CHAPTER 11
Quality of Service (QoS)

11.1 QoS Overview

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical applications such as video-on-demand.

Configure QoS on the Zyxel Device to group and prioritize application traffic and fine-tune network performance. Setting up QoS involves these steps:

1 Configure classifiers to sort traffic into different flows.

2 Assign priority and define actions to be performed for a classified traffic flow.

The Zyxel Device assigns each packet a priority and then queues the packet accordingly. Packets assigned a high priority are processed more quickly than those with low priority if there is congestion, allowing time-sensitive applications to flow more smoothly. Time-sensitive applications include both those that require a low level of latency (delay) and a low level of jitter (variations in delay) such as Voice over IP (VoIP) or Internet gaming, and those for which jitter alone is a problem such as Internet radio or streaming video. There are eight priority levels, with 1 having the highest priority.

This chapter contains information about configuring QoS and editing classifiers.

11.1.1 What You Can Do in this Chapter

- The **General** screen lets you enable or disable QoS and set the upstream bandwidth (Section 11.3 on page 235).
- The **Queue Setup** screen lets you configure QoS queue assignment (Section 11.4 on page 236).
- The **Classification Setup** screen lets you add, edit or delete QoS classifiers (Section 11.5 on page 239).
- The **Shaper Setup** screen limits outgoing traffic transmission rate on the selected interface (Section 11.6 on page 244).
- The **Policer Setup** screen lets you control incoming traffic transmission rate and bursts (Section 11.7 on page 245).
- The **Monitor** screen lets you use any available port to access any available service from a remote WAN device (Section 11.8 on page 249).

11.2 What You Need to Know

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

QoS versus CoS

QoS is used to prioritize source-to-destination traffic flows. All packets in the same flow are given the same priority. CoS (class of service) is a way of managing traffic in a network by grouping similar types of traffic together and treating each type as a class. You can use CoS to give different priorities to different packet types.

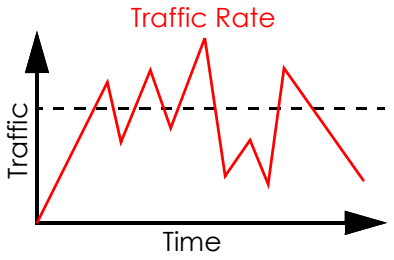
CoS technologies include IEEE 802.1p layer 2 tagging and DiffServ (Differentiated Services or DS). IEEE 802.1p tagging makes use of 3 bits in the packet header, while DiffServ is a new protocol and defines a new DS field, which replaces the eight-bit ToS (Type of Service) field in the IP header.

Tagging and Marking

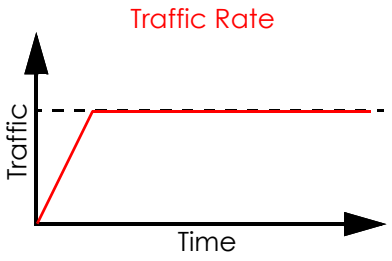
In a QoS class, you can configure whether to add or change the DSCP (DiffServ Code Point) value, IEEE 802.1p priority level and VLAN ID number in a matched packet. When the packet passes through a compatible network, the networking device, such as a backbone switch, can provide specific treatment or service based on the tag or marker.

Traffic Shaping

Bursty traffic may cause network congestion. Traffic shaping regulates packets to be transmitted with a pre-configured data transmission rate using buffers (or queues). Your Zyxel Device uses the Token Bucket algorithm to allow a certain amount of large bursts while keeping a limit at the average rate.



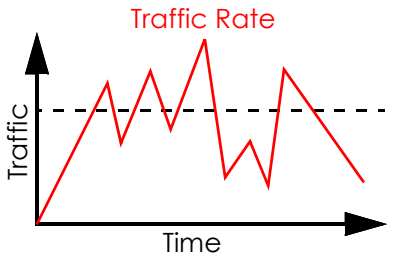
(Before Traffic Shaping)



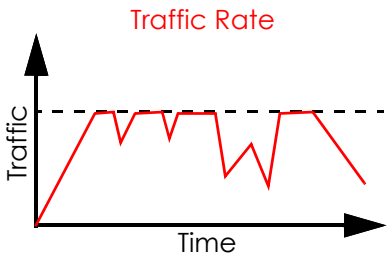
(After Traffic Shaping)

Traffic Policing

Traffic policing is the limiting of the input or output transmission rate of a class of traffic on the basis of user-defined criteria. Traffic policing methods measure traffic flows against user-defined criteria and identify it as either conforming, exceeding or violating the criteria.



(Before Traffic Policing)



(After Traffic Policing)

The Zyxel Device supports three incoming traffic metering algorithms: Token Bucket Filter (TBF), Single Rate Two Color Maker (srTCM), and Two Rate Two Color Marker (trTCM). You can specify actions which are performed on the colored packets. See Section 11.9 on page 250 for more information on each metering algorithm.

Strictly Priority

Strictly Priority (SP) services queues based on priority only. As traffic comes into the Switch, traffic on the highest priority queue, Q7 is transmitted first. When that queue empties, traffic on the next highest priority queue, Q6 is transmitted until Q6 empties, and then traffic is transmitted on Q5 and so on. If higher priority queues never empty, then traffic on lower priority queues never gets sent. SP does not automatically adapt to changing network requirements.

Weighted Round Robin Schedule (WRR)

Round Robin Scheduling services queues on a rotating basis and is activated only when a port has more traffic than it can handle. A queue is given an amount of bandwidth irrespective of the incoming traffic on that port. This queue then moves to the back of the list. The next queue is given an equal amount of bandwidth, and then moves to the end of the list; and so on, depending on the number of queues being used. This works in a looping fashion until a queue is empty.

Weighted Round Robin Scheduling (WRR) uses the same algorithm as round robin scheduling, but services queues based on their priority and queue weight (the number you configure in the queue **Weight** field) rather than a fixed amount of bandwidth. WRR is activated only when a port has more traffic than it can handle. Queues with larger weights get more service than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues and returns to queues that have not yet emptied.

11.3 Quality of Service General Settings

Use this screen to enable or disable QoS and set the upstream bandwidth or assign traffic priority. See Section 11.1 on page 233 for more information.

When one of the following situations happens, the current WAN linkup rate will be used instead:

1. **WAN Managed Upstream Bandwidth** is set to 0
2. **WAN Managed Upstream Bandwidth** is empty
3. **WAN Managed Upstream Bandwidth** is higher than the current WAN interface linkup rate

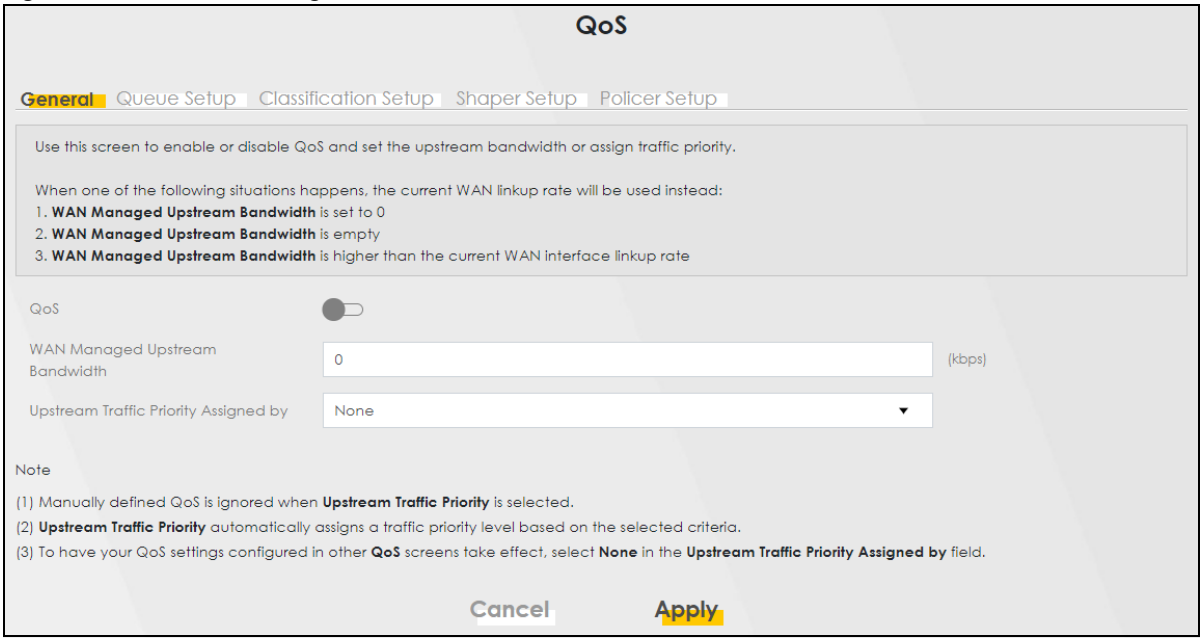
Note: Manually defined QoS is ignored when **Upstream Traffic Priority** is selected.

Note: **Upstream Traffic Priority** automatically assigns a traffic priority level based on the selected criteria.

Note: To have your QoS settings configured in other **QoS** screens take effect, select **None** in the **Upstream Traffic Priority Assigned by** field.

Click **Network Setting** > **QoS** > **General** to open the screen as shown next.

Figure 135 Network Setting > QoS > General



The following table describes the labels in this screen.

Table 68 Network Setting > QoS > General

LABEL	DESCRIPTION
QoS	Click this switch to enable QoS to improve your network performance.
WAN Managed Upstream Bandwidth	Enter the amount of upstream bandwidth for the WAN interfaces that you want to allocate using QoS. The recommendation is to set this speed to match the interfaces' actual transmission speed. For example, set the WAN interfaces' speed to 100000 kbps if your Internet connection has an upstream transmission speed of 100 Mbps. You can also set this number lower than the interfaces' actual transmission speed. This will cause the Zyxel Device to not use some of the interfaces' available bandwidth. If you leave this field blank, the Zyxel Device automatically sets this number to be 95% of the WAN interfaces' actual upstream transmission speed.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

11.4 Queue Setup

Click **Network Setting** > **QoS** > **Queue Setup** to open the screen as shown next.

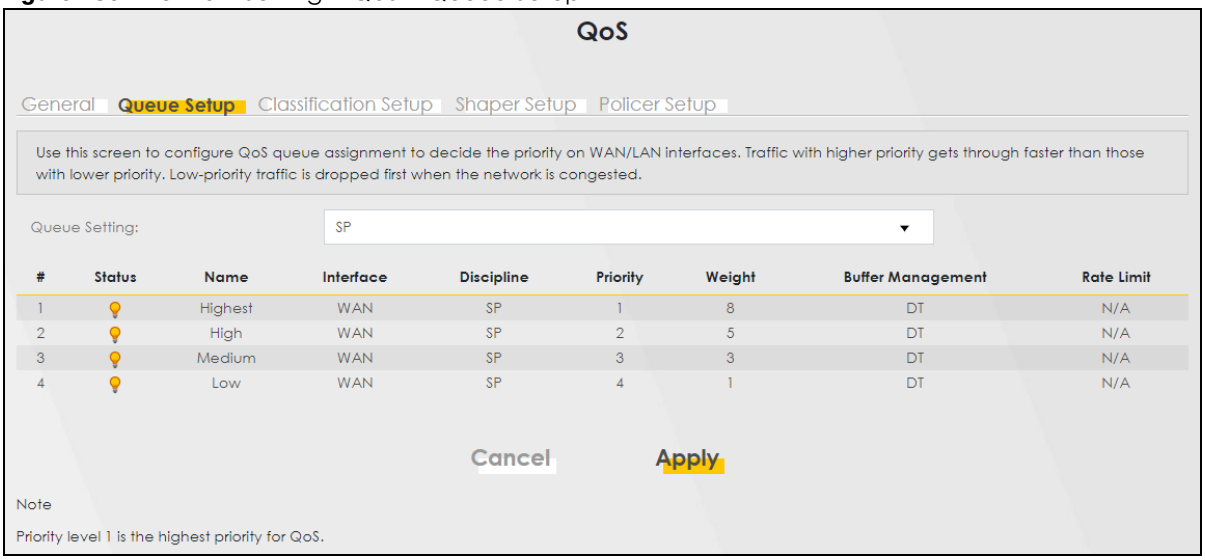
Use this screen to configure QoS queue assignment to decide the priority on WAN or LAN interfaces. Traffic with higher priority gets through faster than those with lower priority. Low-priority traffic is dropped first when the network is congested.

Note: Configure the priority level for a QoS queue from 1 to 8. The smaller the number in the **Priority** column, the higher the priority.

Note: The corresponding classifiers will be removed automatically if a queue is deleted.

Note: Rate limit 0 means there is no rate limit on a queue.

Figure 136 Network Setting > QoS > Queue Setup



The following table describes the labels in this screen.

Table 69 Network Setting > QoS > Queue Setup

LABEL	DESCRIPTION
Queue Setting	Select between **SP** (Strict Priority), **SP+WRR**, or **WRR** (Weighted Round Robin). **SP** scheduling singles out the highest priority queue and ensures all queued traffic in this queue is transmitted before servicing the lower priority queues. WRR scheduling services queues on a rotating basis based on their queue weight (the number you configure in the queue **Weight** field. Queues with larger weights get more service than queues with smaller weights. If you choose **SP+WRR**, the first and second queue will be **SP**, and the third and fourth queue will be **WRR**.
#	This is the index number of the entry.
Status	This field displays whether the queue is active or not. A yellow bulb signifies that this queue is active. A gray bulb signifies that this queue is not active.
Name	This shows the descriptive name of this queue.
Interface	This shows the name of the Zyxel Device's interface through which traffic in this queue passes.
Discipline	This shows the discipline of the queue. The discipline is changed according to the option chosen in **Queue Setting**. If you choose **SP**, the discipline will be SP. If you choose **SP+WRR**, the discipline of the first and second queue will be SP, and the third and fourth queue will be WRR. If you choose **WRR**, the discipline will be WRR. Strict Priority scheduling services the remaining queues using WRR. WRR scheduling services queues on a rotating basis based on their queue weight (the number you configure in the queue Weight field). Queues with larger weights get more service than queues with smaller weights. Note: Queue weights can only be changed when Weighted Round Robin is selected.
Priority	This shows the priority of this queue. The lower the number, the higher the priority level.
Weight	This shows the weight of this queue.
Buffer Management	This shows the queue management algorithm used for this queue. Queue management algorithms determine how the Zyxel Device should handle packets when it receives too many (network congestion).

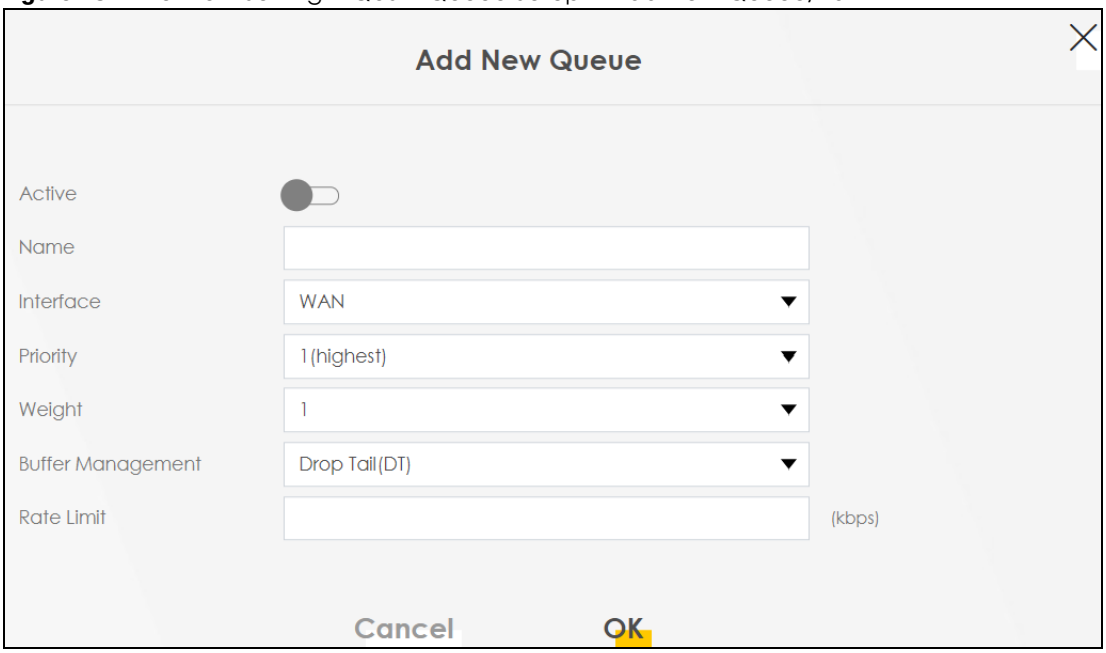
Table 69 Network Setting > QoS > Queue Setup (continued)

LABEL	DESCRIPTION
Rate Limit	This shows the maximum transmission rate allowed for traffic on this queue.
Modify	Click the **Edit** icon to edit the queue. Click the **Delete** icon to delete an existing queue. Note that subsequent rules move up by one when you take this action.

11.4.1 Add a QoS Queue

Click **Add New Queue** or the **Edit** icon in the **Queue Setup** screen to configure a queue.

Figure 137 Network Setting > QoS > Queue Setup > Add New Queue/Edit



The following table describes the labels in this screen.

Table 70 Network Setting > QoS > Queue Setup > Add New Queue/Edit

LABEL	DESCRIPTION
Active	Click this switch to enable the queue.
Name	Enter a descriptive name for this queue. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
Interface	Select the interface to which this queue is applied. This field is read-only if you are editing the queue.
Priority	Select the priority level (from 1 to 8) of this queue. The smaller the number, the higher the priority level. Traffic assigned to higher priority queues gets through faster while traffic in lower priority queues is dropped if the network is congested.
Weight	Select the weight (from 1 to 8) of this queue. If two queues have the same priority level, the Zyxel Device divides the bandwidth across the queues according to their weights. Queues with larger weights get more bandwidth than queues with smaller weights.

Table 70 Network Setting > QoS > Queue Setup > Add New Queue/Edit (continued)

LABEL	DESCRIPTION
Buffer Management	This field displays **Drop Tail (DT)**. **Drop Tail (DT)** is a simple queue management algorithm that allows the Zyxel Device buffer to accept as many packets as it can until it is full. Once the buffer is full, new packets that arrive are dropped until there is space in the buffer again (packets are transmitted out of it).
Rate Limit	Specify the maximum transmission rate (in Kbps) allowed for traffic on this queue. If you enter 0 here, this means there's no rate limit on this queue.
Cancel	Click **Cancel** to exit this screen without saving.
OK	Click **OK** to save your changes.

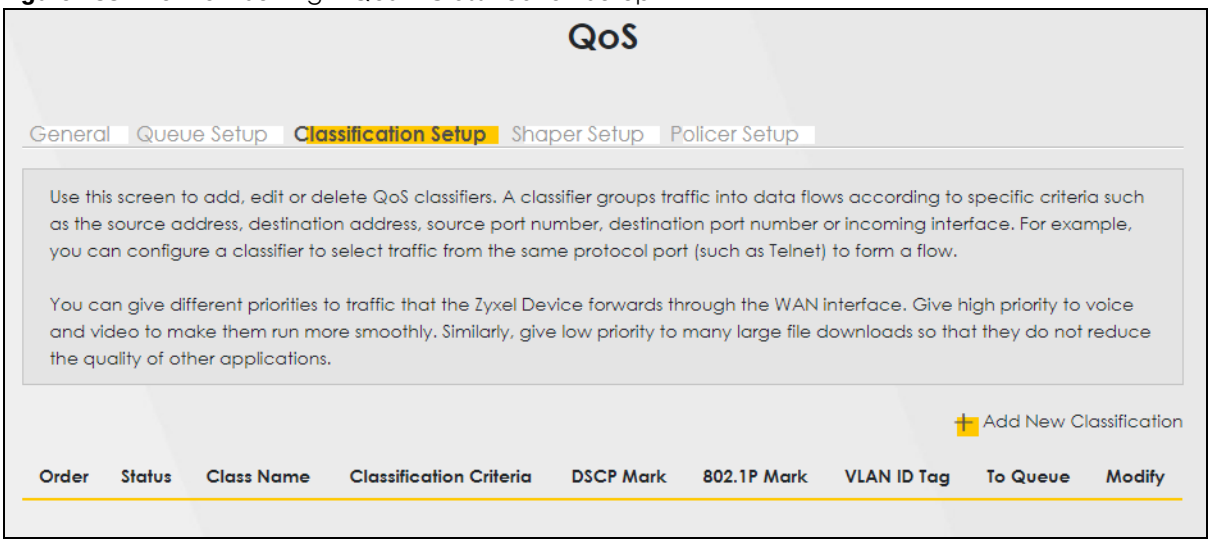
11.5 QoS Classification Setup

Use this screen to add, edit or delete QoS classifiers. A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming interface. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

You can give different priorities to traffic that the Zyxel Device forwards through the WAN interface. Give high priority to voice and video to make them run more smoothly. Similarly, give low priority to many large file downloads so that they do not reduce the quality of other applications.

Click **Network Setting** > **QoS** > **Classification Setup** to open the following screen.

Figure 138 Network Setting > QoS > Classification Setup



The following table describes the labels in this screen.

Table 71 Network Setting > QoS > Classification Setup

LABEL	DESCRIPTION
Add New Classification	Click this to create a new classifier.
Order	This is the index number of the entry. The classifiers are applied in order of their numbering.

Table 71 Network Setting > QoS > Classification Setup (continued)

LABEL	DESCRIPTION
Status	This field displays whether the classifier is active or not. A yellow bulb signifies that this classifier is active. A gray bulb signifies that this classifier is not active.
Class Name	This is the name of the classifier.
Classification Criteria	This shows criteria specified in this classifier, for example the interface from which traffic of this class should come and the source MAC address of traffic that matches this classifier.
DSCP Mark	This is the DSCP number added to traffic of this classifier.
802.1P Mark	This is the IEEE 802.1p priority level assigned to traffic of this classifier.
VLAN ID Tag	This is the VLAN ID number assigned to traffic of this classifier.
To Queue	This is the name of the queue in which traffic of this classifier is put.
Modify	Click the **Edit** icon to edit the classifier. Click the **Delete** icon to delete an existing classifier. Note that subsequent rules move up by one when you take this action.

11.5.1 Add or Edit QoS Class

Click **Add New Classification** in the **Classification Setup** screen or the **Edit** icon next to a classifier to open the following screen.

Figure 139 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step1

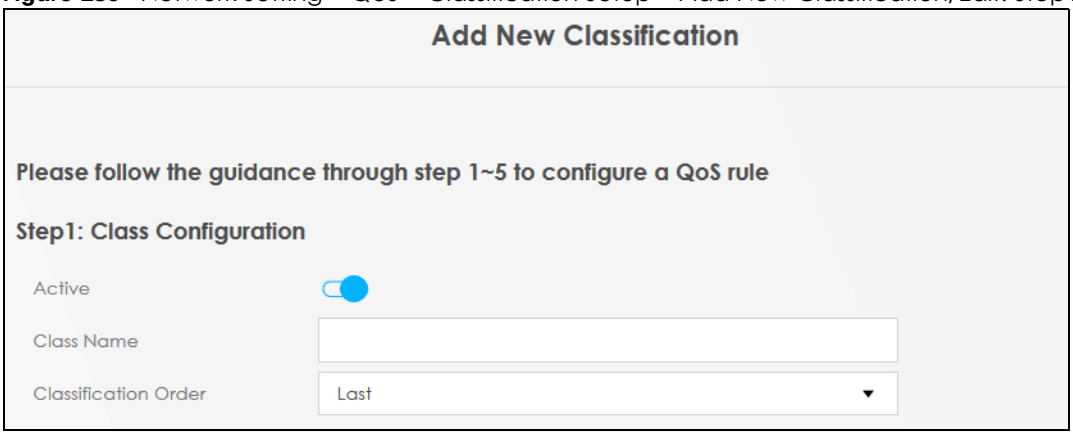


Figure 140 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step2

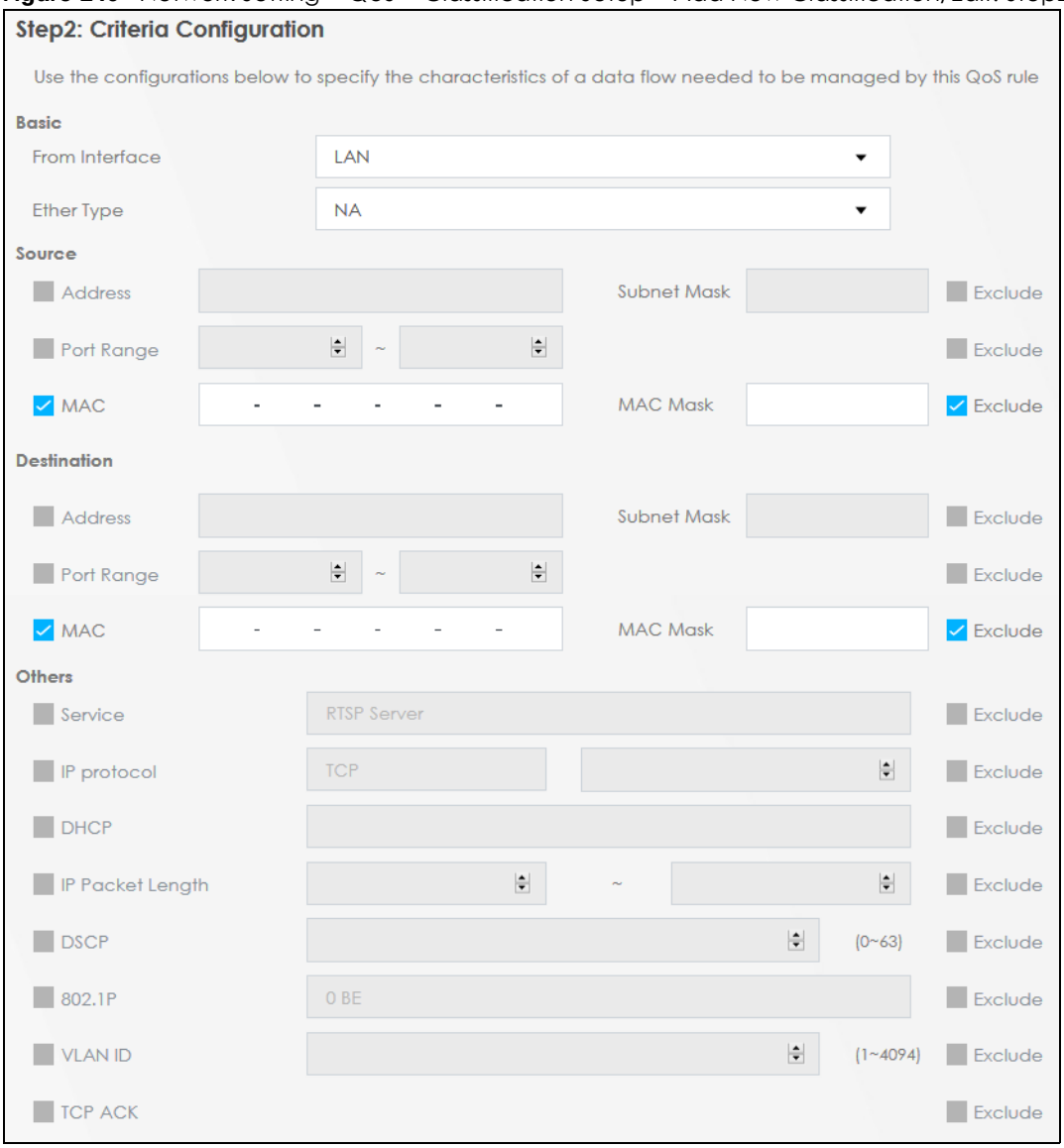


Figure 141 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step3

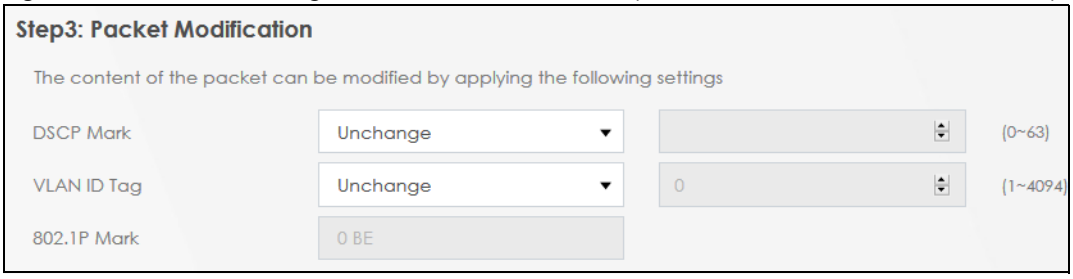


Figure 142 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step4

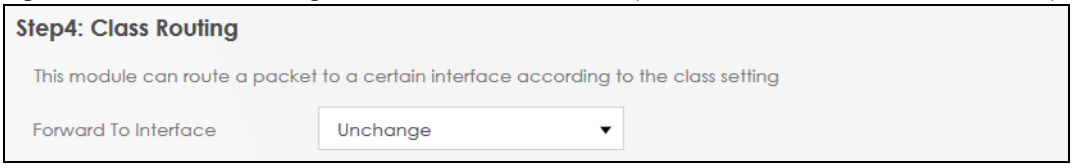
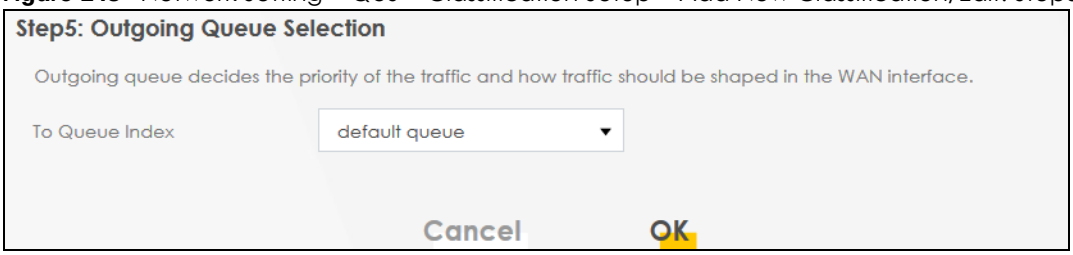


Figure 143 Network Setting > QoS > Classification Setup > Add New Classification/Edit: Step5



The following table describes the labels in this screen.

