BEC MX-1000

MXConnect M2M
Advanced In-Vehicle 4G LTE
Wireless Router

User Manual

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Chapter 1: Introduction

Introduction to your Router

Embedded Dual 4G LTE Industrial Router

MX-1000, Embedded Dual 4G LTE Industrial Router, is integrated with the 802.11n Wireless Access Point and Dual WAN interfaces featuring reliable connectivity and network expandability. This cutting-edge networking device provides multi-GNSS engine for GPS, GLONASS, Galileo and QZSS system for remotely tracking and monitoring vehicles. M1000 is uniquely installed dual 4G LTE modules enabling an extensive range of mission-critical markets to enjoy a robust, always-on Internet experience by plugging dual SIMs. Fallback and Failover between dual 4G LTE connections supports a seamless wireless connection and is perfectly suitable for industrial M2M applications, ranging from fleet management, public safety, smart bus & transportation, automotive, agriculture, construction, and retail services.

Extraordinary Connectivity with Solid Data Protection

The MX-1000 features a rugged, compact design with integrated dual 4G LTE WAN ports, 4-port Gigabit Ethernet switch, 802.11n Wi-Fi access point with multiple SSID supports, and two multi-function USB 2.0 host interfaces for Storage/NAS. SPI firewall, and advanced VPN integration provide security needed to enhance the operations of Public Safety, Energy Wellhead and Gas Industry, Industrial M2M Segment, PoS/Kiosks/ATM, Fleet Management, and Smart Transportation/Bus.

Vehicle Tracking System

MX-1000 is embedded with a GNSS receiver for GPS or GLONASS. To co-work with On-Board Diagnostics(OBD) system, it eases the central control of geographically-dispersed fleets by presenting individual vehicles' detailed information, including remaining fuel levels, rapid accelerations, and locations.

Robust Design to Withstand in the Harshest Environments

The industrial-grade enclosure is designed to resist heat, dust, moisture and provides long-term operation in the toughest of environments. M1000 supports an extended temperatures range from -40 to 140º F (-40 to 60º C) for extremely challenging conditions such as industrial automation, mining plants, wellhead & gas drilling, manufacturing factories, and virtually anywhere that requires a robust wireless connection.

The Future of Internet Connectivity - 4G LTE

To offer an advanced network solution that meets the growing demands of M2M services, MX-1000 exclusively features dual WAN - load balance or auto-failover/failback to provide extraordinary, always-on internet connectivity. In addition to the deployment of dual 4G LTE modules and dual SIMs, MX-1000 broadens wireless coverage to rough terrains and rural areas and persists seamless connectivity without interruptions.

Secure VPN Connections

The MX-1000 supports comprehensive and robust IPSec VPN (Virtual Private Network) protocols for business users to establish private encrypted tunnels over the public Internet to secure data transmission between headquarters and branch offices. It also supports VPN dial in from smart phones for secure remote Internet connection via your home broadband. With a built-in DES/3DES VPN accelerator, the router enhances IPSec VPN performance significantly.

IPv6 Supported

Internet Protocol version 6 (IPv6) is a version of the Internet Protocol that is designed to succeed IPv4. IPv6 has a vastly larger address space than IPv4. The router is already supporting IPv6, you can use it in IPv6 environment no need to change device. The dual-stack protocol implementation in an operating system is a fundamental IPv4-to-IPv6 transition technology. It implements IPv4 and IPv6 protocol stacks either independently or in a hybrid form. The hybrid form is commonly implemented in modern operating systems supporting IPv6.

Quick Start Wizard

Support a WEB GUI page to install this device quickly. With this wizard, simple steps will get you connected to the Internet immediately.

Firmware Upgradeable

Device can be upgraded to the latest firmware through the WEB based GUI.

Features & Specifications

- Dual 4G LTE broadband connectivity (3G Fallback optional)
- Dual-WAN 4G LTE interface for network expandability and reliable connectivity
- High performance antenna for increased coverage, signal reception and efficiency
- Embedded GNSS engine for real-time asset tracking and location data-based applications
- Enterprise level routing functionality
- Gigabit Ethernet WAN (GbE WAN) for Cable/Fiber/xDSL high WAN throughput
- Gigabit Ethernet LAN
- IPv6 ready (IPv4/IPv6 dual stack)
- Multiple wireless SSIDs with wireless guest access and client isolation
- IEEE 802.11 b/g/n compliant Wireless Access Point with Wi-Fi Protected Setup (WPS)
- Wi-Fi Protected Access (WPA-PSK/ WPA2-PSK) and Wired Equivalent Privacy (WEP)
- Secured IPSec VPN with powerful DES/ 3DES/ AES
- Secured PPTP VPN with Pap/ Chap/ MPPE authentication
- Secured L2TP VPN with Pap/Chap authentication
- Secured GRE VPN tunnel
- 32 secured VPN tunnels
- Firewall Security with DoS Preventing and Packet Filtering
- Quality of Service Control for traffic prioritization management
- Universal Plug and Play (UPnP) Compliance
- Ease of Use with Quick Installation Wizard
- USB port for NAS (FTP/ SAMBA server)
- Global Navigation Satellite System (GNSS)
- Small form factor with multiple mounting options, easily installed by a single person
- Power ignition control option when mounted within vehicles
- Hardened enclosure with Industrial-graded components
- Designed to withstand hypothermia, heat and protect from shock, vibration, etc.

High-speed Mobile Wireless Communication

- Embedded Dual 4G LTE module
- High performance external antenna

Global Navigation Satellite System (GNSS)

- Embedded Dual 4G LTE module

- High performance external antenna

Network Protocols and Features

- IPv4, IPv6 or IPv4/IPv6 Dual Stack
- NAT, Static Routing and RIP-1/2
- DHCPv4/v6
- Universal Plug and Play (UPnP) Compliant
- Dynamic Domain Name System (DDNS)
- Virtual Server and DMZ
- SNTP, DNS proxy
- IGMP snooping and IGMP proxy
- MLD snooping and MLD proxy

Firewall

- Built-in NAT Firewall
- Stateful Packet Inspection (SPI)
- DoS attack prevention including Land Attack, Ping of Death, etc
- Access control
- IP&MAC filter, URL Content Filter
- Password protection for system management
- VPN pass-through

Quality of Service Control

- Traffic prioritization management based-on Protocol, Port Number and IP Address (IPv4/IPv6)

IPTV Applications[*2]

- IGMP proxy and IGMP snooping
- MLD proxy and MLD snooping
- Interface Grouping (VLAN)
- Quality of Service (QoS)

Wireless LAN

- Compliant with IEEE 802.11 b/g/n standards
- 2.4 GHz - 2.484GHz radio band for wireless
- Up to 300 Mbps wireless operation rate
- 64/128 bits WEP supported for encryption
- WPS (Wi-Fi Protected Setup) for easy setup

- Wireless Security with WPA-PSK, WPA2-PSK support
- WDS repeater function support
- Multiple SSID
- Wireless client isolation

USB Application Server

- Storage/NAS: SAMBA Server, FTP Server

Virtual Private Network (VPN)

- IPSec VPN Tunnels
- PPTP VPN Tunnels
- L2TP VPN Tunnels
- GRE VPN Tunnels

Management

- Quick Installation wizard
- Web-based GUI for remote and local management
- Firmware upgrades and configuration data upload and download via web-based GUI
- Supports DHCP server / client / relay
- Supports SNMP v1, v2, v3, MIB-I and MIB-II
- TR-069[*1] supports remote management

NOTE:	1. On request for Telco / ISP projects 2. IPTV application may require subscription to IPTV services from a Telco / ISP. 3. Specifications on this datasheet are subject to change without prior notice.

Hardware Specifications

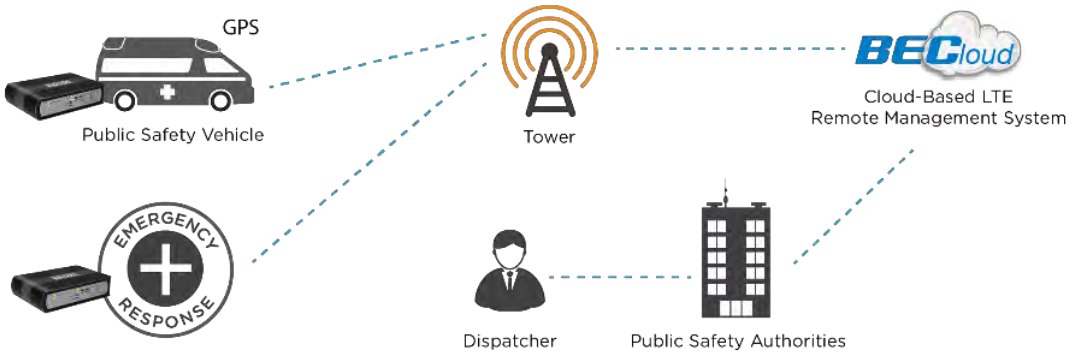
Physical interface

- 4G LTE module: 2 Embeded 4G LTE modules
- Ethernet: 4-port 10 / 100 / 1000Mbps auto-crossover (MDI / MDI-X) Switch
- EWAN: Ethernet port #4 can be configured as an EWAN port for connecting to Cable/Fiber/xDSL modem for Broadband connectivity.
- GNSS: Embeded GNSS
- SIM card slot: 2 mini-SIM(2FF) card slots
- USB: 2 USB 2.0 Type A Host port for storage service
- Mini USB: 2 mini USB connectors for 4G LTE module debug
- 4G LTE antenna: 4 detachable antennas (2 antennas for each 4G LTE module)
- GPS antenna: 1 active GPS antenna
- WiFi antenna: 2 detachable wireless antennas
- Factory default reset button
- Wireless on/off and WPS push button
- 4-pin power connector

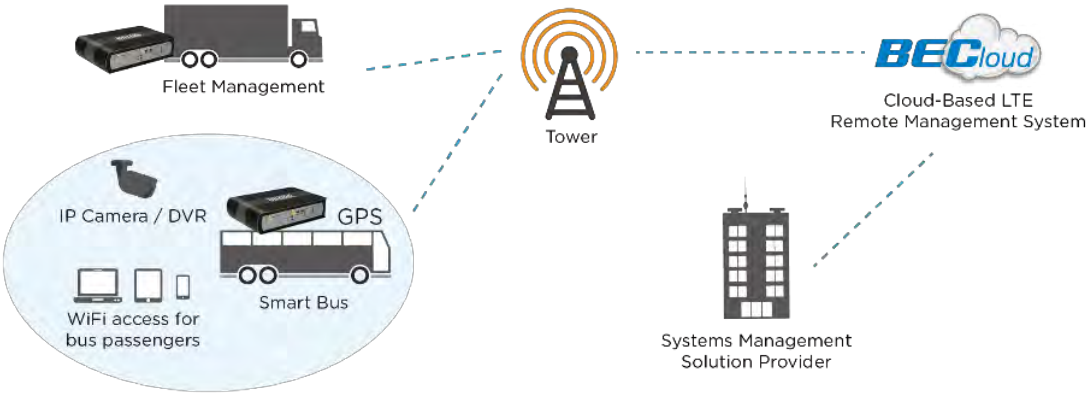
Application Diagram

The MX-1000 is specifically designed to provide outstanding network efficiency and internet security for a wide range of applications and vertical M2M market segments.

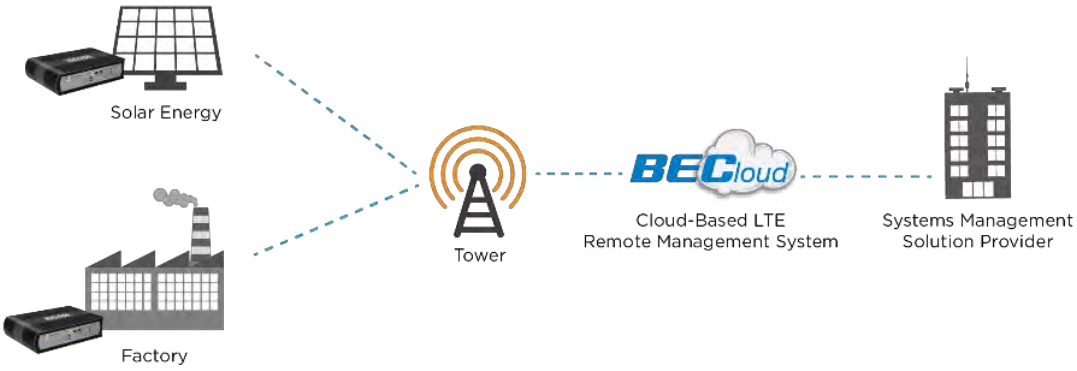
Public Safety:



Fleet Management / Smart Bus:



Energy Industry Segment:



Chapter 2: Product Overview

Important Note for Using This Router

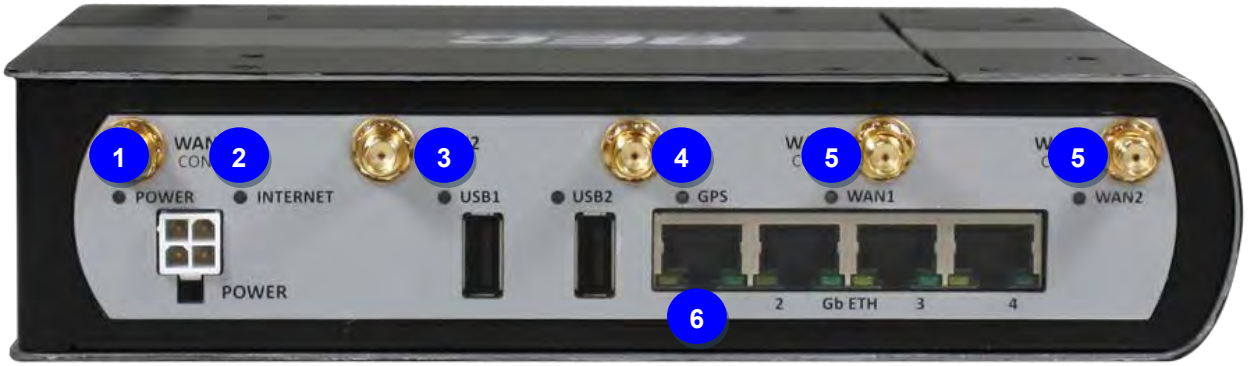
Warning

- ✓ Do not use the router in high humidity or high temperature.
- ✓ Do not open or repair the case yourself. If the device becomes too hot, turn off the power immediately and have it repaired at a qualified service center.
- ✓ Avoid using this product and all accessories outdoors.

Device Description

Index	Item	Description
1	**WiFi antenna**	Screw the supplied WiFi antennas onto the antenna connectors
2	**WiFi/WPS LED**	The single-colour LED behaves as follows: Green: Wireless connection established Green blinking: Data being transmitted / received
3	**WiFi On/Off & WPS button**	By controlling the pressing time, users can achieve two different effects: **(1) WiFi On/Off:** Press & hold the button for **more than 6 seconds** to On/Off the wireless. **(2) WPS:** Press &hold the button for **less than 6 seconds** to trigger WPS function.
4	**Reset button**	After the device is powered on, press it **6 seconds or above**: to restore to factory default settings (this is used when you cannot login to the router, e.g. forgot your password)
5	**Mini USB port**	Connecting to a USB dongle or a hard drive.
6	**SIM card slot**	Insert the mini SIM card(2FF) with the gold contact facing up. Push the mini SIM card(2FF) inwards to eject it **Warning: Before inserting or removing the SIM card, you must disconnect the router from the power adapter.**

Index	Item	Description
1	**4G LTE 1 antenna**	Screw the supplied 4G LTE antennas onto the antenna connectors for 4G LTE module 1.
2	**4G LTE 2 antenna**	Screw the supplied 4G LTE antennas onto the antenna connectors for 4G LTE module 2.
3	**GPS antenna**	Screw the supplied GPS antenna onto the antenna connectors.
4	**Power Jack**	Connect the supplied Power cable to this jack
5	**USB port**	The USB can support setup for storage/file sharing. Connect an external USB dongle / hard drive for storage.
6	**Gigabit Ethernet (LAN 1 ~ LAN 4)**	Connect a UTP Ethernet cable (Cat-5 or Cat-5e) to one of the four LAN ports when connecting to a PC or an office/home network of 10Mbps/ 100Mbps/ 1000Mbps



Index	Item	Description	
1	**Power LED**	The Power dual-colour LED behaves as shown below.	
		Green	System is up and ready
		Red	Boot failure
2	**Internet LED**	The Internet dual-colar LED behaves as shown below.	
		Green	IP connected and traffic is passing through the device.
		Red	IP request failed.
		Off	Either in bridged mode or WAN connection not present.
3	**USB LED**	The single-colar LED behaves as shown below.	
		Green	Connecting to a USB dongle or a hard drive.
4	**GPS LED**	The single-colar LED behaves as shown below.	
		Green	GPS active
5	**WAN LED (Received Signal Strength Indicator)**	The 4G LTE received signal dual-colar LED behaves as shown below.	
		Green	RSSI greater than -69 dBm. Excellent signal condition.
		Green Flashing quickly	RSSI from -81 to -69 dBm. Good signal condition
		Red Flashing quickly	RSSI from -99 to -81 dBm. Fair signal condition.
		Red Flashing slowly	RSSI less than -99 dBm. Poor signal condition.
		Red	No signal and the 4G LTE module is in service
		Off	No LTE module or LTE module fails
6	**Ethernet LED**	The dual-colour LED behaves as shown below.	
		Green	Transmission speed is at Gigabit speed (1000Mbps)
		Orange	Transmission speed is at 10/100Mbps
		Blinking	Data being transmitted/received

The detail instruction in Reset Button

Recovery procedures for non-working routers (e.g. after a failed firmware upgrade flash):

Power on the router, once the Power LED lit red, please press this reset button using the end of paper clip or other small pointed object immediately.

The router's emergency-reflash web interface will then be accessible via http://192.168.1.1 where you can upload a firmware image to restore the router to a functional state.

Please note that the router will only respond with its web interface at this address (**192.168.1.1**), and will not respond to ping request from your PC or other telnet operations.

Note:

Before starting recovery process, please configure the IP address of the PC as 192.168.1.100 and proceed with the following step-by-step guide.

1. Power the router off.

2. Press reset button and power on the router, once the Power lights Red, keeping press reset button over 6 seconds.

3. Internet led flashes Green, router entering recovery procedure and router's IP will reset to Emergency IP address (Say 192.168.1.1).

4. Open browser and access http://192.168.1.1 to upload the firmware.

5. Internet led lit Red, and router starts to write firmware into flash. Please DO NOT power off the router at this step.

6. Internet led lit Green when successfully upgrade firmware.

7. Power the router off and then on.

Cabling

One of the most common causes of problems is bad cabling. Make sure that all connected devices are turned on. On the front panel of the product is a bank of LEDs. Verify that the LAN Link and LEDs are lit. If they are not, verify that you are using the proper cables.

Chapter 3: Basic Installation

The router can be configured with your web browser. A web browser is included as a standard application in the following operating systems: Windows XP / Vista / 7 / 8, Linux, Mac OS, etc. The product provides an easy and user-friendly interface for configuration.

PCs must have an Ethernet interface installed properly and be connected to the router either directly or through an external repeater hub, and have TCP/IP installed and configured to obtain an IP address through a DHCP server or a fixed IP address that must be in the same subnet as the router. The default IP address of the router is **192.168.1.254** and the subnet mask is **255.255.255.0** (i.e. any attached PC must be in the same subnet, and have an IP address in the range of 192.168.1.1 to 192.168.1.253). The best and easiest way is to configure the PC to get an IP address automatically from the router using DHCP. If you encounter any problems accessing the router's web interface it may also be advisable to **uninstall** any kind of software firewall on your PCs, as they can cause problems accessing the 192.168.1.254 IP address of the router. Users should make their own decisions on how to best protect their network.

Please follow the steps below for your PC's network environment installation. First of all, please check your PC's network components. The TCP/IP protocol stack and Ethernet network adapter must be installed. If not, please refer to your Windows-related or other operating system manuals.

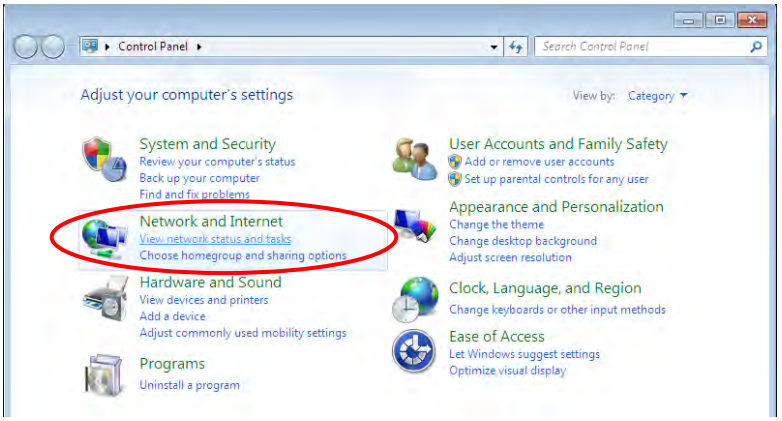
NOTE:

Any TCP/IP capable workstation can be used to communicate with or through the **MX-1000**. To configure other types of workstations, please consult the manufacturer's documentation.

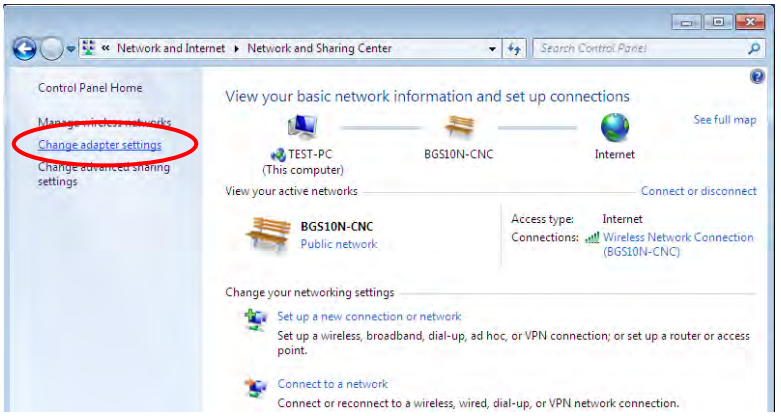
Network Configuration – IPv4

Configuring PC in Windows 7/8 (IPv4)

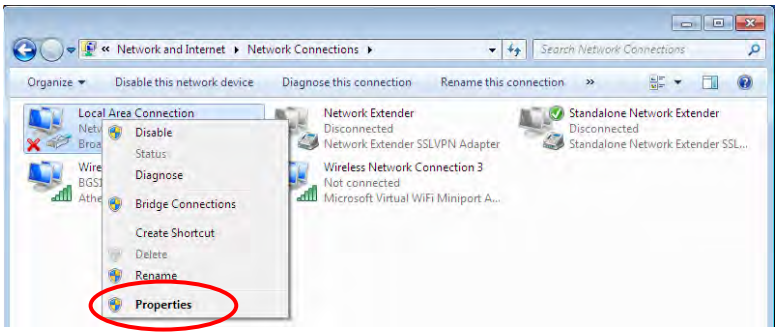
1. Go to **Start**. Click on **Control Panel**.
2. Then click on **Network and Internet**.



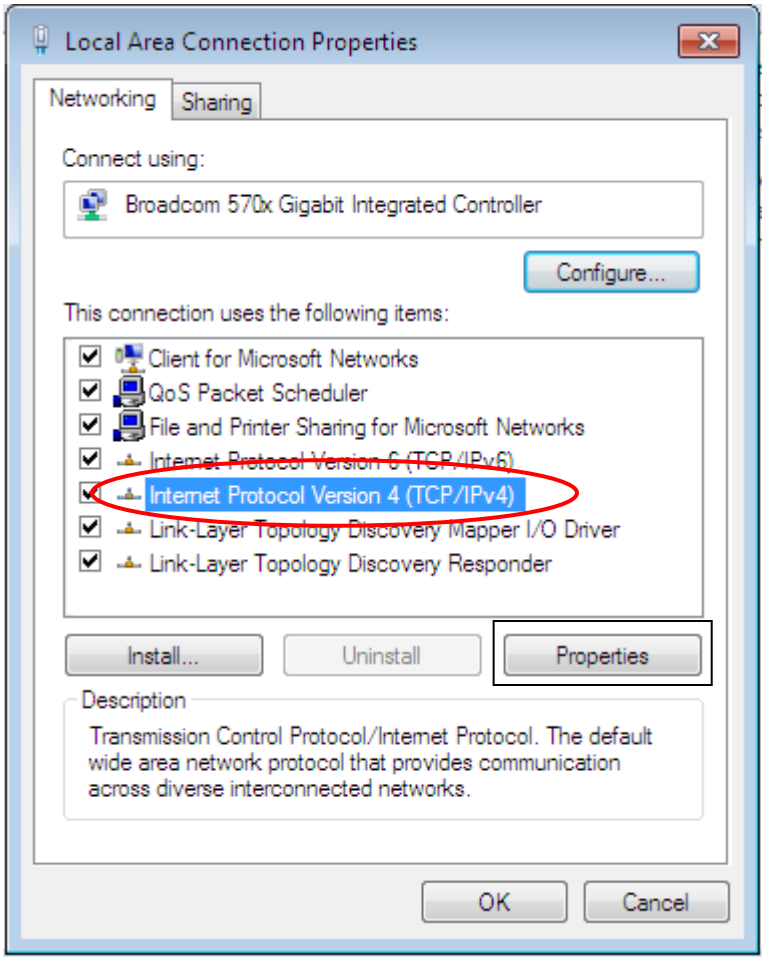
3. When the **Network and Sharing Center** window pops up, select and click on **Change adapter settings** on the left window panel.



4. Select the **Local Area Connection**, and right click the icon to select **Properties**.

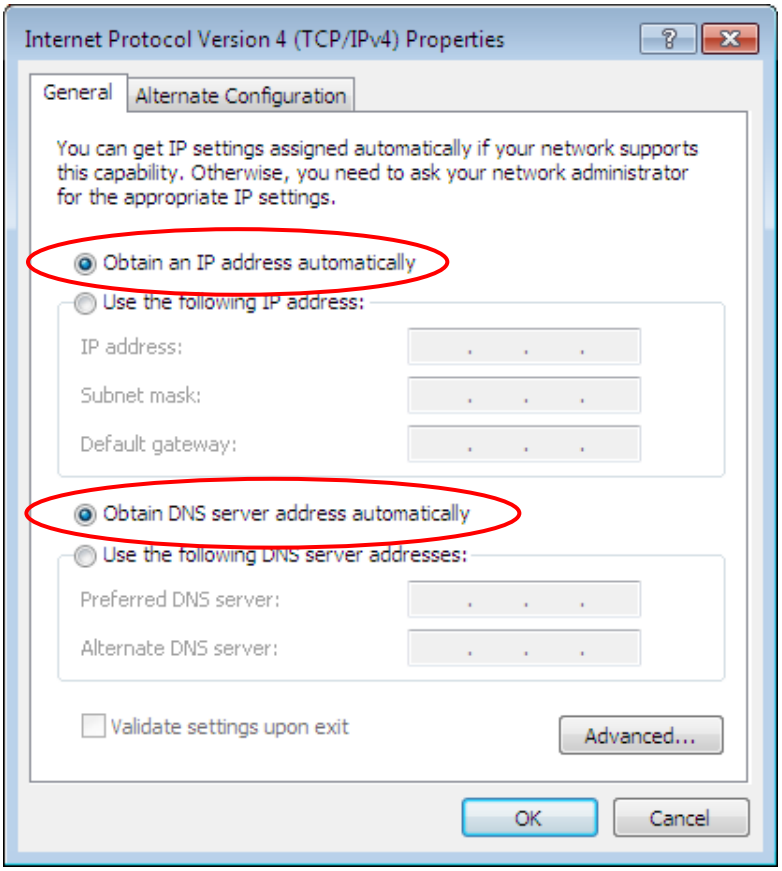


5. Select **Internet Protocol Version 4 (TCP/IPv4)** then click **Properties**.



6. In the **TCP/IPv4 properties** window, select the **Obtain an IP address automatically** and **Obtain DNS Server address automatically** radio buttons. Then click **OK** to exit the setting.

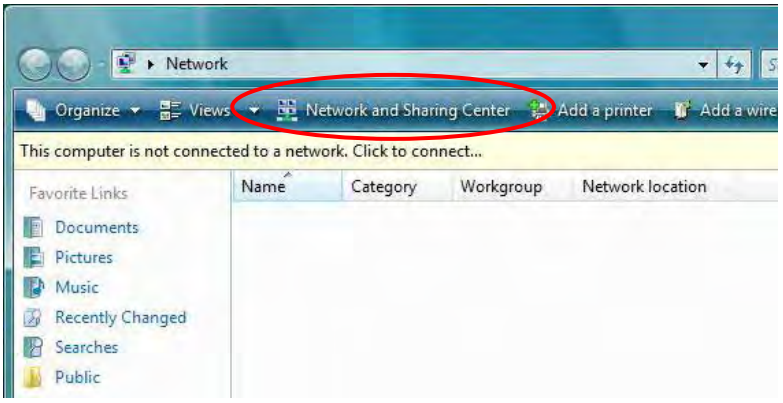
7. Click **OK** again in the **Local Area Connection Properties** window to apply the new configuration.



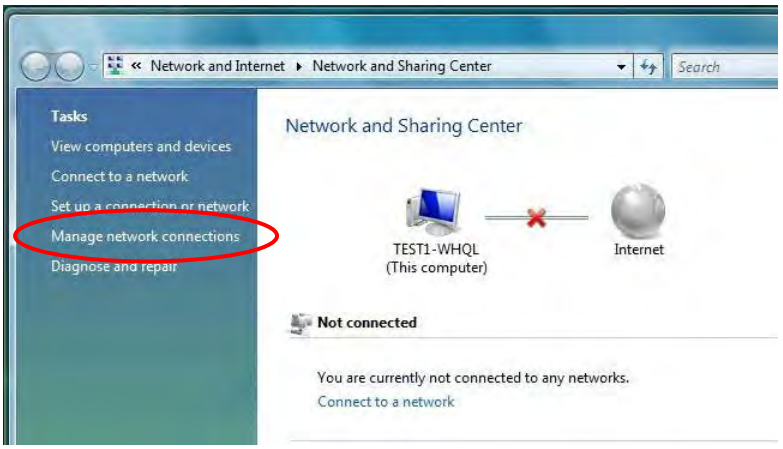
Configuring PC in Windows Vista (IPv4)

1. Go to **Start**. Click on **Network**.

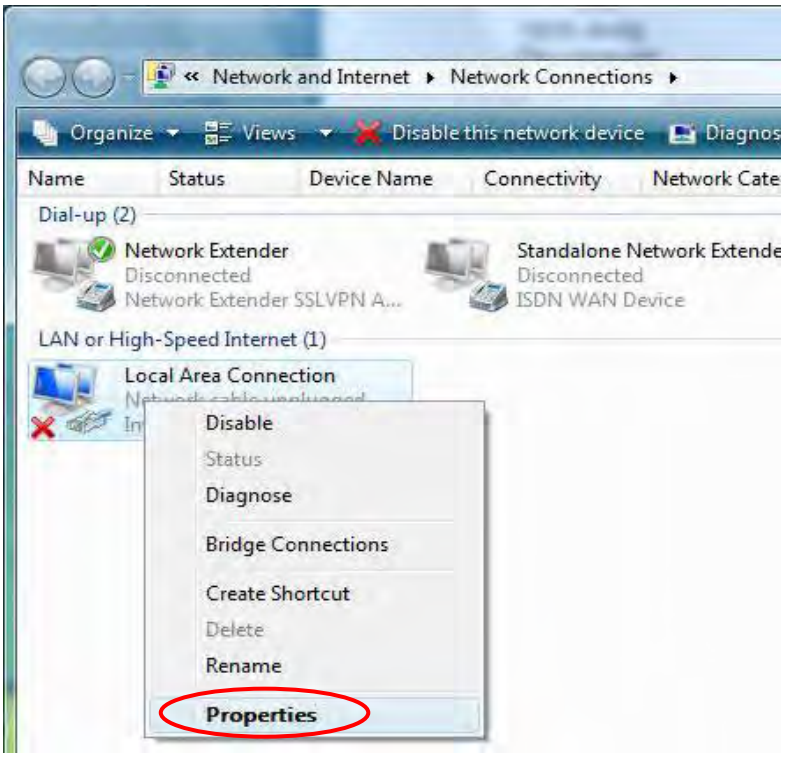
2. Then click on **Network and Sharing Center** at the top bar.



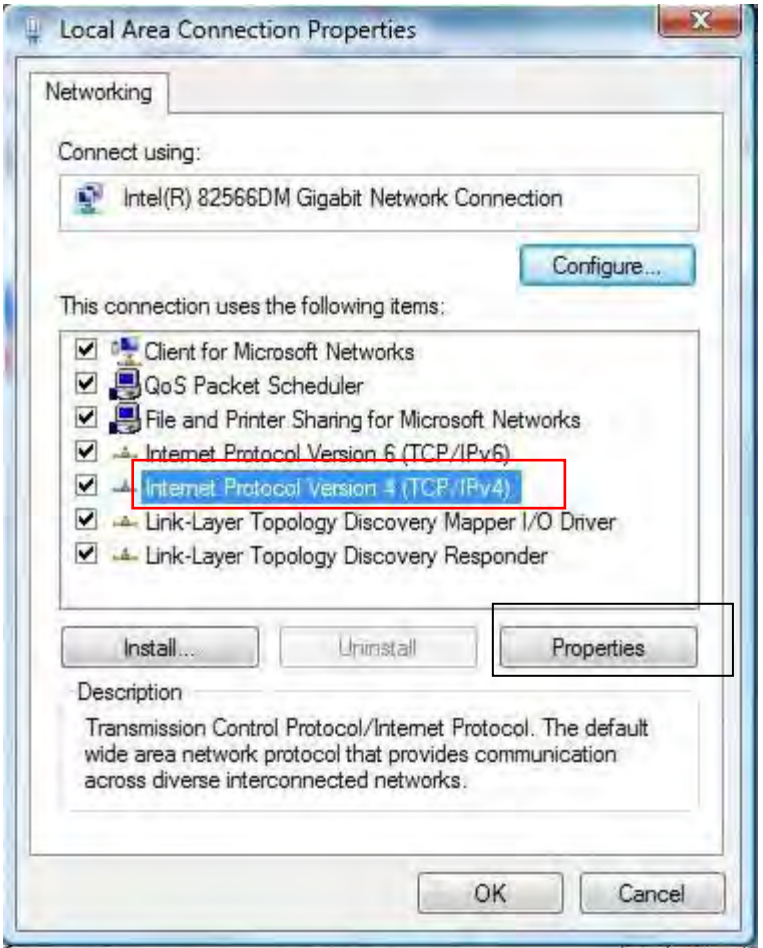
3. When the **Network and Sharing Center** window pops up, select and click on **Manage network connections** on the left window pane.



4. Select the **Local Area Connection**, and right click the icon to select **Properties**.

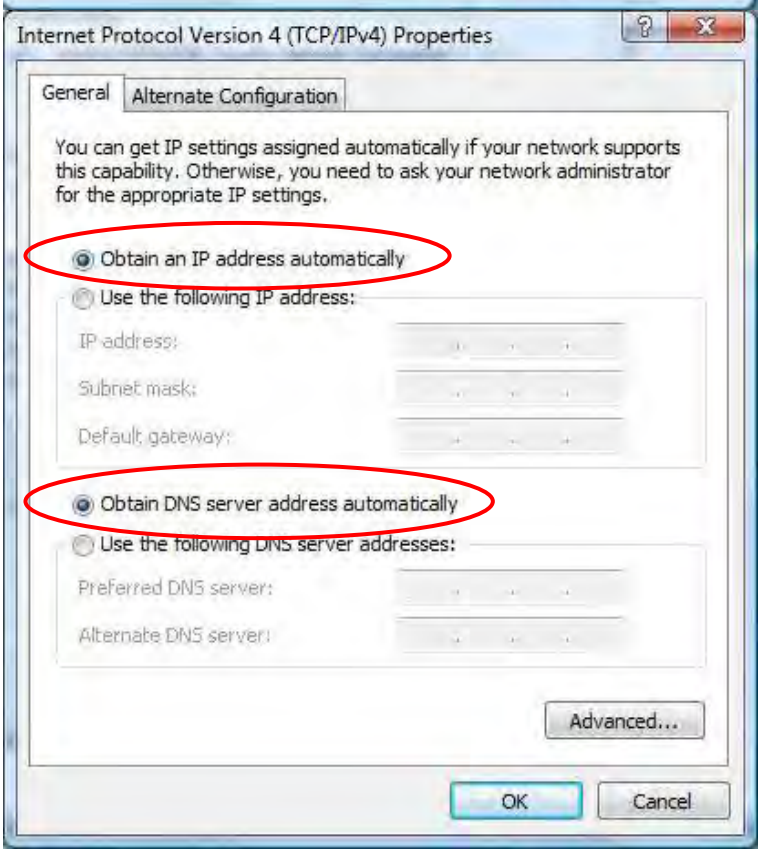


5. Select **Internet Protocol Version 4 (TCP/IPv4)** then click **Properties**.



6. In the **TCP/IPv4 properties** window, select the Obtain an **IP address automatically** and **Obtain DNS Server address automatically** radio buttons. Then click **OK** to exit the setting.

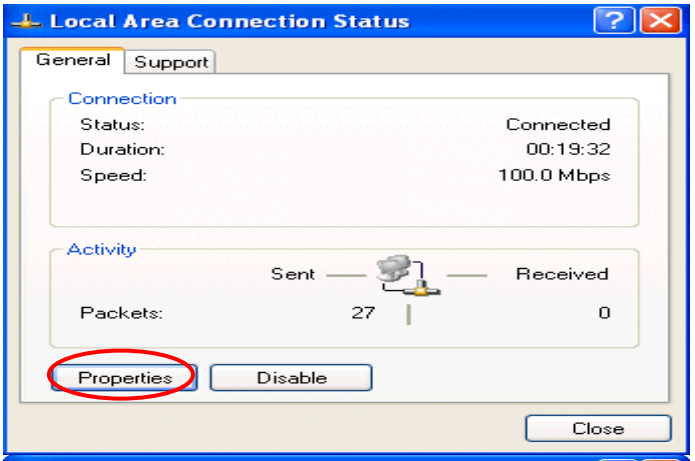
7. Click **OK** again in the **Local Area Connection Properties** window to apply the new configuration.



