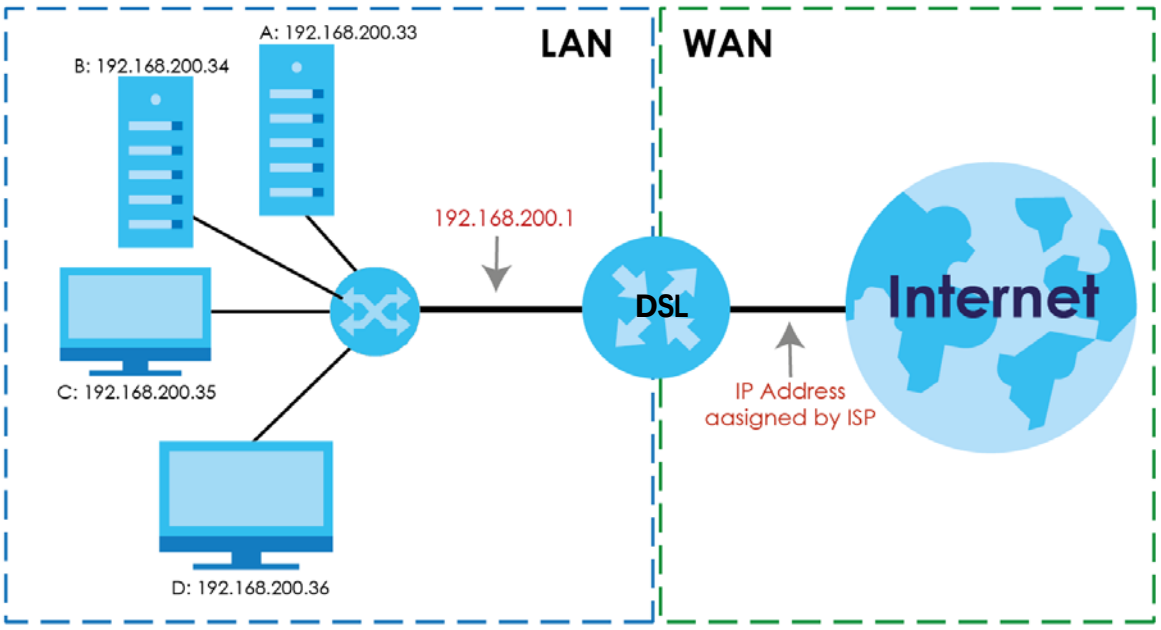
Figure 75 Multiple Servers Behind NAT Example



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

See Appendix C on page 308 for port numbers commonly used for particular services.

Figure 76 Network Setting > NAT > Port Forwarding

The following table describes the fields in this screen.

Table 53 Network Setting > NAT > Port Forwarding

LABEL	DESCRIPTION
Add New Rule	Click this to add a new rule.
#	This is the index number of the entry.
Status	This field displays whether the NAT 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 shows the service's name.
Originating IP	This shows the destination IP address that this NAT rule supports.
WAN Interface	This shows the WAN interface through which the service is forwarded.
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.

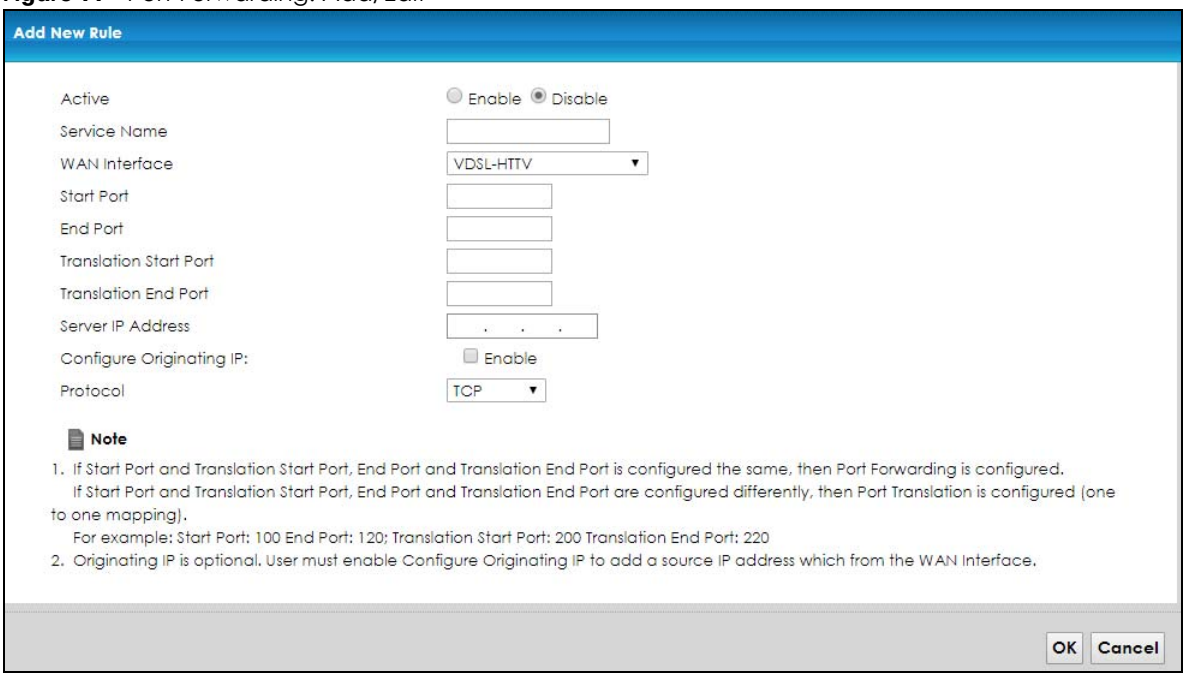
Table 53 Network Setting > NAT > Port Forwarding (continued)

LABEL	DESCRIPTION
Translation End Port	This is the last internal port number that identifies a service.
Protocol	This shows the IP protocol supported by this virtual server, whether it is **TCP**, **UDP**, or **TCP/UDP**.
Modify	Click the **Edit** icon to edit this rule. Click the **Delete** icon to delete an existing rule.

11.2.1 Add/Edit Port Forwarding

Click **Add New Rule** in the **Port Forwarding** screen or click the **Edit** icon next to an existing rule to open the following screen.

Figure 77 Port Forwarding: Add/Edit



The following table describes the labels in this screen.

Table 54 Port Forwarding: Add/Edit

LABEL	DESCRIPTION
Active	Select to enable or disable the rule.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on).
WAN Interface	Select the WAN interface through which the service is forwarded. You must have already configured a WAN connection with NAT enabled.
Start Port	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.

Table 54 Port Forwarding: Add/Edit (continued)

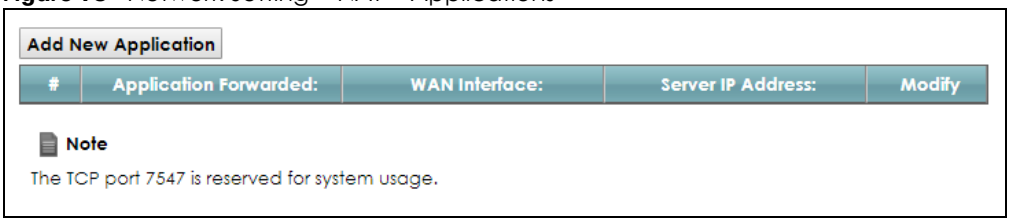
LABEL	DESCRIPTION
End Port	Enter the last port of the original destination port range. To forward only one port, enter the port number in the **Start Port** field above and then enter it again in this field. To forward a series of ports, enter the last port number in a series that begins with the port number in the **Start Port** field above.
Translation Start Port	This shows the port number to which you want the XMG 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	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	Specify the destination IP address of the packets received by this NAT rule.
Originating IP	Type the destination IP address that this NAT rule supports.
Protocol	Select the protocol supported by this virtual server. Choices are **TCP**, **UDP**, or **TCP/UDP**.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.3 The Applications Screen

This screen provides a summary of all NAT applications and their configuration. In addition, this screen allows you to create new applications and/or remove existing ones.

To access this screen, click **Network Setting > NAT > Applications**. The following screen appears.

Figure 78 Network Setting > NAT > Applications



The following table describes the labels in this screen.

Table 55 Network Setting > NAT > Applications

LABEL	DESCRIPTION
Add New Application	Click this to add a new NAT application rule.
#	This is the index number of the entry.
Application Forwarded	This field shows the type of application that the service forwards.
WAN Interface	This field shows the WAN interface through which the service is forwarded.

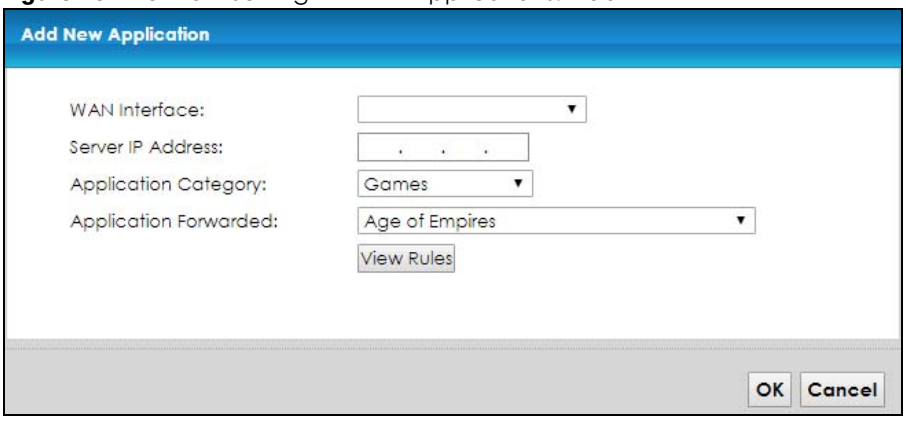
Table 55 Network Setting > NAT > Applications (continued)

LABEL	DESCRIPTION
Server IP Address	This field displays the destination IP address for the service.
Modify	Click the **Delete** icon to delete the rule.

11.3.1 Add New Application

This screen lets you create new NAT application rules. Click **Add New Application** in the **Applications** screen to open the following screen.

Figure 79 Network Setting > NAT > Applications: Add



The following table describes the labels in this screen.

Table 56 Network Setting > NAT > Applications: Add

LABEL	DESCRIPTION
WAN Interface	Select the WAN interface that you want to apply this NAT rule to.
Server IP Address	Enter the inside IP address of the application here.
Application Category	Select the category of the application from the drop-down list box.
Application Forwarded	Select a service from the drop-down list box and the XMG automatically configures the protocol, start, end, and map port number that define the service.
View Rules	Click this to display the configuration of the service that you have chosen in **Application Fowarded**.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.4 The Port Triggering Screen

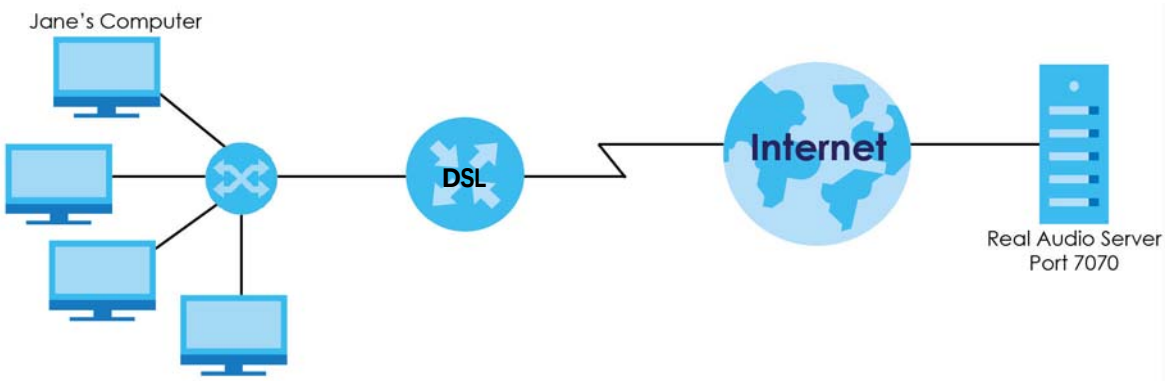
Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem 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 solves this problem by allowing computers on the LAN to dynamically take turns using the service. The XMG 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 XMG's WAN port receives a response with a specific port number and protocol ("open" port), the XMG 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 80 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 XMG to record Jane's computer IP address. The XMG associates Jane's computer IP address with the "open" port range of 6970-7170.

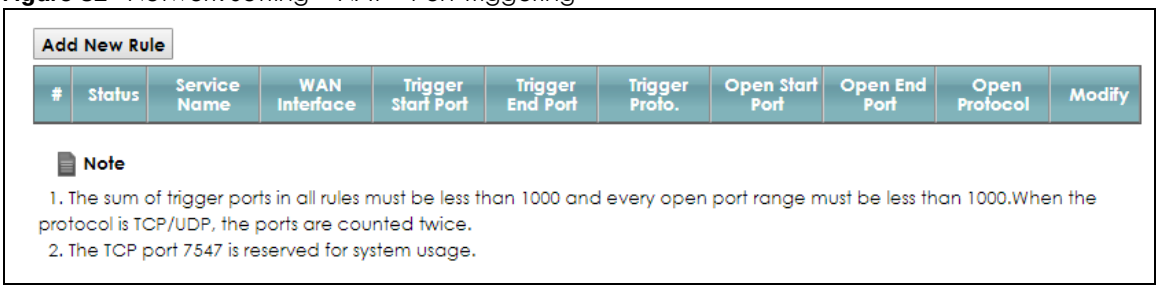
3 The Real Audio server responds using a port number ranging between 6970-7170.

4 The XMG 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 XMG times out in three minutes with UDP (User Datagram Protocol) or two 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 XMG's trigger port settings.

Figure 81 Network Setting > NAT > Port Triggering



The following table describes the labels in this screen.

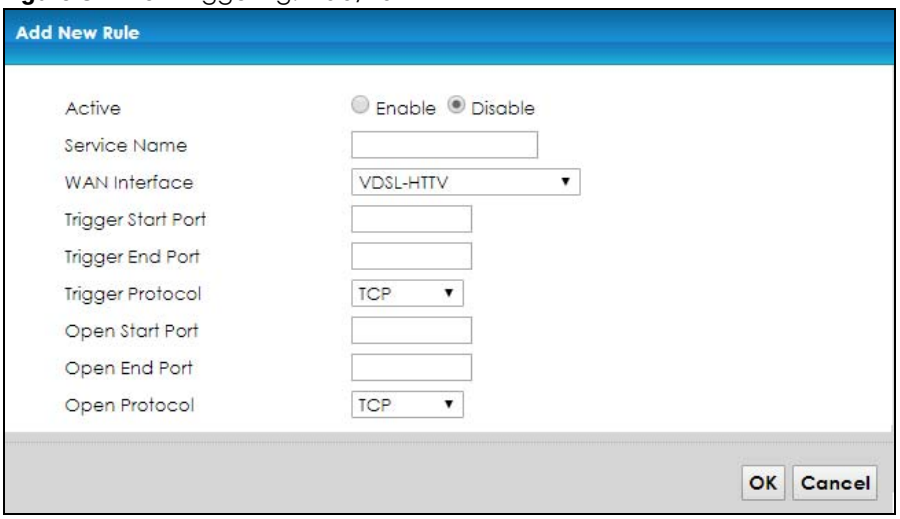
Table 57 Network Setting > NAT > Port Triggering

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 XMG 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 XMG 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 remove an existing rule.

11.4.1 Add/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.

Figure 82 Port Triggering: Add/Edit



The following table describes the labels in this screen.

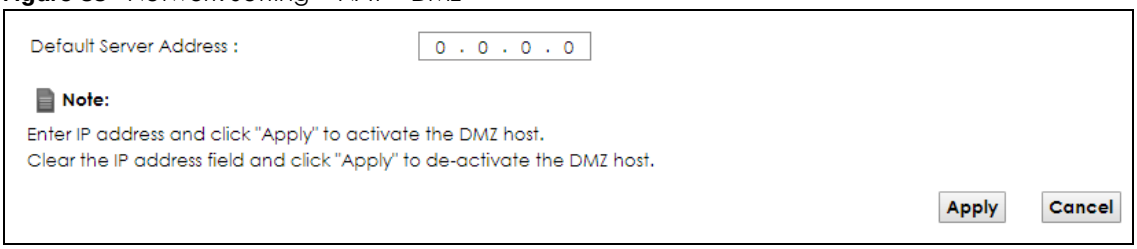
Table 58 Port Triggering: Configuration Add/Edit

LABEL	DESCRIPTION
Active	Select to enable or disable this rule.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on).
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 XMG to record the IP address of the LAN computer that sent the traffic to a server on the WAN. Type a port number or the starting port number in a range of port numbers.
Trigger End Port	Type 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 XMG forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service. Type a port number or the starting port number in a range of port numbers.
Open End Port	Type 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**.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.5 The DMZ Screen

In addition to the servers for specified services, NAT supports a default server IP address. A default server receives packets from ports that are not specified in the **NAT Port Forwarding Setup** screen.

Figure 83 Network Setting > NAT > DMZ



The following table describes the fields in this screen.

Table 59 Network Setting > NAT > DMZ

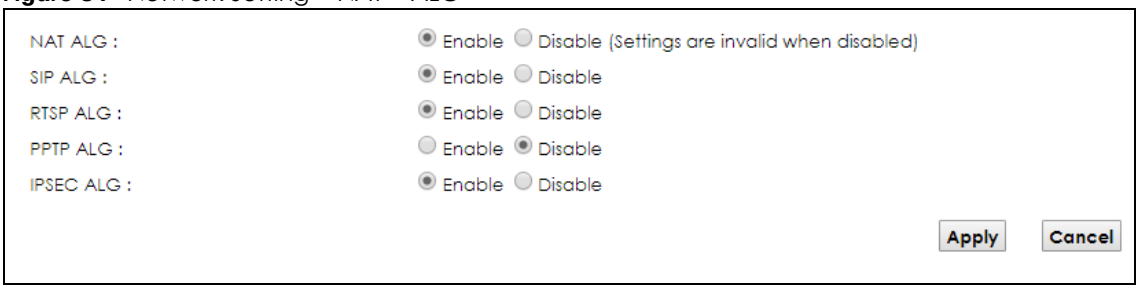
LABEL	DESCRIPTION
Default Server Address	Enter the IP address of the default server which receives packets from ports that are not specified in the **NAT Port Forwarding** screen. Note: If you do not assign a **Default Server Address**, the XMG discards all packets received for ports that are not specified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

11.6 The ALG Screen

Some NAT routers may include a SIP Application Layer Gateway (ALG). A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream. When the XMG registers with the SIP register server, the SIP ALG translates the XMG'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 XMG is behind a SIP ALG.

Use this screen to enable and disable the ALGs in the XMG. To access this screen, click **Network Setting > NAT > ALG**.

Figure 84 Network Setting > NAT > ALG



The following table describes the fields in this screen.

Table 60 Network Setting > NAT > ALG

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

11.7 The Address Mapping Screen

Ordering your rules is important because the XMG applies the rules in the order that you specify. When a rule matches the current packet, the XMG takes the corresponding action and the remaining rules are ignored.

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

Figure 85 Network Setting > NAT > Address Mapping

The following table describes the fields in this screen.

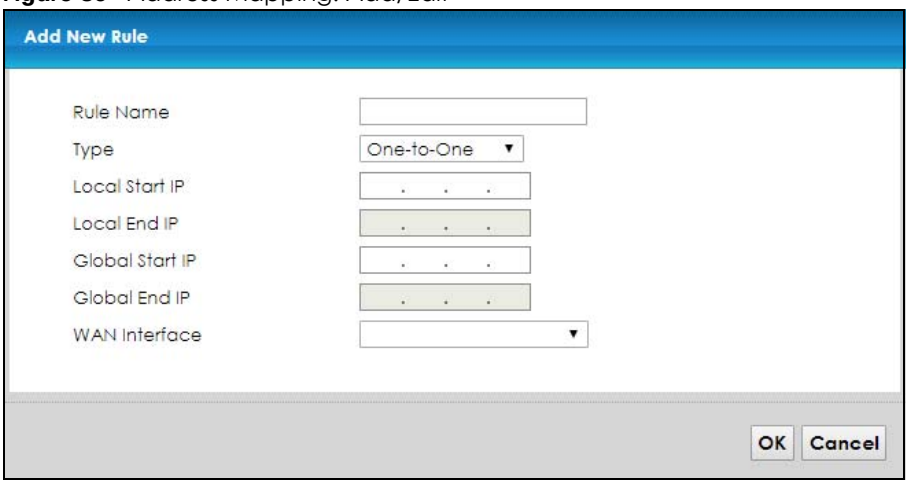
Table 61 Network Setting > NAT > Address Mapping

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
Rule Name	This shows the descriptive name to identify this 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 XMG'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 Name	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.

11.7.1 Add/Edit Address Mapping Rule

To add or edit an address mapping rule, click **Add new rule** or the rule's edit icon in the **Address Mapping** screen to display the screen shown next.

Figure 86 Address Mapping: Add/Edit



The following table describes the fields in this screen.

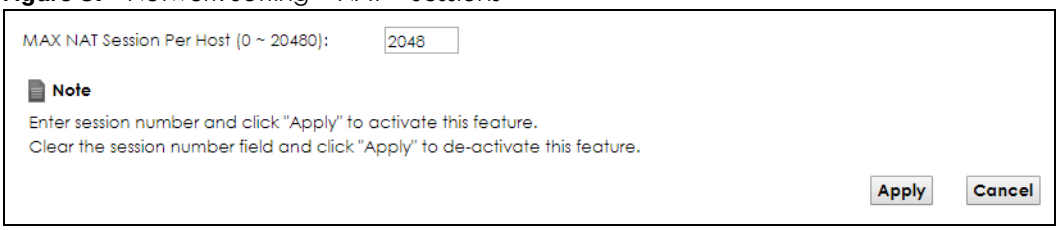
Table 62 Address Mapping: Add/Edit

LABEL	DESCRIPTION
Rule Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on).
Type	Choose the IP/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 (i.e., PAT, port address translation), the XMG'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.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.8 The Sessions Screen

Use this screen to limit the number of concurrent NAT sessions a client can use. Click **Network Setting > NAT > Sessions** to display the following screen.

Figure 87 Network Setting > NAT > Sessions



The following table describes the fields in this screen.

Table 63 Network Setting > NAT > Sessions

LABEL	DESCRIPTION
MAX NAT Session Per Host	Use this field to set a limit to the number of concurrent NAT sessions each client host 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.
Apply	Click this to save your changes on this screen.
Cancel	Click this to exit this screen without saving any changes.

11.9 Technical Reference

This part contains more information regarding NAT.

11.9.1 NAT Definitions

Inside/outside denotes where a host is located relative to the XMG, 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.

Note that inside/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 64 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.

11.9.2 What NAT Does

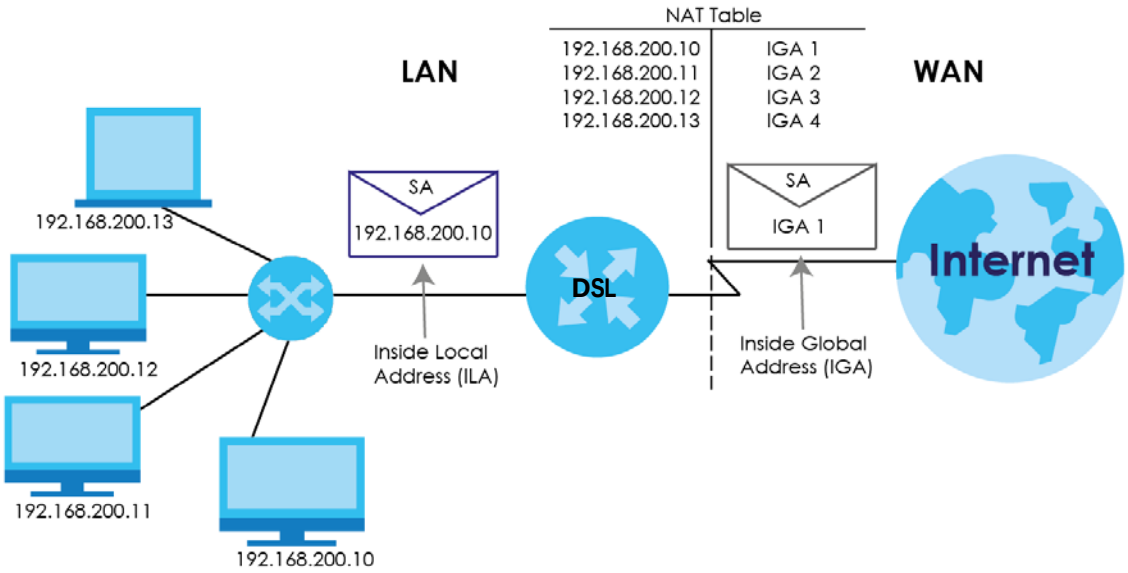
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address)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

11.9.3 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 XMG keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored. The following figure illustrates this.

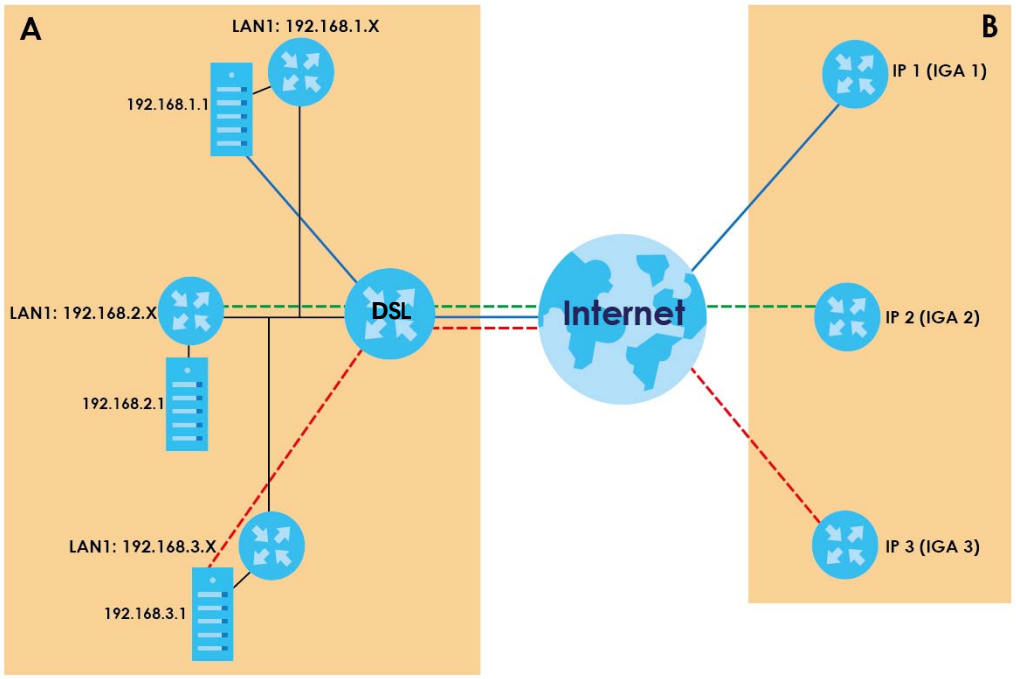
Figure 88 How NAT Works



11.9.4 NAT Application

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

Figure 89 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.