Table 72 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	
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.

Table 72 Network Setting > QoS > Classification Setup > Add New Classification/Edit (continued)

LABEL	DESCRIPTION
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	
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.
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	
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.

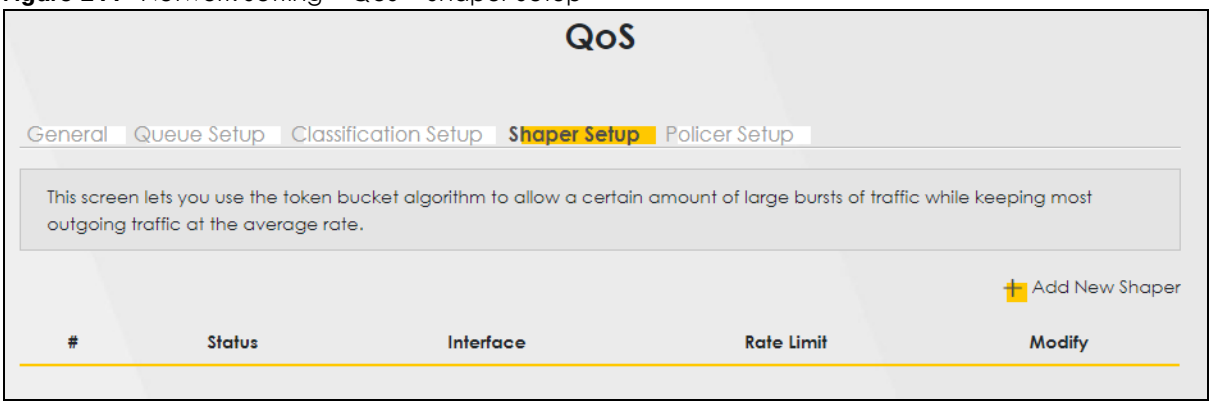
Table 72 Network Setting > QoS > Classification Setup > Add New Classification/Edit (continued)

LABEL	DESCRIPTION
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 144 Network Setting > QoS > Shaper Setup



The following table describes the labels in this screen.

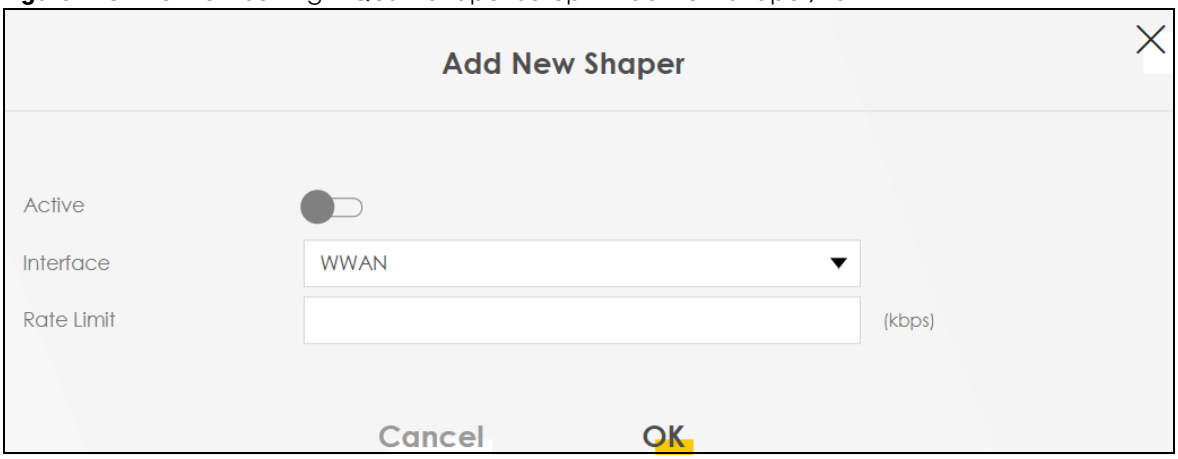
Table 73 Network Setting > QoS > Shaper Setup

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 145 Network Setting > QoS > Shaper Setup > Add New Shaper/Edit



The following table describes the labels in this screen.

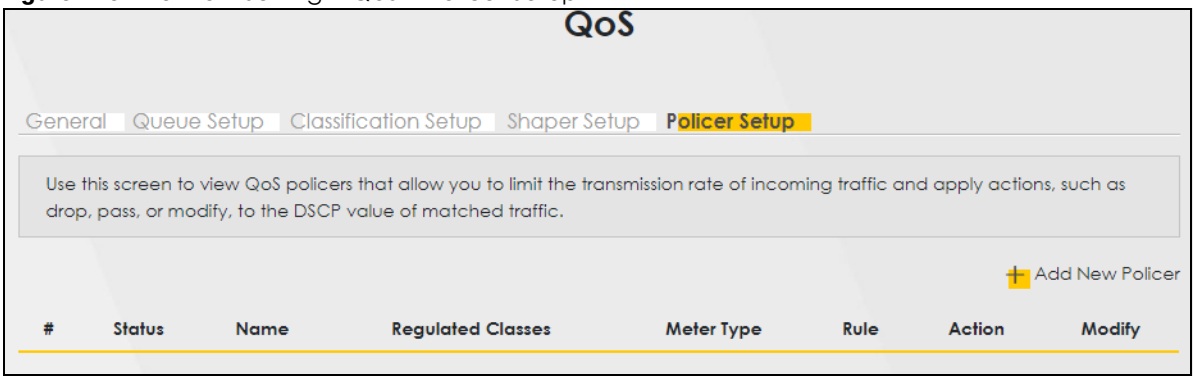
Table 74 Network Setting > QoS > Shaper Setup > Add New Shaper/Edit

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 146 Network Setting > QoS > Policer Setup



The following table describes the labels in this screen.

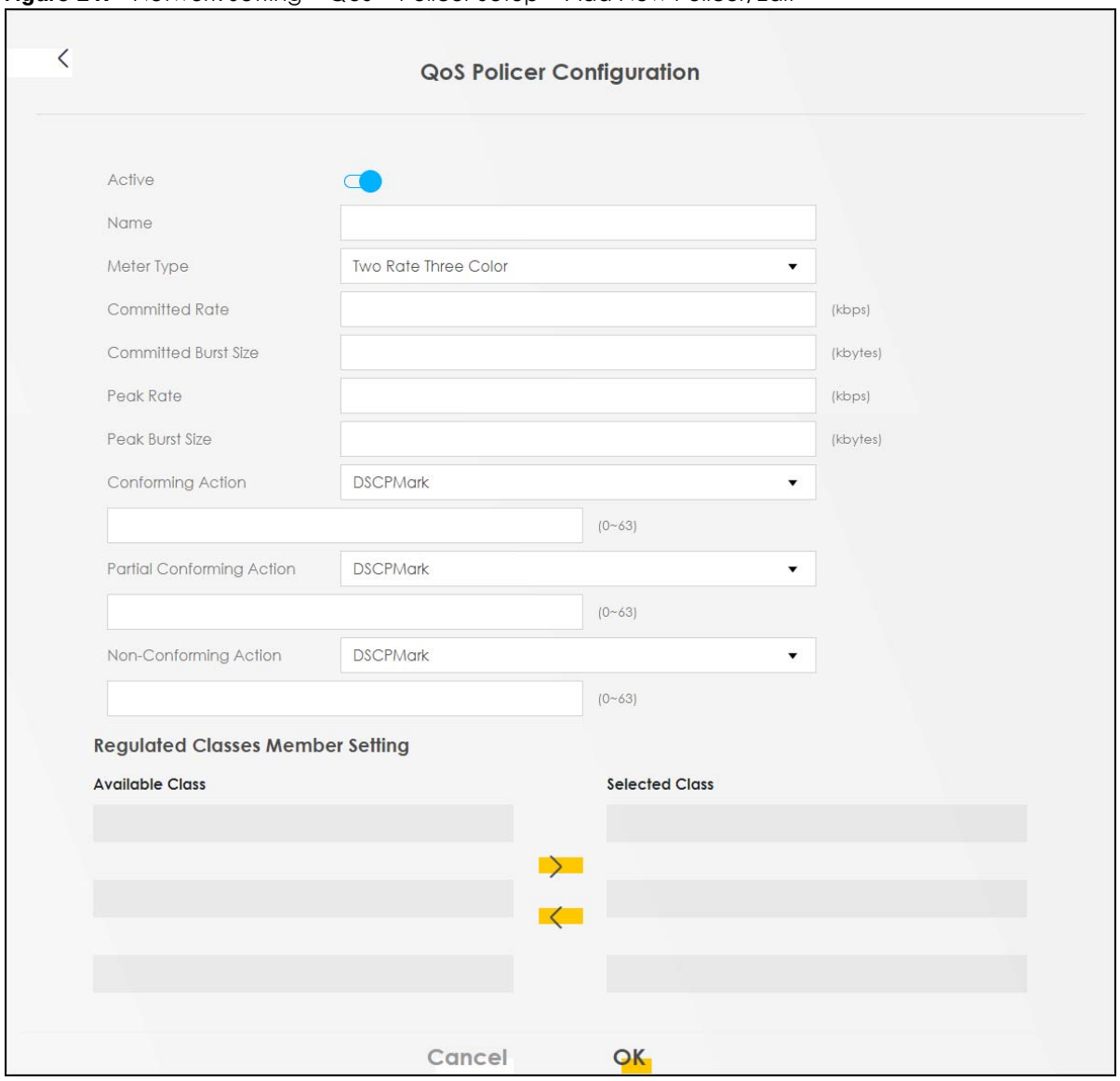
Table 75 Network Setting > QoS > Policer Setup

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 147 Network Setting > QoS > Policer Setup > Add New Policer/Edit



The following table describes the labels in this screen.

Table 76 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 76 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 *b* 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	

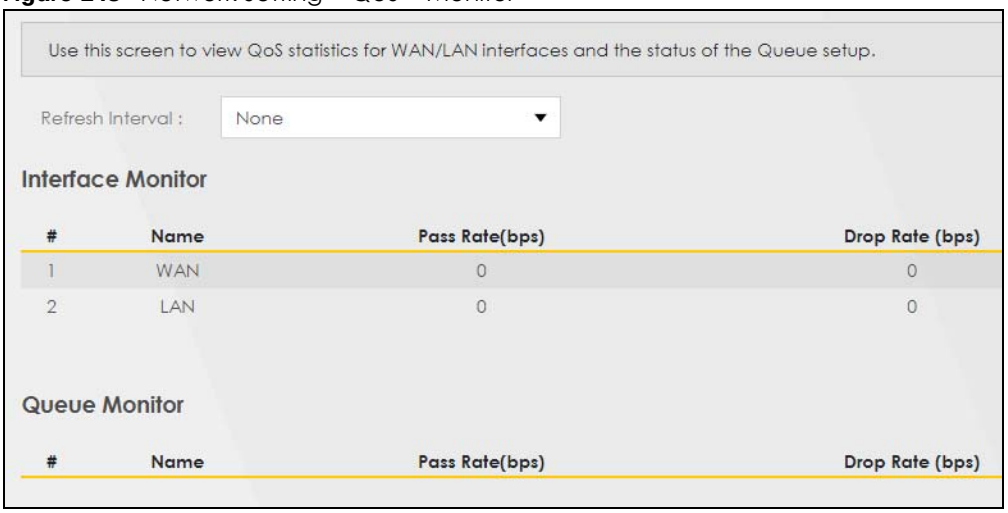
Table 76 Network Setting > QoS > Policer Setup > Add New Policer/Edit (continued)

LABEL	DESCRIPTION
Available Class Selected Class	Select a QoS classifier to apply this QoS policer to traffic that matches the QoS classifier. 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 148 Network Setting > QoS > Monitor



The following table describes the labels in this screen.

Table 77 Network Setting > QoS > Monitor

LABEL	DESCRIPTION
Refresh Interval	Select how often you want theZyxel 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 77 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 78 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)

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 79 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 79 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 (Section 12.2 on page 256).
- Use the **Port Triggering** screen to add and configure the Zyxel Device's trigger port settings (Section 12.3 on page 259).
- Use the **DMZ** screen to configure a default server (Section 12.4 on page 263).
- Use the **ALG** screen to enable or disable the SIP ALG (Section 12.5 on page 263).
- Use the **Address Mapping** screen to enable and disable the NAT Address Mapping in the Zyxel Device (Section 12.6 on page 264).
- Use the **Sessions** screen to limit the number of concurrent NAT sessions each client can use (Section 12.7 on page 267).
- Use the **Port Control Protocol** screen to configure incoming traffic for devices behind the Zyxel Device (Section 12.8 on page 267).

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.

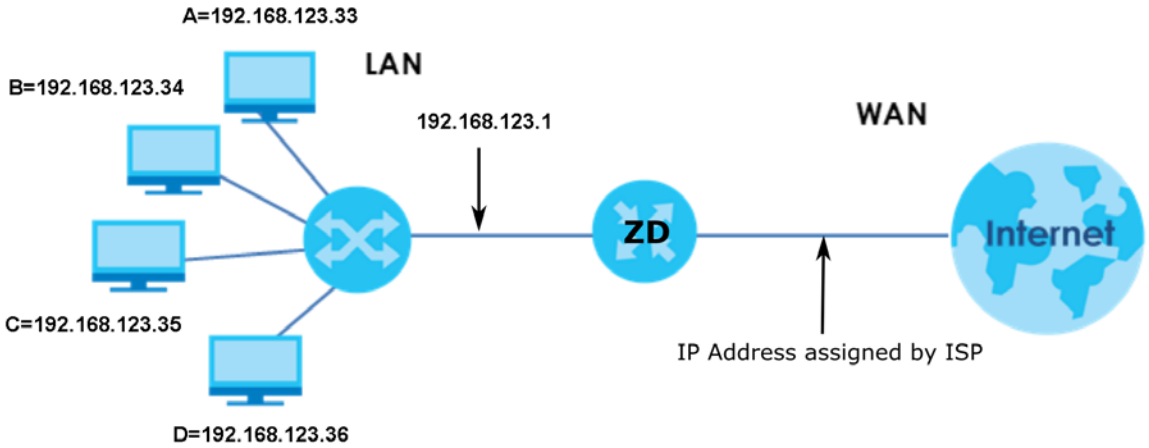
You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 on port 21. In some cases, such as for unknown services or where one server can support more than 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 149 Multiple Servers Behind NAT Example

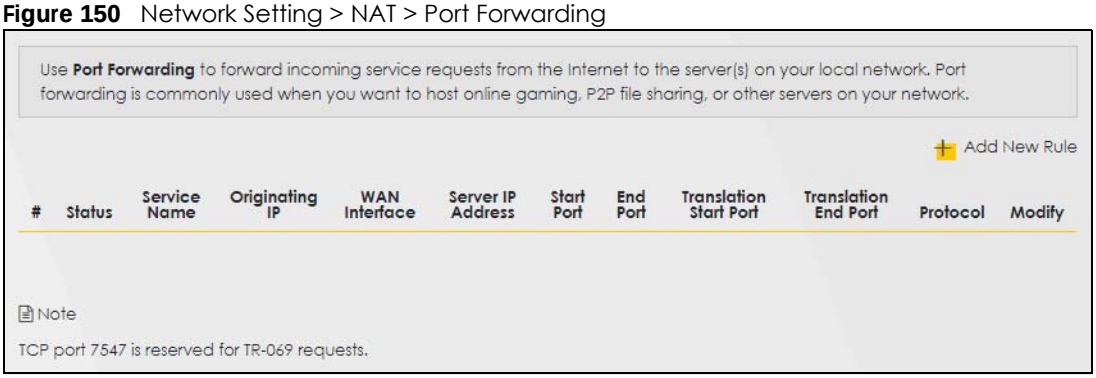


12.2.1 Port Forwarding

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

Note: TCP port 7547 is reserved for system use.

Figure 150 Network Setting > NAT > Port Forwarding



The following table describes the fields in this screen.

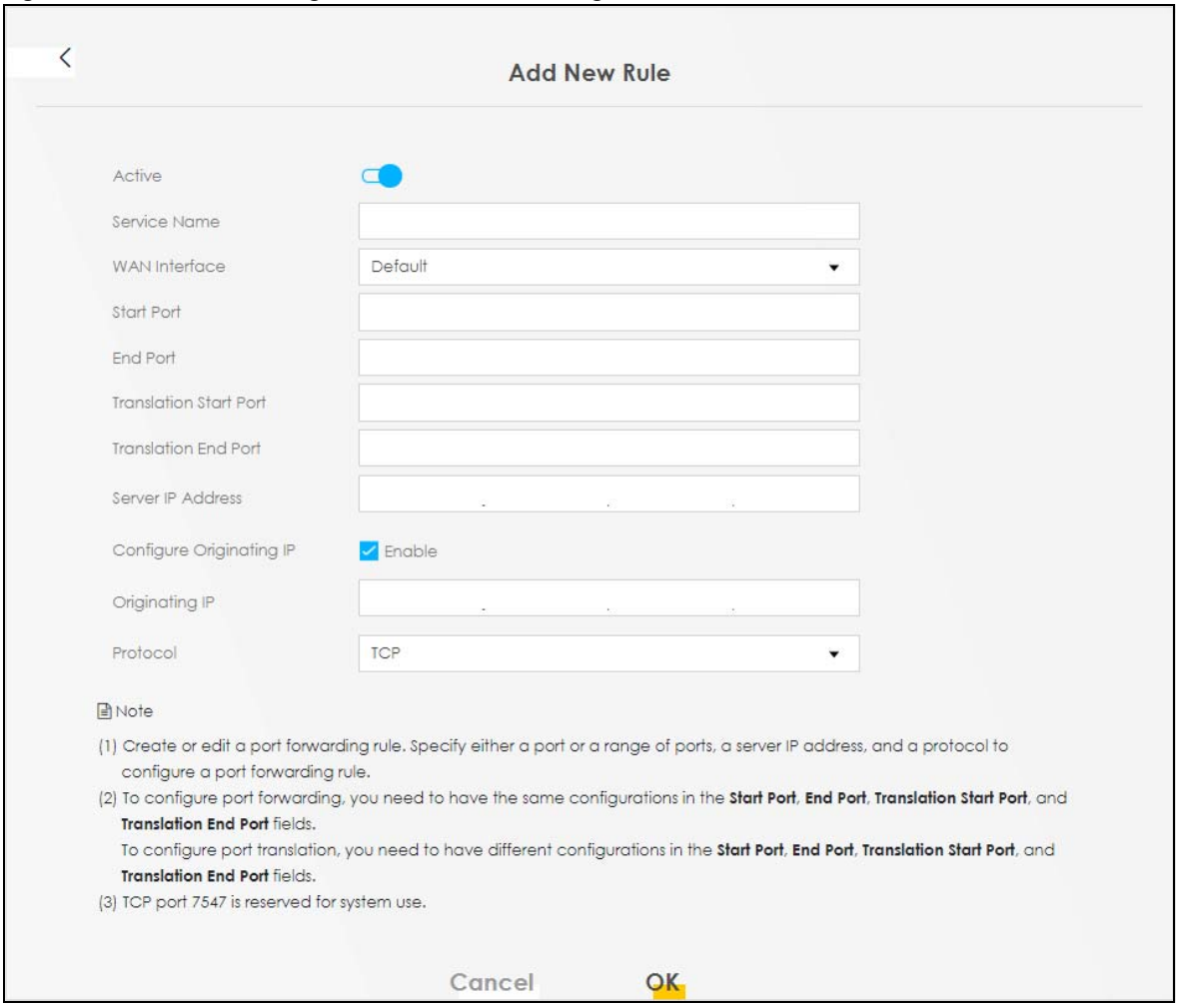
Table 80 Network Setting > NAT > Port Forwarding

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 151 Network Setting > NAT > Port Forwarding: Add or Edit



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 81 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.

Table 81 Network Setting > NAT > Port Forwarding: Add or Edit (continued)

LABEL	DESCRIPTION
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

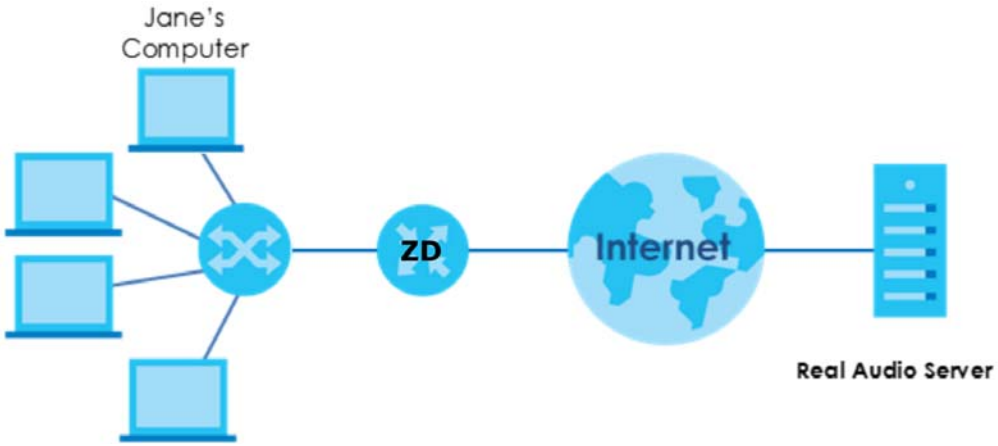
Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding, you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem 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 152 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.

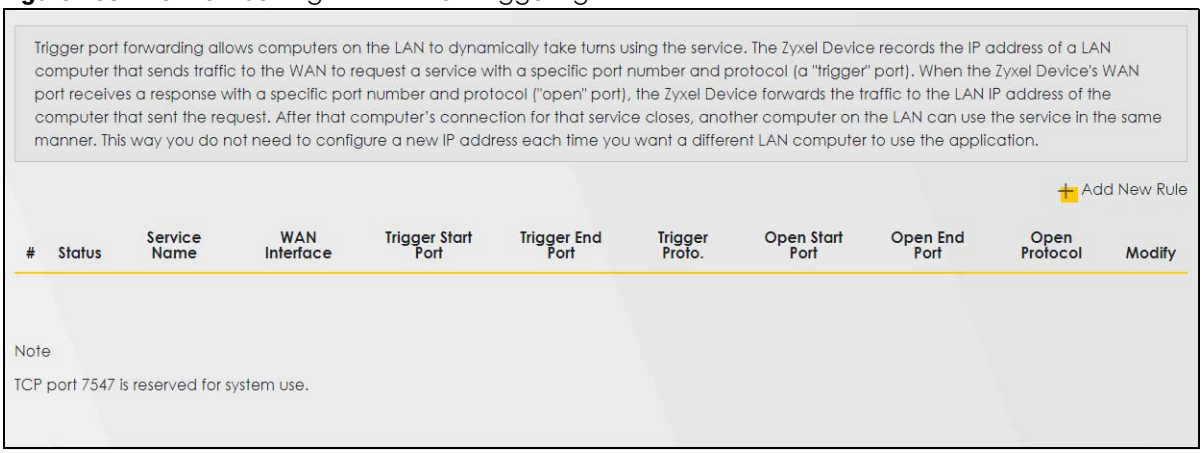
5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The Zyxel Device times out in 3 minutes with UDP (User Datagram Protocol) or 2 hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

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 153 Network Setting > NAT > Port Triggering



The following table describes the labels in this screen.