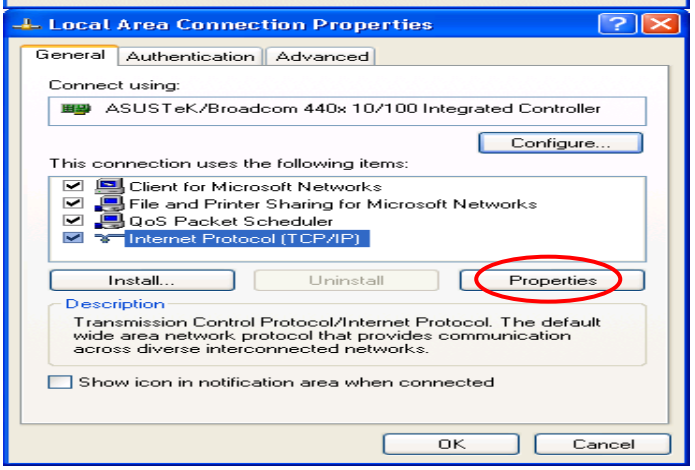
Configuring PC in Windows XP (IPv4)

1. Go to **Start**. Click on **Control Panel.**
2. Then click on **Network and Internet**.

3. In the **Local Area Connection Status** window, click **Properties**.

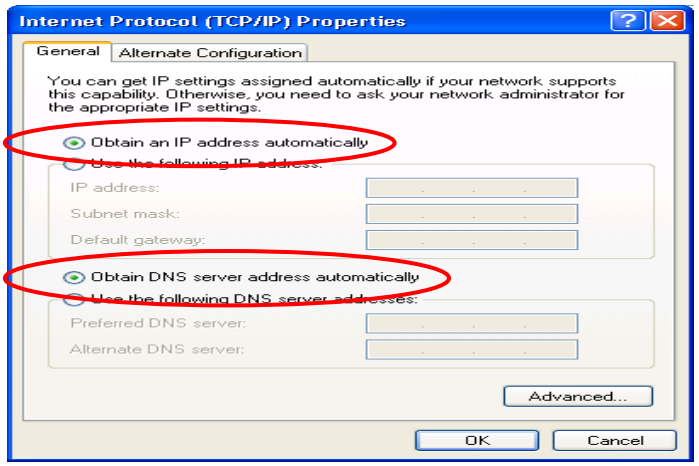


4. Select **Internet Protocol (TCP/IP)** and click **Properties**.



5. Select the **Obtain an IP address automatically** and the **Obtain DNS server address automatically** radio buttons.

6. Click **OK** to finish the configuration.

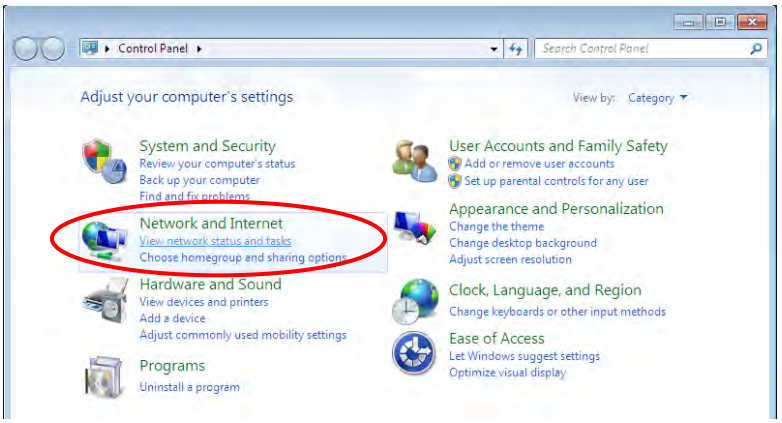


Network Configuration – IPv6

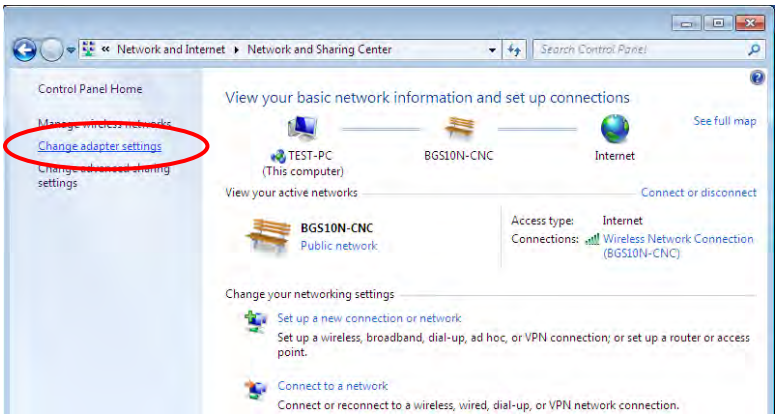
Configuring PC in Windows 7/8 (IPv6)

1. Go to **Start**. Click on **Control Panel**.

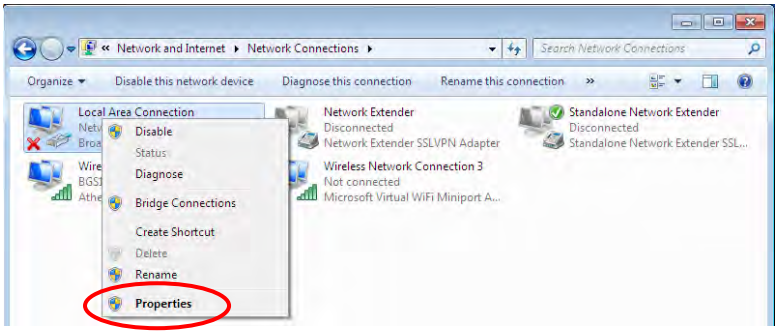
2. Then click on **Network and Internet**.



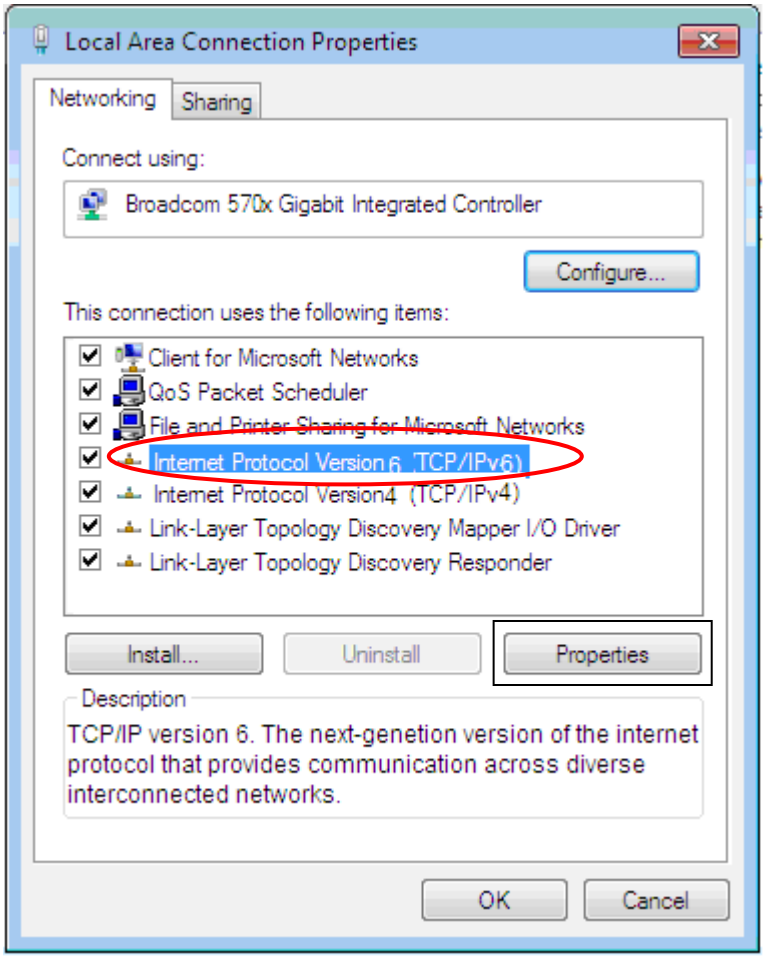
3. When the **Network and Sharing Center** window pops up, select and click on **Change adapter settings** on the left window panel.



4. Select the **Local Area Connection**, and right click the icon to select **Properties**.

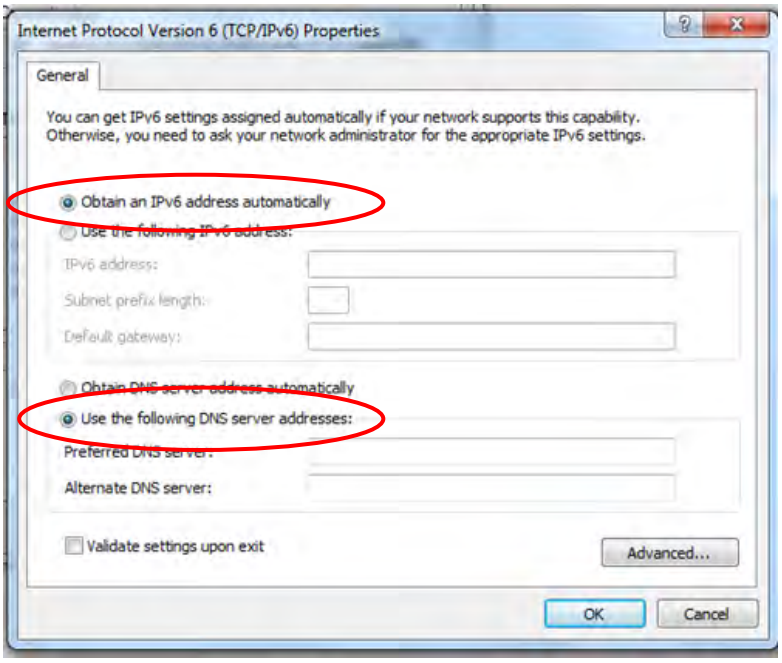


5. Select **Internet Protocol Version 6 (TCP/IPv6)** then click **Properties**.



6. In the **TCP/IPv6 properties** window, select the **Obtain an IPv6 address automatically** and **Obtain DNS Server address automatically** radio buttons. Then click **OK** to exit the setting.

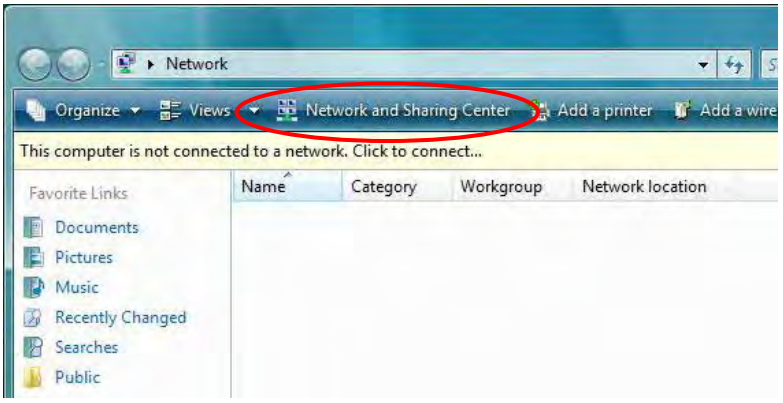
7. Click **OK** again in the **Local Area Connection Properties** window to apply the new configuration.



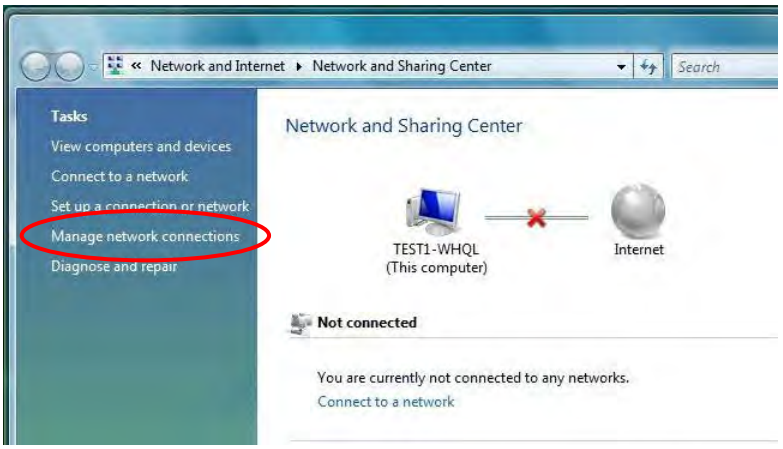
Configuring PC in Windows Vista (IPv6)

1. Go to **Start**. Click on **Network**.

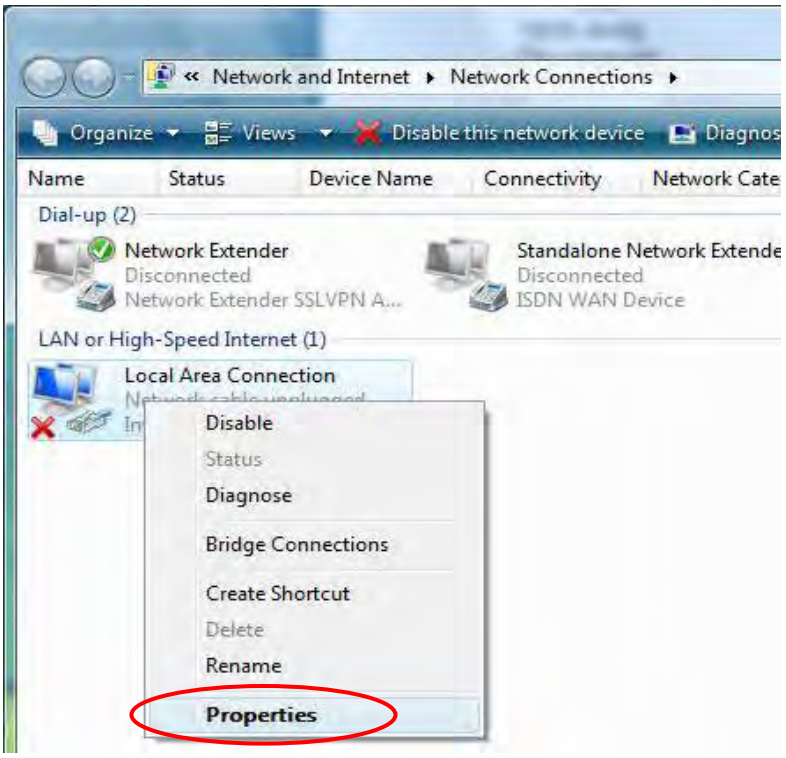
2. Then click on **Network and Sharing Center** at the top bar.



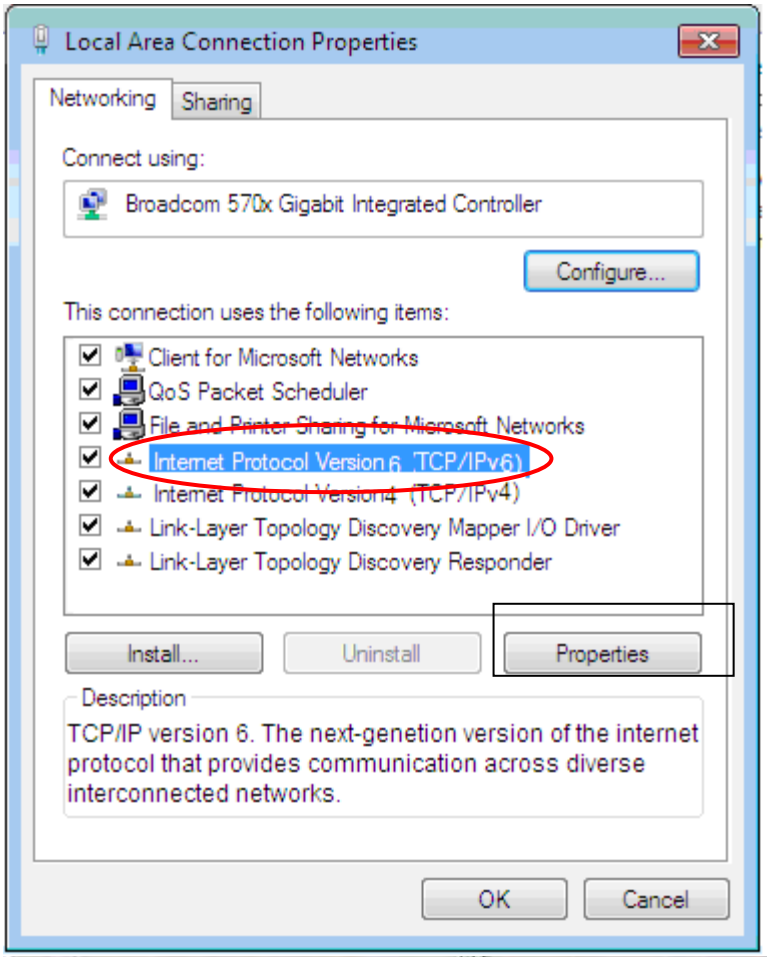
3. When the **Network and Sharing Center** window pops up, select and click on **Manage network connections** on the left window pane.



4. Select the **Local Area Connection**, and right click the icon to select **Properties**.

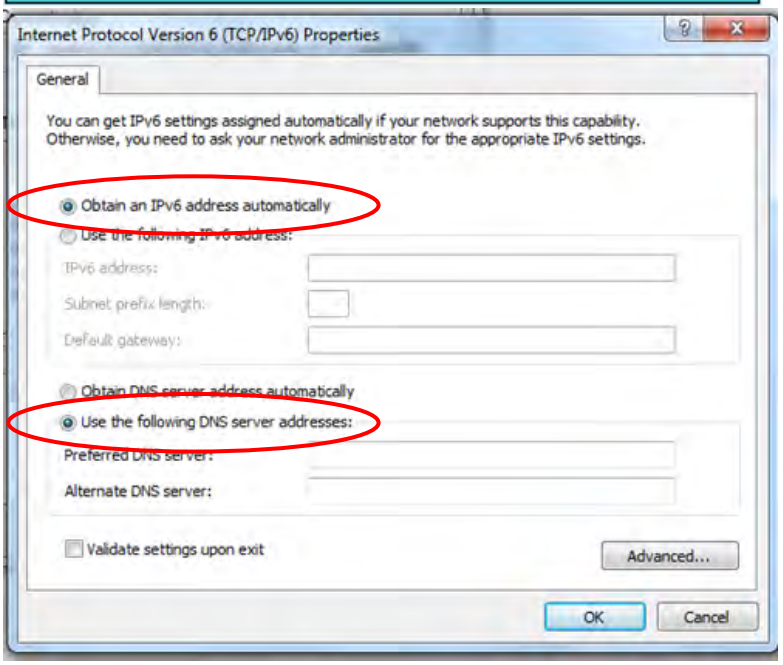


5. Select **Internet Protocol Version 6 (TCP/IPv6)** then click **Properties**.



6. In the **TCP/IPv6 properties** window, select the Obtain an **IP address automatically** and **Obtain DNS Server address automatically** radio buttons. Then click **OK** to exit the setting.

7. Click **OK** again in the **Local Area Connection Properties** window to apply the new configuration.

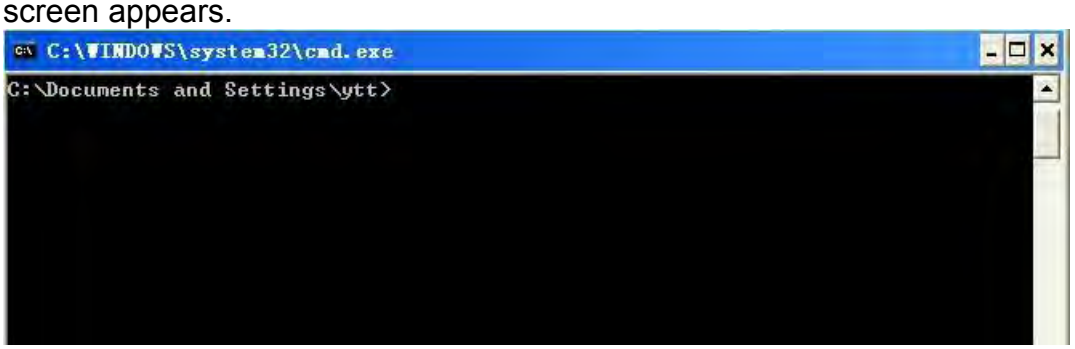


Configuring PC in Windows XP (IPv6)

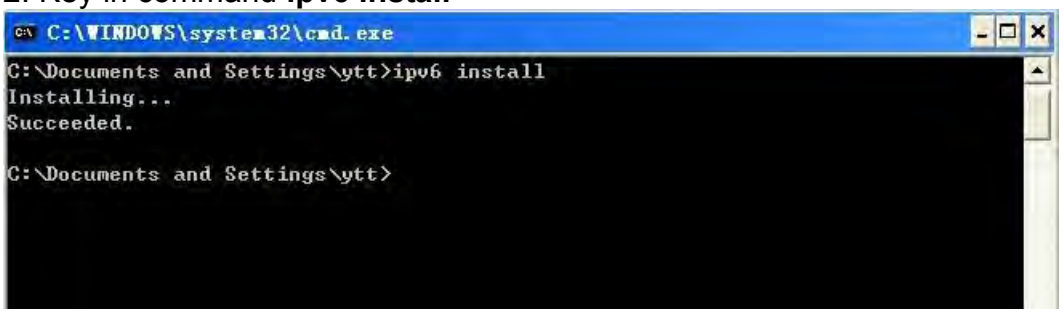
IPv6 is supported by Windows XP, but you need to install it first.

Please follow the steps to install IPv6:

1. On the Desktop, Click **Start** > **Run**, type **cmd**, then press **Enter** key in the keyboard, the following screen appears.



2. Key in command **ipv6 install**



Installation of IPv6 is now completed. Please test it to see if it works or not. .

Default Settings

Before configuring the router, you need to know the following default settings.

Web Interface: (Username and Password)

- ✔ Username: admin
- ✔ Password: admin

The default username and password are “**admin**” and “**admin**” respectively.

If you ever forget the username/password to login to the router, you may press the RESET button up to 6 seconds then release it to restore the factory default settings.
Caution: After pressing the RESET button for more than 6 seconds then release it, to be sure you power cycle the device again.

Device LAN IP Settings

- ✔ IP Address: 192.168.1.254
- ✔ Subnet Mask: 255.255.255.0

DHCP Server:

- ✔ DHCP server is enabled.
- ✔ Start IP Address: 192.168.1.100
- ✔ IP pool counts: 100

Information from Your ISP

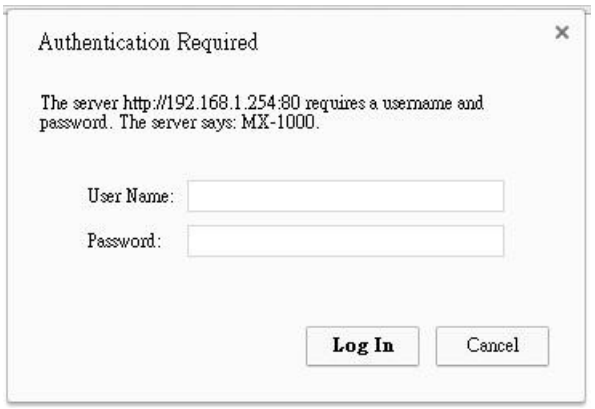
Before configuring this device, you have to check with your ISP (Internet Service Provider) what kind of service is provided such as **4G LTE** or **EWAN** ((Dynamic IP address, Static IP address, PPPoE, Bridge Mode).

Chapter 4: Device Configuration

Login to your Device

Open your web browser, enter the IP address of your router, which by default is **192.168.1.254**, and click "**Go**", a user name and password window prompt appears.

The default username and password is **"admin"** and **"admin"** respectively for the **Administrator.**



Congratulations!

You have successfully logged on to your MX-1000 !

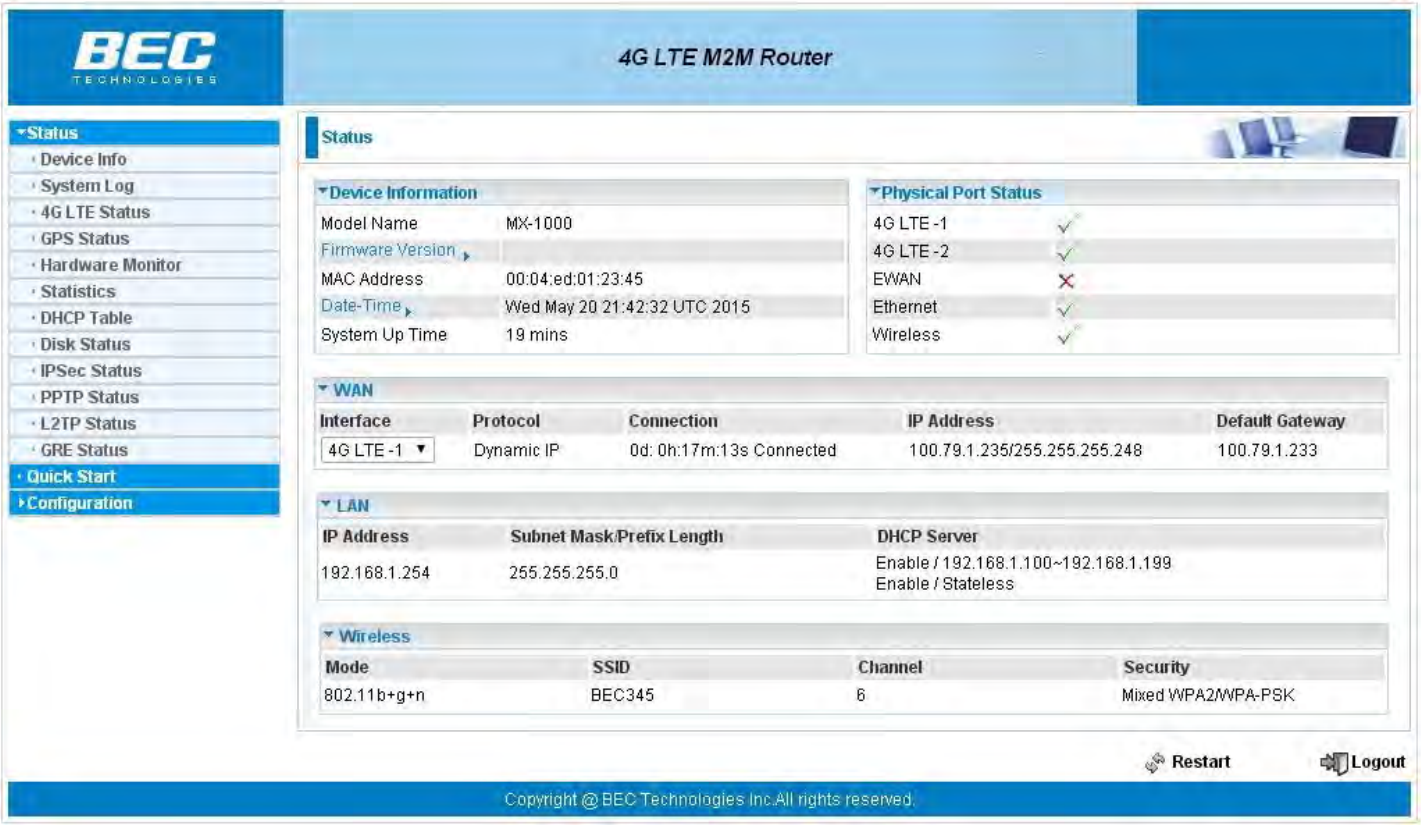
Once you have logged on to your MX-1000 via your web browser, you can begin to set it up according to your requirements. On the configuration homepage, the left navigation pane links you directly to the setup page, which includes:

- **Status**(Device Info, System Log, 4G LTE Status, GPS Status, Hardware Monitor, Statistics, DHCP Table, Disk Status, IPSec Status, PPTP Status, L2TP Status, GRE Status)
- **Quick Start** (Wizard Setup)
- **Configuration** (Interface Setup, Dual WAN, Advanced Setup, VPN, Access Management, Maintenance)

Please see the relevant sections of this manual for detailed instructions on how to configure your gateway.

Status

In this section, you can check the router working status, including **Device Info**, **System Log**, **4G LTE Status, GPS Status, Hardware Monitor, Statistics**, **DHCP Table, Disk Status**, **IPSec Status, PPTP Status, L2TP Status, GRE Status.**



Device Info

It contains basic information of the device.

Device Information

Model Name: Show model name of the router

Firmware Version: This is the Firmware version

MAC Address: This is the MAC Address

Date Time: The current date and time.

System Up Time: The duration since system is up.

Physical Port Status

Here the page shows the status of physical port of 4G LTE, EWAN, Ethernet and Wireless.

WAN

Interface: The WAN interface, "4G LTE-1", "4G LTE-2" and "EWAN".

Protocol: The protocol in use.

Connection: The connection status of the link.

IP Address: The WAN interface IP address obtained.

Default Gateway: The default gateway address.

LAN

IP Address: LAN IP address.

Subnet Mask/Prefix Length: Subnet mask for IPv4 or Prefix length for IPv6 on LAN..

DHCP Server: LAN port DHCP information.

Wireless

Mode: The wireless mode in use.

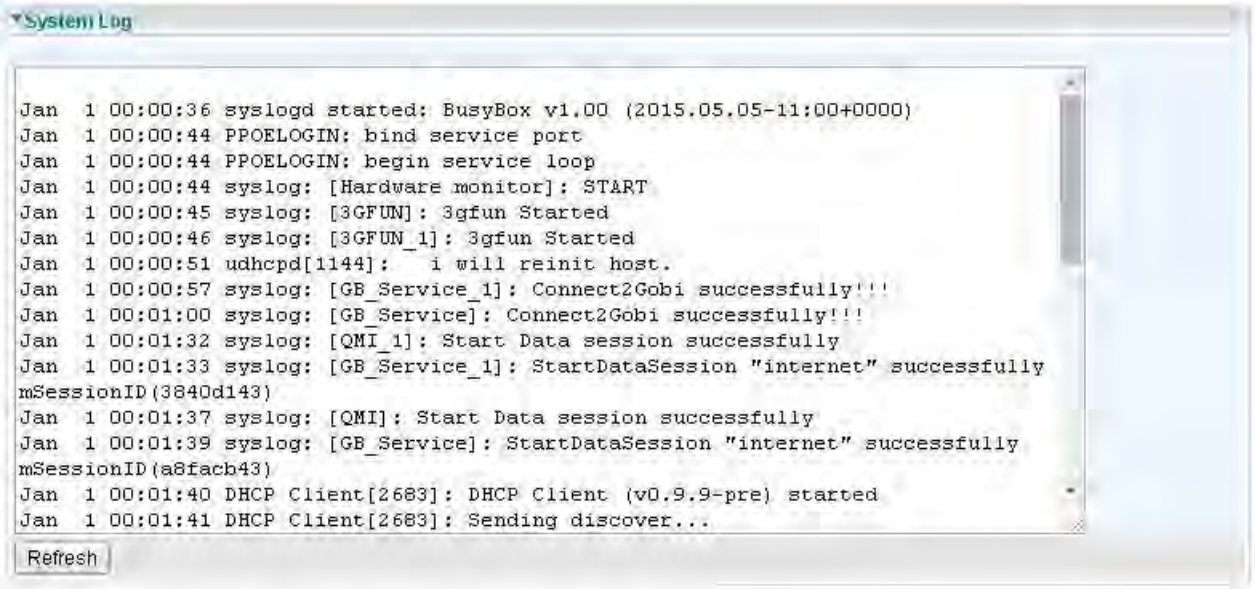
SSID: The SSID.

Channel: The current channel.

Security: The wireless security setting, authentication type.

System Log

In system log, you can check the operations status and any glitches to the router.



Refresh: Press this button to refresh the statistics.

3G/4G-LTE Status

This page contains 3G/4G-LTE connection information.

4G LTE Status	
WAN	4G LTE -1
Status	Up
Signal Strength	-64.00dbm
Signal Information	RSRP:-90 , RSRQ:-13 , SINR:3.6
Network Name	"Chunghwa Telecom"
Cell ID	04D4520D(81023501)
Card IMEI	
Card IMSI	
Network Mode	LTE
Network Band	B3

Refresh

Status: The current status of the 4G LTE connection.

Signal Strength: The signal strength bar and dBm value indicates the current 4G LTE signal strength. The front panel 4G LTE Signal Strength LED indicates the signal strength as well.

Signal Information: Shows important LTE signal parameters such as RSRP (Reference Signal Receiving Power), RSRQ (Reference Signal Receiving Quality), SINR (Signal to Interference plus Noise Ratio).

- RSRP (Reference Signal Receiving Power): is the average power of all resource elements which carry cell-specified reference signals over the entire bandwidth.
- RSRQ (Reference Signal Receiving Quality): measures the signal strength and is calculated based on both RSRP and RSSI.
- RSSI (Received Signal Strength Indicator): parameter which provides information about total received wide-band power (measure in all symbols) including all interference and thermal noise.
- SINR (Signal to Interference plus Noise Ratio): is also a measure of signal quality as well. It is widely used by the operators as it provides a clear relationship between RF conditions and throughput. NOTE: Some LTE modules do not provide this information.

Network Name: The name of the LTE network the router is connecting to.

Cell ID: The ID of base station that the device is connected to.

Card IMEI: The unique identification number that is used to identify the 4G LTE module.

Card IMSI: The international mobile subscriber identity used to uniquely identify the user of a celluar network – a number provisioned in the SIM card..

Network Mode: Show the using network mode.

Network Band: Show the using network band.

Refresh: Press this button to refresh the statistics.

GPS Status

In GPS status, you can check the UTC time, position of the router.

Hardware Monitor

In hardware monitor, you can check the voltage, current and temperature of system.

Statistics

❖ 4G LTE

Statistics	
Traffic Statistics	
Interface	4G LTE -1 4G LTE -2 EWAN Ethernet Wireless
Transmit Statistics	
Transmit Frames of Current Connection	71
Transmit Bytes of Current Connection	9873
Transmit Total Frames	71
Transmit Total Bytes	9873
Receive Statistics	
Receive Frames of Current Connection	13
Receive Bytes of Current Connection	1642
Receive Total Frames	13
Receive Total Bytes	1642
Refresh	

Interface: List all available network interfaces in the router. You are currently checking on the physical status of **3G/4G-LTE** interface**.**

Transmit Frames of Current Connection: This field displays the total number of 4G LTE frames transmitted until the latest second for the current connection.

Transmit Bytes of Current Connection: This field shows the total bytes transmitted till the latest second for the current connection for the current connection.

Transmit Total Frames: The field displays the total number of frames transmitted till the latest second since system is up.

Transmit Total Bytes: This field displays the total number of bytes transmitted until the latest second since system is up.

Receive Frames of Current Connection: This field displays the number of frames received until the latest second for the current connection.

Receive Bytes of Current Connection: This field shows the total bytes received till the latest second for the current connection.

Receive Total Frames: This field displays the total number of frames received until the latest second since system is up.

Receive Total Bytes: This field displays the total frames received till the latest second since system is up.

❖ EWAN

Interface: List all available network interfaces in the router. You are currently checking on the physical status of the **EWAN** port**.**

Transmit Frames: This field displays the total number of frames transmitted until the latest second.

Transmit Multicast Frames: This field displays the total number of multicast frames transmitted till the latest second.

Transmit Total Bytes: This field displays the total number of bytes transmitted until the latest second.

Transmit Collision: This is the number of collisions on this port.

Transmit Error Frames: This field displays the number of error packets on this port.

Receive Frames: This field displays the number of frames received until the latest second.

Receive Multicast Frames: This field displays the number of multicast frames received until the latest second.

Receive Total Bytes: This field displays the number of bytes received until the latest second.

Receive CRC Errors: This field displays the number of error packets on this port.

Receive Under-size Frames: This field displays the number of under-size frames received until the latest second.

Refresh: Press this button to refresh the statistics.

❖ Ethernet

Statistics

Traffic Statistics	
Interface	4G LTE -1 4G LTE -2 EWAN Ethernet Wireless
Transmit Statistics	
Transmit Frames	1771
Transmit Multicast Frames	1004
Transmit Total Bytes	710823
Transmit Collision	0
Transmit Error Frames	0
Receive Statistics	
Receive Frames	585
Receive Multicast Frame	10
Receive Total Bytes	129986
Receive CRC Errors	0
Receive Under-size Frames	0

Refresh

Interface: List all available network interfaces in the router. You are currently checking on the physical status of the **Ethernet** port**.**

Transmit Frames: This field displays the number of frames transmitted until the latest second.

Transmit Multicast Frames: This field displays the number of multicast frames transmitted until the latest second.

Transmit Total Bytes: This field displays the number of bytes transmitted until the latest second.

Transmit Collision: This is the number of collisions on this port.

Transmit Error Frames: This field displays the number of error packets on this port.

Receive Frames: This field displays the number of frames received until the latest second.

Receive Multicast Frames: This field displays the number of multicast frames received until the latest second.

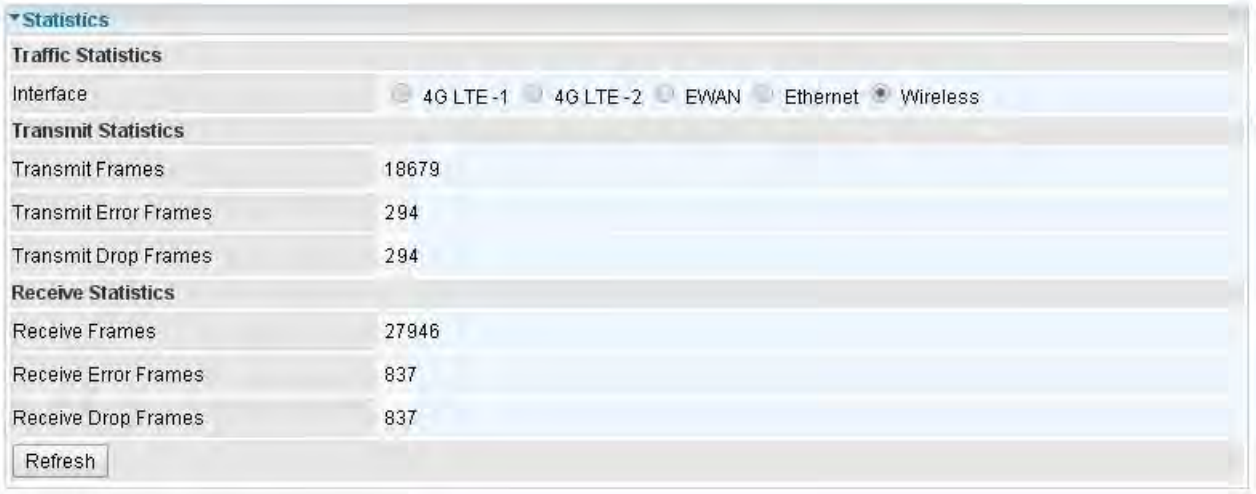
Receive Total Bytes: This field displays the number of bytes received until the latest second.

Receive CRC Errors: This field displays the number of error packets on this port.

Receive Under-size Frames: This field displays the number of under-size frames received until the latest second.

