

Figure 158 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step1

Add New Classification

Please follow the guidance through step 1~5 to configure a QoS rule

Step1: Class Configuration

Active ☒

Class Name

Classification Order Last

Figure 159 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step2

Step2: Criteria Configuration

Use the configurations below to specify the characteristics of a data flow needed to be managed by this QoS rule

Basic

From Interface LAN

Ether Type NA

Source

☐ Address Subnet Mask ☐ Exclude

☐ Port Range ~ ☐ Exclude

☒ MAC MAC Mask ☒ Exclude

Destination

☐ Address Subnet Mask ☐ Exclude

☐ Port Range ~ ☐ Exclude

☒ MAC MAC Mask ☒ Exclude

Others

☐ Service RTSP Server ☐ Exclude

☐ IP protocol TCP ☐ Exclude

☐ DHCP ☐ Exclude

☐ IP Packet Length ~ ☐ Exclude

☐ DSCP (0~63) ☐ Exclude

☐ 802.1P 0 BE ☐ Exclude

☐ VLAN ID (1~4094) ☐ Exclude

☐ TCP ACK ☐ Exclude

Figure 160 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step3

Step3: Packet Modification

The content of the packet can be modified by applying the following settings

DSCP Mark	Unchange ▼	0	(0~63)
VLAN ID Tag	Unchange ▼	0	(1~4094)
802.1P Mark	0 BE		

Figure 161 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step4

Step4: Class Routing

This module can route a packet to a certain interface according to the class setting

Forward To Interface	Unchange ▼
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Figure 162 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step5

Step5: Outgoing Queue Selection

Outgoing queue decides the priority of the traffic and how traffic should be shaped in the WAN interface.

To Queue Index	default queue ▼
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Cancel **OK**

The following table describes the labels in this screen.

Table 88 Network Setting > QoS > Classification Setup > Add New Classification/Edit

LABEL	DESCRIPTION
Step1: Class Configuration	
Active	Click this switch to enable the classifier.
Class Name	Enter a descriptive name for this class. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Classification Order	Select an existing number for where you want to put this classifier to move the classifier to the number you selected after clicking Apply . Select Last to put this rule in the back of the classifier list.
Step2: Criteria Configuration	
Basic	
From Interface	If you want to classify the traffic by an ingress interface, select an interface from the From Interface drop-down list box.
Ether Type	Select a predefined application to configure a class for the matched traffic. Traffic will be classified with the Ether Type of Ethernet frames. Ether Type is a field in an Ethernet frame used to identify the protocol encapsulated in the frame. Select NA to specify traffic that does not belong to any Ether type. If you select IP , you also need to configure source or destination, IP address, DHCP options, DSCP value or the protocol type. If you select IPv6 , you also need to configure source or destination, IPv6 address, DSCP value or the protocol type. If you select 802.1Q , you can configure an 802.1p priority level.
Source	

Table 88 Network Setting > QoS > Classification Setup > Add New Classification/Edit (continued)

LABEL	DESCRIPTION
Address	Select the checkbox and enter the source IP address in dotted decimal notation. A blank source IP address means any source IP address.
Port Range	If you select TCP or UDP in the IP Protocol field, select the checkbox and enter the port numbers of the source.
MAC	Select the checkbox and enter the source MAC address of the packet.
MAC Mask	Enter the mask for the specified MAC address to determine which bits a packet's MAC address should match. Enter "f" for each bit of the specified source MAC address that the traffic's MAC address should match. Enter "0" for the bits of the matched traffic's MAC address, which can be of any hexadecimal characters. For example, if you set the MAC address to 00:13:49:00:00:00 and the mask to ff:ff:ff:00:00:00, a packet with a MAC address of 00:13:49:12:34:56 matches this criteria.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Destination	
Address	Select the checkbox and enter the source IP address in dotted decimal notation. A blank source IP address means any source IP address.
Port Range	If you select TCP or UDP in the IP Protocol field, select the checkbox and enter the port numbers of the source.
MAC	Select the checkbox and enter the source MAC address of the packet.
MAC Mask	Enter the mask for the specified MAC address to determine which bits a packet's MAC address should match. Enter "f" for each bit of the specified source MAC address that the traffic's MAC address should match. Enter "0" for the bits of the matched traffic's MAC address, which can be of any hexadecimal characters. For example, if you set the MAC address to 00:13:49:00:00:00 and the mask to ff:ff:ff:00:00:00, a packet with a MAC address of 00:13:49:12:34:56 matches this criteria.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Others	
Service	This field is available only when you select IP or IPv6 in the Ether Type field. This field simplifies classifier configuration by allowing you to select a predefined application. When you select a predefined application, you do not configure the rest of the filter fields.
IP Protocol	This field is available only when you select IP or IPv6 in the Ether Type field. Select this option and select the protocol (service type) from TCP , UDP , ICMP or IGMP . If you select User defined , enter the protocol (service type) number.
DHCP	This field is available only when you select IP in the Ether Type field. Select this option and select a DHCP option. If you select Vendor Class ID (DHCP Option 60) , enter the Vendor Class Identifier (Option 60) of the matched traffic, such as the type of the hardware or firmware. If you select Client ID (DHCP Option 61) , enter the Identity Association Identifier (IAD Option 61) of the matched traffic, such as the MAC address of the device. If you select User Class ID (DHCP Option 77) , enter a string that identifies the user's category or application type in the matched DHCP packets. If you select Vendor Specific Info (DHCP Option 125) , enter the vendor specific information of the matched traffic, such as the product class, model name, and serial number of the device.
IP Packet Length	This field is available only when you select IP in the Ether Type field. Select this option and enter the minimum and maximum packet length (from 46 to 1500) in the fields provided.

Table 88 Network Setting > QoS > Classification Setup > Add New Classification/Edit (continued)

LABEL	DESCRIPTION
DSCP	This field is available only when you select IP or IPv6 in the Ether Type field. Select this option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided.
802.1P	This field is available only when you select 802.1Q in the Ether Type field. Select this option and select a priority level (between 0 and 7) from the drop-down list box. "0" is the lowest priority level and "7" is the highest.
VLAN ID	This field is available only when you select 802.1Q in the Ether Type field. Select this option and specify a VLAN ID number.
TCP ACK	This field is available only when you select IP in the Ether Type field. If you select this option, the matched TCP packets must contain the ACK (Acknowledge) flag.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Step3: Packet Modification	
DSCP Mark	If you select Remark , enter a DSCP value with which the Zyxel Device replaces the DSCP field in the packets. If you select Unchange , the Zyxel Device keep the DSCP field in the packets.
VLAN ID Tag	If you select Remark , enter a VLAN ID number with which the Zyxel Device replaces the VLAN ID of the frames. If you select Remove , the Zyxel Device deletes the VLAN ID of the frames before forwarding them out. If you select Add , the Zyxel Device treat all matched traffic untagged and add a second VLAN ID. If you select Unchange , the Zyxel Device keep the VLAN ID in the packets.
802.1P Mark	Select a priority level with which the Zyxel Device replaces the IEEE 802.1p priority field in the packets. If you select Unchange , the Zyxel Device keep the 802.1p priority field in the packets.
Step4: Class Routing	
Forward to Interface	Select a WAN interface through which traffic of this class will be forwarded out. If you select Unchange , the Zyxel Device forward traffic of this class according to the default routing table.
Step5: Outgoing Queue Selection	
To Queue Index	Select a queue that applies to this class. You should have configured a queue in the Queue Setup screen already.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

11.6 QoS Shaper Setup

This screen lets you use the token bucket algorithm to allow a certain amount of large bursts of traffic while keeping most outgoing traffic at the average rate. Click **Network Setting > QoS > Shaper Setup**. The screen appears as shown.

Figure 163 Network Setting > QoS > Shaper Setup

QoS

General Queue Setup Classification Setup **Shaper Setup** Policer Setup

This screen lets you use the token bucket algorithm to allow a certain amount of large bursts of traffic while keeping most outgoing traffic at the average rate.

+ Add New Shaper

#	Status	Interface	Rate Limit	Modify
---	--------	-----------	------------	--------

The following table describes the labels in this screen.

Table 89 Network Setting > QoS > Shaper Setup

LABEL	DESCRIPTION
Add New Shaper	Click this to create a new entry.
#	This is the index number of the entry.
Status	This field displays whether the shaper is active or not. A yellow bulb signifies that this policer is active. A gray bulb signifies that this shaper is not active.
Interface	This shows the name of the Zyxel Device's interface through which traffic in this shaper applies.
Rate Limit	This shows the average rate limit of traffic bursts for this shaper.
Modify	Click the Edit icon to edit the shaper. Click the Delete icon to delete an existing shaper. Note that subsequent rules move up by one when you take this action.

11.6.1 Add or Edit a QoS Shaper

Click **Add New Shaper** in the **Shaper Setup** screen or the **Edit** icon next to a shaper to show the following screen.

Figure 164 Network Setting > QoS > Shaper Setup > Add New Shaper/Edit

Add New Shaper

Active ☐

Interface WWAN

Rate Limit (kbps)

Cancel OK

The following table describes the labels in this screen.

Table 90 Network Setting > QoS > Shaper Setup > Add New Shaper/Edit

LABEL	DESCRIPTION
Active	Click this switch to enable the shaper.
Interface	Select a Zyxel Device's interface through which traffic in this shaper applies.
Rate Limit	Enter the average rate limit of traffic bursts for this shaper.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

11.7 QoS Policer Setup

Use this screen to view QoS policers that allow you to limit the transmission rate of incoming traffic and apply actions, such as drop, pass, or modify, to the DSCP value of matched traffic. Click **Network Setting > QoS > Policer Setup**. The screen appears as shown.

Figure 165 Network Setting > QoS > Policer Setup

The following table describes the labels in this screen.

Table 91 Network Setting > QoS > Policer Setup

LABEL	DESCRIPTION
Add New Policer	Click this to create a new entry.
#	This is the index number of the entry.
Status	This field displays whether the policer is active or not. A yellow bulb signifies that this policer is active. A gray bulb signifies that this policer is not active.
Name	This field displays the descriptive name of this policer.
Regulated Classes	This field displays the name of a QoS classifier
Meter Type	This field displays the type of QoS metering algorithm used in this policer.
Rule	These are the rates and burst sizes against which the policer checks the traffic of the member QoS classes.
Action	This shows how the policer has the Zyxel Device treat different types of traffic belonging to the policer's member QoS classes.
Modify	Click the Edit icon to edit the policer. Click the Delete icon to delete an existing policer. Note that subsequent rules move up by one when you take this action.

11.7.1 Add or Edit a QoS Policer

Click **Add New Policer** in the **Policer Setup** screen or the **Edit** icon next to a policer to show the following screen.

Figure 166 Network Setting > QoS > Policer Setup > Add New Policer/Edit

The following table describes the labels in this screen.

Table 92 Network Setting > QoS > Policer Setup > Add New Policer/Edit

LABEL	DESCRIPTION
Active	Click this switch to enable the policer.
Name	Enter a descriptive name for this policer. You can use up to 16 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.

Table 92 Network Setting > QoS > Policer Setup > Add New Policer/Edit (continued)

LABEL	DESCRIPTION
Meter Type	This shows the traffic metering algorithm used in this policer. The Simple Token Bucket algorithm uses tokens in a bucket to control when traffic can be transmitted. Each token represents one byte. The algorithm allows bursts of up to <i>b</i> bytes which is also the bucket size. The Single Rate Three Color Marker (srTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR), the Committed Burst Size (CBS) and the Excess Burst Size (EBS). The Two Rate Three Color Marker (trTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR) and the Peak Information Rate (PIR).
Committed Rate	Specify the committed rate. When the incoming traffic rate of the member QoS classes is less than the committed rate, the device applies the conforming action to the traffic.
Committed Burst Size	Specify the committed burst size for packet bursts. This must be equal to or less than the peak burst size (two rate three color) or excess burst size (single rate three color) if it is also configured. This is the maximum size of the (first) token bucket in a traffic metering algorithm.
Excess Burst Size	Specify the additional amount of bytes that are admitted at the committed rate besides the committed burst size. This is the maximum size of the second token bucket in the srTCM. This field is only available when you select Single Rate Three Color in the Meter Type field.
Peak Rate	Specify the maximum rate at which packets are admitted to the network. The peak rate should be greater than or equal to the committed rate. This is to specify how many bytes of tokens are added to the second bucket every second in the trTCM. This field is only available when you select Two Rate Three Color in the Meter Type field.
Peak Burst Size	Specify the maximum amount of bytes that are admitted at the committed rate. This is the maximum size of the second token bucket in the trTCM. This field is only available when you select Two Rate Three Color in the Meter Type field.
Conforming Action	Specify what the Zyxel Device does for packets within the committed rate and burst size (green-marked packets). • Pass: Send the packets without modification. • DSCP Mark: Change the DSCP mark value of the packets. Enter the DSCP mark value to use.
Partial Conforming Action	Specify the action that the Zyxel Device takes on yellow-marked packets. Select Pass to forward the packets. Select Drop to discard the packets. Select DSCP Mark to assign a specified DSCP number (between 0 and 63) to the packets and forward them. The packets are dropped if there is congestion on the network. This field is only available when you select Single/Two Rate Three Color in the Meter Type field.
Non-Conforming Action	Specify what the Zyxel Device does for packets that exceed the excess burst size or peak rate and burst size (red-marked packets). • Drop: Discard the packets. • DSCP Mark: Change the DSCP mark value of the packets. Enter the DSCP mark value to use. The packets may be dropped if there is congestion on the network.
Regulated Classes Member Setting	

Table 92 Network Setting > QoS > Policer Setup > Add New Policer/Edit (continued)

LABEL	DESCRIPTION
Available Class	Select a QoS classifier to apply this QoS policer to traffic that matches the QoS classifier.
Selected Class	Highlight a QoS classifier in the Available Class box and use the > button to move it to the Selected Class box. To remove a QoS classifier from the Selected Class box, select it and use the < button.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

11.8 QoS Monitor

To view the Zyxel Device's QoS packet statistics, click **Network Setting > QoS > Monitor**. The screen appears as shown.

Figure 167 Network Setting > QoS > Monitor

Use this screen to view QoS statistics for WAN/LAN interfaces and the status of the Queue setup.

Refresh Interval : None

Interface Monitor

#	Name	Pass Rate(bps)	Drop Rate (bps)
1	WAN	0	0
2	LAN	0	0

Queue Monitor

#	Name	Pass Rate(bps)	Drop Rate (bps)
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The following table describes the labels in this screen.

Table 93 Network Setting > QoS > Monitor

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen. Select None to stop refreshing
Interface Monitor	
#	This is the index number of the entry.
Name	This shows the name of the interface on the Zyxel Device.
Pass Rate (bps)	This shows how many packets forwarded to this interface are transmitted successfully.
Drop Rate (bps)	This shows how many packets forwarded to this interface are dropped.
Queue Monitor	
#	This is the index number of the entry.
Name	This shows the name of the queue.

Table 93 Network Setting > QoS > Monitor (continued)

LABEL	DESCRIPTION
Pass Rate (bps)	This shows how many packets assigned to this queue are transmitted successfully.
Drop Rate (bps)	This shows how many packets assigned to this queue are dropped.

11.9 Technical Reference

The following section contains additional technical information about the Zyxel Device features described in this chapter.

IEEE 802.1Q Tag

The IEEE 802.1Q standard defines an explicit VLAN tag in the MAC header to identify the VLAN membership of a frame across bridges. A VLAN tag includes the 12-bit VLAN ID and 3-bit user priority. The VLAN ID associates a frame with a specific VLAN and provides the information that devices need to process the frame across the network.

IEEE 802.1p specifies the user priority field and defines up to eight separate traffic types. The following table describes the traffic types defined in the IEEE 802.1d standard (which incorporates the 802.1p).

Table 94 IEEE 802.1p Priority Level and Traffic Type

PRIORITY LEVEL	TRAFFIC TYPE
Level 7	Typically used for network control traffic such as router configuration messages.
Level 6	Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay).
Level 5	Typically used for video that consumes high bandwidth and is sensitive to jitter.
Level 4	Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions.
Level 3	Typically used for "excellent effort" or better than best effort and would include important business traffic that can tolerate some delay.
Level 2	This is for "spare bandwidth".
Level 1	This is typically used for non-critical "background" traffic such as bulk transfers that are allowed but that should not affect other applications and users.
Level 0	Typically used for best-effort traffic.

DiffServ

QoS is used to prioritize source-to-destination traffic flows. All packets in the flow are given the same priority. You can use CoS (class of service) to give different priorities to different packet types.

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

DSCP and Per-Hop Behavior

DiffServ defines a new Differentiated Services (DS) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

DSCP (6 bits)	Unused (2 bits)
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The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

IP Precedence

Similar to IEEE 802.1p prioritization at layer-2, you can use IP precedence to prioritize packets in a layer-3 network. IP precedence uses three bits of the eight-bit ToS (Type of Service) field in the IP header. There are eight classes of services (ranging from zero to seven) in IP precedence. Zero is the lowest priority level and seven is the highest.

Automatic Priority Queue Assignment

If you enable QoS on the Zyxel Device, the Zyxel Device can automatically base on the IEEE 802.1p priority level, IP precedence and/or packet length to assign priority to traffic which does not match a class.

The following table shows you the internal layer-2 and layer-3 QoS mapping on the Zyxel Device. On the Zyxel Device, traffic assigned to higher priority queues gets through faster while traffic in lower index queues is dropped if the network is congested.

Table 95 Internal Layer2 and Layer3 QoS Mapping

PRIORITY QUEUE	LAYER 2	LAYER 3		
	IEEE 802.1P USER PRIORITY (ETHERNET PRIORITY)	TOS (IP PRECEDENCE)	DSCP	IP PACKET LENGTH (BYTE)
0	1	0	000000	
1	2			
2	0	0	000000	>1100
3	3	1	001110 001100 001010 001000	250 – 1100
4	4	2	010110 010100 010010 010000	

Table 95 Internal Layer2 and Layer3 QoS Mapping (continued)

PRIORITY QUEUE	LAYER 2	LAYER 3		
	IEEE 802.1P USER PRIORITY (ETHERNET PRIORITY)	TOS (IP PRECEDENCE)	DSCP	IP PACKET LENGTH (BYTE)
5	5	3	011110 011100 011010 011000	<250
6	6	4	100110 100100 100010 100000	
		5	101110 101000	
7	7	6	110000	
		7	111000	

Token Bucket

The token bucket algorithm uses tokens in a bucket to control when traffic can be transmitted. The bucket stores tokens, each of which represents one byte. The algorithm allows bursts of up to b bytes which is also the bucket size, so the bucket can hold up to b tokens. Tokens are generated and added into the bucket at a constant rate. The following shows how tokens work with packets:

- A packet can be transmitted if the number of tokens in the bucket is equal to or greater than the size of the packet (in bytes).
- After a packet is transmitted, a number of tokens corresponding to the packet size is removed from the bucket.
- If there are no tokens in the bucket, the Zyxel Device stops transmitting until enough tokens are generated.
- If not enough tokens are available, the Zyxel Device treats the packet in either one of the following ways:
 - In traffic shaping:
 - Holds it in the queue until enough tokens are available in the bucket.
 - In traffic policing:
 - Drops it.
 - Transmits it but adds a DSCP mark. The Zyxel Device may drop these marked packets if the network is overloaded.

Configure the bucket size to be equal to or less than the amount of the bandwidth that the interface can support. It does not help if you set it to a bucket size over the interface's capability. The smaller the bucket size, the lower the data transmission rate and that may cause outgoing packets to be dropped. A larger transmission rate requires a big bucket size. For example, use a bucket size of 10 kbytes to get the transmission rate up to 10 Mbps.

Single Rate Three Color Marker

The Single Rate Three Color Marker (srTCM, defined in RFC 2697) is a type of traffic policing that identifies packets by comparing them to one user-defined rate, the Committed Information Rate (CIR), and two burst sizes: the Committed Burst Size (CBS) and Excess Burst Size (EBS).

The srTCM evaluates incoming packets and marks them with one of three colors which refer to packet loss priority levels. High packet loss priority level is referred to as red, medium is referred to as yellow and low is referred to as green.

The srTCM is based on the token bucket filter and has two token buckets (CBS and EBS). Tokens are generated and added into the bucket at a constant rate, called Committed Information Rate (CIR). When the first bucket (CBS) is full, new tokens overflow into the second bucket (EBS).

All packets are evaluated against the CBS. If a packet does not exceed the CBS it is marked green. Otherwise it is evaluated against the EBS. If it is below the EBS then it is marked yellow. If it exceeds the EBS then it is marked red.

The following shows how tokens work with incoming packets in srTCM:

- A packet arrives. The packet is marked green and can be transmitted if the number of tokens in the CBS bucket is equal to or greater than the size of the packet (in bytes).
- After a packet is transmitted, a number of tokens corresponding to the packet size is removed from the CBS bucket.
- If there are not enough tokens in the CBS bucket, the Zyxel Device checks the EBS bucket. The packet is marked yellow if there are sufficient tokens in the EBS bucket. Otherwise, the packet is marked red. No tokens are removed if the packet is dropped.

Two Rate Three Color Marker

The Two Rate Three Color Marker (trTCM, defined in RFC 2698) is a type of traffic policing that identifies packets by comparing them to two user-defined rates: the Committed Information Rate (CIR) and the Peak Information Rate (PIR). The CIR specifies the average rate at which packets are admitted to the network. The PIR is greater than or equal to the CIR. CIR and PIR values are based on the guaranteed and maximum bandwidth respectively as negotiated between a service provider and client.

The trTCM evaluates incoming packets and marks them with one of three colors which refer to packet loss priority levels. High packet loss priority level is referred to as red, medium is referred to as yellow and low is referred to as green.

The trTCM is based on the token bucket filter and has two token buckets (Committed Burst Size (CBS) and Peak Burst Size (PBS)). Tokens are generated and added into the two buckets at the CIR and PIR respectively.

All packets are evaluated against the PIR. If a packet exceeds the PIR it is marked red. Otherwise it is evaluated against the CIR. If it exceeds the CIR then it is marked yellow. Finally, if it is below the CIR then it is marked green.

The following shows how tokens work with incoming packets in trTCM:

- A packet arrives. If the number of tokens in the PBS bucket is less than the size of the packet (in bytes), the packet is marked red and may be dropped regardless of the CBS bucket. No tokens are removed if the packet is dropped.

- If the PBS bucket has enough tokens, the Zyxel Device checks the CBS bucket. The packet is marked green and can be transmitted if the number of tokens in the CBS bucket is equal to or greater than the size of the packet (in bytes). Otherwise, the packet is marked yellow.

CHAPTER 12

Network Address Translation (NAT)

12.1 NAT Overview

NAT (Network Address Translation – NAT, RFC 1631) is the translation of the IP address of a host in a packet, for example, the source address of an outgoing packet, used within one network to a different IP address known within another network.

12.1.1 What You Can Do in this Chapter

- Use the **Port Forwarding** screen to configure forward incoming service requests to the servers on your local network ([Port Forwarding](#)).
- Use the **Port Triggering** screen to add and configure the Zyxel Device's trigger port settings ([Port Triggering](#)).
- Use the **DMZ** screen to configure a default server ([DMZ](#)).
- Use the **ALG** screen to enable or disable the SIP ALG ([ALG](#)).
- Use the **Address Mapping** screen to enable and disable the NAT Address Mapping in the Zyxel Device ([Address Mapping](#)).
- Use the **Sessions** screen to limit the number of concurrent NAT sessions each client can use ([Sessions](#)).

12.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Inside/Outside and Global/Local

Inside/outside denotes where a host is located relative to the Zyxel Device, for example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/local denotes the IP address of a host in a packet as the packet traverses a router, for example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

NAT

In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host.

Port Forwarding

A port forwarding set is a list of inside (behind NAT on the LAN) servers, for example, web that you can make visible to the outside world even though NAT makes your whole inside network appear as a single computer to the outside world.

12.2 Port Forwarding

Use **Port Forwarding** to forward incoming service requests from the Internet to the servers on your local network. Port forwarding is commonly used when you want to host online gaming, P2P file sharing, or other servers on your network.

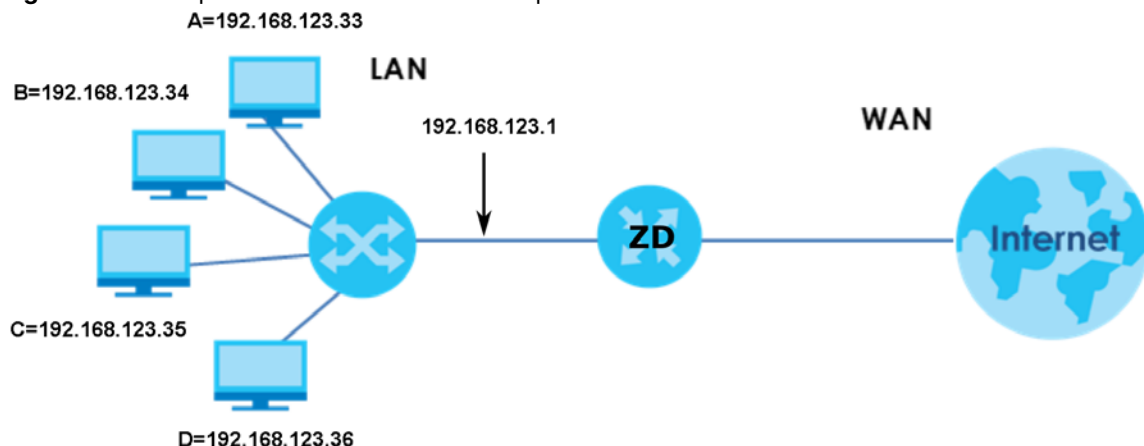
You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example web service), it might be better to specify a range of port numbers. You can allocate a server IP address that corresponds to a port or a range of ports. Please refer to RFC 1700 for further information about port numbers.

Note: Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

Configure Servers Behind Port Forwarding (Example)

Let's say you want to assign ports 21-25 to one Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example), a default server IP address of 192.168.1.35 to a third (**C** in the example), and a default server IP address of 192.168.1.36 to a fourth (**D** in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 168 Multiple Servers Behind NAT Example



12.2.1 Port Forwarding

Click **Network Setting > NAT** to open the **Port Forwarding** screen.

Note: TCP port 7547 is reserved for system use.

Figure 169 Network Setting > NAT > Port Forwarding

Use **Port Forwarding** to forward incoming service requests from the Internet to the server(s) on your local network. Port forwarding is commonly used when you want to host online gaming, P2P file sharing, or other servers on your network.

Add New Rule

#	Status	Service Name	Originating IP	WAN Interface	Server IP Address	Start Port	End Port	Translation Start Port	Translation End Port	Protocol	Modify
Note											
TCP port 7547 is reserved for system use.											

The following table describes the fields in this screen.

Table 96 Network Setting > NAT > Port Forwarding

LABEL	DESCRIPTION
Add New Rule	Click this to add a new port forwarding rule.
#	This is the index number of the entry.
Status	This field indicates whether the rule is active or not. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
Service Name	This is the service's name. This shows User Defined if you manually added a service. You can change this by clicking the edit icon.
Originating IP	This is the source's IP address.
WAN Interface	Select the WAN interface for which to configure NAT port forwarding rules.
Server IP Address	This is the server's IP address.
Start Port	This is the first external port number that identifies a service.
End Port	This is the last external port number that identifies a service.
Translation Start Port	This is the first internal port number that identifies a service.
Translation End Port	This is the last internal port number that identifies a service.
Protocol	This field displays the protocol (TCP, UDP, TCP+UDP) used to transport the packets for which you want to apply the rule.
Modify	Click the Edit icon to edit the port forwarding rule. Click the Delete icon to delete an existing port forwarding rule. Note that subsequent address mapping rules move up by one when you take this action.

12.2.2 Add or Edit Port Forwarding

Create or edit a port forwarding rule. Specify either a port or a range of ports, a server IP address, and a protocol to configure a port forwarding rule. Click **Add New Rule** in the **Port Forwarding** screen or the **Edit** icon next to an existing rule to open the following screen.

Figure 170 Network Setting > NAT > Port Forwarding: Add or Edit

Add New Rule

Active ☒

Service Name

WAN Interface Default ▼

Start Port

End Port

Translation Start Port

Translation End Port

Server IP Address

Configure Originating IP ☒ Enable

Originating IP

Protocol TCP ▼

Note

1.To configure port forwarding, you need to have the same configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

To configure port translation, you need to have different configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

Here's an example to configure port translation. Configure **Start Port** to 100, **End Port** to 120, **Translation Start Port** to 200, and **Translation End Port** to 220.

2.TCP port 7547 is reserved for system use.

Cancel **OK**

Note: To configure port forwarding, you need to have the same configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

To configure port translation, you need to have different configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

Here is an example to configure port translation. Configure **Start Port** to 100, **End Port** to 120, **Translation Start Port** to 200, and **Translation End Port** to 220.

Note: TCP port 7547 is reserved for system use.

The following table describes the labels in this screen.

Table 97 Network Setting > NAT > Port Forwarding: Add or Edit

LABEL	DESCRIPTION
Active	Click to turn the port forwarding rule on or off.
Service Name	Enter a name for the service to forward. You can use up to 256 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
WAN Interface	Select the WAN interface for which to configure NAT port forwarding rules.
Start Port	Configure this for a user-defined entry. Enter the original destination port for the packets. To forward only one port, enter the port number again in the End Port field. To forward a series of ports, enter the start port number here and the end port number in the End Port field.
End Port	Configure this for a user-defined entry. Enter the last port of the original destination port range. To forward only one port, enter the port number in the Start Port field above and then enter it again in this field. To forward a series of ports, enter the last port number in a series that begins with the port number in the Start Port field above.
Translation Start Port	Configure this for a user-defined entry. This shows the port number to which you want the Zyxel Device to translate the incoming port. For a range of ports, enter the first number of the range to which you want the incoming ports translated.
Translation End Port	Configure this for a user-defined entry. This shows the last port of the translated port range.
Server IP Address	Enter the inside IP address of the virtual server here.
Configure Originating IP	Click the Enable checkbox to enter the source IP in the next field.
Originating IP	Enter the source IP address here.
Protocol	Select the protocol supported by this virtual server. Choices are TCP , UDP , or TCP/UDP .
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

12.3 Port Triggering

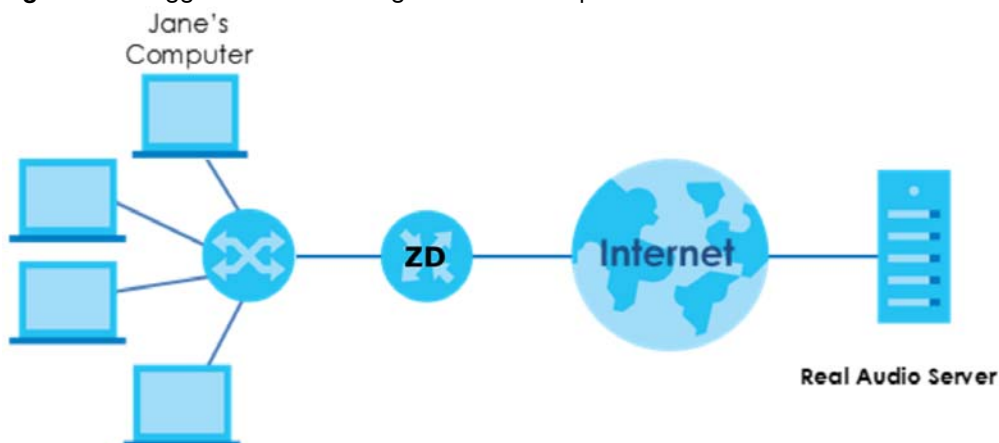
Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding, you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem is that port forwarding only forwards a service to a single LAN IP address. In order to use the same service on a different LAN computer, you have to manually replace the LAN computer's IP address in the forwarding port with another LAN computer's IP address.

Trigger port forwarding allows computers on the LAN to dynamically take turns using the service.

The Zyxel Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a \"trigger\" port). When the Zyxel Device's WAN port receives a response with a specific port number and protocol (\"open\" port), the Zyxel Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

For example:

Figure 171 Trigger Port Forwarding Process: Example



- 1 Jane requests a file from the Real Audio server (port 7070).
- 2 Port 7070 is a "trigger" port and causes the Zyxel Device to record Jane's computer IP address. The Zyxel Device associates Jane's computer IP address with the "open" port range of 6970 – 7170.
- 3 The Real Audio server responds using a port number ranging between 6970 – 7170.
- 4 The Zyxel Device forwards the traffic to Jane's computer IP address.
- 5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The Zyxel Device times out in 3 minutes with UDP (User Datagram Protocol) or 2 hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

Click **Network Setting > NAT > Port Triggering** to open the following screen. Use this screen to view your Zyxel Device's trigger port settings.

Note: TCP port 7547 is reserved for system use.

Note: The sum of trigger ports in all rules must be less than 1000 and every open port range must be less than 1000. When the protocol is TCP/UDP, the ports are counted twice.

Figure 172 Network Setting > NAT > Port Triggering

Trigger port forwarding allows computers on the LAN to dynamically take turns using the service. The Zyxel Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the Zyxel Device's WAN port receives a response with a specific port number and protocol ("open" port), the Zyxel Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

+ Add New Rule

#	Status	Service Name	WAN Interface	Trigger Start Port	Trigger End Port	Trigger Proto.	Open Start Port	Open End Port	Open Protocol	Modify
Note TCP port 7547 is reserved for system use.										

The following table describes the labels in this screen.

Table 98 Network Setting > NAT > Port Triggering

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
#	This is the index number of the entry.
Status	This field displays whether the port triggering rule is active or not. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
Service Name	This field displays the name of the service used by this rule.
WAN Interface	This field shows the WAN interface through which the service is forwarded.
Trigger Start Port	The trigger port is a port (or a range of ports) that causes (or triggers) the Zyxel Device to record the IP address of the LAN computer that sent the traffic to a server on the WAN. This is the first port number that identifies a service.
Trigger End Port	This is the last port number that identifies a service.
Trigger Proto.	This is the trigger transport layer protocol.
Open Start Port	The open port is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The Zyxel Device forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service. This is the first port number that identifies a service.
Open End Port	This is the last port number that identifies a service.
Open Protocol	This is the open transport layer protocol.
Modify	Click the Edit icon to edit this rule. Click the Delete icon to delete an existing rule.

12.3.1 Add or Edit Port Triggering Rule

This screen lets you create new port triggering rules. Click **Add New Rule** in the **Port Triggering** screen or click a rule's **Edit** icon to open the following screen. Use this screen to configure a port or range of ports and protocols for sending out requests and for receiving responses.

Figure 173 Network Setting > NAT > Port Triggering: Add or Edit

The screenshot shows the 'Add New Rule' configuration screen. It includes a back arrow in the top left, a title 'Add New Rule', and a list of configuration options on the left with corresponding input fields on the right. The 'Active' option is a toggle switch. The other options are text inputs or dropdown menus. The 'Trigger Protocol' and 'Open Protocol' dropdowns are currently set to 'TCP'. At the bottom, there are 'Cancel' and 'OK' buttons.

The following table describes the labels in this screen.

Table 99 Network Setting > NAT > Port Triggering: Add or Edit

LABEL	DESCRIPTION
Active	Click this switch to activate this rule.
Service Name	Enter a name to identify this rule. You can use up to 256 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
WAN Interface	Select a WAN interface for which you want to configure port triggering rules.
Trigger Start Port	The trigger port is a port (or a range of ports) that causes (or triggers) the Zyxel Device to record the IP address of the LAN computer that sent the traffic to a server on the WAN. Enter a port number or the starting port number in a range of port numbers.
Trigger End Port	Enter a port number or the ending port number in a range of port numbers.
Trigger Protocol	Select the transport layer protocol from TCP , UDP , or TCP/UDP .
Open Start Port	The open port is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The Zyxel Device forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service. Enter a port number or the starting port number in a range of port numbers.
Open End Port	Enter a port number or the ending port number in a range of port numbers.
Open Protocol	Select the transport layer protocol from TCP , UDP , or TCP/UDP .
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

12.4 DMZ

Use this screen to specify the IP address of a default server to receive packets from ports not specified in the **Port Triggering** screen. The DMZ (DeMilitarized Zone) is a network between the WAN and the LAN that is accessible to devices on both the WAN and LAN with firewall protection. Devices on the WAN can initiate connections to devices on the DMZ but not to those on the LAN.

You can put public servers, such as email and web servers, on the DMZ to provide services on both the WAN and LAN. To use this feature, you first need to assign a DMZ host. Click **Network Setting > NAT > DMZ** to open the **DMZ** screen.

Note: Use an IPv4 address for the DMZ server.

Note: Enter the IP address of the default server in the **Default Server Address** field, and click **Apply** to activate the DMZ host. Otherwise, clear the IP address in the **Default Server Address** field, and click **Apply** to deactivate the DMZ host.

Figure 174 Network Setting > NAT > DMZ

Use this screen to specify the IP address of a default server to receive packets from ports not specified in the **Port Triggering** screen. The DMZ (DeMilitarized Zone) is a network between the WAN and the LAN that is accessible to devices on both the WAN and LAN with firewall protection. Devices on the WAN can initiate connections to devices on the DMZ but not to those on the LAN.

You can put public servers, such as email, web, and FTP servers, on the DMZ to provide services on both the WAN and LAN. To use this feature, you first need to assign a DMZ host.

Default Server Address

Note
Enter the IP address of the default server in the **Default Server Address** field, and click **Apply** to activate the DMZ host. Otherwise, clear the IP address in the **Default Server Address** field, and click **Apply** to deactivate the DMZ host.

Cancel **Apply**

The following table describes the fields in this screen.

Table 100 Network Setting > NAT > DMZ

LABEL	DESCRIPTION
Default Server Address	Enter the IP address of the default server which receives packets from ports that are not specified in the Port Forwarding screen. Note: If you do not assign a default server, the Zyxel Device discards all packets received for ports not specified in the virtual server configuration.
Apply	Click this to save your changes back to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.

12.5 ALG

Application Layer Gateway (ALG) allows customized NAT traversal filters to support address and port translation for certain applications such as Session Initiation Protocol (SIP) or file transfer in Instant Messaging (IM) applications. It allows SIP calls to pass through the Zyxel Device. When the Zyxel Device

registers with the SIP register server, the SIP ALG translates the Zyxel Device's private IP address inside the SIP data stream to a public IP address. You do not need to use STUN or an outbound proxy if your Zyxel Device is behind a SIP ALG.

Click **Network Setting** > **NAT** > **ALG** to open the **ALG** screen. Use this screen to enable and disable the NAT Application Layer Gateway (ALG) in the Zyxel Device.

Application Layer Gateway (ALG) allows certain applications such as Session Initiation Protocol (SIP) or file transfer in Instant Messaging (IM) applications to pass through the Zyxel Device.

Figure 175 Network Setting > NAT > ALG

The following table describes the fields in this screen.

Table 101 Network Setting > NAT > ALG

LABEL	DESCRIPTION
NAT ALG	Enable this to make sure applications such as file transfer in IM applications work correctly with port-forwarding and address-mapping rules.
SIP ALG	Click this switch to enable SIP ALG to make sure SIP (VoIP) works correctly with port-forwarding and address-mapping rules.
RTSP ALG	Click this switch to enable RTSP ALG to have the Zyxel Device detect RTSP traffic and help build RTSP sessions through its NAT. The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
PPTP ALG	Click this switch to enable the PPTP ALG on the Zyxel Device to detect PPTP traffic and help build PPTP sessions through the Zyxel Device's NAT.
IPSEC ALG	Click this switch to enable IPsec ALG on the Zyxel Device to detect IPsec traffic and help build IPsec sessions through the Zyxel Device's NAT.
Apply	Click Apply to save your changes back to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.

12.6 Address Mapping

Address mapping can map local IP Addresses to global IP addresses. Ordering your rules is important because the Zyxel Device applies the rules in the order that you specify. When a rule matches the current packet, the Zyxel Device takes the corresponding action and the remaining rules are ignored.

Use this screen to enable or disable the NAT Address Mapping in the Zyxel Device.

12.6.1 Address Mapping Screen

Click **Network Setting > NAT > Address Mapping** to open the **Address Mapping** screen.

Figure 176 Network Setting > NAT > Address Mapping

Address mapping can map local IP Addresses to global IP addresses. Ordering your rules is important because the Zyxel Device applies the rules in the order that you specify. When a rule matches the current packet, the Zyxel Device takes the corresponding action and the remaining rules are ignored.

 Add New Rule

Rule Name	Local Start IP	Local End IP	Global Start IP	Global End IP	Type	WAN Interface	Modify

The following table describes the fields in this screen.

Table 102 Network Setting > NAT > Address Mapping

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
Rule Name	This is the name of the rule.
Local Start IP	This is the starting Inside Local IP Address (ILA).
Local End IP	This is the ending Inside Local IP Address (ILA). If the rule is for all local IP addresses, then this field displays 0.0.0.0 as the Local Start IP address and 255.255.255.255 as the Local End IP address. This field is blank for One-to-One mapping types.
Global Start IP	This is the starting Inside Global IP Address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP. You can only do this for the Many-to-One mapping type.
Global End IP	This is the ending Inside Global IP Address (IGA). This field is blank for One-to-One and Many-to-One mapping types.
Type	This is the address mapping type. One-to-One: This mode maps one local IP address to one global IP address. Note that port numbers do not change for the One-to-One NAT mapping type. Many-to-One: This mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (i.e., PAT, port address translation), the Device's Single User Account feature that previous routers supported only. Many-to-Many: This mode maps multiple local IP addresses to shared global IP addresses.
WAN Interface	This is the WAN interface to which the address mapping rule applies.
Modify	Click the Edit icon to go to the screen where you can edit the address mapping rule. Click the Delete icon to delete an existing address mapping rule. Note that subsequent address mapping rules move up by one when you take this action.

12.6.2 Add New Rule Screen

To add or edit an address mapping rule, click **Add New Rule** or the **Modify** icon in the **Address Mapping** screen to display the screen shown next.

Figure 177 Network Setting > NAT > Address Mapping > Add New Rule

The screenshot shows the 'Add New Rule' configuration screen. It includes the following fields and controls:

- Rule Name:** A text input field.
- Type:** A dropdown menu currently set to 'Many-to-Many'.
- Local Start IP:** A text input field for the starting local IP address.
- Local End IP:** A text input field for the ending local IP address.
- Global Start IP:** A text input field for the starting global IP address.
- Global End IP:** A range slider control for the ending global IP address.
- WAN Interface:** A dropdown menu currently set to 'Default'.
- Buttons:** 'Cancel' and 'OK' buttons at the bottom right.