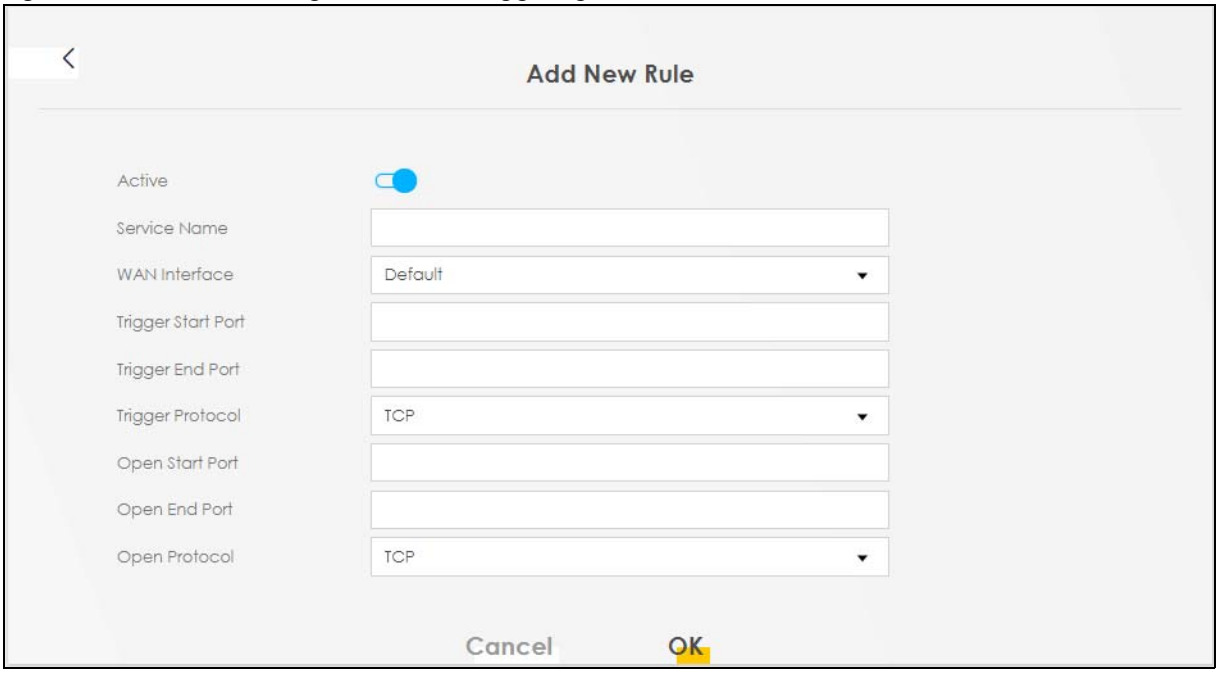
Table 82 Network Setting > NAT > Port Triggering

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 154 Network Setting > NAT > Port Triggering: Add or Edit



The following table describes the labels in this screen.

Table 83 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

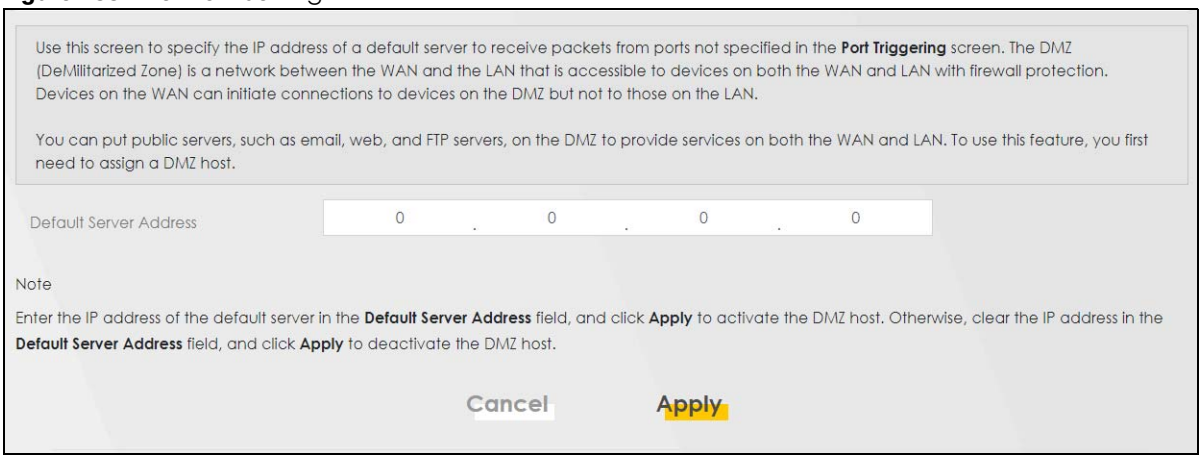
Use this screen to specify the IP address of a default server to receive packets from ports not specified in the **Port Triggering** screen. The DMZ (DeMilitarized Zone) is a network between the WAN and the LAN that is accessible to devices on both the WAN and LAN with firewall protection. Devices on 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 155 Network Setting > NAT > DMZ



The following table describes the fields in this screen.

Table 84 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

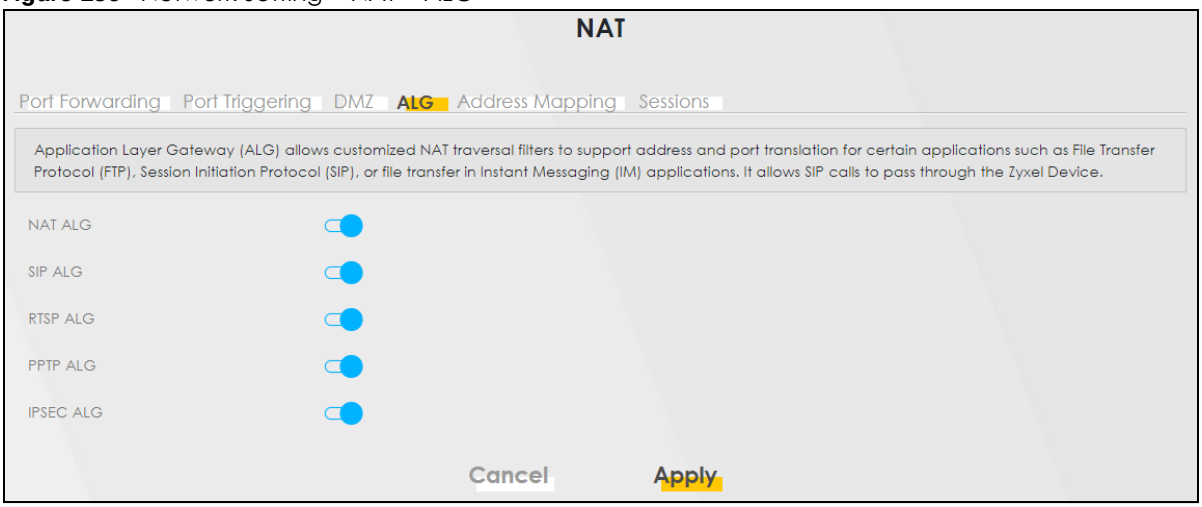
Application Layer Gateway (ALG) allows customized NAT traversal filters to support address and port translation for certain applications such as Session Initiation Protocol (SIP) or file transfer in Instant Messaging (IM) applications. It allows SIP calls to pass through the Zyxel Device. When the Zyxel 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 156 Network Setting > NAT > ALG



The following table describes the fields in this screen.

Table 85 Network Setting > NAT > ALG

LABEL	DESCRIPTION
SIP ALG	Click this switch to enable SIP ALG to make sure SIP (VoIP) works correctly with port-forwarding and address-mapping rules.
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.
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

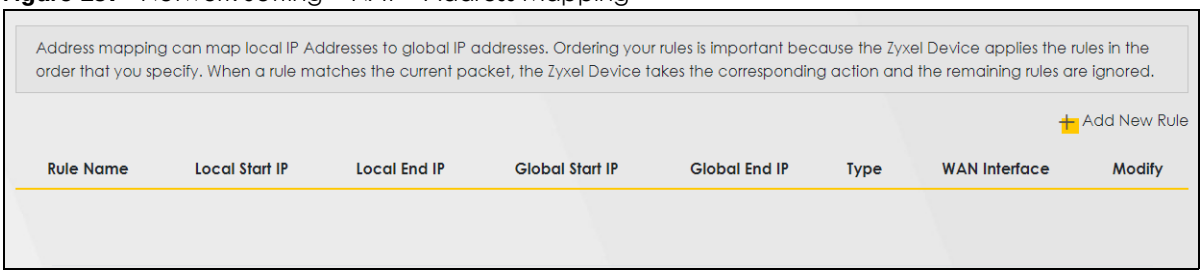
Address mapping can map local IP Addresses to global IP addresses. Ordering your rules is important because the Zyxel Device applies the rules in the order that you specify. When a rule matches the current packet, the Zyxel Device takes the corresponding action and the remaining rules are ignored.

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 157 Network Setting > NAT > Address Mapping



The following table describes the fields in this screen.

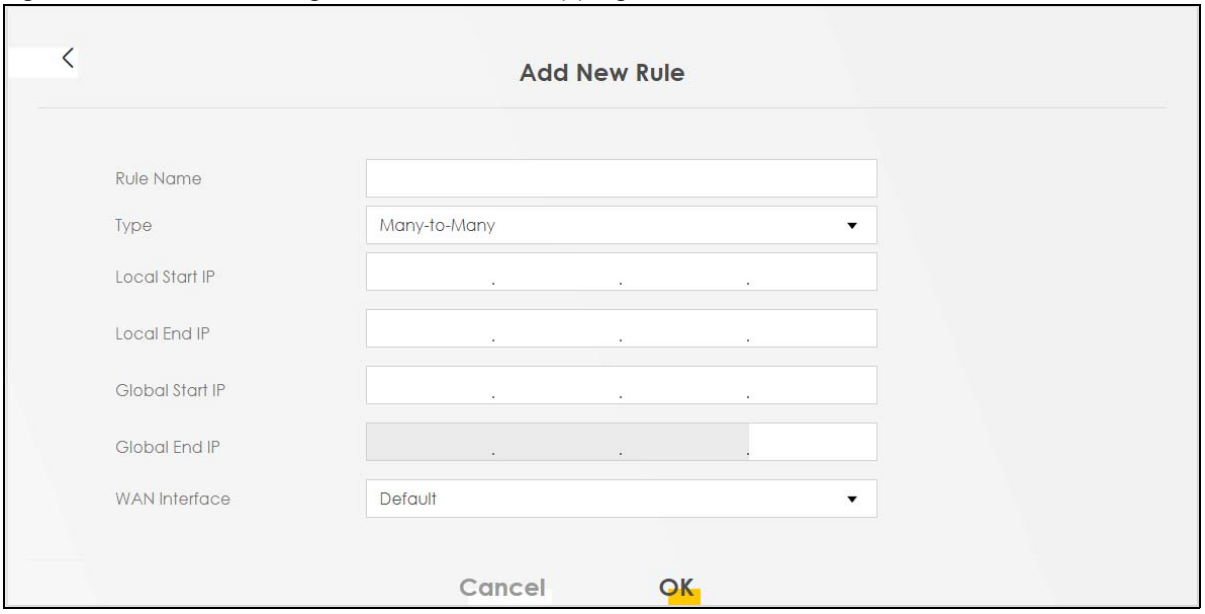
Table 86 Network Setting > NAT > Address Mapping

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 158 Network Setting > NAT > Address Mapping > Add New Rule



The following table describes the fields in this screen.

Table 87 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.

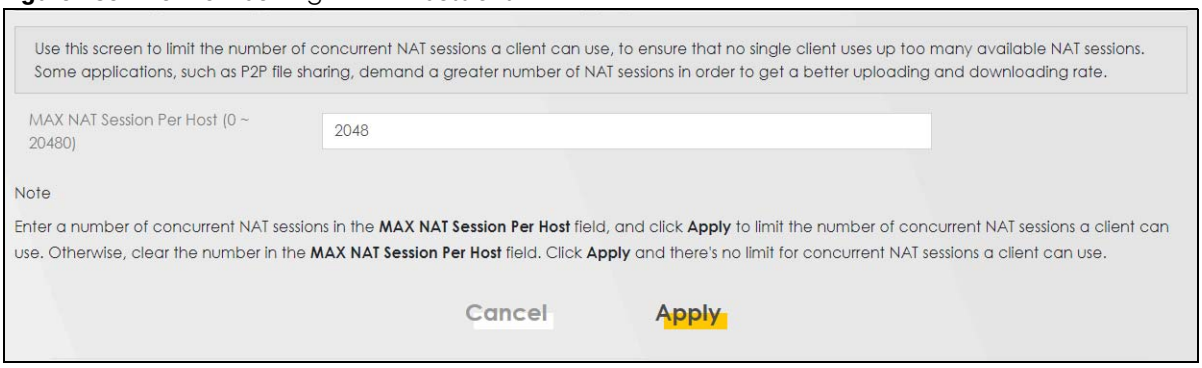
12.7 Sessions

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 159 Network Setting > NAT > Sessions



The following table describes the fields in this screen.

Table 88 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)

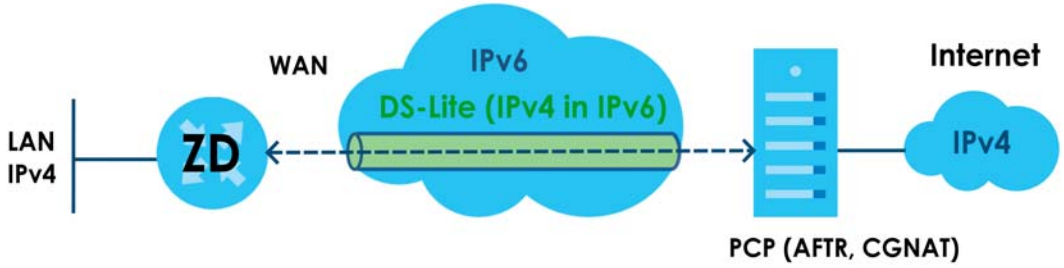
Use this screen to view, add, or delete PCP rules. Port Control Protocol (PCP) allows devices such as web or file sharing servers behind the Zyxel Device to receive incoming traffic.

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.

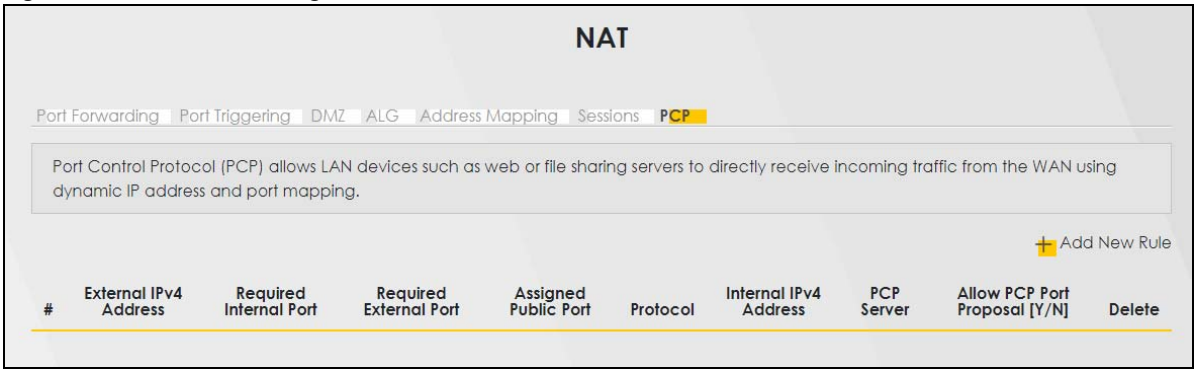
- If you select **Automatically configured by DHCPC**, then the IP address of the PCP server is in assigned to the Zyxel Device using DCHP Option 64.

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

Configuring PCP

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

Figure 160 Network Setting > NAT > PCP



The following table describes the fields in this screen.

Table 89 Network Setting > NAT > PCP

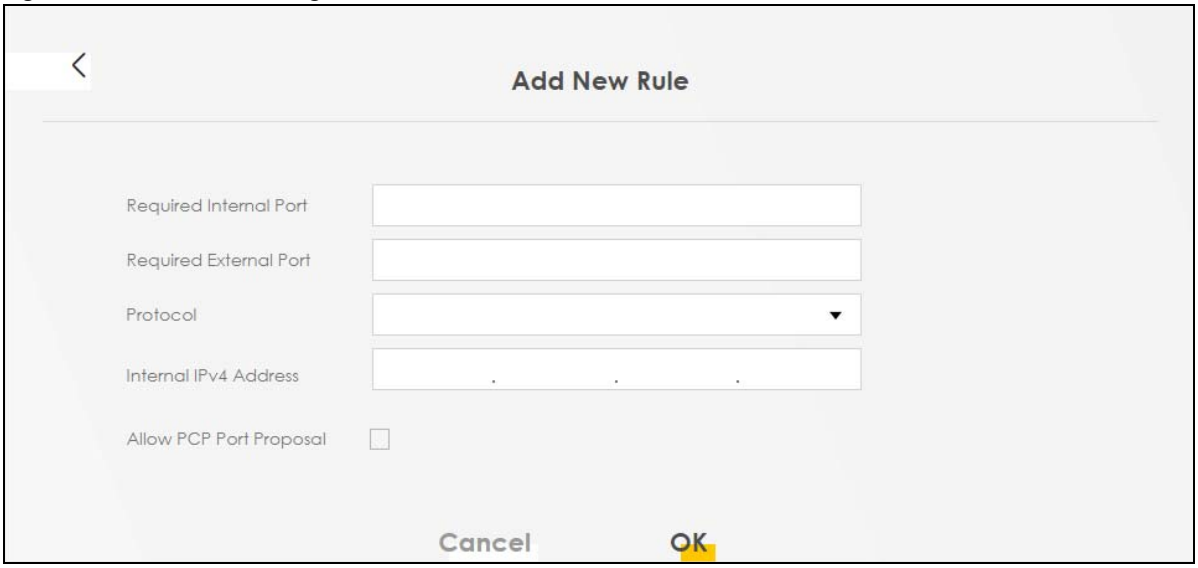
LABEL	DESCRIPTION
Add New Rule	Click this to add a new PCP rule.
#	This is the index number of the rule.
External IPv4 Address	This displays the external IP address assigned by the PCP server. PCP maps from this IP address to the LAN device IP address.
Required Internal Port	This displays the internal 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 161 Network Setting > NAT > PCP > Add New Rule



The following table describes the fields in this screen.

Table 90 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 91 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

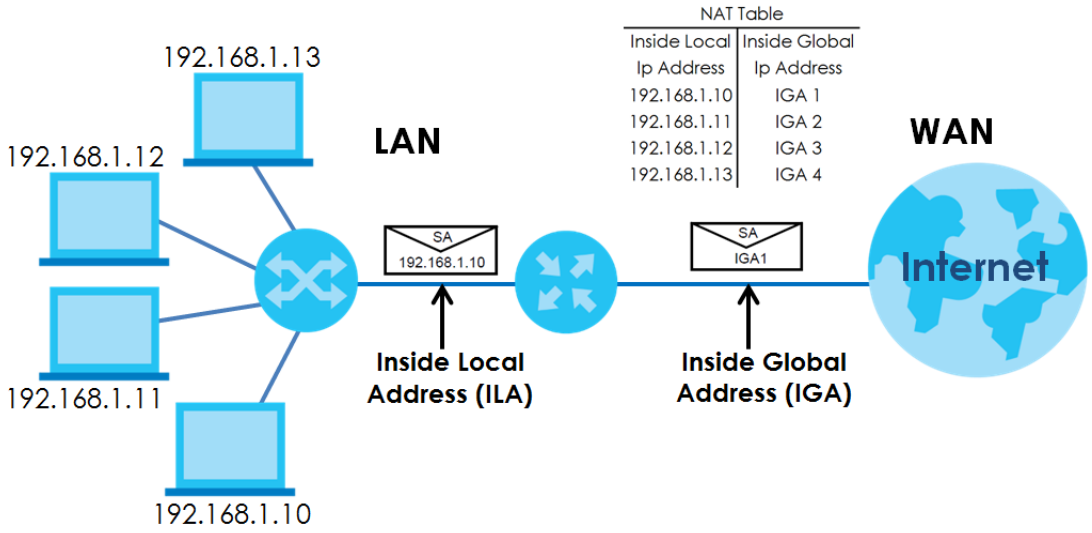
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address)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

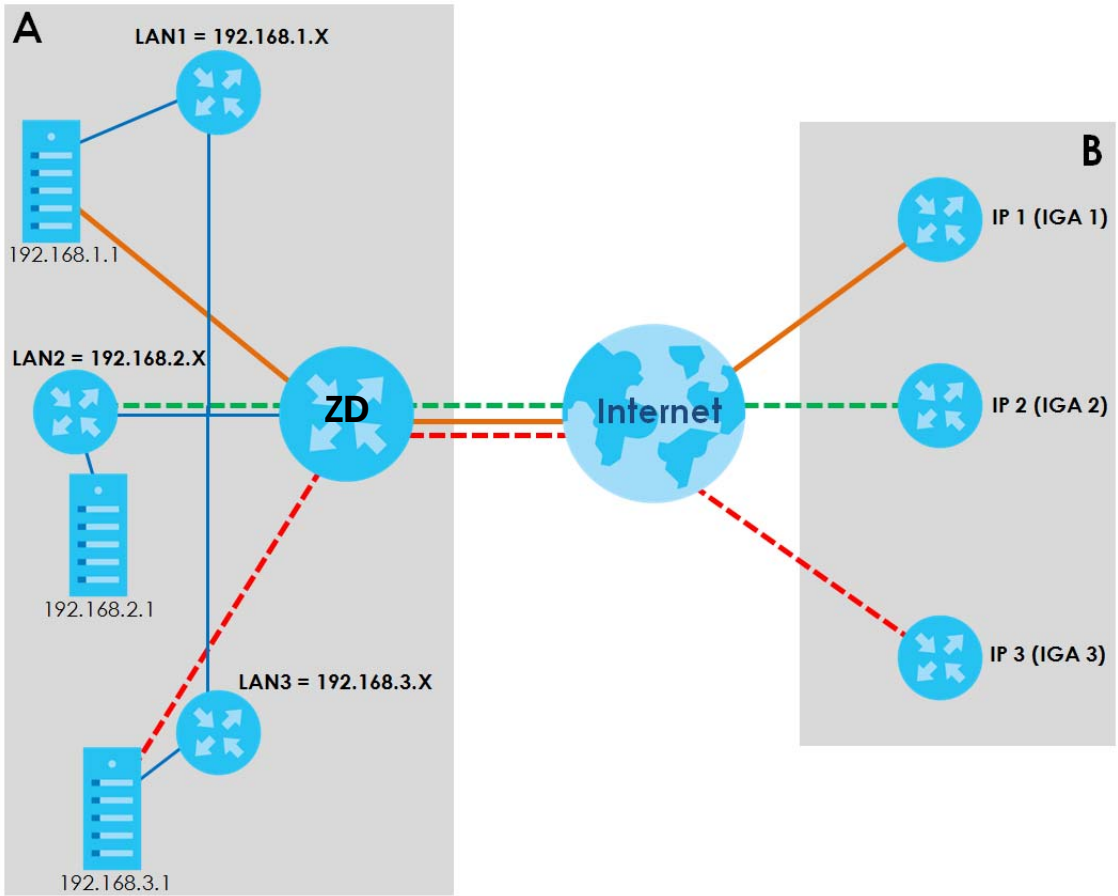
Figure 162 How NAT Works



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 163 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.

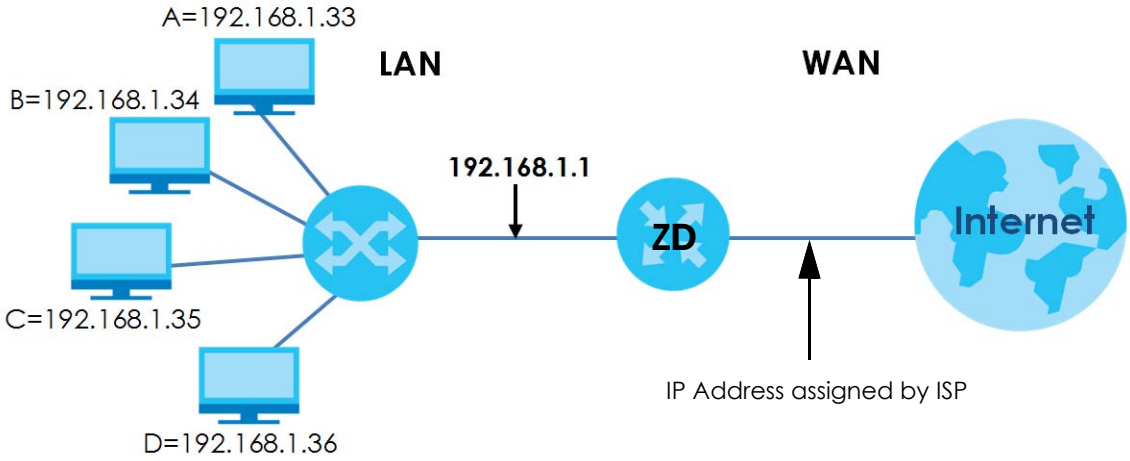
Table 92 Services and Port Numbers

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 164 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 (Section 13.2 on page 275).
- Use the **Dynamic DNS** screen to enable DDNS and configure the DDNS settings on the Zyxel Device (Section 13.3 on page 276).

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.

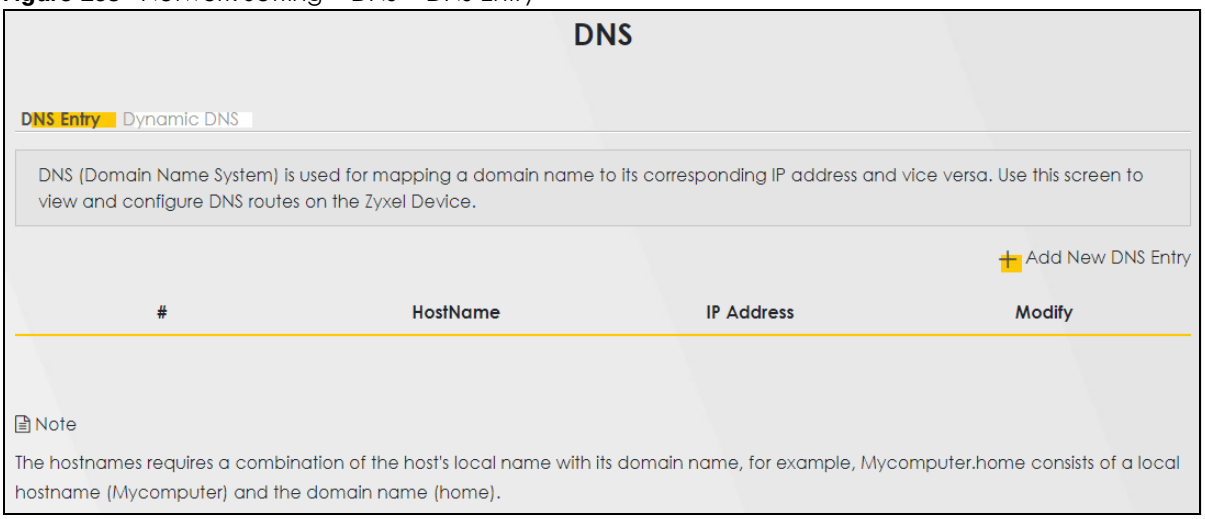
If you have a private WAN IP address, then you cannot use Dynamic DNS.

13.2 DNS Entry

DNS (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 entires 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 165 Network Setting > DNS > DNS Entry



The following table describes the fields in this screen.

