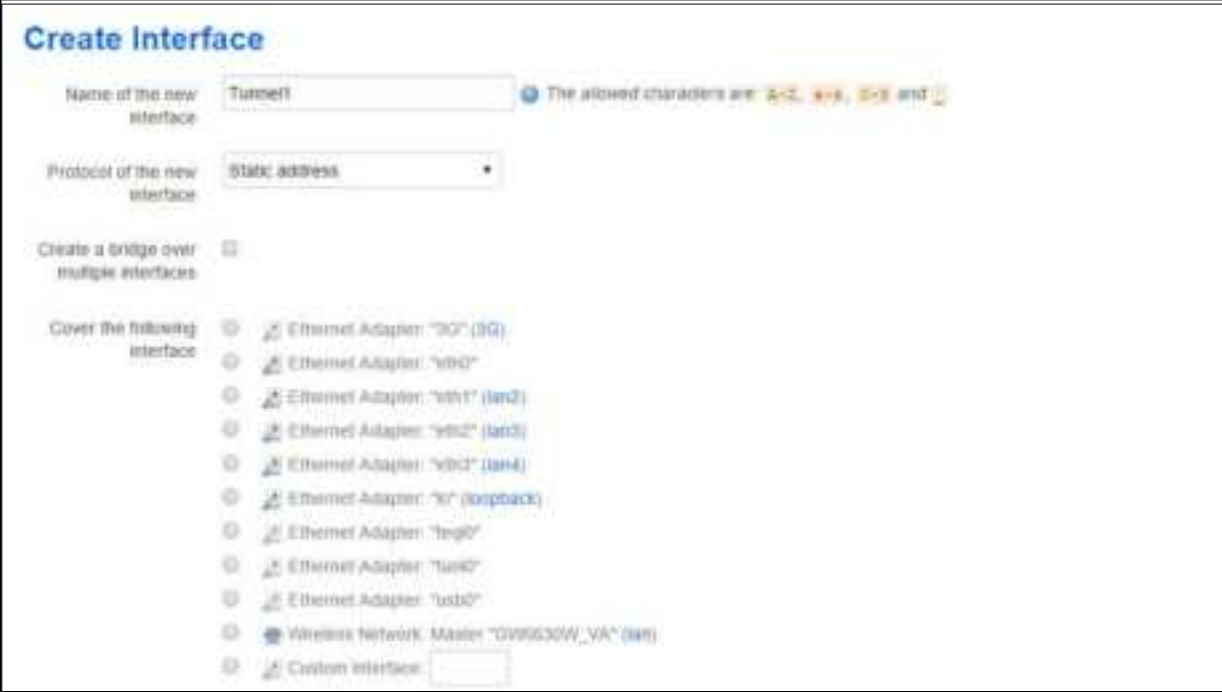
15.1. Creating A GRE Connection Using The Web Interface

To create GRE interfaces through the web interface, in the top menu, select **Network -> interfaces**.

There are three sections in the interfaces page.

Section	Description
Interface overview	Shows existing interfaces and their status. You can create new, and edit existing, interfaces here.
Port Map	In this section, you can map device ports to Ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space-separated port numbers in the port map fields.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

In the Interface Overview section, click **Add new interface**. The Create Interface page appears.



The create interface page

Web Field/UCI/Package Option	Description																										
Web: Name of the new interface UCI: network. <if name> Opt: config interface	Assigns a logical name to the GRE tunnel. The network interface section will be assigned this name <if name>. Type the name of the new interface. Allowed characters are A-Z, a-z, 0-9 and _. Must be less than 11 characters.																										
Web: Protocol of the new interface UCI: network.<if name> .proto Opt: proto	Specifies what protocol the interface will operate on. Select GRE . <table border="1"> <thead> <tr> <th>Option</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Static</td><td>Static configuration with fixed address and netmask.</td></tr> <tr> <td>DHCP Client</td><td>Address and netmask are assigned by DHCP</td></tr> <tr> <td>Unmanaged</td><td>Unspecified</td></tr> <tr> <td>IPv6-inIPv4 (RFC4213)</td><td>Used with tunnel brokers</td></tr> <tr> <td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport</td></tr> <tr> <td>GRE</td><td>Generic Routing Encapsulation protocol</td></tr> <tr> <td>IOT</td><td></td></tr> <tr> <td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr> <tr> <td>PPP</td><td>Point to Point Protocol</td></tr> <tr> <td>PPPoE</td><td>PPP over Ethernet</td></tr> <tr> <td>PPPoATM</td><td>PPP over ATM</td></tr> <tr> <td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS, or GPRS connection using an AT-style 3g modem</td></tr> </tbody> </table>	Option	Description	Static	Static configuration with fixed address and netmask.	DHCP Client	Address and netmask are assigned by DHCP	Unmanaged	Unspecified	IPv6-inIPv4 (RFC4213)	Used with tunnel brokers	IPv6-over-IPv4	Stateless IPv6 over IPv4 transport	GRE	Generic Routing Encapsulation protocol	IOT		L2TP	Layer 2 Tunnelling Protocol	PPP	Point to Point Protocol	PPPoE	PPP over Ethernet	PPPoATM	PPP over ATM	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem
Option	Description																										
Static	Static configuration with fixed address and netmask.																										
DHCP Client	Address and netmask are assigned by DHCP																										
Unmanaged	Unspecified																										
IPv6-inIPv4 (RFC4213)	Used with tunnel brokers																										
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport																										
GRE	Generic Routing Encapsulation protocol																										
IOT																											
L2TP	Layer 2 Tunnelling Protocol																										
PPP	Point to Point Protocol																										
PPPoE	PPP over Ethernet																										
PPPoATM	PPP over ATM																										
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS, or GPRS connection using an AT-style 3g modem																										
Web: Create a bridge over multiple interfaces UCI: network.<if name> Opt: n/a	Not applicable for GRE.																										
Create a bridge over multiple interfaces UCI: network.< name> Opt: n/a	Not applicable for GRE.																										

Click **Submit**. The Common Configuration page appears. There are three sections in the Common Configurations page.

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, mask length, local interface, remote IP address, TTL, tunnel key and MTU.
Advanced Settings	'Bring up on boot' and 'monitor interface state' settings.
Firewall Settings	Assign a firewall zone to the connection.

15.1.1. GRE Connection: Common Configuration: General Setup

Common Configuration

General Setup

Advanced Settings

Firewall Settings

Status

gre-Tunnel1

RX: 0.00 B (0 Pkts.)

TX: 0.00 B (0 Pkts.)

Protocol

GRE

Tunnel IP Address

Mask Length

Local Interface

3G

ADSL

Test_BC

lan1

lan2

lan3

lan4

loopback

ethalias: (no interfaces attached)

Remote IP Address

TTL

128

Tunnel key

MTU

1472

The GRE common configuration page

Web Field/UCI/Package Option	Description				
Web: Protocol of the new interface UCI: network.<if name>.proto Opt: proto	Shows the protocol the interface will operate on . GRE should be currently selected.				
Web: Tunnel IP Address UCI: network.<if name>.ipaddr Opt: ipaddr	Configures local IP address of the GRE interface.				
Web: Mask length UCI: network.<if name> .ipaddr Opt: mask_length	Subnet mask, in CIDR notation, to be applied to the tunnel. Typically '30' for point-to-point tunnels. <table border="1"> <tr> <td>Default</td><td>24</td></tr> <tr> <td>Range</td><td>0-30</td></tr> </table>	Default	24	Range	0-30
Default	24				
Range	0-30				
Web: Local Interface UCI: network. <if name> .remote_ip Opt: local interface	Specifies which interface is going to be linked with the GRE tunnel interface (optional).				
Web: Remote IP address UCI: network. <if name> .remote_ip Opt: remote_ip	For point-to-point tunnels. Specifies remote IP address.				
Web: TTL UCI: network. <if name> .key Opt: key	Sets Time-To-Live value on the interface. <table border="1"> <tr> <td>Default</td><td>128</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	128	Range	
Default	128				
Range					
Web: Tunnel key UCI: network. <if name> .key Opt: key	Sets GRE tunnel ID key (optional). Usually an integer.				
Web: MTU UCI: nwtwork. <if name> .mtu Opt: mtu	Sets GRE MTU (maximum transmission unit) size of PDUs using this interface. <table border="1"> <tr> <td>Default</td><td>1472</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	1472	Range	
Default	1472				
Range					

15.1.2. Configuring IPv6 Routes Using The Web Interface

You can also specify IPv6 routes by defining one or more IPv6 routes. In the IPv6 routes section, click **Add**.

Web Field/UCI/Package Option	Description				
Web: Interface UCI: network.@route[1].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.				
Web: target UCI: network.@route[1].target Opt: target	Specifies the route network IP address, or subnet in CIDR notation: Example: 2001:0DB8:100:F00:BA3::1/64				
Web: Gateway UCI: network.@route[1].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.				
Web: Metric UCI: network.@route[1].metric Opt: metric	Specifies the route metric to use. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: MTU UCI: network.@route[1].mtu Opt: mtu	Defines a specific MTU for this route. If omitted the MTU from the parent interface will be taken. <table border="1"> <tr> <td>Default</td><td>Empty</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Empty	Range	
Default	Empty				
Range					

When you have made your changes, click **Save & Apply**.

15.1.3. GRE Connection: Common Configuration-Advanced Settings

Common Configuration

General Setup

Advanced Settings

Firewall Settings

Bring up on boot

Monitor interface state

GRE TUNNEL1

MEB0L2 - empty

MEB0L2 - vada

PARADOL

SUNNET1 - no interface attached

SUNNET2

SUNNET3

SUNNET4

logback

Check interfaces which should start after this interface is started and stop after this interface is stopped

SNMP Alias Index

Alias (index SNMP agent) Alias indexes are present at 1000 offset. So setting 1 here will create snmp ifTable entry 1001.

Useful when interface creates new (our interface on every startup) ie g. joo interface. With this set the interface could be monitored via constant snmp agent interface table entry

The GRE advanced settings page

Web Field/UCI/Package Option	Description										
Web: Bring up on boot UCI: network.<if name>.auto Opt: auto	Enables the interface to connect automatically on boot up. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled						
Default: 1	Enabled										
0	Disabled										
Web: Monitor interface state UCI: network.<if name>.monitored Opt: monitored	Enabled if status of interface is presented on Monitoring platform. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled						
Default: 1	Enabled										
0	Disabled										
Web: Dependant Interfaces UCI: network[.x..].dependants Opt: dependants	Lists interfaces that are dependant on this parent interface. Dependant interfaces will go down when parent interface is down and will start or restart when parent interface starts. Separate multiple interfaces by a space when using UCI. Example: option dependants 'PPPADSL MOBILE' This replaces the following previous options in child interfaces. <table border="1"> <tr> <td>gre</td><td>option local_interface</td></tr> <tr> <td>lt2p</td><td>option src_ipaddr</td></tr> <tr> <td>iot</td><td>option wan1 wan2</td></tr> <tr> <td>6in4</td><td>option ipaddr</td></tr> <tr> <td>6to4</td><td>option ipaddr</td></tr> </table>	gre	option local_interface	lt2p	option src_ipaddr	iot	option wan1 wan2	6in4	option ipaddr	6to4	option ipaddr
gre	option local_interface										
lt2p	option src_ipaddr										
iot	option wan1 wan2										
6in4	option ipaddr										
6to4	option ipaddr										
Web: SNMP Alias ifindex UCI: network[.x..].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface, that can be polled via the SNMP interface index (snmp_alias_ifindex+1000). For more information, read the chapter 'Configuring SNMP'. <table border="1"> <tr> <td>Default: Blank</td><td>No SNP interface alias index</td></tr> <tr> <td>Range</td><td>0-4294966295</td></tr> </table>	Default: Blank	No SNP interface alias index	Range	0-4294966295						
Default: Blank	No SNP interface alias index										
Range	0-4294966295										

15.1.4. GRE Connection: Firewall Settings

Use this section to select the firewall zone you want to assign to this interface.

Select **unspecified** to remove the interface from the associated zone or fill out the create field to define a new zone and attach the interface to it.

GRE firewall settings

Click **Save and Apply**. This will save the current settings and return you to the Interface Overview page. To configure further settings on the GRE interface select **EDIT** for the relevant GRE interface.

15.1.5. GRE Connection: Adding A Static Route

After you have configured the GRE interface, you must configure a static route, to route the desired traffic over the GRE tunnel. To do this, browse to **Network -> Static Routes**. For more information, read the chapter 'Configuring Static Routes'.

15.2. Configuring GRE Using UCI

GRE using Command Line

The configuration file is stored on `/etc/config/network`.

For the examples below, `tunnel1` is used as the interface logical name.

```
root@VA_router:~# uci show network
network.tunnel1=interface
network.tunnel1.proto=gre
network.tunnel1.monitored=0
network.tunnel1.ipaddr=172.255.255.2
network.tunnel1.mask_length=24
network.tunnel1.local_interface=wan
network.tunnel1.remote_ip=172.255.255.100
network.tunnel1.ttl=128
network.tunnel1.key=1234
network.tunnel1.mtu=1472
network.tunnel1.auto=1
```

GRE Configuration using Package Options

```
root@VA_router:~# uci export network
config interface 'tunnel1'
option proto 'gre'
option monitored '0'
option ipaddr '172.255.255.2'
option mask_length '24'
option local_interface 'wan'
option remote_ip '172.255.255.100'
option ttl '128'
option key '1234'
option mtu '1472'
option auto '1'
```

To change any of the above values use `uci set` command.

To show the current running interfaces, enter:

```
root@VA_router:~# ifconfig

base0
Link encap:Ethernet HWaddr 00:00:00:00:01:01
inet6 addr: fe80::200:ff:fe00:101/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1504 Metric:1
RX packets:39810 errors:0 dropped:0 overruns:0 frame:0 TX packets:365 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:1000
RX bytes:10889090 (10.3 MiB) TX bytes:68820 (67.2 KiB)

eth4
Link encap:Ethernet HWaddr 00:1E:10:1F:00:00
inet addr:10.68.66.54 Bcast:10.68.66.55 Mask:255.255.255.252
inet6 addr: fe80::21e:10ff:fe1f:0/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:81 errors:0 dropped:0 overruns:0 frame:0 TX packets:127 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:1000
RX bytes:8308 (8.1 KiB) TX bytes:12693 (12.3 KiB)

gre-Tunnel1 Link encap:UNSPEC HWaddr 0A-44-42-36-DB-B0-00-48-00-00-00-00- 00-00-00-00
inet addr:13.13.13.2 Mask:255.255.255.248
inet6 addr: fe80::5efe:a44:4236/64 Scope:Link UP RUNNING MULTICAST MTU:1472 Metric:1
RX packets:7 errors:0 dropped:0 overruns:0 frame:0 TX packets:7 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:0
RX bytes:912 (912.0 B) TX bytes:884 (884.0 B)

lo
Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0 inet6 addr: ::1/128 Scope:Host

UP LOOPBACK RUNNING MTU:16436 Metric:1
RX packets:1465 errors:0 dropped:0 overruns:0 frame:0 TX packets:1465 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:0
RX bytes:166202 (162.3 KiB) TX bytes:166202 (162.3 KiB)
```

To display a specific GRE interface, enter `ifconfig gre-<if name>`:


```

root@VA_router:~# ifconfig gre-Tunnel1

gre-Tunnel1 Link encap:UNSPEC HWaddr 0A-44-42-36-00-00-7F-E2-00-00-00- 00-00-00-00-00
inet addr:13.13.13.2 Mask:255.255.255.248
inet6 addr: fe80::5efe:a44:4236/64 Scope:Link UP RUNNING MULTICAST MTU:1472 Metric:1
RX packets:7 errors:0 dropped:0 overruns:0 frame:0 TX packets:7 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:0
RX bytes:912 (912.0 B) TX bytes:8GRE route status

```

To show the current GRE route status, enter:

```

root@VA_router:~# route -n

```

Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	10.68.66.53	0.0.0.0	UG	0	0	0	eth4
0.0.0.0	13.13.13.1	0.0.0.0	UG	1	0	0	0 gre-Tunnel1
10.68.66.52	0.0.0.0	255.255.255.252	U	0	0	0	eth4
13.13.13	.0 0.0.0.0	255.255.255.248	U	0	0	0	gre-Tunnel1
172.19.101.3	13.13.13.1	255.255.255.255	UGH	0	0	0	gre-Tunnel1



NOTE

A GRE route will only be displayed in the routing table when the interface is up.

15.3. GRE Diagnostics

GRE Interface Status

To show the current running interfaces, enter:

```
root@VA_router:~# ifconfig

base0 Link encap:Ethernet HWaddr 00:00:00:00:01:01

inet6 addr: fe80::200:ff:fe00:101/64 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1504 Metric:1

RX packets:39810 errors:0 dropped:0 overruns:0 frame:0

TX packets:365 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:1000

RX bytes:10889090 (10.3 MiB) TX bytes:68820 (67.2 KiB)

eth4 Link encap:Ethernet HWaddr 00:1E:10:1F:00:00

inet addr:10.68.66.54 Bcast:10.68.66.55 Mask:255.255.255.252

inet6 addr: fe80::21e:10ff:fe1f:0/64 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1

RX packets:81 errors:0 dropped:0 overruns:0 frame:0

TX packets:127 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:1000

RX bytes:8308 (8.1 KiB) TX bytes:12693 (12.3 KiB)

gre-Tunnel1 Link encap:UNSPEC HWaddr 0A-44-42-36-DB-B0-00-48-00-00-00-00- 00-00-00-00

inet addr:13.13.13.2 Mask:255.255.255.248

inet6 addr: fe80::5efe:a44:4236/64 Scope:Link

UP RUNNING MULTICAST MTU:1472 Metric:1

RX packets:7 errors:0 dropped:0 overruns:0 frame:0

TX packets:7 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:0

RX bytes:912 (912.0 B) TX bytes:884 (884.0 B)

lo Link encap:Local Loopback

inet addr:127.0.0.1 Mask:255.0.0.0

inet6 addr: ::1/128 Scope:Host

UP LOOPBACK RUNNING MTU:16436 Metric:1

RX packets:1465 errors:0 dropped:0 overruns:0 frame:0

TX packets:1465 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:0

RX bytes:166202 (162.3 KiB) TX bytes:166202 (162.3 KiB)
```

To display a specific GRE interface, enter `ifconfig gre-<if name>`:

```

root@VA_router:~# ifconfig gre-Tunnel1

gre-Tunnel1 Link encap:UNSPEC HWaddr 0A-44-42-36-00-00-7F-E2-00-00-00- 00-00-00-00-00
inet addr:13.13.13.2 Mask:255.255.255.248
inet6 addr: fe80::5efe:a44:4236/64 Scope:Link

UP RUNNING MULTICAST MTU:1472 Metric:1

RX packets:7 errors:0 dropped:0 overruns:0 frame:0

TX packets:7 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:0

RX bytes:912 (912.0 B) TX bytes:8GRE route status

```

To show the current GRE route status, enter:

root@VA_router:~# route -n							
Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	10.68.66.53	0.0.0.0	UG	0	0	0	eth4
0.0.0.0	13.13.13.1	0.0.0.0	UG	1	0	0	0 gre-Tunnel1
10.68.66.52	0.0.0.0	255.255.255.252	U	0	0	0	eth4
13.13.13	.0 0.0.0.0	255.255.255.248	U	0	0	0	gre-Tunnel1
172.19.101.3	13.13.13.1	255.255.255.255	UGH	0	0	0	gre-Tunnel1

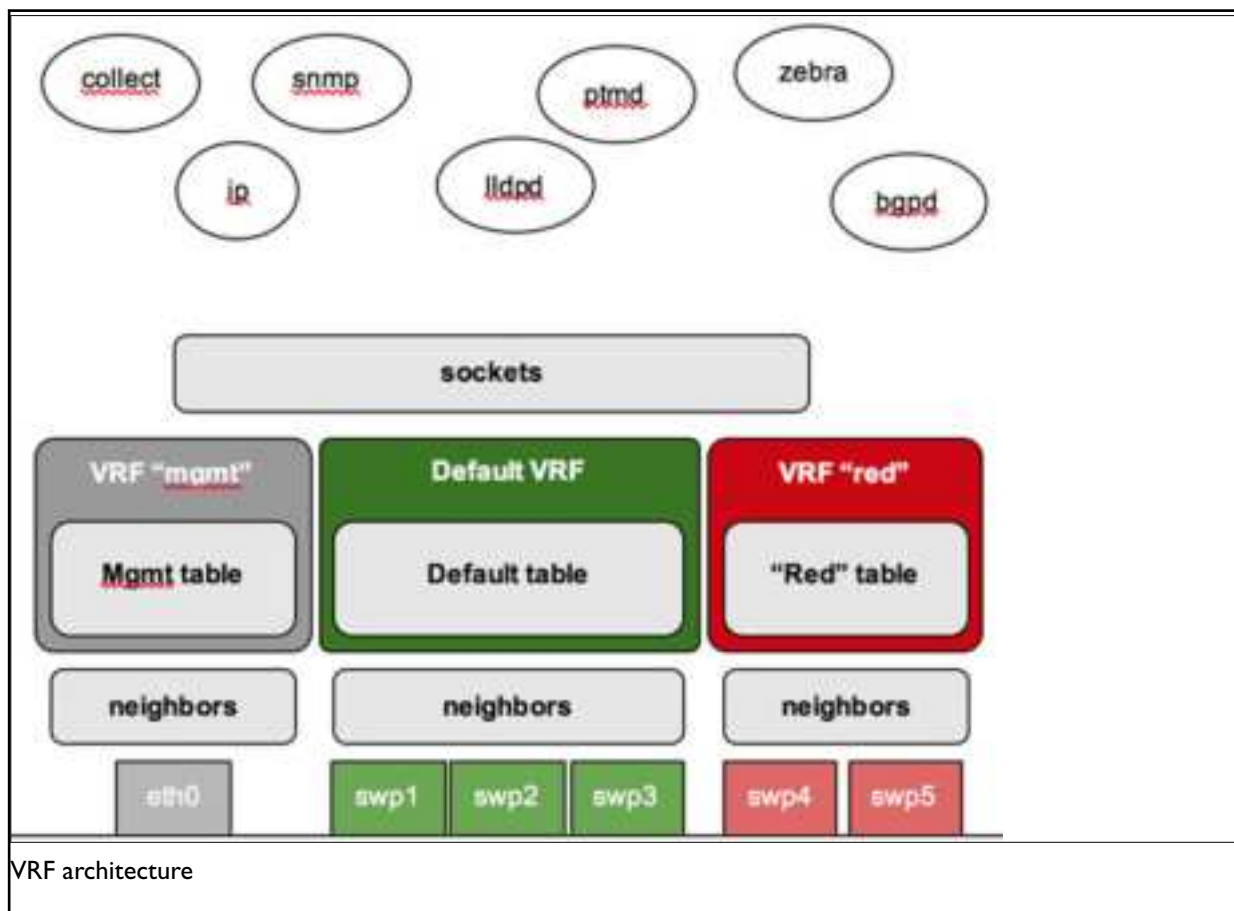
Note: a GRE route will only be displayed in the routing table when the interface is up.

16. Configuring VRF (Virtual Router Forwarding)

Virtual Routing and Forwarding (VRF) is a technology that allows multiple instances of a routing table to exist in a router and work simultaneously. Traffic between routing tables is segregated and so increases security.

VRF overview

An interface is configured to belong to a VRF. Interfaces included in the VRF form an independent routing domain, so routing of incoming and outgoing packets only happens within a VRF. It is also possible to add individual routes to a VRF using static routes.



Configuration package used

Package	Sections
network	interface
	route

16.1. Configuring VRF Using The Web Interface

Setting the VRF for an Interface

To create VRFs, you must add interfaces. To add an interface to a VRF instance, select **Network - > Interfaces**, select the desired interface to edit then select **Common Configuration - > Advanced Settings**.

Enter in the relevant VRF name in the VRF field.

WLAN
MOBILE2
MOBILE
LAN

Interfaces - LAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of all spaces. You can also use VLAN notation INTERFACE.VLANID (e.g. eth0.1)

Common Configuration

General Setup
Advanced Settings
Physical Settings
Firewall Settings

Bring up on boot
☒

Monitor interface state
☒
This interface state would be reported to VA Monitor via keep-alive

Override MAC address

Override MTU

Use gateway metric

Dependant interfaces
☒ Mobile
☒ Mobile2
☒ lan
☒ loopback
☐ wlan (no interfaces attached)

Check interfaces which should start after this interface is started and stop after this interface is stopped

SNMP Alias ifindex
Alias ifindex for SNMP agent. Alias indexes are present at 1000 offset. So setting 1 in 1001. Useful when interface creates new linux interface on every startup (e.g. ppp interface). With this set the interface could be interface table entry

SNMP Alias ifdescr
Alias ifdescr for SNMP agent. Allows to specify a custom ifdescr string

VRF
Camera
Assign interface to this VRF

The interfaces configuration page

Web Field/UCI/Package Option	Description				
Web: VRF	Defines the VRF name to which this interface belongs.				
UCI: network.<if name>.vrf	Note: the name must be consistent across all interfaces that want to reside on that VRF.				
Opt: vrf	<table> <tr> <td>(empty)</td><td>Interface is not attached to a VRF</td></tr> <tr> <td>Range</td><td>0-15 characters</td></tr> </table>	(empty)	Interface is not attached to a VRF	Range	0-15 characters
(empty)	Interface is not attached to a VRF				
Range	0-15 characters				

To add additional interfaces to a VRF, repeat the above for the relevant interface(s).

For example, the above configuration creates a VRF on a LAN interface. To configure this VRF to be used by traffic from a camera on a LAN interface to a VRF on a mobile interface, repeat the above instructions for a mobile interface so the camera VRF will now contain a local network and mobile interface to route traffic.



NOTE

The default VRF is created automatically and is not assigned any VRF name. It is recommended to use this default VRF to access router services and applications; for example, HTTP, SSH, SNMP etc.

16.1.1. Configuring A VRF On A Static Route

Each VRF has its own routing table and static routes can be added to a VRF routing table. To define a static route on a VRF, select **Network - >Static Routes**.

The static routes configuration page

Web Field/UCI/Package Option	Description				
Web: VRF	Defines the VRF name.				
UCI: network.route.vrf	Note: 'none' is a special name to move a route out of a VRF.				
Opt: vrf	Example: network.route.vrf=none				
	<table> <tr> <td>(empty)</td><td>Interface is not attached to a VRF</td></tr> <tr> <td>Range</td><td>0-15 characters</td></tr> </table>	(empty)	Interface is not attached to a VRF	Range	0-15 characters
(empty)	Interface is not attached to a VRF				
Range	0-15 characters				

16.2. Configuring The VRFs Using The Command Line

You configure a VRF using the interface configuration section in the network etc/config/network.

The VRF name must be consistent across all interfaces that want to reside on that VRF.

For the command line examples below, two VRFs called Camera and Management are configured.

VRF using UCI

```
root@VA_router:~# uci show network | grep vrf
network.lan.vrf=Camera
network.Mobile1.vrf=Camera
network.Mobile2.vrf=Management
```

VRF using Package Options

```
root@VA_router:~# uci export network
package network
config interface lan
option vrf 'Camera'
config interface Mobile1
option vrf 'camera'
config interface Mobile2
option vrf 'Management'
```

16.2.1. VRF Using UCI

```
root@VA_router:~# uci show network | grep vrf network.lan.vrf=Camera network.Mobile1.vrf=Camera
network.Mobile2.vrf=Management
```

VRF using Package Options

```
root@VA_router:~# uci export network package network
config interface lan
option vrf 'Camera'
config interface Mobile1
```

```
option vrf 'Camera'
config interface Mobile2
option vrf 'Management'
```

To display a list of running VRFs, enter:

```
root@VA_router:~# ip vrf Name Table
Management 10
Camera 10
```

16.3. VRF Diagnostics

To display a list of running VRFs, enter:

```
root@VA_router:~# ip vrf
Name Table
-----
Management 10
Camera 10
```

VRF Table

To display the routing table for a VRF, enter the command:

```
ip router list vrf <vrf name>
```

VRF Routes

To display the routing table for a VRF, enter the command:

ip route list vrf <vrf name>.

```
root@VA_router:~# ip route list vrf Camera
default via 10.92.163.130 dev qmimux0
10.92.163.128/30 dev qmimux0 proto kernel scope link src 10.92.163.129
172.16.100.0/24 dev eth1 proto kernel scope link src 172.16.100.1
root@VA_router:~# ip route list vrf Management
default via 10.176.120.94 dev qmimux1
10.176.120.92/30 dev qmimux1 proto kernel scope link src 10.176.120.93
```


17. Configuring Static Routes

It is possible to define arbitrary IPv4 routes on specific interfaces using route sections. As for aliases, multiple sections can be attached to an interface. These types of routes are most commonly known as static routes.

You can add static routes to the routing table to forward traffic to specific subnets when dynamic routing protocols are not used or they are not configured for such subnets.

They can be created based on an outgoing interface or next hop IP address.

Configuration Package Used

Package	Sections
network	router

17.1. Configuring Static Routes Using The Web Interface

In the top menu, select Network -> Static Routes. The Routes page appears.

The routes page

In the IPv4 Routes section , click **Add**.

Web Field/UCI/Package Option	Description				
Web: Interface UCI: network.@route[0].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.				
Web: target UCI: network.@router[0].target Opt: target	Specifies the route network IP address.				
Web: netmask UCI: network.@route[0].netmask Opt: netmask	Defines the route netmask. If omitted, 255.255.255.255 is assumed, which makes the target a host address.				
Web: Gateway UCI: network.@route[0].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.				
Web: Metric UCI: network.@route[0].metric Opt: metric	Specifies the route metric to use. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: MTU UCI: network.@route[0].mtu Opt:mtu	Defines a specific MTU for this route. If omitted, the MTU from the parent interface will be taken. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Blank	Range	
Default	Blank				
Range					

17.2. Configuring Routes Using Command Line

By default all routes are named 'route', it is identified by @route then the route's position in the package as a number. For example, for the first route in the package using UCI:

```
network.@route[0]=route
network.@route[0].interface=lan
```

Or using package options:

```
config route
option 'interface' 'lan'
```

However, you can give a route a name if desired. For example, a route named 'myroute' will be: **network.myroute**.

To define a named route using UCI, enter:

```
network.name_your_route=route
network.name_your_route.interface=lan
```

To define a named route using package options, enter:

```
config route 'name_your_route'

option 'interface' 'lan'
```

17.3. IPv4 Routes Using UCI

The command line example routes in the subsections below do not have a configured name.

```
root@VA_router:~# uci show network

network.@route[0]=route
network.@route[0].interface=lan
network.@route[0].target=3.3.3.10
network.@route[0].netmask=255.255.255.255
network.@route[0].gateway=10.1.1.2
network.@route[0].metric=3
network.@route[0].mtu=1400
```

IPv4 Routes using Package Options

```
root@VA_router:~# uci export network

package network

config route
option interface 'lan'
option target '2.2.2.2'
option netmask '255.255.255.255'
option gateway '192.168.100.1'
option metric '1'
option mtu '1500'
```

17.4. IPv6 Routes Using UCI

```
root@VA_router:~# uci show network

network.@route[1]=route
network.@route[1].interface=lan
network.@route[1].target=2001:0DB8:100:F00:BA3::1/64
network.@route[1].gateway=2001:0DB8:99::1
network.@route[1].metric=1
network.@route[1].mtu=1500
```

IPv6 routers using Package Options

```

root@VA_router:~# uci export network
package network

config route

option interface 'lan'
option target '2001:0DB8:100:F00:BA3::1/64'
option gateway '2001:0DB8:99::1'
option metric '1'
option mtu '1500'

```

17.5. Static Routes Diagnostics

To show the current routing status, enter:

Root@VA_router:~# route							
Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
192.168.100.1	*	255.255.255.0	0	0	0	0	eth 0



NOTE

A route will only be displayed in the routing table when the interface is up.

17.6. Configuring IPv6 Routes Using The Web Interface

You can also specify IPv6 routes by defining one or more IPv6 routes. In the IPv6 routes section, click **Add**.

Web Field/UCI/Package Option	Description				
Web: Interface UCI: network.@route[1].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.				
Web: target UCI: network.@route[1].target Opt: target	Specifies the route network IP address, or subnet in CIDR notation: Example: 2001:0DB8:100:F00:BA3::1/64				
Web: Gateway UCI: network.@route[1].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.				
Web: Metric UCI: network.@route[1].metric Opt: metric	Specifies the route metric to use. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: MTU UCI: network.@route[1].mtu Opt: mtu	Defines a specific MTU for this route. If omitted the MTU from the parent interface will be taken. <table border="1"> <tr> <td>Default</td><td>Empty</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Empty	Range	
Default	Empty				
Range					

When you have made your changes, click **Save & Apply**.

18. Configuring BGP (Border Gateway Protocol)

BGP is a protocol for exchanging routing information between gateway hosts, each with its own router, in a network of autonomous systems. BGP is often the protocol used between gateway hosts on the internet. The routing table contains a list of known routers, the addresses they can reach, and a cost metric associated with the path to each router so that the best available route is chosen.

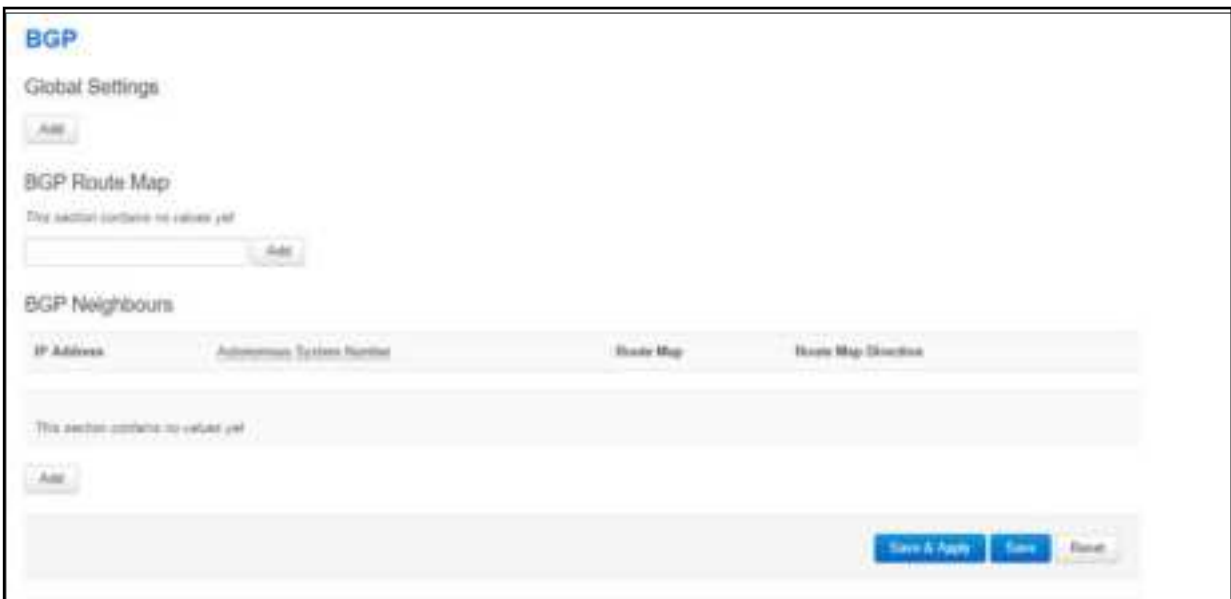
Configuration package used

Package	Sections
bgpd	routing
	peer
	routemap

18.1. Configuring BGP Using The Web Interface

In the top menu, select **Network -> BGP**. The BGP configuration page appears.

The page has three sections: Global Settings, BGP Neighbours and BGP Route Map.



The BGP page

BGP Global Settings

To configure global BGP settings, click **Add**. The Global Settings page appears.

BGP

Global Settings

BGP Enabled

☐

Router ID

Scan Time

The interval in seconds between RIB scans

Autonomous System Number

Log keepalives

☐

Log events

☐

Log filters

☐

Log fsm

☐

Log updates

☐

Network

These networks will be announced to neighbours

The BGP global settings page

Web Field/UCI/Package Option	Description				
Web: BGP Enabled UCI: bgpd.bgpd.enabled Opt: enabled	Enables or disables BGP protocol. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Router ID UCI: bgpd.bgpd.router_id Opt: router_id	Sets a unique router ID in 4 byte format 0.0.0.0.				
Web: Scan Time UCI: bgpd.bgpd.scan_time Opt: scan_time	Defines the interval in seconds between RIB scans. <table border="1"> <tr> <td>Default</td><td>60 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	60 seconds	Range	
Default	60 seconds				
Range					
Web: Autonomous System Number UCI: bgpd.bgpd.asn Opt: asn	Defines the ASN for the local router. Type in the ASN. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>1-4294967295</td></tr> </table>	Default	Blank	Range	1-4294967295
Default	Blank				
Range	1-4294967295				
Web: Log keepalives UCI: bgpd.bgpd.debug_keepalive Opt: debug_keepalives	Defines whether to enable BGP keepalives to the system log. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Log events UCI: bgpd.bgpd.debug_events Opt: debug_events	Defines whether to enable BGP event to the system log. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Log filters UCI: bgpd.bgpd.debug_filters Opt: debug_filters	Defines whether to enable BGP filter events to the system log. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Log fsm UCI: bgpd.bgpd.debug_fsm Opt: debug_fsm	Defines whether to enable BGP state changes to the system log. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Log Updates UCI: bgpd.bgpd.debug_updates Opt: debug_updates	Defines whether to enable BGP updates to the system log. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Network UCI: bgpd.bgpd.network Opt: list network	Sets the list of networks that will be advertised to neighbours in prefix format 0.0.0.0/0. Separate multiple networks by a space using UCI. Ensure the network prefix matches the one shown in the routing table. For more information, read the 'Routes' section below.				
Web: n/a UCI: bgpd.bgpd.vrf Opt: vrf	Defines the VRF with which to associate this BGP routing instance.				

18.2. Optionally Configure A BGP Route Map

Route maps provide a means to both filter and/or apply actions to a route. This allows a policy to be applied to routes. Route maps are an ordered list of route map entries each with a set of criteria that must be matched before specific attributes of the route are modified.

Scroll down to the BGP Route Map section.

Type in a name for the BGP route map name and then click **Add**. The BGP Route Map configuration section appears. You can configure multiple route maps. The examples below are for a route map named ROUTEMAP.

ROUTEMAP

Order

10

Policy Type

Permit

Match Type

IP Address

Match Value

192.168.101.1/32

Permit depends on Match Type. In case of IP Address and BGP Community value is passed as list of items to match.

Deny -> prefer to deny match

Set Option

Route Weight

Set Value

100

The route map section

Web: Match Type	Defines match type. Available options are as follows:																		
Web: Order UCI: bgpd.ROUTEMAP.order Opt: order	Defines the route map order number. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	Blank	Range	1-65535														
Default	Blank																		
Range	1-65535																		
Web: Policy Type UCI: bgpd.ROUTEMAP.permit Opt: permit	Defines the actions taken if the entry is matched. <table border="1"> <tr> <td>Default: Permit</td><td>Permits the route to process the set actions for this entry.</td></tr> <tr> <td>Deny</td><td>Denies the route.</td></tr> </table>	Default: Permit	Permits the route to process the set actions for this entry.	Deny	Denies the route.														
Default: Permit	Permits the route to process the set actions for this entry.																		
Deny	Denies the route.																		
UCI: bgpd.ROUTEMAP.match_type Opt: match_type	Defines match type. Available options are as follows: <table border="1"> <tr> <td>IP address</td><td>Matches IP address</td></tr> <tr> <td>IP Next Hop</td><td>Matches next hop IP address</td></tr> <tr> <td>AS-Path</td><td>Matches AS path</td></tr> <tr> <td>Route Metric</td><td>Matches route metric</td></tr> <tr> <td>BGP Community</td><td>Matches BGP community</td></tr> </table>	IP address	Matches IP address	IP Next Hop	Matches next hop IP address	AS-Path	Matches AS path	Route Metric	Matches route metric	BGP Community	Matches BGP community								
IP address	Matches IP address																		
IP Next Hop	Matches next hop IP address																		
AS-Path	Matches AS path																		
Route Metric	Matches route metric																		
BGP Community	Matches BGP community																		
Web: Match value UCI: bgpd.ROUTEMAP.match Opt: match	Defines the value of the match type. Format depends on the match type selected. In the case of IP address and BGP Community values, the match value is parsed as a list of items to match. Enter '-' prefix to deny match.																		
Web: Set Option UCI: bgpd.ROUTEMAP.set_type Opt: set_type	Defines the set option to be processed on a match. Available options are shown below. <table border="1"> <tr> <td>None</td><td></td></tr> <tr> <td>IP Next Hop</td><td>Setting option for IP next hop.</td></tr> <tr> <td>Local Preference</td><td>Setting option for Local Preference</td></tr> <tr> <td>Router Weight</td><td>Setting option for Route Weight</td></tr> <tr> <td>BGP MED</td><td>Setting option for BGP multi-exit discriminator (BGP metric)</td></tr> <tr> <td>AS Path to Prepend</td><td>Setting option to prepend AS to AS path</td></tr> <tr> <td>BGP Community</td><td>Setting option for BGP community</td></tr> <tr> <td>IPv6 Next Hop</td><td>Setting option for IPv6 Next Hop Global</td></tr> <tr> <td>IPv6 Next Hop Local</td><td>Setting option for IPv6 Next Hop Local</td></tr> </table>	None		IP Next Hop	Setting option for IP next hop.	Local Preference	Setting option for Local Preference	Router Weight	Setting option for Route Weight	BGP MED	Setting option for BGP multi-exit discriminator (BGP metric)	AS Path to Prepend	Setting option to prepend AS to AS path	BGP Community	Setting option for BGP community	IPv6 Next Hop	Setting option for IPv6 Next Hop Global	IPv6 Next Hop Local	Setting option for IPv6 Next Hop Local
None																			
IP Next Hop	Setting option for IP next hop.																		
Local Preference	Setting option for Local Preference																		
Router Weight	Setting option for Route Weight																		
BGP MED	Setting option for BGP multi-exit discriminator (BGP metric)																		
AS Path to Prepend	Setting option to prepend AS to AS path																		
BGP Community	Setting option for BGP community																		
IPv6 Next Hop	Setting option for IPv6 Next Hop Global																		
IPv6 Next Hop Local	Setting option for IPv6 Next Hop Local																		
Web: Value UCI: bgpd.ROUTEMAP.set Opt: set	Defines the set value when a match occurs. Value format depends on the set option you have selected.																		
Web: n/a UCI: bgpd.ROUTEMAP.routing Opt: set	Defines the routing section this BGP route map is related to.																		

18.3. Configure BGP Neighbours

To configure BGP neighbours, in the BGP neighbours section, click **Add**. The BGP Neighbours page appears. You can configure multiple BGP neighbours.

BGP Neighbours

IP Address	Administrative Distance	Route Map	Route Map Direction	IPv6 Local Pref	Holdtime	Keepalive Interval	Connect Time
10.10.10.1	100				seconds	seconds	seconds

The BGP neighbours section

Web Field/UCI/Package Option	Description				
Web: IP Address UCI: bgpd.@peer[0].ipaddr Opt: ipaddr	Sets the IP address of the neighbour.				
Web: Autonomous System Number UCI: bgpd.@peer[0].asn Opt: asn	Sets the ASN of the remote peer. <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>1-4294967295</td></tr> </table>	Default	Blank	Range	1-4294967295
Default	Blank				
Range	1-4294967295				
Web: Route Map UCI: bgpd.@peer[0].route_map Opt: route_map	Sets route map name to use with this neighbour.				
Web: Route Map Direction UCI: bgpd.@peer[0].route_map_in Opt: route_map_in	Defines what direction to apply to the route map. <table border="1"> <tr> <td>Default: 1</td><td>In</td></tr> <tr> <td>0</td><td>Out</td></tr> </table>	Default: 1	In	0	Out
Default: 1	In				
0	Out				
Web: IPv6 UCI: bgpd.@peer[0].ipv6 Opt: ipv6	Defines whether the peer is connected over IPv6. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td></td><td>1</td></tr> </table>	Default	0		1
Default	0				
	1				
Web: Local Peer UCI: bgpd.@peer[0].next_hop_self Opt: next_hop_self	Defines an announced route's next hop as being equivalent to the address of the router if it is learned via BGP. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td></td><td>1</td></tr> </table>	Default	0		1
Default	0				
	1				
Web: Holdtime UCI: bgpd.@peer[0].holdtime_sec Opt: holdtime_sec	Defines how long to wait for incoming BGP messages before assuming peer is dead. The timer is reset every time a BGP message is received. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Keepalive Interval UCI: bgpd.@peer[0].keepalive_sec Opt: keepalive_sec	Defines the interval in seconds for between two successive BGP keep alive messages. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Connect Timer UCI: bgpd.@peer[0].connect_sec Opt: connect_sec	Defines how long to wait after interface is up before retrying the connection on it. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: n/a UCI: bgpd.@peer[0].routing Opt: routing	Defines the routing section this BGP peer is related to.				

18.4. Configuring BGP Using Command Line

Configuring BGP using UCI

You can configure BGP using UCI. The configuration file is stored on:

/etc/config/bgpd

```
root@VA_router:~# uci show bgpd

bgpd.bgpd=routing
bgpd.bgpd.enabled=yes
bgpd.bgpd.router_id=3.3.3.3
bgpd.bgpd.asn=1
bgpd.bgpd.network=11.11.11.0/29 192.168.103.1/32
bgpd.bgpd.vrf=datavrf
bgpd.@peer[0]=peer
bgpd.@peer[0].route_map_in=yes
bgpd.@peer[0].ipaddr=11.11.11.1
bgpd.@peer[0].asn=1
bgpd.@peer[0].route_map=ROUTEMAP
bgpd.@peer[0].ipv6=0
bgpd.@peer[0].next_hop_self=0
bgpd.@peer[0].holdtime_sec=0
bgpd.@peer[0].keepalive_sec=0
bgpd.@peer[0].connect_sec=0
bgpd.@peer[0].routing='bgpd'
bgpd.ROUTEMAP=routemap
bgpd.ROUTEMAP.order=10
bgpd.ROUTEMAP.permit=yes
bgpd.ROUTEMAP.match_type=ip address
bgpd.ROUTEMAP.match=192.168.101.1/32
bgpd.ROUTEMAP.set_type=ip next-hop
bgpd.ROUTEMAP.set='192.168.101.2/32'
bgpd.ROUTEMAP.vrf='bgpd'
```

To change any of the above values use **UCI set** command.

Configuring BGP using Package Options

```
root@VA_router:~# uci export bgpd

package bgpd

config routing 'bgpd'

option enabled 'yes'

option router_id '3.3.3.3'

option asn '1'

list network '11.11.11.0/29'

list network '192.168.103.1/32'


config peer

option route_map_in 'yes'

option ipaddr '11.11.11.1'

option asn '1'

option route_map 'ROUTEMAP' option ipv6 '0'

option next_hop_self '0'

option holdtime_sec '0'

option keepalive_sec '0'

option connect_sec '0'

option routing 'bgpd'

config routemap 'ROUTEMAP'

option order '10' option permit 'yes'

option match_type 'ip address'

option match '192.168.101.1/32'

option set_type 'ip next-hop'

option set '192.168.101.2/32'

option routing 'bgpd'
```

18.5. View Routes Statistics

To view routes statistics, in the top menu click **Status -> Routes**. The routing table appears.

Routes

The following rules are currently active on this system:

ARP

IPv4 Address	MAC Address	Interface
192.168.210.100	50:b7:a3:3c:14:4b	br-lan
10.1.1.124	94:ae:32:ad:81:21	eth1
10.1.10.83	80:13:80:51:39:58	eth1

Active IPv4-Routes

Network	Target	IPv4-Gateway	Metric
wan	0.0.0.0	10.24.24.24	0
wan	0.0.0.0	10.24.24.24	1
LAN2	10.1.0.0/16	0.0.0.0	0
wan	10.24.24.24	0.0.0.0	0
LAN2	192.168.101.1	10.1.10.83	0
lan	192.168.210.0/24	0.0.0.0	0
wan	217.87.128.143	10.24.24.24	0

Active IPv6-Routes

Network	Target	IPv6-Gateway	Metric
loopback	:::0:0:0:0:0	:::0:0:0:0:0	00000000
loopback	:::0:0:0:0:0	:::0:0:0:0:0	00000000
loopback	:::0:0:0:0:1	:::0:0:0:0:0	00000000
LAN2	FF02:::0:0:0:0:FE	:::0:0:0:0:0	00000000
wan0()	FF00:0:0:0:0:0:0:0	:::0:0:0:0:0	00000100
lan	FF00:0:0:0:0:0:0:0	:::0:0:0:0:0	00000100
LAN2	FF00:0:0:0:0:0:0:0	:::0:0:0:0:0	00000100
loopback	0:0:0:0:0:0:0:0	:::0:0:0:0:0	00000000

The routing table

To view routes via the command line, enter:

root@support:~# route -n							
Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
10.1.0.0	0.0.0.0	255.255.0.0	U	0	0	0	br-lan2

19. Configuring OSPF

Introduction

OSPF is a standardised link state routing protocol, designed to scale efficiently to support larger networks. Link state protocols track the status and connection type of each link and produce a calculated metric based on these and other factors, including some set by the network administrator. Link state protocols will take a path which has more hops, but that uses a faster medium over a path using a slower medium with fewer hops. OSPF adheres to the following link state characteristics:

- OSPF adheres to the following link state characteristics:
- OSPF employs a hierarchical network design using areas.
- OSPF will form neighbour relationships with adjacent routers in the same area. Instead of advertising the distance to connected networks, OSPF advertises the status of directly connected links using Link-State Advertisements (LSAs)
- OSPF sends updates (LSAs) when there is a change to one of its links, and will only send the change in the update. LSAs are additionally refreshed every 30 minutes.
- OSPF traffic is multicast either to address 224.0.0.5 for all OSPF routers or 224.0.0.6 for all designated routers.
- OSPF uses the Dijkstra shortest path first algorithm to determine the shortest path.
- OSPF is a classless protocol, and therefore supports Variable Length Subnet Masks (VLSMs).

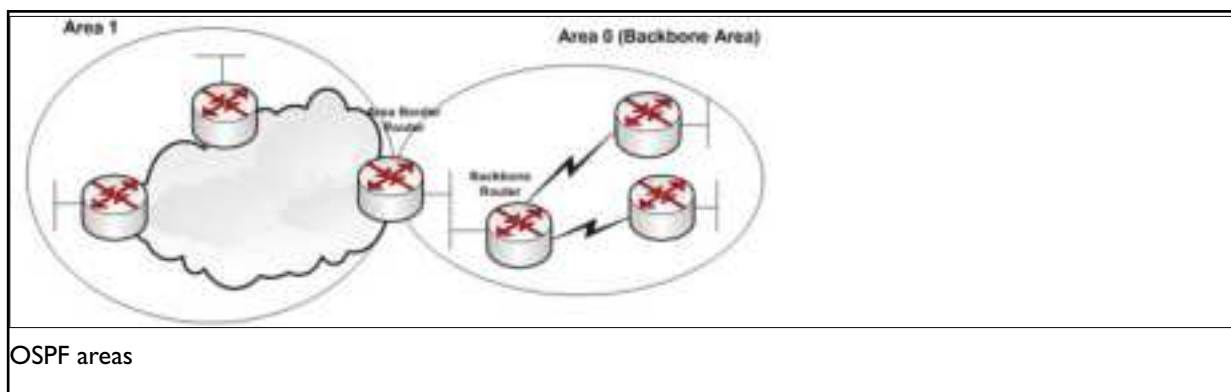
Other characteristics of OSPF include:

- OSPF supports only IP routing.
- OSPF routes have an administrative distance is 110.
- OSPF uses cost as its metric, which is computed based on the bandwidth of the link. OSPF has no hop-count limit.

The OSPF process builds and maintains three separate tables:

- **A neighbour table** containing a list of all neighbouring routers.
- **A topology table** containing a list of all possible routes to all known networks within an area.
- **A routing table** containing the best route for each known network.

19.1. OSPF Areas



OSPF has a number of features that allow it to scale well for larger networks. One of these features is OSPF areas. OSPF areas break up the topology so that routers in one area know less topology information about the

subnets in the other area, and they do not know anything about the routers in the other area at all. With smaller topology databases, routers consume less memory and take less processing time to run SPF. The Area Border Router (ABR) is the border between two areas. The ABR does not advertise full topology information about the part of the network in area 0 to routers in area 1. Instead the ABR advertises summary information about the subnets in area 0. Area 1 will just see a number of subnets reachable via area 0.

19.2. OSPF Neighbours

OSPF forms neighbour relationships, called adjacencies, with other routers in the same area by exchanging 'hello' packets to multicast address 224.0.0.5. Only after an adjacency is formed can routers share routing information.

Each OSPF router is identified by a unique router ID. The router ID can be determined in one of three ways:

- The router ID can be manually specified.
- If not manually specified, the highest IP address configured on any loopback interface on the router will become the router ID.
- If no loopback interface exists, the highest IP address configured on any physical interface will become the router ID.

By default, hello packets are sent out of OSPF-enabled interfaces every 10 seconds for broadcast and point-to-point interfaces, and 30 seconds for non-broadcast and point-to-multipoint interfaces.

OSPF also has a 'dead interval', which indicates how long a router will wait without hearing any hellos before announcing a neighbour as 'down'. The default setting for the dead interval is 40 seconds for broadcast and point-to-point interfaces; and 120 seconds for non-broadcast and point-to-multipoint interfaces. By default, the dead interval timer is four times the hello interval.

OSPF routers will only become neighbours if the following parameters within a hello packet are identical on each router:

- Area ID
- Area type (stub, NSSA, etc.)
- Prefix
- Subnet mask
- Hello interval
- Dead interval
- Network type (broadcast, point-to-point, etc.)
- Authentication

The hello packets also serve as keepalives to allow routers to quickly discover if a neighbour is down. Hello packets also contain a neighbour field that lists the router IDs of all neighbours the router is connected to. A neighbour table is constructed from the OSPF hello packets, which includes the following information:

- The router ID of each neighbouring router
- The current 'state' of each neighbouring router
- The interface directly connecting to each neighbour
- The IP address of the remote interface of each neighbour

19.3. OSPF Designated Routers

In multi-access networks such as Ethernet, there is the possibility of many neighbour relationships on the same physical segment. This leads to a considerable amount of unnecessary Link State Advertisement (LSA) traffic. If a link of a router were to fail, it would flood this information to all neighbours. Each neighbour, in turn, would then flood that same information to all other neighbours. This is a waste of bandwidth and processor load.

To prevent this, OSPF will elect a Designated Router (DR) for each multi-access network, accessed via multicast address 224.0.0.6. For redundancy purposes, a Backup Designated Router (BDR) is also elected.

OSPF routers will form adjacencies with the DR and BDR. If a change occurs to a link, the update is forwarded only to the DR, which then forwards it to all other routers. This greatly reduces the flooding of LSAs. DR and BDR elections are determined by a router's OSPF priority, which is configured on a per-interface basis as a router can have interfaces in multiple multi-access networks. The router with the highest priority becomes the DR; second highest becomes the BDR. If there is a tie in priority, whichever router has the highest router ID will become the DR.

19.4. OSPF Neighbour States

Neighbour adjacencies will progress through several states, described in the table below.

State	Description						
Down	Indicates that no hellos have been heard from the neighbouring router.						
Init	Indicates a hello packet has been heard from the neighbour, but a two-way communication has not yet been initialised.						
2-Way	Indicates that bidirectional communication has been established. Recalls that hello packets contain a neighbour field; thus, communication is considered 2-way when a router sees its own router ID in its neighbour's hello packet. Designated and backup designated routers are elected at this stage.						
ExStart	Indicates that the routers are preparing to share link state information. Master/slave relationships are formed between routers to determine who will begin the exchange.						
Exchange	Indicates that the routers are exchanging Database Descriptors (DBDs). DBDs contain a description of the router's topology database. A router will examine a neighbour's DBD to determine if it has information to share.						
Loading	Indicates the routers are finally exchanging link state advertisements, containing information about all links connected to each router. Essentially, routers are sharing their topology tables with each other.						
Full	Indicates that the routers are fully synchronised. The topology table of all routers in the area should now be identical. Depending on the role of the neighbour, the state may appear as: <table border="1"> <tr> <td>Full/DR</td><td>Indicating that the neighbour is a Designated Router (DR)</td></tr> <tr> <td>Full/BDR</td><td>Indicating that the neighbour is a Backup Designated Router (BDR)</td></tr> <tr> <td>Full/DROther</td><td>Indicating that the neighbour is neither the DR nor BDR. On a multi-access network, OSPF routers will only form full adjacencies with DRs and BDRs. Non-DRs and non-BDRs will still form adjacencies but will remain in a 2-way state. This is normal OSPF behaviour.</td></tr> </table>	Full/DR	Indicating that the neighbour is a Designated Router (DR)	Full/BDR	Indicating that the neighbour is a Backup Designated Router (BDR)	Full/DROther	Indicating that the neighbour is neither the DR nor BDR. On a multi-access network, OSPF routers will only form full adjacencies with DRs and BDRs. Non-DRs and non-BDRs will still form adjacencies but will remain in a 2-way state. This is normal OSPF behaviour.
Full/DR	Indicating that the neighbour is a Designated Router (DR)						
Full/BDR	Indicating that the neighbour is a Backup Designated Router (BDR)						
Full/DROther	Indicating that the neighbour is neither the DR nor BDR. On a multi-access network, OSPF routers will only form full adjacencies with DRs and BDRs. Non-DRs and non-BDRs will still form adjacencies but will remain in a 2-way state. This is normal OSPF behaviour.						

19.5. OSPF Network Types

OSPF's functionality is different across several different network topology types.

State	Description
Broadcast Multi-Access	Indicates a topology where broadcast occurs. Examples include Ethernet, Token Ring and ATM. OSPF characteristics are: OSPF will elect DRs and BDRs Traffic to DRs and BDRs is multicast to 224.0.0.6. Traffic from DRs and BDRs to other routers is multicast to 224.0.0.5 Neighbours do not need to be manually specified.
Point-to-Point	Indicates a topology where two routers are directly connected. An example would be a point-to-point T1. OSPF characteristics are: OSPF will not elect DRs and BDRs All OSPF traffic is multicast to 224.0.0.5 Neighbours do not need to be manually specified
Point-to-Multipoint	Indicates a topology where one interface can connect to multiple destinations. Each connection between a source and destination is treated as a point-to-point link. For example, point to point-to-multipoint frame relay. OSPF characteristics are: OSPF will not elect DRs and BDRs. All OSPF traffic is multicast to 224.0.0.5. Neighbours do not need to be manually specified.
Non-broadcast Multi-access Network (NBMA)	Indicates a topology where one interface can connect to multiple destinations; however, broadcasts cannot be sent across a NBMA network. For example, Frame Relay. OSPF characteristics are: OSPF will elect DRs and BDRs. OSPF neighbours must be manually defined, so all OSPF traffic is unicast instead of multicast. Note: on non-broadcast networks, neighbours must be manually specified, as multicast hellos are not allowed.

19.6. The OSPF Hierarchy

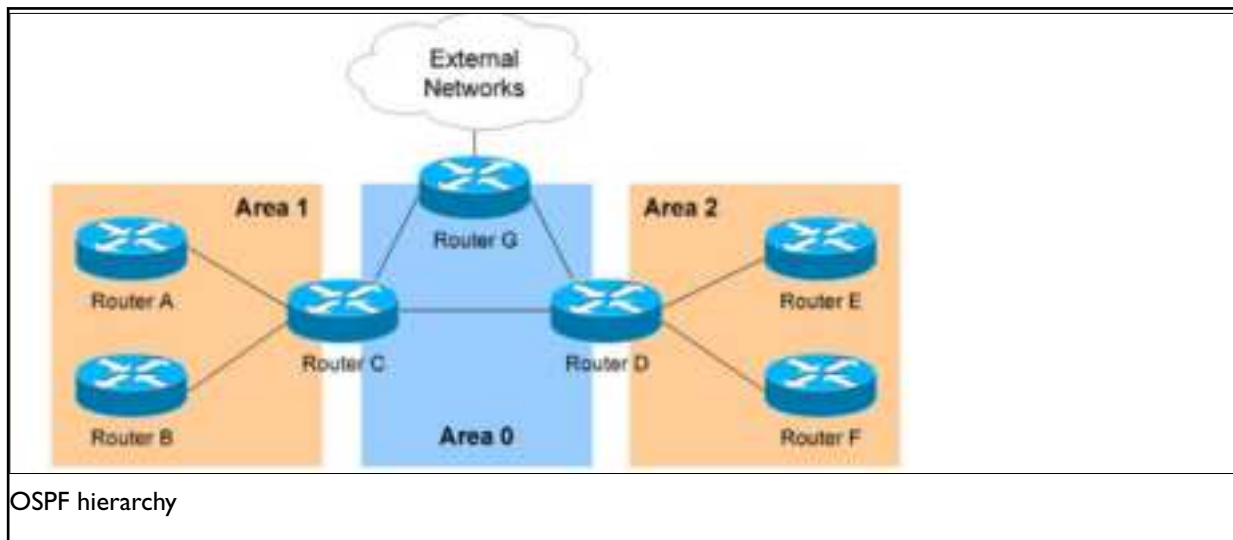
OSPF is a hierarchical system that separates an autonomous system into individual areas. OSPF traffic can either be:

- intra-area (within one area),
- inter-area (between separate areas), or
- external (from another AS).

OSPF routers build a topology database of all links within their area, and all routers within an area will have an identical topology database. Routing updates between these routers will only contain information about links local to their area. Limiting the topology database to include only the local area conserves bandwidth and reduces CPU loads.

Area 0 is required for OSPF to function, and is considered the backbone area. As a rule, all other areas must have a connection into Area 0, though this rule can be bypassed using virtual links. Area 0 is often referred to as the transit area to connect all other areas.

OSPF routers can belong to multiple areas, and therefore contain separate topology databases for each area. These routers are known as Area Border Routers (ABRs).



In the above example three areas exist: Area 0, Area 1, and Area 2. Area 0 is the backbone area for this autonomous system.

Both Area 1 and Area 2 must directly connect to Area 0. Routers A and B belong fully to Area 1, while routers E and F belong fully to Area 2. These are known as internal routers.

Router C belongs to both Area 0 and Area 1; so it is an ABR. Because it has an interface in Area 0, it can also be considered a Backbone Router (BR). The same can be said for Router D, as it belongs to both Area 0 and Area 2.

Router G also belongs to Area 0 however it also has a connection to the internet, which is outside this autonomous system. This makes Router G an Autonomous System Border Router (ASBR).

A router can become an ASBR in one of two ways:

- By connecting to a separate Autonomous System, such as the internet
- By redistributing another routing protocol into the OSPF process.

ASBRs provide access to external networks. OSPF defines two types of external routes, as shown in the table below.

Type 2 (E2)	Includes only the external cost to the destination network. External cost is the metric being advertised from outside the OSPF domain. This is the default type assigned to external routes.
Type 1 (E1)	Includes both the external cost, and the internal cost to reach the ASBR, to determine the total metric to reach the destination network. Type 1 routes are always preferred over Type 2 routes to the same destination.

19.7. OSPF Router Types

The four separate OSPF router types are shown in the table below.

Route Type	Description
Internal Router	All router interfaces belong to only one area.
Area Border Router (ABR)	Have interfaces in at least two separate areas.
Backbone Router	Have at least one interface in area 0.
Autonomous System Border Router (ASBR)	Have a connection to a separate autonomous system.

19.8. Configuring OSPF Using The Web Interface

Configuration Package Used

Package	Sections
ospfd	routing
	network
	interface

Select **Network -> OSPF**. The OSPF page appears.

There are three sections in the OSPF page:

Section	Description
Global Settings	Enables OSPF and configures the OSPF routing section containing global configuration parameters. The web automatically names the routing section ospfd.
Topology Configuration	Configures the network sections.
Interfaces Configuration	Configures the interface sections. Defines interface configuration for OSPF and interface specific parameters.

19.8.1. Global Settings

The Global Settings section configures the ospfd routing section. The web automatically names the routing section 'ospf'.

OSPF

Global Settings

OSPF Enabled

☒

Router ID

IP address format, must be unique, if blank it generates Router ID automatically

Make Default Router

☒

The OSPF global settings configuration page

Web Field/UCI/Package Option	Description				
Web: OSPF Enabled UCI: ospfd.ospfd.enabled Opt: enabled	Enables OSPF advertisements on router. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Router ID UCI: ospfd.ospfd.router_id Opt: router_id	This sets the router ID of the OSPF process. The router ID may be an IP address of the router, but need not be - it can be any arbitrary 32bit number. However it MUST be unique within the entire OSPF domain to the OSPF speaker. If one is not specified, then ospfd will obtain a router-ID automatically from the zebra daemon. <table border="1"> <tr> <td>Default</td><td>Empty</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Empty	Range	
Default	Empty				
Range					
Web: Make Default Router UCI: ospfd.ospfd.default_info_originate Opt: default_info_originate	Defines whether to originate an AS-External (type-5) LSA describing a default route into all external-routing capable areas, of the specified metric and metric type. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: ospfd.ospfd.vty_enabled Opt: vty_enabled	Enable vty for OSPFd (telnet to localhost:2604)				
Web: n/a UCI: ospfd.ospfd.vrf Opt: vrf	Defines the VRF for OSPF <table border="1"> <tr> <td>Default</td><td>No VRF</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	No VRF	Range	
Default	No VRF				
Range					

19.8.2. Topology Configuration

The Topology Configuration section configures the ospfd network section. This section specifies the OSPF enabled interface(s). The router can provide network information to the other OSPF routers via this interface.



NOTE

To advertise OSPF on an interface, the network mask prefix length for the topology configuration statement for the desired interface advertisement must be equal or smaller, that is, a larger network, than the network mask prefix length for the interface.

For example, the topology configuration statement in the screenshot below does not enable OSPF on an interface with address 12.1.1.1/23, but it would enable OSPF on an interface with address 12.1.1.129/25.

Topology Configuration

Network	Mask Length	Area	Stub Area
12.1.1.1	24	0	☒

Only for non-backbone areas

Add

The OSPF topology configuration page

Web Field/UCI/Package Option	Description				
Web: Network UCI: ospfd.@network[0].ip_addr Opt: ip_addr	Specifies the IP address for OSPF enabled interface. Format: A.B.C.D				
Web: Mask Length UCI: ospfd.@network[0].mask_length Opt: mask_length	Specifies the mask length for OSPF enabled interface. The mask length should be entered in CIDR notation.				
Web: Area UCI: ospfd.@network[0].area Opt: area	Specifies the area number for OSPF enabled interface.				
Web: Stub Area UCI: ospfd.@network[0].stub_area Opt: stub_area	Only for non-backbone areas. Configures the area to be a stub area. That is, an area where no router originates routes external to OSPF and hence an area where all external routes are via the ABR(s). ABRs for such an area do not need to pass AS-External LSAs (type-5s) or ASBR-Summary LSAs (type-4) into the area. They need only pass network-summary (type-3) LSAs into such an area, along with a default-route summary. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

19.8.3. Interfaces Configuration

The Interfaces Configuration section contains settings to configure the OSPF interface. It defines interface configurations for OSPF and interface specific parameters.

OSPFv2 allows packets to be authenticated using either an insecure plain text password, included with the packet, or by a more secure MD5 based HMAC (keyed-Hashing for Message Authentication). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire OSPF routing table, to be queried remotely, potentially by anyone on the internet, via OSPFv1.

This section defines key_chains to be used for MD5 authentication.

Interfaces Configuration

Interface ☐ LAN (no interfaces attached)

☒ LAN1 

☐ SERIAL1 

☐ PPPoADSL 

☐ Loopback 

Network Type  Leave as default if unknown. Default depends on the type of interface.

Passive ☒

Hello interval  Defaults: broadcast/point-to-point 10 secs, non-broadcast/point-to-multipoint 20 secs

Dead interval  Defaults: broadcast/point-to-point 40 secs, non-broadcast/point-to-multipoint 120 secs

Routing priority  OSPF route priority, zero for never

Authentication 

Text Auth. Key

The OSPF interfaces configuration section

Web Field/UCI/Package Option	Description										
Web: Interface UCI: ospfd.@interface[0].ospf_interface Opt: ospf_interface	Defines the interface name.										
Web: Network Type UCI: ospfd.@interface[0].network_type Opt: network_type	Defines the network type for specified interface. <table border="1"> <tr> <td>Default</td><td>Autodetect: it will broadcast. If broadcast is not supported on that interface then use point-to-point.</td></tr> <tr> <td>broadcast</td><td></td></tr> <tr> <td>non-broadcast</td><td></td></tr> <tr> <td>point-to-point</td><td></td></tr> <tr> <td>point-to-multipoint</td><td></td></tr> </table>	Default	Autodetect: it will broadcast. If broadcast is not supported on that interface then use point-to-point.	broadcast		non-broadcast		point-to-point		point-to-multipoint	
Default	Autodetect: it will broadcast. If broadcast is not supported on that interface then use point-to-point.										
broadcast											
non-broadcast											
point-to-point											
point-to-multipoint											
Web: Passive UCI: ospfd.@interface[0].passive Opt: passive	Does not send hello packets on the given interface, but does advertise the interface as a stub link in the router-LSA (Link State Advertisement) for this router. This allows you to advertise addresses on such connected interfaces without having to originate AS-External/Type-5 LSAs, which have global flooding scope, as would occur if connected addresses were redistributed into OSPF. This is the only way to advertise non-OSPF links into stub areas. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled						
Default: 0	Disabled										
1	Enabled										
Web: Hello Interval UCI: ospfd.@interface[0].hello_interval Opt: hello_interval	Defines the number of seconds for the Hello Interval timer value. A hello packet will be sent every x seconds, where x is the configured hello interval value on the specified interface. This value must be the same for all routers attached to a common network. The default is every 10 seconds for broadcast and point-to-point interfaces, and 30 seconds for non-broadcast and point-to- multipoint interfaces. <table border="1"> <tr> <td>Default</td><td>10 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	10 seconds	Range							
Default	10 seconds										
Range											
Web: Dead interval UCI: ospfd.@interface[0].dead_interval Opt: dead_interval	Defines the number of seconds for the dead interval timer value used for wait timer and inactivity timer. This value must be the same for all routers attached to a common network. The default is 40 seconds for broadcast and point-to-point interfaces, and 120 seconds for non-broadcast and point-to- multipoint interfaces. By default, the dead interval timer is four times the hello interval. <table border="1"> <tr> <td>Default</td><td>40 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	40 seconds	Range							
Default	40 seconds										
Range											
Web: Routing priority UCI: ospfd.@interface[0].priority Opt: priority	Defines priority to become the designated router. A value of 0 means never become a designated router; other values in the range 1-255 are allowed, with 255 being most likely to be a designated router, and 1 being least likely. <table border="1"> <tr> <td>Default</td><td>1</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	1	Range	0-255						
Default	1										
Range	0-255										
Web: Authentication UCI: ospfd.@interface[0].auth_mode Opt: auth_mode	OSPFv2 (only) allows packets to be authenticated via either an insecure plain text password, included with the packet, or via a more secure MD5 based HMAC (keyed-Hashing for Message AuthenticiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire OSPF routing table to be queried remotely, potentially by anyone on the internet, via OSPFv1. <table border="1"> <tr> <td>Default: no</td><td>No authentication</td></tr> </table>	Default: no	No authentication								
Default: no	No authentication										

Web Field/UCI/Package Option	Description	
	md5	Sets the interface with OSPF MD5 authentication.
	text	Sets the interface with OSPF simple password authentication.
Web: Text Auth. Key UCI: ospfd.@interface[0].text_auth_key Opt: text_auth_key	This command sets authentication string for text authentication. text_auth_key option can have length up to 8 characters. Displayed only when authentication is set to text .	
Web: Key ID UCI: ospfd.@interface[0].key_id Opt: key_id	Specifies key ID. Must be unique and match at both ends. Displayed only when authentication is set to MD5 .	
Web: MD5 Auth. Key UCI: ospfd.@interface[0].md5_auth_key Opt: md5_auth_key	Specifies keyed MD5 chain. Displayed only when authentication is set to MD5 .	

19.9. Configuring OSPF Using The Command Line

OSPF is configured under the ospfd package /etc/config/ospfd. There are three config sections: ospfd, interface and network. You can configure multiple interface and network sections.

By default, all OSPF interface instances are named interface, instances are identified by @interface then the interface position in the package as a number. For example, for the first interface in the package using UCI:

```
ospfd.@interface[0]=interface
ospfd.@interface[0].ospf_interface=lan
```

Or using package options:

```
config interface
option ospf_interface 'lan'
```

By default, all OSPF network instances are named network, it is identified by @network then the interface position in the package as a number. For example, for the first network in the package using UCI:

```
ospfd.@network[0]=network
ospfd.@network[0].ip_addr=12.1.1.1
```

Or using package options:

```
config network
option ip_addr '12.1.1.1'
```

19.10. Configuring OSPF Using UCI

```
root@VA_router:~# uci show ospfd
ospfd.ospfd=routing
ospfd.ospfd.enabled=yes
ospfd.ospfd.default_info_originate=yes
ospfd.ospfd.router_id=1.2.3.4
ospfd.ospfd.vrf=datavrf
ospfd.@network[0]=network
ospfd.@network[0].ip_addr=12.1.1.1
ospfd.@network[0].mask_length=24
ospfd.@network[0].area=0
ospfd.@network[0].stub_area=yes
ospfd.@interface[0]=interface
ospfd.@interface[0].ospf_interface=lan8
ospfd.@interface[0].hello_interval=10
ospfd.@interface[0].dead_interval=40
ospfd.@interface[0].priority=1
ospfd.@interface[0].network_type=broadcast
ospfd.@interface[0].passive=yes
ospfd.@interface[0].auth_mode=text
ospfd.@interface[0].text_auth_key=secret
ospfd.@interface[1]=interface
ospfd.@interface[1].ospf_interface=lan7
ospfd.@interface[1].network_type=point-to-point
ospfd.@interface[1].passive=no
ospfd.@interface[1].hello_interval=30
ospfd.@interface[1].dead_interval=120
ospfd.@interface[1].priority=2
ospfd.@interface[1].auth_mode=md5
ospfd.@interface[1].key_id=1
ospfd.@interface[1].md5_auth_key=test
```

OSPF using package options

```
root@VA_router:~# uci export ospfd
package ospfd
config routing 'ospfd'
option enabled 'yes'
option default_info_originate 'yes'
option router_id '1.2.3.4'
option vrf 'datavrf'
config network
option ip_addr '12.1.1.1'
option mask_length '24'
option area '0'
option stub_area 'yes'
config interface
option ospf_interface 'lan8'
option hello_interval '10'
option dead_interval '40'
option priority '1'
option network_type 'broadcast'
option passive 'yes'
option auth_mode 'text'
option text_auth_key 'secret'
config interface
option ospf_interface 'lan7'
option network_type 'point-to-point'
option passive 'no'
option hello_interval '30'
option dead_interval '120'
option priority '2'
option auth_mode 'md5'
option key_id '1'
option md5_auth_key 'test'
```

19.11. OSPF Diagnostics

Route Status

To show the current routing status, enter:

root@VA_router:~# route -n							
Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	10.206.4.65	0.0.0.0	UG	1	0	0	usb0
10.1.0.0	0.0.0.0	255.255.0.0	U	0	0	0	eth1
10.206.4.64	0.0.0.0	255.255.255.252	U	0	0	0	usb0
11.11.11.0	0.0.0.0	255.255.255.248	U	0	0	0	gre-GRE
89.101.154.151	10.206.4.65	255.255.255.255	UGH	0	0	0	usb0
192.168.100.0	0.0.0.0	255.255.255	U	0	0	0	eth0
192.168.101	11.11.11.1	255.255.255.255	UGH	11	0	0	gre-GRE
192.168.104.1	11.11.11.4	255.255.255.255	UGH	20	0	0	gre-GRE



NOTE

A route will only be displayed in the routing table when the interface is up.

Tracing OSPF Packets

Typically, OSPF uses IP as its transport protocol. The well-known IP protocol type for OSPF traffic is 0x59. To trace OSPF packets on any interface on the router, enter:

`tcpdump -i any -n proto ospf &`

```
root@VA_router:~# tcpdump -i any -n proto ospf & root@VA_router:~# tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
```

```
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535 bytes
```

To stop tracing, enter **fg** to bring tracing task to foreground, and then **<ctrl-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n proto ospf
^C 33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

19.11.1. Quagga/Zebra Console OSPF

Quagga is the routing protocol suite embedded in the router firmware. Quagga is split into different daemons for implementation of each routing protocol. Zebra is a core daemon for Quagga, providing the communication layer to the underlying Linux kernel, and routing updates to the client daemons.

Quagga has a console interface to Zebra for advanced debugging of the routing protocols.

To access, enter:

```
root@VA_router:~# telnet localhost zebra
Entering character mode Escape character is '^]'.
Hello, this is Quagga (version 0.99.21).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
User Access Verification
Password:
```

To see OSPF routing from Zebra console, enter:

```
root@VA_router:~# sh ip route

Codes: K - kernel route, C - connected, S - static, R - RIP,
O - OSPF, I - IS-IS, B - BGP, P - PIM, H - HSLs, o - OLSR,
b - BATMAN, A - Babel,
> - selected route, * - FIB route

K>* 0.0.0.0/0 via 10.206.4.65, usb0
O 10.1.0.0/16 [110/11] via 11.11.11.1, gre-GRE, 02:35:28
C>* 10.1.0.0/16 is directly connected, eth1
C>* 10.206.4.64/30 is directly connected, usb0
O 11.11.11.0/29 [110/10] is directly connected, gre-GRE, 02:35:29
C>* 11.11.11.0/29 is directly connected, gre-GRE
K>* 89.101.154.151/32 via 10.206.4.65, usb0
C>* 127.0.0.0/8 is directly connected, lo
C>* 192.168.100.0/24 is directly connected, eth0
O>* 192.168.101.1/32 [110/11] via 11.11.11.1, gre-GRE, 02:35:28
O>* 192.168.104.1/32 [110/20] via 11.11.11.4, gre-GRE, 02:30:45
O 192.168.105.1/32 [110/10] is directly connected, lo, 02:47:52
C>* 192.168.105.1/32 is directly connected, lo
```

19.11.2. OSPF Debug Console

When option `vty_enabled` is enabled in the OSPF configuration, the OSPF debug console can be accessed for advanced OSPF debugging. For more information, read the Global Settings section above.

To access OSPF debug console enter: `telnet localhost ospfd (password zebra)`

```
root@VA_router:~# telnet localhost ospfd

Entering character mode

Escape character is '^]'.

Hello, this is Quagga (version 0.99.21).

Copyright 1996-2005 Kunihiro Ishiguro, et al.

User Access Verification

Password:
```

To see OSPF routing from OSPF debug console, enter:

```
UUT> sh ip ospf route

===== OSPF network routing table =====

N 10.1.0.0/16 [11] area: 0.0.0.0

via 11.11.11.1, gre-GRE

N 11.11.11.0/29 [10] area: 0.0.0.0

directly attached to gre-GRE

N 192.168.101.1/32 [11] area: 0.0.0.0

via 11.11.11.1, gre-GRE

N 192.168.104.1/32 [20] area: 0.0.0.0

via 11.11.11.4, gre-GRE

N 192.168.105.1/32 [10] area: 0.0.0.0

directly attached to lo

===== OSPF router routing table =====

===== OSPF external routing table =====
```

To see OSPF neighbours from OSPF debug console, enter:

root@VA_router:~# sh ip ospf neighbor							
Neighbor ID	Pri State	Dead Time	Address	Interface	RXmtL	RqstL	DBsmL
1.1.1.1	255 Full/DR	33.961s	11.11.11.1	gre-GRE:11.11.11.5	0	0	0

To see OSPF interface details from OSPF debug console, enter:

```
root@VA_router:~# sh ip ospf interface

base0 is up
ifindex 8, MTU 1518 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>
OSPF not enabled on this interface

eth0 is up
ifindex 9, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>
OSPF not enabled on this interface

eth1 is up
```

```
ifindex 10, MTU 1500 bytes, BW 0 Kbit
<UP,BROADCAST,RUNNING,PROMISC,MULTICAST>
OSPF not enabled on this interface
eth2 is down
ifindex 11, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
eth3 is down
ifindex 12, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
eth4 is down
ifindex 13, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
eth5 is down
ifindex 14, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
eth6 is down
ifindex 15, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
eth7 is down
ifindex 16, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
OSPF not enabled on this interface
gre-GRE is up
ifindex 19, MTU 1472 bytes, BW 0 Kbit <UP,RUNNING,MULTICAST>
Internet Address 11.11.11.5/29, Area 0.0.0.0 MTU mismatch detection:enabled
Router ID 192.168.105.1, Network Type BROADCAST, Cost: 10
Transmit Delay is 1 sec, State Backup, Priority 1
Designated Router (ID) 1.1.1.1, Interface Address 11.11.11.1
Backup Designated Router (ID) 192.168.105.1, Interface Address 11.11.11.5
Multicast group memberships: OSPFAIRouters OSPFDesignatedRouters
Timer intervals configured, Hello 10s, Dead 40s, Wait 40s, Retransmit 5
Hello due in 3.334s
Neighbor Count is 1, Adjacent neighbor count is 1
gre0 is down
ifindex 6, MTU 1476 bytes, BW 0 Kbit <NOARP>
OSPF not enabled on this interface
ifb0 is down
```



```

ifindex 2, MTU 1500 bytes, BW 0 Kbit <BROADCAST,NOARP>

OSPF not enabled on this interface

ifb1 is down

ifindex 3, MTU 1500 bytes, BW 0 Kbit <BROADCAST,NOARP>

OSPF not enabled on this interface

lo is up

ifindex 1, MTU 16436 bytes, BW 0 Kbit <UP,LOOPBACK,RUNNING>

Internet Address 192.168.105.1/32, Broadcast 192.168.105.1, Area 0.0.0.0 MTU mismatch detection:enabled

Router ID 192.168.105.1, Network Type LOOPBACK, Cost: 10 Transmit Delay is 1 sec, State Loopback, Priority 1

No designated router on this network

No backup designated router on this network Multicast group memberships: <None>

Timer intervals configured, Hello 10s, Dead 40s, Wait 40s, Retransmit 5 Hello due in inactive

Neighbor Count is 0, Adjacent neighbor count is 0

sit0 is down

ifindex 7, MTU 1480 bytes, BW 0 Kbit <NOARP>

OSPF not enabled on this interface

teql0 is down

ifindex 4, MTU 1500 bytes, BW 0 Kbit <NOARP>

OSPF not enabled on this interface

tunl0 is down

ifindex 5, MTU 1480 bytes, BW 0 Kbit <NOARP>

OSPF not enabled on this interface

usb0 is up

ifindex 17, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,RUNNING,MULTICAST>

OSPF not enabled on this interface

```

To see OSPF database details from OSPF debug console, enter:

```

root@VA_router:~# sh ip ospf database

OSPF Router with ID (192.168.105.1)

Router Link States (Area 0.0.0.0)

```

```

Link ID ADV Router Age Seq# CkSum Link count 1.1.1.1 1.1.1.1 873 0x80006236 0xd591 3
192.168.104.1 192.168.104.1 596 0x8000000a 0x3a2d 2
192.168.105.1 192.168.105.1 879 0x8000000b 0x4919 2

Net Link States (Area 0.0.0.0)

Link ID ADV Router Age Seq# CkSum 11.11.11.1 1.1.1.1 595 0x80000004 0x5712

```

20. Configuring VRRP

Virtual Router Redundancy Protocol (VRRP) is a networking protocol designed to eliminate the single point of failure inherent in the static default routed environment.

VRRP specifies an election protocol that dynamically assigns responsibility for a virtual router to one of the VRRP routers on a LAN. The VRRP router controlling the IP address(es) associated with a virtual router is called the Master, and forwards packets sent to these IP addresses. The election process provides dynamic failover in the forwarding responsibility from the Master to a backup router should the Master become unavailable. This process allows the virtual router IP address(es) on the LAN to be used as the default first hop router by end hosts. The advantage gained from using VRRP is a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end host.

Two or more routers forming the redundancy cluster are configured with the same router ID and virtual IP address. A VRRP router group operates within the scope of the single LAN. Additionally, the VRRP routers are configured with its initial role (Master or Backup) and the router priority, which is a factor in the master router election process. You can also configure a password authentication to protect VRRP protocol messages against spoofing.

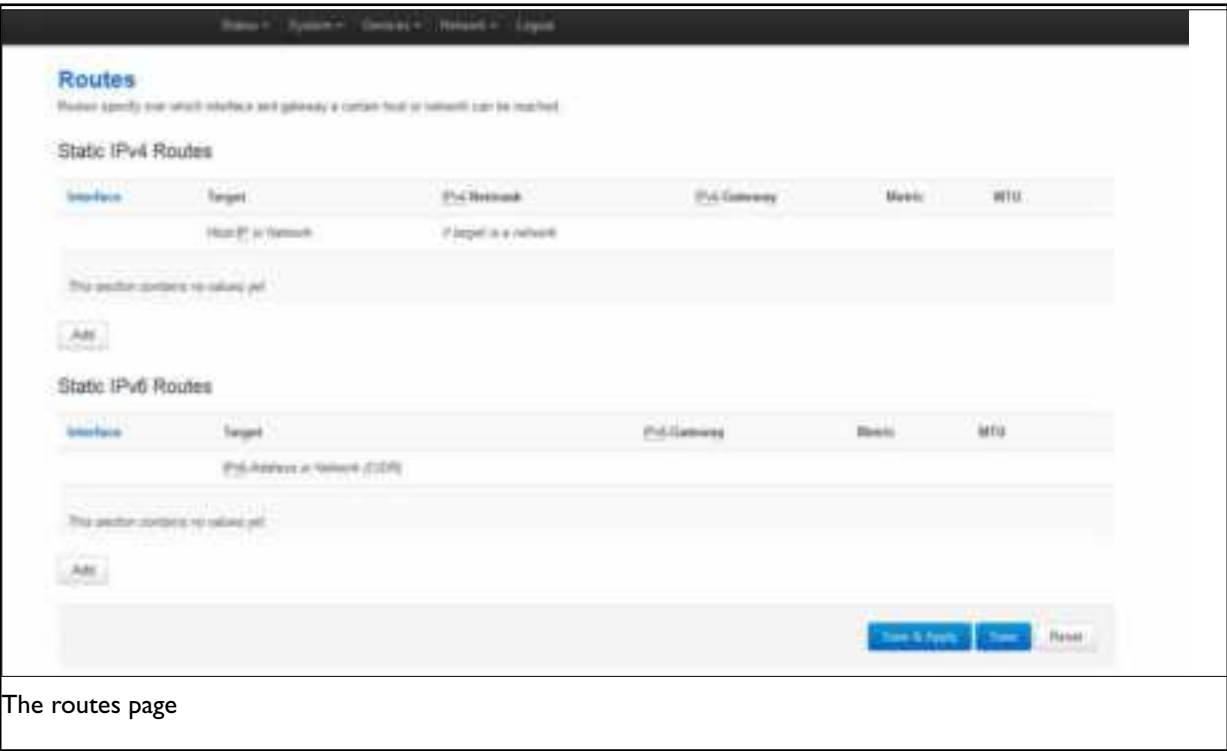
The VRRP protocol is implemented according to internet standard RFC2338.

Configuration package used

Package	Sections
vrrp	main
	vrrp_group

20.1. Configuring Static Routes Using The Web Interface

In the top menu, select Network -> Static Routes. The Routes page appears.



In the IPv4 Routes section , click **Add**.