The following table describes the fields in this screen.

Table 103 Network Setting > NAT > Address Mapping > Add New Rule

LABEL	DESCRIPTION
Rule Name	Enter a descriptive name for this rule. You can use up to 20 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Type	Choose the IP or port mapping type from one of the following. One-to-One: This mode maps one local IP address to one global IP address. Note that port numbers do not change for the One-to-One NAT mapping type. Many-to-One: This mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (for example, PAT, port address translation), the device's Single User Account feature that previous routers supported only. Many-to-Many: This mode maps multiple local IP addresses to shared global IP addresses.
Local Start IP	Enter the starting Inside Local IP Address (ILA).
Local End IP	Enter the ending Inside Local IP Address (ILA). If the rule is for all local IP addresses, then this field displays 0.0.0.0 as the Local Start IP address and 255.255.255.255 as the Local End IP address. This field is blank for One-to-One mapping types.
Global Start IP	Enter the starting Inside Global IP Address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP. You can only do this for the Many-to-One mapping type.
Global End IP	Enter the ending Inside Global IP Address (IGA). This field is blank for One-to-One and Many-to-One mapping types.
WAN Interface	Select a WAN interface to which the address mapping rule applies.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

12.7 Sessions

Use this screen to limit the number of concurrent NAT sessions a client can use, to ensure that no single client uses up too many available NAT sessions. Some applications, such as P2P file sharing, demand a greater number of NAT sessions in order to get a better uploading and downloading rate. Click **Network Setting > NAT > Sessions** to display the following screen.

Use the **Sessions** screen to limit the number of concurrent NAT sessions each client can use. Click **Network Setting > NAT > Sessions** to open the **Sessions** screen.

Note: Enter a number of concurrent NAT sessions in the **MAX NAT Session Per Host** field, and click **Apply** to limit the number of concurrent NAT sessions a client can use. Otherwise, clear the number in the **MAX NAT Session Per Host** field. Click **Apply** and there is no limit for concurrent NAT sessions a client can use.

Figure 178 Network Setting > NAT > Sessions

Use this screen to limit the number of concurrent NAT sessions a client can use, to ensure that no single client uses up too many available NAT sessions. Some applications, such as P2P file sharing, demand a greater number of NAT sessions in order to get a better uploading and downloading rate.

MAX NAT Session Per Host (0 ~ 20480)

Note

Enter a number of concurrent NAT sessions in the **MAX NAT Session Per Host** field, and click **Apply** to limit the number of concurrent NAT sessions a client can use. Otherwise, clear the number in the **MAX NAT Session Per Host** field. Click **Apply** and there's no limit for concurrent NAT sessions a client can use.

Cancel **Apply**

The following table describes the fields in this screen.

Table 104 Network Setting > NAT > Sessions

LABEL	DESCRIPTION
MAX NAT Session Per Host	Use this field to set a common limit to the number of concurrent NAT sessions each client computer can have. If only a few clients use peer to peer applications, you can raise this number to improve their performance. With heavy peer to peer application use, lower this number to ensure no single client uses too many of the available NAT sessions.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

12.8 Port Control Protocol (PCP)

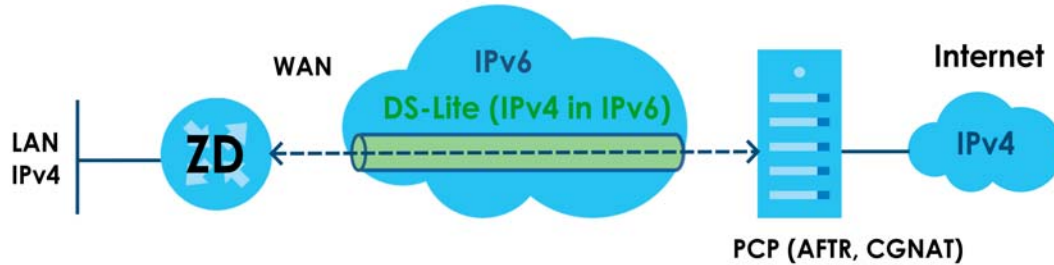
Use this screen to view, add, or delete PCP rules. Port Control Protocol (PCP) allows devices such as web or file sharing servers behind the Zyxel Device to receive incoming traffic.

Example Applications

- Some remote access applications, such as remote desktop or SSH, require incoming traffic to be routed to the user's device in order to establish a remote connection. Use PCP to dynamically map incoming traffic to the user's device, allowing them to establish remote connections.

The PCP server allows dynamic mapping of external ports to internal IP addresses and ports. PCP allows devices to request and release mappings for specific ports, and to specify the lifetime of those mappings. This allows devices to dynamically open and close ports just as needed, and does not need keepalive packets that can drain battery life of home devices such as smartphones.

In the following figure, the Zyxel Device is the PCP client. DS-Lite tunnels IPv4 packets over an IPv6 network to an AFTR (Address Family Transition Router) and Carrier-Grade NAT (CGNAT) which includes the PCP server, then sends traffic to its external IPv4 network. The Port Control Protocol with DS Lite allows you to create PCP mapping rules with the PCP server.



Requirement

You must enable DS Lite (Dual-Stack Lite) in **Network Setting > Broadband > Edit WAN Interface** to use PCP.

- If you select **Automatically configured by DHCP**, then the IP address of the PCP server is assigned to the Zyxel Device using DHCP Option 64.

DS-Lite ☑

☒ Automatically configured by DHCP

☐ Manually Configured

- If you select **Manually Configured**, then you must enter the IPv6 address of the PCP server in the **DS-Lite Relay server IP** field.

DS-Lite ☑

☐ Automatically configured by DHCP

☒ Manually Configured

DS-Lite Relay Server IP

Configuring PCP

Click **Network Setting > NAT > PCP** to display the following screen.

Figure 179 Network Setting > NAT > PCP

NAT

Port Forwarding Port Triggering DMZ ALG Address Mapping Sessions **PCP**

Port Control Protocol (PCP) allows LAN devices such as web or file sharing servers to directly receive incoming traffic from the WAN using dynamic IP address and port mapping.

+ Add New Rule

#	External IPv4 Address	Required Internal Port	Required External Port	Assigned Public Port	Protocol	Internal IPv4 Address	PCP Server	Allow PCP Port Proposal [Y/N]	Delete
---	-----------------------	------------------------	------------------------	----------------------	----------	-----------------------	------------	-------------------------------	--------

The following table describes the fields in this screen.

Table 105 Network Setting > NAT > PCP

LABEL	DESCRIPTION
Add New Rule	Click this to add a new PCP rule.
#	This is the index number of the rule.
External IPv4 Address	This displays the external IP address assigned by the PCP server. PCP maps from this IP address to the LAN device IP address.
Required Internal Port	This displays the internal port number that the PCP server maps to, from the external port.
Required External Port	This displays the proposed external port number that the PCP server maps from, to the internal port.
Assigned Public Port	This displays the allocated external port number assigned by the PCP server for the service on the WAN if Allow PCP Port Proposal is enabled. PCP maps from this port number to the internal port number.
Protocol	This is the protocol (TCP or UDP) for port number that identifies a service.
Internal IPv4 Address	This is the LAN device IP address. PCP maps the external IP address to this IP address.
PCP Server	This field displays the status of the PCP mapping request to the PCP server. • Succeeded - The PCP server successfully mapped the external IP address and port to the internal IP address and port. • Failed - The PCP server failed to map the external IP address and port to the internal IP address and port. Make sure to select Allow PCP Port Proposal to allow the PCP server to assign an external IP address and port if the configured ones are not available.
Allow PCP Port Proposal (Y/N)	This displays Y if the PCP server can assign a different external IP address and port to the required ones you configured.
Delete	Select a rule, then click this icon to remove the rule from the Zyxel Device.

12.8.1 Add New Rule Screen

To add a new PCP rule, click **Add New Rule**. To edit an existing rule, select the rule, then click the **Modify** icon. The following screen displays.

Note: Be careful not to configure conflicting mapping between PCP and NAT port forwarding for incoming traffic.

Figure 180 Network Setting > NAT > PCP > Add New Rule

The following table describes the fields in this screen.

Table 106 Network Setting > NAT > PCP > Add New Rule

LABEL	DESCRIPTION
Required Internal Port	Enter an internal port number that the PCP server maps to, from the external port.
Required External Port	Enter a proposed external port number that the PCP server maps from, to the internal port.
Protocol	Select the transport layer protocol. Choices are TCP and UDP . See the Service Appendix to see what services require what protocol and port number.
Internal IPv4 Address	Enter the IP address of the LAN device. PCP maps the external IP address to this IP address.
Allow PCP Port Proposal	Select this to allow the PCP server to assign an external IP address and port. If you clear this, PCP mapping will fail if the required ones configured are not available on the PCP server.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

12.9 Technical Reference

This part contains more information regarding NAT.

12.9.1 NAT Definitions

Inside or outside denotes where a host is located relative to the Zyxel Device, for example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global or local denotes the IP address of a host in a packet as the packet traverses a router, for example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

Note that inside or outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet. Thus, an inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side. The following table summarizes this information.

Table 107 NAT Definitions

ITEM	DESCRIPTION
Inside	This refers to the host on the LAN.
Outside	This refers to the host on the WAN.
Local	This refers to the packet address (source or destination) as the packet travels on the LAN.
Global	This refers to the packet address (source or destination) as the packet travels on the WAN.

NAT never changes the IP address (either local or global) of an outside host.

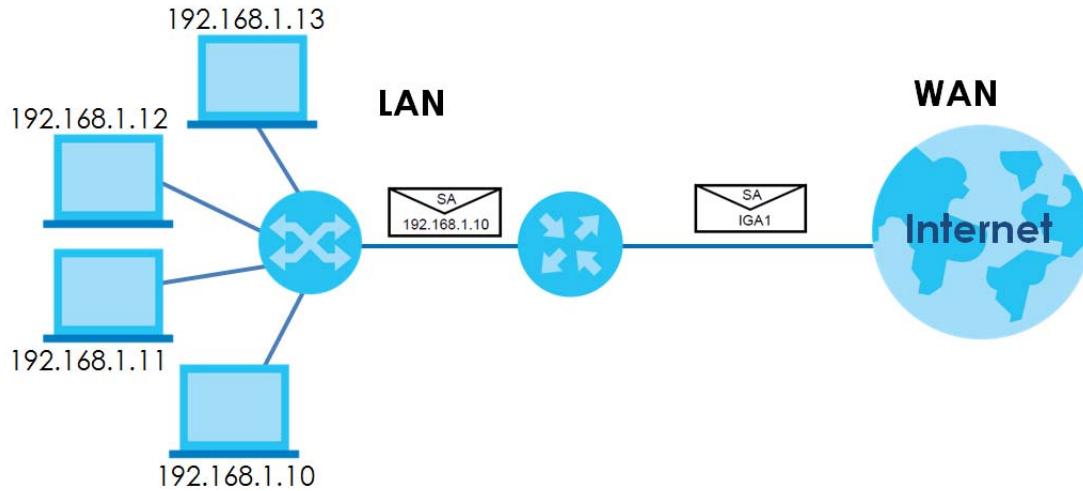
12.9.2 What NAT Does

In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host. Note that the IP address (either local or global) of an outside host is never changed.

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers, for example, a web server and a telnet server, on your local network and make them accessible to the outside world. If you do not define any servers (for Many-to-One and Many-to-Many Overload mapping), NAT offers the additional benefit of firewall protection. With no servers defined, your Zyxel Device filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to *RFC 1631, The IP Network Address Translator (NAT)*.

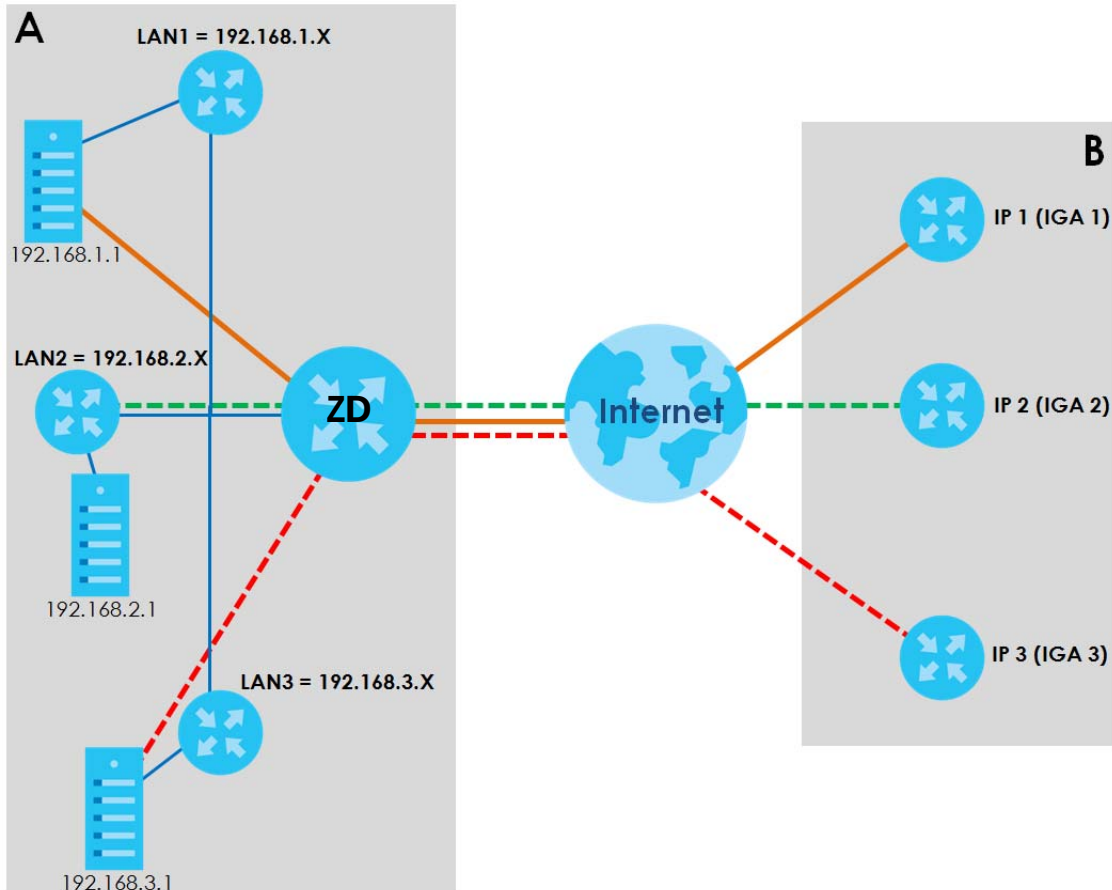
12.9.3 How NAT Works

Each packet has two addresses – a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address (and TCP or UDP source port numbers for Many-to-One and Many-to-Many Overload NAT mapping) in each packet and then forwards it to the Internet. The Zyxel Device keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored. The following figure illustrates this.

Figure 181 How NAT Works

12.9.4 NAT Application

The following figure illustrates a possible NAT application, where three inside LANs (logical LANs using IP alias) behind the Zyxel Device can communicate with three distinct WAN networks.

Figure 182 NAT Application With IP Alias

Port Forwarding: Services and Port Numbers

The most often used port numbers are shown in the following table. Please refer to RFC 1700 for further information about port numbers. Please also refer to the Supporting CD for more examples and details on port forwarding and NAT.

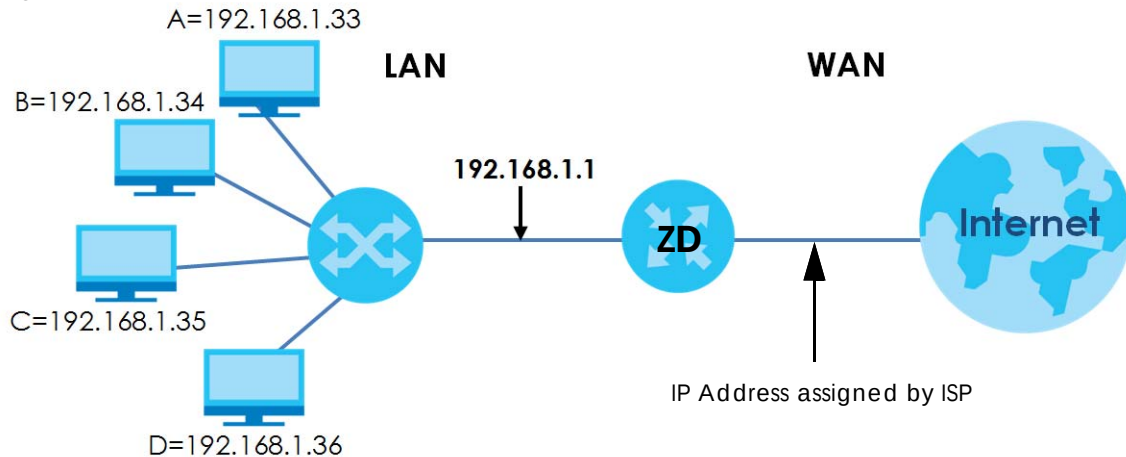
Table 108 Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
SMTP (Simple Mail Transfer Protocol)	25
DNS (Domain Name System)	53
Finger	79
HTTP (Hyper Text Transfer protocol or WWW, Web)	80
POP3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
PPTP (Point-to-Point Tunneling Protocol)	1723

Port Forwarding Example

Let's say you want to assign ports 21 – 25 to one Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example) and assign a default server IP address of 192.168.1.35 to a third (**C** in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 183 Multiple Servers Behind NAT Example



CHAPTER 13

DNS

13.1 DNS Overview

DNS

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a machine before you can access it.

In addition to the system DNS servers, each WAN interface (service) is set to have its own static or dynamic DNS server list. You can configure a DNS static route to forward DNS queries for certain domain names through a specific WAN interface to its DNS servers. The Zyxel Device uses a system DNS server (in the order you specify in the **Broadband** screen) to resolve domain names that do not match any DNS routing entry. After the Zyxel Device receives a DNS reply from a DNS server, it creates a new entry for the resolved IP address in the routing table.

Dynamic DNS

Dynamic DNS allows you to use a dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, and so on). You can also access your Web site on your own computer using a domain name (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they do not know your IP address.

You first need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a domain name. The Dynamic DNS service provider will give you a password or key.

13.1.1 What You Can Do in this Chapter

- Use the **DNS Entry** screen to view, configure, or remove DNS routes ([DNS Entry \(DNS\)](#)).
- Use the **Dynamic DNS** screen to enable DDNS and configure the DDNS settings on the Zyxel Device ([Dynamic DNS](#)).

13.1.2 What You Need To Know

DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

If you have a private WAN IP address, then you cannot use Dynamic DNS.

13.2 DNS Entry (DNS)

DNS (Domain Name System) is used for mapping a domain name to its corresponding IP address and vice versa. Use this screen to view and configure manual DNS entries on the Zyxel Device. Click **Network Setting** > **DNS** to open the **DNS Entry** screen.

Note: The host name should consist of the host's local name and the domain name. For example, Mycomputer.home is a host name where Mycomputer is the host's local name, and .home is the domain name.

Figure 184 Network Setting > DNS > DNS Entry

DNS

DNS Entry | Dynamic DNS

DNS (Domain Name System) is used for mapping a domain name to its corresponding IP address and vice versa. Use this screen to view and configure DNS routes on the Zyxel Device.

+ Add New DNS Entry

#	HostName	IP Address	Modify
---	----------	------------	--------

Note
The hostnames requires a combination of the host's local name with its domain name, for example, Mycomputer.home consists of a local hostname (Mycomputer) and the domain name (home).

The following table describes the fields in this screen.

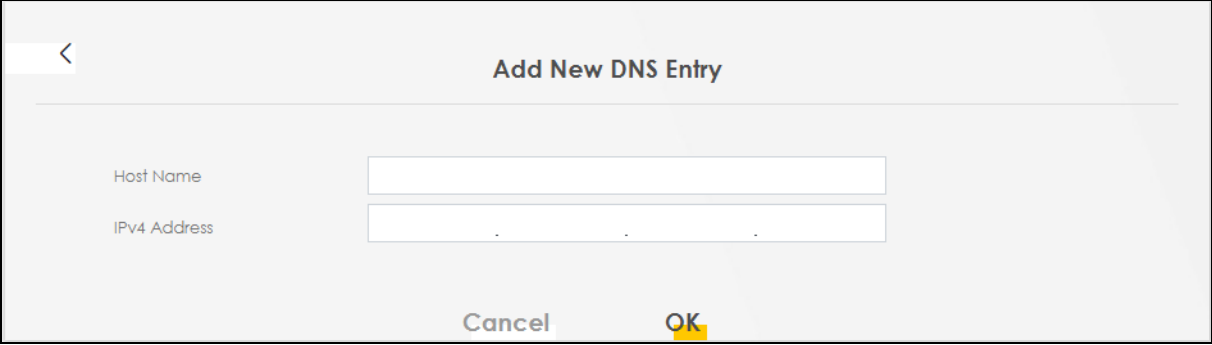
Table 109 Network Setting > DNS > DNS Entry

LABEL	DESCRIPTION
Add New DNS Entry	Click this to create a new DNS entry.
#	This is the index number of the entry.
HostName	This indicates the host name or domain name.
IP Address	This indicates the IP address assigned to this computer.
Modify	Click the Edit icon to edit the rule. Click the Delete icon to delete an existing rule.

13.2.1 Add or Edit DNS Entry

You can manually add or edit the Zyxel Device's DNS name and IP address entry. Click **Add New DNS Entry** in the **DNS Entry** screen or the **Edit** icon next to the entry you want to edit. The screen shown next appears.

Figure 185 Network Setting > DNS > DNS Entry: Add



The following table describes the labels in this screen.

Table 110 Network Setting > DNS > DNS Entry: Add or Edit

LABEL	DESCRIPTION
Host Name	Enter the host name of the DNS entry. You can use up to 256 alphanumeric (0-9, a-z, A-Z) characters with hyphens [-] and periods [.]. You can use the wildcard character, an "*" (asterisk) as the left most part of a domain name, such as *.example.com.
IPv4 Address	Enter the IPv4 address of the DNS entry.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

13.3 Dynamic DNS

Dynamic DNS can update your current dynamic IP address mapping to a hostname. Configure a DDNS service provider on your Zyxel Device. Click **Network Setting > DNS > Dynamic DNS**. The screen appears as shown.

Figure 186 Network Setting > DNS > Dynamic DNS

Dynamic DNS can update your current dynamic IP address mapping to a hostname. Configure a DDNS service provider on your Zyxel Device.

Dynamic DNS Setup

Dynamic DNS ☒ Enable ☐ Disable (Settings are invalid when disable)

Service Provider

Host Name

Username

Password 

☒ Enable Wildcard Option

☒ Enable Off Line Option (Only applies to custom DNS)

Dynamic DNS Status

User Authentication Result

Last Updated Time

Current Dynamic IP

[Cancel](#) [Apply](#)

The following table describes the fields in this screen.

Table 111 Network Setting > DNS > Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Dynamic DNS	Select Enable to use dynamic DNS.
Service Provider	Select your Dynamic DNS service provider from the drop-down list box.
Host Name	Enter the domain name assigned to your Zyxel Device by your Dynamic DNS provider. You can use up to 256 alphanumeric (0-9, a-z, A-Z) characters with hyphens [-] and periods [.]. You can specify up to two host names in the field separated by a comma (",").
Username	Enter your user name.
Password	Enter the password assigned to you.
Enable Wildcard Option	Select the checkbox to enable DynDNS Wildcard.
Enable Off Line Option (Only applies to custom DNS)	Check with your Dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
Dynamic DNS Status	
User Authentication Result	This shows Success if the account is correctly set up with the Dynamic DNS provider account.
Last Updated Time	This shows the last time the IP address the Dynamic DNS provider has associated with the hostname was updated.
Current Dynamic IP	This shows the IP address your Dynamic DNS provider has currently associated with the hostname.

Table 111 Network Setting > DNS > Dynamic DNS (continued)

LABEL	DESCRIPTION
Cancel	Click Cancel to exit this screen without saving.
Apply	Click Apply to save your changes.

CHAPTER 14

IGMP/MLD

14.1 IGMP/MLD Overview

Multicast delivers IP packets to a group of hosts on the network defined by multicast groups. Membership to these multicast groups are established using IGMP/MLD.

Use the **IGMP/MLD** screen to configure IGMP/MLD group settings.

14.1.1 What You Need To Know

Multicast and IGMP

See [Multicast](#) for more information.

Multicast Listener Discovery (MLD)

The Multicast Listener Discovery (MLD) protocol (defined in RFC 2710) is derived from IPv4's Internet Group Management Protocol version 2 (IGMPv2). MLD uses ICMPv6 message types, rather than IGMP message types. MLDv1 is equivalent to IGMPv2 and MLDv2 is equivalent to IGMPv3.

- MLD allows an IPv6 switch or router to discover the presence of MLD hosts who wish to receive multicast packets and the IP addresses of multicast groups the hosts want to join on its network.
- MLD snooping and MLD proxy are analogous to IGMP snooping and IGMP proxy in IPv4.
- MLD filtering controls which multicast groups a port can join.
- An MLD Report message is equivalent to an IGMP Report message, and an MLD Done message is equivalent to an IGMP Leave message.

IGMP Fast Leave

When a host leaves a multicast group (224.1.1.1), it sends an IGMP leave message to inform all routers (224.0.0.2) in the multicast group. When a router receives the leave message, it sends a specific query message to all multicast group (224.1.1.1) members to check if any other hosts are still in the group. Then the router deletes the host's information.

With the IGMP fast leave feature enabled, the router removes the host's information from the group member list once it receives a leave message from a host and the fast leave timer expires.

14.2 The IGMP/MLD Screen

Use this screen to configure multicast groups that the Zyxel Device manages through IGMP/MLD settings. To open this screen, click **Network Setting > IGMP/MLD**.

Note: Some models only support IGMP/MLD **Default Version** configuration.

Note: For DX3300/3301-T0, IGMP/MLD are enabled by default and are not configurable. The default IGMP version is 3. The default MLD version is 2.

Figure 187 Network Setting > IGMP/MLD

IGMP/MLD

Enter IGMP/MLD protocol configuration fields if you want modify default values shown below. Please note that if you modify IGMP query interval, MLD query interval will also be changed, and vice versa.

IGMP Configuration

Default Version	3
Query Interval	125
Query Response Interval	10
Last Member Query Interval	10
Robustness Value	2
Maximum Multicast Groups	25
Maximum Multicast Data Sources(for IGMPv3)	10
Maximum Multicast Groups Members	25
Fast Leave Enable	☒
LAN to LAN (Intra LAN) Multicast Enable	☒
Membership Join Immediate (IPTV)	☒

MLD Configuration

Default Version	2
Query Interval	125
Query Response Interval	10
Last Member Query Interval	10
Robustness Value	2
Maximum Multicast Groups	10
Maximum Multicast Data Sources(for IGMPv3)	10
Maximum Multicast Groups Members	10
Fast Leave Enable	☒
LAN to LAN (Intra LAN) Multicast Enable	☒

The following table describes the labels in this screen.

Table 112 Network Setting > IGMP/MLD

LABEL	DESCRIPTION
IGMP/MLD Configuration	
Default Version	Enter the version of IGMP (1~3) and MLD (1~2) that you want the Zyxel Device to use on the WAN.
Query Interval	Enter the number of seconds the Zyxel Device sends a query message to hosts to get the group membership information.
Query Response Interval	Enter the maximum number of seconds the Zyxel Device can wait for receiving a General Query message. Multicast routers use general queries to learn which multicast groups have members.
Last Member Query Interval	Enter the maximum number of seconds the Zyxel Device can wait for receiving a response to a Group-Specific Query message. Multicast routers use group-specific queries to learn whether any member remains in a specific multicast group.
Robustness Value	Enter the number of times (1~7) the Zyxel Device can resend a packet if packet loss occurs due to network congestion.
Maximum Multicast Groups	Enter a number to limit the number of multicast groups an interface on the Zyxel Device is allowed to join. Once a multicast member is registered in the specified number of multicast groups, any new IGMP or MLD join report frames are dropped by the interface.
Maximum Multicast Data Sources(for IGMPv3)	Enter a number to limit the number of multicast data sources (1-24) a multicast group is allowed to have. Note: The setting only works for IGMPv3 and MLDv2.
Maximum Multicast Group Members	Enter a number to limit the number of multicast members a multicast group can have.
Fast Leave Enable	Select this option to set the Zyxel Device to remove a port from the multicast tree immediately (without sending an IGMP or MLD membership query message) once it receives an IGMP or MLD leave message. This is helpful if a user wants to quickly change a TV channel (multicast group change) especially for IPTV applications.
LAN to LAN (Intra LAN) Multicast Enable	Select this to enable LAN to LAN IGMP snooping capability.
Membership Join Immediate (IPTV)	Select this to have the Zyxel Device add a host to a multicast group immediately once the Zyxel Device receives an IGMP or MLD join message.
Cancel	Click Cancel to exit this screen without saving.
Apply	Click Apply to save your changes back to the Zyxel Device.

CHAPTER 15

VLAN Group

15.1 VLAN Group Overview

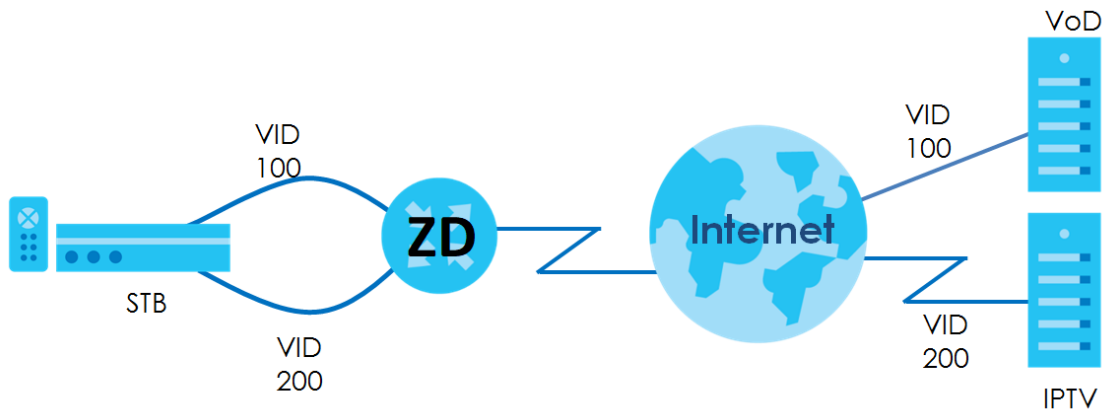
A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same groups; the traffic must first go through a router.

Ports in the same VLAN group share the same frame broadcast domain thus increase network performance through reduced broadcast traffic. Shared resources such as a server can be used by all ports in the same VLAN as the server. Ports can belong to other VLAN groups too. VLAN groups can be modified at any time by adding, moving or changing ports without any re-cabling.

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges. The VLAN ID associates a frame with a specific VLAN and provides the information that switches the need to process the frame across the network.

In the following example, VLAN IDs (VIDs) 100 and 200 are added to identify Video-on-Demand and IPTV traffic respectively coming from the VoD and IPTV multicast servers. The Zyxel Device can also tag outgoing requests to the servers with these VLAN IDs.

Figure 188 VLAN Group Example



15.1.1 What You Can Do in this Chapter

Use these screens to manage VLAN groups on the Zyxel Device.

15.2 VLAN Group Settings

This screen shows the VLAN groups created on the Zyxel Device. Click **Network Setting > VLAN Group** to open the following screen.

Figure 189 Network Setting > VLAN Group

Vlan Group				
After creating a VLAN Group, we can configure the subnet and DHCP settings at the LAN Setup page.				
 Add New VLAN Group				
#	Group Name	VLAN ID	Interface	Modify
1	VlanGroup1	2	LAN1U	 
2	VlanGroup2	4	LAN1U	 
3	VlanGroup3	30	LAN1U	 

The following table describes the fields in this screen.

Table 113 Network Setting > VLAN Group

LABEL	DESCRIPTION
Add New VLAN Group	Click this button to create a new VLAN group.
#	This is the index number of the VLAN group.
Group Name	This shows the descriptive name of the VLAN group.
VLAN ID	This shows the unique ID number that identifies the VLAN group.
Interface	This shows the LAN ports included in the VLAN group and if traffic leaving the port will be tagged with the VLAN ID.
Modify	Click the Edit icon to change an existing VLAN group setting or click the Delete icon to remove the VLAN group.

15.2.1 Add or Edit a VLAN Group

Click the **Add New VLAN Group** button in the **VLAN Group** screen to open the following screen. Use this screen to create a new VLAN group.

Figure 190 Network Setting > VLAN Group > Add New VLAN Group/Edit

The screenshot shows the 'Add New VLAN Group' configuration screen. It features a title bar with a back arrow and the title 'Add New VLAN Group'. Below the title bar, there are two input fields: 'VLAN Group Name' and 'VLAN ID'. Underneath these fields, there are four rows for LAN interfaces: LAN1, LAN2, LAN3, and LAN4. Each row has two checkboxes: 'Include' and 'TX Tagging'. At the bottom of the screen, there are two buttons: 'Cancel' and 'OK'.

The following table describes the fields in this screen.

Table 114 Network Setting > VLAN Group > Add New VLAN Group/Edit

LABEL	DESCRIPTION
VLAN Group Name	Enter a name to identify this group. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
VLAN ID	Enter a unique ID number, from 1 to 4,094, to identify this VLAN group. Outgoing traffic is tagged with this ID if TX Tagging is selected below.
LAN	Select Include to add the associated LAN interface to this VLAN group. Note: Select TX Tagging to tag outgoing traffic from the associated LAN port with the VLAN ID number entered above.
10G LAN	Select Include to add the associated LAN interface to this VLAN group. Note: Select TX Tagging to tag outgoing traffic from the associated LAN port with the VLAN ID number entered above.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

CHAPTER 16

Interface Grouping

16.1 Interface Grouping Overview

By default, all LAN and WAN interfaces on the Zyxel Device are in the default group. Client devices in the default group can communicate with all devices in the default and other groups. Create interface groups to have the Zyxel Device assign IP addresses in different domains. Each group acts as an independent network on the Zyxel Device. Client devices in the same group can communicate with each other directly. Interfaces that do not belong to any user-defined group belong to the default group.

16.1.1 What You Can Do in this Chapter

The **Interface Grouping** screen lets you create multiple networks on the Zyxel Device ([Interface Grouping](#)).

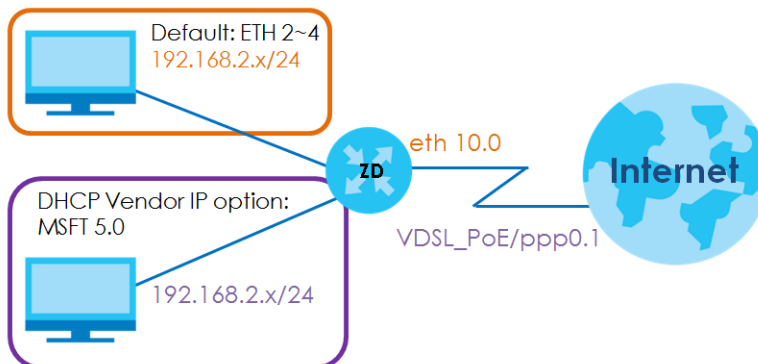
16.2 Interface Grouping

You can manually add a LAN interface to a new group. Alternatively, you can have the Zyxel Device automatically add the incoming traffic and the LAN interface on which traffic is received to an interface group when its DHCP Vendor ID option information matches one listed for the interface group.

Use the **LAN Setup** screen to configure the private IP addresses the DHCP server on the Zyxel Device assigns to the clients in the default and/or user-defined groups. If you set the Zyxel Device to assign IP addresses based on the client's DHCP Vendor ID option information, you must enable DHCP server and configure LAN TCP/IP settings for both the default and user-defined groups. See [Home Networking](#) for more information.

In the following example, the client that sends packets with the DHCP Vendor ID option set to MSFT 5.0 (meaning it is a Windows 2000 DHCP client) is assigned the IP address 192.168.2.2 and uses the WAN VDSL_PoE/ppp0.1 interface.

Figure 191 Interface Grouping Application



You can use this screen to create new user-defined interface groups or modify existing ones. Interfaces that do not belong to any user-defined group always belong to the default group.

Click **Network Setting > Interface Grouping** to open the following screen.

Figure 192 Network Setting > Interface Grouping

Interface Grouping

By default, all LAN and WAN interfaces on the Zyxel Device are in the same group and can communicate with each other. Create interface groups to have the Zyxel Device assign IP addresses in different domains to different groups. Each group acts as an independent network on the Zyxel Device. Devices in different groups cannot communicate with each other directly.

You can use this screen to create new user-defined interface groups or modify existing ones. Interfaces that do not belong to any user-defined group always belong to the default group.

+ Add New Interface Group

Group Name	WAN Interface	LAN Interface	Criteria	Modify
Default	Any WAN	LAN1,LAN2,LAN3,Zyxe L_2581(*2.4G),ZyxeL_2 581_guest1(*2.4G),Zy xel_2581_guest2(*2.4 G),ZyxeL_2581_guest3 (*2.4G),ZyxeL_2581(*5 G),ZyxeL_2581_guest1 (*5G),ZyxeL_2581_gue st2_5G(*5G),ZyxeL_25 81_guest3_5G(*5G)		

The following table describes the fields in this screen.

Table 115 Network Setting > Interface Grouping

LABEL	DESCRIPTION
Add New Interface Group	Click this button to create a new interface group.
Group Name	This shows the descriptive name of the group.
WAN Interface	This shows the WAN interfaces in the group.
LAN Interfaces	This shows the LAN interfaces in the group.
Criteria	This shows the filtering criteria for the group.
Modify	Click the Edit icon to modify an existing Interface group setting or click the Delete icon to remove the Interface group.

16.2.1 Interface Group Configuration

Click the **Add New Interface Group** button in the **Interface Grouping** screen to open the following screen. Use this screen to create a new interface group. If you want to automatically add LAN clients to a new group, use filtering criteria.

Note: An interface can belong to only one group at a time.

Note: After configuring a vendor ID, reboot the client device attached to the Zyxel Device to obtain an appropriate IP address.

Figure 193 Network Setting > Interface Grouping > Add New Interface Group (for Ethernet gateways)

<
Add New Interface Group

Use this screen to create a new interface group. If you want to automatically add LAN clients to a new group, use filtering criteria.

Group Name

WAN Interfaces used in the grouping

ETH type- None

WWAN type- None

Available LAN Interfaces

☐ LAN1
☐ LAN2
☐ LAN3
☐ LAN4
☐ Zyxel_0002(*2.4G)

>
<

Selected LAN Interfaces

Automatically Add Clients With the following DHCP Vendor IDs

#	Filter Criteria	WildCard Support	Modify
+ Add			

Note

(1) After configuring a vendor ID, reboot the client device attached to the Zyxel Device to obtain an appropriate IP address.

(2) You can have up to 15 filter criteria.

Cancel
OK

Figure 194 Network Setting > Interface Grouping > Add New Interface Group/Edit (for DSL gateways)



Add New Interface Group

Use this screen to create a new interface group. If you want to automatically add LAN clients to a new group, use filtering criteria.

Group Name

WAN Interfaces used in the grouping

PTM type-

None

ETH type-

None

Available LAN Interfaces

☐ LAN1

☐ LAN2

☐ LAN3

☐ -WiFi_2A7C1E21(*2.4G)

☐ -WiFi_2A7C1E21_guest1(*2.4G)

Selected LAN Interfaces

>

<

Automotically Add Clients With the following DHCP Vendor IDs

#	Filter Criteria	WildCard Support	Modify

+

Add

Cancel

OK

Figure 195 Network Setting > Interface Grouping > Add New Interface Group/Edit (for PON gateways)

The following table describes the fields in this screen.

Table 116 Network Setting > Interface Grouping > Add New Interface Group/Edit

LABEL	DESCRIPTION
Group Name	Enter a descriptive name for this interface group. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
WAN Interfaces used in the grouping	Select the WAN interface this group uses. The group can have up to one PTM interface, up to one ATM interface, up to one ETH interface, and up to one WWAN interface. Select None to not add a WAN interface to this group.
Selected LAN Interfaces	Select one or more interfaces (Ethernet LAN, wireless LAN) in the Available LAN Interfaces list and use the to move them to the Selected LAN Interfaces list to add the interfaces to this group.
Available LAN Interfaces	To remove a LAN or wireless LAN interface from the Selected LAN Interfaces , use the .
Automatically Add Clients With the following DHCP Vendor IDs	Click Add to identify LAN hosts to add to the interface group by criteria such as the type of the hardware or firmware. See Interface Grouping Criteria for more information.

Table 116 Network Setting > Interface Grouping > Add New Interface Group/Edit (continued)

LABEL	DESCRIPTION
#	This shows the index number of the rule.
Filter Criteria	This shows the filtering criteria. The LAN interface on which the matched traffic is received will belong to this group automatically.
Wildcard Support	This shows if wildcard on DHCP option 60 is enabled.
Modify	Click the Edit icon to change the group setting. Click the Delete icon to delete this group from the Zyxel Device.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

16.2.2 Interface Grouping Criteria

Click the **Add** button in the **Interface Grouping Configuration** screen to open the following screen. Use this screen to automatically add clients to an interface group based on specified criteria. You can choose to define a group based on a MAC address, a vendor ID (DHCP option 60), an Identity Association Identifier (DHCP option 61), vendor specific information (DHCP option 125), or a VLAN group.

Figure 196 Network Setting > Interface Grouping > Interface Group Configuration: Add

Add new criteria

Criteria

☐ Source MAC address
☐ DHCP option 60
☐ DHCP option 61
☒ DHCP option 125

Enterprise Number
 Manufacturer OUI
 Serial Number
 Product Class

☐ VLAN Group

Cancel OK

The following table describes the fields in this screen.