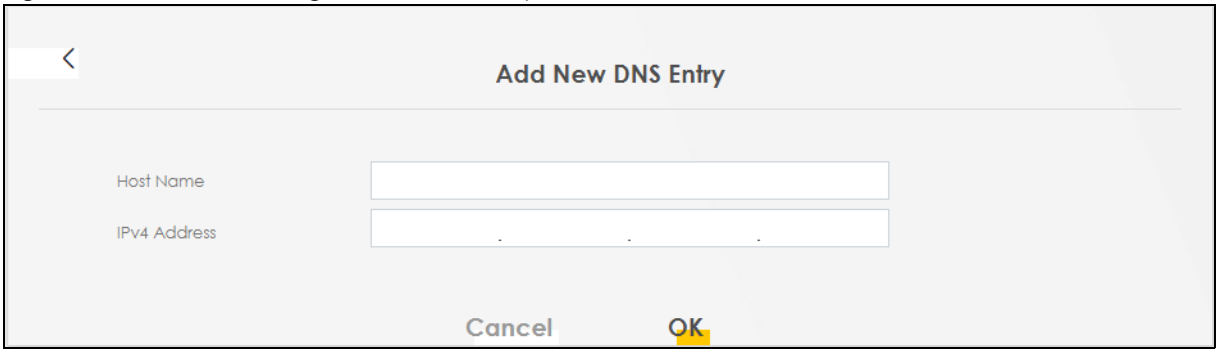
Table 93 Network Setting > DNS > DNS Entry

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 166 Network Setting > DNS > DNS Entry: Add or Edit



The following table describes the labels in this screen.

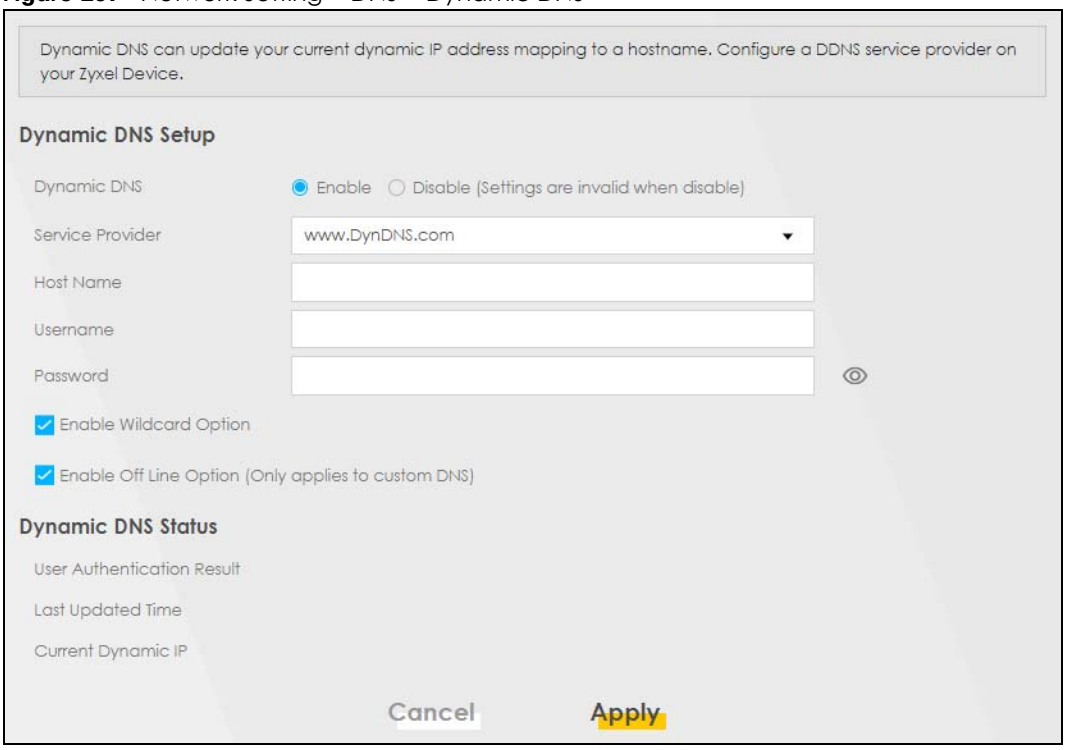
Table 94 Network Setting > DNS > DNS Entry: Add or Edit

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 167 Network Setting > DNS > Dynamic DNS



The following table describes the fields in this screen.

Table 95 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 95 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 on page 164 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.

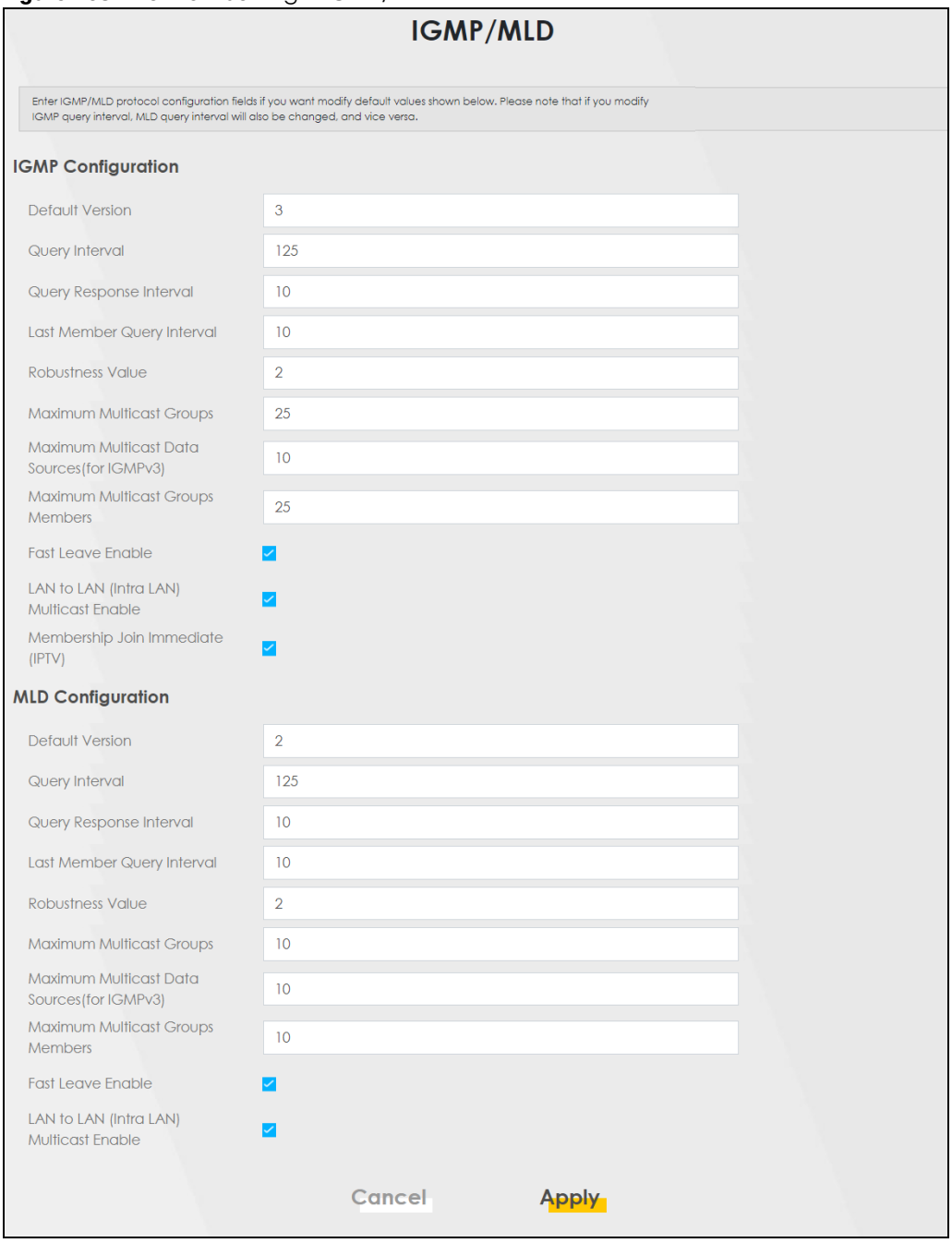
With the IGMP fast leave feature enabled, the router removes the host's information from the group member list once it receives a leave message from a host and the fast leave timer expires.

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 might only support IGMP/MLD **Default Version** configuration.

Figure 168 Network Setting > IGMP/MLD



The following table describes the labels in this screen.

Table 96 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

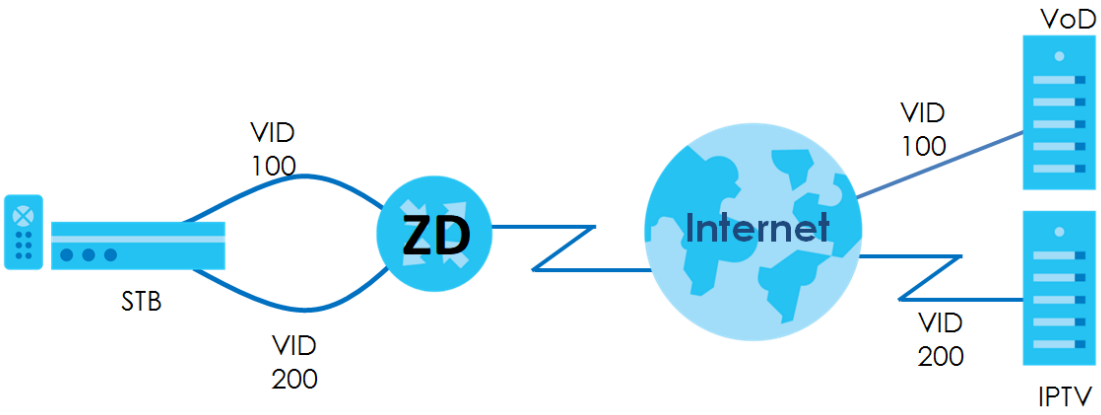
A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same groups; 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 169 VLAN Group Example



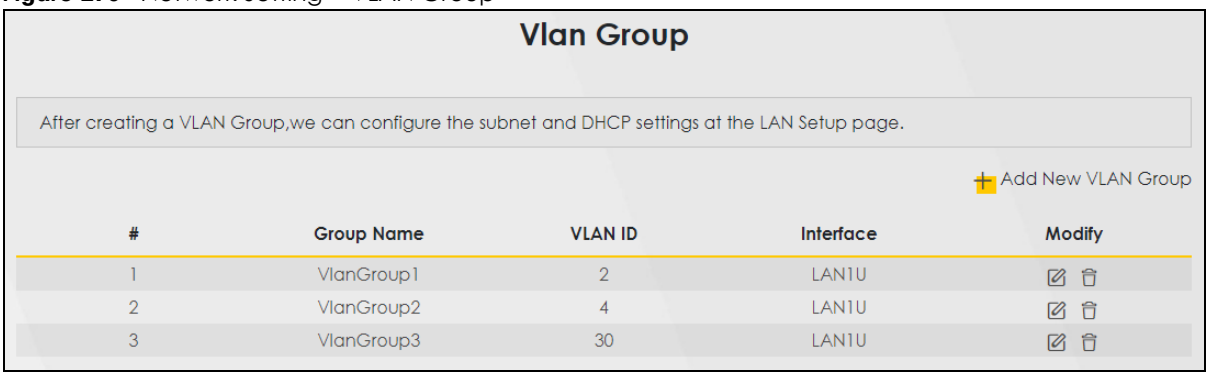
15.1.1 What You Can Do in this Chapter

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 170 Network Setting > VLAN Group



The following table describes the fields in this screen.

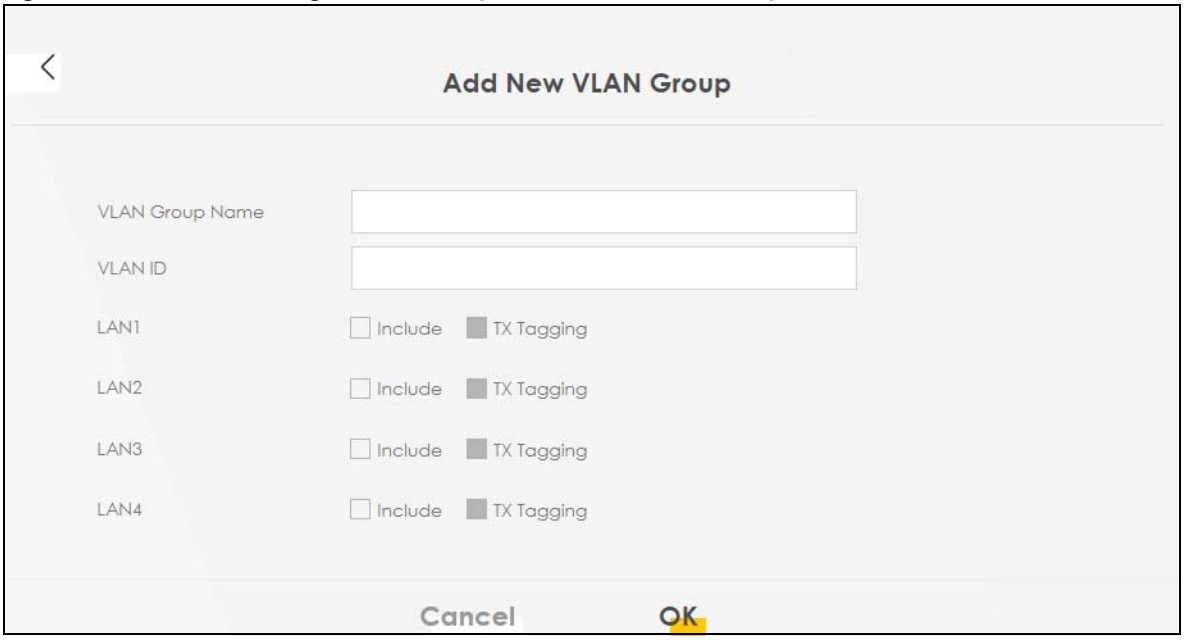
Table 97 Network Setting > VLAN Group

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 171 Network Setting > VLAN Group > Add New VLAN Group/Edit



The following table describes the fields in this screen.

Table 98 Network Setting > VLAN Group > Add New VLAN Group/Edit

LABEL	DESCRIPTION
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 (Section 16.2 on page 285).

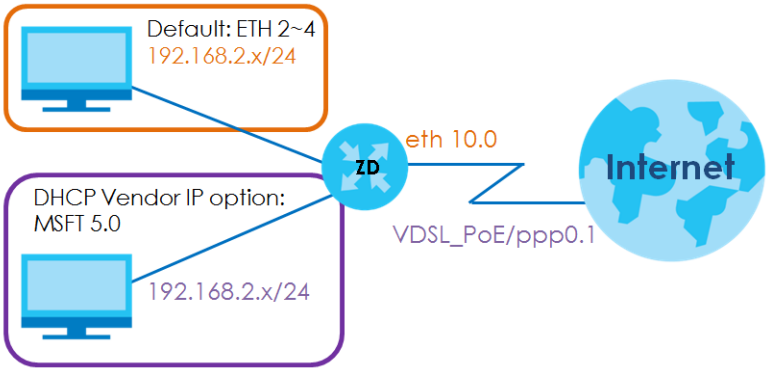
16.2 Interface Grouping

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 Chapter 9 on page 195 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.

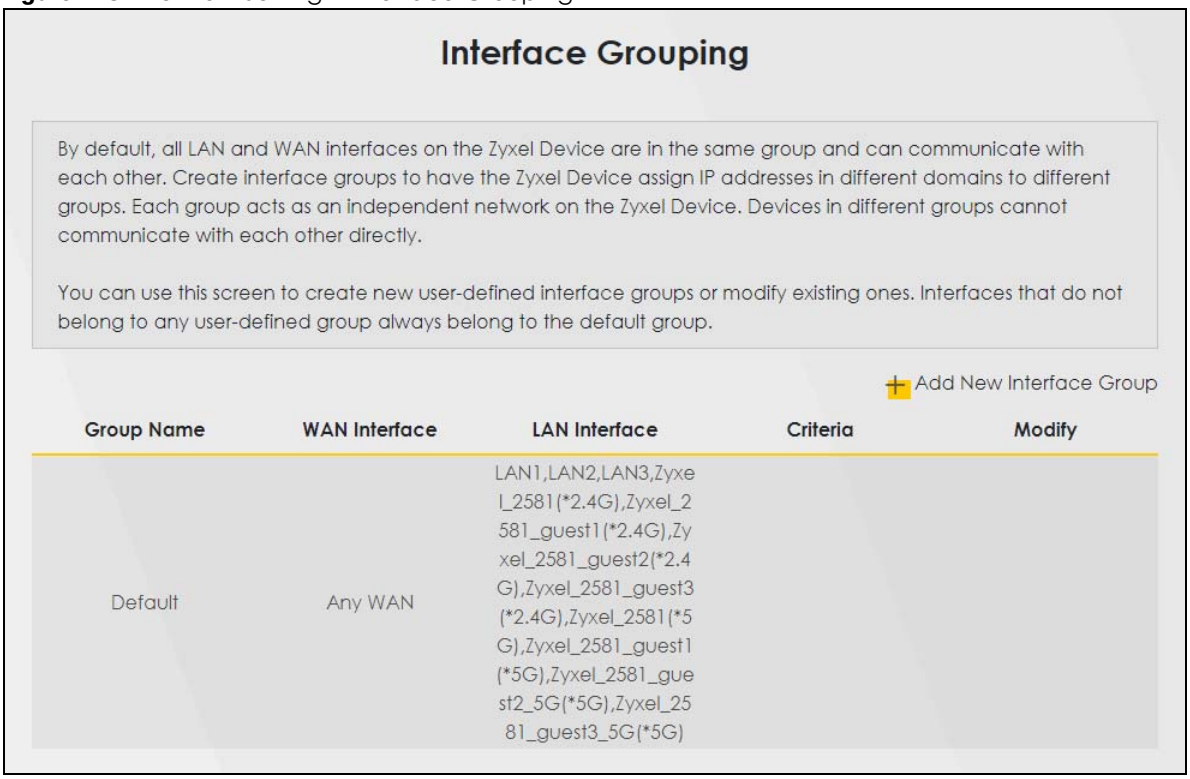
Figure 172 Interface Grouping Application



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 173 Network Setting > Interface Grouping



The following table describes the fields in this screen.

Table 99 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.

Table 99 Network Setting > Interface Grouping (continued)

LABEL	DESCRIPTION
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.

Note: You can have up to 15 filter criteria.

Figure 174 Network Setting > Interface Grouping > Add New Interface Group (for DSL routers)

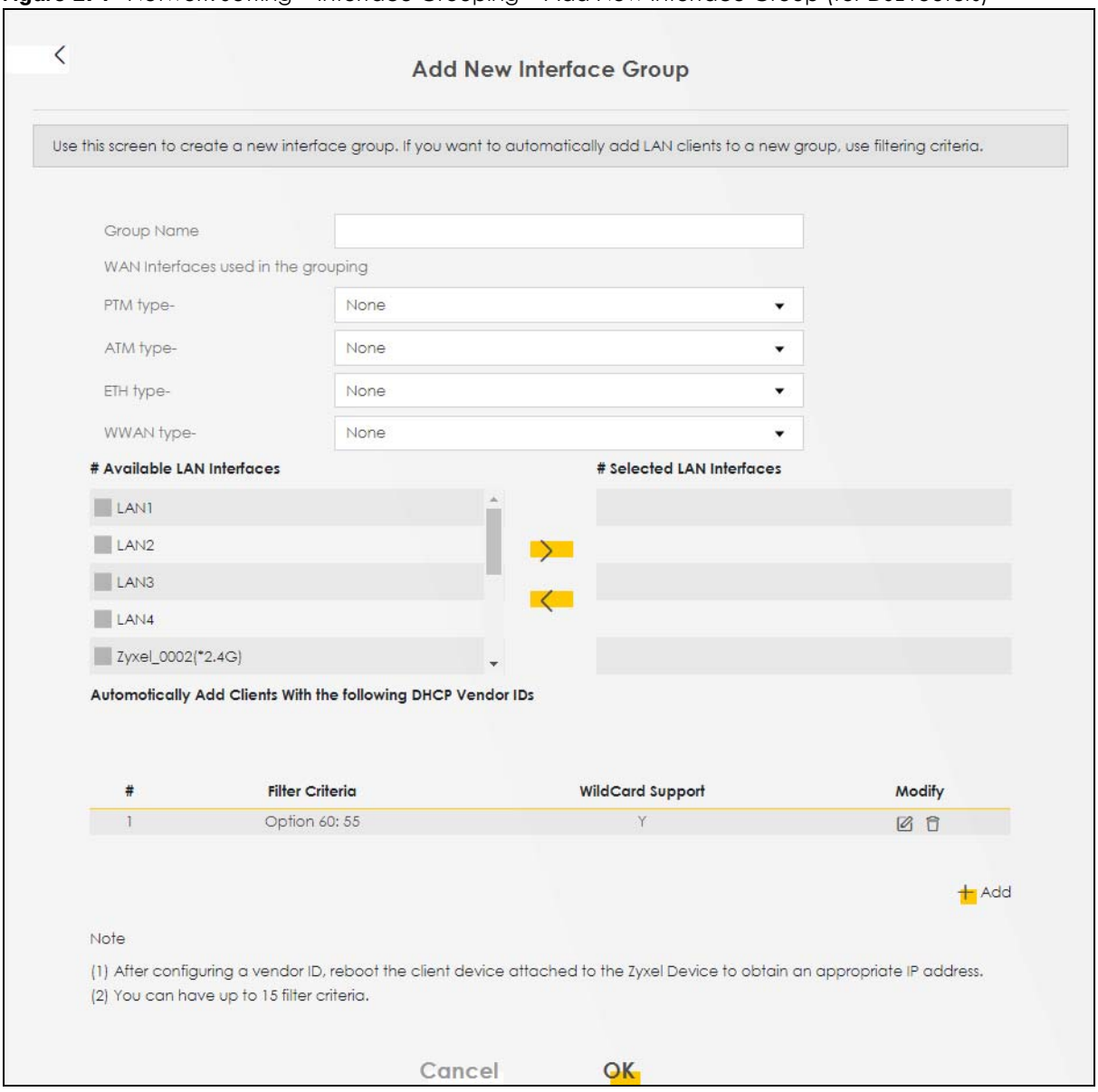


Figure 175 Network Setting > Interface Grouping > Add New Interface Group (for Ethernet routers)

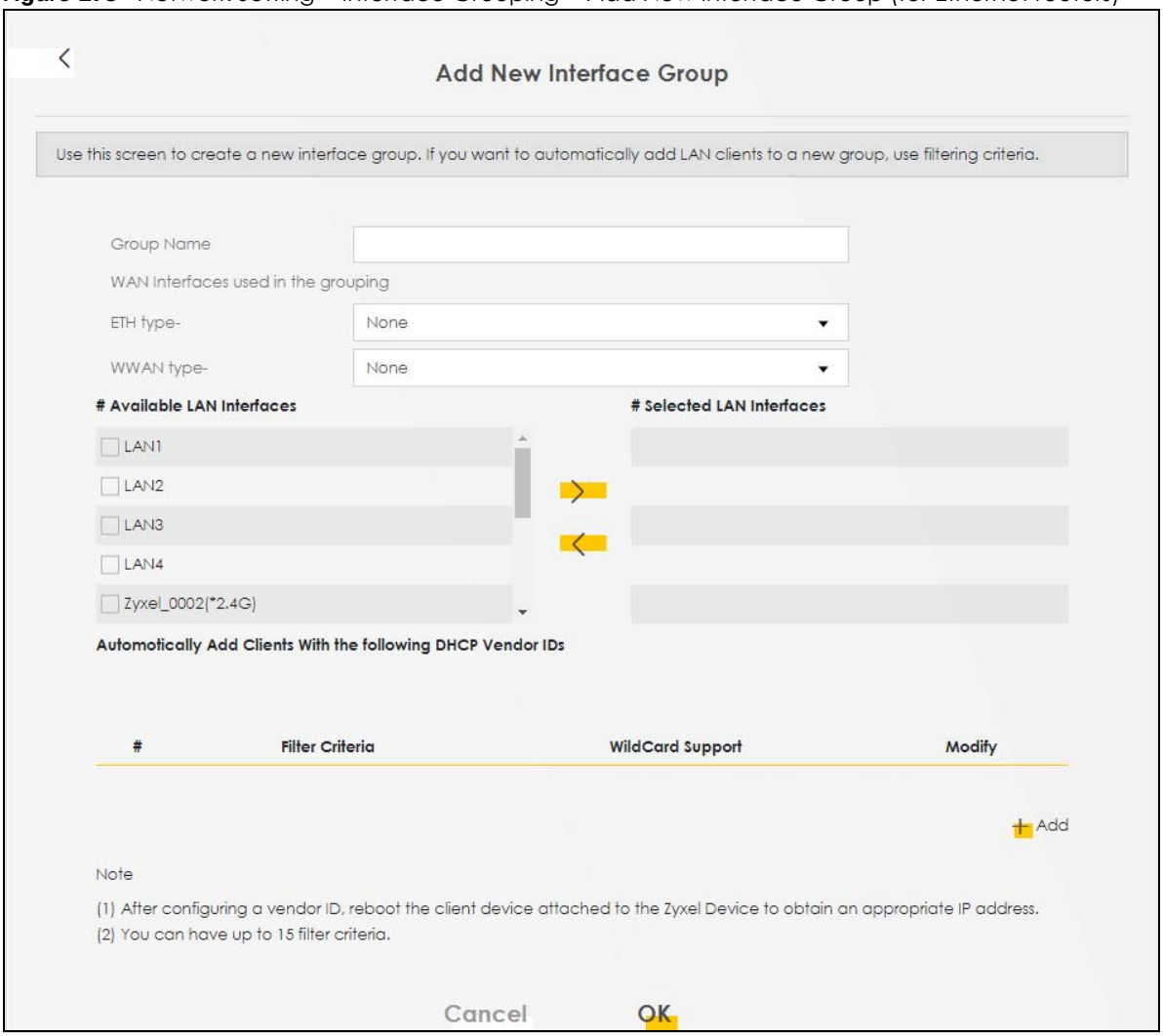
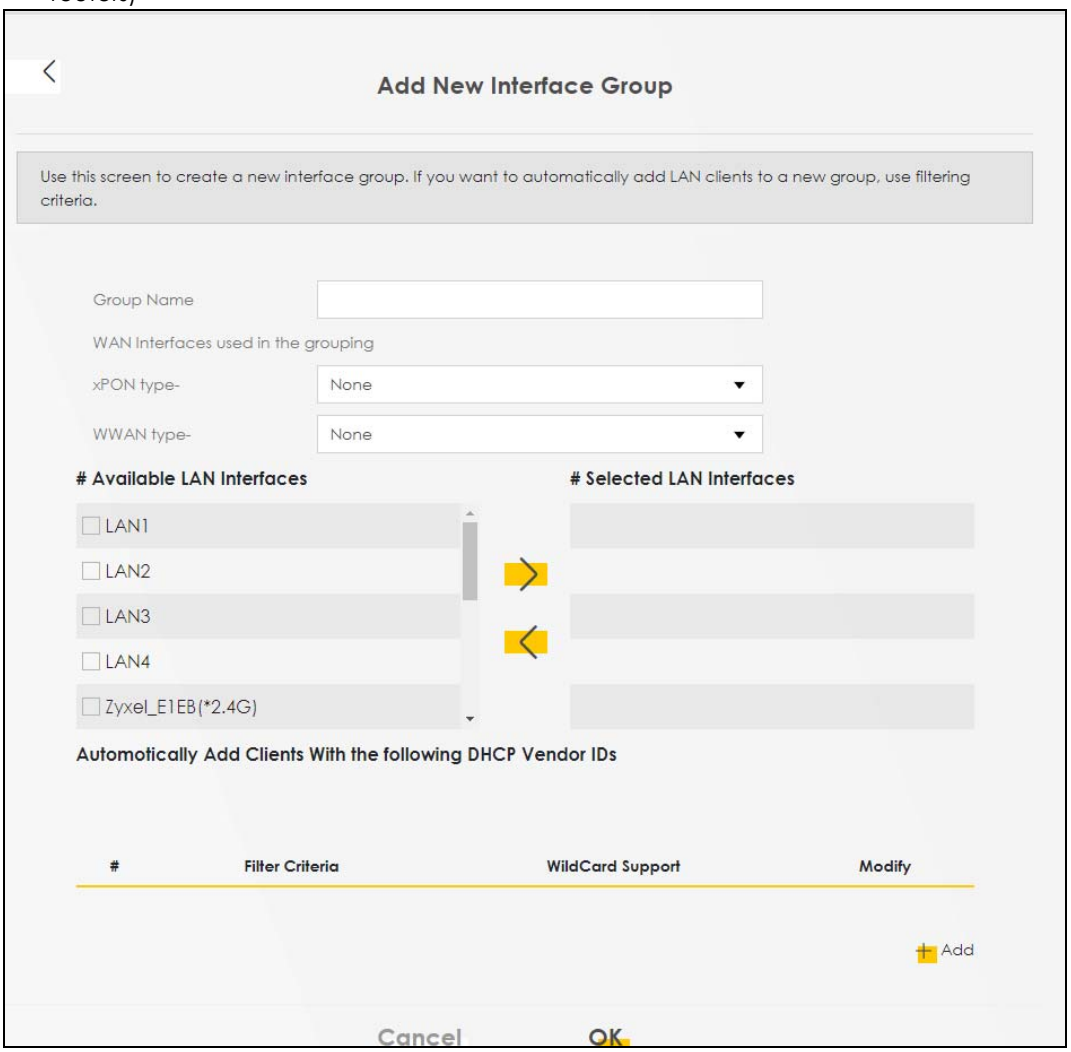


Figure 176 Network Setting > Interface Grouping > Add New Interface Group (for AON and PON routers)



The following table describes the fields in this screen.