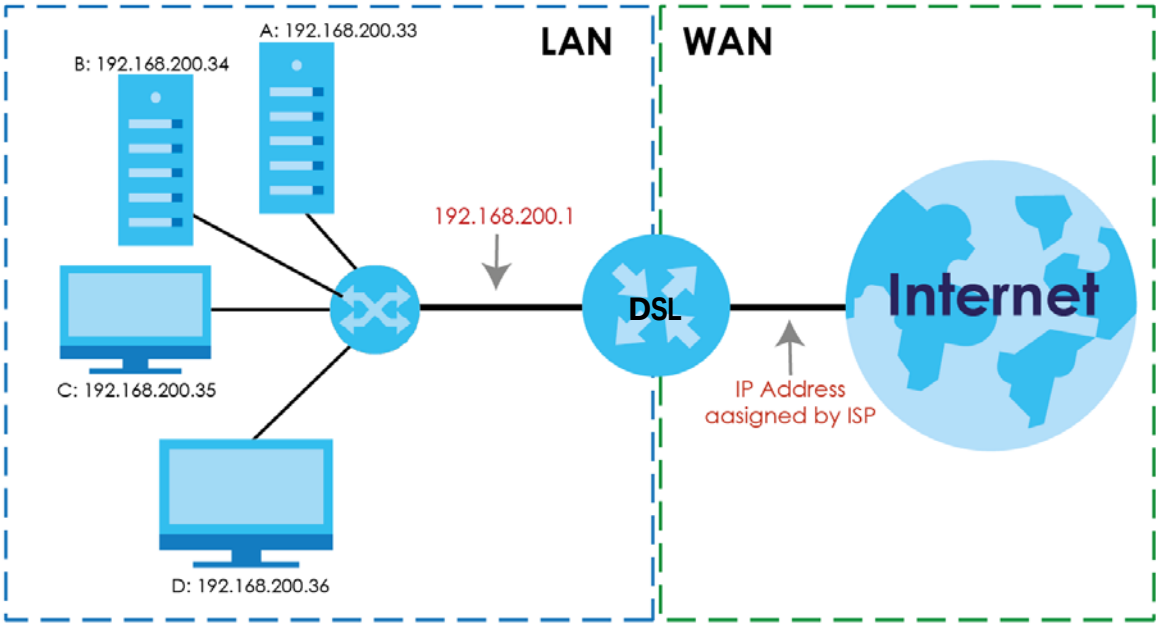
Table 65 Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
FTP (File Transfer Protocol)	21
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
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

Port Forwarding Example

Let's say you want to assign ports 21-25 to one FTP, 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 90 Multiple Servers Behind NAT Example



CHAPTER 12
DNS

12.1 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 server(s), 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 server(s). The XMG 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 XMG 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 update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or 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 don't know your IP address.

First of all, you 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.

12.1.1 What You Can Do in this Chapter

- Use the **DNS Entry** screen to view, configure, or remove DNS routes (Section 12.2 on page 168).
- Use the **Dynamic DNS** screen to enable DDNS and configure the DDNS settings on the XMG (Section 12.3 on page 169).

12.1.2 What You Need To Know

DYNDNS Wildcard

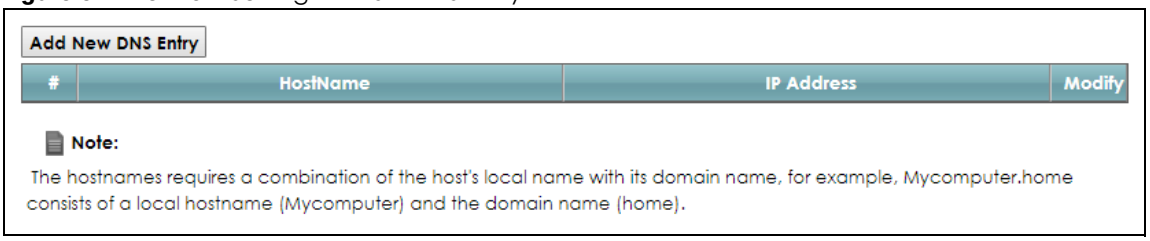
Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

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

12.2 The DNS Entry Screen

Use this screen to view and configure DNS routes on the XMG. Click **Network Setting > DNS** to open the **DNS Entry** screen.

Figure 91 Network Setting > DNS > DNS Entry



The following table describes the fields in this screen.

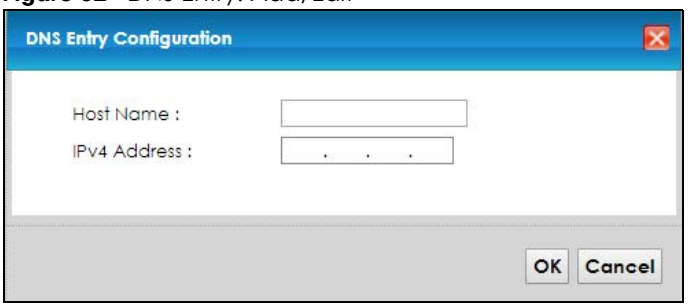
Table 66 Network Setting > DNS > DNS Entry

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.

12.2.1 Add/Edit DNS Entry

You can manually add or edit the XMG'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 92 DNS Entry: Add/Edit



The following table describes the labels in this screen.

Table 67 DNS Entry: Add/Edit

LABEL	DESCRIPTION
Host Name	Enter the host name of the DNS entry.
IPv4 Address	Enter the IPv4 address of the DNS entry.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

12.3 The Dynamic DNS Screen

Use this screen to change your XMG's DDNS. Click **Network Setting > DNS > Dynamic DNS**. The screen appears as shown.

Figure 93 Network Setting > DNS > Dynamic DNS

The following table describes the fields in this screen.

Table 68 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	Type the domain name assigned to your XMG by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
Host/Domain Name	Type the domain name the XMG can route.
Username	Type your user name.
Password	Type the password assigned to you.
Dynamic DNS Status	
User Authentication Result	This shows **Success** if the account is correctly set up with the Dynamic DNS provider account.

Table 68 Network Setting > DNS > > Dynamic DNS (continued)

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

CHAPTER 13
IGMP/MLD

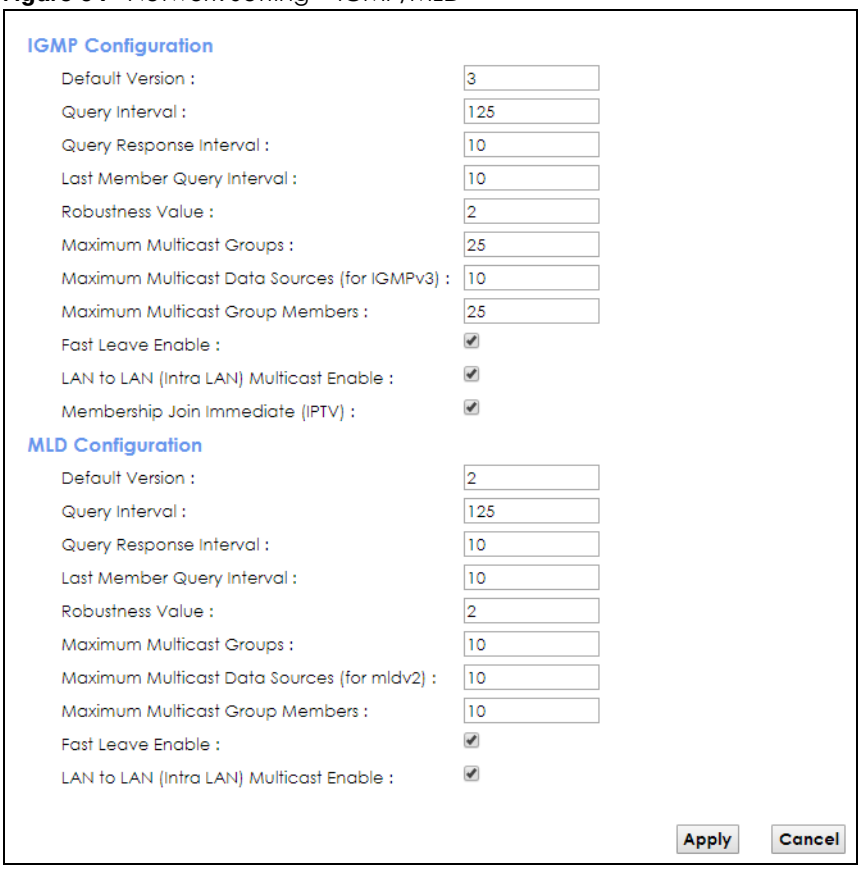
13.1 Overview

Use the **IGMP/MLD** screen to configure IGMP/MLD protocols.

13.2 The IGMP/MLD Screen

Click **Network Setting > IGMP/MLD** to open the following screen.

Figure 94 Network Setting > IGMP/MLD



The following table describes the labels in this screen.

Table 69 Network Setting > IGMP/MLD

LABEL	DESCRIPTION
IGMP Configuration/MLD Configuration	
Default Version	Enter the version (1~3) of the IGMP/MLD packets that the XMG should use.
Query Interval	Specify the amount of time in seconds (1~30000) between general query messages sent by the router.
Query Response Interval	Specify the amount of time in seconds (1~30000) the router waits for a response to a general query message.
Last Member Query Interval	Specify the amount of time in seconds (1~30000) the router waits for a response to a group specific query message.
Robustness Value	Specify how susceptible (1~7) the subnet is to lost packets.
Maximum Multicast Groups	Enter a number to limit the number of multicast groups of an interface on the XMG 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/mldv2)	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 XMG 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 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 XMG add a host to a multicast group immediately once the XMG receives an IGMP or MLD join messages.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

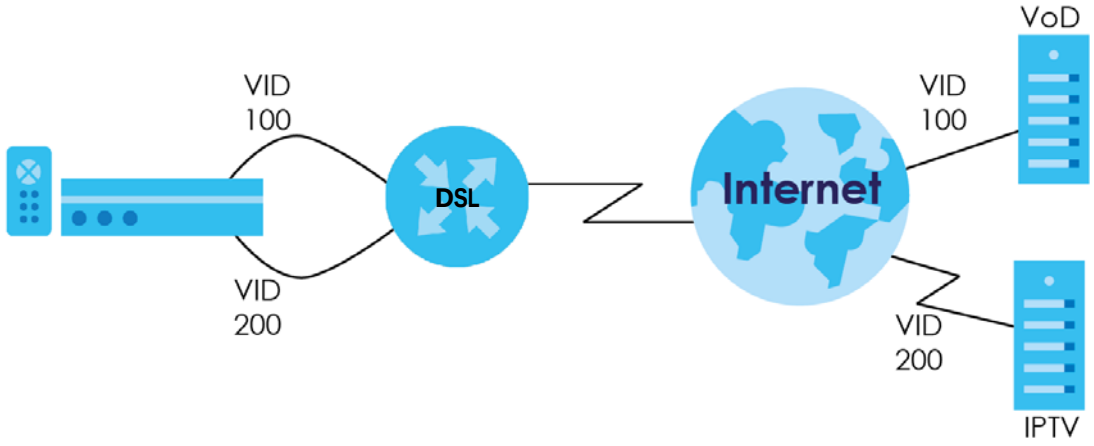
CHAPTER 14
VLAN Group

14.1 Overview

Virtual LAN IDs are used to identify different traffic types over the same physical link.

In the following example, the XMG (DSL) can use VLAN IDs (VID) 100 and 200 to identify Video-on-Demand and IPTV traffic respectively coming from the two VoD and IPTV multicast servers. The XMG (DSL) can also tag outgoing requests to these servers with these VLAN IDs.

Figure 95 VLAN Group Example



14.1.1 What You Can Do in this Chapter

Use these screens to group separate VLAN groups together to be treated as one VLAN group.

14.2 The VLAN Group Screen

Click **Network Setting > Vlan Group** to open the following screen.

Figure 96 Network Setting > Vlan Group

The following table describes the fields in this screen.

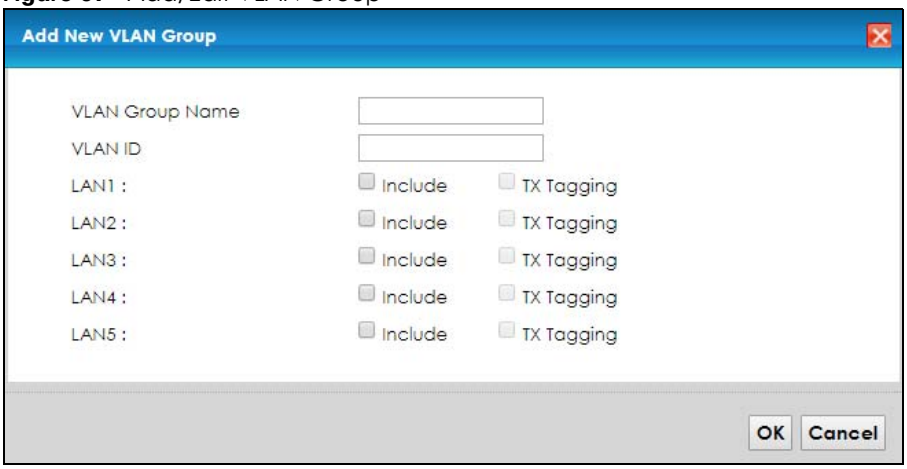
Table 70 Network Setting > Vlan Group

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.
Interfaces	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.

14.2.1 Add/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 97 Add/Edit VLAN Group



The following table describes the fields in this screen.

Table 71 Add/Edit VLAN Group

LABEL	DESCRIPTION
VLAN Group Name	Enter a name to identify this group. You can enter up to 30 characters. You can use letters, numbers, hyphens (-) and underscores (_). Spaces are not allowed.
VLAN ID	Enter a unique ID number, from 1 to 4,094, to identify this VLAN group. Outgoing traffic is tagged with this ID if **Tx Tagging** is selected below.
LAN 1~5	Select **Include** to add the associated LAN interface to this VLAN group. Select **Tx Tagging** to tag outgoing traffic from the associated LAN port with the **VLAN ID** number entered above.
OK	Click **OK** to save your changes back to the XMG.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 15
Interface Grouping

15.1 Overview

By default, all LAN and WAN interfaces on the XMG are in the same group and can communicate with each other. Create interface groups to have the XMG assign the IP addresses in different domains to different groups. Each group acts as an independent network on the XMG. This lets devices connected to an interface group's LAN interfaces communicate through the interface group's WAN or LAN interfaces but not other WAN or LAN interfaces.

15.1.1 What You Can Do in this Chapter

The **Interface Grouping** screens let you create multiple networks on the XMG (Section 15.2 on page 175).

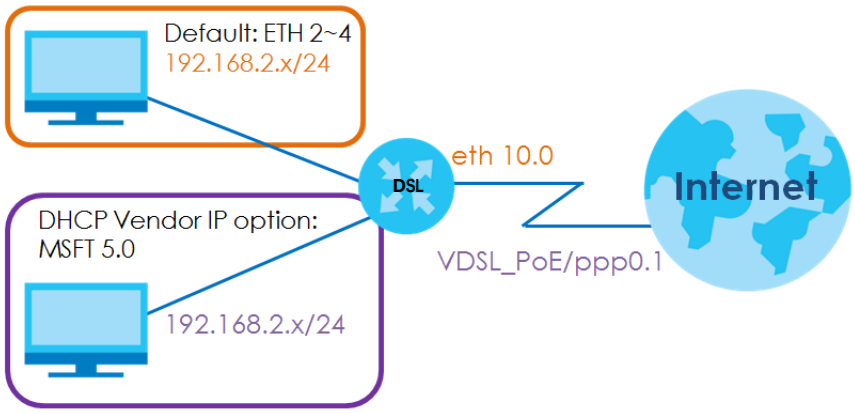
15.2 The Interface Grouping Screen

You can manually add a LAN interface to a new group. Alternatively, you can have the XMG 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** screen to configure the private IP addresses the DHCP server on the XMG assigns to the clients in the default and/or user-defined groups. If you set the XMG 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 8 on page 111 for more information.

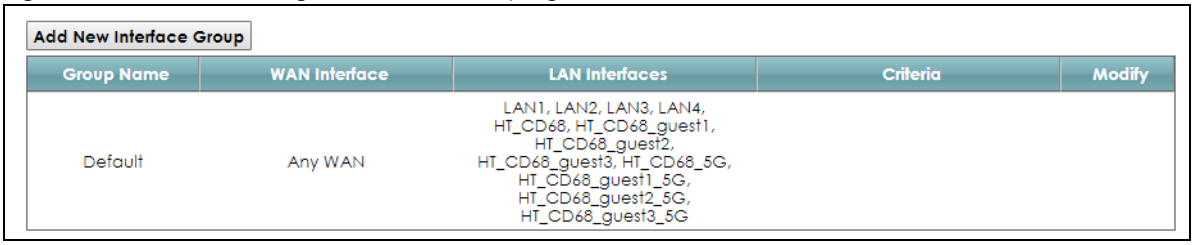
In the following example, the client that sends packets with the DHCP Vendor ID option set to MSFT 5.0 (meaning it is a Windows 2000 DHCP client) is assigned the IP address 192.168.2.2 and uses the WAN VDSL_PoE/ppp0.1 interface.

Figure 98 Interface Grouping Application



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

Figure 99 Network Setting > Interface Grouping



The following table describes the fields in this screen.

Table 72 Network Setting > Interface Grouping

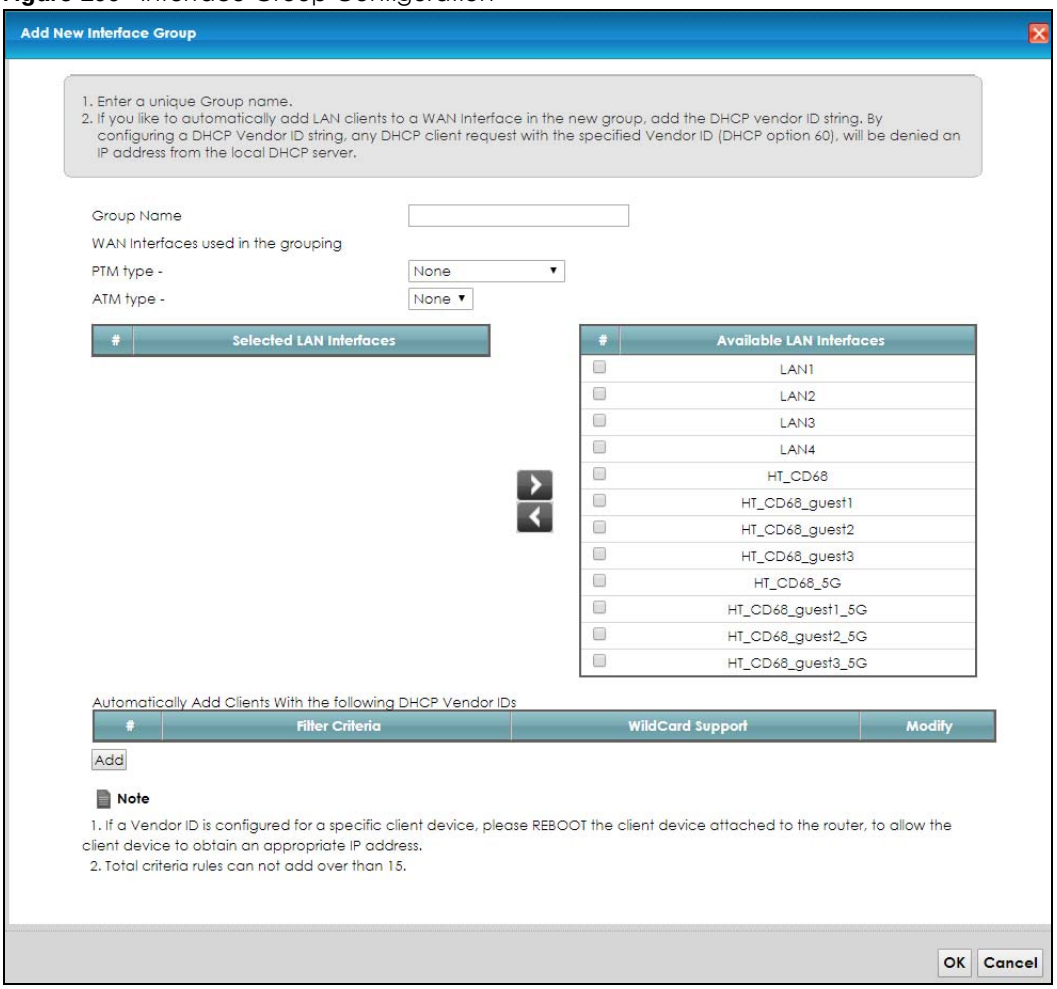
LABEL	DESCRIPTION
Add New Interface Group	Click this button to create a new interface group.
Group Name	This shows the descriptive name of the group.
WAN Interface	This shows the WAN interfaces in the group.
LAN Interfaces	This shows the LAN interfaces in the group.
Criteria	This shows the filtering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

15.2.1 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.

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

Figure 100 Interface Group Configuration



The following table describes the fields in this screen.

Table 73 Interface Group Configuration

LABEL	DESCRIPTION
Group Name	Enter a name to identify this group. You can enter up to 30 characters. You can use letters, numbers, hyphens (-) and underscores (_). Spaces are not 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 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 LAN interfaces (Ethernet LAN, HPNA or wireless LAN) on the **Available LAN Interfaces** list and use the left arrow to move them to the interface list on the left to add the interfaces to this group. To remove a LAN or wireless LAN interface from the interface list on the left, use the right-facing arrow.
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 15.2.2 on page 178 for more information.
#	This shows the index number of the rule.

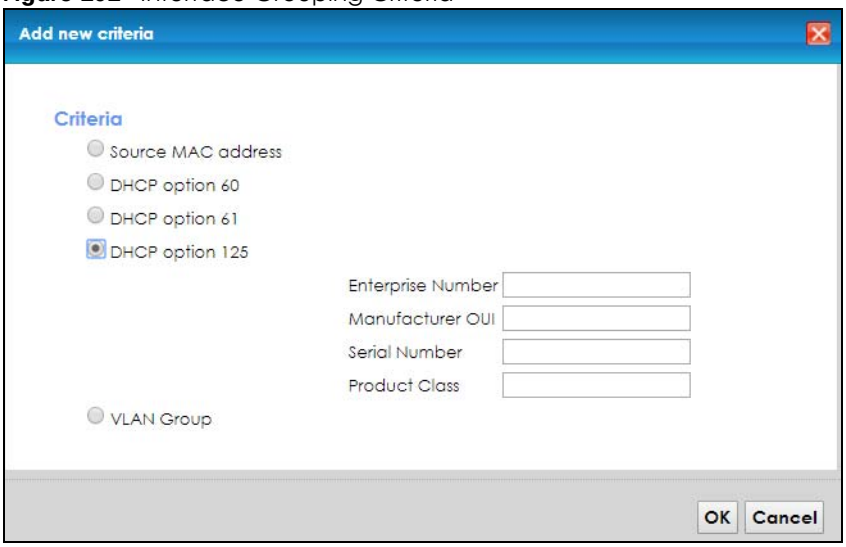
Table 73 Interface Group Configuration (continued)

LABEL	DESCRIPTION
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 **Modify** icon to edit this rule on the XMG.
OK	Click **OK** to save your changes back to the XMG.
Cancel	Click **Cancel** to exit this screen without saving.

15.2.2 Interface Grouping Criteria

Click the **Add** button in the **Interface Grouping Configuration** screen to open the following screen.

Figure 101 Interface Grouping Criteria



The following table describes the fields in this screen.

Table 74 Interface Grouping Criteria

LABEL	DESCRIPTION
Source MAC Address	Select this option and enter the source MAC address of the packet.
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.
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 three bytes of the MAC address.

Table 74 Interface Grouping Criteria (continued)

LABEL	DESCRIPTION
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.
OK	Click **OK** to save your changes back to the XMG.
Cancel	Click **Cancel** to exit this screen without saving.

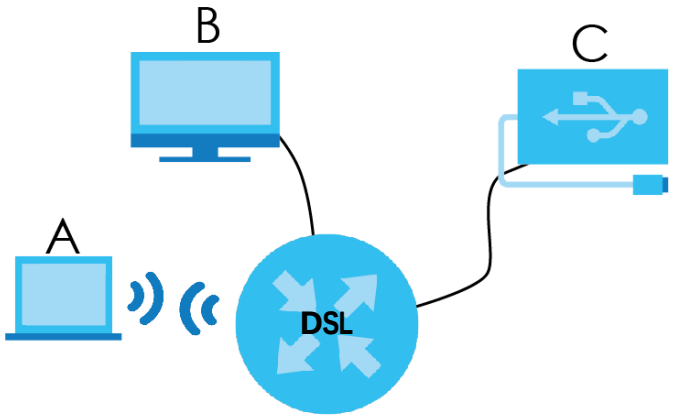
CHAPTER 16
USB Service

16.1 Overview

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

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

Figure 102 File Sharing Overview



The XMG will not be able to join the 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.

16.1.1 What You Can Do in this Chapter

- Use the **File Sharing** screen to enable file-sharing server (Section 16.1.3 on page 181).
- Use the **Media Server** screen to enable or disable the sharing of media files (Section 16.3 on page 182).

16.1.2 What You Need To Know

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

16.1.2.1 About 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 XMG is given a folder, called a "share". If a USB hard drive connected to the XMG 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 XMG supports File Allocation Table (FAT) and FAT32.

Common Internet File System

The XMG 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 XMG. CIFS protocol is supported on Microsoft Windows, Linux Samba and other operating systems (refer to your systems specifications for CIFS compatibility).

16.1.3 Before You Begin

Make sure the XMG is connected to your network and turned on.

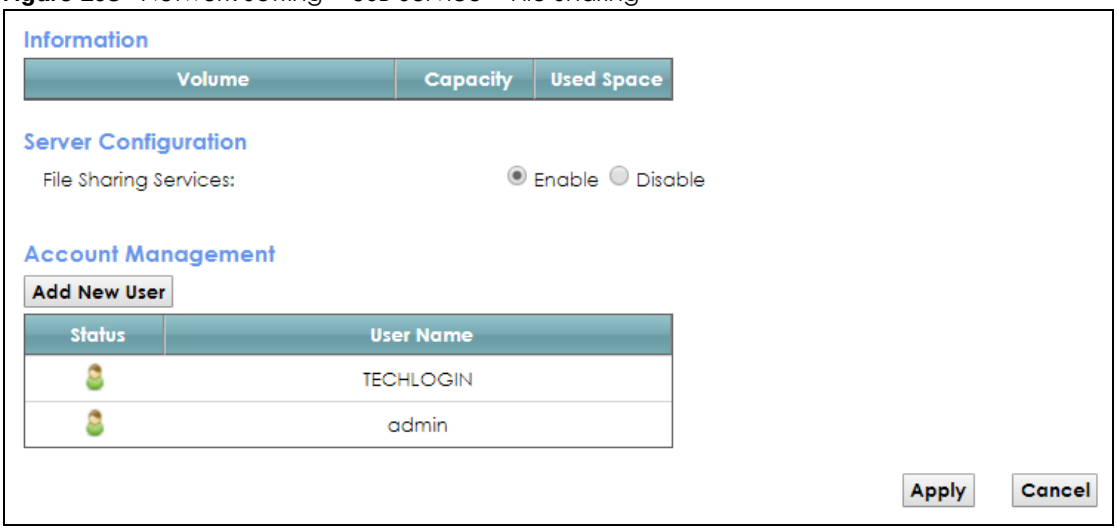
1. Connect the USB device to one of the XMG's USB port. Make sure the XMG is connected to your network.
2. The XMG detects the USB device and makes its contents available for browsing. If you are connecting a USB hard drive that comes with an external power supply, make sure it is connected to an appropriate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

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

16.2 The File Sharing Screen

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

Figure 103 Network Setting > USB Service > File Sharing



Each field is described in the following table.