Web Field/UCI/Package Option	Description				
Web: Interface UCI: network.@route[0].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.				
Web: target UCI: network.@router[0].target Opt: target	Specifies the route network IP address.				
Web: netmask UCI: network.@route[0].netmask Opt: netmask	Defines the route netmask. If omitted, 255.255.255.255 is assumed, which makes the target a host address.				
Web: Gateway UCI: network.@route[0].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.				
Web: Metric UCI: network.@route[0].metric Opt: metric	Specifies the route metric to use. <table border="1"><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td></td></tr></table>	Default	0	Range	
Default	0				
Range					
Web: MTU UCI: network.@route[0].mtu Opt:mtu	Defines a specific MTU for this route. If omitted, the MTU from the parent interface will be taken. <table border="1"><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					

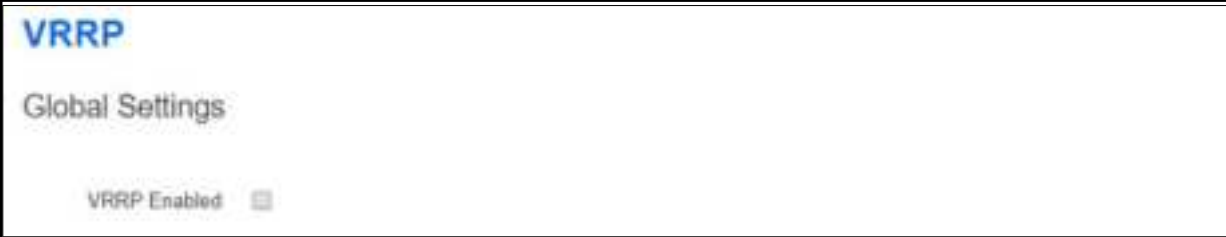
20.2. Configuring VRRP Using The Web Interface

To configure VRRP through the web interface, in the top menu, select **Network -> VRRP**. The VRRP page appears.

Section	Description
Global Settings	Enables VRRP
VRRP Group Configuration	Configures the VRRP group settings

20.3. VRRP Global Settings

The Global Settings section configures the vrrp package main section. To access configuration settings, click **ADD**.



The VRRP global settings configuration page

Web Field/UCI/Package Option	Description				
Web: VRRP Enabled	Globally enables VRRP on the router.				
UCI: vrrp.main.enabled	<table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Opt: Enabled					

20.4. VRRP Group Configuration Settings

The VRRP Group Configuration section configures vrrp package vrrp_group section. To access configuration settings, enter a VRRP group name and click **ADD**.

VRRP Group Configuration

Use the 'Add' textbox to enter a new VRRP group name and create a VRRP group

This section contains no values yet

The VRRP group name configuration page

VRRP Group Configuration

Group enabled ☐

Interface ☐ LAN1: (no interfaces attached)
☐ LAN2:
☐ LAN3:
☐ MOBILE1:
☐ PtoA DSL:
☐ loopback:
 Interface to serve

Current State

Track interfaces ☐ LAN1: (no interfaces attached)
☐ LAN2:
☐ LAN3:
☐ MOBILE1:
☐ PtoA DSL:
☐ loopback:
 Interfaces to monitor

Track IPsec Tunnel ☒ IPsecTunnel1
☒ IPsecTunnel2
 IPsec connection(s) to monitor

Track IPsec Fail Time Consider IPsec tunnel failed if tunnel is down for that many seconds

IPsec Connection IPsec connection to bring down/up when VRRP enters BACKUP/MASTER state

Start role

Router ID

Priority

The VRRP group configuration page

Web Field/UCI/Package Option	Description				
Web: Group Enabled UCI: vrrp.@vrrp_group[X].enabled Opt: Enabled	Enables a VRRP group on the router. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Interface UCI: vrrp.@vrrp_group[X].interface Opt: interface	Sets the local LAN interface name in which the VRRP cluster is to operate. For example, 'lan'. The interface name is taken from the network package and all configured interfaces will be displayed. <table border="1"> <tr> <td>Default</td><td>lan</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	lan	Range	
Default	lan				
Range					
Web: Track Interfaces UCI: vrrp.@vrrp_group[X].track_iface Opt: list track_iface	Defines one or more WAN interfaces that VRRP should monitor. If a monitored interface goes down on the master VRRP router, it goes into 'Fault' state and the backup VRRP router becomes the master. Multiple interfaces are entered using uci set and uci add_list commands. Example: uci set vrrp.@vrrp_group[0].track_iface=wan1 uci add_list vrrp.@vrrp_group[0].track_iface=wan2 or using a list of options via package options list track_iface 'wan1' list track_iface 'wan2' <table border="1"> <tr> <td>Default</td><td>Wan</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Wan	Range	
Default	Wan				
Range					
Web: Track IPsec Tunnel UCI: vrrp.@vrrp_group[X].track_ipsec Opt: list track_ipsec	Defines one or more IPsec tunnels that VRRP should monitor. If a monitored tunnel goes down on the master VRRP router for the configured Track IPsec Fail Time, it goes into 'Fault' state and the backup VRRP router becomes the master. Multiple IPsec connections are entered using uci set and uci add_list commands. Example: uci set vrrp.@vrrp_group[0].track_ipsec=Tunnel1 uci add_list vrrp.@vrrp_group[0].track_ipsec=Tunnel2 or using a list of options via package options list track_ipsec 'Tunnel1' list track_ipsec 'Tunnel2' <table border="1"> <tr> <td>Default: Blank</td><td>No IPsec connection to track</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default: Blank	No IPsec connection to track	Range	
Default: Blank	No IPsec connection to track				
Range					
Web: Track IPsec Fail Time UCI: vrrp.@vrrp_group[X]. track_ipsec_fail_sec Opt: track_ipsec_fail_sec	Defines duration in seconds to determine IPsec tunnel failure. <table border="1"> <tr> <td>Default</td><td>300 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	300 seconds	Range	
Default	300 seconds				
Range					
Web: IPsec connection UCI: vrrp.@vrrp_group[X].ipsec_connection Opt: ipsec_connection	Sets which IPsec connection to bring up or down when VRRP enters 'backup/master' state. Multiple IPsec connections are entered via the package option using a space separator. Example: option ipsec_connection 'IPsecTunnel1 IPsecTunnel2' <table border="1"> <tr> <td>Default</td><td>Blank. No IPsec connection to toggle</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Blank. No IPsec connection to toggle	Range	
Default	Blank. No IPsec connection to toggle				
Range					
Web: Start role	Sets the initial role in which a VRRP router starts up. In a cluster of VRRP routes, set one as a master and the others as backup.				

Web Field/UCI/Package Option	Description				
UCI: vrrp.@vrrp_group[X].init_state Opt: init_state	<table border="1"> <tr> <td>Default</td><td>BACKUP</td></tr> <tr> <td></td><td>MASTER</td></tr> </table>	Default	BACKUP		MASTER
Default	BACKUP				
	MASTER				
Web: Router ID UCI: vrrp.@vrrp_group[X].router_id Opt: router_id	Sets the VRRP router ID (1 to 255). All co-operating VRRP routers serving the same LAN must be configured with the same router ID. <table border="1"> <tr> <td>Default</td><td>1</td></tr> <tr> <td>Range</td><td>1-255</td></tr> </table>	Default	1	Range	1-255
Default	1				
Range	1-255				
Web: Priority UCI: vrrp.@vrrp_group[X].priority Opt: priority	Sets the VRRP router's priority. Higher values equal higher priority. The VRRP routers must use priority values between 1-254. The master router uses a higher priority. <table border="1"> <tr> <td>Default</td><td>100</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	100	Range	0-255
Default	100				
Range	0-255				
Web: Advert intvl UCI: vrrp.@vrrp_group[X].advert_int_sec Opt: advert_int_sec	Sets the VRRP hello value in seconds. This value must match the value set on a peer. <table border="1"> <tr> <td>Default</td><td>120 seconds</td></tr> <tr> <td>Range</td><td>Enable</td></tr> </table>	Default	120 seconds	Range	Enable
Default	120 seconds				
Range	Enable				
Web: Password UCI: vrrp.@vrrp_group[X].password Opt: password	Sets the password to use in the VRRP authentication (simple password authentication method). This field may be left blank if no authentication is required.				
Web: Virtual IP UCI: vrrp.@vrrp_group[X].virtual_ipaddr Opt: virtual_ipaddr	Sets the virtual IP address and mask in prefix format. For example, '11.1.1.99/24'. All co-operating VRRP routers serving the same LAN must be configured with the same virtual IP address.				
Web: GARP delay UCI: vrrp.@vrrp_group[X].garp_delay_sec Opt: garp_delay_sec	Sets the gratuitous ARP message sending delay in seconds.				

20.5. Configuring VRRP Using Command Line

The configuration file is stored on /etc/config/vrrp. There are two config sections: main and vrrp_group.

You can configure multiple VRRP groups. By default, all VRRP group instances are named 'vrrp_group'. Instances are identified by @vrrp_group then the vrrp_group position in the package as a number. For example, for the first vrrp_group in the package using UCI:

```
vrrp.@vrrp_group[0]=vrrp_group
vrrp.@vrrp_group[0].enabled=1
```

Or using package options:

```
config vrrp_group
option enabled '1'
```

However, to better identify, it is recommended to give the vrrp_group instance a name. For example, to define a vrrp_group instance named 'g1' using UCI, enter:

```
vrrp.g1.vrrp_group  
vrrp.g1.enabled=1
```

To define a named keepalive instance using package options, enter:

```
config vrrp_group 'g1'  
option enabled '1'
```

20.5.1. VRRP Using UCI

To view the configuration in UCI format, enter:

```
root@VA_router:~# uci show vrrp  
  
vrrp.main=vrrp  
vrrp.main.enabled=yes  
vrrp.g1=vrrp_group  
vrrp.g1.enabled=yes  
vrrp.g1.interface=lan  
vrrp.g1.track_iface=WAN MOBILE  
vrrp.g1.init_state=BACKUP  
vrrp.g1.router_id=1  
vrrp.g1.priority=100  
vrrp.g1.advert_int_sec=120  
vrrp.g1.password=secret  
vrrp.g1.virtual_ipaddr=10.1.10.150/16  
vrrp.g1.garp_delay_sec=5  
vrrp.g1.ipsec_connection=Test  
vrrp.g1.track_ipsec=conn1 conn2
```

VRRP using package options

To view the configuration in package option format, enter:


```
root@VA_router:~# uci export vrrp

package vrrp

config vrrp 'main'

option enabled 'yes'

config vrrp_group 'g1'

option enabled 'yes'

option interface 'lan'

list track_iface 'WAN'

list track_iface 'MOBILE'

option init_state 'BACKUP'

option router_id '1'

option priority '100'

option advert_int_sec '120'

option password 'secret'

option virtual_ipaddr '10.1.10.150/16'

option garp_delay_sec '5'

option ipsec_connection 'Test'

list track_ipsec 'conn1'

list track_ipsec 'conn2'
```

20.6. VRRP Diagnostics

VRRP Process using UCI

The VRRP process has its own subset of commands.

```
root@VA_router:~# /etc/init.d/vrrp

Syntax: /etc/init.d/vrrp [command]
```

Available commands:

```
start Start the service stop Stop the service restart Restart the service

reload Reload configuration files (or restart if that fails) enable Enable service autostart

disable Disable service autostart
```

To restart VRRP, enter:

```
root@VA_router:~# /etc/init.d/vrrp restart
```

21. Configuring RIP

RIP is a dynamic routing algorithm used on IP-based internet networks.

A distance vector routing algorithm is used by RIP to assist in maintaining network convergence. It uses a metric or 'hop' count as the only routing criteria. Each route is advertised with the number of hops a datagram would take to reach the destination network. The maximum metric for RIP is 15. This limits the size of the network that RIP can support. Smaller metrics are more efficient based on the cost associated with each metric.

RIP protocol is most useful as an Interior Gateway Protocol (IGP). An IGP refers to the routing protocol used within a single autonomous system. There may be a number of autonomous systems, using different routing protocols, combined together to form a large network. In most networking environments, RIP is not the preferred choice for routing as its time to converge and scalability are poor compared to EIGRP or OSPF.

21.1. RIP Characteristics

RIP is a standardised distance vector protocol, designed for use on smaller networks. RIP was one of the first true distance vector routing protocols, and is supported on a wide variety of systems.

RIP adheres to the following distance vector characteristics:

- RIP sends out periodic routing updates, every 30 seconds
- RIP sends out the full routing table every periodic update
- RIP uses a form of distance as its metric, in this case, hopcount
- RIP uses the Bellman-Ford distance vector algorithm to determine the best path to a particular destination

Other characteristics of RIP include:

- RIP supports IP and IPX routing
- RIP utilises UDP port 520
- RIP routes have an administrative distance of 120
- RIP has a maximum hopcount of 15 hops. Any network that is 16 hops away or more is considered unreachable to RIP, thus the maximum diameter of the network is 15 hops. A metric of 16 hops in RIP is considered a poison route or infinity metric.

If multiple paths exist to a particular destination, RIP will load balance between those paths, by default, up to 4, only if the metric (hopcount) is equal. RIP uses a round-robin system of load balancing between equal metric routes, which can lead to pinhole congestion.

For example, two paths might exist to a particular destination, one going through a 9600 baud link, the other via a T1. If the metric (hopcount) is equal, RIP will load balance, sending an equal amount of traffic down the 9600 baud link and the T1. This will cause the slower link to become congested.

21.2. RIP Versions

RIP has two versions, Version 1 (RIPv1) and Version 2 (RIPv2).

RIPv1 (RFC 1058) is classful, and therefore does not include the subnet mask with its routing table updates. Because of this, RIPv1 does not support Variable Length Subnet Masks (VLSMs). When using RIPv1, networks must be contiguous, and subnets of a major network must be configured with identical subnet masks. Otherwise, route table inconsistencies or worse will occur.

RIPv1 sends updates as broadcasts to address 255.255.255.255.

RIPv2 (RFC 2453) is classless, and therefore does include the subnet mask with its routing table updates. RIPv2 fully supports VLSMs, allowing discontinuous networks and varying subnet masks to exist.

Other enhancements offered by RIPv2 include:

- Routing updates are sent via multicast, using address 224.0.0.9
- Encrypted authentication can be configured between RIPv2 routers
- Route tagging is supported

RIPv2 can interoperate with RIPv1. By default:

- RIPv1 routers will sent only Version 1 packets
- RIPv1 routers will receive both Version 1 and 2 updates
- RIPv2 routers will both send and receive only Version 2 updates

The Merlin's **ripd** package supports RIP version 2 as described in RFC2453 and RIP version 1 as described in RFC1058. It is part of Quagga suite of applications for routing.

21.3. Configuring RIP Using The Web Interface

Configuration package used

Package	Sections
ripd	routing
	interface
	key_chain
	offset

To configure RIP using the web interface, select **Network -> RIP**. The RIP page appears. There are four sections in the RIP page.

Section	Description
Global Settings	Enables RIP and configures the RIP routing section containing global configuration parameters. The web automatically names the routing section ripd
Interfaces Configuration	Configures the interface sections. Defines interface configuration for RIP and interface specific parameters.
Offset Configuration	Configures the offset sections for metric manipulation
MD5 Authentication Key Chains	Configures the key_chain sections. Defines MD5 authentication settings.

RIP global settings

The web browser automatically names the routing section 'ripd'.

RIP

Global Settings

Save

RIP Enabled

On

RIP Version

2

Network Interface

eth0

ge0

A.B.C.D (IPaddr) or interface name, e.g. 192.168.100.100 or ge0

RIP Neighbor Address

192.168.100

192.168

A.B.C.D, e.g. 192.168.100.100

Update Time

30

Every update time seconds, the RIP process is scheduled to send an unicast RIP message containing the complete routing table to all neighboring RIP routers.

Timeout Timer

180

Upon expiration of the timeout, the route is no longer valid; however, it is retained in the routing table for a short time so that neighbors can be notified that the route has been dropped.

Garbage Collect Time

0

Upon expiration, the route is finally removed from the routing table.

Make Default Route

☐

Redistribute From

☐

Routes

The RIP global settings configurations page

Web Field/UCI/Package Option	Description				
Web: RIP Enabled UCI: ripd.ripd.enabled Opt: enabled	Enables RIP advertisements on router. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: RIP Version UCI: ripd.ripd.version Opt: version	Specifies the RIP version that will be used. Version 2 is recommended. <table border="1"> <tr> <td>1</td><td>RIP version 1</td></tr> <tr> <td>Default: 2</td><td>RIP version 2</td></tr> </table>	1	RIP version 1	Default: 2	RIP version 2
1	RIP version 1				
Default: 2	RIP version 2				
Web: Network/Interface UCI: ripd.ripd.network Opt: list network	Defines the list of the interfaces that will be used to advertise RIP packets. Format: A.B.C.D/mask or interface name Multiple RIP interfaces are entered using uci set and uci add_list commands. Example: <pre>uci set ripd.ripd.network=lan1 uci add_list ripd.ripd.network=lan2</pre> or using a list of options via package options <pre>list network 'lan1' list network 'lan2'</pre>				
Web: RIP Neighbor Address UCI: ripd.ripd.neighbor Opt: list neighbor	Specifies the list of RIP neighbours. When a neighbour does not understand multicast, this command is used to specify neighbours. In some cases, not all routers will be able to understand multicasting, where packets are sent to a network or a group of addresses. In a situation where a neighbour cannot process multicast packets, it is necessary to establish a direct link between routers. The neighbour command allows the network administrator to specify a router as a RIP neighbour. Multiple RIP neighbours are entered using uci set and uci add_list commands. Example: <pre>uci set ripd.ripd.neighbor=1.1.1.1 uci add_list ripd.ripd.neighbor=2.2.2.2</pre> or using a list of options via package options <pre>list neighbor '1.1.1.1' list neighbor '2.2.2.2'</pre>				
Web: Update Timer UCI: ripd.ripd.tb_update_sec Opt: tb_update_sec	Every update timer seconds, the RIP process is awakened to send an unsolicited response message containing the complete routing table to all neighbouring RIP routers. <table border="1"> <tr> <td>Default</td><td>30</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	30	Range	
Default	30				
Range					
Web: Timeout Timer UCI: ripd.ripd.tb_timeout_sec Opt: tb_timeout_sec	Defines timeout in seconds. Upon expiration of the timeout, the route is no longer valid; however, it is retained in the routing table for a short time so that neighbours can be notified that the route has been dropped. <table border="1"> <tr> <td>Default</td><td>180</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	180	Range	
Default	180				
Range					
Web: Garbage Collect Timer UCI: ripd.ripd.tb_garbage_sec Opt: tb_garbage_sec	Upon expiration of the garbage-collection timer, the route is finally removed from the routing table. This timer starts when Timeout timer expires or when route is advertised as "unreachable". The reason for using this two-stage marking and deleting removal method is to give the router that declared the route no longer reachable a chance to propagate				

Web Field/UCI/Package Option	Description				
	this information to other routers. When the timer expires the route is deleted. If during the garbage collection period a new RIP response for the route is received, then the deletion process is aborted: the garbage- collection timer is cleared, the route is marked as valid again, and a new Timeout timer starts. <table border="1"> <tr> <td>Default</td><td>120</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	120	Range	
Default	120				
Range					
Web: Make Default Router UCI: ripd.ripd.default_info_originate Opt: default_info_originate	Advertising a default route via RIP. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Redistribute Kernel Routes UCI: ripd.ripd.redistribute_kernel_routes Opt: redistribute_kernel_routes	Redistributes routing information from kernel route entries into the RIP tables. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: ripd.ripd.vty_enabled Opt: vty_enabled	Enable vty for RIPd (telnet to localhost:2602).				

21.3.1. RIP Interfaces Configuration

Interfaces Configuration

Interface	Split Horizon	Poison Reverse	Passive	Authentication	Text Auth. Key	MD5 Key Chain Name	
RIPv2 only							
lan	☒	☒	☒	no			Delete
lan2	☒	☐	☐	test	secret		Delete
lan3	☒	☐	☐	md5		chain	Delete

Add

The RIP interfaces configuration page

Web Field/UCI/Package Option	Description						
Web: Interface UCI: ripd.@interface[0].rip_interface Opt: rip_interface	Specifies the interface name.						
Web: Split Horizon UCI: ripd.@interface[0].split_horizon Opt: split_horizon	Prohibits the router from advertising a route back onto the interface from which it was learned. <table border="1"><tr><td>0</td><td>Disabled</td></tr><tr><td>Default: 1</td><td>Enabled</td></tr></table>	0	Disabled	Default: 1	Enabled		
0	Disabled						
Default: 1	Enabled						
Web: Poison Reverse UCI: ripd.@interface[0].poison_reverse Opt: poison_reverse	Router tells its neighbour gateways that one of the gateways is no longer connected. Notifies the gateway, setting the hop count to the unconnected gateway to 16 which would mean "infinite". <table border="1"><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Passive UCI: ripd.@interface[0].passive Opt: passive	Sets the specified interface to passive mode. On passive mode interface, all receiving packets are processed as normal and ripd does not send either multicast or unicast RIP packets except to RIP neighbour specified with a neighbour command. <table border="1"><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Authentication UCI: ripd.@interface[0].auth_mode Opt: auth_mode	RIPv2 (only) allows packets to be authenticated via either an insecure plain text password, included with the packet, or via a more secure MD5 based HMAC (keyed-Hashing for Message Authentication). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire RIP routing table, to be queried remotely, potentially by anyone on the internet, via RIPv1. <table border="1"><tr><td>Default: no</td><td>No authentication.</td></tr><tr><td>md5</td><td>Sets the interface with RIPv2 MD5 authentication.</td></tr><tr><td>text</td><td>Sets the interface with RIPv2 simple password authentication.</td></tr></table>	Default: no	No authentication.	md5	Sets the interface with RIPv2 MD5 authentication.	text	Sets the interface with RIPv2 simple password authentication.
Default: no	No authentication.						
md5	Sets the interface with RIPv2 MD5 authentication.						
text	Sets the interface with RIPv2 simple password authentication.						
Web: Text Auth. Key UCI: ripd.@interface[0].auth_key Opt: auth_key	This command sets the authentication string for text authentication. The string must be shorter than 16 characters.						
Web: MD5 Key Chain Name UCI: ripd.@interface[0].key_chain Opt: key_chain	Specify Keyed MD5 chain.						

21.3.2. Offset Configuration

This section is used for RIP metric manipulation. RIP metric is a value for distance in the network. Usually, ripd package increments the metric when the network information is received. Redistributed routes' metric is set to 1.

Offset Configuration

Metric: 1

Match: 1.1.1.0/24

Add

Delete

The RIP offset configuration section

Web Field/UCI/Package Option	Description				
Web: Metric UCI: ripd.@offset[0].metric Opt: metric	Defines the metric offset value. This modifies the default metric value for redistributed and connected routes. <table border="1"><tr><td>1</td><td></td></tr><tr><td>Range</td><td></td></tr></table>	1		Range	
1					
Range					
Web: Match UCI: ripd.@offset[0].match_network Opt: match_network	Defines the prefixes to match. Format: A.B.C.D/mask				

21.3.3. MD5 Authentication Key Chains

RIPv2 (only) allows packets to be authenticated using either an insecure plain text password, included with the packet, or by a more secure MD5 based HMAC (keyed- Hashing for Message Authentication). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes, that is, the entire RIP routing table, to be queried remotely, potentially by anyone on the internet, using RIPv1.

This section defines key_chains to be used for MD5 authentication.



The MD5 authentication key chains configuration section

Web Field/UCI/Package Option	Description
Web: Key Chain Name UCI: ripd.@key_chain[0].key_chain_name Opt: key_chain_name	Specifies the chain name.
Web: Key ID UCI: ripd.@key_chain[0].key_id Opt: key_id	Specifies the key ID. Must be unique and match at both ends.
Web: Authentication key UCI: ripd.@key_chain[0].auth_key Opt: auth_key	Specifies the keyed MD5 chain.

21.4. Configuring RIP Using Command Line

RIP is configured under the ripd package `/etc/config/ripd`.

There are four config sections ripd, interface, key_chain and offset. You can configure multiple interface, key_chain and offset sections.

By default, all RIP interface instances are named interface, it is identified by @interface then the interface position in the package as a number. For example, for the first interface in the package using UCI:


```
ripd.@interface[0]=interface
ripd.@interface[0].rip_interface=lan
```

Or using package options:

```
config interface
option rip_interface 'lan'
```

By default, all RIP `key_chain` instances are named `key_chain`, it is identified by `@key_chain` then the `key_chain` position in the package as a number. For example, for the first `key_chain` in the package using UCI:

```
ripd.@key_chain[0]=key_chain
ripd.@key_chain[0].key_chain_name=Keychain1
```

Or using package options:

```
config key_chain
option key_chain_name 'Keychain1'
```

By default, all RIP `offset` instances are named `offset`, it is identified by `@offset` then the `offset` position in the package as a number. For example, for the first `offset` in the package using UCI:

```
ripd.@offset[0]=offset
ripd.@offset[0].metric=1
```

Or using package options:

```
config offset
option metric '1'
```

21.4.1. RIP Using UCI

```
root@VA_router:~# uci show ripd

ripd.ripd=routing

ripd.ripd.version=2

ripd.ripd.enabled=yes

ripd.ripd.network=lan2 gre1

ripd.ripd.neighbor=10.1.1.100 10.1.2.100

ripd.ripd.tb_update_sec=30

ripd.ripd.tb_timeout_sec=180

ripd.ripd.tb_garbage_sec=120

ripd.ripd.default_info_originate=yes

ripd.ripd.redistribute_kernel_routes=yes

ripd.@interface[0]=interface

ripd.@interface[0].rip_interface=lan

ripd.@interface[0].auth_mode=no

ripd.@interface[0].split_horizon=1

ripd.@interface[0].poison_reverse=0

ripd.@interface[0].passive=0

ripd.@interface[1]=interface

ripd.@interface[1].rip_interface=lan2

ripd.@interface[1].split_horizon=1

ripd.@interface[1].poison_reverse=0

ripd.@interface[1].passive=0

ripd.@interface[1].auth_mode=text

ripd.@interface[1].auth_key=secret
```

```

ripd.@interface[2]=interface
ripd.@interface[2].rip_interface=lan3
ripd.@interface[2].split_horizon=1
ripd.@interface[2].poison_reverse=0
ripd.@interface[2].passive=0
ripd.@interface[2].auth_mode=md5
ripd.@interface[2].key_chain=Keychain1
ripd.@key_chain[0]=key_chain
ripd.@key_chain[0].key_chain_name=Keychain1
ripd.@key_chain[0].key_id=1
ripd.@key_chain[0].auth_key=123
ripd.@offset[0]=offset
ripd.@offset[0].metric=1
ripd.@offset[0].match_network=10.1.1.1/24

```

21.4.2. RIP Using Package Options

```

root@VA_router:~# uci export ripd
package ripd
config routing 'ripd'
option version '2'
option enabled 'yes'
list network 'lan2'
list network 'gre1'
list neighbor '10.1.1.100'
list neighbor '10.1.2.100'
option tb_update_sec '30'
option tb_timeout_sec '180'
option tb_garbage_sec '120'
option default_info_originate 'yes'
option redistribute_kernel_routes 'yes'
config interface

```

```
option rip_interface 'lan'
option auth_mode 'no'
option split_horizon '1'
option poison_reverse '0'
option passive '0'

config interface
option rip_interface 'lan2'
option split_horizon '1'
option poison_reverse '0'
option passive '0'
option auth_mode 'text'
option auth_key 'textsecret'

config interface
option rip_interface 'lan3'
option split_horizon '1'
option poison_reverse '0'
option passive '0'
option auth_mode 'md5'
option key_chain 'keychain1'
config key_chain
option key_chain_name 'Keychain1'
option key_id '1'
option auth_key '123'

config offset
option metric '1'
option match_network '10.1.1.1/24'
```

21.5. RIP Diagnostics

Route Status

To show the current routing status, enter:

```
root@VA_router:~# route -n
```

Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	10.206.4.65	0.0.0.0	UG	1	0	0	usb0
10.1.0.0	0.0.0.0	255.255.0.0	U	0	0	0	eth1
10.206.4.64	0.0.0.0	255.255.255.252	U	0	0	0	usb0
11.11.11.0	0.0.0.0	255.255.255.248	U	0	0	0	gre-GRE
89.101.154.151	10.206.4.65	255.255.255.255	UGH	0	0	0	usb0
192.168.100.0	0.0.0.0	255.255.255	U	0	0	0	eth0
192.168.101	11.11.11.1	255.255.255.255	UGH	11	0	0	gre-GRE
192.168.104.1	11.11.11.4	255.255.255.255	UGH	20	0	0	gre-GRE

Note: a route will only be displayed in the routing table when the interface is up.

21.5.1. Tracing RIP Packets

RIP uses UDP port 520. To trace RIP packets on any interface on the router, enter:

`tcpdump -i any -n -p port 520 &`

```
root@VA_router:~# tcpdump -i any -n -p port 520 &
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535 bytes
```

To stop tracing enter **fg** to bring tracing task to foreground, and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n -p port 67
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

21.5.2. Quagga/Zebra Console RIP

Quagga is the routing protocol suite embedded in the router firmware. Quagga is split into different daemons for implementation of each routing protocol. Zebra is a core daemon for Quagga, providing the communication layer to the underlying Linux kernel, and routing updates to the client daemons.

Quagga has a console interface to Zebra for advanced debugging of the routing protocols.

To access, enter: `telnet localhost zebra` (password: zebra)

```
root@VA_router:~# telnet localhost zebra
Entering character mode Escape character is '^]'.
Hello, this is Quagga (version 0.99.21).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
User Access Verification
Password:
```

To see RIP routing information from Zebra console, enter:

```

root@VA_router:~# sh ip route

Codes: K - kernel route, C - connected, S - static, R - RIP,
O - OSPF, I - IS-IS, B - BGP, P - PIM, H - HSLs, o - OLSR, b - BATMAN, A - Babel,
> - selected route, * - FIB route

K>* 0.0.0.0/0 via 10.205.154.65, usb0

C>* 10.1.0.0/16 is directly connected, eth1

C>* 10.205.154.64/30 is directly connected, usb0 C>* 11.11.11.0/29 is directly connected, gre-GRE K>* 89.101.154.151/32 via
10.205.154.65, usb0

C>* 127.0.0.0/8 is directly connected, lo

C>* 192.168.100.0/24 is directly connected, eth0

R>* 192.168.104.1/32 [120/3] via 11.11.11.4, gre-GRE, 15:54:47

```

```

C>* 192.168.105.1/32 is directly connected, lo

R>* 192.168.154.154/32 [120/2] via 11.11.11.1, gre-GRE, 16:09:51

```

21.5.3. RIP Debug Console

When option `vtty_enabled` (see Global settings section above) is enabled in the RIP configuration, RIP debug console can be accessed for advanced RIP debugging.

To access RIP debug console enter: `telnet localhost ripd` (password zebra)

```

root@VA_router:~# telnet localhost ripd

Entering character mode Escape character is '^]'.

Hello, this is Quagga (version 0.99.21). Copyright 1996-2005 Kunihiro Ishiguro, et al.

User Access Verification

Password:

```

To see RIP status from RIP debug console, enter:

```

root@VA_router:~# show ip rip

Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP

Sub-codes:

(n) - normal, (s) - static, (d) - default, (r) - redistribute,
(i) - interface

```

Network	Next Hop	Metric From	Tag Time
C(i) 11.11.11.0/29	0.0.0.0	1 self	0
R(n) 192.168.104.1/32	11.11.11.4	3 11.11.11.1	0 02:48
C(i) 192.168.105.1/32	0.0.0.0	1 self	0
R(n) 192.168.154.154/32	11.11.11.1	2 11.11.11.1	0 02:48

To see RIP status from RIP debug console, enter:

```
root@VA_router:~# sh ip rip status

Routing Protocol is "rip"

Sending updates every 30 seconds with +/-50%, next due in 17 seconds

Timeout after 180 seconds, garbage collect after 120 seconds

Outgoing update filter list for all interface is not set

Incoming update filter list for all interface is not set

Default redistribution metric is 1

Redistributing:

Default version control: send version 2, receive version 2

Interface Send Recv Key-chain

gre-GRE 2 2

lo 2 2

Routing for Networks:

11.0.0.0/8

192.168.105.1/32

Routing Information Sources:

Gateway BadPackets BadRoutes Distance Last Update

11.11.11.1 0 0 120 00:00:20

Distance: (default is 120)
```

22. Configuring PIM And IGMP Interfaces

IP multicast is a bandwidth-conserving technology that reduces traffic by simultaneously delivering a single stream of information to potentially thousands of corporate recipients. Applications that take advantage of multicast include video conferencing and corporate communications.

IP multicast delivers application source traffic to multiple receivers without burdening the source or the receivers while using a minimum of network bandwidth.

PIM (Protocol Independent Multicast) and IGMP (Internet Group Management Protocol) are protocols used to create multicasting networks within a regular IP network.

A multicast group is an arbitrary group of receivers that expresses an interest in receiving a particular data stream. The receivers (the designated multicast group) are interested in receiving a data stream from the source. They indicate this by sending an Internet Group Management Protocol (IGMP) host report to their closest router in the network. The routers are then responsible for delivering the data from the source to the receivers. The routers use Protocol Independent Multicast (PIM) between themselves to dynamically create a multicast distribution tree. The data stream will then be delivered only to the network segments that are in the path between the source and the receivers. To summarise: PIM is used between routers while IGMP is used between a receiver and its router only. As a result, PIM must be enabled on all the interfaces on the route from the multicast source to the multicast client while IGMP must be enabled on the interface to the multicast client only.

Configuration Package Used

Package	Sections
pimd	pimd interface

22.1. Configuring PIM And IGMP Using The Web Interface

To configure PIM through the web interface, in the top menu, select **Network -> PIM**. The PIM page appears. To access the Global Settings, click **Add**.



22.1.1. Global Settings

Web Field/UCI/Package Option	Description				
Web: PIM Enabled UCI: pimd.pimd.enabled Opt: enabled	Globally enables PIM on the router. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: SSM Ping Enabled UCI: pimd.pimd.ssm pingd Opt: ssm pingd	Enables answers to SSM pings. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

22.1.2. Interfaces Configuration

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: pimd.interface[x].enabled Opt: enabled	Enables multicast management of the given interface by the PIM application. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Interface UCI: pimd.interface[x].interface Opt: interface	Selects the interface to apply PIM settings to.				
Web: Enable IGMP UCI: pimd.interface[x].igmp Opt: igmp	Enable IGMP on given interface. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table> Note: you must enable PIM SSM and/or IGMP depending on your requirements. ICMP must be enabled on the interface to the multicast client only.	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Enable SSM UCI: pimd.interface[x].ssm Opt: ssm	Enable SSM on given interface. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

To save your configuration updates, click **Save & Apply**.

22.2. Configuring PIM And IGMP Using UCI

You can configure PIM and IGMP through CLI using UCI.

The configuration file is stored on **/etc/config/pimd**

To view the configuration file, enter:

```
root@VA_router:/etc/config1# uci export pimd

package pimd

config routing 'pimd'

option enabled 'yes'


config interface

option enabled 'yes'

option interface 'lan'

option ssm 'yes'

option igmp 'yes'


config interface

option enabled 'yes'

option interface 'wan'

option ssm 'yes'

option igmp 'no'


Alternatively, enter:

uci show pimd

root@VA_router:/etc/config1# uci show pimd

pimd.pimd=routing
pimd.pimd.enabled=yes
pimd.@interface[0]=interface
pimd.@interface[0].enabled=yes
pimd.@interface[0].interface=lan
pimd.@interface[0].ssm=yes
pimd.@interface[0].igmp=yes
pimd.@interface[1]=interface
pimd.@interface[1].enabled=yes
pimd.@interface[1].interface=wan
pimd.@interface[1].ssm=yes
pimd.@interface[1].igmp=no
```

23. Configuring Multi-WAN

Multi-WAN is used for managing WAN interfaces on the router, for example, 3G interfaces to ensure high availability. You can customise Multi-WAN for various needs, but its main use is to ensure WAN connectivity and provide a failover system in the event of failure or poor coverage.

Multi-WAN periodically does a health check on the interface. A health check comprises of a configurable combination of the following:

- interface state
- pings to an ICMP target
- signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks, results in a fail. After a configurable number of health check failures, Multi-WAN will move to the next highest priority interface. Multi- WAN will optionally stop the failed interface and start the new interface, if required.

In some circumstances, particularly in mobile environments, it is desirable for a primary interface to be used whenever possible. In this instance Multi-WAN will perform a health check on the primary interface after a configurable period. If the health checks pass for the configured number of recovery health checks then the primary will be used.

Configuration package used

Package	Sections
multiwan	config
	wan

23.1. Configuring Multi-WAN Using The Web Interface

In the top menu, select **Network -> Multi-Wan**. The Multi-WAN page appears.

Multi-WAN

Multi-WAN allows for the use of multiple options for load balancing and failover.

Enable ☒

Preempt ☐

Alternate Mode ☐ It will use alternate interface after reboot

The multi-WAN page

Web Field/UCI/Package Option	Description				
Web: Enable UCI: multiwan.config.enabled Opt: enabled	Enables or disables Multi-WAN. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Preempt UCI: multiwan.config.preempt Opt: preempt	Enables or disables pre-emption for Multi-WAN. If enabled the router will keep trying to connect to a higher priority interface depending on timer set by ifup_retry_sec <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Alternate Mode UCI: multiwan.config.alt_mode Opt: alt_mode	Enables or disables alternate mode for Multi-WAN. If enabled the router will use an alternate interface after reboot. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

When you have enabled Multi-WAN, you can add the interfaces that will be managed by Multi-WAN, for example 3G interfaces.

The name used for Multi-WAN must be identical, including upper and lowercases, to the actual interface name defined in your network configuration. To check the names and settings are correct, select **Network -> Interfaces** and view the Interfaces Overview page.

In the WAN interfaces section, enter the name of the WAN interface to configure, and then click **Add**. The new section for configuring specific parameters appears.

WAN interfaces

Health Monitor detects and corrects network changes and failed connections.

WAN

Health Monitor Interval	10 sec.	
Health Monitor ICMP Host(s)	DNIS Server(s)	
Health Monitor Contrack Test Host(s)	Default	
Health Monitor ICMP Timeout	3 sec.	
Health Monitor ICMP Interval	1 sec.	
Attempts Before WAN Failover	3	
Attempts Before WAN Recovery	5	
Priority	0	<i>Higher value is higher priority</i>
Exclusive Group	0	<i>Only one interface in group could be up in the same time</i>
Manage Interface State (Up/Down)	☒	
Minimum Up Interval	300 sec.	<i>Minimum interval between two successive interface start attempts</i>
Interface Start Timeout	40 sec.	<i>Time for interface to startup</i>
Signal Threshold (dBm)	-115	<i>Below is a failure</i>
RSCP Threshold for 3G (dBm)	-115	<i>Below is a failure</i>
ECIO Threshold for 3G (dB)	-115	<i>Below is a failure</i>
Signal Test		<i>Free form expression to test signal value</i>

Example interface showing failover traffic destination as the added multi-WAN interface

Web Field/UCI/Package Option	Description								
Web: Health Monitor Interval UCI: multiwan.wan.health_interval Opt: health_interval	Sets the period to check the health status of the interface. The Health Monitor interval will be used for: - Interface state checks - Ping interval - Signal strength checks The health monitor interval has a granularity of 5 seconds. Configured values will be rounded up to the next 5 second value. <table border="1"> <tr> <td>Default: 10</td><td>Perform a health check every 10 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default: 10	Perform a health check every 10 seconds	Range					
Default: 10	Perform a health check every 10 seconds								
Range									
Web: Health Monitor ICMP Host(s) UCI: multiwan.wan.icmp_hosts Opt: icmp_hosts	Sends health ICMPs to configured value DNS servers by default. Configure to any address. <table border="1"> <tr> <td>Disable</td><td>Disables the option</td></tr> <tr> <td>Default: DNS servers</td><td>DNS IP addresses will be used</td></tr> <tr> <td>WAN Gateway</td><td>Gateway IP address will be used</td></tr> <tr> <td>Custom</td><td>Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2'</td></tr> </table>	Disable	Disables the option	Default: DNS servers	DNS IP addresses will be used	WAN Gateway	Gateway IP address will be used	Custom	Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2'
Disable	Disables the option								
Default: DNS servers	DNS IP addresses will be used								
WAN Gateway	Gateway IP address will be used								
Custom	Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2'								
Web: Health Monitor Conntrack Test Host(s) UCI: multiwan.wan.conntrack_hosts Opt: conntrack_hosts	Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval. The Conntrack_hosts option defines the IP for conntrack to track, usually the icmp_host IP is used. If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host. By default the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated. Conntrack is generally used to limit the traffic sent on a GSM network. <table border="1"> <tr> <td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td></tr> <tr> <td>Disable</td><td>Conntrack disabled.</td></tr> <tr> <td>Custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td></tr> </table>	Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	Disable	Conntrack disabled.	Custom	Specifies an IP other than the icmp_host for conntrack to track.		
Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.								
Disable	Conntrack disabled.								
Custom	Specifies an IP other than the icmp_host for conntrack to track.								
Web: Health Monitor ICMP Timeout UCI: multiwan.wan.timeout Opt: timeout	Sets Ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at. <table border="1"> <tr> <td>Default: 3</td><td>Wait 3 seconds for ping reply.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default: 3	Wait 3 seconds for ping reply.	Range					
Default: 3	Wait 3 seconds for ping reply.								
Range									
Web: Health Monitor ICMP Interval UCI: multiwan.wan.icmp_interval Opt: icmp_interval	Defines the interval between multiple pings sent at each health check <table border="1"> <tr> <td>Default</td><td>1</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	1	Range					
Default	1								
Range									
Web: Health Monitor ICMP Count UCI: multiwan.wan.icmp_count Opt: icmp_count	Defines the number of pings to send at each health check. <table border="1"> <tr> <td>Default</td><td>1</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	1	Range					
Default	1								
Range									
Web: Attempts Before WAN Failover UCI: multiwan.wan.health_fail_retries Opt: health_fail_retries	Sets the amount of health monitor retries before the interface is considered a failure. <table border="1"> <tr> <td>Default</td><td>3</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	3	Range					
Default	3								
Range									

Web Field/UCI/Package Option	Description				
Web: Attempts Before WAN Recovery UCI: multiwan.wan.health_recovery_retries Opt: health_recovery_retries	Sets the number of health monitor checks before the interface is considered healthy. Only relevant if pre-empt mode is enabled. <table border="1"> <tr><td>Default</td><td>5</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	5	Range	
Default	5				
Range					
Web: Priority UCI: multiwan.wan.priority Opt: priority	Specifies the priority of the interface. The higher the value, the higher the priority. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Manage Interface State (Up/Down) UCI: multiwan.wan.manage_state Opt: manage_state	Defines whether multi-wan will start and stop the interface. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Exclusive Group UCI: multiwan.wan.exclusive_group Opt: exclusive_group	Defines the group to which the interface belongs; only one interface can be active. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Minimum ifup Interval UCI: multiwan.wan.ifup_retry_sec Opt: ifup_retry_sec	Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled. <table border="1"> <tr><td>Default: 300</td><td>Retry primary interface every 300 seconds</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 300	Retry primary interface every 300 seconds	1	Enabled
Default: 300	Retry primary interface every 300 seconds				
1	Enabled				
Web: Interface Start Timeout UCI: multiwan.wan.ifup_timeout Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. <table border="1"> <tr><td>Default</td><td>40 seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	40 seconds	Range	
Default	40 seconds				
Range					
Web: Signal Threshold (dBm) UCI: multiwan.wan.signal_threshold Opt: signal_threshold	Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics.-115. <table border="1"> <tr><td>Default</td><td>Disabled</td></tr> <tr><td>Range</td><td>-46 to -115 dBm</td></tr> </table>	Default	Disabled	Range	-46 to -115 dBm
Default	Disabled				
Range	-46 to -115 dBm				
Web: RSCP Threshold (dBm) UCI: multiwan.wan.rscp_threshold Opt: rscp_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics. <table border="1"> <tr><td>Default</td><td>-115 Disabled</td></tr> <tr><td>Range</td><td>-46 to -115 dBm</td></tr> </table>	Default	-115 Disabled	Range	-46 to -115 dBm
Default	-115 Disabled				
Range	-46 to -115 dBm				
Web: ECIO Threshold (dB) UCI: multiwan.wan.ecio_threshold Opt: ecio_threshold	Specifies the minimum ECIO signal strength in dB before considering if the interface fails signal health check. Uses the value stored for ecio_db in mobile diagnostics. <table border="1"> <tr><td>Default</td><td>-115 Disabled</td></tr> <tr><td>Range</td><td>-46 to -115 dBm</td></tr> </table>	Default	-115 Disabled	Range	-46 to -115 dBm
Default	-115 Disabled				
Range	-46 to -115 dBm				
Web: Signal Test UCI: multiwan.wan.signal_test Opt: signal_test	Defines a script to test various signal characteristics in multiwan signal test. For example: <pre>option signal_test '(tech == 0) then (sig_dbm > -70) else (rscp_dbm > -105 and ecio_db > -15)'</pre> This states that when technology is GSM, a health fail is determined when signal strength is less than -70dBm. When technology is not GSM a health fail occurs when either rscp_dbm falls below -105dBm or ecio_db falls below -15dB Note: a signal test can also take a UDS script name as a parameter, for example: <pre>option signal_test `uds(script_name)`</pre>				

Web Field/UCI/Package Option	Description																
	Tech values are: <table> <tr><td>0</td><td>GSM</td></tr> <tr><td>1</td><td>GSM Compact</td></tr> <tr><td>2</td><td>UTRAN</td></tr> <tr><td>3</td><td>GSM W/EGPRS</td></tr> <tr><td>4</td><td>UTRAN w/HSPDA</td></tr> <tr><td>5</td><td>UTRAN w/HSUPA</td></tr> <tr><td>6</td><td>UTRAN W/HSUPA and HSDPA</td></tr> <tr><td>7</td><td>E-UTRAN</td></tr> </table>	0	GSM	1	GSM Compact	2	UTRAN	3	GSM W/EGPRS	4	UTRAN w/HSPDA	5	UTRAN w/HSUPA	6	UTRAN W/HSUPA and HSDPA	7	E-UTRAN
0	GSM																
1	GSM Compact																
2	UTRAN																
3	GSM W/EGPRS																
4	UTRAN w/HSPDA																
5	UTRAN w/HSUPA																
6	UTRAN W/HSUPA and HSDPA																
7	E-UTRAN																

23.2. Configuring Multi-WAN Using UCI

Multi-WAN UCI configuration settings are stored on `/etc/config/multiwan`.

Run UCI export or show commands to see multiwan UCI configuration settings. A sample is shown below.


```

root@VA_router:~# uci export multiwan

package multiwan

config multiwan 'config'
option preempt 'yes'
option alt_mode 'no'
option enabled 'yes'

config interface 'wan'
option disabled '0'
option health_interval '10'
option health_fail_retries '3'
option health_recovery_retries '5'
option priority '2'
option manage_state 'yes'
option exclusive_group '0'
option ifup_retry_sec '40' option icmp_hosts 'disable' option icmp_interval '1'
option timeout '3'
option icmp_count '1'
option conntrack_hosts 'disable' option signal_threshold '- 111'
option rscp_threshold '-90'
option ecio_threshold '-15'
option ifup_timeout_sec '120'

root@VA_router:~# uci show multiwan

multiwan.config=multiwan
multiwan.config.preempt=yes
multiwan.config.alt_mode=no
multiwan.config.enabled=yes
multiwan.wan=interface
multiwan.wan.disabled=0

multiwan.wan.health_interval=10multiwan.wan.health_fail_retries=3
multiwan.wan.health_recovery_retries=5
multiwan.wan.priority=2
multiwan.wan.manage_state=yes
multiwan.wan.exclusive_group=0
multiwan.wan.timeout '3'
multiwan.wan.icmp_count '1'

```

```
multiwan.wan.conntrack_hosts 'disable'  
  
multiwan.wan.signal_threshold=-111  
  
multiwan.wan.rscp_threshold=-90  
  
multiwan.wan.ecio_threshold=-15
```

23.3. Multi-WAN Diagnostics

The multiwan package is linked to the network interfaces within `/etc/config/network`.



NOTE

Multi-WAN will not work if the WAN connections are on the same subnet and share the same default gateway.

To view the multiwan package, enter:

```
root@VA_router:~# uci export multiwan
package multiwan

config multiwan 'config'
option enabled 'yes'
option preempt 'yes'
option alt_mode 'no'

config interface 'ADSL'
option health_interval '10'
option icmp_hosts 'dns'
option timeout '3'
option health_fail_retries '3'
option health_recovery_retries '5'
option priority '1'
option manage_state 'yes'
option exclusive_group '0'
option ifup_retry_sec '300'
option ifup_timeout_sec '40'

config interface 'Ethernet'
option health_interval '10'
option icmp_hosts 'dns'
option timeout '3'
option health_fail_retries '3'
option health_recovery_retries '5'
option priority '2'
option manage_state 'yes'
option exclusive_group '0'
option ifup_retry_sec '300'
option ifup_timeout_sec '40'
```

The following output shows the multiwan standard stop/start commands for troubleshooting.

```
root@VA_router:~# /etc/init.d/multiwan
Syntax: /etc/init.d/multiwan [command]
```

Available commands:

start	Start the service
stop	Stop the service
restart	Restart the service
reload	Reload configuration files (or restart if that fails)
enable	Enable service autostart
disable	Disable service autostart

When troubleshooting, make sure that the routing table is correct using **route -n**.

Ensure all parameters in the multiwan package are correct. The name used for Multi- WAN interfaces must be identical, including upper and lowercases, to the interface name defined in the network configuration.

To check the names and settings are correct, browse to **Network -> interfaces** (or alternatively, run: cat/etc/config/network through CLI).

Enter the name of the WAN interface to configure, and then click **Add**. The new section for configuring specific parameters will appear.

24. Automatic Operator Selection

This section describes how to configure and operate the Automatic Operator Selection feature of the Merlin router.

When the roaming SIM is connected, the radio module has the ability to scan available networks. The router, using mobile and multiwan packages, finds available networks to create and sort interfaces according to their signal strength. These interfaces are used for failover purposes.

Configuration Package Used

Package	Sections
Multiwan	General, interfaces
Mobile	Main, template interfaces
Network	2G/3G/4G interface

24.1. Configuring Automatic Selection Via The Web Interface

While the router boots up it checks for mobile networks. Based on available networks, the router creates interfaces and the multiwan package is used to run failover between interfaces. Typically these auto-generated interfaces are sorted by signal strength.

Details for these interfaces are provided in the mobile package. When you have created the interfaces, Multi-WAN manages the operation of primary (predefined) and failover (auto created) interfaces.

Multi-WAN periodically does a health check on the active interface. A health check comprises of a configurable combination of the following:

- interface state
- pings to an ICMP target
- signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in an overall fail. After a configurable number of health check failures, multiwan will move to the next highest priority interface. Multi-WAN will optionally stop the failed interface and start the new interface, if required.

In some circumstances, particularly in mobile environments, it is desirable for a primary interface to be used whenever possible. In this instance, if the active interface is a not the primary interface, multiwan will perform a health check on the primary interface after a configurable period. If the health checks pass for the configured number of recovery health checks then the primary interface will be used.

There are typically three scenarios:

- Primary Mobile Provider (PMP) + roaming: pre-empt enabled
- PMP + roaming: pre-empt disabled
- No PMP + roaming

24.1.1. Scenario 1: PMP + Roaming: Pre-Empt Enabled

Overview

In this scenario, the PMP interface is used whenever possible.

The PMP interface is attempted first. When the health checks fail on the PMP interface, and Multi-WAN moves to an autogenerated interface, a timer is started multiwan option ifup_retry_sec. On expiration of this timer, multiwan will disconnect the current interface and retry the PMP interface.

The PMP interface will then be used if the configurable number of health checks pass the checks.

Software operation

1. multiwan first attempts to bring up the PMP interface. If the PMP interface connects within the time set by multiwan option ifup_timeout continue to step 2. Otherwise go to step 4.
2. A health check is periodically done on the PMP interface as determined by the multiwan option health_interval. If the health check fails for the number of retries (multiwan option health_fail_retries), disconnect the PMP interface.
3. Connect the first auto-generated interface. If the interface connects within the time set by multiwan option ifup_timeout continue to step 5, otherwise multiwan moves to the next auto-generated interface.
4. Wait until the health check fails on the auto-generated interface, or until the PMP interface is available to connect after it was disconnected in step 2. (multiwan option ifup_retry_sec).
5. Disconnect auto-generated interface.
6. If the interface was disconnected due to health check failure then connect the next auto-generated interface and repeat step 4. If the interface was disconnected because ifup_retry_sec of PMP interface timed out, then go back to step 1 and repeat the process.

The PMP predefined interface is defined in the network package. Ensure the interface name matches the interface name defined in the multiwan package.

Create a primary predefined interface

In the web interface top menu, go to **Network -> Interfaces**. The Interfaces page appears.



Click **Add new interface...** The create Interface page appears.

Create Interface

Name of the new interface: The allowed characters are: 0-9, a-z, 0-9 and .

Protocol of the new interface:

Create a bridge over multiple interfaces: ☐

Cover the following interface: ☐ Ethernet Adapter "eth0" (lan)
☐ Ethernet Adapter "gpi0"
☐ Ethernet Adapter "lo" (loopback)
☐ Custom Interface:

Note: If you choose an interface here which is part of another network, it will be moved into this network.

The create interface page

Web Field/UCI/Package Option	Description																										
Web: Name of the new interface UCI: network.3g_s<sim-number>_<short-operator-name> Opt: 3g_s<sim-number>_<short-operator-name>	Type the name of the new interface. Type the interface name in following format: 3g_s<sim-number>_<short-operator-name>. Where<sim-number> is number of roaming SIM (1 or 2) and <short-operator-name> is first four alphanumeric characters of operator name (as reported by 'AT+COPS=?' command). Type the short operator name in lower case, for example: <table border="1"> <thead> <tr> <th>Operator name</th><th>First four alphanumeric numbers</th></tr> </thead> <tbody> <tr> <td>Vodafone UK</td><td>voda</td></tr> <tr> <td>02 -UK</td><td>o2uk</td></tr> <tr> <td>Orange</td><td>oran</td></tr> </tbody> </table>	Operator name	First four alphanumeric numbers	Vodafone UK	voda	02 -UK	o2uk	Orange	oran																		
Operator name	First four alphanumeric numbers																										
Vodafone UK	voda																										
02 -UK	o2uk																										
Orange	oran																										
Web: Protocol of the new interface UCI: network[.x.].proto Opt: proto	Protocol type. Select LTE/UMTS/GPRS/EV-DO. <table border="1"> <thead> <tr> <th>Option</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Static</td><td>Static configuration with fixed address and netmask.</td></tr> <tr> <td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr> <tr> <td>Unmanaged</td><td>Unspecified</td></tr> <tr> <td>IPv6 -in-IPv4 (RFC4213)</td><td>IPv4 tunnels that carry IPv6</td></tr> <tr> <td>IPv6 over IPv4</td><td>IPv6 over IPv4 tunnel</td></tr> <tr> <td>GRE</td><td>Generic Routing Encapsulation</td></tr> <tr> <td>IOT</td><td></td></tr> <tr> <td>L2</td><td>Layer 2 Tunnelling Protocol</td></tr> <tr> <td>PPP</td><td>Point to Point Protocol</td></tr> <tr> <td>PPPoE</td><td>Point to Point Protocol over Ethernet</td></tr> <tr> <td>PPPoATM</td><td>Point to Point Protocol over ATM</td></tr> <tr> <td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem</td></tr> </tbody> </table>	Option	Description	Static	Static configuration with fixed address and netmask.	DHCP Client	Address and netmask are assigned by DHCP.	Unmanaged	Unspecified	IPv6 -in-IPv4 (RFC4213)	IPv4 tunnels that carry IPv6	IPv6 over IPv4	IPv6 over IPv4 tunnel	GRE	Generic Routing Encapsulation	IOT		L2	Layer 2 Tunnelling Protocol	PPP	Point to Point Protocol	PPPoE	Point to Point Protocol over Ethernet	PPPoATM	Point to Point Protocol over ATM	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem
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LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem																										
Web: Create a bridge over multiple interfaces UCI: network[.x.].type Opt: type	Enables bridge between two interfaces. <table border="1"> <tbody> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </tbody> </table>	0	Disabled	1	Enabled																						
0	Disabled																										
1	Enabled																										
Web: Cover the following interface UCI: Opt: ifname	Selects interfaces for bridge connection.																										

Click **Submit**. The Common Configuration page appears.

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Status

3g-3g_s2_nda

RX: 0.00 B (0 Pkts.)
TX: 0.00 B (0 Pkts.)

Protocol

UMTS/GPRS/EV-DO

Service Type

UMTS/GPRS

QoS

1

APN

internet

PHN

PAP/CHAP username

internet

PAP/CHAP password

Back to Overview

Save & Apply

Save

Reset

The common configuration page

Web Field/UCI/Package Option	Description																										
Web: Protocol UCI: network[...].proto Opt: proto	Protocol type. Select LTE/UMTS/GPRS/EV-DO. <table border="1"> <thead> <tr> <th>Option</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Static</td><td>Static configuration with fixed address and netmask.</td></tr> <tr> <td>DHCP Client</td><td>Address and netmask are assigned by DHCP.</td></tr> <tr> <td>Unmanaged</td><td>Unspecified</td></tr> <tr> <td>IPv6 -in-IPv4 (RFC4213)</td><td>IPv4 tunnels that carry IPv6</td></tr> <tr> <td>IPv6 over IPv4</td><td>IPv6 over IPv4 tunnel</td></tr> <tr> <td>GRE</td><td>Generic Routing Encapsulation</td></tr> <tr> <td>IOT</td><td></td></tr> <tr> <td>L2TP</td><td>Layer 2 Tunnelling Protocol</td></tr> <tr> <td>PPP</td><td>Point to Point Protocol</td></tr> <tr> <td>PPPoE</td><td>Point to Point Protocol over Ethernet</td></tr> <tr> <td>PPPoATM</td><td>Point to Point Protocol over ATM</td></tr> <tr> <td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem</td></tr> </tbody> </table>	Option	Description	Static	Static configuration with fixed address and netmask.	DHCP Client	Address and netmask are assigned by DHCP.	Unmanaged	Unspecified	IPv6 -in-IPv4 (RFC4213)	IPv4 tunnels that carry IPv6	IPv6 over IPv4	IPv6 over IPv4 tunnel	GRE	Generic Routing Encapsulation	IOT		L2TP	Layer 2 Tunnelling Protocol	PPP	Point to Point Protocol	PPPoE	Point to Point Protocol over Ethernet	PPPoATM	Point to Point Protocol over ATM	LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem
Option	Description																										
Static	Static configuration with fixed address and netmask.																										
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LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem																										
Web: Service Type UCI: network[...].service Opt: service	Service type that will be used to connect to the network. <table border="1"> <tbody> <tr> <td>gprs_only</td><td>Allows GSM module to only connect to GPRS network.</td></tr> <tr> <td>lte_only</td><td>Allows GSM module to only connect to LTE network.</td></tr> <tr> <td>cdma</td><td>Allows GSM module to only connect to CDMA network.</td></tr> <tr> <td>auto</td><td>GSM module will automatically detect the best available technology code.</td></tr> </tbody> </table>	gprs_only	Allows GSM module to only connect to GPRS network.	lte_only	Allows GSM module to only connect to LTE network.	cdma	Allows GSM module to only connect to CDMA network.	auto	GSM module will automatically detect the best available technology code.																		
gprs_only	Allows GSM module to only connect to GPRS network.																										
lte_only	Allows GSM module to only connect to LTE network.																										
cdma	Allows GSM module to only connect to CDMA network.																										
auto	GSM module will automatically detect the best available technology code.																										
Web: SIM UCI: network[...].sim Opt: sim	Select SIM1 or SIM2. <table border="1"> <tbody> <tr> <td>auto</td><td>Automatically detects which SIM slot is used.</td></tr> <tr> <td>SIM 1</td><td>Selects SIM from slot 1</td></tr> <tr> <td>SIM 2</td><td>Selects SIM from slot 2</td></tr> </tbody> </table>	auto	Automatically detects which SIM slot is used.	SIM 1	Selects SIM from slot 1	SIM 2	Selects SIM from slot 2																				
auto	Automatically detects which SIM slot is used.																										
SIM 1	Selects SIM from slot 1																										
SIM 2	Selects SIM from slot 2																										
Web: APN UCI: network[...].apn Opt: apn	APN name of Mobile Network Operator.																										
Web: APN username UCI: network[...].username Opt: username	Username used to connect to APN.																										
Web: APN password UCI: network[...].password Opt: password	Password used to connect to APN.																										
Web: Modem Configuration UCI: N/A Opt: N/A	Click the link if you need to configure additional options from Mobile Manager.																										

Click **Save & Apply**.

Set Multi-WAN Options For Primary Predefined Interface

On the web interface go to **Network -> Multi-Wan**. The Multi-WAN page appears.

Multi-WAN

Multi-WAN allows for the use of multiple uplinks for failover.

Add

WAN Interfaces

Health Monitor detects and corrects network changes and failed connections.

This section contains no values yet

Add

Save & Apply Save Reset

The Multi-WAN page

In the WAN Interfaces section, type in the name of the Multi-WAN interface. Click **Add**. The Multi-WAN page appears.

Multi-WAN

Multi-WAN allows for the use of multiple options for failover:

☒ Enable

☒ Preempt

☒ Alternate Mode

It will use alternate interface after reboot

WAN Interfaces

Health Monitor detects and corrects network changes and failed connections:

3G_S1_VODA

Health Monitor Interval: 10 sec.

Health Monitor ICMP Host(s): DNS Server(s)

Health Monitor ICMP Timeout: 3 sec.

Attempts Before WAN Failover: 3

Attempts Before WAN Recovery: 5

Priority: 0 Higher value is higher priority

☒ Manage Interface State (Up/Down)

Exclusive Group: 0 Only one interface in group should be up in the same time

Minimum Up Interval: 100 sec. Minimum interval between two successive interface start attempts

Interface Start Timeout: 45 sec. Time for interface to startup

Signal Threshold (dBm): -110 Below is a failure

The Multi-WAN page

Web Field/UCI/Package Option	Description								
Web: Enable UCI: multiwan.config.enabled Opt: enabled	Enables multiwan. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: Preempt UCI: multiwan.config.preempt Opt: preempt	Enables or disables pre-emption for multiwan. If enabled, the router will keep trying to connect to a higher priority interface depending on timer set. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: Alternate Mode UCI: multiwan.config.alt Opt: alt	Enables or disables alternate mode for multiwan. If enabled, the router will use an alternate interface after reboot. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: WAN Interfaces UCI: multiwan.3g_s<sim-number>_<short-operator-name> Opt: 3g_s<sim-number>_<short-operator-name>	Provide the same interface name as chosen in multiwan section below and click Add .								
Web: Health Monitor Interval UCI: multiwan[.x.].health_interval Opt: health_interval	Sets the period to check the health status of the interface. The Health Monitor interval will be used for: - Interface state checks - Ping interval - Signal strength checks								
Web: Health Monitor ICMP Host(s) UCI: multiwan[.x.].icmp_hosts Opt: icmp_hosts	Specifies the target IP address for ICMP packets. <table border="1"> <tr><td>Disable</td><td>Disables the option</td></tr> <tr><td>DNS servers</td><td>DNS IP addresses will be used.</td></tr> <tr><td>WAN Gateway</td><td>Gateway IP address will be used.</td></tr> <tr><td>Custom</td><td>Ability to provide IP address.</td></tr> </table>	Disable	Disables the option	DNS servers	DNS IP addresses will be used.	WAN Gateway	Gateway IP address will be used.	Custom	Ability to provide IP address.
Disable	Disables the option								
DNS servers	DNS IP addresses will be used.								
WAN Gateway	Gateway IP address will be used.								
Custom	Ability to provide IP address.								
Web: Health Monitor Conntrack Test Host(s) UCI: multiwan.wan.conntrack_hosts Opt: conntrack_hosts	Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval. Conntrack_hosts option defines the IP for conntrack to track – usually the icmp_host IP is used. If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host otherwise a ping is sent as normal to the icmp_host. By default the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated. Conntrack is generally used to limit the traffic sent on a GSM network. <table border="1"> <tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td></tr> <tr><td>Disable</td><td>Conntrack is Disabled.</td></tr> <tr><td>Custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td></tr> </table>	Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	Disable	Conntrack is Disabled.	Custom	Specifies an IP other than the icmp_host for conntrack to track.		
Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.								
Disable	Conntrack is Disabled.								
Custom	Specifies an IP other than the icmp_host for conntrack to track.								
Web: Health Monitor ICMP Timeout UCI: multiwan[.x.].timeout Opt: timeout	Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at. <table border="1"> <tr><td>3</td><td>Wait 3 seconds for ping reply.</td></tr> <tr><td>Range</td><td></td></tr> </table>	3	Wait 3 seconds for ping reply.	Range					
3	Wait 3 seconds for ping reply.								
Range									

Web Field/UCI/Package Option	Description				
Web: Health Monitor ICMP Interval UCI: multiwan.wan.icmp_interval Opt: icmp_interval	Defines the interval between multiple pings sent at each health check. <table border="1"> <tr><td>1</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	1		Range	
1					
Range					
Web: Health Monitor ICMP Count UCI: multiwan.wan.icmp_count Opt: icmp_count	Defines the number of pings to send at each health check. <table border="1"> <tr><td>1</td><td></td></tr> <tr><td>Range</td><td>Enabled</td></tr> </table>	1		Range	Enabled
1					
Range	Enabled				
Web: Attempts Before WAN Failover UCI: multiwan.[..x..].health_fail_retries Opt: health_fail_retries	Sets the amount of health monitor retries before the interface is considered a failure. <table border="1"> <tr><td>3</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	3		Range	
3					
Range					
Web: Attempts Before WAN Recovery UCI: multiwan.[..x..].health_recovery_retries Opt: health_recovery_retries	Sets the number of health monitor checks before the interface is considered healthy. Only relevant if pre-empt mode is enabled. <table border="1"> <tr><td>5</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	5		Range	
5					
Range					
Web: Priority UCI: multiwan.[..x..].priority Opt: priority	Specifies the priority of the interface. The higher the value, the higher the priority. This multiwan interface priority must be higher than the one specified in the priority field in the 'Roaming Interface Template' page described in the following section. <table border="1"> <tr><td>0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	0		Range	
0					
Range					
Web: Exclusive Group UCI: multiwan.[..x..].exclusive_group Opt: exclusive_group	Defines the group to which the interface belongs; only one interface can be active. <table border="1"> <tr><td>0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	0		Range	
0					
Range					
Web: Manage Interface State (Up/Down) UCI: multiwan.[..x..].manage_state Opt: manage_state	Defines whether multiwan will start and stop the interface. Select Enabled . <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Minimum ifup Interval UCI: multiwan.[..x..].ifup_retry_sec Opt: ifup_retry_sec	Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled.				
Web: Interface Start Timeout UCI: multiwan.[..x..].ifup_timeout Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. Choose timer greater than 120 seconds. <table border="1"> <tr><td>40</td><td>40 Seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	40	40 Seconds	Range	
40	40 Seconds				
Range					
Web: Signal Threshold (dBm) UCI: multiwan.[..x..].signal_threshold Opt: signal_threshold	Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics. <table border="1"> <tr><td>-115</td><td>Disabled</td></tr> <tr><td>Range</td><td>-46 to -115dBm</td></tr> </table>	-115	Disabled	Range	-46 to -115dBm
-115	Disabled				
Range	-46 to -115dBm				
Web: RSCP Threshold (dBm) UCI: multiwan.[..x..].rscp_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics.				

Web Field/UCI/Package Option	Description																
Opt: rscp_threshold																	
Web: ECIO Threshold (dB) UCI: multiwan[..x..].ecio_threshold Opt: ecio_threshold	Specifies the minimum ECIO signal strength in dB before considering if the interface fails signal health check. Uses the value stored for ecio_db in mobile diagnostics.																
Web: Signal Test UCI: multiwan[..x..].signal_test Opt: signal_test	Defines script to test various signal characteristics in multiwan signal test. For example: <pre>option signal_test '(tech == 0) then (sig_dbm > -70) else (rscp_dbm > -105 and ecio_db > -15)'</pre> This states that when technology is GSM a health fail is determined when signal strength is less than -70dBm. When technology is not GSM a health fail occurs when either rscp_dbm falls below -105dBm or ecio_db falls below -15dB. Tech values are: <table border="1"> <tr><td>0</td><td>GSM</td></tr> <tr><td>1</td><td>GSM Compact</td></tr> <tr><td>2</td><td>UTRAN</td></tr> <tr><td>3</td><td>GSM w/EGPRS</td></tr> <tr><td>4</td><td>UTRAN w/HSPDA</td></tr> <tr><td>5</td><td>UTRAN w/HSUPA</td></tr> <tr><td>6</td><td>UTRAN w/HSUPA and HSDPA</td></tr> <tr><td>7</td><td>E-UTRAN</td></tr> </table>	0	GSM	1	GSM Compact	2	UTRAN	3	GSM w/EGPRS	4	UTRAN w/HSPDA	5	UTRAN w/HSUPA	6	UTRAN w/HSUPA and HSDPA	7	E-UTRAN
0	GSM																
1	GSM Compact																
2	UTRAN																
3	GSM w/EGPRS																
4	UTRAN w/HSPDA																
5	UTRAN w/HSUPA																
6	UTRAN w/HSUPA and HSDPA																
7	E-UTRAN																

Click **Save**.

Set Options For Automatically Created Interfaces (Failover)

In the top menu on the web interface page, select **Services -> Mobile Manager**. The Mobile Manager page appears.

There are five sections in the mobile manager page:

Section	Description
Basic settings	Enable SMS, configure SIM pin code, select roaming SIM, collect ICCIDs and set IMSI.
Advanced	Configure advanced options such as collect ICCIDs and temperature polling interval.
CDMA*	CDMA configuration
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure Preferred Roaming List options.
*Option available only for Telit CE910-SL module.	

24.2. Mobile Manager: Basic Settings

MAIN

Basic

Advanced

CDMA

SMS Enable

☒

PIN-code for SIM1

PIN-code for SIM2

LTE Bands for SIM1

LTE Bands for SIM2

The mobile manager basic page

Web Field/UCI/Package Option	Description				
Web: SMS Enable UCI: mobile.main.sms Opt: sms	Enables or disables SMS functionality. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: PIN code for SIM1 UCI: mobile.main.sim1pin Opt: sim1pin	Depending on the SIM card specifies the pin code for SIM 1. <table> <tr> <td>Blank</td><td>Disabled</td></tr> <tr> <td>Range</td><td>Depends on the SIM provider</td></tr> </table>	Blank	Disabled	Range	Depends on the SIM provider
Blank	Disabled				
Range	Depends on the SIM provider				
Web: PIN code for SIM2 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 2. <table> <tr> <td>Blank</td><td></td></tr> <tr> <td>Range</td><td>Depends on the SIM provider</td></tr> </table>	Blank		Range	Depends on the SIM provider
Blank					
Range	Depends on the SIM provider				
Web: LTE bands for SIM1 UCI: mobile.main.sim1_lte_bands Opt: sim1_lte_bands	Depending on the SIM card specify the LTE bands for SIM 1. Comma delimiter. Example: option sim1_lte_bands '3,20' Limits LTE bands to 3 and 20. Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200 and Asiatel.				
Web: LTE bands for SIM2 UCI: mobile.main.sim2_lte_bands Opt:sim2_lte_bands	Depending on the SIM card specifies the LTE bands for SIM 2. Comma delimiter. Example: option sim1_lte_bands '3,20' Limits LTE bands to 3 and 20. Note: currently only supported by Hucom/Wetelcom, SIMCom7100, Cellient MPL200 and Asiatel.				

24.3. Mobile Manager: Advanced Settings

MAIN

Basic

Advanced

CDMA

Collect ICCIDs

☐ Collect ICCIDs on startup

Force Mode

Automatic

Select network interface mode

Temperature Polling Interval (Seconds)

61

Automatic Firmware Selection

☐ Select firmware based on network operator - only supported on some radio modules

Allow USB Power Cycle

☒ Power cycle usb bus if modem disappeared from the USB bus for more than 40 seconds

The mobile manager advanced page

Web Field/UCI/Package Option	Description				
Web: Collect ICCIDs UCI: mobile.main.init_get_iccids Opt: init_get_iccids	Enables or disables integrated circuit card identifier ICCID's collection functionality. If enabled then both SIM 1 and SIM 2 ICCIDs will be collected otherwise it will default to SIM 1. This will be displayed under mobile stats. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Force Mode UCI: mobile.main.force_mode Opt: force_mode	Defines whether to operate mobile modem in PPP or Ethernet mode. The mode will be dependent on the service provided by the mobile provider. In general, this is Ethernet mode (default). <table border="1"> <tr> <td>Automatic</td><td>Ethernet mode (option not present)</td></tr> <tr> <td>PPP</td><td>Enable PPP mode</td></tr> </table>	Automatic	Ethernet mode (option not present)	PPP	Enable PPP mode
Automatic	Ethernet mode (option not present)				
PPP	Enable PPP mode				
Web: Temperature Polling Interval UCI: mobile.main.temp_poll_interval_sec Opt: temp_poll_interval_sec	Defines the time in seconds to poll the mobile module for temperature. Set to 0 to disable. <table border="1"> <tr> <td>61</td><td>61 seconds</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	61	61 seconds	1	Enabled
61	61 seconds				
1	Enabled				
Web: Automatic Firmware Selection UCI: mobile.main.enable_firmware_autoselect Opt: enable_firmware_autoselect	Defines whether to use time obtained from the mobile carrier to update the system clock when NTP is enabled. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Allow USB Power Cycle UCI: mobile.main.allow_usb_powercycle Opt: allow_usb_powercycle	Enables the selection of an operator-specific firmware in the radio module. The selection is based on the ICCID of the used SIM. At module initialisation the IMSI is checked and if necessary the correct firmware image in the module will be activated. Note: activation of the firmware will lead to delayed startup of the network interface associated with the radio module. Note: this feature is currently only supported for the Telit LE910NA V2 module. Here a Verizon-specific firmware will be selected if the ICCID starts with "891480". <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: n/a UCI: mobile.main.disable_time Opt: disable_time	Defines whether to use time obtained from the mobile carrier to update the system clock when NTP is enabled. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				

24.4. Mobile Manager: CDMA Settings

This configuration page is only supported for the Telit CE910-SL CDMA module.

MAIN

Basic

Advanced

CDMA

IMSI

 If specified over-writes IMSI stored in radio module

HDR Auth User ID

 AN-PPP user id. Supported on Cellent module only

HDR Auth Password

 AN-PPP password. Supported on Cellent module only

Ordered Registration
triggers module
reboot

☐

Station Class Mark

Slot Cycle Index

Slot Mode

Mobile Directory
Number

MOB_TERM_HOME
registration flag

☒

MOB_TERM_FOR_SID
registration flag

☒

MOB_TERM_FOR_NID ☒

The mobile manager CDMA page

Web Field/UCI/Package Option	Description				
Web: IMSI UCI: mobile.main.imsi Opt: imsi	Allows the IMSI (International Mobile Subscriber Identity) to be changed. <table border="1"> <tr> <td>Default</td><td>Programmed in module.</td></tr> <tr> <td>Digits</td><td>Up to 15 digits</td></tr> </table>	Default	Programmed in module.	Digits	Up to 15 digits
Default	Programmed in module.				
Digits	Up to 15 digits				
Web: HDR Auth User ID UCI: mobile.main.hdr_userid Opt: hdr_userid	AN-PPP user ID. Supported on Cellient (CDMA) modem only. <table border="1"> <tr> <td>Blank</td><td></td></tr> <tr> <td>Range</td><td>Depends on the CDMA provider.</td></tr> </table>	Blank		Range	Depends on the CDMA provider.
Blank					
Range	Depends on the CDMA provider.				
Web: HDR Auth User Password UCI: mobile.main.hdr_password Opt: hdr_password	AN-PPP password. Supported on Cellient (CDMA) modem only. <table border="1"> <tr> <td>Blank</td><td></td></tr> <tr> <td>Range</td><td>Depends on the CDMA provider.</td></tr> </table>	Blank		Range	Depends on the CDMA provider.
Blank					
Range	Depends on the CDMA provider.				
Web: Ordered Registration triggers module reboot UCI: mobile.main. mobile.main.cdma_ordered_registration_reboot_enabled Opt: cdma_ordered_registration_reboot_enabled	Enables or disables rebooting the module after an Order Registration command is received from a network. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Station Class Mark UCI: mobile.main.cdma_station_class_mark Opt: cdma_station_class_mark	Allows the station class mark for the MS to be changed. <table border="1"> <tr> <td>Default</td><td>58</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	58	Range	0-255
Default	58				
Range	0-255				
Web: Slot Cycle Index UCI: mobile.main.cdma_slot_cycle_index Opt: cdma_slot_cycle_index	The desired slot cycle index if different from the default. <table border="1"> <tr> <td>Default</td><td>2</td></tr> <tr> <td>Range</td><td>0-7</td></tr> </table>	Default	2	Range	0-7
Default	2				
Range	0-7				
Web: Slot Mode UCI: mobile.main.cdma_slot_mode Opt: cdma_slot_mode	Specifies the slot mode. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td>0-7</td></tr> </table>	Default	0	Range	0-7
Default	0				
Range	0-7				
Web: Mobile Directory Number UCI: mobile.main.cdma_mobile_directory_number Opt: cdma_mobile_directory_number	Allows the mobile directory number (MDN) to be changed.				
Web: MOB_TERM_HOME registration flag UCI: mobile.main. cdma_mob_term_home_registration_flag Opt: cdma_mob_term_home_registration_flag	The MOB_TERM_HOME registration flag. <table border="1"> <tr> <td>Default</td><td>Programmed in module.</td></tr> <tr> <td>Digits</td><td>Up to 15 digits.</td></tr> </table>	Default	Programmed in module.	Digits	Up to 15 digits.
Default	Programmed in module.				
Digits	Up to 15 digits.				
Web: MOB_TERM_FOR_SID registration flag UCI: mobile.main. cdma_mob_term_for_sid_registration_flag Opt: cdma_mob_term_for_sid_registration_flag	The MOB_TERM_FOR_SID registration flag. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: MOB_TERM_FOR_NID registration flag UCI: mobile.main. cdma_mob_term_for_nid_registration_flag Opt: cdma_mob_term_for_nid_registration_flag	The MOB_TERM_FOR_NID registration flag. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Access Overload Control UCI: mobile.main.cdma_access_overload_control Opt: cdma_access_overload_control	Allows the access overload class to be changed. <table border="1"> <tr> <td>Default</td><td>Programmed into module as part of IMSI.</td></tr> <tr> <td>Range</td><td>0-7</td></tr> </table>	Default	Programmed into module as part of IMSI.	Range	0-7
Default	Programmed into module as part of IMSI.				
Range	0-7				

Web Field/UCI/Package Option	Description				
Web: Preferred Serving System UCI: mobile.main.cdma_preferred_serving_system Opt: cdma_preferred_serving_system	The CDMA Preferred Serving System(A/B). <table border="1"> <tr><td>Default</td><td>5</td></tr> <tr><td>Range</td><td>0-7</td></tr> </table>	Default	5	Range	0-7
Default	5				
Range	0-7				
Web: Digital Analog Mode Preference UCI: cdma_digital_analog_mode_preference Opt: cdma_digital_analog_mode_preference	Digital/Analog Mode Preference. <table border="1"> <tr><td>Default</td><td>4</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	4	Range	
Default	4				
Range					
Web: Primary Channel A UCI: mobile.main.cdma_primary_channel_a Opt: cdma_primary_channel_a.	Allows the primary channel (A) to be changed. <table border="1"> <tr><td>Default</td><td>283</td></tr> <tr><td>Range</td><td>1-2016 Any band class 5 channel number</td></tr> </table>	Default	283	Range	1-2016 Any band class 5 channel number
Default	283				
Range	1-2016 Any band class 5 channel number				
Web: Primary Channel B UCI: mobile.main.cdma_primary_channel_b Opt: cdma_primary_channel_b	Allows the primary channel (B) to be changed. <table border="1"> <tr><td>Default</td><td>384</td></tr> <tr><td>Range</td><td>1-2016 Any band class 5 channel number</td></tr> </table>	Default	384	Range	1-2016 Any band class 5 channel number
Default	384				
Range	1-2016 Any band class 5 channel number				
Web: Secondary Channel A UCI: mobile.main.cdma_secondary_channel_a Opt: cdma_secondary_channel_a	Allows the secondary channel (A) to be changed. <table border="1"> <tr><td>Default</td><td>691</td></tr> <tr><td>Range</td><td>1-2016 Any band class 5 channel number</td></tr> </table>	Default	691	Range	1-2016 Any band class 5 channel number
Default	691				
Range	1-2016 Any band class 5 channel number				
Web: Secondary Channel B UCI: mobile.main.cdma_secondary_channel_b Opt: cdma_secondary_channel_b	Allows the secondary channel (B) to be changed. <table border="1"> <tr><td>Default</td><td>777</td></tr> <tr><td>Range</td><td>1-2016 Any band class 5 channel number</td></tr> </table>	Default	777	Range	1-2016 Any band class 5 channel number
Default	777				
Range	1-2016 Any band class 5 channel number				
Web: Preferred Forward & Reverse RC UCI: mobile.main.cdma_preferred_forward_and_reverse_rc Opt: cdma_preferred_forward_and_reverse_rc	The Preferred Forward & Reverse RC value, this takes the form "forward_rc,reverse_rc" Format: forward radio channel, reverse radio channel Default: 0,0				
Web: SID-NID pairs UCI: mobile.main.cdma_sid_nid_pairs Opt: cdma_sid_nid_pairs	Allows specification of SID:NID pairs, this takes the form "SID1,NID1,SID2,NID2, ⋮" <table border="1"> <tr><td>Format</td><td>SID1 (0-65535),NID (0-65535)</td></tr> <tr><td>Default</td><td>0,65535</td></tr> </table>	Format	SID1 (0-65535),NID (0-65535)	Default	0,65535
Format	SID1 (0-65535),NID (0-65535)				
Default	0,65535				

24.5. Mobile Manager: Callers

Callers

Configure caller numbers that may use the SMS service.

Name

CallerGroup1

Name of the caller.

Number

353*

Number of the caller. Use * for wildcard matching.

Enable

☐

Respond

☐

The mobile manager CDMA page

Web Field/UCI/Package Option	Description						
Web: Name UCI: mobile.@caller[0].name Opt: name	Name assigned to the caller. <table> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>No limit</td></tr> </table>	Default	Blank	Range	No limit		
Default	Blank						
Range	No limit						
Web: Number UCI: mobile.@caller[0].number Opt: number	Number of the caller allowed to SMS the router. Add in specific caller numbers, or use the * wildcard symbol. <table> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td>No limit</td></tr> <tr> <td>Characters</td><td>Global value (*) is accepted. International value (+) is accepted</td></tr> </table>	Default	Blank	Range	No limit	Characters	Global value (*) is accepted. International value (+) is accepted
Default	Blank						
Range	No limit						
Characters	Global value (*) is accepted. International value (+) is accepted						
Web: Enable UCI: mobile.@caller[0].enabled Opt: enabled	Enables or disables incoming caller ID. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled		
0	Disabled						
1	Enabled						
Web: Respond UCI: mobile.@caller[0].respond Opt: respond	If checked, the router will return an SMS. Select Respond if you want the router to reply. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled		
0	Disabled						
1	Enabled						

24.6. Roaming Interface Template: Web Interface

Roaming Interface Template

Common config values for interfaces created by Automatic Operator Selection

Interface Signal Sort

Sort interfaces by signal strength so those having better signal strength at the startup would be tried first

Roaming SIM

1

In which slot roaming sim-card is inserted

Firewall Zone

lan

lan_2

lan1_gif

wan

wan1

wan2

wan1_2

unspecified - on create

Append all the generated interfaces to this zone

API

PFI

RAP/CHAP username

RAP/CHAP password

Service Preference

LTE

UMTS

GPRS

CDMA EV-DO

Auto

Order of service preference for the generated interfaces (Use Control button to select multiple)

Health Monitor Interval

10 sec

Health Monitor ICMP Host(s)

DNS Server(s)

Health Monitor Contract Test Host(s)

Default

Health Monitor ICMP Timeout

3 sec

Health Monitor ICMP Interval

1 sec

Attempts Before WAN Failover

3

Attempts Before WAN Recovery

5

The roaming interface template page

Web Field/UCI/Package Option	Description								
Web: Interface Signal Sort UCI: mobile.@roaming_template[0].sort_sig_strength Opt: sort_sig_strength	Sorts interfaces by signal strength priority, so those that have a better signal strength will be tried first. <table><tr><td>0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>			0	Disabled	1	Enabled		
0	Disabled								
1	Enabled								
Web: Roaming SIM UCI: mobile.main.roaming_sim Opt: roaming_sim	Sets in which slot to insert roaming SIM card. <table><tr><td>1</td><td>SIM slot 1</td></tr><tr><td>2</td><td>SIM slot 2</td></tr></table>			1	SIM slot 1	2	SIM slot 2		
1	SIM slot 1								
2	SIM slot 2								
Web: Firewall Zone UCI: mobile.@roaming_template[0].firewall_zone Opt: firewall_zone	Adds all generated interfaces to this zone. Select existing zone or click unspecified or create to create new zone.								
Web: APN UCI: mobile.@roaming_template[0].apn Opt: apn	APN name of Mobile Network Operator.								
Web: PIN UCI: mobile.@roaming_template[0].pincode Opt: pincode	SIM card's PIN number.								
Web: PAP/CHAP username UCI: mobile.@roaming_template[0].username Opt: username	Username used to connect to APN.								
Web: PAP/CHAP password UCI: mobile.@roaming_template[0].password Opt: password	Password used to connect to APN.								
Web: Service Order UCI: mobile.@roaming_template[0].service_order Opt: service_order	Defines a space separated list of services, in preferred order. Valid options are gprs, umts, lte, auto. If no valid_service order is defined, then the configured Service Type is used. Example: mobile.@roaming_template[0].service_order="gprs umts lte auto" <table><tr><td>Default</td><td colspan="2">Blank. Automatically detect best service.</td></tr><tr><td>Range</td><td colspan="2">gprs umts lte auto</td></tr></table>			Default	Blank. Automatically detect best service.		Range	gprs umts lte auto	
Default	Blank. Automatically detect best service.								
Range	gprs umts lte auto								
Web: Health Monitor Interval UCI:	Sets the period, in seconds, to check the health status of the interface. The Health Monitor interval will be used for: • Interface state checks • Ping interval • Signal strength checks <table><tr><td>Default</td><td colspan="2">10. Health checks every 10 seconds.</td></tr><tr><td>Range</td><td colspan="2"></td></tr></table>			Default	10. Health checks every 10 seconds.		Range		
Default	10. Health checks every 10 seconds.								
Range									
Web: Health Monitor ICMP Host(s) UCI: mobile.@roaming_template[0].icmp_host_s	Specifies target IP address for ICMP packets. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr></table>			Web	Description	UCI			
Web	Description	UCI							

Web Field/UCI/Package Option	Description														
Opt: icmp_hosts	Disable	Disables the option.	disable												
	DNS servers	DNS IP addresses will be used.	dns												
	WAN gateway	Gateway IP address will be used.	gateway												
	custom	Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2'													
Web: Health Monitor Contrack Test Host(s) UCI: mobile.@roaming_template[0].contrack_ hosts Opt: contrack_hosts	Contrack is the feature used to track if there is any traffic to and from an IP destination within the health interval. The Contrack_hosts option defines the IP for contrack to track, usually the icmp_host IP is used. If traffic to the contrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host. By default the contrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated. Contrack is generally used to limit the traffic sent on a GSM network. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default</td><td>Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td></td></tr><tr><td>Disable</td><td>Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td>disable</td></tr><tr><td>custom</td><td>Specifies an IP other than the icmp_host for contrack to track.</td><td></td></tr></table>			Web	Description	UCI	Default	Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.		Disable	Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	disable	custom	Specifies an IP other than the icmp_host for contrack to track.	
Web	Description	UCI													
Default	Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.														
Disable	Contrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	disable													
custom	Specifies an IP other than the icmp_host for contrack to track.														
Web: Health Monitor ICMP Timeout UCI: mobile.@roaming_template[0].timeout Opt: timeout	Specifies the time in seconds that Health Monitor ICMP will timeout at. Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at. <table><tr><td>Default</td><td>3. Wait 3 seconds for ping reply.</td></tr><tr><td>Range</td><td></td></tr></table>			Default	3. Wait 3 seconds for ping reply.	Range									
Default	3. Wait 3 seconds for ping reply.														
Range															
Web: Health Monitor ICMP Interval UCI: mobile.@roaming_template[0].interval Opt: icmp_interval	Defines the interval, in seconds, between multiple pings sent at each health check. <table><tr><td>Default</td><td>1</td></tr><tr><td>Range</td><td></td></tr></table>			Default	1	Range									
Default	1														
Range															
Web: Attempts Before WAN Failover UCI: mobile.@roaming_template[1].health_fail_retries Opt: health_fail_retries	Defines the number of health check failures before interface is disconnected. <table><tr><td>Default</td><td>3</td></tr><tr><td>Range</td><td></td></tr></table>			Default	3	Range									
Default	3														
Range															
Web: Attempts Before WAN Recovery UCI: mobile.@roaming_template[0].health_recovery_retries Opt: health_recovery_retries	Sets the number of health check passes before the interface is considered healthy. This field is not used for a roaming template. <table><tr><td>Default</td><td>5</td></tr><tr><td>Range</td><td></td></tr></table>			Default	5	Range									
Default	5														
Range															

Web Field/UCI/Package Option	Description				
Web: Priority UCI: mobile.@roaming_template[0].priority Opt: priority	Type the priority number. The higher the value, the higher the priority. This multi-WAN interface priority must be lower than the one specified in the priority field for the PMP interface. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Multi-WAN: Exclusive Group UCI: mobile.@roaming_template[0].multiwan_exclusive_group Opt: multiwan_exclusive_group	Specifies the Multi-WAN group for the generated roaming interfaces. Defaults to '3g' if not specified.				
Web: Minimum ifup interval UCI: multiwan.wan.ifup_retry_sec Opt: ifup_retry_sec	Not used for a roaming interface. <table border="1"> <tr> <td>Default</td><td>300. Retry primary interface every 300 seconds.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	300. Retry primary interface every 300 seconds.	Range	
Default	300. Retry primary interface every 300 seconds.				
Range					
Web: Interface Start Timeout UCI: mobile.@roaming_template[0].ifup_timeout_sec Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. <table border="1"> <tr> <td>Default</td><td>40</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default	40	1	Enabled
Default	40				
1	Enabled				
Web: Signal Threshold (dBm) UCI: mobile.@roaming_template[0].signal_threshold Opt: signal_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics. <table border="1"> <tr> <td>Default</td><td>-115dBm</td></tr> <tr> <td>Range</td><td>-46 to -115 dBm</td></tr> </table>	Default	-115dBm	Range	-46 to -115 dBm
Default	-115dBm				
Range	-46 to -115 dBm				

When you have configured your settings, click **Save & Apply**.