Table 117 Network Setting > Interface Grouping > Interface Group Configuration: Add

LABEL	DESCRIPTION
Source MAC Address	Enter the source MAC address of the packet.
APAS MAC Filter	Select this option and enter the MAC address of the matched LAN host.
DHCP Option 60	Select this option and enter the Vendor Class Identifier (Option 60) of the matched traffic, such as the type of the hardware or firmware.
Enable wildcard	Select this option to be able to use wildcards in the Vendor Class Identifier configured for DHCP option 60.
DHCP Option 61	Select this and enter the device identity of the matched traffic.
	Enter the Identity Association Identifier (IAID) of the device, for example, the WAN connection index number.
DHCP Option 125	Select this and enter vendor specific information of the matched traffic.
Enterprise Number	Enter the vendor's 32-bit enterprise number registered with the IANA (Internet Assigned Numbers Authority).
Manufacturer OUI	Specify the vendor's OUI (Organization Unique Identifier). It is usually the first 3 bytes of the MAC address.
Serial Number	Enter the serial number of the device.
Product Class	Enter the product class of the device.
VLAN Group	Select this and the VLAN group of the matched traffic from the drop-down list box. A VLAN group can be configured in Network Setting > VLAN Group .
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

CHAPTER 17

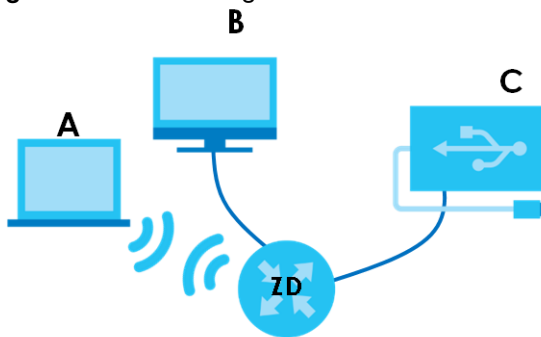
USB Service

17.1 USB Service Overview

You can share files on a USB memory stick or hard drive connected to your Zyxel Device with users on your network.

The following figure is an overview of the Zyxel Device's file server feature. Computers **A** and **B** can access files on a USB device (**C**) which is connected to the Zyxel Device.

Figure 197 File Sharing Overview



The Zyxel Device will not be able to join a workgroup if your local area network has restrictions set up that do not allow devices to join a workgroup. In this case, contact your network administrator.

17.1.1 What You Can Do in this Chapter

- Use the **File Sharing** screen to enable file-sharing server ([USB Service](#)).
- Use the **Media Server** screen to enable or disable the sharing of media files ([Media Server](#)).
- Use the **Print Server** screen to enable or disable the printing of files ([Print Server](#)).

17.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Note: To see how to use the USB port to do the cellular backup, please refer to [Cellular Backup](#).

17.1.3 File Sharing

Workgroup Name

This is the name given to a set of computers that are connected on a network and share resources such as a printer or files. Windows automatically assigns the workgroup name when you set up a network.

Shares

When settings are set to default, each USB device connected to the Zyxel Device is given a folder, called a "share". If a USB hard drive connected to the Zyxel Device has more than one partition, then each partition will be allocated a share. You can also configure a "share" to be a sub-folder or file on the USB device.

File Systems

A file system is a way of storing and organizing files on your hard drive and storage device. Often different operating systems such as Windows or Linux have different file systems. The file sharing feature on your Zyxel Device supports File Allocation Table (FAT) and FAT32.

Common Internet File System

The Zyxel Device uses Common Internet File System (CIFS) protocol for its file sharing functions. CIFS compatible computers can access the USB file storage devices connected to the Zyxel Device. CIFS protocol is supported on Microsoft Windows, Linux Samba and other operating systems (refer to your systems specifications for CIFS compatibility).

17.1.4 Before You Begin

- 1 Make sure the Zyxel Device is connected to your network and turned on.
- 2 Connect the USB device to one of the Zyxel Device's USB port. If you are connecting a USB hard drive that comes with an external power supply, make sure it is connected to an appropriate power source.
- 3 The Zyxel Device detects the USB device and makes its contents available for browsing.

Note: If your USB device cannot be detected by the Zyxel Device, see the troubleshooting for suggestions.

17.2 USB Service

Use this screen to set up file sharing through the Zyxel Device. The Zyxel Device's LAN users can access the shared folder (or share) from the USB device inserted in the Zyxel Device. To access this screen, click **Network Setting > USB Service**.

Figure 198 Network Setting > USB Service

USB Service

The modem can share Files from your USB flash drive or disk when you attach it to the USB port. You may Start from deciding which folders in the USB disks to share and which users can access the shared folders.

Information

Volume	Capacity	Used Space
usb2_sda1	30111 MB	2705 MB

Server Configuration

File Sharing Services ☒

Share Directory List

+ Add New Share

Active	Status	Share Name	Share Path	Share Description	Modify

Account Management

+ Add New User

Status	User Name
	admin

Cancel
Apply

Note: The Share Directory List is only visible when you connect a USB device.

Each field is described in the following table.

Table 118 Network Setting > USB Service

LABEL	DESCRIPTION
Information	
Volume	This is the volume name the Zyxel Device gives to an inserted USB device.
Capacity	This is the total available memory size (in megabytes) on the USB device.
Used Space	This is the memory size (in megabytes) already used on the USB device.
Server Configuration	
File Sharing Services	Click this switch to enable file sharing through the Zyxel Device.
Share Directory List	
This only appears when you have inserted a USB device.	
Add New Share	Click this to set up a new share on the Zyxel Device.
Active	Select this to allow the share to be accessed.

Table 118 Network Setting > USB Service (continued)

LABEL	DESCRIPTION
Status	This field shows the status of the share  : The share is not activated.  : The share is activated.
Share Name	This field displays the name of the file you shared.
Share Path	This field displays the location in the USB of the file you shared.
Share Description	This field displays a description of the file you shared.
Modify	Click the Edit icon to change the settings of an existing share. Click the Delete icon to delete this share in the list.
Account Management	
Add New User	Click this button to create a user account to access the secured shares. This button redirects you to Maintenance > User Account .
Status	This field shows the status of the user.  : The user account is not activated for the share.  : The user account is activated for the share.
User Name	This is the name of a user who is allowed to access the secured shares on the USB device.
Cancel	Click this to restore your previously saved settings.
Apply	Click this to save your changes to the Zyxel Device.

17.2.1 Add New Share

Use this screen to set up a new share or edit an existing share on the Zyxel Device. Click **Add New Share** in the **File Sharing** screen or click the **Edit** or **Modify** icon next to an existing share.

Please note that you need to set up shared folders on the USB device before enabling file sharing in the Zyxel Device. Spaces and the following special characters, ["], [`], ['], [<], [>], [^], [\$], [|], [&], [;], are not allowed for the USB share name.

Figure 199 Network Setting > USB Service > Add New Share

The following table describes the labels in this menu.

Table 119 Network Setting > USB Service > Add New Share

LABEL	DESCRIPTION
Volume	Select the volume in the USB storage device that you want to add as a share in the Zyxel Device. This field is read-only when you are editing the share.
Share Path	Manually enter the file path for the share, or click the Browse button and select the folder that you want to add as a share. This field is read-only when you are editing the share.
Description	You can either enter a short description of the share, or leave this field blank. You can use up to 128 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Access Level	Select Public if you want the share to be accessed by users connecting to the Zyxel Device. Otherwise, select Security .
Allowed	If Security is selected in the Access Level field, select this checkbox to allow/prohibit access to the share.
User Name	This field specifies the user for which the Allowed setting applies. Users can be added or modified in Maintenance > User Account .
Cancel	Click Cancel to return to the previous screen.
OK	Click OK to save your changes.

17.2.2 Add New User Screen

Once you click the **Add New User** button, you will be directed to the **User Account** screen. To create a user account that can access the secured shares on the USB device, click the **Add New Account** button in the **Network Setting > USB Service > User Account** screen.

Please see [User Account](#), for detailed information about **User Account** screen.

17.3 Media Server

The media server feature lets anyone on your network play video, music, and photos from the USB storage device connected to your Zyxel Device without having to copy them to another computer. The Zyxel Device can function as a DLNA-compliant media server, where the Zyxel Device streams files to DLNA-compliant media clients like Windows Media Player. The Digital Living Network Alliance (DLNA) is a group of personal computer and electronics companies that works to make products compatible in a home network.

The Zyxel Device media server enables you to:

- Publish all shares for everyone to play media files in the USB storage device connected to the Zyxel Device.
- Use hardware-based media clients like the DMA-2500 to play the files.

Note: Anyone on your network can play the media files in the published shares. No user name and password or other form of security is used. The media server is enabled by default with the video, photo, and music shares published.

To change your Zyxel Device's media server settings, click **Network Setting > USB Service > Media Server**. The screen appears as shown.

Figure 200 Network Setting > USB Service > Media Server

USB Service

File Sharing **Media Server**

The media server feature lets anyone on your network play video, music, and photos from the USB storage device connected to your Zyxel Device without having to copy them to another computer. The Zyxel Device can function as a DLNA-compliant media server, where the Zyxel Device streams files to DLNA-compliant media clients like Windows Media Player. The Digital Living Network Alliance (DLNA) is a group of personal computer and electronics companies that works to make products compatible in a home network.

Media Server ☒

Interface Default ▼

Volume All USB Devices ▼

Media Library Path /mnt/ Browse

Cancel Apply

The following table describes the labels in this menu.

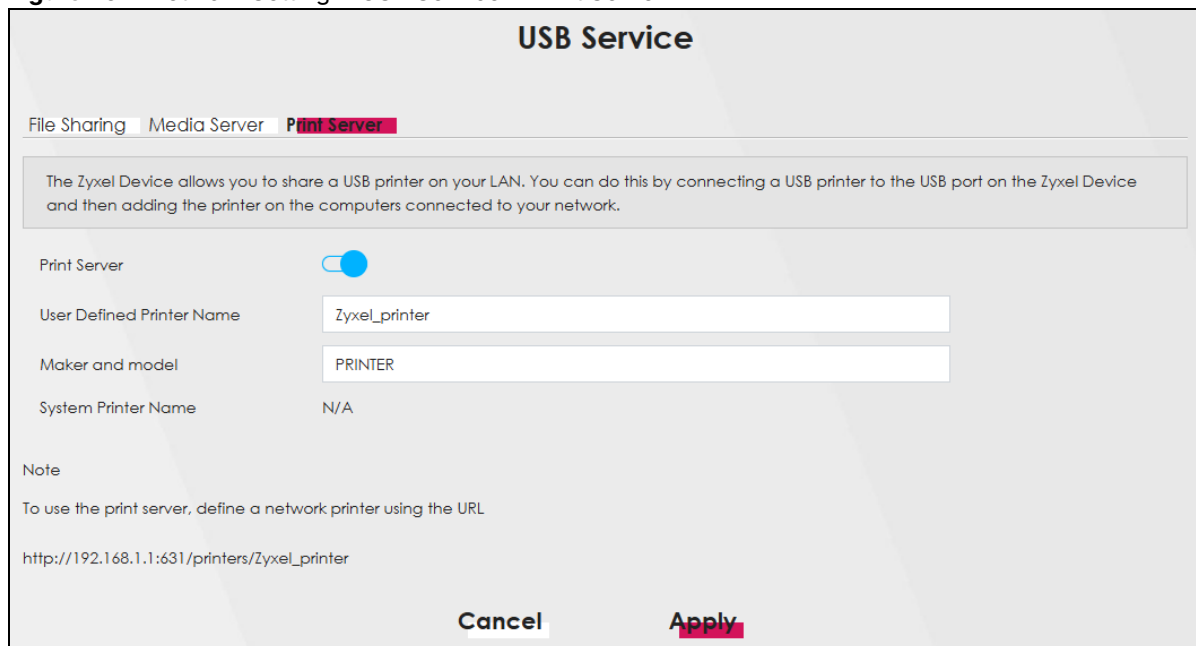
Table 120 Network Setting > USB Service > Media Server

LABEL	DESCRIPTION
Media Server	Click this switch to have the Zyxel Device function as a DLNA-compliant media server. When the switch goes to the right  , the function is enabled. Otherwise, it is not. Enable the media server to let (DLNA-compliant) media clients on your network play media files located in the shares.
Interface	Select an interface on which you want to enable the media server function. An interface can be added or modified in Network Setting > Interface Grouping .
Media Library Path	Enter the path clients use to access the media files on a USB storage device connected to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

17.4 Print Server

You can share a printer on your LAN using the Zyxel Device. To do this, connect a USB printer to the Zyxel Device's USB port using a USB cable, and then add the USB printer to the computers on your network. See [Add a printer](#) for the details on how to add a printer to your computer. This feature allows you to use the USB printer as a network printer. You can configure the printer's settings on this screen.

Figure 201 Network Setting > USB Service > Print Server



USB Service

File Sharing | Media Server | **Print Server**

The Zyxel Device allows you to share a USB printer on your LAN. You can do this by connecting a USB printer to the USB port on the Zyxel Device and then adding the printer on the computers connected to your network.

Print Server ☒

User Defined Printer Name

Maker and model

System Printer Name

Note

To use the print server, define a network printer using the URL

http://192.168.1.1:631/printers/Zyxel_printer

Cancel Apply

The following table describes the labels in this menu.

Table 121 Network Setting > USB Service > Print Server

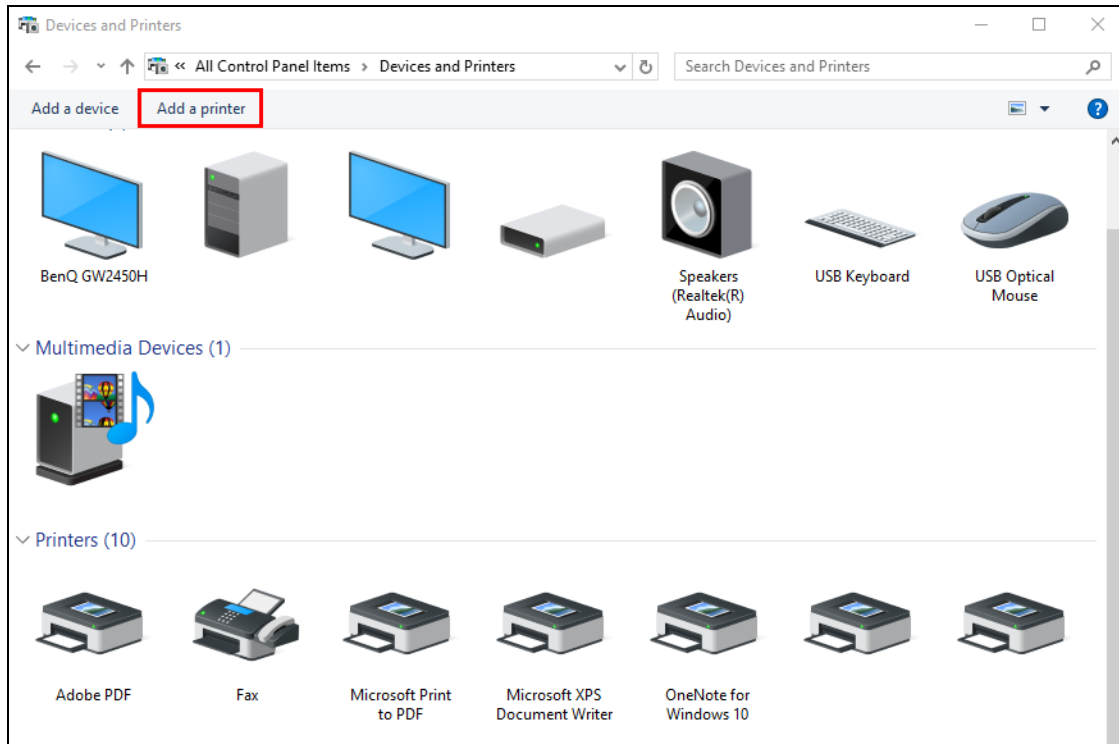
LABEL	DESCRIPTION
Print Server	Click this switch to have the Zyxel Device function as a print server. When the switch goes to the right  , the function is enabled. Otherwise, it is not. Enabling the print server allows a USB printer to function as a network printer. Print server also enables clients on your network to print files from shared folders on devices in LAN.
User Defined Printer Name	Enter the name you want the USB printer to show on LAN. You can use 1-33 alphanumeric (0-9, a-z, A-Z) and special characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;].
Maker and model	Enter the USB printer's manufacturer and product version. Maker refers to the manufacturer or brand of the USB printer. Model refers to the specific product version of the USB printer. For example, in the HP LaserJet 1020 printer, the manufacturer is HP and the model is LaserJet 1020.
System Printer Name	This shows the printer's original device name as recognized by the system. This field shows N/A when there is no printer connected.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

Note: To select the USB printer (network printer) on your computer, you need to use the URL shown on the GUI. The URL will change according to the modification of **User Defined Printer Name** and **Maker and model**. For example, in the screen above, select the USB printer (network printer) on your computer using the URL http://192.168.1.1:631/printers/Zyxel_printer.

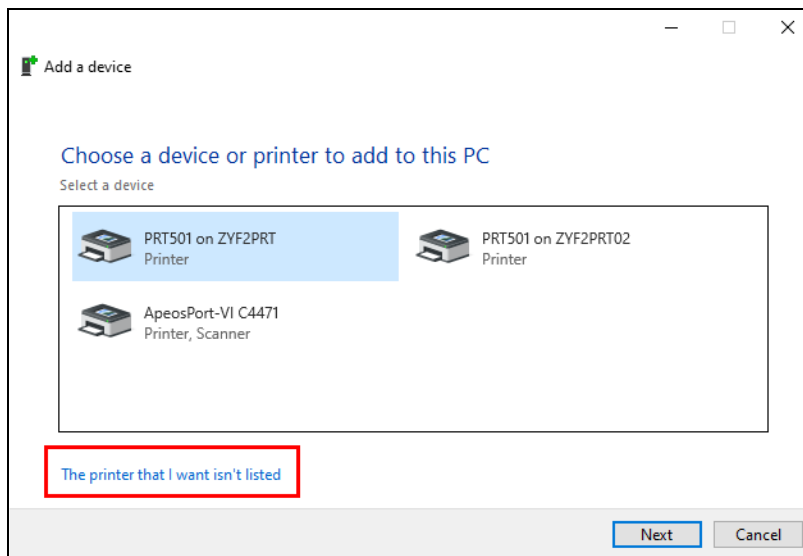
17.4.1 Add a printer

To add a USB printer (network printer) to your computer, follow the steps below:

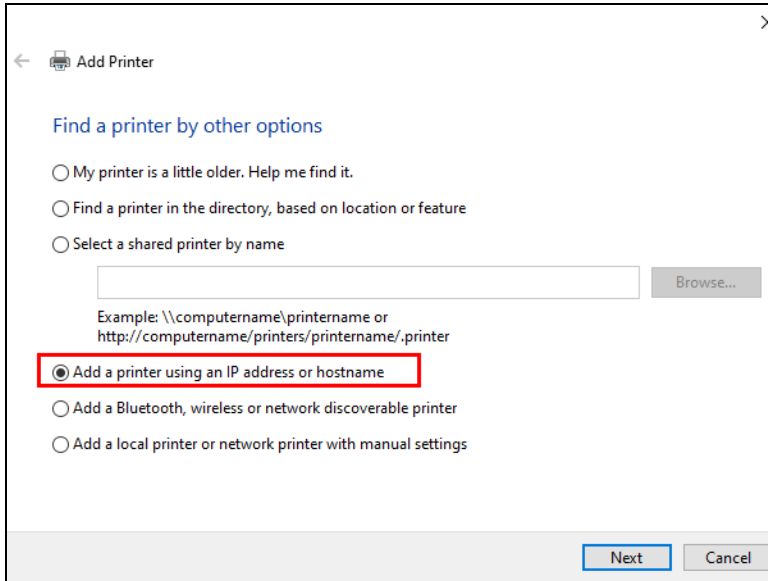
- 1 On your computer, go to **Control Panel > Devices and Printers**. In the top menu bar, click **Add a printer**.



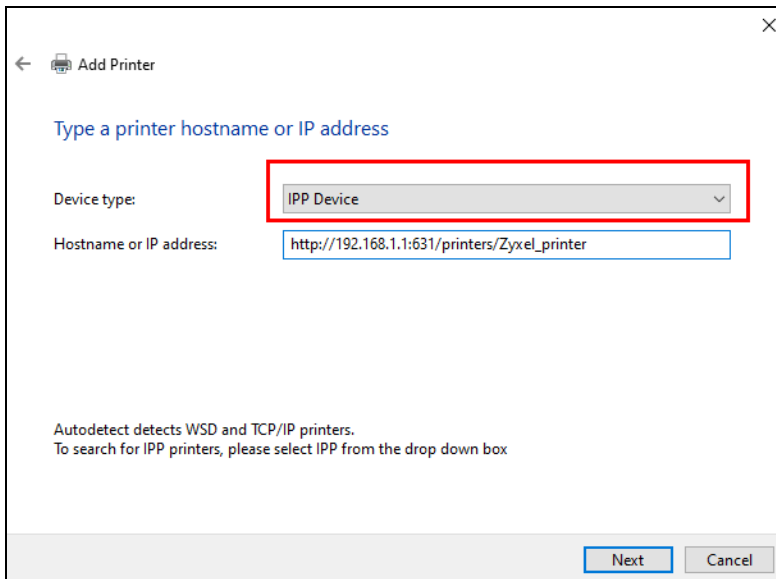
- 2 In this screen, click **The printer that I want isn't listed**.



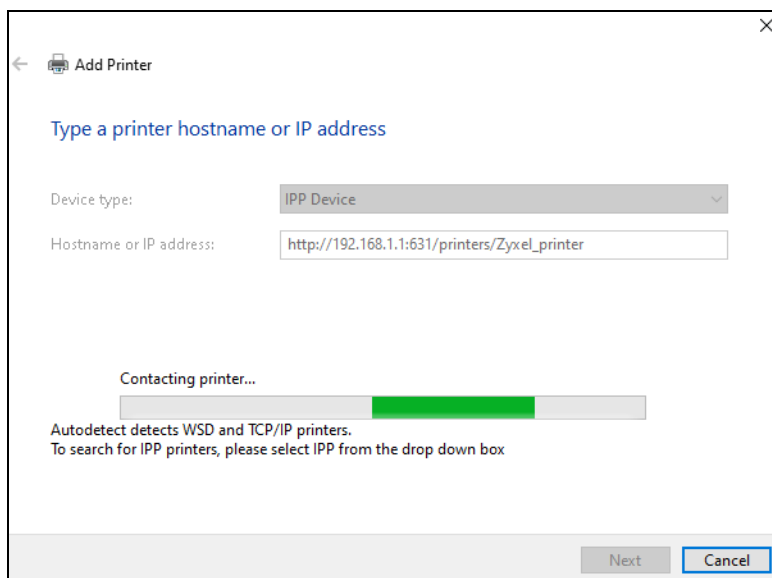
- 3 The screen below appears. Select **Add a printer using an IP address or hostname**. Click **Next**.



- 4 The screen below appears. In the **Device type** drop-down list, select **IPP Device**. Enter the URL of the USB printer (network printer) you want to add to your computer. Click **Next**.



- 5 Your computer starts connecting to the USB printer (network printer). Once the connection is complete, the USB printer (network printer) will appear in your printer list.



CHAPTER 18

Firewall

18.1 Firewall Overview

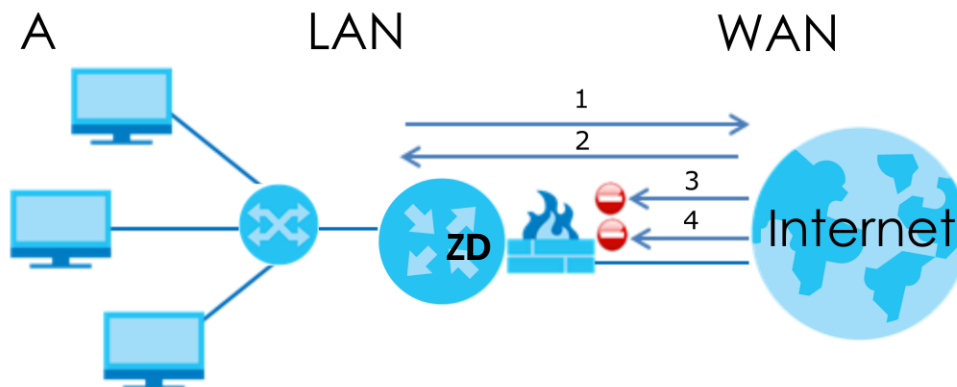
This chapter shows you how to enable the Zyxel Device firewall. Use the firewall to protect your Zyxel Device and network from attacks by hackers on the Internet and control access to it. The firewall:

- allows traffic that originates from your LAN computers to go to all other networks.
- blocks traffic that originates on other networks from going to the LAN.

By default, the Zyxel Device blocks DoS attacks whether the firewall is enabled or disabled.

The following figure illustrates the firewall action. User **A** can initiate an IM (Instant Messaging) session from the LAN to the WAN (**1**). Return traffic for this session is also allowed (**2**). However other traffic initiated from the WAN is blocked (**3** and **4**).

Figure 202 Default Firewall Action



18.1.1 What You Need to Know About Firewall

SYN Attack

A SYN attack floods a targeted system with a series of SYN packets. Each packet causes the targeted system to issue a SYN-ACK response. While the targeted system waits for the ACK that follows the SYN-ACK, it queues up all outstanding SYN-ACK responses on a backlog queue. SYN-ACKs are moved off the queue only when an ACK comes back or when an internal timer terminates the three-way handshake. Once the queue is full, the system will ignore all incoming SYN requests, making the system unavailable for legitimate users.

DoS

Denial-of-Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to

network resources. The Zyxel Device is pre-configured to automatically detect and thwart all known DoS attacks.

DoS Thresholds

For DoS attacks, the Zyxel Device uses thresholds to determine when to drop sessions that do not become fully established. These thresholds apply globally to all sessions. You can use the default threshold values, or you can change them to values more suitable to your security requirements.

DDoS

A Distributed Denial-of-Service (DDoS) attack is one in which multiple compromised systems attack a single target, thereby causing denial of service for users of the targeted system.

ICMP

Internet Control Message Protocol (ICMP) is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.

LAND Attack

In a LAND attack, hackers flood SYN packets into the network with a spoofed source IP address of the target system. This makes it appear as if the host computer sent the packets to itself, making the system unavailable while the target system tries to respond to itself.

Ping of Death

Ping of Death uses a 'ping' utility to create and send an IP packet that exceeds the maximum 65,536 bytes of data allowed by the IP specification. This may cause systems to crash, hang or reboot.

SPI

Stateful Packet Inspection (SPI) tracks each connection crossing the firewall and makes sure it is valid. Filtering decisions are based not only on rules but also context. For example, traffic from the WAN may only be allowed to cross the firewall in response to a request from the LAN.

18.2 Firewall

Use the firewall to protect your Zyxel Device and network from attacks by hackers on the Internet and control access to it.

18.2.1 What You Can Do in this Chapter

- Use the **General** screen to configure the security level of the firewall on the Zyxel Device ([General](#)).
- Use the **Protocol** screen to add or remove predefined Internet services and configure firewall rules ([Protocol \(Customized Services\)](#)).

- Use the **Access Control** screen to view and configure incoming or outgoing filtering rules ([Access Control \(Rules\)](#)).
- Use the **DoS** screen to activate protection against Denial of Service (DoS) attacks ([DoS](#)).

18.3 General

Use the firewall to protect your Zyxel Device and network from attacks by hackers on the Internet and control access to it. Use this screen to set the security level of the firewall on the Zyxel Device. Firewall rules are grouped based on the direction of travel of packets. A higher firewall level means more restrictions on the Internet activities you can perform. Click **Security > Firewall > General** to display the following screen. Use the slider to select the level of firewall protection.

Figure 203 Security > Firewall > General

Use the firewall to protect your Zyxel Device and network from attacks by hackers on the Internet and control access to it. Use this screen to set the security level of the firewall on the Zyxel Device. Firewall rules are grouped based on the direction of travel of packets. A higher firewall level means more restrictions on the Internet activities you can perform.

IPv4 Firewall ☒

IPv6 Firewall ☒

Low Medium (Recommended) High

Direction	Low	Medium (Recommended)	High
LAN to WAN	☒	☒	☐
WAN to LAN	☒	☒	☐

Note

(1) LAN to WAN is your access to all Internet services.

(2) WAN to LAN is the access of other computers on the Internet to devices behind the Zyxel Device.

(3) When the security level is set to **High**, access to Telnet, FTP, HTTP, HTTPS, DNS, IMAP, POP3, SMTP, and IPv6 Ping are still allowed from the LAN.

Cancel Apply

Note: LAN to WAN is your access to all Internet services. WAN to LAN is the access of other computers on the Internet to devices behind the Zyxel Device. When the security level is set to **High**, Telnet, HTTP, HTTPS, DNS, IMAP, POP3, SMTP, and/or IPv6 ICMPv6 (Ping) traffic from the LAN are still allowed.

The following table describes the labels in this screen.

Table 122 Security > Firewall > General

LABEL	DESCRIPTION
IPv4 Firewall	Enable firewall protection when using IPv4 (Internet Protocol version 4).
IPv6 Firewall	Enable firewall protection when using IPv6 (Internet Protocol version 6).

Table 122 Security > Firewall > General (continued)

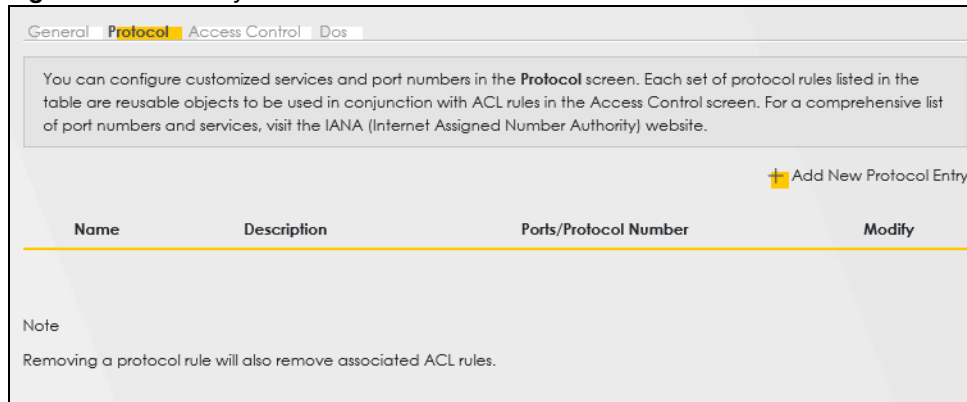
LABEL	DESCRIPTION
High	This setting blocks all traffic to and from the Internet. Only local network traffic and LAN to WAN service (Telnet, HTTP, HTTPS, DNS, POP3, SMTP) is permitted.
Medium	This is the recommended setting. It allows traffic to the Internet but blocks anyone from the Internet from accessing any services on your local network.
Low	This setting allows traffic to the Internet and also allows someone from the Internet to access services on your local network. This would be used with Port Forwarding, Default Server.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

18.4 Protocol (Customized Services)

You can configure customized services and port numbers in the **Protocol** screen. Each set of protocol rules listed in the table are reusable objects to be used in conjunction with ACL rules in the Access Control screen. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. Click **Security > Firewall > Protocol** to display the following screen.

Note: Removing a protocol rule will also remove associated ACL rules.

Figure 204 Security > Firewall > Protocol



General **Protocol** Access Control Dos

You can configure customized services and port numbers in the **Protocol** screen. Each set of protocol rules listed in the table are reusable objects to be used in conjunction with ACL rules in the Access Control screen. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website.

 Add New Protocol Entry

Name	Description	Ports/Protocol Number	Modify
Note Removing a protocol rule will also remove associated ACL rules.			

The following table describes the labels in this screen.

Table 123 Security > Firewall > Protocol

LABEL	DESCRIPTION
Add New Protocol Entry	Click this to configure a customized service.
Name	This is the name of your customized service.
Description	This is a description of your customized service.
Ports/Protocol Number	This shows the port number or range and the IP protocol (TCP or UDP) that defines your customized service.
Modify	Click this to edit a customized service.

18.4.1 Add Customized Service

Add a customized rule or edit an existing rule by specifying the protocol and the port numbers. Click **Add New Protocol Entry** in the **Protocol** screen to display the following screen.

Figure 205 Security > Firewall > Protocol: Add New Protocol Entry

The following table describes the labels in this screen.

Table 124 Security > Firewall > Protocol: Add New Protocol Entry

LABEL	DESCRIPTION
Service Name	Enter a descriptive name for your customized service. You can use up to 16 printable characters except ["], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Description	Enter a description for your customized service. You can use up to 16 printable characters except ["], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Protocol	Select the protocol (TCP , UDP , ICMP , ICMPv6 , or Other) that defines your customized port from the drop down list box.
Protocol Number	Enter a single port number or the range of port numbers (0 – 255) that define your customized service.
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

18.5 Access Control (Rules)

An Access Control List (ACL) rule is a manually-defined rule that can accept, reject, or drop incoming or outgoing packets from your network. This screen displays a list of the configured incoming or outgoing filtering rules. Note the order in which the rules are listed. Click **Security > Firewall > Access Control** to display the following screen.

Note: The ordering of your rules is very important as rules are applied in turn.

Figure 206 Security > Firewall > Access Control

Firewall

General Protocol **Access Control** Dos

An Access Control List (ACL) rule is a manually-defined rule that can accept, reject, or drop incoming or outgoing packets from your network. This screen displays a list of the configured incoming or outgoing filtering rules.

Rules Storage Space Usage + Add New ACL Rule

#	Status	Name	Src IP	Dest IP	Service	Action	Modify
---	--------	------	--------	---------	---------	--------	--------

The following table describes the labels in this screen.

Table 125 Security > Firewall > Access Control

LABEL	DESCRIPTION
Rules Storage Space Usage	This read-only bar shows how much of the Zyxel Device's memory is in use for recording firewall rules. When you are using 80% or less of the storage space, the bar is green. When the amount of space used is over 80%, the bar is red.
Add New ACL Rule	Select an index number and click Add New ACL Rule to add a new firewall rule after the selected index number. For example, if you select "6", your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.
#	This field displays the rule index number. The ordering of your rules is important as rules are applied in turn.
Name	This field displays the rule name.
Src IP	This field displays the source IP addresses to which this rule applies.
Dest IP	This field displays the destination IP addresses to which this rule applies.
Service	This field displays the protocol (All, TCP, UDP, TCP/UDP, ICMP, ICMPv6, or any) used to transport the packets for which you want to apply the rule.
Action	Displays whether the firewall silently discards packets (Drop), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (Reject), or allow the passage of (Accept) packets that match this rule.
Modify	Click the Edit icon to edit the firewall rule. Click the Delete icon to delete an existing firewall rule.

18.5.1 Add New ACL Rule

Click **Add new ACL** rule or the **Edit** icon next to an existing ACL rule in the **Access Control** screen. The following screen displays. Use this screen to accept, reject, or drop packets based on specified parameters, such as source and destination IP address, IP Type, service, and direction. You can also specify a limit as to how many packets this rule applies to at a certain period of time or specify a schedule for this rule.

Figure 207 Security > Firewall > Access Control > Add New ACL Rule

Add New ACL Rule

Active ☒

Filter Name

Order

Select Source IP Address

Source IP Address

Select Destination Device

Destination IP Address

MAC Address

IP Type

Select Service

Protocol

Custom Source Port -

Custom Destination Port -

Policy

Direction

Enable Rate Limit ☐

packet(s) per (1-512)

Scheduler Rules

The following table describes the labels in this screen.

Table 126 Security > Firewall > Access Control > Add New ACL Rule

LABEL	DESCRIPTION
Filter Name	Enter a descriptive name for your filter rule. You can use up to 16 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Order	Assign the order of your rules as rules are applied in turn.
Source IP Address	If you selected Specific IP Address in the previous item, enter the source device's IP address here. Otherwise this field will be hidden if you select the detected device.
Select Destination Device	If you want your rule to apply to packets with a particular (single) IP, select Specific IP Address . If not, select a detected device.
Destination IP Address	If you selected Specific IP Address in the previous item, enter the destination device's IP address here. Otherwise this field will be hidden if you select the detected device.
IP Type	Select between IPv4 or IPv6 . Compared to IPv4 , IPv6 (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in IPv6 address size to 128 bits (from the 32-bit IPv4 address) allows up to 3.4 x 1038 IP addresses. The Zyxel Device can use IPv4/IPv6 dual stack to connect to IPv4 and IPv6 networks, and supports IPv6 rapid deployment (6RD).

Table 126 Security > Firewall > Access Control > Add New ACL Rule (continued)

LABEL	DESCRIPTION
Select Service	Select a service from the Select Service box.
Protocol	Select the protocol (ALL , TCP/UDP , TCP , UDP , ICMP , or ICMPv6) used to transport the packets for which you want to apply the rule.
Custom Source Port	This is a single port number or the starting port number of a range that defines your rule.
Custom Destination Port	This is a single port number or the ending port number of a range that defines your rule.
Policy	Use the drop-down list box to select whether to discard (Drop), deny and send an ICMP destination-unreachable message to the sender (Reject), or allow the passage of (Accept) packets that match this rule.
Direction	Select WAN to LAN to apply the rule to traffic from WAN to LAN. Select LAN to WAN to apply the rule to traffic from LAN to WAN. Select WAN to Router to apply the rule to traffic from WAN to router. Select LAN to Router to apply the rule to traffic from LAN to router.
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

18.6 DoS

DoS (Denial of Service) attacks can flood your Internet connection with invalid packets and connection requests, using so much bandwidth and so many resources that Internet access becomes unavailable. Use the **DoS** screen to activate protection against DoS attacks.

Click **Security > Firewall > DoS** to display the following screen.

Figure 208 Security > Firewall > DoS

General Protocol Access Control **DoS**

DoS (Denial of Service) attacks can flood your Internet connection with invalid packets and connection requests, using so much bandwidth and so many resources that Internet access becomes unavailable.

Use the **DoS** screen to activate protection against DoS attacks.

Dos Protection Blocking ☒ Enable ☐ Disable (Settings are invalid when disable)

Cancel Apply

The following table describes the labels in this screen.

Table 127 Security > Firewall > DoS

LABEL	DESCRIPTION
DoS Protection Blocking	Enable this to protect against DoS attacks. The Zyxel Device will drop sessions that surpass maximum thresholds.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

18.7 Firewall Technical Reference

This section provides some technical background information about the topics covered in this chapter.

18.7.1 Firewall Rules Overview

Your customized rules take precedence and override the Zyxel Device's default settings. The Zyxel Device checks the source IP address, destination IP address and IP protocol type of network traffic against the firewall rules (in the order you list them). When the traffic matches a rule, the Zyxel Device takes the action specified in the rule.

Firewall rules are grouped based on the direction of travel of packets to which they apply:

- LAN to Router
- LAN to WAN
- WAN to LAN
- WAN to Router

By default, the Zyxel Device's stateful packet inspection allows packets traveling in the following directions:

- LAN to Router

These rules specify which computers on the LAN can manage the Zyxel Device (remote management).

Note: You can also configure the remote management settings to allow only a specific computer to manage the Zyxel Device.

- LAN to WAN

These rules specify which computers on the LAN can access which computers or services on the WAN.

By default, the Zyxel Device's stateful packet inspection drops packets traveling in the following directions:

- WAN to LAN

These rules specify which computers on the WAN can access which computers or services on the LAN.

Note: You also need to configure NAT port forwarding (or full featured NAT address mapping rules) to allow computers on the WAN to access devices on the LAN.

- WAN to Router

By default the Zyxel Device stops computers on the WAN from managing the Zyxel Device. You could configure one of these rules to allow a WAN computer to manage the Zyxel Device.

Note: You also need to configure the remote management settings to allow a WAN computer to manage the Zyxel Device.

You may define additional rules and sets or modify existing ones but please exercise extreme caution in doing so.

For example, you may create rules to:

- Block certain types of traffic, such as IRC (Internet Relay Chat), from the LAN to the Internet.

- Allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN.
- Allow everyone except your competitors to access a web server.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by comparing the source IP address, destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the Zyxel Device's default rules.

18.7.2 Guidelines For Security Enhancement With Your Firewall

- 1 Change the default password through the Web Configurator.
- 2 Think about access control before you connect to the network in any way.
- 3 Limit who can access your router.
- 4 Do not enable any local service (such as telnet) that you do not use. Any enabled service could present a potential security risk. A determined hacker might be able to find creative ways to misuse the enabled services to access the firewall or the network.
- 5 For local services that are enabled, protect against misuse. Protect by configuring the services to communicate only with specific peers, and protect by configuring rules to block packets for the services at specific interfaces.
- 6 Protect against IP spoofing by making sure the firewall is active.
- 7 Keep the firewall in a secured (locked) room.

18.7.3 Security Considerations

Note: Incorrectly configuring the firewall may block valid access or introduce security risks to the Zyxel Device and your protected network. Use caution when creating or deleting firewall rules and test your rules after you configure them.

Consider these security ramifications before creating a rule:

- 1 Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC (Internet Relay Chat) is blocked, are there users that require this service?
- 2 Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?
- 3 Does this rule conflict with any existing rules?

Once these questions have been answered, adding rules is simply a matter of entering the information into the correct fields in the Web Configurator screens.

CHAPTER 19

MAC Filter

19.1 MAC Filter Overview

You can configure the Zyxel Device to permit access to clients based on their MAC addresses in the **MAC Filter** screen. This applies to wired connections. 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:A0:C5:00:00:02. You need to know the MAC addresses of wired LAN client to configure this screen.

19.2 MAC Filter

Enable **MAC Address Filter** and add the host name and MAC address of a wired LAN client to the table if you wish to allow or deny them access to your network. You can choose to enable or disable the filters per entry; make sure that the checkbox under **Active** is selected if you want to use a filter. Select **Security > MAC Filter**. The screen appears as shown.

Figure 209 Security > MAC Filter

MAC Filter

You can configure the Zyxel Device to permit access to clients based on their MAC addresses in the **MAC Filter** screen. This applies to wired connections. 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:A0:C5:00:00:02. You need to know the MAC addresses of the LAN client to configure this screen.

Enable **MAC Address Filter** and add the host name and MAC address of a LAN client to the table if you wish to allow or deny them access to your network. You can choose to enable or disable the filters per entry; make sure that the check box under **Active** is selected if you want to use a filter.

MAC Address Filter ☐ Enable ☒ Disable (Settings are invalid when disable)

MAC Restrict Mode ☒ Allow ☐ Deny

Add New Rule

Set	Active	Host Name	MAC Address	Delete
-----	--------	-----------	-------------	--------

The following table describes the labels in this screen.