Table 100 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 Available LAN Interfaces	Select one or more interfaces (Ethernet LAN, wireless LAN) in the **Available LAN Interfaces** list and use the left arrow to move them to the **Selected LAN Interfaces** list to add the interfaces to this group. To remove a LAN or wireless LAN interface from the **Selected LAN Interfaces**, use the right-facing arrow.

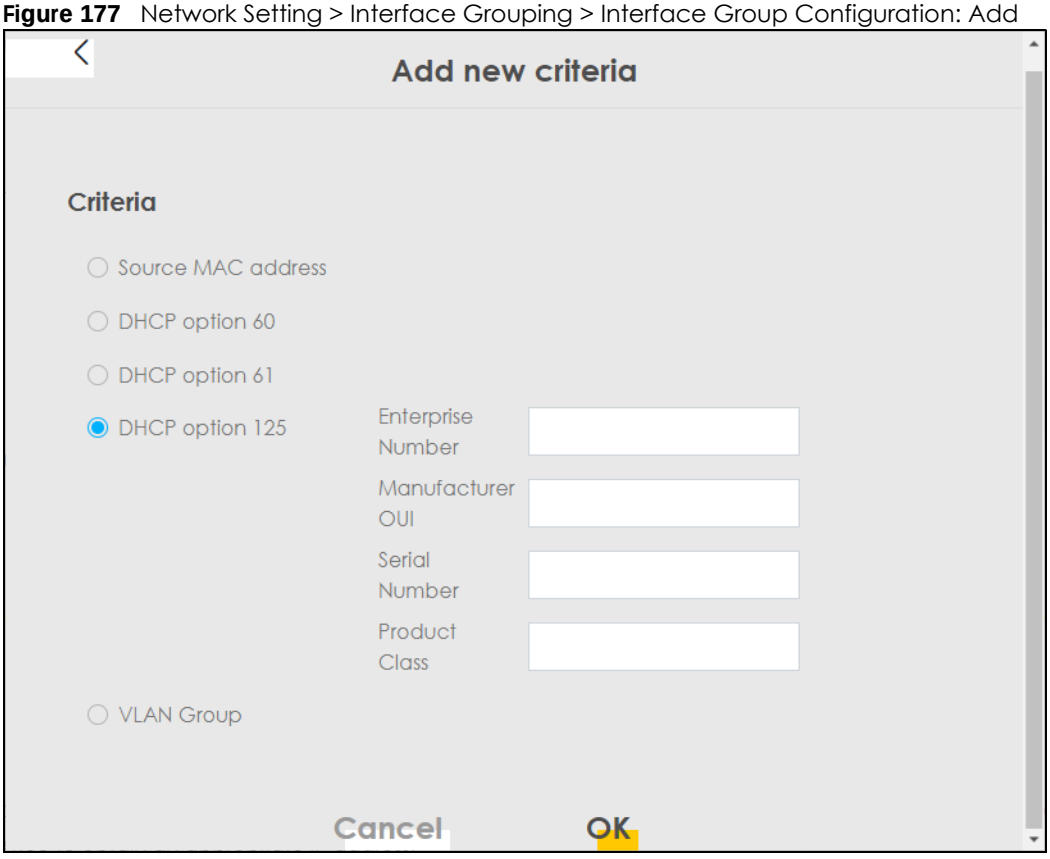
Table 100 Network Setting > Interface Grouping > Add New Interface Group/Edit (continued)

LABEL	DESCRIPTION
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 Section 16.2.2 on page 291 for more information.
#	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 177 Network Setting > Interface Grouping > Interface Group Configuration: Add



The following table describes the fields in this screen.

Table 101 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.

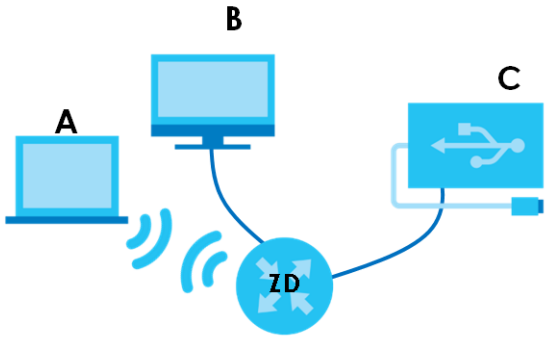
CHAPTER 17
USB Service

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 178 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 (Section 17.2 on page 294).
- Use the **Media Server** screen to enable or disable the sharing of media files (Section 17.3 on page 298).

17.1.2 What You Need To Know

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

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

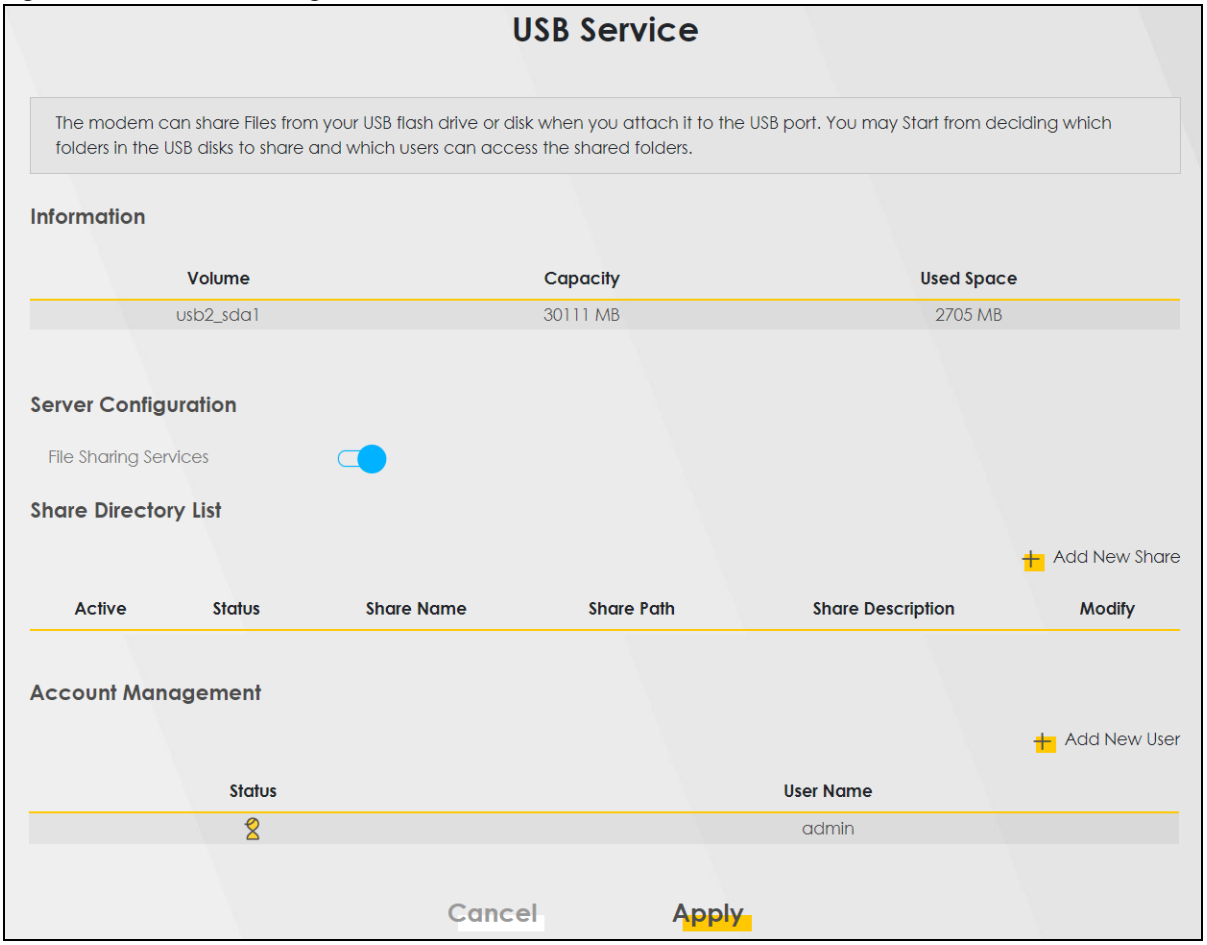
1. Make sure the Zyxel Device is connected to your network and turned on.
2. Connect the USB device to one of the Zyxel Device's USB port. If you are connecting a USB hard drive that comes with an external power supply, make sure it is connected to an appropriate power source.
3. The Zyxel Device detects 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 179 Network Setting > USB Service



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

Each field is described in the following table.

Table 102 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 102 Network Setting > USB Service (continued)

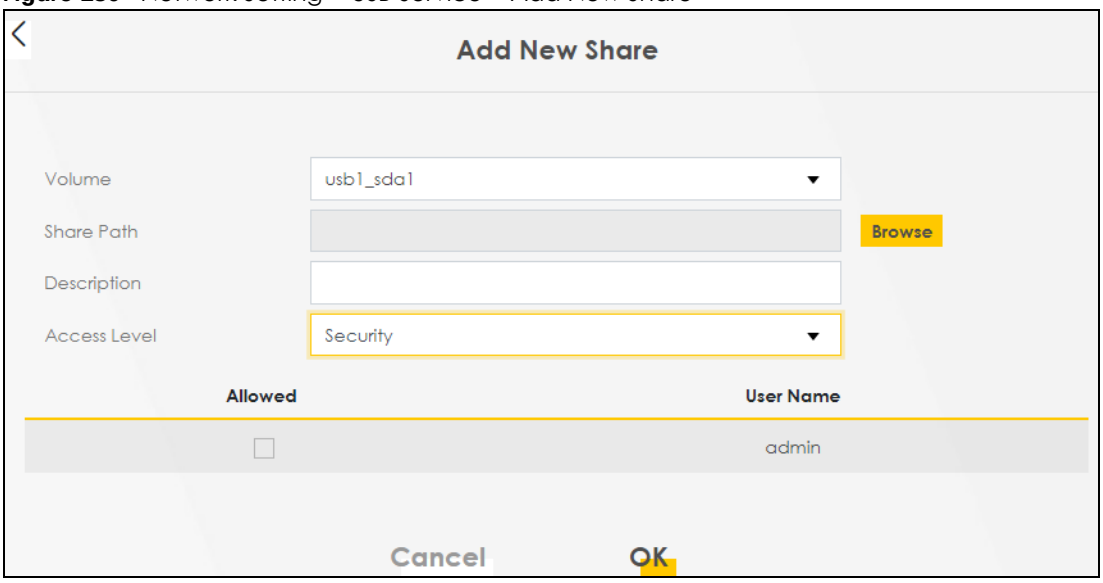
LABEL	DESCRIPTION
Status	This field shows the status of the share  : The share is not activated.  : The share is activated.
Share Name	This field displays the name of the file you shared.
Share Path	This field displays the location in the USB of the file you shared.
Share Description	This field displays 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 180 Network Setting > USB Service > Add New Share



The following table describes the labels in this menu.

Table 103 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 check box 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 Chapter 35 on page 387, 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.

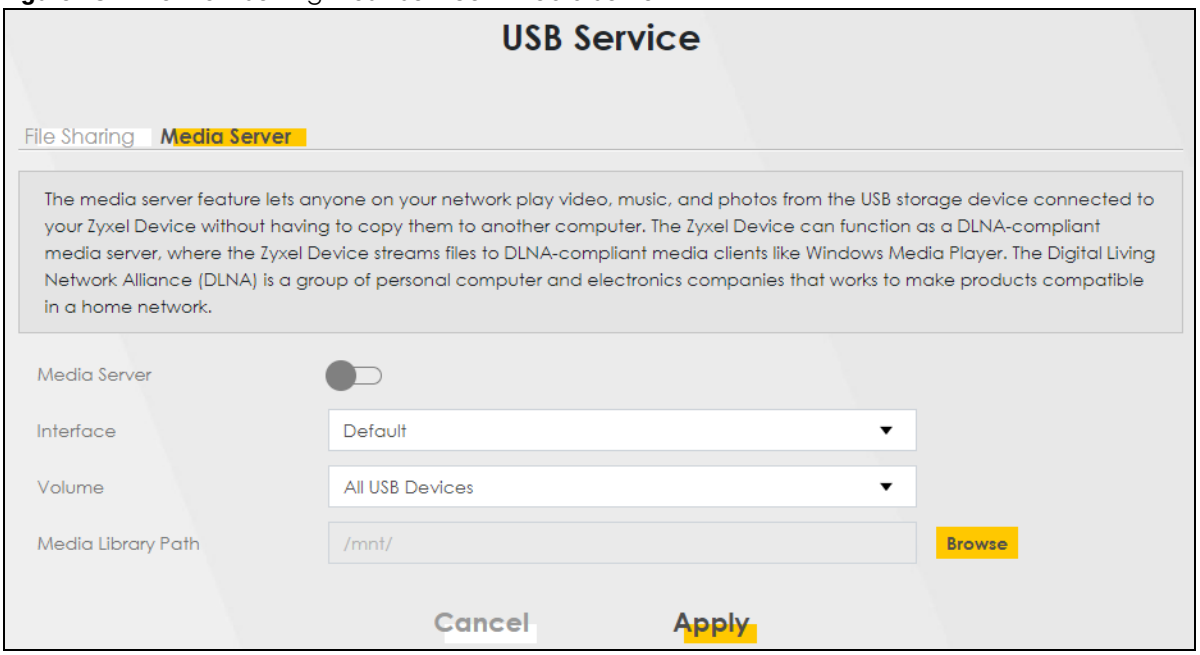
The Zyxel Device media server enables you to:

- 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 181 Network Setting > USB Service > Media Server



The following table describes the labels in this menu.

Table 104 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.

CHAPTER 18
Firewall

18.1 Firewall Overview

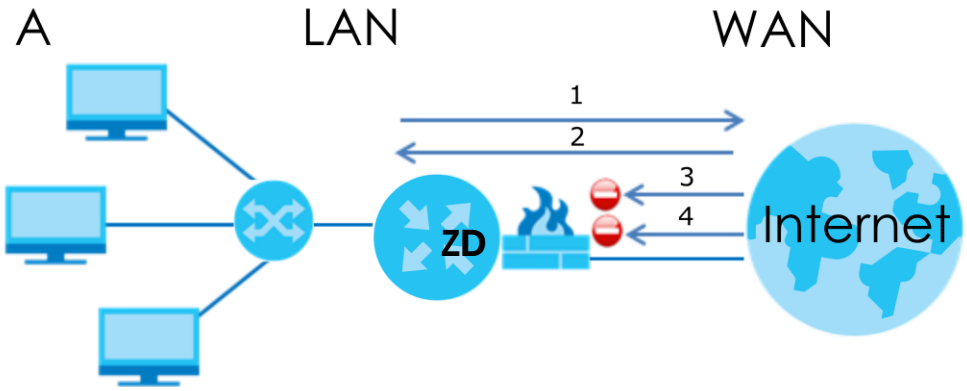
This chapter shows you how to enable the Zyxel Device firewall. Use the firewall to protect your Zyxel Device and network from attacks by hackers on the Internet and control access to it. The firewall:

- 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 182 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 (Section 18.3 on page 302).
- Use the **Protocol** screen to add or remove predefined Internet services and configure firewall rules (Section 18.4 on page 303).

- Use the **Access Control** screen to view and configure incoming or outgoing filtering rules (Section 18.5 on page 304).
- Use the **DoS** screen to activate protection against Denial of Service (DoS) attacks (Section 18.6 on page 307).

18.3 Firewall General Settings

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 183 Security > Firewall > General

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 105 Security > Firewall > General

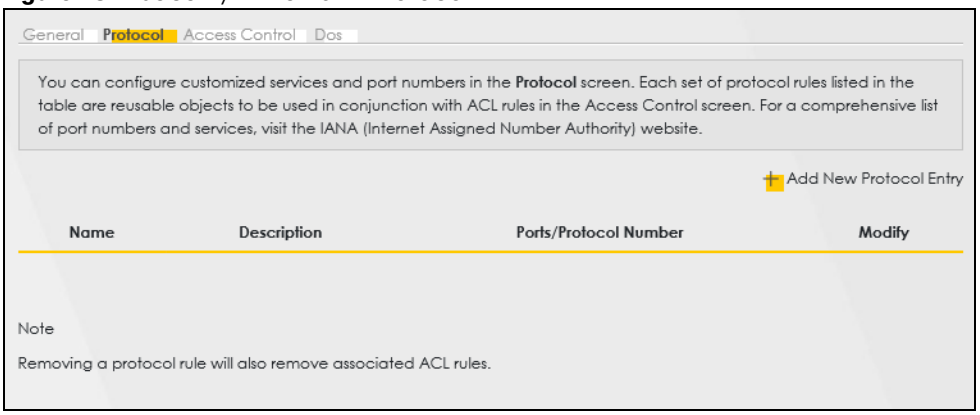
LABEL	DESCRIPTION
IPv4 Firewall	Enable firewall protection when using **IPv4** (Internet Protocol version 4).
IPv6 Firewall	Enable firewall protection when using **IPv6** (Internet Protocol version 6).
High	This setting blocks all traffic to and from the Internet. Only local network traffic and LAN to 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 184 Security > Firewall > Protocol



The following table describes the labels in this screen.

Table 106 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.

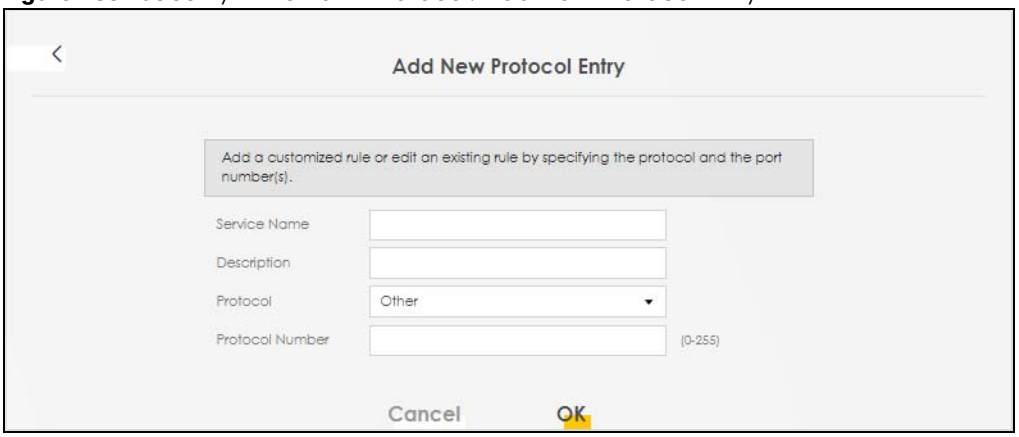
Table 106 Security > Firewall > Protocol (continued)

LABEL	DESCRIPTION
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 185 Security > Firewall > Protocol: Add New Protocol Entry



The following table describes the labels in this screen.

Table 107 Security > Firewall >

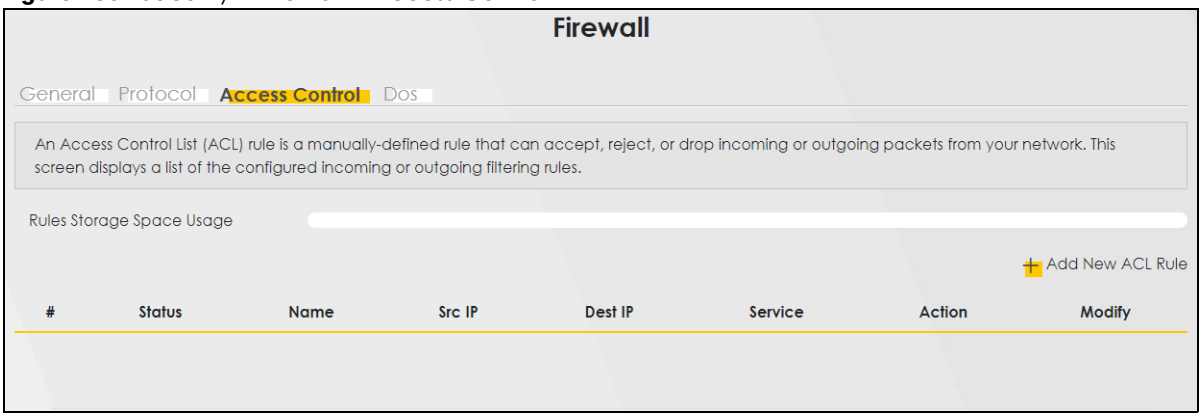
LABEL	DESCRIPTION
Service Name	Enter a descriptive name for your customized service. You can use up to 16 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
Description	Enter a description for your customized service. You can use up to 16 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], 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 186 Security > Firewall > Access Control



The following table describes the labels in this screen.

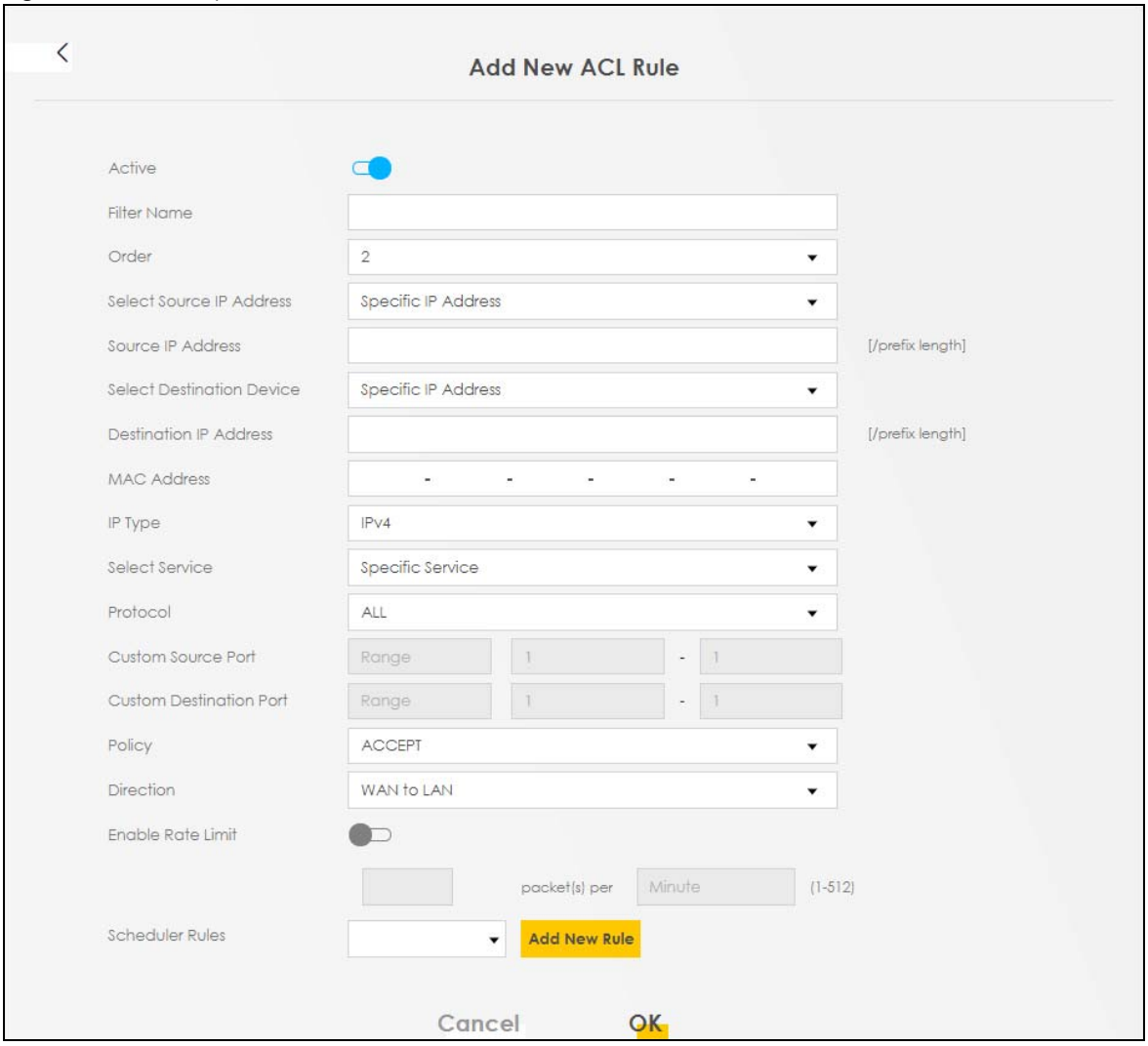
Table 108 Security > Firewall > Access Control

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 187 Security > Firewall > Access Control > Add New ACL Rule



The following table describes the labels in this screen.