System

Reboot

Reboots the operating system of your device

Reboot now ☒

Reboot on 1970 - January - 1 - 00 - 00 - Reboot

Powered by LuCI Trunk (trunk+svn8382) 15.00.32 image1 config2

The reboot page

In the top menu, select **System** -> **Reboot**. The System page appears.

Check the **Reboot now** check box and then click **Reboot**.

24.7. Scenario 2: PMP + Roaming: Pre-Empt Disabled

As in the previous section, Multi-WAN connects the PMP interface and uses auto-created interfaces for failover.

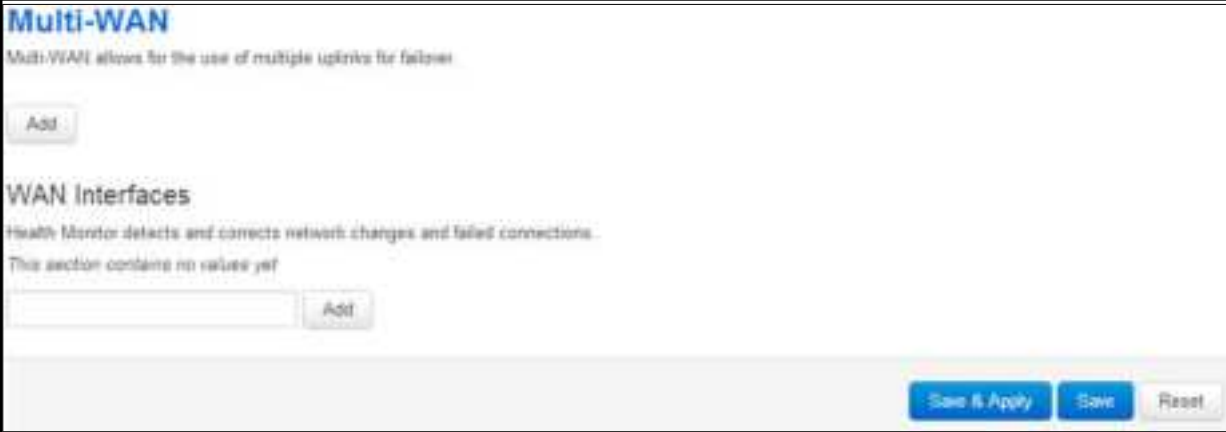
However, in this scenario, the auto-created interface will not be disconnected as soon as the `ifup_retry_sec` expires for the PMP interface. The primary interface will be reconnected when the current auto-created interface fails multiwan health checks after expiration of the `ifup_retry_sec` timer.

Follow the instructions in the section above for creation of the PMP interface, Multi-WAN and Mobile Manager roaming interfaces. The only change in configuration compared to the PMP + roaming: pre-empt enabled scenario is that you must disable the pre-empt option in the multi-WAN package.

24.7.1. Set Multi-WAN Options For Pre-Empt Disabled

To disable PMP + roaming pre-empt, in the top menu, select **Network -> Multi-Wan**.

In the Multi-WAN page, ensure Pre-empt is not selected.



The Multi-WAN page, pre-empt not selected

Click **Save & Apply**.

In the top menu, select **System -> Reboot**. The System Reboot page appears.



The system reboot page

Check the **Reboot now** check box and then click **Reboot**.

24.8. Scenario 3: No PMP + Roaming

In this scenario there is no PMP interface that can be used for a connection. The router scans the available mobile networks at boot and sorts the networks according to signal strength.

The network that offers the best signal strength will be the first to connect. Multi-WAN then controls the failover between the available networks.

Multi-WAN periodically does a health check on the interface. A health check comprises of a configurable combination of the following:

- Interface state
- Pings to an ICMP target
- Signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in a fail. After a configurable number of health check failures, Multi-WAN will disconnect the failed interface and attempt to connect to the next best roaming interface.

24.8.1. Set Options For Automatically Created Interfaces (Failover)

In the top menu on the web interface page, select **Services -> Mobile Manager**. The Mobile Manager page appears.

There are five sections in the mobile manager page:

Section	Description
Basic settings	Enable SMS, configure SIM pin code, select roaming SIM, collect ICCIDs and set IMSI.
Advanced	Configure advanced options such as collect ICCIDs and temperature polling interval.
CDMA*	CDMA configuration
Callers	Configure callers that can use SMS.
Roaming Interface Template	Configure Preferred Roaming List options.
*Option available only for Telit CE910-SL module.	

24.8.2. Basic Settings

Web Field/UCI/Package Option	Description				
Web: SMS Enable UCI: mobile.main.sms Opt: sms	Enables SMS. <table border="1"><tr><td>Default: yes</td><td>Enabled</td></tr><tr><td>no</td><td>Disabled</td></tr></table>	Default: yes	Enabled	no	Disabled
Default: yes	Enabled				
no	Disabled				
Web: Collect ICCIDs UCI: mobile.main.init_get_iccids Opt: init_get_iccids	Enables or disables integrated circuit card identifier ICCID's collection functionality. If enabled then both SIM 1 and SIM 2 ICCIDs will be collected otherwise it will default to SIM 1. This will be display under mobile stats. <table border="1"><tr><td>Default: yes</td><td>Enabled</td></tr><tr><td>no</td><td>Disabled</td></tr></table>	Default: yes	Enabled	no	Disabled
Default: yes	Enabled				
no	Disabled				
Web: PIN code for SIM1 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 1. <table border="1"><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					
Web: PIN code for SIM2 UCI: mobile.main.sim2pin Opt: sim2pin	Depending on the SIM card specify the pin code for SIM 2. <table border="1"><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					
Web: HDR Auto User ID UCI: mobile.main.hdr_userid Opt: hdr_userid	AN-PPP user ID. Supported on Cellient (CDMA) modem only. <table border="1"><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					

24.8.3. Caller Settings

Web Field/UCI/Package Option	Description				
Web: Name UCI: mobile.@caller[0].name Opt: name	Name assigned to the caller. <table><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					
Web: Number UCI: mobile.main.init_get_iccids Opt: init_get_iccids	Number of the caller allowed to SMS the router. Add in specific caller numbers or use the wildcard symbol. <table><tr><td>Default</td><td>Blank</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Blank	Range	
Default	Blank				
Range					
Web: Enable UCI: mobile.main.sim2pin Opt: sim2pin	Enables or disables incoming caller ID. <table><tr><td>Default: no</td><td>Disabled</td></tr><tr><td>yes</td><td>Enabled</td></tr></table>	Default: no	Disabled	yes	Enabled
Default: no	Disabled				
yes	Enabled				
Web: Respond UCI: mobile.@caller[0].respond Opt: respond	If checked, the router will return an SMS. Select Respond if you want the router to reply. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

24.8.4. Configuring No PMP + Roaming Using UCI

The roaming interface configuration file is stored in the mobile package

/etc/config/mobile. To view the mobile package, enter:

```
root@VA_router:~# uci export mobile

package mobile config mobile 'main'

option sms 'yes'

option roaming_sim '1'

option debug '1'

config caller

option name 'Eval'

option number '*'

option enabled 'yes'

option respond 'yes'

config roaming_template

option roaming_sim '1'

option firewall_zone 'wan'

option apn 'test IE'

option username 'test'

option password 'test'

option service 'umts'

option health_fail_retries '2'

option signal_threshold '-100'

option priority '5'

option ifup_timeout_sec '180'

option defaultroute 'yes'

option sort_sig_strength 'yes'

option ifup_retry_sec '200'

option health_interval '120'

option icmp_hosts '172.31.4.129'

option timeout '3'

option health_recovery_retries '3'
```

To view the mobile package via uci commands, enter:

```
root@VA_router:~# uci show mobile

mobile.main=mobile

mobile.main.sms=yes

mobile.main.roaming_sim=1

mobile.main.debug=1

mobile.@caller[0]=caller

mobile.@caller[0].name=Eval

mobile.@caller[0].number=*

mobile.@caller[0].enabled=yes

mobile.@caller[0].respond=yes

mobile.@roaming_template[0]=roaming_template

mobile.@roaming_template[0].roaming_sim=1

mobile.@roaming_template[0].firewall_zone=wan

mobile.@roaming_template[0].apn=stream.co.uk

mobile.@roaming_template[0].username=default

mobile.@roaming_template[0].password=void

mobile.@roaming_template[0].service=umts

mobile.@roaming_template[0].health_fail_retries=2

mobile.@roaming_template[0].signal_threshold=-100

mobile.@roaming_template[0].priority=5

mobile.@roaming_template[0].ifup_timeout_sec=180

mobile.@roaming_template[0].defaultroute=yes

mobile.@roaming_template[0].sort_sig_strength=yes

mobile.@roaming_template[0].ifup_retry_sec=200

mobile.@roaming_template[0].health_interval=120

mobile.@roaming_template[0].icmp_hosts=172.31.4.129

mobile.@roaming_template[0].timeout=3

mobile.@roaming_template[0].health_recovery_retries=3
```

The multiwan package is stored on **/etc/config/multiwan**. To view the multiwan package, enter:

```
root@VA_router:~# uci export multiwan

package multiwan

config multiwan 'config'

option enabled 'yes'

option preempt 'no'

option alt_mode 'no'
```

To see multiwan package via uci, enter:

```
root@VA_router:~# uci show multiwan
multiwan.config=multiwan
multiwan.config.enabled=yes
multiwan.config.preempt=no
multiwan.config.alt_mode=no
```

24.8.5. Roaming Interface Template: Web Interface

Roaming Interface Template

Common config values for interfaces created by Automatic Operator Selection

Interface Signal Sort

☐ Sort interfaces by signal strength so those having better signal strength at the startup would be tried first

Roaming SIM

1

In which slot roaming sim-card is inserted

Firewall Zone

lan lan2 lan1_gpf wan wan1

wan wan1

unspecified -on-creation

Append all the generated interfaces to this zone

API

Pti

RAP/CHAP username

RAP/CHAP password

Service Preference

LTE

UMTS

GPRS

CDMA-EV-DO

Auto

Order of service preference for the generated interfaces (Tap Control button to select multiple)

Health Monitor Interval

10 sec

Health Monitor ICMP Host(x)

DNS Server(x)

Health Monitor Conntrack Test Host(x)

Default

Health Monitor ICMP Timeout

3 sec

Health Monitor ICMP Interval

1 sec

Attempts Before WAN Failover

3

Attempts Before WAN Recovery

5

The roaming interface template page

Web Field/UCI/Package Option	Description						
Web: Interface Signal Sort UCI: mobile.@roaming_template[0].sort_sig_strength Opt: sort_sig_strength	Sorts interfaces by signal strength priority, so those that have a better signal strength will be tried first. <table><tr><td>0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>			0	Disabled	1	Enabled
0	Disabled						
1	Enabled						
Web: Roaming SIM UCI: mobile.main.roaming_sim Opt: roaming_sim	Sets in which slot to insert roaming SIM card. <table><tr><td>1</td><td>SIM slot 1</td></tr><tr><td>2</td><td>SIM slot 2</td></tr></table>			1	SIM slot 1	2	SIM slot 2
1	SIM slot 1						
2	SIM slot 2						
Web: Firewall Zone UCI: mobile.@roaming_template[0].firewall_zone Opt: firewall_zone	Adds all generated interfaces to this zone. Select existing zone or click unspecified or create to create new zone.						
Web: APN UCI: mobile.@roaming_template[0].apn Opt: apn	APN name of Mobile Network Operator.						
Web: PIN UCI: mobile.@roaming_template[0].pincode Opt: pincode	SIM card's PIN number.						
Web: PAP/CHAP username UCI: mobile.@roaming_template[0].username Opt: username	Username used to connect to APN.						
Web: PAP/CHAP password UCI: mobile.@roaming_template[0].password Opt: password	Password used to connect to APN.						
Web: Service Order UCI: mobile.@roaming_template[0].service_order Opt: service_order	Defines a space separated list of services, in preferred order. Valid options are gprs, umts, lte, auto. If no valid_service order is defined, then the configured Service Type is used. Example: mobile.@roaming_template[0].service_order="gprs umts lte auto" <table><tr><td>Default</td><td>Blank. Automatically detect best service.</td></tr><tr><td>Range</td><td>gprs umts lte auto</td></tr></table>			Default	Blank. Automatically detect best service.	Range	gprs umts lte auto
Default	Blank. Automatically detect best service.						
Range	gprs umts lte auto						
Web: Health Monitor Interval UCI:	Sets the period, in seconds, to check the health status of the interface. The Health Monitor interval will be used for: • Interface state checks • Ping interval • Signal strength checks <table><tr><td>Default</td><td>10. Health checks every 10 seconds.</td></tr><tr><td>Range</td><td></td></tr></table>			Default	10. Health checks every 10 seconds.	Range	
Default	10. Health checks every 10 seconds.						
Range							
Web: Health Monitor ICMP Host(s) UCI: mobile.@roaming_template[0].icmp_host_s	Specifies target IP address for ICMP packets. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr></table>			Web	Description	UCI	
Web	Description	UCI					

Web Field/UCI/Package Option	Description														
Opt: icmp_hosts	Disable	Disables the option.	disable												
	DNS servers	DNS IP addresses will be used.	dns												
	WAN gateway	Gateway IP address will be used.	gateway												
	custom	Ability to provide IP address. Multiple pings targets can be entered, comma separated. Pings to both must fail for health check to fail. Example: option icmp_hosts '1.1.1.1,2.2.2.2'													
Web: Health Monitor Conntrack Test Host(s) UCI: mobile.@roaming_template[0].conntrack_hosts Opt: conntrack_hosts	Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval. The Conntrack_hosts option defines the IP for conntrack to track, usually the icmp_host IP is used. If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host; otherwise a ping is sent as normal to the icmp_host. By default the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated. Conntrack is generally used to limit the traffic sent on a GSM network. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td></td></tr><tr><td>Disable</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td><td>disable</td></tr><tr><td>custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td><td></td></tr></table>			Web	Description	UCI	Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.		Disable	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	disable	custom	Specifies an IP other than the icmp_host for conntrack to track.	
Web	Description	UCI													
Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.														
Disable	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	disable													
custom	Specifies an IP other than the icmp_host for conntrack to track.														
Web: Health Monitor ICMP Timeout UCI: mobile.@roaming_template[0].timeout Opt: timeout	Specifies the time in seconds that Health Monitor ICMP will timeout at. Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at. <table><tr><td>Default</td><td>3. Wait 3 seconds for ping reply.</td></tr><tr><td>Range</td><td></td></tr></table>			Default	3. Wait 3 seconds for ping reply.	Range									
Default	3. Wait 3 seconds for ping reply.														
Range															
Web: Health Monitor ICMP Interval UCI: mobile.@roaming_template[0].interval Opt: icmp_interval	Defines the interval, in seconds, between multiple pings sent at each health check. <table><tr><td>Default</td><td>1</td></tr><tr><td>Range</td><td></td></tr></table>			Default	1	Range									
Default	1														
Range															
Web: Attempts Before WAN Failover UCI: mobile.@roaming_template[1].health_fail_retries Opt: health_fail_retries	Defines the number of health check failures before interface is disconnected. <table><tr><td>Default</td><td>3</td></tr><tr><td>Range</td><td></td></tr></table>			Default	3	Range									
Default	3														
Range															
Web: Attempts Before WAN Recovery UCI: mobile.@roaming_template[0].health_recovery_retries Opt: health_recovery_retries	Sets the number of health check passes before the interface is considered healthy. This field is not used for a roaming template. <table><tr><td>Default</td><td>5</td></tr><tr><td>Range</td><td></td></tr></table>			Default	5	Range									
Default	5														
Range															

Web Field/UCI/Package Option	Description				
Web: Priority UCI: mobile.@roaming_template[0].priority Opt: priority	Type the priority number. The higher the value, the higher the priority. This multi-WAN interface priority must be lower than the one specified in the priority field for the PMP interface. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0	Range	
Default	0				
Range					
Web: Multi-WAN: Exclusive Group UCI: mobile.@roaming_template[0].multiwan_exclusive_group Opt: multiwan_exclusive_group	Specifies the Multi-WAN group for the generated roaming interfaces. Defaults to '3g' if not specified.				
Web: Minimum ifup interval UCI: multiwan.wan.ifup_retry_sec Opt: ifup_retry_sec	Not used for a roaming interface. <table border="1"> <tr> <td>Default</td><td>300. Retry primary interface every 300 seconds.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	300. Retry primary interface every 300 seconds.	Range	
Default	300. Retry primary interface every 300 seconds.				
Range					
Web: Interface Start Timeout UCI: mobile.@roaming_template[0].ifup_timeout_sec Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. <table border="1"> <tr> <td>Default</td><td>40</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default	40	1	Enabled
Default	40				
1	Enabled				
Web: Signal Threshold (dBm) UCI: mobile.@roaming_template[0].signal_threshold Opt: signal_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics. <table border="1"> <tr> <td>Default</td><td>-115dBm</td></tr> <tr> <td>Range</td><td>-46 to -115 dBm</td></tr> </table>	Default	-115dBm	Range	-46 to -115 dBm
Default	-115dBm				
Range	-46 to -115 dBm				

When you have configured your settings, click **Save & Apply**.

System

Reboot

Reboots the operating system of your device

Reboot now ☒

Reboot on 1970 - January - 1 - 00 - 00

Powered by LuCI Trunk (trunk+svn8382) 15.00.32 image1 config2

The reboot page

In the top menu, select **System** -> **Reboot**. The System page appears.

Check the **Reboot now** check box and then click **Reboot**.

24.8.6. Set Multi-WAN Options For Primary Predefined Interface

On the web interface go to **Network** -> **Multi-Wan**. The Multi-WAN page appears.

Multi-WAN

Multi-WAN allows for the use of multiple uplinks for failover.

Add

WAN Interfaces

Health Monitor detects and corrects network changes and failed connections.

This section contains no values yet

Add

Save & Apply Save Reset

The Multi-WAN page

In the WAN Interfaces section, type in the name of the Multi-WAN interface. Click **Add**. The Multi-WAN page appears.

Multi-WAN

Multi-WAN allows for the use of multiple options for failover:

☒ Enable

☒ Preempt

☐ Alternate Mode
 ☒ It will use alternate interface after reboot

WAN Interfaces

Health Monitor detects and corrects network changes and failed connections:

3G_S1_VODA

Health Monitor Interval:

Health Monitor ICMP Host(s):

Health Monitor ICMP Timeout:

Attempts Before WAN Failover:

Attempts Before WAN Recovery:

Priority: Higher value is higher priority

☒ Manage Interface State (Up/Down)

Exclusive Group: Only one interface in group should be up in the same time

Minimum Up Interval: Minimum interval between two successive interface start attempts

Interface Start Timeout: Time for interface to startup

Signal Threshold (dBm): Below is a failure

The Multi-WAN page

Web Field/UCI/Package Option	Description								
Web: Enable UCI: multiwan.config.enabled Opt: enabled	Enables multiwan. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: Preempt UCI: multiwan.config.preempt Opt: preempt	Enables or disables pre-emption for multiwan. If enabled, the router will keep trying to connect to a higher priority interface depending on timer set. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: Alternate Mode UCI: multiwan.config.alt Opt: alt	Enables or disables alternate mode for multiwan. If enabled, the router will use an alternate interface after reboot. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled				
0	Disabled								
1	Enabled								
Web: WAN Interfaces UCI: multiwan.3g_s<sim-number>_<short-operator-name> Opt: 3g_s<sim-number>_<short-operator-name>	Provide the same interface name as chosen in multiwan section below and click Add .								
Web: Health Monitor Interval UCI: multiwan[.x.].health_interval Opt: health_interval	Sets the period to check the health status of the interface. The Health Monitor interval will be used for: - Interface state checks - Ping interval - Signal strength checks								
Web: Health Monitor ICMP Host(s) UCI: multiwan[.x.].icmp_hosts Opt: icmp_hosts	Specifies the target IP address for ICMP packets. <table border="1"> <tr> <td>Disable</td><td>Disables the option</td></tr> <tr> <td>DNS servers</td><td>DNS IP addresses will be used.</td></tr> <tr> <td>WAN Gateway</td><td>Gateway IP address will be used.</td></tr> <tr> <td>Custom</td><td>Ability to provide IP address.</td></tr> </table>	Disable	Disables the option	DNS servers	DNS IP addresses will be used.	WAN Gateway	Gateway IP address will be used.	Custom	Ability to provide IP address.
Disable	Disables the option								
DNS servers	DNS IP addresses will be used.								
WAN Gateway	Gateway IP address will be used.								
Custom	Ability to provide IP address.								
Web: Health Monitor Conntrack Test Host(s) UCI: multiwan.wan.conntrack_hosts Opt: conntrack_hosts	Conntrack is the feature used to track if there is any traffic to and from an IP destination within the health interval. Conntrack_hosts option defines the IP for conntrack to track – usually the icmp_host IP is used. If traffic to the conntrack_hosts IP is detected then multiwan does not send a ping health check to the icmp_host otherwise a ping is sent as normal to the icmp_host. By default the conntrack_hosts is checked if the health interval is greater than 5 minutes. This time threshold currently cannot be manipulated. Conntrack is generally used to limit the traffic sent on a GSM network. <table border="1"> <tr> <td>Default</td><td>Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.</td></tr> <tr> <td>Disable</td><td>Conntrack is Disabled.</td></tr> <tr> <td>Custom</td><td>Specifies an IP other than the icmp_host for conntrack to track.</td></tr> </table>	Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.	Disable	Conntrack is Disabled.	Custom	Specifies an IP other than the icmp_host for conntrack to track.		
Default	Conntrack checks for traffic from icmp_host IP when health_interval is greater than 5 minutes.								
Disable	Conntrack is Disabled.								
Custom	Specifies an IP other than the icmp_host for conntrack to track.								
Web: Health Monitor ICMP Timeout UCI: multiwan[.x.].timeout Opt: timeout	Sets ping timeout in seconds. Choose the time in seconds that the health monitor ICMP will timeout at. <table border="1"> <tr> <td>3</td><td>Wait 3 seconds for ping reply.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	3	Wait 3 seconds for ping reply.	Range					
3	Wait 3 seconds for ping reply.								
Range									

Web Field/UCI/Package Option	Description				
Web: Health Monitor ICMP Interval UCI: multiwan.wan.icmp_interval Opt: icmp_interval	Defines the interval between multiple pings sent at each health check. <table border="1"> <tr><td>1</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	1		Range	
1					
Range					
Web: Health Monitor ICMP Count UCI: multiwan.wan.icmp_count Opt: icmp_count	Defines the number of pings to send at each health check. <table border="1"> <tr><td>1</td><td></td></tr> <tr><td>Range</td><td>Enabled</td></tr> </table>	1		Range	Enabled
1					
Range	Enabled				
Web: Attempts Before WAN Failover UCI: multiwan.[..x..].health_fail_retries Opt: health_fail_retries	Sets the amount of health monitor retries before the interface is considered a failure. <table border="1"> <tr><td>3</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	3		Range	
3					
Range					
Web: Attempts Before WAN Recovery UCI: multiwan.[..x..].health_recovery_retries Opt: health_recovery_retries	Sets the number of health monitor checks before the interface is considered healthy. Only relevant if pre-empt mode is enabled. <table border="1"> <tr><td>5</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	5		Range	
5					
Range					
Web: Priority UCI: multiwan.[..x..].priority Opt: priority	Specifies the priority of the interface. The higher the value, the higher the priority. This multiwan interface priority must be higher than the one specified in the priority field in the 'Roaming Interface Template' page described in the following section. <table border="1"> <tr><td>0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	0		Range	
0					
Range					
Web: Exclusive Group UCI: multiwan.[..x..].exclusive_group Opt: exclusive_group	Defines the group to which the interface belongs; only one interface can be active. <table border="1"> <tr><td>0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	0		Range	
0					
Range					
Web: Manage Interface State (Up/Down) UCI: multiwan.[..x..].manage_state Opt: manage_state	Defines whether multiwan will start and stop the interface. Select Enabled . <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Minimum ifup Interval UCI: multiwan.[..x..].ifup_retry_sec Opt: ifup_retry_sec	Specifies the interval in seconds before retrying the primary interface when pre-empt mode is enabled.				
Web: Interface Start Timeout UCI: multiwan.[..x..].ifup_timeout Opt: ifup_timeout	Specifies the time in seconds for interface to start up. If it is not up after this period, it will be considered a fail. Choose timer greater than 120 seconds. <table border="1"> <tr><td>40</td><td>40 Seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	40	40 Seconds	Range	
40	40 Seconds				
Range					
Web: Signal Threshold (dBm) UCI: multiwan.[..x..].signal_threshold Opt: signal_threshold	Specifies the minimum signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for sig_dbm in mobile diagnostics. <table border="1"> <tr><td>-115</td><td>Disabled</td></tr> <tr><td>Range</td><td>-46 to -115dBm</td></tr> </table>	-115	Disabled	Range	-46 to -115dBm
-115	Disabled				
Range	-46 to -115dBm				
Web: RSCP Threshold (dBm) UCI: multiwan.[..x..].rscp_threshold	Specifies the minimum RSCP signal strength in dBm before considering if the interface fails signal health check. Uses the value stored for rscp_dbm in mobile diagnostics.				

Web Field/UCI/Package Option	Description																
Opt: rscp_threshold																	
Web: ECIO Threshold (dB) UCI: multiwan,[..x..].ecio_threshold Opt: ecio_threshold	Specifies the minimum ECIO signal strength in dB before considering if the interface fails signal health check. Uses the value stored for ecio_db in mobile diagnostics.																
Web: Signal Test UCI: multiwan,[..x..].signal_test Opt: signal_test	Defines script to test various signal characteristics in multiwan signal test. For example: <pre>option signal_test '(tech == 0) then (sig_dbm > -70) else (rscp_dbm > -105 and ecio_db > -15)'</pre> This states that when technology is GSM a health fail is determined when signal strength is less than -70dBm. When technology is not GSM a health fail occurs when either rscp_dbm falls below -105dBm or ecio_db falls below -15dB. Tech values are: <table border="1"> <tbody> <tr><td>0</td><td>GSM</td></tr> <tr><td>1</td><td>GSM Compact</td></tr> <tr><td>2</td><td>UTRAN</td></tr> <tr><td>3</td><td>GSM w/EGPRS</td></tr> <tr><td>4</td><td>UTRAN w/HSPDA</td></tr> <tr><td>5</td><td>UTRAN w/HSUPA</td></tr> <tr><td>6</td><td>UTRAN w/HSUPA and HSDPA</td></tr> <tr><td>7</td><td>E-UTRAN</td></tr> </tbody> </table>	0	GSM	1	GSM Compact	2	UTRAN	3	GSM w/EGPRS	4	UTRAN w/HSPDA	5	UTRAN w/HSUPA	6	UTRAN w/HSUPA and HSDPA	7	E-UTRAN
0	GSM																
1	GSM Compact																
2	UTRAN																
3	GSM w/EGPRS																
4	UTRAN w/HSPDA																
5	UTRAN w/HSUPA																
6	UTRAN w/HSUPA and HSDPA																
7	E-UTRAN																

Click **Save**.

24.9. Configuring Automatic Operator Selection Via UCI

While the router boots up it checks for mobile networks. Based on available networks, the router creates interfaces and the multiwan package is used to run failover between interfaces. Typically these auto-generated interfaces are sorted by signal strength.

Details for these interfaces are provided in the mobile package. When you have created the interfaces, Multi-WAN manages the operation of primary (predefined) and failover (auto created) interfaces.

Multi-WAN periodically does a health check on the active interface. A health check comprises of a configurable combination of the following:

- interface state
- pings to an ICMP target
- signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in an overall fail. After a configurable number of health check failures, multiwan will move to the next highest priority interface. Multi-WAN will optionally stop the failed interface and start the new interface, if required.

24.9.1. PMP + Roaming: Pre-Empt & Disabled Using UCI

PMP interface configuration

The PMP interface is configured in the network package /etc/config/network. To view the network configuration file, enter:

To view the mobile configuration file, enter:

```
root@VA_router:~# uci export network

package network

config interface 'loopback'

option ifname 'lo'

option proto 'static'

option ipaddr '127.0.0.1'

option netmask '255.0.0.0'

config interface 'lan'

option ifname 'eth0'

option proto 'static'

option ipaddr '192.168.100.1'

option netmask '255.255.255.0'

config interface '3g_sl_voda'

option auto '0'

option proto '3g'

option service_order 'auto lte umts gprs'

option apn 'testIE'

option username 'test'

option password 'test'

option sim '1'      option operator 'vodafone IE'
```

To view uci commands, enter:


```
root@VA_router:~#uci show network

network.loopback=interface
network.loopback.ifname=lo
network.loopback.proto=static
network.loopback.ipaddr=127.0.0.1
network.loopback.netmask=255.0.0.0

network.lan=interface
network.lan.ifname=eth0
network.lan.proto=static
network.lan.ipaddr=192.168.100.1
network.lan.netmask=255.255.255.0

network.3g_s1_voda=interface
network. 3g_s1_voda.auto=0
network. 3g_s1_voda.proto=3g
network. 3g_s1_voda.service_order='auto lte umts gprs'
network. 3g_s1_voda.apn=test IE
network. 3g_s1_voda.username=test
network. 3g_s1_voda.password=test
network. 3g_s1_voda.sim=1
network. 3g_s1_voda.operator=vodafone IE
```

Roaming Interface Configuration Using UCI

The roaming interface configurations are stored in the mobile package

/etc/config/mobile.

To view the mobile configuration file, enter:

```
root@VA_router:~# uci export mobile

config mobile 'main'

option sms 'yes'

option roaming_sim '1'

option init_get_iccids 'no'

config caller

option name 'Test'

option number '*'

option enabled 'yes'

option respond 'yes'

config roaming_template

option roaming_sim '1'

option firewall_zone 'wan'

option apn 'test IE'

option username 'test'

option password 'test'

option service 'umts'

option health_interval '4'

option icmp_hosts 'disable'

option timeout 'disable'

option health_fail_retries '3'

option signal_threshold '-95'

option priority '5'

option ifup_retry_sec '120'

option ifup_timeout_sec '180'

option defaultroute 'yes'

option sort_sig_strength 'yes'
```

To view the uci command of package mobile, enter:

```
root@VA_router:~#uci show mobile

mobile.main=mobile

mobile.main.sms=yes

mobile.main.roaming_sim=1

mobile.main.init_get_iccids=no

mobile.@caller[0]=caller

mobile.@caller[0].name=Test

mobile.@caller[0].number=*

mobile.@caller[0].enabled=yes

mobile.@caller[0].respond=yes

mobile.@roaming_template[0]=roaming_template

mobile.@roaming_template[0].roaming_sim=1

mobile.@roaming_template[0].firewall_zone=wan

mobile.@roaming_template[0].apn=test IE

mobile.@roaming_template[0].username=test

mobile.@roaming_template[0].password=test

mobile.@roaming_template[0].service=umts

mobile.@roaming_template[0].health_interval=4

mobile.@roaming_template[0].icmp_hosts=disable

mobile.@roaming_template[0].timeout=disable

mobile.@roaming_template[0].health_fail_retries=3

mobile.@roaming_template[0].signal_threshold=-95

mobile.@roaming_template[0].priority=5

mobile.@roaming_template[0].ifup_retry_sec=120

mobile.@roaming_template[0].ifup_timeout_sec=180

mobile.@roaming_template[0].defaultroute=yes

mobile.@roaming_template[0].sort_sig_strength=yes
```

Multi-WAN Configuration Using UCI

The configuration file for package multiwan is stored on **/etc/config/multiwan**

To see configuration file of mobile package, enter:

```
root@VA_router:~# cat /etc/config/multiwan

config multiwan 'config'

option enabled '1'

option preempt '1'

config interface '3g_s1_voda'

option health_fail_retries '3'

option health_interval '3'

option timeout '1'

option icmp_hosts 'disable' option priority '10'

option exclusive_group '3g' option signal_threshold '-95'

option ifup_retry_sec '350'

option ifup_timeout_sec '180'

option manage_state '1'
```

To view the uci command of package multiwan, enter:

```
root@VA_router:~# uci show multiwan

multiwan.config=multiwan

multiwan.config.enabled=1

multiwan.config.preempt=1

multiwan.main_voda=interface

multiwan.main_voda.health_fail_retries=3

multiwan.main_voda.health_interval=3

multiwan.3g_s1_voda.timeout=1

multiwan.3g_s1_voda.icmp_hosts=disable

multiwan.3g_s1 main _voda.priority=10

multiwan.3g_s1_voda.exclusive_group=3g

multiwan.3g_s1_voda.signal_threshold=-95

multiwan.3g_s1_voda.ifup_retry_sec=350

multiwan.3g_s1_voda.ifup_timeout_sec=180

multiwan.3g_s1_voda.manage_state=1
```

The difference between PMP + roaming: pre-empt enabled and disabled is setting one option parameter. To disable pre-empt, enter:

```
uci set multiwan.config.preempt=0

uci commit
```



NOTE

Available values are:

0	Disabled
1	Enabled

24.9.2. Configuring No PMP + Roaming Using UCI

The roaming interface configuration file is stored in the mobile package

/etc/config/mobile. To view the mobile package, enter:

```
root@VA_router:~# uci export mobile

package mobile config mobile 'main'

option sms 'yes'

option roaming_sim '1'

option debug '1'

config caller

option name 'Eval'

option number '*'

option enabled 'yes'

option respond 'yes'

config roaming_template

option roaming_sim '1'

option firewall_zone 'wan'

option apn 'test IE'

option username 'test'

option password 'test'

option service 'umts'

option health_fail_retries '2'

option signal_threshold '-100'

option priority '5'

option ifup_timeout_sec '180'

option defaultroute 'yes'

option sort_sig_strength 'yes'

option ifup_retry_sec '200'

option health_interval '120'

option icmp_hosts '172.31.4.129'

option timeout '3'

option health_recovery_retries '3'
```

To view the mobile package via uci commands, enter:

```
root@VA_router:~# uci show mobile

mobile.main=mobile

mobile.main.sms=yes

mobile.main.roaming_sim=1

mobile.main.debug=1

mobile.@caller[0]=caller

mobile.@caller[0].name=Eval

mobile.@caller[0].number=*

mobile.@caller[0].enabled=yes

mobile.@caller[0].respond=yes

mobile.@roaming_template[0]=roaming_template

mobile.@roaming_template[0].roaming_sim=1

mobile.@roaming_template[0].firewall_zone=wan

mobile.@roaming_template[0].apn=stream.co.uk

mobile.@roaming_template[0].username=default

mobile.@roaming_template[0].password=void

mobile.@roaming_template[0].service=umts

mobile.@roaming_template[0].health_fail_retries=2

mobile.@roaming_template[0].signal_threshold=-100

mobile.@roaming_template[0].priority=5

mobile.@roaming_template[0].ifup_timeout_sec=180

mobile.@roaming_template[0].defaultroute=yes

mobile.@roaming_template[0].sort_sig_strength=yes

mobile.@roaming_template[0].ifup_retry_sec=200

mobile.@roaming_template[0].health_interval=120

mobile.@roaming_template[0].icmp_hosts=172.31.4.129

mobile.@roaming_template[0].timeout=3

mobile.@roaming_template[0].health_recovery_retries=3
```

The multiwan package is stored on **/etc/config/multiwan**. To view the multiwan package, enter:

```
root@VA_router:~# uci export multiwan

package multiwan

config multiwan 'config'

option enabled 'yes'

option preempt 'no'

option alt_mode 'no'
```

To see multiwan package via uci, enter:

```
root@VA_router:~# uci show multiwan
multiwan.config=multiwan
multiwan.config.enabled=yes
multiwan.config.preempt=no
multiwan.config.alt_mode=no
```

24.9.3. Automatic Operator Selection Diagnostics Via The Web Interface

When interfaces are auto-created they are presented in the network and in the multiwan package.

To check interfaces created in the multiwan package, from the top menu, select **Network -> Multi-WAN**.

To check interfaces that have been created in the network package, from the top menu, select **Network -> Interfaces**.

Interface Overview		
Network	Status	Actions
3G_5T_Q28R 3g-5t_q28r	RX: 0.00 B (0 Pkts.) TX: 0.00 B (0 Pkts.)	Connect Stop Edit Delete
3G_5T_V028A 3g-5t_v028a	Uptime: 7h 31m 26s RX: 62.00 B (8 Pkts.) TX: 23.44 KB (329 Pkts.) IPv4: 10.140.1.23/32	Connect Stop Edit Delete
WCLIENT Client 1	MAC Address: 00:00:00:00:00:00 RX: 0.00 B (0 Pkts.) TX: 0.00 B (0 Pkts.)	Connect Stop Edit Delete
LAN eth0	Uptime: 7h 35m 24s MAC Address: 00:E0:CB:10:1A:82 RX: 67.26 KB (502 Pkts.) TX: 132.29 KB (157 Pkts.) IPv4: 10.1.1.9/29	Connect Stop Edit Delete
LOOPBACK lo	Uptime: 7h 35m 30s MAC Address: 00:00:00:00:00:00 RX: 41.72 KB (516 Pkts.) TX: 41.72 KB (516 Pkts.) IPv4: 127.0.0.1/8 IPv6: :::::0:0:0:0:1/128	Connect Stop Edit Delete

The interface overview page

To check the status of the interface you are currently using, in the top menu, click **Status**. The Interface Status page appears.

Scroll down to the bottom of the page to view Multi-WAN Stats.

There are no active leases.

Multi-WAN Status

3g_5t_v028a : Up

3g_5t_q28r : Downloading backup

The multi-WAN status page

24.10. Automatic Operator Selection Diagnostics Via UCI

In this section, you can use UCI to check status of packages and various interfaces associated with automatic operator selection.

24.10.1. Check Roaming Interfaces Discovered

Roaming interfaces discovered during roaming search are stored at: **/var/const_state/roaming**.

This file contains a section for each discovered operator/service combination, along with signal strength, if tested. Time taken to scan is also available along with the time of scan and number of services found.

To check roaming interfaces discovered, enter:

```
root@VA_router:~# cat /var/const_state/roaming

roaming.main2_voda_lte=service
roaming.main2_voda_lte.name=vodafone IE
roaming.main2_voda_lte.shortname=voda IE
roaming.main2_voda_lte.opnum=27201
roaming.main2_voda_lte.interface=main2_voda
roaming.main2_voda_lte.servicetype=7
roaming.main2_voda_lte.sim=2
roaming.main2_voda_lte.tested=0
roaming.main2_voda_lte.signalstrength=0
roaming.main2_voda_ums=service
roaming.main2_voda_ums.name=vodafone IE
roaming.main2_voda_ums.shortname=voda IE
roaming.main2_voda_ums.opnum=27201
roaming.main2_voda_ums.interface=main2_voda
roaming.main2_voda_ums.servicetype=2
roaming.main2_voda_ums.sim=2
roaming.main2_voda_ums.tested=1
roaming.main2_voda_ums.signalstrength=-79
roaming.main2_voda_gprs=service
roaming.main2_voda_gprs.name=vodafone IE
roaming.main2_voda_gprs.shortname=voda IE
```

```
roaming.main2_voda_gprs.opnum=27201
roaming.main2_voda_gprs.interface=main2_voda
roaming.main2_voda_gprs.servicetype=0
roaming.main2_voda_gprs.sim=2
roaming.main2_voda_gprs.tested=0
roaming.main2_voda_gprs.signalstrength=0
roaming.main2_o2IR_ums.service
roaming.main2_o2IR_ums.name=o2 IRL
roaming.main2_o2IR_ums.shortname=o2 - IRL
roaming.main2_o2IR_ums.opnum=27202
roaming.main2_o2IR_ums.interface=main2_o2IR
roaming.main2_o2IR_ums.servicetype=2
roaming.main2_o2IR_ums.sim=2
roaming.main2_o2IR_ums.tested=1
roaming.main2_o2IR_ums.signalstrength=-85
roaming.main2_o2IR_gprs.service
roaming.main2_o2IR_gprs.name=o2 IRL
roaming.main2_o2IR_gprs.shortname=o2 - IRL
roaming.main2_o2IR_gprs.opnum=27202
roaming.main2_o2IR_gprs.interface=main2_o2IR
roaming.main2_o2IR_gprs.servicetype=0
roaming.main2_o2IR_gprs.sim=2
roaming.main2_o2IR_gprs.tested=0
roaming.main2_o2IR_gprs.signalstrength=0
roaming.status=status
roaming.status.num_services=5
roaming.status.scan_update_time=Thu May 12 05:02:38 2022
roaming.status.scan_duration=185
```

Roaming operators are also stored in MIB `vaModemRoaming.mib`.

24.10.2. Check Interfaces Created In Multiwan Package

To check interfaces created in the multiwan package, enter:

```
root@VA_router:~# cat/var/const_state/multiwan
multiwan.main2_3IRL=interface
multiwan.main2_3IRL.timeout=disable
multiwan.main2_3IRL.health_recovery_retries=5
multiwan.main2_3IRL.exclusive_group=3g
multiwan.main2_3IRL.manage_state=yes
multiwan.main2_3IRL.signal_threshold=-80
multiwan.main2_3IRL.ifup_timeout_sec=150
multiwan.main2_3IRL.icmp_hosts=disable
multiwan.main2_3IRL.health_interval=4
multiwan.main2_3IRL.priority=5
multiwan.main2_3IRL.ifup_retry_sec=120
multiwan.main2_3IRL.health_fail_retries=3
multiwan.main2_o2IR=interface
multiwan.main2_o2IR.timeout=disable
multiwan.main2_o2IR.health_recovery_retries=5
multiwan.main2_o2IR.exclusive_group=3g
multiwan.main2_o2IR.manage_state=yes
multiwan.main2_o2IR.signal_threshold=-80
multiwan.main2_o2IR.ifup_timeout_sec=150
multiwan.main2_o2IR.icmp_hosts=disable
multiwan.main2_o2IR.health_interval=4
multiwan.main2_o2IR.priority=5
multiwan.main2_o2IR.ifup_retry_sec=120
multiwan.main2_o2IR.health_fail_retries=3
```

24.10.3. Check Interfaces Created In Network Package

To check interfaces created in the network package, enter:

```
root@VA_router:~# cat /var/const_state/network

network.main2_3IRL=interface

network.main2_3IRL.snmp_alias_ifindex=3

network.main2_3IRL.sim=2

network.main2_3IRL.defaultroute=yes

network.main2_3IRL.username=campen1

network.main2_3IRL.apn=vpn.amylan.co.uk

network.main2_3IRL.opformat=2

network.main2_3IRL.phy=1-1

network.main2_3IRL.roaming_sim=2

network.main2_3IRL.operator=27205

network.main2_3IRL.password=campen1

network.main2_3IRL.auto=no

network.main2_3IRL.service_order=auto

network.main2_3IRL.proto=3g

network.main2_o2IR=interface

network.main2_o2IR.snmp_alias_ifindex=3

network.main2_o2IR.sim=2

network.main2_o2IR.defaultroute=yes

network.main2_o2IR.username=campen1

network.main2_o2IR.apn=vpn.amylan.co.uk

network.main2_o2IR.opformat=2

network.main2_o2IR.phy=1-1

network.main2_o2IR.roaming_sim=2

network.main2_o2IR.operator=27202

network.main2_o2IR.password=campen1

network.main2_o2IR.auto=no

network.main2_o2IR.service_order=auto

network.main2_o2IR.proto=3g
```

24.10.4. Check Current Interface

To check the SIM status of the interface you are currently using, enter:

```
root@VA_router:~# cat /var/const_state/mobile  
mobile.3g_1_1=status  
mobile.3g_1_1.sim2_iccid=89314404000075920976  
mobile.3g_1_1.imei=866802020194140  
mobile.3g_1_1.hw_rev=4534B04SIM7100E  
mobile.3g_1_1.sim_select=yes
```

To check mobile status of the interface you are currently using, enter

```
root@VA_router:~# cat /var/state/mobile  
mobile.3g_1_1=status  
mobile.3g_1_1.auto_info=/tmp/3g_1-1.auto  
mobile.3g_1_1.scan_update_time=Thu May 12 05:02:38 2018  
mobile.3g_1_1.imsi=204043726930595  
mobile.3g_1_1.imsi2=204043726930595  
mobile.3g_1_1.lte_band=3  
mobile.3g_1_1.last_error=no network service  
mobile.3g_1_1.mcc=272 mobile.3g_1_1.last_error_time=2022-02-22 10:41:27  
mobile.3g_1_1.lac=11  
mobile.3g_1_1.cell=46542698  
mobile.3g_1_1.mnc=05  
mobile.3g_1_1.operator_code=27205  
mobile.3g_1_1.operator_name=3 IRL DATA ONLY  
mobile.3g_1_1.rscp_dbm=-86  
mobile.3g_1_1.ecio_db=-8.5  
mobile.3g_1_1.sig_dbm=-51  
mobile.3g_1_1.temperature=37  
mobile.3g_1_1.vam_state=connecting  
mobile.3g_1_1.sim_slot=2  
mobile.3g_1_1.sim_in=yes  
mobile.3g_1_1.technology=UMTS  
mobile.3g_1_1.registered=Roaming  
mobile.3g_1_1.reg_code=5  
mobile.3g_1_1.registered_pkt=Searching  
mobile.3g_1_1.reg_code_pkt=2
```

25. Configuring Connection Watch (Cwatch)

Connection Watch is a recovery feature to enable dynamic recovery of an interface. You can configure multiple instances of Connection Watch.

Connection Watch consists of the following configurable instances:

- Interface(s) to be monitored
- Failure periods
- Recovery actions

If no data is received over the monitored interface during the configured duration, then the recovery action is performed. If more than one interface is specified under a single Connection Watch, the recovery action will be performed only if no data is received on both of the interfaces for the defined period.

Currently three configurable periods and associated recovery actions can be defined. Recovery actions are prioritised based on their configured failure periods, the smallest failure period having the lowest priority. Lowest priority actions are repeated until the next highest priority action executes at which point it then stops leaving only the new action to execute at configured intervals.

Example:

- Failure time 1 = 1 hour; Failure action 1= interface up
- Failure time 2 = 10 hours; Failure action 2 = interface restart
- Failure time 3 = 24 hours; Failure action 3 = reboot

In the above example action execution priorities are action 3 > action 2 > action 1. In the case of failure to detect incoming packets, action 1 is triggered first and is executed at intervals of one hour until action 2 is due. When action 2 is executed, action 1 gets disabled and thereafter only action 2 is executed every 10 hours until action 3 is due.

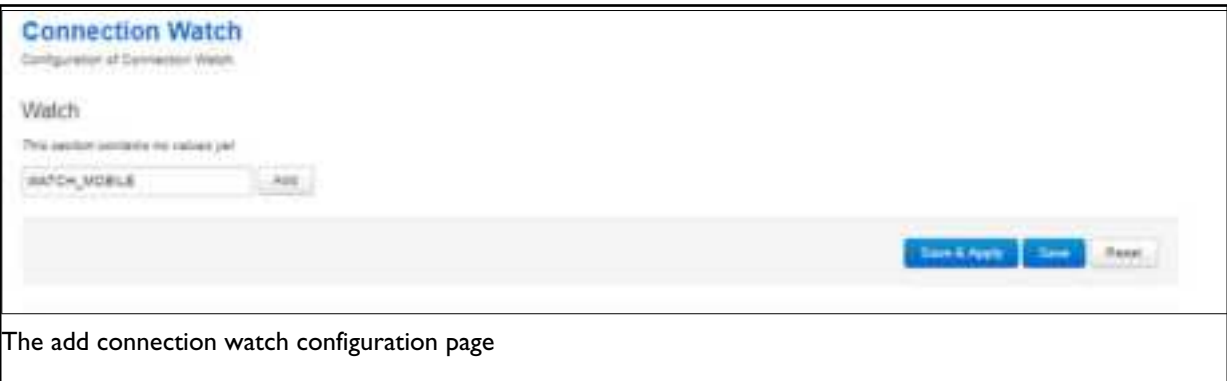
If the status of the interface is detected as 'up' at any stage then no subsequent failure action will occur and all failure timers are reset. In the case of any subsequent failure, all failure actions are re-enabled and the action sequence is repeated.

Configuration package used

Package	Sections
cwatch	watch

25.1. Configuring Connection Watch Using The Web Interface

To configure Connection Watch using the web interface, select **Services - >Connection Watch**. The Connection Watch page appears.



If no Connection Watch configuration exists in the configuration file, first enter a name for the Connection Watch instance and select **Add**.

Connection Watch

Configuration of Connection Watch.

Watch

WATCH_MOBILE

Enabled

☒

Status

Interfaces

☐ LAN

☐ LAN1

☐ MOBILE1

☐ PPPoDSL

☐ loopback

Failure Time for Action 1

1h

Failure Action 1

ifup MOBILE1

Failure Grace Time 1

Interface activity will be ignored during the grace time

Failure Time for Action 2

10h

Failure Action 2

/etc/init.d/usb_startup restart

Failure Grace Time 2

Interface activity will be ignored during the grace time

Failure Time for Action 3

24h

Failure Action 3

reboot

Failure Grace Time 3

Interface activity will be ignored during the grace time

The connection watch configuration page

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: cwatch.@watch[0].enabled Opt: enabled	Enables a cwatch instance. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Interfaces UCI: cwatch.@watch[0].test_ifaces Opt: test_ifaces	Defines the interface name(s) to monitor. Multiple interfaces are delimited by space separator. Example: option test_ifaces 'WANADSL WANMOBILE' If multiple interfaces are defined the failure action will only be triggered if no traffic is received on all interfaces for the defined period.				
Web: Failure Time for Action 1 UCI: cwatch.@watch[0].failure_time_1 Opt: failure_time_1	Defines a duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. <table border="1"> <tr> <td>Default</td><td>1 hour</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default	1 hour	Range	s; m; h; d;
Default	1 hour				
Range	s; m; h; d;				
Web: Failure Action 1 UCI: cwatch.@watch[0].failure_action_1 Opt: failure_action_1	Defines the failure action associated with failure_time_1. Example to force up interface: option failure_action_1 'ifup wan' <table border="1"> <tr> <td>Default</td><td>blank</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	blank	Range	
Default	blank				
Range					
Web: Failure Grace Time 1 UCI: cwatch.@watch[0].failure_grace_time_1 Opt: failure_grace_time_1	Defines a grace time during which interface activity will be ignored after 'Failure Action 1' is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time. This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small amount of packets can be registered as being received while a mobile connection is attempted but fails registration. <table border="1"> <tr> <td>Default: 0</td><td>No grace time</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default: 0	No grace time	Range	s; m; h; d;
Default: 0	No grace time				
Range	s; m; h; d;				
Web: Failure Time for Action 2 UCI: cwatch.@watch[0].failure_time_2 Opt: failure_time_2	Defines a second duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. <table border="1"> <tr> <td>Default</td><td>10 hours</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default	10 hours	Range	s; m; h; d;
Default	10 hours				
Range	s; m; h; d;				
Web: Failure Action 2 UCI: cwatch.@watch[0].failure_action_2 Opt: failure_action_2	Defines the failure action associated with failure_time_2. Example to reset usb: option failure_action_1 '/etc/init.d/usb_startup restart' <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Blank	Range	
Default	Blank				
Range					
Web: Failure Grace Time 2 UCI: cwatch.@watch[0].failure_grace_time_2 Opt: failure_grace_time_2	Defines a grace time during which interface activity will be ignored after 'Failure Action 2' is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time.				

Web Field/UCI/Package Option	Description				
	This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small amount of packets can be registered as being received while a mobile connection is attempted but fails registration. <table border="1"> <tr> <td>Default: 0</td><td>No grace time</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default: 0	No grace time	Range	s; m; h; d;
Default: 0	No grace time				
Range	s; m; h; d;				
Web: Failure Time for Action 3 UCI: cwatch.@watch[0].failure_time_3 Opt: failure_time_3	Defines a third duration to monitor an interface for receive traffic. Duration can be specified in seconds, minutes, hours, days. <table border="1"> <tr> <td>Default</td><td>24 hours</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default	24 hours	Range	s; m; h; d;
Default	24 hours				
Range	s; m; h; d;				
Web: Failure Action 3 UCI: cwatch.@watch[0].failure_action_3 Opt: failure_action_3	Defines the failure action associated with failure_time_3. Example to reset usb: option failure_action_3 'reboot' <table border="1"> <tr> <td>Default</td><td>Blank</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Blank	Range	
Default	Blank				
Range					
Web: Failure Grace Time 3 UCI: cwatch.@watch[0].failure_grace_time_3 Opt: failure_grace_time_3	Defines a grace time during which interface activity will be ignored after 'Failure Action 3' is executed. Connection Watch will assume the interface to be down during the grace period and will not reset the failure action timers even if packets are received during this grace time. This can be used to overcome the situation where packets can be received after a failure action even though the interface eventually fails to connect. For example, during a USB restart on a mobile interface, a small amount of packets can be registered as being received while a mobile connection is attempted but fails registration. <table border="1"> <tr> <td>Default: 0</td><td>No grace time</td></tr> <tr> <td>Range</td><td>s; m; h; d;</td></tr> </table>	Default: 0	No grace time	Range	s; m; h; d;
Default: 0	No grace time				
Range	s; m; h; d;				

25.2. Configuring Cwatch Using Command Line

By default, all cwatch instances are named 'watch', the cwatch instance is identified by @watch then the watch position in the package as a number. For example, for the first route in the package using UCI:

```
cwatch.@watch[0]=watch
cwatch.@watch[0].enabled=1
```

Or using package options:

```
config watch
option enabled '1'
```

However, to better identify it, we recommend giving the cwatch instance a name. For example, a watch named 'WATCH_MOBILE' will be cwatch.WATCH_MOBILE.

To define a named cwatch instance using UCI, enter:

```
cwatch.WATCH_MOBILE=watch
cwatch.WATCH_MOBILE.enabled=1
```

To define a named cwatch instance using package options, enter:

```
config watch 'WATCH_MOBILE'
option 'enabled' '1'
```

25.2.1. Cwatch Using UCI

```
root@VA_router:~# uci show cwatch
cwatch.WATCH_MOBILE=watch
cwatch.WATCH_MOBILE.enabled=1
cwatch.WATCH_MOBILE.test_ifaces=wan
cwatch.WATCH_MOBILE.failure_time_1=1h
cwatch.WATCH_MOBILE.failure_action_1=ifup wan
cwatch.WATCH_MOBILE.failure_time_2=10h
cwatch.WATCH_MOBILE.failure_action_2=/etc/init.d/usb_startup restart
cwatch.WATCH_MOBILE.failure_time_3=24h
cwatch.WATCH_MOBILE.failure_action_3=reboot
```

cwatch using package options

```
root@VA_router:~# uci export cwatch
package cwatch

config watch 'WATCH_MOBILE'
option enabled '1'
option test_ifaces wan
option failure_time_1 '1h'
option failure_action_1 'ifup wan'
option failure_grace_time_1 `30s`
option failure_time_2 '10h'
option failure_action_2 '/etc/init.d/usb_startup restart'
option failure_grace_time_2 `2m`
option failure_time_3 '24h'
option failure_action_3 'reboot'
```

25.3. Cwatch Diagnostics

A syslog message will be generated when cwatch starts:

```
cwatch[x]: cwatch configuration OK. Entering main loop...
```

Syslog messages will be generated when the failure action is triggered:

```
cwatch[x]: Watch WATCH_MOBILE executed action 1 grace time [x]
```

```
cwatch[x]: Watch WATCH_MOBILE executed action 2 grace time [x]
```

```
cwatch[x]: Watch WATCH_MOBILE executed action 3 grace time [x]
```

A syslog message will be generated if there is a problem with the configured cwatch instance.

```
cwatch[x]: Watch WATCH_MOBILE test_ifaces not defined. Watch ignored
```

26. Configuring DHCP Server And DNS (Dnsmasq)

Dynamic Host Configuration Protocol (DHCP) server is responsible for assigning IP addresses to hosts. IP addresses can be given out on different interfaces and different subnets. You can manually configure lease time as well as setting static IP to host mappings.

Domain Name Server (DNS) is responsible for resolution of IP addresses to domain names on the internet.

Dnsmasq is the application which controls DHCP and DNS services. Dnsmasq has two sections; one to specify general DHCP and DNS settings and one or more DHCP pools to define DHCP operation on the desired network interface.

Configuration Package Used

Package	Sections
dhcp	dnsmasq
	dhcp
	host

26.1. Configuring IPv6 Routes Using The Web Interface

You can also specify IPv6 routes by defining one or more IPv6 routes. In the IPv6 routes section, click **Add**.

Web Field/UCI/Package Option	Description				
Web: Interface UCI: network.@route[1].interface Opt: interface	Specifies the logical interface name of the parent or master interface this route belongs to. It must refer to one of the defined interface sections.				
Web: target UCI: network.@route[1].target Opt: target	Specifies the route network IP address, or subnet in CIDR notation: Example: 2001:0DB8:100:F00:BA3::1/64				
Web: Gateway UCI: network.@route[1].gateway Opt: Gateway	Network gateway. If omitted, the gateway from the parent interface is taken. If set to 0.0.0.0 no gateway will be specified for the route.				
Web: Metric UCI: network.@route[1].metric Opt: metric	Specifies the route metric to use. <table border="1"><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td></td></tr></table>	Default	0	Range	
Default	0				
Range					
Web: MTU UCI: network.@route[1].mtu Opt: mtu	Defines a specific MTU for this route. If omitted the MTU from the parent interface will be taken. <table border="1"><tr><td>Default</td><td>Empty</td></tr><tr><td>Range</td><td></td></tr></table>	Default	Empty	Range	
Default	Empty				
Range					

When you have made your changes, click **Save & Apply**.

26.2. Configuring DHCP And DNS Using The Web Interface

In the top menu, select **Network -> DHCP and DNS**. The DHCP and DNS page appears.

DHCP and DNS

Dhcpdng is a combined DHCP-Server and DNS-Forwarder for NAT firewalls

Server Settings

General Settings

Resolv and Hosts Files

TFTP Settings

Advanced Settings

Domain required

☐

Don't forward DNS-Requests without DNS-Name

Authoritative

☐

This is the only DHCP in the local network

Interfaces

☐ eth0

☐ eth1

☐ loopback

☐ wlan0

☐ wlan1

Select interfaces to be served by dhcpdng. If none selected dhcpdng will serve on all interfaces

Local server

Local domain specification. Names matching this domain are never forwarded and resolved from DHCP or hosts file only

Local domain

Local domain suffix appended to DHCP names and hosts file entries

Log queries

☐

Write received DNS-requests to syslog

DNS forwardings

List of DNS servers to forward requests to. To forward only specific domain requests use IP syntax

Refused protection

☐

Dissect upstream RRPC1515 responses

Allow localhost

☐

Allow upstream responses in the 127.0.0.0/8 range, e.g. for RBL services

Domain whitelabel

List of domains to allow RRPC1515 responses for

Active Leases

Hostname	IPv4Address	MACAddress	Leasetime remaining
There are no active leases			

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.
Use the Add button to add a new lease entry. The MACAddress identifies the host, the IPv4Address specifies the fixed address to use and the Hostname is assigned as symbolic name to the responding host.

Hostname	MACAddress	IPv4Address
This section contains no values yet		

Add

Save & Apply

Save

Reset

The DHCP and DNS page

There are three sections: Server Settings, Active Leases, and Static Leases.

26.2.1. Dnsmasq: General Settings

Web Field/UCI/Package Option	Description				
Web: Domain required UCI: dhcp@dnsmasq[0].domainneeded Opt: domainneeded	Defines whether to forward DNS requests without a DNS name. Dnsmasq will never forward queries for plain names, without dots or domain parts, to upstream nameservers. If the name is not known from /etc/hosts or DHCP then a "not found" answer is returned. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Authoritative UCI: dhcp@dnsmasq[0].authoritative Opt: authoritative	Forces authoritative mode. This speeds up DHCP leasing. Used if this is the only server in the network. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Interfaces UCI: dhcp@dnsmasq[0].interface Opt: list interface	Defines the list of interfaces to be served by dnsmasq. If you do not select a specific interface, dnsmasq will serve on all interfaces. Configured interfaces are shown via the web GUI. <table border="1"> <tr> <td>Default</td><td>Lan. Serve only on LAN interface</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Lan. Serve only on LAN interface	Range	
Default	Lan. Serve only on LAN interface				
Range					
Web: Local Server UCI: dhcp@dnsmasq[0].local Opt: local	Specifies the local domain. Names matching this domain are never forwarded and are resolved from DHCP or host files only. <table border="1"> <tr> <td>Default</td><td>/lan/</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	/lan/	Range	
Default	/lan/				
Range					
Web: Local Domain UCI: dhcp@dnsmasq[0].domain Opt: domain	Specifies local domain suffix appended to DHCP names and hosts file entries. <table border="1"> <tr> <td>Default</td><td>lan</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	lan	Range	
Default	lan				
Range					
Web: Log Queries UCI: dhcp@dnsmasq[0].logqueries Opt: logqueries	Writes received DNS requests to syslog. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: DNS Forwardings UCI: dhcp@dnsmasq[0].server Opt: list server	List of DNS servers to forward requests to. To forward specific domain requests only, use // syntax. When using UCI, enter multiple servers with a space between them. <table border="1"> <tr> <td>Default</td><td>No DNS server configured</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	No DNS server configured	Range	
Default	No DNS server configured				
Range					
Web: Rebind Protection UCI: dhcp@dnsmasq[0].rebind_protection Opt: rebind_protection	Enables DNS rebind attack protection by discarding upstream RFC1918 responses. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Allow Localhost UCI: dhcp@dnsmasq[0].rebind_localhost Opt: rebind_localhost	Defines whether to allow upstream responses in the 127.0.0.0/8 range. This is required for DNS-based blacklist services. Only takes effect if rebind protection is enabled. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Domain Whitelist UCI: dhcp@dnsmasq[0].rebind_domain Opt: list rebind_domain	Defines the list of domains to allow RFC1918 responses to. Only takes effect if rebind protection is enabled. When using UCI multiple servers, enter the domains with a space between them. <table border="1"> <tr> <td>Default</td><td>No list configured</td></tr> </table>	Default	No list configured		
Default	No list configured				

Web Field/UCI/Package Option	Description	
	Range	

26.2.2. Dnsmasq: Resolv And Host Files

DHCP and DNS

Dnsmasq is a combined DHCP-Server and DNS-Forwarder for NAT Routers

Server Settings

General Settings | **Resolv and Hosts Files** | DHCP Settings | Advanced Settings

Use `/etc/ethers` ☒ **Read** `/etc/ethers` to configure the DHCP-Server

Leasefile: File where given DHCP-leases will be stored

Ignore resolve file: ☐

Resolve file: local DNS file

Ignore Hosts file: ☐

Additional Hosts file:

The resolv and host files section

Web Field/UCI/Package Option	Description	
Web: Use /etc/ethers	Defines whether static lease entries are read from /etc/ethers.	
UCI: dhcp@dnsmasq[0].readethers	0	Disabled
Opt: readethers	Default: 1	Enabled
Web: Leasefile	Defines the file where given DHCP leases will be stored. The DHCP lease file allows leases to be picked up again if dnsmasq is restarted.	
UCI: dhcp@dnsmasq[0].leasefile	Default	/tmp/dhcp.leases
Opt: leasefile	Range	
Web: Ignore resolve file	Defines whether to use the local DNS file for resolving DNS.	
UCI: dhcp@dnsmasq[0].noresolv	Default: 0	Use local DNS file
Opt: noresolv	1	Ignore local DNS file
Web: Resolve file	Defines the local DNS file.	
UCI: dhcp@dnsmasq[0].resolvfile	Default	/tmp/resolv.conf.auto
Opt: resolvfile	Range	
Web: Ignore Hosts files	Defines whether to use local host's files for resolving DNS.	
UCI: dhcp@dnsmasq[0].nohosts	Default: 0	Use local hosts file
Opt: nohosts	1	Ignore local hosts file
Web: Additional Hosts files	Defines local host's files. When using UCI multiple servers should be entered with a space between them.	
UCI: dhcp@dnsmasq[0].addnhosts		
Opt: list addnhosts		

26.2.3. Dnsmasq: TFTP Settings

DHCP and DNS

Dnsmasq is a combined DHCP-Server and DNS-Forwarder for NAT firewalls

Server Settings

General Settings

Resolv and Hosts Files

TFTP Settings

Advanced Settings

Enable TFTP server

☒

TFTP server root

Root directory for files served via TFTP

Network boot image

Filename of the boot image advertised to clients

The TFTP settings section

Web Field/UCI/Package Option	Description				
Web: Enable TFTP server UCI: dhcp@dnsmasq[0].enable_tftp Opt: enable_tftp	Enables the TFTP server. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: TFTP server Root UCI: dhcp@dnsmasq[0].tftp_root Opt: tftp_root	Defines root directory for file served by TFTP.				
Web: Network boot image UCI: dhcp@dnsmasq[0].dhcp_boot Opt: dhcp_boot	Defines the filename of the boot image advertised to clients. This specifies BOOTP options, in most cases just the file name.				

26.2.4. Dnsmasq: Advanced Settings

DHCP and DNS

Dnsmasq is a combined [DHCP-Server](#) and [DNS-Forwarder](#) for [NAT](#) firewalls

Server Settings

General Settings

Resolve and Hosts Files

TFTP Settings

Advanced Settings

Filter private

☒

Do not forward reverse lookups for local networks

Filter useless

☐

Do not forward requests that cannot be answered by public name servers

Localise queries

☒

Localise hostname depending on the requesting subnet if multiple IPs are available

Expand hosts

☒

Add local domain suffix to names served from hosts files

No negative cache

☐

Do not cache negative replies, e.g. for not existing domains

Strict order

☐

DNS servers will be queried in the order of the resolvfile

Bogus NX Domain Override

List of hosts that supply bogus NX domain results

DNS server port

Listening port for inbound DNS queries

DNS query port

Fixed source port for outbound DNS queries

Max. DHCP leases

Maximum allowed number of active DHCP leases

Max. EDNS0 packet size

Maximum allowed size of EDNS0 UDP packets

Max. concurrent queries

Maximum allowed number of concurrent DNS queries

The advanced settings page

Merlin 4100 Management Guide

281

Web Field/UCI/Package Option	Description				
Web: Filter private UCI: dhcp.@dnsmasq[0]. Opt: boguspriv	Enables disallow option for forwarding reverse lookups for local networks. This rejects reverse lookups to private IP ranges where no corresponding entry exists in /etc/hosts. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled
0	Disabled				
Default: 1	Enabled				
Web: Filter useless UCI: dhcp.@dnsmasq[0].filterwin2k Opt: filterwin2k	Enables disallow option for forwarding requests that cannot be answered by public name servers. Normally enabled for dial on demand interfaces. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Localise queries UCI: dhcp.@dnsmasq[0].localise_queries Opt: localise_queries	Defines whether to use an IP address to match the incoming interface if multiple addresses are assigned to a host name in /etc/hosts.				
Web: Expand hosts UCI: dhcp.@dnsmasq[0].expandhosts Opt: expandhosts	Adds a local domain suffix to names served from host files. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled
0	Disabled				
Default: 1	Enabled				
Web: No negative cache UCI: dhcp.@dnsmasq[0].nonegcache Opt: nonegcache	Enable this to stop caching of negative replies. For example, non- existing domains. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Strict order UCI: dhcp.@dnsmasq[0].strictorder Opt: strictorder	Enable this to query DNS servers in the order of the resolve file. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Bogus NX Domain override UCI: dhcp.@dnsmasq[0].bogusnxdomain Opt: list bogusnxdomain	A list of hosts that supply bogus NX domain results. When using UCI multiple servers, enter the server names with a space between them. <table> <tr> <td>Default</td><td>Empty list</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	Empty list	Range	0-65535
Default	Empty list				
Range	0-65535				
Web: DNS server port UCI: dhcp.@dnsmasq[0].port Opt: port	Listening port for inbound DNS queries. <table> <tr> <td>Default: 53</td><td>Set to 0 to disable DNS functionality.</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default: 53	Set to 0 to disable DNS functionality.	Range	0-65535
Default: 53	Set to 0 to disable DNS functionality.				
Range	0-65535				
Web: DNS query port UCI: dhcp.@dnsmasq[0].queryport Opt: queryport	Defines fixed source port for outbound DNS queries. <table> <tr> <td>Default</td><td>Any</td></tr> <tr> <td>Range</td><td>any; 0-65535</td></tr> </table>	Default	Any	Range	any; 0-65535
Default	Any				
Range	any; 0-65535				
Web: Max DHCP leases UCI: dhcp.@dnsmasq[0].dhcpleasemax Opt: dhcpleasemax	Defines the maximum allowed number of active DHCP leases. <table> <tr> <td>Default</td><td>unlimited</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	unlimited	Range	
Default	unlimited				
Range					
Web: Max EDNS0 packet size UCI: dhcp.@dnsmasq[0].ednspacket_max Opt: ednspacket_max	Defines the maximum allowed size of EDNS.0 UDP packets in bytes. <table> <tr> <td>Default</td><td>1280 bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	1280 bytes	Range	
Default	1280 bytes				
Range					
Web: Max concurrent queries UCI: dhcp.@dnsmasq[0].dnsforwardmax Opt: dnsforwardmax	Maximum allowed number of concurrent DNS queries. <table> <tr> <td>Default: 150</td><td>1280 bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default: 150	1280 bytes	Range	
Default: 150	1280 bytes				
Range					

26.2.5. Active Leases



The active leases section

This section displays all currently active leases.

Web Field/UCI/Package Option	Description
Web: Hostname UCI: n/a Opt: n/a	Displays the hostname of the client.
Web: IPv4 Address UCI: n/a Opt: n/a	Displays the IP address of the client.
Web: MAC Address UCI: n/a Opt: n/a	Displays the MAC address of the client.
Web: Lease time remaining UCI: n/a Opt: n/a	Displays the remaining lease time.

26.2.6. Static Leases: DHCP Server And DNS

Use static leases to assign fixed IP addresses and symbolic hostnames to DHCP clients. Static leases are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served. Click **Add** to add a new lease entry.



The static leases section

Web Field/UCI/Package Option	Description				
Web: Hostname UCI: dhcp.@host[0].name Opt: name	Defines the optional symbolic name to assign to this static DHCP entry. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: MAC Address UCI: dhcp.@host[0].mac Opt: mac	Defines the hardware address that identifies the host.				
Web: IPv4 Address UCI: dhcp.@host[0].ip Opt: ip	The IPv4 address specifies the fixed address to use for this host.				

26.2.7. Configuring DHCP Pools Using The Web Interface

DHCP pools are configured via the interface configuration.

Select **Network -> Interfaces**. Choose the interface you want to add the DHCP pool to and select **Edit**. Scroll to **DHCP Server** section.

Note: this section is only available for interfaces with a static IP address. To assign a DHCP Server to the interface, click **Setup DHCP Server**.

DHCP Server

No DHCP Server configured for this interface
Setup DHCP Server

The DHCP server settings

The DHCP Server configuration options will appear. The DHCP Server is divided into two sub sections: General Setup and Advanced Settings.

DHCP Server

General Setup
Advanced Settings

Ignore interface
☐
☒ Disable DHCP for this interface

Mode
DHCPv4
Mode of operation

Start
100
Lowest leased address as offset from the network address

Limit
150
Maximum number of leased addresses

Leasetime
12h
Expiry time of leased addresses, minimum is 2 Minutes (2m)

DHCP server advanced settings page

Web Field/UCI/Package Option	Description															
Web: Ignore interface UCI: dhcp.@dhcp[x].ignore Opt: ignore	Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled											
Default: 0	Disabled															
1	Enabled															
Web: Mode UCI: dhcp.@dhcp[x].mode Opt: mode	Defines whether the DHCP pool should be enabled for this interface. If not specified for the DHCP pool then the default is disabled i.e. dhcp pool enabled. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: DHCPv4</td><td>DHCP for IPv4</td><td>ipv4</td></tr><tr><td>DHCPv6</td><td>DHCP for IPv6</td><td>ipv6_dhcp</td></tr><tr><td>IPv6 Router Advertisements</td><td>IPv6 RA</td><td>ipv6_ra</td></tr><tr><td>DHCPv6 Prefix Delegation</td><td>DHCPv6 prefix delegation</td><td>ipv6_pd</td></tr></table>	Web	Description	UCI	Default: DHCPv4	DHCP for IPv4	ipv4	DHCPv6	DHCP for IPv6	ipv6_dhcp	IPv6 Router Advertisements	IPv6 RA	ipv6_ra	DHCPv6 Prefix Delegation	DHCPv6 prefix delegation	ipv6_pd
Web	Description	UCI														
Default: DHCPv4	DHCP for IPv4	ipv4														
DHCPv6	DHCP for IPv6	ipv6_dhcp														
IPv6 Router Advertisements	IPv6 RA	ipv6_ra														
DHCPv6 Prefix Delegation	DHCPv6 prefix delegation	ipv6_pd														
Web: Start UCI: dhcp.@dhcp[x].start Opt: start	Defines the offset from the network address for the start of the DHCP pool. Example: for network address 192.168.100.10/24, start=100, DHCP allocation pool will start at 192.168.100.100. For subnets greater than /24, it may be greater than 255 to span subnets. Alternatively, specify in IP address notation using the wildcard '0' where the octet is required to inherit bits from the interface IP address. Example: to define a DHCP scope starting from 10.1.20.0 on an interface with 10.1.0.0/16 address, set start to 0.0.20.1 <table><tr><td>Default</td><td>100</td></tr><tr><td>Range</td><td></td></tr></table>	Default	100	Range												
Default	100															
Range																
Web: Limit UCI: dhcp.@dhcp[x].limit Opt: limit	Defines the size of the address pool. Example: For network address 192.168.100.10/24, start=100, limit=150, DHCP allocation pool will be .100 to .249 <table><tr><td>Default: 150</td><td>Limits DHCP allocation pool to 50 available addresses</td></tr><tr><td>Range</td><td>0-255</td></tr></table>	Default: 150	Limits DHCP allocation pool to 50 available addresses	Range	0-255											
Default: 150	Limits DHCP allocation pool to 50 available addresses															
Range	0-255															
Web: Leasetime UCI: dhcp.@dhcp[x].leasetime Opt: leasetime	Defines the lease time of addresses handed out to clients, for example 12h or 30m. <table><tr><td>Default</td><td>12 hours</td></tr><tr><td>Range</td><td></td></tr></table>	Default	12 hours	Range												
Default	12 hours															
Range																
Web: n/a UCI: dhcp.@dhcp[x].interface Opt: interface	Defines the interface that is served by this DHCP pool. This must be one of the configured interfaces. When configured through the web UI this will be automatically populated with the interface name.															

DHCP Server: Advanced Settings

DHCP Server

General Setup

Advanced Settings

Dynamic DHCP

☒ Dynamically allocate DHCP addresses for clients. If disabled, only clients having static leases will be served.

Force

☐ Force DHCP on this network even if another server is detected.

IPv4-Netmask

Override the netmask sent to clients. Normally it is calculated from the subnet that is served.

DHCP-Options

Define additional DHCP options, for example "6,192.168.2.1,192.168.2.2" which advertises different DNS servers to clients.

The DHCP server advanced settings section

Web Field/UCI/Package Option	Description				
Web: Dynamic DHCP UCI: dhcp@dhcp[x].dynamicdhcp Opt: dynamicdhcp	Defines whether to dynamically allocate DHCP leases. <table> <tr> <td>Default 1</td><td>Dynamically allocate leases</td></tr> <tr> <td>0</td><td>Use /etc/ethers file for serving DHCP leases</td></tr> </table>	Default 1	Dynamically allocate leases	0	Use /etc/ethers file for serving DHCP leases
Default 1	Dynamically allocate leases				
0	Use /etc/ethers file for serving DHCP leases				
Web: Force UCI: dhcp@dhcp[x].force Opt: force	Forces DHCP serving on the specified interface even if another DHCP server is detected on the same network segment. <table> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: IPv4-Netmask UCI: dhcp@dhcp[x].netmask Opt: netmask	Defines a netmask sent to clients that overrides the netmask as calculated from the interface subnet. <table> <tr> <td>Default</td><td>Use netmask from interface subnet</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Use netmask from interface subnet	Range	
Default	Use netmask from interface subnet				
Range					
Web: DHCP-Options UCI: dhcp@dhcp[x].dhcp_option Opt: list dhcp_option	Defines additional options to be added for this dhcp pool. For example, with 'list dhcp_option 26,1470' or 'list dhcp_option mtu, 1470' you can assign a specific MTU per DHCP pool. Your client must accept the MTU option for this to work. Options that contain multiple values should be separated by a comma. Example: list dhcp_option 6,192.168.2.1,192.168.2.2 <table> <tr> <td>Default</td><td>No options defined</td></tr> <tr> <td>Syntax</td><td>Option_number, option_value</td></tr> </table>	Default	No options defined	Syntax	Option_number, option_value
Default	No options defined				
Syntax	Option_number, option_value				
Web: n/a UCI: dhcp@dhcp[x].networkid Opt: networkid	Assigns a network-id to all clients that obtain an IP address from this pool. <table> <tr> <td>Default</td><td>Use network from interface subnet</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	Use network from interface subnet	Range	
Default	Use network from interface subnet				
Range					

26.3. Configuring DHCP And DNS Using Command Line

Possible section types of the DHCP configuration file include Common Options (dnsmasq), DHCP Pools (dhcp) and Static Leases (host). Not all types may appear in the file and most of them are only needed for special configurations.

The configuration section type **dnsmasq** determines values and options relevant to the overall operation of dnsmasq and the DHCP options on all interfaces served.

26.3.1. Configuring Static Leases Using Command Line

Static leases are configured under the **dhcp** package, stored at **/etc/config/dhcp**. By default, all static leases instances are named **host**. The static lease is identified by **@host** then the static lease position in the package as a number. For example, for the first static lease in the package using UCI:

```
dhcp.@host[0]=dhcp
dhcp.@host[0].name=mypc
```

Or using package options:

```
config host
option name 'mypc'
```

However, to better identify, it is recommended to give the static lease instance a name. For example, to create a static instance named **mypc**.

To define a named static lease instance using UCI, enter:

```
dhcp.mypc=host
dhcp.mypc.name=mypc
```

To define a named static lease instance using package options, enter:

```
config dhcp 'mypc'
option name 'mypc'
```

The following examples using UCI and package options add the fixed IP address **192.168.1.2** and the name **"mypc"** for a machine with the (Ethernet) hardware address **00:11:22:33:44:55**.

Example of Static Leases using UCI

```
root@VA_router:~# uci show dhcp.mypc
dhcp.mypc=host
dhcp.mypc.ip=192.168.1.2
dhcp.mypc.mac=00:11:22:33:44:55
dhcp.mypc.name=mypc
```

Example of Static Leases using Package Options

```
root@VA_router:~# uci export dhcp package dhcp
####
config host 'mypc'
option ip '192.168.1.2'
option mac '00:11:22:33:44:55'
option name 'mypc'
```

26.3.2. Configuring DHCP Pools Using Command Line

DHCP pools are configured under the **dhcp** package, stored at **/etc/config/dhcp**.

Sections of the type **dhcp** specify per interface lease pools and settings. Typically, there is at least one section of this type present in the `/etc/config/dhcp` file to cover the LAN interface.

You can disable a lease pool for a specific interface by specifying the `ignore` option in the corresponding section.

You can configure multiple dhcp pools.

By default, all dhcp pool instances are named 'dhcp'. The instance is identified by `@dhcp` then the dhcp pool position in the package as a number. For example, for the first dhcp pool in the package using UCI:

```
dhcp.@dhcp[0]=dhcp
dhcp.@dhcp[0].interface=LAN
```

Or using package options:

```
config dhcp
option interface 'LAN'
```

However, to better identify, it is recommended to give the dhcp pool instance a name. For example, to create a dhcp pool instance named LAN.

To define a named dhcp pool instance using UCI, enter:

```
dhcp.LAN=dhcp
dhcp.LAN.interface=LAN
```

To define a named dhcp pool instance using package options, enter:

```
config dhcp 'LAN'
option interface 'LAN'
```

Configuring DHCP pools using UCI

```
root@VA_router:~# uci show dhcp.LAN
dhcp.LAN=dhcp
dhcp.LAN.interface=lan
dhcp.LAN.start=100
dhcp.LAN.limit=150
dhcp.LAN.lease_time=12h
dhcp.LAN.ignore=0
```

Configuring DHCP pools using package options

```
root@VA_router:~# uci export dhcp
package dhcp
::..
config 'dhcp' 'LAN'
option 'interface' 'LAN' option 'start' '100' option 'limit' '150' option 'lease_time' '12h' option ignore 0
```


27. Configuring DHCP Client

This section describes how to configure an interface as a DHCP client. This section will only detail the configuration for DHCP client. For information on how to configure other interface options such as firewall zone, mapping of switch ports, etc, read the standard interface configuration document.

Configuration Packages Used

Package	Sections
Network	interface

27.1. Configuring DHCP Client Using The Web Interface

DHCP client is configured under the interface configuration by setting the interface protocol to DHCP Client. To create and edit interfaces via the web interface, in the top menu, click **Network -> Interfaces**. The Interfaces overview page appears.

[illegible]

The interfaces overview page

There are three sections in the Interfaces page.

Section	Description
Interface Overview	Shows existing interfaces and their status. You can create new, and edit existing interfaces here.
Port Map	In this section you can map device ports to Ethernet interfaces. Ports are marked with capital letters starting with 'A'. Type in space-separated port character in the port map fields.
ATM Bridges	ATM bridges expose encapsulated Ethernet in AAL5 connections as virtual Linux network interfaces, which can be used in conjunction with DHCP or PPP to dial into the provider network.

Edit an Existing Interface for DHCP Client

To edit an existing interface, from the interface tabs at the top of the page, select the interface you wish to configure. Alternatively, click **Edit** in the interface’s row.

27.1.1. Creating A New Interface For DHCP Client

To create a new interface, in the Interface Overview section, click **Add new interface**. The Create Interface page appears.

Create Interface

Name of the new interface

LAN

The allowed characters are: 0-9, a-z, 0-6 and

Protocol of the new interface

DHCP client

Create a bridge over multiple interfaces

Cover the following interface

☒ Ethernet Adapter "eth0"

☐ Ethernet Adapter "eth1" (lan2)

☐ Ethernet Adapter "eth2"

☐ Ethernet Adapter "eth3"

☐ Ethernet Adapter "eth4"

☐ Ethernet Adapter "eth5"

☐ Ethernet Adapter "eth6"

☐ Ethernet Adapter "eth7"

☐ Ethernet Adapter "lo" (loopback)

☐ Ethernet Adapter "wg0"

☐ Ethernet Adapter "tun0"

☐ Custom Interface

Note: If you select an interface in this menu which is already a part of another network, it will be moved from that network to this network.

Back to Overview

Submit

The create interface page

Web Field/UCI/Package Option	Description																																							
Web: Name of the new interface UCI: network.<if name> Opt: config interface	Assigns a logical name to the interface. The network interface section will assign this name (<if name>). Type the name of the new interface. Allowed characters are A-Z, a-z, 0-9 and _																																							
Web: Protocol of the new interface UCI: network.<if name>.proto Opt: proto	Specifies what protocol the interface will operate on. Select DHCP Client <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Static</td><td>static configuration with fixed address and netmask.</td><td>static</td></tr><tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP</td><td>dhcp</td></tr><tr><td>Unmanaged</td><td>Unspecified</td><td>Empty</td></tr><tr><td>IPv6-inIPv4 (RFC4213)</td><td>Used with tunnel brokers</td><td></td></tr><tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport</td><td></td></tr><tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td></td></tr><tr><td>IOT</td><td></td><td></td></tr><tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td></td></tr><tr><td>PPP</td><td>Point to Point Protocol</td><td></td></tr><tr><td>PPPoE</td><td>PPP over Ethernet</td><td></td></tr><tr><td>PPPoATM</td><td>PPP over ATM</td><td></td></tr><tr><td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem</td><td></td></tr></table>	Option	Description	UCI	Static	static configuration with fixed address and netmask.	static	DHCP Client	Address and netmask are assigned by DHCP	dhcp	Unmanaged	Unspecified	Empty	IPv6-inIPv4 (RFC4213)	Used with tunnel brokers		IPv6-over-IPv4	Stateless IPv6 over IPv4 transport		GRE	Generic Routing Encapsulation protocol		IOT			L2TP	Layer 2 Tunnelling Protocol		PPP	Point to Point Protocol		PPPoE	PPP over Ethernet		PPPoATM	PPP over ATM		LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem	
Option	Description	UCI																																						
Static	static configuration with fixed address and netmask.	static																																						
DHCP Client	Address and netmask are assigned by DHCP	dhcp																																						
Unmanaged	Unspecified	Empty																																						
IPv6-inIPv4 (RFC4213)	Used with tunnel brokers																																							
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport																																							
GRE	Generic Routing Encapsulation protocol																																							
IOT																																								
L2TP	Layer 2 Tunnelling Protocol																																							
PPP	Point to Point Protocol																																							
PPPoE	PPP over Ethernet																																							
PPPoATM	PPP over ATM																																							
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem																																							
Web: Create a bridge over multiple interfaces UCI: network.<if name>.type Opt: type	If you select this option, then the new logical interface created will act as a bridging interface between the chosen existing physical interfaces. <table><tr><td>Default</td><td>Empty</td></tr><tr><td>Bridge</td><td>Configures a bridge over multiple interfaces</td></tr></table>	Default	Empty	Bridge	Configures a bridge over multiple interfaces																																			
Default	Empty																																							
Bridge	Configures a bridge over multiple interfaces																																							
Web: Cover the following interface UCI: network.<if name>.ifname Opt: ifname	Physical interface name to assign to this logical interface. If creating a bridge over multiple interfaces select two interfaces to bridge. When using UCI, the interface names should be separated by a space e.g. option ifname 'eth2 eth3'.																																							

Click **Submit**. The Interface configuration page appears. There are three sections:

Section	Description
Common Configuration	Configure the interface settings such as protocol, IP address, gateway, netmask, custom DNS servers, MTU and firewall configuration.
IP-Aliases	Assign multiple IP addresses to the interface.
DHCP Server	Configure DHCP server settings for this interface.

27.2. Common Configuration

The Common Configuration section has four sub-sections.

Section	Description
General Setup	Configure the basic interface settings such as protocol, IP address, gateway, netmask, custom DNS servers.
Advanced Settings	'Bring up on boot', 'Monitor interface state', Override MAC address, Override MTU and 'Use gateway metric'.
Physical Settings	Bridge interfaces, VLAN PCP to SKB priority mapping.
Firewall settings	Assign a firewall zone to the interface.

Only General Setup and Advanced Settings have DHCP client option configuration options.