Table 128 Security > MAC Filter

LABEL	DESCRIPTION
MAC Address Filter	Select Enable to activate the MAC filter function.
MAC Restrict Mode	Select Allow to only permit the listed MAC addresses access to the Zyxel Device. Select Deny to permit anyone access to the Zyxel Device except the listed MAC addresses.
Set	This is the index number of the MAC address.
Active	Select Active to enable the MAC filter rule. The rule will not be applied if Allow is not selected under MAC Restrict Mode .
Host Name	Enter the host name of a wired LAN client that you want to allow access to the Zyxel Device. You can use up to 17 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
MAC Address	Enter the MAC address of a wired LAN client that you want to allow access to the Zyxel Device. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Delete	Click the Delete icon to delete an existing rule.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

19.2.1 Add New Rule

You can choose to enable or disable the filters per entry; make sure that the checkbox under **Active** is selected if you want to use a filter, as shown in the example below. Select **Security > MAC Filter > Add New Rule**. The screen appears as shown.

Figure 210 Security > MAC Filter > Add New Rule

Set	Active	Host Name	MAC Address	Delete
1	☒	test	BC - 22 - 33 - 11 - 66 - AA	
2	☒	Test	BC - 88 - 99 - 00 - 11 - 2d	

The following table describes the labels in this screen.

Table 129 Security > MAC Filter > Add New Rule

LABEL	DESCRIPTION
Set	This is the index number of the MAC address.
Active	Select Active to enable the MAC filter rule. The rule will not be applied if Allow is not selected under MAC Restrict Mode .
Host Name	Enter the host name of a wired LAN client that you want to allow access to the Zyxel Device. You can use up to 17 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
MAC Address	Enter the MAC addresses of a wired LAN client that you want to allow access to the Zyxel Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Delete	Click the Delete icon to delete an existing rule.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

CHAPTER 20

Home Security

20.1 Home Security Overview

The Zyxel Device supports URL (Uniform Resource Locator) filtering that allows you to block user access to specific websites containing inappropriate or harmful content. Users on your network will not be able to enter the websites with URL domain names, keywords or full URLs you specify. Check [Overview](#) to see if your Zyxel Device supports the Home Security feature.

20.2 Home Security

Use this screen to configure URL filtering settings to block users on your network from accessing certain websites. To access this screen, click **Security > Home Security**.

Figure 211 Security > Home Security

Connected Home Security

You may be more specific by adding URL into the list. The website under the specific domain will be blocked.

Enter Website URL

example.com **Block**

Block List

examplewebsite X

The following table describes the labels in this screen.

Table 130 Security > Home Security

LABEL	DESCRIPTION
Enter Website URL	Enter the URL of a website or URL keyword to which the Zyxel Device blocks access. Click Block to add the website to the Block List. Use keywords, domain names, or full URLs to block websites. For example, if you want to block a website with the domain name "www.exampleWeb.com", you can use the following input formats: • http://exampleWeb.com • https://exampleWeb.com • exampleWeb.com • www.exampleWeb.com • example
Block List	The Zyxel Device prohibits users on your network from viewing the websites with the URLs/keywords in this block list. Click x to remove the entry from the list.

CHAPTER 21

Parental Control

21.1 Parental Control Overview

Parental control allows you to limit the time a user can access the Internet and prevent users from viewing inappropriate content or participating in specified online activities.

Your parental control screens may be different depending on the model you are using. Some Zyxel Devices support scheduling, some support scheduling and URL filtering.

See [Overview](#) for more information.

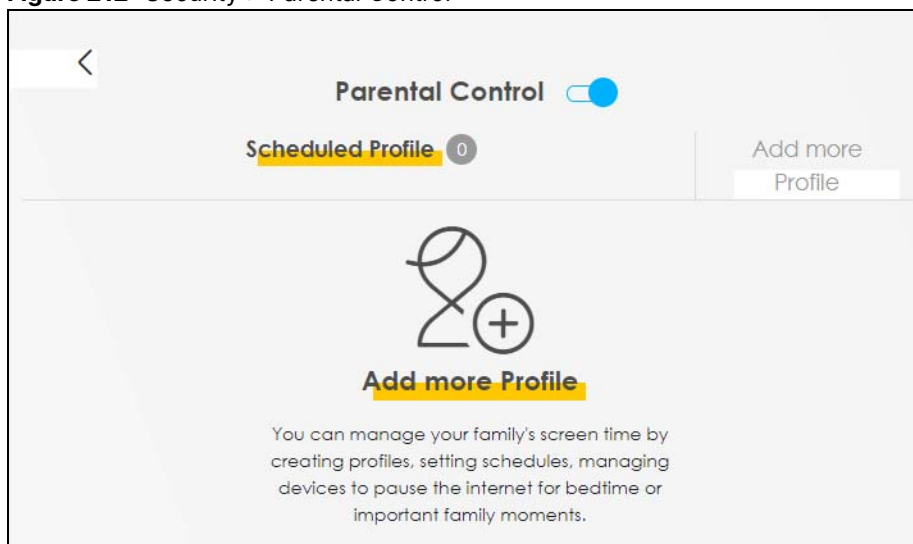
21.2 Parental Control Schedule

Use this screen to enable parental control and view parental control rules and schedules. You can limit the time a user can access the Internet. These rules are defined in a Parental Control Profile (PCP).

Click **Security > Parental Control** to open the following screen.

Note: For some Zyxel Device models, you need to disable MESH to add a new parental control profile.

Figure 212 Security > Parental Control



The following table describes the fields in this screen.

Table 131 Security > Parental Control

LABEL	DESCRIPTION
Parental Control	Click this switch to enable or disable parental control.
Scheduled Profile	This screen shows all the created profiles.
Add more Profile	Click this button to create a new profile.

21.2.1 Add or Edit a Parental Control Profile

Click **Add more Profile** in the **Parental Control** screen to add a new rule or click the **Edit** icon next to an existing rule to edit it. Use this screen to configure a restricted access schedule.

Figure 213 Security > Parental Control > Add more Profile: Select Device

The following table describes the fields in this screen.

Table 132 Security > Parental Control > Add more Profile: Select Device

LABEL	DESCRIPTION
Profile Name	Enter a descriptive name for the profile. You can use up to 17 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Profile Active	Click this switch to enable or disable this profile.
Profile Device List	This field shows the devices selected on the right for this profile.
Blocking Schedule	This field shows the time during which Internet access is blocked on the profile devices.
Next	Click Next to go to the next step to set a schedule for this profile.

21.2.2 Define a Schedule

This screen allow you to define time periods and days during which Internet access is blocked on the profile devices. Finish the settings in the **Select Device** step and click **Next** to access this screen.

Figure 214 Security > Parental Control > Add more Profile: Time limits

The following table describes the fields in this screen.

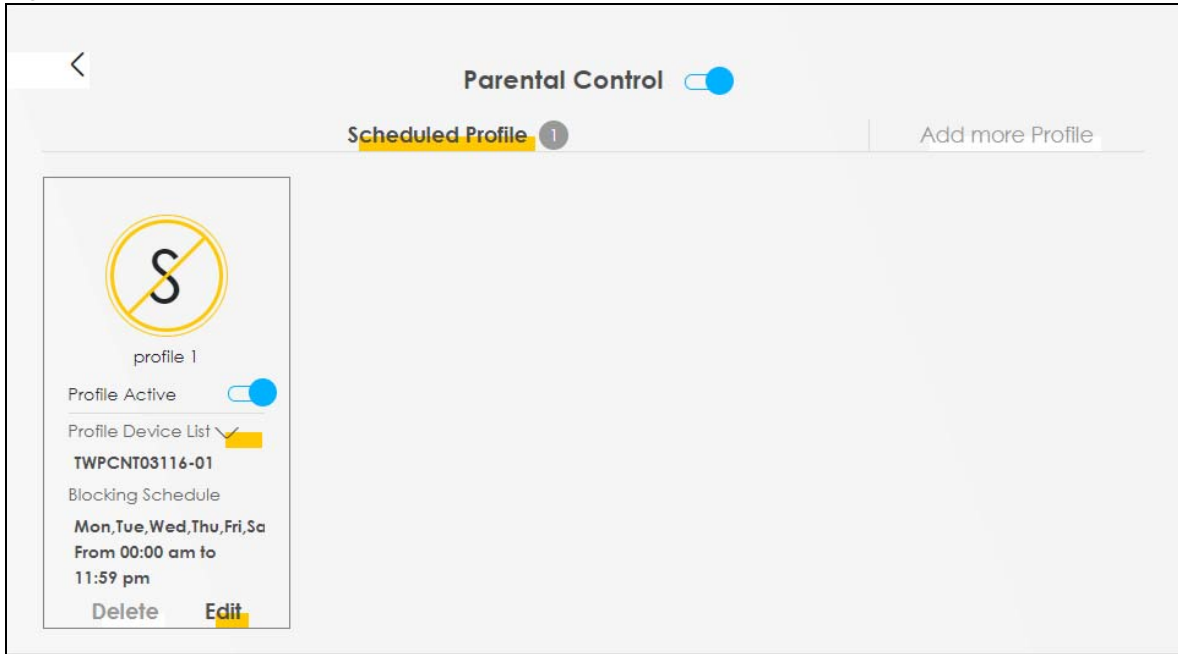
Table 133 Security > Parental Control > Add more Profile: Time limits

LABEL	DESCRIPTION
Profile Name	Enter a descriptive name for the profile.
Profile Active	Click this switch to enable or disable this profile. When the switch goes to the right ( , this profile is active. Otherwise, it is not.
Profile Device List	This field shows the devices selected on the right for this profile.
Blocking Schedule	This field shows the time during which Internet access is blocked on the profile devices.
Schedule	
Add New Schedule	Click this to add a new block for scheduling.
Start/End blocking	Select the time period when Internet access is blocked on the profile devices.
Repeat On	Select the days when Internet access is blocked on the profile devices. Select Whole Week and the scheduler rule will be activated for the whole week.
Back	Click Back to return to the previous screen.
Save	Click Save to save your changes.

21.2.3 Parental Control Scheduled Profile

Use this screen to view and manage the created parental control profiles.

Figure 215 Security > Parental Control > Scheduled Profile



The following table describes the fields in this screen.

Table 134 Security > Parental Control > Scheduled Profile

LABEL	DESCRIPTION
Parental Control	Click this switch to enable or disable parental control. When the switch goes to the right (), the function is enabled. Otherwise, it is not.
Profile Active	Click this switch to enable or disable a created profile. When the switch goes to the right (), this profile is active. Otherwise, it is not.
Scheduled Profile	This screen shows all the created profiles. Click beside Profile Device List to view more information about the profile. You can click Delete to remove the profile or click Edit to change the profile settings. Only the Add more Profile button displays if there is no profile created.
Add more Profile	Click this button to create a new profile.

CHAPTER 22

Scheduler Rule

22.1 Scheduler Rule Overview

A Scheduler Rule allows you to define time periods and days during which the Zyxel Device allows certain actions.

22.2 Scheduler Rule Settings

Use this screen to view, add, or edit time schedule rules. A scheduler rule is a reusable object that is applied to other features, such as Firewall Access Control.

Click **Security** > **Scheduler Rule** to open the following screen.

Figure 216 Security > Scheduler Rule

Scheduler Rule

A Scheduler Rule allows you to define time periods and days during which the Zyxel Device allows certain actions. Use this screen to view, add, or edit time schedule rules. A scheduler rule is a reusable object that is applied to other features, such as Firewall Access Control.

 Add New Rule

#	Rule Name	Day	Time	Description	Modify
1	Profile 1_1	M T W T F S S	00:00-23:59	ParentalControl	

The following table describes the fields in this screen.

Table 135 Security > Scheduler Rule

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
#	This is the index number of the entry.
Rule Name	This shows the name of the rule.
Day	This shows the days on which this rule is enabled.
Time	This shows the period of time on which this rule is enabled.
Description	This shows the description of this rule.
Modify	Click the Edit icon to edit the schedule. Click the Delete icon to delete a scheduler rule. Note: You cannot delete a scheduler rule once it is applied to a certain feature.

22.2.1 Add or Edit a Schedule Rule

Click the **Add New Rule** button in the **Scheduler Rule** screen or click the **Edit** icon next to a schedule rule to open the following screen. Use this screen to configure a restricted access schedule.

Figure 217 Security > Scheduler Rule: Add or Edit

The following table describes the fields in this screen.

Table 136 Security > Scheduler Rule: Add or Edit

LABEL	DESCRIPTION
Rule Name	Enter a descriptive name for this schedule. You can use up to 31 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Day	Select check boxes for the days that you want the Zyxel Device to perform this scheduler rule.
Time of Day Range	Enter the time period of each day, in 24-hour format, during which the rule will be enforced.
Description	Enter a description for this scheduler rule. You can use up to 63 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

CHAPTER 23

Certificates

23.1 Certificates Overview

The Zyxel Device can use certificates (also called digital IDs) to authenticate users. Certificates are based on public-private key pairs. A certificate contains the certificate owner's identity and public key. Certificates provide a way to exchange public keys for use in authentication.

23.1.1 What You Can Do in this Chapter

- Use the **Local Certificates** screen to view and import the Zyxel Device's CA-signed (Certification Authority) certificates ([Local Certificates](#)).
- Use the **Trusted CA** screen to save the certificates of trusted CAs to the Zyxel Device. You can also export the certificates to a computer ([Trusted CA](#)).

23.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Certification Authority

A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities. The certification authority uses its private key to sign certificates. Anyone can then use the certification authority's public key to verify the certificates. You can use the Zyxel Device to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

23.3 Local Certificates

Use this screen to view the Zyxel Device's summary list of certificates, generate certification requests, and import signed certificates. You can import the following certificates to your Zyxel Device:

- Web Server – This certificate secures HTTP connections.
- SSH – This certificate secures remote connections.

Click **Security > Certificates** to open the **Local Certificates** screen.

Figure 218 Security > Certificates > Local Certificates

Certificates

Local Certificates Trusted CA

The Zyxel Device can use certificates (also called digital IDs) to authenticate users. Certificates are based on public-private key pairs. A certificate contains the certificate owner's identity and public key. Certificates provide a way to exchange public keys for use in authentication.

Use this screen to view the Zyxel Device's summary list of certificates, generate certification requests, and import signed certificates.

Replace PrivateKey/Certificate file in PEM format

☐ Private Key is protected by password

No file chosen

Current File	Subject	Issuer	Valid From	Valid To	Modify
--------------	---------	--------	------------	----------	--------

The following table describes the labels in this screen.

Table 137 Security > Certificates > Local Certificates

LABEL	DESCRIPTION
Replace Private Key/Certificate file in PEM format	
Private Key is protected by password	Select the checkbox and enter the private key into the text box to store it on the Zyxel Device. You can use up to 63 alphanumeric (0-9, a-z, A-Z) and special characters, including spaces.
Choose File/Browse	Click this button to find the certificate file you want to upload.
Import Certificate	Click this button to save the certificate that you have enrolled from a certification authority from your computer to the Zyxel Device.
Create Certificate Request	Click this button to go to the screen where you can have the Zyxel Device generate a certification request.
Current File	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have a unique subject information.
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country.
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.

Table 137 Security > Certificates > Local Certificates (continued)

LABEL	DESCRIPTION
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Modify	Click the View icon to open a screen with an in-depth list of information about the certificate. For a certification request, click Load Signed to import the signed certificate. Click the Remove icon to remove the certificate (or certification request). A window displays asking you to confirm that you want to delete the certificate. Note that subsequent certificates move up by one when you take this action.

23.3.1 Create Certificate Request

Click **Security > Certificates > Local Certificates** and then **Create Certificate Request** to open the following screen. Use this screen to have the Zyxel Device generate a certification request. To create a certificate signing request, you need to enter a common name, organization name, state or province name, and the default US two-letter country code (The US country code is by default and not changeable when sold in the U.S.) for the certificate.

Figure 219 Security > Certificates > Local Certificates: Create Certificate Request

The following table describes the labels in this screen.

Table 138 Security > Certificates > Local Certificates: Create Certificate Request

LABEL	DESCRIPTION
Certificate Name	Enter a descriptive name to identify this certificate. You can use up to 63 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Common Name	Select Auto to have the Zyxel Device configure this field automatically. Or select Customize to enter it manually. Enter the IP address (in dotted decimal notation), domain name or email address in the field provided. You can use up to 63 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed. The domain name or email address is for identification purposes only and can be any string.
Organization Name	Enter a descriptive name to identify the company or group to which the certificate owner belongs. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.

Table 138 Security > Certificates > Local Certificates: Create Certificate Request

LABEL	DESCRIPTION
State/Province Name	Enter a descriptive name to identify the state or province where the certificate owner is located. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Country/Region Name	Select a country to identify the nation where the certificate owner is located.
Cancel	Click Cancel to exit this screen without saving.
OK	Click OK to save your changes.

23.3.2 View Certificate Request

Use this screen to view in-depth information about the certificate request. The **Certificate** is used to verify the authenticity of the certification authority. The **Private Key** serves as your digital signature for authentication and must be safely stored. The **Signing Request** contains the certificate signing request value that you will copy upon submitting the certificate request to the CA (certificate authority).

Click the **View** icon in the **Local Certificates** screen to open the following screen.

Figure 220 Security > Certificates > Local Certificates: View Certificate

View Certificate

Certificate Details

Name: Test

Type: none

Subject: /CN=588BF3-VMG8825-B50B-S172V48000015/O=Zyxel/ST=Hsinchu/C=TW

Certificate

Private Key

hGEzXjrkPkeJHmKBehzvdv
 KGLNbx22N1C0qtl++BwFFzOK8xTshyNxGW27goeOY
 1QpuD2RQy1FB+Ky9zVNCRuP
 6C1korOCNOwp2Mds4udfazEZefm7ysyC0P2etwd7
 AbLBM49P1qUsWbGWR9snO74
 Myqhf+kCc2R801HUQvWX7XbHzTG+8RKTpV/oCkLZy
 cUBlyq0IY2f6FkWQBxp9C2H
 xteLLgB6SDFK5vTyQTcj0spmPNdj4ZkxKhqtuLwM8E3
 bzHGdujBwvzZXnf6NxAZ
 fAdmacECaYEA+SlZJoWxoB90BopN1JP3t//IOLPznbs

Signing Request

-----BEGIN CERTIFICATE REQUEST-----
 MIICoDCCAYgCAQAwWzEqMCgGA1UEAwwhNTg4
 QkYzLVZNRzg4MjUtQjUwQjE1MTcy
 VjQ4MDAwMDE1MQ4wDAYDVQKDAVaeXhpbDEQ
 MA4GA1UECAwHSHNpbmNodTElMAkG
 A1UEBhMCVFcwggEiMA0GCSqGSIb3DQEBAQUAA4I
 BDwAwggEKAoIBAQMCMCB3HK+Su
 PeKUpWld2QkPL4qsQsYXhL7chHWxCYAFw9QYXP
 NDQm4I3bS9rfwLqUMFck3F4HQ

Back

The following table describes the fields in this screen.

Table 139 Security > Certificates > Local Certificates: View Certificate

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate.
Type	This field displays general information about the certificate. ca means that a Certification Authority signed the certificate.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).

Table 139 Security > Certificates > Local Certificates: View Certificate (continued)

LABEL	DESCRIPTION
Certificate	This read-only text box displays the certificate in Privacy Enhanced Mail (PEM) format. PEM uses base 64 to convert the binary certificate into a printable form. You can copy and paste the certificate into an email to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution.
Private Key	This field displays the private key of this certificate.
Signing Request	This field displays the CSR (Certificate Signing Request) information of this certificate. The CSR will be provided to a certificate authority, and it includes information about the public key, organization name, domain name, location, and country of this certificate.
Back	Click Back to return to the previous screen.

23.4 Trusted CA

Click **Security > Certificates > Trusted CA** to open the following screen. This screen displays a summary list of certificates of the certification authorities that you have set the Zyxel Device to accept as trusted. The Zyxel Device accepts any valid certificate signed by a certification authority on this list as being trustworthy, which means you do not need to import any certificate that is signed by one of these certification authorities.

Note: A maximum of ten certificates can be added.

Figure 221 Security > Certificates > Trusted CA

The following table describes the labels in this screen.

Table 140 Security > Certificates > Trusted CA

LABEL	DESCRIPTION
Import Certificate	Click this to open a screen where you can save the certificate of a certification authority that you trust to the Zyxel Device.
#	This is the index number of the entry.
Name	This field displays the name used to identify this certificate.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), OU (Organizational Unit or department), Organization (O), State (ST) and Country (C). It is recommended that each certificate have a unique subject information.

Table 140 Security > Certificates > Trusted CA (continued)

LABEL	DESCRIPTION
Type	This field displays general information about the certificate. ca means that a Certification Authority signed the certificate.
Modify	Click the View icon to open a screen with an in-depth list of information about the certificate (or certification request). Click the Remove icon to delete the certificate (or certification request). You cannot delete a certificate that one or more features is configured to use.

23.5 Import Trusted CA Certificate

Click **Import Certificate** in the **Trusted CA** screen to open the **Import Certificate** screen. The Zyxel Device trusts any valid certificate signed by any of the imported trusted CA certificates. Certificates should be in one of the following formats: Binary X.509, PEM (base-64) encoded, Binary PKCS#7, or PEM (base-64) encoded PKCS#7.

Note: You must remove any spaces from the certificate's filename before you can import the certificate.

Figure 222 Security > Certificates > Trusted CA > Import Certificate

The following table describes the labels in this screen.

Table 141 Security > Certificates > Trusted CA > Import Certificate

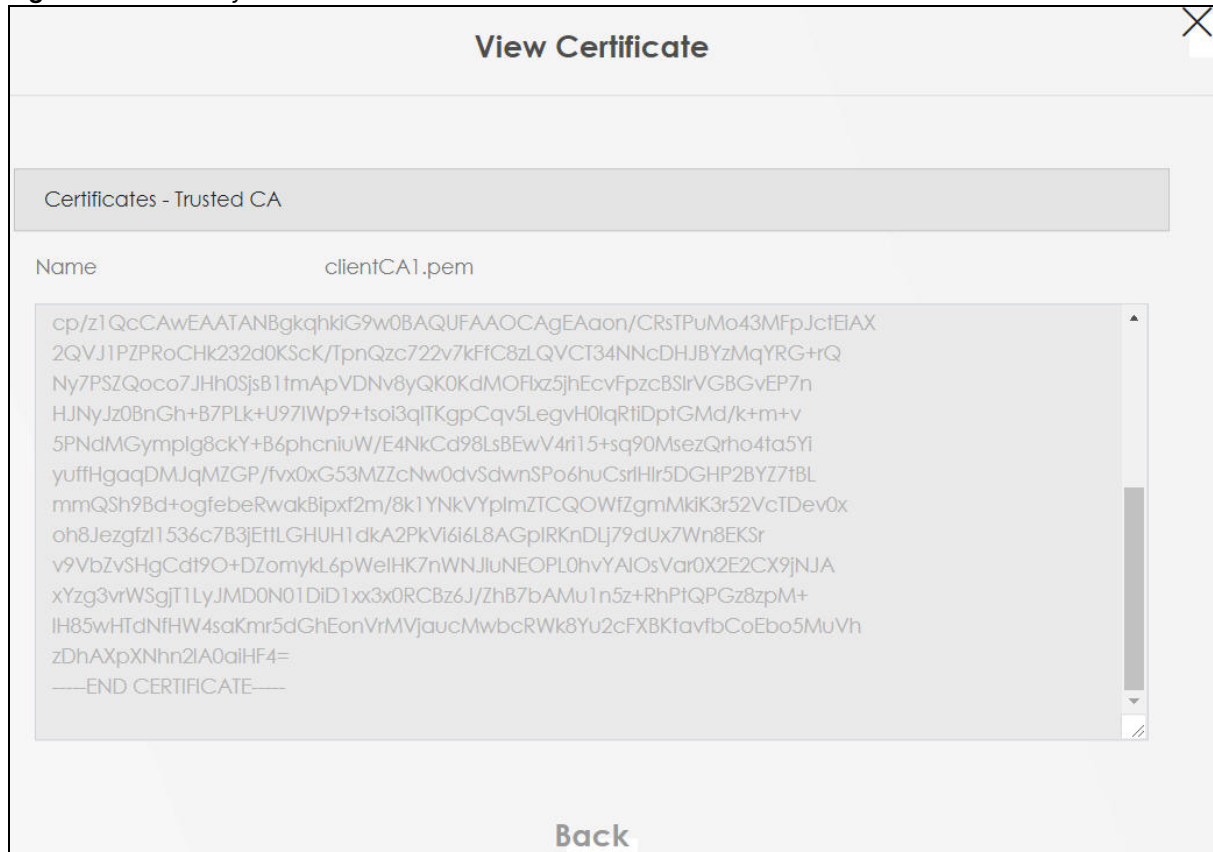
LABEL	DESCRIPTION
Certificate File Path	Enter the location of the file you want to upload in this field or click Choose File/Browse to find it.
Choose File/Browse	Click this to find the certificate file you want to upload.
OK	Click this to save the certificate on the Zyxel Device.
Cancel	Click this to exit this screen without saving.

23.6 View Trusted CA Certificate

Use this screen to view in-depth information about the certification authority's certificate. The certificate text box is read-only and can be distributed to others.

Click **Security > Certificates > Trusted CA** to open the **Trusted CA** screen. Click the **View** icon to open the **View Certificate** screen.

Figure 223 Security > Certificates > Trusted CA > View Certificate



The following table describes the labels in this screen.

Table 142 Security > Certificates > Trusted CA > View Certificate

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate.
	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses 64 ASCII characters to convert the binary certificate into a printable form. You can copy and paste the certificate into an email to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution (through USB thumb drive for example).
Back	Click this to return to the previous screen.

23.7 Certificates Technical Reference

This section provides some technical background information about the topics covered in this chapter.

Certification Authorities

A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities.

Public and Private Keys

When using public-key cryptology for authentication, each host has two keys. One key is public and can be made openly available; the other key is private and must be kept secure. Public-key encryption in general works as follows.

- 1 Tim wants to send a private message to Jenny. Tim generates a public-private key pair. What is encrypted with one key can only be decrypted using the other.
- 2 Tim keeps the private key and makes the public key openly available.
- 3 Tim uses his private key to encrypt the message and sends it to Jenny.
- 4 Jenny receives the message and uses Tim's public key to decrypt it.
- 5 Additionally, Jenny uses her own private key to encrypt a message and Tim uses Jenny's public key to decrypt the message.

The Zyxel Device uses certificates based on public-key cryptology to authenticate users attempting to establish a connection. The method used to secure the data that you send through an established connection depends on the type of connection. For example, a VPN tunnel might use the triple DES encryption algorithm.

The certification authority uses its private key to sign certificates. Anyone can then use the certification authority's public key to verify the certificates.

Advantages of Certificates

Certificates offer the following benefits.

- The Zyxel Device only has to store the certificates of the certification authorities that you decide to trust, no matter how many devices you need to authenticate.
- Key distribution is simple and very secure since you can freely distribute public keys and you never need to transmit private keys.

Certificate File Format

The certification authority certificate that you want to import has to be in PEM (Base-64) encoded X.509 file format. This Privacy Enhanced Mail format uses 64 ASCII characters to convert a binary X.509 certificate into a printable form.

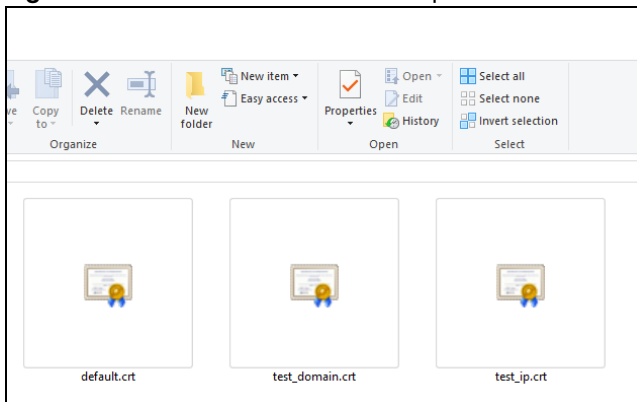
23.7.1 Verify a Certificate

Before you import a trusted CA or trusted remote host certificate into the Zyxel Device, you should verify that you have the actual certificate. This is especially true of trusted CA certificates since the Zyxel Device also trusts any valid certificate signed by any of the imported trusted CA certificates.

You can use a certificate's fingerprint to verify it. A certificate's fingerprint is a message digest calculated using the MD5 or SHA1 algorithms. The following procedure describes how to check a certificate's fingerprint to verify that you have the actual certificate.

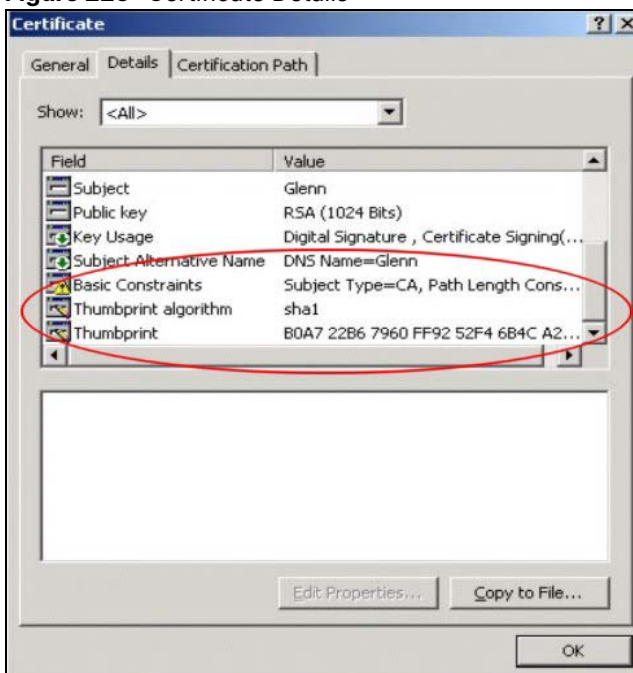
- 1 Browse to where you have the certificate saved on your computer.
- 2 Make sure that the certificate has a ".cer" or ".crt" file name extension.

Figure 224 Certificates on Your Computer



- 3 Double-click the certificate's icon to open the **Certificate** window. Click the **Details** tab and scroll down to the **Thumbprint Algorithm** and **Thumbprint** fields.

Figure 225 Certificate Details



Use a secure method to verify that the certificate owner has the same information in the **Thumbprint Algorithm** and **Thumbprint** fields. The secure method may vary based on your situation. Possible examples would be over the telephone or through an HTTPS connection.

CHAPTER 24

Voice

24.1 Voice Overview

You can make calls over the Internet using VoIP technology. For this, you first need to set up a SIP account with a SIP service provider.

Use this chapter to:

- Connect an analog phone to the Zyxel Device.
- Configure settings such as speed dial.
- Configure network settings to optimize the voice quality of your phone calls.

24.1.1 What You Can Do in this Chapter

These screens allow you to configure your Zyxel Device to make phone calls over the Internet and your regular phone line, and to set up the phone you connect to the Zyxel Device.

- Use the **SIP Account** screen to set up information about your SIP account, control which SIP accounts the phones connected to the Zyxel Device use, and configure audio settings such as volume levels for the phones connected to the Zyxel Device ([SIP Account](#)).
- Use the **SIP Service Provider** screen to configure the SIP server information, and the numbers for certain phone functions ([SIP Service Provider](#)).
- Use the **SIP TLS Common** screen to change the default TLS local port if you need to, and select a local certificate for the SIP server to verify the Zyxel Device. ([SIP TLS Common](#)).
- Use the **Phone** screens to change settings that depend on which region of the world the Zyxel Device is in ([Phone](#)).
- Use the **Call Rule** screen to set up shortcuts for dialing frequently-used (VoIP) phone numbers ([Call Rule](#)).
- Use the **Call History** screen to view a call history list ([Call History](#)).

You do not necessarily need to use all these screens to set up your account. In fact, if your service provider did not supply information on a particular field in a screen, it is usually best to leave it at its default setting.

24.1.2 What You Need to Know About VoIP

VoIP

VoIP stands for Voice over IP. IP is the Internet Protocol, which is the message-carrying standard the Internet runs on. So, Voice over IP is the sending of voice signals (speech) over the Internet (or another network that uses the Internet Protocol).

SIP

SIP stands for Session Initiation Protocol. SIP is a signaling standard that lets one network device (like a computer or the Zyxel Device) send messages to another. In VoIP, these messages are about phone calls over the network. For example, when you dial a number on your Zyxel Device, it sends a SIP message over the network asking the other device (the number you dialed) to take part in the call. To access this screen, click **VoIP > SIP**.

SIP Accounts

A SIP account is a type of VoIP account. It is an arrangement with a service provider that lets you make phone calls over the Internet. When you set the Zyxel Device to use your SIP account to make calls, the Zyxel Device is able to send all the information about the phone call to your service provider on the Internet.

Strictly speaking, you do not need a SIP account. It is possible for one SIP device (like the Zyxel Device) to call another without involving a SIP service provider. However, the networking difficulties involved in doing this make it tremendously impractical under normal circumstances. Your SIP account provider removes these difficulties by taking care of the call routing and setup – figuring out how to get your call to the right place in a way that you and the other person can talk to one another.

SIP Address

A SIP address is a URI (Uniform Resource Identifier) that resembles an email address, using the format: user@domain. It uniquely identifies a telephone extension over a VoIP system. A SIP address of 123-45-67@voip-provider.net tells a client to connect to voip-provider.net and request a connection to 123-45-67. While VoIP can only send voice messages over the Internet, SIP (though strictly speaking is a type of VoIP) can send voice, data, video, and other media. VoIP phones also need to be connected to a computer to function, whereas SIP phones only need to be connected to a modem.

24.2 Before You Begin

- Before you can use these screens, you need to have a VoIP account already set up. If you do not have one yet, you can sign up with a VoIP service provider over the Internet.
- You should have the information your VoIP service provider gave you ready, before you start to configure the Zyxel Device.

24.3 SIP Account

You can make calls over the Internet using VoIP technology. For this, you first need to set up a SIP account with a SIP service provider. The Zyxel Device uses a SIP account to make outgoing VoIP calls, and to check if an incoming call's destination number matches your SIP account's VoIP number. In order to make and receive VoIP calls, you need to enable and configure a SIP account, and then map it to a phone port. The SIP account contains information that allows your Zyxel Device to connect to your VoIP service provider.

To access this screen, click **VoIP > SIP > SIP Account**.

Figure 226 VoIP > SIP > SIP Account

SIP

SIP Account > SIP Service Provider > SIP TLS Common

You can make calls over the Internet using VoIP technology. For this, you first need to set up a SIP account with a SIP service provider.

The Zyxel Device uses a SIP account to make outgoing VoIP calls and check if an incoming call's destination number matches your SIP account's VoIP number. In order to make or receive a VoIP call, you need to enable and configure a SIP account and map it to a phone port. The SIP account contains information that allows your Zyxel Device to connect to your VoIP service provider.

+ Add New Account

#	Enable	SIP Account	Service Provider	Account Number	Modify
1	Disabled	SIP1	ChangeMe	ChangeMe	

The following table describes the labels in this screen.

Table 143 VoIP > SIP > SIP Account

LABEL	DESCRIPTION
Add New Account	Click this to configure a SIP account.
#	This is the index number of the entry.
Enable	This shows whether the SIP account is activated or not. A yellow bulb signifies that this SIP account is activated. A gray bulb signifies that this SIP account is activated.
SIP Account	This shows the name of the SIP account.
Service Provider	This shows the name of the SIP service provider.
Account Number	This shows the SIP number.
Modify	Click the Modify icon to configure the SIP account.

24.3.1 Add or Edit SIP Account

Use this screen to configure a SIP account and map it to a phone port in the **Phone Device** screen. To access this screen, click the **Add New Account** button or click the **Edit** icon of an entry in the **VoIP > SIP > SIP Account** screen.

Note: You do not necessarily need to use all these fields to set up your account.

Figure 227 VoIP > SIP > SIP Account > Add Account or Edit



Add New Account

SIP Account Selection

SIP Account Selection ChangeMe

SIP Service Provider Association

SIP Account Associated with

ChangeMe ▼

General

☐ Enable SIP Account

SIP Account Number

ChangeMe

Authentication

Username

ChangeMe

Password

URL Type

URL Type

SIP ▼

Voice Features

Primary Compression Type

G.711u ▼

Secondary Compression Type

G.711a ▼

Third Compression Type

G.722 ▼

Speaking Volume Control

Middle ▼

Listening Volume Control

Middle ▼

☒ Enable G.168 (Echo Cancellation)

☒ Enable VAD (Voice Active Detector)

Figure 228 VoIP > SIP > SIP Account > Add Account or Edit (Call Features)

Call Features

☒ Send Caller ID

☒ Enable Call Transfer

☒ Enable Call Waiting

Call Waiting Reject Timer

 (10~60) Second

☐ Enable Unconditional Forward

To Number

☐ Enable Busy Forward

To Number

☐ Enable No Answer Forward

To Number

No Answer Time

 (10~119) Second

Caution:

If you enable [Unconditional Forward], [Busy Forward] and [No Answer] will be ignored.

☐ Enable Do Not Disturb (DND)

Warning:

If you enable this item, you will not get indication when somebody call you.

☐ Active Incoming Anonymous Call Block

☐ Enable MWI

MWI Subscribe Expiration Time

 (120~86400)Second

☐ Hot Line / Warm Line Number

☒ Warm Line
 ☐ Hot Line

Hot Line / Warm Line Number

Warm Line Timer

 (5~300) Second

☐ Enable Missed Call Email Notification

Mail Account

Send Notification to e-mail

Missed Call e-mail Title

Notice:

Please configure mail server in "Maintenance > e-mail Notification" page and select the mail server for this feature.

☐ Early Media

IVR Play Index

☐ Music On Hold (MOH)

IVR Play Index

Cancel

OK

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Figure 229 VoIP > SIP > SIP Account > SIP Account Entry Edit

SIP Account Entry Edit

SIP Account Selection
SIP Account Selection SIP1

SIP Service Provider Association
SIP Account Associated with ChangeMe

General
☐ Enable SIP Account
SIP Account Number ChangeMe

Authentication
Username ChangeMe
Password *****

URL Type
URL Type SIP

Voice Features
Primary Compression Type G.711u
Secondary Compression Type G.729
Third Compression Type G.711a
Speaking Volume Control Middle
Listening Volume Control Middle
☒ Enable G.168 (Echo Cancellation)
☐ Enable VAD (Voice Active Detector)

Call Features
☒ Send Caller ID
☒ Enable Call Waiting
Call Waiting Reject Timer 20 (10~60) Second
☐ Enable Do Not Disturb (DND)

Warning:
If you enable this item, you will not get indication when somebody call you.

☐ Active Incoming Anonymous Call Block

Cancel OK

The following table describes the labels in this screen.

Table 144 VoIP > SIP > SIP Account > SIP Account Entry Edit

LABEL	DESCRIPTION
SIP Account Selection	
SIP Account Selection	This field displays ChangeMe if you are creating a new SIP account or the SIP account you are modifying.
SIP Service Provider Association	
SIP Account Associated with	Select the SIP service provider profile to use for the SIP account you are configuring in this screen. You should already have configured a SIP service provider profile in the SIP Service Provider screen. This field is read-only when you are modifying an existing SIP account.
General	

Table 144 VoIP > SIP > SIP Account > SIP Account Entry Edit (continued)

LABEL	DESCRIPTION
Enable SIP Account	Select this if you want the Zyxel Device to use this account. Clear it if you do not want the Zyxel Device to use this account.
SIP Account Number	Enter your SIP number. In the full SIP URI, this is the part before the @ symbol. You can use up to 127 printable characters and spaces.
Authentication	
Username	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 alphanumeric (0-9, a-z, A-Z), printable special characters and spaces.
Password	Enter the password for registering this SIP account, exactly as it was given to you. You can use up to 95 alphanumeric (0-9, a-z, A-Z), printable special characters and spaces.
URL Type	
URL Type	Select whether or not to include the SIP service domain name when the Zyxel Device sends the SIP number. SIP – include the SIP service domain name. TEL – do not include the SIP service domain name.
Voice Features	
Primary/Secondary/Third Compression Type	Select the type of voice coder or decoder (codec) that you want the Zyxel Device to use. G.711 provides higher voice quality but requires more bandwidth (64 kbps). • G.729 provides good sound quality and reduces the required bandwidth to 8 kbps. • G.711a is typically used in Europe. • G.711u is typically used in North America and Japan. • G.726-24 operates at 24 kbps. • G.726-32 operates at 32 kbps. • G.722 operates at 6.3 kbps or 5.3 kbps. When two SIP devices start a SIP session, they must agree on a codec. Select the Zyxel Device's first choice for voice coder or decoder. Select the Zyxel Device's second choice for voice coder or decoder. Select None if you only want the Zyxel Device to accept the first choice. Select the Zyxel Device's third choice for voice coder or decoder. Select None if you only want the Zyxel Device to accept the first or second choice.
Speaking Volume Control	Select the loudness that the Zyxel Device uses for speech that it sends to the peer device. Choices are Minimum , Middle , and Maximum .
Listening Volume Control	Select the loudness that the Zyxel Device uses for speech that it receives from the peer device. Choices are Minimum , Middle , and Maximum .
Enable G. 168 (Echo Cancellation)	Select this if you want to eliminate the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
Enable VAD (Voice Active Detector)	Select this if the Zyxel Device should stop transmitting when you are not speaking. This reduces the bandwidth the Zyxel Device uses.
Call Features	
Send Caller ID	Select this if you want to send identification when you make VoIP phone calls. Clear this if you do not want to send identification.
Enable Call Transfer	Select this to enable call transfer on the Zyxel Device. This allows you to transfer an incoming call (that you have answered) to another phone.