Table 109 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 109 Security > Firewall > Access Control > Add New ACL Rule (continued)

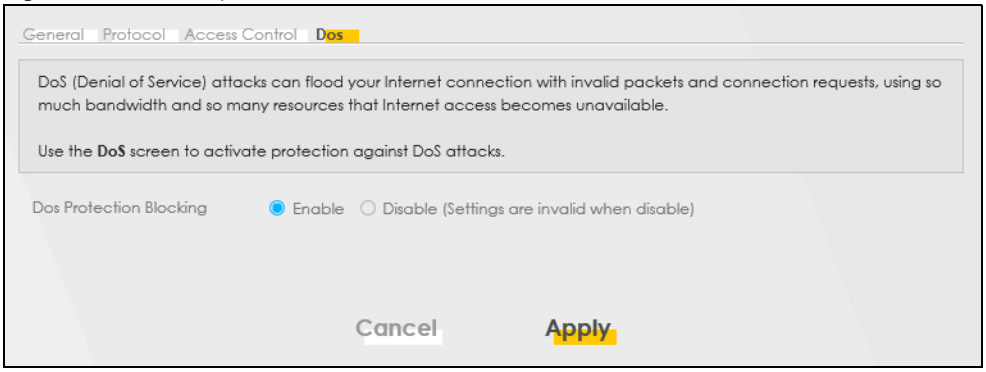
LABEL	DESCRIPTION
Select Service	Select a service from the **Select Service** box.
Protocol	Select the protocol (**ALL**, **TCP/UDP**, **TCP**, **UDP**, **ICMP**, or **ICMPv6**) used to transport the packets for which you want to apply the rule.
Custom Source Port	This is a single port number or the 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 188 Security > Firewall > DoS



The following table describes the labels in this screen.

Table 110 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

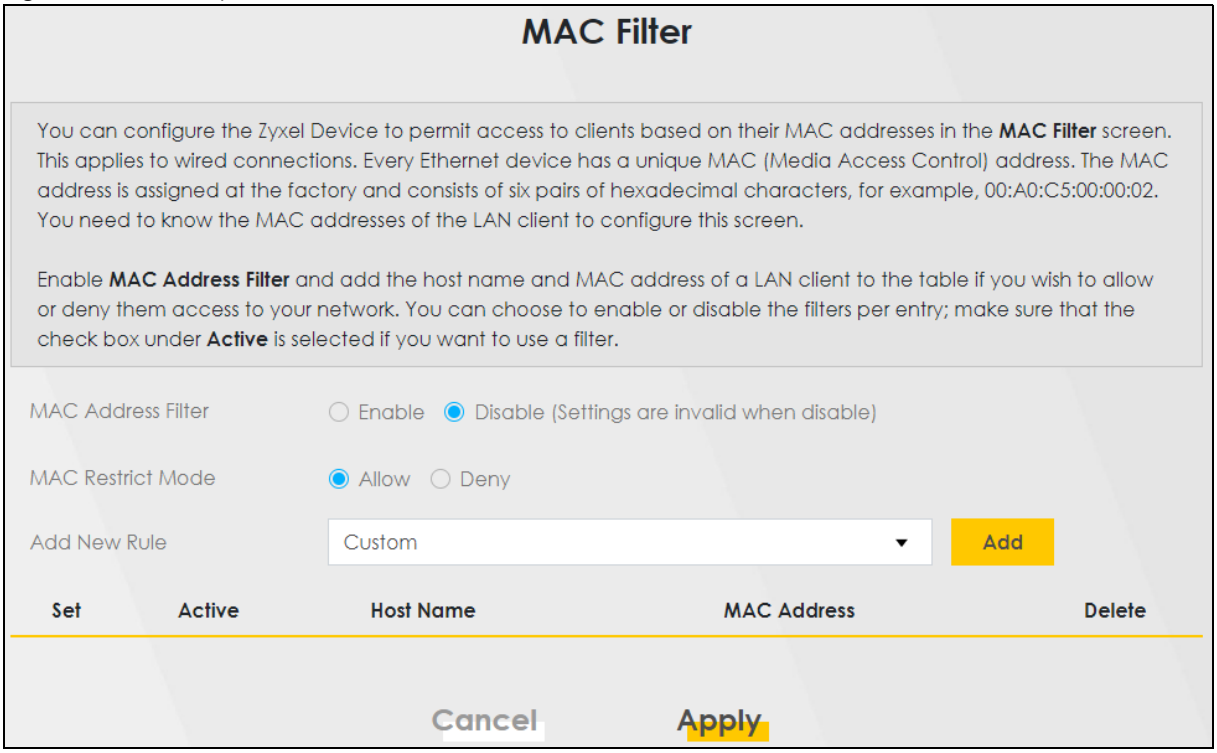
19.1 MAC Filter Overview

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 check box under **Active** is selected if you want to use a filter. Select **Security** > **MAC Filter**. The screen appears as shown.

Figure 189 Security > MAC Filter



The following table describes the labels in this screen.

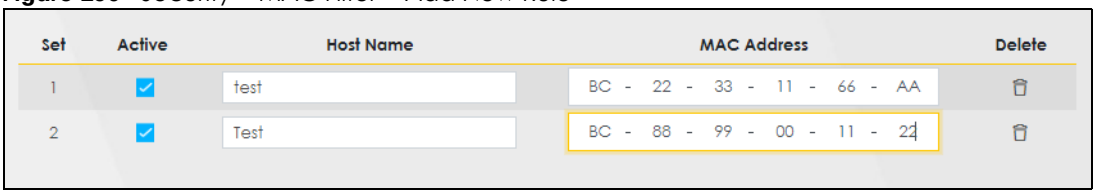
Table 111 Security > MAC Filter

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 check box 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 190 Security > MAC Filter > Add New Rule



The following table describes the labels in this screen.

Table 112 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

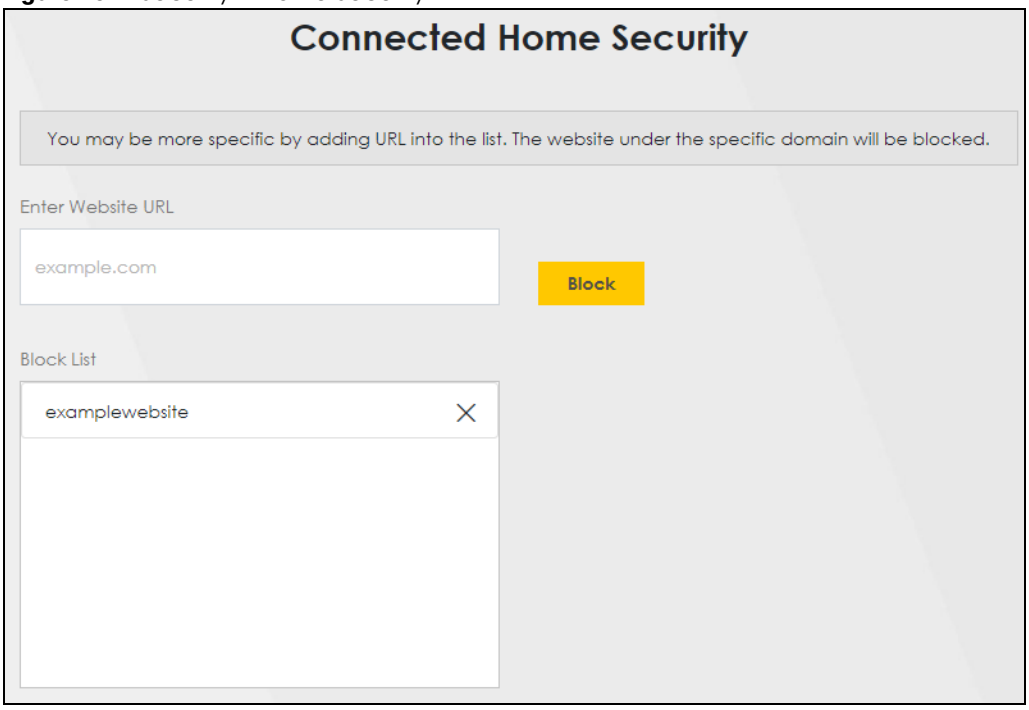
20.1 Home Security Overview

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 Section 1.1 on page 19 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 191 Security > Home Security



The following table describes the labels in this screen.

Table 113 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 Section 1.1 on page 19 for more information.

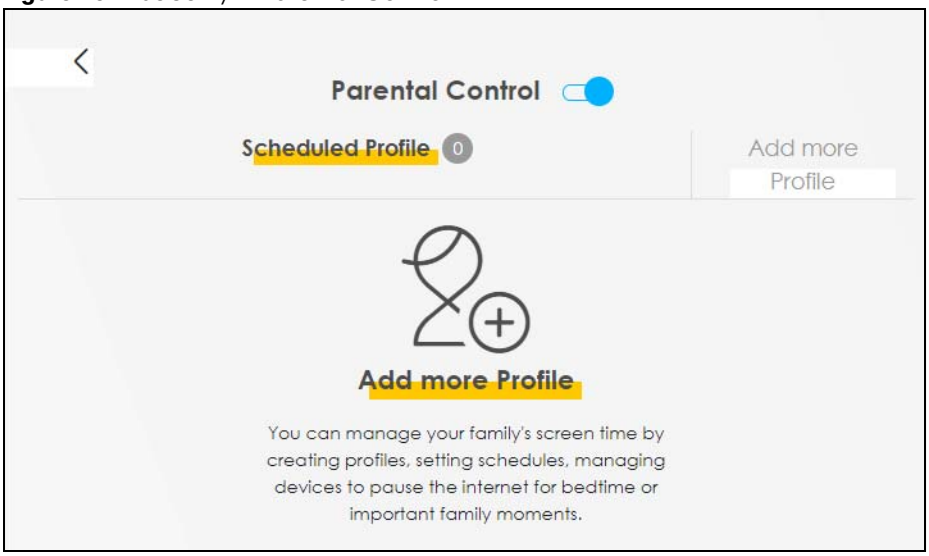
21.2 Parental Control Schedule

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 192 Security > Parental Control



The following table describes the fields in this screen.

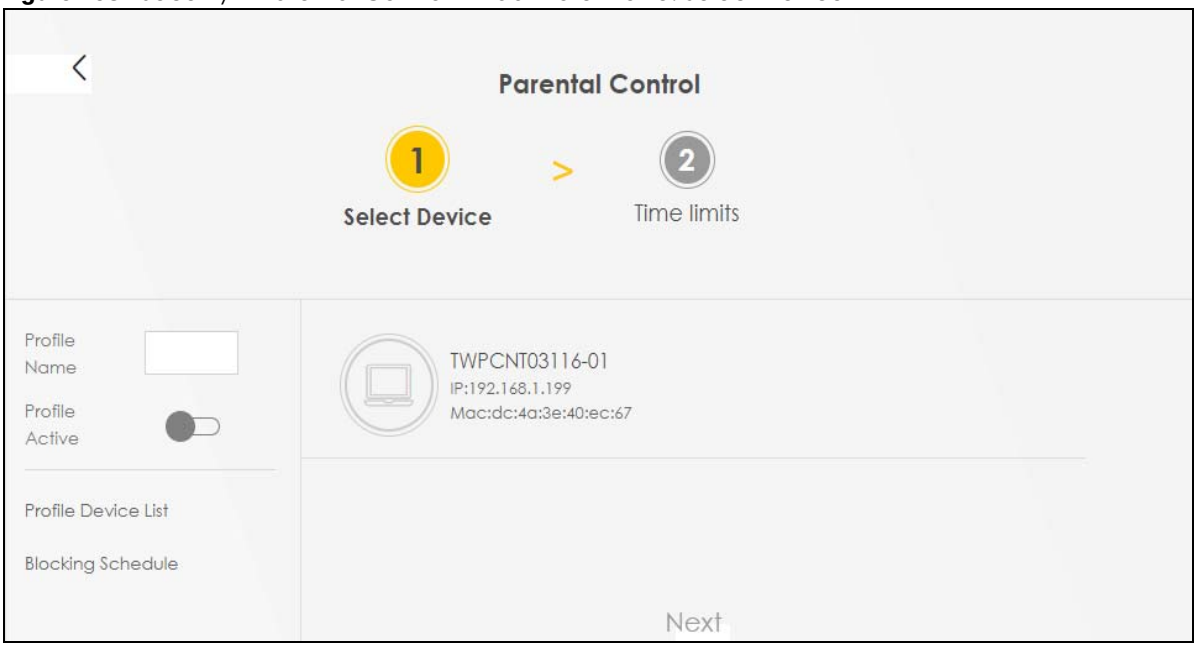
Table 114 Security > Parental Control

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 193 Security > Parental Control > Add more Profile: Select Device



The following table describes the fields in this screen.

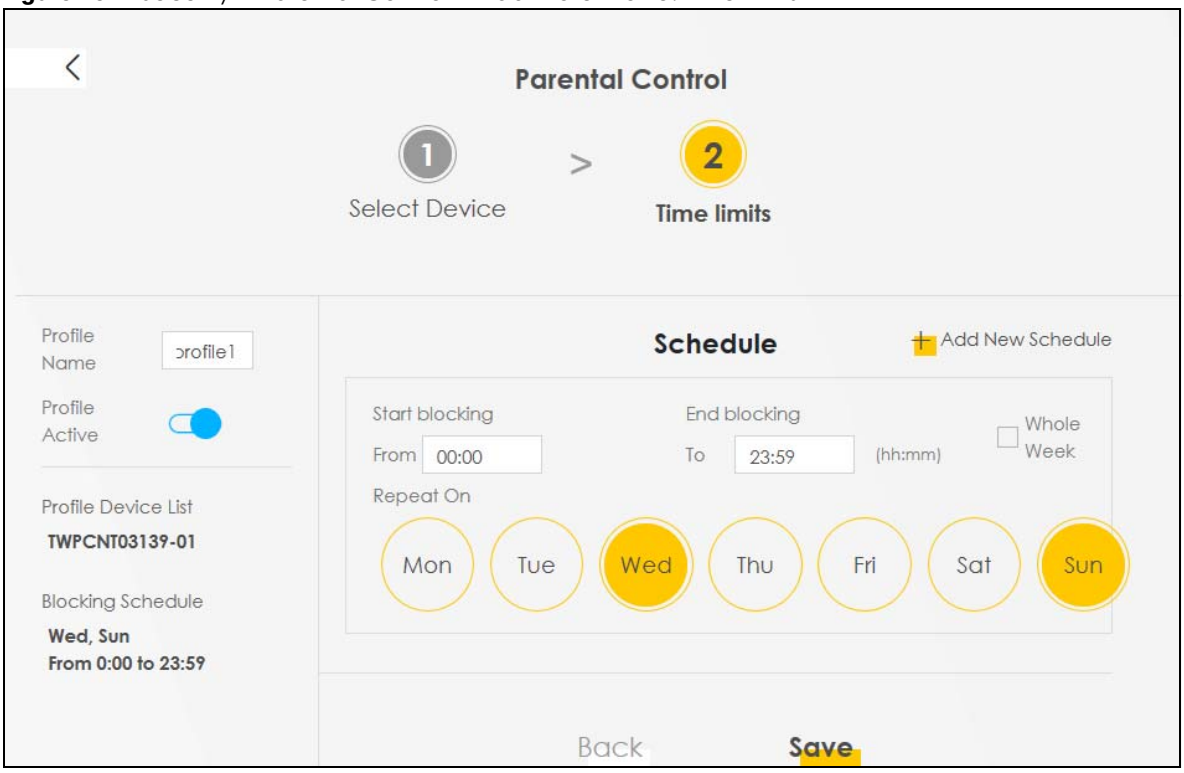
Table 115 Security > Parental Control > Add more Profile: Select Device

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 194 Security > Parental Control > Add more Profile: Time limits



The following table describes the fields in this screen.

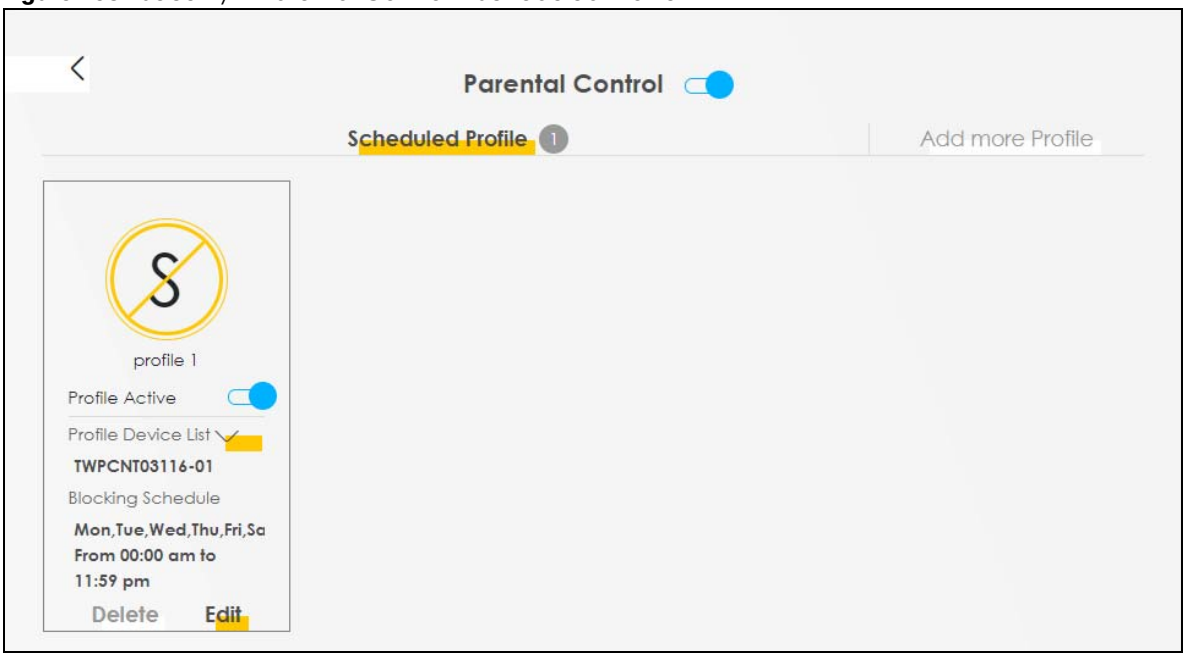
Table 116 Security > Parental Control > Add more Profile: Time limits

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 195 Security > Parental Control > Scheduled Profile



The following table describes the fields in this screen.

Table 117 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

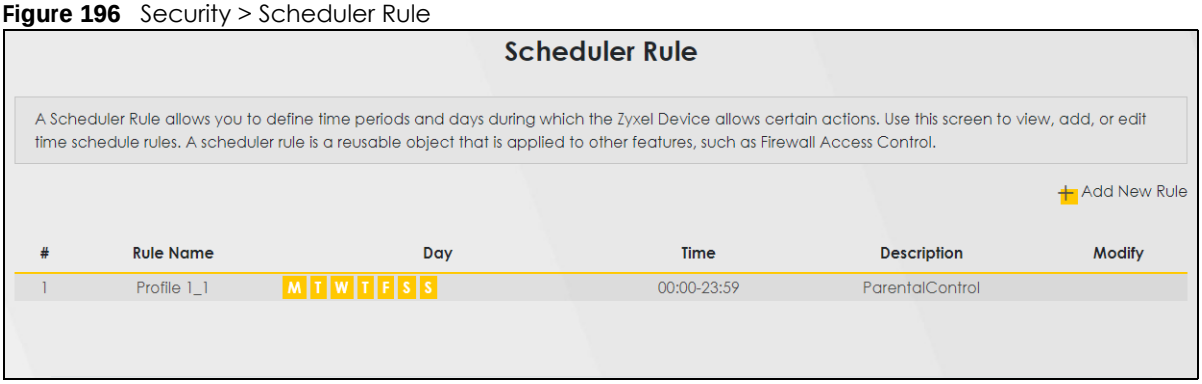
A Scheduler Rule allows you to define time periods and days during which the Zyxel Device allows certain actions.

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 196 Security > Scheduler Rule



The following table describes the fields in this screen.

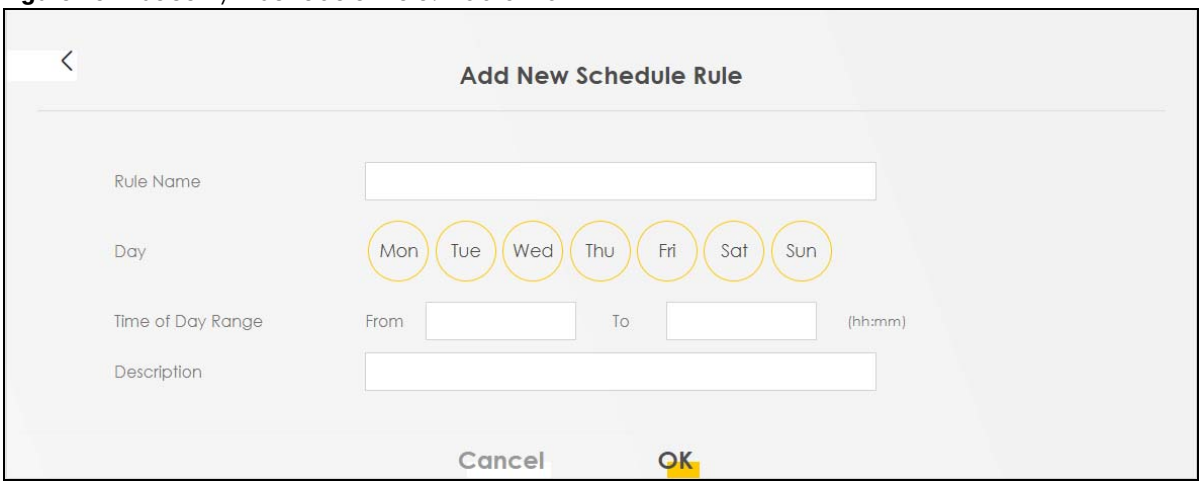
Table 118 Security > Scheduler Rule

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 197 Security > Scheduler Rule: Add or Edit



The following table describes the fields in this screen.

Table 119 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 (Section 23.3 on page 320).
- 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 (Section 23.4 on page 324).

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.

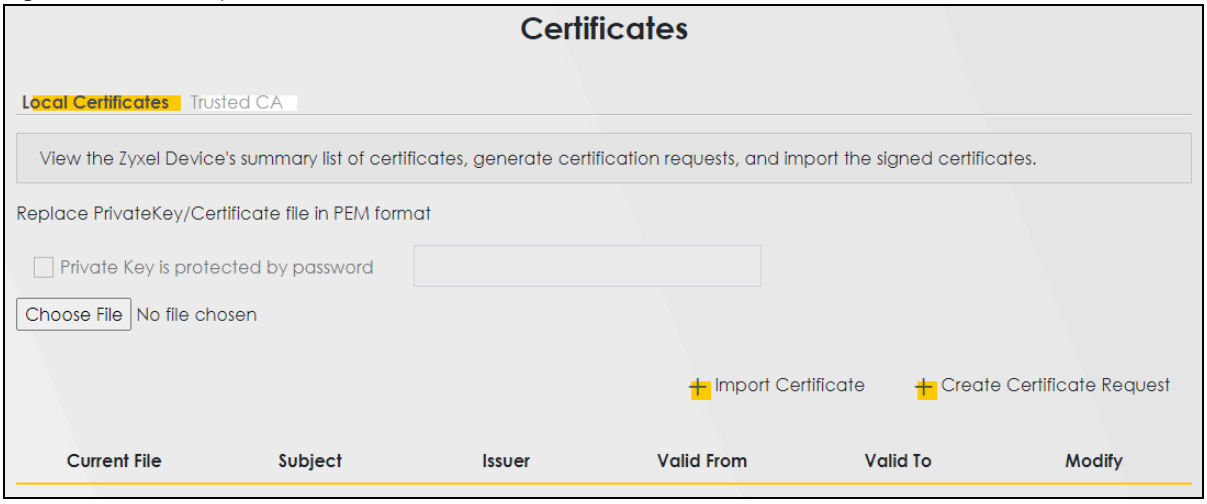
23.3 Local Certificates

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 198 Security > Certificates > Local Certificates



The following table describes the labels in this screen.

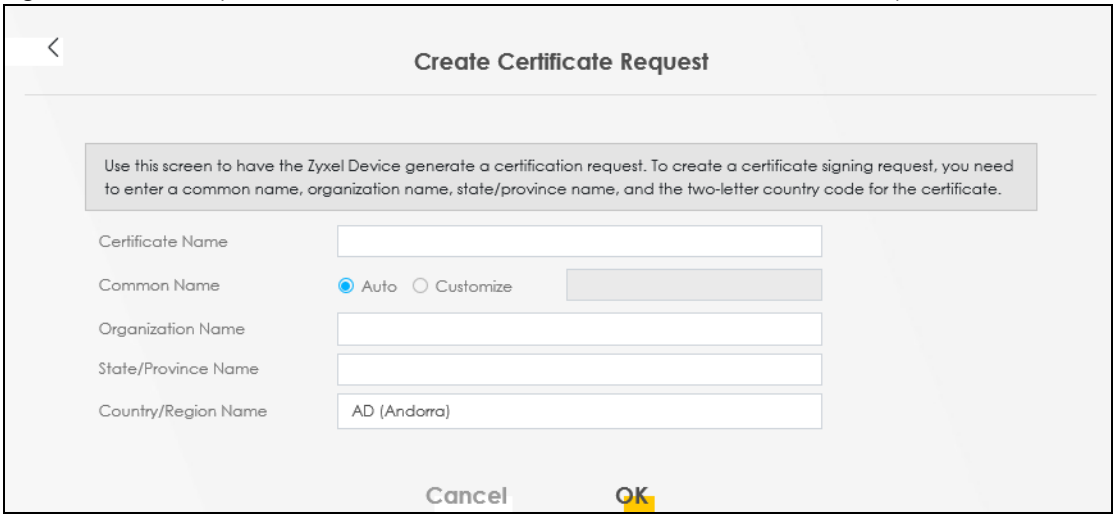
Table 120

LABEL	DESCRIPTION
Replace Private Key/Certificate file in PEM format	
Private Key is protected by password	Select the check box 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.
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 199 Security > Certificates > Local Certificates: Create Certificate Request



The following table describes the labels in this screen.