Refresh: Press this button to refresh the statistics.

❖ Wireless



Statistics	
Traffic Statistics	
Interface	4G LTE-1 4G LTE-2 EWAN Ethernet Wireless
Transmit Statistics	
Transmit Frames	18679
Transmit Error Frames	294
Transmit Drop Frames	294
Receive Statistics	
Receive Frames	27946
Receive Error Frames	837
Receive Drop Frames	837
Refresh	

Interface: List all available network interfaces in the router. You are currently checking on the physical status of the **Wireless.**

Transmit Frames: This field displays the number of frames transmitted until the latest second.

Transmit Error Frames: This field displays the number of error frames transmitted until the latest second.

Transmit Drop Frames: This field displays the number of drop frames transmitted until the latest second.

Receive Frames: This field displays the number of frames received until the latest second.

Receive Error Frames: This field displays the number of error frames received until the latest second.

Receive Drop Frames: This field displays the number of drop frames received until the latest second.

Refresh: Press this button to refresh the statistics.

DHCP Table

DHCP table displays the devices connected to the router with clear information.

DHCP Table

Index	Host Name	IP Address	MAC Address	Expire Time
1	Billion-HC-ee	192.168.1.101	00:C0:9F:D1:E1:CA	0days 23:36:1

Index: The index identifying the connected devices.

Host Name: Show the hostname of the PC.

IP Address: The IP allocated to the device.

MAC Address: The MAC of the connected device.

Expire Time: The total remaining interval since the IP assignment to the PC.

Disk Status

Disk Status

Partition	Disk Space(KB)	Free Space(KB)
usb1_1	15718272	14033064
usb2_1	15734652	11170204

Partition: Display the USB storage partition.

Disk Space (KB): Display the total storage space of the NAS in Kbytes unit.

Free Space (KB): Display the available space in Kbytes unit.

IPSec Status

IPSec Status

Index	Action	Connection Name	Active	Connection State	Statistics	Remote Gateway	Remote Network	Local Network
0	Connect Drop	H-to-B	Yes	Phase1 Established Phase2 Established	191408/43308	69.121.1.30	192.168.0.0/24	192.168.1.0/24

Refresh

Index: The IPSec tunnel index number.

Action: Connect or Drop the connection.

Connection Name: User-defined IPSes VPN connection name.

Active: Show if the tunnel is active for connection.

Connection State: Show the IPSec phase 1 and phase 2 connecting status.

Statistics: Display the upstream/downstream traffic per session in KB. The value clears when session disconnects.

Remote Gateway: The IP of the remote IPSec gateway.

Remote Network: The IP and netmask of remote access range.

Local Network: The IP and netmask of local access range.

PPTP Status

❖ PPTP Server

PPTP Status

PPTP Server

Index	Connection Name	Active	Connection State	Connection Type	Assigned IP Address	Remote Network
1	HS-LL	Yes	Yes	Lan to Lan	192.168.1.2	192.168.0.0 / 255.255.255.0

PPTP Client

Index	Connection Name	Active	Connection State	Connection Type	Server IP Address	Remote Network

Refresh

Index: The PPTP server tunnel index number.

Connection Name: Show user-defined PPTP VPN connection name.

Active: Show if the tunnel is active for connection.

Connection State: Show the connecting status.

Connection Type: Remote Access or LAN to LAN.

Assigned IP Address: Show the IP assigned to the client by PPTP Server.

Remote Network: Display the remote network and subnet mask in LAN to LAN PPTP connection.

Refresh: Click this button to refresh the connection status.

❖ PPTP Client

PPTP Status

PPTP Server

Index	Connection Name	Active	Connection State	Connection Type	Assigned IP Address	Remote Network

PPTP Client

Index	Connection Name	Active	Connection State	Connection Type	Server IP Address	Remote Network
1	BC-LL	Yes	Yes	Lan to Lan	69.121.1.33	192.168.1.0 / 255.255.255.0

Refresh

Index: The PPTP client tunnel index number.

Connection Name: Show user-defined PPTP VPN connection name.

Active: Show if the tunnel is active for connection.

Connection State: Show the connecting status.

Connection Type: Remote Access or LAN to LAN.

Server IP Address: Show the IP of remote PPTP Server.

Remote Network: Display the remote network and subnet mask in LAN to LAN PPTP connection.

Refresh: Click this button to refresh the connection status.

L2TP Status

L2TP Status

Index	Connection Name	Active	Connection State	Connection Mode	Connection Type	Tunnel Remote IP Address
1	HS-LL	Yes	Connected	Dial in	Lan to Lan	192.168.1.200

Refresh

Index: The L2TP tunnel index number.

Connection Name: Display the user-defined L2TP connection name.

Active: Show if the tunnel is active for connection.

Connection State: Show the connecting status.

Connection Mode: The L2TP mode is dialin or dialout.

Connection Type: Remote Access or LAN to LAN.

Tunnel Remote IP Address: Display the remote tunnel IP address.

Refresh: Click this button to refresh the connection status.

GRE Status

GRE Status

Index	Connection Name	Active	Connection State	Remote Gateway IP	Remote Network
1	GRE-0	Yes	Connected	69.121.1.30	192.168.0.0/255.255.255.0

Index: The GRE tunnel index number.

Connection Name: Display the user-defined GRE connection name.

Active: Show if the tunnel is active for connection.

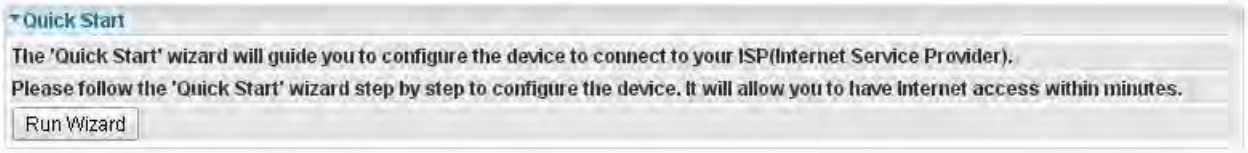
Connection State: Show the connecting status.

Remote Gateway IP: The IP of the remote GRE gateway.

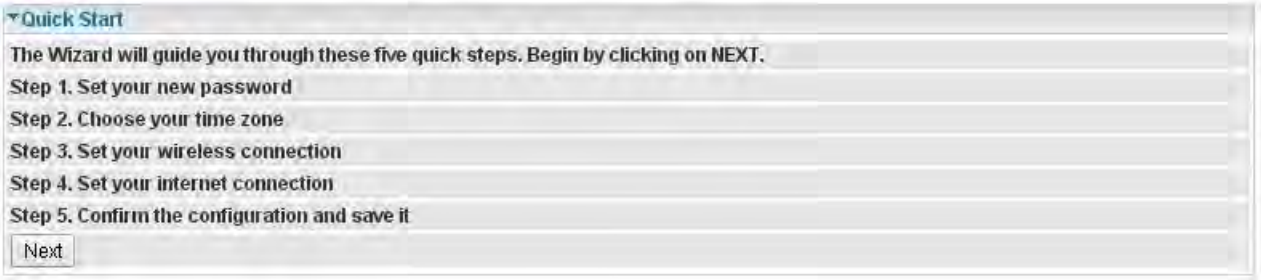
Remote Network: Display the remote network.

Quick Start

This is a useful and easy utility to help you to setup the router quickly and to connect to your ISP (Internet Service Provider) with only a few steps. It will guide you step by step to setup password, time zone, wireless and WAN settings of your device. The Quick Start Wizard is a helpful guide for the first-time users to the device.



For detailed instructions on configuring WAN settings, see refer to the **Interface Setup** section.



Click **NEXT** to move on to Step 1.

Step 1 – Password

Set new password of the “admin” account to access for router management. The default is “admin”. Once changed, please use this new password next time when accessing to the router. Click **NEXT** to continue.

Step 2 – Time Zone

Choose your time zone. Click **NEXT** to continue.

Step 3 – Wireless

Set up your wireless connection if you want to connect to the Internet wirelessly on your PCs. Click **NEXT** to continue.

Quick Start - Wireless

Configure your wireless network, authentication type and click NEXT to continue.

Access Point	(•) Activated ( ) Deactivated
SSID	BEC345
Broadcast SSID	(•) Yes ( ) No
Channel	UNITED STATES ▼ 06 ▼
Security Type	Mixed WPA2/WPA-PSK ▼
WPA Algorithms	TKIP+AES ▼
Pre-Shared Key	842CFFDE (8~63 characters or 64 Hex string)
Key Renewal Interval	600 seconds (10 ~ 4194303)

Back Next

Step 4 – ISP Connection Type

Set up your Internet connection.

4.1 Select an appropriate WAN connection protocol then click **NEXT** to continue.

Quick Start - ISP Connection Type

Select the WAN Interface and Internet Connection Type to connect to your ISP. Click NEXT to continue.

WAN Interface	4G LTE -1 ▼

Back Next

Input all relevant 3G/4G-LTE parameters from your ISP.

Quick Start - 3G/4G-LTE

Enter the 3G information provided to you by your ISP. Click NEXT to continue.

TEL No.	*99***1#
APN	internet
Username	
Password	
PIN	

Back Next

4.2 If selected **EWAN**

Quick Start - ISP Connection Type

Dynamic IP Address

WAN Interface	EWAN ▼
ISP	( ) Dynamic IP Address (Dynamic IP Address) ( ) Static IP Address (Choose this option to set static IP information provided to you by your ISP.) (•) PPPoE (Choose this option if your ISP uses PPPoE.) ( ) Bridge Mode (Choose this option if your ISP uses Bridge Mode.)

Back Next

If selected **PPPoE**, please enter PPPoE account information provided by your ISP. Click **NEXT** to continue. Or, others protocol assigned by your ISP.

Quick Start - PPPoE

Provide the PPPoE information. Click NEXT to continue.

Username	
Password	

Back Next

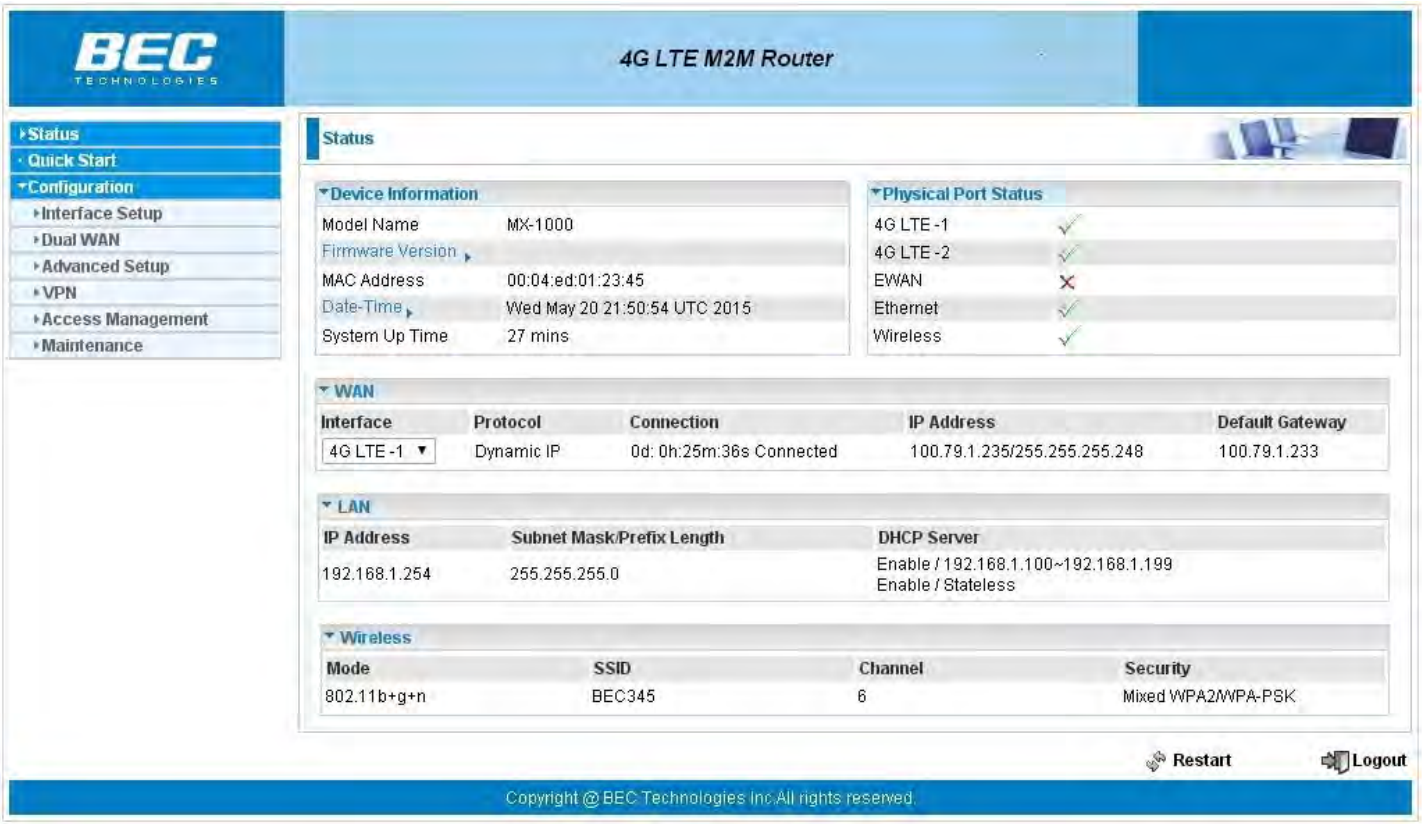
Step 5 – Quick Start Completed

The Setup Wizard has completed. Click on BACK to modify changes or mistakes. Click **NEXT** to save the current settings.

Step 6 – Quick Start Completed

Configuration

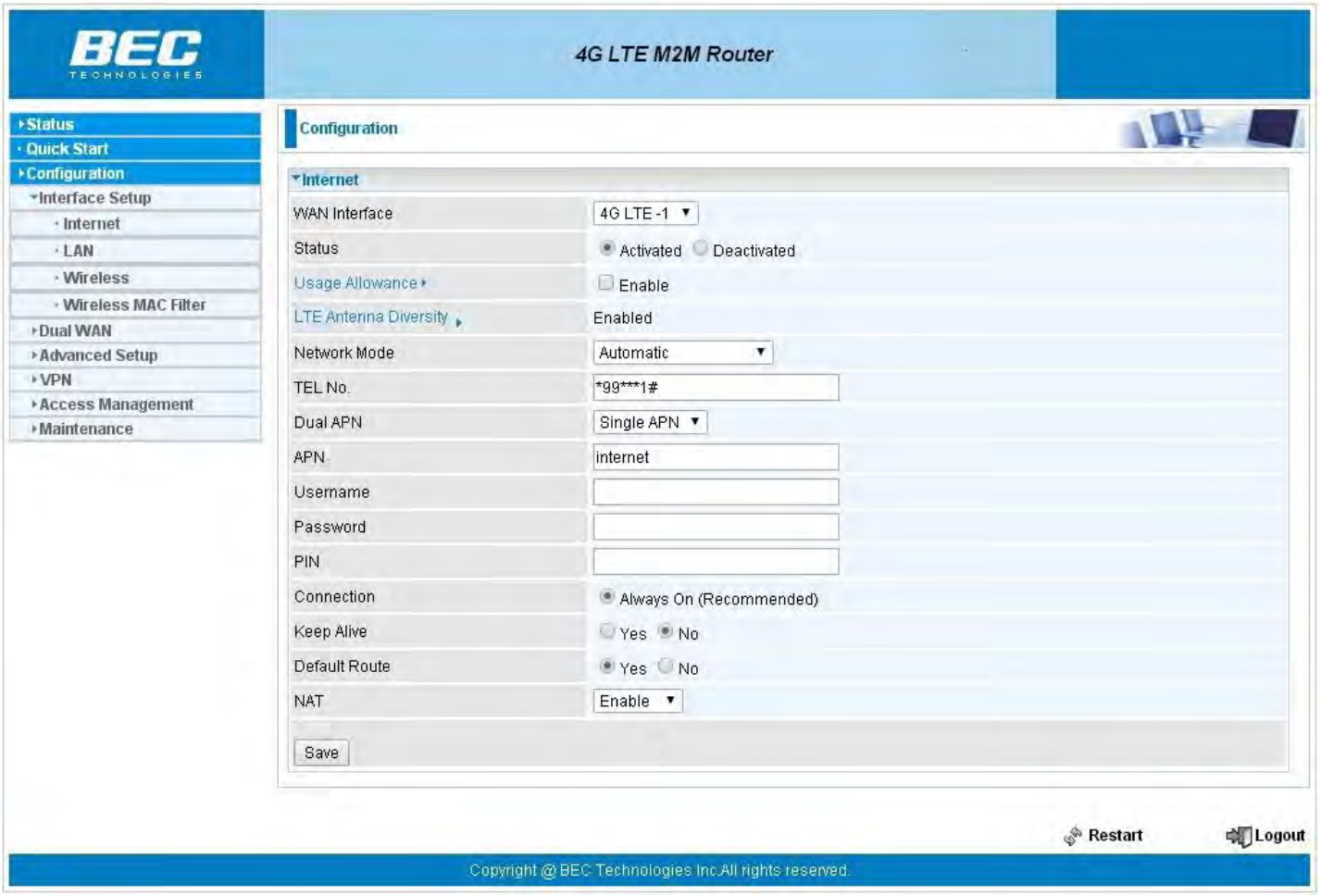
Click to access and configure the available features in the following: **Interface Setup, Dual WAN, Advanced Setup, VPN, Access Management,** and **Maintenance.**



These functions are described in the following sections.

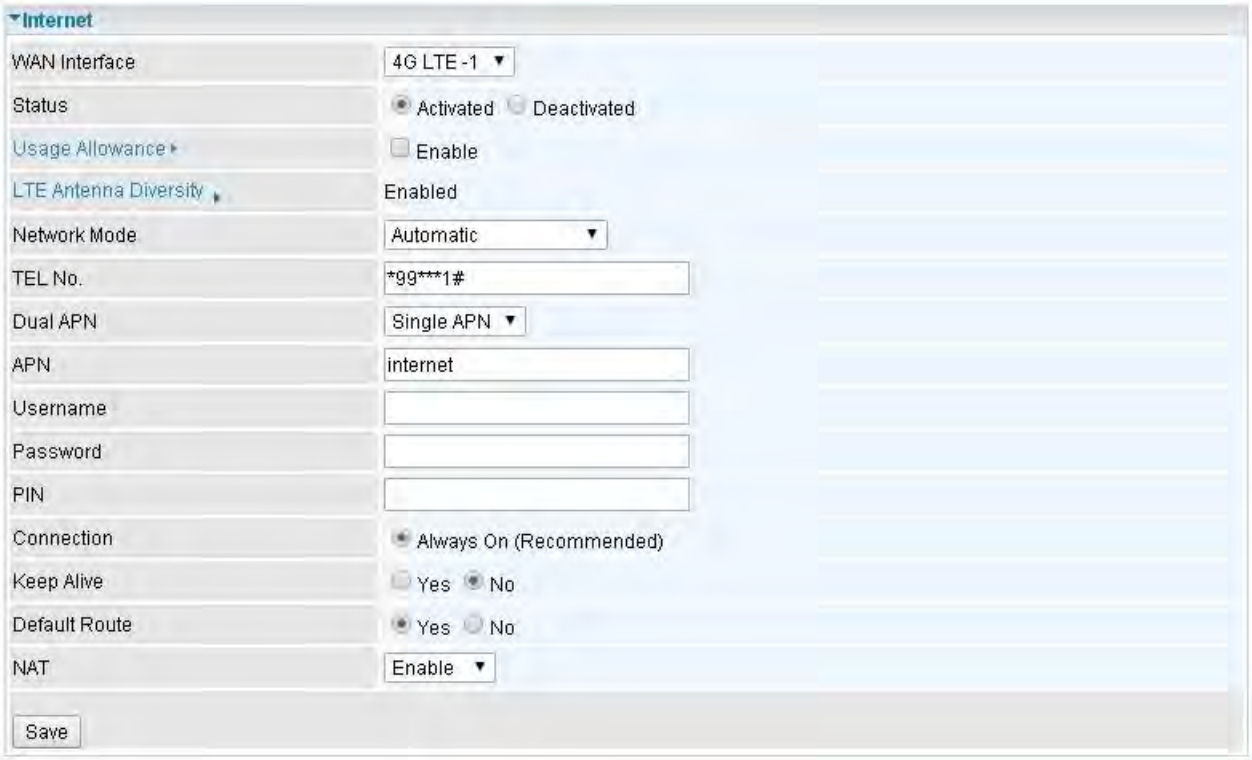
Interface Setup

Here are the features under **Interface Setup: Internet**, **LAN**, **Wireless** and **Wireless MAC Filter**.



Internet

❖ 4G LTE



Status: Choose Activated to enable the 3G/4G-LTE connection.

Usage Allowance: to control 4G LTE flow, click it to further configure about 4G LTE flow control, refer to the following **Usage Allowance** for more information.

Network Mode: There are some options of service standards: “Automatic”, “UMTS 3G only”, “GSM 2G Only”, “UMTS 3G Preferred”, “GSM 2G Preferred”, “GSM and UMTS Only”, “LTE Only”, “GSM, UMTS, LTE”. If you are not sure which mode to use, you may select **Automatic** to auto detect the best mode for you.

TEL No.: The dial string to make a GPRS / 3G/4G-LTE user internetworking call. It may provide by your mobile service provider.

Dual APN: MX-1000 can support up to two APNs. Select Single or Dual.

APN: An APN is similar to a URL on the WWW, it is what the unit makes a GPRS / UMTS call. The service provider is able to attach anything to an APN to create a data connection, requirements for APNs varies between different service providers. Most service providers have an internet portal which they use to connect to a DHCP Server, thus giving you access to the internet i.e. some 3G operators use the APN ‘internet’ for their portal. The default value is “internet”.

Username/Password: Enter the username and password provided by your service provider. The username and password are case sensitive.

PIN: PIN stands for Personal Identification Number. A PIN code is a numeric value used in certain systems as a password to gain access, and authenticate. In mobile phones a PIN code locks the SIM card until you enter the correct code. If you enter the PIN code incorrectly 3 times in a row, then the SIM card will be blocked and you will require a PUK code from your network/service provider.

Connection: Default set to Always on to keep an always-on 3G/4G-LTE connection.

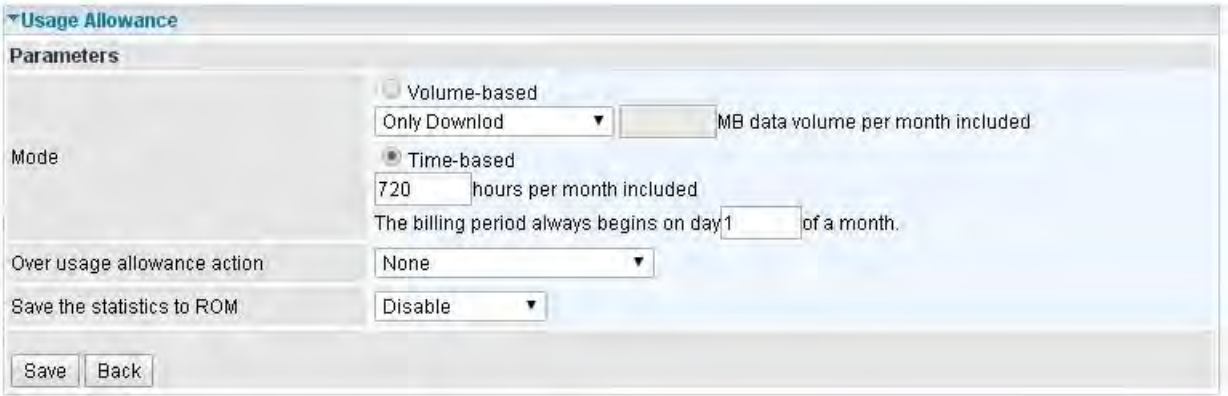
Keep Alive: Select **Yes** to keep the 3G/4G-LTE connection always on.

Keep Alive IP: Enter the IP address whic is used for “ping”, and router will ping the IP to find whether the connection is on or not, if not, router will recover the connection.

Default Route: Select **Yes** to use this interface as default route interface.

NAT: Select this option to Disabled/Enable the NAT (Network Address Translation) function. Enable NAT to grant multiples devices in LAN to access to the Internet through a single WAN IP.

Usage Allowance



Mode: include **Volume-based** and **Time-based** control.

Volume-based include “only Download”, ”only Upload” and “Download and Upload” to limit the flow. Time-based control the flow by providing specific hours per month.

The billing period begins on: the beginning day of billing each month.

Over usage allowance action: what to do when the flow is over usage allowance, the availablemethods are “Disconnect”, “E-mail Alert”, ”E-mail Alert and Disconnect”.

Save the statistics to ROM: to save the statistics to ROM system.

❖ EWAN

Internet	
WAN Interface	EWAN ▼
Status	◉ Activated ○ Deactivated
IPv4/IPv6	
IP Version	○ IPv4 ◉ IPv4/IPv6 ○ IPv6
ISP Connection Type	
ISP	○ Dynamic IP Address ○ Static IP Address ◉ PPPoE ○ Bridge Mode
802.1q Options	
802.1q	○ Activated ◉ Deactivated
VLAN ID	0 (range: 0~4095)
PPPoE	
Username	
Password	
Bridge Interface for PPPoE	○ Activated ◉ Deactivated
Connection Setting	
Connection	◉ Always On (Recommended) ○ Connect Manually
TCP MSS Option	TCP MSS 0 bytes(0 means use default)
IP Options	
IP Common Options	
Default Route	◉ Yes ○ No
TCP MTU Option	TCP MTU 0 bytes(0 means use default:1492)
IPv4 Options	
Get IP Address	○ Static ◉ Dynamic
Static IP Address	0.0.0.0
IP Subnet Mask	0.0.0.0
Gateway	0.0.0.0
NAT	Enable ▼
Dynamic Route	RIP1 ▼ Direction None ▼
IGMP Proxy	○ Enable ◉ Disable
IPv6 Options	
IPv6 Address	/
Obtain IPv6 DNS	◉ Enable ○ Disable
Primary DNS	
Secondary DNS	
MLD Proxy	○ Enable ◉ Disable
Save	

WAN Interface	EWAN
Status	Activated Deactivated
IPv4/IPv6	
IP Version	IPv4 IPv4/IPv6 IPv6
ISP Connection Type	
ISP	Dynamic IP Address Static IP Address PPPoE Bridge Mode
802.1q Options	
802.1q	Activated Deactivated
VLAN ID	0 (range: 0~4095)
PPPoE	
Username	
Password	
Bridge Interface for PPPoE	Activated Deactivated
Connection Setting	
Connection	Always On (Recommended) Connect Manually
TCP MSS Option	TCP MSS 0 bytes(0 means use default)

Status: Select whether to enable the service.

IPv4/IPv6

IP Version: Choose ***IPv4, IPv4/IPv6, IPv6*** based on your environment. If you don't know which one to choose from, please choose IPv4/IPv6 instead.

ISP Connection Type:

ISP: Select the encapsulation type your ISP uses.

- **Dynamic IP:** Select this option if your ISP provides you an IP address automatically.
- **Static IP:** Select this option to set static IP information. You will need to enter in the Connection type, IP address, subnet mask, and gateway address, provided to you by your ISP. Each IP address entered in the fields must be in the appropriate IP form. IP address from by four IP octets separated by a dot (xx.xx.xx.xx). The Router will not accept the IP address if it is not in this format.
- **PPPoE:** Select this option if your ISP requires you to use a PPPoE connection.
- **Bridge:** Select this mode if you want to use this device as an OSI Layer 2 device like a switch.

802.1q Options

802.1q: When activated, please enter a VLAN ID.

VLAN ID: It is a parameter to specify the VLAN which the frame belongs. Enter the VLAN ID identification, tagged: 0-4095.

PPPoE (If selected PPPoE as WAN Connection Type; otherwise, skip this part)

Username: Enter the user name provided by your ISP.

Password: Enter the password provided by your ISP.

Bridge Interface for PPPoE: When "Activated", the device will gain WAN IP from your ISP with the PPPoE account. But if your PC is connected to the router working as a DHCP client, in this mode, the

device acts as a NAT router; while if you dial up with the account within your PC, the device will then work as a bridge forwarding the PPPoE information to the PPPoE server and send the response to your PC, thus your PC gets a public WAN IP working in the internet.

Connection Setting

Connection:

- **Always On:** Click on **Always On** to establish a PPPoE session during start up and to automatically re-establish the PPPoE session when disconnected by the ISP.
- **Connect Manually:** Select Connect Manually when you don't want the connection up all the time.

TCP MSS Option: Enter the maximum size of the data that TCP can send in a segment. Maximum Segment Size (MSS).

IP Options	
IP Common Options	
Default Route	Yes No
TCP MTU Option	TCP MTU 0 bytes(0 means use default:1492)
IPv4 Options	
Get IP Address	Static Dynamic
Static IP Address	0.0.0.0
IP Subnet Mask	0.0.0.0
Gateway	0.0.0.0
NAT	Enable
Dynamic Route	RIP1 Direction None
IGMP Proxy	Enable Disable
IPv6 Options	
IPv6 Address	/
Obtain IPv6 DNS	Enable Disable
Primary DNS	
Secondary DNS	
MLD Proxy	Enable Disable

IP Options

Default Route: Select **Yes** to use this interface as default route interface.

TCP MTU Option: Enter the maximum packet that can be transmitted. Default MTU is set to 1492.

IPv4 Options

Get IP Address: Choose Static or Dynamic

Static IP Address: If Static is selected in the above field, please enter the specific IP address you get from ISP and the following IP subnet mask and gateway address.

IP Subnet Mask: The default is 0.0.0.0. User can change it to other such as 255.255.255.0.Type the subnet mask assigned to you by your ISP (if given).

Gateway: Enter the specific gateway IP address you get from ISP.

NAT: Select Enable if you use this router to hold a group of PCs to get access to the internet.

Dynamic Route:

- **RIP Version:** (Routing Information protocol) Select this option to specify the RIP version, including RIP-1, RIP-2.
- **RIP Direction:** Select this option to specify the RIP direction.
  - **None** is for disabling the RIP function.
  - **Both** means the router will periodically send routing information and accept routing information then incorporate into routing table.
  - **IN only** means the router will only accept but will not send RIP packet.
  - **OUT only** means the router will only send but will not accept RIP packet.

IGMP Proxy: IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group. Choose whether enable IGMP proxy.

IPv6 Options(only when choose IPv4/IPv6 or just IPv6 in IP version field above)

IPv6 Address: Type the WAN IPv6 address from your ISP.

Obtain IPv6 DNS: Choose if you want to obtain DNS automatically.

Primary/Secondary DNS: if you choose Disable in the Obtain IPv6 DNS field, please type the exactly primary and secondary DNS.

MLD Proxy: MLD (Multicast Listener Discovery Protocol) is to IPv6 just as IGMP to IPv4. It is a Multicast Management protocol for IPv6 multicast packets.

When router's Internet configuration is finished successfully, you can go to status to get the connection information.

LAN

A Local Area Network (LAN) is a shared communication system to which many computers are attached and is limited to the immediate area, usually the same building or floor of a building.

IPv4 Parameters	
IP Address	192.168.1.254
IP Subnet Mask	255.255.255.0
Alias IP Address	0.0.0.0 (0.0.0.0 means to close the alias ip)
Alias IP Subnet Mask	0.0.0.0
Snooping	Activated Deactivated
Dynamic Route	RIP1 Direction None
DHCPv4 Server	
DHCPv4 Server	Disabled Enabled Relay
Start IP	192.168.1.100
IP Pool Count	100
Lease Time	86400 seconds (0 sets to default value of 259200)
Physical Ports	LAN1 LAN2 LAN3 LAN4 WLAN1
DNS Relay	Automatically Manually
Primary DNS	
Secondary DNS	
Fixed Host	
IP Address	
MAC Address	

IPv4 Parameters

IP Address: Enter the IP address of Router in dotted decimal notation, for example, 192.168.1.254 (factory default).

IP Subnet Mask: The default is 255.255.255.0. User can change it to other such as 255.255.255.128.

Alias IP Address: This is for local networks virtual IP interface. Specify an IP address on this virtual interface.

Alias IP Subnet Mask: Specify a subnet mask on this virtual interface.

Snooping: Select **Activated** to enable IGMP/MLD Snooping function, Without IGMP/MLD snooping, multicast traffic is treated in the same manner as broadcast traffic - that is, it is forwarded to all ports. With IGMP/MLD snooping, multicast traffic of a group is only forwarded to ports that have members of that group.

Dynamic Route: Select the RIP version from RIP1 or RIP2.

DHCPv4 Server

DHCP (Dynamic Host Configuration Protocol) allows individual clients to obtain TCP/IP configuration at start-up from a server.

DHCPv4 Server: If set to **Enabled**, your MX-1000 can assign IP addresses, default gateway and DNS servers to the DHCP client.

- If set to **Disabled**, the DHCP server will be disabled.
- If set to **Relay**, the MX-1000 acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. Enter the IP address of the actual, remote DHCP server in the Remote DHCP Server field in this case.
- When DHCP is used, the following items need to be set.

Start IP: This field specifies the first of the contiguous addresses in the IP address pool.

IP Pool Count: This field specifies the count of the IP address pool.

Lease Time: The current lease time of client.

DNS Relay Select Automatically obtained or Manually set (if selected. Please set the exactly information).

Primary DNS Server: Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.

Secondary DNS Server: Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.

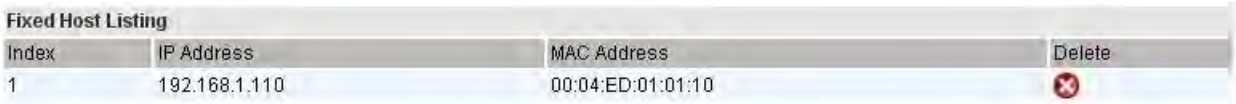
Fixed Host

In this field, users can map the specific IP (must in the DHCP IP pool) for some specific MAC, and this information can be listed in the following table.

IP Address: Enter the specific IP. For example: 192.168.1.110.

MAC Address: Enter the responding MAC. For example: 00:0A:F7:45:6D:ED

When added, you can see the ones listed as showed below:



Fixed Host Listing

Index	IP Address	MAC Address	Delete
1	192.168.1.110	00:04:ED:01:01:10	

IPv6 parameters

The IPv6 address composes of two parts, thus, the prefix and the interface ID.

Interface Address / Prefix Length: Enter a static LAN IPv6 address. If you are not sure what to do with this field, please leave it empty as if contains false information it could result in LAN devices not being able to access other IPv6 device. Router will take the same WAN's prefix to LAN side if the field is empty.

DHCPv6 Server

There are two methods to dynamically configure IPv6 address on hosts, **Stateless** and **Stateful**.

Stateless auto-configuration requires no manual configuration of hosts, minimal (if any) configuration of routers, and no additional servers. The stateless mechanism allows a host to generate its own addresses using a combination of locally available information (MAC address) and information (prefix) advertised by routers. Routers advertise prefixes that identify the subnet(s) associated with a link, while hosts generate an "interface identifier" that uniquely identifies an interface on a subnet. An address is formed by combining the two. When using stateless configuration, you needn't configure

anything on the client.

Stateful configuration, for example using DHCPv6 (which resembles its counterpart DHCP in IPv4.) In the stateful auto configuration model, hosts obtain interface addresses and/or configuration information and parameters from a DHCPv6 server. The Server maintains a database that keeps track of which addresses have been assigned to which hosts.

DHCPv6 Server: Check whether to enable DHCPv6 server.

DHCPv6 Server Type: Select Stateless or Stateful. When DHCPv6 is enabled, this parameter is available.

- **Stateless:** If selected, the PCs in LAN are configured through RA mode, thus, the PCs in LAN are configured through RA mode, to obtain the prefix message and generate an address using a combination of locally available information (MAC address) and information (prefix) advertised by routers, but they can obtain such information like DNS from DHCPv6 Server.
- **Stateful:** If selected, the PCs in LAN will be configured like in IPv4 mode, thus obtain addresses and DNS information from DHCPv6 server.

Start interface ID: enter the start interface ID. The IPv6 address composed of two parts, thus, the prefix and the interface ID. Interface is like the Host ID compared to IPv4.

End interface ID: enter the end interface ID.

Leased Time (hour): the leased time, similar to leased time in DHCPv4, is a time limit assigned to clients, when expires, the assigned ID will be recycled and reassigned.

Router Advertisement: Check to Enable or Disable the Issue Router Advertisement feature. This feature is to send Router Advertisement messages periodically which would multicast the IPv6 Prefix information (similar to v4 network number 192.168.1.0) to all LAN devices if the field is enabled. We suggest enabling this field.

Wireless

This section introduces the wireless LAN and some basic configurations. Wireless LANs can be as complex as a number of computers with wireless LAN cards communicating through access points which bridge network traffic to the wired LAN.

Wireless	
Access Point Settings	
Access Point	Activated Deactivated
AP MAC Address	00:04:ED:01:23:45
Wireless Mode	802.11b+g+n
Channel	UNITED STATES 06 Current Channel : 6
Beacon Interval	100 (range: 20~1000)
RTS/CTS Threshold	2347 (range: 1500~2347)
Fragmentation Threshold	2346 (range: 256~2346, even numbers only)
DTIM Interval	1 (range: 1~255)
TX Power	100 (range:1~100)
IGMP Snooping	Yes No
11n Settings	
Channel Bandwidth	20 MHz
Guard Interval	Auto
MCS	Auto
SSID Settings	
Available SSID	1
SSID Index	SSID1
SSID	BEC345
Broadcast SSID	Yes No
SSID Activated	Always
WPS Settings	
Use WPS	Yes No
WPS State	Configured
WPS Mode	PIN code PBC
Security Settings	
Security Type	Mixed WPA2/WPA-PSK
WPA Algorithms	TKIP+AES
Pre-Shared Key	842CFFDE (8~63 characters or 64 Hex string)
Key Renewal Interval	600 seconds (10 ~ 4194303)
WDS Settings	
AP MAC Address	00:04:ED:01:23:45
WDS Mode	Activated Deactivated
WDS Peer MAC #1	00:00:00:00:00:00
WDS Peer MAC #2	00:00:00:00:00:00
WDS Peer MAC #3	00:00:00:00:00:00
WDS Peer MAC #4	00:00:00:00:00:00
Save	

Access Point Settings	
Access Point	Activated Deactivated
AP MAC Address	00:04:ED:01:23:45
Wireless Mode	802.11b+g+n
Channel	UNITED STATES 06 Current Channel : 6
Beacon Interval	100 (range: 20~1000)
RTS/CTS Threshold	2347 (range: 1500~2347)
Fragmentation Threshold	2346 (range: 256~2346, even numbers only)
DTIM Interval	1 (range: 1~255)
TX Power	100 (range:1~100)
IGMP Snooping	Yes No

Access Point Settings

Access Point: Default setting is set to **Activated**. If you want to close the wireless interface, select **Deactivated.**

AP MAC Address: The MAC address of wireless AP.