Table 144 VoIP > SIP > SIP Account > SIP Account Entry Edit (continued)

LABEL	DESCRIPTION
Enable Call Waiting	Select this to enable call waiting on the Zyxel Device. This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.
Call Waiting Reject Timer	Specify a time of seconds that the Zyxel Device waits before rejecting the second call if you do not answer it.
Enable Unconditional Forward	Select this if you want the Zyxel Device to forward all incoming calls to the specified phone number. Specify the phone number in the To Number field on the right.
Enable Busy Forward	Select this if you want the Zyxel Device to forward incoming calls to the specified phone number if the phone port is busy. Specify the phone number in the To Number field on the right. If you have call waiting, the incoming call is forwarded to the specified phone number if you reject or ignore the second incoming call.
Enable No Answer Forward	Select this if you want the Zyxel Device to forward incoming calls to the specified phone number if the call is unanswered. (See No Answer Time .) Specify the phone number in the To Number field on the right.
No Answer Time	This field is used by the Active No Answer Forward feature. Enter the number of seconds the Zyxel Device should wait for you to answer an incoming call before it considers the call unanswered.
Enable Do Not Disturb (DND)	Select this to turn the do not disturb feature on. This has the Zyxel Device reject all calls destined to the phone line.
Active Incoming Anonymous Call Block	Select this to have the phone not ring for incoming calls with caller ID deactivated.
Enable MWI	Select this if you want to hear a waiting (beeping) dial tone on your phone when you have at least one voice message. Your VoIP service provider must support this feature.
MWI Subscribe Expiration Time	Keep the default value of this field unless your VoIP service provider tells you to change it. Enter the number of seconds the SIP server should provide the message waiting service each time the Zyxel Device subscribes to the service. Before this time passes, the Zyxel Device automatically subscribes again.
Hot Line / Warm Line Number	Select this to enable the hot line or warm line feature on the Zyxel Device.
Hot Line	Select this to have the Zyxel Device dial the specified hot line number immediately when you pick up the telephone.
Warm Line	Select this to have the Zyxel Device dial the specified warm line number after you pick up the telephone and do not press any keys on the keypad for a period of time.
Hot Line / Warm Line Number	Enter the number of the hot line or warm line that you want the Zyxel Device to dial.
Warm Line Timer	Enter a number of seconds that the Zyxel Device waits before dialing the warm line number if you pick up the telephone and do not press any keys on the keypad.
Enable Missed Call Email Notification	Select this option to have the Zyxel Device email you a notification when there is a missed call.
Mail Account	Select a mail account for the email address specified below. If you select None here, email notifications will not be sent through email. You must have configured a mail account already in the Email Notification screen.
Send Notification to e-mail	Notifications are sent to the email address specified in this field. If this field is left blank, notifications will not be sent through email.

Table 144 VoIP > SIP > SIP Account > SIP Account Entry Edit (continued)

LABEL	DESCRIPTION
Missed Call e-mail Title	Type a title that you want to be in the subject line of the email notifications that the Zyxel Device sends.
Early Media	Select this if you want people to hear a customized recording when they call you.
IVR Play Index	Select the tone you want people to hear when they call you. This field is configurable only when you select Early Media . See Technical Reference for information on how to record these tones.
Music On Hold (MOH)	Select this to play a customized recording when you put people on hold.
IVR Play Index	Select the tone to play when you put someone on hold. This field is configurable only when you select Music on Hold . See Technical Reference for information on how to record these tones.
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

24.4 SIP Service Provider

Use this screen to view the SIP service provider information on the Zyxel Device. A SIP provider offers Internet call services using VoIP technology. You may need to consult your SIP service provider for the following settings.

To access this screen, click **VoIP > SIP > SIP Service Provider**.

Figure 230 VoIP > SIP > SIP Service Provider

SIP Account SIP Service Provider

Use this screen to view the SIP service provider information on the Zyxel Device. A SIP provider offers Internet call services using VoIP technology. You may need to consult your SIP service provider for the following settings.

+ Add New Provider

#	SIP Service Provider Name	SIP Proxy Server Address	REGISTER Server Address	SIP Service Domain	Modify
1	ChangeMe	ChangeMe	ChangeMe	ChangeMe	

The following table describes the labels in this screen.

Table 145 VoIP > SIP > SIP Service Provider

LABEL	DESCRIPTION
Add New Provider	Click this button to add a new SIP service provider.
#	This is the index number of the entry.
SIP Service Provider Name	This shows the name of the SIP service provider.
SIP Proxy Server Address	This shows the IP address or domain name of the SIP server.
REGISTER Server Address	This shows the IP address or domain name of the SIP register server.
SIP Service Domain	Enter the SIP service domain name. In the full SIP URI, this is the part after the @symbol. You can use up to 127 printable ASCII Extended set characters.

24.4.1 Provider Entry Add or Edit

Use this screen to configure the SIP server information, the numbers for certain phone functions and dialing plan for a SIP service provider.

Click the **Modify** icon next to a profile of SIP service provider settings in the **VoIP > SIP > SIP Service Provider** to open the following screen.

Note: Click this () to see all the fields in the screen. You do not necessarily need to use all these fields to set up your account. Click again to see and configure only the fields needed for this feature.

Add New Provider

SIP Service Provider Selection

Service Provider Selection · ADD_NEW

General

SIP Service Provider

☒ Enable SIP Service Provider

SIP Service Provider Name

ChangeMe

SIP Local Port

5060

(1025~65535)

SIP Proxy Server Address

ChangeMe

SIP Proxy Server Port

5060

(1025~65535)

SIP REGISTRAR Server Address

ChangeMe

SIP REGISTRAR Server Port

5060

(1025~65535)

SIP Service Domain

ChangeMe

RFC Support

☐ PRACK (RFC 3262, Requires: 100rel)

VoIP IOP Flags

☐ Replace dial digit '#' to '%23' in SIP messages

☐ Remove the 'Route' header in SIP messages

Bound Interface Name

Bound Interface Name

☒ AnyWAN ☐ MultiWAN

Outbound Proxy

Outbound Proxy Address

Outbound Proxy Port

5060

(1025~65535)

☐ Use DHCP Option 120 First

RTP Port Range

Start Port

40000

(1026~65470)

End Port

40030

(1056~65500)

SRTP Support

☒ SRTP Support

Crypto Suite

AES_CM_128_HMAC_SHA1_80

(Encryption and Authentication Type)

DTMF Mode

DTMF Mode

PCM

Transport Type

Transport Type

UDP

FAX Option

☐ G.711 Fax Passthrough ☒ T.38 Fax Relay

QoS Tag

SIP DSCP Mark Setting

46

[0~63]

RTP DSCP Mark Setting

46

[0~63]

Timer Setting

SIP Register Expiration Duration

3600

[20~65535] second

SIP Register Fail Re-try Timer

1800

[30~65535] second

Session Expires (SE)

900

[100~3600] second

Min-SE

600

[90~1800] second

Dialing Interval Selection

Dialing Interval Selection

3

second

SIP Server Locating DNS Method

☒ BASIC ☐ SRV ☐ NAPTR

Cancel

OK

The following table describes the labels in this screen.

Table 146 VoIP > SIP > SIP Service Provider > Add New Provider or Edit

LABEL	DESCRIPTION			
IP Version Policy				
Policy Selection	Select the Internet Protocol version that the SIP service provider supports.			
	- Select IPv4 Only if the SIP service provider supports an IPv4 IP address. - Select IPv6 Only if the SIP service provider supports an IPv6 IP address. - Select IPv4 Prefer to use an IPv4 address over an IPv6 address. If an IPv4 address is not available on the interface, the SIP service provider uses an IPv6 address. The SIP service provider changes to an IPv4 address whenever an IPv4 address is available. This selection applies only to the first service provider. - Select IPv6 Prefer to use an IPv6 address over an IPv4 address. If an IPv6 address is not available on the interface, the SIP service provider uses an IPv4 address. The SIP service provider changes to an IPv6 address whenever an IPv6 address is available. This selection applies only to the first service provider. - Select IPv4 First to use an IPv4 address over an IPv6 address. If an IPv4 address is not available on the interface, the SIP service provider uses an IPv6 address. The SIP service provider selects the IP version based on the first available IP version. This selection applies only to the first service provider. - Select IPv6 First to use an IPv6 address over an IPv4 address. If an IPv6 address is not available on the interface, the SIP service provider uses an IPv4 address. The SIP service provider selects the IP version based on the first available IP version. This selection applies only to the first service provider.			
	Note: Rebooting or resetting the Zyxel Device may cause the SIP service provider to use a different IP version.			
		ISP supports an IPv4 address	ISP supports an IPv6 address	ISP supports both IPv4 and IPv6 addresses
	IPv4 Only	V	X	IPv4
	IPv6 Only	X	V	IPv6
	IPv4 Prefer	V	V	IPv4 ↔ IPv6
	IPv6 Prefer	V	V	IPv6 ↔ IPv4
	IPv4 First	V	V	IPv4; otherwise IPv6
IPv6 First	V	V	IPv6; otherwise IPv4	
SIP Service Provider Selection				
General				
SIP Service Provider	Select this if you want the Zyxel Device to use this SIP provider. Clear it if you do not want the Zyxel Device to use this SIP provider.			
SIP Service Provider Name	Enter the name of your SIP service provider.			
SIP Local Port	Enter the Zyxel Device's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.			
SIP Proxy Server Address	Enter the IP address or domain name of the SIP server provided by your VoIP service provider. You can use up to 95 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. It does not matter whether the SIP server is a proxy, redirect or register server.			
SIP Proxy Server Port	Enter the SIP server's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.			

Table 146 VoIP > SIP > SIP Service Provider > Add New Provider or Edit (continued)

LABEL	DESCRIPTION
SIP REGISTRAR Server Address	Enter the IP address or domain name of the SIP register server, if your VoIP service provider gave you one. Otherwise, enter the same address you entered in the SIP Server Address field. You can use up to 95 printable characters except ["], ['], [<], [>], [^], [\$], [], [&], or [;].
SIP REGISTRAR Server Port	Enter the SIP register server's listening port number, if your VoIP service provider gave you one. Otherwise, enter the same port number you entered in the SIP Server Port field.
SIP Service Domain	Enter the SIP service domain name. In the full SIP URI, this is the part after the @ symbol. You can use up to 127 printable characters except ["], ['], [<], [>], [^], [\$], [], [&], or [;].
RFC Support	
PRACK (RFC 3262, Require: 100rel)	During a call session, there are two types of SIP responses used – final and provisional. Final responses convey the result of a request and require a confirmation response. Provisional responses only convey the request processing progress and does not require a confirmation response, and are therefore considered unreliable. RFC 3262 defines a mechanism to provide reliable transmission of SIP provisional response messages, which convey information on the processing progress of the request. This uses the option tag 100rel and the Provisional Response ACKnowledgement (PRACK) method. Which is, the Zyxel Device includes a SIP Require header field with the option tag 100rel in all INVITE requests. When the Zyxel Device receives a SIP response message indicating that the phone it called is ringing, the Zyxel Device sends a PRACK message to have both sides confirm the message is received. Select this to have the caller require the option tag 100rel to send provisional responses reliably.
VoIP IOP Flags – Select VoIP inter-operability settings.	
Replace dial digit '#' to '%23' in SIP messages	Replace a dial digit "#" with "%23" in the INVITE messages.
Remove the 'Route' header in SIP messages	Remove the 'Route' header in SIP packets.
Bound Interface Name	
Bound Interface Name	If you select AnyWAN, the Zyxel Device automatically activates the VoIP service when any WAN connection is up. If you select MultiWAN, you also need to select the pre-configured WAN connections. The VoIP service is activated only when one of the selected WAN connections is up.
Outbound Proxy	
Outbound Proxy Address	Enter the IP address or domain name of the SIP outbound proxy server if your VoIP service provider has a SIP outbound server to handle voice calls. This allows the Zyxel Device to work with any type of NAT router and eliminates the need for STUN or a SIP ALG. Turn off any SIP ALG on a NAT router in front of the Zyxel Device to keep it from re-translating the IP address (since this is already handled by the outbound proxy server).
Outbound Proxy Port	Enter the SIP outbound proxy server's listening port, if your VoIP service provider gave you one. Otherwise, keep the default value.
Use DHCP Option 120 first	Select this to have the Zyxel Device use DHCP Option 120 first.
RTP Port Range	

Table 146 VoIP > SIP > SIP Service Provider > Add New Provider or Edit (continued)

LABEL	DESCRIPTION
Start/End Port	Enter the listening port numbers for RTP traffic, if your VoIP service provider gave you this information. Otherwise, keep the default values. To enter one port number, enter the port number in the Start Port and End Port fields. To enter a range of ports, - enter the port number at the beginning of the range in the Start Port field. - enter the port number at the end of the range in the End Port field.
SRTP Support	
SRTP Support	When you make a VoIP call using SIP, the Real-time Transport Protocol (RTP) is used to handle voice data transfer. The Secure Real-time Transport Protocol (SRTP) is a security profile of RTP. It is designed to provide encryption and authentication for the RTP data in both unicast and multicast applications. The Zyxel Device supports encryption using AES with a 128-bit key. To protect data integrity, SRTP uses a Hash-based Message Authentication Code (HMAC) calculation with Secure Hash Algorithm (SHA)-1 to authenticate data. HMAC SHA-1 produces a 80 or 32-bit authentication tag that is appended to the packet. Both the caller and callee should use the same algorithms to establish an SRTP session.
Crypto Suite	Select the encryption and authentication algorithm set used by the Zyxel Device to set up an SRTP media session with the peer device. Select AES_CM_128_HMAC_SHA1_80 or AES_CM_128_HMAC_SHA1_32 to enable both data encryption and authentication for voice data. Select AES_CM_128_NULL to use 128-bit data encryption but disable data authentication. Select NULL_CIPHER_HMAC_SHA1_80 to disable encryption but require authentication using the default 80-bit tag.
DTMF Mode	Control how the Zyxel Device handles the tones that your telephone makes when you push its buttons. You should use the same mode your VoIP service provider uses. RFC2833 – send the DTMF tones in RTP packets. PCM – send the DTMF tones in the voice data stream. This method works best when you are using a codec that does not use compression (like G.711). Codecs that use compression (like G.729 and G.726) can distort the tones. SIP INFO – send the DTMF tones in SIP messages.
Transport Type	
Transport Type	Select the protocol used to transport the SIP packets. For UDP and TCP, see the Service appendix for more information on the example services and the required protocol and port number.
Ignore Direct IP	Select Enable to have the connected devices accept SIP requests only from the SIP proxy/register server specified above. SIP requests sent from other IP addresses will be ignored.
FAX Option	This field controls how the Zyxel Device handles fax messages.
G711 Fax Passthrough	Select this if the Zyxel Device should use G.711 to send fax messages. You have to also select which operating codec (G.711Mulaw or G.711Alaw) to use for encoding/decoding FAX data. The peer devices must use the same settings.
T38 Fax Relay	Select this if the Zyxel Device should send fax messages as UDP or TCP/IP packets through IP networks. This provides better quality, but it may have inter-operability problems. The peer devices must also use T.38.
QoS Tag	

Table 146 VoIP > SIP > SIP Service Provider > Add New Provider or Edit (continued)

LABEL	DESCRIPTION
SIP DSCP Mark Setting	Enter the DSCP (DiffServ Code Point) number for SIP message transmissions. The Zyxel Device creates Class of Service (CoS) priority tags with this number to SIP traffic that it transmits.
RTP DSCP Mark Setting	Enter the DSCP (DiffServ Code Point) number for RTP voice transmissions. The Zyxel Device creates Class of Service (CoS) priority tags with this number to RTP traffic that it transmits.
Timer Setting	
SIP Register Expiration Duration	Enter the number of seconds your SIP account is registered with the SIP register server before it is deleted. The Zyxel Device automatically tries to re-register your SIP account when one-half of this time has passed (The SIP register server might have a different expiration).
SIP Register Fall Re-try timer	Enter the number of seconds the Zyxel Device waits before it tries again to register the SIP account, if the first try failed or if there is no response.
Session Expires [SE]	Enter the number of seconds the Zyxel Device lets a SIP session remain idle (without traffic) before it automatically disconnects the session.
Min-SE	Enter the minimum number of seconds the Zyxel Device lets a SIP session remain idle (without traffic) before it automatically disconnects the session. When two SIP devices start a SIP session, they must agree on an expiration time for idle sessions. This field is the shortest expiration time that the Zyxel Device accepts.
Dialing Interval Selection	
Dialing Interval Selection	Enter the number of seconds the Zyxel Device should wait after you stop dialing numbers before it makes the phone call. The value depends on how quickly you dial phone numbers.
SIP Server Location DNS Method	Select the method that the Zyxel Device used to query the ISP's DNS server for SIP server address. The Zyxel Device will use the query result to locate the SIP server for phone service registration. Select BASIC to have the Zyxel Device query the DNS server for a DNS A record that contains the IP address of the SIP server. Select SRV to have the Zyxel Device query the DNS server for a DNS Service (SRV) record. The SRV record is a list of all available SIP servers information that the DNS server maintains. The Zyxel Device will then use the SRV record to perform A query to get the SIP server IP. This is useful if your primary SIP server experiences difficulties, making it hard for your IP phone users to make SIP calls. Select NAPTR to have the Zyxel Device query the DNS server for DNS Name Authority Pointer (NAPTR) records in order to find the available services (transport protocols) supported by the SIP server. The Zyxel Device will then perform an SRV or A query to get the SIP server information.
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

24.5 SIP TLS Common

Use this screen to:

- Change the default TLS local port.
- Select a local certificate for the SIP server to verify the Zyxel Device.

Note: To activate **SIP TLS Common**, select **TLS** in **Transport Type** in the **SIP Service Provider** screen.

To access this screen, click **VoIP > SIP > SIP TLS Common**.

Figure 232 VoIP > SIP > SIP TLS Common

The following table describes the labels in this screen.

Table 147 VoIP > SIP > SIP TLS Common

LABEL	DESCRIPTION
TLS Local Port	Port 5061 is typically used for SIP over TLS. Enter the Zyxel Device's TLS local port number if your VoIP service provider gave you one. Otherwise, keep the default value.
Local Certificate	This is the certificate the SIP server uses to verify the Zyxel Device. Go to Certificate > Local Certificate and import a Zyxel Device certificate that the SIP server can use to verify the Zyxel Device, if required. Then select the certificate you imported in this field.
Verify Server Certificate	Click to enable this if you want the Zyxel Device to verify the certificate from the SIP server. If required or if your VoIP service provider gave you a certificate, import the dedicated CA in Certificate > Trusted CA in order for the Zyxel Device to authenticate the SIP server.

24.6 Phone

Use these screens to configure SIP numbers and regions for IP phones that are connected to the Zyxel Device.

24.6.1 Phone Device

Use this screen to view detailed information on phones used for Internet phone calls (SIP). You can define which phones will ring when a specific SIP address receives an incoming call, and which SIP address will be used when an outgoing call is made with a specific phone.

To access this screen, click **VoIP > Phone > Phone Device**.

Figure 233 VoIP > Phone > Phone Device

Phone

Phone Device
Region

Use this screen to view detailed information on phones used for Internet phone calls (SIP). You can define which phone(s) will ring when a specific SIP address receives an incoming call, and which SIP address will be used when an outgoing call is made with a specific phone.

Analog Phone

#	Phone ID	Internal Number	Incoming SIP Number	Outgoing SIP Number	Modify
1	PHONE1	**11	ChangeMe	ChangeMe	✎
2	PHONE2	**12	ChangeMe	ChangeMe	✎

Each field is described in the following table.

Table 148 VoIP > Phone > Phone Device

LABEL	DESCRIPTION
#	This displays the index number of the phone device.
Phone ID	This field displays the name of a phone port on the Zyxel Device.
Incoming SIP Number	This field displays the SIP address that you use to receive calls on this phone port.
Outgoing SIP Number	This field displays the SIP address that you use to make calls on this phone port.
Modify	Click the Edit icon to configure the SIP account.

24.6.2 Phone Device Edit

Use this screen to control which SIP account and PSTN line each phone uses. Click an **Edit** icon in **VoIP > Phone > Phone Device** to open the following screen.

Figure 234 VoIP > Phone > Phone Device > Edit

Phone Device Edit

SIP Account to Make Outgoing Call

SIP Account	SIP Number
☒ SIP1	ChangeMe
☐ SIP2	ChangeMe

SIP Account(s) to Receive Incoming Call

SIP Account	directoryNumber
☒ SIP1	ChangeMe
☐ SIP2	ChangeMe

Immediate Dial Enable

☒ Immediate Dial Enable

Cancel OK

Each field is described in the following table.

Table 149 VoIP > Phone > Phone Device > Edit

LABEL	DESCRIPTION
SIP Account to Make Outgoing Call	Select the SIP account you want to use when making outgoing calls with the analog phone connected to this phone port.
SIP Account(s) to Receive Incoming Call	Select a SIP account if you want to receive phone calls for the selected SIP account on this phone port. If you select more than one SIP account for incoming calls, there is no way to distinguish between them when you receive phone calls. If you do not select a source for incoming calls, you cannot receive any calls on this phone port.
Immediate Dial Enable	Select this if you want to use the pound key (#) to tell the Zyxel Device to make the phone call immediately, instead of waiting for the number of second you selected in the Dialog Interval Selection field of the VoIP > SIP > SIP Service Provider > Add New Provider or Edit screen. If you select this, dial the phone number, and then press the pound key. The Zyxel Device makes the call immediately instead of waiting. You can still wait, if you want.
Cancel	Click Cancel to exit this screen without saving
OK	Click OK to save your changes.

24.7 Phone Region

Use this screen to configure settings that depend on which region of the world the Zyxel Device is in. Selecting the region where the device is physically located improves the quality of phone calls.

To access this screen, click **VoIP > Phone > Region**.

Figure 235 VoIP > Phone > Region

Phone Device **Region**

Use this screen to configure settings that depend on which region of the world the Zyxel Device is in. Selecting the region where the device is physically located improves the quality of phone calls.

Region Setting NOR - Norway

Call Service Mode Europe Type

Note
You need to reboot the device after changing the region settings for it to take effect.

Cancel Apply

The following table describes the labels in this screen.

Table 150 VoIP > Phone > Region

LABEL	DESCRIPTION
Region Setting	Select the place in which the Zyxel Device is located.
Call Service Mode	Select the mode for supplementary phone services (call hold, call waiting, call transfer and three-way conference calls) that your VoIP service provider supports. Europe Type – use supplementary phone services in European mode. USA Type – use supplementary phone services American mode. You might have to subscribe to these services to use them. Contact your VoIP service provider.
Apply	Click this to save your changes and to apply them to the Zyxel Device.
Cancel	Click this to set every field in this screen to its last-saved value.

Note: You need to reboot the Zyxel Device after changing the region settings for it to take effect.

24.8 Call Rule

Use this screen to add, edit, or remove speed-dial numbers for outgoing calls. Speed dial provides shortcuts for dialing frequently-used (VoIP) phone numbers. You also have to create speed-dial entries if you want to call SIP numbers that contain letters. Once you have configured a speed dial rule, you can use a shortcut (the speed dial number, #01 for example) on your phone's keypad to call the phone number. To access this screen, click **VoIP > Call Rule**.

Figure 236 VoIP > Call Rule

Call Rule

Use this screen to add, edit, or remove speed-dial numbers for outgoing calls. Speed dial provides shortcuts for dialing frequently-used (VoIP) phone numbers. You also have to create speed-dial entries if you want to call SIP addresses that contain letters. Once you have configured a speed dial rule, you can use a shortcut (the speed dial number, #01 for example) on your phone's keypad to call the phone number.

Clear All Speed Dials

Keys	Number	Description
#01		
#02		
#03		
#04		
#05		
#06		
#07		
#08		
#09		
#10		

Cancel **Apply**

The following table describes the labels in this screen.

Table 151 VoIP > Call Rule

LABEL	DESCRIPTION
Keys	This field displays the speed-dial number you should dial to use this entry.
Number	Enter the SIP number you want the Zyxel Device to call when you dial the speed-dial number.
Description	Enter a short description to identify the party you call when you dial the speed-dial number. You can use up to 127 printable characters except ["], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Clear All Speed Dials	Click this button to remove all speed dials saved.
Apply	Click this to save your changes and to apply them to the Zyxel Device.
Cancel	Click this to set every field in this screen to its last-saved value.

24.9 Call History

The Zyxel Device logs calls from or to your SIP addresses. This screen allows you to view a summary of received, dialed and missed calls and a call history list. You can also view detailed information on each outgoing and incoming call.

To access this screen, click **VoIP > Call History**.

Figure 237 VoIP > Call History

Call History

The Zyxel Device logs calls from or to your SIP addresses. This screen allows you to view the summary of received, dialed and missed calls and a call history list. You can also see detailed information for each outgoing call you made or each incoming call from someone calling you. The Zyxel Device stores up to 300 incoming call logs and 300 outgoing call logs. If the number of entries exceed the maximum value, the earliest log of that type will be deleted.

[Clear](#) [Refresh](#)

Summary

Date	Total Calls	Outgoing Calls	Incoming Calls	Missing Calls	Total Duration(hh:mm:ss)
>					

Classify

Incoming
 Outgoing
 Missed

Type	Date/Time	Peer Number	Phone Number	Duration (hh:mm:ss)	Delete
>					

Each field is described in the following table.

Table 152 VoIP > Call History

LABEL	DESCRIPTION
Clear List	Click this button to remove all entries from the call history list.
Clear	Click this button to remove all entries from the call history list.
Refresh	Click this button to renew the call history list.
Export	Click this button to download a call history list.
Summary	
Date	This is the date when the calls were made.
Total Calls	This displays the total number of calls from or to your SIP addresses that day.
Incoming Calls	This displays how many calls you received that day.
Outgoing Calls	This displays how many calls originated from you that day.
Incoming Calls	This displays how many calls you received that day.
Missing Calls	This displays how many incoming calls were not answered that day.
Total Duration (hh:mm:ss)	This displays how long all calls lasted that day.
Classify	Select the type of the calls. The call types are: All , Incoming , Outgoing and Missed .
Type	This displays the type of the calls.
Date	This displays the date and time when the calls were made.
Date/Time	This displays the date and time when the calls were made.
Name	This displays the SIP account you called.
Peer Number	This displays the SIP address that called you or you called.
Number	This displays the SIP address that called you or you called.
Phone Device	This displays the name of a phone port on the Zyxel Device.
Outgoing Number	This displays the SIP address you used to make outgoing calls or receive calls.
Phone Number	This displays the phone number of the call.

Table 152 VoIP > Call History

LABEL	DESCRIPTION
Duration (hh:mm:ss)	This displays how long the call lasted.
Modify	Click the Delete icon to remove the call history.
Delete	Click the Delete icon to remove the call history.

24.10 Technical Reference

This section contains background material relevant to the **VoIP** screens.

VoIP

VoIP is the sending of voice signals over Internet Protocol. This allows you to make phone calls and send faxes over the Internet at a fraction of the cost of using the traditional circuit-switched telephone network. You can also use servers to run telephone service applications like PBX services and voice mail. Internet Telephony Service Provider (ITSP) companies provide VoIP service.

Circuit-switched telephone networks require 64 kilobits per second (Kbps) in each direction to handle a telephone call. VoIP can use advanced voice coding techniques with compression to reduce the required bandwidth.

SIP

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet.

SIP signaling is separate from the media for which it handles sessions. The media that is exchanged during the session can use a different path from that of the signaling. SIP handles telephone calls and can interface with traditional circuit-switched telephone networks.

SIP Identities

A SIP account uses an identity (sometimes referred to as a SIP address). A complete SIP identity is called a SIP URI (Uniform Resource Identifier). A SIP account's URI identifies the SIP account in a way similar to the way an email address identifies an email account. The format of a SIP identity is SIP-Number@SIP-Service-Domain.

SIP Number

The SIP number is the part of the SIP URI that comes before the "@" symbol. A SIP number can use letters like in an email address (johndoe@your-ITSP.com for example) or numbers like a telephone number (1122334455@VoIP-provider.com for example).

SIP Service Domain

The SIP service domain of the VoIP service provider is the domain name in a SIP URI. For example, if the SIP address is 1122334455@VoIP-provider.com, then "VoIP-provider.com" is the SIP service domain.

SIP Registration

Each Zyxel Device is an individual SIP User Agent (UA). To provide voice service, it has a public IP address for SIP and RTP protocols to communicate with other servers.

A SIP user agent has to register with the SIP registrar and must provide information about the users it represents, as well as its current IP address (for the routing of incoming SIP requests). After successful registration, the SIP server knows that the users (identified by their dedicated SIP URIs) are represented by the UA, and knows the IP address to which the SIP requests and responses should be sent.

Registration is initiated by the User Agent Client (UAC) running in the VoIP gateway (the Zyxel Device). The gateway must be configured with information letting it know where to send the REGISTER message, as well as the relevant user and authorization data.

A SIP registration has a limited lifespan. The User Agent Client must renew its registration within this lifespan. If it does not do so, the registration data will be deleted from the SIP registrar's database and the connection broken.

The Zyxel Device attempts to register all enabled subscriber ports when it is switched on. When you enable a subscriber port that was previously disabled, the Zyxel Device attempts to register the port immediately.

Authorization Requirements

SIP registrations (and subsequent SIP requests) require a username and password for authorization. These credentials are validated through a challenge / response system using the HTTP digest mechanism (as detailed in RFC 3261, "SIP: Session Initiation Protocol").

SIP Servers

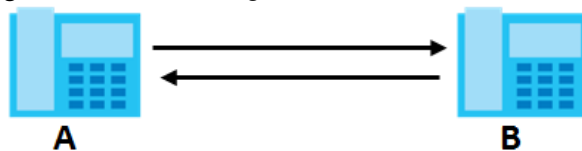
SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

When you use SIP to make a VoIP call, it originates at a client and terminates at a server. A SIP client could be a computer or a SIP phone. One device can act as both a SIP client and a SIP server.

SIP User Agent

A SIP user agent can make and receive VoIP telephone calls. This means that SIP can be used for peer-to-peer communications even though it is a client-server protocol. In the following figure, either **A** or **B** can act as a SIP user agent client to initiate a call. **A** and **B** can also both act as a SIP SIP user agent to receive the call.

Figure 238 SIP User Agent



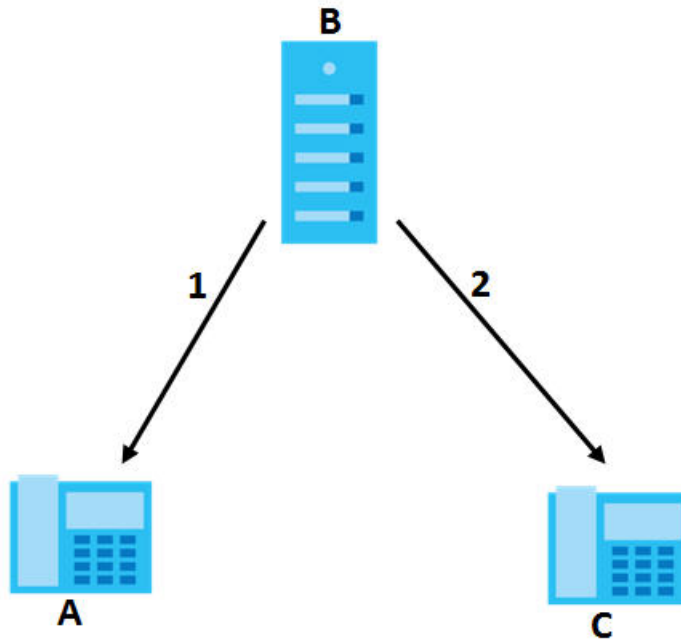
SIP Proxy Server

A SIP proxy server receives requests from clients and forwards them to another server.

In the following example, you want to use client device **A** to call someone who is using client device **C**.

- 1 The client device (**A** in the figure) sends a call invitation to the SIP proxy server (**B**).
- 2 The SIP proxy server forwards the call invitation to **C**.

Figure 239 SIP Proxy Server

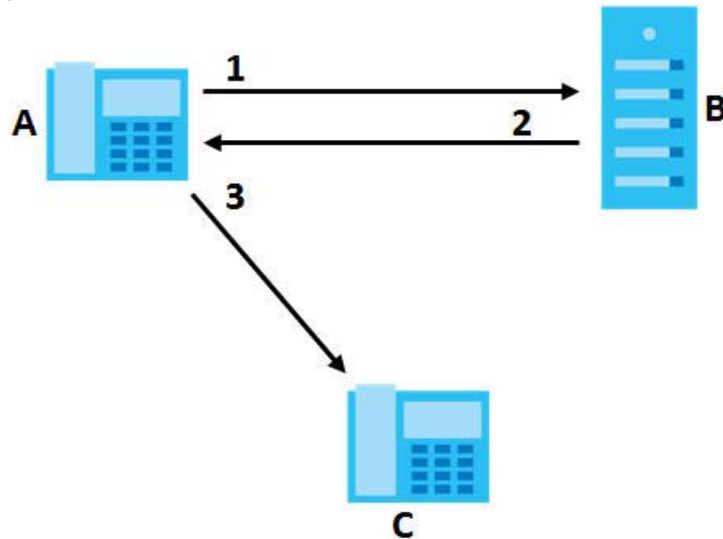


SIP Redirect Server

A SIP redirect server accepts SIP requests, translates the destination address to an IP address and sends the translated IP address back to the device that sent the request. Then the client device that originally sent the request can send requests to the IP address that it received back from the redirect server. Redirect servers do not initiate SIP requests.

In the following example, you want to use client device **A** to call someone who is using client device **C**.

- 1 Client device **A** sends a call invitation for **C** to the SIP redirect server (**B**).
- 2 The SIP redirect server sends the invitation back to **A** with **C**'s IP address (or domain name).
- 3 Client device **A** then sends the call invitation to client device **C**.

Figure 240 SIP Redirect Server

SIP Register Server

A SIP register server maintains a database of SIP identity-to-IP address (or domain name) mapping. The register server checks your user name and password when you register.

RTP

When you make a VoIP call using SIP, the RTP (Real time Transport Protocol) is used to handle voice data transfer. See RFC 1889 for details on RTP.

Pulse Code Modulation

Pulse Code Modulation (PCM) measures analog signal amplitudes at regular time intervals and converts them into bits.

SIP Call Progression

The following figure displays the basic steps in the setup and tear down of a SIP call. A calls B.

Table 153 SIP Call Progression

A		B
1. INVITE	→	
	←	2. Ringing
	←	3. OK
4. ACK	→	
	5. Dialogue (voice traffic)	
6. BYE	→	
	←	7. OK

- 1 **A** sends a SIP INVITE request to **B**. This message is an invitation for **B** to participate in a SIP telephone call.
- 2 **B** sends a response indicating that the telephone is ringing.
- 3 **B** sends an OK response after the call is answered.
- 4 **A** then sends an ACK message to acknowledge that **B** has answered the call.
- 5 Now **A** and **B** exchange voice media (talk).
- 6 After talking, **A** hangs up and sends a BYE request.
- 7 **B** replies with an OK response confirming receipt of the BYE request and the call is terminated.

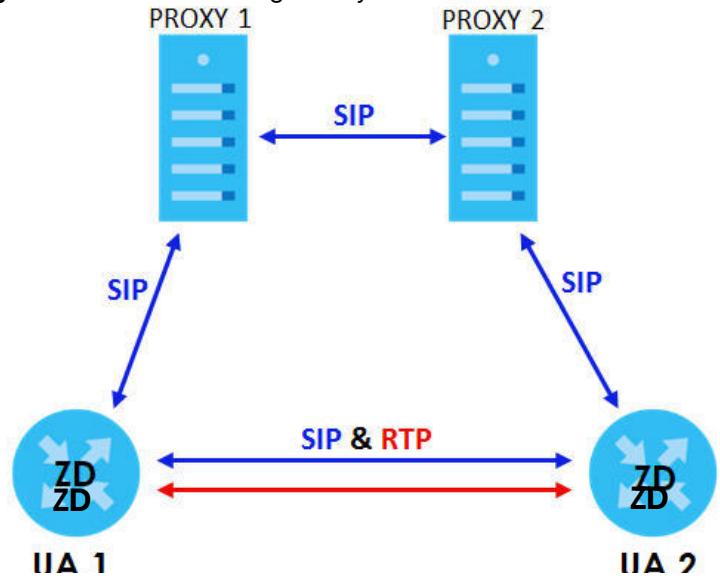
SIP Call Progression Through Proxy Servers

Usually, the SIP UAC sets up a phone call by sending a request to the SIP proxy server. Then, the proxy server looks up the destination to which the call should be forwarded (according to the URI requested by the SIP UAC). The request may be forwarded to more than one proxy server before arriving at its destination.

The response to the request goes to all the proxy servers through which the request passed, in reverse sequence. Once the session is set up, session traffic is sent between the UAs directly, bypassing all the proxy servers in between.

The following figure shows the SIP and session traffic flow between the user agents (**UA 1** and **UA 2**) and the proxy servers (this example shows two proxy servers, **PROXY 1** and **PROXY 2**).

Figure 241 SIP Call Through Proxy Servers

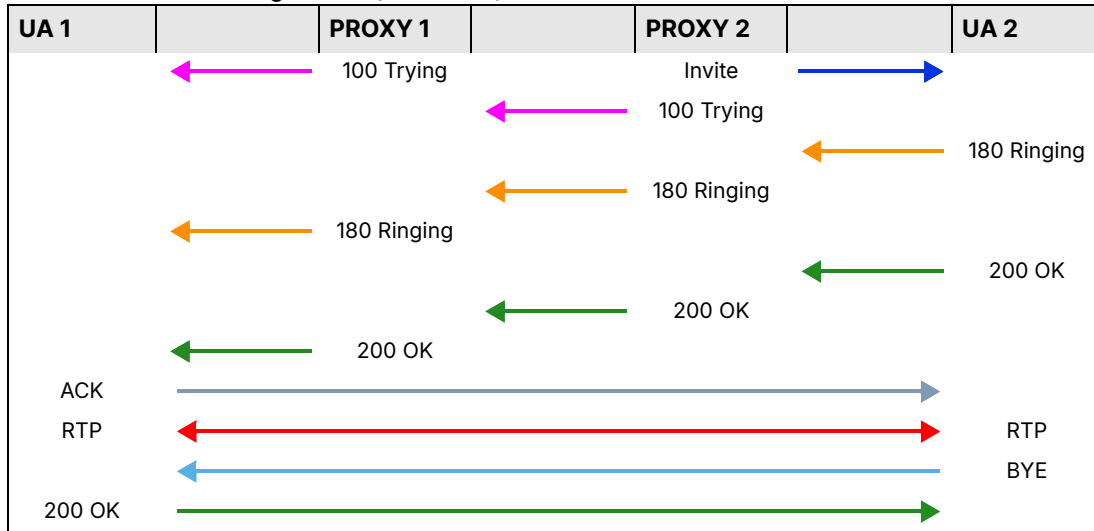


The following table shows the SIP call progression.

Table 154 SIP Call Progression

UA 1		PROXY 1		PROXY 2		UA 2
Invite	→		Invite	→		

Table 154 SIP Call Progression (continued)



- User Agent 1** sends a SIP INVITE request to **Proxy 1**. This message is an invitation to **User Agent 2** to participate in a SIP telephone call. **Proxy 1** sends a response indicating that it is trying to complete the request.
- Proxy 1** sends a SIP INVITE request to **Proxy 2**. **Proxy 2** sends a response indicating that it is trying to complete the request.
- Proxy 2** sends a SIP INVITE request to **User Agent 2**.
- User Agent 2** sends a response back to **Proxy 2** indicating that the phone is ringing. The response is relayed back to **User Agent 1** through **Proxy 1**.
- User Agent 2** sends an OK response to **Proxy 2** after the call is answered. This is also relayed back to **User Agent 1** through **Proxy 1**.
- User Agent 1** and **User Agent 2** exchange RTP packets containing voice data directly, without involving the proxies.
- When **User Agent 2** hangs up, he sends a BYE request.
- User Agent 1** replies with an OK response confirming receipt of the BYE request, and the call is terminated.

Voice Coding

A codec (coder/decoder) codes analog voice signals into digital signals and decodes the digital signals back into analog voice signals. The Zyxel Device supports the following codecs.

- G.711 is a Pulse Code Modulation (PCM) waveform codec. PCM measures analog signal amplitudes at regular time intervals and converts them into digital samples. G.711 provides very good sound quality but requires 64 kbps of bandwidth.
- G.726 is an Adaptive Differential PCM (ADPCM) waveform codec that uses a lower bitrate than standard PCM conversion. ADPCM converts analog audio into digital signals based on the difference between each audio sample and a prediction based on previous samples. The more similar the audio sample is to the prediction, the less space needed to describe it. G.726 operates at 16, 24, 32 or 40 kbps.

- G.729 is an Analysis-by-Synthesis (AbS) hybrid waveform codec that uses a filter based on information about how the human vocal tract produces sounds. G.729 provides good sound quality and reduces the required bandwidth to 8 kbps.

Voice Activity Detection/Silence Suppression

Voice Activity Detection (VAD) detects whether or not speech is present. This lets the Zyxel Device reduce the bandwidth that a call uses by not transmitting “silent packets” when you are not speaking.

Comfort Noise Generation

When using VAD, the Zyxel Device generates comfort noise when the other party is not speaking. The comfort noise lets you know that the line is still connected as total silence could easily be mistaken for a lost connection.

Echo Cancellation

G.168 is an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.

MWI (Message Waiting Indication)

Enable Message Waiting Indication (MWI) enables your phone to give you a message–waiting (beeping) dial tone when you have a voice message(s). Your VoIP service provider must have a messaging system that sends message waiting status SIP packets as defined in RFC 3842.

Custom Tones (IVR)

IVR (Interactive Voice Response) is a feature that allows you to use your telephone to interact with the Zyxel Device. The Zyxel Device allows you to record custom tones for the **Early Media** and **Music On Hold** functions. The same recordings apply to both the caller ringing and on hold tones.

Table 155 Custom Tones Details

LABEL	DESCRIPTION
Total Time for All Tones	900 seconds for all custom tones combined
Maximum Time per Individual Tone	180 seconds
Total Number of Tones Recordable	5 You can record up to 5 different custom tones but the total time must be 900 seconds or less.

Recording Custom Tones

Use the following steps if you would like to create new tones or change your tones:

- 1 Pick up the phone and press “****” on your phone’s keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1101 – 1105 on your phone followed by the “#” key.

- 3 Play your desired music or voice recording into the receiver's mouthpiece. Press the "#" key.
- 4 You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Listening to Custom Tones

Do the following to listen to a custom tone:

- 1 Pick up the phone and press "****" on your phone's keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1201 – 1208 followed by the "#" key to listen to the tone.
- 3 You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Deleting Custom Tones

Do the following to delete a custom tone:

- 1 Pick up the phone and press "****" on your phone's keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1301 – 1308 followed by the "#" key to delete the tone of your choice. Press 14 followed by the "#" key if you wish to clear all your custom tones.

You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

24.10.1 Quality of Service (QoS)

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to provide bandwidth for real-time multimedia applications.

Type of Service (ToS)

Network traffic can be classified by setting the ToS (Type of Service) values at the data source (for example, at the Zyxel Device) so a server can decide the best method of delivery, that is the least cost, fastest route and so on.