27.2.1. Common Configuration: General Setup

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Status

eth3

MAC Address: 00:8D:C8:03:18:20
RX: 0.00 B (0 Pkts.)
TX: 0.00 B (0 Pkts.)

Protocol

DHCP client

Hostname to send when requesting DHCP

ml_router

Accept router advertisements

☐

Send router solicitations

☐

The interface general setup configuration page for DHCP client protocol

Web Field/UCI/Package Option	Description																																							
Web: Status	Shows the current status of the interface.																																							
Web: Protocol UCI: network.<if name>.proto Opt: proto	Protocol type. The interface protocol may be one of the options shown below. The protocol selected in the previous step will be displayed as default but can be changed if required. Select DHCP Client. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Static</td><td>static configuration with fixed address and netmask.</td><td>static</td></tr><tr><td>DHCP Client</td><td>Address and netmask are assigned by DHCP</td><td>dhcp</td></tr><tr><td>Unmanaged</td><td>Unspecified</td><td>Empty</td></tr><tr><td>IPv6-inIPv4 (RFC4213)</td><td>Used with tunnel brokers</td><td></td></tr><tr><td>IPv6-over-IPv4</td><td>Stateless IPv6 over IPv4 transport</td><td></td></tr><tr><td>GRE</td><td>Generic Routing Encapsulation protocol</td><td></td></tr><tr><td>IOT</td><td></td><td></td></tr><tr><td>L2TP</td><td>Layer 2 Tunnelling Protocol</td><td></td></tr><tr><td>PPP</td><td>Point to Point Protocol</td><td></td></tr><tr><td>PPPoE</td><td>PPP over Ethernet</td><td></td></tr><tr><td>PPPoATM</td><td>PPP over ATM</td><td></td></tr><tr><td>LTE/UMTS/GPRS/EV-DO</td><td>CDMA, UMTS or GPRS connection using an AT-style 3G modem</td><td></td></tr></table>	Option	Description	UCI	Static	static configuration with fixed address and netmask.	static	DHCP Client	Address and netmask are assigned by DHCP	dhcp	Unmanaged	Unspecified	Empty	IPv6-inIPv4 (RFC4213)	Used with tunnel brokers		IPv6-over-IPv4	Stateless IPv6 over IPv4 transport		GRE	Generic Routing Encapsulation protocol		IOT			L2TP	Layer 2 Tunnelling Protocol		PPP	Point to Point Protocol		PPPoE	PPP over Ethernet		PPPoATM	PPP over ATM		LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem	
Option	Description	UCI																																						
Static	static configuration with fixed address and netmask.	static																																						
DHCP Client	Address and netmask are assigned by DHCP	dhcp																																						
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IPv6-inIPv4 (RFC4213)	Used with tunnel brokers																																							
IPv6-over-IPv4	Stateless IPv6 over IPv4 transport																																							
GRE	Generic Routing Encapsulation protocol																																							
IOT																																								
L2TP	Layer 2 Tunnelling Protocol																																							
PPP	Point to Point Protocol																																							
PPPoE	PPP over Ethernet																																							
PPPoATM	PPP over ATM																																							
LTE/UMTS/GPRS/EV-DO	CDMA, UMTS or GPRS connection using an AT-style 3G modem																																							
Web: Hostname to send when requesting DHCP UCI: network.<if name>.hostname Opt: hostname	Defines the hostname to include in DHCP requests																																							
Web: Accept router advertisements UCI: network.<if name>.accept_ra Opt: accept_ra	Specifies whether to accept IPv6 Router Advertisements on this interface (optional). Note: default is 1 if protocol is set to DHCP, otherwise the setting defaults to 0. <table><tr><td>0</td><td>Does not accept IPv6 router advertisements</td></tr><tr><td>Default</td><td>Accepts IPv6 router advertisements</td></tr></table>	0	Does not accept IPv6 router advertisements	Default	Accepts IPv6 router advertisements																																			
0	Does not accept IPv6 router advertisements																																							
Default	Accepts IPv6 router advertisements																																							
Web: Send router solicitations UCI: network.<if name>.send_rs Opt: send_rs	Specifies whether to send router solicitations on this interface (optional). Note: defaults to 1 for static protocol, otherwise the setting defaults to 0. <table><tr><td>Default 0</td><td>Does not send router solicitations</td></tr><tr><td>1</td><td>Sends router solicitations</td></tr></table>	Default 0	Does not send router solicitations	1	Sends router solicitations																																			
Default 0	Does not send router solicitations																																							
1	Sends router solicitations																																							

27.2.2. Common Configuration: Advanced Settings

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Bring up on boot

☒

Monitor interface state

☐

This interface state would be reported to VA Monitor via `keep-alive`

Use broadcast flag

☐

Required for certain ISPs, e.g. Charter with DOCSIS 3

Use default gateway

☒

If unchecked, no default route is configured

Use DNS servers advertised by peer

☒

If unchecked, the advertised DNS server addresses are ignored

Use gateway metric

Client ID to send when requesting DHCP

Vendor Class to send when requesting DHCP

Override MAC address

Override MTU

Dependant interfaces

☐ ADSL

☐ LAN2

The interface advanced settings page for DHCP client protocol

Web Field/UCI/Package Option	Description				
Web: Bring up on boot UCI: network.<if name>.auto Opt: auto	Enables the interface to connect automatically on boot up. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Monitor interface state UCI: network.<if name>.monitored Opt: monitored	Enabled if the status of the interface is presented on the monitoring platform. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Use broadcast flag UCI: network.<if name>.broadcast Opt: broadcast	Enables the broadcast flag in DHCP requests (required for certain ISPs). <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Use default gateway UCI: network.<if name>.gateway Opt: gateway	Defines whether to suppress the DHCP assigned default gateway. When disabled via web option, the gateway is set to 0.0.0.0. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	0	Disabled	1	Enabled
0	Disabled				
1	Enabled				
Web: Use DNS servers advertised by peer UCI: n/a Opt: n/a	Defines whether to override DHCP assigned DNS servers with configured list of DNS servers. When unchecked allows configuration of custom DNS servers via web. There is no uci option set when checking or unchecking this option.				
Web: Use custom DNS servers UCI: network.<if name>.dns Opt: dns	Defines whether to override DHCP assigned DNS servers with configured list of DNS servers. Multiple DNS Servers are separated by a space if using UCI. Example: option dns '1.1.1.1 2.2.2.2' <table border="1"> <tr><td>Default: 0</td><td>Disabled. (option gateway set to 0.0.0.0)</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled. (option gateway set to 0.0.0.0)	1	Enabled
Default: 0	Disabled. (option gateway set to 0.0.0.0)				
1	Enabled				
Web: Use gateway metric UCI: network.<if name>.metric Opt: metric	Specifies the default route metric to use for this interface. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default: 0	Disabled	Range	
Default: 0	Disabled				
Range					
Web: Client ID to send when requesting DHCP UCI: network.< name> clientid Opt: clientid	Defines whether to override the client identifier in DHCP requests. <table border="1"> <tr><td>Default</td><td>Blank. Do not override</td></tr> <tr><td>Range</td><td>Override</td></tr> </table>	Default	Blank. Do not override	Range	Override
Default	Blank. Do not override				
Range	Override				
Web: Vendor Class to send when requesting DHCP UCI: network.<name>.vendorid Opt: vendorid	Defines whether to override the vendor class in DHCP requests <table border="1"> <tr><td>Default</td><td>Blank. Do not override</td></tr> <tr><td>Range</td><td>Override</td></tr> </table>	Default	Blank. Do not override	Range	Override
Default	Blank. Do not override				
Range	Override				
Web: Override MAC address UCI: network.< name>.macaddr Opt: macaddr	Overrides the MAC address assigned to this interface. Must be in the form: hh:hh:hh:hh:hh:hh, where h is a hexadecimal number.				
Web: Override MTU UCI: network.<name>.mtu Opt: mtu	Defines the value to override the default MTU on this interface. 1500 1500 bytes <table border="1"> <tr><td>Default</td><td>1500 bytes</td></tr> </table>	Default	1500 bytes		
Default	1500 bytes				
Web: Dependant Interfaces UCI: network.[if_name].dependants	Lists interfaces that are dependant on this parent interface. Dependant interfaces will go down when the parent interface is down and will start or restart when the parent interface starts.				

Web Field/UCI/Package Option	Description										
Opt: dependants	Separate multiple interfaces by a space when using UCI. Example: option dependants 'PPPADSL MOBILE' This replaces the following previous options in child interfaces. <table border="1"> <tr><td>gre</td><td>option local_interface</td></tr> <tr><td>lt2p</td><td>option src_ipaddr</td></tr> <tr><td>iot</td><td>option wan1 wan2</td></tr> <tr><td>6in4</td><td>option ipaddr</td></tr> <tr><td>6to4</td><td>option ipaddr</td></tr> </table>	gre	option local_interface	lt2p	option src_ipaddr	iot	option wan1 wan2	6in4	option ipaddr	6to4	option ipaddr
gre	option local_interface										
lt2p	option src_ipaddr										
iot	option wan1 wan2										
6in4	option ipaddr										
6to4	option ipaddr										
Web: SNMP Alias ifIndex UCI: network.@interface[X].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface, that can be polled using via the SNMP interface index (snmp_alias_ifindex+1000) <table border="1"> <tr><td>Blank</td><td>No SNMP interface alias index</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Blank	No SNMP interface alias index	1	Enabled						
Blank	No SNMP interface alias index										
1	Enabled										

27.3. Configuring DHCP Client Using Command Line

The configuration files for DHCP client are stored on **/etc/config/network**

DHCP Client using UCI

```

root@VA_router:~# uci show network
network.DHCPCLIENTLAN=interface
network.DHCPCLIENTLAN.proto=dhcp
network.DHCPCLIENTLAN.ifname=eth3
network.DHCPCLIENTLAN.monitored=0
network.DHCPCLIENTLAN.broadcast=0
network.DHCPCLIENTLAN.accept_ra=1
network.DHCPCLIENTLAN.send_rs=0
network.DHCPCLIENTLAN.metric=1

```

DHCP client using Package Options

```

root@VA_router:~# uci export network package network
config interface 'DHCPCLIENTLAN'
option proto 'dhcp'
option ifname 'eth3'
option monitored '0'
option broadcast '0'
option accept_ra '1'
option send_rs '0'
option metric '1'

```


27.4. DHCP Client Diagnostics

Interface Status

To view the IP address of DHCP client interface, enter:

```
3g-CDMA Link encap:Point-to-Point Protocol
inet addr:10.33.152.100 P-t-P:178.72.0.237 Mask:255.255.255.255
UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1400 Metric:1
RX packets:6 errors:0 dropped:0 overruns:0 frame:0
TX packets:23 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:3
RX bytes:428 (428.0 B) TX bytes:2986 (2.9 KiB)

eth0 Link encap:Ethernet HWaddr 00:E0:C8:12:12:15
inet addr:192.168.100.1 Bcast:192.168.100.255
Mask:255.255.255.0
inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link
```

```
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:6645 errors:0 dropped:0 overruns:0 frame:0 TX packets:523 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:1000
RX bytes:569453 (556.1 KiB) TX bytes:77306 (75.4 KiB)

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0 inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:16436 Metric:1
RX packets:385585 errors:0 dropped:0 overruns:0 frame:0 TX packets:385585 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:0
RX bytes:43205140 (41.2 MiB) TX bytes:43205140 (41.2 MiB)
```

To display a specific interface, enter:

```
root@VA_router:~# ifconfig eth0
eth0 Link encap:Ethernet HWaddr 00:E0:C8:12:12:15 inet addr:192.168.100.1 Bcast:192.168.100.255
Mask:255.255.255.0
inet6 addr: fe80::2e0:c8ff:fe12:1215/64 Scope:Link UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:7710 errors:0 dropped:0 overruns:0 frame:0 TX packets:535 errors:0 dropped:0 overruns:0 carrier:0 collisions:0
txqueuelen:1000
RX bytes:647933 (632.7 KiB) TX bytes:80978 (79.0 KiB)
```

ARP Table Status

```
root@VA_router:~# arp
? (10.67.253.141) at 30:30:41:30:43:36 [ether] on eth8
? (10.47.48.1) at 0a:44:b2:06 [ether] on gre-gre1
```

Route Status

root@VA_router:~# route -n							
Kernel IP routing table							
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
192.168.100.0	*	255.255.255.0	U	0	0	0	eth0



NOTE

A route will only be displayed in the routing table when the interface is up.

28. Configuring DHCP Forwarding

This section describes how to configure the router to forward DHCP requests from an interface to a network DHCP server.

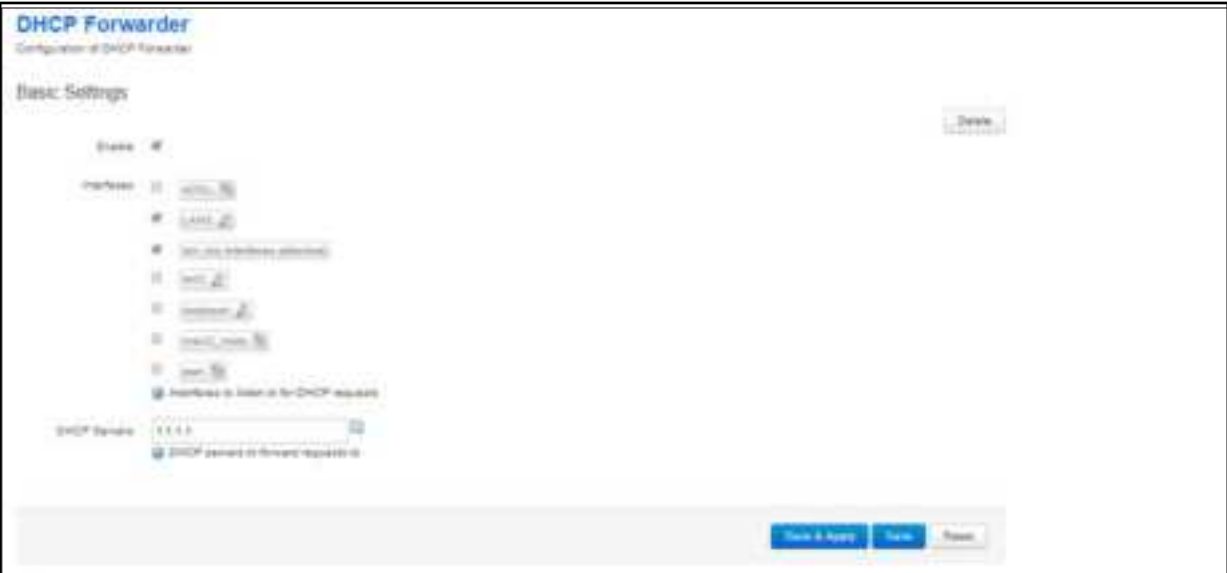
Configuration Packages Used

Package	Sections
dhcp_fwd	dhcpfwd

28.1. Configuring DHCP Using The Web Interface

To configure DHCP forwarding using the web interface, in the top menu, click **Network -> DHCP-Forwarder**.

The DHCP forwarder page appears. The web GUI creates a dhcpfwd section called main so this will be used in the uci examples below.



The DHCP forwarder configuration page

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: dhcp_fwd.main.enabled Opt: enabled	Defines whether DHCP forwarding is enabled or disabled. <table border="1"> <tr> <td>Default: 0</td><td>Do not send router solicitations</td></tr> <tr> <td>1</td><td>Send router solicitations</td></tr> </table>	Default: 0	Do not send router solicitations	1	Send router solicitations
Default: 0	Do not send router solicitations				
1	Send router solicitations				
Web: Interfaces UCI: dhcp_fwd.main.listen_interface Opt: list listen_interface	Defines a list of the source interface name(s) to forward DHCP messages from. Multiple interface_name(s) are entered using uci set and uci add_list commands. Example: <pre>uci set dhcp_fwd.main.listen_interface=LAN1 uci add_list dhcp_fwd.main.listen_interface=LAN2</pre> or using a list of options via package options <pre>list listen_interface 'LAN1' list listen_interface 'LAN2'</pre>				
Web: DHCP Servers UCI: dhcp_fwd.main.server Opt: list server	Defines a list of the network DHCP servers to forward DHCP messages to. Multiple interface_name(s) are entered using uci set and uci add_list commands. Example: <pre>uci set dhcp_fwd.main.server=1.1.1.1 uci add_list dhcp_fwd.main.main.server=2.2.2.2</pre> or using a list of options via package options <pre>list server '1.1.1.1' list server '2.2.2.2'</pre>				

28.2. Configuring DHCP Forwarding Using Command Line

The configuration files for DHCP client are stored in `/etc/config/dhcp_fwd`

DHCP Forwarding using UCI

```
root@VA_router:~# uci show
dhcp_fwd dhcp_fwd.main=dhcpfwd
dhcp_fwd.main.enabled=1
dhcp_fwd.main.listen_interface=LAN3 lan2
dhcp_fwd.main.server=1.1.1.1
```

DHCP Forwarding using Package Options

```
root@VA_router:~# uci export dhcp_fwd
package dhcp_fwd
config dhcpfwd 'main'
option enabled '1'
list listen_interface 'lan2'
list server '1.1.1.1'
```

28.3. DHCP Forwarding Over IPSec

DHCP messages are forwarded over the WAN interface using the IP address of the WAN interface as the source IP for the transmitted packet. This means that when forwarding over an IPSec tunnel a source NAT firewall rule is required to change the source IP to match an IPSec connection rule.

Package	Sections
firewall	redirect

28.3.1. Configuring Source NAT For DHCP Forwarding Over IPSec

To enter a source NAT rule, browse to **Network -> Firewall**. Select **Traffic Rules** tab. The Firewall - Traffic Rules page appears.

Configure a source NAT rule that changes the source IP for UDP destination port 67 from the required LAN.

For more information on configuring a source NAT rule, read the ‘Configuring Firewall’ chapter of this manual.

Source NAT

Source NAT is a specific form of masquerading which allows fine grained control over the source IP used for outgoing traffic, for example to map multiple WANs addressed to internal subnets.

Name	Protocol	Source	Destination	SNAT	Enable	Sort
This section contains no values yet						

New source NAT

Name	Source zone	Destination zone	To source IP	To source port	
DHCPMessages	lan	wan	192.168.100.1	Unset source	Add and edit...

Save & Apply

Save

Reset

The firewall > traffic rules configuration page

Web Field/UCI/Package Option	Description
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select the interface where the DHCP requests are originating .
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select the interface where the DHCP requests are intended to be transmitted .
Web: To source IP UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic source IP. Select the source IP address to match the required IPsec rule .
Web: To source port UCI: firewall.@redirect[X].src_dport Opt: src_dport	Defines the port number to rewrite matched traffic source port number. Leave empty.

Firewall - Traffic Rules - SNAT DHCPMessages

This page allows you to change advanced properties of the traffic rule entry, such as matched source and destination hosts.

Rule is enabled

Name

Protocol You may specify multiple by selecting "> custom >" and then entering protocols separated by space.

Source zone

Web Field/UCI/Package Option	Description																					
Web: Rule is enabled UCI: firewall.@redirect[X].enabled Opt: enabled	Defines whether source NAT rule is enabled. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.																					
Web: Protocol UCI: firewall.@redirect[X].proto Opt: proto	Defines the protocol for the source NAT rule to match. Select UDP . <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>All protocols</td><td>Match all protocols</td><td>all</td></tr><tr><td>TCP+UDP</td><td>Match TCP and UCP protocols</td><td>tcp upd</td></tr><tr><td>TCP</td><td>Match TCP protocol</td><td>tcp</td></tr><tr><td>UCP</td><td>Match UDP protocol</td><td>udp</td></tr><tr><td>ICMP</td><td>Match ICMP protocol</td><td>icmp</td></tr><tr><td>Custom</td><td>Enter custom protocol</td><td></td></tr></table>	Option	Description	UCI	All protocols	Match all protocols	all	TCP+UDP	Match TCP and UCP protocols	tcp upd	TCP	Match TCP protocol	tcp	UCP	Match UDP protocol	udp	ICMP	Match ICMP protocol	icmp	Custom	Enter custom protocol	
Option	Description	UCI																				
All protocols	Match all protocols	all																				
TCP+UDP	Match TCP and UCP protocols	tcp upd																				
TCP	Match TCP protocol	tcp																				
UCP	Match UDP protocol	udp																				
ICMP	Match ICMP protocol	icmp																				
Custom	Enter custom protocol																					
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select the interface where the DHCP requests are originating .																					
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select the interface where the DHCP requests are intended to be transmitted .																					
Web: Destination port UCI: firewall.@redirect[X].port Opt: port	Defines the destination port number to match. Select 67 .																					
Web: SNAT IP address UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic. Select the source IP address to match the required IPSec rule .																					

28.4. Configuring Source NAT For DHCP Forwarding Over IPSec

To enter a source NAT rule, browse to **Network -> Firewall**. Select **Traffic Rules** tab. The Firewall - Traffic Rules page appears.

Configure a source NAT rule that changes the source IP for UDP destination port 67 from the required LAN.

For more information on configuring a source NAT rule, read the 'Configuring Firewall' chapter of this manual.

Source NAT

Source NAT is a specific form of masquerading which allows fine grained control over the source IP used for outgoing traffic, for example to map multiple clients addressed to internal subnets.

Name	Protocol	Source	Destination	SNAT	Enable	Sort
This section contains no values yet						

New source NAT

Name	Source zone	Destination zone	To source IP	To source port	
DhcpMessages	lan	wan	192.168.100.1	Do not rewrite	Add and edit...

Save & Apply

Save

Reset

The firewall > traffic rules configuration page

Web Field/UCI/Package Option	Description
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select the interface where the DHCP requests are originating
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select the interface where the DHCP requests are intended to be transmitted .
Web: To source IP UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic souce IP. Select the source IP address to match the required IPsec rule .
Web: To source port UCI: firewall.@redirect[X].src_dport Opt: src_dport	Defines the port number to rewrite matched traffic souce port number. Leave empty.

Firewall - Traffic Rules - SNAT DHCPMessages

This page allows you to change advanced properties of the traffic rule entry, such as matched source and destination hosts.

Rule is enabled

Name

Protocol ⓘ You may specify multiple by selecting "custom" and then entering protocols separated by space

Source zone

Source MAC address

Source IP address

Source port ⓘ Match incoming traffic originating from the given source port or port range on the client host

Destination zone

Destination IP address

Destination port ⓘ Match forwarded traffic to the given destination port or port range

SNAT IP address ⓘ Rewrite matched traffic to the given address

SNAT port ⓘ Rewrite matched traffic to the given source port. May be left empty to only rewrite the IP address

Extra arguments ⓘ Passes additional arguments to iptables. Use with care!

The firewall > traffic rules > SNAT configuration page

Web Field/UCI/Package Option	Description																					
Web: Rule is enabled UCI: firewall.@redirect[X].enabled Opt: enabled	Defines whether source NAT rule is enabled. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Name UCI: firewall.@redirect[X].name Opt: name	Defines a name for the source NAT rule.																					
Web: Protocol UCI: firewall.@redirect[X].proto Opt: proto	Defines the protocol for the source NAT rule to match. Select UDP . <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>All protocols</td><td>Match all protocols</td><td>all</td></tr><tr><td>TCP+UDP</td><td>Match TCP and UCP protocols</td><td>tcp upd</td></tr><tr><td>TCP</td><td>Match TCP protocol</td><td>tcp</td></tr><tr><td>UCP</td><td>Match UDP protocol</td><td>udp</td></tr><tr><td>ICMP</td><td>Match ICMP protocol</td><td>icmp</td></tr><tr><td>Custom</td><td>Enter custom protocol</td><td></td></tr></table>	Option	Description	UCI	All protocols	Match all protocols	all	TCP+UDP	Match TCP and UCP protocols	tcp upd	TCP	Match TCP protocol	tcp	UCP	Match UDP protocol	udp	ICMP	Match ICMP protocol	icmp	Custom	Enter custom protocol	
Option	Description	UCI																				
All protocols	Match all protocols	all																				
TCP+UDP	Match TCP and UCP protocols	tcp upd																				
TCP	Match TCP protocol	tcp																				
UCP	Match UDP protocol	udp																				
ICMP	Match ICMP protocol	icmp																				
Custom	Enter custom protocol																					
Web: Source Zone UCI: firewall.@redirect[X].src Opt: src	Defines the source interface for the source NAT rule. Select the interface where the DHCP requests are originating .																					
Web: Destination Zone UCI: firewall.@redirect[X].dest Opt: dest	Defines destination interface for the source NAT rule. Select the interface where the DHCP requests are intended to be transmitted .																					
Web: Destination port UCI: firewall.@redirect[X].port Opt: port	Defines the destination port number to match. Select 67 .																					
Web: SNAT IP address UCI: firewall.@redirect[X].src_dip Opt: src_dip	Defines the IP address to rewrite matched traffic. Select the source IP address to match the required IPSec rule .																					

28.5. Configuring Source NAT For DHCP Forwarding Over IPSec Using Command Line

Source NAT for DHCP Forwarding over IPSec using UCI

```
root@VA_router:~# uci show firewall

#####

firewall.@redirect[0]=redirect
firewall.@redirect[0].target=SNAT
firewall.@redirect[0].src=lan
firewall.@redirect[0].dest=wan
firewall.@redirect[0].src_dip=192.168.100.1
firewall.@redirect[0].name=DHCPMessages
firewall.@redirect[0].proto=udp
firewall.@redirect[0].dest_port=67
```

Source NAT for DHCP Forwarding over IPsec using Package Options

```
root@VA_router:~# uci export firewall

package firewall

#####

config redirect
option target 'SNAT'
option src 'lan'
option dest 'wan'
option src_dip '192.168.100.1'
option name 'DHCPMessages'
option proto 'udp'
option dest_port '67'
```

28.6. DHCP Forwarding Diagnostics

Tracing DHCP Packets

To trace DHCP packets on any interface on the router, enter:

```
root@VA_router:~# tcpdump -i any -n -p port 67 &

root@VA_router:~# tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535 bytes
16:39:20.666070 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
16:39:20.666166 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
```

To stop tracing enter **fg** (to bring tracing task to foreground), and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n -p port 67
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```

```
16:39:20.666166 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request
from 00:e0:c8:13:02:3d, length 360
```

ARP Table Status

To show the current ARP table of the router, enter **arp**

```
root@VA_router:~# arp
? (10.67.253.141) at 30:30:41:30:43:36 [ether] on eth8
? (10.47.48.1) at 0a:44:b2:06 [ether] on gre-gre1
```

29. Configuring Dynamic DNS

Dynamic DNS (DDNS) functionality on a Merlin router will dynamically perform DDNS updates to a server so it can associate an IP address with a correctly associated DNS name. Users can then contact a machine, router, device and so on with a DNS name rather than a dynamic IP address.

An account is required with the provider, and one or more domain names are associated with that account. A dynamic DNS client on the router monitors the public IP address associated with an interface and whenever the IP address changes, the client notifies the DNS provider to update the corresponding domain name.

When the DNS provider responds to queries for the domain name, it sets a low lifetime, typically a minute or two at most, on the response so that it is not cached. Updates to the domain name are thus visible throughout the whole internet with little delay.



NOTE

Most providers impose restrictions on how updates are handled: updating when no change of address occurred is considered abusive and may result in an account being blocked. Sometimes, addresses must be refreshed periodically, for example, once a month, to show that they are still in active use.

Configuration Packages Used

Package	Sections
ddns	service

29.1. Configuring Dynamic DNS Using The Web Interface

In the top menu, select **Services -> Dynamic DNS**. The Dynamic DNS configuration page appears.



The Dynamic DNS configuration page

Enter a name that will be used for the dynamic DNS section in the configuration. Select Add. The Dynamic DNS configuration options appear.

Dynamic DNS Settings

Dynamic DNS

Dynamic DNS allows that your router can be reached with a fixed hostname while having a dynamically changing IP address.

DDNS1

Enable ☐

Service

Custom update URL

Hostname

Username

Password

Source of IP address

Network

Check for changed IP every

Check-time unit

Force update every

Force-time unit

Listen on ☐ ☐

The Dynamic DNS main settings page

Web Field/UCI/Package Option	Description						
Web: Enabled UCI: <code>ddns.<name>.enabled</code> Opt: <code>enabled</code>	Enables a dynamic DNS entry on the router <table border="1"> <tr> <td>0. Default</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	0. Default	Disabled	1	Enabled		
0. Default	Disabled						
1	Enabled						
Web: Service UCI: <code>ddns.<name>.service_name</code> Opt: <code>service_name</code>	Defines the dynamic DNS provider.						
Web: Customer update-URL UCI: <code>ddns.<name>.update_url</code> Opt: <code>update_url</code>	Defines the customer DNS provider. Displayed when the service is set to custom in the web interface.						
Web: Hostname UCI: <code>ddns.<name>.domain</code> Opt: <code>domain</code>	Defines the fully qualified domain name associated with this entry. This is the name to update with the new IP address as needed.						
Web: Password UCI: <code>ddns.<name>.password</code> Opt: <code>password</code>	Defines the password to use for authenticating domain name updates with the selected provider.						
Web: Source of IP address UCI: <code>ddns.<name>.ip_source</code> Opt: <code>ip_source</code>	Defines the type of interface whose IP needs to be updated. <table border="1"> <tr> <td>network</td><td>IP is associated with a network configuration.</td></tr> <tr> <td>interface</td><td>IP is associated with an interface.</td></tr> <tr> <td>web</td><td>IP is associated with a URL.</td></tr> </table>	network	IP is associated with a network configuration.	interface	IP is associated with an interface.	web	IP is associated with a URL.
network	IP is associated with a network configuration.						
interface	IP is associated with an interface.						
web	IP is associated with a URL.						
Web: Network UCI: <code>ddns.<name>ip_network</code> Opt: <code>ip_network</code>	Defines the network whose IP needs to be updated. Displayed when the Source of IP address option is set to network. All the configured network interfaces will be shown.						
Web: Interface UCI: <code>ddns.<name>.ip_interface</code> Opt: <code>ip_interface</code>	Defines the interface whose IP needs to be updated. Displayed when the Source of IP address option is set to interface. All the configured interfaces will be shown.						
Web: URL UCI: <code>ddns.<name>.ip_url</code> Opt: <code>ip_url</code>	Defines the URL where the IP downloaded from. Displayed when the Source of IP address option is set to URL.						
Web: Check for changed IP every UCI: <code>ddns.<name>.check_interval</code> Opt: <code>check_interval</code>	Defines how often to check for an IP change. Used in conjunction with <code>check_unit</code> . <table border="1"> <tr> <td>Default</td><td>10</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	10	Range			
Default	10						
Range							
Web: Check-time unit UCI: <code>ddns.<name>.check_unit</code> Opt: <code>check_unit</code>	Defines the time unit to use for check for an IP change. Used in conjunction with <code>check_interval</code> . <table border="1"> <tr> <td>Default</td><td>72</td></tr> <tr> <td>Range</td><td>Enabled</td></tr> </table>	Default	72	Range	Enabled		
Default	72						
Range	Enabled						
Web: Force update every UCI: <code>ddns.<name>.force_interval</code> Opt: <code>force_interval</code>	Defines how often to force an IP update to the provider. Used in conjunction with <code>force_unit</code> . <table border="1"> <tr> <td>Default</td><td>72. Disabled</td></tr> <tr> <td>Range</td><td>Enabled</td></tr> </table>	Default	72. Disabled	Range	Enabled		
Default	72. Disabled						
Range	Enabled						

Web Field/UCI/Package Option	Description				
Web: Force-time unit UCI: <code>ddns.<name>.force_unit</code> Opt: <code>force_unit</code>	Defines the time unit to use for check for an IP change. Used in conjunction with <code>force_interval</code> . <table border="1"> <tr> <td>Default</td><td>Hours</td></tr> <tr> <td>Range</td><td>Minutes-hours</td></tr> </table>	Default	Hours	Range	Minutes-hours
Default	Hours				
Range	Minutes-hours				
Web: Listen on UCI: <code>ddns.<name>.interface</code> Opt: <code>interface</code>	Defines the interface for ddns monitoring. Typically, this will be the same as the interface whose IP is being updated – as defined <code>ip_network</code> or <code>ip_interface</code> . All configured interfaces will be displayed.				

29.2. Dynamic DNS Using UCI

Dynamic DNS uses the ddns package `/etc/config/ddns`

UCI Commands for DDNS

```

root@VA_router:~# uci show ddns

ddns.ddns1=service

ddns.ddns1.enabled=1

ddns.ddns1.service_name=dyndns.org
ddns.ddns1.domain=fqdn_of_interface
ddns.ddns1.username=testusername
ddns.ddns1.password=testpassword
ddns.ddns1.ip_source=network
ddns.ddns1.ip_network=dsl0
ddns.ddns1.check_interval=10
ddns.ddns1.check_unit=minutes
ddns.ddns1.force_interval=72
ddns.ddns1.force_unit=hours
ddns.ddns1.interface=dsl0

```

Package Options for DDNS


```
root@VA_router:~# uci export ddns
package ddns

config service 'ddns1'
option enabled '1'
option service_name 'dyndns.org'
option domain 'fqdn_of_interface'
option username 'test'
option password 'test'
option ip_source 'network'
option ip_network 'dsl0'
option check_interval '10'
option check_unit 'minutes'
option force_interval '72'
option force_unit 'hours'
option interface 'dsl0'
```

30. Configuring Host Names

Hostnames are human-readable names that identify a device connected to a network. There are several different ways in which hostnames can be configured and used on the router.

- Local host file records
- PTR records
- Static DHCP leases

Local Host File Records

The hosts file is an operating system that maps hostnames to IP addresses. It is used preferentially to other name resolution methods such as DNS.

The hosts file contains lines of text consisting of an IP address in the first text field followed by one or more host names. Each field is separated by white space; tabs are often preferred for historical reasons, but spaces are also used. Comment lines may be included; they are indicated by an octothorpe (#) in the first position of such lines. Entirely blank lines in the file are ignored.

By default, the router's local host file contains:

```
127.0.0.1 localhost
::1 ip6-localhost ip6-loopback
```

The local host file is stored at `/etc/hosts`

Configuration Packages Used

Packages	Sections
network	host

30.1. Configuring Local Host Files Entries Using The Web Interface

In the top menu, select **Network -> Interfaces**. The Interfaces configuration page appears.

Browse to **Host Records** section at the bottom of the page.

Host Records

Hostname	IP Address
This section contains no values yet	
Add	

The host records page

Select **Add**. Enter a hostname and IP address and select **Save & Apply**.

Host Records

Hostname

IP-Address

Hostname1

1.1.1.1

Delete

Add

The hosts records configuration page

Web Field/UCI/Package Option	Description
Web: Hostname UCI: network.host.hostname Opt: hostname	Defines the hostname.
Web: IP-Address UCI: network.host.addr Opt: addr	Defines the IP address associated with the hostname.

30.2. Local Host Records Using Command Line

Local host records are configured in the host section of the network package

/etc/config/network.

You can configure multiple hosts.

By default, all host instances are named host and are identified by @host then the host position in the package as a number. For example, for the first host in the package using UCI:

```
network.@host[0]=host
network.@host[0].hostname=Device1
```

Or using package options:

```
config host
option hostname 'Device1'
```

Local Host Records using UCI

```
root@VA_router:~# uci show network
network.@host[0]=host
network.@host[0].hostname=Device1
network.@host[0].addr=1.1.1.1
```

Local Host Records using Package Options

```

root@VA_router:~# uci export network package network
***
config host
option hostname 'Device1'
option addr '1.1.1.1'

```

30.3. Local Host Records Diagnostics

Hosts Files

Local host records are written to the local hosts file stored at **/etc/hosts**. To view the local hosts file, enter:

```

root@VA_router:~# cat /etc/hosts
127.0.0.1 localhost
::1 ip6-localhost ip6-loopback
1.1.1.1 Device1

```

30.4. Configuring PTR Records Using The Web Interface

PTR records are used for reverse DNS.

The primary purpose for DNS is to map domains to IP addresses. A pointer record works in the opposite way; it associates an IP address with a domain name.

Configuration Packages Used

Package	Sections
dhcp	domain

In the top menu, select **Network -> Hostnames**. The Hostnames configuration page appears.



The hostnames entries page

Select **Add**. Enter a hostname and IP address for the PTR record and select **Save & Apply**.

Hostnames

Host entries

Hostnames	IP address	
Domain1	2.2.2.2	Deletes

Add

The hostnames configuration page

30.5. PTR Records Using Command Line

PTR records are configured in the **domain** section of the dhcp package.

/etc/config/dhcp.

Multiple **domains** can be configured.

By default, all domain instances are named domain and are identified by @domain then the domain position in the package as a number. For example, for the first domain in the package using UCI:

```
dhcp.@domain[0]=domain
dhcp.@domain[0].name=Domain1
```

Or using package options:

```
config domain
option name 'Domain1'
```

PTR Records using UCI

```
root@VA_router:~# uci show dhcp
dhcp.@domain[0]=domain
dhcp.@domain[0].name=Domain1
dhcp.@domain[0].ip=2.2.2.2
```

PTR Records using Package Options

```
root@VA_router:~# uci export dhcp package dhcp
config domain
option name 'Domain1'
option ip '2.2.2.2'
```

30.6. PTR Records Diagnostics

PTR Records Table

To view PTR records, enter:

```
root@VA_router:~# pgrep -fl dnsmasq

4724 /usr/sbin/dnsmasq -K -D -y -Z -b -E -s lan -S /lan/ -l
/tmp/dhcp.leases -r /tmp/resolv.conf.auto --stop-dns-rebind --rebind-
localhost-ok -A /Device1.lan/1.1.1.1 --ptr-record=1.1.1.1.in-
addr.arpa,Device1.lan -A /Device2.lan/2.2.2.2 --ptr-record=2.2.2.2.in-
addr.arpa,Device2.lan
```

30.7. Configuring Static Leases Using The Web Interface

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients based on the MAC (hardware) address.

They are also required for non dynamic interface configurations where only hosts with a corresponding lease are served.

Package	Sections
dhcp	host

In the top menu, select **Network -> DHCP and DNS**. The DHCP and DNS configuration page appears.

Browse to **Static leases** section.

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.
Use the Add Button to add a new lease entry. The MAC-Address identifies the host, the IP-Address specifies to the fixed address to use and the Hostname is assigned as symbolic name to the requesting host.

Hostname

MAC Address

IP Address

This section contains no values yet

Add

The static leases add page

Select **Add**. Enter a hostname, MAC address and IP address for the static lease. Select **Save & Apply**.

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.
Use the Add Button to add a new lease entry. The MAC-Address identifies the host, the IP-Address specifies to the fixed address to use and the Hostname is assigned as symbolic name to the requesting host.

Hostname

MAC Address

IP Address

host1

aa:bb:cc:dd:ee:ff

4.4.4.4

Delete

Add

The static leases configuration page

Web Field/UCI/Package Option	Description
Web: Hostname UCI: dhcp.host.name Opt: name	Defines the symbolic hostname to assign.
Web: MAC-Address UCI: dhcp.host.mac Opt: mac	Defines the MAC address for this host. MAC addresses should be entered in the format aa:bb:cc:dd:ee:ff
Web: IPv4-Address UCI: dhcp.host.ip Opt: ip	Defines the IP address to be used for this host.

30.8. Configuring Static Leases Using Command Line

Static leases are configured under the **dhcp** package, stored at **/etc/config/dhcp**. By default, all static leases instances are named **host**. The static lease is identified by **@host** then the static lease position in the package as a number. For example, for the first static lease in the package using UCI:

```
dhcp.@host[0]=dhcp
dhcp.@host[0].name=mypc
```

Or using package options:

```
config host
option name 'mypc'
```

However, to better identify, it is recommended to give the static lease instance a name. For example, to create a static instance named **mypc**.

To define a named static lease instance using UCI, enter:

```
dhcp.mypc=host
dhcp.mypc.name=mypc
```

To define a named static lease instance using package options, enter:

```
config dhcp 'mypc'
option name 'mypc'
```

The following examples using UCI and package options add the fixed IP address 192.168.1.2 and the name "mypc" for a machine with the (Ethernet) hardware address 00:11:22:33:44:55.

Example of Static Leases using UCI

```
root@VA_router:~# uci show dhcp.mypc  
  
dhcp.mypc=host  
  
dhcp.mypc.ip=192.168.1.2  
  
dhcp.mypc.mac=00:11:22:33:44:55  
  
dhcp.mypc.name=mypc
```

Example of Static Leases using Package Options

```
root@VA_router:~# uci export dhcp package dhcp  
  
■■■■  
  
config host 'mypc'  
  
option ip '192.168.1.2'  
  
option mac '00:11:22:33:44:55'  
  
option name 'mypc'
```


31. Configuring Firewall

The firewall itself is not required. It is a set of scripts which configure Netfilter. If preferred, you can use Netfilter directly to achieve the desired firewall behaviour.



NOTE

The UCI firewall exists to simplify configuring Netfilter for many scenarios, without requiring the knowledge to deal with the complexity of Netfilter.

The firewall configuration consists of several zones covering one or more interfaces. Permitted traffic flow between the zones is controlled by forwardings. Each zone can include multiple rules and redirects (port forwarding rules).

The Netfilter system is a chained processing filter where packets pass through various rules. The first rule that matches is executed often leading to another rule-chain until a packet hits either ACCEPT or DROP/REJECT.

Accepted packets pass through the firewall. Dropped packets are prohibited from passing. Rejected packets are also prohibited but an ICMP message is returned to the source host.

A minimal firewall configuration for a router usually consists of one 'defaults' section, at least two 'zones' (LAN and WAN) and one forwarding to allow traffic from LAN to WAN. Other sections that exist are 'redirects', 'rules' and 'includes'.

Configuration Package Used

Package	Sections
firewall	

31.1. Scenario 3: No PMP + Roaming

In this scenario there is no PMP interface that can be used for a connection. The router scans the available mobile networks at boot and sorts the networks according to signal strength.

The network that offers the best signal strength will be the first to connect. Multi-WAN then controls the failover between the available networks.

Multi-WAN periodically does a health check on the interface. A health check comprises of a configurable combination of the following:

- Interface state
- Pings to an ICMP target
- Signal level checks using signal threshold, RSCP threshold and ECIO threshold option values

A fail for any of the above health checks results in a fail. After a configurable number of health check failures, Multi-WAN will disconnect the failed interface and attempt to connect to the next best roaming interface.

31.2. Configuring Firewall Using The Web Interface

In the top menu, select **Network -> Firewall**. The Firewall page appears. It is divided into three sections:

Section	Description
General Settings	Defines the firewall zones, both global and specific.
Port Forwards	Port Forwards are also known as Redirects. This section creates the redirects using DNAT (Destination Network Address Translation) with Netfilter.
Traffic Rules	Defines rules to allow or restrict access to specific ports, hosts or protocols.

31.2.1. Firewall - Zone Settings - General Settings Page

The General Setting page is divided into two sections.

Section	Description
General Settings	Defines the global firewall setting that do not belong to any specific zones.
Zones	The zones section groups one or more interfaces and serves as a source or destination for forwardings, rules and redirects. Masquerading (NAT) of outgoing traffic is controlled on a per-zone basis.

Firewall - Zone Settings - General Settings section

The General Settings page, or defaults section declares global firewall settings that do not belong to any specific zones. These default rules take effect last and more specific rules take effect first.

The Firewall - Zone settings - general settings page

Web Field/UCI/Package Option	Description						
Web: Enable SYN-flood protection UCI: firewall.defaults.syn_flood Opt: syn_flood	Enables SYN flood protection. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled		
0	Disabled						
Default: 1	Enabled						
Web: Drop invalid packets UCI: firewall.defaults.drop_invalid Opt: drop_invalid	Drops packets not matching any active connection. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Input UCI: firewall.defaults.input Opt: input	Default policy for the Input chain. <table border="1"> <tr> <td>Default: Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Default: Accept	Accepted packets pass through the firewall.	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Drop	Dropped packets are blocked by the firewall.
Default: Accept	Accepted packets pass through the firewall.						
Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Drop	Dropped packets are blocked by the firewall.						
Web: Output UCI: firewall.defaults.output Opt: output	Default policy for the Output chain. <table border="1"> <tr> <td>Default: Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Default: Accept	Accepted packets pass through the firewall.	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Drop	Dropped packets are blocked by the firewall.
Default: Accept	Accepted packets pass through the firewall.						
Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Drop	Dropped packets are blocked by the firewall.						
Web: Forward UCI: firewall.defaults.forward Opt: forward	Default policy for the Forward chain. <table border="1"> <tr> <td>Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Default: Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Accept	Accepted packets pass through the firewall.	Default: Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Drop	Dropped packets are blocked by the firewall.
Accept	Accepted packets pass through the firewall.						
Default: Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Drop	Dropped packets are blocked by the firewall.						

Firewall - Zone Settings - Zones Settings section

The Zones section groups one or more interfaces and serves as a source or destination for forwardings, rules and redirects. Masquerading (NAT) of outgoing traffic is controlled on a per-zone basis. To view a zone's settings, click **Edit**. The Firewall - Zone Settings - Zone "[name]" page appears.

The number of concurrent dynamic/static NAT entries of any kind (NAT/PAT/DNAT/SNAT) is not limited in any way by software; the only hardware limitation is the amount of RAM installed on the device.

There are two sections in Firewall - Zone Settings - Zone "x" page: General Settings and Advanced settings

Firewall zone: general settings

General Settings

Port Forwards

Traffic Rules

Firewall - Zone Settings - Zone "lan"

Zone "lan"

This section defines common properties of "lan". The Input and Output options set the default policies for traffic entering and leaving this zone while the Forward option describes the policy for forwarded traffic between different networks within the zone. Covered networks specifies which available networks are member of this zone.

General Settings

Advanced Settings

Name

lan

Input

accept

Output

accept

Forward

accept

Masking

☐

MSB clamping

☐

Covered networks

☒ LAN0 (the interfaces attached)

☒ LAN0

☒ LAN0

☐ WAN0

☐ WAN0

☐ WAN0

The Firewall - zone settings - general settings tab

Web Field/UCI/Package Option	Description						
Web: name UCI: firewall.<zone label>.name Opt: name	Sets the unique zone name. Maximum of 11 characters allowed. Note: the zone label is obtained by using the 'uci show firewall' command and is of the format '@zone[x]' where x is an integer starting at 0.						
Web: Input UCI: firewall. <zone label>.input Opt: input	Default policy for incoming zone traffic. Incoming traffic is traffic entering the router through an interface selected in the 'Covered Networks' option for this zone. <table border="1"> <tr> <td>Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Default: Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Accept	Accepted packets pass through the firewall.	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Default: Drop	Dropped packets are blocked by the firewall.
Accept	Accepted packets pass through the firewall.						
Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Default: Drop	Dropped packets are blocked by the firewall.						
Web: Output UCI: firewall. <zone label>.output Opt: output	Default policy for outgoing zone traffic. Outgoing traffic is traffic leaving the router through an interface selected in the 'Covered Networks' option for this zone. <table border="1"> <tr> <td>Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Default: Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Accept	Accepted packets pass through the firewall.	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Default: Drop	Dropped packets are blocked by the firewall.
Accept	Accepted packets pass through the firewall.						
Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Default: Drop	Dropped packets are blocked by the firewall.						
Web: Forward UCI: firewall. <zone label>.forward Opt: forward	Default policy for internal zone traffic between interfaces. Forward rules for a zone describe what happens to traffic passing between different interfaces within that zone. <table border="1"> <tr> <td>Accept</td><td>Accepted packets pass through the firewall.</td></tr> <tr> <td>Reject</td><td>Rejected packets are blocked by the firewall and ICMP message is returned to the source host.</td></tr> <tr> <td>Default: Drop</td><td>Dropped packets are blocked by the firewall.</td></tr> </table>	Accept	Accepted packets pass through the firewall.	Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.	Default: Drop	Dropped packets are blocked by the firewall.
Accept	Accepted packets pass through the firewall.						
Reject	Rejected packets are blocked by the firewall and ICMP message is returned to the source host.						
Default: Drop	Dropped packets are blocked by the firewall.						
Web: Masquerading UCI: firewall. <zone label>.masq Opt: masq	Specifies whether outgoing zone traffic should be masqueraded (NATTED). This is typically enabled on the wan zone.						
Web: MSS Clamping UCI: firewall. <zone label>.mtu_fix Opt: mtu_fix	Enables MSS clamping for outgoing zone traffic. Subnets are allowed. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Covered Networks UCI: firewall.<zone label>.network Opt:	Defines a list of interfaces attached to this zone, if omitted, the value of name is used by default. Note: use the uci list syntax to edit this setting though UCI.						

Firewall zone: advanced settings

General Settings
Port Forwards
Traffic Rules

Firewall - Zone Settings - Zone "lan"

Zone "lan"

This section defines common properties of "lan". The input and output options set the default policies for traffic entering and leaving this zone while the forward option describes the policy for forwarded traffic between different networks within the zone. Covered networks specifies which available networks are member of this zone.

General Settings
Advanced Settings

Restrict to address family
IPv4 and IPv6

Restrict Masquerading to given source subnets
0.0.0.0/0

Restrict Masquerading to given destination subnets
0.0.0.0/0

Force connection tracking
☐

Enable logging on this zone
☐

Allow NAT Reflections
☒

The Firewall - zone settings - advanced settings tab

Web Field/UCI/Package Option	Description												
Web: Restrict to address family UCI: firewall. <zone_label>.family Opt: family	Restricts zone to IPv4, IPv6 or both IPv4 and IPv6. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>IPv4 and IPv6</td><td>Any address family</td><td>any</td></tr><tr><td>IPv4 only</td><td>IPv4 only</td><td>ipv4</td></tr><tr><td>IPv6 only</td><td>IPv6 only</td><td>ipv6</td></tr></table>	Option	Description	UCI	IPv4 and IPv6	Any address family	any	IPv4 only	IPv4 only	ipv4	IPv6 only	IPv6 only	ipv6
Option	Description	UCI											
IPv4 and IPv6	Any address family	any											
IPv4 only	IPv4 only	ipv4											
IPv6 only	IPv6 only	ipv6											
Web: Restrict Masquerading to given source subnets UCI: firewall. <zone_label>.masq_src Opt: masq_src	Limits masquerading to the given source subnets. Negation is possible by prefixing the subnet with '!'. Multiple subnets are allowed.												
Web: Restrict Masquerading to given destination subnets UCI: firewall. <zone_label>.masq_dest Opt: masq_dest	Limits masquerading to the given destination subnets. Negation is possible by prefixing the subnet with '!'. Multiple subnets are allowed. Multiple IP addresses/subnets should be separated by a space, for example: option masq_dest '1.1.1.1 2.2.2.0/24'.												
Web: Force connection tracking UCI: firewall. <zone_label>.conntrack Opt: conntrack	Forces connection tracking for this zone. <table><tr><td>0</td><td>Disabled</td></tr><tr><td>Default: 1</td><td>If masquerading is used. Otherwise, default is 0.</td></tr></table>	0	Disabled	Default: 1	If masquerading is used. Otherwise, default is 0.								
0	Disabled												
Default: 1	If masquerading is used. Otherwise, default is 0.												
Web: Enable logging on this zone UCI: firewall. <zone_label>.log Opt: log	Creates log rules for rejected and dropped traffic in this zone.												
Web: Allow NAT reflections UCI: firewall. <zone_label>.reflection Opt: reflection	Enable/disable all NAT reflections for this zone. Note: for configs with a large number of firewall rules, disabling NAT reflection will speed up load of firewall rules on interface start. <table><tr><td>0</td><td>Disable reflection</td></tr><tr><td>Default: 1</td><td>Enable reflection</td></tr></table>	0	Disable reflection	Default: 1	Enable reflection								
0	Disable reflection												
Default: 1	Enable reflection												
Web: n/a UCI: firewall. <zone_label>.log_limit Opt: log_limit	Limits the amount of log messages per interval.												

Inter-zone forwarding

This section controls the traffic flow between zones. Selecting a source or destination zone generates a forwarding rule. Only one direction is covered by any forwarding rule. Hence for bidirectional traffic flow between two zones then two rules are required, with source and destination alternated.

Inter-Zone Forwarding

The options below control the forwarding policies between this zone (lan) and other zones. Destination zones cover forwarded traffic originating from "lan". Source zones match forwarded traffic from other zones targeted at "lan". The forwarding rule is unidirectional, e.g. a forward from lan to wan does not imply a permission to forward from wan to lan as well.

Allow forward to destination zones:

☒ lan
☒ MOBILE1
☒ PRIVATE

Allow forward from source zones:

☒ lan
☒ MOBILE1
☒ PRIVATE

The inter-zone forwarding section

Web Field/UCI/Package Options	Description
Web: Allow forward to destination zones UCI: firewall. <forwarding label>.dest Opt: dest	Allows forward to other zones. Enter the current zone as the source. Enabling this option puts two entries into the firewall file: destination and source.
UCI: firewall. <forwarding label>.src Opt: src	
Web: Allow forward from source zones UCI: firewall.<forwarding label>.dest Opt: dest	Allows forward from other zones. Enter the current zone as the destination. Enabling this option puts two entries into the firewall file: destination and source.
UCI: firewall. <forwarding label>.src Opt: src	

31.2.2. Firewall Port Forwards Page

Port forwards are also known as redirects. The Firewall Port Forwards section creates the redirects using DNAT (Destination Network Address Translation) with Netfilter. The redirects are from the firewall zone labelled as wan to the firewall zone labelled as lan. These zones can refer to multiple external and internal interfaces as defined in the Firewall Zone settings.

The firewall port forward page

To edit an existing port forward select **edit**. To add a new port forward select **add**.

Web Field/UCI/Package Option	Description												
Web: name UCI: firewall.<redirect_label>.name Opt: name	Sets the port forwarding name. For Web UI generated redirects the <redirect label> takes the form of @redirect[x], where x is an integer starting from 0.												
Web: Protocol UCI: firewall.<redirect_label>.proto Opt: proto	Defines layer 4 protocol to match incoming traffic. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Default: tcp+udp</td><td>Match either TCP or UDP packets</td><td>tcp udp</td></tr><tr><td>tcp</td><td>Match TCP packets only</td><td>tcp</td></tr><tr><td>udp</td><td>Match UDP packets only</td><td>udp</td></tr></table>	Option	Description	UCI	Default: tcp+udp	Match either TCP or UDP packets	tcp udp	tcp	Match TCP packets only	tcp	udp	Match UDP packets only	udp
Option	Description	UCI											
Default: tcp+udp	Match either TCP or UDP packets	tcp udp											
tcp	Match TCP packets only	tcp											
udp	Match UDP packets only	udp											
Web: External port UCI: firewall.<redirect_label>.src_dport Opt: src_dport	Specifies the incoming TCP/UDP port or port range to match. This is the incoming destination port specified by the external host. Port ranges specified as start:stop, for example, 2001:2020. <table><tr><td>Default: Blank</td><td>Match traffic to any port</td></tr><tr><td>Range</td><td>1-65535</td></tr></table>	Default: Blank	Match traffic to any port	Range	1-65535								
Default: Blank	Match traffic to any port												
Range	1-65535												
Web: Internal IP address UCI: firewall.<redirect_label>.dest_ip Opt: dest_ip	Specifies the internal (LAN) IP address for the traffic to be redirected to.												
Web: Internal port UCI: firewall.<redirect_label>.dest_port Opt: dest_port	Specifies the destination tcp/udp port for the redirect traffic.												

The defined redirects can be sorted into a specific order to be applied. More specific rules should be placed first.

After the redirect is created and saved, to make changes, click **Edit**. This will provide further options to change the source/destination zones; specify source MAC addresses and enable NAT loopback (reflection).

General Settings
Port Forwards
Traffic Rules

Firewall - Port Forwards - (Unnamed Entry)

This page allows you to change advanced properties of the port forwarding entry. In most cases there is no need to modify those settings.

Rule is enabled

Name

Protocol

Source zone ☐ ☒ LAN: LAN1, LAN2, LAN3 ☐ WAN: MOBILE1, PoA/DSL

Source MAC address
 Only match incoming traffic from these MACs

Source IP address
 Only match incoming traffic from this IP or range

Source port
 Only match incoming traffic originating from the given source port or port range on the client host

External IP address
 Only match incoming traffic directed at the given IP address

External port
 Match incoming traffic directed at the given destination port or port range on this host

Internal zone ☐ ☒ LAN: LAN1, LAN2, LAN3 ☐ WAN: MOBILE1, PoA/DSL

Internal IP address
 Redirect matched incoming traffic to the specified internal host

Internal port
 Redirect matched incoming traffic to the given port on the internal host

Enable NAT Loopback ☒

Extra arguments
 Passes additional arguments to iptables. Use with care!

The firewall port forwards edits page

Web Field/UCI/Package Option	Description												
Web: Rule is enabled UCI: firewall.<redirect label>.enabled Opt: enabled	Specifies if this redirect should be enabled or disabled. <table><tr><td>0</td><td>Disabled</td></tr><tr><td>Default: 1</td><td>Enabled</td></tr></table>	0	Disabled	Default: 1	Enabled								
0	Disabled												
Default: 1	Enabled												
Web: Name UCI: firewall.<redirect label>.name Opt: name	Sets the port forwarding name. For Web UI generated redirects the <redirect label> takes the form of @redirect[x], where x is an integer starting from 0.												
Web: Protocol UCI: firewall.<redirect label>.proto Opt: proto	Defines layer 4 protocol to match incoming traffic. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Default: tcp+udp</td><td>Match either TCP or UDP packets</td><td>tcp udp</td></tr><tr><td>tcp</td><td>Match TCP packets only</td><td>tcp</td></tr><tr><td>udp</td><td>Match UDP packets only</td><td>udp</td></tr></table>	Option	Description	UCI	Default: tcp+udp	Match either TCP or UDP packets	tcp udp	tcp	Match TCP packets only	tcp	udp	Match UDP packets only	udp
Option	Description	UCI											
Default: tcp+udp	Match either TCP or UDP packets	tcp udp											
tcp	Match TCP packets only	tcp											
udp	Match UDP packets only	udp											
Web: Source zone UCI: firewall.<redirect label>.src Opt: src	Specifies the traffic source zone. It must refer to one of the defined zone names. When using the web interface, this is set to WAN initially.												
Web: Source MAC address UCI: firewall.<redirect label>.src_mac Opt: list src_mac	Defines the list of source MAC addresses that this redirect will match. Format: aa:bb:cc:dd:ee:ff Multiple RIP interfaces are entered using uci set and uci add_list commands. Example: uci set firewall.@redirect[0].src_mac=aa:bb:cc:dd:ee:ff uci add_list firewall.@redirect[0].src_mac=12:34:56:78:90:12 or using a list of options via package options list network 'aa:bb:cc:dd:ee:ff' list network '12:34:56:78:90:12'												
Web: Source IP address UCI: firewall.<redirect label>.src_ip Opt: src_ip	Defines a source IP address that this redirect will match. <table><tr><td>Default: Blank</td><td>Match traffic from any source IP</td></tr><tr><td>Range</td><td>A.B.C.D/mask</td></tr></table>	Default: Blank	Match traffic from any source IP	Range	A.B.C.D/mask								
Default: Blank	Match traffic from any source IP												
Range	A.B.C.D/mask												
Web: Source port UCI: firewall.<redirect label>.src_port Opt: src_port	Defines a source IP port that this redirect will match. You can enter multiple ports, using a space separator. *For example: option src_port '22 23' *see note below on use with options src_dport and dest_port <table><tr><td>Default: Blank</td><td>Match traffic from any source IP</td></tr><tr><td>Range</td><td>1 - 65535</td></tr></table>	Default: Blank	Match traffic from any source IP	Range	1 - 65535								
Default: Blank	Match traffic from any source IP												
Range	1 - 65535												
Web: External port UCI: firewall.<redirect label>.src_dport Opt: src_dport	Specifies the incoming TCP/UDP port or port range to match. This is the incoming destination port specified by the external host. Port ranges specified in format start:stop, for example, 2001:2020. You can enter multiple ports, using a space separator. *For example: option src_dport '22 23'												

Web Field/UCI/Package Option	Description				
	*see note below on use with options src_port and dest_port <table border="1"> <tr> <td>Default: Blank</td><td>Match traffic from any source IP</td></tr> <tr> <td>Range</td><td>1 - 65535</td></tr> </table>	Default: Blank	Match traffic from any source IP	Range	1 - 65535
Default: Blank	Match traffic from any source IP				
Range	1 - 65535				
Web: Internal zone UCI: firewall.<redirect label>.dest Opt: dest	Specifies the traffic destination zone, must refer to one of the defined zone names.				
Web: Internal IP address UCI: firewall.<redirect label>.dest_port Opt: dest_port	Specifies the internal (LAN) IP address for the traffic to be redirected to.				
Web: Internal zone UCI: firewall.<redirect label>.dest_ip Opt: dest_ip	Specifies the destination tcp/udp port for the redirect traffic. You can enter multiple ports, using a space separator. *For example: option dest_port '22 23' *See note below table on use with options src_port and src_dport.				
Web: Enable NAT Loopback UCI: firewall.<redirect label>.reflection Opt: reflection	Enable or disable NAT reflection for this redirect. <table border="1"> <tr> <td>0</td><td>Reflection disabled</td></tr> <tr> <td>Default: 1</td><td>Reflection enabled</td></tr> </table>	0	Reflection disabled	Default: 1	Reflection enabled
0	Reflection disabled				
Default: 1	Reflection enabled				
Web: Extra arguments UCI: firewall.<redirect label>.extra Opt: extra	Passes extra arguments to IP tables. This is useful to specify additional match options, like -m policy --dir in for IPSec. The arguments are entered as text strings.				



NOTE

*redirect rule options src_port and src_dport/dest_port accept space- separated lists of ports. If src_port is a list, then src_dport/dst_port cannot be, to avoid ambiguity.

If src_dport/dest_port are lists of different lengths, then the missing values of the shorter list default to the corresponding port in the other list. For example, if configuration file is:

```
option src_dport '21 22 23'
option dest_port '21 22 23 24'
```

then the firmware will interpret the values as:

```
option src_dport '21 22 23 24'
option dest_port '21 22 23 24'
```

31.2.3. Firewall Traffic Rules Page

Rules can be defined to allow or restrict access to specific ports, hosts or protocols.

General Settings
Port Forwards
Traffic Rules

Firewall - Traffic Rules - (Unnamed Rule)

This page allows you to change advanced properties of the traffic rule entry, such as matched source and destination hosts.

Rule is enabled

Name

Restrict to address family

Protocol

Match ICMP type

Source zone

☐ Any zone

☒ lan: LAN1: LAN2: LAN3:

☐ wan: MOBILE1: PoAASL:

Source MAC address

Source address

Source port

Destination zone

☐ Device (Input)

☐ Any zone (forward)

☒ lan: LAN1: LAN2: LAN3:

☐ wan: MOBILE1: PoAASL:

Destination address

Destination port

Action

Extra arguments Passes additional arguments to iptables. Use with care!

The firewall traffic rules page

Web Field/UCI/Package Option	Description																		
Web: Rule is enabled UCI: firewall.<rule_label>.enabled Opt: enabled	Enables or disables traffic rule. <table><tr><td>0</td><td>Rule is disabled</td></tr><tr><td>Default: 1</td><td>Rule is enabled</td></tr></table>	0	Rule is disabled	Default: 1	Rule is enabled														
0	Rule is disabled																		
Default: 1	Rule is enabled																		
Web: Name UCI: firewall.<rule_label>.name Opt: name	Select a descriptive name limited to less than 11 characters. No spaces are allowed in the naming convention.																		
Web: Restrict to address family UCI: firewall.<rule_label>.family Opt: family	Restrict to protocol family. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Default: IPv4 and IPv6</td><td>Traffic rule applies to any address family</td><td>any</td></tr><tr><td>IPv4 only</td><td>IPv4 only</td><td>ipv4</td></tr><tr><td>IPv6 only</td><td>IPv6 only</td><td>ipv6</td></tr></table>	Option	Description	UCI	Default: IPv4 and IPv6	Traffic rule applies to any address family	any	IPv4 only	IPv4 only	ipv4	IPv6 only	IPv6 only	ipv6						
Option	Description	UCI																	
Default: IPv4 and IPv6	Traffic rule applies to any address family	any																	
IPv4 only	IPv4 only	ipv4																	
IPv6 only	IPv6 only	ipv6																	
Web: Protocol UCI: firewall.<rule_label>.proto Opt: proto	Matches incoming traffic using the given protocol. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Default: tcp+udp</td><td>Applies rule to TCP and UDP only</td><td>tcp udp</td></tr><tr><td>tcp</td><td>Applies rule to TCP only</td><td>tcp</td></tr><tr><td>udp</td><td>Applies rule to UDP only</td><td>udp</td></tr><tr><td>ICMP</td><td>Applies rule to ICMP only</td><td>icmp</td></tr><tr><td>custom</td><td>Specify protocol from /etc/protocols</td><td></td></tr></table>	Option	Description	UCI	Default: tcp+udp	Applies rule to TCP and UDP only	tcp udp	tcp	Applies rule to TCP only	tcp	udp	Applies rule to UDP only	udp	ICMP	Applies rule to ICMP only	icmp	custom	Specify protocol from /etc/protocols	
Option	Description	UCI																	
Default: tcp+udp	Applies rule to TCP and UDP only	tcp udp																	
tcp	Applies rule to TCP only	tcp																	
udp	Applies rule to UDP only	udp																	
ICMP	Applies rule to ICMP only	icmp																	
custom	Specify protocol from /etc/protocols																		
Web: Match ICMP type UCI: firewall.<rule_label>.icmp_type Opt: icmp_type	Match specific icmp types. This option is only valid when ICMP is selected as the protocol. ICMP types can be listed as either type names or type numbers. Note: for a full list of valid ICMP type names, see the ICMP Options table below.																		
Web: Source zone UCI: firewall.<rule_label>.src Opt: src	Specifies the traffic source zone, must refer to one of the defined zone names. For typical port forwards, this is usually WAN.																		
Web: Source MAC address UCI: firewall.<rule_label>.src_mac Opt: src_mac	Matches incoming traffic from the specified MAC address. The MAC address must be entered in the following format: aa:bb:cc:dd:ee:ff. To only match the first portion of the MAC address append /prefix to the option value, where prefix defines the bits from the start of the MAC to match on. Example: option src_mac 00:E0:C8:12:34:56/24 will match on all packets with prefix 00:E0:C8.																		
Web: Source address UCI: firewall.<rule_label>.src_ip Opt: src_ip	Matches incoming traffic from the specified source IP address.																		
Web: Source port UCI: firewall.<rule_label>.src_port Opt: src_port	Matches incoming traffic originating from the given source port or port range on the client host.																		
Web: Destination zone UCI: firewall.<rule_label>.dest Opt: dest	Specifies the traffic destination zone. Must refer to one of the defined zone names.																		

Web Field/UCI/Package Option	Description																	
Web: Destination address UCI: firewall.<rule_label>.dest_ip Opt: dest_ip	For DNAT, redirects matched incoming traffic to the specified internal host. For SNAT, matches traffic directed at the given address.																	
Web: Destination port UCI: firewall.<rule_label>.dest_port Opt: dest_port	For DNAT, redirects matched incoming traffic to the given port on the internal host. For SNAT, matches traffic directed at the given ports.																	
Web: Action UCI: firewall.<rule_label>.target Opt: target	Action to take when rule is matched. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>drop</td><td>Drop matching traffic</td><td>drop</td></tr><tr><td>Default: accept</td><td>Allow matching traffic</td><td>accept</td></tr><tr><td>reject</td><td>Reject matching traffic</td><td>reject</td></tr><tr><td>don't track</td><td>Disable connection tracking for the rule. See the Connection Tracking section below for more information.</td><td>No Track</td></tr></table>			Option	Description	UCI	drop	Drop matching traffic	drop	Default: accept	Allow matching traffic	accept	reject	Reject matching traffic	reject	don't track	Disable connection tracking for the rule. See the Connection Tracking section below for more information.	No Track
Option	Description	UCI																
drop	Drop matching traffic	drop																
Default: accept	Allow matching traffic	accept																
reject	Reject matching traffic	reject																
don't track	Disable connection tracking for the rule. See the Connection Tracking section below for more information.	No Track																
Web: Extra arguments UCI: firewall.<rule_label>.extra Opt: extra	Passes extra arguments to IP tables. This is useful to specify additional match options, like -m policy --dir in for IPSec.																	
Web: n/a UCI: firewall.<rule_label>.reflection Opt: reflection	Disables NAT reflection for this redirect if set to 0. Applicable to DNAT targets.																	
Web: n/a UCI: firewall.<rule_label>.limit Opt: limit	Sets maximum average matching rate; specified as a number, with an optional / second, /minute, /hour or /day suffix. Example: 3/hour.																	
Web: n/a UCI: firewall.<rule_label>.limit_burst Opt: limit_burst	Sets maximum initial number of packets to match. This number gets recharged by one every time the limit specified above is not reached, up to this number.																	
Web: n/a UCI: firewall.<rule_label>.recent Opt: recent	Sets number of allowed connections within specified time. This command takes two values e.g. recent=2 120 will allow 2 connections within 120 seconds.																	

ICMP Options	ICMP Options	ICMP Options	ICMP Options
address-mask-reply	host-redirect	pong	time-exceeded
address-mask-request	host-unknown	port-unreachable	timestamp-reply
any	host-unreachable	precedence-cutoff	timestamp-request
communication- prohibited	ip-header-bad	protocol-unreachable	TOS-host-redirect
destination-unreachable	network-prohibited	redirect	TOS-host-unreachable
echo-reply	network-redirect	required-option-missing	TOS-network-redirect
echo-request	network-unknown	router-advertisement	TOS-network- unreachable
fragmentation-needed	network-unreachable	router-solicitation	ttl-exceeded
host-precedence- violation	parameter-problem	source-quench	ttl-zero-during- reassembly
host-prohibited	ping	source-route-failed	ttl-zero-during-transit

31.3. Configuring Firewall Using UCI

Firewall is configured under the firewall package `/etc/config/firewall`.

There are six config sections: defaults, zone, forwarding, redirect, rule and include. You can configure multiple zone, forwarding and redirect sections.

Firewall: General Settings

To set general (default) settings, enter:

```
uci add firewall defaults
uci set firewall.@defaults[0].syn_flood=1
uci set firewall.@defaults[0].drop_invalid=1
uci set firewall.@defaults[0].input=ACCEPT
uci set firewall.@defaults[0].output=ACCEPT
uci set firewall.@defaults[0].forward=ACCEPT
```



NOTE

This command is only required if there is no defaults section.

Firewall Zone Settings

By default, all firewall zone instances are named zone, instances are identified by `@zone` then the zone position in the package as a number. For example, for the first zone in the package using UCI, enter:

```
firewall.@zone[0]=zone
firewall.@zone[0].name=lan
```

Or using package options:

```
config zone
option name 'lan'
```

To set up a firewall zone, enter:


```
uci add firewall zone
uci set firewall.@zone[1].name=lan
uci set firewall.@zone[1].input=ACCEPT
uci set firewall.@zone[1].output=ACCEPT
uci set firewall.@zone[1].forward=ACCEPT
uci set firewall.@zone[1].network=lan1wifi_client
uci set firewall.@zone[1].family=any
uci set firewall.@zone[1].masq_src=10.0.0.0/24
uci set firewall.@zone[1].masq_dest=20.0.0.0/24
uci set firewall.@zone[1].conntrack=1
uci set firewall.@zone[1].masq=1
uci set firewall.@zone[1].mtu_fix=1
uci set firewall.@zone[1].log=1
uci set firewall.@zone[1].log_limit=5
```

Inter-zone Forwarding

By default, all inter-zone instances are named 'forwarding'; instances are identified by `@forwarding` then the forwarding position in the package as a number. For example, for the first forwarding in the package using UCI, enter:

```
firewall.@forwarding[0]=forwarding
firewall.@forwarding[0].src=lan
```

Or using package options:

```
config forwarding
option src 'lan'
```

To enable forwarding of traffic from WAN to LAN, enter:

```
uci add firewall forwarding
uci set firewall.@forwarding[1].dest=wan
uci set firewall.@forwarding[1].src=lan
```

Firewall Port Forwards

By default, all port forward instances are named 'redirect'; instances are identified by `@redirect` then the redirect position in the package as a number. For example, for the first redirect in the package using UCI, enter:

```
firewall.@redirect[0]=redirect
firewall.@redirect[0].name=Forward
```

Or using package options:

```
config redirect
    option name 'Forward'
```

To set port forwarding rules, enter:

```
uci add firewall redirect
uci set firewall.@redirect[1].name=Forward
uci set firewall.@redirect[1].proto=tcp
uci set firewall.@redirect[1].src=wan # <- zone names uci set firewall.@redirect[1].dest=lan # <- zone names
uci set firewall.@redirect[1].src_dport=2001
uci set firewall.@redirect[1].dest_ip=192.168.0.100
uci set firewall.@redirect[1].dest_port=2005
uci set firewall.@redirect[1].enabled=1
```

Firewall Traffic Rules

By default, all traffic rules instances are named rule, instances are identified by @rule then the rule position in the package as a number. For example, for the first rule in the package using UCI, enter:

```
firewall.@rule[0]=rule
firewall.@rule[0].enabled=1
```

Or using package options:

```
config rule
    option enabled '1'
```

To set traffic rules, enter:

```
uci add firewall rule

uci set firewall.@rule[1].enabled=1

uci set firewall.@rule[1].name=Allow_ICMP

uci set firewall.@rule[1].family=any

uci set firewall.@rule[1].proto=ICMP

uci set firewall.@rule[1].icmp_type=any

uci set firewall.@rule[1].src=wan

uci set firewall.@rule[1].src_mac=ff:ff:ff:ff:ff:ff

uci set firewall.@rule[1].src_port=

uci set firewall.@rule[1].dest=lan

uci set firewall.@rule[1].dest_port=

uci set firewall.@rule[1].dest_ip=192.168.100.1

uci set firewall.@rule[1].target=ACCEPT

uci set firewall.@rule[1].extra=

uci set firewall.@rule[1].src_ip=8.8.8.8

uci set firewall.@rule[1].src_dip=9.9.9.9

uci set firewall.@rule[1].src_dport=68

uci set firewall.@rule[1].reflection=1

uci set firewall.@rule[1].limit=3/second

uci set firewall.@rule[1].limit_burst=30
```

Custom Firewall Scripts: Includes

It is possible to include custom firewall scripts by specifying one or more include sections in the firewall configuration.

There is only one possible parameter for includes:

Parameter	Description
pth	Specifies a shell script to execute on boot or firewall restarts.

Custom scripts are executed as shell scripts and are expected to contain iptables commands.

IPv6 Notes

As described above, the option family is used for distinguishing between IPv4, IPv6 and both protocols. However, the family is inferred automatically if a specific IP address family is used. For example, if IPv6 addresses are used then the rule is automatically treated as IPv6 only rule.

```
config rule

    option src wan

    option src_ip fdca:f00:ba3::/64

    option target ACCEPT
```

Similarly, the following rule is automatically treated as IPv4 only.

```
config rule
option src wan
option dest_ip 88.77.66.55
option target REJECT
```

Rules without IP addresses are automatically added to iptables and ip6tables, unless overridden by the family option. Redirect rules (port forwards) are always IPv4 since there is no IPv6 DNAT support at present.

31.3.1. Implications Of DROP Vs. REJECT

The decision whether to drop or to reject traffic should be done on a case-by-case basis. Many people see dropping traffic as a security advantage over rejecting it because it exposes less information to a hypothetical attacker. While dropping slightly increases

security, it can also complicate the debugging of network issues or cause unwanted side-effects on client programs.

If traffic is rejected, the router will respond with an icmp error message ("destination port unreachable") causing the connection attempt to fail immediately. This also means that for each connection attempt a certain amount of response traffic is generated. This can actually harm if the firewall is attacked with many simultaneous connection attempts, the resulting backfire of icmp responses can clog up all available upload and make the connection unusable (DoS).

When connection attempts are dropped the client is not aware of the blocking and will continue to re-transmit its packets until the connection eventually times out. Depending on the way the client software is implemented, this could result in frozen or hanging programs that need to wait until a timeout occurs before they're able to continue.

DROP

- less information is exposed
- less attack surface
- client software may not cope well with it (hangs until connection times out)
- may complicate network debugging (where was traffic dropped and why)

REJECT

- may expose information (like the IP at which traffic was actually blocked)
- client software can recover faster from rejected connection attempts
- network debugging easier (routing and firewall issues clearly distinguishable)

31.3.2. Connection Tracking

By default, the firewall will disable connection tracking for a zone if no masquerading is enabled. This is achieved by generating NOTRACK firewall rules matching all traffic passing via interfaces referenced by the firewall zone. The purpose of NOTRACK is to speed up routing and save memory by circumventing resource intensive connection tracking in cases where it is not needed. You can check if connection tracking is disabled by issuing `iptables -t raw -S`, it will list all rules, check for NOTRACK target.

NOTRACK will render certain iptables extensions unusable, for example the MASQUERADE target or the state match will not work.

If connection tracking is required, for example by custom rules in `/etc/firewall.user`, you must enable the `conntrack` option in the corresponding zone to disable NOTRACK. It should appear as option `'conntrack' '1'` in the right zone in `/etc/config/firewall`.

The default configuration accepts all LAN traffic, but blocks all incoming WAN traffic on ports not currently used for connections or NAT. To open a port for a service, add a rule section:

```
config rule

option src wan

option dest_port 22

option target ACCEPT

option proto tcp
```

This example enables machines on the internet to use SSH to access your router.

31.3.3. Firewall Rule Examples

Opening Ports

The default configuration accepts all LAN traffic, but blocks all incoming WAN traffic on ports not currently used for connections or NAT. To open a port for a service, add a rule section:

```
config rule

option src          wan

option dest_port    22

option target       ACCEPT

option proto        tcp
```

This example enables machines on the internet to use SSH to access your router.

Forwarding Ports (Destination NAT/DNAT)

This example forwards http, but not HTTPS, traffic to the web server running on 192.168.1.10:

```
config redirect

option src wan

option src_dport 80

option proto tcp

option dest_ip 192.168.1.10
```

The next example forwards one arbitrary port that you define to a box running SSH behind the firewall in a more secure manner because it is not using default port 22.

```
config 'redirect'

option 'name' 'ssh'

option 'src' 'wan'

option 'proto' 'tcpudp'

option 'src_dport' '5555'

option 'dest_ip' '192.168.1.100'

option 'dest_port' '22'

option 'target' 'DNAT'

option 'dest' 'lan'
```

Source NAT (SNAT)

Source NAT changes an outgoing packet destined for the system so that it looks as though the system is the source of the packet.

Define source NAT for UDP and TCP traffic directed to port 123 originating from the host with the IP address 10.55.34.85. The source address is rewritten to 63.240.161.99

```
config redirect
option src      lan
option dest     wan
option src_ip   10.55.34.85
option src_dip  63.240.161.99
option dest_port 123
option target   SNAT
```

When used alone, Source NAT is used to restrict a computer's access to the internet, but allows it to access a few services by manually forwarding what appear to be a few local services; for example, NTP to the internet. While DNAT hides the local network from the internet, SNAT hides the internet from the local network.

Source NAT and destination NAT are combined and used dynamically in IP masquerading to make computers with private (192.168.x.x, etc) IP addresses appear on the internet with the system's public WAN IP address.

True Destination Port Forwarding

This usage is similar to SNAT, but as the destination IP address is not changed, machines on the destination network need to be aware that they will receive and answer requests from a public IP address that is not necessarily theirs. Port forwarding in this fashion is typically used for load balancing.

```
config redirect
option src      wan
option src_dport 80
option dest     lan
option dest_port 80
option proto    tcp
```

Block Access to a Specific Host

The following rule blocks all connection attempts to the specified host address.

```
config rule
option src      lan
option dest     wan
option dest_ip  123.45.67.89
option target   REJECT
```

Block Access to the Internet using MAC

The following rule blocks all connection attempts from the client to the internet.

```

config rule

option src      lan

option dest      wan

option src_mac   00:00:00:00:00:00

option target    REJECT

```

Block Access to the Internet for Specific IP on Certain Times

The following rule blocks all connection attempts to the internet from 192.168.1.27 on weekdays between 21:00 and 09:00

```

config rule

option src      lan

option dest      wan

option src_ip    192.168.1.27

option extra     '-m time--weekdays Mon,Tue,Wed,Thu,Fri --
timestart 21:00 --timestop 09:00'

option target    REJECT

```

Restricted Forwarding Rule

The example below creates a forward rule rejecting traffic from LAN to WAN on the ports 1000-1100.

```

config rule

option src      lan

option dest      wan

option dest_port 1000-1100

option proto     tcpudp

option target    REJECT

```

Denial of Service Protection Rule

The example below shows a sample configuration of SSH DoS attack where if more than two SSH connections are attempted within 120 seconds, every further connection will be dropped. You can configure this for any port number.

```

config rule 'sshattack'

option src 'lan'

option dest_port '22'

option proto 'tcp'

option recent '2 120'

option target 'DROP'

```

IP Spoofing Prevention Mechanism

Configure IP spoofing protection on a per interface basis in the `/etc/config/network` configuration file. the example below shows the `ipv4_rp_filter` option enabled on the `Vlan12` interface in the network file. When reverse path filtering mechanism is enabled, the router will check whether a receiving packet source address is routable.

If it is routable through the interface from which it came, then the machine will accept the packet.

If it is not routable through the interface from which it came, then the machine will drop that packet.

```
config interface 'Vlan12'
option type 'bridge'
option proto 'static'
option monitored '0'
option ipaddr '10.1.28.122'
option netmask '255.255.0.0'
option ifname 'eth1 eth3.12'
option ipv4_rp_filter '1'
```

Simple DMZ Rule

The following rule redirects all WAN ports for all protocols to the internal host `192.168.1.2`.

```
config redirect
option src wan
option proto all
option dest_ip 192.168.1.2
```

Transparent Proxy Rule (External)

The following rule redirects all outgoing HTTP traffic from LAN through an external proxy at `192.168.1.100` listening on port `3128`. It assumes the router LAN address to be `192.168.1.1` - this is needed to masquerade redirected traffic towards the proxy.


```

config redirect

option src      lan

option proto    tcp

option src_ip   !192.168.1.100

option src_dport 80

option dest_ip  192.168.1.100

option dest_port 3128

option target    DNAT


config redirect

option dest      lan

option proto     tcp

option src_dip   192.168.1.1

option dest_ip   192.168.1.100

option dest_port 3128

option target    SNAT

```

Transparent proxy rule (same host)

The rule below redirects all outgoing HTTP traffic from LAN through a proxy server listening at port 3128 on the router itself.

```

config redirect

option src      lan

option proto    tcp

option src_dport 80

option dest_port 3128

```

IPSec Passthrough

This example enables proper forwarding of IPSec traffic through the WAN.

```

AH protocol config rule

option src      wan

option dest     lan

option proto    ah

option target    ACCEPT # ESP protocol config rule


option src      wan

option dest     lan

option proto    esp

option target    ACCEPT

```

For some configurations you also have to open port 500/UDP.

```
# ISAKMP protocol

config rule

option src      wan
option dest     lan
option proto    udp
option src_port 500
option dest_port 500
option target   ACCEPT
```

Manual iptables Rules

You can specify traditional iptables rules, in the standard iptables UNIX command form, in an external file and included in the firewall config file. It is possible to use this process to include multiple files.

```
config include

option path /etc/firewall.user

config include

option path /etc/firewall.vpn
```

The syntax for the includes is Linux standard and therefore different from UCIs.

Firewall Management

After a configuration change, to rebuild the firewall rules, enter:

```
root@VA_router:/# /etc/init.d/firewall restart
```

Executing the following command will flush all rules and set the policies to ACCEPT on all standard chains:

```
root@VA_router:/# /etc/init.d/firewall stop
```

To manually start the firewall, enter:

```
root@VA_router:/# /etc/init.d/firewall start
```

To permanently disable the firewall, enter:

```
root@VA_router:/# /etc/init.d/firewall disable
```



NOTE

Disable does not flush the rules, so you might be required to issue a stop before.

To enable the firewall again, enter:

```
root@VA_router:/# /etc/init.d/firewall enable
```

Debug Generated Rule Set

It is possible to observe the iptables commands generated by the firewall programme. This is useful to track down iptables errors during firewall restarts or to verify the outcome of certain UCI rules.

To see the rules as they are executed, run the `fw` command with the `FW_TRACE` environment variable set to **1**:

```
root@VA_router:/# FW_TRACE=1 fw reload
```

To direct the output to a file for later inspection, enter:

```
root@VA_router:/# FW_TRACE=1 fw reload 2> /tmp/iptables.log
```

32. Configuring IPSec

Internet Protocol Security (IPSec) is a protocol suite used to secure communications at IP level. Use IPSec to secure communications between two hosts or between two networks. Merlin routers implement IPSec using strongSwan software.

If you need to create an IPSec template for DMVPN, read the chapter 'Dynamic Multipoint Virtual Private Network (DMVPN)'.

The number of IPSec tunnels supported by your router is not limited in any way by software; the only hardware limitation is the amount of RAM installed on the device.

Configuration package used

Package	Sections
strongswan	general
	connection
	secret

32.1. Configuring IPSec Using The Web Interface

To configure IPSec using the web interface, in the top menu, select **Services -> IPSec**. The strongSwan IPSec VPN page appears. There are three sections:

Common Settings	Control the overall behaviour of strongSwan. This behaviour is common across all tunnels.
Connection Settings	Together, these sections define the required parameters for a two-way IKEv1 tunnel.
Secret Settings	

32.1.1. Configure Common Settings Using The Web Interface

strongSwan IPsec VPN
Configuration of the strongSwan IPsec VPN system

Enable StrongSwan IPsec: ☒ Default: 1

Strict CRL Policy: Default: 1 Defines if a fresh CRL must be available in order for the peer authentication based on RSA signatures to succeed. (RFC4210 additionally recognizes 'yes' which reverts to 'yes' if at least one CRL URI is defined and to 'no' if no URI is known.

Unique IDs: Default: 1 Whether a particular participant ID should be kept unique, with any new (automatically keyed) connection using an ID from a different IP address deemed to replace all old ones using that ID. Participant IDs normally are unique, so a new (automatically-keyed) connection using the same ID is almost invariably intended to replace an old one. The IKEv2 daemon also accepts the value 'replace' which is identical to 'yes' and the value 'keep' to reject new IKE SA setups and keep the duplicate established earlier.

Cache CRLs: ☒ Default: 1 CRLs fetched via HTTP or LDAP will be cached.

Disable Revocation (CRL and OCSP): ☐ Default: 1

Send INITIAL CONTACT by default: ☒ Default: 1 Send INITIAL CONTACT authentication when first connection attempt for all connections.

Debug:

The common settings section

Web Field/UCI/Package Option	Description								
Web: Enable strongswan UCI: strongswan.general.enable Opt: enabled	Enables or disables IPsec. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled				
0	Disabled								
Default: 1	Enabled								
Web: Strict CRL Policy UCI: strongswan.general.strictcrlpolicy Opt: strictcrlpolicy	Defines if a fresh CRL must be available for the peer authentication based on RSA signatures to succeed. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled				
0	Disabled								
Default: 1	Enabled								
Web: Unique IDs UCI: strongswan.general.uniqueids Opt: uniqueids	Defines whether a particular participant ID should be kept unique, with any new, automatically keyed, connection using an ID from a different IP address deemed to replace all old ones using that ID. Participant IDs normally are unique, so a new, automatically- keyed, connection using the same ID is almost invariably intended to replace an old one. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled				
0	Disabled								
Default: 1	Enabled								
Web: Cache CRLs UCI: strongswan.general.cachecrls Opt: cachecrls	Certificate Revocation Lists (CRLs) fetched via HTTP or LDAP will be cached in /etc/ipsec.d/crls/ under a unique file name derived from the certification authority's public key. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>Default: 1</td><td>Enabled</td></tr> <tr><td>replace</td><td>Identical to Yes</td></tr> <tr><td>keep</td><td>Rejects new IKE SA and keeps the duplicate established earlier</td></tr> </table>	0	Disabled	Default: 1	Enabled	replace	Identical to Yes	keep	Rejects new IKE SA and keeps the duplicate established earlier
0	Disabled								
Default: 1	Enabled								
replace	Identical to Yes								
keep	Rejects new IKE SA and keeps the duplicate established earlier								
Web: Disable Revocation UCI: strongswan.general.revocation_disabled Opt: revocation_disabled	Defines whether disable CRL and OCSP checking for revoked certificates. <table border="1"> <tr><td>0</td><td>Disabled</td></tr> <tr><td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled				
0	Disabled								
Default: 1	Enabled								
Web: Send INITIAL CONTACT by default UCI: strongswan.general.initial_contact	Defines whether the first attempt to contact a remote peer by this strongswan instance sets the initial_contact flag, which should cause compliant peers to automatically bring down any previous sessions. This can also be enabled or disabled per connection.								