Wireless Mode: The default setting is **802.11b+g+n** (Mixed mode). If you do not know or have both 11g and 11b devices in your network, then keep the default in **mixed mode**. From the drop-down manual, you can select **802.11g** if you have only 11g card. If you have only 11b card, then select **802.11b** and if you only have 802.11n then select **802.11n**.

Channel: The range of radio frequencies used by IEEE 802.11b/g/n wireless devices is called a channel. There are Regulation Domains and Channel ID in this field. The Channel ID will be different based on Regulation Domains. Select a channel from the drop-down list box.

Beacon interval: The Beacon Interval value indicates the frequency interval of the beacon. Enter a value between 20 and 1000. A beacon is a packet broadcast by the Router to synchronize the wireless network.

RTS/CTS Threshold: The RTS (Request To Send) threshold (number of bytes) for enabling RTS/CTS handshake. Data with its frame size larger than this value will perform the RTS/CTS handshake. Enter a value between 1500 and 2347.

Fragmentation Threshold: The threshold (number of bytes) for the fragmentation boundary for directed messages. It is the maximum data fragment size that can be sent. Enter a value between 256 and 2346, even number only.

DTIM Interval: This value, between 1 and 255, indicates the interval of the Delivery Traffic Indication Message (DTIM).

TX Power: The transmission power of the antennas, ranging from 1-100, the higher the more powerful of the transmission performance.

IGMP Snooping: Enable or disable the IGMP Snooping function for wireless. Without IGMP snooping, multicast traffic is treated in the same manner as broadcast traffic - that is, it is forwarded to all ports. With IGMP snooping, multicast traffic of a group is only forwarded to ports that have members of that group."

11n Settings	
Channel Bandwidth	20 MHz
Guard Interval	Auto
MCS	Auto
SSID Settings	
Available SSID	1
SSID Index	SSID1
SSID	BEC345
Broadcast SSID	Yes No
SSID Activated	Always

11n Settings

Channel Bandwidth: Select either **20 MHz** or **20/40 MHz** for the channel bandwidth. The wider the Channel bandwidth the better the performance will be.

Guard Interval: Select either **400nsec** or **800nsec** for the guard interval. The guard interval is here to ensure that data transmission do not interfere with each other. It also prevents propagation delays, echoing and reflections. The shorter the Guard Interval, the better the performance will be. We recommend users to select Auto.

MCS: There are options **0~15** and **AUTO** to select for the **Modulation and Coding Scheme**. We recommend users selecting **AUTO**.

SSID Settings

Available SSID: User can determine how many virtual SSIDs to be used. Default is 1, maximum is 4.

SSID Index: Select the number of SSIDs you want to config; up to 4 SSIDs are available in the list.

SSID: The SSID is the unique name of a wireless access point (AP) to be distinguished from another. For security propose, change the default **wlan-ap** to a unique ID name to the AP which is already built-in to the router's wireless interface. Make sure your wireless clients have exactly the SSID as the device, in order to get connected to your network.

Broadcast SSID: Select **Yes** to make the SSID visible so a station can obtain the SSID through passive scanning. Select **No** to hide the SSID in so a station cannot obtain the SSID through passive scanning.

Clients Isolation: This parameter is to control access between two wireless clients. If users enable this function, then each of the wireless clients will not be able to communicate with the other.

SSID Activated: Select the time period during which the SSID is active. Default is always which means the SSID will be active all the time without time control. See Time Schedule to set the timeslot to flexibly control when the SSID functions.

WPS Settings	
Use WPS	Yes No
WPS State	Configured
WPS Mode	PIN code PBC

WPS Settings

WPS (Wi-Fi Protected Setup) feature is a standard protocol created by Wi-Fi Alliance. This feature greatly simplifies the steps needed to create a Wi-Fi network for a residential or an office setting. WPS

supports 2 types of configuration methods which are commonly known among consumers: **PIN Method** & **PBC Method**.

Use WPS: Enable this feature by choosing the ”YES” radiobutton.

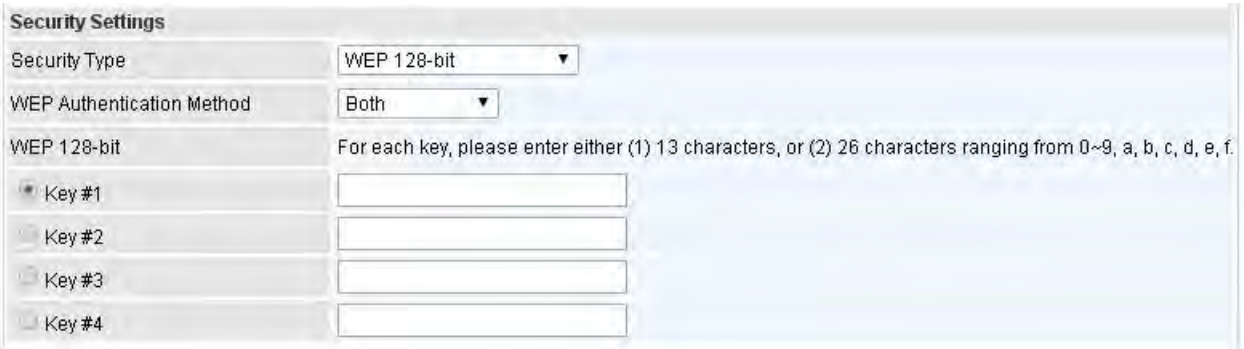
WPS State: Display whether the WPS is **configured** or **unconfigured**.

WPS Mode: Select the mode which to start WPS, choose between **PIN Code** and **PBC** (Push Button). Selecting **Pin Code** mode will require you to know the enrollee PIN code.

To future understand the two modes of configuration; please refer to the example of the **Wi-Fi Protected Setup.**

Security Settings

Security Type: You can disable or enable wireless security for protecting wireless network. The default type of wireless security is OPEN and to allow all wireless stations to communicate with the access points without any data encryption.
To prevent unauthorized wireless stations from accessing data transmitted over the network, the router offers secure data encryption, known as WEP and WPA.
There are five alternatives to select from: WEP 64-bit, WEP 128-bit, WPA-PSK, WPA2-PSK, and Mixed WPA/WPA2-PSK. If you require high security for transmissions, please select WPA-PSK, WPA2-PSK or WPA/WPA2-PSK.



WEP 64-bit, WEP 128-bit

WEP Authentication Method: WEP authentication method, there are two methods of authentication used, Open System authentication (OPENWEB) and Share Key authentication (SHAREDWEB). We suggest you select OPENWEB.

Key 1 to Key 4: Enter the key to encrypt wireless data. To allow encrypted data transmission, the WEP Encryption Key values on all wireless stations must be the same as the router. There are four keys for your selection. The input format is in HEX style, 5 and 13 HEX codes are required for 64-bitWEP and 128-bitWEP respectively.

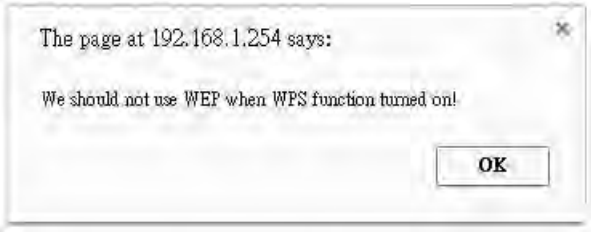
If you chose **WEP 64-bit**, then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F").

If you chose **WEP 128-bit**, then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F").

You must configure all four keys, but only one key can be activated at any one time. The default key is key 1.

Note: When you enable **WPS** function, this **WEP** function will be invalid. And if you select one of

WEP-64Bits/ WEP-128Bits, the following prompt box will appear to notice you.



Security Settings	
Security Type	Mixed WPA2/WPA-PSK
WPA Algorithms	TKIP+AES
Pre-Shared Key	(8~63 characters or 64 Hex string)
Key Renewal Interval	600 seconds (10 ~ 4194303)

WPA-PSK, WPA2-PSK, Mixed WPA2/WPA-PSK

WPA Algorithms: TKIP (Temporal Key Integrity Protocol) or AES (Advanced Encryption System) utilizes a stronger encryption method and incorporates Message Integrity Code (MIC) to provide protection against hackers.

Pre-Shared key: The key for network authentication. The input format should be 8-63 ASKII characters or 64 hexadecimal characters

Key Renewal Interval: The time interval for changing the security key automatically between wireless client and AP.

WDS Settings	
AP MAC Address	60:03:47:6C:48:00
WDS Mode	Activated Deactivated
WDS Peer MAC #1	00:00:00:00:00:00
WDS Peer MAC #2	00:00:00:00:00:00
WDS Peer MAC #3	00:00:00:00:00:00
WDS Peer MAC #4	00:00:00:00:00:00

WDS Settings

WDS (Wireless distributed system) is a wireless access point mode that enables wireless link and communication with other access point. It is easy to be installed, just define the peer's MAC of the connected AP.

WDS Mode: select Activated to enable WDS feature and Deactivated to disable this feature.

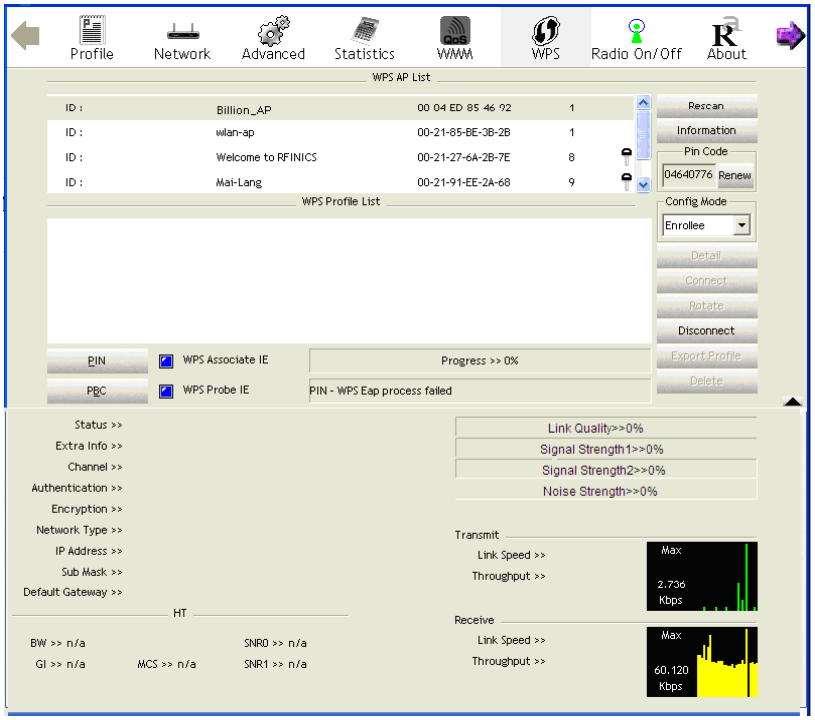
MAC Address: Enter the AP MAC addresses (in XX:XX:XX:XX:XX:XX format) of the peer connected AP.

Wi-Fi Protected Setup (WPS) Example I:

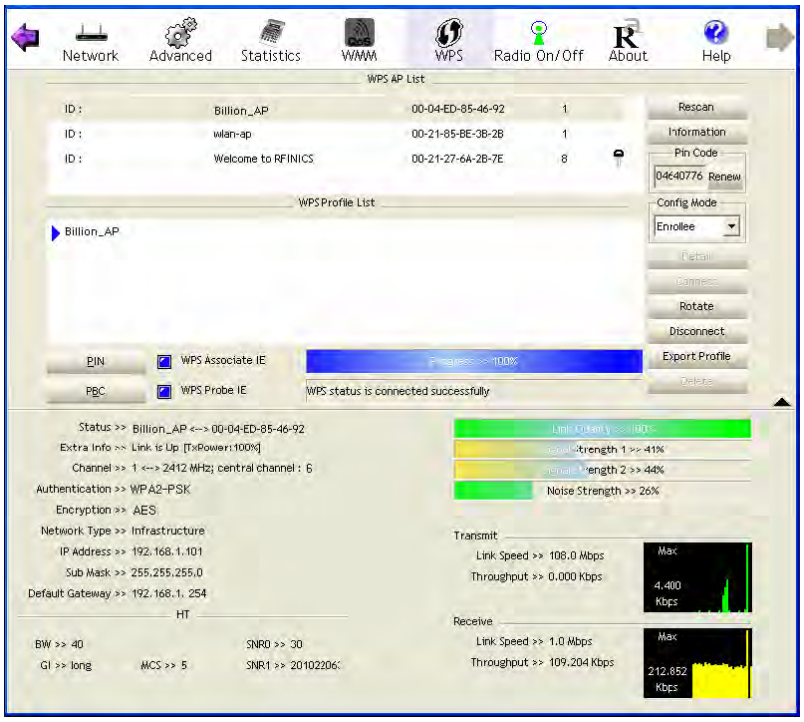
PIN Method: Configure AP as Registrar

1. Jot down the client's Pin (e.g. 04640776).
2. Enter the Enrollee (Client) PIN code and then press Start WPS.

3. Launch the wireless client's WPS utility (e.g. Ralink Utility). Set the Config Mode as Enrollee, press the WPS button on the top bar, select the AP (e.g. Billion_AP) from the WPS AP List column. Then press the PIN button located on the middle left of the page to run the scan.



4. The client's SSID and security setting will now be configured to match the SSID and security setting of the registrar (router).



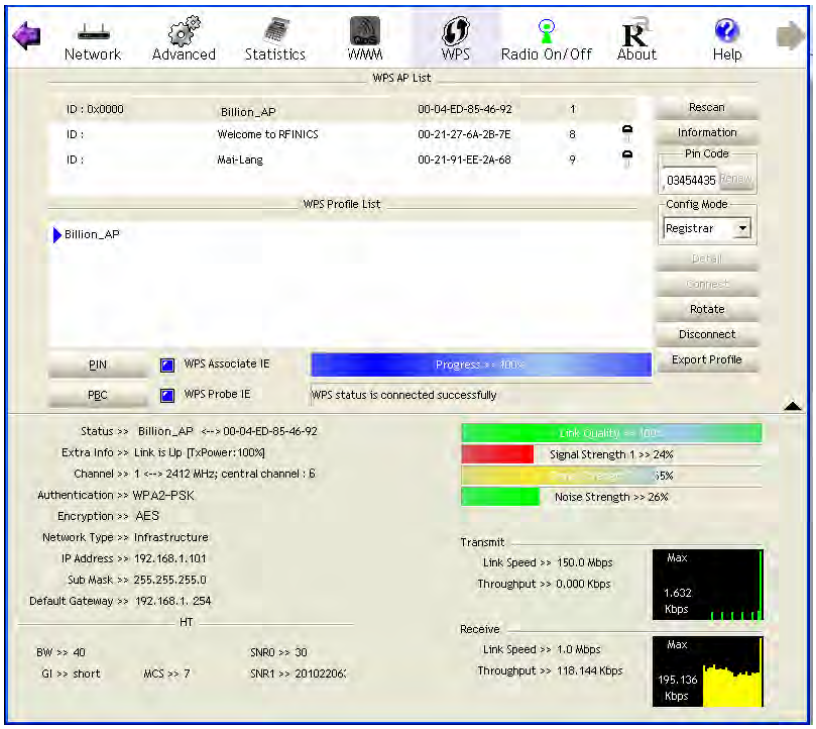
Wi-Fi Protected Setup (WPS) Example II:

PIN Method: Configure AP as Enrollee

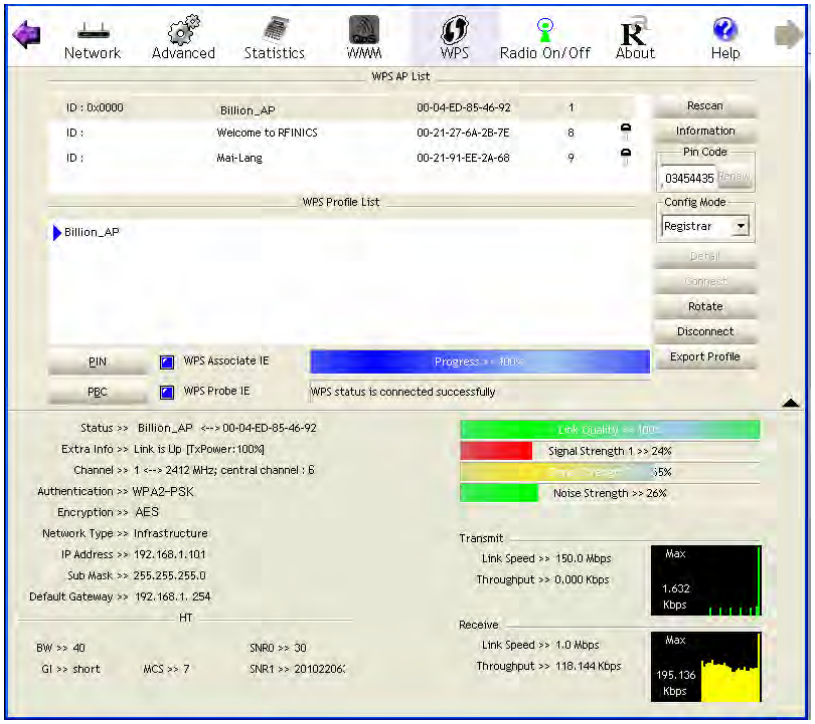
1. Jot down the WPS PIN (e.g. 70963205). Press Start WPS.

SSID Settings	
Available SSID	1
SSID Index	SSID1
SSID	Billion-AP
Broadcast SSID	Yes No
Clients Isolation	Yes No
SSID Activated	Always
WPS Settings	
Use WPS	Yes No
WPS State	Configured
WPS Mode	PIN code PBC
AP PIN Code	70963205 Generate
Enrollee PIN Code	
WPS Progress	Idle Start WPS
Security Settings	
Security Type	WPA2-PSK
WPA Algorithms	AES
Pre-Shared Key	billion00486c (8~63 characters or 64 Hex string)
Key Renewal Interval	600 seconds (10 ~ 4194303)

2. Launch the wireless client's WPS utility (e.g. Ralink Utility). Set the Config Mode as Registrar. Enter the PIN number in the PIN Code column then choose the correct AP (e.g. Billion_AP) from the WPS AP List before pressing the PIN button to run the scan.



3. The router's (AP's) SSID and security setting will now be configured to match the SSID and security setting of the registrar (client).



4. Now to make sure that the setup is correctly done, cross check to see if the SSID and the security setting of the registrar setting match with the parameters found on both Wireless Configuration and Wireless Security Configuration page.

Wi-Fi Protected Setup (WPS) Example III:

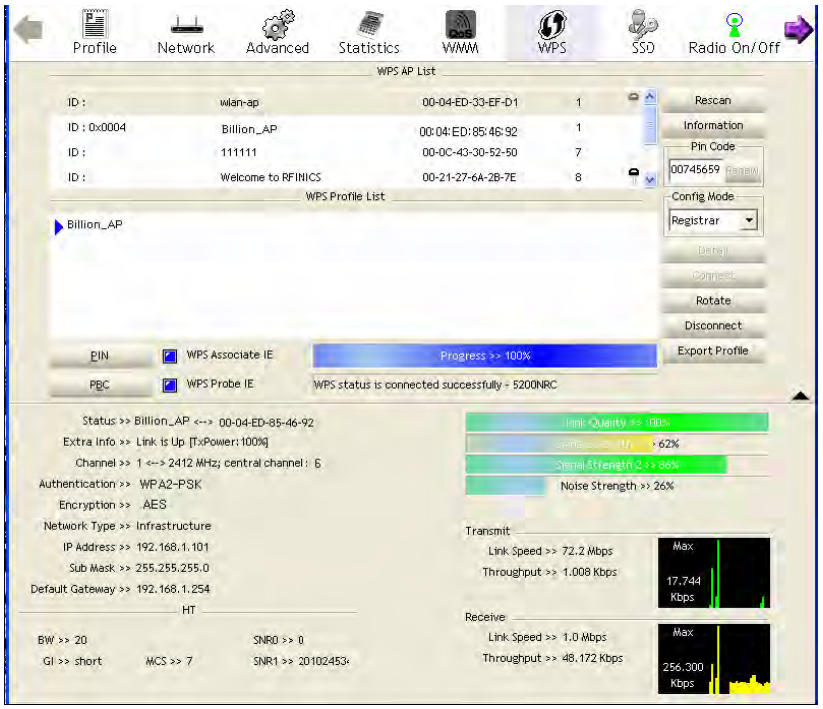
PBC Method:

1. Press the PBC radio button, Then Start WPS.

SSID Settings	
Available SSID	1
SSID Index	SSID1
SSID	Billion-AP
Broadcast SSID	Yes No
Clients Isolation	Yes No
SSID Activated	Always
WPS Settings	
Use WPS	Yes No
WPS State	Configured
WPS Mode	PIN code PBC
Security Settings	
Security Type	WPA2-PSK
WPA Algorithms	AES
Pre-Shared Key	billion00486c (8~63 characters or 64 Hex string)
Key Renewal Interval	600 seconds (10 ~ 4194303)

2. Launch the wireless client's WPS Utility (e.g. Ralink Utility). Set the Config Mode as Enrollee. Then press the WPS button and choose the correct AP (e.g. Billion_AP) from the WPS AP List section before pressing the PBC button to run the scan.

3. When the PBC button is pushed, a wireless communication will be established between your router and the PC. The client's SSID and security setting will now be configured to match the SSID and security setting of the router.



Wireless MAC Filter

The MAC filter screen allows you to configure the router to give exclusive access to up to 8 devices (Allow Association) or exclude up to 8 devices from accessing the router (Deny Association). Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:AA:BB:00:00:02.

You need to know the MAC address of the devices you wish to filter.

SSID Index: Select the targeted SSID you want the MAC filter rules to apply to.

Active: Select **Activated** to enable MAC address filtering.

Action: Define the filter action for the list of MAC addresses in the MAC address filter table.

Select **Deny** to block access to the AP, MAC addresses not listed will be allowed to access the router. Select **Allow** to permit access to the router, MAC addresses not listed will be denied access to the router.

MAC Address: Enter the MAC addresses (in XX:XX:XX:XX:XX:XX format) of the wireless station that are allowed or denied access to the specified in these address fields.

Dual WAN

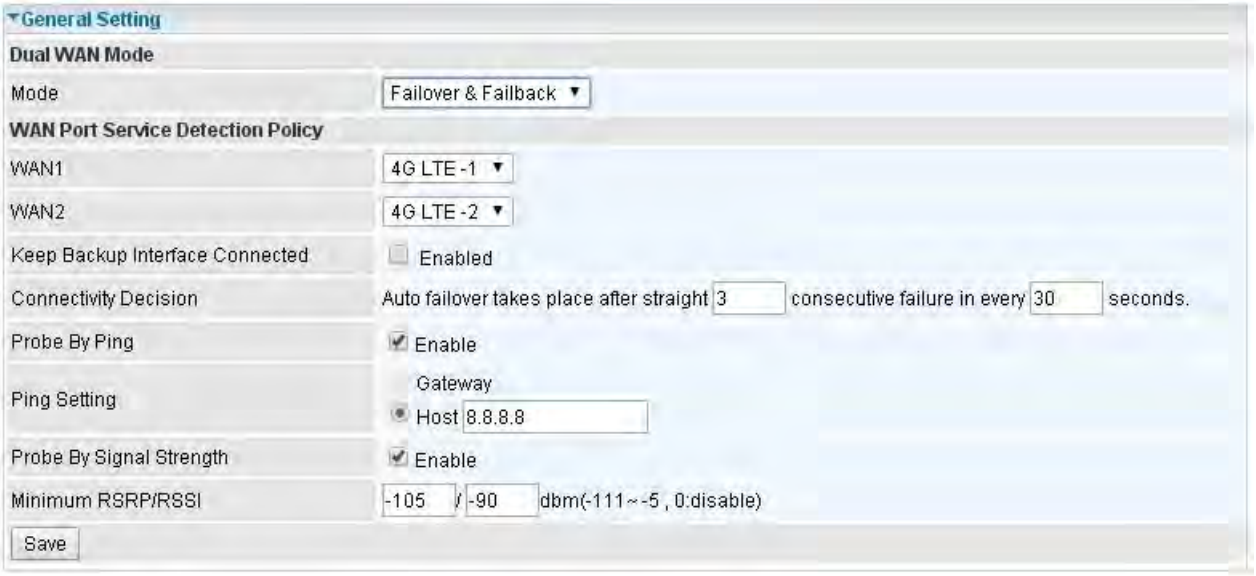
Dual WAN is specially designed to offer users failover/fallback.

Auto failover/failback is to ensure an always-on internet connection. Users can set a WAN1 (main WAN) and WAN 2 (backup WAN), and when WAN1 fails, it will switch to WAN2, and when WAN1 restores, it will switch to WAN1 again.

General Setting

Select **Failover** to enable the failover/failback feature to keep WAN always on.

❖ Failover & Failback



WAN Port Service Detection Policy

WAN1: Select “4G LTE 1”, “4G LTE 2” or “EWAN” for WAN1 (The main WAN).

WAN2: Select the “4G LTE 2” or “EWAN” for WAN2 as backup port if you select “4G LTE 1” as WAN1.

Keep Backup Interface Connected: Select if to keep backup WAN interface connected.

Connectivity Decision: Set how many times of probing failure to switch to backup port.

Probe Cycle: Set the time duration for the **Probe Cycle** to determine when the router will switch to the backup connection (backup port) once the main connection (main port) fails. For example, when set to 30 seconds, the probe will be conducted every 30 seconds.

Note:

1) The time set is for each probe cycle, but the decision to change to the backup port is determined by **Probe Cycle** multiplied by **connection Decision amount** (e.g. From the image above it will be 30 seconds multiplied by 3 consecutive fails, the router will determine failover to WAN2 (backup port)).

2).The failback setting follow the same decision policy as the failover. For example, according to settings above in the screenshot, the connection probe will be carried out every 30 seconds, and 3 consecutive times of probe success is found, the router will determine failback to WAN1 (main WAN).

Probe WAN 1: Choose the probe policy, to probe gateway or host (users decide themselves)

- **Gateway:** It will send ping packets to gateway of Wan1 interface and wait for response from it in every “Probe Cycle” to check the connectivity of the gateway of WAN1 interface.
- **Host:** It will send ping packets to specific host and wait for response in every “Probe Cycle”. The host must be an IP address.

❖ Failover & Priority

WAN Port Service Detection Policy

WAN1: Select “4G LTE 1”, “4G LTE 2” or “EWAN” for WAN1 (The main WAN).

WAN2: Select the “4G LTE 2” or “EWAN” for WAN2 as backup port if you select “4G LTE 1” as WAN1.

Connectivity Decision: Set how many times of probing failure to switch to backup port.

Probe Cycle: Set the time duration for the **Probe Cycle** to determine when the router will switch to the backup connection (backup port) once the main connection (main port) fails. For example, when set to 30 seconds, the probe will be conducted every 30 seconds.

Note:

1) The time set is for each probe cycle, but the decision to change to the backup port is determined by **Probe Cycle** multiplied by **connection Decision amount** (e.g. From the image above it will be 30 seconds multiplied by 3 consecutive fails, the router will determine failover to WAN2 (backup port)).

2).The failback setting follow the same decision policy as the failover. For example, according to settings above in the screenshot, the connection probe will be carried out every 30 seconds, and 3 consecutive times of probe success is found, the router will determine failback to WAN1 (main WAN).

Priority by: The condition is signal strength.

❖ Load Balance

WAN Port Service Detection Policy

WAN1: Select “4G LTE 1”, “4G LTE 2” or “EWAN” for WAN1 (The main WAN).

WAN2: Select the “4G LTE 2” or “EWAN” for WAN2 as backup port if you select “4G LTE 1” as WAN1.

Service Detection: Select if to keep detecte WAN interface connected.

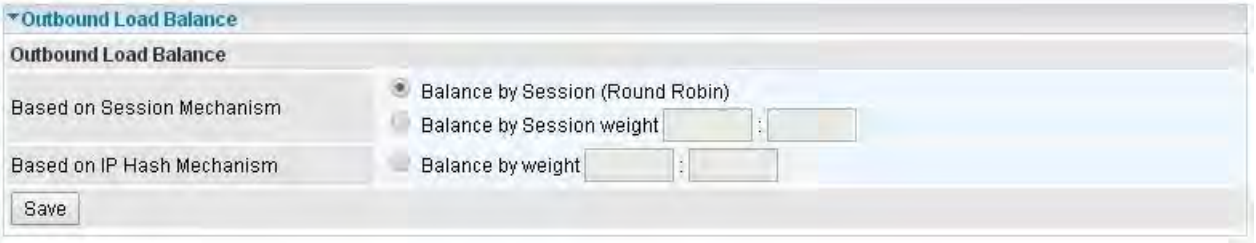
Connectivity Decision: Set how many times of probing failure to disable load balance.

Probe WAN 1/2: Choose the probe policy, to probe gateway or host (users decide themselves)

- **Gateway:** It will send ping packets to gateway of Wan1 interface and wait for response from it in every “Probe Cycle” to check the connectivity of the gateway of WAN1 interface.
- **Host:** It will send ping packets to specific host and wait for response in every “Probe Cycle”. The host must be an IP address.

Outbound Load Balance

The connections are distributed over WAN1 and WAN2 so that it can utilize bandwidth of both WAN ports. With Outbound load balance, traffic may be routed to a faster link when one of the WAN is slower or congested so that user gains better throughput and less delay.



User can distribute outbound traffic based on **Session Mechanism** or **IP Hash Mechanism**.

Base on Session Mechanism:

Balance by Session (Round Robin): Balance session traffic based on a round robin method.

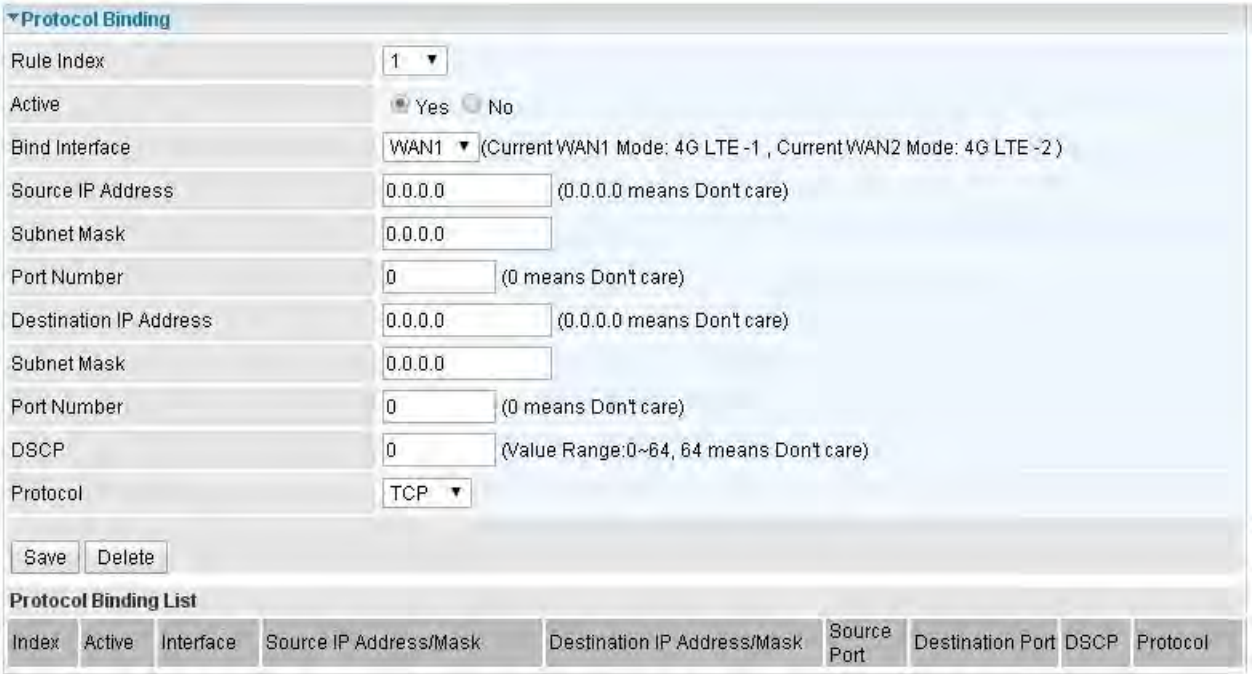
Balance by Session weight: Balance session traffic based on a weight ratio. Enter the desired ratio in the fields provided.

Base on IP Hash Mechanism:

Balance by weight: Use an IP hash to balance traffic based on a ratio. Enter the desired ratio into the fields provided.

Protocol Binding

Protocol Binding lets you direct specific traffic to go out from a specific WAN port. Policies determine how specific types of internet traffic are routed, for example, traffic from a particular IP(es) granted access to only one WAN port rather than using both of the WAN ports as with load balancing.



Rule Index: The index marking the rule. Maximum entries can be 16.

Active: Select whether to enable the rule.

Bind Interface: To determine the WAN interface the to-be-set rule will apply to and what type of traffic is to be bound to forward to the which WAN interface.

Source IP Address: Enter the source IP address featuring the traffic origin.

Subnet Mask: Enter the subnet of the designation network.

Port Number: Enter the port number which defines the application.

Destination IP Address: Enter the destination IP address featuring the traffic destination.

Subnet Mask: Enter the subnet of the designation network.

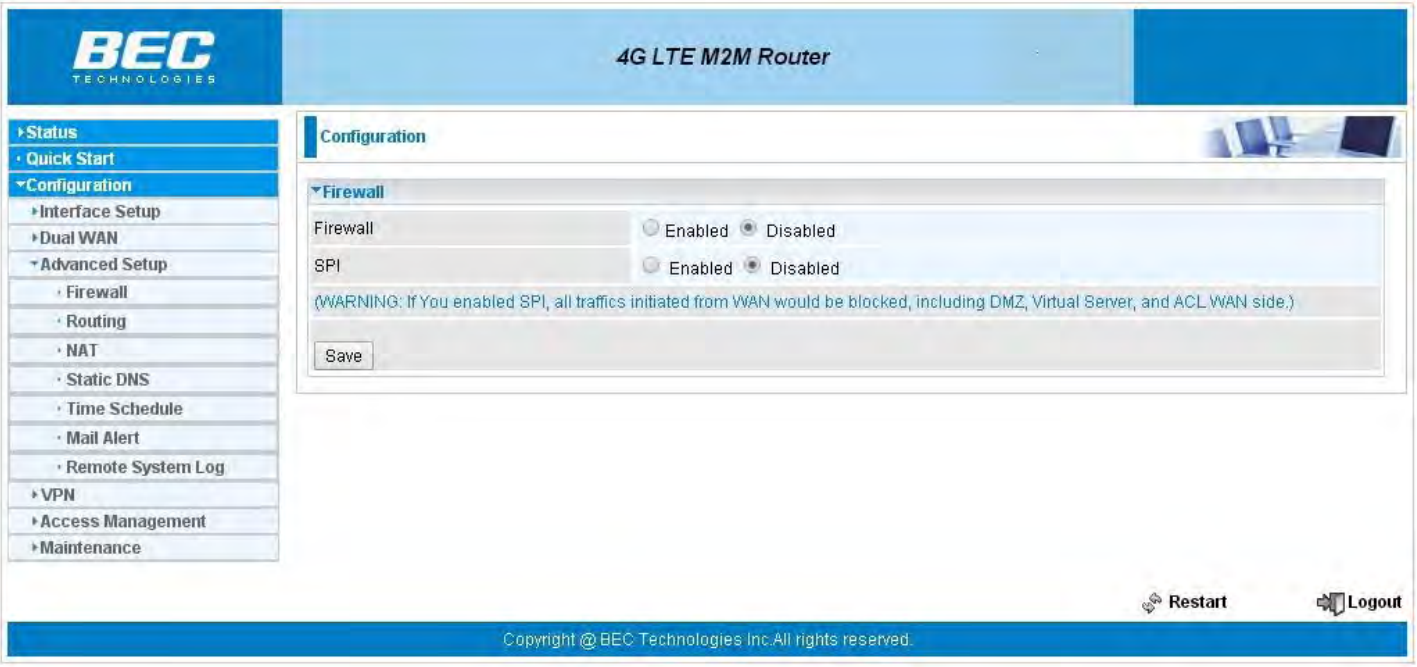
Port Number: Enter the port number which defines the application.

DSCP: The DSCP value. Value Range:0~64, 64 means Don't care

Protocol: Select the protocol traffic is using (TCP, UDP, ICMP).

Advanced Setup

Advanced Step provides advanced features including **Firewall**, **Routing**, **NAT**, **Static DNS**, **Time Schedule**, **Mail Alert** and **Remote System Log** for advanced users.



Firewall

Your router includes a firewall for helping to prevent attacks from hackers. In addition to this, when using NAT (Network Address Translation) the router acts as a “natural” Internet firewall, since all PCs on your LAN use private IP addresses that cannot be directly accessed from the Internet.

Firewall: To automatically detect and block Denial of Service (DoS) attacks, such as Ping of Death, SYN Flood, Port Scan and Land Attack.

- **Enabled:** It activates your firewall function.
- **Disabled:** It disables the firewall function.

SPI: If you enabled SPI, all traffics initiated from WAN would be blocked, including DMZ, Virtual Server, and ACL WAN side.

- **Enabled:** It activates your SPI function.
- **Disabled:** It disables the SPI function.

Routing

This is static route feature. You are equipped with the capability to control the routing of all the traffic across your network. With each routing rule created, user can specifically assign the destination where the traffic will be routed to.

Routing Table

Index	Destination IP Address	Subnet Mask	Gateway IP Address	Metric	Interface	Edit	Drop
0	100.87.150.196	255.255.255.252	0.0.0.0	0	ppp12		
1	100.72.1.208	255.255.255.248	0.0.0.0	0	ppp11		
2	192.168.1.0	255.255.255.0	0.0.0.0	0	br0		
3	127.0.0.0	255.255.0.0	0.0.0.0	0	lo		
4	239.0.0.0	255.0.0.0	0.0.0.0	0	br0		
5	0.0.0.0	0.0.0.0	100.72.1.209	0	ppp11		

Add Route

Index: Item number

Destination IP Address: IP address of the destination network

Subnet Mask: The subnet mask of destination network.

Gateway IP Address: IP address of the gateway or existing interface that this route uses.

Metric: It represents the cost of transmission for routing purposes. The number need not be precise, but it must be between 1 and 15.

Interface: Media/channel selected to append the route.

Edit: Edit the route; this icon is not shown for system default route.

Drop: Drop the route; this icon is not shown for system default route.