Table 75 Network Setting > USB Service > File Sharing

LABEL	DESCRIPTION
Information	
Volume	This is the volume name the XMG 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	Select **Enable** to activate file sharing through the XMG.
Account Management	
Add New User	Click this button to access the **User Account** screen, use this screen to create a new user account to access the secured shared. For more information see Section 31.2 on page 256.
Active	Select this to allow the user to access the secured shares.
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.
Modify	Click the **Edit** icon to modify the user account. Click the **Delete** icon to remove the user account from the XMG.
Apply	Click this to save your changes to the XMG.
Cancel	Click this to restore your previously saved settings.

16.3 The Media Server Screen

The media server feature lets anyone on your network play video, music, and photos from the USB storage device connected to your XMG (without having to copy them to another computer). The XMG can function as a DLNA-compliant media server. The XMG 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.

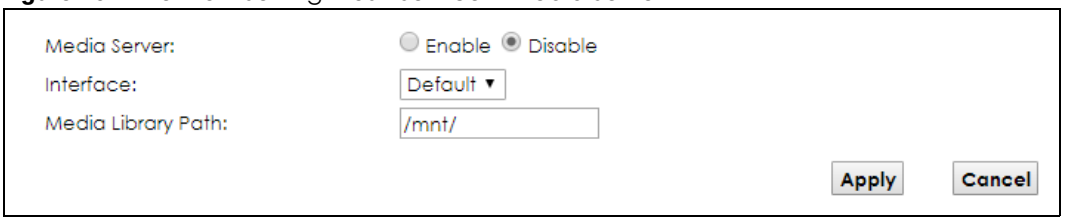
The XMG media server enables you to:

- Publish all shares for everyone to play media files in the USB storage device connected to the XMG.
- 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 XMG's media server settings, click **Network Setting > USB Service > Media Server**. The screen appears as shown.

Figure 104 Network Setting > USB Service > Media Server



The following table describes the labels in this menu.

Table 76 Network Setting > USB Service > Media Server

LABEL	DESCRIPTION
Media Server	Select **Enable** to have the XMG function as a DLNA-compliant media server. 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.
Media Library Path	Enter the path clients use to access the media files on a USB storage device connected to the XMG.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

CHAPTER 17
Firewall

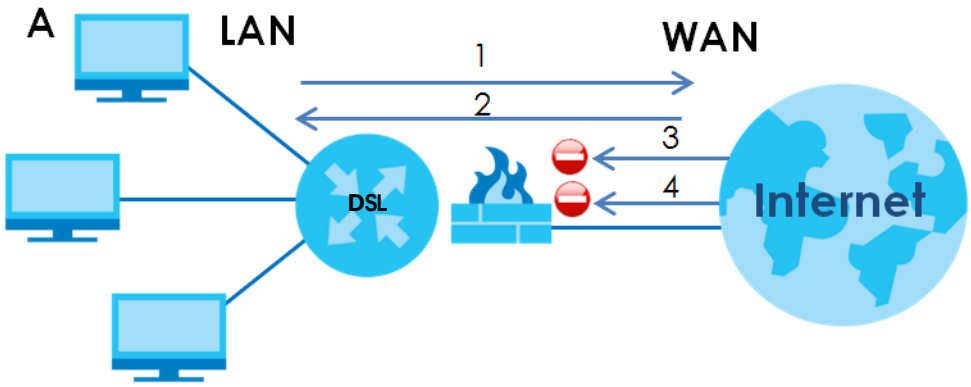
17.1 Overview

This chapter shows you how to enable and configure the XMG's security settings. Use the firewall to protect your XMG and network from attacks by hackers on the Internet and control access to it. By default 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.

The following figure illustrates the default 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 105 Default Firewall Action



17.1.1 What You Can Do in this Chapter

- Use the **General** screen to configure the security level of the firewall on the XMG (Section 17.2 on page 185).
- Use the **Protocol** screen to add or remove predefined Internet services and configure firewall rules (Section 17.3 on page 186).
- Use the **Access Control** screen to view and configure incoming/outgoing filtering rules (Section 17.4 on page 188).
- Use the **DoS** screen to activate protection against Denial of Service (DoS) attacks (.Section 17.5 on page 190).

17.1.2 What You Need to Know

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

Denials 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 XMG is pre-configured to automatically detect and thwart all known DoS attacks.

DDoS

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

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

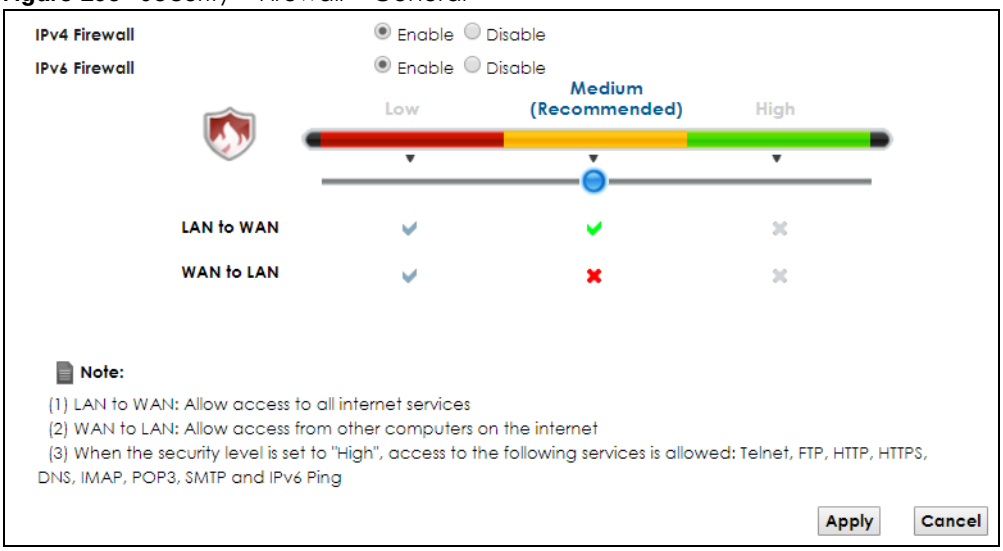
Stateful Packet Inspection (SPI) tracks each connection crossing the firewall and makes sure it is valid. Filtering decisions are based not only on rules but also context. For example, traffic from the WAN may only be allowed to cross the firewall in response to a request from the LAN.

17.2 The Firewall Screen

Use this screen to set the security level of the firewall on the XMG. Firewall rules are grouped based on the direction of travel of packets to which they apply.

Click **Security > Firewall** to display the **General** screen.

Figure 106 Security > Firewall > General



The following table describes the labels in this screen.

Table 77 Security > Firewall > General

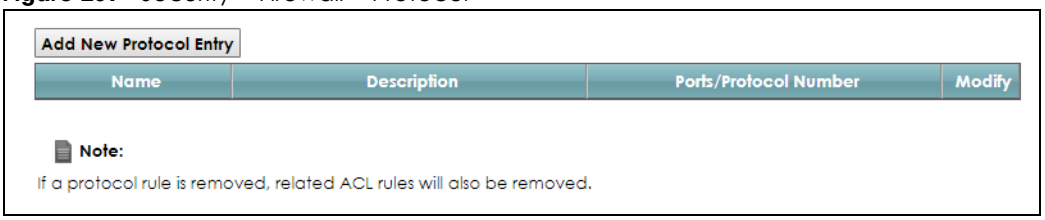
LABEL	DESCRIPTION
IPv4/IPv6 Firewall	Select **Enable** to activate the firewall feature on the XMG.
Low	Select **Low** to allow LAN to WAN and WAN to LAN packet directions.
Medium	Select **Medium** to allow LAN to WAN but deny WAN to LAN packet directions.
High	Select **High** to deny LAN to WAN and WAN to LAN packet directions.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

17.3 The Protocol Screen

You can configure customized services and port numbers in the **Protocol** screen. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. See Appendix C on page 308 for some examples.

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

Figure 107 Security > Firewall > Protocol



The following table describes the labels in this screen.

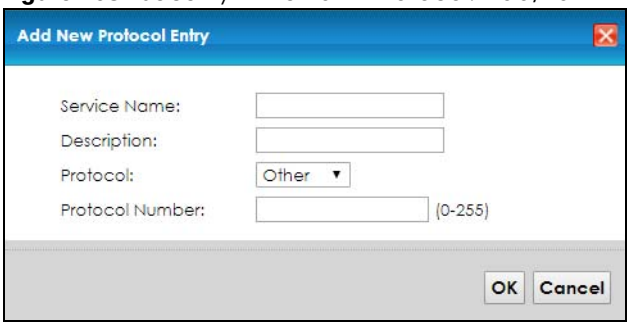
Table 78 Security > Firewall > Protocol

LABEL	DESCRIPTION
Add New Protocol Entry	Click this to add a new service.
Name	This is the name of your customized service.
Description	This is the description of your customized service.
Ports/Protocol Number	This shows the IP protocol (**TCP**, **UDP**, **ICMP**, or **TCP/UDP**) and the port number or range of ports that defines your customized service. **Other** and the protocol number displays if the service uses another IP protocol.
Modify	Click the **Edit** icon to edit the entry. Click the **Delete** icon to remove this entry.

17.3.1 Add/Edit a Service

Use this screen to add a customized service rule that you can use in the firewall's ACL rule configuration. Click **Add New Protocol Entry** or the edit icon next to an existing service rule in the **Protocol** screen to display the following screen.

Figure 108 Security > Firewall > Protocol: Add/Edit



The following table describes the labels in this screen.

Table 79 Security > Firewall > Protocol: Add/Edit

LABEL	DESCRIPTION
Service Name	Enter a unique name (up to 32 printable English keyboard characters, including spaces) for your customized port.
Description	Enter a description for your customized port.
Protocol	Choose the IP protocol (**TCP**, **UDP**, **ICMP**, **ICMPv6** or **Other**) that defines your customized port from the drop-down list box. Select **Other** to be able to enter a protocol number.
Source/ Destination Port	These fields are displayed if you select **TCP** or **UDP** as the IP port. Select **Single** to specify one port only or **Range** to specify a span of ports that define your customized service. If you select **Any**, the service is applied to all ports. Type a single port number or the range of port numbers that define your customized service.
Protocol Number	This field is displayed if you select **Other** as the protocol. Enter the protocol number of your customized port.
ICMPv6 Type	This field is displayed if you select **ICMPv6** as the protocol. Enter the type value for the ICMPv6 messages.

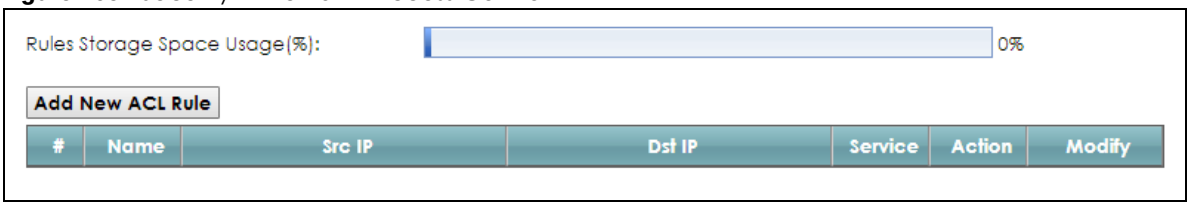
Table 79 Security > Firewall > Protocol: Add/Edit (continued)

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

17.4 The Access Control Screen

Click **Security > Firewall > Access Control** to display the following screen. This screen displays a list of the configured incoming or outgoing filtering rules.

Figure 109 Security > Firewall > Access Control



The following table describes the labels in this screen.

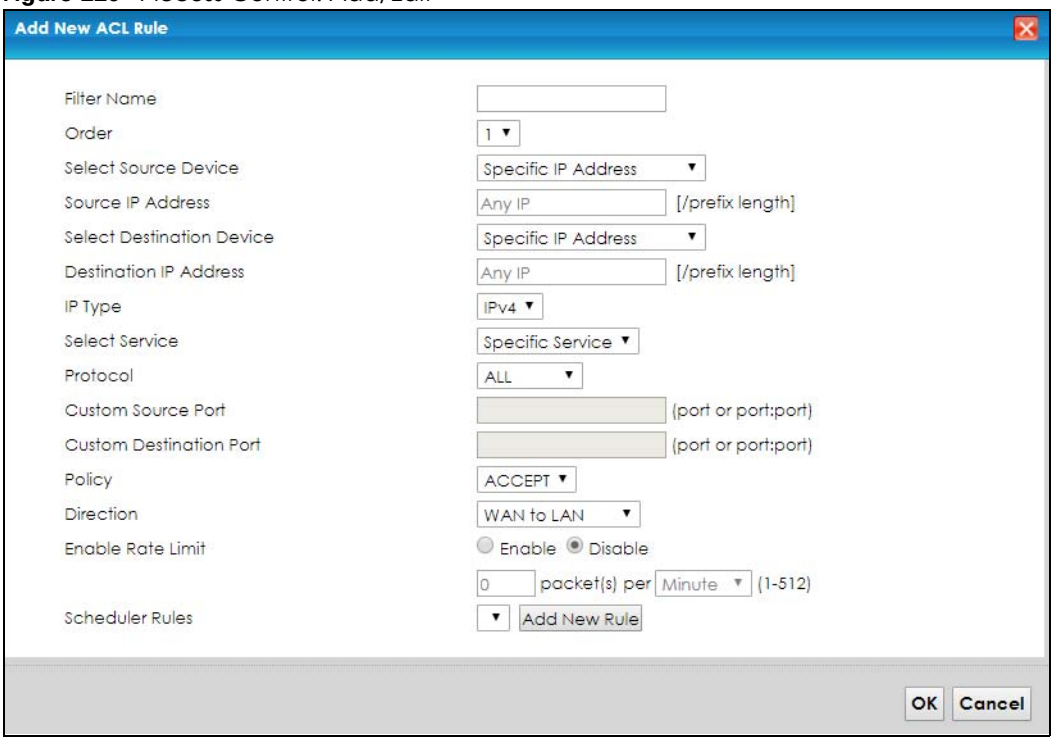
Table 80 Security > Firewall > Access Control

LABEL	DESCRIPTION
Add New ACL Rule	Click this to go to add a filter rule for incoming or outgoing IP traffic.
#	This is the index number of the entry.
Name	This displays the name of the rule.
Src IP	This displays the source IP addresses to which this rule applies. Please note that a blank source address is equivalent to **Any**.
Dst IP	This displays the destination IP addresses to which this rule applies. Please note that a blank destination address is equivalent to **Any**.
Service	This displays the transport layer protocol that defines the service and the direction of traffic to which this rule applies.
Action	This field displays whether the rule silently discards packets (**DROP**), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (**REJECT**) or allows the passage of packets (**ACCEPT**).
Modify	Click the **Edit** icon to edit the rule. Click the **Delete** icon to delete an existing rule. Note that subsequent rules move up by one when you take this action. Click the **Move To** icon to change the order of the rule. Enter the number in the # field.

17.4.1 Add/Edit an 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.

Figure 110 Access Control: Add/Edit



The following table describes the labels in this screen.

Table 81 Access Control: Add/Edit

LABEL	DESCRIPTION
Filter Name	Enter a descriptive name of up to 16 alphanumeric characters, not including spaces, underscores, and dashes. You must enter the filter name to add an ACL rule. This field is read-only if you are editing the ACL rule.
Order	Select the order of the ACL rule.
Select Source Device	Select the source device to which the ACL rule applies. If you select **Specific IP Address**, enter the source IP address in the field below.
Source IP Address	Enter the source IP address.
Select Destination Device	Select the destination device to which the ACL rule applies. If you select **Specific IP Address**, enter the destiniation IP address in the field below.
Destination IP Address	Enter the destination IP address.
IP Type	Select whether your IP type is **IPv4** or **IPv6**.
Select Service	Select the transport layer protocol that defines your customized port from the drop-down list box. The specific protocol rule sets you add in the **Security > Firewall > Service > Add** screen display in this list. If you want to configure a customized protocol, select **Specific Service**.
Protocol	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Choose the IP port (**TCP/UDP**, **TCP**, **UDP**, **ICMP**, or **ICMPv6**) that defines your customized port from the drop-down list box.

Table 81 Access Control: Add/Edit (continued)

LABEL	DESCRIPTION
Custom Source Port	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Enter a single port number or the range of port numbers of the source.
Custom Destination Port	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Enter a single port number or the range of port numbers of the destination.
Policy	Use the drop-down list box to select whether to discard (**DROP**), deny and send an ICMP destination-unreachable message to the sender of (**REJECT**) or allow the passage of (**ACCEPT**) packets that match this rule.
Direction	Use the drop-down list box to select the direction of traffic to which this rule applies.
Enable Rate Limit	Select **Enable** to set a limit on the upstream/downstream transmission rate for the specified protocol. Specify how many packets per minute or second the transmission rate is.
Scheduler Rules	Select a schedule rule for this ACL rule form the drop-down list box. You can configure a new schedule rule by click **Add New Rule**. This will bring you to the **Security > Scheduler Rules** screen.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

17.5 The DoS Screen

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 111 Security > Firewall > DoS

The following table describes the labels in this screen.

Table 82 Security > Firewall > DoS

LABEL	DESCRIPTION
DoS Protection Blocking	Select **Enable** to enable protection against DoS attacks.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 18
MAC Filter

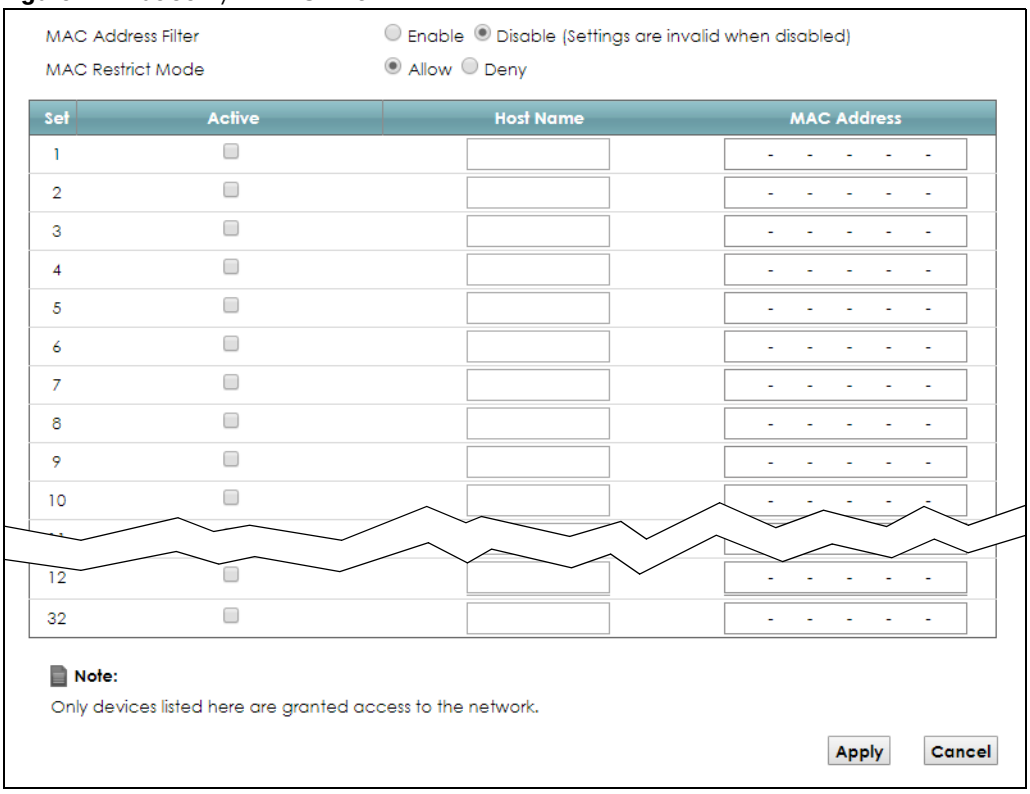
18.1 Overview

You can configure the XMG to permit access to clients based on their MAC addresses in the **MAC Filter** screen. This applies to wired and wireless connections. Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC addresses of the devices to configure this screen.

18.2 The MAC Filter Screen

Use this screen to allow wireless and LAN clients access to the XMG. Click **Security** > **MAC Filter**. The screen appears as shown.

Figure 112 Security > MAC Filter



The following table describes the labels in this screen.

Table 83 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 XMG. Select **Deny** to permit anyone access to the XMG 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 **Active** is not selected.
Host Name	Enter the host name of the wireless or LAN clients that are allowed access to the XMG.
MAC Address	Enter the MAC addresses of the wireless or LAN clients that are allowed access to the XMG 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.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

CHAPTER 19
Parental Control

19.1 Overview

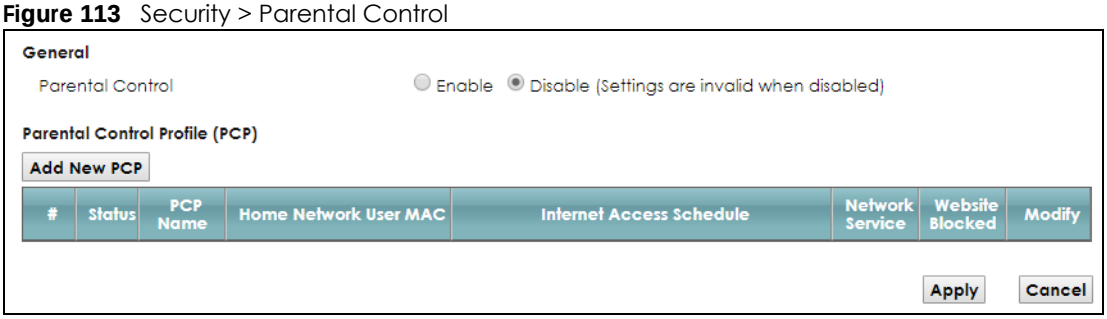
Parental control allows you to block web sites with the specific URL. You can also define time periods and days during which the XMG performs parental control on a specific user.

19.2 The Parental Control Screen

Use this screen to enable parental control, view the parental control rules and schedules.

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

Figure 113 Security > Parental Control



The following table describes the fields in this screen.

Table 84 Security > Parental Control

LABEL	DESCRIPTION
General	
Parental Control	Select **Enable** to activate parental control.
Parental Control Profile (PCP)	
Add New PCP	Click this if you want to configure a new Parental Control Profile.
#	This shows the index number of the rule.
Status	This 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.
PCP Name	This shows the name of the rule.
Home Network User MAC	This shows the MAC address of the LAN user's computer to which this rule applies.
Internet Access Schedule	This shows the day(s) and time on which parental control is enabled.
Network Service	This shows whether the network service is configured. If not, **None** will be shown.

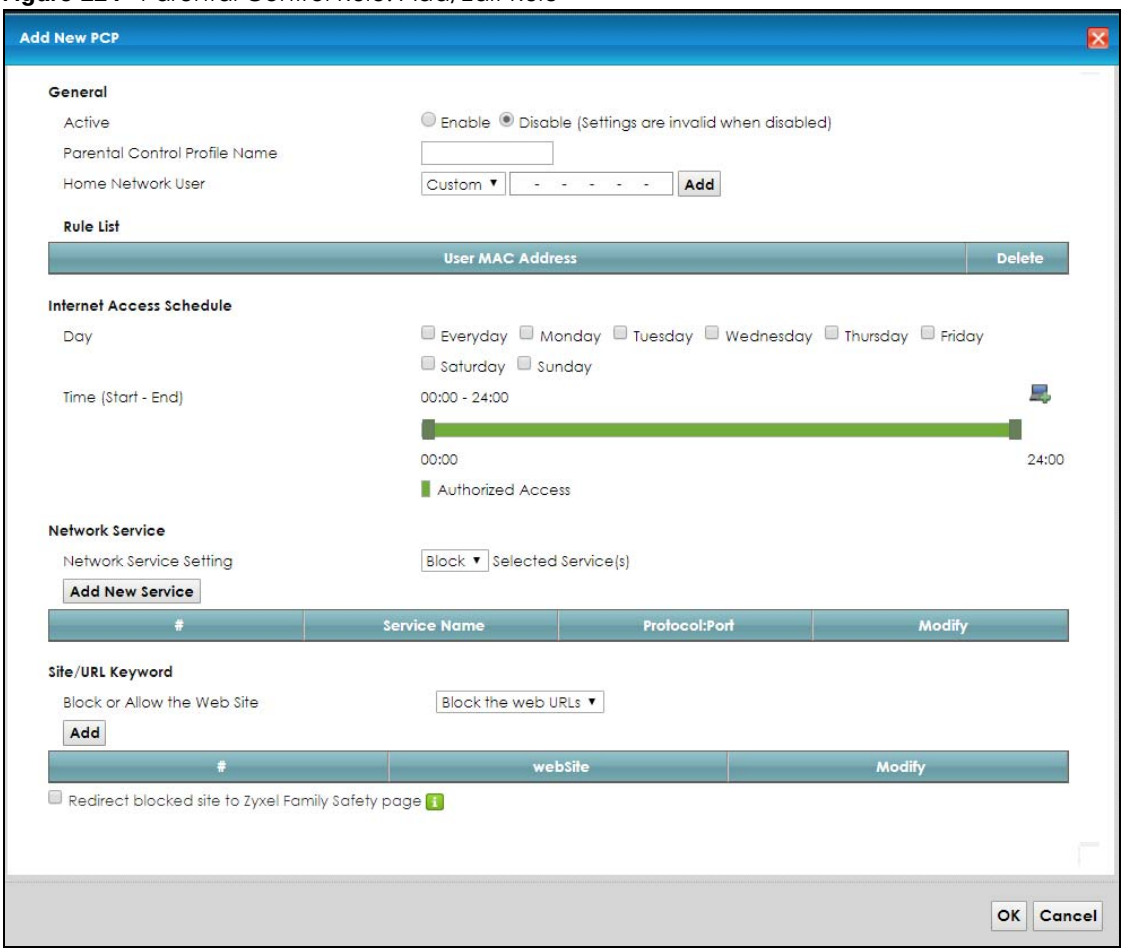
Table 84 Security > Parental Control (continued)

LABEL	DESCRIPTION
Website Blocked	This shows whether the website block is configured. If not, **None** will be shown.
Modify	Click the **Edit** icon to go to the screen where you can edit the rule. Click the **Delete** icon to delete an existing rule.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

19.2.1 Add/Edit a Parental Control Profile

Click **Add New PCP** 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 and/or URL filtering settings to block the users on your network from accessing certain web sites.