Web Field/UCI/Package Option	Description	
Opt: initial_contact		
Web: Debug	Enables debugging. This option is used for trouble shooting issues. It is not suitable for a production environment.	
UCI: strongswan.general.debug		
Opt: debug		
	Default: None	Debug disabled
	Control	Debug enabled. Shows generic control flow with errors and very basic auditing logs.
	All	Debug enabled. Most verbose logging also includes sensitive information such as keys.

32.1.2. Common Settings: Configure Connection Using Web Interface

Connections

Enabled

SE

Aggressive Mode

SE

Name

Disable

Autostart Action

route

Operation on startup

add

adds a connection without starting it

delete

deletes a connection and resets tunnel state. If traffic is detected between local and remote, a connection is established

start

adds a connection and brings it up immediately

ignore

do nothing

Connection Type

Serial

Details

The configure connection page

Web Field/UCI/Package Option	Description										
Web: Enabled UCI: strongswan.@connection[X].enabled Opt: enable	Enables or disables an IPSec connection. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled						
Default: 0	Disabled										
1	Enabled										
Web: Aggressive UCI: strongswan.@connection[X].aggressive Opt: aggressive	Enables or disables IKE aggressive mode. Note: using aggressive mode along with PSK authentication is a less secure method than main mode and should be avoided. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled						
Default: 0	Disabled										
1	Enabled										
Web: Name UCI: strongswan.@connection[X].name Opt: name	Specifies a name for the tunnel.										
Web: Autostart Action UCI: strongswan.@connection[X].auto Opt: auto	Specifies when the tunnel is initiated. <table border="1"> <tr> <td>start</td><td>On start up.</td></tr> <tr> <td>Default: route</td><td>When traffic routes this way.</td></tr> <tr> <td>add</td><td>Loads a connection without starting it.</td></tr> <tr> <td>ignore</td><td>Ignores the connection.</td></tr> <tr> <td>always</td><td>Actively retries to establish the tunnel if it went down.</td></tr> </table>	start	On start up.	Default: route	When traffic routes this way.	add	Loads a connection without starting it.	ignore	Ignores the connection.	always	Actively retries to establish the tunnel if it went down.
start	On start up.										
Default: route	When traffic routes this way.										
add	Loads a connection without starting it.										
ignore	Ignores the connection.										
always	Actively retries to establish the tunnel if it went down.										
Web: Connection Type UCI: strongswan.@connection[X].type Opt: type	Defines the type of IPSec connection. <table border="1"> <tr> <td>Default: tunnel</td><td>Connection uses tunnel mode.</td></tr> <tr> <td>transport</td><td>Connection uses transport mode.</td></tr> <tr> <td>pass</td><td>Connection does not perform any IPSec processing</td></tr> <tr> <td>drop</td><td>Connection drops all the packets</td></tr> </table>	Default: tunnel	Connection uses tunnel mode.	transport	Connection uses transport mode.	pass	Connection does not perform any IPSec processing	drop	Connection drops all the packets		
Default: tunnel	Connection uses tunnel mode.										
transport	Connection uses transport mode.										
pass	Connection does not perform any IPSec processing										
drop	Connection drops all the packets										

32.1.3. Common Settings: IP Addressing Using The Web Interface

The IP addressing settings

Web Field/UCI/Package Option	Description						
Web: Remote GW Address UCI: strongswan.@connection[X]. remoteaddress Opt: remoteaddress	Sets the public IP address of the remote peer.						
Web: Local ID UCI: strongswan.@connection[X].localid Opt: localid	Defines the local peer identifier.						
Web: Remote ID UCI: strongswan.@connection[X].remoteid Opt:remoteid	Defines the remote peer identifier.						
Web: Local LAN IP Address UCI: strongswan.@connection[X]. locallan Opt: locallan	Defines the local IP of LAN.						
Web: Local LAN IP Address Mask UCI: strongswan.@connection[X]. locallanmask Opt: locallanmask	Defines the subnet of local LAN.						
Web: Remote LAN IP Address UCI: strongswan.@connection[X]. remotelan Opt:remotelan	Defines the IP address of LAN serviced by remote peer.						
Web: Remote LAN IP Address Mask UCI: strongswan.@connection[X]. remotelanmask Opt:remotelanmask	Defines the Subnet of remote LAN.						
Web: Local Protocol UCI: strongswan.@connection[X].localproto Opt: localproto	Restricts the connection to a single port on the local side.						
Web: Local Port UCI: strongswan.@connection[X].localport Opt: localport	Restricts the connection to a single protocol on the local side.						
Web: Remote Protocol UCI: strongswan.@connection[X].remoteproto Opt: remoteproto	Restricts the connection to a single protocol on the remote side.						
Web: Remote Port UCI: strongswan.@connection[X].remoteport Opt: remoteport	Restricts the connection to a single port on the remote side.						
Web: Authby UCI: strongswan.@connection[X].authby Opt: authby	Defines how the two secure gateways should authenticate. Note: using aggressive mode along with PSK authentication is unsecure and should be avoided. <table> <tr> <td>Pubkey</td><td>For public key signatures.</td></tr> <tr> <td>Rsasig</td><td>For RSA digital signatures.</td></tr> <tr> <td>ecdsasig</td><td>For elliptic curve DSA signatures.</td></tr> </table>	Pubkey	For public key signatures.	Rsasig	For RSA digital signatures.	ecdsasig	For elliptic curve DSA signatures.
Pubkey	For public key signatures.						
Rsasig	For RSA digital signatures.						
ecdsasig	For elliptic curve DSA signatures.						

Web Field/UCI/Package Option	Description	
	Psk	Using a preshared key.
	zauthrsasig	Enables eXtended Authentication (ZAtuh) with addition to RSA signatures.
	zauthpsk	Using extended authentication and preshared key.
	never	Can be used if negotiation is never to be attempted or accepted (shunt connection)

32.2. Common Settings: IPSec Settings Using The Web Interface

The screenshot shows the 'Common Settings: IPSec settings' page. It contains the following fields and descriptions:

- IKE identity:** Defines the identity/username the client uses to reply to an XAuth request. If not defined, the IKEv1 identity will be used as XAuth identity.
- Reauthenticate:** Reauthenticate the peer at every rekeying of the IKE SA.
- IKE algorithm:** aes256-sha1-md5p192a
- ESP algorithm:** aes-sha1-md5p192a
- WAN interface:** wan
- IKE SA time:** 900s. How long the keying channel of a connection should last before being renegotiated.
- Key life:** 500s. Symmetric key lifetime. How long a particular instance of a connection (a set of encryption/authentication keys for user packets) should last, from successful negotiation to expiry.
- Rekey margin:** 30s. Symptom for margin time. How long before connection expiry or keying channel expiry should attempts to negotiate a replacement begin.
- Keying time:** N/Await. How many attempts (a positive integer or N/Await) should be made to negotiate a connection, or a replacement for one, before giving up (default 3). The value 'N/Await' means 'never give up'.
- Restart delay:** 0s. Delay (termination of previous IKE SA and start of the next IKE SA of automatic connection) if 0 then random delay in the range of 1 to Rekey margin is used.
- DPD Action:** restart. Controls the use of the DPD protocol when R_U_THERE notification messages (IKEv1) or empty INFORMATIONAL messages (IKEv2) are periodically sent in order to check the liveness of the IPsec peer. If no activity is detected, all connections with a dead peer are stopped and unsecured (less) put in the hold state (hold) or restarted (restart). The default is none which disables the active sending of DPD messages.
- DPD Delay:** 30s. Defines the period time interval with which R_U_THERE messages/INFORMATIONAL exchanges are sent to the peer.
- DPD Timeout:** 180s. Defines the timeout interval, after which all connections to a peer are deleted in case of inactivity.
- Inherit CHILD SA:** Inherit CHILD SA when IKE SA is released.
- Send INITIAL CONTACT:** Send INITIAL CONTACT notification when first connection attempt.

The common settings: IPSec settings page

Figure 4. Common settings: IPSec settings

Web Field/UCI/Package Option	Description
Web: XAuth Identity UCI: strongswan.@connection[X].xauth_identity Opt: xauth_identity	Defines Xauth ID.
Web: IKE Algorithm UCI: strongswan.@connection[X].ike Opt: ike	Specifies the IKE algorithm to use. The format is: encAlgo authAlgo DHGroup encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144 modp8192 For example, a valid IKE algorithm is: aes128-sha-modp1536.
Web: ESP algorithm UCI: strongswan.@connection[X].esp Opt: esp	Specifies the esp algorithm to use. encAlgo: 3des aes128 aes256 serpent twofish blowfish authAlgo: md5 sha sha2 DHGroup: modp1024 modp1536 modp2048 modp3072 modp4096 modp6144

Web Field/UCI/Package Option	Description								
	modp8192 For example, a valid IKE algorithm is: aes128-sha-modp1536.								
Web: WAN Interface UCI: strongswan.@connection[X].waniface Opt: waniface	This is a space-separated list of the WAN interfaces the router will use to establish a tunnel with the secure gateway. On the web, a list of the interface names is automatically generated. If you want to specify more than one interface use the "custom" value. Example: if you have a 3G WAN interface called 'wan' and a WAN ADSL interface called 'dsl' and wanted to use one of these interfaces for this IPSec connection, you would use: 'wan adsl'.								
Web: IKE Life Time UCI: strongswan.@connection[X].ikelifetime Opt: ikelifetime	Specifies how long the keying channel of a connection (ISAKMP or IKE SA) should last before being renegotiated. <table border="1"> <tr> <td>Default:</td><td>3 hr</td></tr> <tr> <td>Timespec</td><td>1d, 1h, 25m, 10s</td></tr> </table>	Default:	3 hr	Timespec	1d, 1h, 25m, 10s				
Default:	3 hr								
Timespec	1d, 1h, 25m, 10s								
Web: Key Life UCI: strongswan.@connection[X].keylife Opt: keylife	Specifies how long a particular instance of a connection (a set of encryption/authentication keys for user packets) should last, from successful negotiation to expiry. Normally, the connection is renegotiated (via the keying channel) before it expires (see rekeymargin). <table border="1"> <tr> <td>Default:</td><td>1h</td></tr> <tr> <td>Timespec</td><td>1d, 1h, 25m, 10s</td></tr> </table>	Default:	1h	Timespec	1d, 1h, 25m, 10s				
Default:	1h								
Timespec	1d, 1h, 25m, 10s								
Web: Rekey Margin UCI: strongswan.@connection[X].rekeymargin Opt: rekeymargin	Specifies how long before connection expiry or keying- channel expiry should attempt to negotiate a replacement begin. Relevant only locally, other end need not agree on it. <table border="1"> <tr> <td>Default:</td><td>9m</td></tr> <tr> <td>Timespec</td><td>1d, 2h, 9m, 10s</td></tr> </table>	Default:	9m	Timespec	1d, 2h, 9m, 10s				
Default:	9m								
Timespec	1d, 2h, 9m, 10s								
Web: Restart Delay UCI: strongswan.@connection[X].restartdelay Opt: restartdelay	Defines specific delay when re-establishing a connection. Previously if <code>close_action=restart</code>, then the new option <code>restartdelay</code> controls how many seconds it waits before attempting to re-establish the tunnel to allow the headend some time to tidy up. If not set, it defaults to zero, which means that the previous behaviour of choosing a random time interval in the range 0..<code>RekeyMargin</code> seconds takes effect. Relevant only locally, other end need not agree on it. <table border="1"> <tr> <td>Default:</td><td>0</td></tr> <tr> <td>Timespec</td><td>1d, 2h, 9m, 10s</td></tr> </table>	Default:	0	Timespec	1d, 2h, 9m, 10s				
Default:	0								
Timespec	1d, 2h, 9m, 10s								
Web: Keying Tries UCI: strongswan.@connection[X].keyingtries Opt: keyingtries	Specifies how many attempts, for example, a positive integer or %forever, should be made to negotiate a connection, or a replacement for one, before giving up. The value %forever means 'never give up'. Relevant only locally, the other end need not agree on it.								
Web: DPD Action UCI: strongswan.@connection[X].dpdaction Opt: dpdaction	Defines DPD (Dead Peer Detection) action. <table border="1"> <tr> <td>Default: None</td><td>Disables DPD.</td></tr> <tr> <td>Clear</td><td>Clear down the tunnel if peer does not respond. Reconnect when traffic brings the tunnel up.</td></tr> <tr> <td>Hold</td><td>Clear down the tunnel and bring up as soon as the peer is available.</td></tr> <tr> <td>Restart</td><td>Restarts DPD when no activity is detected.</td></tr> </table>	Default: None	Disables DPD.	Clear	Clear down the tunnel if peer does not respond. Reconnect when traffic brings the tunnel up.	Hold	Clear down the tunnel and bring up as soon as the peer is available.	Restart	Restarts DPD when no activity is detected.
Default: None	Disables DPD.								
Clear	Clear down the tunnel if peer does not respond. Reconnect when traffic brings the tunnel up.								
Hold	Clear down the tunnel and bring up as soon as the peer is available.								
Restart	Restarts DPD when no activity is detected.								
Web: DPD Delay UCI: strongswan.@connection[X].dpddelay Opt: dpddelay	Defines the period time interval with which R_U_THERE messages and INFORMATIONAL exchanges are sent to the peer. These are only sent if no other traffic is received. <table border="1"> <tr> <td>Default:</td><td>30s</td></tr> <tr> <td>Timespec</td><td>1d, 2h, 25m, 10s</td></tr> </table>	Default:	30s	Timespec	1d, 2h, 25m, 10s				
Default:	30s								
Timespec	1d, 2h, 25m, 10s								
Web: DPD Timeout UCI: strongswan.@connection[X].dpdtimeout Opt: dpdtimeout	Defines the timeout interval, after which all connections to a peer are deleted in case of inactivity. <table border="1"> <tr> <td>Default:</td><td>150s</td></tr> <tr> <td>Timespec</td><td>1d, 2h, 25m, 10s</td></tr> </table>	Default:	150s	Timespec	1d, 2h, 25m, 10s				
Default:	150s								
Timespec	1d, 2h, 25m, 10s								
Web: Inherit CHILD SA UCI: strongswan.@connection[X].inherit_child	Defines whether the existing phase two IPSEC SA is maintained through IKE rekey for this tunnel. This is normally set to match the behaviour on the IPSEC headend.								

Web Field/UCI/Package Option	Description	
Opt: inherit_child	Default: 0	Delete the existing IPSEC SA on IKE rekey
	1	Maintain the existing IPSEC SA on IKE rekey
Web: Send INITIAL CONTACT UCI: strongswan.@connection[X].initial_contact Opt: initial_contact	Defines whether the first attempt to contact a remote peer by this strongswan instance sets the initial_contact flag which should cause compliant peers to automatically bring down any previous sessions.	
	Default: 0	Do not set initial contact flag
	1	Set initial contact flag on first attempt.

32.3. Configure Secret Settings Using The Web Interface

Each tunnel requires settings to configure how the local end point of the tunnel proves its identity to the remote end point.

The screenshot shows the 'Secrets' configuration page. At the top, there's a header with 'Enabled', 'ID selector', 'Secret Type', and 'Secret'. Below this, there's a note: 'To match local/remote id enter local id followed by space followed by remote id'. The table contains two rows of secrets, each with a 'Delete' button. At the bottom, there's an 'Add' button and a 'Save & Apply' button.

The IPsec secret settings section

Figure 5. Configure secret settings

Web Field/UCI/Package Option	Description										
Web: Enabled UCI: strongswan.@secret[X].enabled Opt: enabled	Defines whether this set of credentials is to be used or not. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled						
Default: 0	Disabled										
1	Enabled										
Web: ID selector UCI: strongswan.@secret[X].idtype Opt: idtype	Defines whether IP address or userfqdn is used.										
Web: ID selector UCI: strongswan.@secret[X].localaddress Opt: localaddress	Defines the local address this secret applies to.										
Web: ID selector UCI: strongswan.@secret[X].remoteaddress Opt: remoteaddress	Defines the remote address this secret applies to.										
Web: N/A UCI: strongswan.@secret[X].userfqdn Opt: userfqdn	FQDN or Xauth name used of Extended Authentication. This must match xauth_identity from the configuration connection section.										
Web: Secret Type UCI: strongswan.@secret[X].secrettype Opt: secrettype	Specifies the authentication mechanism to be used by the two peers. <table> <tr> <td>Psk</td><td>Preshared secret</td></tr> <tr> <td>Pubkey</td><td>Public key signatures</td></tr> <tr> <td>Rsasig</td><td>RSA digital signatures</td></tr> <tr> <td>Ecdsasig</td><td>Elliptic Curve DSA signatures</td></tr> <tr> <td>Xauth</td><td>Extended authentication</td></tr> </table>	Psk	Preshared secret	Pubkey	Public key signatures	Rsasig	RSA digital signatures	Ecdsasig	Elliptic Curve DSA signatures	Xauth	Extended authentication
Psk	Preshared secret										
Pubkey	Public key signatures										
Rsasig	RSA digital signatures										
Ecdsasig	Elliptic Curve DSA signatures										
Xauth	Extended authentication										

32.4. Configuring An IPSec Template For DMVPN Via The Web Interface

To configure IPSec using the web interface, in the top menu, select **Services -> IPSec**. The strongSwan IPSec VPN page appears. There are three sections:

Common Settings	Control the overall behaviour of strongSwan. This behaviour is common across all tunnels.
Connection Settings	Together, these sections define the required parameters for a two-way IKEv1 tunnel.
Secret Settings	

32.5. Configuring IPSec Using UCI

Common Settings

```
# Commands

touch /etc/config/strongswan

uci set strongswan.general=general

uci set strongswan.general.enabled=yes

uci set strongswan.general.strictcrlpolicy=no

uci set strongswan.general.uniqueids=yes

uci set strongswan.general.cachecrls=no

uci set strongswan.general.debug=none

uci set strongswan.general.initial_contact=0

uci commit
```

Connection Settings



NOTE

Xauth is not supported in IKEv2.

```
touch /etc/config/strongswan

uci add strongswan connection

uci set strongswan.@connection[0].ikelifetime=3h
uci set strongswan.@connection[0].keylife=1h
uci set strongswan.@connection[0].rekeymargin=9m
uci set strongswan.@connection[0].keyingtries=3
uci set strongswan.@connection[0].restartdelay=0
uci set strongswan.@connection[0].dpdaction=none
uci set strongswan.@connection[0].dpddelay=30s
uci set strongswan.@connection[0].dpdtimeout=150s
uci set strongswan.@connection[0].enabled=yes
uci set strongswan.@connection[0].name=3G_Backup
uci set strongswan.@connection[0].auto=start
uci set strongswan.@connection[0].type=tunnel
uci set strongswan.@connection[0].remoteaddress=100.100.100.100
uci set strongswan.@connection[0].localid=192.168.209.1
uci set strongswan.@connection[0].remoteid=100.100.100.100
uci set strongswan.@connection[0].locallan=192.168.209.1
uci set strongswan.@connection[0].locallanmask=255.255.255.255
uci set strongswan.@connection[0].remotelan=172.19.101.3
uci set strongswan.@connection[0].remotelanmask=255.255.255.255
uci set strongswan.@connection[0].authby=xauthpsk
uci set strongswan.@connection[0].xauth_identity=testxauth
uci set strongswan.@connection[0].ike=3des-md5-modp1024
uci set strongswan.@connection[0].esp=3des-md5
uci set strongswan.@connection[0].waniface=wan
uci set strongswan.@connection[0].inherit_child=0
uci set strongswan.@connection[0].initial_contact=0
uci commit
```

This will create the following output:

```
config connection

option ikelifetime '3h'

option keylife '1h'

option rekeymargin '9m'

option keyingtries '3'

option restartdelay '0'

option dpdaction 'none'

option dpddelay '30s'

option dpdtimeout '150s'

option enabled 'yes'

option name '3G_Backup'

option auto 'start'

option type 'tunnel'

option remoteaddress '100.100.100.100 '

option localid '192.168.209.1'

option remoteid '100.100.100.100 '

option locallan '192.168.209.1'

option locallanmask '255.255.255.255'

option remotelan '172.19.101.3'

option remotelanmask '255.255.255.255'

option authby 'xauthpsk'

option xauth_identity 'testxauth'

option ike '3des-md5-modp1024'

option esp '3des-md5'

option waniface 'wan'

option inherit_child '0'

option initial_contact '0'
```

32.6. Shunt Connection Using UCI

If the remote LAN network is 0.0.0.0/0 then all traffic generated on the local LAN will be sent via the IPSec tunnel. This includes the traffic destined to the router's IP address. To avoid this situation you must include an additional config connection section.


```
# Commands

touch /etc/config/strongswan

uci add strongswan connection

uci set strongswan.@connection[1].name=local

uci set strongswan.@connection[1].enabled=yes

uci set strongswan.@connection[1].locallan=10.1.1.1

uci set strongswan.@connection[1].locallanmask=255.255.255.255

uci set strongswan.@connection[1].remotelan=10.1.1.0

uci set strongswan.@connection[1].remotelanmask=255.255.255.0

uci set strongswan.@connection[1].type=pass

uci set strongswan.@connection[1].auto=route

uci commit
```

This will create the following output:

```
config connection

option name 'local' option enabled 'yes'

option locallan '10.1.1.1'

option locallanmask '255.255.255.255'

option remotelan '10.1.1.0'

option remotelanmask '255.255.255.0' option type 'pass'

option auto 'route'
```

Traffic originated on `remotelan` and destined to `locallan` address is excluded from VPN IPSec policy.

32.7. Secret Settings Using UCI

Each tunnel also requires settings for how the local end point of the tunnel proves its identity to the remote end point.

A sample secret section, which could be used with the connection section in ‘Connection Settings’, is shown below.

```
# Commands to add a secret for psk auth

touch /etc/config/strongswan

uci add strongswan secret

uci set strongswan.@secret[0].enabled=yes

uci set strongswan.@secret[0].localaddress=192.168.209.1

uci set strongswan.@secret[0].remoteaddress= 100.100.100.100

uci set strongswan.@secret[0].secrettype=psk

uci set strongswan.@secret[0].secret=secret

uci commit
```

This will create the following output:

```
config secret

option enabled 'yes'

option localaddress '192.168.209.1'

option remoteaddress '100.100.100.100 '

option secrettype 'psk'

option secret 'secret'
```

If xauth is defined as the authentication method then you must include an additional config secret section, as shown in the example below.

```
# Commands to add a secret for xauth auth touch /etc/config/strongswan

uci add strongswan secret

uci set strongswan.@secret[1].enabled=yes

uci set strongswan.@secret[1].idtype=userfqdn uci set strongswan.@secret[1].userfqdn=testxauth

uci set strongswan.@secret[1].remoteaddress=100.100.100.100 uci set strongswan.@secret[1].secret=xauth

uci set strongswan.@secret[1].secrettype=XAUTH

uci commit
```

This will create the following output:

```
config secret

option enabled 'yes'

option idtype 'userfqdn'

option userfqdn 'testxauth'

option remoteaddress '100.100.100.100'

option secret 'xauth'

option secrettype 'XAUTH'
```

32.8. Configuring An IPSec Template To Use With DMVPN Using UCI

The following example shows how to configure an IPSec connection template to use with DMVPN.

```
# Commands

touch /etc/config/strongswan

uci set strongswan.general=general
uci set strongswan.general.enabled=yes
uci set strongswan.general.strictcrpolicy=no
uci set strongswan.general.uniqueids=yes
uci set strongswan.general.cachecrls=yes
uci set strongswan.general.nattraversal=yes
```

```
uci add strongswan connection

uci set strongswan.@connection[0].enabled=yes
uci set strongswan.@connection[0].name=dmpvpn
uci set strongswan.@connection[0].type=transport
uci set strongswan.@connection[0].localproto=gre
uci set strongswan.@connection[0].remoteproto=gre
uci set strongswan.@connection[0].ike=aes-sha1-modp1024
uci set strongswan.@connection[0].esp=aes128-sha1
uci set strongswan.@connection[0].waniface=lan4
uci set strongswan.@connection[0].auto=ignore
uci set strongswan.@connection[0].ikelifetime=28800s
uci set strongswan.@connection[0].keylife=300s
uci set strongswan.@connection[0].rekeymargin=30s
uci set strongswan.@connection[0].keyingtries=%forever
uci set strongswan.@connection[0].dpdaction=hold
uci set strongswan.@connection[0].dpddelay=30s
uci set strongswan.@connection[0].dpdtimeout=150s
```

```
uci add strongswan secret

uci set strongswan.@secret[0].enabled=yes
uci set strongswan.@secret[0].secrettype=psk
uci set strongswan.@secret[0].secret=secret
```

This will create package strongswan.

```

config general 'general'

option enabled 'yes'

option strictcrtpolicy 'no'

option uniqueids 'yes'

option cachecrls 'yes'

option nattraversal 'yes'


config connection

option enabled 'yes'

option name 'dmvpn'

option type 'transport'

option localproto 'gre'

option remoteprototo 'gre'

option ike 'aes-sha1-modp1024'

option esp 'aes128-sha1'

option waniface 'lan4'

option auto 'ignore'

option ikelifetime '28800s'

option keylife '300s'

option rekeymargin '30s'

option keyingtries '%forever'

option dpdaction 'hold'

option dpddelay '30s'

option dpdtimeout '150s' config secret

option enabled 'yes'

option secrettype 'psk'

option secret 'secret'

```

32.9. IPSec Diagnostics

IPSec Status using the Web Interface

In the top menu, click **Status -> IPSec**. The IPSec Connections page appears.

IPsec Connections									
Name	IKE					SA			
	Status	Remote	Established	Encryption	Integrity	Status	Policy	Data bit/Sec	Keying in
dmvpn_213_233_148_2	ESTABLISHED	213.233.148.2	2 hours ago	DES_CBC	HMAC_MD5_96	INSTALLED			
dmvpn_89_101_134_101	ESTABLISHED	89.101.134.101	2 hours ago	DES_CBC	HMAC_MD5_96	INSTALLED			

The IPSec connections page

In the Name column, the syntax contains the IPSec Name defined in package dmvpn and the remote IP address of the hub, or the spoke separated by an underscore; for example, dmvpn_213.233.148.2.

IPSec Diagnostics using UCI

Viewing IPSec Configuration

To view IPSec configuration via UCI, enter:

```
root@VA_router:~# uci export strongswan
```

To restart strongSwan, enter:

```
root@VA_router:~# /etc/init.d/strongswan restart
```

IPSec Status

```
root@VA_router:~# ipsec statusall
Security Associations (1 up, 0 connecting):

dmvpn_89_101_154_151[1]: ESTABLISHED 2 hours ago,
10.68.234.133[10.68.234.133], 89.101.154.151[89.101.154.151]

dmvpn_89_101_154_151{1}: REKEYING, TRANSPORT, expires in 55 seconds
dmvpn_89_101_154_151{1}: 10.68.234.133/32[gre] === 192.168./32[gre]
dmvpn_89_101_154_151{1}: INSTALLED, TRANSPORT, ESP in UDP SPIs: cca7b970_i
d874dc90_o
dmvpn_89_101_154_151{1}: 10.68.234.133/32[gre] === 89.101.154.151/32[gre]
```

To view a list of IPSec commands, enter:

```
root@VA_router:~# ipsec --help
```

33. Configuring SCEP (Simple Certificate Enrolment Protocol)

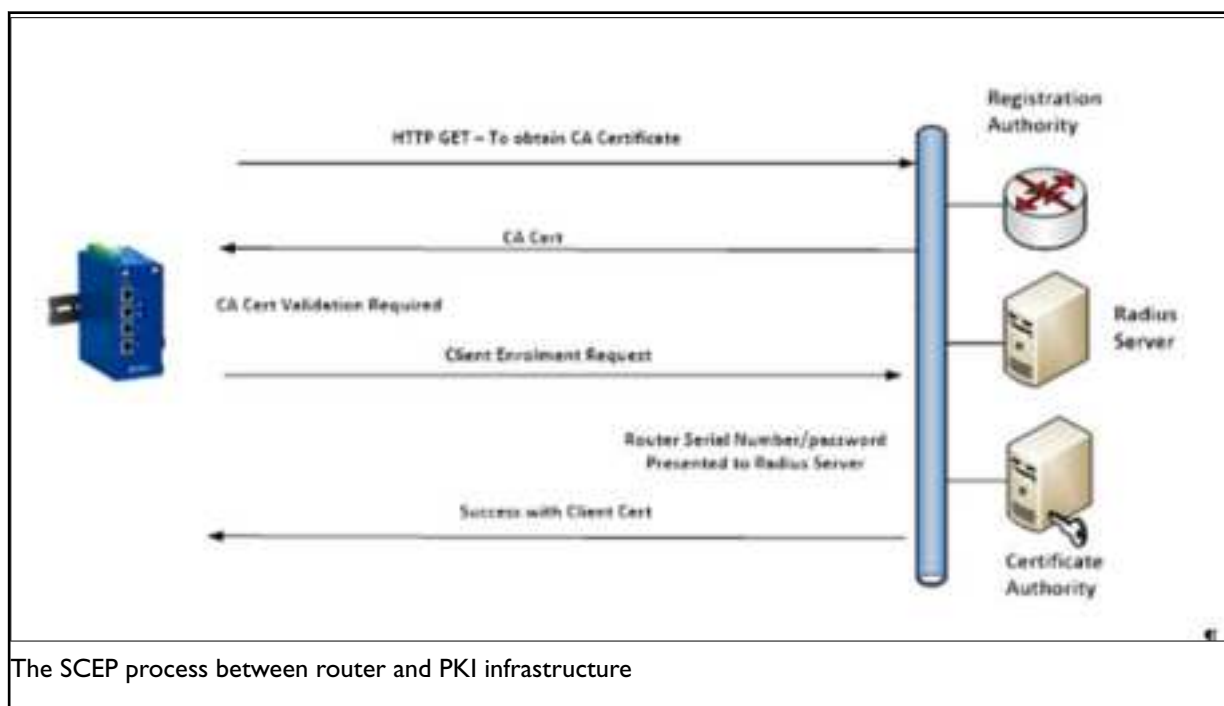
SCEP is a method for automatically obtaining x.509 certificates for IPSec validation. This protocol is commonly used in a Private Key Infrastructure (PKI).

The SCEP method has the following steps:

- Obtain a copy of the Certificate Authority (CA) certificate and validate it.
- Generate a Certificate Signing Request (CSR) and send it securely to the CA.
- Re-enrol as necessary to obtain a new certificate prior to the expiration of the current certificate.

This section only details the SCEP portion of an IPSec configuration. For more

information on configuring general IPSec, read the chapter 'Configuring IPSec'.



Configuration package used

Package	Sections
strongswan	scep_cert

33.1. Configuring SCEP Using The Web Interface

To define an automatically enrolled certificate, using SCEP, select **Services -> IPSec**. Scroll down to the SCEP Certificate section. Enter a name for the SCEP section and select **Add**.

SCEP Certificate

SCEP works only on IOS

This section contains no values yet

SCEP certificate name section

The SCEP certificate configuration section options appear.

SCEPCERT

Enabled

☐

Blocking

☐

Don't start IPsec until certificate is received

SCEP URL

SCEP server URL

SCEP DN

Distinguished Name

SCEP Password

Certificate Path

Location to store certificate on the router (defaults to /etc/ipsec.d/certs/.pem)

Private Key Path

Location to store private key on the router (defaults to /etc/ipsec.d/private/.pem)

CA Certificate Path

Location to store CA certificate on the router

Minimal Renew Margin (in Hours)

Renew certificate not less than Minimal Renew Margin hours before expiration

Maximal Renew Margin (in Hours)

Renew certificate not more than Maximal Renew Margin hours before expiration

Minimal Retry Interval (in Seconds)

Minimal SCEP poll time

Maximal Retry Interval (in Seconds)

Maximal SCEP poll time

Private Key Length (in bits)

HTTP Method

PKCS#7 Encryption Algorithm

PKCS#7 Digest Algorithm

PKCS#10 Signature Algorithm

CA Implementation

Force certain CA implementation. Leave blank unless you know what you're doing

The SCEP certificate section options

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: strongswan.@scep_cert[0].enabled Opt: enabled	Defines whether SCEP automatic enrolment is enabled. <table border="1"> <tr> <td>0</td><td>Disabled</td></tr> <tr> <td>Default: 1</td><td>Enabled</td></tr> </table>	0	Disabled	Default: 1	Enabled
0	Disabled				
Default: 1	Enabled				
Web: Blocking UCI: strongswan.@scep_cert[0].blocking Opt: blocking	Defines whether to wait until the certificate is received before starting IPsec. <table border="1"> <tr> <td>Default: 0</td><td>Wait until the certificate is received before starting IPsec.</td></tr> <tr> <td>1</td><td>Do not wait until the certificate is received.</td></tr> </table>	Default: 0	Wait until the certificate is received before starting IPsec.	1	Do not wait until the certificate is received.
Default: 0	Wait until the certificate is received before starting IPsec.				
1	Do not wait until the certificate is received.				
Web: SCEP URL UCI: strongswan.@scep_cert[0].url Opt: url	Defines the URL for the SCEP server.				
Web: SCEP DN UCI: strongswan.@scep_cert[0].dn Opt: dn	Defines the Distinguished Name to use for new certificate. Note: substring %serial will be replaced with a router's serial number.				
Web: SCEP Password UCI: strongswan.@scep_cert[0].scep_psk Opt: scep_psk	Defines a SCEP password.				
Web: Certificate Path UCI: strongswan.@scep_cert[0].cert_path Opt: cert_path	Defines the filepath to store the certificate on the router (absolute or relative). <table border="1"> <tr> <td>Default: Empty</td><td>/etc/ipsec.d/certs/.pem</td></tr> </table>	Default: Empty	/etc/ipsec.d/certs/.pem		
Default: Empty	/etc/ipsec.d/certs/.pem				
Web: Private Key Path UCI: strongswan.@scep_cert[0].key_path Opt: key_path	Defines the filepath to store the private key on the router (absolute or relative). <table border="1"> <tr> <td>Default: Empty</td><td>/etc/ipsec.d/certs/.pem</td></tr> </table>	Default: Empty	/etc/ipsec.d/certs/.pem		
Default: Empty	/etc/ipsec.d/certs/.pem				
Web: CA Certificate Path UCI: strongswan.@scep_cert[0].cacert Opt: cacert	Defines the filepath to store the CA certificate on the router (absolute or relative). <table border="1"> <tr> <td>Default: Empty</td><td>/etc/ipsec.d/certs/.pem</td></tr> </table>	Default: Empty	/etc/ipsec.d/certs/.pem		
Default: Empty	/etc/ipsec.d/certs/.pem				
Web: Minimal Renewal Margin (Hours) UCI: strongswan.@scep_cert[0].minmargin_hrs Opt: minmargin_hrs	Defines the minimum duration, in hours, from certificate expiration for renewal of certificate. Note: a random value between minimal and maximal renewal margin will be used. <table border="1"> <tr> <td>Default:</td><td>10 hours</td></tr> </table>	Default:	10 hours		
Default:	10 hours				
Web: Maximal Renewal Margin (Hours) UCI: strongswan.@scep_cert[0].maxmargin_hrs Opt: maxmargin_hrs	Defines the maximum duration, in hours, from certificate expiration for renewal of certificate. Note: the retry interval will be set to a random value between minimal and maximal renewal margin. <table border="1"> <tr> <td>Default:</td><td>24 hours</td></tr> </table>	Default:	24 hours		
Default:	24 hours				
Web: Minimal Retry Interval (Seconds) UCI: strongswan.@scep_cert[0].minretry Opt: minretry	Defines the minimal poll time, in seconds. Note: the retry interval will be set to a random value between minimal and maximal renewal margin. The retry interval is used when the server replies with PENDING status for initial request (also called manual mode). <table border="1"> <tr> <td>Default:</td><td>10 hours</td></tr> </table>	Default:	10 hours		
Default:	10 hours				
Web: Maximal Retry Interval (Seconds) UCI: strongswan.@scep_cert[0].maxretry	Defines the maximal poll time, in seconds.				

Web Field/UCI/Package Option	Description																		
Opt: maxretry	Note: the retry interval will be set to a random value between minimal and maximal renewal margin. The retry interval is used when the server replies with PENDING status for initial request (also called manual mode). <table><tr><td>Default:</td><td>100 seconds</td></tr></table>	Default:	100 seconds																
Default:	100 seconds																		
Web: Private Key Length (in bits) UCI: strongswan.@scep_cert[0].key_len Opt: key_len	Defines the private key length. <table><tr><td>Default: 2048</td><td>2048 bits</td></tr><tr><td>4096</td><td>4096 bits</td></tr><tr><td>6144</td><td>6144 bits</td></tr><tr><td>8192</td><td>8192 bits</td></tr><tr><td>--custom--</td><td>Defines custom length</td></tr></table>	Default: 2048	2048 bits	4096	4096 bits	6144	6144 bits	8192	8192 bits	--custom--	Defines custom length								
Default: 2048	2048 bits																		
4096	4096 bits																		
6144	6144 bits																		
8192	8192 bits																		
--custom--	Defines custom length																		
Web: HTTP Method UCI: strongswan.@scep_cert[0].method Opt: method	Defines the HTTP method used for client enrolment. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: GET</td><td>HTTP GET</td><td>get</td></tr><tr><td>POST</td><td>HTTP POST</td><td>post</td></tr></table>	Web	Description	UCI	Default: GET	HTTP GET	get	POST	HTTP POST	post									
Web	Description	UCI																	
Default: GET	HTTP GET	get																	
POST	HTTP POST	post																	
Web: PKCS#7 Encryption Algorithm UCI: strongswan.@scep_cert[0].pkcs7_enc_algo Opt: pkcs7_enc_algo	Defines the symetric encryption algorithm to use. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: aes256</td><td></td><td>aes256</td></tr><tr><td>aes192</td><td></td><td>aes192</td></tr><tr><td>aes128</td><td></td><td>aes128</td></tr><tr><td>3des</td><td></td><td>3des</td></tr></table>	Web	Description	UCI	Default: aes256		aes256	aes192		aes192	aes128		aes128	3des		3des			
Web	Description	UCI																	
Default: aes256		aes256																	
aes192		aes192																	
aes128		aes128																	
3des		3des																	
Web: PKCS#7 Digest Algorithm UCI: strongswan.@scep_cert[0].pkcs7_dgst_algo Opt: pkcs7_dgst_algo	Defines the hash algorithm for pkcs7 digest calculation. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: sha512</td><td></td><td>sha512</td></tr><tr><td>sha384</td><td></td><td>sha284</td></tr><tr><td>sha256</td><td></td><td>sha256</td></tr><tr><td>sha1</td><td></td><td>sha1</td></tr><tr><td>md5</td><td></td><td>md5</td></tr></table>	Web	Description	UCI	Default: sha512		sha512	sha384		sha284	sha256		sha256	sha1		sha1	md5		md5
Web	Description	UCI																	
Default: sha512		sha512																	
sha384		sha284																	
sha256		sha256																	
sha1		sha1																	
md5		md5																	
Web: PKCS#7 Signature Algorithm UCI: strongswan.@scep_cert[0].pkcs10_sig_algo Opt: pkcs10_sig_algo	Defines the hash algorithm for pkcs10 signature. <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: sha512</td><td></td><td>sha512</td></tr><tr><td>sha384</td><td></td><td>sha284</td></tr><tr><td>sha256</td><td></td><td>sha256</td></tr><tr><td>sha1</td><td></td><td>sha1</td></tr><tr><td>md5</td><td></td><td>md5</td></tr></table>	Web	Description	UCI	Default: sha512		sha512	sha384		sha284	sha256		sha256	sha1		sha1	md5		md5
Web	Description	UCI																	
Default: sha512		sha512																	
sha384		sha284																	
sha256		sha256																	
sha1		sha1																	
md5		md5																	
Web: CA Implementation UCI: strongswan.@scep_cert[0].caimpl Opt: caimpi	Defines the SCEP server implementation <table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>Default: Empty</td><td>Automatically deducted from URL.</td><td></td></tr><tr><td>Microsoft CA</td><td>Mircosoft CA</td><td>ms</td></tr><tr><td>EJB CA</td><td>Enterprise Java Beans Certificate Authority</td><td>ejbca</td></tr></table>	Web	Description	UCI	Default: Empty	Automatically deducted from URL.		Microsoft CA	Mircosoft CA	ms	EJB CA	Enterprise Java Beans Certificate Authority	ejbca						
Web	Description	UCI																	
Default: Empty	Automatically deducted from URL.																		
Microsoft CA	Mircosoft CA	ms																	
EJB CA	Enterprise Java Beans Certificate Authority	ejbca																	

33.2. Configuring SCEP Certificate Using The Command Line

SCEP is configured using the **scep_cert** configuration section in the strongswan package

/etc/config/strongswan.

You can configure multiple SCEP configuration sections.

By default, all SCEP certificate instances are named 'scep_cert'. The SCEP certificate instance is identified by @scep_cert then the SCEP certificate position in the package as a number. For example, for the first SCEP certificate in the package using UCI, enter:

```
strongswan.@scep_cert[0]=scep_cert
strongswan.@scep_cert[0].enabled=1
```

Or using package options, enter:

```
config scep_cert
option enabled '1'
```

However, to better identify it, we recommend giving the SCEP certificate instance a name. For example, a SCEP certificate named 'SCEPCERT' will be strongswan.SCEPCERT.

To define a named SCEP certificate instance using UCI, enter:

```
strongswan.SCEPCERT=scep_cert
strongswan.SCEPCERT.enabled=1
```

To define a named SCEP certificate instance using package options, enter:

```
config scep_cert 'SCEPCERT'
option 'enabled' '1'
```

SCEP certificate using UCI

```
root@VA_router:~# uci show strongswan
package strongswan

#####

strongswan.SCEPCERT=scep_cert
strongswan.SCEPCERT.enabled=1
strongswan.SCEPCERT.url=url
strongswan.SCEPCERT.dn=dn
strongswan.SCEPCERT.scep_psk=password
strongswan.SCEPCERT.cert_path=/etc/ipsec.d/certs/
strongswan.SCEPCERT.key_path=/etc/ipsec.d/private/
strongswan.SCEPCERT.cacert=/etc/ipsec.d/cacerts/
strongswan.SCEPCERT.minmargin_hrs=10
strongswan.SCEPCERT.maxmargin_hrs=240
strongswan.SCEPCERT.minretry=10
strongswan.SCEPCERT.maxretry=100
strongswan.SCEPCERT.key_len=2048
strongswan.SCEPCERT.method=get
strongswan.SCEPCERT.pkcs7_enc_algo=aes256
strongswan.SCEPCERT.pkcs7_dgst_algo=sha512
strongswan.SCEPCERT.pkcs10_sig_algo=sha512
strongswan.SCEPCERT.caimpl=ms
```

SCEP certificate using package options

```
root@VA_router:~# uci export strongswan
package strongswan

#####

config scep_cert 'SCEPCERT'
option enabled '1'
option url 'url' option dn 'dn'
option scep_psk 'password'
option cert_path '/etc/ipsec.d/certs/'
option key_path '/etc/ipsec.d/private/'
option cacert '/etc/ipsec.d/cacerts/'
option minmargin_hrs '10'
option maxmargin_hrs '240'
option minretry '10'
option maxretry '100'
option key_len '2048' option method 'get'
option pkcs7_enc_algo 'aes256'
option pkcs7_dgst_algo 'sha512'
option pkcs10_sig_algo 'sha512'
option caimpl 'ms'
```

33.3. SCEP Diagnostics

Syslog

SCEP certificate status can be monitored via the system log. An example of SCEP syslog messages is shown below.

```

Aug 14 04:51:01 user:notice 00E0C81604BE ipsec: ca cert
'/etc/ipsec.d/cacerts/vaebjtest' expired or not yet downloaded

Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: loaded plugins: curl aes des sha1 sha2 md5 random x509 pkcs1 pkcs7
pem openssl gmp

Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: building CRED_CONTAINER - PKCS7 failed, tried 2 builders

Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: unable to parse PKCS#7, assuming plain CA cert

Aug 14 04:51:01 authpriv.info 00E0C81604BE scepclient[9146]: written ca cert file '/etc/ipsec.d/cacerts/vaebjtest' (1200 bytes)

Aug 14 04:51:01 authpriv.info 00E0C81604BE ipsec_starter[9172]: Starting strongSwan 5.0.2 IPsec [starter]...

Aug 14 04:51:01 daemon.info 00E0C81604BE ipsec: 00[DMN] Starting IKE charon daemon (strongSwan 5.0.2, Linux 3.18.11, mips)

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading ca certificates from '/etc/ipsec.d/cacerts'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loaded ca certificate "CN=VAejbcaTestCA, O=VA, C=IE" from '/etc/
ipsec.d/cacerts/vaebjtest'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading aa certificates from '/etc/ipsec.d/aacerts'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading ocsp signer certificates from '/etc/ipsec.d/ocspcerts'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading attribute certificates from '/etc/ipsec.d/acerts'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading crls from '/etc/ipsec.d/crls'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading secrets from '/etc/ipsec.secrets'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loading secrets from '/var/conf/ipsec.secrets'

Aug 14 04:51:02 daemon.info 00E0C81604BE ipsec: 00[CFG] loaded RSA private key from '/etc/ipsec.d/private/ejb_cert.pem'

```

33.4. Strongswan Process Using UCI

The strongswan process has its own subset of commands.

```

root@VA_router:~# /etc/init.d/strongswan

Syntax: /etc/init.d/dsl_control [command]

```

Available commands:

```

start Start the service

stop Stop the service

restart Restart the service

reload Reload configuration files (or restart if that fails)

enable Enable service autostart

disable Disable service autostart

```

To restart strongswan, enter:

```

root@VA_router:~# /etc/init.d/strongswan restart

```

34. Dynamic Multipoint Virtual Private Network (DMVPN)

Dynamic Multipoint Virtual Private Network (DMVPN) is a scalable method of creating VPN IPsec networks. DMVPN is a suite of three protocols: NHRP, GRE and IPsec, used to dynamically create VPN tunnels between different endpoints in the network without having to pre-configure each device with VPN details of the rest of endpoints in the network.

Prerequisites for Configuring DMVPN

Before configuring DMVPN, you must first configure:

- A GRE interface; read the previous chapter, 'Configuring GRE interfaces'.
- An IPsec connection to use as a template. Read the previous chapter 'Configuring IPsec'.

Advantages of using DMVPN

Using DMVPN eliminates the need of IPsec configuration to the physical interface. This reduces the number of lines of configuration required for a VPN development. For example, for a 1000-site deployment, DMVPN reduces the configuration effort at the hub from 3900 lines to 13.

- Adding new peers (spokes) to the VPN requires no changes at the hub.
- Better scalability of the network.
- Dynamic IP addresses can be used at the peer's site.
- Spokes can be connected in private or public network.
- NHRP NAT extension allows spoke-to-spoke tunnels to be built, even if one or more spokes is behind a Network Address Translation (NAT) device.
- New hubs can be added to the network to improve the performances and reliability.
- Ability to carry multicast and main routing protocols traffic (RIP, OSPF, BGP).
- DMVPN can be deployed using Activator, the automated provisioning system.
- Simplifies branch communications by enabling direct branch to branch connectivity.
- Simplifies configuration on the spoke routers. The same IPsec template configuration is used to create spoke-to-hub and spoke-to-spoke VPN IPsec tunnel.
- Improves business resiliency by preventing disruption of business-critical applications and services by incorporating routing with standards-based IPsec technology.

34.1. Configuring DMVPN Using The Web Interface

Configuration Packages Used

Package	Sections
network	For configuring GRE tunnels.
strongswan	For enabling and configuring the IPsec connection template
dmvpn	

The DMVPN section contains fields required to configure the parameters relative to the DMVPN Hub. These are used for DMVPN tunnels, such as GRE tunnels, GRE tunnel remote IP, DMVPN Hub IP and password.

There are two sections in the DMVPN page: General and DMVPN Hub Settings.

DMVPN General Settings

In the top menu, select **Network -> DMVPN**. The DMVPN page appears.

DMVPN

General

Enable DMVPN

IPsec template connection

dmvpn

Delete

The DMVPN general section

Web Field/UCI/Package Option	Description				
Web: Enable DMVPN UCI: dmvpn.common.enabled Opt: enable	Enables DMVPN. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1md5</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1md5	Enabled
Default: 0	Disabled				
1md5	Enabled				
Web: IPsec template connection UCI: dmvpn.common.ipsec_template_name Opt: ipsec_template_name	Selects the IPsec connection, defined in strongSwan, to be used as a template.				

DMVPN Hub Settings

DMVPN Hub Settings

Hub Interface

Hub Remote (Endpoint IP Address)

Hub Remote (Endpoint Mask Length)

DMVPN Hub IP Address

Hub Authentication

Hub Holding Time

Use as Default Route

Default Route Metric

Hub Auto Configuration

ipmi

10.0.0.1

10.0.0.1/24

3600

0

ipmi

0

Apply

Back

Save & Apply

Cancel

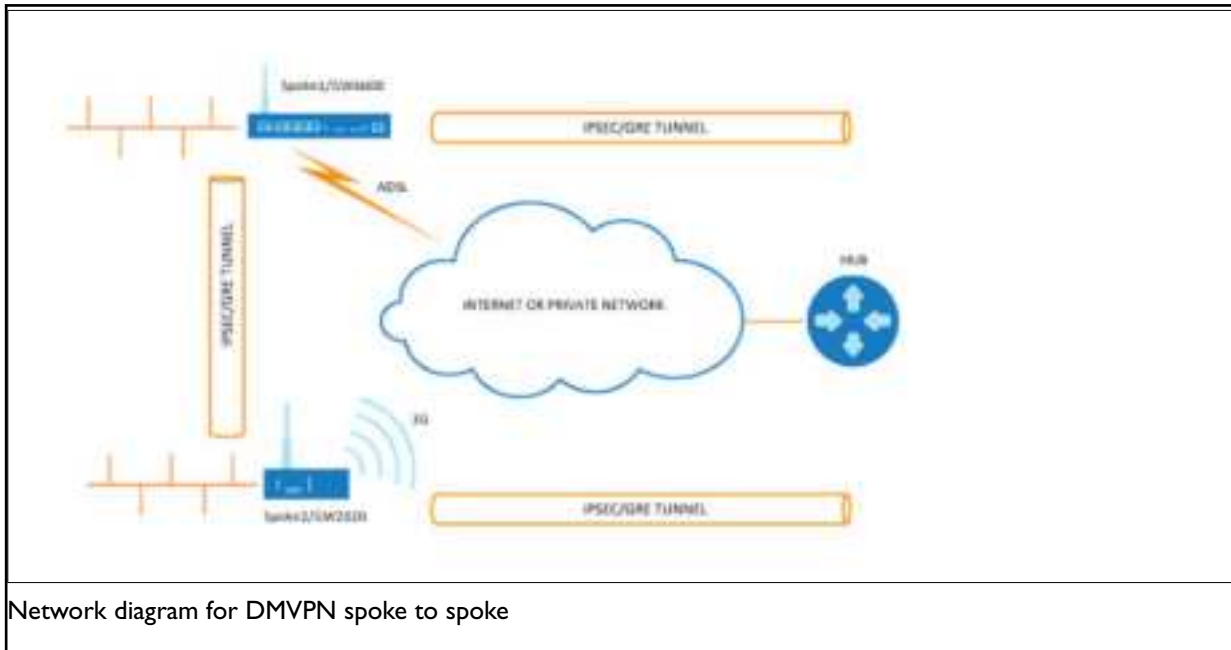
Reset

The DMVPN hub settings section

Web Field/UCI/Option	Description				
Web: GRE Interface UCI: dmvpn.@interface[X].gre_interface Opt: gre_interface	Specifies which GRE interface will be used with this DMVPN configuration.				
Web: GRE Remote Endpoint IP Address UCI: dmvpn.@interface[X].gre_endpoint_ip Opt: gre_endpoint_ip	Configures the GRE IP address of the hub.				
Web: GRE Remote Endpoint Mask Length UCI: dmvpn.@interface[X].gre_endpoint_mask_length Opt: gre_endpoint_mask_length	Configures the length of the mask of the GRE interface on the hub. For example, if the mask is 255.255.0.0 the length will be 16.				
Web: DMVPN Hub IP Address UCI: dmvpn.@interface[X].nhs_ip Opt: nhs_ip	Configures the physical IP address for the DMVPN hub.				
Web: NHRP Authentication UCI: dmvpn.@interface[X].cisco_auth Opt: cisco_auth	Enables authentication on NHRP. The password will be applied in plaintext to the outgoing NHRP packets. Maximum length is 8 characters.				
Web: NHRP Holding Time UCI: dmvpn.@interface[X].holding_time Opt: holding_time	Timeout for cached NHRP requests.				
Web: Use as Default Route UCI: dmvpn.@interface[X].defaultroute Opt: defaultroute	Adds a default route into tunnel interface. <table border="1"> <tr> <td>incomplete</td><td>Resolution request sent.</td></tr> <tr> <td>1</td><td>Negative cached.</td></tr> </table>	incomplete	Resolution request sent.	1	Negative cached.
incomplete	Resolution request sent.				
1	Negative cached.				
Web: Default Route Metric UCI: dmvpn.@interface[X].defaultroutemetric Opt: defaultroutemetric	Metric to use for the default route.				
Web: LED state indication UCI: dmvpn.@interface[X].led Opt: led	LED to use for indicating if the VPN is up.				

34.2. DMVPN Scenarios

Scenario 1

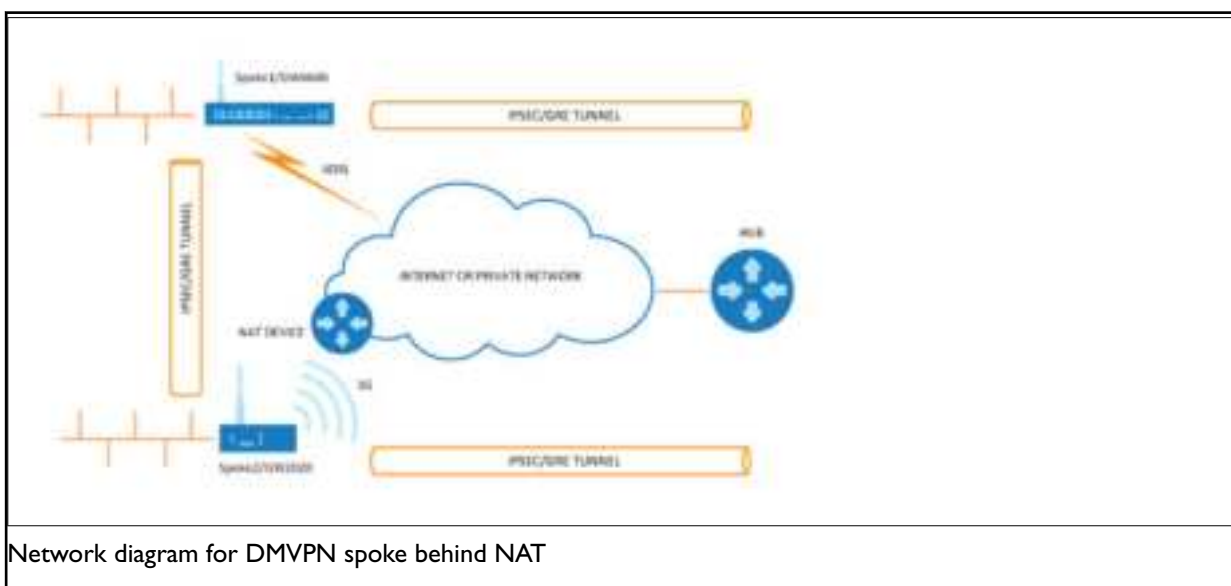


Spoke1, spoke2 and a hub are in the same public or private network.

- Spoke1 and spoke2 connect on their WAN interface: ADSL, 3G and initiate main mode IPsec in transport mode to the hub.
- After an IPsec tunnel is established, spokes register their NHRP membership with the hub.
- GRE tunnels come up.
- Hub caches the GRE tunnel and real IP addresses of each spoke.
- When spoke1 wants to talk to spoke2, it sends an NHRP resolution request to the hub.
- The hub checks its cache table and forwards that request to spoke2.
- Spoke2 caches spoke1's GRE and real IP address and sends an NHRP resolution reply via the hub.
- Spoke1 receives an NHRP resolution reply and updates its NHRP table with spoke2 information. Then it initiates VPN IPsec connection to spoke2.
- When an IPsec tunnel is established, spoke 1 and spoke 2 can send traffic directly to each other.

Scenario 2

Spoke1 is in a private (NAT-ed) network, spoke2 and hub are in public network.



- Spoke1 sends an NHRP registration request to the hub.
- Hub receives this request and compares the source tunnel address of the spoke with the source of the packet.
- Hub sends an NHRP registration reply with a NAT extension to spoke1.
- The NAT extension informs spoke1 that it is behind the NAT-ed device.
- Spoke1 registers its pre- and post-NAT address.
- When spoke1 wants to talk to spoke2, it sends an NHRP resolution request to the hub.
- Hub checks its cache table and forwards that request to spoke2.
- Spoke2 caches spoke1's GRE pre- and post-NAT IP address and sends an NHRP resolution reply via the hub.
- Spoke1 receives the NHRP resolution reply and updates its NHRP table with spoke2 information. It initiates a VPN IPSec connection to spoke2.
- When the IPSec tunnel is established, spoke1 and spoke2 can send traffic directly to each other.



NOTE

If an IPSec tunnel fails to be established between the spokes then packets between the spokes are sent via the hub.

34.3. Configuring DMVPN Using The Web Interface

Configuration Packages Used

Package	Sections
network	For configuring GRE tunnels.
strongswan	For enabling and configuring the IPSec connection template
dmvpn	

The DMVPN section contains fields required to configure the parameters relative to the DMVPN Hub. These are used for DMVPN tunnels, such as GRE tunnels, GRE tunnel remote IP, DMVPN Hub IP and password.

There are two sections in the DMVPN page: General and DMVPN Hub Settings.

DMVPN General Settings

In the top menu, select **Network -> DMVPN**. The DMVPN page appears.

The DMVPN general section

Web Field/UCI/Package Option	Description				
Web: Enable DMVPN UCI: dmvpn.common.enabled Opt: enable	Enables DMVPN. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1md5</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1md5	Enabled
Default: 0	Disabled				
1md5	Enabled				
Web: IPsec template connection UCI: dmvpn.common.ipsec_template_name Opt: ipsec_template_name	Selects the IPsec connection, defined in strongSwan, to be used as a template.				

DMVPN Hub Settings

DMVPN Hub Settings

DMVPN Enable

DMVPN Remote Computer IP Address

DMVPN Remote Computer Mask Length

DMVPN Hub IP Address

DMVPN Authentication

DMVPN Holding Time

Use as Default Route

Default Route Metric

DMVPN Interface

10.0.0.1

255.255.255.0

10.0.0.1

3600

0

0

0

0

0

10.0.0.1

255.255.255.0

10.0.0.1

3600

0

0

0

0

0

Save

Cancel

Apply

Save & Apply

Save

Cancel

The DMVPN hub settings section

Web Field/UCI/Option	Description				
Web: GRE Interface UCI: dmvpn.@interface[X].gre_interface Opt: gre_interface	Specifies which GRE interface will be used with this DMVPN configuration.				
Web: GRE Remote Endpoint IP Address UCI: dmvpn.@interface[X].gre_endpoint_ip Opt: gre_endpoint_ip	Configures the GRE IP address of the hub.				
Web: GRE Remote Endpoint Mask Length UCI: dmvpn.@interface[X].gre_endpoint_mask_length Opt: gre_endpoint_mask_length	Configures the length of the mask of the GRE interface on the hub. For example, if the mask is 255.255.0.0 the length will be 16.				
Web: DMVPN Hub IP Address UCI: dmvpn.@interface[X].nhs_ip Opt: nhs_ip	Configures the physical IP address for the DMVPN hub.				
Web: NHRP Authentication UCI: dmvpn.@interface[X].cisco_auth Opt: cisco_auth	Enables authentication on NHRP. The password will be applied in plaintext to the outgoing NHRP packets. Maximum length is 8 characters.				
Web: NHRP Holding Time UCI: dmvpn.@interface[X].holding_time Opt: holding_time	Timeout for cached NHRP requests.				
Web: Use as Default Route UCI: dmvpn.@interface[X].defaultroute Opt: defaultroute	Adds a default route into tunnel interface. <table border="1"> <tr> <td>incomplete</td><td>Resolution request sent.</td></tr> <tr> <td>1</td><td>Negative cached.</td></tr> </table>	incomplete	Resolution request sent.	1	Negative cached.
incomplete	Resolution request sent.				
1	Negative cached.				
Web: Default Route Metric UCI: dmvpn.@interface[X].defaultroutemetric Opt: defaultroutemetric	Metric to use for the default route.				
Web: LED state indication UCI: dmvpn.@interface[X].led Opt: led	LED to use for indicating if the VPN is up.				

34.4. DMVPN Diagnostics

In the top menu, click **Status -> IPSec**. The IPSec Connections page appears.

IPSec Connections									
Name	IKE					SA			
	Status	Remote	Established	Encryption	Integrity	Status	Policy	Data In/Out	Rekey In
dmvpn_213_233_146_2	ESTABLISHED	213.233.146.2	2 hours ago	3DES_CBC	HMAC_SHA_96	INITIALIZED			
dmvpn_88_191_144_151	ESTABLISHED	88.191.144.151	2 hours ago	3DES_CBC	HMAC_SHA_96	INITIALIZED			

The IPSec connections page

In the Name column, the syntax contains the IPSec name defined in package dmvpn and the remote IP address of the hub, or the spoke separated by an underscore; for example, dmvpn_213.233.148.2.

To check the status of DMVPN, in the top menu, click **Status -> DMVPN**.

NBMA peers			
NBMA Address	Interface	Address	Type
213.233.148.2	GRE	11.11.11.3/32	spoke
89.101.154.151	GRE	11.11.11.1/29	hub
Powered by LuCI Theme (dark) v0.8.331 (VE-16.00.28 image) config2			
The NBMA peers page			

To check DMVPN status, enter:

```
:~# opennhrpctl show
Status: ok
Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.7/32
Alias-Address: 11.11.11.3
Flags: up
Interface: gre-GRE
Type: local
Protocol-Address: 11.11.11.3/32
Flags: up
Interface: gre-GRE
Type: cached
Protocol-Address: 11.11.11.2/32
NBMA-Address: 178.237.115.129
NBMA-NAT-OA-Address: 172.20.38.129
Flags: used up
Expires-In: 0:18
Interface: gre-GRE
Type: static
Protocol-Address: 11.11.11.1/29
NBMA-Address: 89.101.154.151
Flags: up
```

Interface	Description	
Type	incomplete	Resolution request sent.
	negative	Negative cached.
	cached	Received/relayed resolution reply.
	shortcut_route	Received/relayed resolution for route.
	dynamic	NHC resolution.
	dynamic_nhs	Dynamic NHS from dns-map.
	static	Static mapping from config file.
	dynamic_map	Static dns-map from config file.
	local_route	Non-local destination, with local route.
	local_addr	Local destination (IP or off-NBMA subnet).
Protocol Address	Tunnel IP address	
NBMA-Address	Pre-NAT IP address if NBMA-NAT-OA-Address is present or real address if NAT is not present.	
NBMA-NAT-OA-Address	Post NAT IP address. This field is present when address is translated in the network.	
Flags	up	Can send all packets (registration ok).
	unique	Peer is unique.
	used	Peer is kernel ARP table.
	lower-up	openhrp script executed successfully.
Expires-In	Expiration time.	

You can check IPsec status using UCI commands.

```

root@VA-router:~# ipsec status

Security Associations (1 up, 0 connecting):

dmvpn_89_101_154_151[1]: ESTABLISHED 2 hours ago,
10.68.234.133[10.68.234.133]. 89.101.154.151[89.101.154.151]

dmvpn_89_101_154_151{1}: REKEYING, TRANSPORT, expires in 55 seconds
dmvpn_89_101_154_151{1}: 10.68.234.133/32[gre] === 192.168./32[gre]

dmvpn_89_101_154_151{1}: INSTALLED, TRANSPORT, ESP in UDP SPIs: cca7b970_id874dc90_o
dmvpn_89_101_154_151{1}: 10.68.234.133/32[gre] === 89.101.154.151/32[gre]

```

You can check DMVPN status using UCI commands.

```
:~# opennhrpctl show  
  
Status: ok  
  
Interface: gre-GRE  
  
Type: local  
  
Protocol-Address: 11.11.11.7/32  
  
Alias-Address: 11.11.11.3  
  
Flags: up  
  
Interface: gre-GRE  
  
Type: local  
  
Protocol-Address: 11.11.11.3/32  
  
Flags: up  
  
Interface: gre-GRE  
  
Type: cached  
  
Protocol-Address: 11.11.11.2/32  
  
NBMA-Address: 178.237.115.129  
  
NBMA-NAT-OA-Address: 172.20.38.129  
  
Flags: used up  
  
Expires-In: 0:18  
  
Interface: gre-GRE  
  
Type: static  
  
Protocol-Address: 11.11.11.1/29  
  
NBMA-Address: 89.101.154.151  
  
Flags: up
```

35. Configuring QoS: VLAN PCP Tagging

Merlin routers have the capability to respect and set PCP priority values inside 802.1Q VLAN tagged frames. The following partial export of network configuration shows how to configure VLAN priorities for specific interfaces (VLANs).

```
root@VA_router:~# uci export network package network
config va_switch
option eth0 'A E'
option eth1 'B F'
option eth2 'C G'
option eth3 'D'
option eth4 'H'
```



```

config interface 'VLAN_1'

option type 'bridge'

option proto 'static'

option ipaddr '10.1.28.99'

option netmask '255.255.0.0'

option ifname 'eth0 eth4'


config interface 'VLAN_2'

option type 'bridge'

option proto 'static'

option ipaddr '192.168.2.1'

option netmask '255.255.255.0'

option ifname 'eth1 eth4.2'

option vlan_qos_map_ingress '1:1'

option vlan_qos_map_egress '0:1'


config interface 'VLAN_3'

option ifname 'eth2 eth4.3'

option type 'bridge'

option proto 'static'

option ipaddr '192.168.3.1'

option netmask '255.255.255.0'

option vlan_qos_map_ingress '3:3'

option vlan_qos_map_egress '0:3'


config interface 'VLAN_4'

option ifname 'eth3 eth4.4'

option type 'bridge'

option proto 'static'

option ipaddr '192.168.3.1'

option netmask '255.255.255.0'

option vlan_qos_map_ingress '5:5'

option vlan_qos_map_egress '0:5'

```

UCI Package Options	Description
UCI: network.<if name>.vlan_qos_map_ingress	VLAN priority code point to socket buffer mapping.
Opt: list vlan_qos_map_ingress	Example: network.<if name>. vlan_qos_map_ingress =1:1
UCI: network.<if name>.vlan_qos_map_egress	Socket buffer to VLAN priority code point mapping.
Opt: list vlan_qos_map_egress	Example: network.<if name>. vlan_qos_map_egress =0:1

The above sample configuration specifies that any frames on VLAN2, VLAN3 and VLAN4 will be processed or have their PCP value adjusted according to QoS values set.

VLAN1 VLAN1 is an untagged VLAN so there are no 802.1Q tags on the frames.

VLAN2 Any frames received on VLAN2 destined to VLAN2 with PCP priority of 1 will be forwarded without altering the priority; it will be still set to 1. Any frames received on VLAN2 destined to VLAN2 with a PCP priority set to 0 will have a priority of 1 set as they leave the router on VLAN2.

VLAN3 Any frames received on VLAN3 destined to VLAN3 with a PCP priority of 3 will be forwarded without altering the priority; it will be still set to 3. Any frames received on VLAN3 destined to VLAN2 with PCP priority set to 0 will have a priority of 3 set as they leave the router on VLAN3.

VLAN4 Any frames received on VLAN4 destined to VLAN2 with PCP priority of 5 will be forwarded without altering the priority; it will be still set to 5. Any frames received on VLAN4 destined to VLAN2 with PCP priority set to 0 will have a priority of 5 set as they leave the router on VLAN4.

Four queues are supported and are structured as follows: · Queue 1: PCP values 0 and 1 - Default
· Queue 2: PCP values 2 and 3 - Normal · Queue 3: PCP values 4 and 5 - High · Queue 4: PCP values 6 and 7 - Express

Value 7 is the highest priority and 0 is the lowest. These queues prioritise 802.1Q tagged frames as they are received on the port, these are hardware defined.

When 802.1Q frames are received on the port they are processed according to the above queues on arrival, even if not defined in the configuration. Then if value 'vlan_qos_map_ingress' is configured you can modify the PCP priority for egress if the frame was to be forwarded on another tagged interface.

When frames are received on an untagged VLAN interface configured with 'vlan_qos_map_egress' and are destined to tagged interface, 802.1Q tag will be created with a default priority of 0 and then the priority will be set according to the PCP value specified as the frames leave port.

36. Management Configuration Settings

This chapter contains the configuration sections and parameters required to manage and monitor your device using Activator and Monitor.

Activator

Activator is a proprietary provisioning system, where specific router configurations and firmware can be stored to allow central management and provisioning. Activator has two distinct roles in provisioning firmware and configuration files to a router.

- Autoload activation of firmware and configuration files on router boot up:
- Autoload is generally used for router installation. In this scenario the router will initiate the request for firmware and configuration files when it boots up. The router is installed with a factory config that will allow it to contact Activator. The autoload feature controls the behaviour of the router in requesting firmware and configuration files; this includes when to start the Activation process and the specific files requested. The HTTP Client (uhttpd) contains information about Activator server and the protocol used for activation.
- Deployment of firmware to routers after installation:
- In this scenario, Activator initiates the process. This process, known as Active Updates, allows for central automatic deployment of firmware and configuration files. It is used when configuration or firmware changes need to be pushed to live routers.

Monitor

Monitor is a proprietary tool, based on SNMP protocol, to monitor wide networks of deployed routers. The router is configured to send information to Monitor, which is then stored and viewed centrally via the Monitor application. This includes features such as traffic light availability status, syslog and SLA monitoring.

Configuration Packages Used

Package	Sections
autoload	main
httpclient	default
management_users	user

36.1. Autoload: Boot Up Activation

Autoload configurations specify how the device should behave with respect to activation when it boots up. Autoload entries contain information about the specific files to be downloaded and the destination for the downloaded file. Standard autoload entry configurations to download are:

- A firmware file (\$\$.img)
- A configuration file (\$\$.ini)
- A .vas file (\$\$.vas). This file signals the end of the autoloaod sequence to Activator

Activator identifies the device using the serial number of the router. \$\$ syntax is used to denote the serial number of the router when requesting a file. The requested files are written to the alternate image or config segment.

You can change the settings either directly in the configuration file or via appropriate UCI set commands. It is normal procedure for autoload to be enabled in the router's factory settings and disabled in running configurations (config 1 and 2).

Autoload may already have been set at factory config level. If you wish to enable autoload services, proceed through the following steps.

Autoload Packages

Package	Sections
autoload	main

Create a Configuration File

In the top menu, select **Services -> Autoload**. The Autoload page has two sections: Basic Settings and Entries. Click **Add** to access configuration settings for each section.

Autoload

Configuration of the VW Autoload Service

Basic Settings

Basic settings should be checked according to your network.

Enabled

☒

Start Time

Retry Time

Bus Using Config

Bus Using Image

Delete

Entries

Configured	Segment Name	Remote Filename	
	Download destination	Use 00 for the serial number	
☒	allconfig	00_00	Delete
☒	allimage	00_img	Delete
☒	alllog	00_log	Delete

Add

Save & Apply

Save

Reset

The autoload settings page

Web Field/UCI/Package Option	Description								
Basic Settings									
Web: Enabled UCI: autoload.main.enabled Opt: Enabled	Enables activation at system boot. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled				
Default: 0	Disabled								
1	Enabled								
Web: Start Timer UCI: autoload.main.StartTimer Opt: StartTimer	Defines how long to wait after the boot up completes before starting activation. <table border="1"> <tr> <td>Default:</td><td>10</td></tr> <tr> <td>Range</td><td>0-300 secs</td></tr> </table>	Default:	10	Range	0-300 secs				
Default:	10								
Range	0-300 secs								
Web: Retry Timer UCI: autoload.main.RetryTimer Opt: RetryTimer	Defines how many seconds to wait between retries if a download of a particular autoload entry fails. <table border="1"> <tr> <td>Default:</td><td>10</td></tr> <tr> <td>Range</td><td>0-300 Secs</td></tr> </table>	Default:	10	Range	0-300 Secs				
Default:	10								
Range	0-300 Secs								
Web: N/A UCI: autoload.main.NumberOfRetries Opt: Numberofretries	Defines how many retries to attempt before failing the overall activation sequence, backing off and trying the whole activation sequence again. <table border="1"> <tr> <td>Default:</td><td>5</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default:	5	Range					
Default:	5								
Range									
Web: N/A UCI: autoload.main.BackoffTimer Opt: Backofftimer	Defines how many minutes to back off for if a download and all retries fail. After the backoff period, the entire autoload sequence will start again. <table border="1"> <tr> <td>Default:</td><td>15</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default:	15	Range					
Default:	15								
Range									
Web: Boot Using Config UCI: autoload.main.BootUsingConfig Opt: BootUsingConfig	Specifies which configuration to boot up with after the activation sequence. <table border="1"> <tr> <td>Default: Altconfig</td><td>Alternative configuration</td></tr> <tr> <td>Config1</td><td>Configuration 1</td></tr> <tr> <td>Config2</td><td>Configuration 2</td></tr> <tr> <td>Factconf</td><td>Factory configuration</td></tr> </table>	Default: Altconfig	Alternative configuration	Config1	Configuration 1	Config2	Configuration 2	Factconf	Factory configuration
Default: Altconfig	Alternative configuration								
Config1	Configuration 1								
Config2	Configuration 2								
Factconf	Factory configuration								
Web: Boot Using Image UCI: autoload.main.BootUsingImage Opt: BootUsingImage	Specifies which image to boot up with after the activation sequence completes successfully. <table border="1"> <tr> <td>Default: Altimage</td><td>Alternative image</td></tr> <tr> <td>Image 1</td><td>image 1</td></tr> <tr> <td>Image 2</td><td>image 2</td></tr> </table>	Default: Altimage	Alternative image	Image 1	image 1	Image 2	image 2		
Default: Altimage	Alternative image								
Image 1	image 1								
Image 2	image 2								
Entries									
Web: Configured UCI: autoload.@entry[x].Configured Opt: Configured	Enables the autoload sequence to process this entry. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled				
Default: 0	Disabled								
1	Enabled								
Web: Segment Name UCI: autoload.@entry[x].SegmentName Opt: SegmentName	Defines where the downloaded file should be stored: (config1 config2 altconfig image1 image2 altimage). Typically only altconfig and altimage are used.								
Web: RemoteFilename UCI: autoload.@entry[x].RemoteFilename Opt: RemoteFilename	Defines the name of the file to be downloaded from Activator. <table border="1"> <tr> <td>\$\$\$.vas</td><td>Notifies activator sequence is complete.</td></tr> <tr> <td>\$\$\$.ini</td><td>Request configuration</td></tr> <tr> <td>\$\$\$.img</td><td>Request firmware</td></tr> </table> Note: \$\$\$.vas should always be requested last.	\$\$\$.vas	Notifies activator sequence is complete.	\$\$\$.ini	Request configuration	\$\$\$.img	Request firmware		
\$\$\$.vas	Notifies activator sequence is complete.								
\$\$\$.ini	Request configuration								
\$\$\$.img	Request firmware								

36.2. Autoload Using UCI

```
root@VA_router:/# uci show autoload

autoload.main=core

autoload.main.Enabled=yes

autoload.main.StartTimer=10

autoload.main.RetryTimer=30

autoload.main.NumberOfRetries=5

autoload.main.BackoffTimer=15

autoload.main.BootUsingConfig=altconfig

autoload.main.BootUsingImage=altimage

autoload.@entry[0]=entry

autoload.@entry[0].Configured=yes

autoload.@entry[0].SegmentName=altconfig

autoload.@entry[0].RemoteFilename=$$.ini

autoload.@entry[1]=entry

autoload.@entry[1].Configured=yes

autoload.@entry[1].SegmentName=altimage

autoload.@entry[1].RemoteFilename=$$.img

autoload.@entry[2]=entry

autoload.@entry[2].Configured=yes

autoload.@entry[2].SegmentName=config1

autoload.@entry[2].RemoteFilename=$$.vas
```

Autoload using Package Options

```

root@VA_router:/# uci export autoload

package 'autoload'

config 'core' 'main'

option 'Enabled' "yes"

option 'StartTimer' "10"

option 'RetryTimer' "30"

option 'NumberOfRetries' "5"

option 'BackoffTimer' "15"

option 'BootUsingConfig' "altconfig"

option 'BootUsingImage' "altimage"

config 'entry'

option 'Configured' "yes"

option 'SegmentName' "altconfig"

option 'RemoteFilename' "\$\$.ini"

config 'entry'

option 'Configured' "yes"

option 'SegmentName' "altimage"

option 'RemoteFilename' "\$\$.img"

config 'entry'

option 'Configured' "yes"

option 'SegmentName' "config1"

option 'RemoteFilename' "\$\$.vas"

```

36.3. HTTP Client: Configuring Activation Using The Web Interface

This section contains the settings for the HTTP Client used during activation and active updates of the device.

The httpclient core section configures the basic functionality of the module used for retrieving files from Activator during the activation process.

HTTP Client Configuration Packages

Package	Sections
Httpclient	default

Web Configuration

To configure HTTP Client for Activator, in the top menu, click **Services -> HTTP Client**. The HTTP Client page has two sections: Basic Settings and Advanced Settings.

Http Client

Configuration of the Http Client used for management of the device. These settings are used to specify the interaction between this device and the Activator management system.

Basic Settings

Basic settings for the Activator client, check that these are correct according to your network.

Enabled ☒

Server IP Address

Secure Server IP Address

Secure Download ☐

Advanced Settings

Usually unnecessary to change these settings.

Activator Download Path

Check Server Certificate ☐

Present Client Certificate to Server ☐

Certificate File Format

Certificate File Path

Certificate Key File Path

Save & Apply

Save

Reset

The HTTP client page

Web Field/UCI/ Package Option	Description				
Basic Settings					
Web: Enabled UCI: httpclient.default.enabled Opt: Enabled	Enables the HTTP client. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Server IP Address UCI: httpclient.default.Fileserver Opt: list Fileserver	Specifies the address of Activator that uses http port 80. This can be an IP address or FQDN. The syntax should be x.x.x.x:80 or FQDN:80. Multiple servers should be separated by a space using UCI.				
Web: Secure Server IP Address UCI: httpclient.default.SecureFileServer Opt: list SecureFileServer	Specifies the address of Secure Activator that uses port 443. This can be an IP address or FQDN. The syntax should be x.x.x.x:443 or FQDN:443. Multiple servers should be separated by a space using UCI.				
Web: Secure Download UCI: httpclient.default.SecureDownload Opt: SecureDownload	Enables Secure Download (port 443). <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Advanced Settings					
Web: Activator Download Path UCI: httpclient.default.ActivatorDownloadPath Opt: ActivatorDownloadPath	Specifies the URL on Activator to which the client should send requests. <table border="1"> <tr> <td>Default:</td><td>/Activator/Sessionless/Httpserver.asp</td></tr> </table>	Default:	/Activator/Sessionless/Httpserver.asp		
Default:	/Activator/Sessionless/Httpserver.asp				
Web: Check Server Certificate UCI: httpclient.default.ValidateServerCertificateEnabled Opt: ValidateServerCertificateEnabled	Checks for the certificate's presence and validity. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Present Client Certificate to Server UCI: httpclient.default.ValidateServerCertificateEnabled	Specifies if the client presents its certificate to the server to identify itself. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

Web Field/UCI/ Package Option	Description				
Opt: ValidateServerCertificateEnabled					
Web: Certificate File Format UCI: httpclient.default.CertificateFormat Opt: CertificateFormat	Specifies the value the client expects to see in the specified field in the server certificate. <table><tr><td>Default:</td><td>PEM</td></tr><tr><td></td><td>DER</td></tr></table>	Default:	PEM		DER
Default:	PEM				
	DER				
Web: Certificate File Path UCI: httpclient.default.CertificateFile Opt: CertificateFile	Defines the directory/location of the certificate. <table><tr><td>Default:</td><td>/etc/httpclient.crt</td></tr></table>	Default:	/etc/httpclient.crt		
Default:	/etc/httpclient.crt				
Web: Certificate Key File Path UCI: httpclient.default.CertificateKey Opt: CertificateKey	Specifies the directory/location of the certificate key. <table><tr><td>Default:</td><td>/etc/httpclient.key</td></tr></table>	Default:	/etc/httpclient.key		
Default:	/etc/httpclient.key				
Web: N/A UCI: httpclient.default.ActivatorChunkyDownloadPath Opt: ActivatorChunkyDownloadPath	Enables partial download activations and active updates. The default value is: <code>httpclient.default.ActivatorChunkyDownloadPath=/activator/partial/download</code> The URL, on Activator, to which the client should send requests for chunky image download.				
Web: N/A UCI: httpclient.default.ChunkSize Opt: ChunkSize	Specifies the size of each packet payload. <table><tr><td>Default:</td><td>100k bytes</td></tr><tr><td>1-infinite</td><td>Available values in kbps</td></tr></table>	Default:	100k bytes	1-infinite	Available values in kbps
Default:	100k bytes				
1-infinite	Available values in kbps				
Web: N/A UCI: httpclient.default.RateLimit Opt: RateLimit	Throttle activation/active updates traffic received by device to specified limit. <table><tr><td>Default: None</td><td>By default, there is no limit.</td></tr><tr><td>1-infinite</td><td>Available values in kbps</td></tr></table>	Default: None	By default, there is no limit.	1-infinite	Available values in kbps
Default: None	By default, there is no limit.				
1-infinite	Available values in kbps				
Web: N/A UCI: httpclient.default.CAFile Opt: CAFile	Defines the path to the certificate authority file stored on the router.				
Web: N/A UCI: httpclient.default.IgnoreServerCertificateStatus	Defines whether to skip the status check on the server certificate. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

Web Field/UCI/ Package Option	Description
Opt: IgnoreServerCertificate Status	

36.4. Httpclient: Activator Configuration Using UCI

```

root@VA_router:~# uci show httpclient

httpclient.default=core

httpclient.default.Enabled=yes

httpclient.default.FileServer=10.1.83.36:80 10.1.83.37:80

httpclient.default.SecureFileServer=10.1.83.36:443 10.1.83.37:443

httpclient.default.ActivatorDownloadPath=/Activator/Sessionless/Httpserver.asp

httpclient.default.SecureDownload=no

httpclient.default.PresentCertificateEnabled=no

httpclient.default.ValidateServerCertificateEnabled=no

httpclient.default.CertificateFile=/etc/httpclient.crt

httpclient.default.CertificateFormat=PEM

httpclient.default.CertificateKey=/etc/httpclient.key

httpclient.default.ActivatorChunkyDownloadPath=/activator/partial/download

httpclient.default.ChunkSize=100k

httpclient.default.RateLimit=2

httpclient.default.CAFile='/'

httpclient.default.IgnoreServerCertificateStatus=0

```

Httpclient: Activator Configuration using Package Options

```

root@VA_router:~# uci export httpclient

package httpclient

config core 'default'

option Enabled 'yes'

list FileServer '1.1.1.1:80'

list FileServer '1.1.1.2:80'

listSecureFileServer '1.1.1.1:443'

list SecureFileServer '1.1.1.2:443'

option ActivatorDownloadPath '/Activator/Sessionless/Httpserver.asp'

option SecureDownload 'no'

option PresentCertificateEnabled 'no'

option ValidateServerCertificateEnabled 'no'

option CertificateFile '/etc/httpclient.crt'

option CertificateFormat 'PEM'

option CertificateKey '/etc/httpclient.key'

option ActivatorChunkyDownloadPath '/activator/partial/download'

option ChunkSize '100k'

option RateLimit '2'

option CAFile ''

option IgnoreServerCertificateStatus '0'

```

36.5. User Management Using UCI

User management is not currently available using the web interface. You can configure the feature using UCI or Activator.

Configuration packages used

Package	Sections
management_users	Users

Configuring User Management

You can create different users on the system by defining them in the user management configuration file. This gives users access to different services.

Web Field/UCI/Package Option	Description				
General settings					
Web: n/a UCI: management_users.@user[x].enabled Opt: enable	Enables/creates the user. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: management_users.@user[x].username Opt: username	Specifies the user's username.				
Web: n/a UCI: management_users.@user[x].password Opt: password	Specifies the user's password. When entering the user password enter in plain text using the password option. After reboot the password is displayed encrypted via the CLI using the hashpassword option. UCI: management_users.@user[x].hashpassword Opt: hashpassword. Note: a SRP user password will be displayed using the srphash option.				
Web: n/a UCI: management_users.@user[x].webuser Opt: webuser	Specifies web access permissions for the user. Note: webuser will only work if linuxuser is set to Enabled . <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: management_users.@user[x].chapuser Opt: chapuser	Specifies CHAP access permissions for the PPP connection. Note: chapuser will only work if linux user is set to no . <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: management_users.@user[x].papuser Opt: papuser	Specifies PAP access permissions for the PPP connection. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: management_users.@user[x].srpuser Opt: srpuser	Specifies SRP access permissions for the PPP connection. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: management_users.@user[x].smsuser Opt: smsuser	Specifies SMS access permissions for the user. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: linuxuser Opt: linuxuser	Specifies linuxuser access permissions for the user. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: List allowed_pages Opt: list allowed_pages	Specifies which pages the user can view. Multiple pages should be entered using a space to separate if using UCI.				

Note:



NOTE

webuser will only work if linuxuser is set to **yes**

chapuser will only work if linuxuser is set to **no**

When a new user is created on the system and given web access, you will no longer be able to login to the router web interface with the default root user details. The user must use their new user login details.

User Management using UCI Example

```
root@VA_router:~# uci show management_users
management_users.@user[0]=user
management_users.@user[0].enabled=1
management_users.@user[0].username=test
management_users.@user[0].hashpassword=$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0
management_users.@user[0].webuser=1
management_users.@user[0].linuxuser=1
management_users.@user[0].papuser=0
management_users.@user[0].chapuser=0
management_users.@user[0].srpuser=0
management_users.@user[0].smsuser=0
```

User Management using Package Options Example

```
root@VA_router:~# uci export management_users
package management_users
config user
option enabled '1'
option username 'test'
option hashpassword '$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0'
option webuser '1'
option linuxuser '1'
option papuser '0'
option chapuser '0'
option srpuser '0'
option smsuser '0'
```

36.6. Configuring Management User Password Using UCI

The user password is displayed encrypted via the CLI using the hashpassword option.

```
root@VA_router:~# uci show management_users
management_users.@user[0].username=test
management_users.@user[0].hashpassword=$1$XVzDHHPQ$SKK4geFonctihuffMjS4U0
```

If you are changing the password via the UCI, enter the new password in plain text using the password option.

```
root@VA_router:~# uci set management_users.@user[0].password=newpassword
root@VA_router:~# uci commit
```

The new password will take effect after reboot and will now be displayed in encrypted format through the hashpassword option.

Using Package Options

The root password is displayed encrypted via CLI using the hashpassword option.

```
root@VA_router:~# uci export management_users
package management_users

config user

option hashpassword '$1$wRYYijOz$EeHN.GQcxXhRgNPVbqxVw'
```

If you are changing the password using UCI, enter the new password in plain text using the password option.

```
package management_users

config user

option hashpassword '$1$wRYYijOz$EeHN.GQcxXhRgNPVbqxVw'
option password 'newpassword'
```

The new password will take effect after reboot and will now be displayed in encrypted format via the hashpassword option.

36.7. Configuring User Access To Specific Web Pages

To specify particular pages a user can view, add the list allowed_pages. Examples are:

```
list allowed_pages '/admin/status'
```

The user can view admin status page only.

```
List allowed_pages '/admin/system/flashops'
```

The user can view flash operation page only. To specify monitor widgets only, enter:

```
listallowed_pages 'monitor/<widgetname>'
```

Example widget names are: dhcp, arp, 3gstats, interfaces, memory, multiwan, network, openvpn, routes, system, ipsec, dmvpn, tservd.