Add Route

Static Route

Destination IP Address	0.0.0.0
Destination Subnet Mask	0.0.0.0
Gateway IP Address / Interface	0.0.0.0 / 4G LTE -1
Metric	1

Save Back

Destination IP Address: This is the destination subnet IP address.

Destination Subnet Mask: The subnet mask of destination network.

Gateway IP Address/Interface: This is the gateway IP address or existing interface to which packets are to be forwarded.

Metric: It represents the cost of transmission for routing purposes. The number need not be precise, but it must be between 1 and 15.

NAT

The NAT (Network Address Translation) feature transforms a private IP into a public IP, allowing multiple users to access the internet through a single IP account, sharing the single IP address. NAT break the originally envisioned model of IP end-to-end connectivity across the internet so NAT can cause problems where IPSec/ PPTP encryption is applied or some application layer protocols such as SIP phones are located behind a NAT. And NAT makes it difficult for systems behind a NAT to accept incoming communications.

In this session, there are “VPN Passthrough”, “SIP ALG”, “DMZ” and “Virtual Server” provided to solve these nasty problems.

NAT Status: Enabled. It depends on ISP Connection Type in Internet settings.

VPN Passthrough: VPN pass-through is a feature of routers which allows VPN client on a private network to establish outbound VPNs unhindered.

SIP ALG: Enable the SIP ALG when SIP phone needs ALG to pass through the NAT. Disable the SIP ALG when SIP phone includes NAT-Traversal algorithm.

Interface: Select to set DMZ/Virtual Server for “3G/4G-LTE” or “EWAN”.

Click **DMZ** Edit or **Virtual Server** Edit to move on to set the DMZ or Virtual Server parameters, which are represented in the following scenario.

DMZ

NOTE: This feature disables automatically if WAN connection is in BRIDGE mode.

The DMZ Host is a local computer exposed to the Internet. When setting a particular internal IP address as the DMZ Host, all incoming packets will be checked by the Firewall and NAT algorithms then passed to the DMZ host, when a packet received does not use a port number used by any other Virtual Server entries.

DMZ for: Indicate the related WAN interface which allows outside network to connect in and communicate.

DMZ:

- **Enabled:** It activates your DMZ function.
- **Disabled:** It disables the DMZ function.

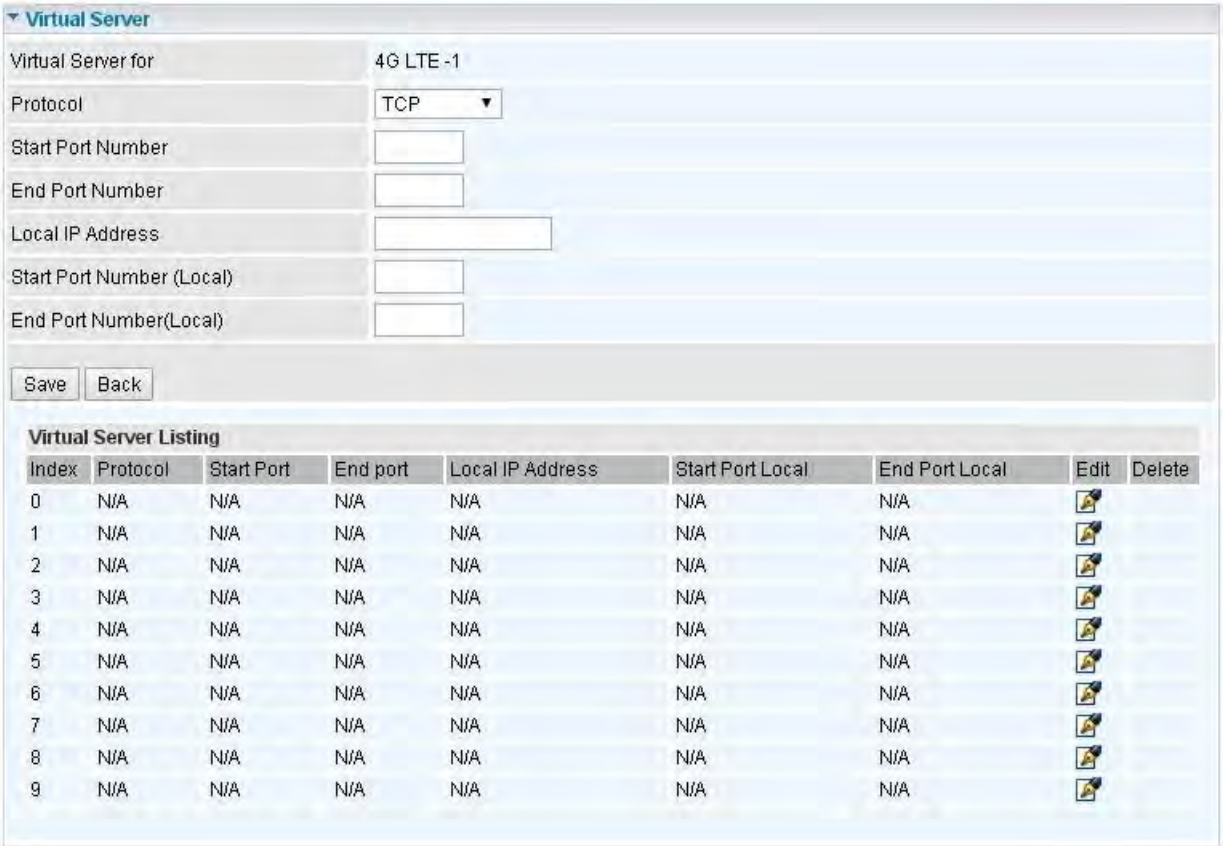
DMZ Host IP Address: Give a static IP address to the DMZ Host when **Enabled** radio button is checked. Be aware that this IP will be exposed to the WAN/Internet.

Select the **Save** button to apply your changes.

Virtual Server

NOTE: This feature disables automatically if WAN connection is in BRIDGE mode.

The device can be configured as a virtual server so that remote users accessing services such as Web or FTP services via the public (WAN) IP address can be automatically redirected to local servers in the LAN network. Depending on the requested service (TCP/UDP port number), the device redirects the external service request to the appropriate server within the LAN network.



Virtual Server for: Indicate the related WAN interface which allows outside network to connect in and communicate.

Protocol: Choose the application protocol.

Start / End Port Number: Enter a port or port range you want to forward.

(Example: Start / End: 21 or Start: 1000, End: 2000).

The starting greater than zero (0) and the ending port must be the same or larger than the starting port.

Local IP Address: Enter your local server IP address in this field.

Start / End Port Number (Local): Enter the start / end port number of the local application (service).

Examples of well-known and registered port numbers are shown below. For further information, please see IANA's website at http://www.iana.org/assignments/port-numbers

Well-known and Registered Ports

Port Number	Protocol	Description
21	TCP	FTP Control
22	TCP & UDP	SSH Remote Login Protocol
23	TCP	Telnet
25	TCP	SMTP (Simple Mail Transfer Protocol)
53	TCP & UDP	DNS (Domain Name Server)
69	UDP	TFTP (Trivial File Transfer Protocol)
80	TCP	World Wide Web HTTP
110	TCP	POP3 (Post Office Protocol Version 3)
443	TCP & UDP	HTTPS
1503	TCP	T.120
1720	TCP	H.323
7070	UDP	RealAudio

Using port forwarding does have security implications, as outside users will be able to connect to PCs on your network. For this reason you are advised to use specific Virtual Server entries just for the ports your application requires, instead of using DMZ. As doing so will result in all connections from the WAN attempt to access to your public IP of the DMZ PC specified.

Attention

If you have disabled the NAT option in the WAN-ISP section, the Virtual Server function will hence be invalid.
If the DHCP server option is enabled, you have to be very careful in assigning the IP addresses of the virtual servers in order to avoid conflicts. The easiest way of configuring Virtual Servers is to manually assign static IP address to each virtual server PC, with an address that does not fall into the range of IP addresses that are to be issued by the DHCP server. You can configure the virtual server IP address manually, but it must still be in the same subnet as the router.

Example : How to setup Port Forwarding for port 21 (FTP server)

If you have a FTP server in your LAN network and want others to access it through WAN.

Step 1: Assign a static IP to your local computer that is hosting the FTP server.

Step 2: Login to the Gateway and go to **Configuration / Advanced Setup / NAT / Virtual Server.**

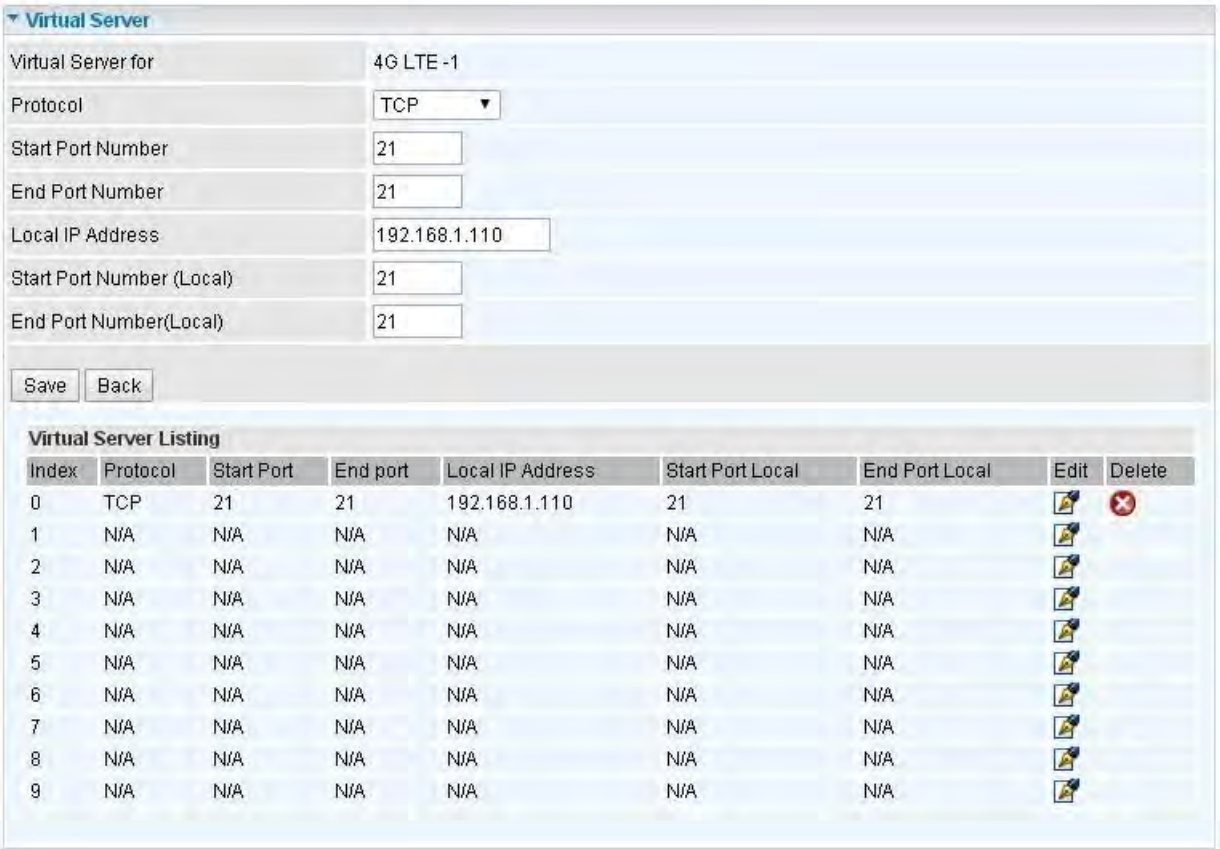
FTP server uses TCP protocol with port 21.

Enter ”21” to Start and End Port Number. MX-1000 will accept port 21 requests from WAN side.

Eneter the static IP assiged to the local PC that is hosting the FTP server. Ex: 192.168.1.110

Enter ”21” to Local Start and End Port number. MX-1000 will forward port 21 request from WAN to the specific LAN PC (ex:192.168.1.110) in the network.

Step 3: Click **Save** to save settings.



Static DNS

The Domain Name System (DNS) is a hierarchical naming system built on a distributed database for computers, services, or any resource connected to the Internet or a private network associates various information with domain names assigned to each of the participating entities. Most importantly, it translates domain names meaningful to humans into the numerical identifiers associated with networking equipment for the purpose of locating and addressing these devices worldwide.

An often-used analogy to explain the Domain Name System is that it serves as the phone book for the Internet by translating human-friendly computer hostnames into IP addresses. For example, the domain name www.example.com can be translated into the addresses 192.0.32.10 (IPv4).

IP Address: The IP address you are going to give a specific domain name.

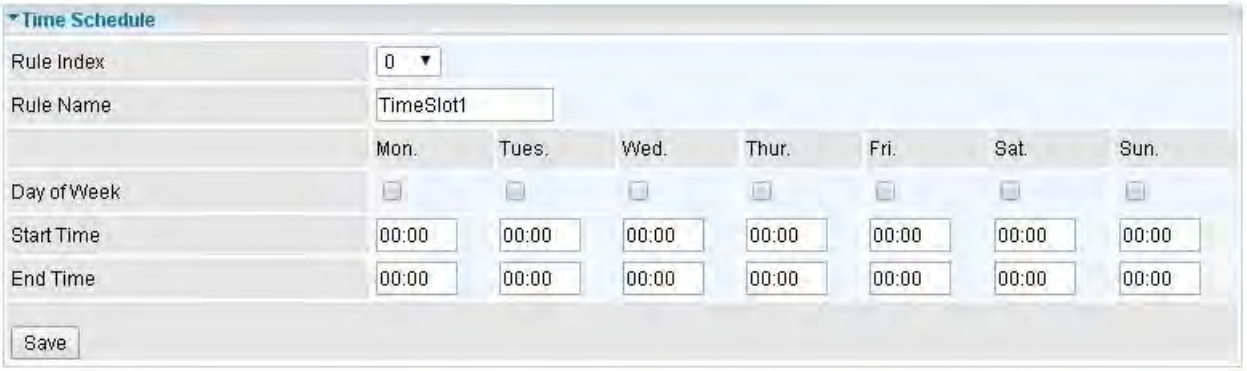
Domain Name: The friendly domain name for the IP address.

Press **Save** button to apply your settings.

Time Schedule

The Time Schedule supports up to **16** timeslots which helps you to manage your Internet connection. In each time profile, you may schedule specific day(s) i.e. Monday through Sunday to restrict or allowing the usage of the Internet by users or applications.

This Time Schedule correlates closely with router's time, since router does not have a real time clock on board; it uses the Simple Network Time Protocol (SNTP) to get the current time from an SNTP server from the Internet.



Rule Index: The rule index (0-15) for identifying each timeslot.

Rule Name: User-defined identification for each time period.

Day of Week: Mon. to Sun. Specify the time interval for each timeslot from "Day of Week".

Start Time: The starting point of the interval for the timeslot, anytime in 00:00 – 24:00.

End Time: The ending point of the interval for the timeslot, anytime in 00:00 – 24:00.

For example, user can add a timeslot named “TimeSlot1” which features a period from 9:00 of Saturday to 18:00 of Sunday.

Time Schedule

Rule Index	0						
Rule Name	TimeSlot1						
	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.
Day of Week	☐	☐	☐	☐	☐	☑	☑
Start Time	00:00	00:00	00:00	00:00	00:00	09:00	00:00
End Time	00:00	00:00	00:00	00:00	00:00	24:00	18:00

Save

Another TimeSlot2 spanning from 09:00 to 18:00 of Wednesday

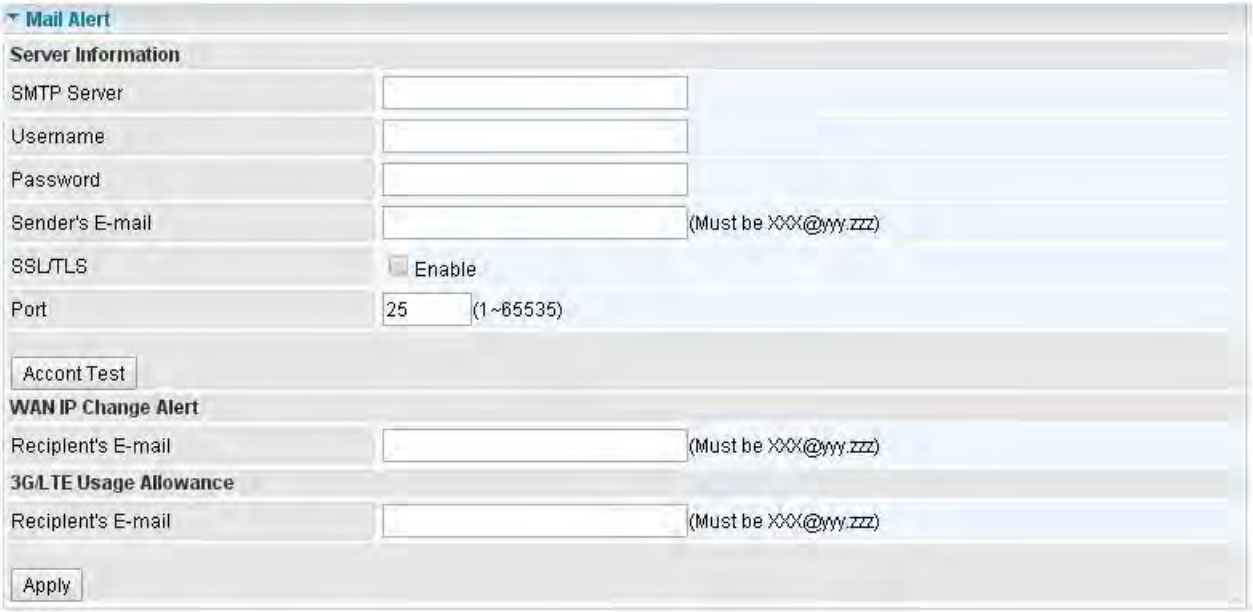
Time Schedule

Rule Index	1						
Rule Name	TimeSlot2						
	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.
Day of Week	☐	☐	☑	☐	☐	☐	☐
Start Time	00:00	00:00	09:00	00:00	00:00	00:00	00:00
End Time	00:00	00:00	18:00	00:00	00:00	00:00	00:00

Save

Mail Alert

Mail alert is designed to keep system administrator or other relevant personnel alerted of any unexpected events that might have occurred to the network computers or server for monitoring efficiency. With this alert system, appropriate solutions may be tackled to fix problems that may have arisen so that the server can be properly maintained.



SMTP Server: Enter the SMTP server that you would like to use for sending emails.

Username: Enter the username of your email account to be used by the SMTP server.

Password: Enter the password of your email account.

Sender's Email: Enter your email address.

SSL/TLS: Check to whether to enable SSL encryption feature.

Port: the port, default is 25.

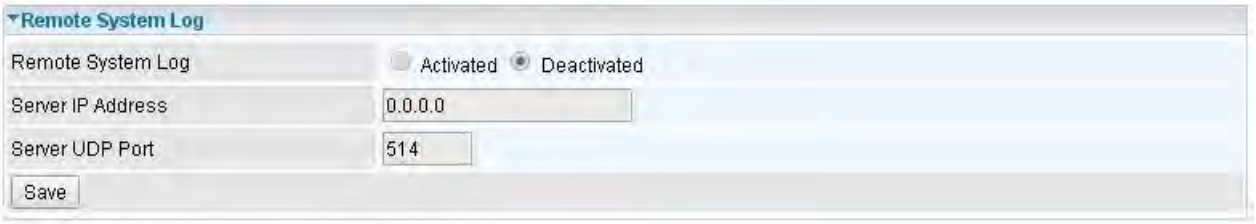
Account Test: Press this button to test the connectivity and feasibility to your sender's e-mail.

Recipient's Email (WAN IP Change Alert): Enter the email address that will receive the alert message once a WAN IP change has been detected.

Recipient's Email (3G/LTE Usage Allowance): Enter the email address that will receive the alert message once the 3G over Usage Allowance occurs.

Remote System Log

Remote System Log is designed to keep remote administrators informed of the system-operating information. Administrator can set up a remote system log server for receiving and monitoring the system information by enabling remote system log feature on the router.



Remote System Log: Select whether to activate “Remote System Log”.

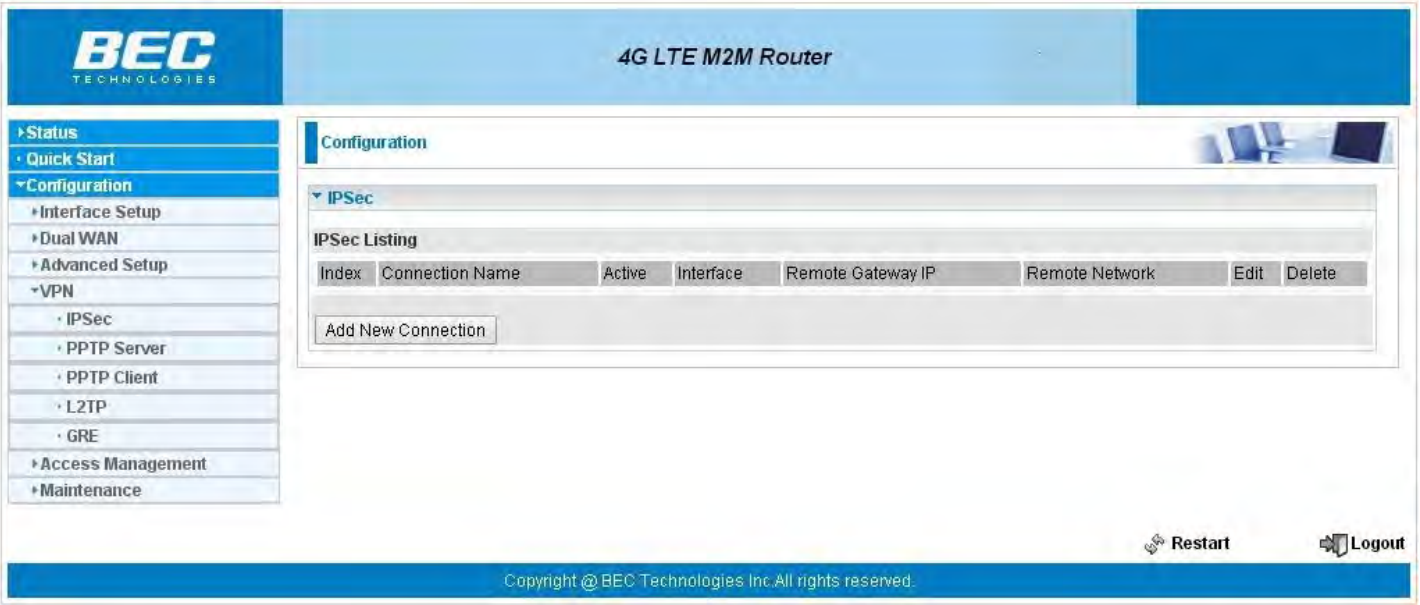
Server IP Address: Enter the remote syslog server IP address.

Server UDP Port: Enter the UDP port of the remote syslog server.

VPN

A **Virtual Private Network** (**VPN**) is a private network that interconnects remote (and often geographically separate) networks through primarily public communication infrastructures such as the Internet. VPNs provide security through tunneling protocols and security procedures such as encryption. For example, a VPN could be used to securely connect the branch offices of an organization to a head office network through the public Internet.

MX-1000 supports **IPSec, PPTP, L2TP, GRE** for enterprise users.



IPSec

Internet Protocol Security (**IPSec**) is a protocol suite for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a communication session. IPsec also includes protocols for establishing mutual authentication between agents at the beginning of the session and negotiation of cryptographic keys to be used during the session.

IPSec is an end-to-end security scheme operating in the Internet Layer of the Internet Protocol Suite. It can be used in protecting data flows between a pair of security gateways (*network-to-network*), or between a security gateway and a host (*network-to-host*).

A total of 8 IPSec tunnels can be added.

Click **Add New Connection** to create IPSec connections.

IPSec Connection Setting

IPSec

Connection Name					
Active	Yes No				
Interface	Auto				
Remote Gateway IP	(0.0.0.0 means any)				
Local Access Range	Subnet	Local IP Address	0.0.0.0	IP Subnetmask	0.0.0.0
Remote Access Range	Subnet	Remote IP Address	0.0.0.0	IP Subnetmask	0.0.0.0
IKE Mode	Main	Pre-Shared Key			
Local ID Type	Default Wan IP	IDContent	*		
Remote ID Type	Default Wan IP	IDContent	*		
Encryption Algorithm	DES	Authentication Algorithm	MD5	Diffie-Hellman Group	MODP1024(DH2)
IPSec Proposal	ESP	AH			
	Authentication Algorithm	MD5	Encryption Algorithm	DES	
Perfect Forward Secrecy	None				
Phase 1 (IKE)SA Lifetime	480 min(s)	Phase 2 (IPSec)	60 min(s)		
Keepalive	None	PING to the IP(0.0.0.0:NEVER)	0.0.0.0	Interval	10 seconds **
Disconnection Time after No Traffic	180 seconds (180 at least)				
Reconnection Time	3 min(s) (3 at least)				

Note * : FQDN with @ as first character means don't resolve domain name.

Note ** : (0-3600, 0 means NEVER)

Save Back

Connection Name: A given name for the connection (e.g. “connection to office”).

Active: Select **Yes** to activate the tunnel.

Interface: Select the set used interface for the IPSec connection, when you select 3G/4G-LTE interface, the IPSec tunnel would via this interface to connect to the remote peer.

Remote Gateway IP: The WAN IP address of the remote VPN gateway that is to be connected, establishing a VPN tunnel.

Local Access Range: Set the IP address or subnet of the local network.

- **Single IP:** The IP address of the local host, for establishing an IPSec connection between a security gateway and a host (*network-to-host*).
- **Subnet:** The subnet of the local network, for establishing an IPSec tunnel between a pair of security gateways (*network-to-network*)

Remote Access Range: Set the IP address or subnet of the remote network.

- **Single IP:** The IP address of the local host, for establishing an IPSec connection between a security gateway and a host (network-to-host). If the remote peer is a host, select Single Address.
- **Subnet:** The subnet of the local network, for establishing an IPSec tunnel between a pair of security gateways (network-to-network), If the remote peer is a network, select Subnet.

IKE Mode	Main	Pre-Shared Key			
Local ID Type	Default Wan IP	IDContent	*		
Remote ID Type	Default Wan IP	IDContent	*		
Encryption Algorithm	DES	Authentication Algorithm	MD5	Diffie-Hellman Group	MODP1024(DH2)

IPSec Phase 1(IKE)

IKE Mode: IKE, Internet Key Exchange, is the mechanism to negotiate and exchange parameters and keys between IPSec peers to establish security associations(SA). Select Main or Aggressive mode.

Pre-Shared Key: This is for the Internet Key Exchange (IKE) protocol, a string from 4 to 128 characters. Both sides should use the same key. IKE is used to establish a shared security policy and authenticated keys for services (such as IPSec) that require a key. Before any IPSec traffic can be passed, each router must be able to verify the identity of its peer. This can be done by manually entering the pre-shared key into both sides (router or hosts).

Local ID Type and **Remote ID Type:** When the mode of IKE is aggressive, Local and Remote peers can be identified by other IDs.

IDContent: Enter IDContent the name you want to identify when the Local and Remote Type are Domain Name; Enter IDContent IP address you want to identify when the Local and Remote Type are IP addresses (IPv4 and IPv6 supported).

Encryption Algorithm: Select the encryption algorithm from the drop-down menu. There are several options: DES and AES (128, 192 and 256). 3DES and AES are more powerful but increase latency.

- **DES:** Stands for Data Encryption Standard, it uses 56 bits as an encryption method.
- **3DES:** Stands for Triple Data Encryption Standard, it uses 168 (56*3) bits as an encryption method.
- **AES:** Stands for Advanced Encryption Standards, you can use 128, 192 or 256 bits as encryption method.

Authentication Algorithm: Authentication establishes the integrity of the datagram and ensures it is not tampered with in transmission. There are 3 options: Message Digest 5 (MD5) and Secure Hash Algorithm (SHA1, SHA256). SHA1 is more resistant to brute-force attacks than MD5. However, it is slower.

- **MD5:** A one-way hashing algorithm that produces a 128−bit hash.
- **SHA1:** A one-way hashing algorithm that produces a 160−bit hash.

Diffle-Hellman Group: It is a public-key cryptography protocol that allows two parties to establish a shared secret over an unsecured communication channel (i.e. over the Internet). MODP stands for Modular Exponentiation Groups.

IPSec Proposal	ESP	AH		
	Authentication Algorithm	MD5	Encryption Algorithm	DES
Perfect Forward Secrecy	None			

IPSec Phase 2(IPSec)

IPSec Proposal: Select the IPSec security method. There are two methods of verifying the authentication information, AH(Authentication Header) and ESP(Encapsulating Security Payload). Use ESP for greater security so that data will be encrypted and the data origin be authenticated but using AH data origin will only be authenticated but not encrypted.

Authentication Algorithm: Authentication establishes the integrity of the datagram and ensures it is not tampered with in transmission. There are 3 options: Message Digest 5 (MD5) and Secure Hash Algorithm (SHA1, SHA256). SHA1 is more resistant to brute-force attacks than MD5. However, it is slower.

- **MD5:** A one-way hashing algorithm that produces a 128−bit hash.
- **SHA1:** A one-way hashing algorithm that produces a 160−bit hash.

Encryption Algorithm: Select the encryption algorithm from the drop-down menu. There are several options: DES and AES (128, 192 and 256). 3DES and AES are more powerful but increase latency.

- **DES:** Stands for Data Encryption Standard, it uses 56 bits as an encryption method.
- **3DES:** Stands for Triple Data Encryption Standard, it uses 168 (56*3) bits as an encryption method.
- **AES:** Stands for Advanced Encryption Standards, you can use 128, 192 or 256 bits as encryption method.

Perfect Forward Secrecy: It is a public-key cryptography protocol that allows two parties to establish a shared secret over an unsecured communication channel (i.e. over the Internet). MODP stands for Modular Exponentiation Groups.

Phase 1 (IKE)SA Lifetime	480	min(s)	Phase 2 (IPSec)	60	min(s)

IPSec SA Lifetime

SA Lifetime: Specify the number of minutes that a Security Association (SA) will stay active before new encryption and authentication key will be exchanged. There are two kinds of SAs, IKE and IPSec. IKE negotiates and establishes SA on behalf of IPSec, an IKE SA is used by IKE.

- **Phase 1 (IKE):** To issue an initial connection request for a new VPN tunnel. The range can be from 5 to 15,000 minutes, and the default is 480 minutes.
- **Phase 2 (IPSec):** To negotiate and establish secure authentication. The range can be from 5 to 15,000 minutes, and the default is 60 minutes. A short SA time increases security by forcing the two parties to update the keys. However, every time the VPN tunnel re-negotiates, access through the tunnel will be temporarily disconnected.

Keepalive	None ▼	PING to the IP(0.0.0.0:NEVER)	0.0.0.0	Interval	10	seconds **
Disconnection Time after No Traffic	180	seconds (180 at least)				
Reconnection Time	3	min(s) (3 at least)				

IPSec Conneciton Keep Alvie

Keep Alive:

- **None:** The default setting is None. To this mode, it will not detect the remote IPSec peer has been lost or not. It only follows the policy of Disconnection time after no traffic, which the remote IPSec will be disconnected after the time you set in this function.
- **PING:** This mode will detect the remote IPSec peer has lost or not by pinging specify IP

address.

- **DPD:** Dead peer detection (DPD) is a keeping alive mechanism that enables the router to be detected lively when the connection between the router and a remote IPSec peer has lost. Please be noted, it must be enabled on the both sites.

PING to the IP: It is able to IP Ping the remote PC with the specified IP address and alert when the connection fails. Once alter message is received, Router will drop this tunnel connection. Reestablish of this connection is required. Default setting is 0.0.0.0 which disables the function

Interval: This sets the time interval between Pings to the IP function to monitor the connection status. Default interval setting is 10 seconds. Time interval can be set from 0 to 3600 second, 0 second disables the function.

Ping to the IP	Interval (sec)	Ping to the IP Action
0.0.0.0	0	No
0.0.0.0	2000	No
xxx.xxx.xxx.xxx (A valid IP Address)	0	No
xxx.xxx.xxx.xxx(A valid IP Address)	2000	Yes, activate it in every 2000 second.

Disconnection Time after No Traffic: It is the NO Response time clock. When no traffic stage time is beyond the Disconnection time set, Router will automatically halt the tunnel connection and re-establish it base on the Reconnection Time set. 180 seconds is minimum time interval for this function.

Reconnection Time: It is the reconnecting time interval after NO TRAFFIC is initiated. 3 minutes is minimum time interval for this function.

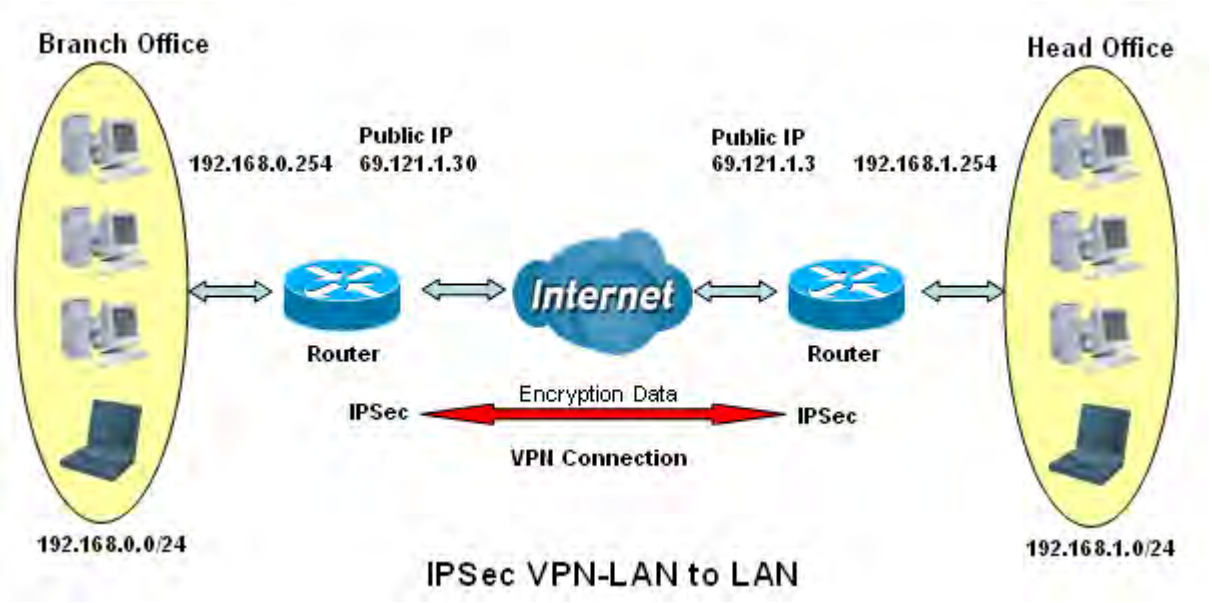
Click **SAVE** to submit the settings.

Examples: How to establish an IPSec Tunnel

1. **LAN-to-LAN connection**

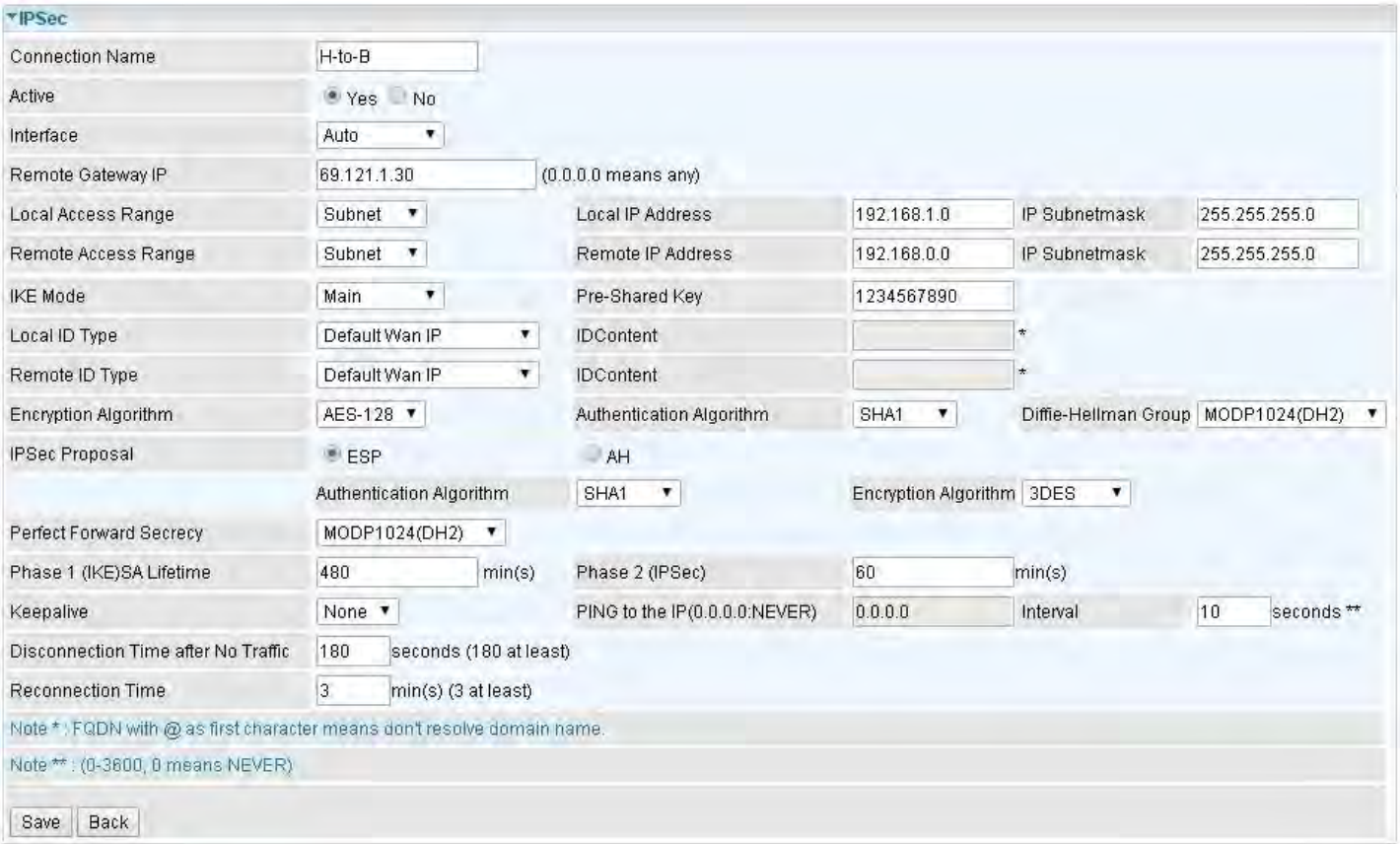
Two MX-1000 want to setup a secure IPSec VPN tunnel

Note: The IPSec Settings shall be consistent between the two routers.