Figure 114 Parental Control Rule: Add/Edit Rule

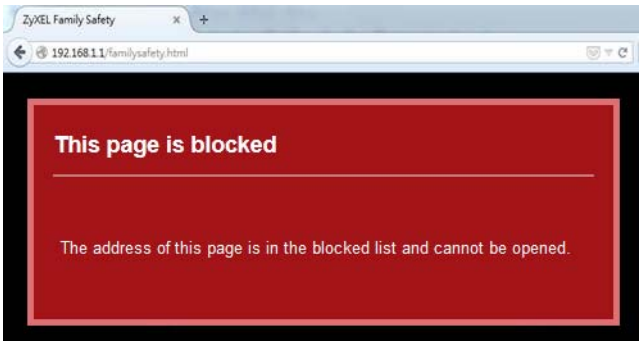


The following table describes the fields in this screen.

Table 85 Parental Control Rule: Add/Edit

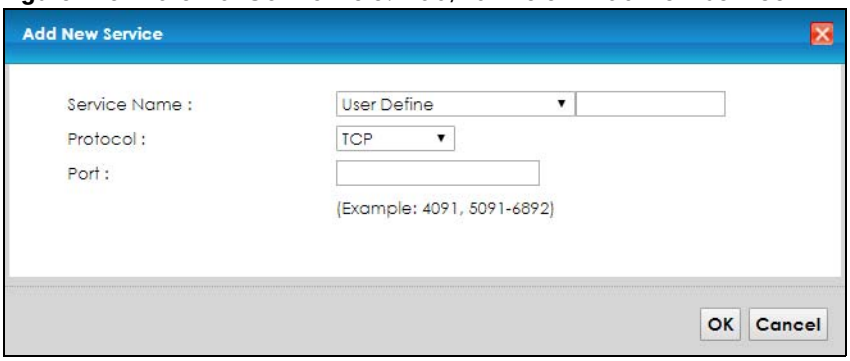
LABEL	DESCRIPTION
General	
Active	Select to enable or disable this parental control rule.
Parental Control Profile Name	Enter a descriptive name for the rule.
Home Network User	Select the LAN user that you want to apply this rule to from the drop-down list box. If you select **Custom**, enter the LAN user's MAC address. If you select **All**, the rule applies to all LAN users.
Rule List	In **Home Network User**, select **Custom**, enter the LAN user's MAC address, then click the **Add** icon to enter a computer MAC address for this PCP. Up to five are allowed. Click the **Delete** icon to remove one.
Internet Access Schedule	
Day	Select check boxes for the days that you want the XMG to perform parental control.
Time	Drag the time bar to define the time that the LAN user is allowed access (**Authorized access**) or denied access (**No access**). Click the **Add** icon above the time bar to add a new time bar. Up to three are allowed.
Network Service	
Network Service Setting	If you select **Block**, the XMG prohibits the users from viewing the Web sites with the URLs listed below. If you select **Allow**, the XMG blocks access to all URLs except ones listed below.
Add New Service	Click this to show a screen in which you can add a new service rule. You can configure the **Service Name**, **Protocol**, and **Name** of the new rule.
#	This shows the index number of the rule.
Service Name	This shows the name of the rule.
Protocol:Port	This shows the protocol and the port of the rule.
Modify	Click the **Edit** icon to go to the screen where you can edit the rule. Click the **Delete** icon to delete an existing rule.
Site/URL Keyword	
Block or Allow the Web Site	If you select **Block the Web URLs**, the XMG prohibits the users from viewing the Web sites with the URLs listed below. If you select **Allow the Web URLs**, the XMG blocks access to all URLs except ones listed below.
Add	Click **Add** to show a screen to enter the URL of web site or URL keyword to which the XMG blocks or allows access.
#	This shows the index number of the rule.
WebSite	This shows the URL of web site or URL keyword to which the XMG blocks or allows access.
Modify	Click the **Edit** icon to go to the screen where you can edit the rule. Click the **Delete** icon to delete an existing rule.

Table 85 Parental Control Rule: Add/Edit (continued)

LABEL	DESCRIPTION
Redirect blocked site to Zyxel Family Safety page	Select this to redirect users who access any blocked websites listed above to the Zyxel Family Safety page as shown next. **Figure 115** Zyxel Family Safety Page Example 
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

Click **Security > Parental Control > Add/Edit Rule > Add New Service** to open the following screen.

Figure 116 Parental Control Rule: Add/Edit Rule > Add New Service



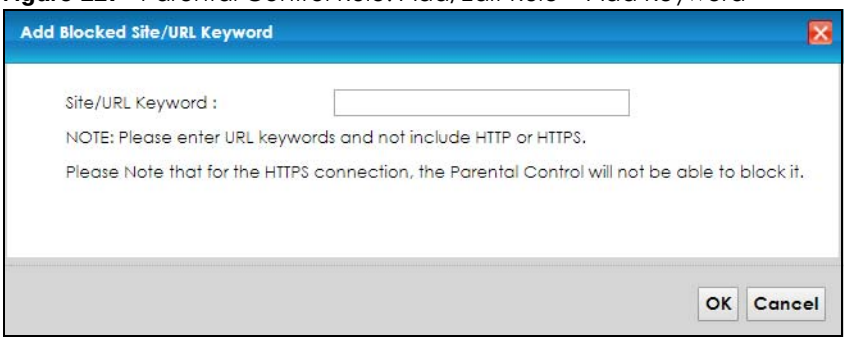
The following table describes the fields in this screen.

Table 86 Parental Control Rule: Add/Edit Rule > Add New Service

LABEL	DESCRIPTION
Service Name	Select the name of the service. Otherwise, select **User Define** and manualy specify the protocol and the port of the service. If you have chosen a pre-defined service in the **Service Name** field, this field will not be configurable.
Protocol	Select the transport layer protocol used for the service. Choices are TCP, UDP, or TCP & UDP.
Port	Enter the port of the service. If you have chosen a pre-defined service in the Service Name field, this field will not be configurable.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

Click **Security > Parental Control > Add/Edit Rule > Add Keyword** to open the following screen.

Figure 117 Parental Control Rule: Add/Edit Rule > Add Keyword



The following table describes the fields in this screen.

Table 87 Parental Control Rule: Add/Edit Rule > Add Keyword

LABEL	DESCRIPTION
Site/URL Keyword	Enter a keyword and click **OK** to have the XMG to block access to the website URLs that contain the keyword
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 20
Scheduler Rule

20.1 Overview

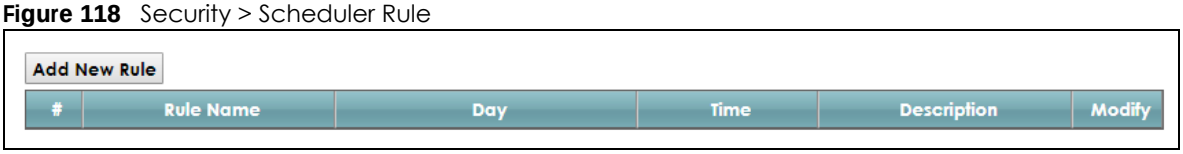
You can define time periods and days during which the XMG performs scheduled rules of certain features (such as Firewall Access Control) in the **Scheduler Rule** screen.

20.2 The Scheduler Rule Screen

Use this screen to view, add, or edit time schedule rules.

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

Figure 118 Security > Scheduler Rule



The following table describes the fields in this screen.

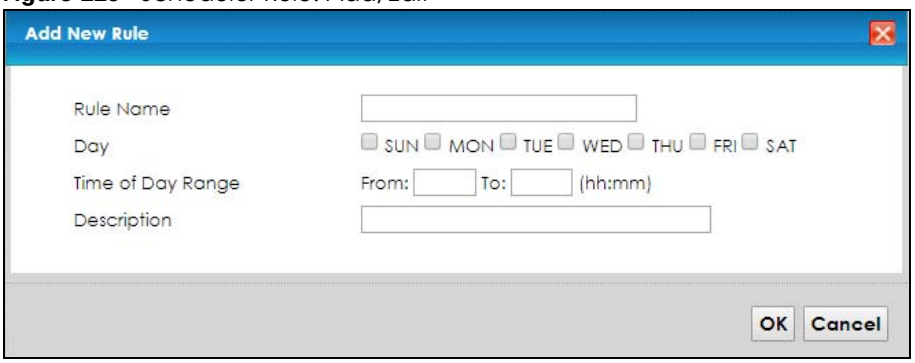
Table 88 Security > Scheduler Rule

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 day(s) 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.

20.2.1 Add/Edit a Schedule

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 119 Scheduler Rule: Add/Edit



The following table describes the fields in this screen.

Table 89 Scheduler Rule: Add/Edit

LABEL	DESCRIPTION
Rule Name	Enter a name (up to 31 printable English keyboard characters, not including spaces) for this schedule.
Day	Select check boxes for the days that you want the XMG 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.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 21
Certificates

21.1 Overview

The XMG 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.

21.2 What You Can Do in this Chapter

- Use the **Local Certificates** screen to generate certification requests and import the XMG's CA-signed certificates (Section 21.5 on page 204).
- Use the **Trusted CA** screen to save the certificates of trusted CAs to the XMG (Section 21.5 on page 204).

21.3 What You Need to Know

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

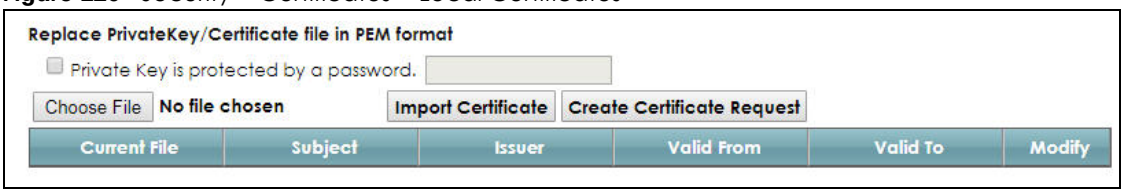
Certification Authority

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 XMG to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

21.4 The Local Certificates Screen

Click **Security > Certificates** to open the **Local Certificates** screen. This is the XMG's summary list of certificates and certification requests.

Figure 120 Security > Certificates > Local Certificates



The following table describes the labels in this screen.

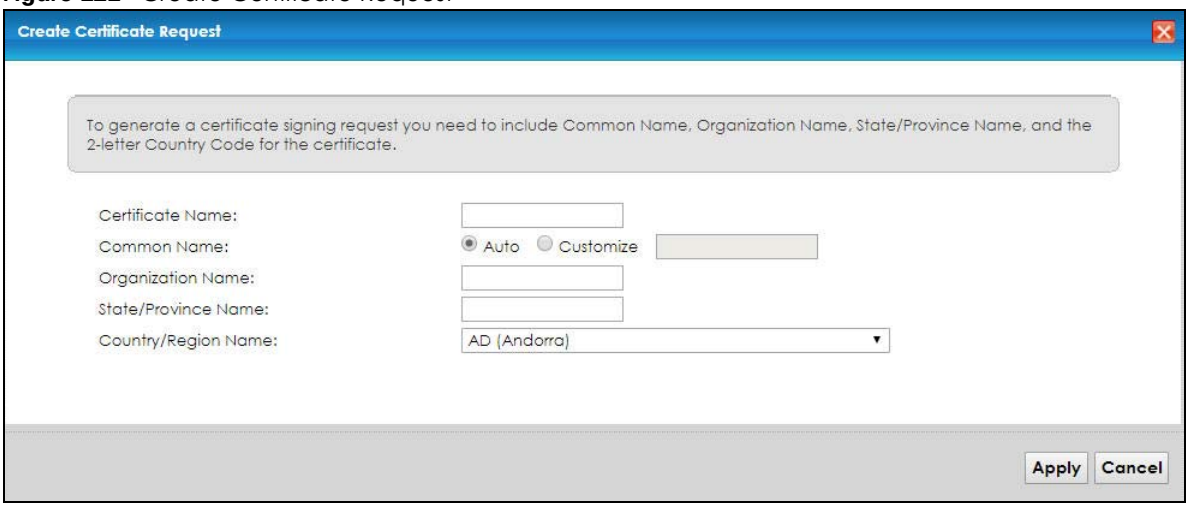
Table 90 Security > Certificates > Local Certificates

LABEL	DESCRIPTION
Private Key is protected by a password	Select the checkbox and enter the private key into the text box to store it on the XMG. The private key should not exceed 63 ASCII characters (not including spaces).
Choose File	Click this 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 XMG.
Create Certificate Request	Click this button to go to the screen where you can have the XMG 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 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 (or certification request). For a certification request, click **Load Signed** to import the signed certificate. 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.

21.4.1 Create Certificate Request

Click **Security** > **Certificates** > **Local Certificates** and then **Create Certificate Request** to open the following screen. Use this screen to have the XMG generate a certification request.

Figure 121 Create Certificate Request



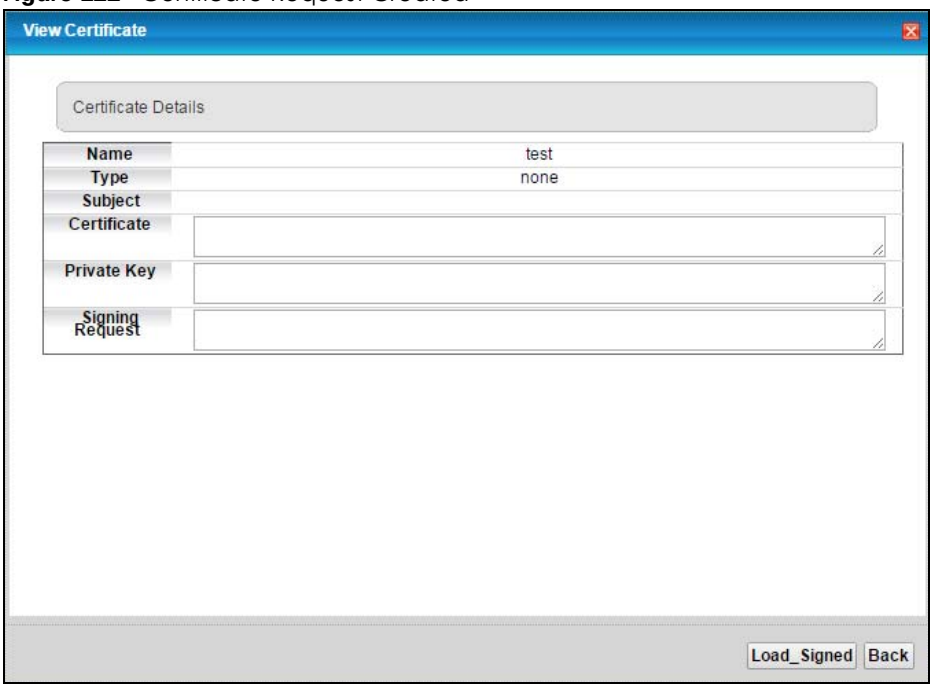
The following table describes the labels in this screen.

Table 91 Create Certificate Request

LABEL	DESCRIPTION
Certificate Name	Type up to 63 ASCII characters (not including spaces) to identify this certificate.
Common Name	Select **Auto** to have the XMG configure this field automatically. Or select **Customize** to enter it manually. Type the IP address (in dotted decimal notation), domain name or e-mail address in the field provided. The domain name or e-mail address can be up to 63 ASCII characters. The domain name or e-mail address is for identification purposes only and can be any string.
Organization Name	Type up to 63 characters to identify the company or group to which the certificate owner belongs. You may use any character, including spaces, but the XMG drops trailing spaces.
State/Province Name	Type up to 32 characters to identify the state or province where the certificate owner is located. You may use any character, including spaces, but the XMG drops trailing spaces.
Country/Region Name	Select a country to identify the nation where the certificate owner is located.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

After you click **Apply**, the following screen displays to notify you that you need to get the certificate request signed by a Certificate Authority. If you already have, click **Load_Signed** to import the signed certificate into the XMG. Otherwise click **Back** to return to the **Local Certificates** screen.

Figure 122 Certificate Request Created

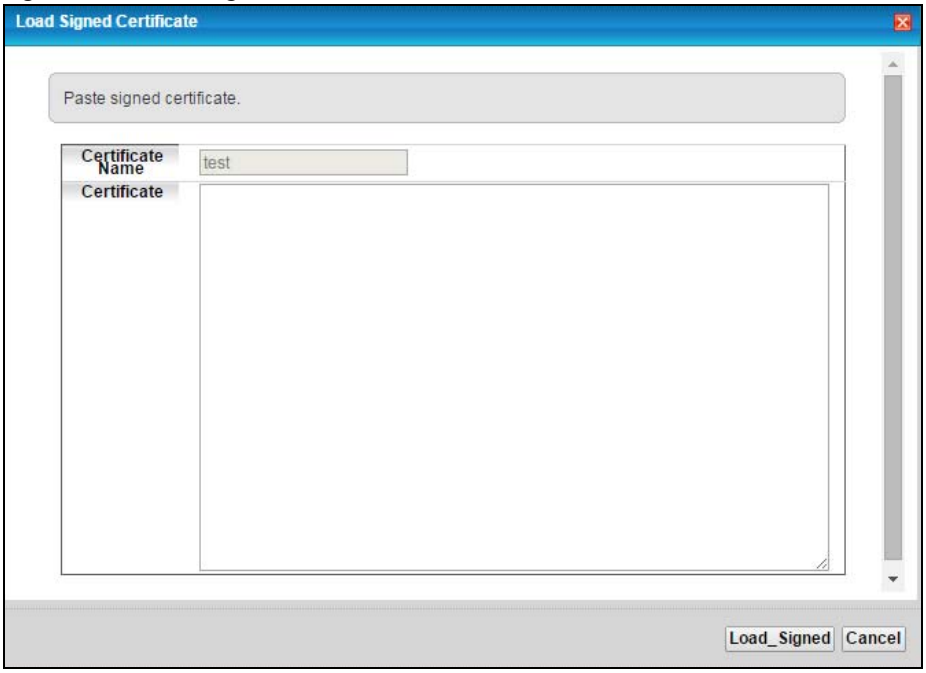


21.4.2 Load Signed Certificate

After you create a certificate request and have it signed by a Certificate Authority, in the **Local Certificates** screen click the certificate request's **Load Signed** icon to import the signed certificate into the XMG.

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

Figure 123 Load Signed Certificate



The following table describes the labels in this screen.

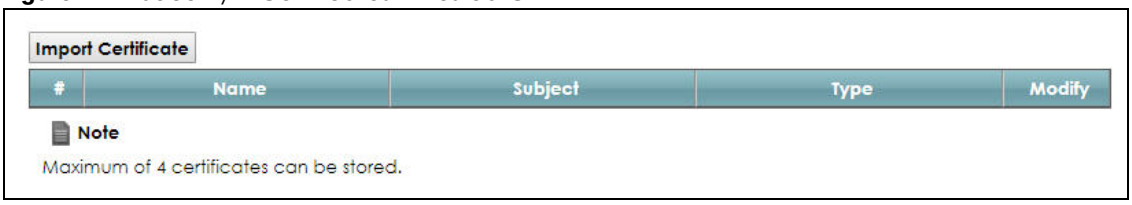
Table 92 Load Signed Certificate

LABEL	DESCRIPTION
Certificate Name	This is the name of the signed certificate.
Certificate	Copy and paste the signed certificate into the text box to store it on the XMG.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

21.5 The Trusted CA Screen

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 XMG to accept as trusted. The XMG accepts any valid certificate signed by a certification authority on this list as being trustworthy; thus you do not need to import any certificate that is signed by one of these certification authorities.

Figure 124 Security > Certificates > Trusted CA



The following table describes the fields in this screen.

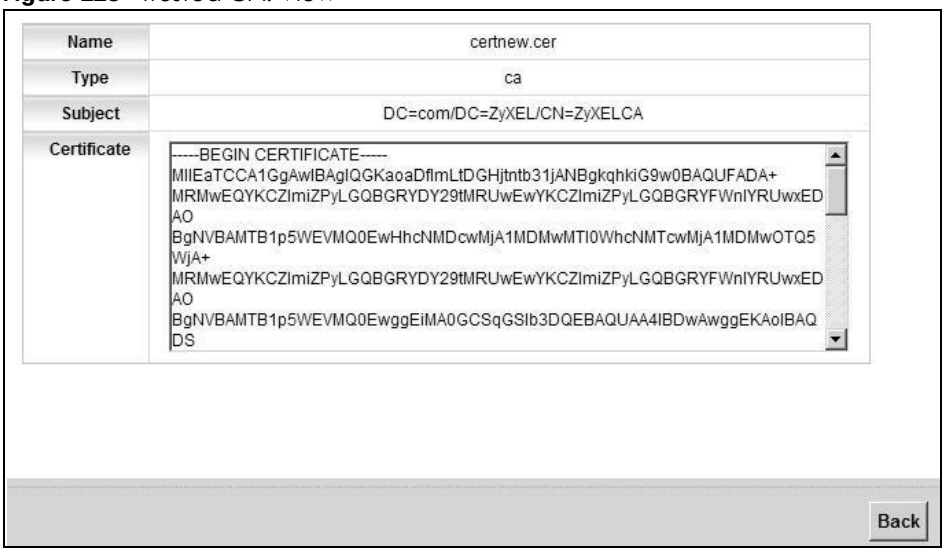
Table 93 Security > Certificates > Trusted CA

LABEL	DESCRIPTION
Import Certificate	Click this button to open a screen where you can save the certificate of a certification authority that you trust to the XMG.
#	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 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** button to delete the certificate (or certification request). You cannot delete a certificate that one or more features is configured to use.

21.5.1 View Trusted CA Certificate

Click the **View** icon in the **Trusted CA** screen to open the following screen. Use this screen to view in-depth information about the certification authority's certificate.

Figure 125 Trusted CA: View



The following table describes the fields in this screen.

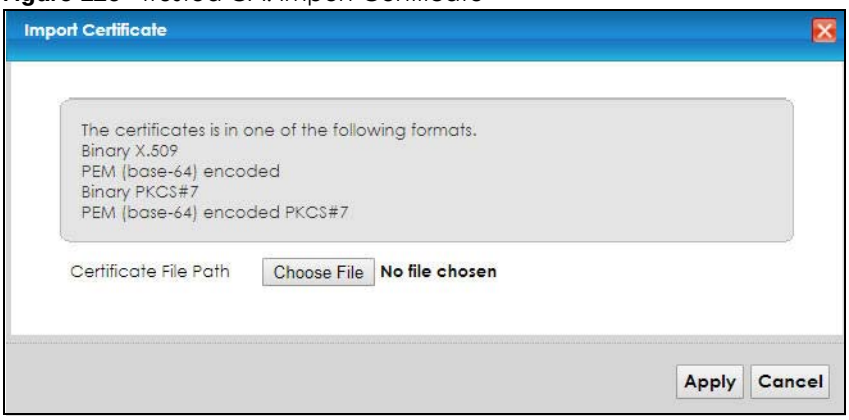
Table 94 Trusted CA: View

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 e-mail 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 (via floppy disk for example).
Back	Click **Back** to return to the previous screen.

21.5.2 Import Trusted CA Certificate

Click the **Import Certificate** button in the **Trusted CA** screen to open the following screen. The XMG trusts any valid certificate signed by any of the imported trusted CA certificates.

Figure 126 Trusted CA: Import Certificate



The following table describes the fields in this screen.

Table 95 Trusted CA: Import Certificate

LABEL	DESCRIPTION
Certificate File Path	Type in the location of the certificate you want to upload in this field or click **Choose File** to find it.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 22
VoIP

22.1 Overview

Use this chapter to:

- Connect an analog phone to the XMG.
- Make phone calls over the Internet, as well as the regular phone network.
- Configure settings such as speed dial.
- Configure network settings to optimize the voice quality of your phone calls.

22.1.1 What You Can Do in this Chapter

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

- Use the **SIP Account** screen () to set up information about your SIP account, control which SIP accounts the phones connected to the XMG use and configure audio settings such as volume levels for the phones connected to the XMG.
- Use the **SIP Service** Provider screen () to configure the SIP server information, QoS for VoIP calls, the numbers for certain phone functions, and dialing plan.
- Use the **Phone Device** screen () to view detailed information of the XMG's phone ports.
- Use the **Region** screen () to change settings that depend on the country you are in.
- Use the **Call Rule** screen () to set up shortcuts for dialing frequently-used (VoIP) phone numbers.

You don't 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.

22.1.2 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 signalling standard that lets one network device (like a computer or the XMG) send messages to another. In VoIP, these messages are about phone calls over

the network. For example, when you dial a number on your XMG, it sends a SIP message over the network asking the other device (the number you dialed) to take part in the call.

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 XMG to use your SIP account to make calls, the XMG is able to send all the information about the phone call to your service provider on the Internet. Strictly speaking, you don't need a SIP account. It is possible for one SIP device (like the XMG) 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.

22.2 Before You Begin

- Before you can use these screens, you need to have a VoIP account already set up. If you don't 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 XMG.

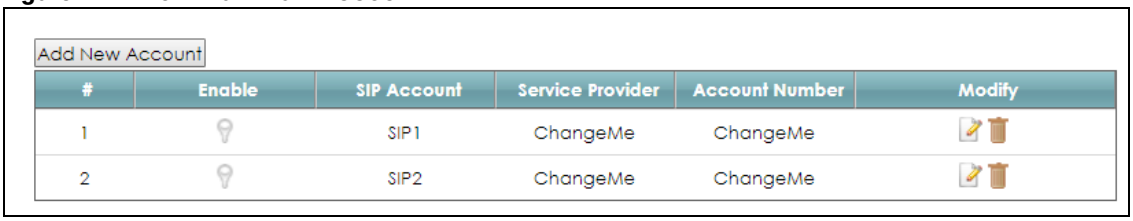
22.3 The SIP Account Screen

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

See Section 21.3.1 on page 219 for how to map a SIP account to a phone port.

Use this screen to view SIP account information. You can also enable and disable each SIP account. To access this screen, click **VoIP > SIP > SIP Account**.

Figure 127 VoIP > SIP > SIP Account



The following table describes the labels in this screen.

Table 96 VoIP > SIP > SIP Account

LABEL	DESCRIPTION
Add New Account	Click this to configure a SIP account.
#	This is the index number of the entry.