37. Configuring Monitor

Introduction

Our monitoring system (Monitor) is a secure portal that provides:

- Central monitoring of devices
- Device status
- GPS location
- Syslog reporting
- Real time diagnostics
- Email notification
- Advanced statistics
- Dashboard graph reporting

You must configure each router in the network to send the required information to Monitor. This chapter explains how to configure the different information that can be sent to Monitor, including the required router configuration for:

- Reporting device status to Monitor
- Reporting GPS location to Monitor
- Reporting syslog to Monitor
- Interface statistic collection (ISAD)

37.1. Reporting Device Status To Monitor

To allow Monitor to track the IP address and ongoing presence of a device, a keepalive heartbeat SNMP trap is sent from the router. The router is capable of sending SNMP in version 1, 2c and 3.

The SNMP keepalive heartbeat sends basic information on interface status but can also be configured to contain more detailed information such as GPS location.

The basic heartbeat configuration consists of two parts:

- enabling the heartbeat keepalive
- enabling the interface(s) to be monitored

Configuration Package Used

Package	Sections
monitor	keepalive
network	interface

37.2. Configuring Keepalive Heartbeat Using The Web Interface

Select **Services -> Monitor**. The Monitor Keepalive & ISAD page appears. The keepalive heartbeat is configured under the **Basic Settings** section.

A single instance keepalive can be configured to multiple monitor address using the same reference, heartbeat interval and other options. Or alternatively multiple keepalive instances can be configured with unique options.

Monitor Keepalive & ISAD

Configuration of the VA Monitor Keepalive Service and Interface Stats Upload.

Basic Settings

Basic settings should be checked according to your network.

KEEPALIVE1

Enabled

☒

Dev Reference

router1

Monitor Address

1.1.1.1

Monitor Heartbeat Interval

1

SNMP Protocol Version

1

The Monitor & ISAD keepalive page

Basic Settings

Web Field/UCI/Package Option	Description						
Web: Enabled UCI: monitor:@keepalive[0].enabled Opt: Enabled	Enables Monitor to send heartbeats to the router. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Dev Reference UCI: monitor:@keepalive[0].dev_reference Opt: dev_reference	Sets a unique identification for this device known to Monitor.						
Web: Monitor Address UCI: monitor:@keepalive[0].monitor_ip Opt: list monitor_ip	Defines the IP address of Monitor. It is possible to specify multiple addresses to which SNMP heartbeat traps will be sent. To configure via UCI use a space separator. Example: monitor.@keepalive[0].monitor_ip=1.1.1.1 2.2.2.2						
Web: Monitor Heartbeat Interval UCI: monitor:@keepalive[0].interval_min Opt: interval_min	Specifies the interval, in minutes, at which traps are sent. <table> <tr> <td>Default: 1</td><td>SNMP version 1</td></tr> <tr> <td>2c</td><td>SNMP version 2c</td></tr> <tr> <td>3</td><td>SNMP version 3</td></tr> </table>	Default: 1	SNMP version 1	2c	SNMP version 2c	3	SNMP version 3
Default: 1	SNMP version 1						
2c	SNMP version 2c						
3	SNMP version 3						

The figure below shows options that are relevant only if you have selected SNMP version 3.

SNMP Protocol Version	3
User Name	
Authentication Protocol	SHA
Authentication Password	
Privacy Protocol	AES
Privacy Password	
SNMPv3 Context	
SNMPv3 Context Engine ID	
SNMPv3 Security Engine ID	

The Monitor & ISAD keepalive page for SNMP v3

Web Field/UCI/Package Option	Description						
Web: User Name UCI: monitor:@keepalive[0].snmp_uname Opt: snmp_uname	Specifies the user name. <table border="1"><tr><td>Default:</td><td>Blank</td></tr></table>	Default:	Blank				
Default:	Blank						
Web: Authentication Password UCI: monitor:@keepalive[0].snmp_auth_pass Opt: snmp_auth_pass	Specifies snmpv3 authentication password.						
Web: Authentication Protocol UCI: monitor:@keepalive[0].snmp_auth_proto Opt: snmp_auth_proto	Specifies snmpv3 authentication protocol. <table border="1"><tr><td>Default:</td><td>Blank</td></tr><tr><td>MD5</td><td>MD5 as authentication protocol.</td></tr><tr><td>SHA</td><td>SHA as authentication protocol.</td></tr></table>	Default:	Blank	MD5	MD5 as authentication protocol.	SHA	SHA as authentication protocol.
Default:	Blank						
MD5	MD5 as authentication protocol.						
SHA	SHA as authentication protocol.						
Web: Privacy Protocol UCI: monitor:@keepalive[0].snmp_priv_proto Opt: snmp_priv_proto	Specifies snmpv3 privacy protocol. <table border="1"><tr><td>Default:</td><td>Blank</td></tr><tr><td>AES</td><td>AED as privacy protocol.</td></tr><tr><td>DES</td><td>MD5 as privacy protocol.</td></tr></table>	Default:	Blank	AES	AED as privacy protocol.	DES	MD5 as privacy protocol.
Default:	Blank						
AES	AED as privacy protocol.						
DES	MD5 as privacy protocol.						
Web: Privacy Password UCI: monitor:@keepalive[0].snmp_priv_pass Opt: snmp_priv_pass	Specifies snmpv3 privacy password.						
Web: SNMPv3 Context UCI: monitor:@keepalive[0].snmp_context Opt: snmp_context	Specifies snmpv3 context name.						
Web: SNMPv3 Context Engine ID UCI: monitor:@keepalive[0].snmp_context_eid Opt: snmp_context_eid	Specifies snmpv3 context engine ID						

37.3. Configuring Keepalive Heartbeat Using Command Line

Keepalive is configured under the monitor package.

By default, all keepalive instances are named 'keepalive', instances are identified by @keepalive then the keepalive position in the package as a number. For example, for the first keepalive in the package using UCI:

```
monitor:@keepalive[0]=keepalive
monitor:@ keepalive[0].enabled=1
```

Or using package options:

```
config keepalive
option enabled '1'
```

However, to better identify, it is recommended to give the keepalive instance a name. For example, to create a keepalive instance named keepalive1.

To define a named keepalive instance using UCI, enter:

```
monitor:keepalived1=keepalived
monitor:keepalived1.enable=1
```

To define a named keepalived instance using package options, enter:

```
config keepalived 'keepalived1'
option enabled '1'
```

Keepalived using UCI

```
root@VA_router:~# uci show monitor
monitor:keepalived1=keepalived
monitor:keepalived1.enabled=1
monitor:keepalived1.interval_min=1
monitor:keepalived1.dev_reference=router1
monitor:keepalived1.monitor_ip=10.1.83.36
monitor:keepalived1.snmp_version=1
monitor:keepalived2=keepalived
monitor:keepalived2.enable=1
monitor:keepalived2.interval_min=1
monitor:keepalived2.monitor_ip=172.16.250.100
monitor:keepalived2.dev_reference=TEST
monitor:keepalived2.snmp_version=2c
monitor:keepalived3=keepalived
monitor:keepalived3.enable=1
monitor:keepalived3.interval_min=1
monitor:keepalived3.monitor_ip=172.16.250.101
monitor:keepalived3.dev_reference=TEST
monitor:keepalived3.snmp_version=3
monitor:keepalived3.snmp_uname=TEST
monitor:keepalived3.snmp_auth_pass=vasecret
monitor:keepalived3.snmp_auth_proto=MD5
monitor:keepalived3.snmp_priv_pass=vasecret
monitor:keepalived3.snmp_priv_proto=DES
```

Keepalived using Package Options

```
root@VA_router:~# uci export monitor

package 'monitor'

config keepalive 'keepalivev1'

option enabled '1'

option interval_min '1'

option dev_reference 'router1'

option enabled 'yes'

list monitor_ip '10.1.83.36'

config keepalive 'keepalivev2'

option enable '1'

option interval_min '1'

list monitor_ip '172.16.250.100'

option dev_reference 'TEST'

option snmp_version '2c'

config keepalive 'keepalivev3'

option enable '1'

option interval_min '1'

list monitor_ip '172.16.250.101'

option dev_reference 'TEST'

option snmp_version '3'

option snmp_uname 'TEST'

option snmp_auth_pass 'vasecret'

option snmp_auth_proto 'MD5'

option snmp_priv_pass 'vasecret'

option snmp_priv_proto 'DES'
```

37.4. Enabling Interface Status In Keepalive Heartbeat Via Web Interface

The keepalive heartbeat can send information on multiple interfaces. To send an interface status to Monitor, select **Network -> Interfaces**, then under the required interface select **Edit**. Under **Advanced Settings** enable the Monitor interface state option.

Interfaces - WAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and i spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g., eth0.1).

Common Configuration

General Setup

Advanced Settings

Firewall Settings

Bring up on boot

Monitor interface state

This interface state would be reported to VA Monitor via keep-alive

The interface common configuration page

Web Field/UCI/Package Option	Description				
Web: Monitor interface state	Enables interface status to be sent in the heartbeat trap to Monitor.				
UCI: network.@interface[0].monitored	<table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Opt: monitored					

37.5. Enable Interface Status Using UCI

Interface status is configured under the network package.

```
root@VA_router:~# uci show network
network.@interface[0]=interface
network.@interface[0].monitored=1
```

Enable Interface Status using Package Option

```
root@VA_router:~# uci export network
package network
config interface 'WAN'
option monitored '1'
```

37.6. Reporting GPS Location To Monitor

To allow Monitor to display a router GPS location, you can configure the GPS coordinates to be sent in the heartbeat keepalive from the router.

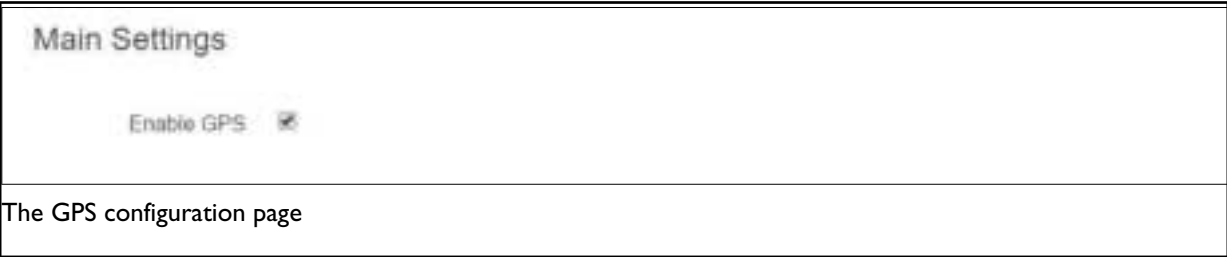
GPS location is only available in supported hardware models.

Ensure monitor heartbeat is correctly configured as in the previous section.

Package	Sections
gpsd	gpsd

Configuring GPS Location via the Web Interface

Select **Services -> GPS**. The GPS configuration page appears. The web interface configures a gpsd section named core.



Web Field/UCI/Package Option	Description				
Web: Enable GPS	Enables GPS coordinates to be sent in the heartbeat keepalive to Monitor.				
UCI: monitor:core.enabled	<table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Opt: enabled					

Configuring GPS Location using Command Line

GPS location is configured under the gpsd package.

GPS Location using UCI

```
root@VA_router:~# uci show gpsd
gpsd.core=gpsd
gpsd.core.enabled=1
```

GPS Location using Package Options

```
root@VA_router:~# uci export gpsd
package gpsd
config gpsd 'core'
option enabled '1'
```

37.7. GPS Diagnostics

To view information on GPS coordinates via the web interface, select **Status -> GPS Information**. There are two tabs: Status and Satellite Information.

System	System Information
GPS Status (Map)	
Enabled	Yes
Fix	Yes
Fix Mode	3D
Fix Data (UTC) (11:44:55.151 Mode/VFFP)	37.851 14.881500000000
Latitude	53.422493
Longitude	-7.384242
Altitude (m)	55
Speed (km/h)	0.00
Course (km/h)	4.20

The GPS status page

System

System Information

Visible Satellites

Used	PRN	Signal/Noise Ratio (dB)	Elevation	Azimuth
No	6	27	0	74
Yes	12	36	79	177
No	17	22	0	28
No	19	21	24	40
No	22	18	2	347
Yes	24	36	52	112
Yes	26	22	47	226
Yes	32	24	61	298
No	35	22	0	0

The GPS visible satellites page

To view GPS coordinates via command line, enter:

```
root@VA_router:~# gpspeek
Fix: 3D,1495467700,53.342529,-6.241236,27.700000,202.600000,0.000000,0.000000
```

37.8. Reporting Syslog To Monitor

Configuration Package Used

Package	Sections
system	main

Configuring Syslog to Monitor via the Web Interface

Monitor can display syslog events sent from the router. To configure the router to send syslog events, select **System -> System -> Logging** and set **External system log server** to the Monitor IP. You can also configure the syslog server port if required.

All syslog events are sent to the syslog server.

System

Here you can configure the basic aspects of your device like its hostname or the timezone.

System Properties

General Settings

Logging

Language and Style

System log buffer size

400

3 MB

External system log server

1.1.1.1

External system log server port

514

The system properties page

Web Field/UCI/Package Option	Description
Web: External system log server UCI: system.main.log_ip Opt: log_ip	Defines the external syslog server IP address.
Web: External system log server UCI: system.main.log_port Opt: log_port	Defines the external syslog server destination port number for syslog messages. Default: 514

37.9. Configuring Syslog Events To Monitor Using Command Line

Syslog is configured under the system package.

Syslog Events to Monitor using UCI

```
root@VA_router:~# uci show system
system.main=system

system.main.log_ip=1.1.1.1
system.main.log_port=514
```

Syslog Events to Monitor using Package Options

```
root@VA_router:~# uci export system
package system
config system 'main'
option log_ip '1.1.1.1'
option log_port '514'
```

37.10. Configuring ISAD

ISAD is a system for collecting interface stats to be displayed on Monitor.

The following section explains how to configure interface statistics collection (iSAD). Statistical data is collected in bins with each bin containing interface transmit and receive packets/bytes/errors for a period. Signal strength and also temperature parameters are also stored in the bins. Bins are uploaded to Monitor periodically.



NOTE

ensure monitor keepalive heartbeat and interface status is correctly configured as in section 40.2 above. Interfaces should have option monitored enabled as part of the collection.

ISAD replaces the deprecated SLA feature.

Package	Sections
monitor	interface_stats

Configuring ISAD using the web interface

Interface Stats

Enabled

☒

Bin Period

1h

Maximum Number of Bins

24

The Monitor keepalive & ISAD interface stats page

Select **Services -> Monitor**. The Monitor Keepalive & ISAD page appears. ISAD is configured under the **Interface Stats** section.

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: monitor.stats.enabled=1 Opt: enabled	Enables ISAD. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Bin Period UCI: monitor.stats.bin_period Opt: time	Specifies how long to collect data for one bin. Specifies the interval, in minutes, at which traps are sent. <table border="1"> <tr> <td>Default: 1 hr</td><td>Bin collected for 1 hour.</td></tr> </table>	Default: 1 hr	Bin collected for 1 hour.		
Default: 1 hr	Bin collected for 1 hour.				
Web: Maximum Number of Bins UCI: monitor.stats.bin_cache_size Opt: bin_cache_size	Specifies the maximum number of bins to store. <table border="1"> <tr> <td>Default: Empty</td><td>24</td></tr> </table>	Default: Empty	24		
Default: Empty	24				

Configuring ISAD using the command line

ISAD is configured under the monitor package.

Configuring ISAD using UCI

```

root@VA_router:~# uci show monitor
monitor:keepalive1=keepalive
monitor:keepalive1.enabled=1
monitor:keepalive1.interval_min=1
monitor:keepalive1.dev_reference=router1
monitor:keepalive1.monitor_ip=10.1.83.36
monitor:keepalive1.snmp_version=1
monitor:stats=interface_stats
monitor:stats.enabled=1
monitor:stats.bin_period=1h
monitor:stats.bin_cache_size=24

```

Configuring ISAD using package options

```
root@VA_router:~# uci export monitor
package monitor

config keepalive 'keepalive1'
option interval_min '1'
option enabled '1'
list monitor_ip '10.1.83.36'
option dev_reference 'router1'

config interface_stats 'stats'
option enabled '1'
option bin_period '1h'
option bin_cache_size '24'
```

37.11. ISAD Diagnostics

Checking Process

To check to see if ISAD is running, enter:

```
root@VA_router:~# pgrep -fl isad
5303 /usr/sbin/isad -b 60 -s 10 -c 200 -u /var/state /var/const_state
```

Checking Bin Statistics

To check if stats are being collected, enter:

```
root@VA_router:~# cat /var/state/monitor
monitor:bin_0=isad
monitor:bin_0.end_ts=85020
monitor:bin_0.start_ts=84960
monitor:bin_1=isad
monitor:bin_1.end_ts=85080
monitor:bin_1.start_ts=85020
monitor:bin_2=isad
monitor:bin_2.end_ts=85140
monitor:bin_2.start_ts=85080
```

ISAD Operation

The bin statistics stored on the router must be periodically pushed statistics to Monitor. This is normally done centrally when statistics are enabled on Monitor. Monitor contacts each router and auto-generates a script that will automatically schedule the upload of the bin statistics.

However, if Monitor cannot access the router WAN IP, you must do this manually on each router using a UDS script. An example is shown below where the bins are uploaded every hour to a Monitor server IP 89.101.154.154 using TFTP.

```
package uds

config script 'isb_upload_scr'

option enabled '1'

option exec_type 'periodic'

option period '1h'

list text '/usr/sbin/isb_upload.lua 89.101.154.154:69'
```

37.12. Speedtest Reporting

To assist in determining WAN line speed characteristics the router can be configured to:

- Implement a Discard Protocol (RFC863)
- Implement a Character Generation Protocol (RFC864)

**NOTE**

A central client is required to generate the speedtest traffic and produce the measurement reports.

Configuration is not currently available via the web interface.

Web Field/UCI/Package Option	Description				
Web: n/a UCI: monitor:speedtest.discard_enabled Opt: discard_enabled	Enables listening on TCP port 9 and discarding all received data. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: monitor:speedtest.chargen_enabled Opt: chargen_enabled	Enables listening on TCP port 19 and streaming data to the connected client at maximum possible speed. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

Configuring Speedtest via the Command Line

Speedtest options are configured in the speedtest configuration section of the monitor package.

Speedtest using UCI

```
root@VA_router:~# uci show monitor
monitor:speedtest=speedtest
monitor:speedtest.discard_enabled
monitor:speedtest.chargen_enabled
```

Speedtest using Package Options

```
root@VA_router:~# uci export monitor
package monitor

config speedtest
option discard_enabled '0'
option chargen_enabled '0'
```

38. Configuring SNMP

SNMP (Simple Network Management Protocol) is an internet-standard protocol for managing devices on IP networks. SNMP exposes management data in the form of a hierarchy of variables in a MIB (Management Information Base). These variables can be queried individually, or in groups using their OIDs (Objective Identifiers) defined in MIBs. In addition, information from the router can be pushed to a network management station in the form of SNMP traps.

Configuration Package Used

Package	Sections				
snmpd	access agent com2sec constant	exec group heartbeat informreceiver	inventory inventory_iftable monitor_disk monitor_ioerror	monitor_load monitor_memory monitor_process pass	system trapreceiver usm_user view

The SNMP application has several configuration sections:

System and Agent	Configures the SNMP agent
Com2Sec	Maps SNMP community names into an arbitrary security name.
Group	Assigns community names and SNMP protocols to groups.
View and Access	Creates views and sub-views of the whole available SNMP tree and grants specific access to those views on a group by group basis.
usm_user	Defines a user for SNMPv3 USM.
Trap Receiver	Sets the address of a notification receiver that should be sent SNMPv1 TRAPs and SNMPv2c TRAP2s.
Inform Receiver	Sets the address of a notification receiver that should be sent SNMPv2 INFORM notifications respectively.

38.1. Configuring SNMP Using The Web Interface

In the top menu, select **Services -> SNMP**. The SNMP Service page appears.

SNMP Service

Configuration of the SNMP service.

System Settings

System Location

Desk_001

System Contact

jak.brown@company.com

System Name

Test Router

Agent Settings

Agent Address

UDP 161

Enable Authentication Traps

☐

Enable Link State Notification

☒ Generate Traps for when interface goes up or down

The SNMP service page

System and Agent Settings

Web Field/UCI/Package Option	Description				
System Settings					
Web: System Location UCI: snmpd.system[0].sysLocation Opt: sysLocation	Sets the system location, system contact or system name for the agent. This information is reported in the 'system' group in the mibII tree.				
Web: System Contact UCI: snmpd.system[0].sysContact Opt: sysContact					
Web: System Name UCI: snmpd.system[0].sysName Opt: sysName					
Agent Settings					
Web: Agent Address UCI: snmpd.agent[0].agentaddress Opt: agentaddress	Specifies the address(es) and port(s) on which the agent should listen. [(udp tcp):][address:]port [.#:] Example: udp:127.0.0.1:161, tcp:161, localhost:9161				
Web: Enable Authentication Traps UCI: snmpd.agent[0].authtrapienabled Opt: authtrapienabled	Enables or disables SNMP authentication trap. <table border="1"><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table> Note: this is the SNMP poll authentication trap you set when there is a community mismatch.	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Enable Link State Notification UCI: snmpd.agent[0].link_updown_notify Opt: link_updown_notify	Generates trap/info when interface goes up or down. When enabled, the router sends a trap notification link up or down. <table border="1"><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

38.1.1. Com2Sec Settings

To access Com2Sec settings, scroll down the SNMP Services page.

Use the COM2Sec section to map SNMP community names into an arbitrary security name. Map community names into security names based on the community name and the source subnet. Use the first source/community combination that matches the incoming packet.

A community string is a password that is applied to a device to restrict both read-only and read-write access to the SNMP data on the device. These community strings should be chosen carefully to ensure they are not trivial. They should also be changed at regular intervals and in accordance with network security policies.

COM2SEC Settings

Security Name	Source	Community	
public	10.10.10.10	public	Delete
private	10.10.10.10	private	Delete
			Add

The COM2SEC settings section

Web Field/UCI/Package Option	Description
Web: Security Name UCI: snmpd.com2sec[x].secname Opt: secname	Specifies an arbitrary security name for the user.
Web: Source UCI: snmpd.com2sec[x].source Opt: source	A hostname, localhost or a subnet specified as a.b.c.d/mask or a.b.c.d/bits or 'default' for no restrictions.
Web: Community UCI: snmpd.com2sec[x].community Opt: community	Specifies the community string being presented in the request.

38.1.2. Group Settings Using The Web Interface

Group settings assign community names and SNMP protocols to groups.

Group Settings

Group	Version	Security Name	
public_v1	public	v1	no
public_v2c	public	v2c	no
public_usm	public	usm	no
private_v1	private	v1	no
private_v2c	private	v2c	no

The group settings section

Web Field/UCI/Package Option	Description								
Web: Group UCI: snmpd.group[x].group Opt: group	Specifies an arbitrary group name.								
Web: Version UCI: snmpd.group[x].version Opt: version	Specifies the SNMP version number being used in the request: v1, v2c and usm (User-based Security Module) are supported. <table> <tr> <td>Default: v1</td><td>SNMP v1</td></tr> <tr> <td>v2v</td><td>SNMP v2</td></tr> <tr> <td>usm</td><td>SNMP v3</td></tr> <tr> <td>any</td><td>Any SNMP version</td></tr> </table>	Default: v1	SNMP v1	v2v	SNMP v2	usm	SNMP v3	any	Any SNMP version
Default: v1	SNMP v1								
v2v	SNMP v2								
usm	SNMP v3								
any	Any SNMP version								
Web: Security Name UCI: snmpd.group[x].secname Opt: secname	Specifies the already defined security name that is being included in this group.								

38.1.3. View Settings

View settings define a named "view", which is a subset of the overall OID tree. This is most commonly a single subtree, but several view directives can be given with the same view name, to build up a more complex collection of OIDs.

View Settings

Name	Type	OID
all	of	included

The view settings section

Web Field/UCI/Package Option	Description
Web: Name UCI: snmpd.view[x].viewname Opt: viewname	Specifies an arbitrary view name. Typically it describes what the view shows.
Web: Type UCI: snmpd.view[x].type Opt: type	Specifies whether the view lists oids that are included in the view or lists oids to be excluded from the view; in which case all other oids are visible apart from those ones listed. Default: Included Excluded
Web: OID UCI: snmpd.view[x].oid Opt: oid	OID to be included in or excluded from the view. Only numerical representation is supported. Default: 1 Everything 1.3.6.1.2.1.2 Interfaces table

38.1.4. Access Settings Using The Web Interface

Access settings map from a group of users/communities, in a specific context and with a particular SNMP version and minimum security level, to one of three views, depending on the request being processed.

Access Settings

group	context	version	level	profile	read	write	notify
public_access	public	any	readOnly	exact	all	none	none
private_access	private	any	readOnly	exact	all	all	all

The access settings section

Web Field/UCI/Package Option	Description								
Web: Group UCI: snmpd.access[x].group Opt: group	Specifies the group to which access is being granted.								
Web: Context UCI: snmpd.access[x].context Opt: context	SNMPv3 request context is matched against the value according to the prefix below. For SNMP v1 and SNMP v2c, the context must be none . <table border="1"> <tr> <td>Default:</td><td>none</td></tr> <tr> <td></td><td>all</td></tr> </table>	Default:	none		all				
Default:	none								
	all								
Web: Version UCI: snmpd.access[x].version Opt: version	Specifies the SNMP version number being used in the request: any, v1, v2c and usm are supported. <table border="1"> <tr> <td>Default: v1</td><td>SNMP v1</td></tr> <tr> <td>v2v</td><td>SNMP v2</td></tr> <tr> <td>usm</td><td>SNMP v3</td></tr> <tr> <td>any</td><td>Any SNMP version</td></tr> </table>	Default: v1	SNMP v1	v2v	SNMP v2	usm	SNMP v3	any	Any SNMP version
Default: v1	SNMP v1								
v2v	SNMP v2								
usm	SNMP v3								
any	Any SNMP version								
Web: Level UCI: snmpd.access[x].level Opt: level	Specifies the security level. For SNMP v1 and SNMP v2c the level must be noauth . <table border="1"> <tr> <td>Default</td><td>nouath</td></tr> <tr> <td></td><td>auth</td></tr> <tr> <td></td><td>priv</td></tr> </table>	Default	nouath		auth		priv		
Default	nouath								
	auth								
	priv								
Web: Prefix UCI: snmpd.access[x].prefix Opt: prefix	Specifies how the context should be matched against the context of the incoming pdu. <table border="1"> <tr> <td>Default:</td><td>exact</td></tr> <tr> <td></td><td>any</td></tr> <tr> <td></td><td>all</td></tr> </table>	Default:	exact		any		all		
Default:	exact								
	any								
	all								
Web: Read UCI: snmpd.access[x].read Opt: read	Specifies the view to be used for read access.								
Web: Write UCI: snmpd.access[x].write Opt: write	Specifies the view to be used for write access.								
Web: Notify UCI: snmpd.access[x].notify Opt: notify	Specifies the view to be used for notify access.								

38.1.5. Trap Receiver

Trap receiver settings define a notification receiver that should be sent SNMPv1 TRAPs and SNMPv2c TRAP2.

Web Field/UCI/Package Option	Description				
Web: Host UCI: snmpd.trapreceiver[x].host Opt: host	Host address. Can be either an IP address or an FQDN.				
Web: Port UCI: snmpd.trapreceiver[x].port Opt: port	UDP port to be used for sending traps. <table border="1"><tr><td>Default:</td><td>162</td></tr></table>	Default:	162		
Default:	162				
Web: Version UCI: snmpd.trapreceiver[x].version Opt: version	SNMP version. <table border="1"><tr><td>Default:</td><td>v1</td></tr><tr><td></td><td>v2</td></tr></table>	Default:	v1		v2
Default:	v1				
	v2				
Web: Community UCI: snmpd.trapreceiver[x].community Opt: community	Community to use in trap messages for this host.				

38.1.6. Inform Receiver Using The Web Interface

Inform receiver settings define a notification receiver that should be sent SNMPv2c INFORM notifications.



The inform receiver settings page

Web Field/UCI/Package Option	Description
Web: Host UCI: snmpd.informreceiver[x].host Opt: host	Host address. Can be either an IP address or an FQDN.
Web: Port UCI: snmpd.informreceiver[x].port Opt: port	UDP port to be used for sending traps.
Web: Community UCI: snmpd.informreceiver[x].community Opt: community	Community to use in inform messages for this host.

38.1.7. USM User Using Web Interface

Configure a user for for SNMPv3 USM (User Based Security Model).



The USM user settings page

Web Field/UCI/Package Option	Description				
Web: Username UCI: snmpd.@usm_user[0].name Opt: name	Defines a USM username.				
Web: Auth Protocol UCI: snmpd.@usm_user[0].auth_protocol Opt: auth_protocol	Defines the authentication protocol to use. Note: if omitted the user will be defined as noauth user. <table border="1"> <tr> <td>MD5</td><td></td></tr> <tr> <td>SHA</td><td></td></tr> </table>	MD5		SHA	
MD5					
SHA					
Web: Auth Password UCI: snmpd.@usm_user[0].auth_password Opt: auth_password	Defines the authentication password. Note: password must be at least 8 characters long.				
Web: Priv Protocol UCI: snmpd.@usm_user[0].priv_protocol Opt: priv_protocol	Defines the privacy protocol to use. Note: if omitted the user will be defined as authNoPriv user. <table border="1"> <tr> <td>MD5</td><td></td></tr> <tr> <td>SHA</td><td></td></tr> </table>	MD5		SHA	
MD5					
SHA					
Web: Priv Password UCI: snmpd.@usm_user[0].priv_password Opt: priv_password	Defines the privacy password. Note: the password must be at least 8 characters long.				
Web: OID UCI: snmpd.@usm_user[0].oid Opt: oid	Defines the OID branch to restrict this user to. Similar to view restrictions in v1 and v2c				

38.2. Configuring SNMP Using Command Line

SNMP is configured under the snmpd package. The configuration files are stored on **/etc/config/snmpd**.

System Settings using UCI

```

root@VA_router:~# uci show snmpd
snmpd.system=system
snmpd.system.sysLocation=Office 123
snmpd.system.sysContact=Mr White
snmpd.system.sysName=Backup Access 4
snmpd.agent=agent
snmpd.agent.agentaddress=UDP:161
snmpd.agent.authtrapenabled=yes
snmpd.agent.link_updown_notify=yes

```

System Settings using Package Options

```
root@VA_router:~# uci export snmpd
package snmpd config 'system'
option sysLocation 'Office 123'
option sysContact 'Mr White'
option sysName 'Backup Access 4'
config 'agent'
option agentaddress 'UDP:161'
option authtrapenabled '1'
option link_updown_notify '1'
```

Another sample agent configuration shown below causes the agent to listen on UDP port 161, TCP port 161 and UDP port 9161 on only the interface associated with the localhost address.

```
config 'agent'
option agentaddress 'UDP:161,tcp:161,localhost:9161'
```

38.2.1. Com2sec Using UCI

The following sample specifies that a request from any source using “public” as the community string will be dealt with using the security name “ro”. However, any request from the localhost itself using “private” as the community string will be dealt with using the security name “rw”.



NOTE

The security names of “ro” and “rw” here are simply names – the fact of a security name having read only or read-write permissions is handled in the access section and dealt with at a group granularity.

```
snmpd.c2s_1=com2sec
snmpd.c2s_1.source=default
snmpd.c2s_1.community=public
snmpd.c2s_1.secname=rw
snmpd.c2s_2=com2sec
snmpd.c2s_2.source=localhost
snmpd.c2s_2.community=private
snmpd.c2s_2.secname=ro
```

Com2sec using Package Options

```
config 'com2sec' 'public'
option secname 'ro'
option source 'default'
option community 'public'
config 'com2sec' 'private'
option secname 'rw'
option source 'localhost'
option community 'private'
```

38.2.2. Group Settings Using Command Line

The following example specifies that a request from the security name “ro” using snmp v1, v2c or USM (User Based Security Model for SNMPv3) are all mapped to the “public” group. Similarly, requests from the security name “rw” in all protocols are mapped to the “private” group.

```
snmpd.grp_1_v1=group
snmpd.grp_1_v1.version=v1
snmpd.grp_1_v1.group=public
snmpd.grp_1_v1.secname=ro
snmpd.grp_1_v2c=group
snmpd.grp_1_v2c.version=v2c
snmpd.grp_1_v2c.group=public
snmpd.grp_1_v2c.secname=ro
snmpd.grp_1_usm=group
snmpd.grp_1_usm.version=usm
snmpd.grp_1_usm.group=public
snmpd.grp_1_usm.secname=ro
snmpd.grp_1_access=access
snmpd.grp_1_access.context=none
snmpd.grp_1_access.version=any
snmpd.grp_1_access.level=noauth
snmpd.grp_1_access.prefix=exact
snmpd.grp_1_access.read=all
snmpd.grp_1_access.write=none
snmpd.grp_1_access.notify=none
snmpd.grp_1_access.group=public
snmpd.grp_2_v1=group
snmpd.grp_2_v1.version=v1
snmpd.grp_2_v1.group=public
snmpd.grp_2_v1.secname=ro
snmpd.grp_2_v2c=group
snmpd.grp_2_v2c.version=v2c
snmpd.grp_2_v2c.group=public
snmpd.grp_2_v2c.secname=ro
snmpd.grp_2_usm=group
snmpd.grp_2_usm.version=usm
snmpd.grp_2_usm.group=public
snmpd.grp_2_usm.secname=ro
snmpd.grp_2_access=access
snmpd.grp_2_access.context=none
snmpd.grp_2_access.version=any
```



```
snmpd.grp_2_access.level=noauth
snmpd.grp_2_access.prefix=exact
snmpd.grp_2_access.read=all
snmpd.grp_2_access.write=all
snmpd.grp_2_access.notify=all
snmpd.grp_2_access.group=public
```

Group settings using package options

```
config 'group' 'public_v1'
option group 'public'
option version 'v1'
option secname 'ro'
config 'group' 'public_v2c'
option group 'public'
option version 'v2c'
option secname 'ro'
config 'group' 'public_usm'
option group 'public'
option version 'usm'
option secname 'ro'
config 'group' 'private_v1'
option group 'private'
option version 'v1'
option secname 'rw'
config 'group' 'private_v2c'
option group 'private'
option version 'v2c'
option secname 'rw'
config 'group' 'private_usm'
option group 'private'
option version 'usm'
option secname 'rw'
```

38.2.3. View Settings Using UCI

The following example defines two views, one for the entire system and another for only mib2.

```
snmpd.all=view
snmpd.all.viewname=all
snmpd.all.oid=.1
snmpd.mib2=view
snmpd.mib2.viewname=mib2
snmpd.mib2.type=included
snmpd.mib2.oid=.iso.org.dod.Internet.mgmt.mib-2
```

View Settings using Package Options

```
config 'view' 'all'
option viewname 'all'
option type 'included'
option oid '.1'
config 'view' 'mib2'
option viewname 'mib2'
option type 'included'
option oid '.iso.org.dod.Internet.mgmt.mib-2'
```

38.2.4. Access Settings Using Command Line

The following example shows the “public” group being granted read access on the “all” view and the “private” group being granted read and write access on the “all” view.

Although it is possible to write some settings using SNMP write permission, it is not recommended as any changes to the configuration made through an `snmpset` command may conflict with the UCI configuration. In this instance the changes will be overwritten by other processes and will not persist after a reboot.

Access using Package Options

```

config 'access' 'public_access'

option group 'public'

option context 'none'

option version 'any'

option level 'noauth'

option prefix 'exact'

option read 'all'

option write 'none'

option notify 'none'

config 'access' 'private_access'

option group 'private'

option context 'none'

option version 'any'

option level 'noauth'

option prefix 'exact'

option read 'all'

option write 'all'

option notify 'all'

```

38.2.5. SNMP Traps Settings Using Command Line

By default, all SNMP trap instances are named 'trapreceiver', it is identified by @trapreceiver then the trap receiver position in the package as a number. For example, for the first trap receiver in the package using UCI:

```

snmpd.@trapreceiver[0]=trapreceiver
snmpd.@trapreceiver[0].host=1.1.1.1:161

```

Or using package options:

```

config trapreceiver

```

```

option host '1.1.1.1:161'

```

However, to better identify it, it is recommended to give the trap receiver instance a name. For example, to create a trap receiver instance named TrapRecv1.

To define a named trap receiver instance using UCI, enter:

```

snmpd.TrapRecv1=TrapRecv1
snmpd.TrapRecv1.host=1.1.1.1:161

```

To define a named trap receiver instance using package options, enter:

```
config trapreceiver TrapRecv1
option host '1.1.1.1:161'
```

SNMP Trap using UCI

```
snmpd.@trapreceiver[0]=trapreceiver
snmpd.@trapreceiver[0].host=1.1.1.1:161
snmpd.@trapreceiver[0].version=v1
snmpd.@trapreceiver[0].community=public
```

SNMP Trap using Package Options

```
# for SNMPv1 or v2c trap receivers
config trapreceiver
option host 'IPADDR[:PORT]'
option version 'v1|v2c'
option community 'COMMUNITY STRING'
```

38.2.6. SNMP Inform Receiver Settings Using Command Line

By default, all SNMP inform receiver instances are named 'informreceiver', it is identified by @informreceiver then the inform receiver position in the package as a number. For example, for the first inform receiver in the package using UCI:

```
snmpd.@informreceiver [0]=informreceiver
snmpd.@informreceiver [0].host=1.1.1.1
```

Or using package options:

```
config informreceiver
option host '1.1.1.1'
```

However, to better identify it, it is recommended to give the inform receiver instance a name. For example, to create a inform receiver instance named InformRecv1.

To define a named trap receiver instance using UCI, enter:

```
snmpd.InformRecv1=InformRecv1
snmpd.InformRecv1.host=1.1.1.1
```

To define a named trap receiver instance using package options, enter:

```
config informreceiver InformRecv1
option host '1.1.1.1'
```

SNMP Inform Receiver using UCI

```
snmpd.@informreceiver[0]=informreceiver
snmpd.@informreceiver[0].host=1.1.1.1
snmpd.@informreceiver[0].port=67
snmpd.@informreceiver[0].community=private
```

SNMP Inform Receiver using Package Options

```
config informreceiver
option host '1.1.1.1'
option port '67'
option community 'private'
```

38.2.7. SNMP USM User Settings

By default, all USM User instances are named 'usm_user', it is identified by @usm_user then the USM user position in the package as a number. For example, for the first USM User in the package using UCI:

```
snmpd.@usm_user[0]=usm_user
snmpd.@usm_user[0].name=username
```

Or using package options:

```
config usm_user
option name 'username'
```

However, to better identify it, it is recommended to give the usm_user instance a name. For example, to create a usm_user instance named User1.

To define a named usm_user instance using UCI, enter:

```
snmpd.User1=User1
snmpd.User1.name=username
```

To define a named usm_user instance using package options, enter:

```
config usm_user 'User1'
option name 'username'
```

SNMP USM using UCI

```
snmpd.@usm_user[0]=usm_user
snmpd.@usm_user[0].name=username
snmpd.@usm_user[0].auth_protocol=SHA
snmpd.@usm_user[0].auth_password=password
snmpd.@usm_user[0].priv_protocol=AES
snmpd.@usm_user[0].priv_password=password
snmpd.@usm_user[0].oid=1.2.3.4
```

SNMP USM using Package Options

```
config usm_user
option name 'username'
option auth_protocol 'SHA'
option auth_password 'password'
option priv_protocol 'AES'
option priv_password 'aespassword'
option oid '1.2.3.4'
```

38.3. Configuring SNMP Interface Alias With Static SNMP Index

A Linux interface index changes dynamically. This is not ideal for SNMP managers that require static interface indexes to be defined.

The network package interface section allows defining a static SNMP interface alias index for this interface.

An alias entry is created in the SNMP ifEntry table at index (snmp_alias_ifindex + 1000). This entry is a shadow of the real underlying Linux interface corresponding to the UCI definition. You may use any numbering scheme you wish; the alias values do not need to be consecutive.

Package	Sections
network	interface

Configuring SNMP Interface Alias

To enter and SNMP alias for an interface, select **Network -> Interfaces -> Edit-> Common Configuration -> Advanced Settings**.

Enter a small index value for **SNMP Alias ifindex** that is unique to this interface. To retrieve SNMP statistics for this interface, configure the SNMP manager to poll (snmp_alias_ifindex + 1000). For example, if an interface is configured with an snmp_alias_ifindex of 11, then the SNMP manager should poll ifIndex=1011. The ifIndex will remain fixed regardless of how many times the underlying interface is added or removed.

If the Linux interface associated with the UCI entry is active when the alias index is polled, the normal ifEntry information for that interface is reported. Otherwise, a dummy entry is created with the same ifDescr, and its ifOper field set to **DOWN**.



NOTE

If you are using SIM roaming, where mobile interfaces are created dynamically, you need to specify a fixed snmp_alias_ifindex value and a fixed ifName value in the roaming template. All roaming entries will then map to the same Linux interface name and underlying device.

SNMP Alias ifindex

Alias Index SNMP agent: Alias indexes are present at 1000 offset. So setting 1 here will create snmp ifIndex entry 1001. Useful when interface creates new linux interface on every startup (e.g. 3gpp interface). With this set the interface could be monitored via constant snmp agent interface table entry

The interface SNMP alias ifindex field advanced settings page

UCI/Package Option	Description				
Web: SNMP Alias ifindex UCI: network.@interface[X].snmp_alias_ifindex Opt: snmp_alias_ifindex	Defines a static SNMP interface alias index for this interface that can be polled using via the SNMP interface index. snmp_alias_ifindex+1000 <table border="1"> <tr> <td>Default: Blank</td><td>No SNMP interface alias index</td></tr> <tr> <td>Range:</td><td>0-4294966295</td></tr> </table>	Default: Blank	No SNMP interface alias index	Range:	0-4294966295
Default: Blank	No SNMP interface alias index				
Range:	0-4294966295				
Web: n/a UCI: network.@interface[X].snmp_alias_ifdescr Opt: snmp_alias_ifdescr	Defines an alias name to be reported for the UCI name in the enterprise MIB for UCI interfaces, and in alias entries in the ifIndex table. If present, this option supercedes the default ifDescr value (usually the UCI interface name, or configured ifName). <table border="1"> <tr> <td>Default: Blank</td><td>No SNMP interface alias name</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default: Blank	No SNMP interface alias name	Range	
Default: Blank	No SNMP interface alias name				
Range					

38.4. Automatic SNMP Traps

Last Gasp

The router will automatically generate an SNMP trap when power loss is detected, and attempt to deliver to the configured trap receiver - ORK firmware family only.



NOTE

Whether the hardware is able to deliver the last gasp depends on the hold up time on the particular hardware model and the network conditions.

Event	SNMP Trap Format
Shutdown	{ SNMPv1 { Trap(28) E:8072.4 192.168.100.1 enterpriseSpecific s=2 8382 } }

Cold Start

On completion of system start up, the router will generate a cold start SNMP trap and deliver to the configured trap receiver.

Event	SNMP Trap Format
Startup	{ SNMPv1 { Trap(29) E:8072.3.2.10 192.168.100.1 coldStart 9 } }

38.5. SNMP Diagnostics

SNMP Process

To check the SNMP process is running correctly, enter:

```
root@VA_router:~# pgrep -fl snmpd
6970 /usr/sbin/snmpd -Lsd0-6 -p /var/run/snmpd.pid -m -c /var/conf/snmpd.conf
```

SNMP Port

To check the SNMP service is listening on the configured port, enter:

```
root@VA_router:~# netstat -pantu | grep snmp
udp      0 0 0.0.0.0:161    0.0.0.0:*      6970/snmpd
```

Reviving SNMP Values

SNMP values can be queried by an `snmpwalk` or `snmpget` command either locally or remotely.

snmpwalk

To create an `snmpwalk` locally, enter `snmpwalk`. An example `snmpwalk` is shown below:

```
root@VA_router:~# snmpwalk -c public -v 1localhost .1.3.6.1.2.1.1
iso.3.6.1.2.1.1.1.0= STRING: "Virtual Access GWXXXX, SN# 00E0C812D1A0,
EDG-21.00.07.008"
iso.3.6.1.2.1.1.2.0 = OID: iso.3.6.1.4.1.2078
iso.3.6.1.2.1.1.3.0 = Timeticks: (71816) 0:11:58.16
iso.3.6.1.2.1.1.4.0 = STRING: "info@virtualaccess.com"
iso.3.6.1.2.1.1.5.0 = STRING:"GWXXXX"
iso.3.6.1.2.1.1.6.0 = STRING: "UK"
iso.3.6.1.2.1.1.7.0 = INTEGER: 79
iso.3.6.1.2.1.1.8.0 = Timeticks: (60) 0:00:00.60
iso.3.6.1.2.1.1.9.1.2.1 = OID: iso.3.6.1.2.1.4
iso.3.6.1.2.1.1.9.1.2.2 = OID: iso.3.6.1.6.3.1
iso.3.6.1.2.1.1.9.1.2.3 = OID: iso.3.6.1.2.1.49
iso.3.6.1.2.1.1.9.1.2.4 = OID: iso.3.6.1.2.1.50
iso.3.6.1.2.1.1.9.1.2.5 = OID: iso.3.6.1.6.3.16.2.2.1
iso.3.6.1.2.1.1.9.1.2.6 = OID: iso.3.6.1.6.3.10.3.1.1
iso.3.6.1.2.1.1.9.1.2.7 = OID: iso.3.6.1.6.3.11.3.1.1
iso.3.6.1.2.1.1.9.1.2.8 = OID: iso.3.6.1.6.3.15.2.1.1
iso.3.6.1.2.1.1.9.1.2.9 = OID: iso.3.6.1.2.1.10.131
iso.3.6.1.2.1.1.9.1.4.4 = Timeticks: (35) 0:00:00.35
iso.3.6.1.2.1.1.9.1.4.5 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.6 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.7 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.8 = Timeticks: (38) 0:00:00.38
iso.3.6.1.2.1.1.9.1.4.9 = Timeticks: (60) 0:00:00.60
```

snmpget

To create an `snmpget` command locally, enter:

```
root@VA_router:~# snmpget -c public -v 1 localhost .1.3.6.1.4.1.2078.3.14.2
iso.3.6.1.4.1.2078.3.14.2 = STRING: "EDG-21.00.07.008"
```

SNMP Status

To see an overview including tx/rx packets and uptime of the SNMP process, enter:


```
root@VA_router:~# snmpstatus -c public -v 2c localhost  
[UDP: [0.0.0.0]-&gt;[127.0.0.1]:161]=&gt;[Virtual Access GWXXXXX, SN#  
00E0C812D1A0, EDG-21.00.07.008] Up: 0:17:05.87
```

39. Event System

Merlin routers feature an event system. It allows you to forward Merlin specific router events to predefined targets for efficient control and management of devices.

This chapter explains how the event system works and how to configure it using the web interface and the command line.

Configuration Package Used

Package	Section
va_eventd	main
	forwarding
	target
	conn_tester

39.1. Implementation Of The Event System

The event system is implemented by the `va_eventd` application. The `va_eventd` application defines three types of object.

Forwardings	Rules that define what kind of events should be generated. For example, you might want an event to be created when an IPSec tunnel comes up or down.
Targets	Define the targets to send the event to. The event may be sent to a target via a syslog message, an snmp trap or email.
Connection testers	Define methods to test the target is reachable. IP connectivity to a server and link state may be checked prior to sending events.

For example, if you want to configure an SNMP trap to be sent, when an IPSec tunnel comes up, you will need to:

- Define a forwarding rule for IPSec tunnel up events.
- Set an SNMP manager as the target.
- Optionally use a connection tester to ensure the SNMP manager is reachable.

Supported Events

Events have a class, ID name and a severity. These properties are used to fine tune which events to report.



NOTE

Only VA events can be forwarded using the event system. A comprehensive table of events is available from the CLI by entering `vae_cli -d`.

Supported Targets

The table below describes the targets currently supported.

Target	Description
Syslog	Event sent to syslog server.
Email	Event sent via email.
SNMP	Event sent via SNMP trap.
Exec	Command executed when event occurs.
SMS	Event sent via SMS.
File	Events written to a file.

The attributes of a target vary significantly depending on its type.

Supported Connection Testers

The table below describes the methods to test a connection that are currently supported.

Type	Description
link	Checks if the interface used to reach the target is up.
ping	Pings the target. And then assumes there is connectivity during a configurable amount of time.

39.2. Configuring The Event System Using The Web Interface

To configure the event system, select **Services -> VA Event System**. The VA Event System page appears.

There are four sections in the VA Event System page.

Section	Description
Basic Settings	Configures basic global event system parameters.
Connection Tester	Configures the connection testers.
Events Destination	Configures the event targets.
Event Filters	Configures the forwarding rules.

39.3. Connection Tester

A connection tester is used to verify the event destination before forwarding the event. Connection testers configure the uci `conn_tester` section rules. Multiple connection testers can be configured. There are two types of connection tester:

Type	Description
link	Checks if the interface used to reach the target is up.
ping	Pings the target. And then assumes there is connectivity during a configurable amount of time.

The event system connection tester configuration page

Web Field/UCI/Package Option	Description						
Web: Enabled UCI: va_eventd.@conn_tester[0].enabled Opt: enabled	Enables a connection tester. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Connection Tester Name UCI: va_eventd.@conn_tester[0].name Opt: name	Defines the connection tester name. This is used when configuring a connection tester for an event destination.						
Web: Type UCI: va_eventd.@conn_tester[0].type Opt: type	Defines the connection tester type. <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Ping</td><td>Verifies target by ping</td><td>ping</td></tr></table>	Web Value	Description	UCI	Ping	Verifies target by ping	ping
Web Value	Description	UCI					
Ping	Verifies target by ping	ping					
Web: Ping Target UCI: va_eventd.@conn_tester[0].ping_dest_ad dr Opt: ping_dest_addr	Defines the IP address for the target ping. Note: only displayed if connection tester type is set to 'Ping'.						
Web: Ping Source UCI: va_eventd.@conn_tester[0].ping_source Opt: ping_source	Defines an interface or IP address to source the pings from.						
Web: Ping Success Duration UCI: va_eventd.@conn_tester[0].ping_success_duration_sec Opt: ping_success_duration_sec	Defines the duration, in seconds, for which a successful ping defines a connection tester as up. Note: only displayed if connection tester type is set to 'Ping'.						
Web: Link Interface UCI: va_eventd.@conn_tester[0].link_iface Opt: link_iface	Defines the interface to monitor when the connection tester type is set to 'link'. Configured interfaces are listed. Note: only displayed if configured syslog server.						

39.4. Event Destination

An event destination is the target for the event. Event destinations configure the uci target section rules. Multiple event destinations can be configured. There are currently six configurable event destinations.

Target Type	Description
Syslog	Event sent to syslog server.
Email	Event sent via email.
SNMP	Event sent via SNMP trap.
Execute	Command executed when event occurs.
SMS	Event sent via SMS.
File	Event written to a file

The available configuration options differ depending on the event destination type.

39.4.1. Syslog Target

When a syslog target receives an event, it sends it to the configured syslog server.

The screenshot shows the 'Event Destination' configuration page. At the top right is a 'Delete' button. Below it, the 'Enabled' checkbox is checked. The 'Destination Name' field contains 'SYSLOG'. The 'Type' dropdown is set to 'Syslog'. The 'Connection Tester Name' dropdown is set to 'PINGER'. The 'Destination Address' field contains '192.168.100.126:614'. The 'Syslog Over TCP' checkbox is checked. The 'Message Template' field is empty. A blue information icon next to the message template field points to a note: 'For Syslog and SNMP (your message template has reasonable default set if it safe to leave blank)'. The page is titled 'The event system syslog event destination configuration page' at the bottom.

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. This is used in the event filters section. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Destination name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For syslog server choose Syslog . <table><tr><td>Web Value</td><td>Description</td><td>UCI</td></tr><tr><td>Syslog</td><td>Syslog server</td><td>syslog</td></tr><tr><td>Email</td><td>Event sent via email</td><td></td></tr><tr><td>SNMP</td><td>Event sent via SNMP trap</td><td></td></tr><tr><td>Exec</td><td>Command executed when event occurs</td><td></td></tr><tr><td>SMS</td><td>Event send via SMS</td><td></td></tr><tr><td>File</td><td>File targer</td><td></td></tr></table>	Web Value	Description	UCI	Syslog	Syslog server	syslog	Email	Event sent via email		SNMP	Event sent via SNMP trap		Exec	Command executed when event occurs		SMS	Event send via SMS		File	File targer	
Web Value	Description	UCI																				
Syslog	Syslog server	syslog																				
Email	Event sent via email																					
SNMP	Event sent via SNMP trap																					
Exec	Command executed when event occurs																					
SMS	Event send via SMS																					
File	File targer																					
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester (if any) to use to verify the syslog target. <table><tr><td>Default: None</td><td>No connection tester: UCI option not present.</td></tr><tr><td>Range:</td><td></td></tr></table>	Default: None	No connection tester: UCI option not present.	Range:																		
Default: None	No connection tester: UCI option not present.																					
Range:																						
Web: Destination Address UCI: va_eventd.@target[0]. target_addr Opt: target_addr	Defines the syslog target IP/FQDN and port. <table><tr><td>Default:</td><td></td></tr><tr><td>Range</td><td>a.b.c.d : port or fqdn : port</td></tr></table>	Default:		Range	a.b.c.d : port or fqdn : port																	
Default:																						
Range	a.b.c.d : port or fqdn : port																					
Web: Syslog Over TCP UCI: va_eventd.@target[0].tcp_syslog Opt: tcp_syslog	Defines whether to use TCP for delivery of the syslog event. <table><tr><td>Default: 0</td><td>Use UDP</td></tr><tr><td>1</td><td>Use TCP</td></tr></table>	Default: 0	Use UDP	1	Use TCP																	
Default: 0	Use UDP																					
1	Use TCP																					
Web: Message Template UCI: va_eventd.@target[0].template Opt: template	Defines the message template to use for the event. In general, this should be left empty. See the section on message templates below.																					
Web: n/a UCI: va_eventd.@target[0].facility Opt: facility	Defines a custom facility to overwrite existing facility on syslog messages before delivery to syslog target. <table><tr><td>Default:</td><td>Does not overwrite existing facility.</td></tr><tr><td>Range</td><td></td></tr></table>	Default:	Does not overwrite existing facility.	Range																		
Default:	Does not overwrite existing facility.																					
Range																						
Web: n/a UCI: va_eventd.@target[0].severity Opt: severity	Defines a custom severity to overwrite existing severity on syslog messages before delivery to syslog target. <table><tr><td>Default:</td><td>Does not overwrite existing facility.</td></tr><tr><td>Range</td><td></td></tr></table>	Default:	Does not overwrite existing facility.	Range																		
Default:	Does not overwrite existing facility.																					
Range																						

39.4.2. Email Target

When an email target receives an event, it sends it to the configured email address.

Event Destination

Details

Enabled

☒

Distribution Name

Email Target

Type

E-mail

Connection Type

None

From

To

Subject Template

Template for email subject

Body Template

Template for email body. Safe to leave blank

SMTP Server Address

SMTP User Name

root

SMTP Password

☒

Use TLS

☐

Send Timeout

10

The event system email event destination configuration page

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. <table><tr><td>Default: 0</td><td>disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	disabled	1	Enabled																	
Default: 0	disabled																					
1	Enabled																					
Web: Destination name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For an email server choose Email . <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table>	Web Value	Description	UCI	Syslog	Syslog target	syslog	SNMP Trap	SNMP target	snmptrap	Email	Email target	email	Execute	Execute target	exec	SMS	SMS target	sms	File	File target	file
Web Value	Description	UCI																				
Syslog	Syslog target	syslog																				
SNMP Trap	SNMP target	snmptrap																				
Email	Email target	email																				
Execute	Execute target	exec																				
SMS	SMS target	sms																				
File	File target	file																				
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester (if any) to use to verify the email target. <table><tr><td>Default:</td><td>none. No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table>	Default:	none. No connection tester. UCI option not present.	Range																		
Default:	none. No connection tester. UCI option not present.																					
Range																						
Web: From UCI: va_eventd.@target[0].from Opt: from	Defines the 'from' address for the email.																					
Web: To UCI: va_eventd.@target[0].to Opt: to	Defines the 'to' address for the email.																					
Web: Subject Template UCI: va_eventd.@target[0].subject_template Opt: subject_template	Defines subject template for the email. In general, this should be left empty. Example: va_eventd.@target[0].subject_template="%{severityName} % {eventName} !!!" See the section on message templates below.																					
Web: Body Template UCI: va_eventd.@target[0].body_template Opt: body_template	Defines the email body template. In general, this should be left blank. Example: va_eventd.@target[0].body_template="%{eventName} (%{class}:%{subclass}) happened!" See the section on message templates below.																					
Web: SMTP Server Address UCI: va_eventd.@target[0].smtp_addr Opt: smtp.addr	Defines the email server address and port. <table><tr><td>Default:</td><td></td></tr><tr><td>Range</td><td>a.b.c.d:port or fqdn:port</td></tr></table>	Default:		Range	a.b.c.d:port or fqdn:port																	
Default:																						
Range	a.b.c.d:port or fqdn:port																					
Web: SMTP User Name UCI: va_eventd.@target[0].smtp_user Opt: smtp_user	Defines user name for SMTP authentication.																					
Web: SMTP Password UCI: va_eventd.@target[0].smtp_password Opt: smtp_password	Defines the password for SMTP authentication.																					

Web Field/UCI/Package Option	Description				
Web: Use TLS UCI: va_eventd.@target[0].use_tls Opt: use_tls	Enables TLS (Transport Layer Security) support. <table border="1"> <tr><td>Default:</td><td>0</td></tr> <tr><td>Range:</td><td>0-1</td></tr> </table>	Default:	0	Range:	0-1
Default:	0				
Range:	0-1				
Web: Send Timeout UCI: va_eventd.@target[0].timeout_sec Opt: timeout_sec	Defines the email send timeout in seconds. <table border="1"> <tr><td>Default:</td><td>10</td></tr> <tr><td>Range:</td><td></td></tr> </table>	Default:	10	Range:	
Default:	10				
Range:					
Web: Use StartTLS UCI: va_eventd.@target[0].tls_starttls Opt: tls_starttls	Enables StartTLS support for TLS. (Only displayed when TLS is enabled) <table border="1"> <tr><td>Default:</td><td>0</td></tr> <tr><td>Range:</td><td>0-1</td></tr> </table>	Default:	0	Range:	0-1
Default:	0				
Range:	0-1				
Web: Force SSLv3 UCI: va_eventd.@target[0].tls_forssl3 Opt: tls_forssl3	Enables force SSLv3 for TLS. (Only displayed when TLS is enabled)				

39.4.3. SNMP Target

When a SNMP target receives an event, it sends it in a trap to the configured SNMP manager.

The screenshot shows the 'Event Destination' configuration page. At the top right is a 'Delete' button. Below it, the 'Enabled' checkbox is checked. The configuration fields are: 'Destination Name' with value 'SNMP', 'Type' with a dropdown showing 'SNMP Trap', 'Connection Test Name' with a dropdown showing 'None', 'Destination Address' with value '192.168.100.126:514', 'Message Template' (empty), 'Agent Address' with value 'localhost', 'SNMP Protocol Version' with a dropdown showing '1', and 'Community' (empty). A blue information icon next to the 'Message Template' field has a tooltip that says: 'For Syslog and SNMP Agent message template has reasonable default so it is safe to leave blank'.

The event system SNMP event destination configuration page

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Destination name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For SNMP server, choose SNMP Trap . <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table>	Web Value	Description	UCI	Syslog	Syslog target	syslog	SNMP Trap	SNMP target	snmptrap	Email	Email target	email	Execute	Execute target	exec	SMS	SMS target	sms	File	File target	file
Web Value	Description	UCI																				
Syslog	Syslog target	syslog																				
SNMP Trap	SNMP target	snmptrap																				
Email	Email target	email																				
Execute	Execute target	exec																				
SMS	SMS target	sms																				
File	File target	file																				
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester (if any) to use to verify the SNMP target. <table><tr><td>Default:</td><td>None. No connection tester. UCI option not present.</td></tr></table>	Default:	None. No connection tester. UCI option not present.																			
Default:	None. No connection tester. UCI option not present.																					
Web: Destination Address UCI: va_eventd.@target[0]. target_addr Opt: target_addr	Defines the SNMP target IP/FQDN and port. <table><tr><td>Range:</td><td>a.b.c.d:port or fqdn:port</td></tr></table>	Range:	a.b.c.d:port or fqdn:port																			
Range:	a.b.c.d:port or fqdn:port																					
Web: Message Template UCI: va_eventd.@target[0].template Opt: template	Defines the message template to use for the event. In general, this should be left empty. Example: va_eventd.@target[0].template="%{eventName} % {eventSpecificTemplate}" See the section on message templates below.																					
Web: Agent Address UCI: va_eventd.@target[0]. agent_addr Opt: agent_addr	Defines the IP address to source the SNMP trap. (optional) <table><tr><td>Default: localhost</td><td>Local IP</td></tr><tr><td>Range</td><td>Localhost or IP address</td></tr></table>	Default: localhost	Local IP	Range	Localhost or IP address																	
Default: localhost	Local IP																					
Range	Localhost or IP address																					
Web: SNMP Protocol Version UCI: va_eventd.@target[0].snmp_version Opt: snmp_version	Defines the SNMP version. <table><tr><td>Default: 1</td><td>SNMPv1</td></tr><tr><td>2c</td><td>SNMPv2c</td></tr><tr><td>3</td><td>SNMPv3</td></tr></table>	Default: 1	SNMPv1	2c	SNMPv2c	3	SNMPv3															
Default: 1	SNMPv1																					
2c	SNMPv2c																					
3	SNMPv3																					
Web: Community UCI: va_eventd.@target[0].community Opt: community	Defines the community string for SNMPv1.																					
Web: Username UCI: va_eventd.@target[0].snmp_uname Opt: snmp_uname	Defines the username for SNMPv3. Only displayed when SNMP protocol version is SNMPv3																					
Web: Authentication Protocol UCI: va_eventd.@target[0].snmp_auth_proto Opt: snmp_auth_proto	Defines the SNMPv3 authentication protocol. Only displayed when SNMP protocol version is SNMPv3.																					

Web: Authentication Password UCI: va_eventd.@target[0].snmp_auth_pass Opt: snmp_auth_pass	Defines the SNMPv3 authentication password. Only displayed when SNMPv3 authentication protocol is configured. <table border="1"> <tr><td>MD5</td><td></td></tr> <tr><td>SHA</td><td></td></tr> </table>	MD5		SHA	
MD5					
SHA					
Web: Privacy Protocol UCI: va_eventd.@target[0].snmp_priv_proto Opt: snmp_priv_proto	Defines the SNMPv3 privacy protocol. Only displayed when SNMP authentication protocol is configured. <table border="1"> <tr><td>MD5</td><td></td></tr> <tr><td>SHA</td><td></td></tr> </table>	MD5		SHA	
MD5					
SHA					
Web: Privacy Password UCI: va_eventd.@target[0].snmp_priv_pass Opt: snmp_priv_pass	Defines SNMPv3 privacy password. Only displayed when SNMP privacy protocol is configured. <table border="1"> <tr><td>DES</td><td></td></tr> <tr><td>AES</td><td></td></tr> </table>	DES		AES	
DES					
AES					
Web: SNMPv3 Context UCI: va_eventd.@target[0].snmp_context Opt: snmp_context	Defines the SNMPv3 context. Only displayed when SNMP authentication protocol is configured.				
Web: SNMPv3 Context Engine ID UCI: va_eventd.@target[0].snmp_context_eid Opt: snmp_context_eid	Defines the SNMPv3 context engine ID. Only displayed when SNMP authentication protocol is configured.				
Web: SNMPv3 Security Engine ID UCI: va_eventd.@target[0].snmp_sec_eid Opt: snmp_sec_eid	Defines the SNMPv3 security engine ID. Only displayed when SNMP authentication protocol is configured.				

39.4.4. Exec Target

When an Execute target receives an event, it executes a shell command.

The screenshot shows the 'Event Destination' configuration page. At the top right is a 'Delete' button. Below it, the 'Enabled' checkbox is checked. The 'Destination Name' field contains 'ExecTarget'. The 'Type' dropdown menu is set to 'Execute'. The 'Connection Tester Name' dropdown menu is set to 'None'. The 'Command Template' field is empty, with a blue circular icon and the text 'Reconfigure for the command to be executed' next to it.

The event system exec event destination configuration page

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Destination name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For shell command execution, choose Execute . <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table>	Web Value	Description	UCI	Syslog	Syslog target	syslog	SNMP Trap	SNMP target	snmptrap	Email	Email target	email	Execute	Execute target	exec	SMS	SMS target	sms	File	File target	file
Web Value	Description	UCI																				
Syslog	Syslog target	syslog																				
SNMP Trap	SNMP target	snmptrap																				
Email	Email target	email																				
Execute	Execute target	exec																				
SMS	SMS target	sms																				
File	File target	file																				
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester, if any, to use to verify the execute target. <table><tr><td>Default: None</td><td>No connection tester. UCI option not present.</td></tr><tr><td>Range</td><td></td></tr></table>	Default: None	No connection tester. UCI option not present.	Range																		
Default: None	No connection tester. UCI option not present.																					
Range																						
Web: Command Template UCI: va_eventd.@target[0].cmd_template Opt: cmd_template	Defines the command template to use for the event. Example to log a syslog message: va_eventd.@target[0].cmd_template="logger -t eventer % {eventName} " See the section on message templates below.																					

39.4.5. SMS Target

When an SMS target receives an event, it sends an SMS message.

Event Destination

Enabled ☒

Destination Name

SMS Target

Type

SMS

Connection Tester Name

None

Message Template

For Syslog and SNMP types message template has reasonable default so it is safe to leave blank

Phone Number

Where text will be sent

Delete

The event system SMS event destination configuration page

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Destination name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For SMS destination, choose SMS . <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table>	Web Value	Description	UCI	Syslog	Syslog target	syslog	SNMP Trap	SNMP target	snmptrap	Email	Email target	email	Execute	Execute target	exec	SMS	SMS target	sms	File	File target	file
Web Value	Description	UCI																				
Syslog	Syslog target	syslog																				
SNMP Trap	SNMP target	snmptrap																				
Email	Email target	email																				
Execute	Execute target	exec																				
SMS	SMS target	sms																				
File	File target	file																				
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester; if any, to use to verify the SMS target. <table><tr><td>Default: None</td><td>No connection tester. UCI option not present.</td></tr></table>	Default: None	No connection tester. UCI option not present.																			
Default: None	No connection tester. UCI option not present.																					
Web: Message Template UCI: va_eventd.@target[0].template Opt: template	Defines the message template to use for the event. In general, this should be left empty. Example: va_eventd.@target [0] .template="% {eventName} " See the section on message templates below.																					
Web: Phone Number UCI: va_eventd.@target[0].callee Opt: callee	Defines the phone number for sending SMS to.																					

39.4.6. File Target

When file target receives an event, it logs to a file.

Event Destination

Details

Enabled: ☒

Destination Name:

Type:

Connection Tester Name:

Message Template:

File Name:

Max Size (KB):

For Syslog and SNMP Agent message templates use reasonable default as it is safe to leave blank

File to store events

Maximum file size in KB. Other events will be overwritten when reached

The event system file event destination configuration page

Web Field/UCI/Package Option	Description																					
Web: Enabled UCI: va_eventd.@target[0].enabled Opt: enabled	Enables an event destination. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled																	
Default: 0	Disabled																					
1	Enabled																					
Web: Destination Name UCI: va_eventd.@target[0].name Opt: name	Defines a name for the event destination.																					
Web: Type UCI: va_eventd.@target[0].type Opt: type	Defines the event destination type. For file choose File . <table><tr><th>Web Value</th><th>Description</th><th>UCI</th></tr><tr><td>Syslog</td><td>Syslog target</td><td>syslog</td></tr><tr><td>SNMP Trap</td><td>SNMP target</td><td>snmptrap</td></tr><tr><td>Email</td><td>Email target</td><td>email</td></tr><tr><td>Execute</td><td>Execute target</td><td>exec</td></tr><tr><td>SMS</td><td>SMS target</td><td>sms</td></tr><tr><td>File</td><td>File target</td><td>file</td></tr></table>	Web Value	Description	UCI	Syslog	Syslog target	syslog	SNMP Trap	SNMP target	snmptrap	Email	Email target	email	Execute	Execute target	exec	SMS	SMS target	sms	File	File target	file
Web Value	Description	UCI																				
Syslog	Syslog target	syslog																				
SNMP Trap	SNMP target	snmptrap																				
Email	Email target	email																				
Execute	Execute target	exec																				
SMS	SMS target	sms																				
File	File target	file																				
Web: Connection Tester Name UCI: va_eventd.@target[0]. conn_tester Opt: conn_tester	Defines the connection tester (if any) to use to verify the File target. <table><tr><td>Default: None</td><td>No connection tester: UCI option not present</td></tr></table>	Default: None	No connection tester: UCI option not present																			
Default: None	No connection tester: UCI option not present																					
Web: Message Template UCI: va_eventd.@target[0].template Opt: template	Defines the message template to use for the event. In general, this should be left empty. See the section on message templates below.																					
Web: File Name UCI: va_eventd.@target[0].file_name Opt: file_name	Defines a file name for the event destination. Full path.																					
Web: Max Size (KiB) UCI: va_eventd.@target[0].max_size_kb Opt: file_name	Defines a file size in kilobits. <table><tr><td>Default:</td><td>2048</td></tr></table>	Default:	2048																			
Default:	2048																					

39.5. Event Filters

Event filters are used to classify the events to be sent to the event destination. Multiple event filters can be defined. Event filters configure the uci forwarding section rules.

Event Filters

Enabled ☐

Class Name

None

Event Name

None

Minimum Severity

debug

Maximum Severity

debug

Target

SNMP

The event system event filters configuration page

Web Field/UCI/Package Option	Description																
Web: Enabled UCI: va_eventd.@forwarding[0].enabled Opt: enabled	Enables an event filter. <table border="1"> <tr> <td>Default: 1</td><td>Disabled</td></tr> <tr> <td>0</td><td>Enabled</td></tr> </table>	Default: 1	Disabled	0	Enabled												
Default: 1	Disabled																
0	Enabled																
Web: Class Name UCI: va_eventd.@forwarding[0].className Opt: className	Only match events with the given class name. Available class names are listed or can be viewed using the command <code>vae_cli -d</code>																
Web: Event Name UCI: va_eventd.@forwarding[0].eventName Opt: eventName	Only match events with the given event name. Available event names are listed. The event name is optional and can be omitted.																
Web: Minimum Severity UCI: va_eventd.@forwarding[0].severity Opt: severity	Defines the minimum event severity. The minimum severity event is DEBUG. Events generated within the minimum and maximum event severity will be matched. Minimum and maximum severity are specified in the one UCI option and entered using a dash (-) separator in the form minimum-maximum. Example: <code>va_eventd.@forwarding[0].severity=debug-error</code> <table border="1"> <tr> <td>debug</td><td>minimum severity</td></tr> <tr> <td>info</td><td></td></tr> <tr> <td>notice</td><td></td></tr> <tr> <td>warning</td><td></td></tr> <tr> <td>error</td><td></td></tr> <tr> <td>critical</td><td></td></tr> <tr> <td>alert</td><td></td></tr> <tr> <td>emergency</td><td>maximum severity</td></tr> </table>	debug	minimum severity	info		notice		warning		error		critical		alert		emergency	maximum severity
debug	minimum severity																
info																	
notice																	
warning																	
error																	
critical																	
alert																	
emergency	maximum severity																
Web: Maximum Severity UCI: va_eventd.@forwarding[0].severity Opt: severity	Defines the maximum event severity. The maximum event severity is EMERGENCY. Events generated within the minimum and maximum event severity will be matched. The UCI command for specifying minimum and maximum severity is the same and is entered with two parameters using a dash (-) separator minimum-maximum. Example: <code>va_eventd.@forwarding[0].severity=debug-error</code> <table border="1"> <tr> <td>debug</td><td>minimum severity</td></tr> <tr> <td>info</td><td></td></tr> <tr> <td>notice</td><td></td></tr> <tr> <td>warning</td><td></td></tr> <tr> <td>error</td><td></td></tr> <tr> <td>critical</td><td></td></tr> <tr> <td>alert</td><td></td></tr> <tr> <td>emergency</td><td>maximum severity</td></tr> </table>	debug	minimum severity	info		notice		warning		error		critical		alert		emergency	maximum severity
debug	minimum severity																
info																	
notice																	
warning																	
error																	
critical																	
alert																	
emergency	maximum severity																
Web: Target UCI: va_eventd.@forwarding[0].target Opt: target	Defines the event destination to forward the event to. All configured event destinations will be displayed.																

39.6. Configuring The Event System Using Command Line

The event system configuration files are stored at `/etc/config/va_eventd`

There are four config sections main, conn_tester, target and forwarding. You can configure multiple conn_tester, target and forwarding sections.

By default, all conn_tester instances are named conn_tester, it is identified by @conn_tester then the conn_tester position in the package as a number. For example, for the first conn_tester in the package using UCI:

```
va_eventd.@conn_tester[0]=conn_tester
va_eventd.@conn_tester[0].enabled=1
```

Or using package options, enter:

```
config conn_tester
option enabled '1'
```

By default, all target instances are named target. The target instance is identified by @target then the target position in the package as a number. For example, for the first target in the package using UCI:

```
va_eventd.@target[0]=target
va_eventd.@target[0].enabled=1
```

Or using package options, enter:

```
config target
option enabled '1'
```

By default, all forwarding instances are named forwarding. The forwarding instance is identified by @forwarding then the forwarding position in the package as a number. For example, for the first forwarding rule in the package using UCI:

```
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=1
```

Or using package options:

```
config forwarding
option enabled '1'
```


39.6.1. Event System Using UCI

```
root@VA_router:~# uci show va_eventd

#Sample basic settings

va_eventd.main=va_eventd

va_eventd.main.event_queue_file=/tmp/event_buffer

va_eventd.main.event_queue_size=128K


#Sample SNMP

va_eventd.@conn_tester[0]=conn_tester

va_eventd.@conn_tester[0].type=ping

va_eventd.@conn_tester[0].ping_dest_addr=192.168.100.1

va_eventd.@conn_tester[0].ping_success_duration_sec=60

va_eventd.@conn_tester[0].name=SNMPTest

va_eventd.@conn_tester[0].ping_source=LAN1

va_eventd.@target[0]=target

va_eventd.@target[0].suppress_duplicate_forwardings=no

va_eventd.@target[0].type=snmp

va_eventd.@target[0].agent_addr=localhost

va_eventd.@target[0].name=SNMPTarget

va_eventd.@target[0].conn_tester=SNMPTest

va_eventd.@target[0].target_addr=192.168.100.126:68

va_eventd.@target[0].snmp_version=3

va_eventd.@target[0].snmp_uname=v3username

va_eventd.@target[0].snmp_auth_proto=MD5

va_eventd.@target[0].snmp_auth_pass=md5password

va_eventd.@target[0].snmp_priv_proto=AES

va_eventd.@target[0].snmp_priv_pass=aespassword

va_eventd.@target[0].snmp_context=v3context
```

```

va_eventd.@target[0].snmp_context_eid=v3contextID
va_eventd.@target[0].snmp_sec_eid=v3SecurityID
va_eventd.@forwarding[0]=forwarding
va_eventd.@forwarding[0].enabled=yes
va_eventd.@forwarding[0].className=mobile
va_eventd.@forwarding[0].target=SNMPTarget
va_eventd.@forwarding[0].eventName=LinkUp
va_eventd.@forwarding[0].severity=notice-notice

#Sample Syslog
va_eventd.@conn_tester[1]=conn_tester
va_eventd.@conn_tester[1].name=SyslogTest
va_eventd.@conn_tester[1].type=ping
va_eventd.@conn_tester[1].ping_dest_addr=192.168.100.2
va_eventd.@conn_tester[1].ping_source=LAN1
va_eventd.@conn_tester[1].ping_success_duration_sec=60
va_eventd.@target[1]=target
va_eventd.@target[1].name=SyslogTarget
va_eventd.@target[1].type=syslog
va_eventd.@target[1].conn_tester=SyslogTest
va_eventd.@target[1].target_addr=192.168.100.2:514
va_eventd.@target[1].tcp_syslog=0
va_eventd.@forwarding[1]=forwarding
va_eventd.@forwarding[1].enabled=yes
va_eventd.@forwarding[1].severity=debug-error
va_eventd.@forwarding[1].target=SyslogTarget

#Sample Email
va_eventd.@conn_tester[2]=conn_tester
va_eventd.@conn_tester[2].name=EmailTest
va_eventd.@conn_tester[2].type=link
va_eventd.@conn_tester[2].link_iface=PoAADSL
va_eventd.@target[2]=target
va_eventd.@target[2].timeout_sec=10
va_eventd.@target[2].name=EmailTarget
va_eventd.@target[2].type=email
va_eventd.@target[2].conn_tester=EmailTest

```

```

va_eventd.@target[2].from=from@example.com (<.from%3Dfrom@example.com>)
va_eventd.@target[2].to=to@example.com (<.to%3Dto@example.com>)

va_eventd.@target[2].subject_template=%{serial} %{severityName} %{eventName}!!!
va_eventd.@target[2].body_template=%{eventName} (%{class}.%{subclass}) happened!
va_eventd.@target[2].smtp_addr=192.168.100.3:25
va_eventd.@target[2].smtp_user=root
va_eventd.@target[2].smtp_password=admin
va_eventd.@target[2].use_tls=0
va_eventd.@target[2].tls_starttls=0
va_eventd.@target[2].tls_forcessl3=0
va_eventd.@forwarding[2]=forwarding
va_eventd.@forwarding[2].enabled=yes
va_eventd.@forwarding[2].className=power
va_eventd.@forwarding[2].eventName=IgnitionOff
va_eventd.@forwarding[2].severity=notice-notice
va_eventd.@forwarding[2].target=EmailTarget

#Sample SMS
va_eventd.@target[3]=target
va_eventd.@target[3].name=SMSTarget
va_eventd.@forwarding[3].target=SMSTarget
va_eventd.@target[3].type=sms
va_eventd.@target[3].template=%{serial} %{severityName} %{eventName}!!!
va_eventd.@target[3].callee=0123456789
va_eventd.@forwarding[3]=forwarding
va_eventd.@forwarding[3].enabled=yes
va_eventd.@forwarding[3].target=SMSTarget
va_eventd.@forwarding[3].className=auth
va_eventd.@forwarding[3].eventName=LoginSSH
va_eventd.@forwarding[3].severity=notice-notice

#Sample Execute
va_eventd.@target[4]=target
va_eventd.@target[4].name=ExecTarget
va_eventd.@target[4].type=exec
va_eventd.@target[4].cmd_template=logger -t eventer %{eventName}
va_eventd.@forwarding[4]=forwarding
va_eventd.@forwarding[4].enabled=yes

```

```
va_eventd.@forwarding[4].target=ExecTarget
va_eventd.@forwarding[4].className=ppp
va_eventd.@forwarding[4].severity=debug-error

#Sample File
va_eventd.@target[5]=target
va_eventd.@target[5].name=FileTarget
va_eventd.@target[5].type=file
va_eventd.@target[5].file_name=tmp\eventfile
va_eventd.@target[5].max_size_kb=1028
va_eventd.@forwarding[5]=forwarding
va_eventd.@forwarding[5].enabled=yes
va_eventd.@forwarding[5].target=FileTarget
va_eventd.@forwarding[5].severity=debug-error
```

Event system using package options

```
root@VA_router:~# uci export
va_eventd package va_eventd

config va_eventd 'main'
option event_queue_file '/tmp/event_buffer'
option event_queue_size '128K'

# Sample SNMP
config conn_tester
option type 'ping'
option ping_dest_addr '192.168.100.1'
option ping_success_duration_sec '60'
option name 'SNMPTest'
option ping_source 'LAN1'

config target
option suppress_duplicate_forwardings 'no'
option type 'snmp'
option agent_addr 'localhost'
option name 'SNMPTarget'
option conn_tester 'SNMPTest'
option target_addr '192.168.100.126:68'
option snmp_version '3'
option snmp_undef 'v3username'
option snmp_auth_proto 'MD5'
```

```
option snmp_auth_pass 'md5password'
option snmp_priv_proto 'AES'
option snmp_priv_pass 'aespassword'
option snmp_context 'v3context'
option snmp_context_eid 'v3contextID'
option snmp_sec_eid 'v3SecurityID'

config forwarding
option enabled 'yes'
option className 'mobile'
option severity 'notice-notice'
option target 'SNMPTarget'
option eventname 'LinkUp'

# Sample Syslog
config conn_tester
option name 'SyslogTest'
option type 'ping'
option ping_dest_addr '192.168.100.2'
option ping_source 'LAN1'
option ping_success_duration_sec '60'

config target
option name 'SyslogTarget'
option type 'syslog'
option conn_tester 'SyslogTest'
option target_addr '192.168.100.2:514'
option tcp_syslog '0'
```

```

config forwarding
option enabled 'yes'
option severity 'debug-error'
option target 'SyslogTarget'

# Sample Email
config conn_tester
option name 'EmailTest' option type 'link'
option link_iface 'PoAADSL'

config target
option timeout_sec '10'
option name 'EmailTarget'
option type 'email'
option conn_tester 'EmailTest'
option from 'from@example.com'
option to 'to@example.com'
option subject_template '%{serial} %{severityName} %{eventName}!!!'
option body_template '%{eventName} (%{class}:%{subclass}) happened!'
option smtp_addr '192.168.100.3:25'
option smtp_user 'root'
option smtp_password 'admin'
option use_tls 'no'
option tls_starttls 'no'
option tls_forcessl3 'no'

config forwarding
option enabled 'yes'
option target 'EmailTarget'
option className 'power'
option eventName 'IgnitionOff'
option severity 'notice-notice'

```

```

# Sample SMS

config target

option name 'SMSTarget'

option type 'sms'

option template '%{serial} %{severityName} %{eventName}!!!' option callee '0123456789'

config forwarding

option enabled 'yes'

option target 'SMSTarget'

option className 'auth'

option eventName 'LoginSSH'

option severity 'notice-notice'

# Sample Execute

config target

option name 'ExecTarget'

option type 'exec'

option cmd_template 'logger -t eventer %{eventName}'

config forwarding

option enabled 'yes'

option target 'ExecTarget'

option className 'ppp'

option severity 'debug-error'

# Sample File

config target

option name 'FileTarget'

option type 'file'

option file_name '\tmp\eventfile'

option max_size_kb '1028'

config forwarding

option enabled 'yes'

option target 'FileTarget'

option severity 'debug-error'

```

39.7. Event System Diagnostics

To view a list of all available class names, events and severity levels, enter:


```
root@VA_router:~# vae_cli -d
```

The following is an example of the output from this command:

Class	ID	Name	Severity	Specific Template
internal	1	EventdConfigErr	error	%{p1} %{p2}: %{p3} has bad value..
internal	2	EventdConfigWarn	warning	%{p1} %{p2}: %{p3} has bad value
internal	3	EventdConfigUnknown	informat	%{p1} %{p2}: field '%{p3}' is no
internal	4	EventdSystemErr	error	%{p1} %{p2}: %{p3} %{p4} %{p5} %
internal	5	EventdSystemWarn	error	%{p1} %{p2}: %{p3} %{p4} %{p5} %
internal	6	EventdUpAndRunning	informat	
internal	7	EventdStopped	warning	%{p1}
mobile	1	SIMin	notice	SIM card #{p1} inserted
mobile	2	SIMout	notice	SIM card #{p1} removed
mobile	3	LinkUp	notice	3g link %{p1} up using sim #{p2}
mobile	4	LinkDown	notice	3g link %{p1} down
mobile	5	SMSByPassword	notice	Received SMS from %{p1} (by pass
mobile	6	SMSByCaller	notice	Received SMS from %{p1} (%{p2}):
mobile	7	SMSFromUnknown	warning	Received SMS from unknown sender
mobile	8	SMSSendSuccess	informat	SMS send success: %{p1}
mobile	9	SMSSendError	warning	SMS send error: %{p1}
mobile	10	SMSSent	notice	Sent SMS to %{p1}: %{p2}
ethernet	1	LinkUp	notice	Ethernet %{p1} up
ethernet	2	LinkDown	notice	Ethernet %{p1} down
auth	2	BadPasswordSSH	warning	SSH login attempt from %{p2}: ba
auth	3	BadUserConsole	warning	Console login attempt on %{p1}:
auth	4	BadPasswordConsole	warning	Console login attempt on %{p2}:
auth	5	BadUserTelnet	warning	Telnet login attempt bad username
auth	6	BadPasswordTelnet	warning	Telnet login attempt bad passwo.
auth	7	BadUserLuCI	warning	LuCI login attempt bad username
auth	8	BadPasswordLuCI	warning	LuCI login attempt bad password.
auth	9	Login SSH	notice	SSH login: user%{p2}from %{p3}
auth	10	LogoffSSH	notice	SSH logoff: user %{p1} due to %
auth	11	LoginConsole	notice	Console login: user %{p1} on %{p2}
auth	12	LoginConsole	notice	Console logoff on %{p1}
auth	13	LoginTelnet	notice	Telnet login: user %{p1}
auth	14	LoginLuCI	notice	LuCI login: user %{p1}
auth	15	ConsoleCommand	informat	%{p1}@%{p2}%{p3}
auth	16	LuCIAction	informat	%{p1}@%{p2}%{p3}{p4}{p5}
ipsec	6	IPSecInitIKE	informat	IPSec IKE %{p1} established
ipsec	7	IPSecInitSA	informat	IPSec IKE %{p1} established
ipsec	8	IPSecCloseIKE	informat	IPSec IKE %{p1} deleted
ipsec	9	IPSecCloseSA	informat	IPSec SA %{p1} closed
ipsec	10	IPSecDPDTimeout	informat	IPSec IKE %{p1} DPD established
wifi	1	WiFiConnectedToAp	notice	WiFi %{p1} connected to AP %{p2}
wifi	2	WiFiDisconnectedFromAP	notice	WiFi %{p1} disconnected from AP
wifi	3	WiFiStationAttached	notice	WiFi station %{p2} connected to ..
wifi	4	WiFiStationDetached	notice	WiFi station %{p2} disconnected ..
wifi	5	WiFiStationAttachFailed	notice	WiFi station %{p2} failed to con..
ppp	1	LinkUp	informat	PPP for interface %{p2} (protoco..

pp	2	LinkDown	informat	PPP for interface %{p2} (protoco..
ppp	3	ConnEstablished	informat	PPP connection for interface %{p..
adsl	1	LinkUp	notice	ADSL trained. Starting interface..
adsl	2	LinkDown	notice	ADSL down. Stopping interface %{\n..
adsl	3	Silent	debug	ADSL silent
adsl	4	Training	debug	ADSL training
adsl	5	TrainingSuccess	notice	ADSL training successful: data ..
system	1	BootSuccess	informat	Success booting into %{p1}
system	2	DigitalInputChange	notice	Digital Input %{p1} changed valu..
ntp	1	InitialSync	notice	Initial NTP sync: time: %{p1}; o..
ntp	2	Adjust	nformat	NTP adjust by %{p1}
ntp	3	QueryTimeout	warning	NTP query to %{p1} timed out. Ne..
ntp	4	QueryFailed	warning	NTP query failed: %{p1}

40. Configuring Data Usage Monitor

Merlin software provides support for monitoring of data usage on mobile interfaces and to disable if the monthly limit is exceeded. This allows an element of control over data usage for SIMs with a limited data plan.



NOTICE

DISCLAIMER: data usage statistics calculated by this data usage feature are best estimates and may vary from the mobile carrier statistics that are used for billing. Westermo cannot be held liable for any fees charged by the carrier to the customer for their data usage. We recommend that the configured data usage is lower than the allowance and that traffic percentage alerts are used.

Configuration Package Used

Package	Sections
procrustes	limit

40.1. Configuring Data Using The Web Interface

Select **Services -> Data Usage**. The Data Usage page appears.

Procrustes

Monitor network traffic for interface groups and stop interfaces and blacklist sim cards if limits are reached

Interface Group

This section contains no values yet

The data usage page

You can monitor interfaces as a collective group, so enter a name for the group and select **Add**. The examples below show a group name configured as ‘wan’.

You can configure multiple groups.