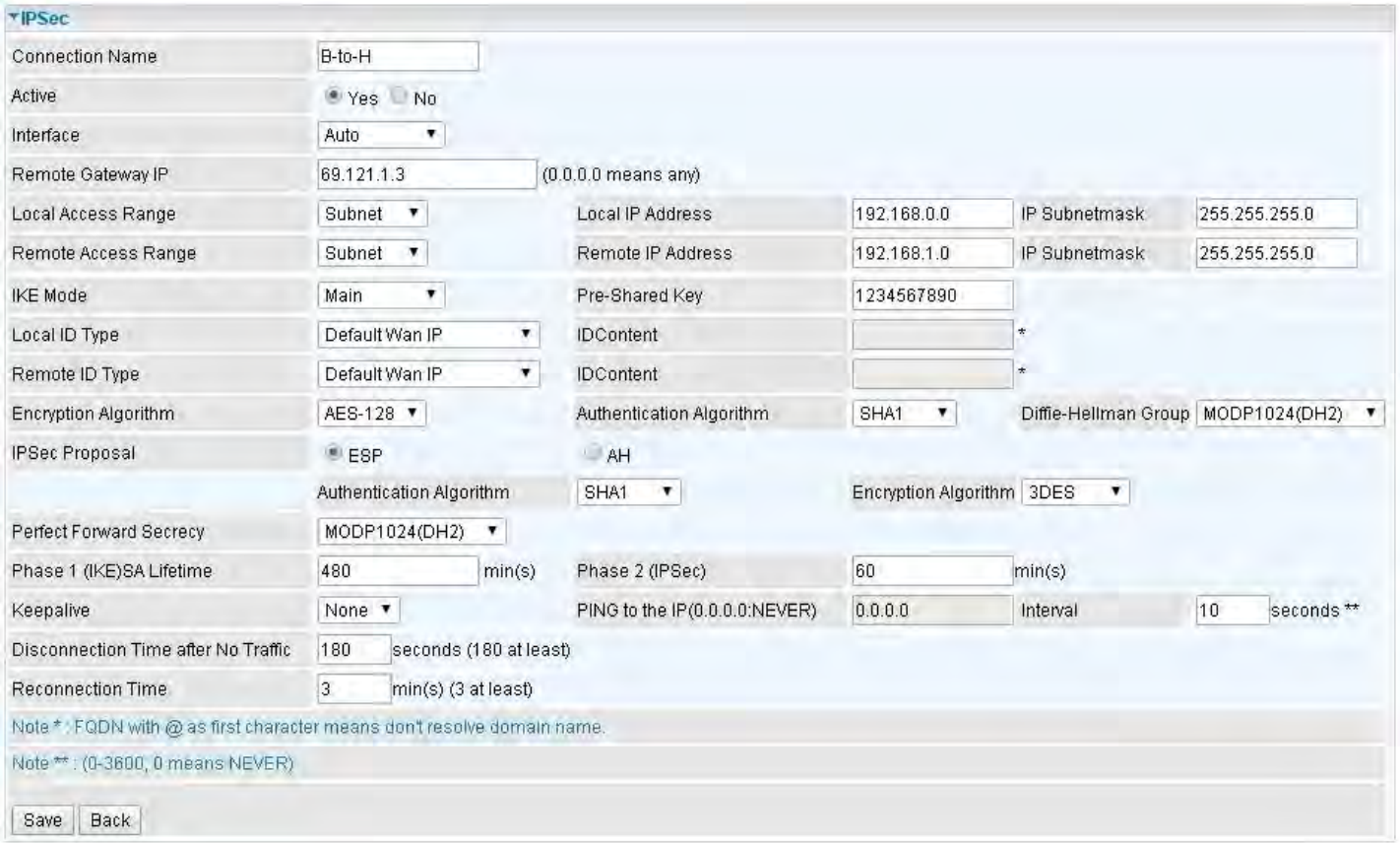
Head Office Side:

Item		Description
Connection Name	H-to-B	Name for IPSec tunnel
Remote Secure Gateway	69.121.1.30	IP address of the Branch office gateway
Access Netork		
Local Access Range	Subnet	Head Office network
Local Netwrok IP Address	192.168.1.0	
Local Netwrok Netmask	255.255.255.0	
Remote Access Range	Subnet	Branch office network
Remote Netwrok IP Address	192.168.0.0	
Remote Netwrok Netmask	255.255.255.0	
IPSec Proposal		
IKE Mode	Main	Security Plan
Pre-Shared Key	1234567890	
Phase 1 Encryption	AES-128	
Phase 1 Authentication	SHA1	
Phase 1 Diffie-Hellman Group	MODP 1024(group2)	
Phase 2 Proposal	ESP	
Phase 2 Authentication	SHA1	
Phase 2 Encryption	3DES	
Prefer Forward Security	MODP 1024(group2)	



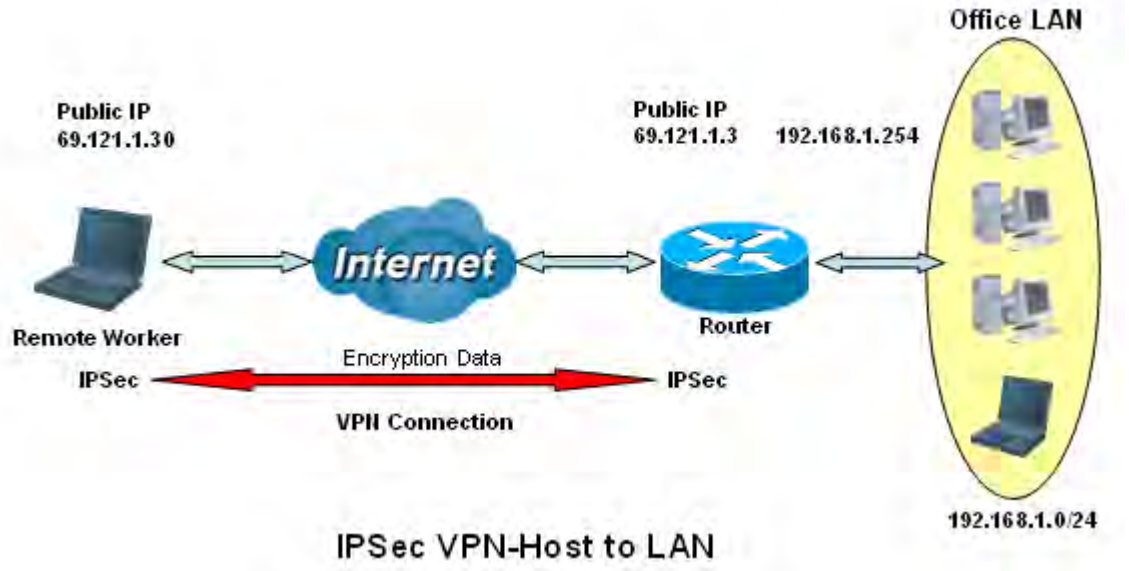
Branch Office Side:

Item		Description
Connection Name	B-to-H	Name for IPSec tunnel
Remote Secure Gateway	69.121.1.3	IP address of the Branch office gateway
Access Netork		
Local Access Range	Subnet	Head Office network
Local Netwrok IP Address	192.168.0.0	
Local Netwrok Netmask	255.255.255.0	
Remote Access Range	Subnet	Branch office network
Remote Netwrok IP Address	192.168.1.0	
Remote Netwrok Netmask	255.255.255.0	
IPSec Proposal		
IKE Mode	Main	Security Plan
Pre-Shared Key	1234567890	
Phase 1 Encryption	AES-128	
Phase 1 Authentication	SHA1	
Phase 1 Diffie-Hellman Group	MODP 1024(group2)	
Phase 2 Proposal	ESP	
Phase 2 Authentication	SHA1	
Phase 2 Encryption	3DES	
Prefer Forward Security	MODP 1024(group2)	



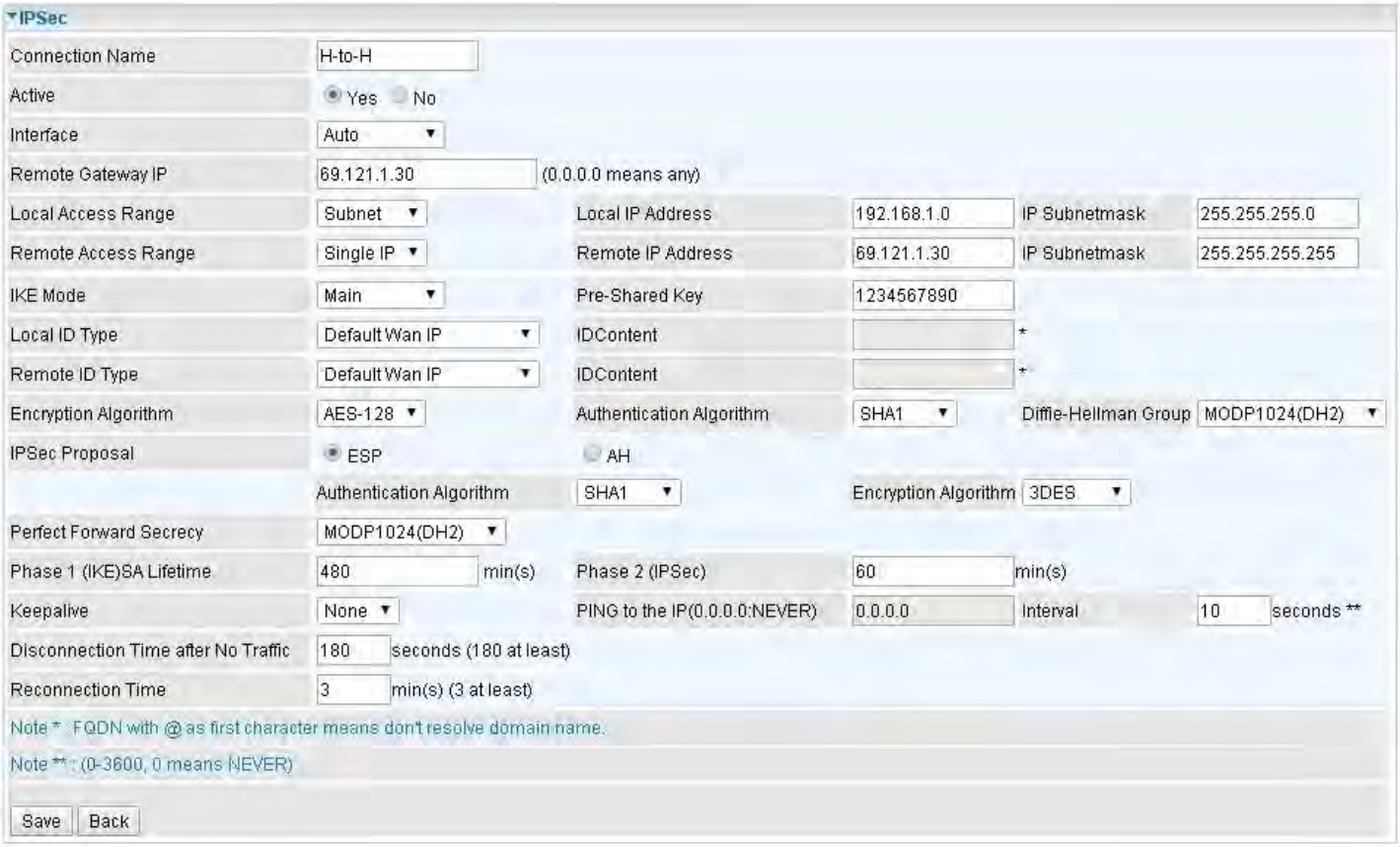
2. **Host to LAN**

Router servers as VPN server, and host should install the IPSec client to connect to head office through IPSec VPN.



Head Office Side:

Item		Description
Connection Name	H-to-H	Name for IPSec tunnel
Remote Secure Gateway	69.121.1.30	IP address of the Branch office gateway
Access Netork		
Local Access Range	Subnet	Head Office network
Local Netwrok IP Address	192.168.1.0	
Local Netwrok Netmask	255.255.255.0	
Remote Access Range	Signal IP	Host
Remote Netwrok IP Address	69.121.1.30	
Remote Netwrok Netmask	255.255.255.255	
IPSec Proposal		
IKE Mode	Main	Security Plan
Pre-Shared Key	1234567890	
Phase 1 Encryption	AES-128	
Phase 1 Authentication	SHA1	
Phase 1 Diffie-Hellman Group	MODP 1024(group2)	
Phase 2 Proposal	ESP	
Phase 2 Authentication	SHA1	
Phase 2 Encryption	3DES	
Prefer Forward Security	MODP 1024(group2)	



PPTP Server

The **Point-to-Point Tunneling Protocol** (PPTP) is a Layer2 tunneling protocol for implementing virtual private networks through IP network.

In the Microsoft implementation, the tunneled PPP traffic can be authenticated with PAP, CHAP, and Microsoft CHAP V1/V2 . The PPP payload is encrypted using Microsoft Point-to-Point Encryption (MPPE) when using MSCHAPv1/v2.

Note: 4 sessions for Client and 4 sessions for Server respectively.

PPTP Server: Select **Actived** to activate PPTP Server. **Deactived** to deactivate PPTP Server.

Authentication Type: The authentication type, Pap or Chap, and MPPE 128bit Encryption. When using PAP, the password is sent unencrypted, whilst CHAP encrypts the password before sending, and also allows for challenges at different periods to ensure that an intruder has not replaced the client. When passed the authentication with MS-CHAPv2, the MPPE encryption is supported.

MS-DNS: Directly set the IP of DNS server or let the 192.168.1.254(the router by default) be the MS-DNS server.

Rule Index: 4 rules can be added, 1-4 digit to mark each rule.

Connection Name: User-defined name for the PPTP connection.

Active: Select **Yes** to activate the account. PPTP server is waiting for the client to connect to this account.

Username: Please input the username for this account.

Password: Please input the password for this account.

Connection Type: Select Remote Access for single user, Select LAN to LAN for remote gateway.

Private IP Address Assigned to Dial-in User: Specify the private IP address to be assigned to dialin clients, and the IP should be in the same subnet as local LAN, but not occupied.

Remote Network IP Address: Please input the subnet IP for remote network.

Remote Network Netmask: Please input the Netmask for remote network.

Click **Save** button to save your changes.

PPTP Client

PPTP client can help you dial the PPTP server to establish PPTP tunnel over Internet. A total of 4 sessions can be created for PPTP client.

Rule Index: 4 rules can be added, 1-4 digit to mark each rule.

Connection Name: User-defined name for the PPTP connection.

Active: Select **Yes** to activate the account. PPTP server is waiting for the client to connect to this account.

Authentication Type: The authentication type, Pap or Chap, and MPPE 128bit Encryption. When using PAP, the password is sent unencrypted, whilst CHAP encrypts the password before sending, and also allows for challenges at different periods to ensure that an intruder has not replaced the client. When passed the authentication with MS-CHAPv2, the MPPE encryption is supported.

Username: Please input the username for this account.

Password: Please input the password for this account.

Connection Type: Select Remote Access for single user, Select LAN to LAN for remote gateway.

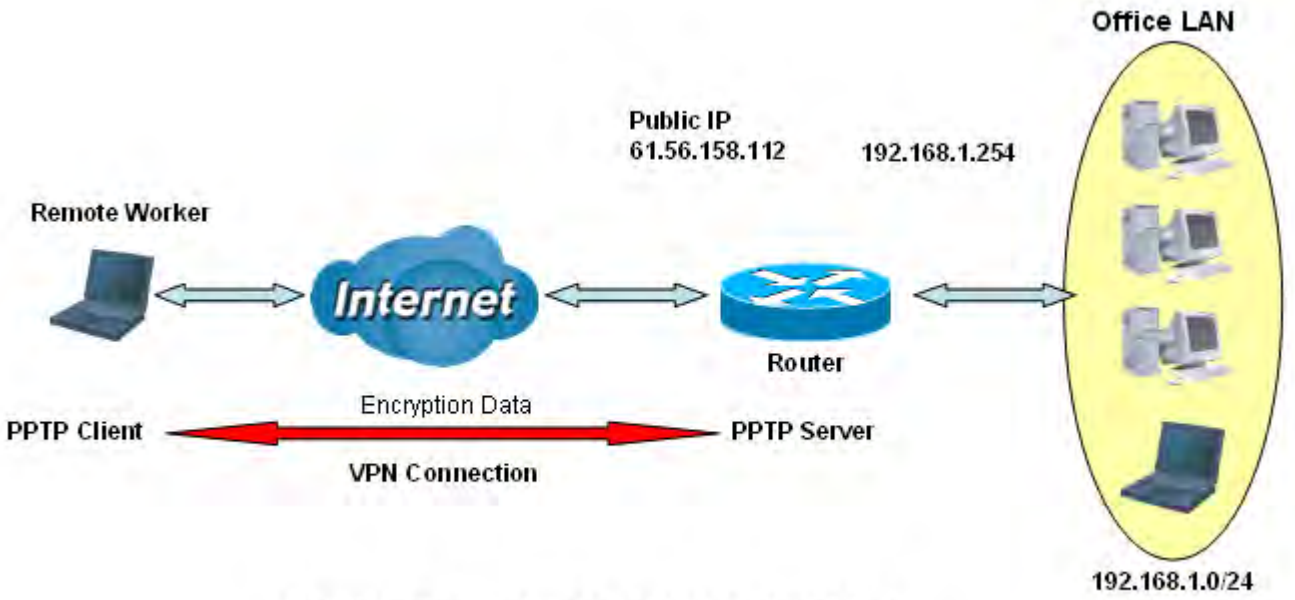
Server Address: Enter the WAN IP address of the PPTP server.

Remote Network IP Address: Please input the subnet IP for remote network.

Remote Network Netmask: Please input the Netmask for remote network.

Click **Save** button to save your changes.

Example: **PPTP Dial-in Remote Access connection**

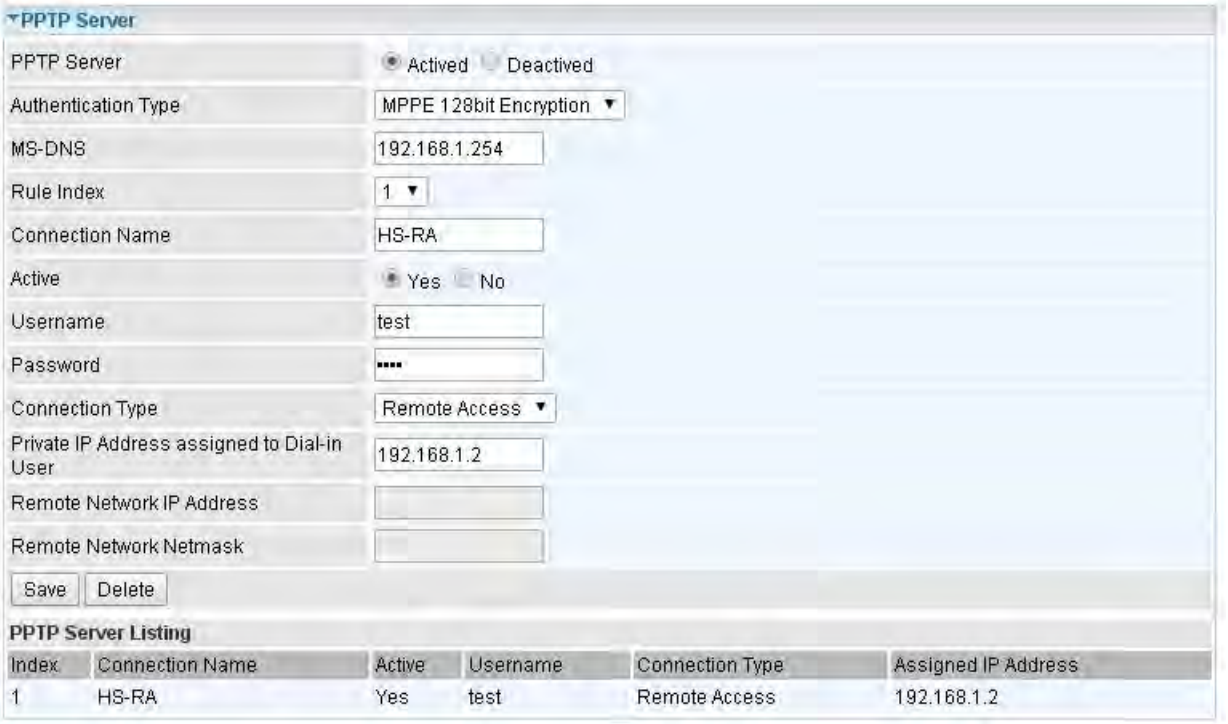


PPTP VPN-Remote Access (Dial-in)

Configuring PPTP Server in the Office

The input IP address 192.168.1.2 will be assigned to the remote worker. Please make sure this IP is not used in the Office LAN.

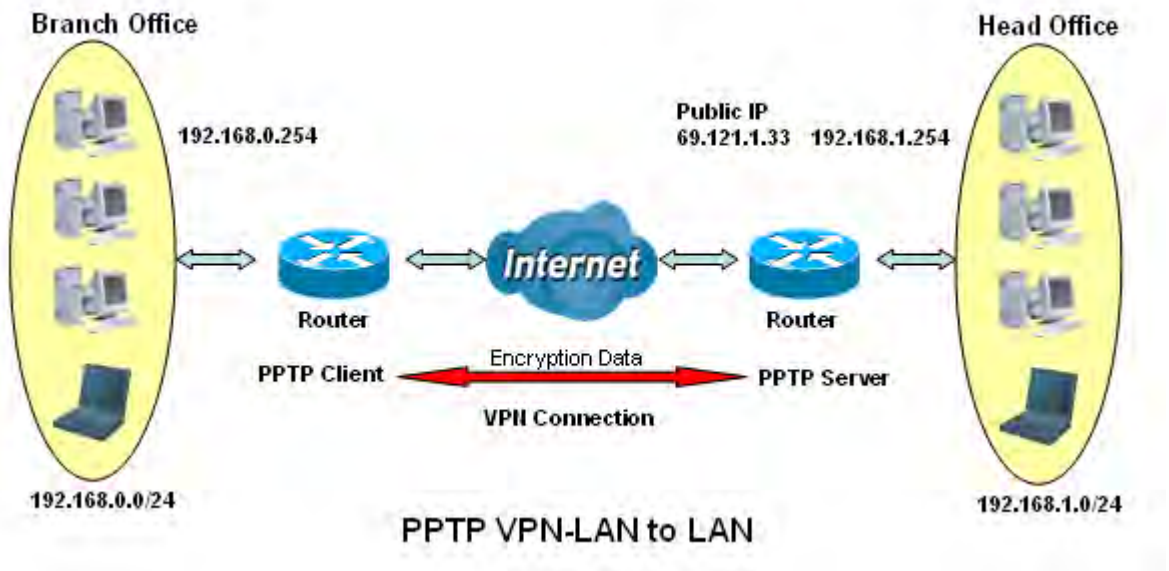
Item		Description
Connection Name	HS-RA	Give a name of L2TP conneciton
Authentication Type	MPPE 128bit	Authentication type
Username	test	Dial in authenticate user name
Passwrod	test	Dial in authenticate user password
Conneciton Type	Remote Access	Remote access for dial in
Assigned IP	192.168.1.2	An IP assigned to the dial in client



Example: PPTP LAN to LAN connection

The branch office establishes a PPTP VPN tunnel with head office to connect two private networks over the Internet. The routers are installed in the head office and branch offices accordingly.

Note: Both office LAN networks must be in different subnets with the LAN-LAN application.



Configuring PPTP Server in the Head office

The IP address 192.168.1.2 will be assigned to the router located in the branch office. Please make sure this IP is not used in the head office LAN.

Item		Description
Connection Name	HS-LL	Give a name of PPTP conneciton
Authentication Type	MPPE 128bit	Authentication type
Username	test	Dial in authenticate user name
Passwrod	test	Dial in authenticate user password
Conneciton Type	LAN to LAN	LAN to LAN for dial in
Assigned IP	192.168.1.2	An IP assigned to the dial in client
Remote Network IP	129.168.0.0	Remote access network
Remote Network Netmask	255.255.255.0	

Configuring PPTP Client in the Branch office

The IP address 69.1.121.33 is the Public IP address of the router located in head office.

Item		Description
Connection Name	BC-LL	Give a name of PPTP conneciton
Authentication Type	MPPE 128bit	Authentication type
Username	test	Dial in authenticate user name
Passwrod	test	Dial in authenticate user password
Conneciton Type	LAN to LAN	LAN to LAN for dial in
Server IP	69.121.1.33	Dialed server IP
Remote Network IP	129.168.1.0	Remote access network
Remote Network Netmask	255.255.255.0	

L2TP

L2TP, Layer 2 Tunneling Protocol is a tunneling protocol used to support virtual private networks (VPNs). It does not provide any encryption or confidentiality by itself; it relies on an encryption protocol that it passes within the tunnel to provide.

Note: 4 sessions for dial-in connections and 4 sessions for dial-out connections

Rule Index: The Index to mark the session.

Connection Name: User-defined name for the connection.

Active: To enable or disable the tunnel.

Conneciton Mode:

Connection Mode: Select Dial In to operate as a L2TP server.

Authentication Type: Default is Chap/Pap(CHAP, Challenge Handshake Authentication Protocol. PAP, Password Authentication Protocol.) if you want the router to determine the authentication type to use, or else manually specify PAP if you know which type the server is using (when acting as a client), or else the authentication type you want clients connecting to you to use (when acting as a server).

Username: Please input the username for this account.

Password: Please input the password for this account.

Private IP Address Assigned to Dial-in User: The private IP to be assigned to dialin user by L2TP

server. The IP should be in the same subnet as local LAN, and should not be occupied.

Connection Mode	Dial out
Server IP Address	
Authentication Type	Chap/Pap
Username	
Password	

Connection Mode: Choose Dial Out if you want your router to operate as a client (connecting to a remote L2TP Server, e.g, your office server).

Server IP Address: Enter the IP address of your VPN Server.

Authentication Type: Default is Chap/Pap(CHAP, Challenge Handshake Authentication Protocol. PAP, Password Authentication Protocol.) if you want the router to determine the authentication type to use, or else manually specify PAP if you know which type the server is using (when acting as a client), or else the authentication type you want clients connecting to you to use (when acting as a server).

Username: Please input the username for this account.

Password: Please input the password for this account.

Conneciton Type:

Connection Type	Remote Access

Connection Type: Remote Access for single user.

Connection Type	Lan to Lan
Remote Network IP Address	
Remote Network Netmask	

Connection Type: If “LAN to LAN” is selected, enter the peer network information, such as network address and netmask.

Tunel Authentication and Active as Default Router:

Tunnel Authentication	Enable
Secret Password	
Local Host Name	
Remote Host Name	
Active as Default Route	Enable

Tunnel Authentication: This enables router to authenticate both the L2TP remote and L2TP host. This is only valid when L2TP remote supports this feature.

Secret Password: The secure password length should be 16 characters which may include numbers and characters.

Local Host Name: Enter hostname of Local VPN device that is connected / establishes a VPN tunnel.

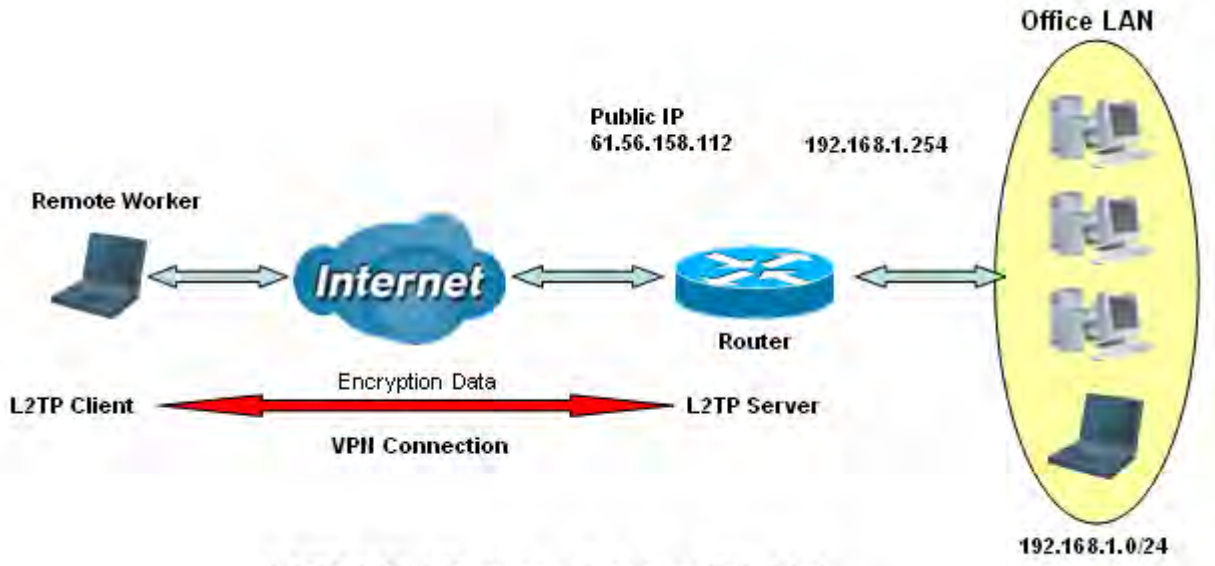
Remote Host Name: Enter hostname of remote VPN device. It is a tunnel identifier from the Remote VPN device matches with the Remote hostname provided. If remote hostname matches, tunnel will be connected; otherwise, it will be dropped.

Active as Default Route: Enabled to let the tunnel to be the default route for traffic, under this circumstance, all packets will be forwarded to this tunnel and routed to the next hop.

Examples:

1. **Configuring a L2TP VPN - Remote Access Dial-in Connection**

A remote worker establishes a L2TP VPN connection with the head office using Microsoft's VPN Adapter (included with Windows XP/2000/ME, etc.). The router is installed in the head office, connected to a couple of PCs and Servers.



L2TP VPN-Remote Access (Dial-in)

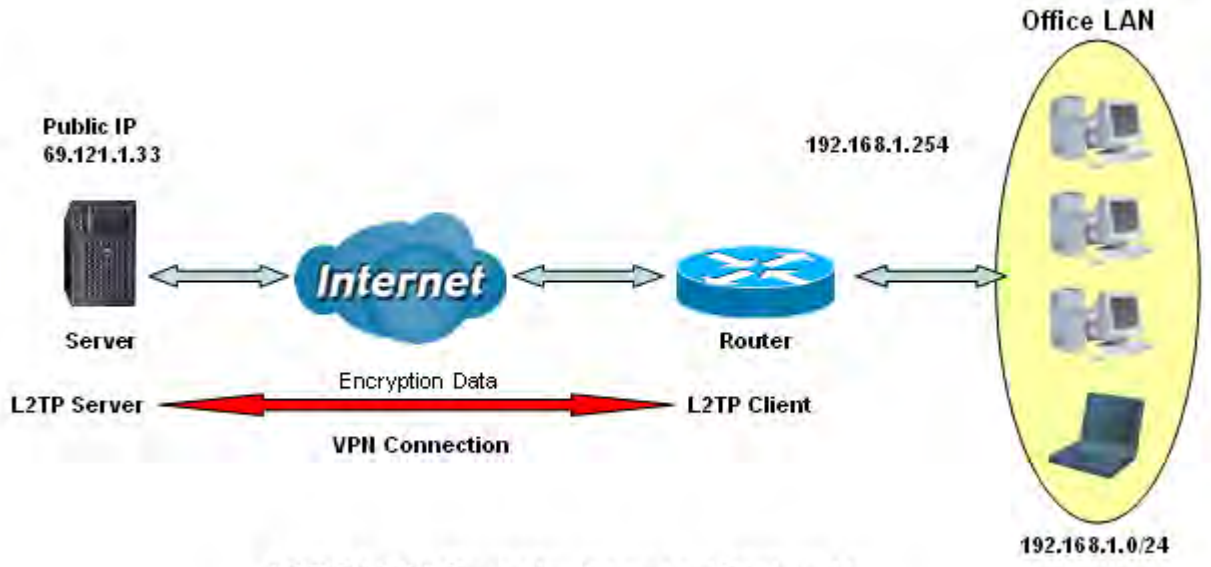
Configuring L2TP VPN Dial-in in the Office

The input IP address 192.168.1.200 will be assigned to the remote worker. Please make sure this IP is not used in the Office LAN.

Item		Description
Connection Name	HS-RA	Give a name of L2TP conneciton
Connection Mode	Dial in	Operate as L2TP server
Authentication Type	Chap/Pap	Authentication type
Username	test	Dial in authenticate user name
Passwrod	test	Dial in authenticate user password
Assigned IP	192.168.1.200	An IP assigned to the dial in client
Conneciton Type	Remote Access	Remote access for dial in

2. **Configuring a Remote Access L2TP VPN Dial-out Connection**

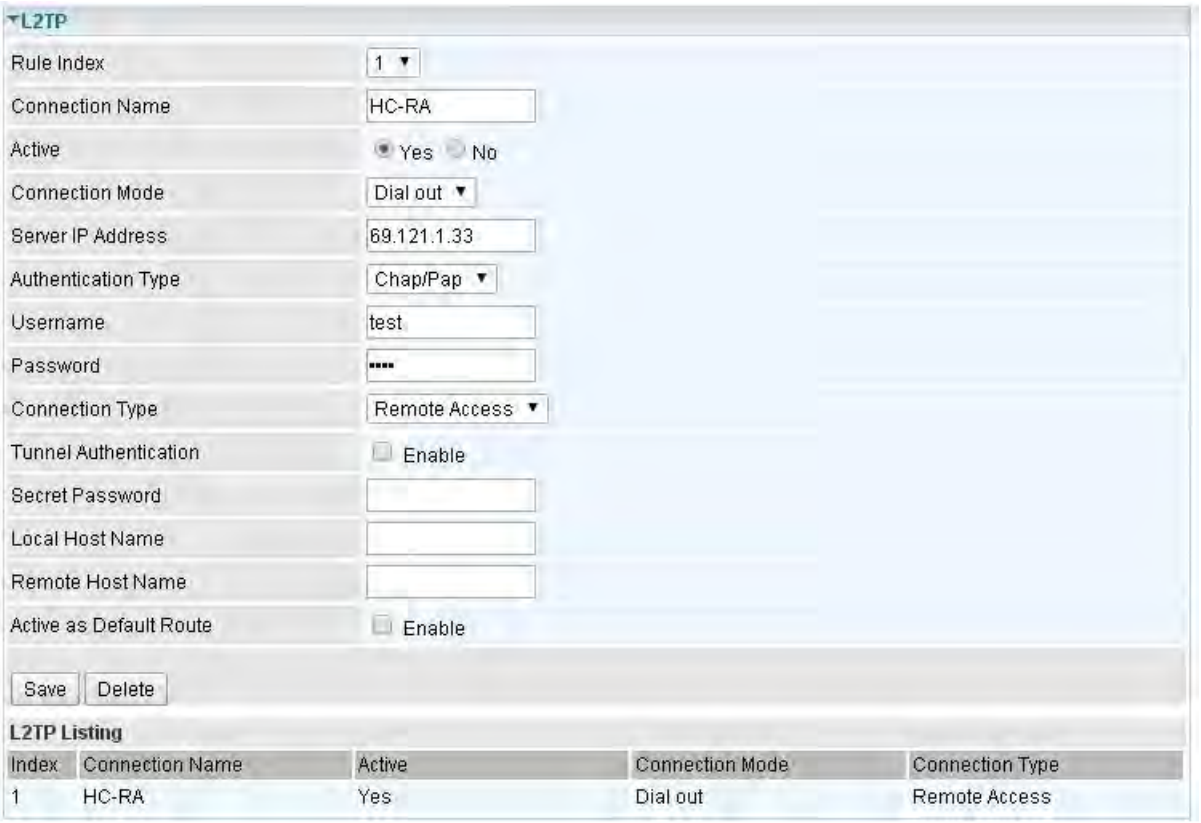
A company's office establishes a L2TP VPN connection with a file server located at a separate location. The router is installed in the office, connected to a couple of PCs and Servers.



L2TP VPN-Remote Access (Dial-out)

Configuring L2TP VPN Dial-out in the Office

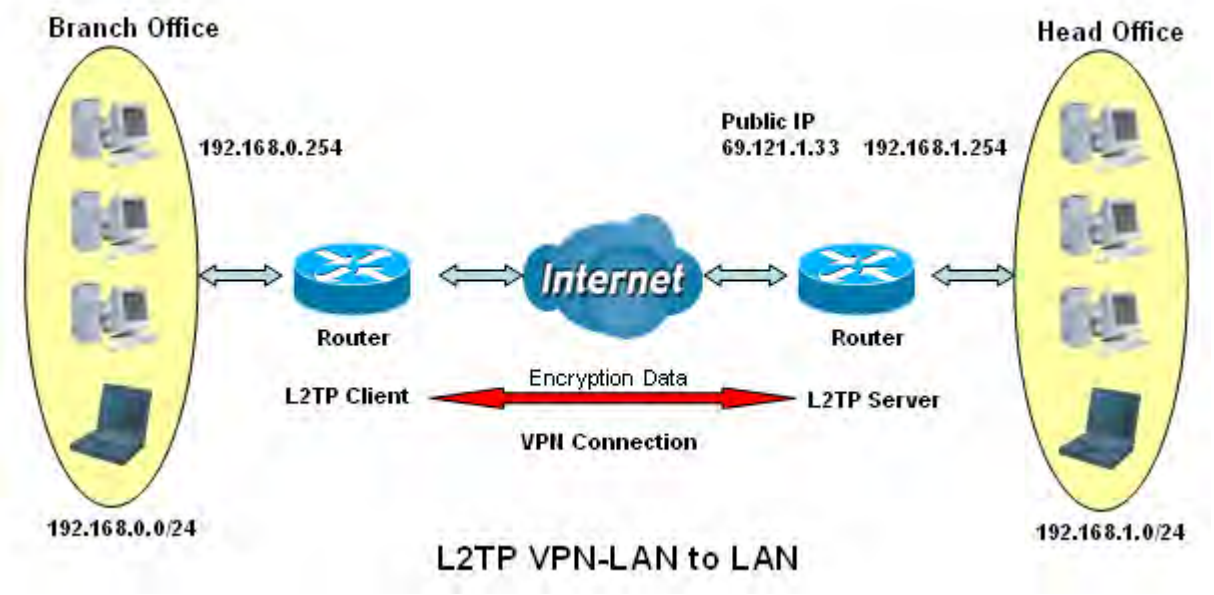
Item		Description
Connection Name	HC-RA	Give a name of L2TP conneciton
Connection Mode	Dial out	Operate as L2TP client
Server IP	69.121.1.33	Dialed server IP
Authentication Type	Chap/Pap	Authentication type
Username	test	Dial out authenticate user name
Passwrod	test	Dial out authenticate user password
Conneciton Type	Remote Access	Remote access for dial out



Example: Configuring L2TP LAN-to-LAN VPN Connection

The branch office establishes a L2TP VPN tunnel with head office to connect two private networks over the Internet. The routers are installed in the head office and branch office accordingly.