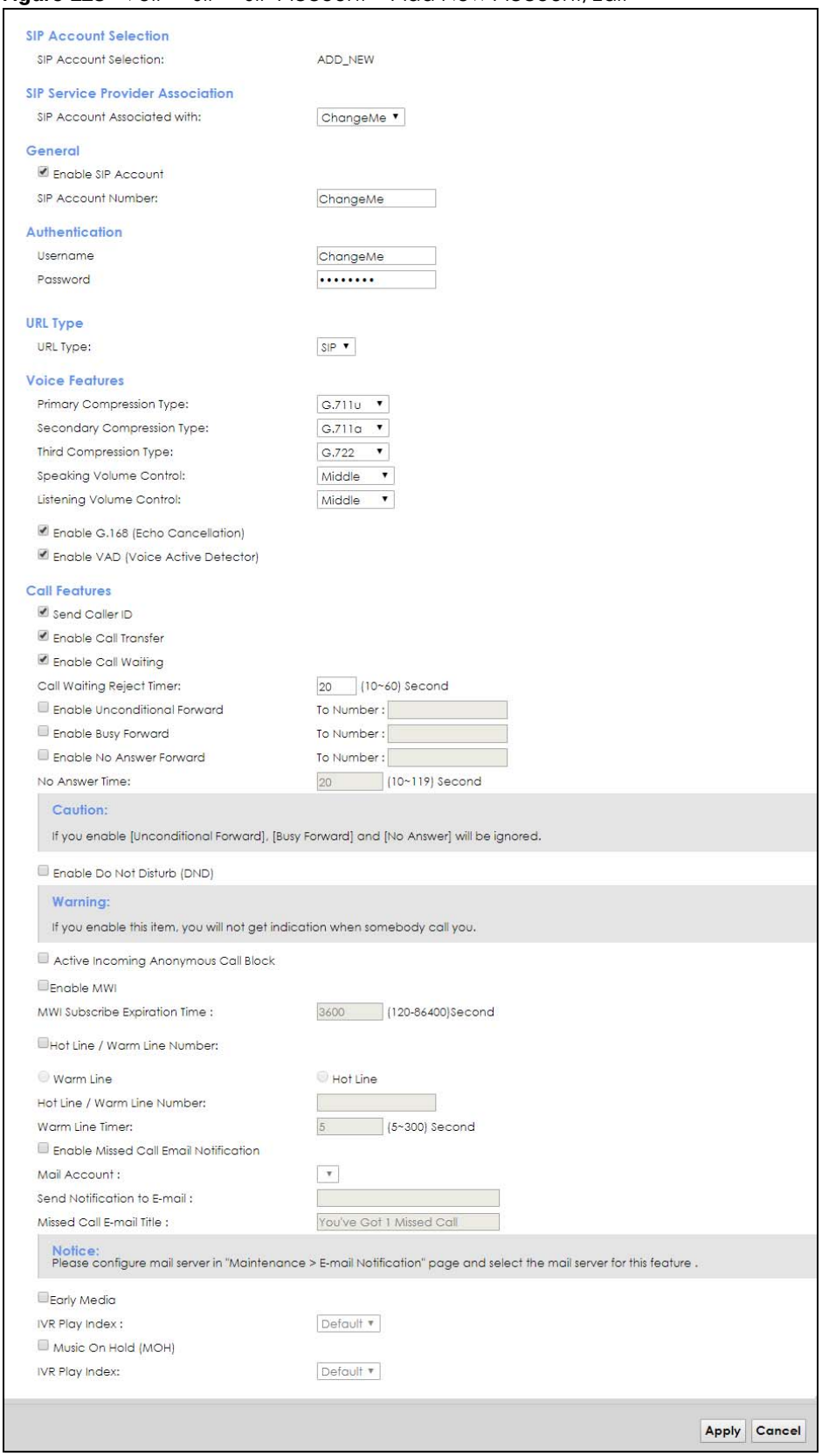
Table 96 VoIP > SIP > SIP Account

LABEL	DESCRIPTION
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 not 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 **Edit** icon to configure the SIP account. Click the **Delete** icon to delete this SIP account from the XMG.

22.3.1 The SIP Account Add/Edit Screen

Use this screen to configure a SIP account and map it to a phone port. 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.

Figure 128 VoIP > SIP > SIP Account > Add New Account/Edit



Each field is described in the following table.

Table 97 VoIP > SIP > SIP Account > Add New Account/Edit

LABEL	DESCRIPTION
SIP Account Selection	
SIP Account Selection	This field displays **ADD_NEW** 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. This field is read-only when you are modifying a SIP account.
General	
Enable SIP Account	Select this if you want the XMG to use this account. Clear it if you do not want the XMG 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 ASCII characters.
Authentication	
Username	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII characters.
Password	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII Extended set characters.
URL Type	
URL Type	Select whether or not to include the SIP service domain name when the XMG sends the SIP number. **SIP** - include the SIP service domain name. **TEL** - do not include the SIP service domain name.
Voice Features	
Primary Compression Type Secondary Compression Type Third Compression Type	Select the type of voice coder/decoder (codec) that you want the XMG to use. G.711 provides high voice quality but requires more bandwidth (64 kbps). G.711 is the default codec used by phone companies and digital handsets. • **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** is a 7 KHz wideband voice codec that operates at 48, 56 and 64 kbps. By using a sample rate of 16 kHz, G.722 can provide higher fidelity and better audio quality than narrowband codecs like G.711, in which the voice signal is sampled at 8 KHz. The XMG must use the same codec as the peer. When two SIP devices start a SIP session, they must agree on a codec. Select the XMG's first choice for voice coder/decoder. Select the XMG's second choice for voice coder/decoder. Select **None** if you only want the XMG to accept the first choice. Select the XMG's third choice for voice coder/decoder. Select **None** if you only want the XMG to accept the first or second choice.
Speaking Volume Control	Select the loudness that the XMG uses for speech that it sends to the peer device. **-12** is the quietest, and **12** is the loudest.
Listening Volume Control	Select the loudness that the XMG uses for speech that it receives from the peer device. **-12** is the quietest, and **12** is the loudest.

Table 97 VoIP > SIP > SIP Account > Add New Account/Edit (continued)

LABEL	DESCRIPTION
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 XMG should stop transmitting when you are not speaking. This reduces the bandwidth the XMG 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 XMG. This allows you to transfer an incoming call (that you have answered) to another phone.
Enable Call Waiting	Select this to enable call waiting on the XMG. This allows you to place a call on hold while you answer another incoming call on the same telephone number.
Call Waiting Reject Timer	Specify a time of seconds that the XMG waits before rejecting the second call if you do not answer it.
Enable Unconditional Forward	Select this if you want the XMG 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 XMG 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 XMG 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 XMG should wait for you to answer an incoming call before it considers the call is unanswered.
Enable Do Not Disturb (DND)	Select this to set your phone to not ring when someone calls you.
Active Incoming Anonymous Call Block	Select this if you do not want the phone to ring when someone tries to call you with caller ID deactivated.
Enable MWI (Message Waiting Indication)	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 for 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 XMG subscribes to the service. Before this time passes, the XMG automatically subscribes again.
Hot Line / Warm Line Number	Select this to enable the hot line or warm line feature on the XMG.
Warm Line	Select this to have the XMG 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	Select this to have the XMG dial the specified hot line number immediately when you pick up the telephone.
Hot Line / Warm Line Number	Enter the number of the hot line or warm line that you want the XMG to dial.

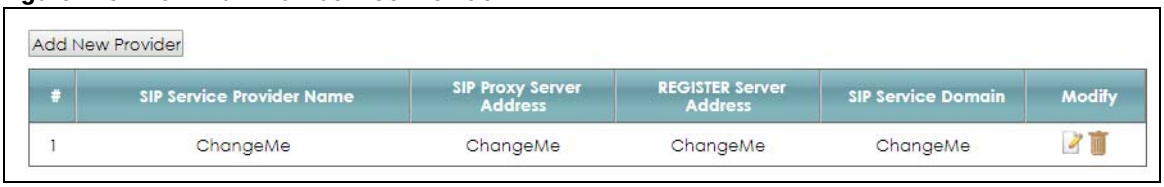
Table 97 VoIP > SIP > SIP Account > Add New Account/Edit (continued)

LABEL	DESCRIPTION
Warm Line Timer	Enter a number of seconds that the XMG 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 E-mail Notification	Select this option to have the XMG e-mail you a notification when there is a missed call.
Mail Account	Select a mail account for the e-mail address specified below. If you select **None** here, e-mail notifications will not be sent via e-mail. You must have configured a mail account already in the **E-mail Notification** screen.
Send Notification to E-mail	Notifications are sent to the e-mail address specified in this field. If this field is left blank, notifications will not be sent via e-mail.
Missed Call E-mail Title	Type a title that you want to be in the subject line of the e-mail notifications that the XMG sends.
Early Media	Select this option 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 22.10 on page 222 for information on how to record these tones.
Music On Hold	Select this option 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 22.10 on page 222 for information on how to record these tones.
Apply	Click this to save your changes and to apply them to the XMG.
Cancel	Click this to set every field in this screen to its last-saved value.

22.4 The SIP Service Provider Screen

Use this screen to view the SIP service provider information on the XMG. Click **VoIP > SIP > SIP Service Provider** to open the following screen.

Figure 129 VoIP > SIP > SIP Service Provider



Each field is described in the following table.

Table 98 VoIP > SIP > SIP Service Provider

LABEL	DESCRIPTION
Add New Provider	Click this to configure a new service provider on the XMG.
#	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.

Table 98 VoIP > SIP > SIP Service Provider (continued)

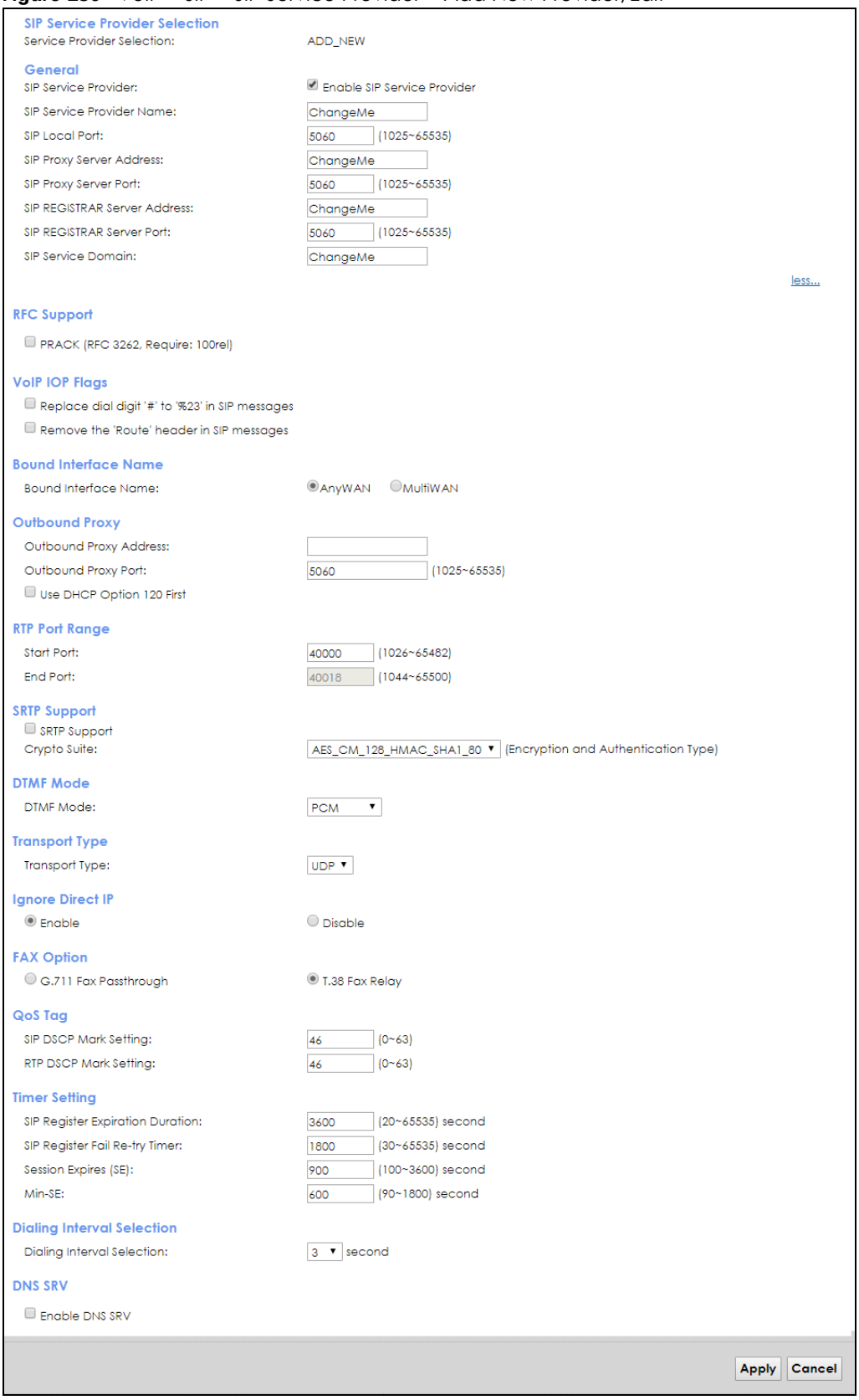
LABEL	DESCRIPTION
REGISTER Server Address	This shows the IP address or domain name of the SIP register server.
SIP Service Domain	This shows the SIP service domain name.
Modify	Click the **Edit** icon to configure the SIP service provider. Click the **Delete** icon to delete this SIP service provider from the XMG.

22.4.1 The SIP Service Provider Add/Edit Screen

Use this screen to configure a SIP service provider on the XMG. Click the **Add New Provider** button or an **Edit** icon in the **VoIP > SIP > SIP Service Provider** to open the following screen.

Note: Click **more** to see all the fields in the screen. You don't necessarily need to use all these fields to set up your account. Click **less** to see and configure only the fields needed for this feature.

Figure 130 VoIP > SIP > SIP Service Provider > Add New Provider/Edit



Each field is described in the following table.

Table 99 VoIP > SIP > SIP Service Provider > Add New Provider/Edit

LABEL	DESCRIPTION
SIP Service Provider Selection	
Service Provider Selection	Select the SIP service provider profile you want to use for the SIP account you configure in this screen. If you change this field, the screen automatically refreshes.
General	
SIP Service Provider	Select this to enable the SIP service provider.
SIP Service Provider Name	Enter the name of your SIP service provider.
SIP Local Port	Enter the XMG'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 ASCII characters. 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 ASCII characters.
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 ASCII Extended set characters.
RFC Support	
PRACK (RFC 3262, Require: 100rel)	PRACK (RFC 3262) defines a mechanism to provide reliable transmission of SIP provisional response messages, which convey information on the processing progress of the request. This uses the option tag 100rel and the Provisional Response ACKnowledgement (PRACK) method. Select this to have the the peer device require the option tag 100rel to send provisional responses reliably.
VoIP IOP Flags	Select the VoIP inter-operability settings you want to activate.
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 **Any_WAN**, the XMG automatically activates the VoIP service when any WAN connection is up. If you select **MultiWAN**, you also need to select two or more pre-configured WAN interfaces. 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 XMG 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 XMG 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.

Table 99 VoIP > SIP > SIP Service Provider > Add New Provider/Edit (continued)

LABEL	DESCRIPTION
Use DHCP Option 120 First	Select this to enable the SIP server via DHCP option 120.
RTP Port Range	
Start Port End Port	Enter the listening port number(s) 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 XMG 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 XMG 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	
DTMF Mode	Control how the XMG 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 transport layer protocol **UDP** or **TCP** (usually UDP) used for SIP.
Ignore Direct IP	Select **Enable** to have the connected CPE 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 XMG handles fax messages.
G711 Fax Passthrough	Select this if the XMG 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 XMG 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	

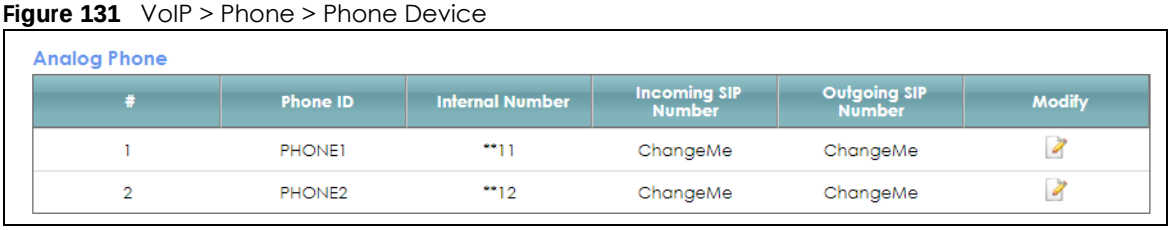
Table 99 VoIP > SIP > SIP Service Provider > Add New Provider/Edit (continued)

LABEL	DESCRIPTION
SIP DSCP Mark Setting	Enter the DSCP (DiffServ Code Point) number for SIP message transmissions. The XMG 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 XMG 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 XMG 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 Fail Re-try timer	Enter the number of seconds the XMG 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 XMG lets a SIP session remain idle (without traffic) before it automatically disconnects the session.
Min-SE	Enter the minimum number of seconds the XMG 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 XMG accepts.
Dialing Interval Selection	
Dialing Interval Selection	Enter the number of seconds the XMG should wait after you stop dialing numbers before it makes the phone call. The value depends on how quickly you dial phone numbers.
DNS SRV	
Enable DNS SRV	Select this to have the XMG use DNS procedures to resolve the SIP domain and find the SIP server's IP address, port number and supported transport protocol(s). The XMG first uses DNS Name Authority Pointer (NAPTR) records to determine the transport protocols supported by the SIP server. It then performs DNS Service (SRV) query to determine the port number for the protocol. The XMG resolves the SIP server's IP address by a standard DNS address record lookup. The **SIP Server Port** and **REGISTER Server Port** fields in the **General** section above are grayed out and not applicable and the **Transport Type** can also be set to **AUTO** if you enable this option.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

22.5 The Phone Device Screen

Use this screen to view detailed information of the XMG's phone ports. To access this screen, click **VoIP > Phone > Phone Device**.

Figure 131 VoIP > Phone > Phone Device



Each field is described in the following table.

Table 100 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 XMG.
Internal Number	This field displays the internal call prefix of a phone port on the XMG.
Incoming SIP Number	This field displays the SIP number that you use to receive calls on this phone port.
Outgoing SIP Number	This field displays the SIP number that you use to make calls on this phone port.
Modify	Click the **Edit** icon to configure the SIP account.

22.5.1 The Phone Device Edit Screen

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

Figure 132 VoIP > Phone > Phone Device > Edit

Each field is described in the following table.

Table 101 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 Incomming 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.

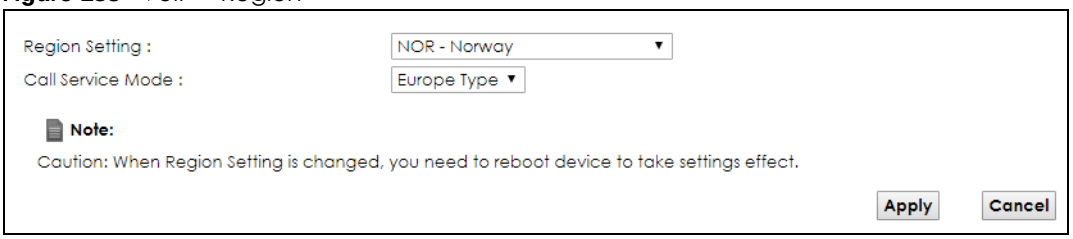
Table 101 VoIP > Phone > Phone Device > Edit

LABEL	DESCRIPTION
Immediate Dial Enable	Select this if you want to use the pound key (#) to tell the XMG to make the phone call immediately, instead of waiting the number of seconds you selected in the **Dialing Interval Selection** field of the **VoIP > SIP > SIP Service Provider > Add New Provider/Edit** screen. If you select this, dial the phone number, and then press the pound key. The XMG makes the call immediately, instead of waiting. You can still wait, if you want.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

22.6 The Region Screen

Use this screen to maintain settings that depend on which region of the world the XMG is in. To access this screen, click **VoIP > Region**.

Figure 133 VoIP > Region



Each field is described in the following table.

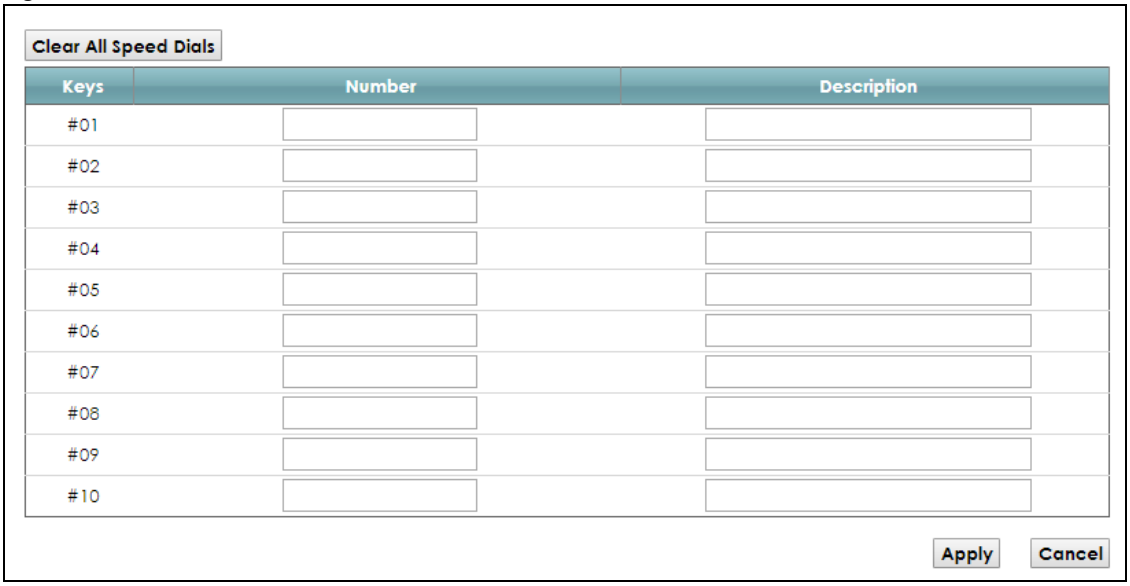
Table 102 VoIP > Region

LABEL	DESCRIPTION
Region Settings	Select the place in which the XMG 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 XMG.
Cancel	Click this to set every field in this screen to its last-saved value.

22.7 The Call Rule Screen

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.

Figure 134 VoIP > Call Rule



Each field is described in the following table.

Table 103 VoIP > Call Rule

LABEL	DESCRIPTION
Clear All Speed Dials	Click this to erase all the speed-dial entries on this screen.
Keys	This field displays the speed-dial number you should dial to use this entry.
Number	Enter the SIP number you want the XMG to call when you dial the speed-dial number.
Description	Enter a name to identify the party you call when you dial the speed-dial number. You can use up to 127 printable ASCII characters.
Apply	Click this to save your changes and to apply them to the XMG.
Cancel	Click this to set every field in this screen to its last-saved value.

22.8 The Call History Screen

Use this screen to see detailed information for each outgoing call made. Click **VoIP > Call History** to open the following screen.

Figure 135 VoIP > Call History

The following table describes the labels in this screen.

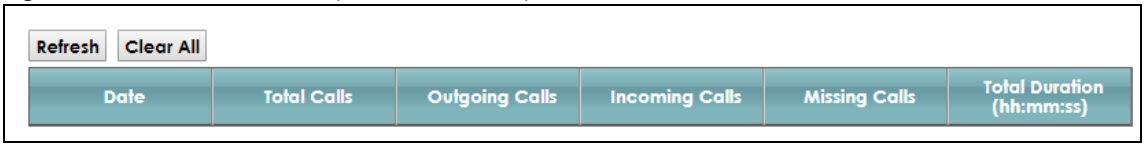
Table 104 VoIP > Call History

LABEL	DESCRIPTION
Classify	Select the type of calls you want to view in the dialed called list.
Clear List	Click this button to remove all entries from the dialed called list.
Refresh	Click this button to renew the dialed called list.
Type	This displays the type of call it is: **Incoming, Outgoing,** or **Missed.**
Date	This is the date when the call was made.
Name	
Number	This displays the phone number from which the call was made.
Phone Device	
Outgoing Number	This displays the phone number to which the call was made.
Duration (hh:mm:ss)	This displays how long the call lasted.
Modify	Click the **Export** button to extract a document containing the dialed called list.

22.9 The Call Summary Screen

The XMG logs calls from or to your SIP numbers. This screen allows you to view the summary of received, dialed and missed calls. Click **VoIP > Call History > Call Summary** to open the following screen.

Figure 136 VoIP > Call History > Call Summary



The following table describes the labels in this screen.

Table 105 VoIP > Call History > Call Summary

LABEL	DESCRIPTION
Refresh	Click this button to renew the call history list.
Clear All	Click this button to remove all entries from the call history list.
Date	This is the date when the calls were made.
Total Calls	This displays the total number of calls from or to your SIP numbers 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,

22.10 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 e-mail address identifies an e-mail 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 e-mail 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 XMG 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 XMG). 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 XMG attempts to register all enabled subscriber ports when it is switched on. When you enable a subscriber port that was previously disabled, the XMG 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 via a challenge / response system using the HTTP digest mechanism (as detailed in RFC 3261, "SIP: Session Initiation Protocol").

SIP Servers

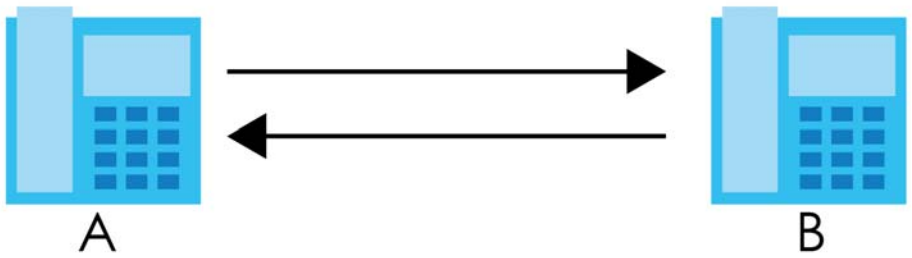
SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

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 user agent to receive the call.

Figure 137 SIP User Agent



SIP Proxy Server

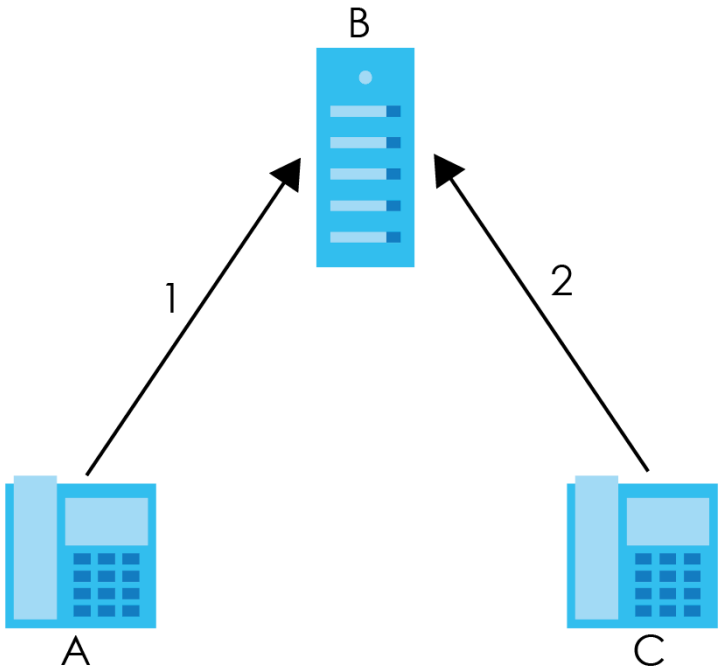
A SIP proxy server receives requests from clients and forwards them to another server.

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 138 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.