Procrustes

Monitor network traffic for interface groups and stop interfaces and blacklist client cards if limits are reached

Interface Group

WAN

Enabled

DISCLAIMER

By clicking Enabled you agree that data presented are estimates and may vary from what your carrier uses for billing. Virtual Access cannot be held liable for any fees charged by the carrier to the customer for their data usage. We recommend that you set the configured data usage level than the allowance and also use traffic alerts.

Interfaces

lan

wan

no interfaces attached

no interfaces attached

no interfaces attached

no interfaces attached

no interfaces attached

Billing Start

1

Day of month when billing period starts (1-28)

Monthly Limit (MB)

30

0 means "no limit"

Monthly Warnings (MB)

15

25

When usage would reach any of these levels, message will be sent

The data usage configuration page

Web Field/UCI/Package Option	Description				
Web: Enabled UCI: procrustes.@limit[0].enabled Opt: enabled	Enable data usage monitor on this interface group. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Billing Start UCI: procrustes.@limit[0].billing_period_start_day Opt: billing_period_start_day	Day of month on which the billing period starts. <table> <tr> <td>Default: 0</td><td>Zero means no limit</td></tr> </table>	Default: 0	Zero means no limit		
Default: 0	Zero means no limit				
Web: Interfaces UCI: procrustes.@limit[0].interfaces Opt: interfaces	Monitor and apply limits to these interfaces as a group. Configure multiple interfaces via UCI using a space separator. Example: <pre>uci set procrustes.@limit[0].interfaces="lan wan"</pre>				
Web: Monthly Limit (MB) UCI: procrustes.@limit[0].monthly_data_limit Opt: monthly_data_limit	Defines monthly data traffic limit in megabytes (MB). This is total RX and TX on the interface. <table> <tr> <td>Default: 0</td><td>Zero means no limit</td></tr> </table>	Default: 0	Zero means no limit		
Default: 0	Zero means no limit				
Web: Monthly Warnings (MB) UCI: procrustes.@limit[0].monthly_warning_levels Opt: monthly_warning_levels	Defines data usage limits for generating a log message and a VA event alert when used traffic reaches specified levels. Levels are specified in MB. Set multiple limits via UCI using a space separator. Example: <pre>uci set procrustes.@limit[0].monthly_warning_levels="15 25"</pre> <table> <tr> <td>Default: 0</td><td>Zero means no limit</td></tr> </table>	Default: 0	Zero means no limit		
Default: 0	Zero means no limit				

40.2. Configuring Data Using Command Line

Data usage is configured under the **procrustes** package **/etc/config/procrustes**.

By default, all limit instances are named 'limit', and are identified by @limit followed by the limit position in the package as a number. For example, for the first limit in the package using UCI:

```
procrustes.@limit[0]=limit
procrustes.@limit[0].enabled=1
```

Or using package options, enter:

```
config limit
option enabled '1'
```

However, to better identify instances, it is recommended to give the limit instance a name. For example, create a limit instance named **MOBILE1**.

To define a named limit instance using UCI, enter:

```
procrustes.@limit[0]=wan
procrustes.wan.enabled=1
```

To define a named limit instance using package options, enter:

```
config limit 'wan'
option enabled '1'
```

The following examples show two limit groups wan and lan.

Procrustes using UCI

```
root@VA_router:~# uci show procrustes
procrustes.lan=limit
procrustes.lan.enabled=1
procrustes.lan.interfaces=LAN1
procrustes.lan.billing_period_start_day=1
procrustes.lan.monthly_data_limit=30
procrustes.lan.monthly_warning_levels=15 25
procrustes.wan=limit
procrustes.wan.enabled=1
procrustes.wan.interfaces=MOBILE1
procrustes.wan.billing_period_start_day=1
procrustes.wan.monthly_data_limit=30
procrustes.wan.monthly_warning_levels=15 25
```

Procrustes using package options

```

root@VA_router:~# uci export procrustes
package procrustes

config limit 'lan'
option enabled '1'
option interfaces 'LAN1'
option billing_period_start_day '1'
option monthly_data_limit '30'
option monthly_warning_levels '15 25'

config limit 'wan'
option enabled '1'
option interfaces 'MOBILE1'
option billing_period_start_day '1'
option monthly_data_limit '30'
option monthly_warning_levels '15 25'

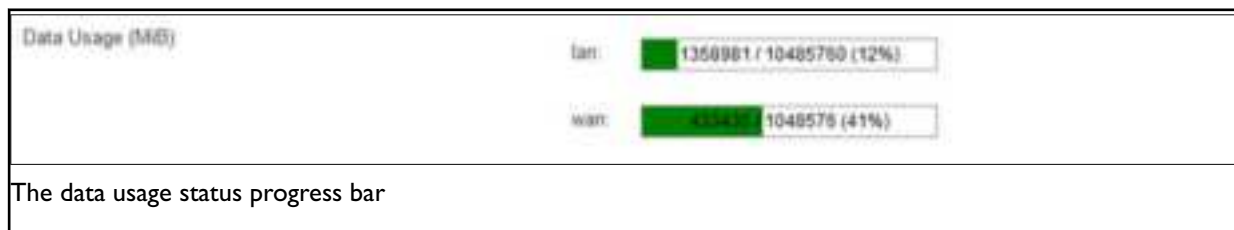
```

40.3. Data Usage Diagnostics

Data Usage Status using the Web Interface

Select **Status -> Overview**. The Status page appears.

To check current data usage, scroll to **Network -> Data Usage (MiB)** row. Data usage is presented as progress bar.



Syslog Events

The following events can be generated in logs by the data usage feature:

Severity	Tag	Text
NOTICE	procrustes	<if_group_name>: using counter 1404674 saved on 2017-09-30 16:26:57
NOTICE	procrustes	<if_group_name>: warning level 2097152 is reached
WARNING	procrustes	<if_group_name>: hard limit 10485760 is reached

NOTICE	procrustes	Data limit on SIM <iccid> exceeded and sim will be banned until the next month
ERROR	procrustes	Could not get iccid for <ifname>
DEBUG	procrustes	Interface <ifname> is not up
WARNING	procrustes	network.<ifname>.ifname is not defined
NOTICE	procrustes	<ifname>: reached billing start. Resetting..
DEBUG	procrustes	Saving current limit values
NOTICE	procrustes	<if_group_name>: not enabled
WARNING	procrustes	<if_group_name>: defines no interfaces
DEBUG	procrustes	<if_group_name>: sim interface <ifname>
ERROR	procrustes	Daemonization failed
ERROR	procrustes	another procrustes is running. Exiting..
NOTICE	procrustes	No limits defined. Exiting..
ERROR	mobile	SIM <iccid> is blacklisted, not establishing connection

Viewing Data Usage

The router has a monitoring application named `procrustatus.lua` that can be used for viewing data usage.

This application displays data statistics used for different interface groups, percentage of time left to next billing period start and percentage of data left for use before the interface will be shut down.

To view the application, enter the command `procrustes.lua`

root@VA_router:~# procrustatus.lua				
name	current	max	time left	data left
lan:	1404674/	10485760	1.03%	86.60%
wan:	433436/	1048576	1.03%	58.66%

Alternatively, to check total data usage, enter:

root@VA_router:~# cat /var/state/procrustes				
procrustes.lan.total_bytes=215780				
procrustes.wan.total_bytes=433436				

Additional Debugging Commands

Additional useful debugging commands via the command line are described in the table below.

Diagnostic Command	Description
<code>logread grep procrustes</code>	Shows logs related to "procrustes" only
<code>is /root/procrustes/sim_blacklist/</code>	Shows list of blacklisted SIM iccids

41. Configuring Terminal Server

Overview

Terminal server is a background application whose main task is to forward data between TCP connections or UDP streams and asynchronous or synchronous serial ports.

The terminal server application serves up to four sessions simultaneously, one for each serial port, depending on the device. Each terminal server session has an IP endpoint and an associated specific serial port.

You can configure the IP endpoint of each terminal server session to be a:

- TCP server: each session is listening on a unique port.
- TCP client: the terminal server makes a TCP connection to external TCP server.
- UDP endpoint: the terminal server forwards data between a UDP stream and a serial port.

Configuration packages used

Package	Sections
tservd	main
	port

41.1. Configuring Terminal Server Using The Web Interface

In the top menu, select **Services -> Terminal Server**. The Terminal Server Configuration page appears. You must configure two sections:

- Main Settings are to enable the terminal server, syslog settings, and to enable log setting.
- The Port Settings section is for general port settings, serial settings such as port mode, port speed, parity stip bit and so on. And finally, network settings to configure the network side of the terminal server.

Configure Main Settings

Terminal Server

Configuration of the VA Terminal Server

Main Settings

Enable

☒ enable terminal server

Debug Enable

☐ enabling detailed debug logging (state transitions, data transfer etc)

Syslog severity

Informational

Log RX-TX

☒ enable logging data transfers

The terminal server main settings page

Web Field/UCI/Package Option	Description																
Web: Enable UCI: tservd.main.enable Opt: enable	Enables Terminal Server on the router. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																
Web: Debug Enable UCI: tservd.main.debug_ev_enable Opt: debug_ev_enable	Enables detailed debug logging. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																
Web: Syslog severity UCI: tservd.main.log_severity Opt: log_severity	Determines the syslog level. Events up to this priority will be logged. <table border="1"> <tr><td>0</td><td>Emergency</td></tr> <tr><td>1</td><td>Alert</td></tr> <tr><td>2</td><td>Critical</td></tr> <tr><td>3</td><td>Error</td></tr> <tr><td>4</td><td>Warning</td></tr> <tr><td>5</td><td>Notice</td></tr> <tr><td>6</td><td>Informational</td></tr> <tr><td>7</td><td>Debug</td></tr> </table>	0	Emergency	1	Alert	2	Critical	3	Error	4	Warning	5	Notice	6	Informational	7	Debug
0	Emergency																
1	Alert																
2	Critical																
3	Error																
4	Warning																
5	Notice																
6	Informational																
7	Debug																
Web: Log RX-TX UCI: tservd.main.debug_rx_tx_enable Opt: debug_rx_tx_enable	Enables logging data transfers. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																

41.1.1. Configuring Port Settings

The Port Settings section is divided into 3 sub-sections:

- General
- Serial
- Network

Port Settings: General Section

In this section you can configure general port settings. The settings are usually the same for the central and the remote site.

Port Settings

PORT1

General

Serial

Network

Enable ☒ enable port

Network Forwarding Buffer Size Forwarding buffer size (serial to network)

Network Forwarding Timeout (ms) Forwarding timeout in milliseconds (serial to network)

Network Forwarding timer mode Forwarding timer mode (serial to network)

Serial Forwarding Buffer Size Forwarding buffer size (network to serial)

Serial Forwarding Timeout (ms) Forwarding timeout in milliseconds (network to serial)

Serial Forwarding timer mode Forwarding timer mode (network to serial)

Proxy mode ☐ enable proxy mode

Disable remote client's local echo (Telnet option) ☐

Telnet COM port control (RFC2217) ☐

Enable HDLC Pseudoprotocol over UDP (RFC4018) ☐

Serial receive debug log size bytes (0=disable)

Serial transmit debug log size bytes (0=disable)

The port settings general section

Web Field/UCI/Package Option	Description				
Web: Enable UCI: tservd.@port[0].enable Opt: enable	Enables terminal server port. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Network Forwarding Buffer Size UCI: tservd.@port[0].fwd_buffer_size Opt: fwd_buffer_size	Forwarding buffer size in bytes (serial to network). <table border="1"> <tr> <td>Default:</td><td>256 bytes</td></tr> <tr> <td>Range</td><td>0-2048</td></tr> </table>	Default:	256 bytes	Range	0-2048
Default:	256 bytes				
Range	0-2048				
Web: Network Forwarding Timeout(ms) UCI: tservd.@port[0].fwd_timeout Opt: fwd_timeout	Forwarding timeout in milliseconds (serial to network). <table border="1"> <tr> <td>Default:</td><td>30ms</td></tr> <tr> <td>Range</td><td>0-10000</td></tr> </table>	Default:	30ms	Range	0-10000
Default:	30ms				
Range	0-10000				
Web: Network Forwarding Timer Mode UCI: tservd.@port[0].fwd_timer_mode Opt: fwd_timer_mode	Forwarding timer mode (serial to network). <table border="1"> <tr> <td>Default: Idle</td><td>Timer is restarted on each received data.</td></tr> <tr> <td>Aging</td><td>Timer is started on the first Rx.</td></tr> </table>	Default: Idle	Timer is restarted on each received data.	Aging	Timer is started on the first Rx.
Default: Idle	Timer is restarted on each received data.				
Aging	Timer is started on the first Rx.				
Web: Serial Forwarding Buffer Size UCI: tservd.@port[0].sfwd_buffer_size Opt: sfwd_buffer_size	Forwarding buffer size in bytes (network to serial). Set to 0 to use maximum possible network Rx buffer size. <table border="1"> <tr> <td>Default:</td><td>20ms</td></tr> <tr> <td>Range</td><td>0-10000</td></tr> </table>	Default:	20ms	Range	0-10000
Default:	20ms				
Range	0-10000				
Web: Serial Forwarding Timeout (ms) UCI: tservd.@port[0].sfwd_timeout Opt: sfwd_timeout	Forwarding timeout in milliseconds (network to serial). Set to 0 to forward to serial immediately. <table border="1"> <tr> <td>Default:</td><td>20ms</td></tr> <tr> <td>Range</td><td>0-10000</td></tr> </table>	Default:	20ms	Range	0-10000
Default:	20ms				
Range	0-10000				
Web: Serial Forwarding Timer Mode UCI: tservd.@port[0].sfwd_timer_mode Opt: sfwd_timer_mode	Forwarding timer mode (network to serial). <table border="1"> <tr> <td>Default: Idle</td><td>Timer is restarted on each received data.</td></tr> <tr> <td>Aging</td><td>Timer started on the first Rx.</td></tr> </table>	Default: Idle	Timer is restarted on each received data.	Aging	Timer started on the first Rx.
Default: Idle	Timer is restarted on each received data.				
Aging	Timer started on the first Rx.				
Web: Proxy Mode UCI: tservd.@port[0].proxy_mode Opt: proxy_mode	Defines if a special proxy mode should be configured to allow 'hijacking' of the terminal server. It allows a connection to be made from a remote location and redirect terminal server data temporarily for troubleshooting. When enabled, a TCP proxy server is started which listens for an incoming TCP connection from a remote peer. Once an incoming new TCP connection on the proxy server TCP port is accepted: • The existing terminal server TCP client connection is disconnected. • The terminal server automatically reconnects the TCP client side but this time to the local loopback address 127.0.0.1 and to the local proxies TCP port number. • When the proxy server has both local and remote TCP sessions connected it simply forwards the data between the two connections, taking into account the flow control. • When either side TCP socket closes, the main terminal server client reconnects to the normal IP destination and the server proxy returns to listening for another connection from the far end. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Disable Remote Client's Local Echo (Telnet option)	Set to 1 to send IAC WILL ECHO Telnet option to remote client forcing it to disable local echo. For server mode only.				

UCI: tsvrld.@port[0].disable_echo Opt: disable_echo	<table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Telnet COM Port Control UCI: tsvrld.@port[0].com_port_control Opt: com_port_control	Set to 1 to enable support for Telnet COM port control (RFC2217). <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Enable HDLC Pseudowire over UDP (RFC4618) UCI: tsvrld.@port[0].hdlc_pw_enabled Opt: hdlc_pw_enabled	Set to 1 to enable HDLC pseudowire over UDP support based on RFC4618. Requires Transport Mode (udpmode) to be enabled. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Serial Receive Debug Log Size UCI: tsvrld.@port[0].serialRxLogSize Opt: serialRxLogSize	Configures serial receive log size in bytes and enables receive data logging. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Serial Transmit Debug Log Size UCI: tsvrld.@port[0].serialTxLogSize Opt: serialTxLogSize	Configures serial transmit log size in bytes and enables transmit data logging. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

Port Settings: Serial Section

In this section you can configure serial interface settings, such as port mode, port speed, parity stip bit and so on.



NOTE

The displayed settings vary depending on options selected.

The figure below shows the options available if you have selected RS232 mode.

Port Settings

PORT1

General
Serial
Network

Enable
☒
enable port

Network Forwarding Buffer Size
200
Forwarding buffer size (serial to network)

Network Forwarding Timeout (ms)
10
Forwarding timeout in milliseconds (serial to network)

Network Forwarding timer mode
idle
Forwarding timer mode (serial to network)

Serial Forwarding Buffer Size
0
Forwarding buffer size (network to serial)

Serial Forwarding Timeout (ms)
20
Forwarding timeout in milliseconds (network to serial)

Serial Forwarding timer mode
idle
Forwarding timer mode (network to serial)

Proxy mode
☐
enable proxy mode

Disable remote client's local echo (Telnet option)
☐

Telnet COM port control (RFC2217)
☐

Enable HOLD Pseudoterminal over UDP (RFC4818)
☐

Serial receive debug log size
0
bytes (0-disable)

Serial transmit debug log size
0
bytes (0-disable)

The serial section fields (port mode RS232)

The figure below shows the options available if you have selected RS485 mode.

PORT2

General

Serial

Network

Device

devttySC1

serial device name

Portmode

RS-485 Full duplex

serial interface mode

GPIO Control

☒

use GPIO pin to set the port mode

Speed (baud)

19200

asynchronous baud rate

Word size

8

serial device word size in bits

Parity

None

serial device parity in bits

Stop bits

1

serial device number of stop bits

Flow Control

RTS/CTS

serial device flow control type

RS485 termination

☐

enable RS485 line termination

Auto RTS Invert

☐

invert RTS in auto-RTS mode

Keep serial port always open

☒

keep serial port always actuated

RTS timeout

30

RS232/ half duplex mode RTS timeout in milliseconds

POST RTS timeout

20

RS232/ half duplex mode Post RTS timeout in milliseconds

Serial device idle timeout

0

Serial device idle timeout in seconds

The serial section fields (port mode RS485)

The figure below shows the options available if you have selected X.21 mode.

PORT1

General

Serial

Network

Device

serial device name

Portmode

serial interface mode

GPIO Control

☐
use GPIO pin to set the port mode

Keep serial port always open

☒
keep serial port always activated

Serial device idle timeout

Serial device idle timeout in seconds

Synchronous mode

synchronous mode

DTR control mode

DTR output control mode

RTS control mode

RTS output control mode

Synchronous rate

synchronous baud rate

Invert receive clock

☐
enable receive clock inversion

Invert transmit clock

☐
enable transmit clock inversion

Rx MSBF

☐
receive most significant bit first

Tx MSBF

☐
transmit most significant bit first

Rx data delay

Rx data delay in bit positions

Tx data delay

Tx data delay in bit positions

Dual X.21 card bit reverse

☐

Dual X.21 card DTE TT invert

☐

Dual X.21 card DCE TCLK invert

☐

Dual X.21 card DCE RCLK invert

☐

Dual X.21 card CLK invert

☐

Dual X.21 card RX data delay

Delete

The serial section fields (port mode X.21)

Web Field/UCI/Package Option	Description										
Web: Device UCI: tservd.@port[0].devName Opt: devName	Serial device name. <table border="1"> <tr> <td>Default: /dev/ttySC0</td><td>serial port 1</td></tr> <tr> <td>/dev/ttySC1</td><td>serial port 2</td></tr> <tr> <td>/dev/ttySC2</td><td>serial port 3</td></tr> <tr> <td>/dev/ttySC3</td><td>serial port 4</td></tr> </table>	Default: /dev/ttySC0	serial port 1	/dev/ttySC1	serial port 2	/dev/ttySC2	serial port 3	/dev/ttySC3	serial port 4		
Default: /dev/ttySC0	serial port 1										
/dev/ttySC1	serial port 2										
/dev/ttySC2	serial port 3										
/dev/ttySC3	serial port 4										
Web: Port mode UCI: tservd.@port[0].port_mode Opt: port_mode	Sets the serial interface mode. <table border="1"> <tr> <td>Default: rs232</td><td>RS232 mode</td></tr> <tr> <td>rs485hdx</td><td>RS485 2-wire half-duplex mode in which the transmitter drives the RTS.</td></tr> <tr> <td>rs485fdx</td><td>RS485 4-wire full-duplex mode.</td></tr> <tr> <td>v23</td><td>Uses V.23 leased line card driver.</td></tr> <tr> <td>x21</td><td>Uses USB serial card in sync mode.</td></tr> </table>	Default: rs232	RS232 mode	rs485hdx	RS485 2-wire half-duplex mode in which the transmitter drives the RTS.	rs485fdx	RS485 4-wire full-duplex mode.	v23	Uses V.23 leased line card driver.	x21	Uses USB serial card in sync mode.
Default: rs232	RS232 mode										
rs485hdx	RS485 2-wire half-duplex mode in which the transmitter drives the RTS.										
rs485fdx	RS485 4-wire full-duplex mode.										
v23	Uses V.23 leased line card driver.										
x21	Uses USB serial card in sync mode.										
Web: GPIO Control UCI: tservd.@port[1].serial_mode)gpio_control Opt: serial_mode_gpio_control	Enables or disables software control of the port mode between RS232 and RS485. Applies only to port 1 (ttySC1) and not to port 0. Note: the port mode is set with the option port mode described above. <table border="1"> <tr> <td>Default: 0</td><td>Port mode is configurable by hardware settings and is not user configurable. Set to 0 for port 0.</td></tr> <tr> <td>1</td><td>Enabled. Port mode is configurable by software settings. This is applicable to serial port 1 on devices that are capable of RS485.</td></tr> </table>	Default: 0	Port mode is configurable by hardware settings and is not user configurable. Set to 0 for port 0.	1	Enabled. Port mode is configurable by software settings. This is applicable to serial port 1 on devices that are capable of RS485.						
Default: 0	Port mode is configurable by hardware settings and is not user configurable. Set to 0 for port 0.										
1	Enabled. Port mode is configurable by software settings. This is applicable to serial port 1 on devices that are capable of RS485.										
Web: Speed (bps) UCI: tservd.@port[0].speed Opt: speed	Serial device speed in baud (bps). <table border="1"> <tr> <td>Default:</td><td>9600</td></tr> <tr> <td>Range</td><td>115200; 57600; 38400; 19200; 9600; 4800; 2400; 1800; 1200; 600; 300; 200; 150; 134; 110; 75; 50</td></tr> </table>	Default:	9600	Range	115200; 57600; 38400; 19200; 9600; 4800; 2400; 1800; 1200; 600; 300; 200; 150; 134; 110; 75; 50						
Default:	9600										
Range	115200; 57600; 38400; 19200; 9600; 4800; 2400; 1800; 1200; 600; 300; 200; 150; 134; 110; 75; 50										
Web: Word size UCI: tservd.@port[0].wsiz Opt: wsiz	Serial device word size. <table border="1"> <tr> <td>Default:</td><td>8</td></tr> <tr> <td>Range</td><td>5-8</td></tr> </table>	Default:	8	Range	5-8						
Default:	8										
Range	5-8										
Web: Parity UCI: tservd.@port[0].parity Opt: parity	Serial device parity <table border="1"> <tr> <td>Default: 0</td><td>None</td></tr> <tr> <td>1</td><td>Even</td></tr> <tr> <td>2</td><td>odd</td></tr> <tr> <td>3</td><td>Space</td></tr> </table>	Default: 0	None	1	Even	2	odd	3	Space		
Default: 0	None										
1	Even										
2	odd										
3	Space										
Web: Stop Bits UCI: tservd.@port[0].stops Opt: stops	Serial device number of stop bits. <table border="1"> <tr> <td>Default: 1</td><td></td></tr> <tr> <td>Range</td><td>1-2</td></tr> </table>	Default: 1		Range	1-2						
Default: 1											
Range	1-2										
Web: Flow Control UCI: tservd.@port[0].fc_mode Opt: fc_mode	Serial flow control mode. <table border="1"> <tr> <td>Default: 0</td><td>None</td></tr> <tr> <td>1</td><td>RTS/CTS</td></tr> <tr> <td>2</td><td>XON/XOFF</td></tr> </table>	Default: 0	None	1	RTS/CTS	2	XON/XOFF				
Default: 0	None										
1	RTS/CTS										
2	XON/XOFF										
Web: RS485 Termination UCI: tservd.@port[0].rs485_line_termination Opt: rs485_line_termination	Enables or disables RS485 termination. Applies only if port mode is set to RS485. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled						
Default: 0	Disabled										
1	Enabled										
Web: Auto RTS Invert UCI: tservd.@port[0].rtsinvert	Invert RTS in auto-RTS mode, if port mode is set to RS485. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> </table>	Default: 0	Disabled								
Default: 0	Disabled										

Opt: rtsinvert	<table><tr><td>1</td><td>Enabled</td></tr></table>	1	Enabled								
1	Enabled										
Web: Keep Serial Port Always Open UCI: tservd.@port[0].tty_always_open Opt: tty_always_open	Keep serial port always open.										
Web: RS232 Half Duplex UCI: tservd.@port[0].hd_mode Opt: hd_mode	Defines whether to enable special mode in the asynchronous serial driver for communication to an externally connected V.23 half-duplex modem. Note: this setting does not enable half-duplex mode in the serial hardware of the router. <table><tr><td>Default</td><td>30ms</td></tr></table>	Default	30ms								
Default	30ms										
Web: RTS Timeout UCI: tservd.@port[0].rts_timeout Opt: rts_timeout	In RS232 half-duplex mode, time in milliseconds between raising RTS and enabling the transmitter. For use with an externally connected V.23 modem. <table><tr><td>Default</td><td>30ms</td></tr></table>	Default	30ms								
Default	30ms										
Web: POST RTS Timeout UCI: tservd.@port[0].post_rts_timeout Opt: post_rts_timeout	In RS232 half-duplex mode, sets the time in milliseconds between dropping RTS (transmission finished) and enabling the receiver. For use with externally connected V.23 modem. <table><tr><td>Default</td><td>20ms</td></tr></table>	Default	20ms								
Default	20ms										
Web: Synchronous mode UCI: tservd.@port[0].sync_mode Opt: sync_mode	Defines synchronous frame mode. This setting is only displayed if an Atmel USB serial card is enabled. <table><tr><td>Default: hdlc</td><td>HDLC frame mode</td></tr><tr><td>transp</td><td>Transparent mode</td></tr></table>	Default: hdlc	HDLC frame mode	transp	Transparent mode						
Default: hdlc	HDLC frame mode										
transp	Transparent mode										
Web: Use CRC32 UCI: tservd.@port[0].sync_crc32 Opt: sync_crc32	Defines whether to use CRC32 or CRC16 in HDLC mode. This setting is only displayed if an Atmel USB serial card is enabled. <table><tr><td>Default: 0</td><td>Use CRC16</td></tr><tr><td>1</td><td>Use CRC32</td></tr></table>	Default: 0	Use CRC16	1	Use CRC32						
Default: 0	Use CRC16										
1	Use CRC32										
Web: DTR control mode UCI: tservd.@port[0].dtr_control_mode Opt: dtr_control_mode	Defines DTR line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21. <table><tr><td>Default: auto</td><td>Defines DTR line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.</td></tr><tr><td>on</td><td>DTR always on</td></tr><tr><td>off</td><td>DTR always off</td></tr><tr><td>app</td><td>DTR controlled by the application</td></tr><tr><td>ontx</td><td>In HDLC mode DTR is on during frame transmission.</td></tr></table>	Default: auto	Defines DTR line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.	on	DTR always on	off	DTR always off	app	DTR controlled by the application	ontx	In HDLC mode DTR is on during frame transmission.
Default: auto	Defines DTR line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.										
on	DTR always on										
off	DTR always off										
app	DTR controlled by the application										
ontx	In HDLC mode DTR is on during frame transmission.										
Web: RTS control mode UCI: tservd.@port[0].rts_control_mode Opt: rts_control_mode	Defines RTS line control modes. Only displayed if an Atmel USB serial card is enabled and port mode is X21. <table><tr><td>Default: auto</td><td>Defines RTS line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.</td></tr><tr><td>on</td><td>RTS always on</td></tr><tr><td>off</td><td>RTS always off</td></tr><tr><td>app</td><td>RTS controlled by the application</td></tr><tr><td>ontx</td><td>In HDLC mode RTS is on during frame transmission.</td></tr></table>	Default: auto	Defines RTS line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.	on	RTS always on	off	RTS always off	app	RTS controlled by the application	ontx	In HDLC mode RTS is on during frame transmission.
Default: auto	Defines RTS line control modes. This setting is only displayed if an Atmel USB serial card is enabled and port mode is X21.										
on	RTS always on										
off	RTS always off										
app	RTS controlled by the application										
ontx	In HDLC mode RTS is on during frame transmission.										
Web: Synchronous rate UCI: tservd.@port[0].sync_speed Opt: sync_speed	Defines the synchronous speed in bps. Set to 0 for external clock. If not set to 0, an internal clock is used. This setting is only displayed if an Atmel USB serial card is enabled. <table><tr><td>Default: 64000</td><td>64 kbps</td></tr><tr><td>Range</td><td>2048000; 1024000; 768000; 512000; 384000; 256000; 128000; 19200; 9600</td></tr></table>	Default: 64000	64 kbps	Range	2048000; 1024000; 768000; 512000; 384000; 256000; 128000; 19200; 9600						
Default: 64000	64 kbps										
Range	2048000; 1024000; 768000; 512000; 384000; 256000; 128000; 19200; 9600										

Web: Invert receive clock UCI: tserverd.@port[0].sync_invert_rxclk Opt: sync_invert_rxclk	Defines receive clock inversion. Normal clock data is sampled on falling edge. Inverted clock data is sampled on rising edge. This setting is only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: Invert transmit clock UCI: tserverd.@port[0].sync_invert_txclk Opt: sync_invert_txclk	Defines transmit clock inversion. Normal clock data transmitted on falling edge. Inverted clock data transmitted on rising edge. Only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: RX MSBF UCI: tserverd.@port[0].sync_rx_msb Opt: sync_rx_msb	Defines whether most significant bit is received first. This setting is only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default: 0</td><td>Receive least significant bit first</td></tr> <tr> <td>1</td><td>Receive most significant bit first</td></tr> </table>	Default: 0	Receive least significant bit first	1	Receive most significant bit first
Default: 0	Receive least significant bit first				
1	Receive most significant bit first				
Web: TX MSBF UCI: tserverd.@port[0].sync_tx_msb Opt: sync_tx_msb	Defines whether most significant bit is transmitted first. This setting is only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default: 0</td><td>Transmit least significant bit first</td></tr> <tr> <td>1</td><td>Transmit most significant bit first</td></tr> </table>	Default: 0	Transmit least significant bit first	1	Transmit most significant bit first
Default: 0	Transmit least significant bit first				
1	Transmit most significant bit first				
Web: RX data delay UCI: tserverd.@port[0].sync_rxdata_dly Opt: sync_rxdata_dly	Defines the number of bit positions to delay sampling data from the detecting clock edge. This setting is only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default</td><td>0</td></tr> </table>	Default	0		
Default	0				
Web: TX data delay UCI: tserverd.@port[0].sync_txdata_dly Opt: sync_txdata_dly	Defines the number of bit positions to delay the output of data from the detecting clock edge. This setting is only displayed if an Atmel USB serial card is enabled. <table border="1"> <tr> <td>Default</td><td>0</td></tr> </table>	Default	0		
Default	0				
Web: Dual X.21 card bit reverse UCI: tserverd.@port[0].bit_reverse Opt: bit_reverse	Enables bit reversal of all bits in 8 byte word during transmission. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Reverse</td></tr> </table>	Default: 0	Normal	1	Reverse
Default: 0	Normal				
1	Reverse				
Web: Dual X.21 card DTE TT Invert UCI: tserverd.@port[0].dte_tt_inv Opt: dte_tt_inv	Enables X.21 TT clock signal inversion. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: Dual X.21 card DCE TCLK Invert UCI: tserverd.@port[0].dce_tclk_inv Opt: dce_tclk_inv	Enables X.21 DCE TCLK signal inversion. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: Dual X.21 card DCE RCLK Invert UCI: tserverd.@port[0].dce_rclk_inv Opt: dce_rclk_inv	Enables X.21 DCE RCLK signal inversion. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: Dual X.21 card CLK Invert UCI: tserverd.@port[0].x21_clk_invert Opt: x21_clk_invert	Enables X.21 DCE CLK signal inversion. <table border="1"> <tr> <td>Default: 0</td><td>Normal</td></tr> <tr> <td>1</td><td>Invert</td></tr> </table>	Default: 0	Normal	1	Invert
Default: 0	Normal				
1	Invert				
Web: Dual X.21 card RX data delay UCI: tserverd.@port[0] x21_data_delay	Sets X.21 card RX data delay in number of bit positions. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td>0-7</td></tr> </table>	Default	0	Range	0-7
Default	0				
Range	0-7				

Opt: x21_data_delay									
Web: n/a UCI: tservd.@port[0].sync_tx_idle Opt: sync_tx_idle	Defines the value of idle character (decimal) to transmit in case of transmit underrun. In HDLC mode, this configures inter-frame fill. <table border="1"> <tr> <td>Default: 0</td><td>Transmit 0 (in HDLC mode)</td></tr> <tr> <td>126</td><td>Transmit flags (in HDLC mode)</td></tr> <tr> <td>255</td><td>Transmit 1 (in HDLC mode)</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default: 0	Transmit 0 (in HDLC mode)	126	Transmit flags (in HDLC mode)	255	Transmit 1 (in HDLC mode)	Range	0-255
Default: 0	Transmit 0 (in HDLC mode)								
126	Transmit flags (in HDLC mode)								
255	Transmit 1 (in HDLC mode)								
Range	0-255								
Web: n/a UCI: tservd.@port[0].v23_inband_carrier_signalling Opt: v23_inband_carrier_signalling	Enables signalling of carrier by sending special characters <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled				
Default: 0	Disabled								
1	Enabled								
Web: n/a UCI: tservd.@port[0].v23_inband_carrier_on_char Opt: v23_inband_carrier_on_char	Defines the character decimal to signal remote carrier on. <table border="1"> <tr> <td>Default</td><td>255</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	255	Range	0-255				
Default	255								
Range	0-255								
Web: n/a UCI: tservd.@port[0].v23_tx_gain Opt: v23_tx_gain	Defines the transmit gain for v23 mode. <table border="1"> <tr> <td>Default</td><td>2</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	2	Range	0-255				
Default	2								
Range	0-255								
Web: n/a UCI: tservd.@port[0].v23_rx_loss Opt: v23_rx_loss	Defines the receive loss for v23 mode. <table border="1"> <tr> <td>Default: 1</td><td>Receives samples divided by 1</td></tr> </table>	Default: 1	Receives samples divided by 1						
Default: 1	Receives samples divided by 1								
Web: n/a UCI: tservd.@port[0].v23_rts_to_cts_delay Opt: v23_rts_to_cts_delay	Defines the v23 modem RTS to CTS delay in milliseconds <table border="1"> <tr> <td>Default</td><td>20</td></tr> </table>	Default	20						
Default	20								
Web: n/a UCI: tservd.@port[0].v23_is_four_wire Opt: v23_is_four_wire	Defines the V23 modem LIM operation. <table border="1"> <tr> <td>Default: 0</td><td>2-wire</td></tr> <tr> <td>1</td><td>4-wire</td></tr> </table>	Default: 0	2-wire	1	4-wire				
Default: 0	2-wire								
1	4-wire								
Web: n/a UCI: tservd.@port[0].v23_tx_timeout Opt: v23_tx_timeout	Defines the V23 modem receive echo suppression timeout in milliseconds. <table border="1"> <tr> <td>Default</td><td>20</td></tr> </table>	Default	20						
Default	20								
Web: n/a UCI: tservd.@port[0].v23_tx_rampdown Opt: v23_tx_rampdown	Defines the time, in milliseconds, it takes the V23 transmitter to rampdown carrier from peak to zero. <table border="1"> <tr> <td>Default</td><td>30</td></tr> </table>	Default	30						
Default	30								
Web: n/a UCI: tservd.@port[0].v23_tx_maxfill Opt: v23_tx_maxfill	Defines the maximum transmit queue fill level in bytes. <table border="1"> <tr> <td>Default</td><td>127</td></tr> <tr> <td>Range</td><td>0-255</td></tr> </table>	Default	127	Range	0-255				
Default	127								
Range	0-255								

Port Settings: Network Section

In this section you can configure the network side of the terminal server.



NOTE

The displayed settings vary depending on options selected.

PORT1

General

Serial

Network

Transport mode

TCP

Network transport protocol

Local IP

0.0.0.0

Local IP interface to use

TCP mode

Server

TCP mode

TCP listen port

100

TCP listening port

Remote IP 1

0.0.0.0

remote peer IP address (primary)

Remote IP 2

0.0.0.0

remote peer IP address (failover)

Enable TCP keepalive

☒

enable TCP keepalive

TCP Keepalive interval

5

TCP Keepalive send interval (seconds)

TCP Keepalive timeout

2

TCP Keepalive timeout (seconds)

TCP Keepalive count

1

TCP Keepalive maximum probe count

TCP User timeout

20000

TCP close maximum wait ack time (milliseconds)

TCP nodelay

☐

disable TCP Nagle algorithm

TCP always on

☒

keep TCP always connected

Close TCP on DSR

☐

close TCP session on detection of DSR signal line

Reconnect time (ms)

3000

time in milliseconds to start re-connecting after setting DTR low

The port settings network fields (TCP server mode)

Web Field/UCI/Package Option	Description				
Web: Transport Mode UCI: <code>tservd.@port[0].udpMode</code> Opt: <code>udpMode</code>	Selects the transport mode. <table border="1"> <tr> <td>Default: 0</td><td>TCP</td></tr> <tr> <td>1</td><td>UDP</td></tr> </table>	Default: 0	TCP	1	UDP
Default: 0	TCP				
1	UDP				
Web: Local IP UCI: <code>tservd.@port[0].local_ip</code> Opt: <code>local_ip</code>	Sets the local IP address to listen on. <table border="1"> <tr> <td>Default: 0.0.0.0</td><td>Listen on any interface</td></tr> <tr> <td>Range</td><td>IPv4 address</td></tr> </table>	Default: 0.0.0.0	Listen on any interface	Range	IPv4 address
Default: 0.0.0.0	Listen on any interface				
Range	IPv4 address				
Web: TCP Mode UCI: <code>tservd.@port[0].server_mode</code> Opt: <code>server_mode</code>	Select between server and client modes of TCP. Only displayed if Transport Mode is TCP. <table border="1"> <tr> <td>Default: 1</td><td>Server mode</td></tr> <tr> <td>0</td><td>Client mode</td></tr> </table>	Default: 1	Server mode	0	Client mode
Default: 1	Server mode				
0	Client mode				
Web: TCP Listen Port UCI: <code>tservd.@port[0].listen_port</code> Opt: <code>listen_port</code>	Sets the TCP listen port for server mode. Only displayed if transport mode is TCP and server mode is enabled. <table border="1"> <tr> <td>Default</td><td>999</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	999	Range	1-65535
Default	999				
Range	1-65535				
Web: Remote TCP Port 1 UCI: <code>tservd.@port[0].ip_port1</code> Opt: <code>ip_port1</code>	Destination peer port IP 1 number. Only displayed if client mode is enabled. <table border="1"> <tr> <td>Default</td><td>951</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	951	Range	1-65535
Default	951				
Range	1-65535				
Web: Remote TCP Port 2 UCI: <code>tservd.@port[0].ip_port2</code> Opt: <code>ip_port2</code>	Destination peer port IP 2 number for failover. Only displayed if client mode is enabled. <table border="1"> <tr> <td>Default</td><td>951</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	951	Range	1-65535
Default	951				
Range	1-65535				
Web: Remote IP 1 UCI: <code>tservd.@port[0].remote_ip1</code> Opt: <code>remote_ip1</code>	Destination peer IP 1 address. <table border="1"> <tr> <td>Default</td><td>0.0.0.0</td></tr> <tr> <td>Range</td><td>IPv4 address</td></tr> </table>	Default	0.0.0.0	Range	IPv4 address
Default	0.0.0.0				
Range	IPv4 address				
Web: Remote IP 2 UCI: <code>tservd.@port[0].remote_ip2</code> Opt: <code>remote_ip2</code>	Destination peer IP 2 address for failover. <table border="1"> <tr> <td>Default</td><td>0.0.0.0</td></tr> <tr> <td>Range</td><td>IPv4 address</td></tr> </table>	Default	0.0.0.0	Range	IPv4 address
Default	0.0.0.0				
Range	IPv4 address				
Web: Enable TCP Keepalives UCI: <code>tservd.@port[0].tcp_keepalives_enabled</code> Opt: <code>tcp_keepalives_enabled</code>	Enables or disables TCP keepalives. Only displayed if transport mode is TCP. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: TCP Keepalive Interval UCI: <code>tservd.@port[0].tcp_keepalive_interval</code> Opt: <code>tcp_keepalive_interval</code>	Interval in seconds between TCP keepalive probes. Only displayed if transport mode is TCP. <table border="1"> <tr> <td>Default</td><td>5</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	5	Range	0-65535
Default	5				
Range	0-65535				
Web: TCP Keepalive Timeout UCI: <code>tservd.@port[0].tcp_keepalive_timeout</code> Opt: <code>tcp_keepalive_timeout</code>	Time in seconds to wait for response to a TCP keepalive probe. Only displayed if transport mode is TCP. <table border="1"> <tr> <td>Default</td><td>2 seconds</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	2 seconds	Range	0-65535
Default	2 seconds				
Range	0-65535				
Web: TCP Keepalive Count UCI: <code>tservd.@port[0].tcp_keepalive_count</code>	Number of TCP keepalive probes to send before connection is closed. Only displayed if transport mode is TCP.				

Opt: tcp_keepalive_count	<table> <tr> <td>Default</td><td>1</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	1	Range	0-65535
Default	1				
Range	0-65535				
Web: TCP User Timeout UCI: tservd.@port[0].tcp_user_timeout Opt: tcp_user_timeout	Maximum time in milliseconds for TCP to wait for transmitted data to be 'acked' before closing connection in established state. Set to 0 to use kernel defaults. Only displayed if transport mode is TCP. <table> <tr> <td>Default: 20000</td><td>20 seconds</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default: 20000	20 seconds	Range	0-65535
Default: 20000	20 seconds				
Range	0-65535				
Web: TCP Nodelay UCI: tservd.@port[0].tcp_nodelay Opt: tcp_nodelay	Sets TCP to delay behaviour. Only displayed if transport mode is TCP. <table> <tr> <td>Default: 0</td><td>Normal operation</td></tr> <tr> <td>1</td><td>Disable TCP Nagle algorithm. Only display if transport mode is TCP.</td></tr> </table>	Default: 0	Normal operation	1	Disable TCP Nagle algorithm. Only display if transport mode is TCP.
Default: 0	Normal operation				
1	Disable TCP Nagle algorithm. Only display if transport mode is TCP.				
Web: TCP Always on UCI: tservd.@port[0].tcp_always_on Opt: tcp_always_on	Keep TCP session always connected. Only displayed if transport mode is TCP and client mode is enabled.				
Web: Close TCP on DSR UCI: tservd.@port[0].close_tcp_on_dsr Opt: close_tcp_on_dsr	Close TCP session on detection of DSR signal low. Only displayed if Transport Mode is TCP and client mode is enabled. <table> <tr> <td>Default: 0</td><td>Disabled. TCP connection/UDP session is initiated on detecting high state on the DSR interface signal.</td></tr> <tr> <td>1</td><td>Enabled. If it disconnects in the established state the TCP connection/UDP session is re-initiated.</td></tr> </table>	Default: 0	Disabled. TCP connection/UDP session is initiated on detecting high state on the DSR interface signal.	1	Enabled. If it disconnects in the established state the TCP connection/UDP session is re-initiated.
Default: 0	Disabled. TCP connection/UDP session is initiated on detecting high state on the DSR interface signal.				
1	Enabled. If it disconnects in the established state the TCP connection/UDP session is re-initiated.				
Web: Reconnect Time (ms) UCI: tservd.@port[0].disc_time_ms Opt: disc_time_ms	Time in milliseconds to start reconnecting after setting DTR low. <table> <tr> <td>Default: 50000</td><td>5 seconds</td></tr> <tr> <td>Range</td><td>0-10000</td></tr> </table>	Default: 50000	5 seconds	Range	0-10000
Default: 50000	5 seconds				
Range	0-10000				
Web: UDP Keepalive Interval UCI: tservd.@port[0].udpKaIntervalMs Opt: udpKaIntervalMs	Defines time in milliseconds to send UDP keepalives (empty UDP packets) when no data to send. Only displayed if transport mode is UDP. <table> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default: 0	Disabled	Range	0-65535
Default: 0	Disabled				
Range	0-65535				
Web: UDP Keepalive Count UCI: tservd.@port[0].udpKaCount Opt: udpKaCount	Defines the maximum number of remote UDP keepalives not received before UDP stream is considered broken. Only displayed if transport mode is UDP. <table> <tr> <td>Default</td><td>3</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	3	Range	0-65535
Default	3				
Range	0-65535				
Web: local UDP Port UCI: tservd.@port[0].udpLocalPort Opt: udpLocalPort	Local UDP port used by terminal server. Only displayed if transport mode is UDP. <table> <tr> <td>Default</td><td>0</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535
Default	0				
Range	0-65535				
Web: remote UDP Port UCI: tservd.@port[0].udpRemotePort Opt: udpRemotePort	Remote UDP port used by terminal server. Only displayed if transport mode is UDP.				

41.2. Configuring Terminal Server Using UCI

```
root@VA_router:~# uci show tservd
tservd.main=tservd
tservd.main.log_severity=0
tservd.main.debug_rx_tx_enable=1
tservd.main.debug_ev_enable=1
tservd.@port[0]=port
tservd.@port[0].devName=/dev/ttySC0
tservd.@port[0].remote_ip1=0.0.0.0
tservd.@port[0].remote_ip2=0.0.0.0
```

Configuring Terminal Server using Package Options

```
root@VA_router:~# uci export tservd
package tservd
config tservd 'main'
option log_severity '0'
option debug_rx_tx_enable '1'
option debug_ev_enable '1'

config port
option devName '/dev/ttySC0'
option remote_ip1 '0.0.0.0'
option remote_ip2 '0.0.0.0'
```

41.3. Configuring Terminal Server DSR Signal Management Network

On the IP network side, the terminal server can operate in one of three modes:

- TCP Client
- TCP Server
- UDP

Based on the chosen network configuration, the DSR behaviour may vary.

DSR Signal Behaviour in TCP Client Mode

TCP Connection Management

Initial TCP connection initiation or next TCP connection initiation after disconnection is affected by configuration options `tcp_always_on` and `close_tcp_on_dsr`.

When option `tcp_always_on` is enabled terminal server keeps the TCP session always connected. If it disconnects in the established state, the TCP session is reinitiated.

If `tcp_always_on` is disabled TCP connection is initiated on detection of a high state on the DSP interface signal.

When option `close_tcp_on_dsr` is enabled terminal server detecting DSR down signal and closes the established TCP connection.

If option `close_tcp_on_dsr` is disabled then detecting DSR down does not affect the TCP connection.

TCP Connection Initiation at Startup

If you have set option `tcp_always_on1`, or DSR state is UP, the TCP connection setup is initiated immediately.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal. When DSR UP is detected, the TCP connection is initiated.

TCP Connection Clearing

The TCP connection is cleared either by the network or by the terminal server application itself.

The TCP connection is cleared by the terminal server when it detects DSR interface signal DOWN and option `close_tcp_on_dsr` is 1.

TCP Connection Re-initiation

After TCP connection clearing, the terminal server takes action to re-setup the TCP connection after a hand off timeout.

If you have set option `tcp_always_on1`, or DSR state is UP, the TCP connection setup is initiated.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal and then initiates a new TCP connection.

DSR Signal Behaviour in TCP Server Mode

TCP Connection Initiation at Startup

After a short startup delay, the terminal server starts listening for an incoming TCP connection from the remote peer.

TCP Connection Clearing

When in a TCP connection state, the TCP connection is cleared only by the network. Serial interface signals such as DSR do not cause TCP disconnection.

TCP Connection Re-initiation

When a TCP session goes down in the connected state, the terminal server immediately restarts listening for a new TCP connection from a remote peer.

DSR Signal Behaviour in UDP Mode

UDP Session Setup at Startup

If you have set option `tcp_always_on1`, or DSR state is UP, the UDP session is setup immediately on startup.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal. When DSR UP is detected, the UDP session is setup.

UDP Session Clearing

A UDP session is normally never cleared, but if it is closed by the network sub-system, it gets re-setup after a hand off timeout.

A DSR signal DOWN event does not clear UDP session in the connected state.

UDP Session Reset

After UDP session clearing the terminal server takes action to reset up a UDP session after a hand off timeout.

If you have set option `tcp_always_on1`, or DSR state is UP, the UDP session is setup.

If you have set option `tcp_always_on0`, and DSR is DOWN, the terminal server waits for a DSR UP signal and then it resets up the UDP session.

41.4. Serial Mode GPIO Control

On some models of Merlin routers it is possible to change the physical transmission mode between RS232 and RS485. This is only applicable to the second serial port on the routers: `/dev/ttySC1`.

To enable `serial_mode_gpio_control` set the option to **1**.

Use the `portmode` option in addition to `serial_mode_gpio_control` to select between RS232, RS485 full duplex, RS485 half duplex, X.21 and V.23.

Checking the Current `serial_mode_gpio_control`

To check if terminal server is running, enter the following command:

```
root@VA_router:~# uci show tservd | grep serial_mode_gpio_control
```

The output of the above command will look similar to the example below if `serial_mode_gpio_control` is enabled for the second serial port.

```
tservd.port0.serial_mode_gpio_control=0
tservd.port1.serial_mode_gpio_control=1
```

41.5. Terminal Server Diagnostics

The `tservd` process has to be running otherwise diagnostics options for terminal server will not be available.

Checking the Terminal Server Process

```
root@VA_router:~# -fl tservd
1264 root      1032 S tservd
```

If Terminal Server is running it will be shown with its process ID.

Terminal Server Statistics

To view terminal server statistics, enter:

```

root@VA_router:~#tserf show stats

TERMINAL 1, Dev: /dev/ttySC0

State: LISTENING

Serial Bytes   Rx (0) Tx (0) TxErrs (0)

TCP Packets Rx(0) Tx (0) TxErrs (0)   TxBlocked (0)

TCP Bytes     Rx (0) Tx (0)

UDP Datagrams Rx (0) Tx (0) TxErrs (0)

UDP Bytes     Rx (0) Tx (0)

DSR    Up (0) Down (0)

```

Terminal Server Debug Statistics

To see debug statistics about terminal server, enter:

```

root@VA_router:~# tserf show debug all

TERMINAL 1, Dev: /dev/ttySC0

State: LISTENING

netRxBuf length=0 offset=0 hdrsz=0

ttyRxBuf length=0 offset=16 hdrsz=16

line_status_mask = 0x0 line_status = 0x0

RFC2217 negotiated=0

Tcp tx last error: 0

```

Terminal Server Serial Signals Debugging

To see terminal server serial signals statistics, enter:

```

root@VA_router:~# tserf show serial

TERMINAL-1, Dev: /dev/ttySC1

DSR=0 DTR=1 RTS=1 CTS=0 CAR=0 CD=0 RNG=0 LE=0 RI=0 ST=0 SR=0

TERMINAL-2, Dev: /dev/ttySC0

DSR=0 DTR=1 RTS=1 CTS=0 CAR=0 CD=0 RNG=0 LE=0 RI=0 ST=0 SR=0

```

Terminal Server Advanced Debugging

To view terminal server advanced debug commands for the terminal server, enter:

```
root@VA_router:~# tserv

=== Termserv diagnostics. Command syntax: ===

tserv show stats - show statistics

tserv clear stats - clear statistics

tserv show serial - show serial interface status

tserv send serial0 &lt;data>- send data to serial port 0

tserv start capture N, N=port number (0 to 3) - start capturing rx serial data

tserv print capture N, N=port number (0 to 3) - print captured rx serial data

tserv show serial txlog-hex <Port> [length], Port=port cfg index (0 to 3), length=length to show

tserv show serial rxlog-hex <Port> [length], Port=port cfg index (0 to 3), length=length to show

tserv show serial txlog-asc <Port> [length], Port=port cfg index (0 to 3), length=length to show

tserv show serial rxlog-asc <Port> [length], Port=port cfg index (0 to 3), length=length to show

tserv show debug - show debug info

tserv start userial rxlog - start USB serial card rx log

tserv quit - terminate termserv process
```

42. Configuring Terminal Package

Terminal package is used to automatically add entries to `getty` to `inittab` for extra incoming console/terminal connections.

Configuration Packages Used

Package	Sections
terminal	terminal

Terminal package is not available to configure using the web interface.

Web Field/UCI/Package Option	Description				
Web: n/a UCI: terminal.console.enabled Opt: enabled	Enables Terminal on the router. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: terminal.console.device Opt: device	String value point at the tty device in /dev folder. <table><tr><td>Default</td><td>None</td></tr><tr><td><string></td><td>Device name. (e.g. ttySC0 to use serial port 0)</td></tr></table>	Default	None	<string>	Device name. (e.g. ttySC0 to use serial port 0)
Default	None				
<string>	Device name. (e.g. ttySC0 to use serial port 0)				
Web: n/a UCI: terminal.console.speed Opt: speed	Set the speed of serial connection. <table><tr><td>Default</td><td>115200</td></tr><tr><td>Range</td><td>Supported port speed</td></tr></table>	Default	115200	Range	Supported port speed
Default	115200				
Range	Supported port speed				
Web: n/a UCI: terminal.console.type Opt: type	String value represents supported terminal emulation mode. <table><tr><td>Default</td><td>vt100</td></tr><tr><td>string</td><td>Supported terminal type.</td></tr></table>	Default	vt100	string	Supported terminal type.
Default	vt100				
string	Supported terminal type.				
Web: n/a UCI: terminal.console.flowcontrol Opt: flowcontrol	Enables hardware flow control RTS/CTS. <table><tr><td>Default: 0</td><td>Disabled</td></tr><tr><td>1</td><td>Enabled</td></tr></table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				

42.1. Configuring Terminal Package Using UCI

```
root@VA_router:~# uci show terminal
terminal.ttySC0=terminal
terminal.ttySC0.enabled=1
terminal.ttySC0.device=ttySC0
terminal.ttySC0.speed=115200
terminal.ttySC0.type=vt100
terminal.ttySC0.flowcontrol=1
```

Configuring Terminal using Package Options

```
root@VA_router:~# uci export terminal
package terminal
config terminal 'ttySC0'
option enabled '0'
option device 'ttySC0'
option speed '115200'
option type 'vt100'
option flowcontrol '1'
```

42.2. Terminal Diagnostics

Checking Terminal Entry in inittab

To check if terminal configuration is running, enter the following commands and confirm the line referring to the device name is present and looks similar to the last line below:

```
root@VA_router:~# cat /etc/inittab

::sysinit:/etc/init.d/rcS S boot

::shutdown:/etc/init.d/rcS K stop

ttyLTQ0::askfirst:getty -L 115200 ttyLTQ0 vt100

ttyLTQ1::askfirst:getty -L 115200 ttyLTQ1 vt100

ttySC0::respawn:getty -h -L 115200 ttySC0 vt100
```

43. Configuring RTUD

This chapter describes how to configure the RTUD feature on a Merlin router. RTU is only available on routers with a digital I/O interface.

You can edit parameters using:

- the text editor 'vi' or 'nano' after logging in using SSH;
- the router's web interface; or
- Activator.

Terminology

DI	Digital Input
DO	Digital Output
DNP3	Distributed Network Protocol version 3
I/O	Input/Output
IP	Internet Protocol
MQTT	Message Queuing Telemetry Transport
RTU	Remote Terminal Unit
RTUD	Remote Terminal Unit Daemon
SCADA	Supervisory Control and Data Acquisition
TCP	Transport Control Protocol
Where a configuration parameter has the value of 1 or 0	1 = Enabled 0 = Disabled
Where a configuration parameter has the value NULL	This means blank. Specify as " "

RTUD Overview

Merlin Series routers have an integrated digital IO block consisting of three digital inputs (DI) and 1 digital output (DO). The digital inputs are presented on the terminal block as a series of input contact terminals. The digital output is presented on the terminal block as a relay output contact.

The RTUD feature is implemented on the router by the RTUD daemon application. It allows the remote SCADA master to monitor and control the digital IOs of the router that acts as the RTU slave using several supported SCADA communication protocols:

- IEC 670-5-104 [1]
- DNP3 [2]
- Modbus TCP [3]
- MQTT

Configuration Package Used

Package	Sections
rtud	main

43.1. Configuring RTUD Using The Web Interface

To configure RTUD using the web interface, in the top menu browse to **SCADA -> RTUD**. The RTUD page appears.

There are five section tabs in the RTUD page:

Section	Description
General	Enables the SCADA RTU and selects the RTU protocol
IEC104	Configuration of IEC104 protocol options
DNP3	Configuration of DNP3 protocol options
ModbusTCP	Configuration of ModbusTCP protocol options
Advanced	Advanced debug configuration options

RTUD

Configuration of RTUD. RTUD is a SCADA application which acts as SCADA RTU, processing the router's Digital Inputs and Output to SCADA Master. RTUD supports IEC 60870-5-104, DNP3, Modbus TCP and MQTT Protocols.

Main Settings

General

IEC104

DNP3

ModbusTCP

MQTT

Advanced

Delete

Enable

☐ Enable SCADA RTU simulation emulation

Auto generate configuration

☐ Enables automatic detection of GPIO present on board and auto generation of RTUD config

RTU Protocol

MQTT

Get the RTU communication protocol

Local IP1

Local IP interface address 1 RTU sends to

Local IP2

Local IP interface address 2 RTU sends to

Synchronize time

☐ Enables RTU time synchronization to SCADA Master time

Short Pulse (ms)

Short pulse duration (milliseconds)

Long Pulse (ms)

Long pulse duration (milliseconds)

Execute Timeout (sec)

Maximum time in seconds allowed between Select and Execute

The RTUD main settings page

43.1.1. Configuring RTUD General Options

RTUD

Configuration of RTUD. RTUD is a SCADA application which acts as SCADA RTU, ensuring the router's Digital Inputs and Output to SCADA Master. RTUD supports IEC 60870-5-104, DNP3, Modbus TCP and MQTT Protocols.

Main Settings

General

EC194

ONFI

ModbusTCP

MQTT

Advanced

Enable

☐

Enable SCADA RTU substation emulation

Auto generate configuration

☐

Enables automatic detection of GPIO present on board and auto generation of RTUD config

RTU Protocol

MQTT

Set the RTU communication protocol

Local IP1

Local IP interface address 1 RTU advert to

Local IP2

Local IP interface address 2 RTU advert to

Synchronise time

☐

Enables RTU time synchronisation to SCADA Master time

Short Pulse (ms)

Short pulse duration (milliseconds)

Long Pulse (ms)

Long pulse duration (milliseconds)

Execute Timeout (secs)

Maximum time in seconds allowed between Select and Execute

The RTUD main settings page showing the general settings tab

Web Field/UCI/Package Option	Description						
Web: Enabled UCI: rtud.main.enabled Opt: enabled	Enables or disables RTUD application. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: RTU Protocol UCI: rtud.main.protocol Opt: protocol	Sets the RTU communication protocol. <table border="1"> <tr> <td>Default: iec104</td><td>IEC 60870-5-104</td></tr> <tr> <td>mbtcp</td><td>Modbus TCP</td></tr> <tr> <td>dnp3</td><td>Distributed Network Protocol V3 (over TCP)</td></tr> </table>	Default: iec104	IEC 60870-5-104	mbtcp	Modbus TCP	dnp3	Distributed Network Protocol V3 (over TCP)
Default: iec104	IEC 60870-5-104						
mbtcp	Modbus TCP						
dnp3	Distributed Network Protocol V3 (over TCP)						
Web: Local IP UCI: rtud.main.local_ip Opt: local_ip	Defines the local IP interface address the RTU binds to. <table border="1"> <tr> <td>Default</td><td>0.0.0.0</td></tr> <tr> <td>Range</td><td>A valid IPv4 or IPv6 address.</td></tr> </table>	Default	0.0.0.0	Range	A valid IPv4 or IPv6 address.		
Default	0.0.0.0						
Range	A valid IPv4 or IPv6 address.						
Web: Synchronize Time UCI: rtud.main.sync_time Opt: sync_time	Enables RTU time synchronisation to master time. If enabled, the router will set its clock as the corresponding commands from the master station in each communication protocol. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled		
Default: 0	Disabled						
1	Enabled						
Web: Short Pulse UCI: rtud.main.short_pulse Opt: short_pulse	Short pulse duration in milliseconds, currently used in IEC104 protocol in processing digital output setting command, if the master specifies its use. <table border="1"> <tr> <td>Default</td><td>50</td></tr> <tr> <td>Range</td><td>10-1000</td></tr> </table>	Default	50	Range	10-1000		
Default	50						
Range	10-1000						
Web: Long Pulse UCI: rtud.main.long_pulse Opt: long_pulse	Long pulse duration in milliseconds, currently used in IEC104 protocol in processing digital output setting command, if the master specifies its use. <table border="1"> <tr> <td>Default: 0</td><td>1000</td></tr> <tr> <td>Range</td><td>10-1000</td></tr> </table>	Default: 0	1000	Range	10-1000		
Default: 0	1000						
Range	10-1000						

43.1.2. Configure RTUD Advanced Options

SCADA RTU
Configuration of SCADA RTU

Main Settings

General IEC104 DNP3 ModbusTCP **Advanced**

Syslog severity: Notice ⓘ Specifies the lowest severity to be logged

Enable tracing: ☐ ⓘ Enables RTU protocol tracing to syslog

Dump data: ☐ ⓘ Enable logging if hex data content of every RTU protocol frame to syslog

Expert debug: ☐ ⓘ Enable logging developer level debug information to syslog

Save & Apply Save Reset

The RTUD advanced settings page

Figure 6.

Web Field/UCI/Package Option	Description																
Web: Log level UCI: rtud.main.loglevel Opt: loglevel	Determines the syslog level. Events up to this priority will be logged. Default is 5 - Notice. <table border="1"> <tr><td>0</td><td>Emergency</td></tr> <tr><td>1</td><td>Alert</td></tr> <tr><td>2</td><td>Critical</td></tr> <tr><td>3</td><td>Error</td></tr> <tr><td>4</td><td>Warning</td></tr> <tr><td>5</td><td>Notice</td></tr> <tr><td>6</td><td>Informational</td></tr> <tr><td>7</td><td>Debug</td></tr> </table>	0	Emergency	1	Alert	2	Critical	3	Error	4	Warning	5	Notice	6	Informational	7	Debug
0	Emergency																
1	Alert																
2	Critical																
3	Error																
4	Warning																
5	Notice																
6	Informational																
7	Debug																
Web: Trace UCI: rtud.main.trace_on Opt: trace_on	Enables protocol tracing to syslog. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																
Web: Dump data UCI: rtud.main.dump_data Opt: dump_data	Enables logging the context of protocol frames in ASCII hex format to syslog. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled												
Default: 0	Disabled																
1	Enabled																
Web: Expert debug UCI: rtud.main.expert_debug Opt: expert_debug	Enables highest level of debug logging. For Westermo engineering use only.																

43.1.3. Configuring RTUD IEC104 Options

The screenshot shows the 'Main Settings' page for RTUD IEC104 options. The page has a 'Delete' button in the top right corner. The settings are organized into tabs: General, IEC104, OPC, ModbusTCP, and Advanced. The IEC104 tab is currently selected. The settings listed are:

- IEC104 Listening TCP Port:** 3454. Description: Listen TCP port IEC104-RTU before go.
- IEC104 R:** 12. Description: IEC104 Maximum number of outstanding frames.
- IEC104 T:** 1000. Description: IEC104 Timeout for sending frames in case of no data (milliseconds).
- IEC104 ADDR:** 5. Description: ASCII address of the IEC104 RTU.
- IEC104 DUT Select:** A. Description: Most significant digit in the value of destination field.
- IEC104 RT Type:** 3PI (single point). Description: Specifies IEC104 type ID to use when sending digital inputs.
- Digital Input 0 I/O:** 1. Description: IEC104 Information Object Address of DI/OUT 0.
- Digital Input 1 I/O:** 2. Description: IEC104 Information Object Address of DI/OUT 1.

Web Field/UCI/Package Option	Description															
Web: IEC104 Listening TCP Port UCI: rtud.main.iec104_listen_tcpport Opt: iec104_listen_tcpport	Local TCP port IEC104 RTC listens on. <table><tr><td>Default</td><td>2404</td></tr><tr><td>Range</td><td>1-65535</td></tr></table>	Default	2404	Range	1-65535											
Default	2404															
Range	1-65535															
Web: IEC104 K UCI: rtud.main.iec104_k Opt: iec104_k	IEC parameter K. Maximum number of outstanding frames. <table><tr><td>Default</td><td>12</td></tr><tr><td>Range</td><td>1-3267</td></tr></table>	Default	12	Range	1-3267											
Default	12															
Range	1-3267															
Web: IEC104 T2 UCI: rtud.main.iec104_t2 Opt: iec104_t2	IEC 104 parameter T2. Timeout for sending, in milliseconds, S frames in case of no data. <table><tr><td>Default</td><td>1000</td></tr><tr><td>Range</td><td>1-6000</td></tr></table>	Default	1000	Range	1-6000											
Default	1000															
Range	1-6000															
Web: IEC104 ASDU Common Address UCI: rtud.main.iec104_asdu_addr Opt: iec104_asdu_addr	IEC 104 parameter CA (also known as CASDU). ASDU common address of the RTU. <table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>1-65535</td></tr></table>	Default	0	Range	1-65535											
Default	0															
Range	1-65535															
Web: IEC104 COT Source Octet UCI: rtud.main.iec104_cot_source_octet Opt: iec104_cot_source_octet	IEC104 parameter COT value. The value of the most significant octet in the 'cause of transmission' header field. <table><tr><td>Default</td><td>1</td></tr><tr><td>Range</td><td>0-255</td></tr></table>	Default	1	Range	0-255											
Default	1															
Range	0-255															
Web: IEC104 DI Type ID UCI: rtud.main.iec104_type_id Opt: iec104_type_id	Defines the IEC104 Type ID for digital inputs <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>SPI</td><td>Single point</td><td>1</td></tr><tr><td>DPI (double point</td><td>Double point</td><td>3</td></tr><tr><td>SPI</td><td>Single point with time</td><td>30</td></tr><tr><td>DPI</td><td>Double point with time</td><td>31</td></tr></table>	Option	Description	UCI	SPI	Single point	1	DPI (double point	Double point	3	SPI	Single point with time	30	DPI	Double point with time	31
Option	Description	UCI														
SPI	Single point	1														
DPI (double point	Double point	3														
SPI	Single point with time	30														
DPI	Double point with time	31														
Web: Digital Input 0 IOA UCI: rtud.main.dg_input0_ioaddr Opt: dg_input0_ioaddr	IEC104 Information Object Address (IOA) of Digital Input 0. <table><tr><td>Default</td><td>1</td></tr><tr><td>Range</td><td>1-1677712</td></tr></table>	Default	1	Range	1-1677712											
Default	1															
Range	1-1677712															
Web: Digital Input 1 IOA UCI: rtud.main.dg_input1_ioaddr Opt: dg_input1_ioaddr	IEC104 Information Object Address (IOA) of Digital Input 1. <table><tr><td>Default</td><td>2</td></tr><tr><td>Range</td><td>1-1677712</td></tr></table>	Default	2	Range	1-1677712											
Default	2															
Range	1-1677712															
Web: Digital Input 0 IOA UCI: rtud.main.dg_output0_ioaddr Opt: dg_output0_ioaddr	IEC104 Information Object Address (IOA) of Digital Input 0. <table><tr><td>Default</td><td>3</td></tr><tr><td>Range</td><td>1-1677712</td></tr></table>	Default	3	Range	1-1677712											
Default	3															
Range	1-1677712															

43.1.4. Configure RTUD DNP3 Options

StatusSystemServicesNetworkLogout

SCADA RTU
Configuration of SCADA RTU

Main Settings

GeneralIEC104DNP3ModbusTCPAdvanced

DNP3 Listening TCP Port

20000

Local TCP port DNP3 RTU listens on

DNP3 Source Address

0

Local (RTU) DNP3 address

DNP3 Remote Address

0

Remote (Master) DNP3 address

Save & ApplySaveReset

Web Field/UCI/Package Option	Description				
Web: DNP3 Listening TCP Port	Sets the local TCP port the DNP3 RTU listens on.				
UCI: rtud.main.dnp3_listen_tcpport	<table><tr><td>Default</td><td>2000</td></tr><tr><td>Range</td><td>1-65535</td></tr></table>	Default	2000	Range	1-65535
Default	2000				
Range	1-65535				
Opt: dnp3_listen_tcpport					
Web: DNP3 Source Address	Sets the local (RTU) DNP3 address.				
UCI: rtud.main.dnp3_dl_srcaddr	<table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>0-65535</td></tr></table>	Default	0	Range	0-65535
Default	0				
Range	0-65535				
Opt: dnp3_dl_srcaddr					
Web: DNP3 Remote Address	Sets the remote (Master) DNP3 address				
UCI: rtud.main.dnp3_dl_dstadr	<table><tr><td>Default</td><td>1</td></tr><tr><td>Range</td><td>0-255</td></tr></table>	Default	1	Range	0-255
Default	1				
Range	0-255				
Opt: dnp3_dl_dstadr					

43.1.5. Configure RTUD Modbus Options

StatusSystemServicesNetworkLogout

SCADA RTU

Configuration of SCADA RTU

Main Settings

General

IEC104

DNP3

ModbusTCP

Advanced

ModbusTCP Slave Address

0

Modbus TCP slave address (decimal 1-247)

Modbus TCP Listening Port

502

Local TCP port Modbus RTU listens on

Modbus Discreet Inputs Start Address

0

Modbus Digital Inputs Start Address

Modbus Coils Start Address

0

Modbus Digital Outputs (Coils) Start Address

Save & Apply

Save

Reset

Web Field/UCI/Package Option	Description				
Web: Modbus TCP Slave Address UCI: rtud.main.mbtcp_devaddr Opt: mbtcp_devaddr	Sets the Modbus slave address. <table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>1-247</td></tr></table>	Default	0	Range	1-247
Default	0				
Range	1-247				
Web: Modbus TCP Listening Port UCI: rtud.main.mbtcp_listen_tcpport Opt: mbtcp_listen_tcpport	Sets the local TCP port Modbus RTU listens on. <table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>1-65535</td></tr></table>	Default	0	Range	1-65535
Default	0				
Range	1-65535				
Web: Modbus Discreet Inputs Start Address UCI: rtud.main.mbtcp_di_start_addr Opt: mbtcp_di_start_addr	Sets the Modbus Discreet Inputs start address. This is the address of the first digital input in the modbus data model. Note: address of inputs and outputs are allowed to overlap, that is, may be the same. <table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>0-65535</td></tr></table>	Default	0	Range	0-65535
Default	0				
Range	0-65535				
Web: Modbus Coils Start Address UCI: rtud.main.mbtcp_co_start_addr Opt: mbtcp_co_start_addr	Sets the Modbus Coils Start address. This is the address of the first digital output in the modbus data model. Note: address of inputs and outputs are allowed to overlap, that is, may be the same. <table><tr><td>Default</td><td>0</td></tr><tr><td>Range</td><td>0-65535</td></tr></table>	Default	0	Range	0-65535
Default	0				
Range	0-65535				

43.2. Controlling The RTUD Application Manually Using The Web Interface

When you have enabled RTUD, the application starts automatically. If necessary, you can control the application manually.

Browse to the top menu and select **System -> Startup**.

Status - System - Services - Network - Logout					
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop
80	root	rtud	Enabled	Start	Restart Stop

The startup page

Find the RTUD entry and click either **Enabled/Disabled**, **Start**, **Restart**, or **Stop**, depending on which option you require.

To check if the application is running, select **Status -> Processes**. The Processes page appears.

Status - System - Services - Network - Logout					
2557	root	/usr/sbin/rtud -c /etc/rtud.conf	0%	2%	Hang Up Terminate Kill
2608	root	/usr/sbin/rtud -P /usr/sbin/rtud -f 22 -b /usr/sbin/rtud	0%	2%	Hang Up Terminate Kill
2609	root	/usr/sbin/rtud	0%	2%	Hang Up Terminate Kill
2658	root	/usr/sbin/rtud -L 2557 -p /usr/sbin/rtud -p /usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	2%	Hang Up Terminate Kill
2659	root	/usr/sbin/rtud	0%	2%	Hang Up Terminate Kill
3005	root	/usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	51%	Hang Up Terminate Kill
3147	root	/usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	2%	Hang Up Terminate Kill
3587	root	/usr/sbin/rtud	0%	0%	Hang Up Terminate Kill
3841	root	/usr/sbin/rtud -c /usr/sbin/rtud.conf -f 22 -b /usr/sbin/rtud -p /usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	50%	Hang Up Terminate Kill
3842	root	/usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	1790	Hang Up Terminate Kill
3843	root	/usr/sbin/rtud -c /usr/sbin/rtud.conf	0%	1790	Hang Up Terminate Kill

The status process page

43.3. Configuring RTUD Using Command Line

The RTUD configuration is stored in `/etc/config/rtud`

You must restart the RTUD application for your option changes to take effect. The default content of the RTUD configuration file is shown below.

RTUD using UCI

```
root@VA_router:~# uci show rtud

rtud.main=rtud

rtud.main.enable=1

# set to 1 to enable RTUD daemon

rtud.main.protocol=iec104

rtud.main.local_ip=0.0.0.0

rtud.main.sync_time=0

rtud.main.short_pulse=50

rtud.main.long_pulse1000

rtud.main.loglevel=5

rtud.main.trace_on=0

rtud.main.dump_data=0


rtud.main.iec104_listen_tcpport=2404

rtud.main.iec104_k=12

rtud.main.iec104_t2=10000

rtud.main.iec104_asdu_addr=0

rtud.main.iec104_cot_source_octet=1


rtud.main.dg_input0_ioaddr=1

rtud.main.dg_input1_ioaddr=2

rtud.main.dg_output0_ioaddr=3


rtud.main.dnp3_listen_tcpport=20000

rtud.main.dnp3_dl_srcaddr=0

rtud.main.dnp3_dl_dstaddr=0


rtud.main.mbtcp_devaddr=0

rtud.main.mbtcp_listen_port=502

rtud.main.mbtcp_di_start_addr=0

rtud.main.mbtcp_co_start_addr=0
```

RTUD using Package Options


```
root@VA_router:~# uci export rtud

package rtud

config rtud main

# set to 1 to enable RTUD daemon

option enable 0

option protocol 'iec104'

option local_ip '0.0.0.0'

option sync_time 0

option short_pulse 50

option long_pulse 1000

option loglevel 5

option trace_on 0

option dump_data 0

option expert_debug 0

option iec104_listen_tcpport 2404

option iec104_k 12

option iec104_t2 10000

option iec104_asdu_addr 0

option iec104_cot_source_octet 1


option dg_input0_ioaddr 1

option dg_input1_ioaddr 2

option dg_output0_ioaddr 3


option dnp3_listen_tcpport 20000

option dnp3_dl_srcaddr 0

option dnp3_dl_dstaddr 0


option mbtcp_devaddr 0

option mbtcp_listen_port 502

option mbtcp_di_start_addr 0

option mbtcp_co_start_addr 0
```

43.4. RTUD Diagnostics

Viewing RTUD Statistics using the Web Interface

To view the RTUD point list, session status and counters, from the top menu, select **Status -> RTUD**.

Status + System + Services + Network + Logout			
SCADA RTU Points			
IO Name	IO Type	IO Address	IO Value
dg_input0	Input	IOA1	0
dg_input1	Input	IOA2	0
dg_output0	Output	IOA3	0
SCADA RTU Statistics			
Protocol	State	Link Rx/Tx/Errs	App Rx/Tx/Errs
IEC104	LISTENING	0 / 0 / 0	0 / 0 / 0

The RTUD points and stats page

RTUD Diagnostic Options

To view RTUD diagnostic options, enter:

```

root@VA_router:~# rtu

=== RTU daemon diagnostics. Command syntax: ===

rtu set loglevel <level>; (0 to 7)

rtu show config - show config

rtu show stats - show stats

rtu clear stats - clear stats

rtu show points - show RTU IO points

rtu show dnp3 - show DNP3 stats

rtu show modbus - show Modbus stats

rtu set point <IO name>; <value>; set output IO point valu

```

44. SCADA IEC 104 Gateway

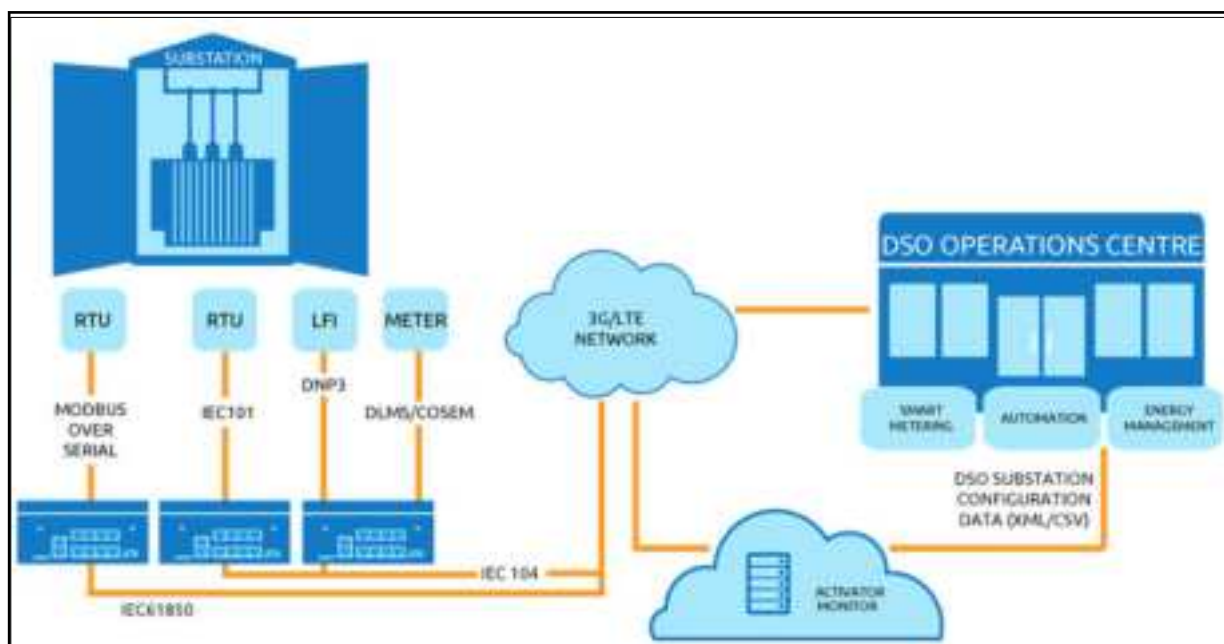
Supervisory control and data acquisition (SCADA) systems are used by industrial organisations and companies to control and monitor physical processes, examples of which are electricity transmission, gas and oil transportation in pipelines, water distribution and traffic lights control. Alarm handling is usually an important part of most SCADA implementations.

SCADA systems usually consist of:

- Supervisory computers
- Remote terminal units (RTUs)
- Programmable logic controllers (PLCs)

The IEC 104 gateway feature on the router is used for SCADA protocol conversion where the SCADA master is running IEC 104 protocol:

- IEC 104 to IEC 101 conversion (balanced and unbalanced)
- IEC 104 to DNP3
- IEC 104 to MODBUS (serial to TCP)
- IEC 612850 to IEC 101 unbalanced conversion



Example network for IEC 104 to RTU protocol conversion

Configuration for the above conversions is done in two parts:

- IEC 104 gateway (iecd package), and
- Terminal server (tservd package)

The IEC 104 gateway handles the protocol processing while the terminal server handles low level serial communication.



NOTE

The terminal server is not required for IEC 104 to Modbus TCP.

Configuration Packages Used

Package	Sections
iecd	main
	port
	point
tservd	main
	port

44.1. IEC 104 Gateway Configuration Using The Web Interface

In the top menu, select **Services -> IEC104 Gateway**. The IEC 104 gateway page appears.

IEC104 Gateway
Configuration of IEC104 Gateway

Main Settings

Enable ☒ [Enable IEC104 Gateway](#)

Port Settings

This section contains no values yet

IEC101 Links

Port number	IEC101 Link Address	IEC101 Link ASDU Addr
(7, 4) Serial port	Link address of the IEC101 station	ASDU address of the IEC101 station

This section contains no values yet

Points

The IEC 104 gateway configuration page

There are four sections in the IEC 104 Gateway page:

Section	Description
Main Settings	Enables the IEC 104 gateway.
Port Settings	Sets the IEC 104 SCADA master communication settings and the protocol methods used by the RTUs: • IEC 101 unbalanced or balanced • DNP3 • Modbus over serial • Modbus over TCP
IEC101 Links	Defines the IEC 101 slave links used in IEC 101 conversion. Each link is defined by a <code>config iec101link</code> section block. There is a maximum of 32 links supported. In IEC 101 unbalanced mode all of these links can be used. In IEC 101 balanced mode only one outstation per serial port is assumed since these will be point to point links.
Points	Configures the data point mappings. Note: there are no data point mappings in IEC104 to IEC101 conversion.

44.1.1. Main Settings



Web Field/UCI/Package Option	Description				
Web: Enable	Enables IEC104 gateway.				
UCI: iecd.main.enable	<table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Opt: enable					

44.1.2. Port Settings

The port configuration will depend on the desired protocol conversion. There are 5 sections.

Section	Description
General	Enables an IEC104 port and selects the RTU protocol method.
IEC104	Defines the IEC104 gateway configuration for communication with the SCADA Master.
IEC101	Defines the IEC104 to IEC101 conversion parameters.
DNP3	Defines the IEC104 to DNP3 conversion parameters.
Modbus	Defines the IEC104 to MODBUS conversion parameters (Modbus over serial or Modbus over TCP).
Advanced	Defines logging and TCP keepalive options for all conversion methods.

In the Port Settings section, enter a text name that will be used for the iecd port section, for example, Port1. Select **Add**. The IECD port configuration options appear.

44.1.3. Port Settings: General

In this section you can configure general port settings. Check **Enable** to enable the port and select the appropriate RTU protocol from the Slave Protocol and Master Protocol drop-down menus.

Port Settings

PORT1

General

IEC104

IEC101

DNP3

Modbus

Advanced

Enable

☐

Enables IEC104 Gateway port

Slave Protocol

IEC104

Set protocol method used by SCADA master to connect to this router (acting as a slave)

Master Protocol

IEC101

Set protocol method used by this router (acting as a master) to connect to outstations

The IEC 104 gateway port settings: general configuration page

Web Field/UCI/Package Option	Description
Web: Enable UCI: iecd.<port>.enable Opt: enable	Enables an IEC104 port.
Web: Slave Protocol UCI: iecd.<port>.slave_protocol Opt: slave_protocol	Defines the protocol method used by the SCADA master to connect to this router (acting as slave).
Web: Master Protocol UCI: iecd.<port>.master_protocol Opt: master_protocol	Defines the protocol method used by this router (acting as a master) to connect to the outstations.
Web: n/a UCI: iecd.<port>.pointmap_file Opt: pointmap_file	Defines the path to the points map file, for example: /root/iecd/iecd_points1.csv

44.1.4. Port Settings: IEC 104

In this section you can configure IEC104 settings.

PORT1

General

IEC104

IEC101

DNP3

Modbus

Advanced

IEC104 Uses RTU ID

☐
☒

On/Keep IEC104 Always Up; If IEC104 UP only while RTU data link up

IEC104 IDA Offset

0

Value to add to each information Object Address of each configured point

IEC104 Local IP

0.0.0.0

Local IP address this IEC104 peer binds to

IEC104 Listening TCP Port

2434

Local TCP port this IEC104 peer listens on

IEC1850 Local IP

0.0.0.0

Local IP address this IEC1850 peer binds to

IEC1850 Listening TCP Port

102

Local TCP port this IEC1850 peer listens on

IEC104 K

12

Maximum number of outstanding I frames

IEC104 W

9

Receiver acknowledges sender frames after at most W frames (Recommended 2/3 of K)

IEC104 T2

10000

Timeout for sending S frames in case of no data (milliseconds)

Enable IEC104 time synchronization

☐
☒

Enables synchronization of router time to IEC104 master time

Transfer comms status in NT bit

☐
☒

Enables transfer of RTU comms status in IEC104 Net Topical bit with each data point

IEC104 CASDU

1

Common ASDU address

Send EOI

☐
☒

Enables sending of IEC104 End Of Initialization message to Master

Enable IEC 62351-5 secure mode

☐
☒

Enables IEC 62351-5 security

The IEC 104 gateway port IEC 104 configuration page

Web Field/UCI/Package Option	Description						
Web: IEC104 Track RTU DL UCI: iecd.<port>.iec104_track_rtu_dl Opt: iec104_track_rtu_dl	Defines whether the IEC 104 link follows the state of the RTU data link. <table border="1"> <tr> <td>Default: 0</td><td>Always listens and accepts connection from the IEC 104 master. This means IEC 104 is always up independently of the RTU protocol.</td></tr> <tr> <td>1</td><td>IEC 104 is up only while RTU data link is up. The IEC 104 socket is closed and IEC 104 will only start listening when RTU data link is up.</td></tr> </table>	Default: 0	Always listens and accepts connection from the IEC 104 master. This means IEC 104 is always up independently of the RTU protocol.	1	IEC 104 is up only while RTU data link is up. The IEC 104 socket is closed and IEC 104 will only start listening when RTU data link is up.		
Default: 0	Always listens and accepts connection from the IEC 104 master. This means IEC 104 is always up independently of the RTU protocol.						
1	IEC 104 is up only while RTU data link is up. The IEC 104 socket is closed and IEC 104 will only start listening when RTU data link is up.						
Web: IEC104 IOA Offset UCI: iecd.<port>.ioa_offset Opt: ioa_offset	Defines the value to add to each Information Object Address of each configured point. <table border="1"> <tr> <td>Default</td><td>0</td></tr> </table>	Default	0				
Default	0						
Web: IEC104 Local IP UCI: iecd.<port>.iec104_local_ip Opt: iec104_local_ip	Defines the local IP address this IEC 104 peer binds to. <table border="1"> <tr> <td>Default</td><td>0.0.0.0</td></tr> <tr> <td></td><td>Blind to outgoing port.</td></tr> </table>	Default	0.0.0.0		Blind to outgoing port.		
Default	0.0.0.0						
	Blind to outgoing port.						
Web: IEC104 Listening TCP Port UCI: iecd.<port>.iec104_local_tcpport Opt: iec104_local_tcpport	Defines the local TCP port this IEC 104 peer listens on. <table border="1"> <tr> <td>Default</td><td>2404</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	2404	Range	1-65535		
Default	2404						
Range	1-65535						
Web: IEC61850 Local IP UCI: iecd.<port>.iec61850_local_ip Opt: iec61850_local_ip	Defines the local IP address this IEC 61850 peer binds to. <table border="1"> <tr> <td>Default</td><td>0.0.0.0</td></tr> <tr> <td></td><td>Blind to outgoing port.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0.0.0.0		Blind to outgoing port.	Range	
Default	0.0.0.0						
	Blind to outgoing port.						
Range							
Web: IEC61850 Listening TCP Port UCI: iecd.<port>.iec61850_local_tcpport Opt: iec61850_local_tcpport	Defines the local TCP port this IEC 61850 peer listens on. <table border="1"> <tr> <td>Default</td><td>102</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	102	Range	1-65535		
Default	102						
Range	1-65535						
Web: IEC104 K UCI: iecd.<port>.iec104_k Opt: iec104_k	Defines the maximum number of outstanding I frames. <table border="1"> <tr> <td>Default</td><td>12</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	12	Range			
Default	12						
Range							
Web: IEC104 W UCI: iecd.<port>.iec104_w Opt: iec104_w	Defines the number of frames after which the receiver will acknowledge. It is recommended that this value is 2/3 the value of IEC 104K. <table border="1"> <tr> <td>Default</td><td>9</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	9	Range			
Default	9						
Range							
Web: IEC104 T2 UCI: iecd.<port>.iec104_t2 Opt: iec104_t2	Defines the timeout in milliseconds for sending S frames in case of no data. <table border="1"> <tr> <td>Default</td><td>10000 milliseconds.</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	10000 milliseconds.	Range			
Default	10000 milliseconds.						
Range							
Web: Enable IEC104 time synchronization UCI: iecd.<port>.iec104_sync_time Opt: iec104_sync_time	Enables synchronisation of router time to IEC 104 master time. <table border="1"> <tr> <td>Default: 1</td><td>Enable synchronisation.</td></tr> <tr> <td>0</td><td>Disable synchronisation.</td></tr> </table>	Default: 1	Enable synchronisation.	0	Disable synchronisation.		
Default: 1	Enable synchronisation.						
0	Disable synchronisation.						
Web: Transfer comms status in NT bit UCI: iecd.<port>.iec104_comms_status_nt Opt: iec104_comms_status_nt	Enables transfer of RTU comms status in IEC 104 Not Topical bit with each data point. <table border="1"> <tr> <td>Default</td><td></td></tr> <tr> <td>1</td><td></td></tr> </table>	Default		1			
Default							
1							
Web: IEC104 CASDU UCI: iecd.<port>.iec104_casdu	Defines IEC104 common ASDU address. <table border="1"> <tr> <td>Default: 1</td><td></td></tr> </table>	Default: 1					
Default: 1							

Web Field/UCI/Package Option	Description
Opt: iec104_casdu	Range
Web: Send EOI UCI: iecd.<port>.iec104_send_eoi Opt: iec104_send_eoi	Enables sending of IEC 104 End Of Initialisation message to the master. Default: 0 1
Web: Enable IEC 62351-5 secure mode UCI: iecd.<port>.iec104_secure_on Opt: iec104_secure_on	Enables IEC 62351-5 security. Default: 0 1
Web: n/a UCI: iecd. <port>.iec104_rtu_dl_start_dt Opt: iec104_rtu_dl_start_dt	Defines the start operation of the RTU data link. Default: 0 The RTU data link is always started and established at startup and kept up. 1 The RTU data link layer is started and established when IEC104 is up and the START DT message from the IEC104 master is received. When the RTU data link comes up: send START DT CONF to the IEC104 master.
Web: n/a UCI: iecd.<port>.iec104_gi_resp_time Opt: iec104_gi_resp_time	Defines the time in milliseconds between sending successive general interrogation response messages. Default: 200 milliseconds Range: 50-1000
Web: n/a UCI: iecd.<port>.iec104_txq_size Opt: iec104_txq_size	Defines the maximum size of transmit ASDU queue in the application layer (number of frames). Default: 128 Range: 2-256
Web: n/a UCI: iecd.<port>.iec104_cmd_delay_time Opt: iec104_cmd_delay_time	Defines the maximum allowable received command age in milliseconds. If set to 0, control commands time verification is disabled. Default: 0 5000 milliseconds 1 1000-60000
Web: n/a UCI: iecd.<port>.iec104_fsm_debug_on Opt: iec104_fsm_debug_on	Enables the log for IEC 104 state transitions and events. Default: 0 Enable 1 Disable
Web: n/a UCI: iecd.<port>.iec104_dump_data Opt: iec104_dump_data	Enables RX/TX Hex dump. Default: 0 Enable 1 Disable
Web: n/a UCI: iecd.<port>.iec104_trace_on Opt: iec104_trace_on	Enables protocol tracing. Default: 0 Enable 1 Disable

44.1.5. Port Settings: IEC 101

The IEC 104 to IEC 101 conversion feature on the router allows converting commands in the control direction, and the responses and process data in the monitor direction, between the SCADA master running the IEC 104 protocol and the remote RTUs running IEC101 protocol over a serial interface.