DiffServ

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCP) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.³

3. The Zyxel Device does not support DiffServ at the time of writing.

DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

Figure 242 DiffServ: Differentiated Service Field

DSCP (6-bit)	Unused (2-bit)
-----------------	-------------------

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

24.10.2 Phone Services Overview

Supplementary services such as call hold, call waiting, and call transfer, are generally available from your VoIP service provider. The Zyxel Device supports the following services:

- Call Return
- Call Hold
- Call Waiting
- Making a Second Call
- Call Transfer
- Call Forwarding
- Three-Way Conference
- Internal Calls
- Call Park and Pickup
- Do not Disturb
- IVR
- Call Completion
- CCBS
- Outgoing SIP

Note: To take full advantage of the supplementary phone services available through the Zyxel Device's phone ports, you may need to subscribe to the services from your VoIP service provider.

24.10.2.1 The Flash Key

Flashing means to press the hook for a short period of time (a few hundred milliseconds) before releasing it. On newer telephones, there should be a "flash" key (button) that generates the signal electronically. If the flash key is not available, you can tap (press and immediately release) the hook by hand to achieve the

same effect. However, using the flash key is preferred since the timing is much more precise. With manual tapping, if the duration is too long, it may be interpreted as hanging up by the Zyxel Device.

You can invoke all the supplementary services by using the flash key.

24.10.2.2 Europe Type Supplementary Phone Services

This section describes how to use supplementary phone services with the **Europe Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 156 European Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. Switch back to the call (if there is no second call).
Flash	0	Drop the call presently on hold or reject an incoming call which is waiting for answer.
Flash	1	Disconnect the current phone connection and answer the incoming call or resume with caller presently on hold.
Flash	2	1. Switch back and forth between two calls. 2. Put a current call on hold to answer an incoming call. 3. Separate the current three-way conference call into two individual calls (one is on-line, the other is on hold).
Flash	3	Create three-way conference connection.
Flash	*98#	Transfer the call to another phone.

European Call Hold

Call hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key and then "2" to switch back and forth between caller **A** and **B** by putting either one on hold.

Press the flash key and then "0" to disconnect the call presently on hold and keep the current call on line.

Press the flash key and then "1" to disconnect the current call and resume the call on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

European Call Waiting

This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to a telephone number, you will hear a call waiting tone. Take one of the following actions.

- Reject the second call.
Press the flash key and then press "0".

- Disconnect the first call and answer the second call.
Either press the flash key and press "1", or just hang up the phone and then answer the phone after it rings.
- Put the first call on hold and answer the second call.
Press the flash key and then "2".

European Call Transfer

Do the following to transfer an incoming call (that you have answered) to another phone.

- 1 Press the flash key to put the caller on hold.
- 2 When you hear the dial tone, dial "*98#" followed by the number to which you want to transfer the call.
- 3 After you hear the ring signal or the second party answers it, hang up the phone.

European Three-Way Conference

Use the following steps to make three-way conference calls.

- 1 When you are on the phone talking to someone, press the flash key to put the caller on hold and get a dial tone.
- 2 Dial a phone number directly to make another call.
- 3 When the second call is answered, press the flash key and press "3" to create a three-way conversation.
- 4 Hang up the phone to drop the connection.
- 5 If you want to separate the activated three-way conference into two individual connections (one is on-line, the other is on hold), press the flash key and press "2".

24.10.2.3 USA Type Supplementary Services

This section describes how to use supplementary phone services with the **USA Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 157 USA Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. After the second call is successful, press the flash key again to have a three-way conference call. Put a current call on hold to answer an incoming call.
Flash	*98#	Transfer the call to another phone.

USA Call Hold

Call hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key to switch back and forth between caller **A** and **B** by putting either one on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

USA Call Waiting

This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to your telephone number, you will hear a call waiting tone.

Press the flash key to put the first call on hold and answer the second call.

USA Call Transfer

Do the following to transfer an incoming call (that you have answered) to another phone.

- 1** Press the flash key to put the caller on hold.
- 2** When you hear the dial tone, dial **"*98#"** followed by the number to which you want to transfer the call.
- 3** After you hear the ring signal or the second party answers it, hang up the phone.

USA Three-Way Conference

Use the following steps to make three-way conference calls.

- 1** When you are on the phone talking to someone (party A), press the flash key to put the caller on hold and get a dial tone.
- 2** Dial a phone number directly to make another call (to party B).
- 3** When party B answers the second call, press the flash key to create a three-way conversation.
- 4** Hang up the phone to drop the connection.
- 5** If you want to separate the activated three-way conference into two individual connections (with party A on-line and party B on hold), press the flash key.
- 6** If you want to go back to the three-way conversation, press the flash key again.
- 7** If you want to separate the activated three-way conference into two individual connections again, press the flash key. This time the party B is on-line and party A is on hold.

24.10.2.4 Phone Functions Summary

The following table shows the key combinations you can enter on your phone's keypad to use certain features.

Table 158 Phone Functions Summary

ACTION	FUNCTION	DESCRIPTION
*98#	Call transfer	Transfer a call to another phone. See Europe Type Supplementary Phone Services (Europe type) and USA Type Supplementary Services (USA type).
*66#	Call return	Place a call to the last person who called you.
*95#	Enable Do Not Disturb	Use these to set your phone not to ring when someone calls you, or to turn this function off.
#95#	Disable Do Not Disturb	
*41#	Enable Call Waiting	Use these to allow you to put a call on hold when you are answering another, or to turn this function off.
#41#	Disable Call Waiting	
****	IVR	Use these to set up Interactive Voice Response (IVR). IVR allows you to record custom caller ringing tones (the sound a caller hears before you pick up the phone) and on hold tones (the sound someone hears when you put their call on hold).
####	Internal Call	Call the phone(s) connected to the Zyxel Device.
*82	One Shot Caller Display Call	Activate or deactivate caller ID for the next call only.
*67	One Shot Caller Hidden Call	

CHAPTER 25

Log

25.1 What You Need To Know

The following terms and concepts may help as you read this chapter.

Alerts and Logs

An alert is a type of log that warrants more serious attention. They include system errors, attacks (access control) and attempted access to blocked web sites. Some categories such as **System Errors** consist of both logs and alerts. You may differentiate them by their color in the **View Log** screen. Alerts display in red and logs display in black.

25.2 System Log

Use the **System Log** screen to see the system logs. You can filter the entries by selecting a severity level and/or category. Click **System Monitor > Log** to open the **System Log** screen.

Figure 243 System Monitor > Log > System Log

#	Time	Facility	Level	Category	Messages
---	------	----------	-------	----------	----------

The following table describes the fields in this screen.

Table 159 System Monitor > Log > System Log

LABEL	DESCRIPTION
Level	Select a severity level from the drop-down list box. This filters search results according to the severity level you have selected. When you select a severity, the Zyxel Device searches through all logs of that severity or higher.
Category	Select the type of logs to display.
Clear Log	Click this to delete all the logs.
Refresh	Click this to renew the log screen.
Export Log	Click this to export the selected logs.
E-mail Log Now	Click this to send the log files to the email address you specify in the Maintenance > Log Setting screen.
#	This field is a sequential value and is not associated with a specific entry.

Table 159 System Monitor > Log > System Log (continued)

LABEL	DESCRIPTION
Time	This field displays the time the log was recorded.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Level	This field displays the severity level of the log that the Zyxel Device is to send to this syslog server.
Category	This field displays the type of the log.
Messages	This field states the reason for the log.

25.3 Security Log

Use the **Security Log** screen to see the security-related logs for the categories that you select. You can filter the entries by selecting a severity level and/or category. Click **System Monitor > Log > Security Log** to open the following screen.

Figure 244 System Monitor > Log > Security Log

System Log **Security Log**

Use the **Security Log** screen to see the security-related logs for the categories that you select. You can filter the entries by selecting a severity level and/or category.

Level: All ▼ Category: All ▼

[Clear Log](#) [Refresh](#) [Export Log](#) [E-mail Log Now](#)

#	Time	Facility	Level	Category	Messages
---	------	----------	-------	----------	----------

The following table describes the fields in this screen.

Table 160 System Monitor > Log > Security Log

LABEL	DESCRIPTION
Level	Select a severity level from the drop-down list box. This filters search results according to the severity level you have selected. When you select a severity, the Zyxel Device searches through all logs of that severity or higher.
Category	Select the type of logs to display.
Clear Log	Click this to delete all the logs.
Refresh	Click this to renew the log screen.
Export Log	Click this to export the selected logs.
E-mail Log Now	Click this to send the log files to the email address you specify in the Maintenance > Log Setting screen.
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Level	This field displays the severity level of the log that the Zyxel Device is to send to this syslog server.
Category	This field displays the type of the log.
Messages	This field states the reason for the log.

CHAPTER 26

Traffic Status

26.1 Traffic Status Overview

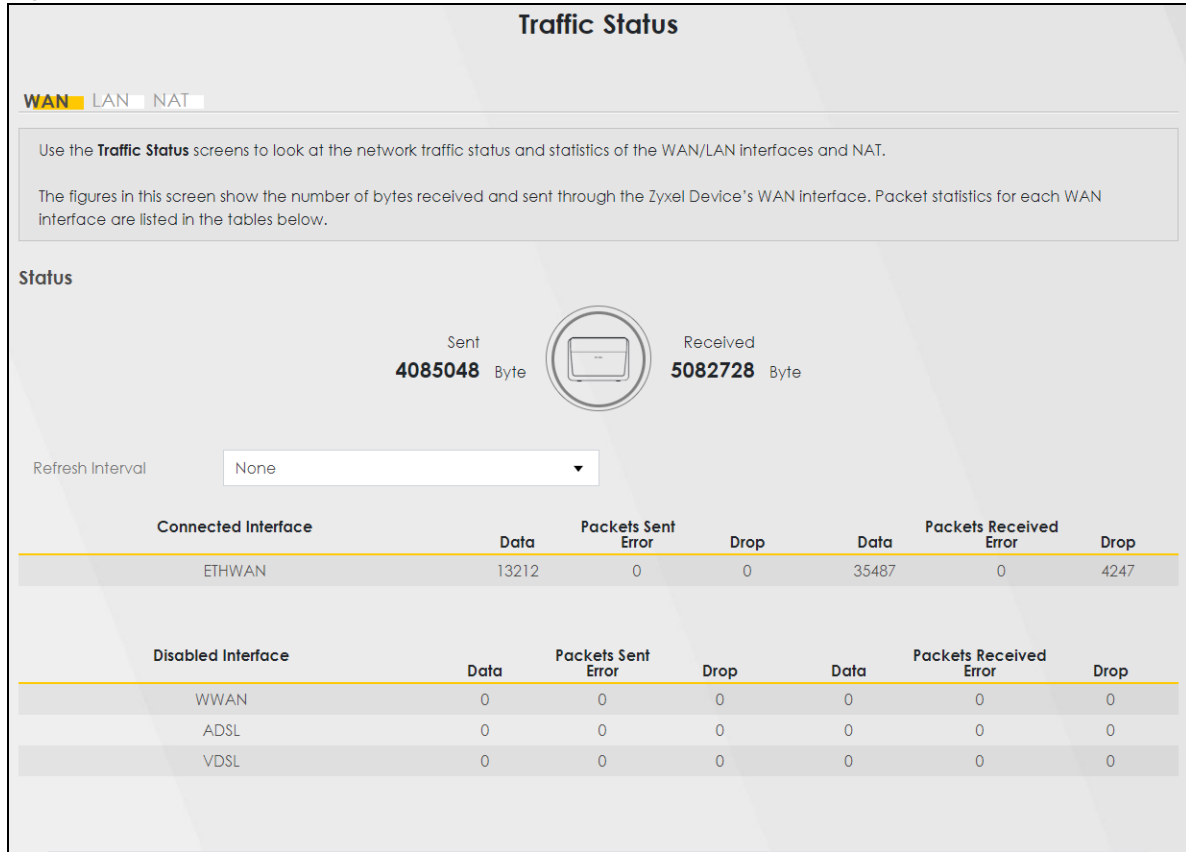
Use the **Traffic Status** screens to look at the network traffic status and statistics of the WAN/LAN interfaces and NAT.

26.1.1 What You Can Do in this Chapter

- Use the **WAN** screen to view the WAN traffic statistics ([WAN Status](#)).
- Use the **LAN** screen to view the LAN traffic statistics ([LAN Status](#)).
- Use the **NAT** screen to view the NAT status of the Zyxel Device's clients ([NAT Status](#)).

26.2 WAN Status

Click **System Monitor > Traffic Status** to open the **WAN** screen. The figures in this screen show the number of bytes received and sent through the Zyxel Device's WAN interface. The table below shows packet statistics for each WAN interface.

Figure 245 System Monitor > Traffic Status > WAN

The following table describes the fields in this screen.

Table 161 System Monitor > Traffic Status > WAN

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen.
Connected Interface	This shows the name of the WAN interface that is currently connected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.
Disabled Interface	This shows the name of the WAN interface that is currently disabled.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.

Table 161 System Monitor > Traffic Status > WAN (continued)

LABEL	DESCRIPTION
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

26.3 LAN Status

Click **System Monitor > Traffic Status > LAN** to open the following screen. This screen allows you to view packet statistics for each LAN or WLAN interface on the Zyxel Device.

Figure 246 System Monitor > Traffic Status > LAN

The screenshot shows the 'Traffic Status' screen with the 'LAN' tab selected. It includes a 'Refresh Interval' dropdown set to 'None'. Below is a table of statistics for LAN1 through 5G WLAN, categorized by Bytes Sent, Bytes Received, Sent (Packets), and Received (Packets).

Interface	LAN1	LAN2	LAN3	LAN4	10G LAN	2.4G WLAN	5G WLAN
Bytes Sent	14373042	0	0	0	0	7718440	32324333
Bytes Received	3094454	0	0	0	0	540127	3624349

Interface	LAN1	LAN2	LAN3	LAN4	10G LAN	2.4G WLAN	5G WLAN
Sent (Packet)	Data	39245	0	0	0	39300	85541
	Error	0	0	0	0	20	12
	Drop	0	0	0	0	0	4
Received (Packet)	Data	23658	0	0	0	2668	15754
	Error	0	0	0	0	8	43
	Drop	0	0	0	0	0	0

The following table describes the fields in this screen.

Table 162 System Monitor > Traffic Status > LAN

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen.
Interface	This shows the LAN or WLAN interface.
Bytes Sent	This indicates the number of bytes transmitted on this interface.
Bytes Received	This indicates the number of bytes received on this interface.
Interface	This shows the LAN or WLAN interfaces.
Sent (Packets)	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Received (Packets)	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

26.4 NAT Status

Click **System Monitor > Traffic Status > NAT** to open the following screen. This screen lists the devices that have received an IP address from the Zyxel Device LAN or WLAN interfaces and have ever established a session with the Zyxel Device.

Figure 247 System Monitor > Traffic Status > NAT

Traffic Status

WAN LAN **NAT**

This screen lists the devices that have received an IP address from the Zyxel Device's LAN or WLAN interface(s) and have ever established a session with the Zyxel Device.

Refresh Interval: None

Device Name	IPv4 Address	MAC Address	NO. of Open Sessions
NT122788-PC01	192.168.1.191	d8:4e:2e:40:ee:5f	26

Total:

The following table describes the fields in this screen.

Table 163 System Monitor > Traffic Status > NAT

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen.
Device Name	This displays the name of the connected host.
IPv4 Address	This displays the IP address of the connected host.
MAC Address	This displays the MAC address of the connected host.
No. of Open Sessions	This displays the number of NAT sessions currently opened for the connected host.
Total	This displays what percentage of NAT sessions the Zyxel Device can support is currently being used by all connected hosts. You can also see the number of active NAT sessions and the maximum number of NAT sessions the Zyxel Device can support

CHAPTER 27

VoIP Status

27.1 VoIP Status Screen

Click **System Monitor > VoIP Status** to open the following screen. You can view the Voice over IP (VoIP) registration, current call status and phone numbers in this screen.

Figure 248 System Monitor > VoIP Status

Information, such as whether a SIP account is registered and the total call volume made by a SIP account, can be viewed in the page.

Poll Interval sec [Set Interval](#) [Stop](#)

(s)

SIP Status

Account	Register Action	Registration	Registration Time	URI	Message Waiting	Last Incoming Number	Last Outgoing Number
1	☐	Disabled		ChangeMe@ChangeMe	No		

Call Status

Account	Duration	Status	Call Type	Codec	From Phone Port Type	To Phone Port Type	Peer Number
---------	----------	--------	-----------	-------	----------------------	--------------------	-------------

Phone Status

Phone	Outgoing Number	Incoming Number	Hook Status
Phone 1	ChangeMe	ChangeMe	On-hook

The following table describes the labels in this screen.

Table 164 System Monitor > VoIP Status

LABEL	DESCRIPTION
Poll Interval	Enter the number of seconds the Device needs to wait before updating this screen and then click Set Interval . Click Stop to have the Device stop updating this screen.
SIP Status	
Account	This column displays each SIP account in the Device.
Register Action	Click on this switch to register/unregister the SIP account. This switch will turn blue if a registration attempt is successful; otherwise, it will revert to its unregistered setting. Unregistering an account does not delete the SIP account itself, but removes the mapping between your SIP identity and your IP address or domain name,
Registration Time	This field displays the last time the Device successfully registered the SIP account. The field is blank if the Device has never successfully registered this account.

Table 164 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
URI	This field displays the account number and service domain of the SIP account. You can change these in the VoIP > SIP screen.
Message Waiting	This field indicates whether or not there are any messages waiting for the SIP account.
Last Incoming Number	This field displays the last number that called the SIP account. The field is blank if no number has ever dialed the SIP account.
Last Outgoing Number	This field displays the last number the SIP account called. The field is blank if the SIP account has never dialed a number.
Call Status	
Account	This column displays each SIP account in the Device.
Duration	This field displays how long the current call has lasted.
Status	This field displays the current state of the phone call. Idle – There are no current VoIP calls, incoming calls or outgoing calls being made. Dial – The callee's phone is ringing. Ring – The phone is ringing for an incoming VoIP call. Process – There is a VoIP call in progress. DISC – The callee's line is busy, the callee hung up or your phone was left off the hook.
Call Type	This field displays the call direction type of the current VoIP call. Outgoing Call – It is a SIP VoIP call made by local phone ports, and this SIP account is able to issue a (SIP-based) call setup to the SIP account of remote peers for a VoIP call establishment. This (SIP-based) call setup signal is sent to the SIP server first, and then the SIP server would relay it to the target peer after correctly resolving and locating the target peer. During the call setup (signaling) phase, Calling state is displayed in the Status field, and it turns to InCall state once the call is successfully established. Incoming Call – It is a SIP VoIP call made or originated by remote SIP accounts to connect to this local SIP account. One or more local phone ports can be configured to receive this type of call, see the Incoming Number below, and all of them should begin to ring during the call setup (signaling phase), see the Status above. Once some remote SIP accounts start to ring one local phone, answer by off-hook to the call, and the call is successfully established. The other ringing local phone ports will stop ringing and turning to InCall state in the Status field. Internal Call – It is a local VoIP call between two different local phone ports. No SIP signaling is needed and thus no SIP server is involved to establish this type of call. This type of call is established through the Internal and Non-SIP local setup signaling procedure between the call-originating and call-terminating local phone ports. In general, one or more local phone ports can be designed to receive this type of call, and once any of the ringing phones answer the call, the other ringing ones will stop ringing. During the call setup phase (signaling phase), Calling state is displayed in Status field, and turns to InCall state once the call is successfully established.
Codec	This field displays what voice codec is being used for a current VoIP call through a phone port.
From Phone Port Type	This field displays the phone ports type used to originate, start, or create the current VoIP call. Two possible type values will be displayed here: SIP – For the current call which is categorized as Incoming Call in the Call Type field, this field will show the type SIP. FXS – As for the other cases: Outgoing Call and Internal Call, this field will show the corresponding local phone port type: FXS, the legacy analog phone port on the device.
To Phone Port Type	This field displays the phone ports type used to receive the current VoIP call. Three possible type values will be displayed here: SIP – For the current call which is categorized as Outgoing Call in the Call Type field, this field will show the type SIP. FXS and Unknown – As for the other cases: Incoming Call and Internal Call, this field will show the corresponding local phone port type: FXS, the legacy analog phone port on the device. While the call is established, this field shows Unknown during the call setup phase (signaling phase). This is because one or more local phone ports can be configured or designed to receive these two types of calls, see the Call Type above, and the local phone port will answer the call that hasn't been determined yet at that time.

Table 164 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
Peer Number	This field displays the SIP number of the party that is currently engaged in a VoIP call through a phone port.
Phone Status	
Phone	This field displays the name of a phone port on the Device.
Outgoing Number	This field displays the SIP number that you use to make calls on this phone port.
Incoming Number	This field displays the SIP number that you use to receive calls on this phone port.
Hook Status	This field displays whether the phone is in the on or off hook status.
	Off-Hook means a telephone connected to one of the phone port has its receiver off the hook.
	On-Hook means a telephone connected to one of the phone port has its receiver on the hook.

CHAPTER 28

ARP Table

28.1 ARP Table Overview

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol (IP) address to a physical machine address, known as a Media Access Control (MAC) address, on the local area network.

An IP version 4 address is 32 bits long. MAC addresses are 48 bits long. The ARP table maintains an association between each MAC address and its corresponding IP address.

28.1.1 How ARP Works

When an incoming packet destined for a host device on a local area network arrives at the device, the device's ARP program looks in the ARP table and, if it finds the address, sends it to the device.

If no entry is found for the IP address, ARP broadcasts the request to all the devices on the LAN. The device fills in its own MAC and IP address in the sender address fields, and puts the known IP address of the target in the target IP address field. In addition, the device puts all ones in the target MAC field (FF.FF.FF.FF.FF.FF is the Ethernet broadcast address). The replying device (which is either the IP address of the device being sought or the router that knows the way) replaces the broadcast address with the target's MAC address, swaps the sender and target pairs, and unicasts the answer directly back to the requesting machine. ARP updates the ARP table for future reference and then sends the packet to the MAC address that replied.

28.2 ARP Table

Use the ARP table to view the IPv4-to-MAC address mappings for each device connected to the Zyxel Device. The neighbor table shows the IPv6-to-MAC address mappings of each IPv6 neighbor. To open this screen, click **System Monitor > ARP Table**.

Figure 249 System Monitor > ARP Table

ARP Table			
Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network. The ARP table maintains an association between each MAC address and its corresponding IP address. Use the ARP table to view the IPv4-to-MAC address mapping(s) for the LAN. The neighbor table shows the IPv6-to-MAC address mapping(s) of each neighbor.			
IPv4 ARP Table			
#	IPv4 Address	MAC Address	Device
1			br0
2			br0
IPv6 Neighbour Table			
#	IPv6 Address	MAC Address	Device
1			br0
2			br0

The following table describes the labels in this screen.

Table 165 System Monitor > ARP Table

LABEL	DESCRIPTION
#	This is the ARP table entry number.
IPv4 / IPv6 Address	This is the learned IPv4 or IPv6 IP address of a device connected to the Zyxel Device.
MAC Address	This is the MAC address of the connected device with the listed IP address.
Device	This is the type of interface used by the connected device. You can click the device type to go to its configuration screen.

CHAPTER 29

Routing Table

29.1 Routing Table Overview

Routing is based on the destination address only and the Zyxel Device takes the shortest path to forward a packet.

29.2 Routing Table

The table below shows IPv4 and IPv6 routing information. The IPv4 subnet mask is '255.255.255.255' for a host destination and '0.0.0.0' for the default route. The gateway address is written as '*'(IPv4)/ '::'(IPv6) if none is set.

Click **System Monitor > Routing Table** to open the following screen.

Figure 250 System Monitor > Routing Table

Routing Table					
Routing is based on the destination address only and the Zyxel Device takes the shortest path to forward a packet. The table below shows IPv4 and IPv6 routing information. The IPv4 subnet mask is '255.255.255.255' for a host destination and '0.0.0.0' for the default route. The gateway address is written as '*' (IPv4) / '::' (IPv6) if none is set. Destination: This indicates the destination IPv4 address or IPv6 address and prefix of this route. Gateway: This indicates the IPv4 address or IPv6 address of the gateway that helps forward this route's traffic. Subnet Mask: This indicates the destination subnet mask of the IPv4 route. Flag: This indicates the route status. U-Up: The route is up. I-Reject: The route is blocked and will force a route lookup to fail. G-Gateway: The route uses a gateway to forward traffic. H-Host: The target of the route is a host. R-Reinstate: The route is reinstated for dynamic routing. D-Dynamic (redirect): The route is dynamically installed by a routing daemon or redirect. M-Modified (redirect): The route is modified from a routing daemon or redirect. Metric: The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". The smaller the number, the lower the "cost". Interface: This indicates the name of the interface through which the route is forwarded.					
IPv4 Routing Table					
Destination	Gateway	Subnet Mask	Flag	Metric	Interface
192.168.1.1	0.0.0.0	255.255.0.0	U	0	lo
192.168.1.1	0.0.0.0	255.255.255.0	U	0	br0
192.168.1.1	0.0.0.0	255.0.0.0	U	0	br0
IPv6 Routing Table					
Destination	Gateway	Flag	Metric	Interface	
fe80::/64	::	U	256	eth0	
fe80::/64	::	U	256	eth0.1	
fe80::/64	::	U	256	eth0.2	
fe80::/64	::	U	256	eth0.3	
fe80::/64	::	U	256	eth0.4	
fe80::/64	::	U	256	nas10	
fe80::/64	::	U	256	br0	
fe80::/64	::	U	256	ra0	
fe80::/64	::	U	256	ra1	
fe80::/64	::	U	256	ra2	
fe80::/64	::	U	256	ra3	
fe80::/64	::	U	256	rai0	
fe80::/64	::	U	256	rai1	
fe80::/64	::	U	256	rai2	
fe80::/64	::	U	256	rai3	
fe80::/64	::	U	256	rai5	
::1/128	::	U	0	lo	

The following table describes the labels in this screen.

Table 166 System Monitor > Routing Table

LABEL	DESCRIPTION
IPv4 / IPv6 Routing Table	
Destination	This indicates the destination IPv4 address or IPv6 address and prefix of this route.
Gateway	This indicates the IPv4 address or IPv6 address of the gateway that helps forward this route's traffic.
Subnet Mask	This indicates the destination subnet mask of the IPv4 route.

Table 166 System Monitor > Routing Table (continued)

LABEL	DESCRIPTION
Flag	This indicates the route status. U–Up: The route is up. !–Reject: The route is blocked and will force a route lookup to fail. G–Gateway: The route uses a gateway to forward traffic. H–Host: The target of the route is a host. R–Reinstate: The route is reinstated for dynamic routing. D–Dynamic (redirect): The route is dynamically installed by a routing daemon or redirect. M–Modified (redirect): The route is modified from a routing daemon or redirect.
Metric	The metric represents the "cost of transmission." A router determines the best route for transmission by choosing a path with the lowest "cost." The smaller the number, the lower the "cost."
Interface	This indicates the name of the interface through which the route is forwarded. • brx indicates a LAN interface where x can be 0 – 3 to represent LAN1 to LAN4 respectively. • ethx indicates an Ethernet WAN interface using IPoE or in bridge mode. • ppp0 indicates a WAN interface using PPPoE. • wlx indicates a wireless interface where x can be 0 – 1.

CHAPTER 30

Multicast Status

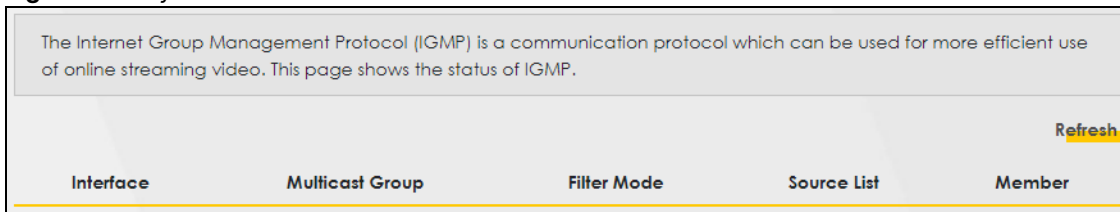
30.1 Multicast Status Overview

Use the **Multicast Status** screens to look at IGMP/MLD group status and traffic statistics.

30.2 The IGMP Status Screen

Use this screen to look at the current list of multicast groups the Zyxel Device manages through IGMP. Configure IGMP in **Network Setting > IGMP/MLD**. To open this screen, click **System Monitor > Multicast Status > IGMP Status**.

Figure 251 System Monitor > Multicast Status > IGMP Status



The Internet Group Management Protocol (IGMP) is a communication protocol which can be used for more efficient use of online streaming video. This page shows the status of IGMP.				
Refresh				
Interface	Multicast Group	Filter Mode	Source List	Member

The following table describes the labels in this screen.

Table 167 System Monitor > Multicast Status > IGMP Status

LABEL	DESCRIPTION
Refresh	Click this button to update the information on this screen.
Interface	This field displays the name of an interface on the Zyxel Device that belongs to an IGMP multicast group.
Multicast Group	This field displays the name of the IGMP multicast group to which the interface belongs.
Filter Mode	INCLUDE means that only the IP addresses in the Source List get to receive the multicast group's traffic. EXCLUDE means that the IP addresses in the Source List are not allowed to receive the multicast group's traffic but other IP addresses can.
Source List	This is the list of IP addresses that are allowed or not allowed to receive the multicast group's traffic depending on the filter mode.
Member	This is the list of the members of the multicast group.

30.3 The MLD Status Screen

Use this screen to look at the current list of multicast groups the Zyxel Device manages through MLD. Configure MLD in **Network Setting > IGMP/MLD**. To open this screen, click **System Monitor > Multicast Status > MLD Status**.

Figure 252 System Monitor > Multicast Status > MLD Status

The Multicast Listener Discovery (MLD) is a communication protocol for IPv6 which can be used for more efficient use of online streaming video. This page shows the status of MLD.

Refresh

Interface	Multicast Group	Filter Mode	Source List	Member
-----------	-----------------	-------------	-------------	--------

The following table describes the labels in this screen.

Table 168 System Monitor > Multicast Status > MLD Status

LABEL	DESCRIPTION
Refresh	Click this button to update the status on this screen.
Interface	This field displays the name of an interface on the Zyxel Device that belongs to an MLD multicast group.
Multicast Group	This field displays the name of the MLD multicast group to which the interface belongs.
Filter Mode	INCLUDE means that only the IP addresses in the Source List get to receive the multicast group's traffic. EXCLUDE means that the IP addresses in the Source List are not allowed to receive the multicast group's traffic but other IP addresses can.
Source List	This is the list of IP addresses that are allowed or not allowed to receive the multicast group's traffic depending on the filter mode.
Member	This is the list of members in the multicast group.

CHAPTER 31

xDSL Statistics

31.1 xDSL Statistics Overview

You can view information about DSL statistics, such as port details, in this screen.

31.2 xDSL Statistics

Use this screen to view detailed **DSL statistics**. Click **System Monitor > xDSL Statistics** to open the following screen.

Note: This screen is only available if your Zyxel Device is a DSL gateway.

Figure 253 System Monitor > xDSL Statistics

xDSL Statistics

Use this screen to view detailed DSL information. It allows you to see the DSL status, check port details, and see DSL counters.

Monitor

TypeStatsRefresh IntervalNo RefreshLineLine 0

Status

=====

xDSL Training Status: Idle
Mode: G.DMT
Traffic Type: Inactive
Link Uptime: N/A

=====

xDSL Port Details	Upstream	Downstream
Line Rate:	0.000 Mbps	0.000 Mbps
Actual Net Data Rate:	0.000 Mbps	0.000 Mbps
Trellis Coding:	N/A	N/A
SNR Margin:	0.0 dB	0.0 dB

=====

The following table describes the labels in this screen.

Table 169 System Monitor > xDSL Statistics

LABEL	DESCRIPTION
Monitor	
Type	Select the type of DSL line for refreshing statistics.
Refresh Interval	Select the time interval for refreshing statistics.
Line	Select which DSL line's statistics you want to display.
Status	
xDSL Training Status	This displays the current state of setting up the DSL connection.
Mode	This displays the ITU standard used for this connection.
Traffic Type	This displays the type of traffic the DSL port is sending and receiving. Inactive displays if the DSL port is not currently sending or receiving traffic.
Link Uptime	This displays how long the port has been running (or connected) since the last time it was started.
xDSL Port Details	
Upstream	These are the statistics for the traffic direction going out from the port to the service provider.
Downstream	These are the statistics for the traffic direction coming into the port from the service provider.
Line Rate	These are the data transfer rates at which the port is sending and receiving data.
Actual Net Data Rate	These are the rates at which the port is sending and receiving the payload data without transport layer protocol headers and traffic.
Trellis Coding	This displays whether or not the port is using Trellis coding for traffic it is sending and receiving. Trellis coding helps to reduce the noise in ADSL transmissions. Trellis may reduce throughput but it makes the connection more stable.
SNR Margin	This is the upstream and downstream Signal-to-Noise Ratio margin (in dB). A DMT sub-carrier's SNR is the ratio between the received signal power and the received noise power. The signal-to-noise ratio margin is the maximum that the received noise power could increase with the system still being able to meet its transmission targets.
Actual Delay	This is the upstream and downstream interleave delay. It is the wait (in milliseconds) that determines the size of a single block of data to be interleaved (assembled) and then transmitted. Interleave delay is used when transmission error correction (Reed- Solomon) is necessary due to a less than ideal telephone line. The bigger the delay, the bigger the data block size, allowing better error correction to be performed.
Transmit Power	This is the upstream and downstream far end actual aggregate transmit power (in dBm). Upstream is how much power the port is using to transmit to the service provider. Downstream is how much power the service provider is using to transmit to the port.
Receive Power	Upstream is how much power the service provider is receiving from the port. Downstream is how much power the port is receiving from the service provider.
Actual INP	Sudden spikes in the line's level of external noise (impulse noise) can cause errors and result in lost packets. This could especially impact the quality of multimedia traffic such as voice or video. Impulse noise protection (INP) provides a buffer to allow for correction of errors caused by error correction to deal with this. The number of DMT (Discrete Multi-Tone) symbols shows the level of impulse noise protection for the upstream and downstream traffic. A higher symbol value provides higher error correction capability, but it causes overhead and higher delay which may increase error rates in received multimedia data.
Attainable Net Data Rate	These are the highest theoretically possible transfer rates at which the port could send and receive payload data without transport layer protocol headers and traffic.
xDSL Counters	
Downstream	These are the statistics for the traffic direction coming into the port from the service provider.
Upstream	These are the statistics for the traffic direction going out from the port to the service provider.

Table 169 System Monitor > xDSL Statistics (continued)

LABEL	DESCRIPTION
FEC	This is the number of Far End Corrected blocks.
CRC	This is the number of Cyclic Redundancy Checks.
ES	This is the number of Errored Seconds meaning the number of seconds containing at least one error block or at least one defect.
SES	This is the number of Severely Errored Seconds meaning the number of seconds containing 30% or more error blocks or at least one defect. This is a subset of ES.
UAS	This is the number of UnAvailable Seconds.
LOS	This is the number of Loss Of Signal seconds.
LOF	This is the number of Loss Of Frame seconds.
LOM	This is the number of Loss Of Margin seconds.
Retr	This is the number of DSL retraining count in BRCM DSL driver.
HostInitRetr	This is the number of the retraining counts the host initiated.
FailedRetr	This is the number of failed retraining attempts.

CHAPTER 32

WLAN Station Status

32.1 WLAN Station Status Overview

Click **System Monitor > WLAN Station Status** to open the following screen. Use this screen to view information and status of the WiFi stations (WiFi clients) that are currently associated with the Zyxel Device. Being associated means that a WiFi client (for example, your computer with a WiFi network card installed) has connected successfully to an AP (or WiFi router) using the same SSID, channel, and WiFi security settings.

Figure 254 System Monitor > WLAN Station Status (For 2.4 GHz and 5 GHz models)

WLAN Station Status

Use this screen to view information and status of the wireless stations (wireless clients) that are currently associated with the Zyxel Device. Being associated means that a wireless client (for example, your computer with a wireless network card installed) has connected successfully to an AP (or wireless router) using the same SSID, channel, and WiFi security settings.

Refresh Interval

WLAN 2.4G Station Status

#	MAC Address	Rate (Mbps)	RSSI (dBm)	SNR	Level
---	-------------	-------------	------------	-----	-------

WLAN 5G Station Status

#	MAC Address	Rate (Mbps)	RSSI (dBm)	SNR	Level
---	-------------	-------------	------------	-----	-------

WLAN MLO Station Status

#	MAC Address	Rate (Mbps)	RSSI (dBm)	SNR	Level
---	-------------	-------------	------------	-----	-------

Figure 255 System Monitor > WLAN Station Status (for 2.4 GHz, 5 GHz, and 6 GHz models)

WLAN Station Status

Use this screen to view information and status of the wireless stations (wireless clients) that are currently associated with the Zyxel Device. Being associated means that a wireless client (for example, your computer with a wireless network card installed) has connected successfully to an AP (or wireless router) using the same SSID, channel, and WiFi security settings.

Refresh Interval None

WLAN 2.4G Station Status

#	IP	MAC Address	SSID	Rate (Mbps)	RSSI (dBm)	SNR	Level	Channel

WLAN 5G Station Status

#	IP	MAC Address	SSID	Rate (Mbps)	RSSI (dBm)	SNR	Level	Channel

WLAN 6G Station Status

#	IP	MAC Address	SSID	Rate (Mbps)	RSSI (dBm)	SNR	Level	Channel

WLAN MLO Station Status

#	MAC Address	Rate (Mbps)	RSSI (dBm)	SNR	Level

The following table describes the labels in this screen.

Table 170 System Monitor > WLAN Station Status

LABEL	DESCRIPTION
#	This is the index number of an associated WiFi station.
IP	This field displays the IP address of an associated WiFi station.
MAC Address	This field displays the MAC address of an associated WiFi station.
SSID	This field displays the SSID (Service Set Identifier) this WiFi station is associated with.
Rate (Mbps)	This field displays the transmission rate of WiFi traffic between an associated WiFi station and the Zyxel Device.
RSSI (dBm)	The RSSI (Received Signal Strength Indicator) field shows the WiFi signal strength of the station's WiFi connection. The normal range is -30dBm to -79dBm. If the value drops below -80dBm, try moving the associated WiFi station closer to the Zyxel Device to get better signal strength.
SNR	The Signal-to-Noise Ratio (SNR) is the ratio between the received signal power and the received noise power. The greater the number, the better the quality of WiFi. The normal range is 15 to 40. If the value drops below 15, try moving the associated WiFi station closer to the Zyxel Device to get better quality WiFi.

Table 170 System Monitor > WLAN Station Status (continued)

LABEL	DESCRIPTION
Level	This field displays a number which represents the strength of the WiFi signal between an associated WiFi station and the Zyxel Device. The Zyxel Device uses the RSSI and SNR values to determine the strength of the WiFi signal. 5 means the Zyxel Device is receiving an excellent WiFi signal. 4 means the Zyxel Device is receiving a very good WiFi signal. 3 means the Zyxel Device is receiving a weak WiFi signal, 2 means the Zyxel Device is receiving a very weak WiFi signal. 1 means the Zyxel Device is not receiving a WiFi signal.
Channel	This field displays the wireless channel bandwidth of an associated WiFi station.

CHAPTER 33

Cellular Statistics

33.1 Cellular Statistics Overview

Use the **Cellular Statistics** screens to look at cellular Internet connection status. By default, a cellular WAN connection is used as a backup for the wired DSL or Ethernet WAN connections.

33.2 Cellular Statistics Settings

To open this screen, click **System Monitor > Cellular Statistics**. Cellular information is available on this screen only when you insert a compatible cellular dongle in the USB port on the Zyxel Device.

Figure 256 System Monitor > Cellular Statistics

Cellular Statistics

Use the **Cellular Statistics** screens to look at cellular Internet connection status. By default, a cellular WAN connection is used as a backup for the wired DSL/Ethernet WAN connections.

Cellular information is available on this screen only when you insert a compatible cellular dongle in the USB port on the Zyxel Device.

Monitor

Refresh Interval

None

Status

Cellular Status	No Device
Service Provider	N/A
Signal Strength	N/A
Connection Uptime	N/A
Cellular Card Manufacturer	N/A
Cellular Card Model	N/A
Cellular Card F/W Version	N/A
SIM Card IMSI	N/A
VID/PID	N/A

The following table describes the labels in this screen.

Table 171 System Monitor > Cellular Statistics

LABEL	DESCRIPTION
Monitor	
Refresh Interval	Select how often you want the Zyxel Device to update this screen. Select None to stop refreshing.
Status	
Cellular Status	This field displays the status of the cellular Internet connection. This field can display: GSM – Global System for Mobile Communications, 2G GPRS – General Packet Radio Service, 2.5G EDGE – Enhanced Data rates for GSM Evolution, 2.75G WCDMA – Wideband Code Division Multiple Access, 3G HSDPA – High-Speed Downlink Packet Access, 3.5G HSUPA – High-Speed Uplink Packet Access, 3.75G HSPA – HSDPA+HSUPA, 3.75G
Service Provider	This field displays the name of the service provider.
Signal Strength	This field displays the strength of the signal in dBm.
Connection Uptime	This field displays the time the connection has been up.
Cellular Card Manufacturer	This field displays the manufacturer of the cellular card.
Cellular Card Model	This field displays the model name of the cellular card.
Cellular Card F/W Version	This field displays the firmware version of the cellular card.
SIM Card IMSI	The International Mobile Subscriber Identity or IMSI is a unique identification number associated with all cellular networks. This number is provisioned in the SIM card.
VID/PID	This field displays the USB Vendor ID and Product ID of the cellular card.