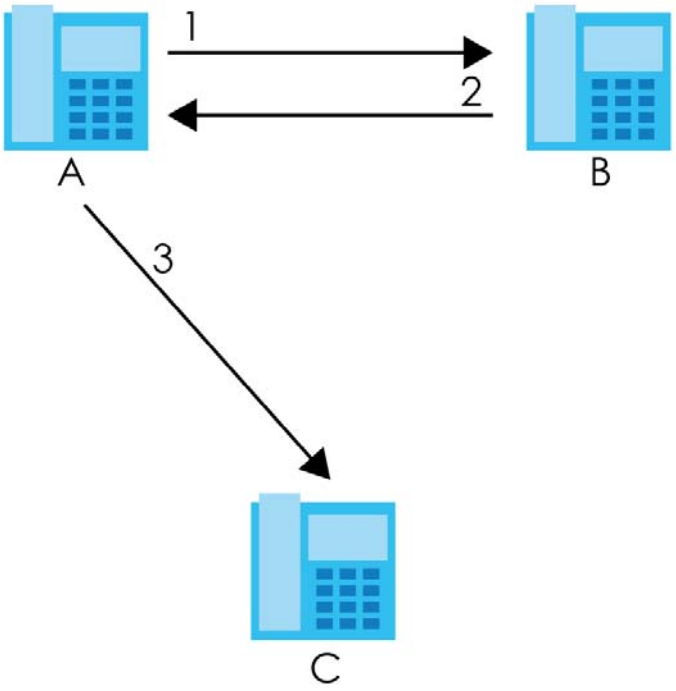
In the following example, you want to use client device **A** to call someone who is using client device **C**.

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 139 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 106 SIP Call Progression

A		B
1. INVITE	→	
	←	2. Ringing
	←	3. OK
4. ACK	→	

Table 106 SIP Call Progression (continued)

A		B
	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.

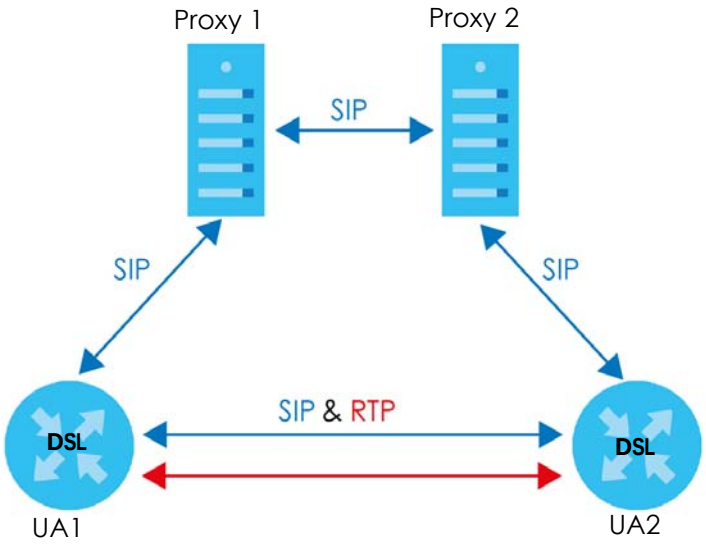
SIP Call Progression Through Proxy Servers

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.

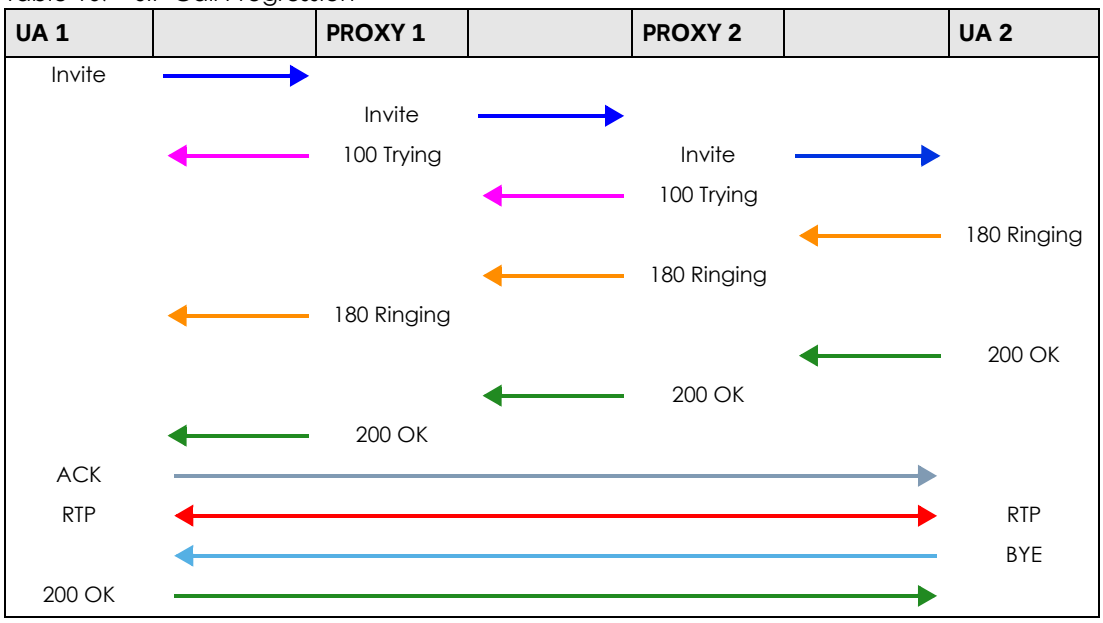
The following figure shows the SIP and session traffic flow between the user agents (**UA 1** and **UA 2**) and the proxy servers (this example shows two proxy servers, **PROXY 1** and **PROXY 2**).

Figure 140 SIP Call Through Proxy Servers



The following table shows the SIP call progression.

Table 107 SIP Call Progression



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** via **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** via **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 XMG 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 XMG reduce the bandwidth that a call uses by not transmitting "silent packets" when you are not speaking.

Comfort Noise Generation

When using VAD, the XMG 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 XMG. The XMG 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 108 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.

22.10.1 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 XMG) 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 141 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.

22.10.2 Phone Services Overview

Supplementary services such as call hold, call waiting, and call transfer. are generally available from your VoIP service provider. The XMG 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 XMG does not support DiffServ at the time of writing.

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

22.10.2.1 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 XMG.

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

22.10.2.2 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 109 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".

22.10.2.3 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 110 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.

22.10.2.4 Phone Functions Summary

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

Table 111 Phone Functions Summary

ACTION	FUNCTION	DESCRIPTION
*98#	Call transfer	Transfer a call to another phone. See Section 22.10.2.2 on page 232 (Europe type) and Section 22.10.2.3 on page 233 (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 XMG.
*82	One Shot Caller Display Call	Activate or deactivate caller ID for the next call only.
*67	One Shot Caller Hidden Call	

CHAPTER 23
Log

23.1 Overview

The web configurator allows you to choose which categories of events and/or alerts to have the XMG log and then display the logs or have the XMG send them to an administrator (as e-mail) or to a syslog server.

23.1.1 What You Can Do in this Chapter

- Use the **System Log** screen to see the system logs (Section 23.2 on page 237).
- Use the **Security Log** screen to see the security-related logs for the categories that you select (Section 23.3 on page 237).

23.1.2 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.

Syslog Overview

The syslog protocol allows devices to send event notification messages across an IP network to syslog servers that collect the event messages. A syslog-enabled device can generate a syslog message and send it to a syslog server.

Syslog is defined in RFC 3164. The RFC defines the packet format, content and system log related information of syslog messages. Each syslog message has a facility and severity level. The syslog facility identifies a file in the syslog server. Refer to the documentation of your syslog program for details. The following table describes the syslog severity levels.

Table 112 Syslog Severity Levels

CODE	SEVERITY
0	Emergency: The system is unusable.
1	Alert: Action must be taken immediately.
2	Critical: The system condition is critical.
3	Error: There is an error condition on the system.
4	Warning: There is a warning condition on the system.

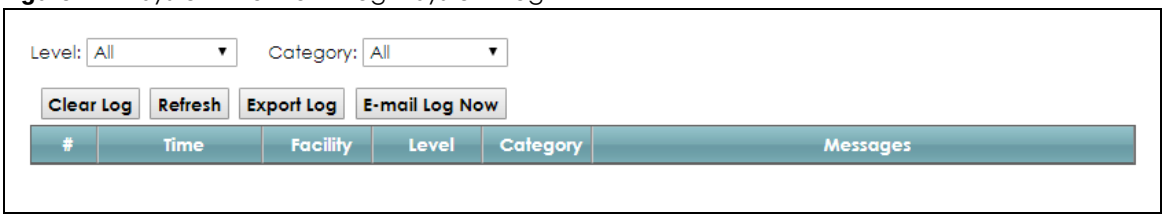
Table 112 Syslog Severity Levels

CODE	SEVERITY
5	Notice: There is a normal but significant condition on the system.
6	Informational: The syslog contains an informational message.
7	Debug: The message is intended for debug-level purposes.

23.2 The System Log Screen

Use the **System Log** screen to see the system logs. Click **System Monitor > Log** to open the **System Log** screen.

Figure 142 System Monitor > Log > System Log



The following table describes the fields in this screen.

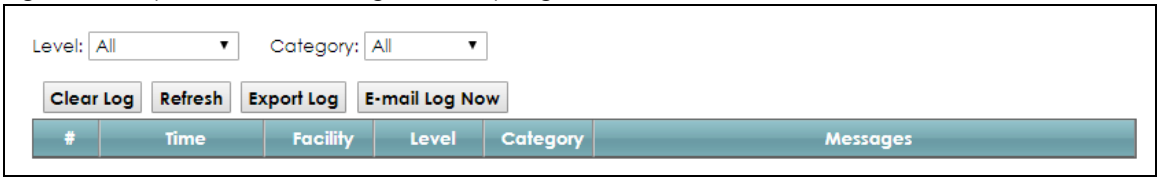
Table 113 System Monitor > Log > System Log

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 XMG 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 log(s).
Email Log Now	Click this to send the log file(s) to the E-mail address you specify in the **Maintenance > Logs 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 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.

23.3 The Security Log Screen

Use the **Security Log** screen to see the security-related logs for the categories that you select. Click **System Monitor > Log > Security Log** to open the following screen.

Figure 143 System Monitor > Log > Security Log



The following table describes the fields in this screen.

Table 114 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 XMG 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 log(s).
E-mail Log Now	Click this to send the log file(s) to the E-mail address you specify in the **Maintenance > Logs 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 device is to send to this syslog server.
Category	This field displays the type of the log.
Messages	This field states the reason for the log.

CHAPTER 24
Traffic Status

24.1 Overview

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

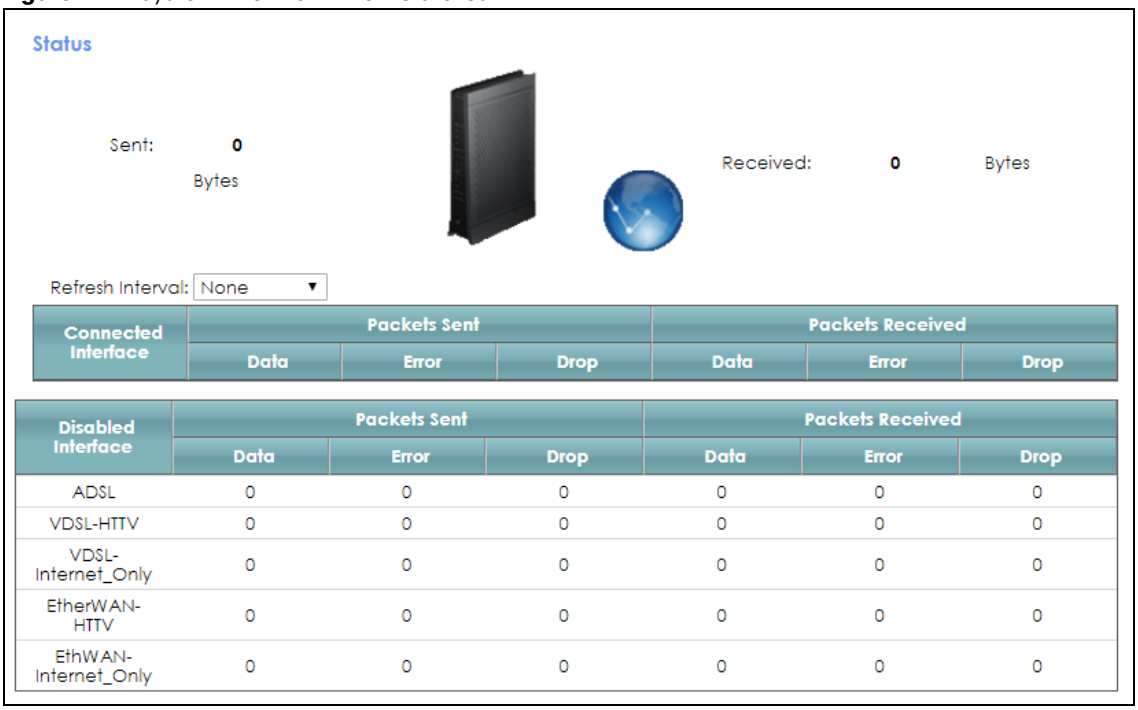
24.1.1 What You Can Do in this Chapter

- Use the **WAN** screen to view the WAN traffic statistics (Section 24.2 on page 239).
- Use the **LAN** screen to view the LAN traffic statistics (Section 24.3 on page 240).
- Use the **NAT** screen to view the NAT status of the XMG's client(s) (Section 24.4 on page 241)

24.2 The WAN Status Screen

Click **System Monitor > Traffic Status** to open the **WAN** screen. The figure in this screen shows the number of bytes received and sent on the XMG.

Figure 144 System Monitor > Traffic Status > WAN



The following table describes the fields in this screen.

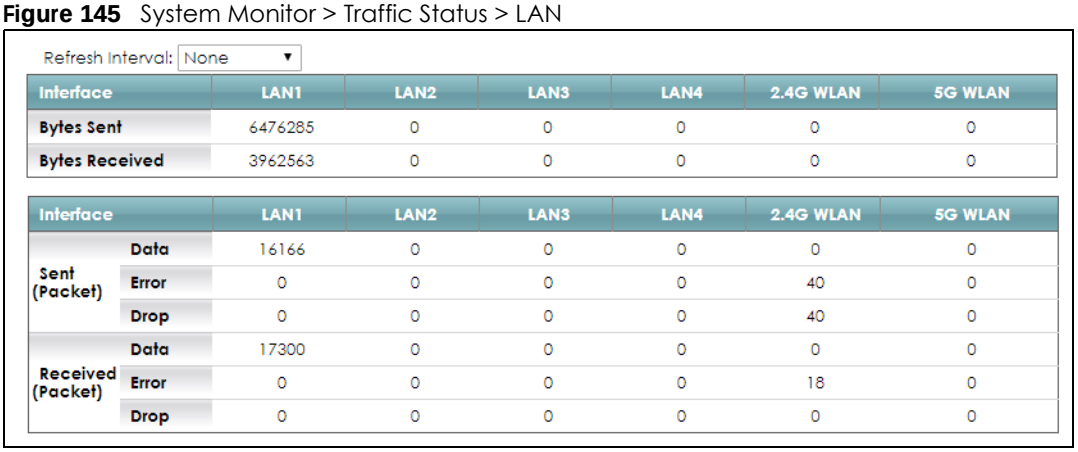
Table 115 System Monitor > Traffic Status > WAN

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the XMG to update this screen.
Connected Interface	This shows the name of the WAN interface that is currently connected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.
	Click **more...** to show more information. Click **hide more** to hide them.
Disabled Interface	This shows the name of the WAN interface that is currently disconnected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

24.3 The LAN Status Screen

Click **System Monitor > Traffic Status > LAN** to open the following screen. The figure in this screen shows the interface that is currently connected on the XMG.

Figure 145 System Monitor > Traffic Status > LAN



The following table describes the fields in this screen.

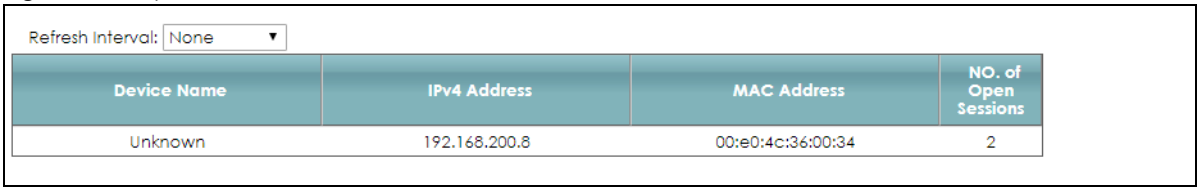
Table 116 System Monitor > Traffic Status > LAN

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

24.4 The NAT Status Screen

Click **System Monitor > Traffic Status > NAT** to open the following screen. The figure in this screen shows the NAT session statistics for hosts currently connected on the XMG.

Figure 146 System Monitor > Traffic Status > NAT



The following table describes the fields in this screen.

Table 117 System Monitor > Traffic Status > NAT

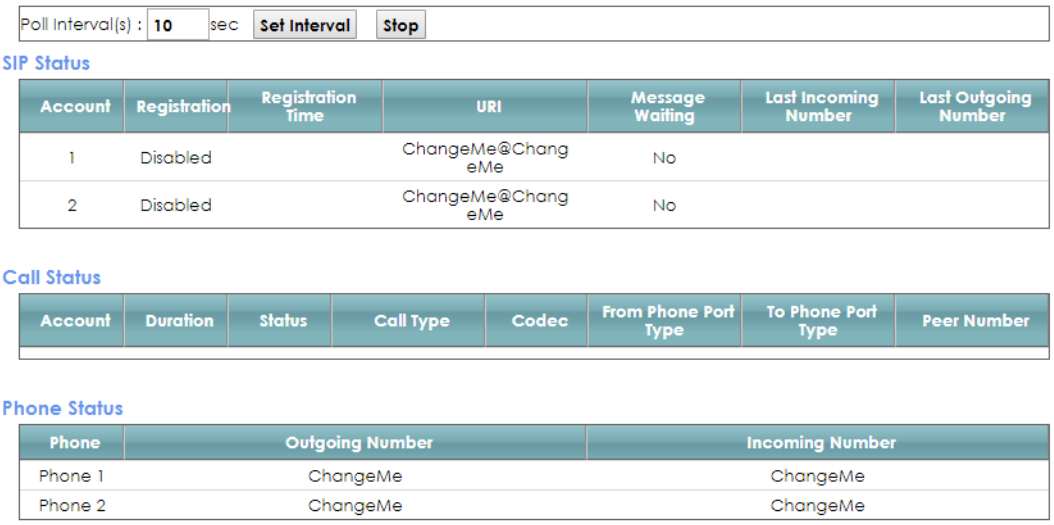
LABEL	DESCRIPTION
Refresh Interval	Select how often you want the XMG to update this screen.
Device Name	This displays the name of the connected host.
IPv4 Address	This displays the IPv4 address of the connected host.
MAC Address	This displays the MAC address of the connected host.
No. of Open Session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

CHAPTER 25
VoIP Status

25.1 The VoIP Status Screen

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

Figure 147 System Monitor > VoIP Status



The following table describes the labels in this screen.

Table 118 System Monitor > VoIP Status

LABEL	DESCRIPTION
Poll Interval(s)	Enter the number of seconds the XMG needs to wait before updating this screen and then click **Set Interval**. Click **Stop** to have the XMG stop updating this screen.
SIP Status	
Account	This column displays the index of each SIP account that has already configured in the XMG.

Table 118 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
Registration	This field displays the current registration status of the SIP account.**Registered** - The SIP account is activated and has registered with a SIP server. **Unregistered** - The XMG is activated and triesto register the SIP account with the SIP server, the attempt fails. A registration auto-recovery mechanism should be activated so that the XMG will automatically try to register the SIP account again after a period of time, and you can activate it in **VoIP > SIP > SIP Service Provider > Edit > SIP Register Fail Re-Try Timer**. The XMG will recover to **Registered** state until the **Register** button in the **Connection Status > Status** page is pressed. **Disabled** - The SIP account is not active. You have to make sure the corresponding SIP Service Provider and SIP Account are both enabled for proper activation. You can activate them in **VoIP > SIP > SIP Service Provider > Edit > Enable SIP Service Provider** and **VoIP > SIP > SIP Account > Edit > Enable SIP Account**.
Registration Time	This field displays the last time the XMG successfully registered the SIP account on the SIP server. The field is blank if the SIP has not yet successfully registered this account.
URI	This field displays the account number and service domain of the SIP account, which is used to identify the SIP account on the SIP server. You can change these in the **VoIP > SIP > SIP Service Provider > Edit > SIP Service Domain** and **VoIP > SIP > SIP Account > Edit > SIP Account Number**.
Message Waiting	This field indicates whether or not (Yes or No is displayed here, respectively) there are any new voice messages leaving on the SIP server and waiting to be read. You have to enable the MWI function in the **VoIP >SIP > SIP Account > Edit > Enable MWI**, and the SIP server should also support the voice mailbox function.
Last Incoming Number	Regardless of the status of the incoming call to this local SIP account, this field will display the SIP account number of the remote peer at the last incoming VoIP call.
Last Outgoing Number	Regardless of the status of the outgoing call, this field will display the last phone number you dialed to make an outgoing VoIP call via this SIP account, Note: The dialed number is recorded in this field only during the outgoing (SIP-based) call setup signaling procedure. If you dial numbers and on-hook quickly as well as making the outgoing call before the outgoing (SIP-based) call signaling procedure starts, the numbers you dial here will not be recorded.
Call Status (This table displays the status of all active and ongoing calls. If there are no active or ongoing calls, this table will be blank.)	
Account	For the current VoIP call categorized as **Outgoing Call** or **Incoming Call** in the **Call Type** field, this field displays the SIP account number used in the current VoIP call. For the current VoIP call categorized as **Internal Call**, this field displays the local internal phone number of the call-originating phone port.
Duration	This field displays how long the current VoIP call has lasted. Note: The time calculation starts from the beginning of the call setup signaling procedure, rather than the moment when the call is successfully established.

Table 118 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
Status	This field displays the current call progress or call process state of the VoIP phone call. **Calling** - This state is only associated with the call categorized as **Outgoing Call** or **Internal Call** in the **Call Type** field. For the **Outgoing Call**, it means the SIP account has issued a (SIP-based) call setup signal to the SIP server, tries to make an outgoing VoIP call to the SIP account of remote peers. As for the **Internal Call**, it means the call-originating local phone port has issued a (Internal and Non-SIP) call setup signal to other target local phone ports, and the phones attached to the target local phone ports will be ringing. **Ringing** - The state is only associated with the call categorized as **Incoming Call** in the **Call Type** field. This state indicates that there is an incoming VoIP call setup signaling coming to the SIP account, and the phone ports configured to receive the incoming call from the SIP account will be ringing. **InCall** - Whichever type is in the **Call Type** field, this state will indicate that the call setup signaling procedure has finished, and thus the call has been successfully established. The users of both peers can begin to converse on the phone. **OnHold** - This state is only associated with the call categorized as **Outgoing Call** or **Incoming Call** in the **Call Type** field. This state indicates that the current call is connecting to the SIP account, and the remote peer is in the OnHold state. This situation happens under the following two scenarios: (a) the remote peer put the call on hold, or (b) the local user put the call on hold.
Call Type	This field displays the call direction type of the current VoIP call. **Outgoing Call** - It's a SIP VoIP call made by local phone ports, and this SIP account is able to issue a (SIP-based) call setup to the SIP account of remote peers for a VoIP call establishment. This (SIP-based) call setup signal is sent to the SIP server first, and then the SIP server would relay it to the target peer after correctly resolving and locating the target peer. During the call setup (signaling) phase, **Calling** state is displayed in the **Status** field, and it turns to **InCall** state once the call is successfully established. **Incoming Call** - It's a SIP VoIP call made or originated by remote SIP accounts to connect to this local SIP account. One or more local phone ports can be configured to receive this type of call, see the **Incoming Number** below, and all of them should begin to ring during the call setup (signaling phase), see the **Status** above. Once some remote SIP accounts start to ring one local phone, answer by off-hook to the call, and the call is successfully established. The other ringing local phone ports will stop ringing and turning to **InCall** state in the **Status** field. **Internal Call** - It's a local VoIP call between two different local phone ports. No SIP signaling is needed and thus no SIP server is involved to establish this type of call. This type of call is established via the Internal and Non-SIP local setup signaling procedure between the call-originating and call-terminating local phone ports. In general, one or more local phone ports can be designed to receive this type of call, and once any of the ringing phones answer the call, the other ringing ones will stop ringing. During the call setup phase (signaling phase), **Calling** state is displayed in **Status** field, and turns to **InCall** state once the call is successfully established.
Codec	This field displays what voice codec is being used for a current VoIP call through a phone port. Note: Before the call is established, meaning when it's **Calling** or **Ringing** state in **Status**, the state of this codec field will be **Unknown**, since the codec hasn't been determined during the call setup (signaling) phase.
From Phone Port Type	This field displays the phone ports type used to originate, start, or create the current VoIP call. Two possible type values will be displayed here: **SIP** - For the current call which is categorized as **Incoming Call** in the **Call Type** filed, this field will show the type **SIP**. **FXS** - As for the other cases: **Outgoing Call** and **Internal Call**, this field will show the corresponding local phone port type: **FXS**, the legacy analog phone port on the device.

Table 118 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
To Phone Port Type	This field displays the phone ports type used to receive the current VoIP call. Three possible type values will be displayed here: **SIP** - For the current call which is categorized as **Outgoing Call** in the **Call Type** field, this field will show the type **SIP**. **FXS** and **Unknown** - As for the other cases: **Incoming Call** and **Internal Call**, this field will show the corresponding local phone port type: **FXS**, the legacy analog phone port on the device. While the call is established, this field shows **Unknown** during the call setup phase (signaling phase). This is because one or more local phone ports can be configured or designed to receive these two types of calls, see the **Call Type** above, and the local phone port will answer the call that hasn't been determined yet at that time.
Peer Number	This field displays the phone Number for the **Outgoing Call** and **Internal Call** cases or the SIP account number for the **Incoming Call** case of the remote party that's engaged in the current VoIP call.
Phone Status (This table displays the name and the SIP account binding relationship of different local phone ports. The SIP account binding relationship can be configured in **VoIP > Phone > Phone Device**.)	
Phone	This field displays the name of each local phone port on the XMG.
Outgoing Number	This field displays the single SIP account number that you use to make outgoing calls on this phone port.
Incoming Number	This field displays the SIP account number that you use to receive incoming calls on this phone port.

CHAPTER 26
ARP Table

26.1 Overview

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

An IP (version 4) address is 32 bits long. In an Ethernet LAN, MAC addresses are 48 bits long. The ARP Table maintains an association between each MAC address and its corresponding IP address.