IEC 104 to IEC 101 conversion can be configured for two modes:

IEC 101 Mode	Description
Unbalanced	In IEC 101 unbalanced mode, the router supports communication of up to 32 IEC 101 slaves connected onto the same serial interface.
Balanced	IEC 101 balanced mode is used in point-to-point configuration. That is, the router is communicating to a single IEC 101 outstation on the serial interface. Each peer, either the controlling station (Master) or controlled station (RTU) can initiate communication in balanced mode.

Port Settings

Done

PORT1

General

IEC104

IEC101

DNP3

Modbus

Advanced

IEC101 Station Target IP: 127.0.0.1

Remote IP address of IEC101 station to connect to

IEC101 Station Target TCP Port: 999

Remote TCP port of IEC101 station to connect to

IEC101 Link Mode: Balanced

Specifies IEC101 link communication mode

IEC101 Station COT Tx Length: 2

Cause of Transmission length (1 or 2 bytes)

IEC101 Station COT Source Octet: 8

Most significant octet in the cause of transmission field

IEC101 Station ASDU Addr Length: 2

Length of Common Address of ASDU (1 or 2 bytes)

IEC101 Station Info Object Addr Length: 2

Length of the information object address (1, 2 or 3 bytes)

IEC101 Station poll time: 10000

RTU/polling interval if line idle (milliseconds)

IEC101 Station Link Addr Length: 1

Length of the link address field (1, 1 or 2 bytes)

The IEC 104 gateway port IEC101 configuration page

Web Field/UCI/Package Option	Description				
Web: IEC101 Station Target IP UCI: iecd.<port>.iec101_target_ip Opt: iec101_target_ip	Defines the remote IP address of the IEC101 station to connect to. <table border="1"> <tr> <td>Default</td><td>127.0.0.1</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	127.0.0.1	Range	
Default	127.0.0.1				
Range					
Web: IEC101 Station Target TCP Port UCI: iecd.<port>.iec101_target_tcpport Opt: iec101_target_tcpport	Defines the remote TCP port of the IEC101 station to connect to. <table border="1"> <tr> <td>Default</td><td>999</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	999	Range	
Default	999				
Range					
Web: IEC101 Link Mode UCI: iecd.<port>.iec101_mode Opt: iec101_mode	Defines the IEC101link communication mode. <table border="1"> <tr> <td>Default</td><td>Unbalanced</td></tr> <tr> <td></td><td>Balanced</td></tr> </table>	Default	Unbalanced		Balanced
Default	Unbalanced				
	Balanced				
Web: IEC101 Station COT Tx Length UCI: iecd.<port>.iec101_cot_tx_length Opt: iec101_cot_tx_length	Defines the Cause of Transmission length (1 or 2 bytes). <table border="1"> <tr> <td>Default</td><td>2 bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	2 bytes	Range	
Default	2 bytes				
Range					
Web: IEC101 Station COT Source Length UCI: iecd.<port>.iec101_cot_source_octet Opt: iec101_cot_source_octet	Defines the most significant octet in the Cause of Transmission field. <table border="1"> <tr> <td>Default</td><td>0</td></tr> <tr> <td></td><td></td></tr> </table>	Default	0		
Default	0				
Web: IEC101 Station ASDU Addr Length UCI: iecd.<port>.iec101_asdu_addrlen Opt: iec101_asdu_addrlen	Defines the length of Common Address of ASDU (1 or 2 bytes). <table border="1"> <tr> <td>Default</td><td>2 bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	2 bytes	Range	
Default	2 bytes				
Range					
Web: IEC101 Station Info Object Addr Length UCI: iecd.<port>.iec101_info_obj_addrlen Opt: iec101_info_obj_addrlen	Defines the length of the Information Object Address (1, 2 or 3 bytes). <table border="1"> <tr> <td>Default</td><td>2 bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	2 bytes	Range	
Default	2 bytes				
Range					
Web: IEC101 Station Poll Time UCI: iecd.<port>.iec101_data_polling_time Opt: iec101_data_polling_time	Defines the RTU polling interval in milliseconds if the line is idle. <table border="1"> <tr> <td>Default</td><td>1000 milliseconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	1000 milliseconds	Range	
Default	1000 milliseconds				
Range					
Web: IEC101 Link Addr Length UCI: iecd.<port>.iec101_link_addrlen Opt: iec101_link_addrlen	Defines the length of the link address field (0, 1 or 2 bytes). <table border="1"> <tr> <td>Default:1</td><td>bytes</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default:1	bytes	Range	
Default:1	bytes				
Range					
Web: n/a UCI: iecd.<port>.iec101_ack_delay Opt: iec101_ack_delay	Defines the time to wait in milliseconds for an IEC101 ACK. <table border="1"> <tr> <td>Default</td><td>0 seconds</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	0 seconds	Range	
Default	0 seconds				
Range					
Web: n/a UCI: iecd.<port>.iec101_frame_rsp_time Opt: iec101_frame_rsp_time	Defines the maximum number of milliseconds before resending an IEC101 frame. <table border="1"> <tr> <td>Default</td><td>3</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	3	Range	
Default	3				
Range					
Web: n/a UCI: iecd.<port>.iec101_max_tx_retry Opt: iec101_max_tx_retry	Defines the maximum number of times to retry sending an IEC101 frame. <table border="1"> <tr> <td>Default</td><td>3</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	3	Range	
Default	3				
Range					
Web: n/a UCI: iecd.<port>.iec101_txq_size	Defines the size of transmit ASDU queue (number of frames) in the IEC101 link layer.				

Web Field/UCI/Package Option	Description				
Opt: iec101_txq_size	<table border="1"> <tr> <td>Default</td><td>128</td></tr> <tr> <td>Range</td><td></td></tr> </table>	Default	128	Range	
Default	128				
Range					
Web: n/a UCI: iecd.<port>.iec101_send_spont_delay_acq Opt: iec101_send_spont_delay_acq	Defines whether to send DELAY ACQUISITION SPONTANEOUS message as part of 'Acquisition of Transmission Delay' procedure. Note: this option is used in the scenario where an IEC104 Master is talking to an IEC101 RTU. <table border="1"> <tr> <td>Default: 0</td><td>Do not send DELAY ACQUISITION SPONTANEOUS message.</td></tr> <tr> <td>1</td><td>Send DELAY ACQUISITION SPONTANEOUS message.</td></tr> </table>	Default: 0	Do not send DELAY ACQUISITION SPONTANEOUS message.	1	Send DELAY ACQUISITION SPONTANEOUS message.
Default: 0	Do not send DELAY ACQUISITION SPONTANEOUS message.				
1	Send DELAY ACQUISITION SPONTANEOUS message.				
Web: n/a UCI: iecd.<port>.iec101_fsm_debug_on Opt: iec101_fsm_debug_on	Enables logging IEC104 state transitions and events. <table border="1"> <tr> <td>Default: 0</td><td></td></tr> <tr> <td>1</td><td></td></tr> </table>	Default: 0		1	
Default: 0					
1					
Web: n/a UCI: iecd.<port>.iec101_dump_data Opt: iec101_dump_data	Enables RX/TX Hex dump. <table border="1"> <tr> <td>Default: 0</td><td></td></tr> <tr> <td>1</td><td></td></tr> </table>	Default: 0		1	
Default: 0					
1					

44.1.6. Port Settings: DNP3

The IEC 104 to DNP3 conversion feature on the router allows converting commands in the control direction, and the responses and process data in the monitor direction, between the SCADA master running the IEC104 protocol and the remote RTU running DNP3 over serial protocol.

The screenshot shows the 'Port Settings' page with the 'DNP3' tab selected. The configuration fields are as follows:

- DNP3 Station Target IP:** 127.0.0.1
- DNP3 Station Target TCP Port:** 8000
- DNP3 Slave Station Address:** 0
- DNP3 Outstation Address:** 0
- Enable DNP3 Data Link Confirms:** ☒ Enabled DNP3 Data Link Level User Data Confirmation
- DNP3 Data Link Keep Alive:** 15000
- DNP3 Frame Response Time:** 100
- DNP3 Maximum Frame Retry:** 1
- DNP3 Outstation Poll Time:** 30000
- Enable DNP3 Unolicited Responses:** ☒ Enabled DNP3 Application Level Unsolicited Responses
- Enable DNP3 Time Synchronization:** ☒ Enabled DNP3 Time Synchronization

The IEC 104 gateway port DNP3 configuration page

Web Field/UCI/Package Option	Description				
Web: DNP3 Station Target IP UCI: iecd.<port>.dnp3_target_ip Opt: dnp3_target_ip	Defines the remote IP address of the DNP3 station to connect to.				
Web: DNP3 Station Target TCP Port UCI: iecd.<port>.dnp3_target_tcpport Opt: dnp3_target_tcpport	Defines the remote TCP port of the DNP3 station to connect to. <table border="1"> <tr><td>Default</td><td>999</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	999	Range	
Default	999				
Range					
Web: DNP3 Master Station Address UCI: iecd.<port>.dnp3_dl_srcaddr Opt: dnp3_dl_srcaddr	Defines the local (Master) DNP3 address. <table border="1"> <tr><td>Default: 0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	Default: 0		Range	
Default: 0					
Range					
Web: DNP3 Outstation Address UCI: iecd.<port>.dnp3_dl_dstaddr Opt: dnp3_dl_dstaddr	Defines the remote (Outstation) DNP3 address. <table border="1"> <tr><td>Default: 0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	Default: 0		Range	
Default: 0					
Range					
Web: Enable DNP3 Data Link Confirms UCI: iecd.<port>.dnp3_dl_cfrm_user_data Opt: dnp3_dl_cfrm_user_data	Enables DNP3 data link layer user data confirmations. <table border="1"> <tr><td>Default: 0</td><td></td></tr> <tr><td>Range</td><td></td></tr> </table>	Default: 0		Range	
Default: 0					
Range					
Web: DNP3 Data Link Keep Alive UCI: iecd.<port>.dnp3_dl_keep_alive_int Opt: dnp3_dl_keep_alive_int	Defines the DNP3 data link keepalive interval in milliseconds (0 to disable). <table border="1"> <tr><td>Default</td><td>15000 milliseconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	15000 milliseconds	Range	
Default	15000 milliseconds				
Range					
Web: DNP3 Frame Response Time UCI: iecd.<port>.dnp3_dl_frame_rsp_time Opt: dnp3_dl_frame_rsp_time	Defines the maximum amount of time in milliseconds to receive a frame acknowledgement from the DNP3 outstation. <table border="1"> <tr><td>Default</td><td>1000 milliseconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	1000 milliseconds	Range	
Default	1000 milliseconds				
Range					
Web: DNP3 Maximum Frame Retry UCI: iecd.<port>.dnp3_dl_max_tx_retry Opt: dnp3_dl_max_tx_retry	Defines the maximum number of times to retry confirmed frame delivery to the DNP3 outstation.				
Web: DNP3 Outstation Poll Time UCI: iecd.<port>.dnp3_app_poll_time Opt: dnp3_app_poll_time	Defines the DNP3 outstation poll time in milliseconds. <table border="1"> <tr><td>Default</td><td>3</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	3	Range	
Default	3				
Range					
Web: Enable DNP3 Unsolicited Responses UCI: iecd.<port>.dnp3_app_unsol_enable Opt: dnp3_app_unsol_enable	Enables DNP3 application level unsolicited responses. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Enable DNP3 Time Synchronization UCI: iecd.<port>.dnp3_app_sync_time Opt: dnp3_app_sync_time	Enables DNP3 time synchronisation. <table border="1"> <tr><td>Default: 0</td><td>Disabled</td></tr> <tr><td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: n/a UCI: iecd.<port>.dnp3_dl_utxq_size Opt: dnp3_dl_utxq_size	Defines the size of DNP3 data link transmit unconfirmed service frame queue (number of frames). <table border="1"> <tr><td>Default</td><td>128</td></tr> <tr><td>Range</td><td>2-256</td></tr> </table>	Default	128	Range	2-256
Default	128				
Range	2-256				
Web: n/a	Defines the size of DNP3 data link transmit confirmed service frame queue (number of frames).				

Web Field/UCI/Package Option	Description						
UCI: iecd.<port>.dnp3_dl_ctxq_size Opt: dnp3_dl_ctxq_size	<table border="1"> <tr> <td>Default</td><td>128</td></tr> <tr> <td>Range</td><td>2-256</td></tr> </table>	Default	128	Range	2-256		
Default	128						
Range	2-256						
Web: n/a UCI: iecd.<port>.dnp3_app_read_attr Opt: dnp3_app_read_attr	Enables reading DNP3 device attributes at the start of the session. This feature is useful for debugging and is not recommended for production.						
Web: n/a UCI: iecd.<port>.dnp3_app_firstpoll_delay Opt: dnp3_app_firstpoll_delay	Defines initial timeout from start-up in milliseconds before performing the first DNP3 integrity poll. <table border="1"> <tr> <td>Default</td><td>5000 milliseconds</td></tr> <tr> <td>Range</td><td>5000-65535</td></tr> </table>	Default	5000 milliseconds	Range	5000-65535		
Default	5000 milliseconds						
Range	5000-65535						
Web: n/a UCI: iecd.<port>.dnp3_app_evpoll_time Opt: dnp3_app_evpoll_time	Defines DNP3 outstation event polling interval in milliseconds. <table border="1"> <tr> <td>Default</td><td>3000 milliseconds</td></tr> <tr> <td>Range</td><td>1000-65535</td></tr> </table>	Default	3000 milliseconds	Range	1000-65535		
Default	3000 milliseconds						
Range	1000-65535						
Web: n/a UCI: iecd.<port>.dnp3_app_frag_rx_time Opt: dnp3_app_frag_rx_time	Defines DNP3 application level fragment response timeout. <table border="1"> <tr> <td>Default</td><td>1000 milliseconds</td></tr> <tr> <td>Range</td><td>1000-65535</td></tr> </table>	Default	1000 milliseconds	Range	1000-65535		
Default	1000 milliseconds						
Range	1000-65535						
Web: n/a UCI: iecd.<port>.dnp3_app_txq_size Opt: n/a	Defines DNP3 application level transmit queue size (number of frames). <table border="1"> <tr> <td>Default</td><td>64</td></tr> <tr> <td>Range</td><td>2-256</td></tr> </table>	Default	64	Range	2-256		
Default	64						
Range	2-256						
Web: n/a UCI: iecd.<port>.dnp3_app_output_mode Opt: dnp3_app_output_mode	Defines a decimal code that controls how the router sends a DNP3 binary output command to a DNP3 RTU. The most commonly used model is Select/Operate . Note: this command is used where the router is acting as a DNP3 master. <table border="1"> <tr> <td>Default: 0</td><td>Use WRITE command</td></tr> <tr> <td>1</td><td>Use Slect/Operate message sequence</td></tr> <tr> <td>2</td><td>Use Direct Operate message</td></tr> </table>	Default: 0	Use WRITE command	1	Use Slect/Operate message sequence	2	Use Direct Operate message
Default: 0	Use WRITE command						
1	Use Slect/Operate message sequence						
2	Use Direct Operate message						
Web: n/a UCI: iecd.<port>.dnp3_app_evpoll_mode Opt: dnp3_app_evpoll_mode	Defines DNP3 outstation event polling interval in milliseconds. <table border="1"> <tr> <td>Default</td><td>3000 milliseconds</td></tr> <tr> <td>Range</td><td>1000-65535</td></tr> </table>	Default	3000 milliseconds	Range	1000-65535		
Default	3000 milliseconds						
Range	1000-65535						
Web: n/a UCI: iecd.<port>.dnp3_fsm_debug_on Opt: dnp3_fsm_debug_on	Enables DNP3 link and application level state machine transition and event logging into syslog. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>0</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	0	Disabled		
Default: 1	Enabled						
0	Disabled						
Web: n/a UCI: iecd.<port>.dnp3_object_parser_debug_on Opt: dnp3_object_parser_debug_on	Enables or disables logging low level debug information when parsing DNP3 objects in the received DNP3 slave messages <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>2</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	2	Disabled		
Default: 1	Enabled						
2	Disabled						
Web: n/a UCI: iecd.<port>.dnp3_dump_data Opt: dnp3_dump_data	Enables RX/TX Hex dump. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> <tr> <td>2</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	2	Disabled		
Default: 1	Enabled						
2	Disabled						
Web: n/a UCI: iecd.<port>.dnp3_trace_on	Enables DNP3 protocol tracing. <table border="1"> <tr> <td>Default: 1</td><td>Enabled</td></tr> </table>	Default: 1	Enabled				
Default: 1	Enabled						

Web Field/UCI/Package Option	Description	
Opt: dnp3_trace_on	2	Disabled

44.1.7. Port Settings: Modbus

The IEC 104 to Modbus conversion feature on the router allows converting commands in the control direction and the responses and process data in the monitor direction between the SCADA Master running the IEC 104 protocol and the remote RTUs running Modbus protocol.

The router software supports two variations of the Modbus protocol:

- Modbus over serial: the Modbus devices are connected to the serial interface of the router.
- Modbus TCP: the Modbus devices are located on the IP network reachable from the router.

In the Modbus over serial variation, currently the router supports Modbus 'RTU mode' frame format of the Modbus specification only.

Port Settings

PORT1

General IEC104 IEC105 DNP3 **Modbus** Advanced

Modbus protocol: **Modbus Serial** Get protocol variation used by RTU that connects to this router

Modbus local IP: **0.0.0.0** Local IP (interface) to use in modbus mode

Modbus local port: **888** Local port to use in modbus mode

Modbus remote IP: **127.0.0.1** Remote IP address to use in modbus mode

Modbus remote port: **502** Remote port to use in modbus mode

Modbus polling time: **3000** Modbus slave polling interval in milliseconds

Modbus frame response time: **1000** Maximum time allowed to receive a response frame from a Modbus slave (milliseconds)

The IEC 104 gateway port modbus configuration page

Web Field/UCI/Package Option	Description									
Web: Modbus Protocol UCI: iecd.<port>.modbus_protocol Opt: modbus_protocol	Defines the protocol variation used by RTU that connects to this router. <table><tr><th>Option</th><th>Description</th><th>UCI</th></tr><tr><td>Modbus serial</td><td>Modbus over serial</td><td>modbus_serial</td></tr><tr><td>Modbus TCP</td><td>Modbus over TCP</td><td>modbus_tcp</td></tr></table>	Option	Description	UCI	Modbus serial	Modbus over serial	modbus_serial	Modbus TCP	Modbus over TCP	modbus_tcp
Option	Description	UCI								
Modbus serial	Modbus over serial	modbus_serial								
Modbus TCP	Modbus over TCP	modbus_tcp								
Web: Modbus local IP UCI: iecd.<port>.modbus_local_ip Opt: modbus_local_ip	Defines the local IP to use in Modbus mode. <table><tr><td>Default</td><td>0.0.0.0</td></tr><tr><td>Range</td><td></td></tr></table>	Default	0.0.0.0	Range						
Default	0.0.0.0									
Range										
Web: Modbus local port UCI: iecd.<port>.modbus_local_port Opt: modbus_local_port	Defines the local port to use in Modbus mode. <table><tr><td>Default</td><td>888</td></tr><tr><td>Range</td><td></td></tr></table>	Default	888	Range						
Default	888									
Range										
Web: Modbus remote IP UCI: iecd.<port>.modbus_remote_ip Opt: modbus_remote_ip	Defines the remote IP address. <table><tr><td>Default</td><td>127.0.0.1</td></tr><tr><td>Range</td><td></td></tr></table>	Default	127.0.0.1	Range						
Default	127.0.0.1									
Range										
Web: Modbus remote port UCI: iecd.<port>.modbus_remote_port Opt: modbus_remote_port	Defines the remote port. <table><tr><td>Default</td><td>999</td></tr><tr><td>Range</td><td></td></tr></table>	Default	999	Range						
Default	999									
Range										
Web: Modbus polling time UCI: iecd.<port>.modbus_polling_time Opt: modbus_polling_time	Defines the slave polling interval in milliseconds. <table><tr><td>Default</td><td>3000</td></tr><tr><td>Range</td><td></td></tr></table>	Default	3000	Range						
Default	3000									
Range										
Web: Modbus frame response time UCI: iecd.<port>.modbus_resp_time Opt: modbus_resp_time	Defines in milliseconds the maximum time allowed to receive a response frame from a Modbus slave. <table><tr><td>Default</td><td>1000</td></tr><tr><td>Range</td><td></td></tr></table>	Default	1000	Range						
Default	1000									
Range										
Web: n/a UCI: iecd.<port>.modbus_dump_data Opt: modbus_dump_data	Enables RX/TX Hex dump.									
Web: n/a UCI: iecd.<port>.modbus_trace_on Opt: modbus_trace_on	Enables Modbus protocol tracing.									
Web: n/a UCI: iecd.<port>.modbus_fsm_debug_on Opt: modbus_fsm_debug_on	Enables Modbus state machine debugging.									

44.1.8. Port Settings: Advanced

In this section you can configure the advanced port settings.

Port Settings

PORT1

General

ICM4

ICM1

CMF3

Modbus

Advanced

Syslog severity

Emergency

Specifies the lowest severity to be logged by ICD

Enable TCP keepalives

Enable TCP keepalives

TCP Keepalive interval

5

TCP Keepalive send interval (seconds)

TCP Keepalive timeout

5

TCP Keepalive timeout (seconds)

TCP Keepalive count

3

TCP Keepalive maximum probe count

The IEC 104 gateway port advanced configuration page

Web Field/UCI/Package Option	Description																
Web: Syslog severity UCI: iecd.<port>.loglevel Opt: loglevel	Defines the lowest severity used for logging events by iecd. <table> <tr><td>0</td><td>Emergency</td></tr> <tr><td>1</td><td>Alert</td></tr> <tr><td>2</td><td>Critical</td></tr> <tr><td>3</td><td>Error</td></tr> <tr><td>4</td><td>Warning</td></tr> <tr><td>5</td><td>Notice</td></tr> <tr><td>6</td><td>Informational</td></tr> <tr><td>7</td><td>Debug</td></tr> </table>	0	Emergency	1	Alert	2	Critical	3	Error	4	Warning	5	Notice	6	Informational	7	Debug
0	Emergency																
1	Alert																
2	Critical																
3	Error																
4	Warning																
5	Notice																
6	Informational																
7	Debug																
Web: Enable TCP keepalives UCI: iecd.<port>.tcp_keepalive_enabled Opt: tcp_keepalive_enabled	Defines whether to enable TCP keepalive. <table> <tr><td>Default: 1</td><td>Enabled</td></tr> <tr><td>2</td><td>Disabled</td></tr> </table>	Default: 1	Enabled	2	Disabled												
Default: 1	Enabled																
2	Disabled																
Web: TCP Keepalive interval UCI: iecd.<port>.tcp_keepalive_interva Opt: tcp_keepalive_interval	Defines the TCP keepalive interval in seconds. <table> <tr><td>Default</td><td>5 seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	5 seconds	Range													
Default	5 seconds																
Range																	
Web: TCP Keepalive timeout UCI: iecd.<port>.tcp_keepalive_timeout Opt: tcp_keepalive_timeout	Defines the TCP keepalive timeout in seconds. <table> <tr><td>Default</td><td>5 seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	5 seconds	Range													
Default	5 seconds																
Range																	
Web: TCP Keepalive count UCI: iecd.<port>.tcp_keepalive_count Opt: tcp_keepalive_count	Defines the number of unanswered keepalives before terminating the TCP session. <table> <tr><td>Default</td><td>3 seconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	3 seconds	Range													
Default	3 seconds																
Range																	
Web: n/a UCI: iecd.<port>.tcp_user_timeout Opt: tcp_user_timeout	Defines the maximum time in milliseconds to wait for a TCP ACK after data transmission before closing the connection in TCP established state. Set to 0 to use kernel defaults (about 15-20 minutes). <table> <tr><td>Default</td><td>2000 milliseconds</td></tr> <tr><td>Range</td><td></td></tr> </table>	Default	2000 milliseconds	Range													
Default	2000 milliseconds																
Range																	

Merlin 4100 Management Guide

513

44.2. IEC 101 Links

The following section defines the IEC 101 slave links used in IEC 101 conversion. Each link is defined by a config iec101link section block. There is a maximum of 32 links supported.

In IEC 101 unbalanced mode all of these links can be used. However, as IEC 101 balanced mode is used in a point to point scenario, it is assumed there will be only one outstation per serial port. Only the first link configured for that port will be used. Each peer, either the controlling station (Master) or the controlled station (RTU) can initiate communication in balanced mode.

IEC101 Links

Port number	IEC101 Link Address	IEC101 Link ASDU Addr
/1: 4: Serial port	Link address of the IEC101 station	ASDU address of the IEC101 station
Add Delete		

IEC101 slave links configuration page

Web Field/UCI/Package Option	Description
Web: Port Number UCI: iecd.iec101link[x].portno Opt: portno	Defines the serial port number to which this point belongs.
Web: IEC101 Link Address UCI: iecd.iec101link[x].address Opt: address	Defines the IEC101 station link address.
Web: IEC101 Link ASDU Station UCI: iecd. iec101link[x].asduaddr Opt: asduaddr	Defines the IEC101 station common ASDU address.

44.3. Point Mappings

IEC 104 point mappings are used for DNP3 and Modbus conversion only.

The point mappings comprise the information necessary to perform conversion between each data variable (point) on the remote RTU and the corresponding variable in the IEC 104 domain.

Modbus TCP requires a device route file (**/root/iecd/devroute.csv**) to map the point configuration to an IP address. For more information, read the Modbus route file section below.

There is a maximum of 1200 point mappings supported per serial port.

Points

Cancel

Port number	1	④ (1-4) Serial port
IEC101 Type ID	1	④ IEC101 Data Type ID
IEC104 Type ID	1	④ IEC104 Data Type ID
IEC101 I/OA	1	④ IEC101 Information Object Address
IEC104 I/OA	1	④ IEC104 Information Object Address
Device Addr	1	④ Modbus slave address
DNP3 options	0	④ DNP3 options bitmask
Group	0	④ DNP3 group id or Modbus data type
Index	0	④ DNP3 Point index or Modbus data index
Index2	0	④ DNP3 Point secondary index
Modbus options	0	④ Modbus options bitmask
Modbus bitmask mask	0	④ Modbus bitmask mask
Modbus CtrlMode index	0	④ Modbus Control Mode register index
Modbus CtrlMode value	0	④ Modbus Control Mode register value
Local Digital Output GPIO number	0	④ Local Digital Output GPIO number
IEC61850 DO		④ IEC61850 Data Object reference, Maximum 32 characters

The IEC 104 gateway point mapping configuration page

Web Field/UCI/Package Option	Description																																		
Web: Port Number UCI: iecd.point[x].portno Opt: portno	Defines the port number to which this point belongs (1 to 4). This corresponds to the serial port number.																																		
Web: IEC101 Type ID UCI: iecd.point[x].iec101_type_id Opt: iec101_type_id	Defines the IEC101 type ID (data type). All types are defined in IEC-60870-5-104 <table border="1"> <tr><td>1</td><td>Single point information</td></tr> <tr><td>2</td><td>Double point information</td></tr> <tr><td>7</td><td>Bitstring 32 bits</td></tr> <tr><td>9</td><td>Measured normalised value short signed</td></tr> <tr><td>11</td><td>Measured scaled value short signed</td></tr> <tr><td>13</td><td>IEEE STD 754 - Short floating point number</td></tr> <tr><td>14</td><td>IEEE STD 754 - Short floating point number with time tag CP24Time2a</td></tr> <tr><td>15</td><td>Integrated totals, 32 bit signed integer</td></tr> <tr><td>20</td><td>Packed single point information with status change detection</td></tr> <tr><td>21</td><td>Measured normalised value short signed without quality descriptor</td></tr> <tr><td>30</td><td>Single point information with time tag CP56Time2a</td></tr> <tr><td>31</td><td>Double point information with time tag CP56Time2a</td></tr> <tr><td>33</td><td>Bitstring of 32 bits with time tag CP56Time2a</td></tr> <tr><td>34</td><td>Measure normalised value short signed time tag CP56Time2a</td></tr> <tr><td>35</td><td>Measured value, scaled value with time tag CP56Time2a</td></tr> <tr><td>36</td><td>Measured value, short floating point number with time tag CP56Time 2a</td></tr> <tr><td>37</td><td>Integrated totals with time tag CP56Time2a</td></tr> </table>	1	Single point information	2	Double point information	7	Bitstring 32 bits	9	Measured normalised value short signed	11	Measured scaled value short signed	13	IEEE STD 754 - Short floating point number	14	IEEE STD 754 - Short floating point number with time tag CP24Time2a	15	Integrated totals, 32 bit signed integer	20	Packed single point information with status change detection	21	Measured normalised value short signed without quality descriptor	30	Single point information with time tag CP56Time2a	31	Double point information with time tag CP56Time2a	33	Bitstring of 32 bits with time tag CP56Time2a	34	Measure normalised value short signed time tag CP56Time2a	35	Measured value, scaled value with time tag CP56Time2a	36	Measured value, short floating point number with time tag CP56Time 2a	37	Integrated totals with time tag CP56Time2a
1	Single point information																																		
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35	Measured value, scaled value with time tag CP56Time2a																																		
36	Measured value, short floating point number with time tag CP56Time 2a																																		
37	Integrated totals with time tag CP56Time2a																																		
Web: IEC104 Type ID UCI: iecd.point[x].iec104_type_id Opt: iec104_type_id	Defines the IEC104 type ID (data type). All types are defined in IEC-60870-5-104 <table border="1"> <tr><td>1</td><td>Single point information</td></tr> <tr><td>2</td><td>Double point information</td></tr> <tr><td>7</td><td>Bitstring 32 bits</td></tr> <tr><td>9</td><td>Measured normalised value short signed</td></tr> <tr><td>11</td><td>Measured scaled value short signed</td></tr> <tr><td>13</td><td>IEEE STD 754 - Short floating point number</td></tr> <tr><td>14</td><td>IEEE STD 754 - Short floating point number with time tag CP24Time2a</td></tr> <tr><td>15</td><td>Integrated totals, 32 bit signed integer</td></tr> <tr><td>20</td><td>Packed single point information with status change detection</td></tr> <tr><td>21</td><td>Measured normalised value short signed without quality descriptor</td></tr> <tr><td>30</td><td>Single point information with time tag CP56Time2a</td></tr> <tr><td>31</td><td>Double point information with time tag CP56Time2a</td></tr> <tr><td>33</td><td>Bitstring of 32 bits with time tag CP56Time2a</td></tr> <tr><td>34</td><td>Measure normalised value short signed time tag CP56Time2a</td></tr> <tr><td>35</td><td>Measured value, scaled value with time tag CP56Time2a</td></tr> <tr><td>36</td><td>Measured value, short floating point number with time tag CP56Time 2a</td></tr> <tr><td>37</td><td>Integrated totals with time tag CP56Time2a</td></tr> </table>	1	Single point information	2	Double point information	7	Bitstring 32 bits	9	Measured normalised value short signed	11	Measured scaled value short signed	13	IEEE STD 754 - Short floating point number	14	IEEE STD 754 - Short floating point number with time tag CP24Time2a	15	Integrated totals, 32 bit signed integer	20	Packed single point information with status change detection	21	Measured normalised value short signed without quality descriptor	30	Single point information with time tag CP56Time2a	31	Double point information with time tag CP56Time2a	33	Bitstring of 32 bits with time tag CP56Time2a	34	Measure normalised value short signed time tag CP56Time2a	35	Measured value, scaled value with time tag CP56Time2a	36	Measured value, short floating point number with time tag CP56Time 2a	37	Integrated totals with time tag CP56Time2a
1	Single point information																																		
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35	Measured value, scaled value with time tag CP56Time2a																																		
36	Measured value, short floating point number with time tag CP56Time 2a																																		
37	Integrated totals with time tag CP56Time2a																																		
Web: IEC101 IOA UCI: iecd.point[x].iec101_ioa Opt: iec101_ioa	Defines IEC104 information object address. This is how remote an IEC104 SCADA master knows one point from another. <table border="1"> <tr> <td>Range</td><td>1-116777215</td></tr> </table>	Range	1-116777215																																
Range	1-116777215																																		
Web: IEC104 IOA UCI: iecd.point[x].iec104_ioa Opt: iec104_ioa	Defines IEC104 information object address. This is how a remote IEC104 SCADA master knows one point from another. <table border="1"> <tr> <td>Range</td><td>1-116777215</td></tr> </table>	Range	1-116777215																																
Range	1-116777215																																		

Web: Device Addr UCI: iecd.point[x].devaddr Opt: devaddr	Defines the Modbus device address of the RTU (Modbus slave address). Used for identifying the point mapping to IP address in the device route file for Modbus TCP. This is not used in DNP3 mode.												
Web: DNP3 Options UCI: iecd.point[x].dnp3options Opt: dnp3options	For DNP3. Defines the DNP3 options bitmap. <table border="1"> <tr><td>Default</td><td>1</td></tr> <tr><td>Range</td><td>1-116777215</td></tr> </table>	Default	1	Range	1-116777215								
Default	1												
Range	1-116777215												
Web: Group UCI: iecd.point[x].group Opt: group	For DNP3. Defines the DNP3 group number to which this data point maps to. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-255</td></tr> </table> For Modbus. Defines the Modbus data type. <table border="1"> <tr><td>Default: 0</td><td>Discreet input</td></tr> <tr><td>1</td><td>Input register</td></tr> <tr><td>2</td><td>Holding register</td></tr> <tr><td>3</td><td>Coil</td></tr> </table>	Default	0	Range	0-255	Default: 0	Discreet input	1	Input register	2	Holding register	3	Coil
Default	0												
Range	0-255												
Default: 0	Discreet input												
1	Input register												
2	Holding register												
3	Coil												
Web: Index UCI: iecd.point[x].index Opt: index	For DNP3. Defines the DNP3 point index. For Modbus. Defines the Modbus data index (point number). <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Index2 UCI: iecd.point[x].index2 Opt: index2	For DNP3. Defines the DNP3 secondary point index. For Modbus. Defines the Modbus data index (point number). <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Modbus options UCI: iecd.point[x].mb_options Opt: mb_options	For Modbus. Defines the Modbus options bitmap. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Modbus bitmap mask UCI: iecd.point[x].bitmap_mask Opt: bitmap_mask	For Modbus. Defines the Modbus bitmap mask. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Modbus CtrlMode index UCI: iecd.point[x].ctrlmode_index Opt: ctrlmode_index	For Modbus. Defines the Modbus control mode register index. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Modbus CtrlMode value UCI: iecd.point[x].ctrlmode_val Opt: ctrlmode_val	For Modbus. Defines the Modbus control mode register value. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: Local Digital Output GPIO number UCI: iecd.point[x].local_gpio_output_nr Opt: local_gpio_output_nr	Defines the local digital output GPIO number. <table border="1"> <tr><td>Default</td><td>0</td></tr> <tr><td>Range</td><td>0-65535</td></tr> </table>	Default	0	Range	0-65535								
Default	0												
Range	0-65535												
Web: IEC61850 DO UCI: iecd.point[x].iec61850_do	Defines the IEC61850 Data Object reference. (Maximum 32 characters). <table border="1"> <tr><td>Default</td><td>0</td></tr> </table>	Default	0										
Default	0												

Opt: iec61850_do	Range	0-32 characters
Web: n/a	Defines the DWORD type. Relevant for Modbus data types IR (input registers) and HR (holding registers).	
UCI: iecd.point[x].dword		
Opt: dword		
	Default: 0	Data point is treated as 16 bit wide
	1	Data point is treated as 32 bit wide. Two consecutive 16 bit registers are read from the Modbus device.

MODBUS device route file

If the configured MODBUS protocol variation is Modbus TCP, then the device route file at

/root/iecd/devroute.csv is used to map the device address (`iecd.point[x].devaddr`) from the point mapping to the remote IP address of the Modbus TCP slave device.

The devroute.csv file entries will have the following format:

<Modbus device addr>, <IP address>

For example, for the point mapping file, enter:

```
config point
option portno 1
option iec104_type_id 30
option iec104_ioa 64213
option devaddr 1
option group 0
option index 2
```

For the devroute.csv entry, enter:

```
1,192.168.0.106
```

44.4. IEC 104 Gateway Configuration Using Command Line

The IEC104 gateway uses the iecd package /etc/config/iecd. You can configure multiple port, iec101link and points sections.

By default, IEC104 gateway port instances are named port. It is identified by @port followed by the port position in the package as a number. For example, for the first port in the package using UCI:

```
iecd.@port[0]=port
iecd.@port[0].enable=1
```

Or using package options:

```
config port
option enable '1'
```

By default, all IEC104 gateway IEC101 link instances are named iec101link, the instance is identified by @iec101link followed by the link position in the package as a number.

For example, for the first IEC101 link in the package using UCI:

```
iecd.@iec101link[0]=iec101link  
iecd.@iec101link[0].portno=1
```

Or using package options:

```
config iec101link  
option portno '1'
```

By default, all IEC104 gateway point instances are named point, it is identified by @point followed by the point position in the package as a number. For example, for the first point in the package using UCI:

```
iecd.@point[0]=point  
iecd.@point[0].portno=1
```

Or using package options:

```
config point  
option portno '1'
```

44.5. IEC 104 To IEC 101 Conversion (Balanced Or Unbalanced)

The following example shows IEC 104 to IEC 101 unbalanced conversion with one IEC 101 link.

To configure IEC 104 to IEC 101 balanced conversion set option iec101_mode to

IEC 104 to IEC 101 using UCI

```

root@VA_router:~# uci show iecd

iecd.main=iecd

iecd.main.enable=1

iecd.port1=port

iecd.port1.enable=1

iecd.port1.loglevel=5

iecd.port1.tcp_keepalive_enabled=1

iecd.port1.tcp_keepalive_interval=5

iecd.port1.tcp_keepalive_timeout=5

iecd.port1.tcp_keepalive_count=3

iecd.port1.tcp_user_timeout=20000

iecd.port1.master_protocol=iec101

iecd.port1.slave_protocol=iec104

iecd.port1.ioa_offset=0

iecd.port1.pointmap_file=/root/iecd/iecd_points1.csv

iecd.port1.iec104_local_ip=0.0.0.0

iecd.port1.iec104_local_tcpport=2404

iecd.port1.iec104_k=12

iecd.port1.iec104_w=9

iecd.port1.iec104_t2=10000

iecd.port1.iec104_gi_resp_time=200

iecd.port1.iec104_txq_size=128

iecd.port1.iec104_sync_time=1

iecd.port1.iec104_time_tagged_cmds=0

iecd.port1.iec104_cmd_delay_time=5000

iecd.port1.iec104_fsm_debug_on=0

iecd.port1.iec104_dump_data=0

iecd.port1.iec104_trace_on=0

#IEC101 conversion options

iecd.port1.iec101_target_ip=127.0.0.1

iecd.port1.iec101_target_tcpport=999

iecd.port1.iec101_mode=unbalanced #balanced or unbalanced

iecd.port1.iec101_cot_tx_length=1

iecd.port1.iec101_cot_source_octet=0

iecd.port1.iec101_asdu_addrln=1

iecd.port1.iec101_info_obj_addrln=2

```



```
iecd.port1.iec101_data_polling_time=500
iecd.port1.iec101_ack_delay=0
iecd.port1.iec101_link_addrlen=1
iecd.port1.iec101_frame_rsp_time=2000
iecd.port1.iec101_max_tx_retry=3
iecd.port1.iec101_txq_size=128
iecd.port1.iec101_send_spont_delay_acq=1
iecd.port1.iec101_fsm_debug_on=0
iecd.port1.iec101_dump_data=0
iecd.port1.iec101_trace_on=0
```

The following section defines IEC101 slave links used in IEC101 unbalanced mode on each link is defined by a config block 'config iec101link'

To add more links repeat the section block for each added link. # Maximum 32 links are supported

```
iecd.@iec101link[0]=iec101link
iecd.@iec101link[0].portno=1
iecd.@iec101link[0].address=6
iecd.@iec101link[0].asduaddr=6
#No data point mappings for IEC104 to IEC101 conversion
```

IEC 104 to IEC 101 using Package Options

```
root@VA_router:~# uci export iecd

package iecd

config iecd 'main'

option enable '1'

config port 'port1'

option enable '1'

option loglevel '5'

option tcp_keepalive_enabled '1'

option tcp_keepalive_interval '5'

option tcp_keepalive_timeout '5'

option tcp_keepalive_count '3'

option tcp_user_timeout '20000'

option master_protocol 'iec101'

option slave_protocol 'iec104'

option ioa_offset '0'

option pointmap_file '/root/iecd/iecd_points1.csv'

option iec104_local_ip '0.0.0.0'

option iec104_local_tcpport '2404'

option iec104_k '12'

option iec104_w '9'

option iec104_t2 '10000'

option iec104_gi_resp_time '200'

option iec104_txq_size '128'

option iec104_sync_time '1'

option iec104_time_tagged_cmds '0'

option iec104_cmd_delay_time '5000'

option iec104_fsm_debug_on '0'

option iec104_dump_data '0'

option iec104_trace_on '0'

#IEC101 conversion options

option iec101_target_ip '127.0.0.1'

option iec101_target_tcpport '999'

option iec101_mode 'unbalanced' #balanced or unbalanced
```

```

option iec101_cot_tx_length '1'

option iec101_cot_source_octet '0'

option iec101_asdu_addrlen '1'

option iec101_info_obj_addrlen '2'

option iec101_data_polling_time '500'

option iec101_ack_delay '0'

option iec101_link_addrlen '1'

option iec101_frame_rsp_time '2000'

option iec101_max_tx_retry '3'

option iec101_txq_size '128'

option iec101_send_spont_delay_acq '1'

option iec101_fsm_debug_on '0'

option iec101_dump_data '0'

option iec101_trace_on '0'

# The following section defines IEC101 slave links used in IEC101 unbalanced mode on
# Each link is defined by a config block 'config iec101link'

# To add more links repeat the section block for each added link. To remove links, simply remove the link block from the configuration
# Maximum 32 links are supported

# Definition of options within the section block:

# portno - port number to which this point belongs (1 to 4) # address - IEC101 slave link address
# asduaddr IEC101 slave common ASDU address

config iec101link

option portno 1

option address 6

option asduaddr 6

#No data point mappings for IEC104 to IEC101 conversion

```

44.6. IEC104 To Modbus Conversion

The following example shows IEC104 to Modbus over serial.

To configure Modbus TCP, set `option modbus_protocol` to `modbus_tcp`.

When configuring Modbus TCP, the device route file at `/root/iecd/devroute.csv` must be configured to map the device address `option devaddr` from the point mapping to the remote IP address of the Modbus TCP slave device.

The `devroute.csv` file entries will have the following format:

```
<Modbus device addr>, <IP address>
```

For example, for the point mapping file:

```
config point
option portno 1
option iec104_type_id 30
option iec104_ioa 64213
option devaddr 1
option group 0
option index 2
```

For the devroute.csv entry:

```
1,192.168.0.106
```

44.6.1. IEC104 To Modbus Using UCI

```
root@VA_router:~# uci show iecd
iecd.main=iecd
iecd.main.enable=1
iecd.port1=port
iecd.port1.enable=1
iecd.port1.loglevel=5
iecd.port1.tcp_keepalive_enabled=1
iecd.port1.tcp_keepalive_interval=5
iecd.port1.tcp_keepalive_timeout=5
iecd.port1.tcp_keepalive_count=3
iecd.port1.tcp_user_timeout=20000
iecd.port1.master_protocol=modbus
iecd.port1.slave_protocol=iec104
iecd.port1.ioa_offset=0
iecd.port1.pointmap_file=/root/iecd/iecd_points1.csv
iecd.port1.iec104_local_ip=0.0.0.0
iecd.port1.iec104_local_tcpport=2404
iecd.port1.iec104_k=12
iecd.port1.iec104_w=9
iecd.port1.iec104_t2=10000
iecd.port1.iec104_gi_resp_time=200
iecd.port1.iec104_txq_size=128
iecd.port1.iec104_sync_time=1
iecd.port1.iec104_time_tagged_cmds=0
iecd.port1.iec104_cmd_delay_time=5000
iecd.port1.iec104_fsm_debug_on=0
iecd.port1.iec104_dump_data=0
iecd.port1.iec104_trace_on=0
iecd.port1.iec101_cot_source_octet=0
```

Modbus Conversion Options

```
iecd.port1.modbus_protocol=modbus_serial
iecd.port1.modbus_local_ip=0.0.0.0
iecd.port1.modbus_local_port=888
iecd.port1.modbus_remote_ip=127.0.0.1
iecd.port1.modbus_remote_port=999
iecd.port1.modbus_polling_time=3000
iecd.port1.modbus_resp_time=1000
iecd.port1.modbus_dump_data=0
iecd.port1.modbus_trace_on=0
iecd.port1.modbus_fsm_debug_on=0
```

Modbus Data Point Mappings

```
iecd.@point[0]=point
iecd.@point[0].portno=1
iecd.@point[0].iec104_type_id=36
iecd.@point[0].iec104_ioa=6620161
iecd.@point[0].iec101_ioa=0
iecd.@point[0].devaddr=11
iecd.@point[0].group=1
iecd.@point[0].index=18459
iecd.@point[0].dword=1
iecd.@point[1]=point
iecd.@point[1].portno=1
iecd.@point[1].iec104_type_id=36
iecd.@point[1].iec104_ioa=6620162
iecd.@point[1].iec101_ioa=0
iecd.@point[1].devaddr=11
iecd.@point[1].group=1
iecd.@point[1].index=18461
iecd.@point[1].dword=1
```

IEC 104 to Modbus using Package Options

```
root@VA_router:~# uci export iecd

package iecd

config iecd 'main'

option enable '1'

config port 'port1'

option enable '1'

option loglevel '5'

option tcp_keepalive_enabled '1'

option tcp_keepalive_interval '5'

option tcp_keepalive_timeout '5'

option tcp_keepalive_count '3'

option tcp_user_timeout '20000' option master_protocol 'modbus' option slave_protocol 'iec104' option ioa_offset '0'

option pointmap_file '/root/iecd/iecd_points1.csv' option iec104_local_ip '0.0.0.0'

option iec104_local_tcpport '2404'

option iec104_k '12'

option iec104_w '9'

option iec104_t2 '10000'

option iec104_gi_resp_time '200'

option iec104_txq_size '128'

option iec104_sync_time '1'

option iec104_time_tagged_cmds '0'

option iec104_cmd_delay_time '5000'

option iec104_fsm_debug_on '0'

option iec104_dump_data '0'

option iec104_trace_on '0'

option iec101_cot_source_octet '0'
```

Modbus Conversion Options

```

option modbus_protocol 'modbus_serial'

option modbus_local_ip '0.0.0.0'

option modbus_local_port '888'

option modbus_remote_ip '127.0.0.1'

option modbus_remote_port '999'

option modbus_polling_time '3000'

option modbus_resp_time '1000'

option modbus_dump_data '0'

option modbus_trace_on '0'

option modbus_fsm_debug_on '0'

config point

option portno '1'

option iec104_type_id '36'

option iec104_ioa '6620161'

option iec101_ioa '0'

option devaddr '11'

option group '1'

option index '18459'

option dword '1'

config point

option portno '1'

option iec104_type_id '36'

option iec104_ioa '6620162'

option iec101_ioa '0'

option devaddr '11'

option group '1'

option index '18461'

option dword '1'

```

44.7. Configuring The Terminal Server

The terminal server is used to control the data from the serial port over the IP network.

The terminal server configuration can be found at **Services -> Terminal Server**. The Terminal Server Configuration page appears. You must configure two main sections: Main Settings and Port Settings.

The terminal server for IEC104 to each of the RTU protocol conversions differ only slightly. This section shows the command line options for configuring the terminal server for IEC104 conversion.

For more detailed information on configuring the terminal server using the web GUI and

option values, read the chapter, 'Configuring terminal server'.

Configuring the Terminal Server for IEC 104 to IEC 101 using UCI

```
root@VA_router:~# uci show tservd

tservd.main=tservd

tservd.main.enable=1

tservd.main.debug_ev_enable=0

tservd.main.log_severity=5

tservd.main.debug_rx_tx_enable=0

tservd.port1=port

tservd.port1.enable=1

tservd.port1.devName=/dev/ttySC0

tservd.port1.ip_port1=0

tservd.port1.ip_port2=0

tservd.port1.remote_ip1=0.0.0.0

tservd.port1.remote_ip2=0.0.0.0

tservd.port1.tcp_always_on=1

tservd.port1.close_tcp_on_dsr=0

tservd.port1.tty_always_open=1

tservd.port1.fwd_timeout=0

tservd.port1.fwd_timer_mode=idle

tservd.port1.fwd_buffer_size=1

tservd.port1.sfwd_buffer_size=0

tservd.port1.sfwd_timeout=0

tservd.port1.sfwd_timer_mode=idle

tservd.port1.speed=9600

tservd.port1.wsize=8

tservd.port1.parity=1

tservd.port1.stops=1

tservd.port1.fc_mode=0

tservd.port1.disc_time_ms=5000

tservd.port1.server_mode=1

tservd.port1.proxy_mode=0

tservd.port1.local_ip=0.0.0.0

tservd.port1.listen_port=999

tservd.port1.udpMode=0

tservd.port1.udpLocalPort=0

tservd.port1.udpRemotePort=0

tservd.port1.udpKaIntervalMs=0
```

```
tserverd.port1.udpKaCount=3  
tserverd.port1.serial_mode_gpio_control=1  
tserverd.port1.tcp_nodelay=1  
tserverd.port1.portmode=rs232
```

Configuring IEC 104 to IEC 101 using Package Options

```
root@VA_router:~# uci export tserverd  
  
package tserverd  
  
config tserverd main  
  
# set to 1 to enable terminal server  
option enable 1  
  
# enables detailed debug logging (state transitions, data transfer etc)  
option debug_ev_enable 0  
  
# sets syslog level (0 to 7), default is 6  
option log_severity 5
```

```

option debug_rx_tx_enable 0

config port 'port1'

# enables this port option enable 1

# serial device name

option devName '/dev/ttySC0'

# destination peer port IP number (two number for failover) option ip_port1 0

option ip_port2 0

# destination peer ip address (two addresses for failover) option remote_ip1 '0.0.0.0'

option remote_ip2 '0.0.0.0'

# keep TCP session always connected option tcp_always_on 1

# close TCP session on detection of DSR signal low option close_tcp_on_dsr 0

# keep serial port always open (if option not present, default is 0) option tty_always_open 1

# Forwarding timeout in milliseconds (serial to network)

option fwd_timeout 0

# Forwarding timer mode (serial to network), 'idle'=timer re-started on each received data,
# 'aging'=timer started on first rx

option fwd_timer_mode 'idle'

# Forwarding buffer size (serial to network)

option fwd_buffer_size 1

# Forwarding buffer size (network to serial), 0=use maximum possible network rx buffer size

option sfwd_buffer_size 0

# Forwarding timeout in milliseconds (network to serial), 0=forward to serial immediately

option sfwd_timeout 0

# Forwarding timer mode (network to serial), 'idle'=timer re-started on each received data,
# 'aging'=timer started on first rx

option sfwd_timer_mode 'idle'

# serial device speed in baud

option speed 9600

# serial device word size (5,6,7,8)

option wsize 8

# serial device parity (0=none, 1=even, 2=odd)

option parity 1

# serial device number of stop bits (1 or 2)

option stops 1

# serial flow control mode (0=none, 1=RTS CTS, 2=XONXOFF)

option fc_mode 0

```

```
# time in milliseconds to start re-connecting after setting DTR low

option disc_time_ms 5000

# TCP server mode

option server_mode 1

# Proxy mode (off by default)

option proxy_mode 0

# Local IP address to listen on (0.0.0.0=listen on any interface)

option local_ip '0.0.0.0'

# TCP listen port for server mode

option listen_port 999

# UDP mode

option udpMode 0

# UDP local port UDP mode

option udpLocalPort 0

# UDP port for UDP mode

option udpRemotePort 0

# If set to non zero, send empty UDP packets every this many milliseconds to remote peer

option udpKaIntervalMs 0

# Max number of consecutive remote UDP keepalive missed (not received) before UDP

# session considered broken

option udpKaCount 3

option serial_mode_gpio_control 1

option tcp_nodelay 1

# rs232 - RS-232 mode, rs485hdx - rs485 2 wire half duplex mode in which transmitter drives

# RTS. rs485fdx - RS485 4 wire full duplex mode. 'v23' - using V.23 leased line card driver.

# x21 - use USB serial card in sync mode

option portmode 'rs232'
```

44.7.1. Configuring The Terminal Server For IEC104 To DNP3

The terminal server configuration for IEC104 to DNP3 is the same as for IEC104 to IEC101 except for serial device parity which is set to **none**.

Parity setting using uci:

```
tservd.port1.parity=1
```

Parity setting using package options:

```
option parity 0
```

44.7.2. Configuring The Terminal Server For IEC 104 To Modbus Over Serial

The terminal server is only used for IEC104 to Modbus over serial. It is not used for Modbus over TCP.

The options necessary for IEC104 to Modbus configuration are listed below. These options are for the first serial port only.

IEC104 to Modbus over Serial using UCI

```
root@VA_router:~# uci show tservd

tservd.main=tservd

tservd.main.enable=1

tservd.main.debug_ev_
enable=0 tservd.main.log_severity=5

tservd.main.debug_rx_tx_enable=0

tservd.port1=port tservd.port1.enable=1

tservd.port1.devName=/dev/ttySC0

tservd.port1.ip_port1=999

tservd.port1.ip_port2=999

tservd.port1.remote_ip1=127.0.0.1

tservd.port1.remote_ip2=127.0.0.1

tservd.port1.tcp_always_on=1

tservd.port1.close_tcp_on_dsr=0

tservd.port1.tty_always_open=1

tservd.port1.fwd_timeout=10

tservd.port1.fwd_timer_mode=idle

tservd.port1.fwd_buffer_size=300

tservd.port1.sfwd_buffer_size=0

tservd.port1.sfwd_timeout=0

tservd.port1.sfwd_timer_mode=idle

tservd.port1.speed=19200

tservd.port1.wsize=8

tservd.port1.parity=1

tservd.port1.stops=1

tservd.port1.fc_mode=0

tservd.port1.disc_time_ms=5000

tservd.port1.server_mode=1

tservd.port1.proxy_mode=0

tservd.port1.local_ip=0.0.0.0

tservd.port1.listen_port=999

tservd.port1.udpMode=1

tservd.port1.udpLocalPort=999

tservd.port1.udpRemotePort=888

tservd.port1.udpKaIntervalMs=0

tservd.port1.udpKaCount=3
```

```
tserverd.port1.serial_mode_gpio_control=1  
tserverd.port1.portmode=rs232
```

IEC104 to Modbus over serial using package options


```

root@VA_router:~# uci export

tserverd package tserverd

config tserverd main

# set to 1 to enable terminal server

option enable 1

# enables detailed debug logging (state transitions, data transfer etc)

option debug_ev_enable 0

# sets syslog level (0 to 7), default is 6

option log_severity 5

option debug_rx_tx_enable 0

config port 'port1'

# enables this port

option enable 1

# serial device name

option devName '/dev/ttySC0'

destination peer port IP number (two number for failover)

option ip_port1 999

option ip_port2 999

# destination peer ip address (two addresses for failover)

option remote_ip1 '127.0.0.1'

option remote_ip2 '127.0.0.1'

# keep TCP session always connected

option tcp_always_on 1

# close TCP session on detection of DSR signal low

option close_tcp_on_dsr 0

# keep serial port always open (if option not present, default is 0)

option tty_always_open 1

# Forwarding timeout in milliseconds (serial to network)

option fwd_timeout 10

# Forwarding timer mode (serial to network), 'idle'=timer re-started on each received data,

# 'aging'=timer started on first rx

option fwd_timer_mode 'idle'

# Forwarding buffer size (serial to network)

option fwd_buffer_size 300

# Forwarding buffer size (network to serial), 0=use maximum possible network rx buffer size

```

```
option sfwd_buffer_size 0

# Forwarding timeout in milliseconds (network to serial), 0=forward to serial immediately
option sfwd_timeout 0

# Forwarding timer mode (network to serial), 'idle'=timer re-started on each received data,
# 'aging'=timer started on first rx
option sfwd_timer_mode 'idle'

# serial device speed in baud
option speed 19200

# serial device word size (5,6,7,8)
option wsize 8

# serial device parity (0=none, 1=even, 2=odd)
option parity 1

# serial device number of stop bits (1 or 2)
option stops 1

# serial flow control mode (0=none, 1=RTS CTS, 2=XONXOFF)
option fc_mode 0

# time in milliseconds to start re-connecting after setting DTR low
option disc_time_ms 5000

# TCP server mode
option server_mode 1

# Proxy mode (off by default)
option proxy_mode 0

# Local IP address to listen on (0.0.0.0=listen on any interface)
option local_ip '0.0.0.0'

# TCP listen port for server mode
option listen_port 999

# UDP mode
option udpMode 1

# UDP local port UDP mode
option udpLocalPort 999

# UDP port for UDP mode
option udpRemotePort 888

# If set to non zero, send empty UDP packets every this many milliseconds to remote peer
option udpKaIntervalMs 0

# Max number of consecutive remote UDP keepalive missed (not received) before UDP
# session considered broken
```

```

option udpKaCount 3

option serial_mode_gpio_control 1

# rs232 - RS-232 mode, rs485hdx - rs485 2 wire half duplex mode in which transmitter
drives

# RTS. rs485fdx - RS485 4 wire full duplex mode. 'v23' - using V.23 leased line card driver.

# x21 - use USB serial card in sync mode

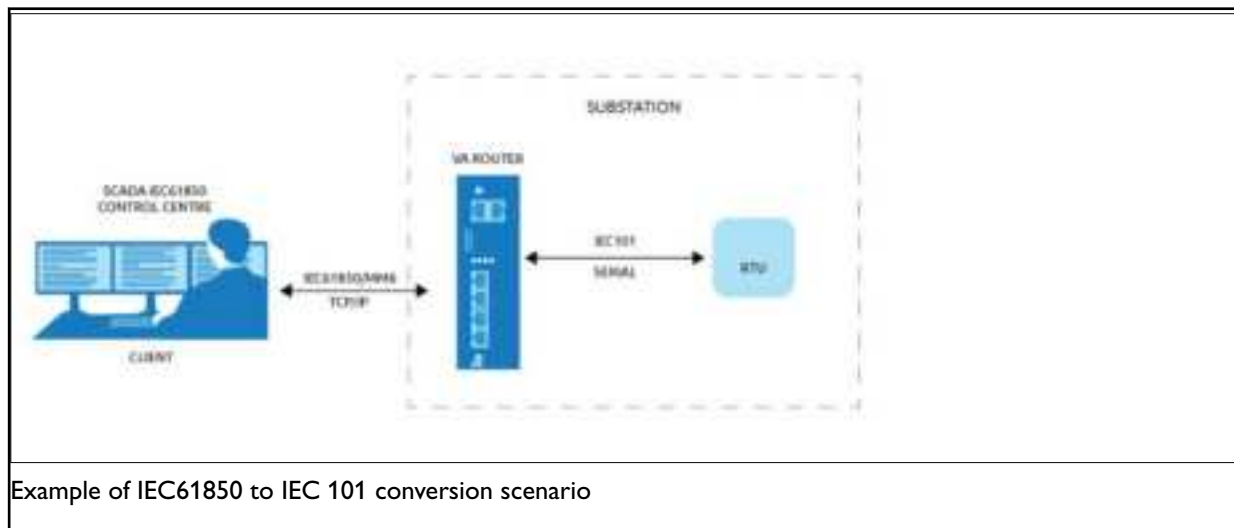
option portmode 'rs232'

```

44.8. Configuring IEC61850 To IEC101 Conversion

The IEC61850 to IEC101-unbalanced conversion feature of the router allows converting commands in the control direction and the responses and process data in the monitor direction between the SCADA master running the IEC61850 protocol and the remote RTUs running IEC101 protocol in unbalanced mode over serial interface.

In IEC101 unbalanced mode, the router supports communication of up to 32 IEC101 slaves connected onto the same serial interface.



Example of IEC61850 to IEC 101 conversion scenario

The IEC104 gateway and terminal server are used for IEC61850 to IEC101 conversion, as in the other protocol conversions however the IEC62850 options are currently not available via the web interface. The following section details command line configuration.

Web Field/UCI/Package Option	Description				
iecd port Config Section					
Web: n/a UCI: iecd.<port>.slave_protocol Opt: slave_protocol	Defines what protocol the SCADA control centre is using to connect to this gateway. <table border="1"> <tr> <td>Default: iec104</td><td>IC104</td></tr> <tr> <td>iec61850</td><td>IEC61850</td></tr> </table>	Default: iec104	IC104	iec61850	IEC61850
Default: iec104	IC104				
iec61850	IEC61850				
Web: n/a UCI: iecd.<port>.iec61850_local_ip Opt: iec61850_local_ip	Defines the local IP address this IEC61850 peer binds to.				
Web: n/a UCI: iecd.<port>.iec61850_local_tcpport Opt: iec61850_local_tcpport	Defines the local TCP port this IEC104 peer listens on. <table border="1"> <tr> <td>Default</td><td>2404</td></tr> <tr> <td>Range</td><td>1-65535</td></tr> </table>	Default	2404	Range	1-65535
Default	2404				
Range	1-65535				
iecd point Config Section					
Web: n/a UCI: iecd.point[x].iec61850_ld Opt: iec61850_ld	Defines the IEC61850 logical device name. For example: <pre>option iec61850_ld 'SENSORS'</pre> <table border="1"> <tr> <td>Range</td><td>0-32 characters</td></tr> </table>	Range	0-32 characters		
Range	0-32 characters				
Web: n/a UCI: iecd.point[x].iec61850_ln Opt: iec61850_ln	Defines the IEC61850 logical node name. For example: <pre>option iec61850_ln 'LLN0'</pre> <table border="1"> <tr> <td>Range</td><td>0-32 characters</td></tr> </table>	Range	0-32 characters		
Range	0-32 characters				
Web: n/a UCI: iecd.point[x].iec61850_do Opt: iec61850_do	Defines the IEC61850 data object name. For example: <pre>option iec61850_do 'SPS01'</pre> <table border="1"> <tr> <td>Range</td><td>0-32 characters</td></tr> </table>	Range	0-32 characters		
Range	0-32 characters				
Web: n/a UCI: iecd.point[x].iec101_type_id Opt: iec101_type_id	Defines the IEC104 type ID (data type). For example: 1 – Single Point Information 2 – Double Point Information All types are defined in IEC-60870-5-101.				
Web: IEC101 IOA UCI: iecd.point[x].iec101_ioa Opt: iec101_ioa	Defines IEC101 information object address. <table border="1"> <tr> <td>Default: 1</td><td>Single point Information</td></tr> <tr> <td>Range</td><td>1-16777215</td></tr> </table>	Default: 1	Single point Information	Range	1-16777215
Default: 1	Single point Information				
Range	1-16777215				

Relation of IEC 101 Data Types to IEC 61859 Data Type

Supported data type combinations are listed below:

option iec101_type_id (IEC101 explanation)	option iec61850_do (IEC61850 explanation)	IEC101 point R/W	IEC61850 point R/W
'1' SPI (Single Point Information)	'SPS' Single-point status	read only	read only
'1' SPI (Single Point Information)	'SPC' Controllable single-point	read-write	read-write
'1' SPI (Single Point Information)	'SPG' Single point setting	--	write only
'3' DPI (Double Point Information)	'DPS' Double-point status	read only	read only
'3' DPI (Double Point Information)	'DPC' Controllable double-point	read-write	read-write
'11' Measured value, scaled value short signed	'INS' Integer status	read only	read only
'11' Measured value, scaled value short signed	'STV' Status value	read only	read only
'11' Measured value, scaled value short signed	'ENS' Enumerated Status	read only	read only
'11' Measured value, scaled value short signed	'ENC' Controllable enumerated status	read-write	read-write
'11' Measured value, scaled value short signed	'ENG' Enumerated status setting	--	write only
'11' Measured value, scaled value short signed	'INC' Controllable integer status	read-write	read-write
'11' Measured value, scaled value short signed	'CMD' Command	--	write only
'11' Measured value, scaled value short signed	'ING' Integer status setting	--	write only
'11' Measured value, scaled value short signed	'MV' Measured Value	read only	read only
'13' Measured value, short floating point number	'MV' Measured Value	read only	read only
'13' Measured value, short floating point number	'APC' Controllable analog set point	read-write	read-write
'13' Measured value, short floating point number	'SPV' Set point value	--	write only
'13' Measured value, short floating point number	'ASG' Analog setting	--	write only

44.8.1. IEC 61850 To IEC 101 Conversion Using UCI

```
root@VA_router:~# uci show iecd
iecd.main=iecd iecd.main.enable=1
iecd.port1=port iecd.port1.enable=1
iecd.port1.loglevel=5
iecd.port1.tcp_keepalive_enabled=1
iecd.port1.tcp_keepalive_interval=5
iecd.port1.tcp_keepalive_timeout=5
iecd.port1.tcp_keepalive_count=3
iecd.port1.tcp_user_timeout=20000
iecd.port1.master_protocol=iec101
iecd.port1.slave_protocol=iec61850
iecd.port1.ioa_offset=0
iecd.port1.pointmap_file=/root/iecd/iecd_points1.csv
iecd.port1.iec104_local_ip=0.0.0.0
iecd.port1.iec104_local_tcpport=2404
iecd.port1.iec104_k=12
iecd.port1.iec104_w=9
iecd.port1.iec104_t2=10000
iecd.port1.iec104_gi_resp_time=200
iecd.port1.iec104_txq_size=128
iecd.port1.iec104_sync_time=1
iecd.port1.iec104_time_tagged_cmds=0
iecd.port1.iec104_cmd_delay_time=5000
iecd.port1.iec104_fsm_debug_on=0
iecd.port1.iec104_dump_data=0
iecd.port1.iec104_trace_on=0
iecd.port1.iec61850_local_ip=0.0.0.0
iecd.port1.iec61850_local_tcpport=104
iecd.port1.iec101_target_ip=127.0.0.1
iecd.port1.iec101_target_tcpport=999
iecd.port1.iec101_mode=unbalanced
iecd.port1.iec101_cot_tx_length=1
iecd.port1.iec101_cot_source_octet=0
iecd.port1.iec101_asdu_addrln=1
```

```

iecd.port1.iec101_info_obj_addrlen=2
iecd.port1.iec101_data_polling_time=500
iecd.port1.iec101_ack_delay=0
iecd.port1.iec101_link_addrlen=1
iecd.port1.iec101_frame_rsp_time=2000
iecd.port1.iec101_max_tx_retry=3
iecd.port1.iec101_txq_size=128
iecd.port1.iec101_send_spont_delay_acq=1
iecd.port1.iec101_fsm_debug_on=0
iecd.port1.iec101_dump_data=0
iecd.port1.iec101_trace_on=0
iecd.@iec101link[0]=iec101link
iecd.@iec101link[0].portno=1
iecd.@iec101link[0].address=6
iecd.@iec101link[0].asduaddr=6
iecd.@point[0]=point
iecd.@point[0].portno=1
iecd.@point[0].iec61850_id=SENSORS
iecd.@point[0].iec61850_ln=LLN0
iecd.@point[0].iec61850_do=SPSS01
iecd.@point[0].iec104_type_id=1
iecd.@point[0].iec104_ioa=5
iecd.@point[0].iec101_type_id=1
iecd.@point[0].iec101_ioa=5
iecd.@point[0].devaddr=1
iecd.@point[0].group=1
iecd.@point[0].index=0
iecd.@point[0].dword=0
iecd.@point[1]=point
iecd.@point[1].portno=1
iecd.@point[1].iec61850_id=SENSORS
iecd.@point[1].iec61850_ln=LLN0
iecd.@point[1].iec61850_do=SPSS02
iecd.@point[1].iec104_type_id=1
iecd.@point[1].iec104_ioa=6
iecd.@point[1].iec101_type_id=1

```

```
iecd.@point[1].iec101_ioa=6
iecd.@point[1].devaddr=1
iecd.@point[1].group=1
iecd.@point[1].index=0
iecd.@point[1].dword=0
```

IEC 61850 to IEC 101 Conversion using Package Options

```
root@VA_router:~# uci export iecd package iecd

config iecd 'main'
option enable '1'

config port 'port1'
option enable '1'
option loglevel '5'
option tcp_keepalive_enabled '1'
option tcp_keepalive_interval '5'
option tcp_keepalive_timeout '5'
option tcp_keepalive_count '3'

option tcp_user_timeout '20000' option master_protocol 'iec101' option slave_protocol 'iec61850' option ioa_offset '0'
option pointmap_file '/root/iecd/iecd_points1.csv'

# IEC104 related settings
option iec104_local_ip '0.0.0.0'
option iec104_local_tcpport '2404'
option iec104_k '12'
option iec104_w '9'
option iec104_t2 '10000'
option iec104_gj_resp_time '200'
option iec104_txq_size '128'
option iec104_sync_time '1'
option iec104_time_tagged_cmds '0'
option iec104_cmd_delay_time '5000'
option iec104_fsm_debug_on '0'
```



```

option iec104_dump_data '0'

option iec104_trace_on '0'

# IEC61850 related settings

option iec61850_local_ip '0.0.0.0'

option iec61850_local_tcpport '104'

option iec101_target_ip '127.0.0.1'

option iec101_target_tcpport '999' option iec101_mode 'unbalanced' option iec101_cot_tx_length '1'

option iec101_cot_source_octet '0'

option iec101_asdu_addrlen '1'

option iec101_info_obj_addrlen '2'

option iec101_data_polling_time '500'

option iec101_ack_delay '0'

option iec101_link_addrlen '1'

option iec101_frame_rsp_time '2000'

option iec101_max_tx_retry '3'

option iec101_txq_size '128'

option iec101_send_spont_delay_acq '1'

option iec101_fsm_debug_on '0'

option iec101_dump_data '0'

option iec101_trace_on '0'

# The following section defines IEC101 slave links used in IEC101 unbalanced mode on

# Each link is defined by a config block 'config iec101link'

# To add more links repeat the section block for each added link. To remove links, simply remove the link block from the configuration

# Maximum 32 links are supported #

# Definition of options within the section block:

# portno - port number to which this point belongs (1 to 4) # address - IEC101 slave link address

# asduaddr IEC101 slave common ASDU address

```

```
config iec101link
option portno 1
option address 6
option asduaddr 6
config point
option portno '1'
option iec61850_id 'SENSORS'
option iec61850_in 'LLN0'
option iec61850_do 'SPSS01'
option iec104_type_id '1'
option iec104_ioa '5'
option iec101_type_id 1
option iec101_ioa '5'
option devaddr '1'
option group '1'
option index '0'
option dword '0'
config point
option portno '1'
option iec61850_id 'SENSORS'
option iec61850_in 'LLN0'
option iec61850_do 'SPSS02'
option iec104_type_id '1'
option iec104_ioa '6'
option iec101_type_id 1
option iec101_ioa '6'
option devaddr '1'
option group '1'
option index '0'
option dword '0'
```

44.9. SCADA IEC 104 Gateway Diagnostics

The `iecd` and `tserv` background services are started automatically at router power up. You can manually stop, start or restart these services as follows:

iecd

```

/etc/init.d/iecd stop – stops IECD service

/etc/init.d/iecd start – starts IECD service

/etc/init.d/iecd restart – stops and starts IECD service

```

tservd

```

/etc/init.d/tservd stop – stops TSERVD service

/etc/init.d/ tservd start – starts TSERVD service

/etc/init.d/ tservd restart – stops and starts TSERVD service

```

Events

The diagnosing and protocol tracing on the router the following features are available:

- Viewing syslog events (error messages)
- Running and viewing protocol traces (using syslog)
- Viewing statistic counters and debug information using diagnostic commands

To see the appropriate debug information, you must enable different debug options.

The following table summarizes various options for tracing and diagnostics of the IEC 104 to IEC 101/DNP3/Modbus conversion:

Diagnostic Feature	IEC 104	IEC 101	DNP3	Modbus
Protocol Tracing	option log_severity '7' option iec104_trace_on '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option iec101_trace_on '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option dnp3_trace_on '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option modbus_trace_on '1' /etc/init.d/iecd restart logread -f
Viewing Rx / Tx Hex dump	option log_severity '7' option iec104_dump_data '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option iec101_dump_data '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option dnp3_dump_data '1' /etc/init.d/iecd restart logread -f	option log_severity '7' option modbus_dump_data '1' /etc/init.d/iecd restart logread -f
Viewing Statistics	iec show stats	iec show stats	iec show stats	iec show stats
Clearing Statistics	iec clear stats	iec clear stats	iec clear stats	iec clear stats
Viewing debug information	N/a	N/a	N/a	iec show modbus debug
View point loaded points	iec show points	iec show points	iec show points	iec show points

Viewing Statistics

To view IEC 104 gateway statistics, enter:

```
root@VA_router:~/iecd# iec show stats
```

Modbus Stats

```
Modbus DL Frames Rx 20 Tx 3845 TxErrs 0
Modbus DL CRCErrs 0 Bad Addr 0 LengthErrs 0 UnknownPeer 0 SessionClose 0
Modbus App PDU Rx 20 PDU Tx 3845 PDU Rx Errors 0 PDU Rx Exception 0
Modbus App PDU Rx Timeout 3825 Unknown DevAddr 0 Rx Unexpected FC 0
Modbus App PDU TxQ Overrun 0
```

IEC104 Stats

```
IEC104 DL state: CLOSED
IEC104 DL uptime: 0 hrs 0 mins 0 secs
IEC104 DL PktsRx 15 PktsTx 21 TxQ Overrun 0
IEC104 App ASDU Rx 6 ASDU Tx 12 Bad ASDU 0
```

Viewing Point Mappings

To view IEC 104 gateway point mappings, enter:

```
root@VA_router:~/iecd# iec show points
==== IEC104 point map: ====
IEC 104 Types Legend:
-----
SPI: Single point information (1 bit)
DPI: Double point information (2 bit)
MVA: Measured normalized value (16 bit signed)
MVAFP: Measured value, floating point number (32 bit signed)
SVA: Measured scaled value (16 bit signed)
BSTR32: Bitstring of 32 bits
IT: Integrated Total (Counter 32 bit)
CP24: with 3 octet time tag CP24Time2a
CP56: with 7 octet time tag CP56Time2a
NQD: Without quality descriptor
-----
(#1) IOA=64213, Val=0x00000000, IEC104Typeld=30 (SPI-CP56) DevAddr 1 Modbus pt 1, Type 0 (Discreet Input (1bit))
(#2) IOA=64214, Val=0x00000000, IEC104Typeld=30 (SPI-CP56) DevAddr 1 Modbus pt 2, Type 0 (Discreet Input (1bit))
(#3) IOA=64215, Val=0x00000000, IEC104Typeld=30 (SPI-CP56) DevAddr 1 Modbus pt 9, Type 0 (Discreet Input (1bit))
(#4) IOA=64216, Val=0x00000000, IEC104Typeld=30 (SPI-CP56) DevAddr 1 Modbus pt 10, Type 0 (Discreet Input (1bit))
(#5) IOA=64217, Val=0x00000000, IEC104Typeld=34 (MVA-CP56) DevAddr 1 Modbus pt 2, Type 1 (Input Register (16 bit))
(#6) IOA=64218, Val=0x00000000, IEC104Typeld=34 (MVA-CP56) DevAddr 1 Modbus pt 7, Type 1 (Input Register (16 bit))
(#7) IOA=64219, Val=0x00000000, IEC104Typeld=34 (MVA-CP56) DevAddr 1 Modbus pt 1, Type 2 (Holding Register (16 bit))
```

45. DNP3 Outstation Application

Merlin routers have a feature that allows the router to operate as a DNP3 outstation application. A DNP3 SCADA master can poll the router and obtain the following information:

- Router uptime in seconds.
- The serial number of the router.
- The status of up to two router interfaces.

Configuration Packages Used

Package	Sections
dnposd	dnposd

45.1. Configuring DNP3 Outstation Using The Web Interface

To configure the DNP3 outstation, from the top menu select **Services -> DNP3 Outstation**.

Check the **Enable** box and fill in your unique parameters.

The router listens for inbound UDP connections from the SCADA master on the specified port.

The web automatically names the dnposd config section 'main'.

DNP3 Outstation

Configuration of the DNP3 Outstation Daemon

Settings

Enable

☒

Local DNP Address

Master DNP Address

Master IP Address

Local Port

Local udp port to listen to incoming DNP requests

Monitor Interface 1

Name of first interface to monitor and report status

Monitor Interface 2

Name of second interface to monitor and report status

DNP3 outstation settings

Web Field/UCI/Package Option	Description				
Web: Enable UCI: dnposd.main.enabled Opt: enabled	Enables the DNP3 outstation application on the router. <table border="1"> <tr> <td>Default: 0</td><td>Disabled</td></tr> <tr> <td>1</td><td>Enabled</td></tr> </table>	Default: 0	Disabled	1	Enabled
Default: 0	Disabled				
1	Enabled				
Web: Local DNP Address UCI: dnposd.main.local_address Opt: local_address	Defines the DNP3 address of the router. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default:	Blank	Range	0-65535
Default:	Blank				
Range	0-65535				
Web: Master DNP Address UCI: dnposd.main.master_address Opt: master_address	Defines the DNP3 address of the SCADA master. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default:	Blank	Range	0-65535
Default:	Blank				
Range	0-65535				
Web: Master IP Address UCI: dnposd.main.master_host Opt: master_host	Defines the IP address of the SCADA master. Only requests from this host will be processed.				
Web: Local Port UCI: dnposd.main.local_port Opt: local_port	Defines the UDP port for the router to listen on for incoming DNP3 messages from the SCADA master. <table border="1"> <tr> <td>Default:</td><td>20000</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default:	20000	Range	0-65535
Default:	20000				
Range	0-65535				
Web: Monitor Interface1 UCI: dnposd.main.monitor_if1 Opt: monitor_if1	Defines the first interface to monitor for status. Note: the interface names need to exactly match to the physical names. You can view the physical name by using the ifconfig command via command line. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default:	Blank	Range	0-65535
Default:	Blank				
Range	0-65535				
Web: Monitor Interface2 UCI: dnposd.main.monitor_if2 Opt: monitor_if2	Defines the second interface to monitor for status. Note: the interface names need to exactly match to the physical names. You can view the physical name by using the ifconfig command via command line. <table border="1"> <tr> <td>Default:</td><td>Blank</td></tr> <tr> <td>Range</td><td>0-65535</td></tr> </table>	Default:	Blank	Range	0-65535
Default:	Blank				
Range	0-65535				

45.2. Configuring DNP3 Outstation Using Command Line

DNP3 outstation is configured under the dnposd package /etc/config/dnp3osd

DNP3 Outstation using UCI

```
root@VA_router:~# uci show dnposd
dnposd.main=dnposd
dnposd.main.local_port=20000
dnposd.main.enabled=yes
dnposd.main.local_address=1
dnposd.main.master_address=2
dnposd.main.master_host=10.1.10.21
dnposd.main.monitor_if1=wwan0
dnposd.main.monitor_if2=pppoa-DSL
```

Modify these commands by running a `uci set <parameter>` command followed by `uci commit`.

DNP3 Outstation using Package Options

```
root@VA_router:~# uci export dnposd
package dnposd
config dnposd 'main'
option local_port '20000'
option enabled 'yes'
option local_address '1'
option master_address '2'
option master_host '10.1.10.21'
option monitor_if1 'wwan0'
option monitor_if2 'pppoa-DSL'
```

45.3. DNP3 Outstation Diagnostics

Restarting dnposd

To restart dnposd service, enter:

```
root@VA_router:~# /etc/init.d/dnposd restart
```

Tracing DNP3 Packets

By default, the DNP3 outstation listens on UDP port 20000. To trace UDP packets on port 20000, enter:

```
root@VA_router:~# tcpdump -i any -n udp -p port 20000 &
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 65535 bytes
```

To stop tracing, enter `fg` to bring tracing task to foreground, and then **<CTRL-C>** to stop the trace.

```
root@VA_router:~# fg
tcpdump -i any -n udp -p port 20000
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
```


46. Configuring The Dual Use Serial/Digital Input Port

The RJ45 dual use port is configurable to act as either RS-232 or as a digital input. With no configuration on the router the port will operate as a digital input. To operate as an RS-232 serial port the terminal server must be configured correctly.



NOTE

The default Westermo factory configuration will have the port configured for RS-232 operation.

46.1. RJ45 Pin Numbering

Please refer to the ‘Hardware Specification’ chapter in this document for the pin numbering of the RS-232 and digital input signals

46.2. Configuring The Dual Use Port For RS-232

This section describes how to configure the port for RS-232.

46.2.1. Configuration Package Used

Package	Sections
tservd	main
	port

Table 11. The sections of the TSERVD package

46.2.2. Configuring The Dual Use Port For RS-232 Using The Web UI

In the top menu, select **SCADA -> Terminal Server**. The TSERVD configuration page appears. You must configure two sections:

- Main Settings to enable the terminal server and other global settings.
- Port Settings to configure the serial interface for RS-232 operation and any other required RS232 settings.



NOTE

This section only details options to ensure the dual use port operates as RS232. For more detailed Terminal Server configuration please see ‘Configuring the Terminal Server’ section in this document.

Enable The Terminal Server

In the **Main Settings**, ensure the checkbox for the **Enable** configuration option is enabled.

TSERVD

Configuration of TSERVD. TSERVD is a Terminal Server application which converts traffic between TCP or UDP IP and Serial Interfaces.

Main Settings

Enable

☒

enable VA Terminal Server

Debug Enable

☐

enables detailed debug logging (state transitions, data transfer etc)

Syslog severity

Informational

Log RX-TX

☐

enable logging data transfers

The TSERVD main settings section

Web Field/UCI/Package Option	Description
Web: Enable	Enables the Terminal Server on the router. Ensure Enable is checked
UCI: tservd.main.enable	
Opt: enable	

Web	Description	UCI
Default: checked	Enabled	1
unchecked	Disabled	0

Table 12. Information table for the TSERVD main settings section

Configure The Serial Interface For RS-232 Operation

Scroll down to **Port Settings** and select the **Serial** tab. Ensure **Serial Port** is set to serial1 and **Port Mode** is set to RS-232.

Port Settings

PORT1

General

Serial

Network

Advanced

Serial Port

serial1

Serial port name

Port Mode

RS-232

Serial interface mode

The TSERVD port serial settings configuration section

Web Field/UCI/Package Option	Description		
Web: Serial Port	Sets the serial port. Select serial1		
UCI: tservd.@port[0]. serialPortName			
Opt: serialPortName			
	Web	Description	UCI
	serial1	RS232 mode.	serial1
Web: Port mode	Sets the serial interface mode. Select RS-232		
UCI: tservd.@port[0].port_mode			
Opt: port_mode			
	Web	Description	UCI
	Default: RS-232	RS232 mode.	rs232

Information table for TSERVD port serial settings

Configure any other additional settings for desired RS-232 behaviour and select **Save & Apply**.

46.2.3. Configuring The Dual Use Port For RS-232 Using UCI

```
root@We-Host:~# uci show tservd
tservd.main=tservd
tservd.main.enable=1
...
tservd.port1=port
tservd.port1.serialPortName=serial1
tservd.port1.portmode=rs232
...
```

46.2.4. Configuring The Dual Use Port For RS-232 Using Package Options

```
root@We-Host:~# uci export tservd
package tservd

config tservd 'main'
    option enable '1'

config port 'port1'
    option serialPortName 'serial1'
    option portmode 'rs232'
```

46.3. Configuring The Dual Use Port For Digital Input

To enable the dual use port for digital input configuration, ensure that the Terminal Server is disabled. There are currently no configuration options for digital input operation.

46.3.1. Configuring The Dual Use Port For Digital Input Using The Web UI

In the top menu, select **SCADA -> Terminal Server**. In the Main Settings section, ensure the checkbox for the **Enable** is disabled.

TSERVD

Configuration of TSERVD. TSERVD is a Terminal Server application which converts traffic between TCP or UDP IP and Serial Interfaces.

Main Settings

Enable

☐

enable VA Terminal Server

Debug Enable

☐

enables detailed debug logging (state transitions, data transfer etc)

Syslog severity

Informational

▼

Log RX-TX

☐

enable logging data transfers

The TSERVD main settings configuration section

Web Field/UCI/Package Option	Description											
Web: Enable	Enables the Terminal Server on the router. Ensure Enable is unchecked											
UCI: tservd.main.enable												
Opt: enable												
	<table><tr><th>Web</th><th>Description</th><th>UCI</th></tr><tr><td>checked</td><td>Enabled</td><td>1</td></tr><tr><td>Default: unchecked</td><td>Disabled</td><td>0</td></tr></table>	Web	Description	UCI	checked	Enabled	1	Default: unchecked	Disabled	0		
Web	Description	UCI										
checked	Enabled	1										
Default: unchecked	Disabled	0										

The TSERVD main settings configuration section

If any changes were made, select **Save & Apply**.

46.3.2. Configuring The Dual Use Port For Digital Input Using UCI

```
root@We-Host:~# uci show tservd
tservd.main=tservd
tservd.main.enable=0
```

46.3.3. Configuring The Dual Use Port For Digital Input Using Package Options

```
root@We-Host:~# uci export tservd
package tservd

config tservd 'main'
    option enable '0'
```

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