CHAPTER 34

Optical Signal Status

34.1 Overview

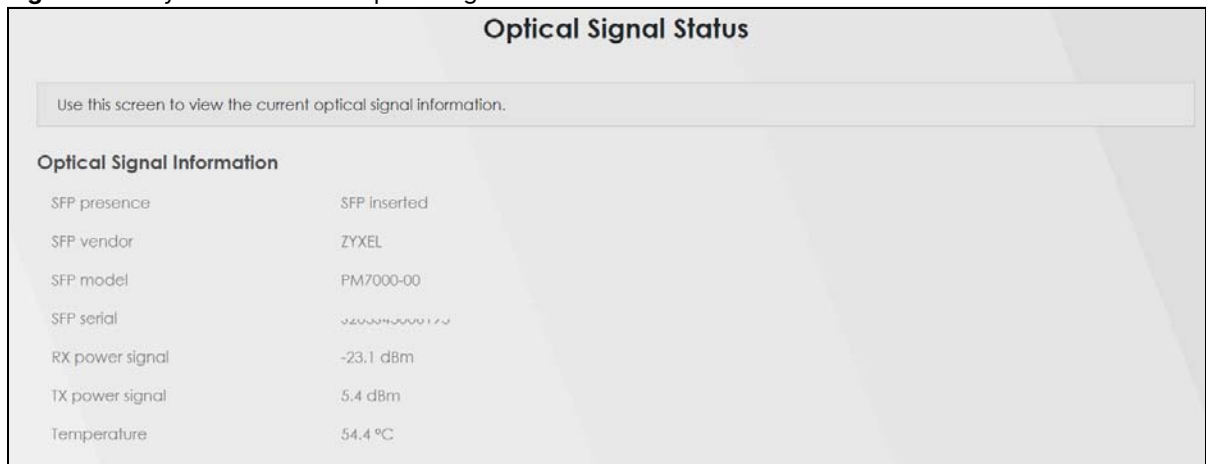
Use this screen to view the PON (Passive Optical Network) transceiver's TX power and RX power level and temperature.

34.2 The Optical Signal Status Screen

Click **System Monitor > Optical Signal Status** to open the **Optical Signal Status** screen to see the real-time DDMI (Digital Diagnostics Monitoring Interface) parameters.

The PON transceiver's support for the DDMI function lets you monitor the PON transceiver's parameters to perform component monitoring, fault isolation, and failure prediction tasks. This allows proactive, preventative network maintenance to help ensure service continuity.

Figure 257 System Monitor > Optical Signal Status



The following table describes the labels in this screen.

Table 172 System Monitor > Optical Signal Status

LABEL	DESCRIPTION
Optical Signal Information	
SFP presence	This displays whether the SFP transceiver is inserted.
SFP vendor	This displays the vendor name of the inserted SFP transceiver.
SFP model	This displays the model name of the inserted SFP transceiver.
SFP serial	This displays the serial number of the inserted SFP transceiver.
RX power signal	This displays the PON transceiver's receiving power in dBm.

Table 172 System Monitor > Optical Signal Status (continued)

LABEL	DESCRIPTION
TX power signal	This displays the PON transceiver's transmitting power in dBm.
Temperature	This displays the PON transceiver's temperature in degrees Celsius.

Note: Make sure the fiber optic cable is well connected to the PON port.

The following table shows the normal range of optical signal information.

Table 173 Normal Range of Optical Signal Information

LABEL	NORMAL RANGE
RX power signal	-9 to -28 dBm Note: The higher the value, the stronger the signal as there is less background noise. For example, -9 dBm is a stronger signal than -28 dBm.
TX power signal	4 to 9 dBm
Temperature	0 to 85 degrees Celsius (185 degrees Fahrenheit)

Note: If the TX and RX power signals of the DDMI are out of range, inspect the fiber optic cable for dirt, any fiber optic cable bends or excessive curves. If the fiber optic cable is clean and undamaged, use the power meter to measure whether the actual RX power signal of the Zyxel Device falls within the normal range.

CHAPTER 35

System

35.1 System Overview

Use this screen to name your Zyxel Device (Host) and give it an associated domain name for identification purposes.

35.2 System

Click **Maintenance** > **System** to open the following screen. Assign a unique name to the Zyxel Device so it can be easily recognized on your network.

Figure 258 Maintenance > System

System

Use this screen to name your Zyxel Device (Host) and give it an associated domain name for identification purposes.

Assign a unique name to the Zyxel Device so it can be easily recognized on your network. You can use up to 30 characters, including spaces.

Host Name

Domain Name

Cancel **Apply**

The following table describes the labels in this screen.

Table 174 Maintenance > System

LABEL	DESCRIPTION
Host Name	Enter a descriptive host name for your Zyxel Device. You can use up to 30 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed. For some models, the supported maximum input length is 16 alphanumeric characters.
Domain Name	Enter a domain name for your host Zyxel Device. You can use up to 30 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Cancel	Click Cancel to abandon this screen without saving.
Apply	Click Apply to save your changes.

CHAPTER 36

User Account

36.1 User Account Overview

In the **User Account** screen, you can view the settings of the “admin” that you use to log into the Zyxel Device to manage it.

The number of accounts you can create:

Administrator Account	4
User Account	4

The privileges of administrator and user accounts differ. Some features are available only to the administrator accounts but are not accessible to user accounts.

Below is an example of the account privilege.

Table 175 Account Privilege Comparison Table - Example

	ADMINISTRATOR	USER
Wizard		
Quick Start	YES	NO
Configuration		
Connection Status	YES	YES
Network		
Broadband	YES	NO
Wireless	YES	NO
Home Networking	YES	NO
Routing	YES	NO
QoS	YES	NO
NAT	YES	NO
DNS	YES	NO
IGMP/MLD	YES	NO
Interface Grouping	YES	NO
Security		
Firewall	YES	NO
Mac Filter	YES	NO
Certificates	YES	NO
System Monitor		
Log	YES	YES

Table 175 Account Privilege Comparison Table - Example (continued)

	ADMINISTRATOR	USER
Traffic Status	YES	YES
ARP Table	YES	YES
Routing Table	YES	YES
Multicast Status	YES	YES
WLAN Station Status	YES	YES
Maintenance		
System	YES	NO
User Account	YES	YES
Remote Management	YES	YES
Time	YES	YES
Email Notification	YES	YES
Log Setting	YES	YES
Firmware Upgrade	YES	YES
Backup/Restore	YES	YES
Reboot	YES	YES
Diagnostic	YES	YES

36.2 User Account

Click **Maintenance > User Account** to open the following screen. Use this screen to create and manage user accounts and their privileges on the Zyxel Device.

Figure 259 Maintenance > User Account

User Account

In the **User Account** screen, you can view the settings of the "admin" and other user accounts that you use to log into the Zyxel Device to manage it.

Use this screen to create or manage user accounts and their privileges on the Zyxel Device.

+ Add New Account

#	Active	User Name	Retry Times	Idle Timeout	Lock Period	Group	Remote Privilege	Modify
1	☒	admin	3	5	5	Administrator	LAN,WAN	

Cancel Apply

The following table describes the labels in this screen.

Table 176 Maintenance > User Account

LABEL	DESCRIPTION
#	This is the index number.
Active	This indicates whether the user account is active or not. The checkbox is selected when the user account is enabled. It is cleared when it is disabled.

Table 176 Maintenance > User Account (continued)

LABEL	DESCRIPTION
User Name	This displays the name of the account used to log into the Zyxel Device Web Configurator.
Retry Times	This displays the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	This displays the length of inactive time before the Zyxel Device will automatically log the user out of the Web Configurator.
Lock Period	This field displays the length of time a user must wait before attempting to log in again after a number of consecutive wrong passwords have been entered as defined in Retry Times .
Group	This field displays this user has Administrator privileges.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

36.2.1 User Account Add or Edit

Add or change the name of the user account, set the security password and the retry times, and whether this user will have **Administrator** or **User** privileges. Click **Add New Account** or the **Edit** icon of an existing account in the **Maintenance > User Account** to open the following screen.

Figure 260 Maintenance > User Account: Add

User Account Add

Active ☒

User Name

Password

Verify Password

Retry Times (0~5), 0 : Not limit

Idle Timeout Minute(s) (1~60)

Lock Period Minute(s) (5~90)

Group

Remote Privilege ☐ LAN ☐ WAN ☒ LAN/WAN

Cancel OK

Figure 261 Maintenance > User Account: Edit

The following table describes the labels in this screen.

Table 177 Maintenance > User Account > User Account Add/Edit

LABEL	DESCRIPTION
Active	Click to enable (switch turns blue) or disable (switch turns gray) to activate or deactivate the user account.
User Name	Enter a name for this account. You can use up to 31 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed.
Verify Password	Enter the new password again for confirmation.
Retry Times	Enter the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	Enter the length of inactive time before the Zyxel Device will automatically log the user out of the Web Configurator.
Lock Period	Enter the length of time a user must wait before attempting to log in again after a number of consecutive wrong passwords have been entered as defined in Retry Times .
Cancel	Click Cancel to restore your previously saved settings.
OK	Click OK to save your changes.

CHAPTER 37

Remote Management

37.1 Remote Management Overview

Use Remote Management to control web services (HTTP, HTTPS, SSH, SNMP, and Ping) can access the Zyxel Device through which interfaces.

Note: Use the Web Configurator (HTTP) to manage the Zyxel Device.

37.1.1 What You Can Do in this Chapter

- Use the **MGMT Services** screen to allow various approaches to access the Zyxel Device remotely from a WAN and/or LAN connection ([MGMT Services](#)).
- Use the **Trust Domain** screen to enable users to permit access from local management services by entering specific IP addresses ([Trust Domain](#)).

37.2 MGMT Services

Use this screen to configure the interfaces through which services can access the Zyxel Device. You can also specify service port numbers computers must use to connect to the Zyxel Device. Click **Maintenance > Remote Management > MGMT Services** to open the following screen.

Figure 262 Maintenance > Remote Management > MGMT Services

Remote Management

MGMT Services Trust Domain

Use this screen to configure the interfaces through which services can access the Zyxel Device. You can also specify service port numbers computers must use to connect to the Zyxel Device.

Service Control

WAN Interface used for services ☐ Any_WAN ☒ Multi_WAN

☒ WWAN ☒ ADSL ☒ VDSL ☒ ETHWAN

Service	LAN	WLAN	WAN	Trust Domain	Port
HTTPS	☒ Enable	☒ Enable	☐ Enable	☐ Enable	443
SSH	☒ Enable	☒ Enable	☐ Enable	☐ Enable	22
SNMP	☒ Enable	☒ Enable	☐ Enable	☐ Enable	161
PING	☒ Enable	☒ Enable	☐ Enable	☐ Enable	

Cancel **Apply**

Figure 263 Maintenance > Remote Management > MGMT Services (PON devices)

Remote Management

MGMT Services Trust Domain

Use this screen to configure the interfaces through which services can access the Zyxel Device. You can also specify service port numbers computers must use to connect to the Zyxel Device.

Service Control

WAN Interface used for services ☒ Any_WAN ☐ Multi_WAN

☐ WWAN ☐ GPON ☐ GPON-1 ☐ GPON-2

Service	LAN	WLAN	WAN	Trust Domain	Port
HTTPS	☒ Enable	☒ Enable	☐ Enable	☐ Enable	443
SSH	☒ Enable	☒ Enable	☐ Enable	☐ Enable	22
SNMP	☒ Enable	☒ Enable	☐ Enable	☐ Enable	161
PING	☒ Enable	☒ Enable	☐ Enable	☐ Enable	

Cancel **Apply**

The following table describes the fields in this screen.

Table 178 Maintenance > Remote Management > MGMT Services

LABEL	DESCRIPTION
Service Control	
WAN Interface used for services	Select Any_WAN to have the Zyxel Device automatically activate the remote management service when any WAN connection is up. Select Multi_WAN and then select one or more WAN connections to have the Zyxel Device activate the remote management service when the selected WAN connections are up.
WWAN	Enable the WWAN (cellular) connection configured in Network Setting > Broadband > Cellular Backup to access the service on the Zyxel Device.
GPON	Enable the Gigabit Ethernet Passive Optical Network WAN connection configured in Network Setting > Broadband > Add New WAN Interface or Modify to access the service on the Zyxel Device.
Service	This is the service you may use to access the Zyxel Device.
LAN	Select the Enable checkbox for the corresponding services that you want to allow access to the Zyxel Device from the LAN.
WLAN	Select the Enable checkbox for the corresponding services that you want to allow access to the Zyxel Device from the WLAN.
WAN	Select the Enable checkbox for the corresponding services that you want to allow access to the Zyxel Device from all WAN connections.
Trust Domain	Select the Enable checkbox for the corresponding services that you want to allow access to the Zyxel Device from the trusted host IP address.
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Redirect	To allow only secure Web Configurator access, select this to redirect all HTTP connection requests to the HTTPS server. For example, if you enter http://192.168.1.1 in your browser to access the Web Configurator, then the Zyxel Device will automatically change this to the more secure https://192.168.1.1 for access.
Apply	Click Apply to save your changes back to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.

37.3 Trust Domain

Use this screen to view a list of public IP addresses which are allowed to access the Zyxel Device through the services configured in the **Maintenance > Remote Management > MGMT Services** screen. Click **Maintenance > Remote Management > Trust Domain** to open the following screen.

Note: Enter the IP address of the management station permitted to access the local management services. If specific services from the trusted hosts are allowed access but the trust domain list is empty, all public IP addresses can access the Zyxel Device from the WAN using the specified services.

Figure 264 Maintenance > Remote Management > Trust Domain

View a list of public IP addresses which you want to allow access to the Zyxel Device through the services configured in this screen.

If this list is empty, all public IP addresses can access the Zyxel Device from the WAN through the specified services.

+ Add Trust Domain

IP Address	Delete
------------	--------

The following table describes the fields in this screen.

Table 179 Maintenance > Remote Management > Trust Domain

LABEL	DESCRIPTION
Add Trust Domain	Click this to add a trusted host IP address.
IP Address	This field shows a trusted host IP address.
Delete	Click the Delete icon to remove the trusted host IP address.

37.3.1 Add Trust Domain

Use this screen to add a public IP addresses or a complete domain name of a device which is allowed to access the Zyxel Device. Enter the IP address of the management station permitted to access the local management services. If specific services from the trusted-hosts are allowed access but the trust domain list is empty, all public IP addresses can access the Zyxel Device from the WAN using the specified services.

Click the **Add Trust Domain** button in the **Maintenance > Remote Management > Trust Domain** screen to open the following screen.

Figure 265 Maintenance > Remote Management > Trust Domain > Add Trust Domain

Add Trust Domain

Enter the IP address of the management station permitted to access the local management services. If specific services from the trusted hosts are allowed access but the trust domain list is empty, all public IP addresses can access the Zyxel Device from the WAN using the specified services.

IP Address [/prefix length]

Cancel **OK**

The following table describes the fields in this screen.

Table 180 Maintenance > Remote Management > Trust Domain > Add Trust Domain

LABEL	DESCRIPTION
IP Address	Enter a public IPv4/IPv6 IP address which is allowed to access the service on the Zyxel Device from the WAN.
OK	Click OK to save your changes back to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.

CHAPTER 38

Power Monitor

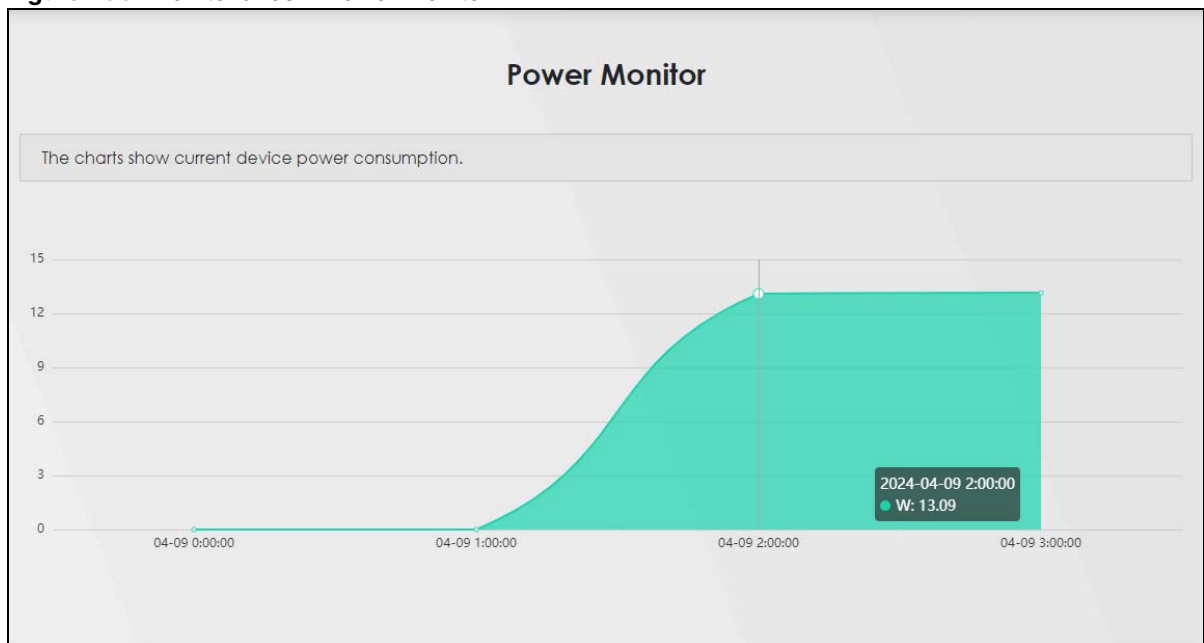
38.1 Power Monitor Overview

This chapter explains how to monitor the power consumption of the Zyxel Device.

38.2 Power Monitoring

Click **Maintenance > Power Monitor** to open the following screen. Use this screen to view the current and past amount of power consumed by the Zyxel Device.

Figure 266 Maintenance > Power Monitor



The following table describes the fields in this screen.

Table 181 Maintenance > Power Monitor

LEGEND	DESCRIPTION
Y-axis	The y-axis shows the amount of power consumed by the Zyxel Device in watts.
X-axis	The x-axis shows the period over which the power consumption is recorded. The maximum period for recording is 48 hours. After 48 hours, the power consumption data wraps around and new ones replace the earliest ones.

Note: The power consumption data is lost when you turn off the power to your Zyxel Device or when the Zyxel Device is reset to its factory default setting.

CHAPTER 39

Time Settings

39.1 Time Settings Overview

This chapter shows you how to configure system related settings, such as system date and time.

39.2 Time

For effective scheduling and logging, the Zyxel Device system time must be accurate. Use this screen to configure the Zyxel Device's time based on your local time zone. You can enter a time server address, select the time zone where the Zyxel Device is physically located, and configure Daylight Savings settings if needed.

To change your Zyxel Device's time and date, click **Maintenance** > **Time**. The screen appears as shown.

Figure 267 Maintenance > Time

Configure the Zyxel Device's time based on your local time zone. You can add a time server address, select your time zone, and configure Daylight Savings if your location uses it.

Current Date/Time

Current Time 14:21:53
Current Date 2019-02-27

Time and Date Setup

Time Protocol SNTP (RFC-1769)

First Time Server Address pool.ntp.org
Second Time Server Address clock.nyc.he.net
Third Time Server Address clock.sjc.he.net
Fourth Time Server Address None
Fifth Time Server Address None

Time Zone

Time Zone (GMT+08:00) Taipei

Daylight Savings

Active ☒

Start Rule

Day ☒ 1 in
☐ Last Sunday in

Month March
Hour 2 0

End Rule

Day ☒ 1 in
☐ Last Sunday in

Month October
Hour 3 0

Cancel Apply

The following table describes the fields in this screen.

Table 182 Maintenance > Time

LABEL	DESCRIPTION
Current Date/Time	
Current Time	This displays the time of your Zyxel Device. Each time you reload this screen, the Zyxel Device synchronizes the time with the time server.
Current Date	This displays the date of your Zyxel Device. Each time you reload this screen, the Zyxel Device synchronizes the date with the time server.
Time and Date Setup	
Time Protocol	This displays the time protocol used by your Zyxel Device.

Table 182 Maintenance > Time (continued)

LABEL	DESCRIPTION
First – Fifth Time Server Address	Select an NTP time server from the drop-down list box. Otherwise, select Other and enter the IP address or URL (up to 29 printable characters in length) of your time server. Select None if you do not want to configure the time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone	
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 Savings Daylight Saving Time is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.	
Active	Click this switch to enable or disable Daylight Saving Time. When the switch turns blue, the function is enabled. Otherwise, it is not.
Start Rule	Configure the day and time when Daylight Saving Time starts if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The Time field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States, set the day to Second, Sunday, the month to March and the time to 2 in the Hour field. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to Last, Sunday and the month to March. The time you select in the o'clock field depends on your time zone. In Germany for instance, you would select 2 in the Hour field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Rule	Configure the day and time when Daylight Saving Time ends if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The Time field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would set the day to First, Sunday, the month to November and the time to 2 in the Hour field. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to Last, Sunday, and the month to October. The time you select in the o'clock field depends on your time zone. In Germany for instance, you would select 2 in the Hour field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Cancel	Click Cancel to exit this screen without saving.
Apply	Click Apply to save your changes.

CHAPTER 40

Email Notification

40.1 Email Notification Overview

A mail server is an application or a computer that can receive, forward and deliver email messages.

To have the Zyxel Device send reports, logs or notifications through email, you must specify an email server and the email addresses of the sender and receiver.

40.2 Email Notification

Use this screen to view, remove and add email account information on the Zyxel Device. This account can be set to send email notifications for logs.

Click **Maintenance > E-mail Notification** to open the **E-mail Notification** screen.

Note: The default port number of the mail server is 25.

Figure 268 Maintenance > E-mail Notification

E-mail Notification

A mail server is an application or a computer that can receive, forward and deliver e-mail messages.

To have the modem send reports, logs or notifications via e-mail, you must specify an e-mail server and the e-mail addresses of the sender and receiver.

Use this screen to view, remove and add e-mail account information on the modem. This account can be set to receive e-mail notifications for logs.

 Add New e-mail

Mail Server Address	Username	Port	Security	E-mail Address	Modify	Remove
---------------------	----------	------	----------	----------------	--------	--------

 Note
The default port number of the mail server is 25.

The following table describes the labels in this screen.

Table 183 Maintenance > E-mail Notification

LABEL	DESCRIPTION
Add New e-mail	Click this button to create a new entry (up to 32 can be created).
Mail Server Address	This displays the server name or the IP address of the mail server.
Username	This displays the user name of the sender's mail account.
Port	This field displays the port number of the mail server.
Security	This field displays the protocol used for encryption.
E-mail Address	This field displays the email address that you want to be in the from or sender line of the email that the Zyxel Device sends.
Modify	Click the Edit icon to configure the entry. Click the Delete icon to remove the entry.
Remove	Click this button to delete the selected entries.

40.2.1 E-mail Notification Edit

Click the **Add** button in the **E-mail Notification** screen. Use this screen to configure the required information for sending email through a mail server.

Figure 269 Maintenance > E-mail Notification > Add

Add New e-mail

E-mail Notification Configuration

Mail Server Address (SMTP Server NAME or IP)

Port Default:25

Authentication Username

Authentication Password

Account e-mail Address

Connection Security ☐ SSL ☒ STARTTLS

Cancel **OK**

The following table describes the labels in this screen.

Table 184 Maintenance > E-mail Notification > Add

LABEL	DESCRIPTION
Mail Server Address	Enter the server name or the IP address of the mail server for the email address specified in the Account e-mail Address field. If this field is left blank, reports, logs or notifications will not be sent through email.
Port	Enter the same port number here as is on the mail server for mail traffic.
Authentication Username	Enter the user name. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [\$], [], [&], or [;]. Spaces are allowed. This is usually the user name of a mail account you specified in the Account email Address field.
Authentication Password	Enter the password associated with the user name above.
Account e-mail Address	Enter the email address that you want to be in the from or sender line of the email notification that the Zyxel Device sends. If you activate SSL/TLS authentication, the email address must be able to be authenticated by the mail server as well.
Cancel	Click this button to begin configuring this screen afresh.
OK	Click this button to save your changes and return to the previous screen.

CHAPTER 41

Log Setting

41.1 Log Setting Overview

You can configure where the Zyxel Device sends logs and which type of logs the Zyxel Device records in the **Logs Setting** screen.

41.2 Log Setting

Use this screen to configure where the Zyxel Device sends logs, and which type of logs the Zyxel Device records.

If you have a server that is running a syslog service, you can also save log files to it by enabling **Syslog Logging**, and then entering the IP address of the server in the **Syslog Server** field. Select **Remote** to store logs on the syslog server, or select **Local File** to store logs on the Zyxel Device. Select **Local File and Remote** to store logs on both the Zyxel Device and the syslog server. To change your Zyxel Device's log settings, click **Maintenance > Log Setting**. The screen appears as shown.

Figure 270 Maintenance > Log Setting

Log Settings

Use this screen to configure where the Zyxel Device sends logs, and which type of logs the Zyxel Device records.

If you have a server that is running a syslog service, you can also save log files to it by enabling **Syslog Logging** and then entering the IP address of the server in the **Syslog Server** field. Select **Remote** to store logs on the syslog server, or select **Local File** to store logs on the Zyxel Device. Select **Local File and Remote** to store logs on both the Zyxel Device and on the syslog server.

Syslog Settings

Syslog Logging

☒

Mode

Local File and Remote

Syslog Server

0.0.0.0

(Server NAME or IPv4/IPv6 Address)

UDP Port

514

(Server Port)

Enable Syslog over TLS

☒

Local Certificate Used by Syslog Client

E-mail Log Settings

E-mail Log Settings

☒

Mail Account

Select one account

System Log Mail Subject

Security Log Mail Subject

Send Log to

(E-Mail Address)

Send Alarm to

(E-Mail Address)

Alarm Interval

60

(seconds)

Active Log

System Log

☒ WAN-DHCP

☒ DHCP Server

☒ PPPoE

☐ TR-069

☐ HTTP

☐ UPNP

☒ System

☒ xDSL

☐ ACL

☐ Wireless

☐ MESH

☐ IGMP

☐ Voice

☐ ZYEE

Security Log

☐ Account

☒ Attack

☒ Firewall

☐ MAC Filter

Cancel

Apply

The following table describes the fields in this screen.

Table 185 Maintenance > Log Setting

LABEL	DESCRIPTION
Syslog Settings	
Syslog Logging	Slide the switch to the right to enable syslog logging.
Mode	Select Remote to have the Zyxel Device send to an external syslog server. Select Local File to have the Zyxel Device save the log file on the Zyxel Device itself. Select Local File and Remote to have the Zyxel Device save the log file on the Zyxel Device itself and send it to an external syslog server. Note: A warning appears upon selecting Remote or Local File and Remote. Just click OK to continue.
Syslog Server	Enter the server name or IP address of the syslog server that will log the selected categories of logs.
UDP Port	Enter the port number used by the syslog server.
E-mail Log Settings	
E-mail Log Settings	Slide the switch to the right to allow to the email address specified in Send Log to. Note: Make sure that the Mail Server Address field is not left blank in the Maintenance > E-mail Notifications screen.
Mail Account	Select a server specified in Maintenance > E-mail Notifications to send the logs to.
System Log Mail Subject	This field allows you to enter a descriptive name for the system log email (for example Zyxel System Log). Up to 127 printable characters are allowed for the System Log Mail Subject including special characters inside the square brackets [!#%()*+,-./:=?@[{}~].
Security Log Mail Subject	This field allows you to enter a descriptive name for the security log email (for example Zyxel Security Log). Up to 127 printable characters are allowed for the Security Log Mail Subject including special characters inside the square brackets [!#%()*+,-./:=?@[{}~].
Send Log to	This field allows you to enter the log's designated email recipient. The log's format is plain text file sent as an email attachment.
Send Alarm to	This field allows you to enter the alarm's designated e-mail recipient. The alarm's format is plain text file sent as an email attachment.
Alarm Interval	Select the frequency of showing of the alarm.
Active Log	
System Log	Select the categories of System Logs that you want to record.
Security Log	Select the categories of Security Logs that you want to record.
Apply	Click Apply to save your changes.
Cancel	Click Cancel to restore your previously saved settings.

41.2.1 Example Email Log

An 'End of Log' message displays for each mail in which a complete log has been sent. The following is an example of a log sent by email.

- You may edit the subject title.
- The date format here is Day-Month-Year.
- The date format here is Month-Day-Year. The time format is Hour-Minute-Second.
- 'End of Log' message shows that a complete log has been sent.

Figure 271 Email Log Example

```

Subject: Firewall Alert From
Date: Fri, 07 Apr 2000 10:05:42
From: user@zyxel.com
To: user@zyxel.com

1|Apr 7 00 |From:192.168.1.1      To:192.168.1.255 |default policy |forward
  |09:54:03 |UDP      src port:00520 dest port:00520 |<1,00>         |
2|Apr 7 00 |From:192.168.1.131     To:192.168.1.255 |default policy |forward
  |09:54:17 |UDP      src port:00520 dest port:00520 |<1,00>         |
3|Apr 7 00 |From:192.168.1.6       To:10.10.10.10   |match          |forward
  |09:54:19 |UDP      src port:03516 dest port:00053 |<1,01>         |
.....{snip}.....
.....{snip}.....
126|Apr 7 00 |From:192.168.1.1      To:192.168.1.255 |match          |forward
   |10:05:00 |UDP      src port:00520 dest port:00520 |<1,02>         |
127|Apr 7 00 |From:192.168.1.131     To:192.168.1.255 |match          |forward
   |10:05:17 |UDP      src port:00520 dest port:00520 |<1,02>         |
128|Apr 7 00 |From:192.168.1.1      To:192.168.1.255 |match          |forward
   |10:05:30 |UDP      src port:00520 dest port:00520 |<1,02>         |

End of Firewall Log

```

CHAPTER 42

Firmware Upgrade

42.1 Firmware Upgrade Overview

This chapter explains how to upload new firmware to your Zyxel Device if you get new firmware releases from your service provider.

42.2 Firmware Upgrade

This screen lets you upload new firmware to your Zyxel Device.

Get the latest firmware from your service provider. Then upload the firmware file to your Zyxel Device. The upload process uses HTTP (Hypertext Transfer Protocol). The upload may take up to 3 minutes. After a successful upload, the Zyxel Device will reboot.

Click **Maintenance > Firmware Upgrade** to open the **following** screen.

Do NOT turn off the Zyxel Device while firmware upload is in progress!

Figure 272

Figure 273 Maintenance > Firmware Upgrade

The screenshot shows the 'Firmware Upgrade' screen. At the top, the title 'Firmware Upgrade' is centered. Below it, a light gray box contains instructions: 'This screen lets you upload new firmware to your Zyxel Device.', 'Download the latest firmware file from the Zyxel website and upload it to your Zyxel Device using this screen. The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the Zyxel Device will reboot.', and 'Restore Partial Default Settings After Firmware Upgrade' followed by 'Reset All Settings Except Mesh After Firmware Upgrade resets all your configurations, except for Mesh WiFi settings, to the factory defaults after firmware upgrade.' Below this box, the 'Upgrade Firmware' section has two checkboxes: 'Reset All Settings After Firmware Upgrade' and 'Reset All Settings Except Mesh After Firmware Upgrade', both currently unchecked. It also shows 'Current Firmware Version: V5.18(ACHN.0)b2'. There is a 'File Path' label, a 'Choose File' button, and 'No file chosen' text. To the right is a yellow 'Upload' button. The 'Upgrade WWAN Package' section shows 'Current WWAN Package Version: 1.24', a 'File Path' label, a 'Choose File' button, 'No file chosen' text, and another yellow 'Upload' button.

The following table describes the labels in this screen.

Table 186 Maintenance > Firmware Upgrade

LABEL	DESCRIPTION
Upgrade Firmware	
Restore Default Settings After Firmware Upgrade	Select this to reset all your configurations, including Mesh WiFi settings, to the factory defaults after firmware upgrade. Otherwise, make sure this is cleared if you do not want the Zyxel Device to lose all its current configurations and return to the factory defaults. Note: Make sure to back up the Zyxel Device's configuration settings first in case the reset all settings process is not successful.
File Path	Enter the location of the file you want to upload in this field or click Choose File/Browse to find it.
Choose File/Browse	Click this to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click this to begin the upload process. This process may take up to 3 minutes. Note: Only use firmware for your Zyxel Device's specific model. Refer to the label on the bottom of your Zyxel Device. For example, if the Zyxel Device's current firmware version is V5.70(ACDZ.0)B4, you must upload the firmware file containing "ACDZ".
Online Firmware Upgrade	
Do Online Firmware Upgrade	
Check for Latest Firmware Now	With the Zyxel Device connected to the Internet, click this to check for new firmware online from the Zyxel server. If a newer firmware is available, follow the online prompt to upload the new firmware to your Zyxel Device.

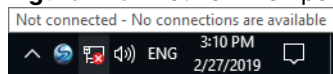
After you see the firmware updating screen, wait a few minutes before logging into the Zyxel Device again.

Figure 274 Firmware Uploading



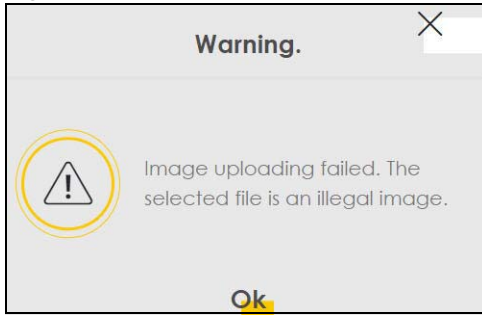
The Zyxel Device automatically restarts in this time, causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 275 Network Temporarily Disconnected



After 2 minutes, log in again and check your new firmware version in the **Connection Status** screen.

If the upload was not successful, an error screen will appear. Click **OK** to go back to the **Firmware Upgrade** screen.

Figure 276 Error Message

42.3 Online Upgrade

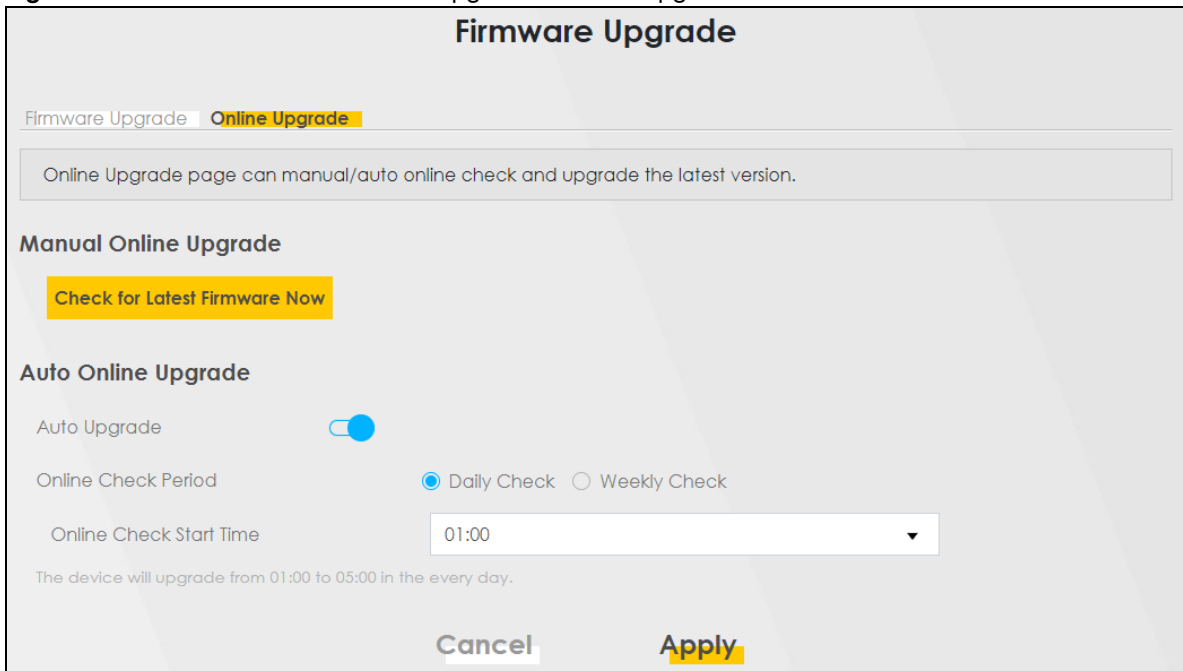
This screen lets you check for new firmware for your Zyxel Device by checking online for the latest firmware file now or scheduling when the Zyxel Device will check online for the latest firmware file.

Note: Make sure your Zyxel Device is connected to the Internet.

The upload process uses HTTP (Hypertext Transfer Protocol) and may take more than 3 minutes. After a successful upload, the Zyxel Device will reboot automatically.

Click **Maintenance > Firmware Upgrade > Online Upgrade** to open the **following** screen.

Do NOT turn off the Zyxel Device while firmware upload is in progress!

Figure 277 Maintenance > Firmware Upgrade > Online Upgrade

The following table describes the labels in this screen.

Table 187 Maintenance > Firmware Upgrade > Online Upgrade

LABEL	DESCRIPTION
Manual Online Upgrade	
Check for Latest Firmware Now	Click this to have the Zyxel Device check for new firmware immediately. If a newer firmware is available, follow the online prompt to upload the new firmware to your Zyxel Device.
Auto Online Upgrade	
Auto Upgrade	Click the switch to the right to activate automatic firmware upgrade. Note: To minimize disruption to your network, the Zyxel Device will upgrade the firmware from 01:00 to 05:00 by default.
Online Check Period	Select Daily Check when you want the Zyxel Device to check online for new firmware everyday. Select Weekly Check when you want the Zyxel Device to check online for new firmware once a week.
The day of every week	Select the day that you want the Zyxel Device to check for new firmware. Note: This field only appears when you select Weekly Check in Online Check Period .
Online Check Start Time	Select the hour of the day that you want the Zyxel Device to check for new firmware.
Cancel	Click Cancel to close the window with changes unsaved.
Apply	Click Apply to save the changes back to the Zyxel Device.

CHAPTER 43

Backup/Restore

43.1 Backup/Restore Overview

Information related to factory default settings and backup configuration are shown in this screen. You can also use this to restore Zyxel Device's previous configurations.

43.2 Backup/Restore

Click **Maintenance** > **Backup/Restore**. Information related to factory defaults, backup configuration, and restoring configuration appears in this screen, as shown next.

Figure 278 Maintenance > Backup/Restore

Backup/Restore

Backup/Restore ROM-D

Information related to factory default settings and backup configuration are shown in this screen. You can also use this to restore previous device configurations.

Backup Configuration allows you to back up (save) the Zyxel Device's current configuration to a file on your computer. Once your Zyxel Device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes.

Restore Configuration allows you to upload a new or previously saved configuration file from your computer to your Zyxel Device.

Backup Configuration

Click Backup to save the current configuration of your system to your computer.

Backup

Restore Configuration

To restore a previously saved configuration file to your system, browse to the location of the configuration file and click Upload.

File Path

Choose File

No file chosen

Upload

Perform Mesh Full Factory Reset

Mesh Full Factory Reset allows you to clear the controller and agents' all user-entered configuration information and return to factory default settings. After resetting, the

- Password is printed on a label on the bottom of the device, written after the text "Password".
- LAN IP address will be 192.168.1.1
- DHCP will be reset to default setting

Reset All Settings

Perform Mesh Partial Factory Reset

Mesh Partial Factory Reset allows you to keep certain user configurables while bringing the reset of the controller and agents to factory default setting.

- System will keep Wi-fi settings, include these user settings (Mesh Enable/Disable, Mesh Controller Mode, Mesh Backhaul information, Single SSID Enable/Disable, SSIDs, WPA keys, Encryption modes, 2.4GHz Enable/Disable, 5GHz Enable/Disable, Guest Wi-Fi Enable/Disable, Guest Wi-Fi Isolation setting, 802.11 Mode, PMF setting)

Reset All Settings Except Mesh

Backup Configuration

Backup Configuration allows you to back up (save) the Zyxel Device's current configuration to a file on your computer. Once your Zyxel Device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Click **Backup** to save the Zyxel Device's current configuration to your computer.

Restore Configuration

Restore Configuration allows you to upload a new or previously saved configuration file from your computer to your Zyxel Device.

Table 188 Maintenance > Backup/Restore: Restore Configuration

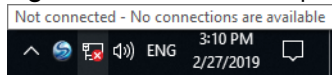
LABEL	DESCRIPTION
File Path	the location of the file you want to upload in this field or click Choose File / Browse to find it.
Choose File / Browse	Click this to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click this to begin the upload process.
Reset	Click this to reset your settings back to the factory default.

Do not turn off the Zyxel Device while configuration file upload is in progress.

After the Zyxel Device configuration has been restored successfully, the login screen appears. Login again to restart the Zyxel Device.

The Zyxel Device automatically restarts in this time, causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

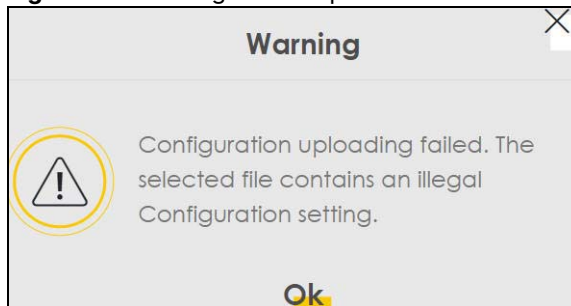
Figure 279 Network Temporarily Disconnected



If you restore the default configuration, you may need to change the IP address of your computer to be in the same subnet as that of the default Zyxel Device IP address (192.168.1.1 – 192.168.225.225).

If the upload was not successful, an error screen will appear. Click **OK** to go back to the **Configuration** screen.

Figure 280 Configuration Upload Error

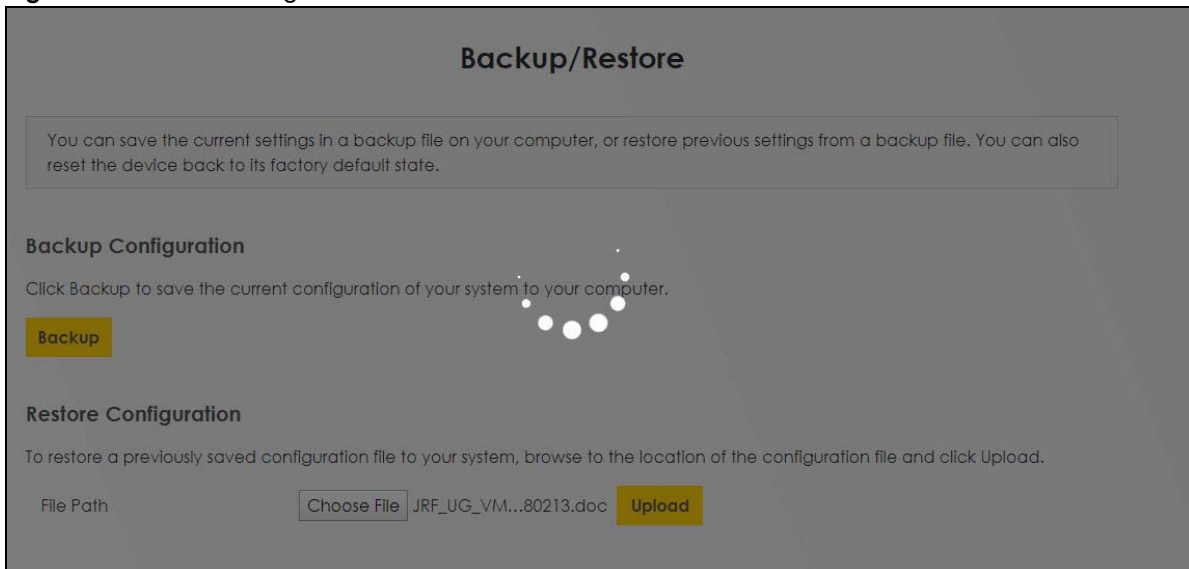


Back to Factory Default Settings

Figure 281 Reset Warning Message



Figure 282 Reset In Progress



You can also press the **Reset** button on the Zyxel Device to reset the Zyxel Device to the factory defaults.