26.1.1 How ARP Works

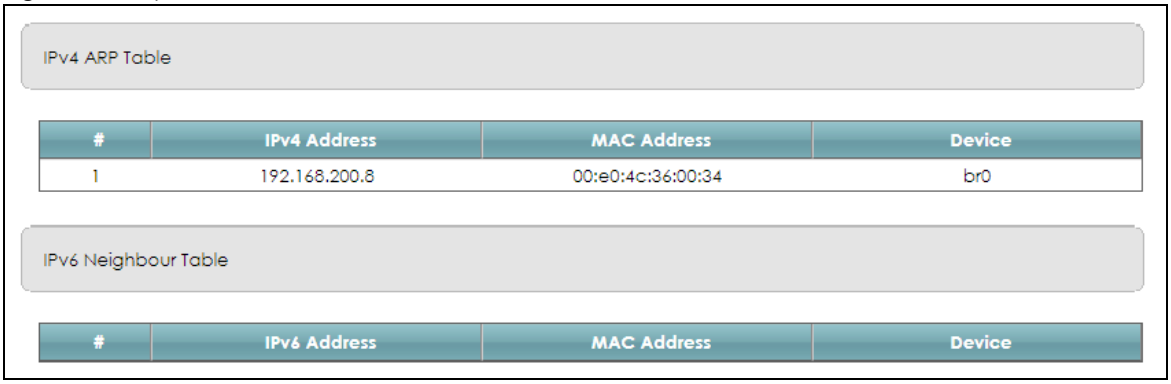
When an incoming packet destined for a host device on a local area network arrives at the device, the device's ARP program looks in the ARP Table and, if it finds the address, sends it to the device.

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

26.2 ARP Table Screen

Use the ARP table to view IP-to-MAC address mapping(s). To open this screen, click **System Monitor** > **ARP Table**.

Figure 148 System Monitor > ARP Table



The following table describes the labels in this screen.

Table 119 System Monitor > ARP Table

LABEL	DESCRIPTION
#	This is the ARP table entry number.
IPv4/IPv6 Address	This is the learned IPv4 or IPv6 address of a device connected to a port.
MAC Address	This is the MAC address of the device with the listed IP address.
Device	This is the type of interface used by the device.

CHAPTER 27
Routing Table

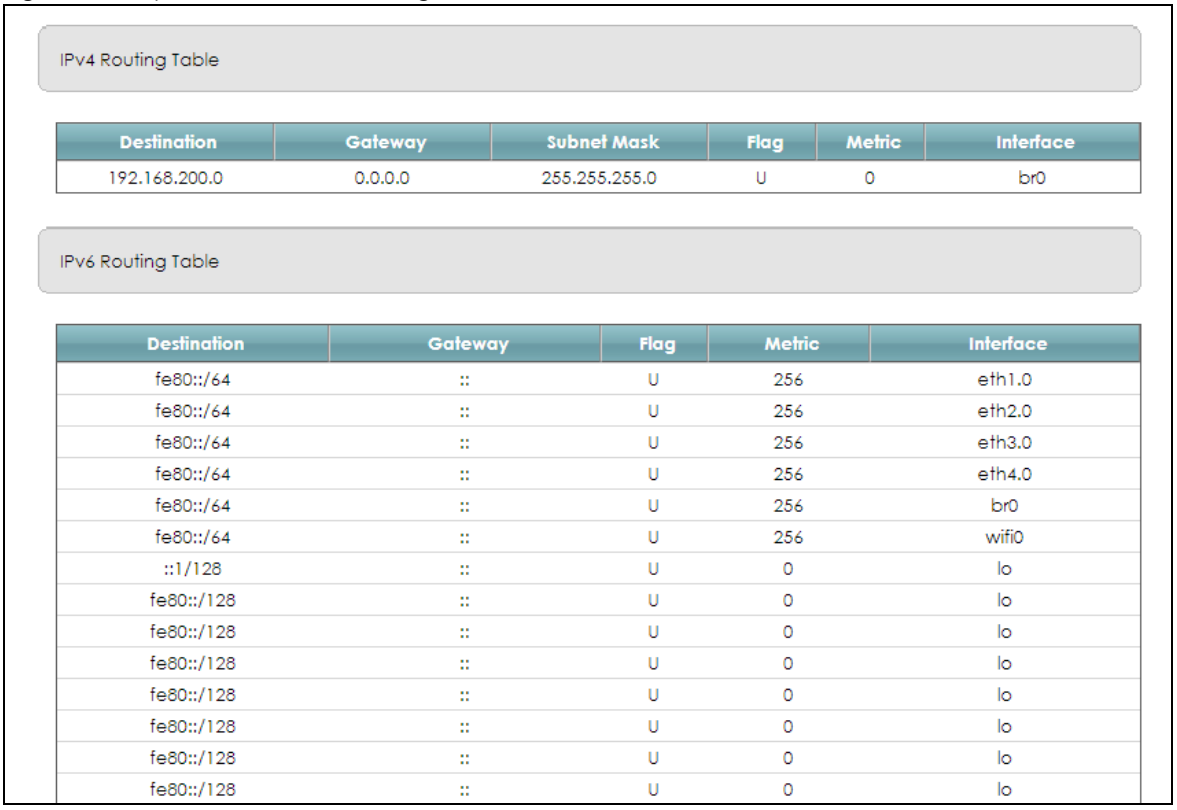
27.1 Overview

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

27.2 The Routing Table Screen

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

Figure 149 System Monitor > Routing Table



The following table describes the labels in this screen.

Table 120 System Monitor > Routing Table

LABEL	DESCRIPTION
IPv4/IPv6 Routing Table	
Destination	This indicates the destination IPv4 address or IPv6 address and prefix of this route.

Table 120 System Monitor > Routing Table (continued)

LABEL	DESCRIPTION
Gateway	This indicates the IPv4 address or IPv6 address of the gateway that helps forward this route's traffic.
Subnet Mask	This indicates the destination subnet mask of the IPv4 route.
Flag	This indicates the route status. **U-Up:** The route is up. **!-Reject:** The route is blocked and will force a route lookup to fail. **G-Gateway:** The route uses a gateway to forward traffic. **H-Host:** The target of the route is a host. **R-Reinstate:** The route is reinstated for dynamic routing. **D-Dynamic (redirect):** The route is dynamically installed by a routing daemon or redirect. **M-Modified (redirect):** The route is modified from a routing daemon or redirect.
Metric	The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". The smaller the number, the lower the "cost".
Interface	This indicates the name of the interface through which the route is forwarded. **brx** indicates a LAN interface where x can be 0~3 to represent LAN1 to LAN4 respectively. **ptm0** indicates a DSL WAN interface using IPoE, IPoA or in bridge mode. **ethx** indicates an Ethernet WAN interface using IPoE or in bridge mode. **ppp0** indicates a WAN interface using PPPoE or PPPoA.

CHAPTER 28
Multicast Status

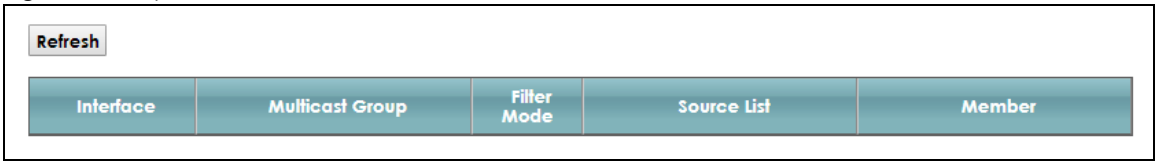
28.1 Overview

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

28.2 The IGMP Status Screen

Use this screen to look at the current list of multicast groups the XMG has joined and which ports have joined it. To open this screen, click **System Monitor > Multicast Status > IGMP Status**.

Figure 150 System Monitor > Multicast Status > IGMP Status



The following table describes the labels in this screen.

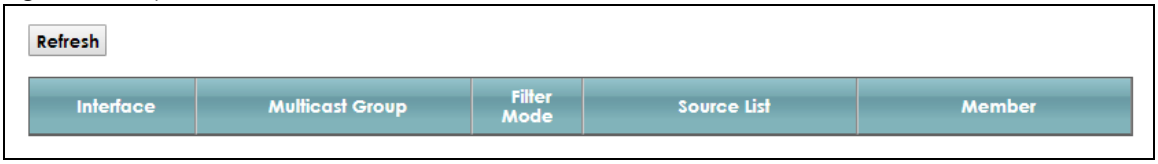
Table 121 System Monitor > Multicast Status > IGMP Status

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

28.3 The MLD Status Screen

Use this screen to look at the current list of multicast groups the XMG has joined and which ports have joined it. To open this screen, click **System Monitor > Multicast Status > MLD Status**.

Figure 151 System Monitor > Multicast Status > MLD Status



The following table describes the labels in this screen.

Table 122 System Monitor > Multicast Status > MLD Status

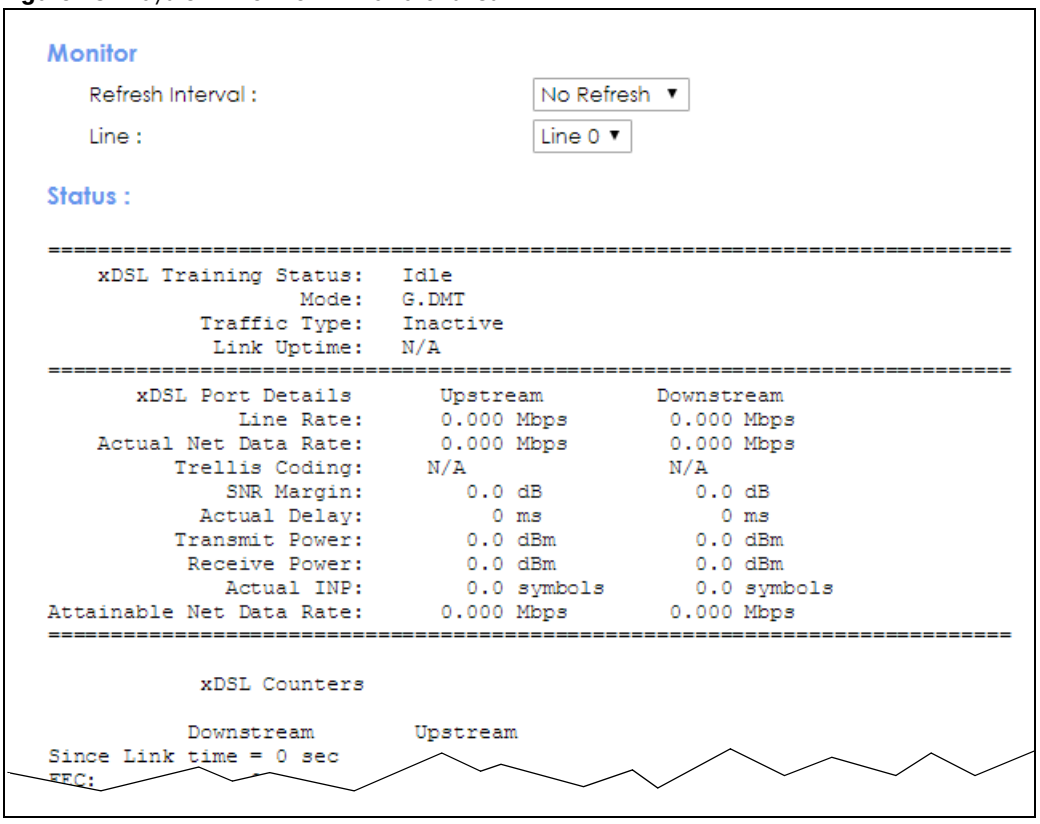
LABEL	DESCRIPTION
Refresh	Click this button to update the status on this screen.
Interface	This field displays the name of an interface on the XMG that belongs to an MLD multicast group.
Multicast Group	This field displays the name of the MLD multicast group to which the interface belongs.
Filter Mode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

CHAPTER 29
xDSL Statistics

29.1 The xDSL Statistics Screen

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

Figure 152 System Monitor > xDSL Statistics



The following table describes the labels in this screen.

Table 123 Status > xDSL Statistics

LABEL	DESCRIPTION
Refresh Interval	Select the time interval for refreshing statistics.
Line	Select which DSL line's statistics you want to display.
xDSL Training Status	This displays the current state of setting up the DSL connection.
Mode	This displays the ITU standard used for this connection.
Traffic Type	This displays the type of traffic the DSL port is sending and receiving. **Inactive** displays if the DSL port is not currently sending or receiving traffic.

Table 123 Status > xDSL Statistics (continued)

LABEL	DESCRIPTION
Link Uptime	This displays how long the port has been running (or connected) since the last time it was started.
xDSL Port Details	
Upstream	These are the statistics for the traffic direction going out from the port to the service provider.
Downstream	These are the statistics for the traffic direction coming into the port from the service provider.
Line Rate	These are the data transfer rates at which the port is sending and receiving data.
Actual Net Data Rate	These are the rates at which the port is sending and receiving the payload data without transport layer protocol headers and traffic.
Trellis Coding	This displays whether or not the port is using Trellis coding for traffic it is sending and receiving. Trellis coding helps to reduce the noise in ADSL transmissions. Trellis may reduce throughput but it makes the connection more stable.
SNR Margin	This is the upstream and downstream Signal-to-Noise Ratio margin (in dB). A DMT sub-carrier's SNR is the ratio between the received signal power and the received noise power. The signal-to-noise ratio margin is the maximum that the received noise power could increase with the system still being able to meet its transmission targets.
Actual Delay	This is the upstream and downstream interleave delay. It is the wait (in milliseconds) that determines the size of a single block of data to be interleaved (assembled) and then transmitted. Interleave delay is used when transmission error correction (Reed- Solomon) is necessary due to a less than ideal telephone line. The bigger the delay, the bigger the data block size, allowing better error correction to be performed.
Transmit Power	This is the upstream and downstream far end actual aggregate transmit power (in dBm). Upstream is how much power the port is using to transmit to the service provider. Downstream is how much port the service provider is using to transmit to the port.
Receive Power	Upstream is how much power the service provider is receiving from the port. Downstream is how much power the port is receiving from the service provider.
Actual INP	Sudden spikes in the line's level of external noise (impulse noise) can cause errors and result in lost packets. This could especially impact the quality of multimedia traffic such as voice or video. Impulse noise protection (INP) provides a buffer to allow for correction of errors caused by error correction to deal with this. The number of DMT (Discrete Multi-Tone) symbols shows the level of impulse noise protection for the upstream and downstream traffic. A higher symbol value provides higher error correction capability, but it causes overhead and higher delay which may increase error rates in received multimedia data.
Total Attenuation	This is the upstream and downstream line attenuation, measured in decibels (dB). This attenuation is the difference between the power transmitted at the near-end and the power received at the far-end. Attenuation is affected by the channel characteristics (wire gauge, quality, condition and length of the physical line).
Attainable Net Data Rate	These are the highest theoretically possible transfer rates at which the port could send and receive payload data without transport layer protocol headers and traffic.
xDSL Counters	
Downstream	These are the statistics for the traffic direction coming into the port from the service provider.
Upstream	These are the statistics for the traffic direction going out from the port to the service provider.
FEC	This is the number of Far End Corrected blocks.
CRC	This is the number of Cyclic Redundancy Checks.
ES	This is the number of Errored Seconds meaning the number of seconds containing at least one errored block or at least one defect.
SES	This is the number of Severely Errored Seconds meaning the number of seconds containing 30% or more errored blocks or at least one defect. This is a subset of ES.
UAS	This is the number of UnAvailable Seconds.
LOS	This is the number of Loss Of Signal seconds.

Table 123 Status > xDSL Statistics (continued)

LABEL	DESCRIPTION
LOF	This is the number of Loss Of Frame seconds.
LOM	This is the number of Loss of Margin seconds.

CHAPTER 30
System

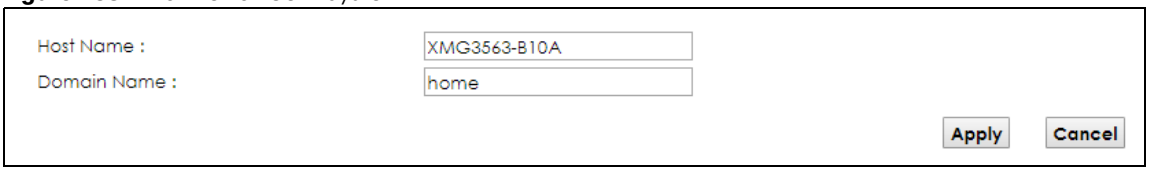
30.1 Overview

In the **System** screen, you can name your XMG (Host) and give it an associated domain name for identification purposes.

30.2 The System Screen

Click **Maintenance > System** to open the following screen.

Figure 153 Maintenance > System



The following table describes the labels in this screen.

Table 124 Maintenance > System

LABEL	DESCRIPTION
Host Name	Type a hostname for your XMG. Enter a descriptive name of up to 16 alphanumeric characters, not including spaces, underscores, and dashes.
Domain Name	Type a Domain name for your host XMG.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to abandon this screen without saving.

CHAPTER 31
User Account

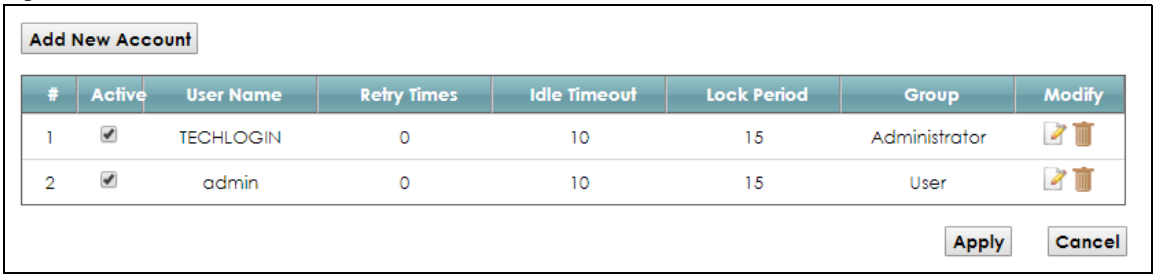
31.1 Overview

In the **User Account** screen, you can view the settings of the "admin" and other user accounts that you used to log in the XMG.

31.2 The User Account Screen

Click **Maintenance > User Account** to open the following screen.

Figure 154 Maintenance > User Account



The following table describes the labels in this screen.

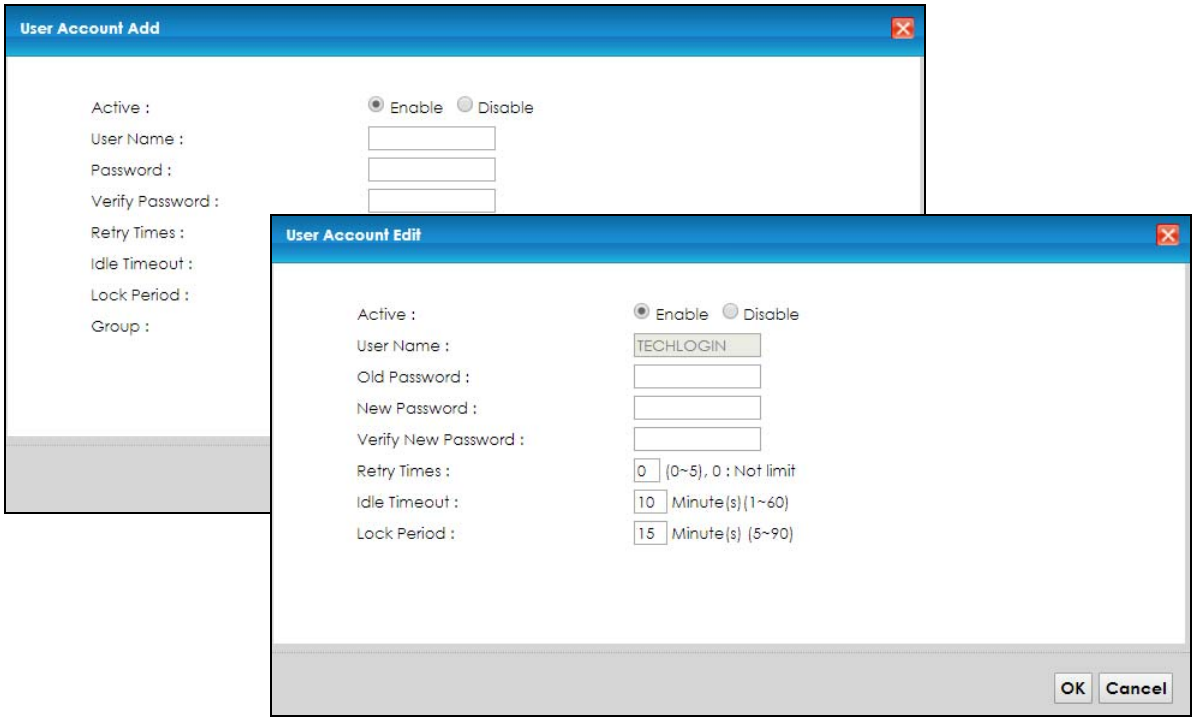
Table 125 Maintenance > User Account

LABEL	DESCRIPTION
Add New Account	Click this button to add a new user account.
#	This is the index number
Active	Select the check box to enable a user account.
User Name	This field displays the name of the account used to log into the XMG web configurator.
Retry Times	This field displays the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	This field displays the length of inactive time before the XMG will automatically log the user out of the web configurator.
Lock Period	This field displays the length of time a user must wait before attempting to log in again after a number of consecutive wrong passwords have been entered as defined in **Retry Times**.
Group	This field displays whether this user has **Administrator** or **User** privileges.
Modify	Click the **Edit** icon to configure the entry. Click the **Delete** icon to remove the entry.

31.2.1 The User Account Add/Edit Screen

Click **Add New Account** or the **Edit** icon of an existing account in the **Maintenance > User Account** to open the following screen.

Figure 155 Maintenance > User Account > Add/Edit



The following table describes the labels in this screen.

Table 126 Maintenance > User Account > Add/Edit

LABEL	DESCRIPTION
Active	Select **Enable** to activate a user account.
User Name	Enter a new name for the account. This field displays the name of an existing account.
Old Password	Type the default password or the existing password used to access the XMG web configurator.
Password/New Password	Type your new system password (up to 256 characters). Note that as you type a password, the screen displays a (*) for each character you type. After you change the password, use the new password to access the XMG.
Verify Password/ Verify New Password	Type the new password again for confirmation.
Retry Times	Enter the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	Enter the length of inactive time before the XMG will automatically log the user out of the web configurator.
Lock Period	Enter the length of time a user must wait before attempting to log in again after a number if consecutive wrong passwords have been entered as defined in **Retry Times**.
Group	Specify whether this user will have **Administrator** or **User** privleges.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 32
Remote Management

32.1 Overview

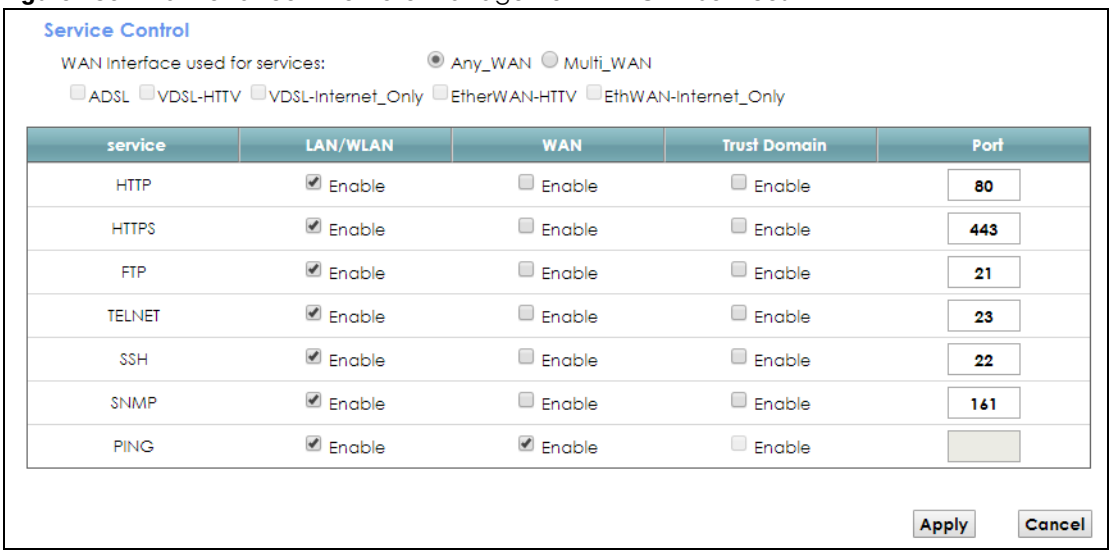
Remote management controls through which interface(s), which services can access the XMG.

Note: The XMG is managed using the Web Configurator.

32.2 The MGMT Services Screen

Use this screen to configure through which interface(s), which services can access the XMG. You can also specify the port numbers the services must use to connect to the XMG. Click **Maintenance > Remote Management > MGMT Services** to open the following screen.

Figure 156 Maintenance > Remote Management > MGMT Services



The following table describes the fields in this screen.

Table 127 Maintenance > Remote Management > MGMT Services

LABEL	DESCRIPTION
WAN Interface used for services	Select **Any_WAN** to have the XMG automatically activate the remote management service when any WAN connection is up. Select **Multi_WAN** and then select one or more WAN connections to have the XMG activate the remote management service when the selected WAN connections are up.
service	This is the service you may use to access the XMG.

Table 127 Maintenance > Remote Management > MGMT Services (continued)

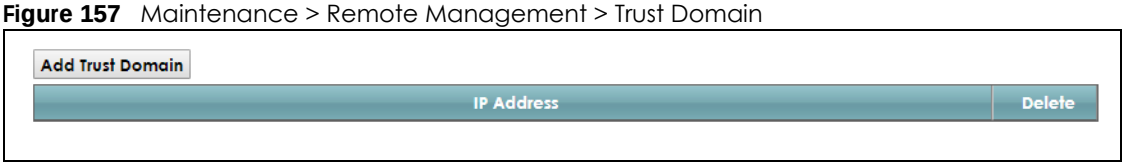
LABEL	DESCRIPTION
LAN/WLAN	Select the **Enable** check box for the corresponding services that you want to allow access to the XMG from the LAN/WLAN.
WAN	Select the **Enable** check box for the corresponding services that you want to allow access to the XMG from all WAN connections.
Trust Domain	Select the **Enable** check box for the corresponding services that you want to allow access to the XMG from the trusted hosts configured in the **Maintenance > Remote MGMT > Trust Domain** screen. If you only want certain WAN connections to have access to the XMG using the corresponding services, then clear **WAN**, select **Trust Domain** and configure the allowed IP address(es) in the **Trust Domain** screen.
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Apply	Click **Apply** to save your changes back to the XMG.
Cancel	Click **Cancel** to restore your previously saved settings.

32.3 The Trust Domain Screen

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

Note: If this list is empty, all public IP addresses can access the XMG from the WAN through the specified services.

Figure 157 Maintenance > Remote Management > Trust Domain



The following table describes the fields in this screen.