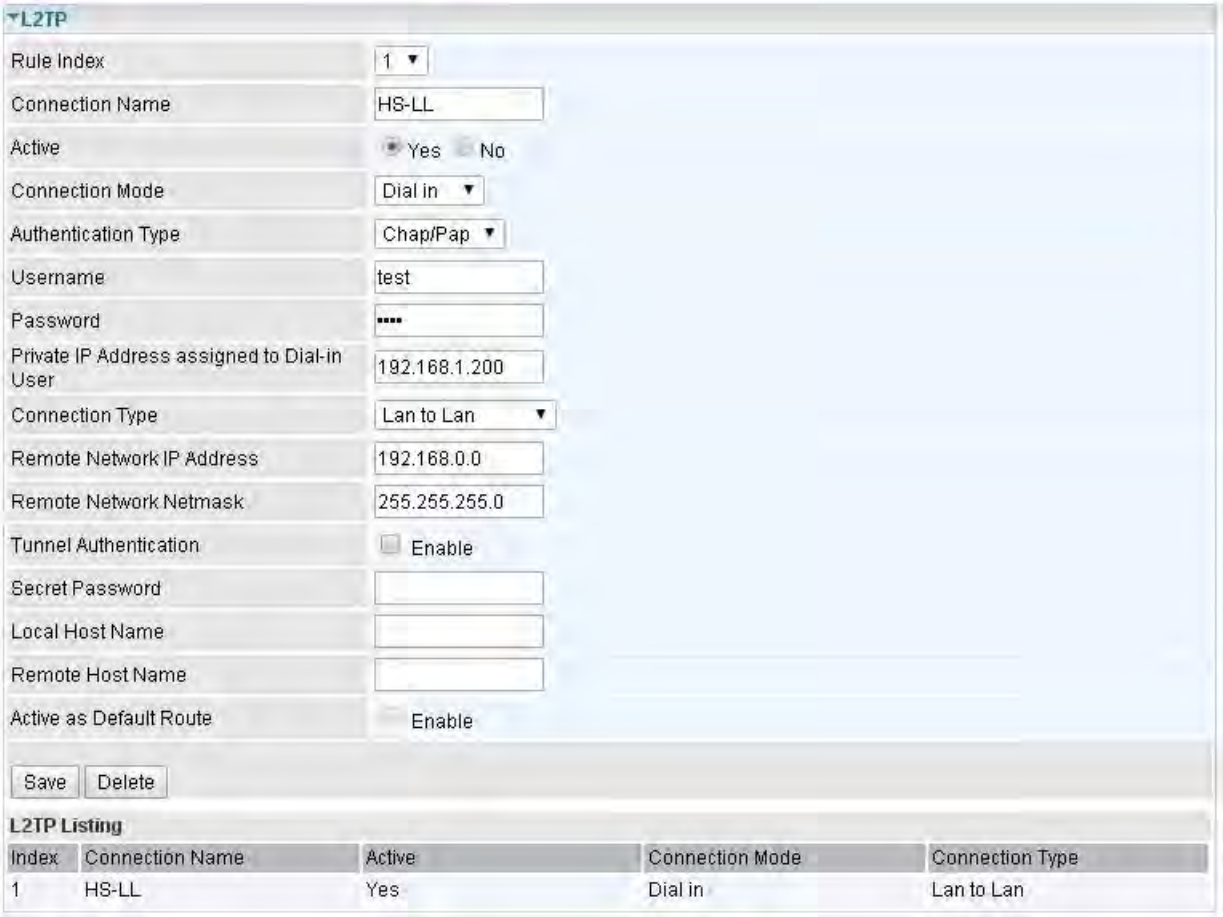
Note: Both office LAN networks must be in different subnets with the LAN-LAN application.



Configuring L2TP VPN Dial-in in the Head office

The IP address 192.168.1.200 will be assigned to the router located in the branch office. Please make sure this IP is not used in the head office LAN.

Item		Description
Connection Name	HS-LL	Give a name of L2TP conneciton
Connection Mode	Dial in	Operate as L2TP server
Authentication Type	Chap/Pap	Authentication type
Username	Test	Dial in authenticate user name
Passwrod	Test	Dial in authenticate user password
Assigned IP	192.168.1.200	An IP assigned to the dial in client
Conneciton Type	LAN to LAN	LAN to LAN for dial in
Remote Network IP	129.168.0.0	Remote access network
Remote Network Netmask	255.255.255.0	



Configuring L2TP VPN Dial-out in the Branch office

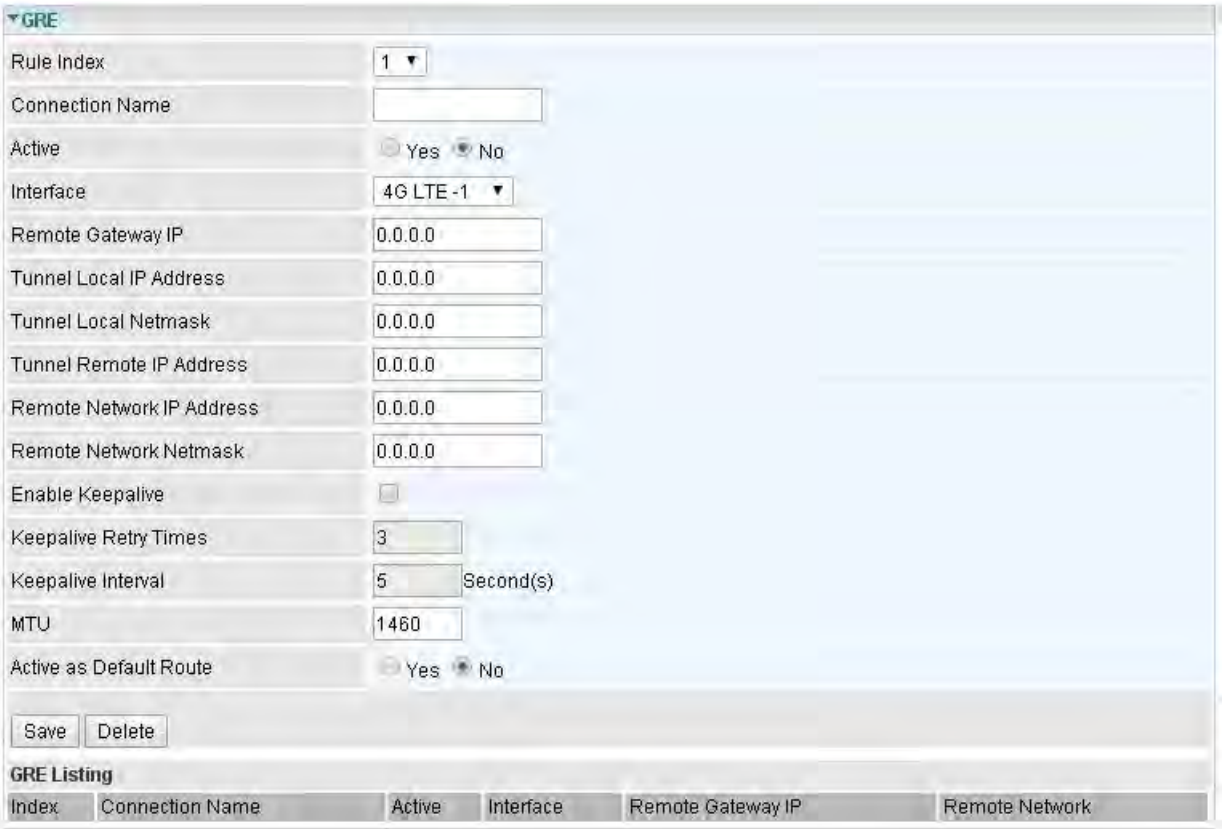
The IP address 69.1.121.33 is the Public IP address of the router located in head office.

Item		Description
Connection Name	BC-LL	Give a name of L2TP conneciton
Connection Mode	Dial out	Operate as L2TP client
Server IP	69.121.1.33	Dialed server IP
Authentication Type	Chap/Pap	Authentication type
Username	test	Dial in authenticate user name
Passwrod	test	Dial in authenticate user password
Conneciton Type	LAN to LAN	LAN to LAN for dial out
Remote Network IP	129.168.1.0	Remote access network
Remote Network Netmask	255.255.255.0	

GRE Tunnel

Generic Routing Encapsulation (GRE) is a tunneling protocol that can encapsulate a wide variety of network layer protocol packets inside virtual point-to-point links over an IP network.

Note: up to 8 tunnels can be added.



Rule Index: 8 GRE rules can be added, 1-8 digit to mark each rule.

Connection Name: User-defined name for the connection.

Active: Select Yes to activate the GRE tunnel.

Interface: Select the exact WAN interface configured for the tunnel as the local IP.

Remote Gateway: The remote GRE gateway IP.

Tunnel Local IP: Please set the source IP for the local tunnel.

Tunnel Local Netmask: Please set the netmask for the local tunnel.

Tunnel Remote IP Address: Set the peer IP address of the tunnel.

Remote Network IP Address: Please set the subnet IP for remote network.

Remote Network Netmask: Please set the Netmask for remote network.

Enable Keepalive: Normally, the tunnel interface is always up. Enable keepalive to determine when the tunnel interface is to be closed. The local router sends keepalive packets to the peer router, if keepalive response is not received from peer router within the allowed time ('retry time' multiply 'interval', based on default settings, the time interval can be 30 seconds), the local router will shut up its tunnel interface.

Keepalive Retry Times: Set the keepalive retry times, default is 3.

Keepalive Interval: Set the keepalive Interval, unit in seconds. Default is 5 seconds.

MTU: Maximum Transmission Unit.

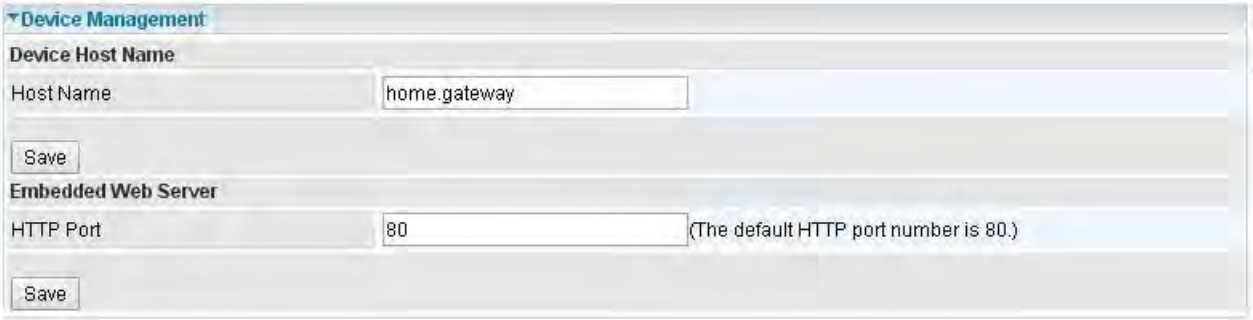
Active as Default Route: Select if to set the GRE tunnel as the default route.

Access Management

Access Management equipments the users with the ability of maintaining the access management, including **Device Management**, **SNMP**, **Universal Plug & Play**, **Dynamic DNS**, **Access Control**, **Packet Filter**, **CWMP(TR-069)**, **Parental Control**, and **SAMBA & FTP Server.**

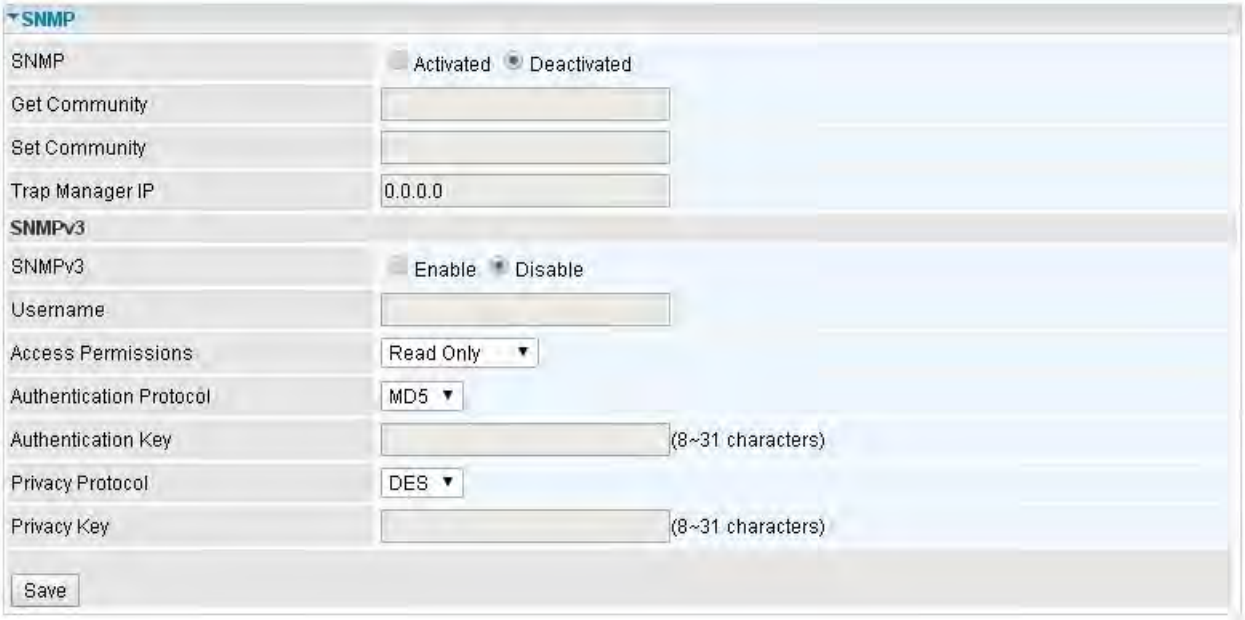
Device Management

Device management offers users a way to change the embedded web server accessing port, default 80. User can change the http port to 8080 or something else here.



SNMP

Simple Network Management Protocol (SNMP) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. MX-1000 serves as a SNMP agent which allows a manager station to manage and monitor the router through the network.



SNMP: Select to enable SNMP feature.

Get Community: Type the Get Community, which is the password for the incoming Get-and-GetNext requests from the management station.

Set Community: Type the Set Community, which is the password for incoming Set requests from the management station.

Trap Manager IP: Enter the IP of the server receiving the trap message (when some exception occurs) sent by this SNMP agent.

SNMPv3: Enable to activate the SNMPv3.

Username: Enter the name allowed to access the SNMP agent.

Access Permissions: Set the access permissions for the user; RO--read only and RW--read and writer.

Authentication Protocol: Select the authentication protocol, MD5 and SHA. SNMP agent can communicate with the manager station through authentication and encryption to secure the message exchange. Set the authentication and encryption information here and below.

Authentication Key: Set the authentication key, 8-31 characters.

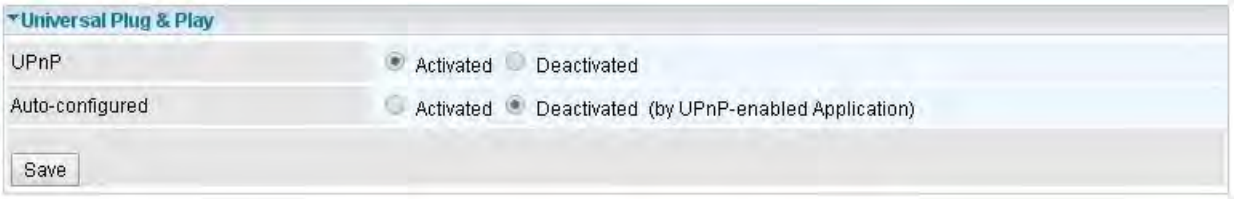
Privacy Protocol: Select the privacy mode, DES and AES.

Privacy Key: Set the privacy key, 8-31 characters.

Universal Plug & Play

UPnP offers peer-to-peer network connectivity for PCs and other network devices, along with control and data transfer between devices. UPnP offers many advantages for users running NAT routers through UPnP NAT Traversal, and on supported systems makes tasks such as port forwarding much easier by letting the application control the required settings, removing the need for the user to control advanced configuration of their device.

Both the user's Operating System and the relevant application must support UPnP in addition to the router. Windows XP and Windows ME natively support UPnP (when the component is installed), and Windows 98 users may install the Internet Connection Sharing client from Windows XP in order to support UPnP. Windows 2000 does not support UPnP.



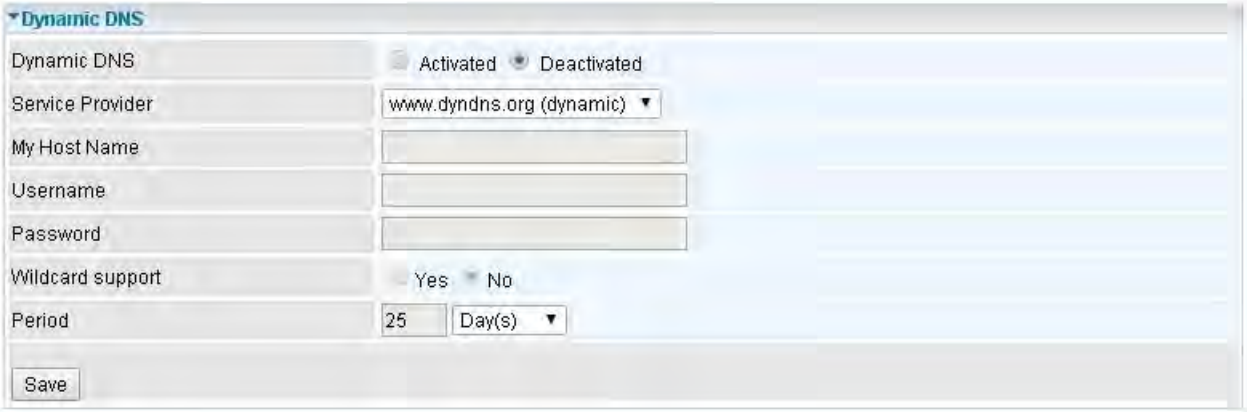
UPnP: Select this checkbox to activate UPnP. Be aware that anyone could use a UPnP application to open the web configuration's login screen without entering the MX-1000 IP address.

Auto-configured: Select this check box to allow UPnP-enabled applications to automatically configure the MX-1000 so that they can communicate through the gateway, for example by using NAT traversal, UPnP applications automatically reserve a NAT forwarding port in order to communicate with another UPnP enabled device; this eliminates the need to manually configure port forwarding for the UPnP enabled application.

Dynamic DNS

The Dynamic DNS function allows you to alias a dynamic IP address to a static hostname, allowing users whose ISP does not assign them a static IP address to use a domain name. This is especially useful for hosting servers via your internet connection, so that anyone wishing to connect to you may use your domain name, rather than having to use your dynamic IP address, which changes from time to time. This dynamic IP address is the WAN IP address of the router, which is assigned to you by your ISP.

Here users can register different WAN interfaces with different DNS(es). But note that first users have to go to the Dynamic DNS registration service provider to register an account.



Dynamic DNS: Select this check box to activate Dynamic DNS.

Service Provider: Select from drop-down menu for the appropriate service provider, for example: www.dyndns.org.

My Host Name: Type the domain name assigned to your router by your Dynamic DNS provider.

Username: Type your user name.

Password: Type the password.

Wildcard support: Select this check box to enable DYNDNS Wildcard.

Period: Set the time period between updates, for the Router to exchange information with the DDNS server. In addition to updating periodically as per your settings, the router will perform an update when your dynamic IP address changes.

Example: How to register a DDNS account

Note first users have to go to the Dynamic DNS registration service provider to register an account.

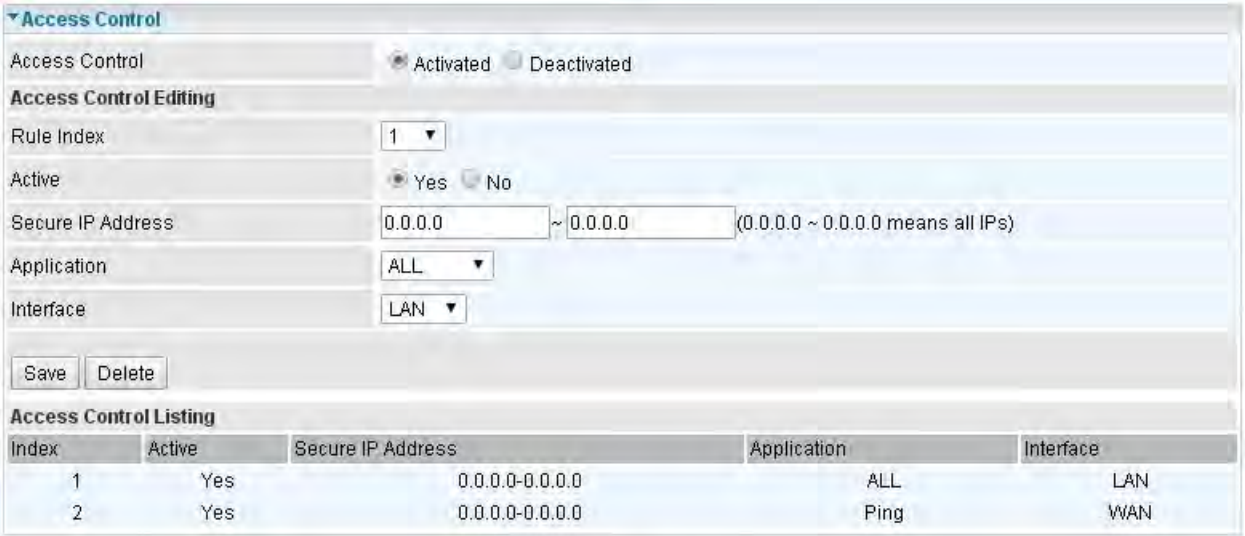
User ***test1*** register a Dynamic Domain Names in DDNS provider **http://www.dyndns.org/** .

DDNS: www.hometest.com using username/password test/test

Access Control

Access Control Listing allows you to determine which services/protocols can access MX-1000 interface from which computers. It is a management tool aimed to allow IPs (set in secure IP address) to access specified embedded applications (Web, etc, user can set) through some specified interface (LAN, WAN or both). User can have an elaborate understanding in the examples below.

The maximum number of entries is **16**.



Access Control: Select whether to make Access Control function available.

Rule Index: This is item number

Active: Select to activate the rule.

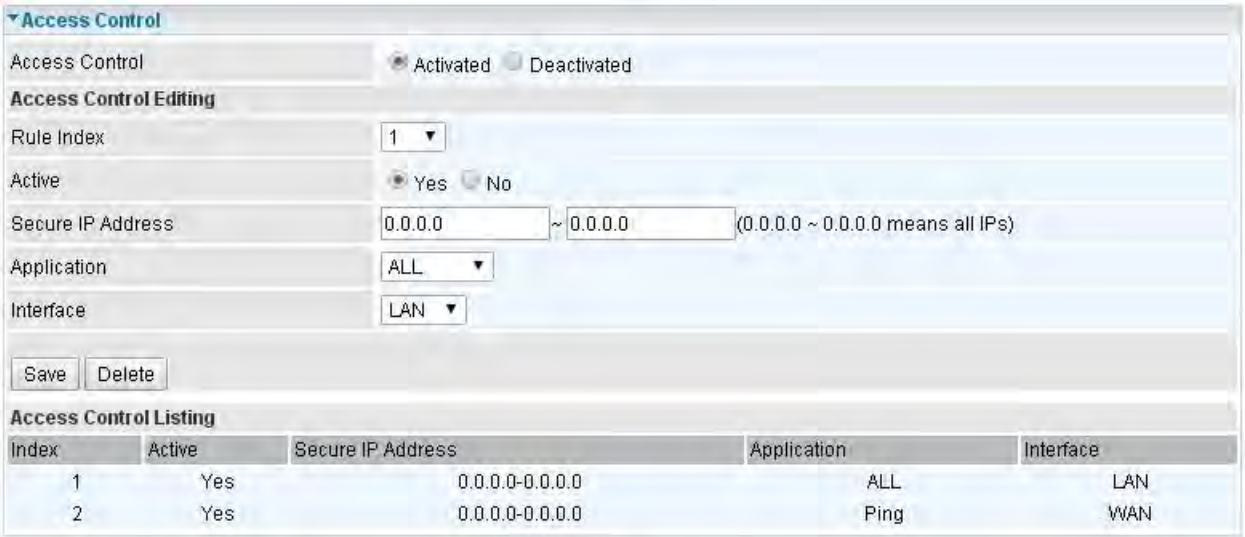
Secure IP Address: The default 0.0.0.0 allows any client to use this service to manage the gateway. Type an IP address range to restrict access to the client(s) without a matching IP address.

Application: Choose a service that you want to all access to all the secure IP clients. The drop-down menu lists all the common used applications.

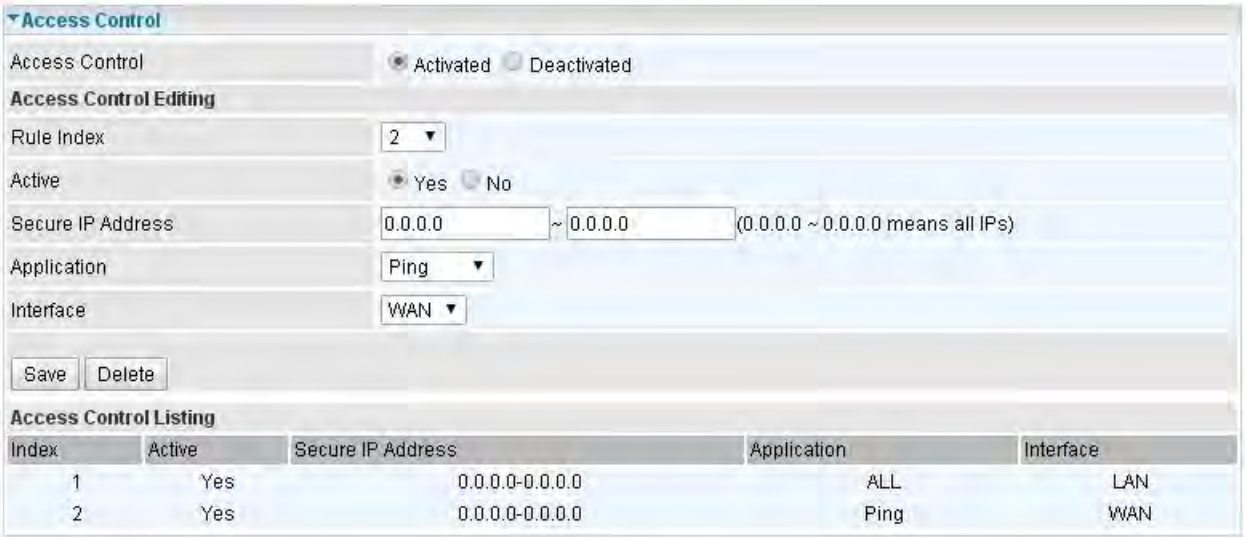
Interface: Select the access interface. Choices are **LAN**, **WAN** and **Both**.

By default, the “Access Control” has **two default rules**.

Default Rule 1: (Index 1), a rule to allow only clients from LAN to have access to all embedded applications (Web, FTP, etc). Under this situation, clients from WAN cannot access the router even from Ping.



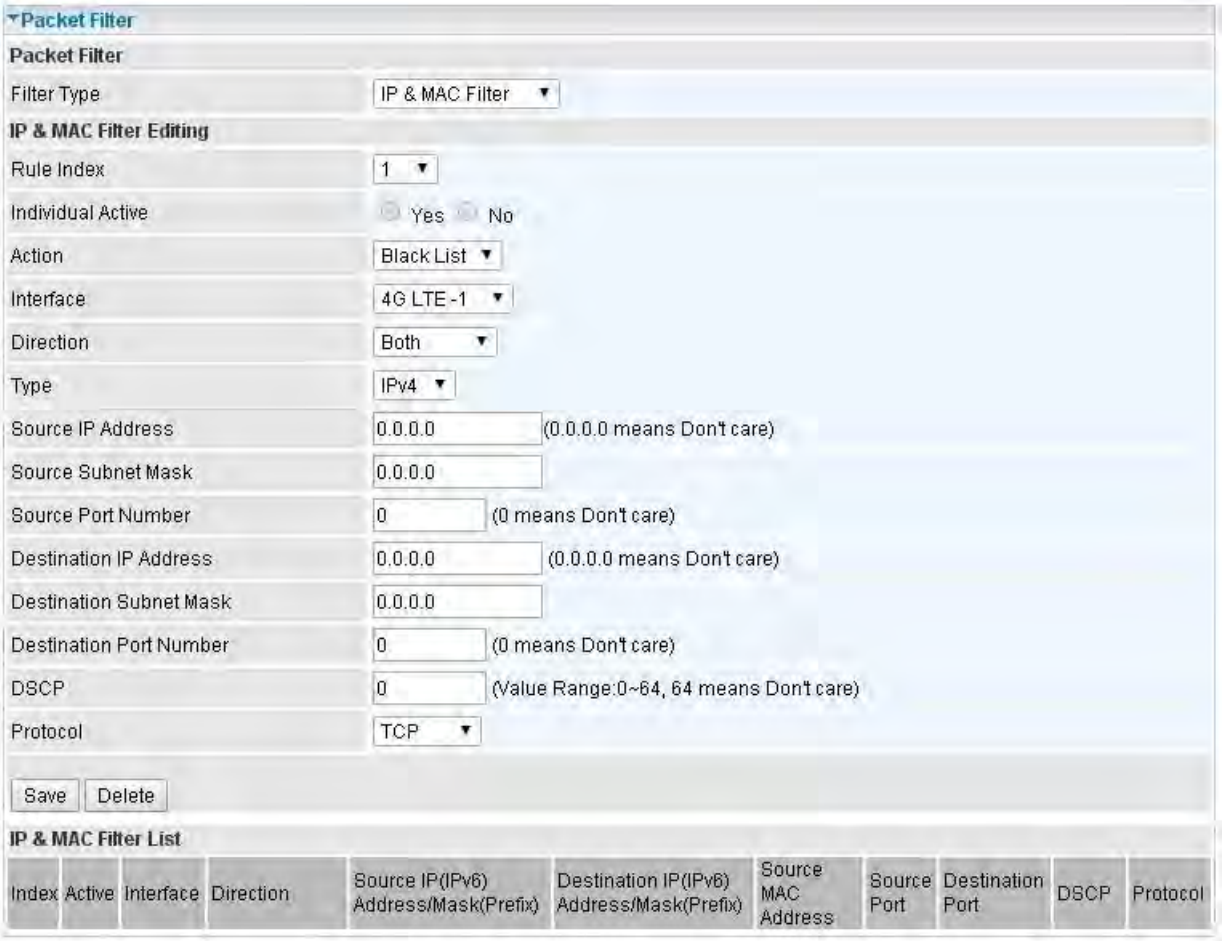
Default Rule 2: (Index 2), an ACL rule to open Ping to WAN side.



Packet Filter

You can filter the packages by MAC address, IP address, Protocol, Port number and Application or URL.

❖ Packet Filter - IP & MAC Filter



Packet Filter

Filter Type: There are three types "**IP & MAC Filter**", "**Application Filter**", and "**URL Filter**" that user can select for this filter rule. Here we set **IP & MAC Filter**.

IP & MAC Filter Editing

Rule Index: This is item number

Individual Active: Select **Yes** to activate the rule.

Action: This is how to deal with the packets matching the rule. Allow please select White List or block selecting Black List.

Interface: Select to determine which interface the rule will be applied to.

Direction: Select to determine whether the rule applies to outgoing packets, incoming packets or packets of both directions.

Type: Choose type of field you want to specify to monitor. Select "IPv4" for IPv4 address, port number and protocol. Select "IPv6" for IPv6 address, port number and protocol. Select "MAC" for MAC address.

Source IP Address: The source IP address of packets to be monitored. 0.0.0.0 means “Don’t care”.

Source Subnet Mask: Enter the subnet mask of the source network.

Source Port Number: The source port number of packets to be monitored. 0 means “Don’t care”.

Destination IP Address: The destination IP address of packets to be monitored. 0.0.0.0 means “Don’t care”.

Destination Subnet Mask: Enter the subnet mask of the destination network.

Destination Port Number: This is the Port that defines the application. (e.g. HTTP is port 80.)

DSCP: DSCP: Differentiated Services Code Point, it is recommended that this option be configured by an advanced user or keep 0. (0 means Don’t care.)

Protocol: Specify the packet type (TCP, UDP, ICMP, and ICMPv6) that the rule applies to.

IP/MAC Filter List

Index: Item number**.**

Active: Whether the connection is currently active.

Interface: show the interface the rule applied to.

Direction: show the direction the rule applied to.

Source IP (IPv6) Address/Mask (Prefix): The source IP address or range of packets to be monitored.

Destination IP (IPv6) Address/Mask (Prefix): This is the destination subnet IP address.

Source MAC Address: show the MAC address of the rule applied.

Source Port: The source port number of packets to be monitored.

Destination Port: This is the Port or Port Ranges that defines the application.

DSCP: show the set DSCP.

Protocol: It is the packet protocol type used by the application. Select either **TCP** or **UDP** or **ICMP or ICMPv6**

❖ Packet Filter - Application Filter

Application Filter: Select this option to Activated/Deactivated the Application filter.

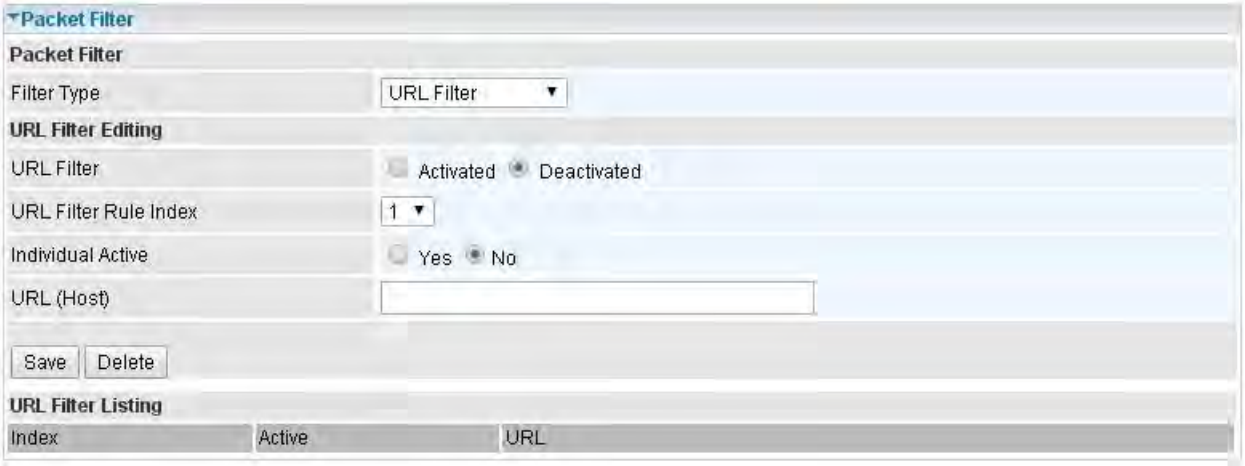
ICQ: Select this option to Allow/Deny ICQ.

MSN: Select this option to Allow/Deny MSN.

YMSG: Select this option to Allow/Deny Yahoo messenger.

Real Audio/Video (RTSP): Select this option to Allow/Deny Real Audio/Video (RTSP).

❖ Packet Filter - URL Filter



URL Filter: Select **Activated** to enable URL Filter.

URL Filter Rule Index: This is item number.

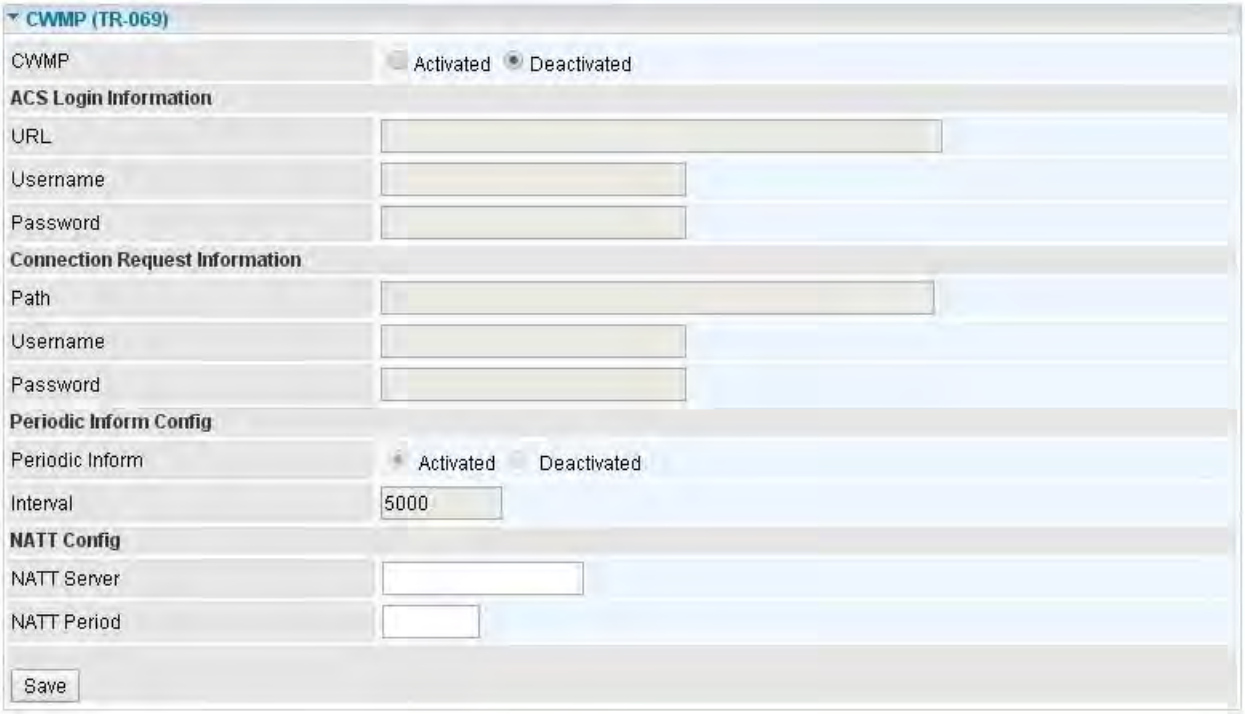
Individual Active: To give control to the specific URL access individually, for example, you want to prohibit access to www.yahoo.com, please first press Activated in “URL Filter” field, and also Yes in “Individual Active” field; if some time you want to allow access to this URL, you simply select No in individual active field. In a word, the command serves as a switch to the access of some specific URL with the filter on.