Table 121 Security > Certificates > Local Certificates: Create Certificate Request

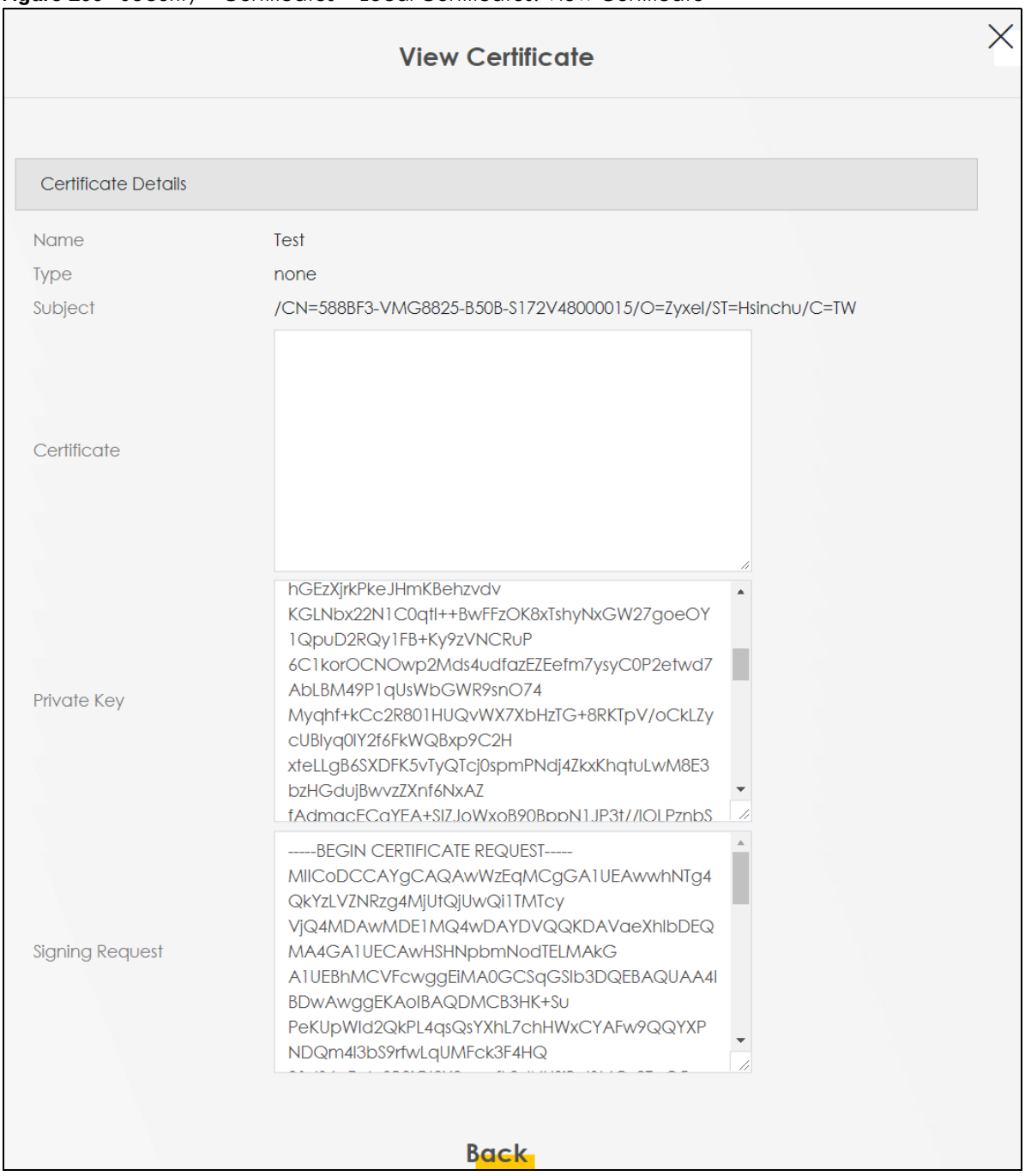
LABEL	DESCRIPTION
Certificate Name	Enter a descriptive name to identify this certificate. You can use up to 63 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
Common Name	Select **Auto** to have the Zyxel Device configure this field automatically. Or select **Customize** to enter it manually. Enter the IP address (in dotted decimal notation), domain name or email address in the field provided. You can use up to 63 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], 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 ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
State/Province Name	Enter a descriptive name to identify the state or province where the certificate owner is located. You can use up to 32 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], 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 200 Security > Certificates > Local Certificates: View Certificate



The following table describes the fields in this screen.

Table 122 Security > Certificates > Local Certificates: View Certificates

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).
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 201 Security > Certificates > Trusted CA

The following table describes the labels in this screen.

Table 123 Trusted CA

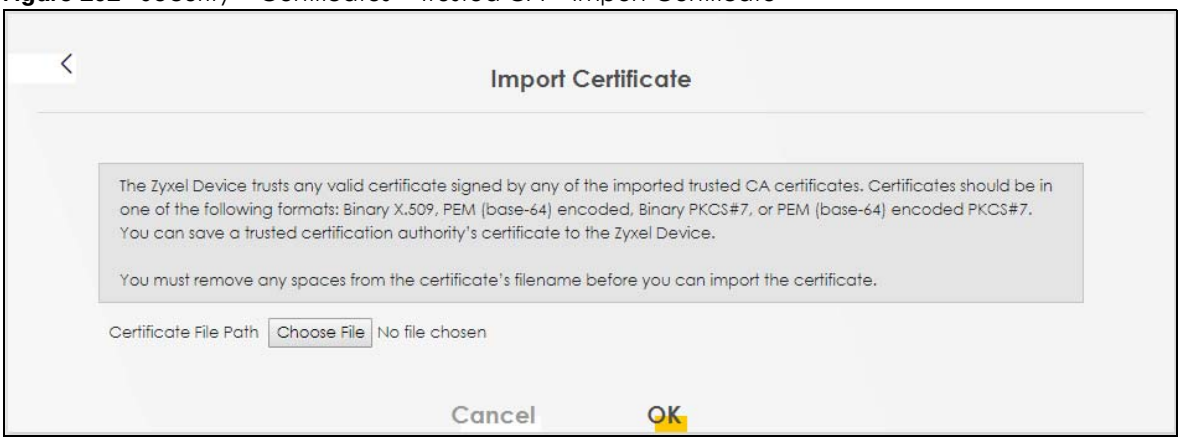
LABEL	DESCRIPTION
Import Certificate	Click this to open a screen where you can save the certificate of a certification authority that you trust to the Zyxel Device.
#	This is the index number of the entry.
Name	This field displays the name used to identify this certificate.
Subject	This field displays 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.
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 202 Security > Certificates > Trusted CA > Import Certificate



The following table describes the labels in this screen.

Table 124 Security > Certificates > Trusted CA > Import Certificate

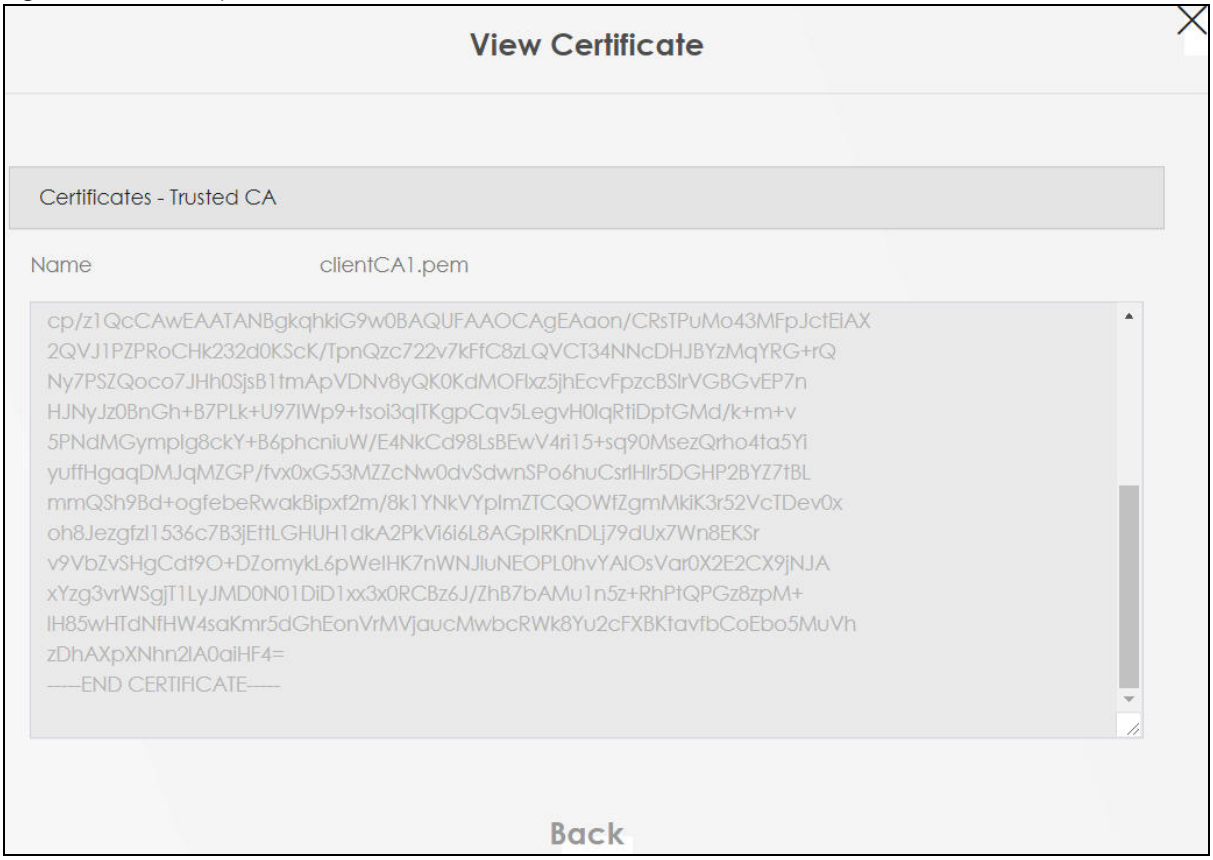
LABEL	DESCRIPTION
Certificate File Path	Enter the location of the file you want to upload in this field or click **Choose File/Browse** to find it.
Choose File/ Browse	Click this to find the certificate file you want to upload.
OK	Click this to save the certificate on the Zyxel Device.
Cancel	Click this 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 203 Security > Certificates > Trusted CA > View Certificate



The following table describes the labels in this screen.

Table 125 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

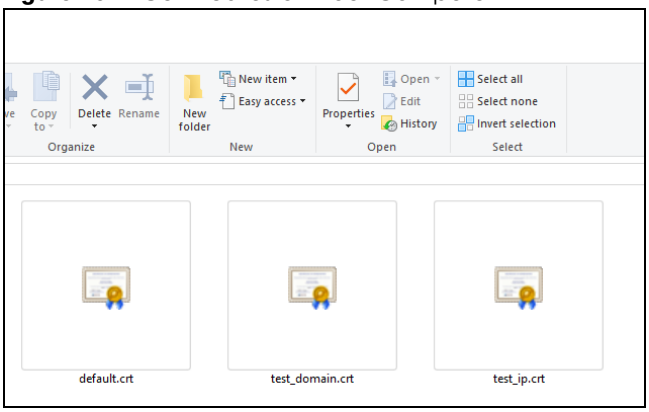
Before you import a trusted CA or trusted remote host certificate into the Zyxel Device, you should verify that you have the actual certificate. This is especially true of trusted CA certificates since the Zyxel Device also trusts any valid certificate signed by any of the imported trusted CA certificates.

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.

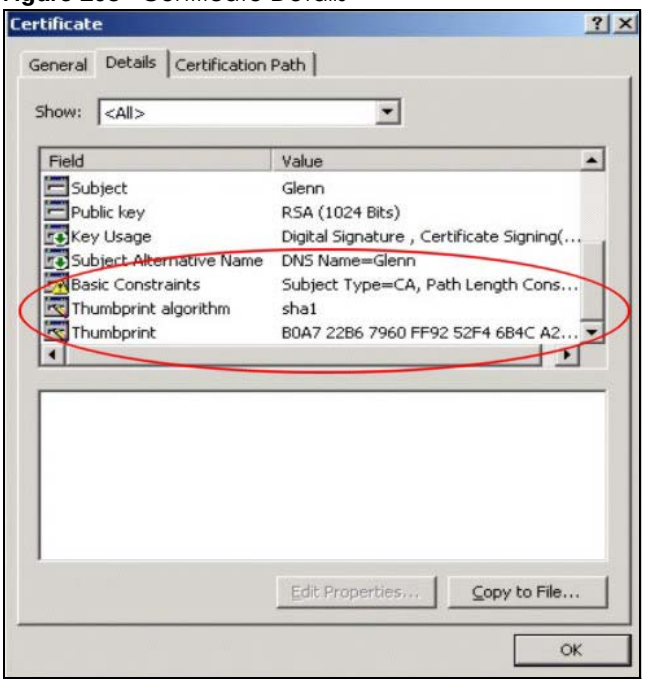
2 Make sure that the certificate has a ".cer" or ".crt" file name extension.

Figure 204 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 205 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 (Section 24.3 on page 331).
- Use the **SIP Service Provider** screen to configure the SIP server information, and the numbers for certain phone functions (Section 24.4 on page 338).
- 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.(Section 24.5 on page 343).
- Use the **Phone** screens to change settings that depend on which region of the world the Zyxel Device is in (Section 24.6 on page 344).
- Use the **Call Rule** screen to set up shortcuts for dialing frequently-used (VoIP) phone numbers (Section 24.8 on page 347).
- Use the **Call History** screen to view a call history list (Section 24.9 on page 348).

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

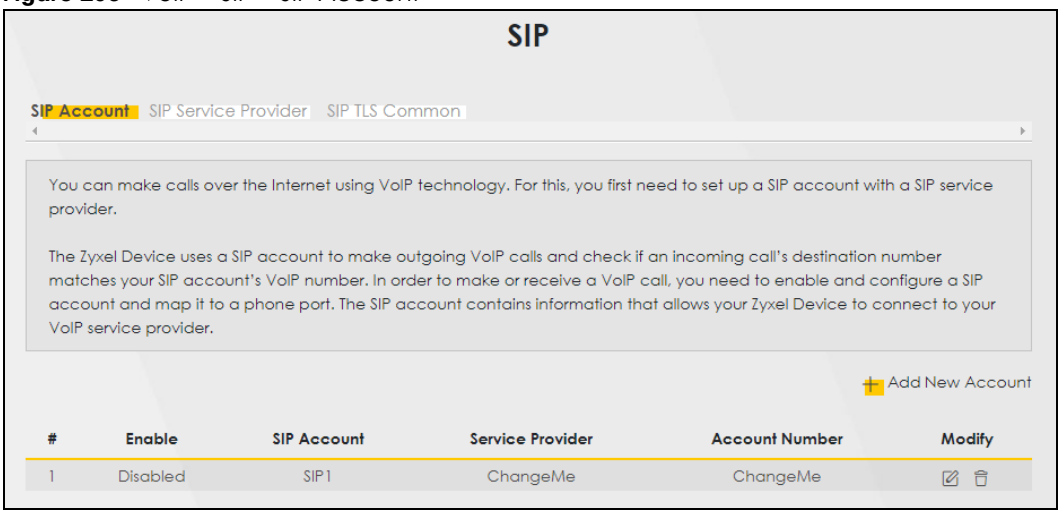
- Before you can use these screens, you need to have a VoIP account already set up. If you do not have one yet, you can sign up with a VoIP service provider over the Internet.
- You should have the information your VoIP service provider gave you ready, before you start to configure the Zyxel Device.

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 206 VoIP > SIP > SIP Account



The following table describes the labels in this screen.

Table 126 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 207 VoIP > SIP > SIP Account > Add Account or Edit

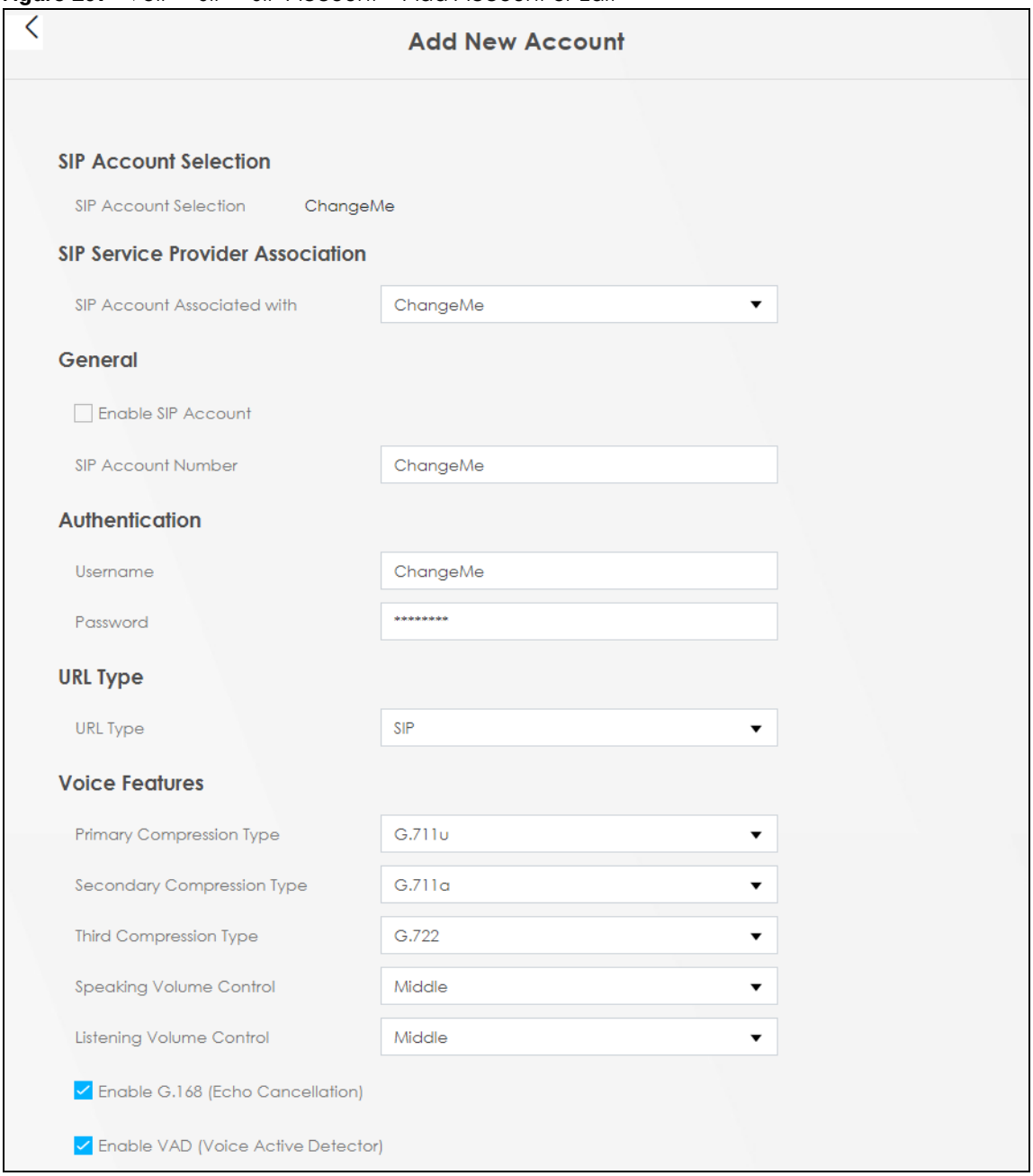


Figure 208 VoIP > SIP > SIP Account > Add Account or Edit (Call Features)

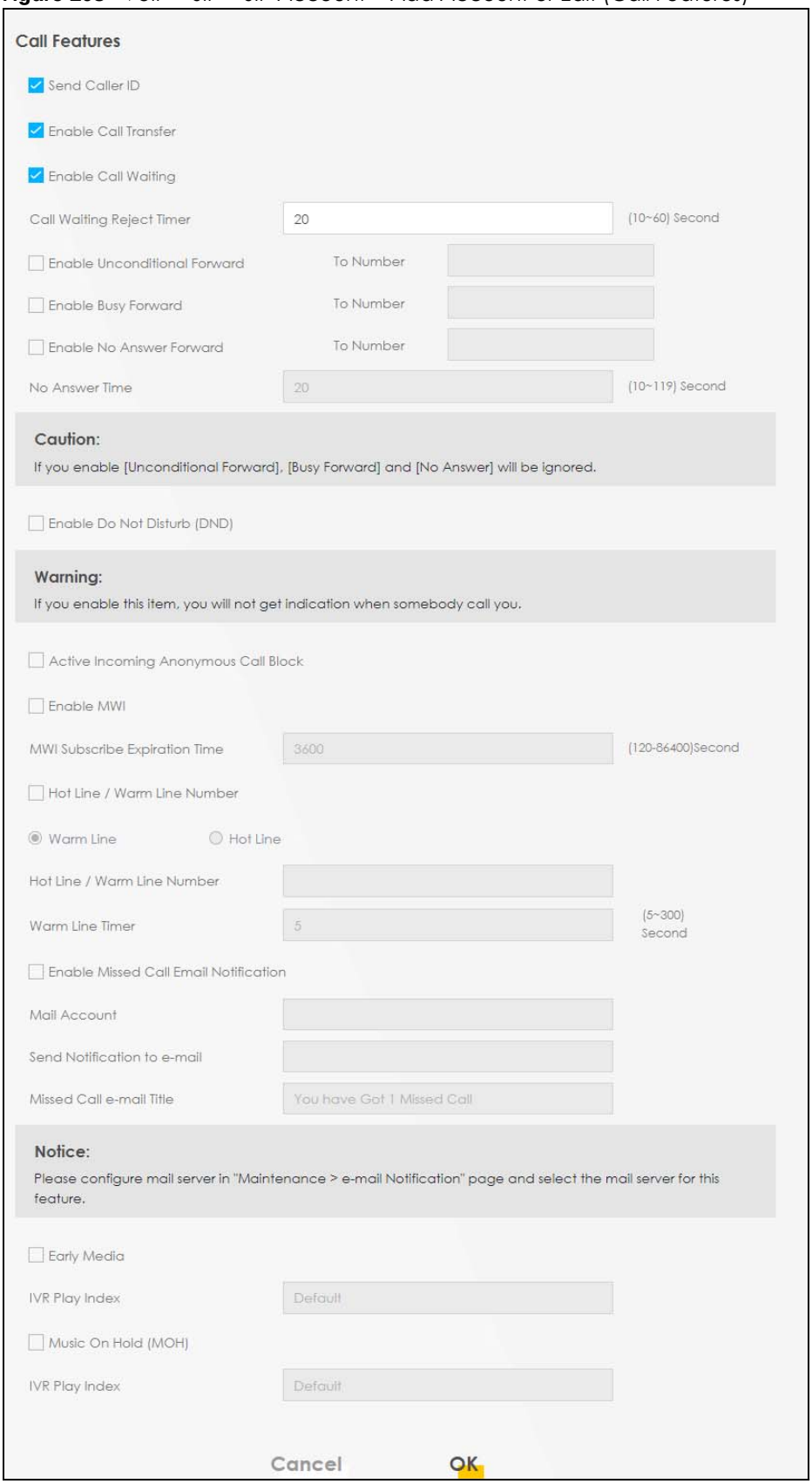
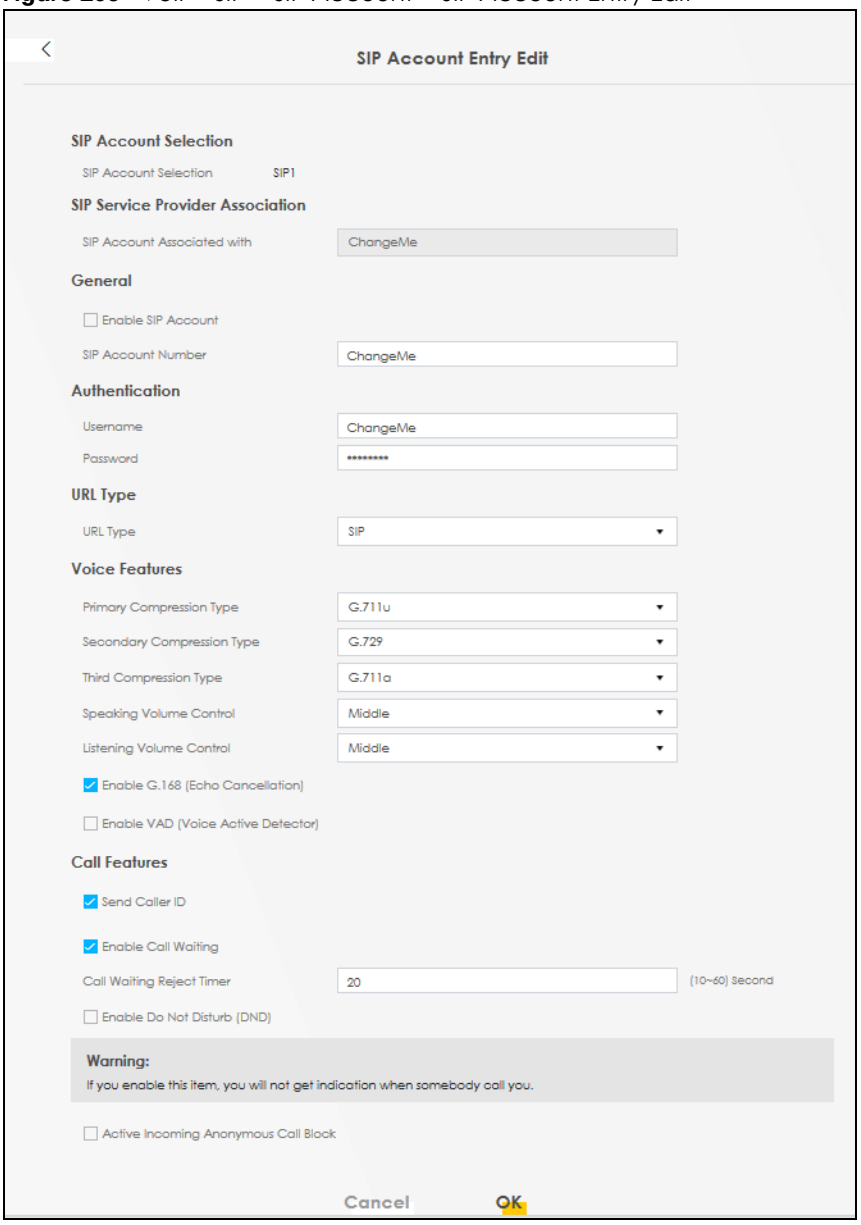


Figure 209 VoIP> SIP > SIP Account > SIP Account Entry Edit



The following table describes the labels in this screen.

Table 127 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 127 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 127 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 127 VoIP > SIP > SIP Account > SIP Account Entry Edit (continued)

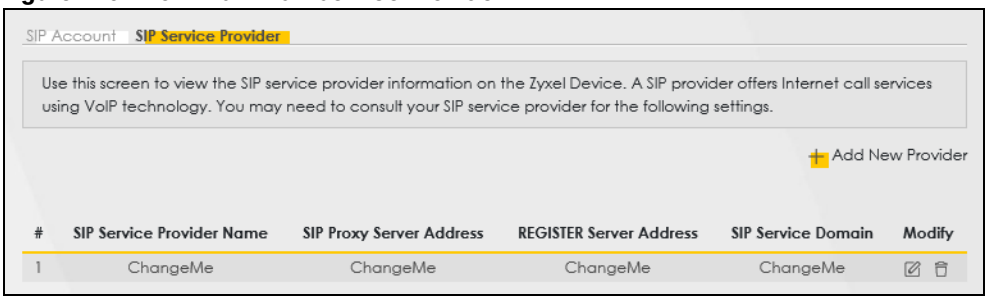
LABEL	DESCRIPTION
Missed Call e-mail Title	Type a title that you want to be in the subject line of the email notifications that the Zyxel Device sends.
Early Media	Select this if you want people to hear a customized recording when they call you.
IVR Play Index	Select the tone you want people to hear when they call you. This field is configurable only when you select **Early Media**. See Section 24.10 on page 350 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 Section 24.10 on page 350 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 210 VoIP > SIP > SIP Service Provider



The following table describes the labels in this screen.

Table 128 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.