Perform Partial Factory Reset

Click the **Reset All Settings Except Mesh** button to clear all user-entered configuration information and return the Zyxel Device to its factory defaults except for Mesh WiFi settings. The following warning screen appears.

Figure 283 Reset Warning Message

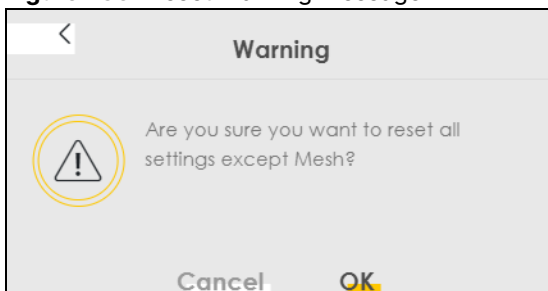
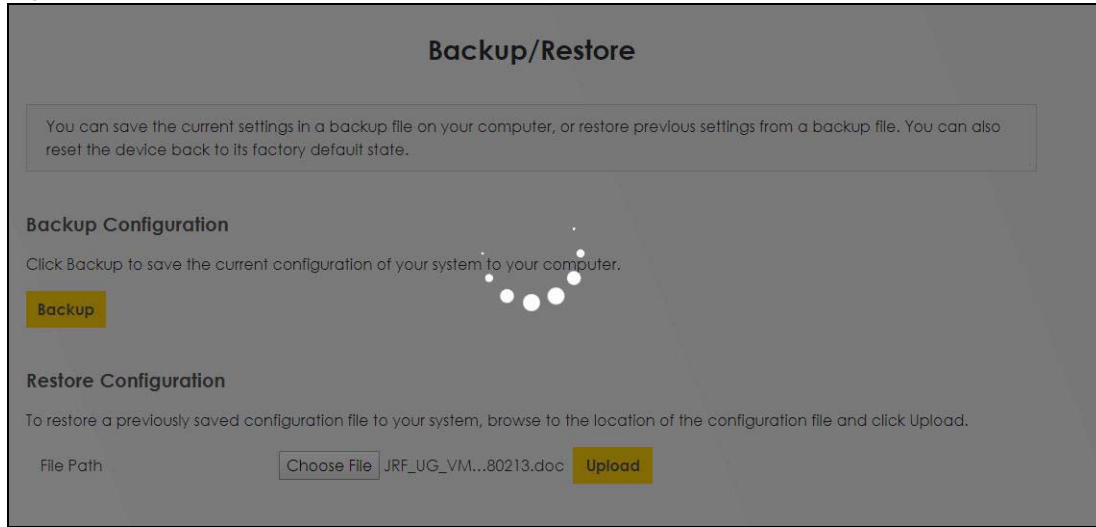


Figure 284 Reset In Process

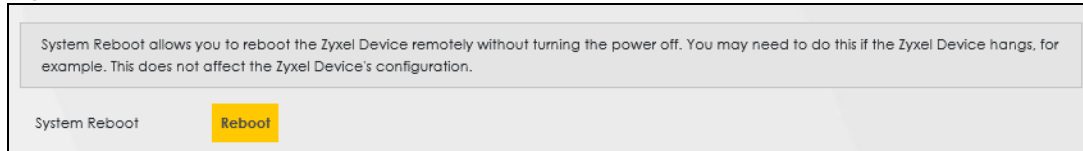
43.3 Reboot

For Zyxel Device supports mesh, this page displays **Mesh Reboot**. For Zyxel Device doesn't not support mesh, this page displays **System Reboot**,

43.3.1 System Reboot

System Reboot allows you to restart the Zyxel Device remotely without turning the power off. You may need to do this if the Zyxel Device hangs, for example. This does not affect the Zyxel Device's configuration.

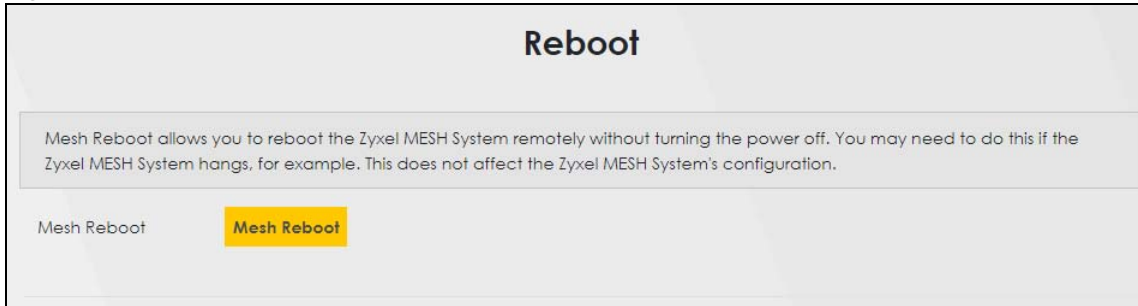
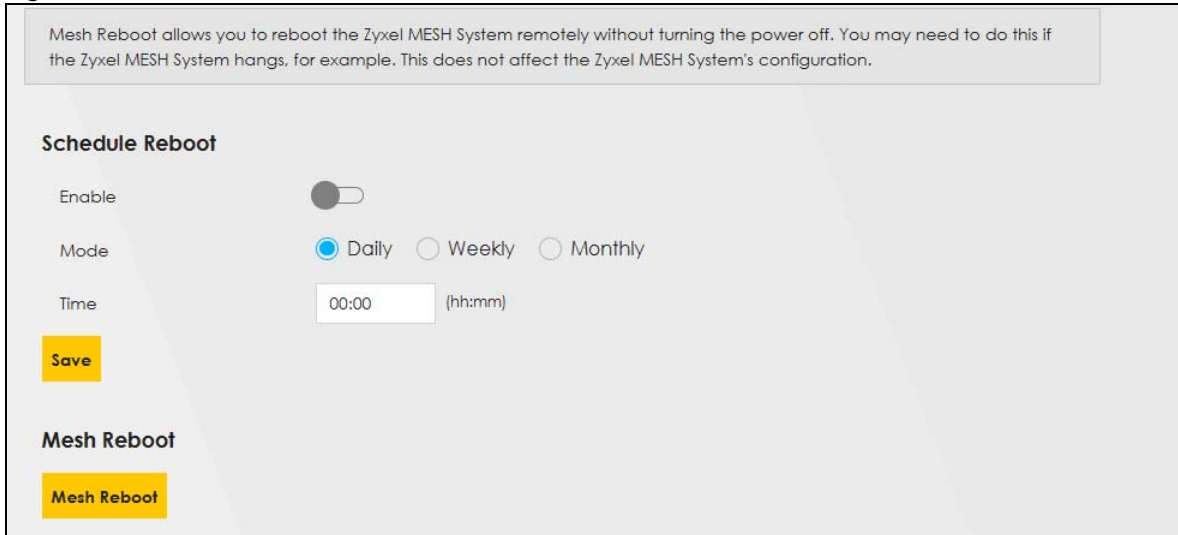
Go to **Maintenance > Reboot**. Click **Reboot** to have the Zyxel Device restart.

Figure 285 Maintenance > Reboot > System Reboot

43.3.2 Mesh Reboot and Schedule Reboot

Mesh Reboot allows you to reboot the Zyxel Mesh system remotely without turning the power off. You may need to do this if the Mesh system hangs, for example. This does not affect the Zyxel Mesh system's configuration.

Go to **Maintenance > Reboot**. Click **Mesh Reboot** to have the Zyxel Mesh system reboot.

Figure 286 Maintenance > Reboot > Mesh Reboot**Figure 287** Maintenance > Reboot > Schedule Reboot and Mesh Reboot

The following table describes the labels in this screen.

Table 189 Maintenance > Reboot > Schedule Reboot and Mesh Reboot

LABEL	DESCRIPTION
Enable	Click this switch to the right to have the Zyxel Device reboot periodically.
Mode	Select the mode to apply periodic rebooting of the Zyxel Device. You can choose from rebooting daily, weekly, or monthly.
Time of Day	Select the time of the day that you plan to reboot the Zyxel Device remotely.
Save	Click this button to save your schedule reboot settings for the Zyxel Device.
Mesh Reboot	Click this button to reboot the Zyxel Mesh system remotely without turning the power off.

CHAPTER 44

Diagnostic

44.1 Diagnostic Overview

The **Diagnostic** screen displays information to help you identify Internet connection problems with the Zyxel Device.

The route between an Ethernet switch and one of its Customer-Premises Equipment (CPE) may go through switches owned by independent organizations. A connectivity fault point generally takes time to discover and impacts subscriber's network access. In order to eliminate the management and maintenance efforts, IEEE 802.1ag is a Connectivity Fault Management (CFM) specification which allows network administrators to identify and manage connection faults. Through discovery and verification of the path, CFM can detect, analyze and isolate connectivity faults in bridged LANs.

44.1.1 What You Can Do in this Chapter

- The **Ping&Traceroute&Nslookup** screen lets you ping an IP address or trace the route packets take to a host ([Diagnostic](#)).

44.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

How CFM Works

A Maintenance Association (MA) defines a VLAN and associated Maintenance End Point (MEP) ports on the device under a Maintenance Domain (MD) level. An MEP port has the ability to send Connectivity Check Messages (CCMs) and get other MEP ports information from neighbor devices' CCMs within an MA.

CFM provides two tests to discover connectivity faults.

- Loopback test – checks if the MEP port receives its Loop Back Response (LBR) from its target after it sends the Loop Back Message (LBM). If no response is received, there might be a connectivity fault between them.
- Link trace test – provides additional connectivity fault analysis to get more information on where the fault is. If an MEP port does not respond to the source MEP, this may indicate a fault. Administrators can take further action to check and resume services from the fault according to the line connectivity status report.

44.3 Diagnostic

Use this screen to ping, traceroute or nslookup for troubleshooting. Ping and traceroute are used to test whether a particular host is reachable. After entering an IP address and clicking one of the buttons to start a test, the results will be shown in the screen. Use nslookup to find the IP address for a host name and the host name for an IP address.

Click **Maintenance > Diagnostic** to open the following screen.

Figure 288 Maintenance > Diagnostic

The **Diagnostic** screens display information to help you identify problems with the Zyxel Device.

Use this screen to ping, traceroute, or nslookup for troubleshooting. Ping and traceroute are used to test whether a particular host is reachable. After entering an IP address and clicking on one of the buttons to start a test, the results will be shown in the Ping/Traceroute Test area. Use nslookup to find the IP address for a host name and vice versa.

Diagnostic Test

TCP/IP

Address

Ping Ping 6 Trace Route Trace Route 6 Nslookup

The following table describes the fields in this screen.

Table 190 Maintenance > Diagnostic

LABEL	DESCRIPTION
Ping/TraceRoute Test	The result of tests is shown here in the info area.
Select Test Method	
Ping	Select this to perform a ping test on the IPv4 address or host name in order to test a connection. The ping statistics will show in the info area.
Ping 6	Select this to perform a ping test on the IPv6 address or host name in order to test a connection. The ping statistics will show in the info area.
Trace Route	Select this to perform the IPv4 trace route function. This determines the path a packet takes to the specified host.
Trace Route 6	Select this to perform the IPv6 trace route function. This determines the path a packet takes to the specified host.
Nslookup	Select this to perform a DNS lookup on the IP address or host name.
TCP/IP	

Table 190 Maintenance > Diagnostic (continued)

LABEL	DESCRIPTION
Address	Enter the IP address of a computer that you want to perform ping, trace route or nslookup in order to test a connection.
Start Test	Click this to perform the selected test method.

PART III

Troubleshooting and Appendices

Appendices contain general information. Some information may not apply to your Zyxel Device.

CHAPTER 45

Troubleshooting

45.1 Troubleshooting Overview

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- [Accessibility and Compatibility Problems](#)
- [Power and Hardware Problems](#)
- [Device Access Problems](#)
- [Internet Problems](#)
- [WiFi Problems](#)
- [Mesh Problems](#)
- [USB Problems](#)
- [VoIP Problems](#)
- [UPnP Problems](#)

45.2 Accessibility and Compatibility Problems

[Screen reader not reading content.](#)

- Ensure the latest version of the screen reader is installed.
- Check if the screen reader's accessibility settings are enabled.

[Web browser not displaying correctly.](#)

- Clear your web browser cache.
- Ensure that JavaScript is enabled.
- Try using a different supported web browser.

45.3 Power and Hardware Problems

The Zyxel Device does not turn on.

- 1 Make sure you are using the power adapter included with the Zyxel Device.
 - 2 Make sure the power adapter is connected to the Zyxel Device and plugged in to an appropriate power source. Make sure the power source is turned on.
 - 3 Disconnect and re-connect the power adapter to the Zyxel Device.
 - 4 Make sure you have pressed the **POWER** button to turn on the Zyxel Device.
 - 5 If the problem continues, contact the vendor.
-

The LED does not behave as expected.

- 1 Make sure you understand the normal behavior of the LED.
 - 2 Check the hardware connections.
 - 3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.
 - 4 Turn the Zyxel Device off and on.
 - 5 If the problem continues, contact the vendor.
-

45.4 Device Access Problems

I do not know the IP address of the Zyxel Device.

- 1 The default IP address is 192.168.1.1.
 - 2 If you changed the IP address, you might be able to find the IP address of the Zyxel Device by looking up the IP address of your computer's default gateway. To do this in Microsoft Windows, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the Zyxel Device, depending on your network environment.
 - 3 If this does not work, reset the Zyxel Device to its factory defaults.
 - Locate a small hole labeled **RESET** on the Zyxel Device.
 - Use a paperclip or a similar tool to press and hold the **RESET** button for more than 5 seconds.
-

- Release the button, and the Zyxel Device will reset to its default settings, including the default IP address, user name, and password.

Note: Resetting the Zyxel Device will erase all your custom settings, so you need to reconfigure it.

I forgot the admin password.

- 1 See the Zyxel Device label or this document's cover page for the default admin password.
- 2 If you changed the password from default and cannot remember the new one, you have to reset the Zyxel Device to its factory default settings.

I cannot access the Web Configurator login screen.

- 1 Make sure you are using the correct IP address.
 - The default IP address is 192.168.1.1.
 - If you changed the IP address, use the new IP address.
 - If you changed the IP address and have forgotten the new address, see the troubleshooting suggestions for [I do not know the IP address of the Zyxel Device](#).
- 2 Check the hardware connections, and make sure the LEDs are behaving as expected.
- 3 Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled.
- 4 Clear the Internet browser cache and try accessing the Web Configurator login screen again. Outdated browser data can cause login issues. If the problem persists, try logging into the web configurator using a different browser. (e.g., Chrome, Firefox, Edge)
- 5 If it is possible to log in from another interface, check the service control settings for HTTP and HTTPS (**Maintenance > Remote Management**).
- 6 Reset the Zyxel Device to its factory default, and try to access the Zyxel Device with the default IP address.
- 7 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

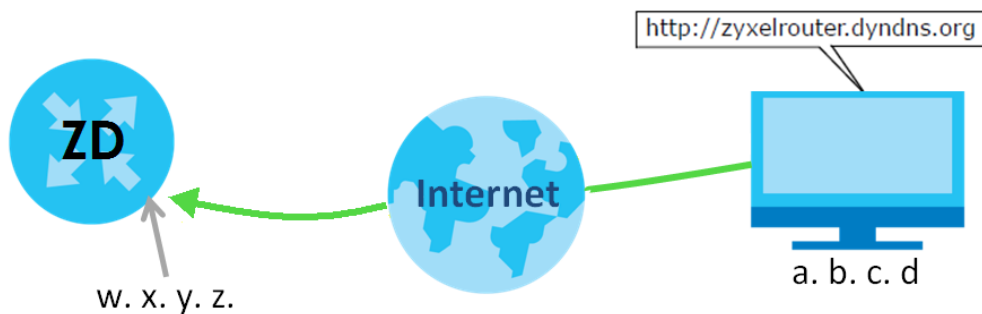
- Make sure you have logged out of any earlier management sessions using the same user account even if they were through a different interface or using a different browser.
- Try to access the Zyxel Device using another service, such as Telnet. If you can access the Zyxel Device, check the remote management settings and firewall rules to find out why the Zyxel Device does not respond to HTTP.

I cannot log into the Zyxel Device.

- 1 For first-time Zyxel Device logins, after using the label password to access the web configurator, ensure your new password meets the requirements on the screen. For example, some models require the new password to be at least 8 characters long and include at least one uppercase letter, one lowercase letter, one number, and one special character.
- 2 Make sure you have entered the user name and password correctly. The default user name is **admin**. These both user name and password are case-sensitive, so make sure [Caps Lock] is not on.
- 3 You cannot log in to the Web Configurator while someone is using Telnet to access the Zyxel Device. Log out of the Zyxel Device in the other session, or ask the person who is logged in to log out.
- 4 Turn the Zyxel Device off and on.
- 5 If this does not work, you have to reset the Zyxel Device to its factory default. To reset the Zyxel Device, press the **RESET** button until the POWER LED begins to blink and then release it.

I cannot log into the Zyxel Device using DDNS.

If you connect your Zyxel Device to the Internet and it uses a dynamic WAN IP address, it is inconvenient for you to manage the Zyxel Device from the Internet. The Zyxel Device's WAN IP address changes dynamically. Dynamic DNS (DDNS) allows you to access the Zyxel Device using a domain name.



To use this feature, you have to apply for DDNS service at www.dyndns.org.

Note: If you have a private WAN IP address, then you cannot use DDNS.

Here are the three steps to use a domain name to log in the Web Configurator:

Step 1 Register for a DDNS Account on www.dyndns.org

- 1 Open a browser and enter **<http://www.dyndns.org>**.
- 2 Apply for a user account. This tutorial uses **UserName1** and **12345** as the username and password.
- 3 Log into www.dyndns.org using your account.

- 4 Add a new DDNS host name. This tutorial uses the following settings as an example.
 - Hostname: **zyxelrouter.dyndns.org**
 - Service Type: **Host with IP address**
 - IP Address: Enter the WAN IP address that your Zyxel Device is currently using. You can find the IP address on the Zyxel Device's Web Configurator **Status** page.

Then you will need to configure the same account and host name on the Zyxel Device later.

Step 2 Configure DDNS on Your Zyxel Device

Configure the following settings in the **Network Setting > DNS > Dynamic DNS** screen.

- Select **Enable Dynamic DNS**.
- Select **www.DynDNS.com** as the service provider.
- Enter **zyxelrouter.dyndns.org** in the **Host Name** field.
- Enter the user name (**UserName1**) and password (**12345**). Click **Apply**.

Step 3 Test the DDNS Setting

Now you should be able to access the Zyxel Device from the Internet. To test this:

- 1 Open a web browser on the computer (using the IP address **a.b.c.d**) that is connected to the Internet.
- 2 Enter **http://zyxelrouter.dyndns.org** and press [Enter].
- 3 The Zyxel Device's login page should appear. You can then log into the Zyxel Device and manage it.

I cannot connect to the Zyxel Device using Telnet, SSH, or Ping.

- 1 See the Remote Management section for details on allowing web services (such as HTTPS, Telnet, SSH and Ping) to access the Zyxel Device.
- 2 Check the server **Port** number field for the web service in the **Maintenance > Remote Management** screen. You must use the same port number in order to use that web service for remote management.
- 3 Try the troubleshooting suggestions for [I cannot access the Web Configurator login screen](#). Ignore the suggestions about your browser.

I cannot access the Zyxel Device from outside the network (WAN).

To test if this is due to CGNAT, follow these steps:

- 1 Log in to your Zyxel Device's Web Configurator using the default IPv4 address (for example, 192.168.1.1).
- 2 Locate the WAN IP address on the **Dashboard** screen. You can find this information in the Network or WAN settings.

- 3 Go to a website that can show you the public IP address of your network (for example, <https://whatsmyip.com>). When you access this site, it will display your public IP address.



- 4 Compare the WAN IP address displayed on the **Dashboard** screen with the public IP address shown on the <https://whatsmyip.com> website.
- If both IP addresses are the same, your ISP is not using Carrier-Grade NAT, and you should be able to access your Zyxel Device from the WAN (outside).
 - If the IP addresses are different, it indicates that your ISP is using Carrier-Grade NAT, and your Zyxel Device has a shared public IP address. As a result, remote access to your Zyxel Device from the WAN will not be possible.

If you discover that your Zyxel Device is behind a Carrier-Grade NAT and you need remote access, you must contact your ISP and request a public IP address for your SIM card or Zyxel Device.

45.5 Internet Problems

[I cannot access the Internet.](#)

- 1 Check the hardware connections and make sure the LEDs are behaving as expected. See the **Quick Start Guide**.
- 2 Make sure you entered your ISP account information correctly on the **Network Setting > Broadband** screen. Fields on this screen are case-sensitive, so check if [Caps Lock] is on or off.
- 3 If you are trying to access the Internet wirelessly, make sure that you enabled the WiFi in the Zyxel Device and your WiFi client and that the WiFi settings in the WiFi client are the same as the settings in the Zyxel Device.
- 4 Disconnect all the cables from your Zyxel Device and reconnect them.
- 5 If the problem continues, contact your ISP.

[How to verify if my WAN connection is active?](#)

- 1 Check the LED indicators on the Zyxel Device to see if the WAN connection is active.

- 2 Log into the web configurator. In **Connection Status**, if the WAN connection is down, the **WAN Status** field displays **Connection down**. If there is an active WAN connection, the **WAN Status** field shows the type and speed of the connection. For example, Ethernet WAN 1000/Full means the Zyxel Device's Ethernet WAN link speed is 1000 megabits per second (1 Gbps).

I cannot connect to the Internet using an Ethernet connection.

- 1 Make sure you have the Ethernet WAN port connected to a Modem or Router.
- 2 Make sure you configured a proper Ethernet WAN interface (**Network Setting > Broadband** screen) with the Internet account information provided by your ISP and that it is enabled.
- 3 Check that the WAN interface you are connected to is in the same interface group as the Ethernet connection (**Network Setting > Interface Group**).
- 4 If you set up a WAN connection using bridging service, make sure you turn off the DHCP feature in the **Network Setting > Home Networking > LAN Setup** screen to have the clients get WAN IP addresses directly from your ISP's DHCP server.

I cannot connect to the Internet using a Fiber connection.

- 1 Make sure the Fiber/SFP port has a compatible SFP/SFP+ transceiver installed with a fiber/Ethernet cable connected to it.
- 2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the **Quick Start Guide**.

The **PON** LED is off if the optical transceiver has malfunctioned or the fiber cable is not connected or is broken or damaged enough to break the PON connection.

The **LOS** LED is red if the GPON Device is not receiving an optical signal.

The **LOS** LED blinks red if the GPON Device is receiving a weak optical signal.

- 3 Disconnect all the cables from your device and reconnect them. Make sure the fiber cable is not curved too much.
- 4 If that does not work, restart your Zyxel Device.
- 5 If the problems continues, contact your ISP.

I cannot connect to the Internet using a cellular connection.

- 1 The DSL and Ethernet connections have priority in that order. If the DSL or Ethernet connection is up, then the cellular connection will be down.

- 2 Make sure you have connected a compatible cellular dongle to the USB port, if required.
- 3 Make sure you have configured **Network Setting > Broadband > Cellular Backup** correctly.
- 4 Check that the Zyxel Device is within range of a cellular base station.

The Zyxel Device cannot assign individual IP addresses to the connected client devices.

- 1 Make sure to select **Bridge** in **Network Setting > Broadband > Add/Edit New WAN Interface: Mode**.
- 2 Make sure to reboot the Zyxel Device after changing to **Bridge** mode.
- 3 Make sure the Zyxel Device can get an IP address dynamically (DHCP) from the router controller.

The Internet connection is slow or intermittent.

- 1 There might be a lot of traffic on the network. If the Zyxel Device is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.
- 2 If your Zyxel Device keeps alternating between ISPs, then choose a fixed ISP. Go to the **Network Setting > Cellular PLMN** screen, disable **PLMN Auto Selection** and then choose your preferred ISP.
- 3 Turn the Zyxel Device off and on.
- 4 If the problem continues, contact the network administrator or vendor, or try the advanced suggestions in [I cannot access the Web Configurator login screen](#).

Note: If your Zyxel Device is an outdoor-type, inclement weather like rain and hot weather may affect cellular signals.

What should I do if my Zyxel Device is under attack?

A slow Internet speed, a web browser that keeps redirecting you, suspicious activity alerts from your ISP, and increased pop-ups on the Zyxel Device; could be signs that your Zyxel Device is under attack. If you suspect that your Zyxel Device is under attack, do the following:

- 1 Create an ACL (Access Control List) rule to block the ports being targeted. See [Access Control \(Rules\)](#) for more information on using ACL. See also [Configure a Firewall Rule](#) for more information on configuring a firewall rule. Go to **System Monitor > Log > Security Log** to view the security-related logs to determine which ports are being targeted. See [Security Log](#) for more information on security logs.
- 2 Contact your ISP to report the attack and seek assistance.
- 3 When possible, turn off the Zyxel Device for 24 hours, then turn it on again.

- 4 Request the ISP to change your IP address.

45.6 WiFi Problems

I cannot connect to the Zyxel Device WiFi.

- 1 Check the WiFi LED status to make sure the Zyxel Device WiFi is on.
- 2 Make sure your WiFi client is within transmission range of the Zyxel Device.
- 3 Make sure you entered the correct SSID and password. See the Zyxel Device back label for the default SSID and password.
- 4 Make sure your WiFi client is using the same WiFi security type (WPA2-PSK, WPA3-SAE, or none) as the Zyxel Device.
- 5 Make sure the WiFi adapter on your WiFi client is working properly. Right-click your computer's network adapter then select **Properties** to check your network adapter status.
- 6 Make sure the WiFi adapter on your WiFi client is IEEE 802.11-compatible and supports the same WiFi standard as the Zyxel Device radio.

Note: To check if it is your Zyxel Device that is causing the problem and not your WiFi connection, try using a wired connection.

The WiFi connection is slow and intermittent.

The following factors may cause interference:

- Obstacles: walls, ceilings, furniture, and so on.
- Building Materials: metal doors, aluminum studs.
- Electrical devices: microwaves, monitors, electric motors, cordless phones, and other wireless devices.

To optimize the speed and quality of your WiFi connection, you can:

- Move your wireless device closer to the AP if the signal strength is low.
- Reduce wireless interference that may be caused by other WiFi networks or surrounding wireless electronics such as cordless phones.
- Place the AP where there are minimum obstacles (such as walls and ceilings) between the AP and the WiFi client.
- Reduce the number of WiFi clients connecting to the same AP simultaneously, or add additional APs if necessary.

- Try closing some programs that use the Internet, especially peer-to-peer applications. If the WiFi client is sending or receiving a lot of information, it may have too many programs open that use the Internet.
- Place the Zyxel Device where there are minimum obstacles (such as walls and ceilings) between the Zyxel Device and the WiFi client. Avoid placing the Zyxel Device inside any type of box that might block WiFi signals.

I want to allow or block specific devices from connecting to the Zyxel Device's WiFi network.

MAC authentication allows devices with MAC addresses listed in the Zyxel Device's MAC address list to connect or block access to its WiFi network.

To set up MAC authentication of your Zyxel Device, follow the steps below:

- 1 Log into your Zyxel Device's Web Configurator, and go to **Network Setting > Wireless > MAC Authentication**.
- 2 In the **General** section, select the SSID of the WiFi network for which you want to configure MAC authentication from the dropdown list.
- 3 There are two ways to configure the MAC authentication:
 - 3a Set the MAC addresses you want to block access to the Zyxel Device's WiFi network.
 - In the **MAC Restrict Mode** section, select **Deny**.
 - In the **MAC address list** section, click the  icon to add a new MAC address.
 - The **Add MAC address to list** screen will appear. In the **MAC Address** field, enter the MAC address you want to block access to the Zyxel Device's WiFi network.
 - 3b Set the MAC addresses you want to allow to connect to the Zyxel Device's WiFi network.
 - In the **MAC Restrict Mode** section, select **Allow**.
 - In the **MAC address list** section, click the  icon to add a new MAC address.
 - The **Add MAC address to list** screen will appear. In the **MAC Address** field, enter the MAC address you want to allow to connect to the Zyxel Device's WiFi network.

45.7 Mesh Problems

I can't build a mesh network between the Zyxel Device and the extender(s).

Different mesh technologies may be incompatible, so make sure the Zyxel Device and the extender(s) use the same mesh technology.

To build a mesh network and ensure the smooth client roaming between the Zyxel Device and the extender(s), please check the following.

- 1 Make sure the Zyxel Device and the extender(s) have consistent SSID and security settings.
- 2 Make sure the Zyxel Device and the extender(s) are not too far or too close to each other.

45.8 USB Problems

The Zyxel Device fails to detect my USB device.

- 1 Disconnect the USB device.
- 2 Reboot the Zyxel Device.
- 3 If you are connecting a USB hard drive that comes with an external power supply, make sure it is connected to an appropriate power source that is on.
- 4 Reconnect your USB device to the Zyxel Device.

45.9 VoIP Problems

I cannot make phone calls through the phone connected to the Zyxel Device.

- 1 Pick up the phone and check the phone tone. You should hear the dial tone if your configuration on the Zyxel Device is correct, and your phone is successfully connected to the SIP server.
- 2 Check that the settings from your VoIP service are entered correctly on the Zyxel Device.
- 3 Make sure your phone is connected to the Zyxel Device phone port through an RJ-11 cable. Check the Zyxel Device phone LED for the corresponding phone status.
- 4 Make sure the Zyxel Device has an Internet connection. See [Internet Problems](#) for more information.
- 5 Make sure your SIP account is registered and your SIP service plan is valid. Use the **System Monitor > VoIP Status** screen to check the account **Registration** status.
- 6 Make sure your SIP server settings (in the **VoIP > SIP > SIP Service Provider** and the **VoIP > SIP > SIP Account** screens) use the correct information from your SIP service provider. For example, your SIP service provider name, SIP account and password.
- 7 Make sure your phone settings (in the **VoIP > Phone > Phone Device** screen) are correct.
- 8 Contact the SIP server administrator and make sure your SIP server is not down.

I am experiencing echoes during calls.

Go to **VoIP > SIP > SIP Account > SIP Account Entry Edit**. Click **Enable G.168 (Echo Cancellation)** to eliminate echo during calls.

45.10 UPnP Problems

My computer cannot detect UPnP settings from the Zyxel Device.

- 1 Make sure that UPnP is enabled in your computer.
- 2 On the Zyxel Device, make sure that UPnP is enabled on the **Network Settings > Home Networking > UPnP** screen.
- 3 Disconnect the Ethernet cable from the Zyxel Device's Ethernet port or from your computer.
- 4 Reconnect the Ethernet cable.
- 5 Restart your computer.

45.11 Getting More Troubleshooting Help

Search for support information for your model at <https://service-provider.zyxel.com/global/en/tech-support> and community.zyxel.com for more troubleshooting suggestions.

APPENDIX A

Customer Support

In the event of problems that cannot be solved by using this manual, you should contact your vendor. If you cannot contact your vendor, then contact a Zyxel office for the region in which you bought the Zyxel Device.

For Zyxel Communication offices, see <https://service-provider.zyxel.com/global/en/contact-us> for the latest information.

For Zyxel Network offices, see <https://www.zyxel.com/index.shtml> for the latest information.

Please have the following information ready when you contact an office.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

Corporate Headquarters (Worldwide)

Taiwan

- Zyxel Communications (Taiwan) Co., Ltd.
- <https://www.zyxel.com>

Asia

China

- Zyxel Communications Corporation–China Office
- <https://www.zyxel.com/cn/sc>

India

- Zyxel Communications Corporation–India Office
- <https://www.zyxel.com/in/en-in>

Kazakhstan

- Zyxel Kazakhstan
- <https://www.zyxel.com/ru/ru>

Korea

- Zyxel Korea Co., Ltd.
- <http://www.zyxel.kr/>

Malaysia

- Zyxel Communications Corp.
- <https://www.zyxel.com/global/en>

Philippines

- Zyxel Communications Corp.
- <https://www.zyxel.com/global/en>

Singapore

- Zyxel Communications Corp.
- <https://www.zyxel.com/global/en>

Taiwan

- Zyxel Communications (Taiwan) Co., Ltd.
- <https://www.zyxel.com/tw/zh>

Thailand

- Zyxel Thailand Co., Ltd.
- <https://www.zyxel.com/th/th>

Vietnam

- Zyxel Communications Corporation–Vietnam Office
- <https://www.zyxel.com/vn/vi>

Europe

Belarus

- Zyxel Communications Corp.
- <https://www.zyxel.com/ru/ru>

Belgium (Netherlands)

- Zyxel Benelux
- <https://www.zyxel.com/nl/nl>
- <https://www.zyxel.com/fr/fr>

Bulgaria

- Zyxel Bulgaria

- <https://www.zyxel.com/bg/bg>

Czech Republic

- Zyxel Communications Czech s.r.o.
- <https://www.zyxel.com/cz/cs>

Denmark

- Zyxel Communications A/S
- <https://www.zyxel.com/dk/da>

Finland

- Zyxel Communications
- <https://www.zyxel.com/fi/fi>

France

- Zyxel France
- <https://www.zyxel.com/fr/fr>

Germany

- Zyxel Deutschland GmbH.
- <https://www.zyxel.com/de/de>

Hungary

- Zyxel Hungary & SEE
- <https://www.zyxel.com/hu/hu>

Italy

- Zyxel Communications Italy S.r.l.
- <https://www.zyxel.com/it/it>

Norway

- Zyxel Communications A/S
- <https://www.zyxel.com/no/no>

Poland

- Zyxel Communications Poland
- <https://www.zyxel.com/pl/pl>

Romania

- Zyxel Romania
- <https://www.zyxel.com/ro/ro>

Russian Federation

- Zyxel Communications Corp.
- <https://www.zyxel.com/ru/ru>

Slovakia

- Zyxel Slovakia
- <https://www.zyxel.com/sk/sk>

Spain

- Zyxel Iberia
- <https://www.zyxel.com/es/es>

Sweden

- Zyxel Communications A/S
- <https://www.zyxel.com/se/sv>

Switzerland

- Studerus AG
- <https://www.zyxel.com/ch/de-ch>
- <https://www.zyxel.com/fr/fr>

Turkey

- Zyxel Turkey A.S.
- <https://www.zyxel.com/tr/tr>

UK

- Zyxel Communications UK Ltd.
- <https://www.zyxel.com/uk/en-gb>

Ukraine

- Zyxel Ukraine
- <https://www.zyxel.com/ua/uk-ua>

South America

Argentina

- Zyxel Communications Corp.
- <https://www.zyxel.com/co/es-co>

Brazil

- Zyxel Communications Brasil Ltda.

- <https://www.zyxel.com/br/pt>

Colombia

- Zyxel Communications Corp.
- <https://www.zyxel.com/co/es-co>

Ecuador

- Zyxel Communications Corp.
- <https://www.zyxel.com/co/es-co>

South America

- Zyxel Communications Corp.
- <https://www.zyxel.com/co/es-co>

Middle East

Israel

- Zyxel Communications Corp.
- <https://il.zyxel.com>

North America

USA

- Zyxel Communications, Inc. – North America Headquarters
- <https://www.zyxel.com/us/en-us>

APPENDIX B

Wireless LANs

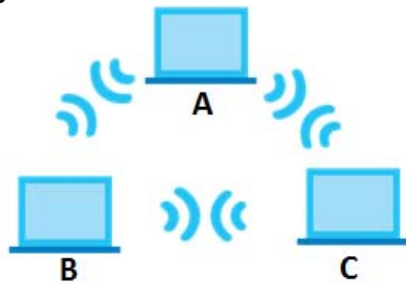
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

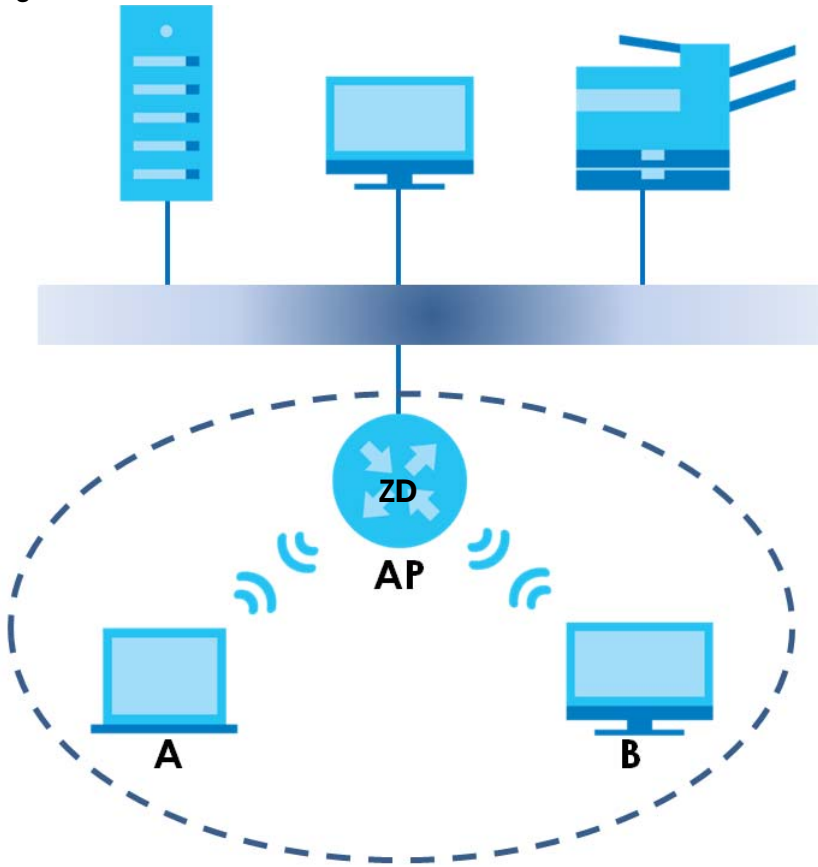
Figure 289 Peer-to-Peer Communication in an Ad-hoc Network



BSS

A Basic Service Set (BSS) exists when all communications between WiFi clients or between a WiFi client and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between WiFi clients in the BSS. When Intra-BSS is enabled, WiFi client **A** and **B** can access the wired network and communicate with each other. When Intra-BSS is disabled, WiFi client **A** and **B** can still access the wired network but cannot communicate with each other.

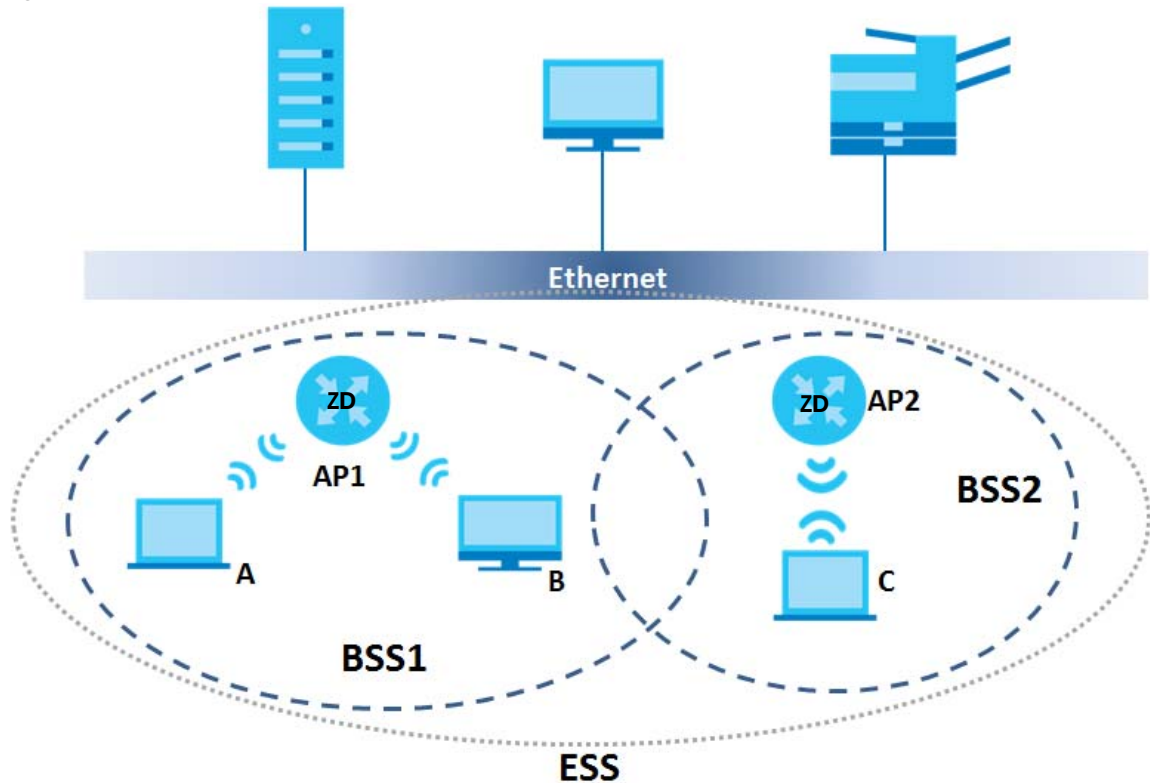
Figure 290 Basic Service Set

ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated WiFi clients within the same ESS must have the same ESSID in order to communicate.

Figure 291 Infrastructure WLAN

Channel

A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.