URL (Host): Specified URL which is prohibited from accessing.

CWMP (TR-069)

CWMP, short for CPE WAN Management Protocol, also called TR069 is a Broadband Forum technical specification entitled CPE WAN Management Protocol (CWMP). It defines an application layer protocol for remote management of end-user devices. It defines an application layer protocol for remote management of end-user devices.

As a bidirectional SOAP/HTTP based protocol it can provides the communication between customer premises equipment (CPE) and Auto Configuration Server (ACS). It includes both a safe configuration and the control of other CPE management functions within an integrated framework. In the course of the booming broadband market, the number of different internet access possibilities grew as well (e.g. modems, routers, gateways, set-top box, VoIP-phones).At the same time the configuration of this equipment became more complicated –too complicated for end-users. For this reason, TR-069 was developed. It provides the possibility of auto configuration of the access types. Using TR-069 the terminals can get in contact with the Auto Configuration Servers (ACS) and establish the configuration automatically and let ACS configure CPE automatically.



CWMP: Select activated to enable CWMP.

ACS Login Information

URL: Enter the ACS server login URL.

User Name: Specify the ACS User Name for ACS authentication to the connection from CPE.

Password: Enter the ACS server login password.

Connection Request Information

Path: Local path in HTTP URL for an ACS to make a Connection Request notification to the CPE.

Username: Username used to authenticate an ACS making a Connection Request to the CPE.

Password: Password used to authenticate an ACS making a Connection Request to the CPE.

Periodic Inform Config

Periodic Inform: Select Activated to authorize the router to send an Inform message to the ACS automatically.

Interval(s): Specify the inform interval time (sec) which CPE used to periodically send inform message to automatically connect to ACS. When the inform interval time arrives, the CPE will send inform message to automatically connect to ACS.

Parental Control

Parental Control provides Web content filtering offering safer and more reliable web surfing for users. Please get an account and configure at the selected Provider “www.opendns.com” in advance. If activated, the Parental Control has the top priority as DNS when accessing internet.

Host Name, Username and Password: Enter your registered domain name and your username and password at the provider website www.opendns.com.

SAMBA & FTP Server

Samba and FTP are served as network sharing.

SAMBA Server: Activated to enable SAMBA sharing.

Work Group: The same mechanism like in Microsoft work group, please set the Work Group name.

NetBIOS Name: The sharing NetBIOS name.

FTP Server: Activated to enable FTP sharing.

FTP Server Port: Set the working port. Well-known one is 21. User can change it.

SAMBA/FTP login account:

- **Default user:** admin/admin, it is the administrative user and a super user, it has the full authority of SAMBA /FTP access and operation permission of objects in SAMBA and FTP server.
- **New user:** users can create new user(s) to grant it (them) access and permission to the SAMBA & FTP server.

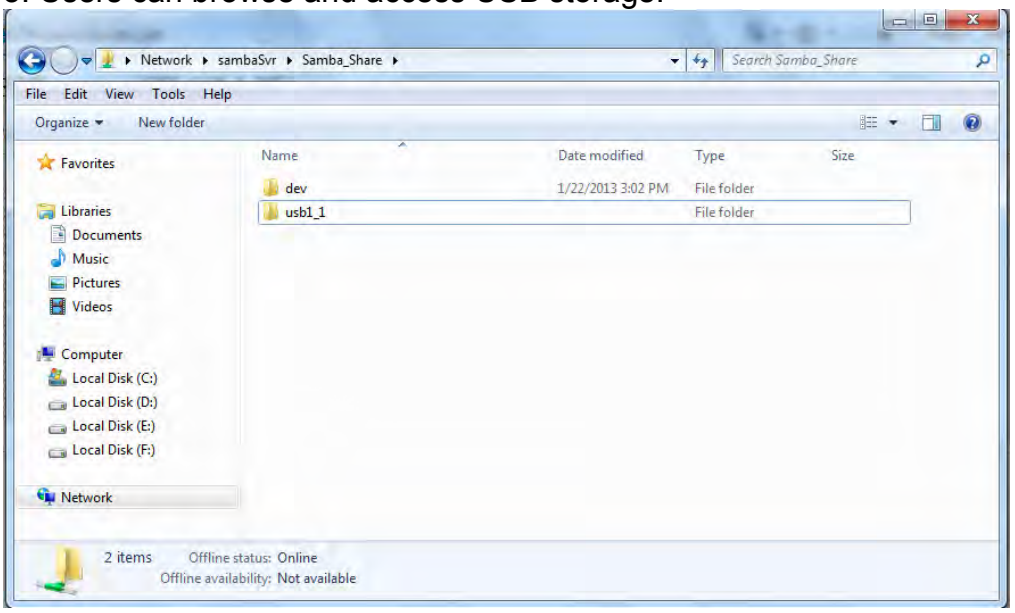
Please see User Management.

Example: How to setup Samb

1. Go directly to Start > Run (enter \\192,168,1,254 (from LAN side), \\SambaSvr , but if you enter \\SambaSvr, please be sure your working PC is in the same workgroup as set in the samba server set above.)

2. Enter the Username and password.

3. Users can browse and access USB storage.



Example: How to setup FTP：

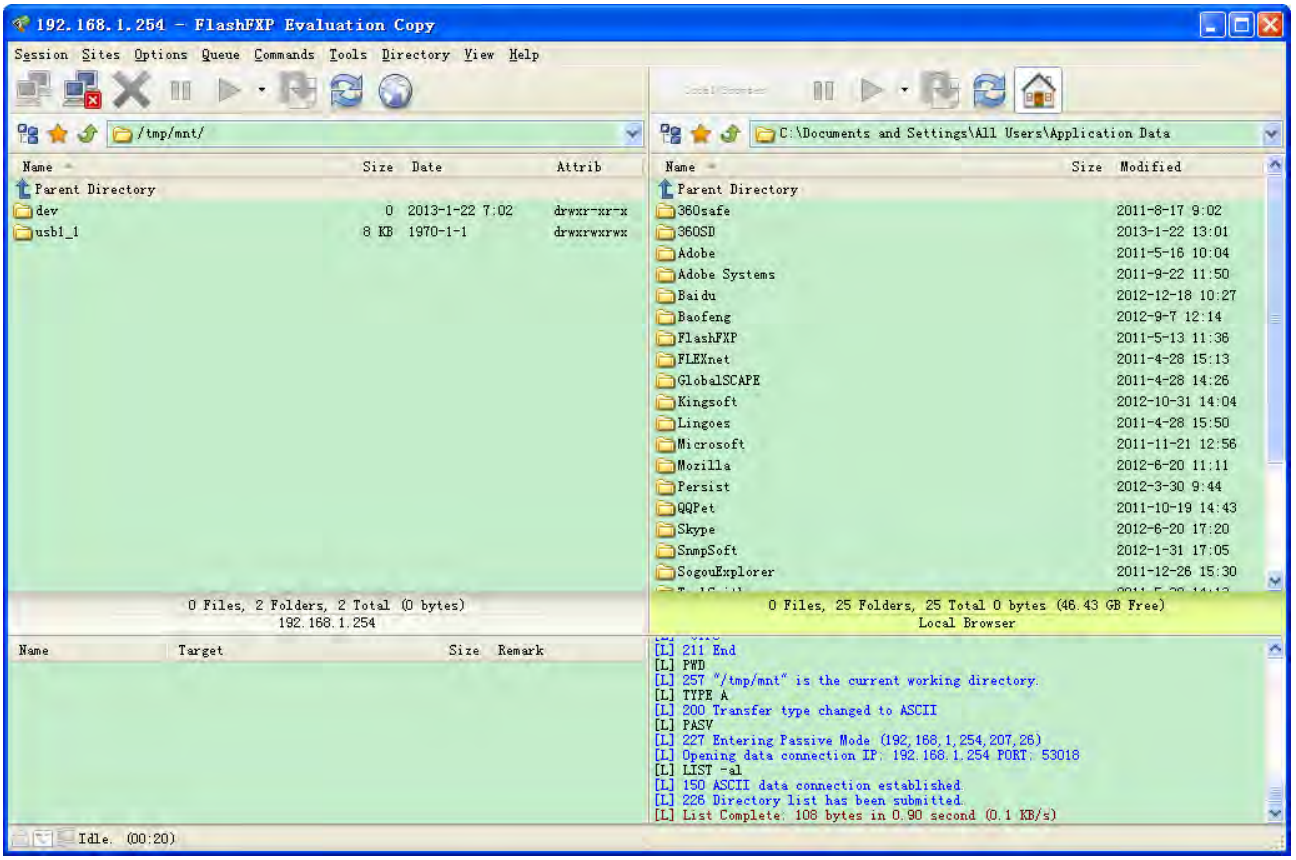
1. **Access via FTP tools**

Take popular FTP tool of FlashFXP for example:

1) Open FlashFXP

2) Create ftp sites (LAN IP / WAN IP, 192.168.1.254, and set the account, port).

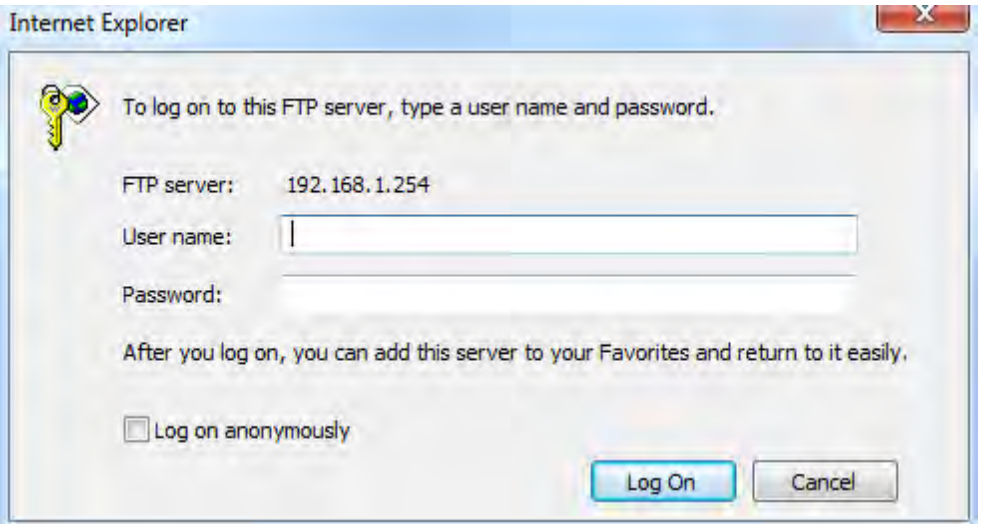
3) Connect to the ftp site.



2. **Web FTP access**

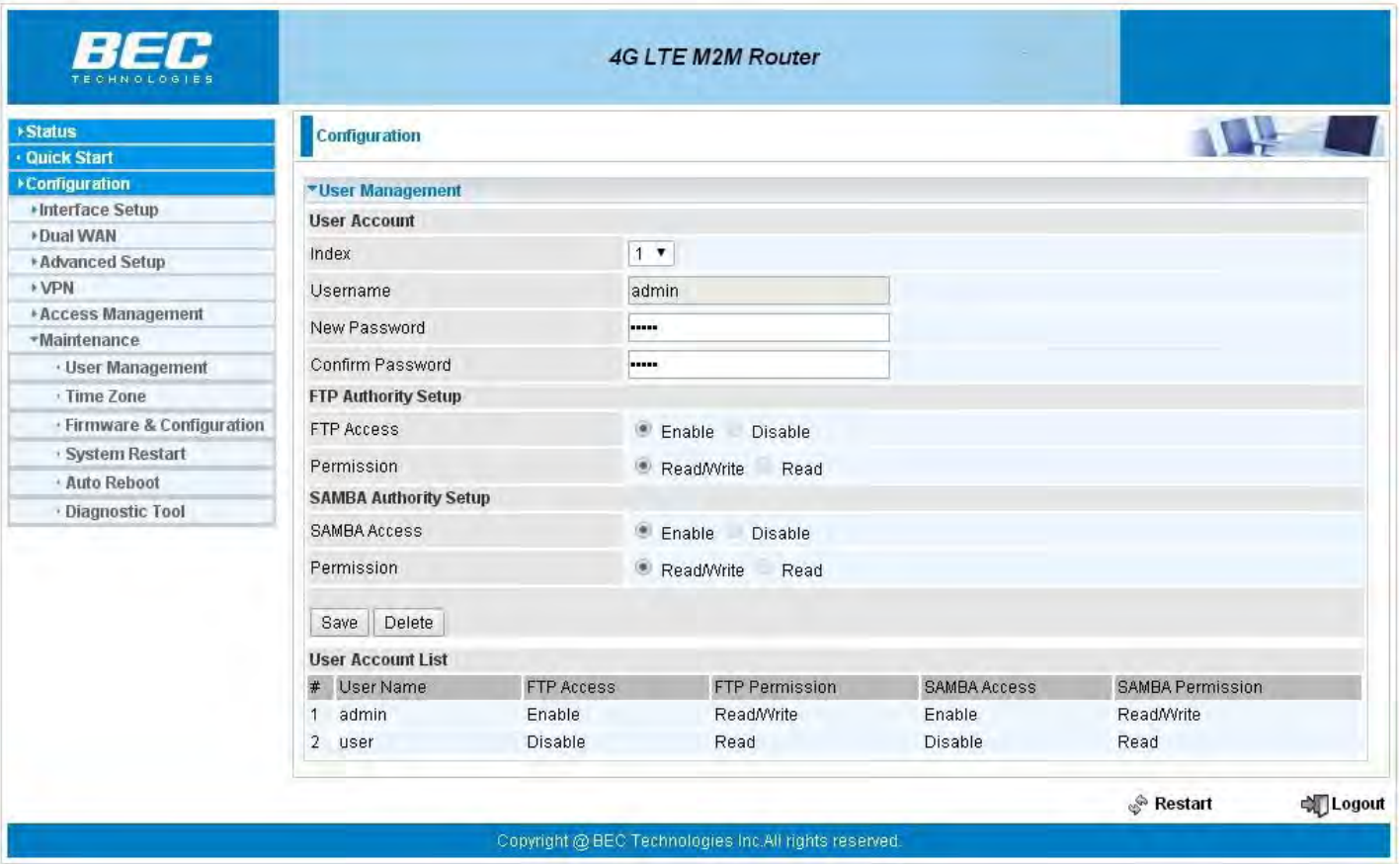
1) Enter ftp://192.168.1.254 at the address bar of the web page.

2) Enter the account's username and password.



Maintenance

Maintenance equipments the users with the ability of maintaining the device as well as examining the connectivity of the WAN connections, including **User Management**, **Time Zone**, **Firmware & Configuration**, **System Restart**, and **Diagnostic Tool.**

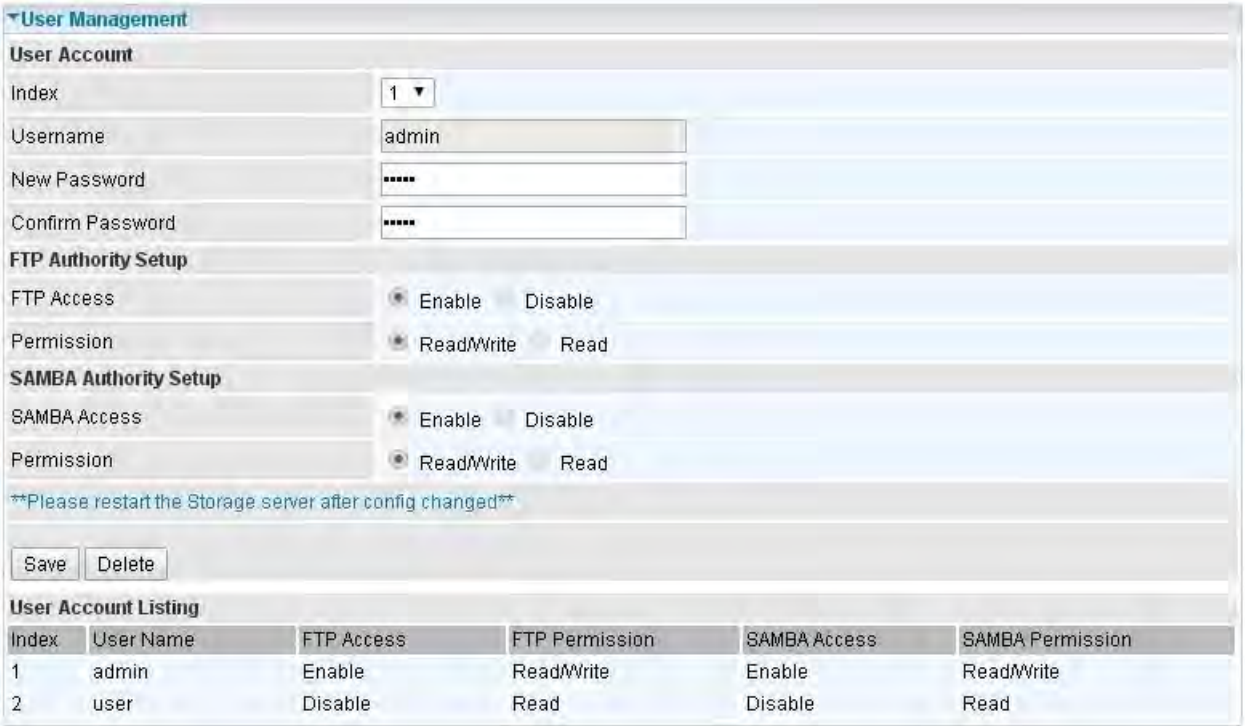


User Management

User Management controls the Router Web GUI permission, FTP/SAMBA access to the specific account.

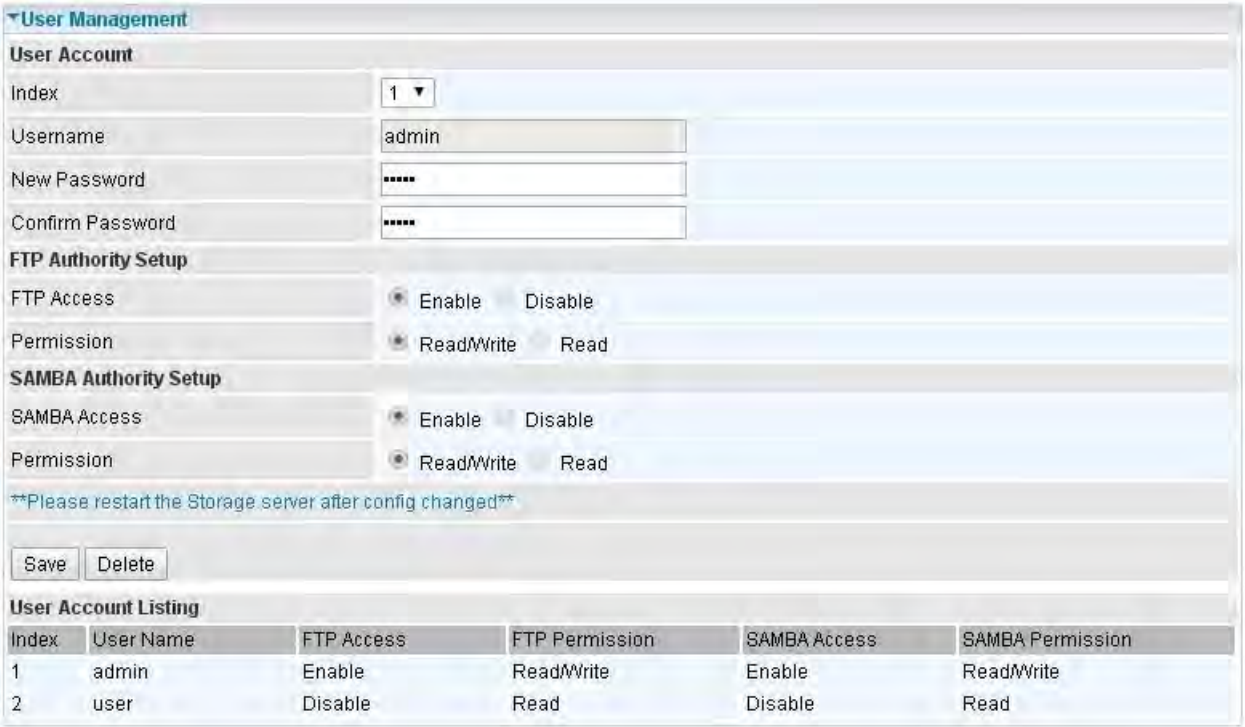
In factory setting, the default accounts are **admin/admin** and **user/user.** The default root account admin has been authorized to web access of router, Samba access, and FTP access. **user/user** is equipment with limited access (specified by advanced users with admin account) to router web, and FTP/SAMBA . A total of **6** other accounts can be created to grant access to the access of Samba and FTP and web page (need to be specified).

Note: Please go to SAMBA & FTP Server to re-activate FTP and SAMBA server to enable the changes to the FTP and SAMBA account set here.



❖ Admin / Admin

admin/admin is the root account provided by our router.



User Setup

Index: User account index, total is 8.

User Name: Users can create account(s) to give it (them) access to SAMBA and FTP.

New Password: Enter a new password for this user account.

Confirmed Password: Re-enter the new password again; you must enter the password exactly the same as in the previous field

FTP Authority Setup

FTP Access: Enable to grant the user access to the FTP server.

Permission: Set the operation permission for the user, Read/Write or Read.

SAMBA Authority

SAMBA Access: Enable to grant the user access to the SAMBA server.

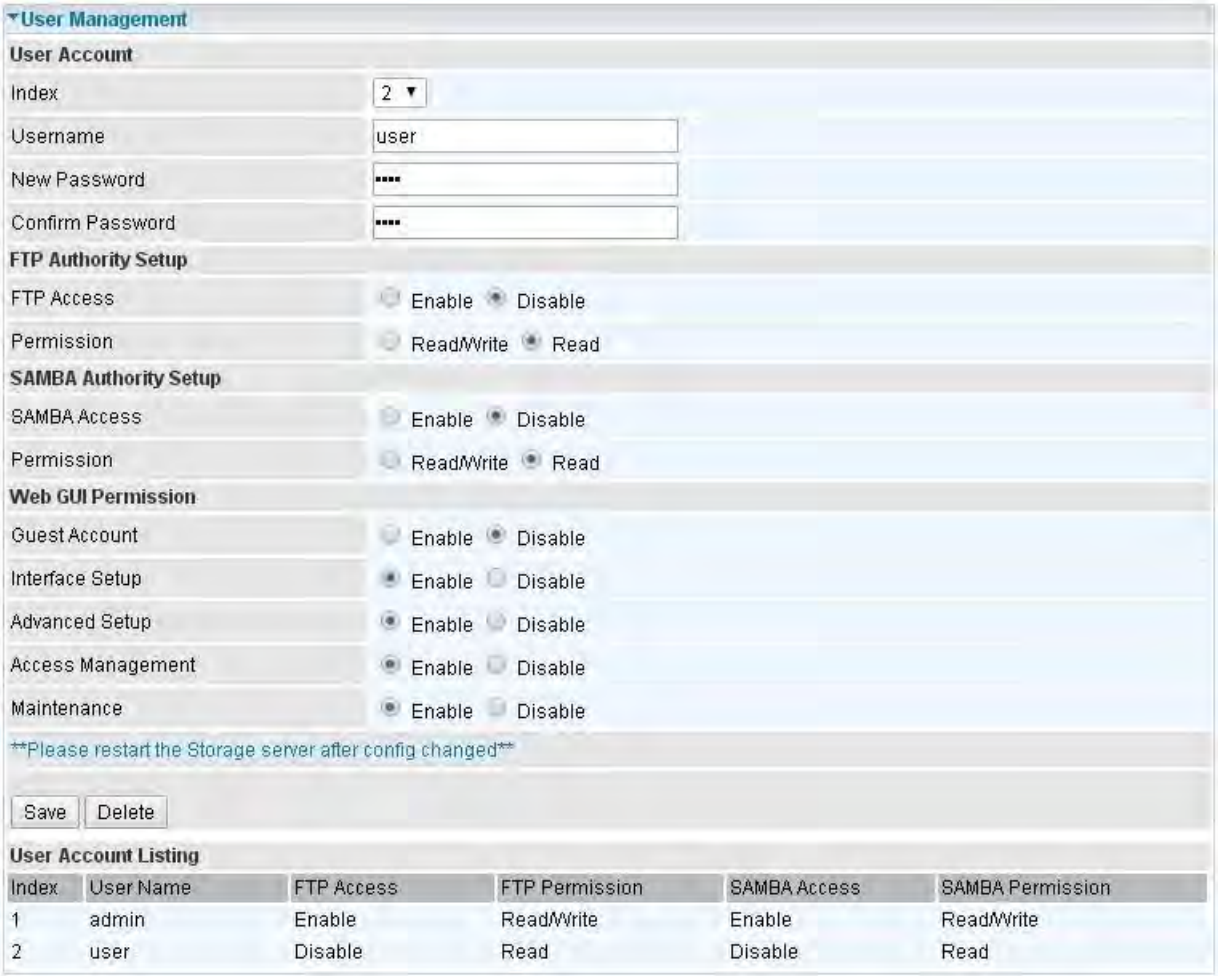
Permission: Set the operation permission for the user, Read/Write or Read.

Web GUI Permission

Login using the Administrator account, you will have the full accessibility to manage & control your gateway device and can also create user accounts for others to control some of the open configuration settings.

- Status
- Quick Start
- Configuration
  - Interface Setup
  - Dual WAN
  - Advanced Setup
  - VPN
  - Access Management
  - Maintenance
    - User Management
    - Time Zone
    - Firmware & Configuration
    - System Restart
    - Auto Reboot
    - Diagnostic Tool

❖ User / User and/or Adding additonal user accounts



User Setup

Index: User account index, total is 8.

User Name: Users can create account(s) to give it (them) access to SAMBA and FTP.

New Password: Type the password for the user account.

Confirmed Password: Type password again for confirmation.

FTP Authority Setup

FTP Access: Enable to grant the user access to the FTP server.

Permission: Set the operation permission for the user, Read/Write or Read.

SAMBA Authority

SAMBA Access: Enable to grant the user access to the SAMBA server.

Permission: Set the operation permission for the user, Read/Write or Read.

Web GUI Permission

Guest Account: A pre-set guest account setting granted with **Interface Setup**, **Advanced Setup**,

VoIP Setup, **Access Management** and **Maintenance** access. Enable to have access to Interface Setup, Advanced Setup and Access Management or disable to set the specifics yourself.

Interface Setup: Enable to allowing access to Interface Setup with this account.

Advanced Setup: Enable to allowing access to Advanced Setup with this account.

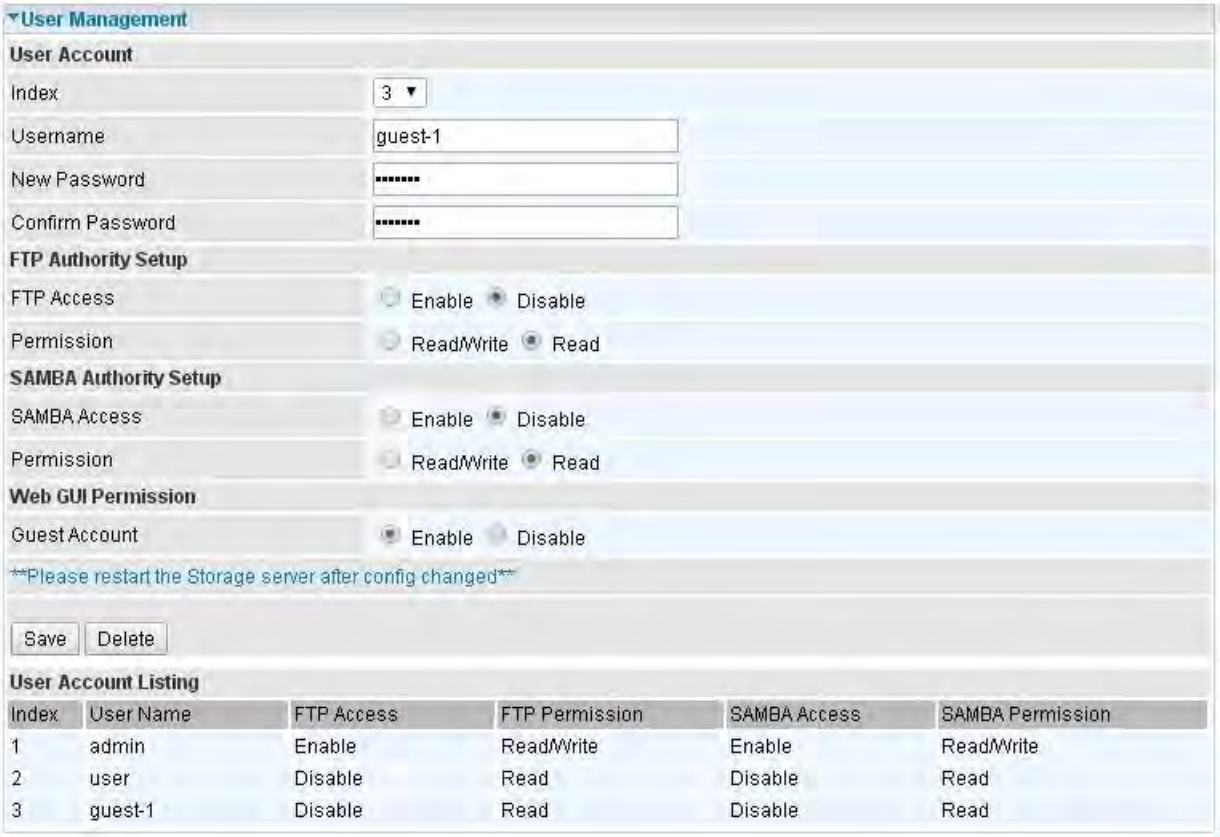
VOIP Setup: Enable to allowing access to VoIP Setup with this account.

Access Management: Enable to allowing access to Access Management with this account.

Maintenance: Enable to allowing access to Maintenance with this account.

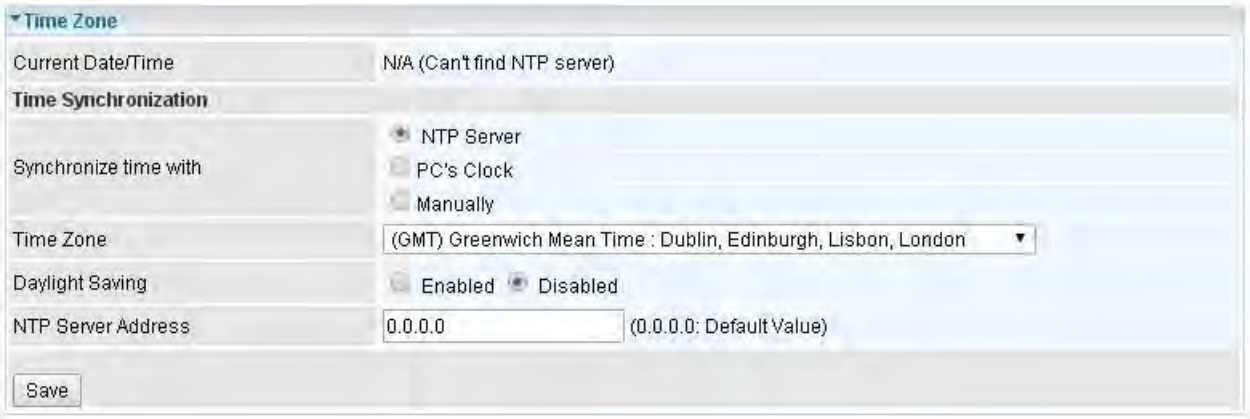
When customers use the “user” account to login to the router, they are offered with only configuration items set in **Web GUI Permission**.

Web GUI shown when “user” account uses Guest account on Web GUI Permission



Time Zone

The router does not have a real time clock on board; instead, it uses the Simple Network Time Protocol (SNTP) to get the current time from an SNTP server outside your network. Choose your local time zone. After a successful connection to the Internet, the router will retrieve the correct local time from the SNTP server you have specified. If you prefer to specify an SNTP server other than the default, simply enter its IP address as shown above. Your ISP may provide an SNTP server for you to use.



Current Date/Time: To show the current time based on the time synchronization mechanism users choose below.

Synchronize time with: Select the methods to synchronize the time.

- **NTP Server automatically:** To synchronize time with the NTP server.
- **PC's Clock:** To synchronize time with the PC's clock.
- **Manually:** Select this, user need to set the time yourself manually.

Time Zone: Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).

Daylight Saving: Select this option if you use daylight savings time.

NTP Server Address: Enter the IP address of your time server. Check with your ISP/network administrator if you are unsure of this information.

Firmware & Configuration

Firmware is the software that controls the hardware and provides all functionalities which are available in the GUI. This software may be improved and/or modified; your MX-1000 provides an easy way to update the code to take advantage of the changes. .

To upgrade the firmware of MX-1000, you should download or copy the firmware to your local environment first. Press the **"Choose File"** button to specify the path of the firmware file. Then, click **"Upgrade"** to start upgrading. When the procedure is completed, MX-1000 will reset automatically to make the new firmware work.

Upgrade: Choose Firmware or Configuration you want to update.

System Restart with:

- **Current Settings:** Restart the device with the current settings automatically when finishing upgrading.
- **Factory Default Settings:** Restart the device with factory default settings automatically when finishing upgrading.

File: Type in the location of the file you want to upload in this field or click **"Choose File"** to find it.

Choose File: Click **"Choose File"** to find the configuration file or firmware file you want to upload. Remember that you must extract / decompress / unzip the .zip files before you can upload them.

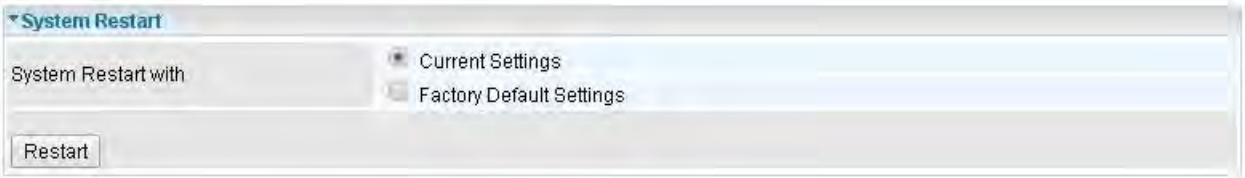
Backup Configuration: Click **"Backup"** button to back up the current running configuration file and save it to your computer in the event that you need this configuration file to be restored back to your device when making false configurations and want to restore to the original settings.

Upgrade: Click **"Upgrade"** to begin the upload process. This process may take up to two minutes.

DO NOT turn off / power off the device or interrupt the firmware upgrading while it is still in process. Improper operation could damage your BiPAC 4500VNOZ / BiPAC 4500VNPZ.

System Restart

Click **System Restart** with option **Current Settings** to reboot your router.



If you wish to restart the router using the factory default settings (for example, after a firmware upgrade or if you have saved an incorrect configuration), select ***Factory Default Settings*** to restore to factory default settings.

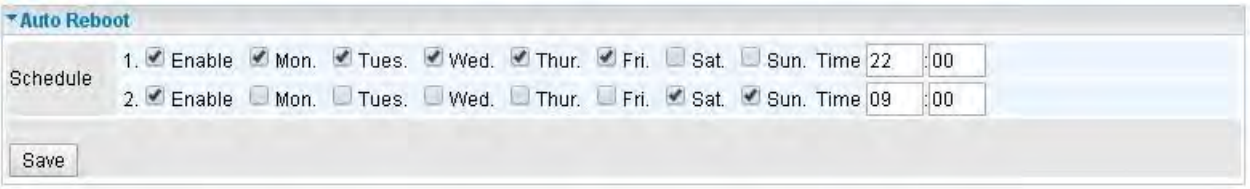
You may also restore your router to factory settings by holding the small Reset pinhole button on the back of your router in about more than 6s seconds whilst the router is turned on.

Auto Reboot

Auto reboot offers flexible rebooting service (reboot with the current configuration) of router for users in line with scheduled timetable settings

Enable to set the time schedule for rebooting.

For example, the router is scheduled to reboot at 22:00 every single weekday, and to reboot at 9:00 on Saturday and Sunday. You can set as follows:



Diagnostics Tool

The Diagnostic Test page shows the test results for the connectivity of the physical layer and protocol layer for both LAN and WAN sides.

3G/4G-LTE:

Click START to begin to diagnose the connection.

EWAN:

Click START to begin to diagnose the connection.

Chapter 5: Troubleshooting

If your MX-1000 is not functioning properly, you can refer to this chapter for simple troubleshooting before contacting your service provider support. This can save you time and effort but if symptoms persist, consult your service provider.

Problems with the Router

Problem	Suggested Action
None of the LEDs is on when you turn on the router	Check the connection between the router and the adapter. If the problem persists, most likely it is due to the malfunction of your hardware. Please contact your service provider for technical support.
You have forgotten your login username or password	Try the default username "admin" and password "admin". If this fails, you can restore your router to its factory settings by pressing the reset button on the device rear side.

Problem with LAN Interface

Problem	Suggested Action
Cannot PING any PC on LAN	Check the Ethernet LEDs on the front panel. The LED should be on for the port that has a PC connected. If it does not lit, check to see if the cable between your router and the PC is properly connected. Make sure you have first uninstalled your firewall program before troubleshooting.
	Verify that the IP address and the subnet mask are consistent for both the router and the workstations.

Recovery Procedures

Problem	Suggested Action

- The front LEDs display incorrectly **- Still cannot access to the router management interface after pressing the RESET button.** **- Software / Firmware upgrade failure**	Before starting recovery process, please configure the IP address of the PC as 192.168.1.100 and proceed with the following step-by-step guide. 1. Power the router off. 2. Press reset button and power on the router, once the Power lights Red, keeping press reset button over 6 seconds. 3. Internet LED flashes Green, router entering recovery procedure and router's IP will reset to Emergency IP address (Say 192.168.1.1). 4. Open browser and access http://192.168.1.1 to upload the firmware. 5. Internet LED lit Red, and router starts to write firmware into flash. Please DO NOT power off the router at this step. 6. Internet LED lit Green when successfully upgrade firmware. 7. Power the router off and then on.

Appendix: Product Support & Contact

If you come across any problems please contact the dealer from where you have purchased the product.

Contact Billion

WORLDWIDE

http://www.billion.com

MAC OS is a registered Trademark of Apple Computer, Inc.

Windows 7/98, Windows NT, Windows 2000, Windows ME, Windows XP, and Windows Vista are registered Trademarks of Microsoft Corporation.

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. . This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Co-location statement

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.