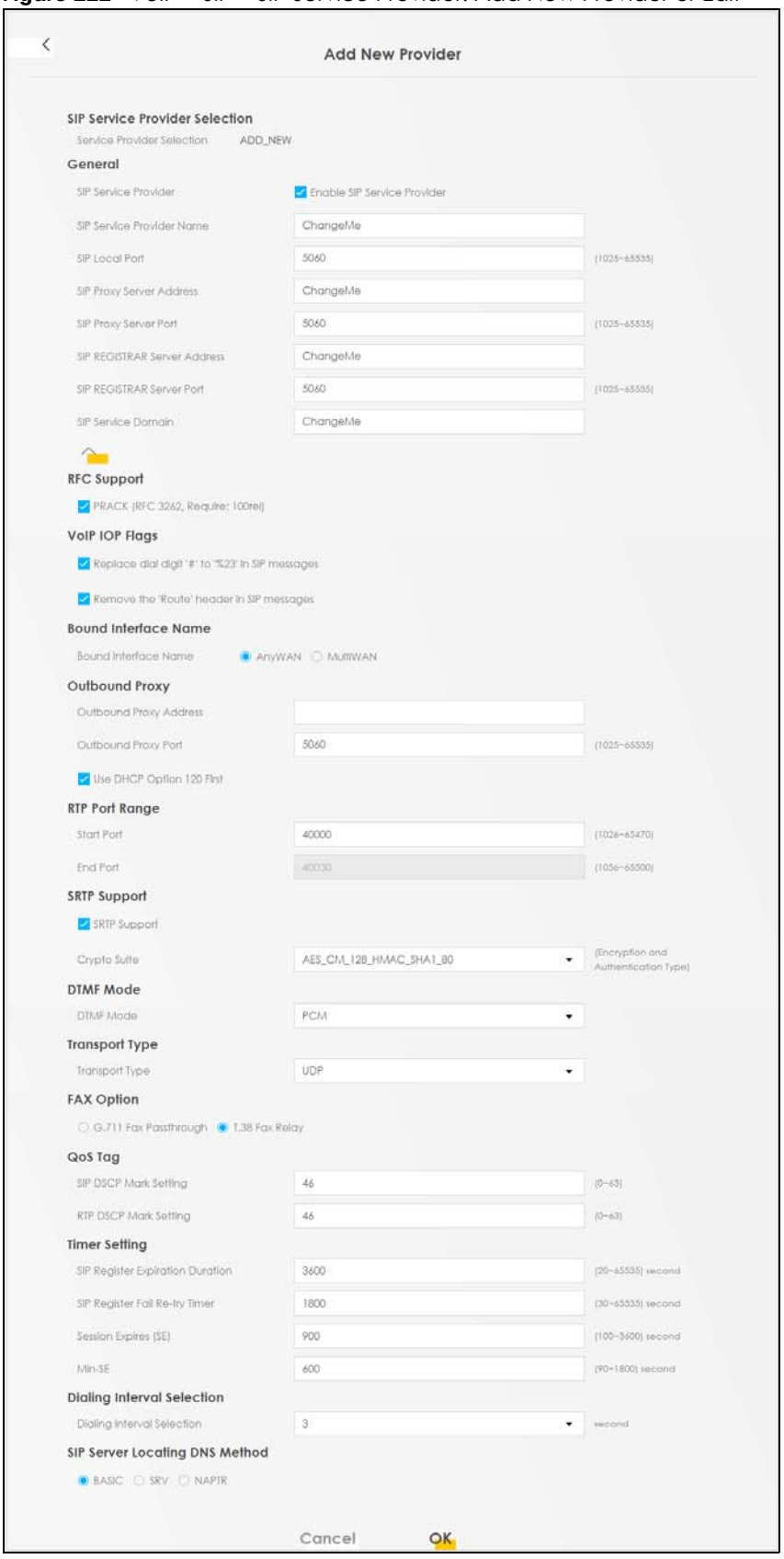
24.4.1 Provider Entry Add/Edit

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.

Figure 211 VoIP > SIP > SIP Service Provider: Add New Provider or Edit



The following table describes the labels in this screen.

Table 129 VoIP > SIP > SIP Service Provider > Add New Provider or Edit

LABEL	DESCRIPTION
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 ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. It does not matter whether the SIP server is a proxy, redirect or register server.
SIP Proxy Server Port	Enter the SIP server's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
SIP REGISTRAR Server Address	Enter the IP address or domain name of the SIP register server, if your VoIP service provider gave you one. Otherwise, enter the same address you entered in the **SIP Server Address** field. You can use up to 95 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], 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	
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 129 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 129 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

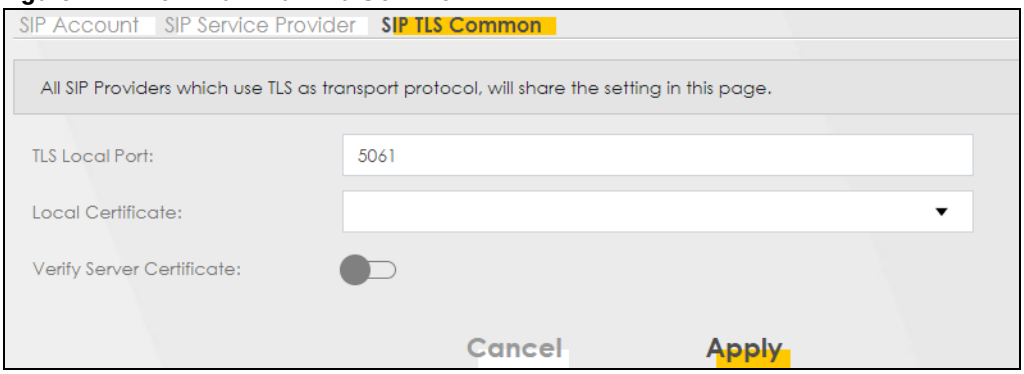
Use this screen to:

- 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 212 VoIP > SIP > SIP TLS Common



The following table describes the labels in this screen.

Table 130 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

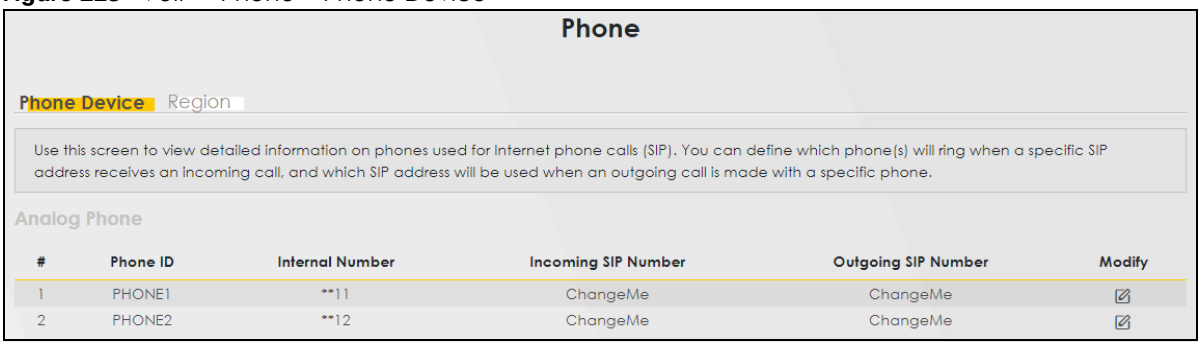
Use these screens to configure SIP numbers and regions for IP phones that are connected to the Zyxel Device.

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 213 VoIP > Phone > Phone Device



Each field is described in the following table.

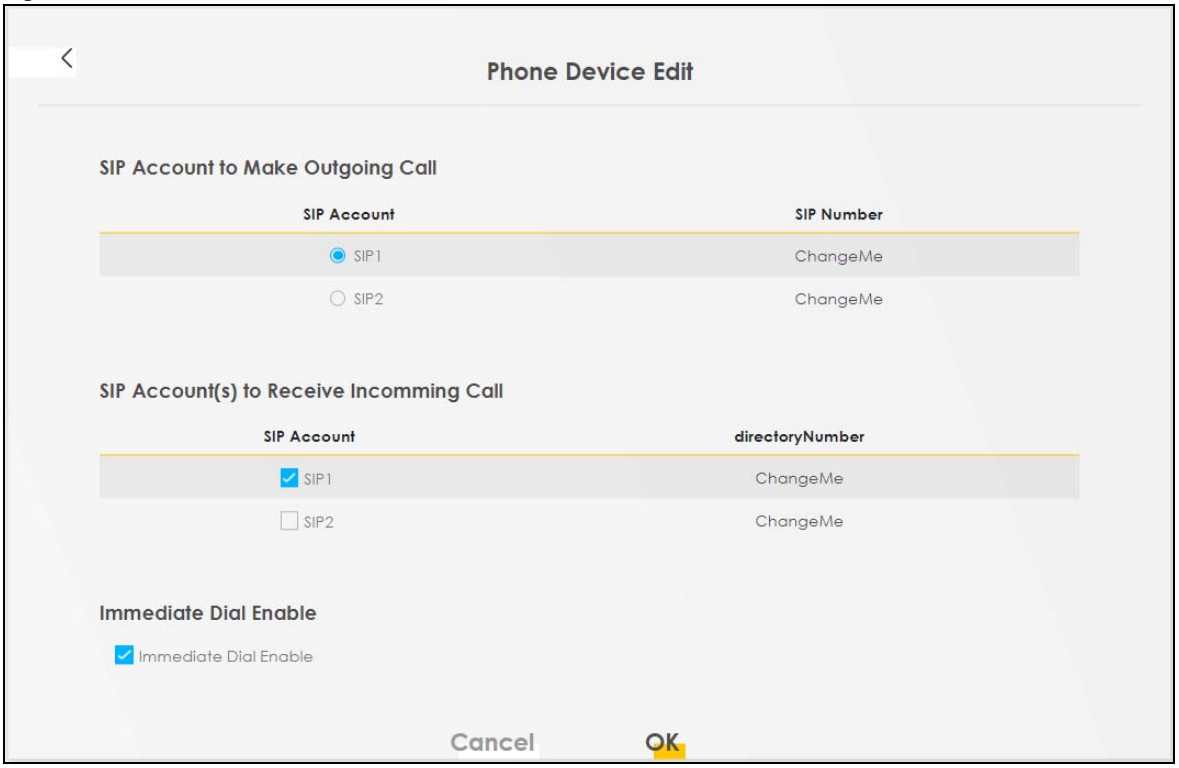
Table 131 VoIP > Phone > Phone Device

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 214 VoIP > Phone > Phone Device > Edit



Each field is described in the following table.

Table 132 VoIP > Phone > Phone Device > Edit

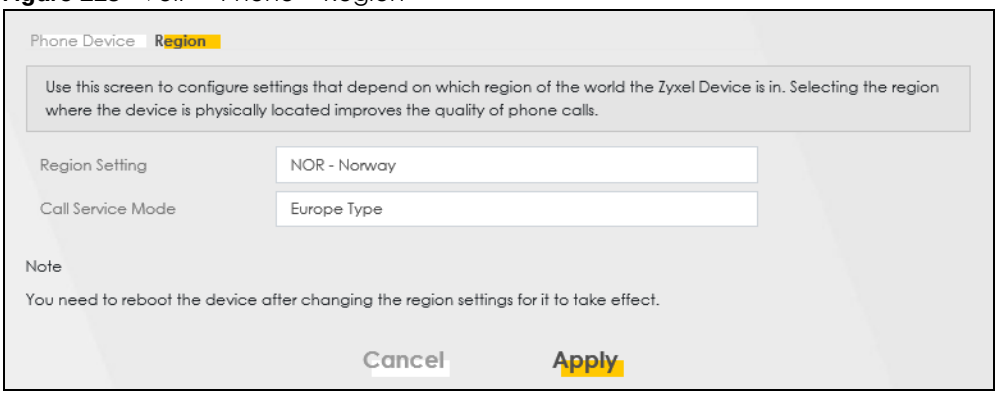
LABEL	DESCRIPTION
SIP Account to Make Outgoing Call	Select the SIP account you want to use when making outgoing calls with the analog phone connected to this phone port.
SIP Account(s) to Receive Incoming Call	Select a SIP account if you want to receive phone calls for the selected SIP account on this 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 215 VoIP > Phone > Region



The following table describes the labels in this screen.

Table 133 VoIP > Phone > Region

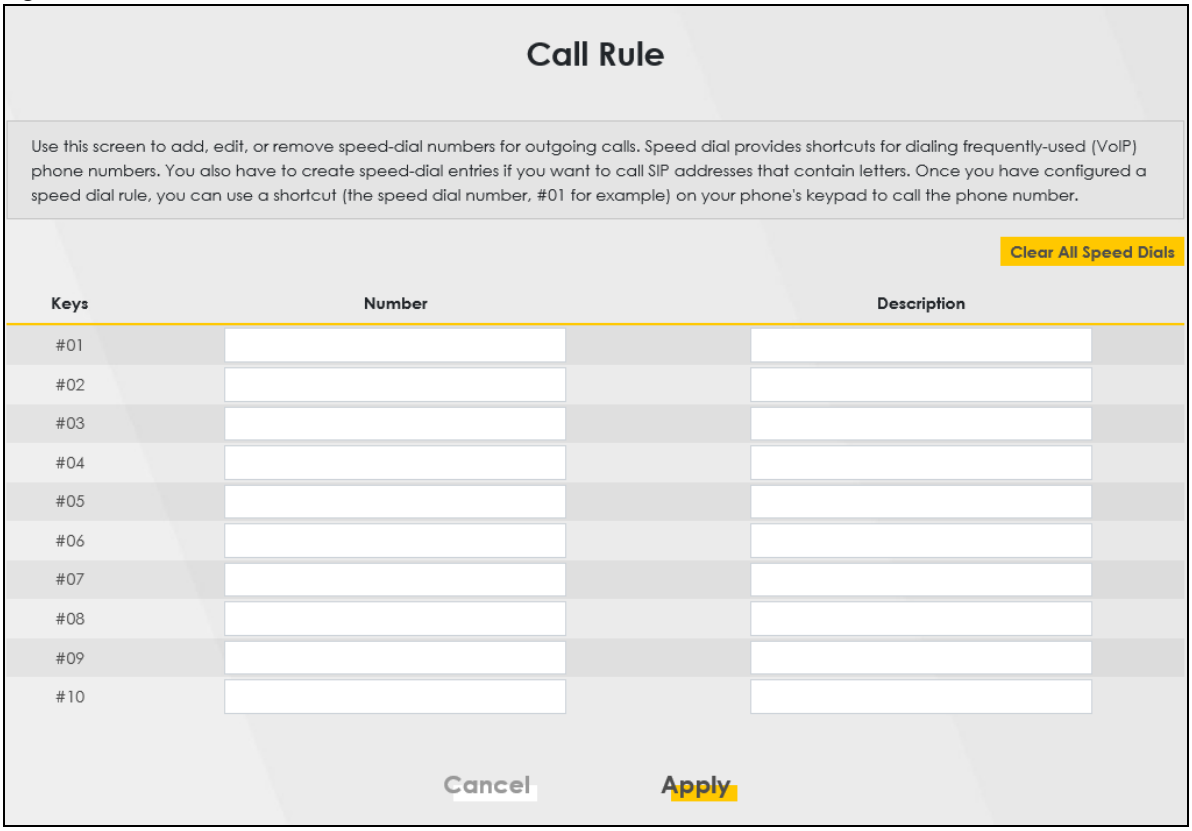
LABEL	DESCRIPTION
Region Setting	Select the place in which the Zyxel Device is located.
Call Service Mode	Select the mode for supplementary phone services (call hold, call waiting, call transfer and three-way conference calls) that your VoIP service provider supports. • **Europe Type** – use supplementary 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 216 VoIP > Call Rule



The following table describes the labels in this screen.

Table 134 VoIP > Call Rule

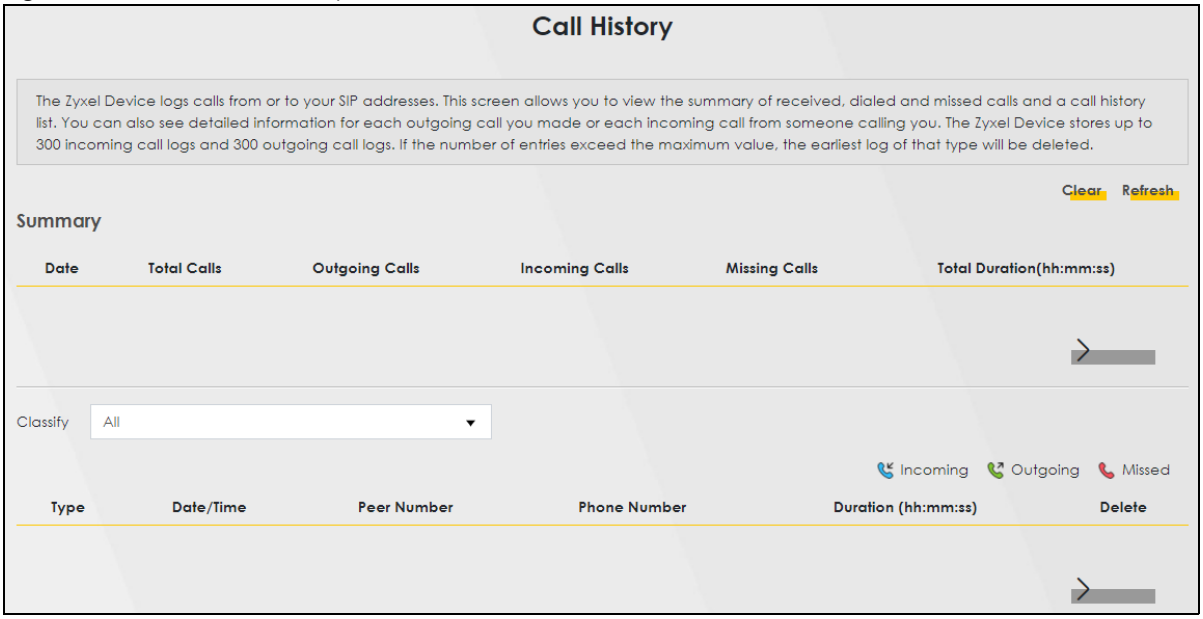
LABEL	DESCRIPTION
Keys	This field displays the speed-dial number you should dial to use this entry.
Number	Enter the SIP number you want the Zyxel Device to call when you dial the speed-dial number.
Description	Enter a short description to identify the party you call when you dial the speed-dial number. 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 217 VoIP > Call History



Each field is described in the following table.

Table 135 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 135 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

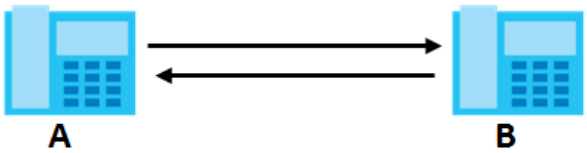
SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

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 218 SIP User Agent



SIP Proxy Server

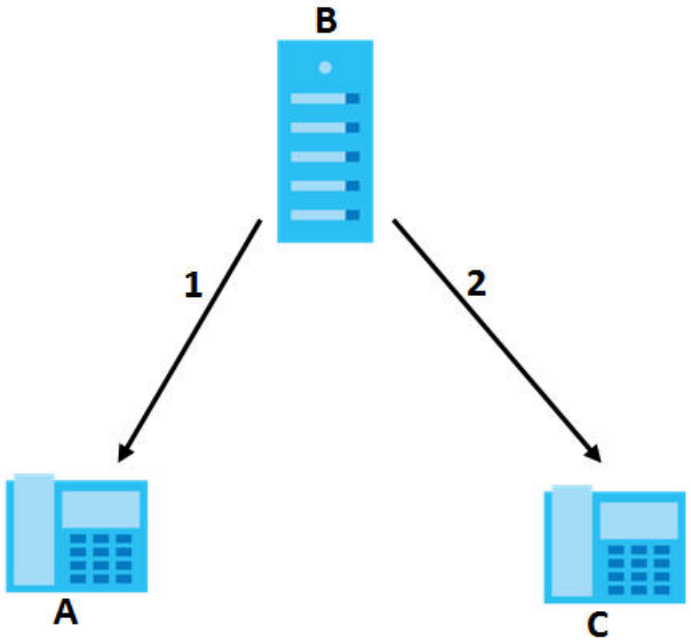
A SIP proxy server receives requests from clients and forwards them to another server.

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 219 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.

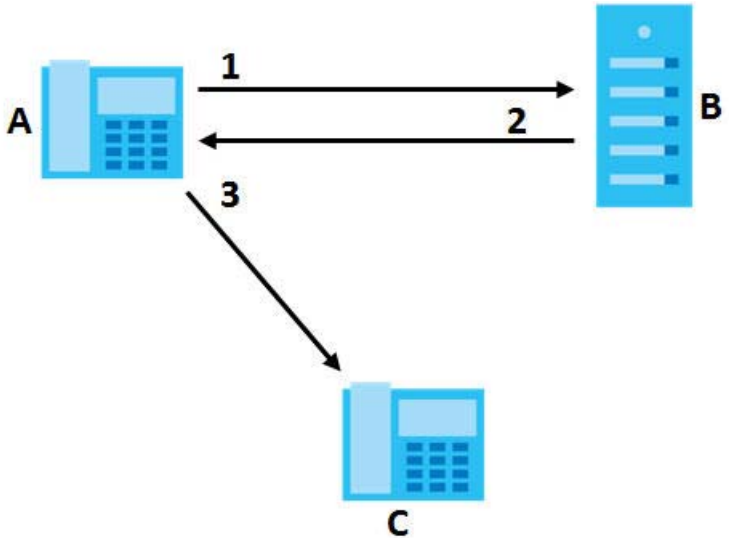
In the following example, you want to use client device **A** to call someone who is using client device **C**.

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 220 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 136 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.

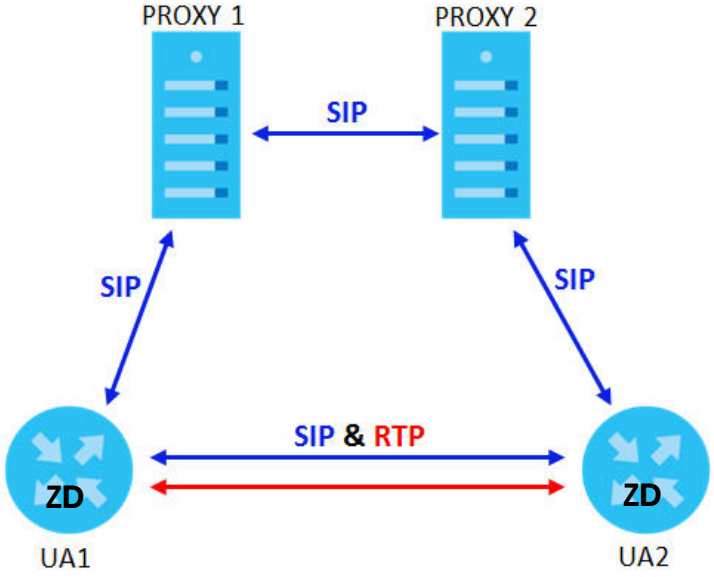
SIP Call Progression Through Proxy Servers

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 221 SIP Call Through Proxy Servers

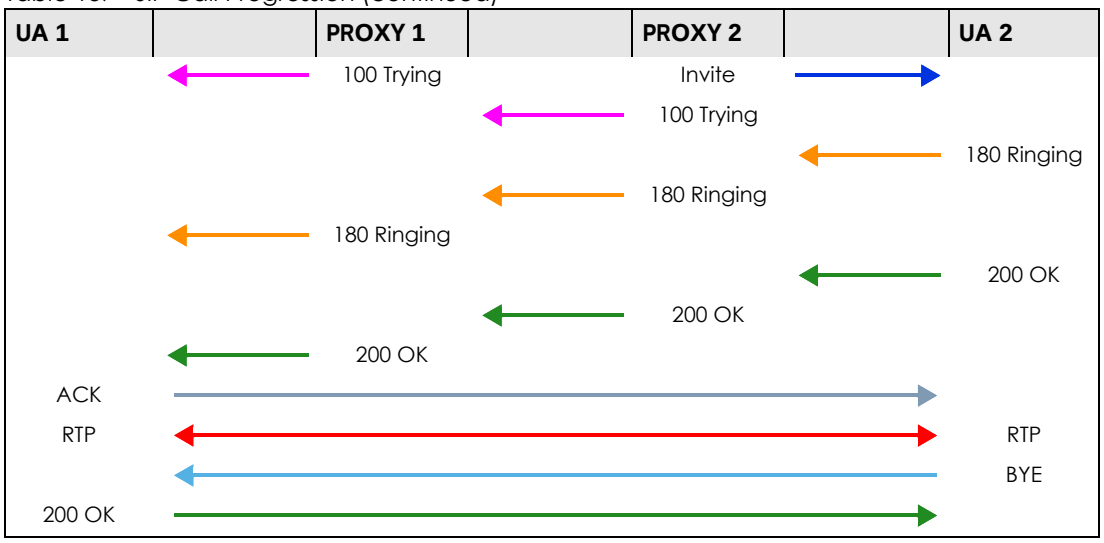


The following table shows the SIP call progression.

Table 137 SIP Call Progression

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

Table 137 SIP Call Progression (continued)



1 **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.

2 **Proxy 1** sends a SIP INVITE request to **Proxy 2**. **Proxy 2** sends a response indicating that it is trying to complete the request.

3 **Proxy 2** sends a SIP INVITE request to **User Agent 2**.

4 **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**.

5 **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**.

6 **User Agent 1** and **User Agent 2** exchange RTP packets containing voice data directly, without involving the proxies.

7 When **User Agent 2** hangs up, he sends a BYE request.

8 **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 138 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]

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 222 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

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

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 139 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 140 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 141 Phone Functions Summary

ACTION	FUNCTION	DESCRIPTION
*98#	Call transfer	Transfer a call to another phone. See Section 24.10.2.2 on page 359 (Europe type) and Section 24.10.2.3 on page 360 (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.

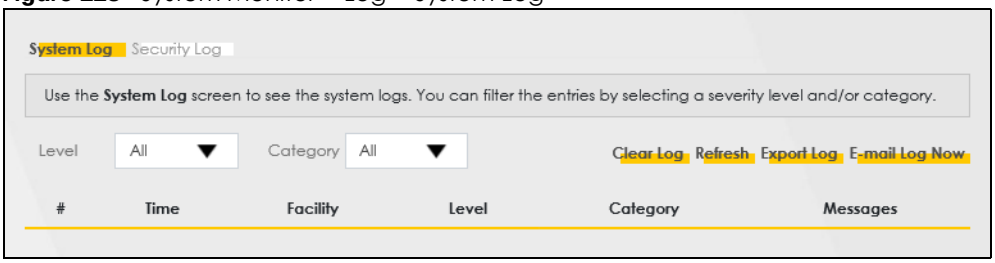
Alerts and Logs

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 223 System Monitor > Log > System Log



The following table describes the fields in this screen.

Table 142 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.

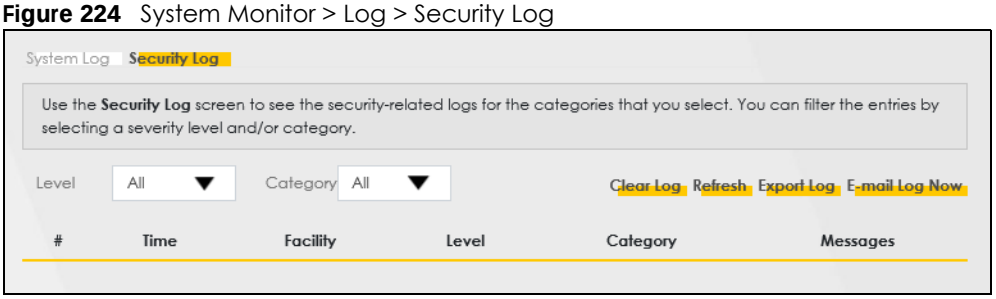
Table 142 System Monitor > Log > System Log (continued)

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 224 System Monitor > Log > Security Log



The following table describes the fields in this screen.

Table 143 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.