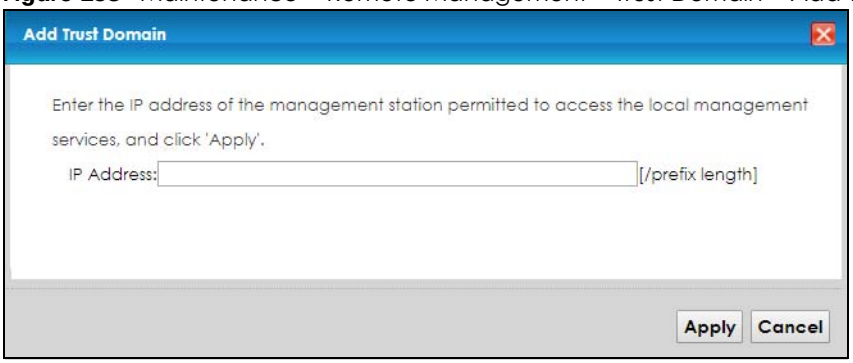
Table 128 Maintenance > Remote Management > Trust Domain

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

32.3.1 The Add Trust Domain Screen

Use this screen to configure a public IP address which is allowed to access the XMG. Click the **Add Trust Domain** button in the **Maintenance > Remote Management > Turst Domain** screen to open the following screen.

Figure 158 Maintenance > Remote Management > Trust Domain > Add Trust Domain



The following table describes the fields in this screen.

Table 129 Maintenance > Remote Management > Trust Domain > Add Trust Domain

LABEL	DESCRIPTION
IP Address	Enter a public IPv4 IP address which is allowed to access the service on the XMG from the WAN.
Apply	Click **Apply** to save your changes back to the XMG.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 33
TR-069 Client

33.1 Overview

This chapter explains how to configure the XMG's TR-069 auto-configuration settings.

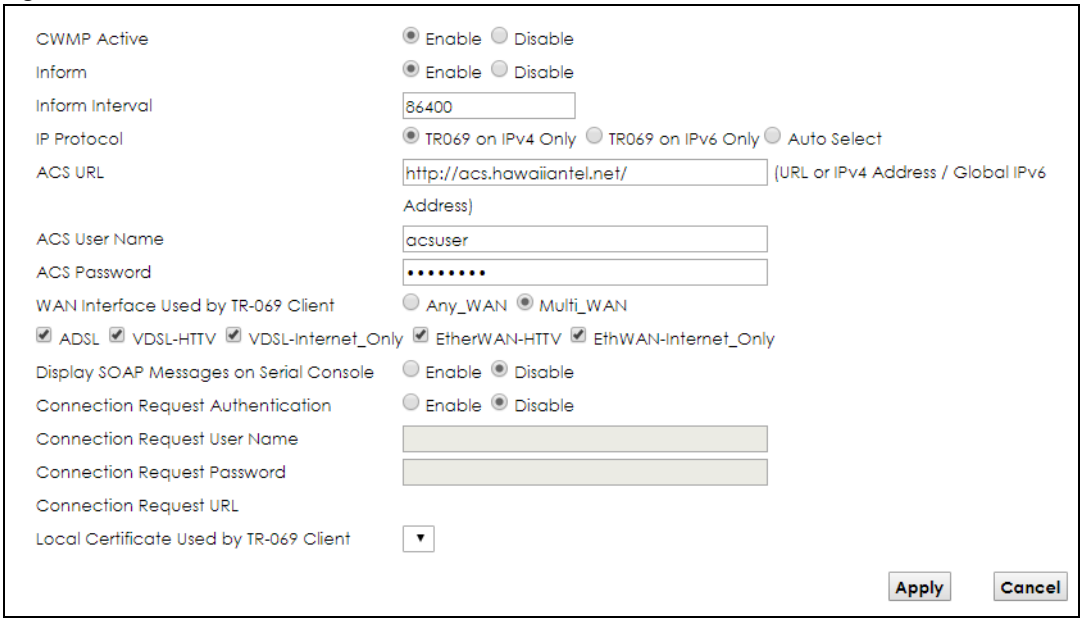
33.2 The TR-069 Client Screen

TR-069 defines how Customer Premise Equipment (CPE), for example your XMG, can be managed over the WAN by an Auto Configuration Server (ACS). TR-069 is based on sending Remote Procedure Calls (RPCs) between an ACS and a client device. RPCs are sent in Extensible Markup Language (XML) format over HTTP or HTTPS.

An administrator can use an ACS to remotely set up the XMG, modify settings, perform firmware upgrades as well as monitor and diagnose the XMG. You have to enable the device to be managed by the ACS and specify the ACS IP address or domain name and username and password.

Click **Maintenance > TR-069 Client** to open the following screen. Use this screen to configure your XMG to be managed by an ACS.

Figure 159 Maintenance > TR-069 Client



The following table describes the fields in this screen.

Table 130 Maintenance > TR-069 Client

LABEL	DESCRIPTION
CWMP Active	Select **Enable** to activate CWMP (CPE WAN Management Protocol) and allow the XMG to be managed by a management server.
Inform	Select **Enable** for the XMG to send periodic inform via TR-069 on the WAN. Otherwise, select **Disable**.
Inform Interval	Enter the time interval (in seconds) at which the XMG sends information to the auto-configuration server.
IP Protocol	Select the protocol on which you want to TR-069 to be used.
ACS URL	Enter the URL or IP address of the auto-configuration server.
ACS User Name	Enter the TR-069 user name for authentication with the auto-configuration server.
ACS Password	Enter the TR-069 password for authentication with the auto-configuration server.
WAN Interface used by TR-069 client	Select a WAN interface through which the TR-069 traffic passes. If you select **Any_WAN**, you should also select the pre-configured WAN connection(s).
Display SOAP messages on serial console	Select **Enable** to show the SOAP messages on the console.
Connection Request Authentication	Select this option to enable authentication when there is a connection request from the ACS.
Connection Request User Name	Enter the connection request user name. When the ACS makes a connection request to the XMG, this user name is used to authenticate the ACS.
Connection Request Password	Enter the connection request password. When the ACS makes a connection request to the XMG, this password is used to authenticate the ACS.
Connection Request URL	This shows the connection request URL. The ACS can use this URL to make a connection request to the XMG.
Local certificate used by TR-069 client	You can choose a local certificate used by TR-069 client. The local certificate should be imported in the **Security** > **Certificates** > **Local Certificates** screen.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 34
SNMP

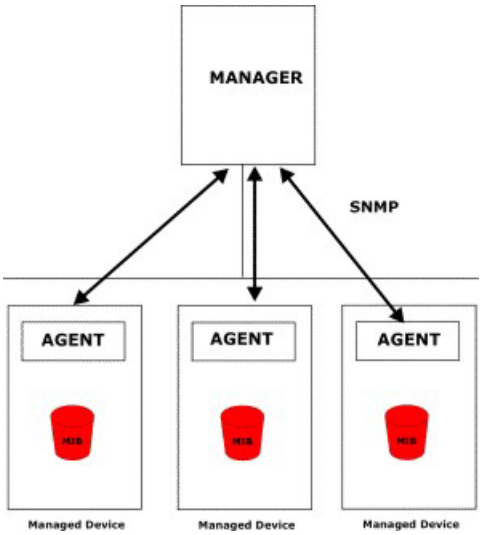
34.1 Overview

This chapter explains how to configure the SNMP settings on the XMG.

34.2 The SNMP Screen

Simple Network Management Protocol is a protocol used for exchanging management information between network devices. Your XMG supports SNMP agent functionality, which allows a manager station to manage and monitor the XMG through the network. The XMG supports SNMP version one (SNMPv1) and version two (SNMPv2c). The next figure illustrates an SNMP management operation.

Figure 160 SNMP Management Model



An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the XMG). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

Click **Maintenance > SNMP** to open the following screen. Use this screen to configure the XMG SNMP settings.

Figure 161 Maintenance > SNMP

The following table describes the fields in this screen.

Table 131 Maintenance > SNMP

LABEL	DESCRIPTION
SNMP Agent	Select **Enable** to let the XMG act as an SNMP agent, which allows a manager station to manage and monitor the XMG through the network. Select **Disable** to turn this feature off.
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station.
Trap Community	Enter the **Trap Community**, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.
System Name	Enter the SNMP system name.
System Location	Enter the SNMP system location.
System Contact	Enter the SNMP system contact.
Trap Destination	Type the IP address of the station to send your SNMP traps to.
Apply	Click this to save your changes back to the XMG.
Cancel	Click this to restore your previously saved settings.

CHAPTER 35
Time Settings

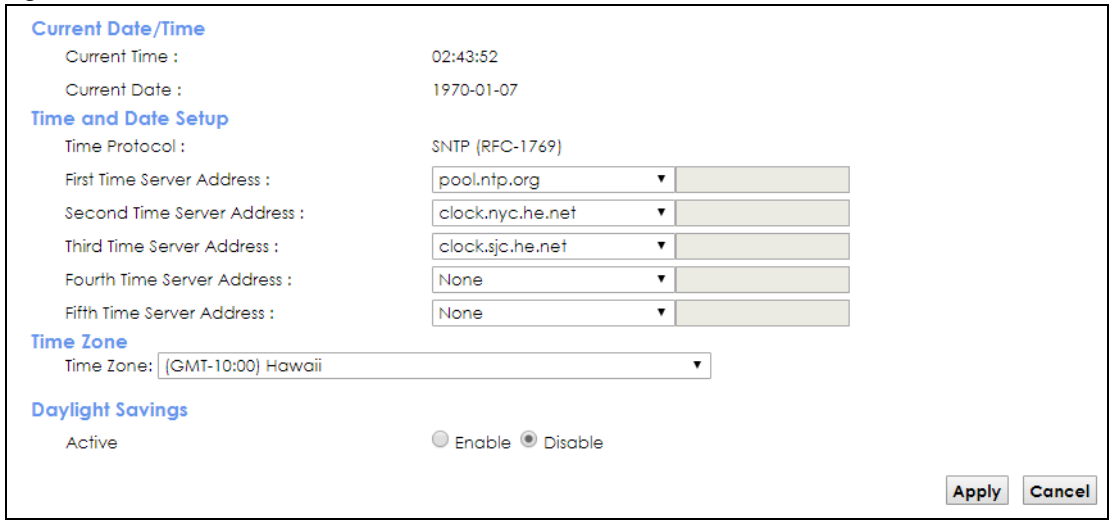
35.1 Overview

This chapter shows you how to configure system related settings, such as system time, password, name, the domain name and the inactivity timeout interval.

35.2 The Time Screen

To change your XMG's time and date, click **Maintenance > Time**. The screen appears as shown. Use this screen to configure the XMG's time based on your local time zone.

Figure 162 Maintenance > Time



The following table describes the fields in this screen.

Table 132 Maintenance > Time

LABEL	DESCRIPTION
Current Date/Time	
Current Time	This field displays the time of your XMG. Each time you reload this page, the XMG synchronizes the time with the time server.
Current Date	This field displays the date of your XMG. Each time you reload this page, the XMG synchronizes the date with the time server.
Time and Date Setup	

Table 132 Maintenance > Time (continued)

LABEL	DESCRIPTION
First ~ Fifth Time Server Address	Select an NTP time server from the drop-down list box. Otherwise, select **Other** and enter the IP address or URL (up to 29 extended ASCII characters in length) of your time server. Select **None** if you don't want to configure the time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone	
Time Protocol	This displays the time protocol used by the XMG.
First ~ Fifth Time Server Address	Select an **NTP** time server from the drop-down list box. Otherwise, select **Other** and enter the IP address or URL (up to 29 extended ASCII characters in length) of your time server. Select **None** if you don't want to configure the time server. Check with your ISP/network administrator if you are unsure of this information.
Time zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Savings	Daylight Saving Time is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
Active	Select **Enable** if you use Daylight Saving Time.
Start Rule	Configure the day and time when Daylight Saving Time starts if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The **Hour** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States, set the day to **Second**, **Sunday**, the month to **March** and the time to **2** in the **Hour** field. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to **Last**, **Sunday** and the month to **March**. The time you select depends on your time zone. In Germany for instance, you would select **2** in the **Hour** field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Rule	Configure the day and time when Daylight Saving Time ends if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The **Time** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would set the day to **First**, **Sunday**, the month to **November** and the time to **2** in the **Time** field. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to **Last**, **Sunday**, and the month to **October**. The time you select depends on your time zone. In Germany for instance, you would select **2** in the **Time** field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

CHAPTER 36
E-mail Notification

36.1 Overview

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

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

36.2 The E-mail Notification Screen

Click **Maintenance > E-mail Notification** to open the **E-mail Notification** screen. Use this screen to view, remove and add mail server information on the XMG.

Figure 163 Maintenance > E-mail Notification

The following table describes the labels in this screen.

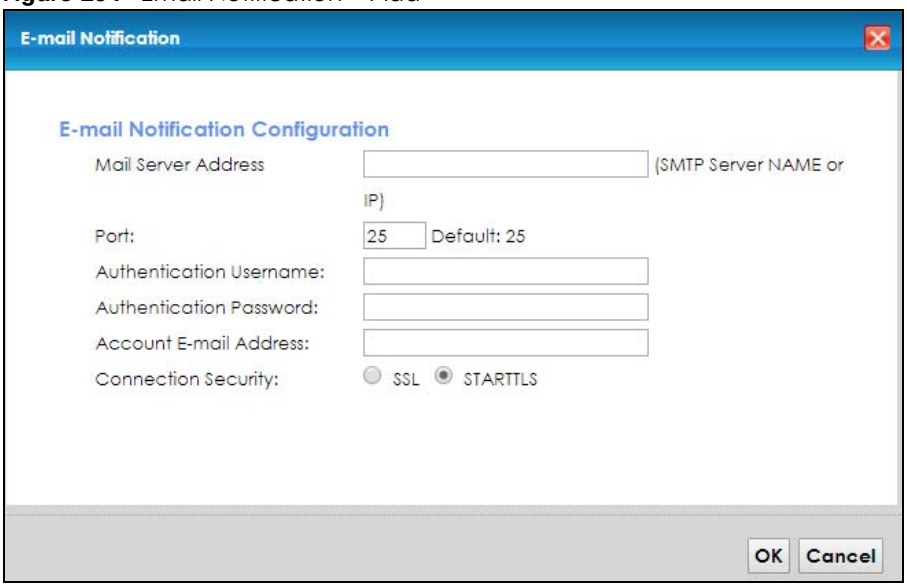
Table 133 Maintenance > E-mail Notification

LABEL	DESCRIPTION
Add New E-mail	Click this button to create a new entry.
Mail Server Address	This field displays the server name or the IP address of the mail server.
Username	This field displays the user name of the sender's mail account.
Port	This field displays the port number of the mail server.
Security	This field displays the protocol used for encryption.
E-mail Address	This field displays the e-mail address that you want to be in the from/sender line of the e-mail that the XMG sends.
Remove	Click this button to delete the selected entry(ies).

36.2.1 E-mail Notification Edit

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

Figure 164 Email Notification > Add



The following table describes the labels in this screen.

Table 134 Email Notification > Add

LABEL	DESCRIPTION
Mail Server Address	Enter the server name or the IP address of the mail server for the e-mail address specified in the **Account Email Address** field. If this field is left blank, reports, logs or notifications will not be sent via e-mail.
Port	Enter the same port number here as is on the mail server for mail traffic.
Authentication Username	Enter the user name (up to 32 characters). This is usually the user name of a mail account you specified in the **Account Email Address** field.
Authentication Password	Enter the password associated with the user name above.
Account E-mail Address	Enter the e-mail address that you want to be in the from/sender line of the e-mail notification that the XMG sends. If you activate SSL/TLS authentication, the e-mail address must be able to be authenticated by the mail server as well.
Connection Security	Select **SSL** to use Secure Sockets Layer (SSL) or Transport Layer Security (TLS) if you want encrypted communications between the mail server and the XMG. Select **STARTTLS** to upgrade a plain text connection to a secure connection using SSL/TLS.
OK	Click this button to save your changes and return to the previous screen.
Cancel	Click this button to exit this screen without saving.

CHAPTER 37
Log Setting

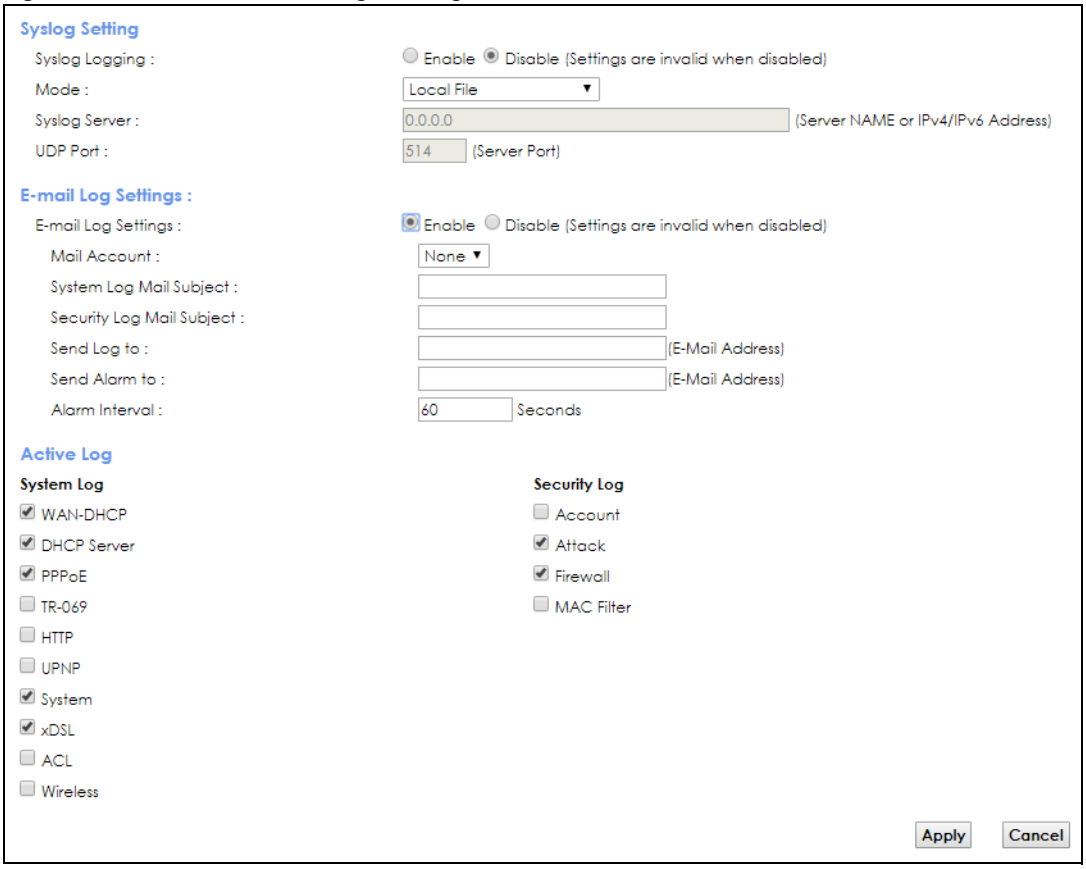
37.1 Overview

You can configure where the XMG sends logs and which logs and/or immediate alerts the XMG records in the **Logs Setting** screen.

37.2 The Log Settings Screen

To change your XMG's log settings, click **Maintenance > Logs Setting**. The screen appears as shown.

Figure 165 Maintenance > Logs Setting



The following table describes the fields in this screen.

Table 135 Maintenance > Logs Setting

LABEL	DESCRIPTION
Syslog Setting	
Syslog Logging	The XMG sends a log to an external syslog server. Select **Enable** to enable syslog logging.
Mode	Select the syslog destination from the drop-down list box. If you select **Remote**, the log(s) will be sent to a remote syslog server. If you select **Local File**, the log(s) will be saved in a local file. If you want to send the log(s) to a remote syslog server and save it in a local file, select **Local File and Remote**.
Syslog Server	Enter the server name or IP address of the syslog server that will log the selected categories of logs.
UDP Port	Enter the port number used by the syslog server.
E-mail Log Settings	
E-mail Log Settings	Select **Enable** to have the XMG send logs and alarm messages to the configured e-mail addresses.
Mail Account	This section is available only when you select **Enable** in the **E-mail Log Settings** field. Select a mail account from which you want to send logs. You can configure mail accounts in the **Maintenance > E-mail Notification** screen.
System Log Mail Subject	Type a title that you want to be in the subject line of the system log e-mail message that the XMG sends.
Security Log Mail Subject	Type a title that you want to be in the subject line of the security log e-mail message that the XMG sends.
Send Log to	The XMG sends logs to the e-mail address specified in this field. If this field is left blank, the XMG does not send logs via E-mail.
Send Alarm to	Alerts are real-time notifications that are sent as soon as an event, such as a DoS attack, system error, or forbidden web access attempt occurs. Enter the E-mail address where the alert messages will be sent. Alerts include system errors, attacks and attempted access to blocked web sites. If this field is left blank, alert messages will not be sent via E-mail.
Alarm Interval	Specify how often the alarm should be updated.
Active Log	
System Log	Select the categories of system logs that you want to record.
Security Log	Select the categories of security logs that you want to record.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

37.2.1 Example E-mail Log

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

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

Figure 166 E-mail Log Example

```
Subject:
        Firewall Alert From
   Date:
        Fri, 07 Apr 2000 10:05:42
   From:
        user@zyxel.com
     To:
        user@zyxel.com
  1|Apr  7 00 |From:192.168.200.1     To:192.168.1.255   |default policy  |forward
   | 09:54:03 |UDP     src port:00520 dest port:00520  |<1,00>          |
  2|Apr  7 00 |From:192.168.200.131   To:192.168.1.255   |default policy  |forward
   | 09:54:17 |UDP     src port:00520 dest port:00520  |<1,00>          |
  3|Apr  7 00 |From:192.168.200.6     To:10.10.10.10 |match           |forward
   | 09:54:19 |UDP     src port:03516 dest port:00053  |<1,01>          |
……..{snip}……..
……..{snip}……..
126|Apr  7 00 |From:192.168.200.1     To:192.168.1.255   |match           |forward
   | 10:05:00 |UDP     src port:00520 dest port:00520  |<1,02>          |
127|Apr  7 00 |From:192.168.200.131   To:192.168.1.255   |match           |forward
   | 10:05:17 |UDP     src port:00520 dest port:00520  |<1,02>          |
128|Apr  7 00 |From:192.168.200.1     To:192.168.1.255   |match           |forward
   | 10:05:30 |UDP     src port:00520 dest port:00520  |<1,02>          |

End of Firewall Log
```

CHAPTER 38
Firmware Upgrade

38.1 Overview

This chapter explains how to upload new firmware to your XMG. You can download new firmware releases from your nearest Zyxel FTP site (or www.zyxel.com) to use to upgrade your device's performance.

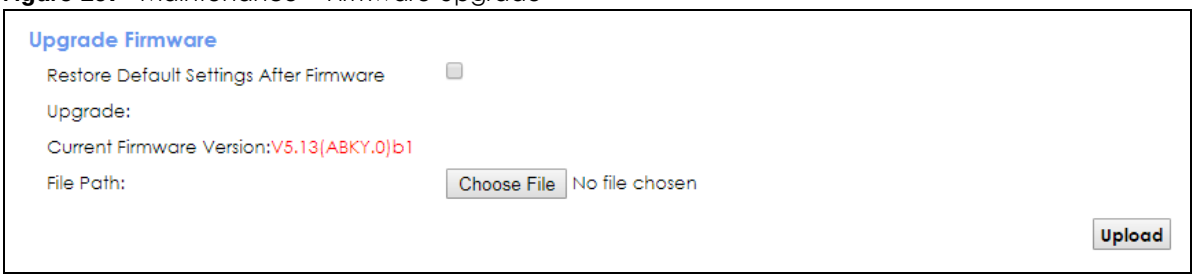
Only use firmware for your device's specific model. Refer to the label on the bottom of your XMG.

38.2 The Firmware Screen

Click **Maintenance > Firmware Upgrade** to open the following screen. The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot.

Do NOT turn off the XMG while firmware upload is in progress!

Figure 167 Maintenance > Firmware Upgrade



The following table describes the labels in this screen. After you see the firmware updating screen, wait two minutes before logging into the XMG again.

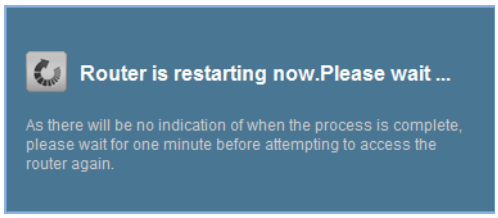
Table 136 Maintenance > Firmware Upgrade

LABEL	DESCRIPTION
Upgrade Firmware	
Restore Default Settings After Firmware Upgrade	Click the check box to have the XMG automatically reset itself after the new firmware is uploaded.
Current Firmware Version	This is the present Firmware version and the date created.
File Path	Type in the location of the file you wasnt to upload in this field or click **Choose File** to find it.

Table 136 Maintenance > Firmware Upgrade

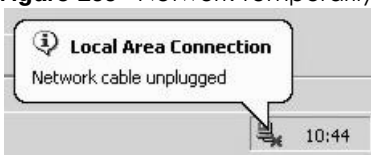
LABEL	DESCRIPTION
Choose File	Click this to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click this to begin the upload process. This process may take up to two minutes.

Figure 168 Firmware Uploading



The XMG automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 169 Network Temporarily Disconnected



After two minutes, log in again and check your new firmware version in the **Status** screen.

CHAPTER 39
Backup/Restore

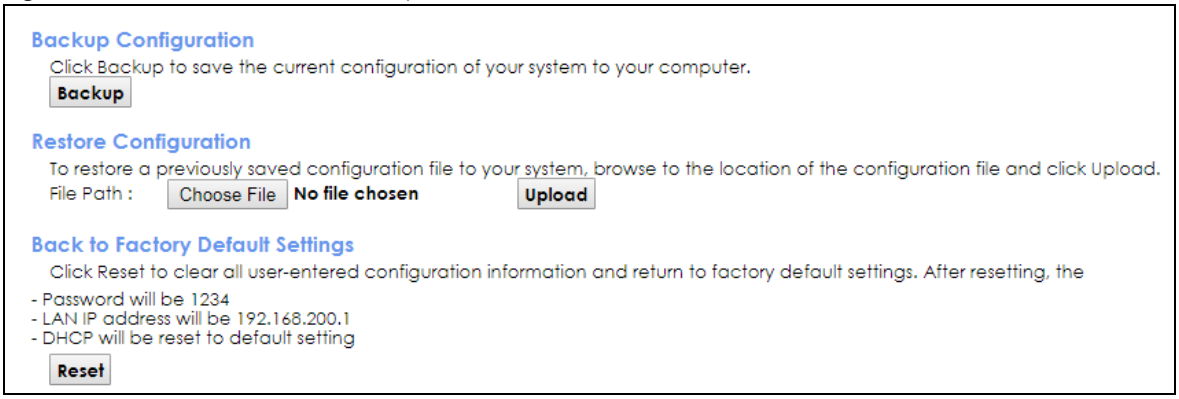
39.1 Overview

The **Backup/Restore** screen allows you to backup and restore device configurations. You can also reset your device settings back to the factory default.

39.2 The Backup/Restore Screen

Click **Maintenance > Backup/Restore**. Information related to factory defaults, backup configuration, and restoring configuration appears in this screen, as shown next.

Figure 170 Maintenance > Backup/Restore



Backup Configuration

Backup Configuration allows you to back up (save) the XMG's current configuration to a file on your computer. Once your XMG is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Click **Backup** to save the XMG's current configuration to your computer.

Restore Configuration

Restore Configuration allows you to upload a new or previously saved configuration file from your computer to your XMG.

Table 137 Restore Configuration

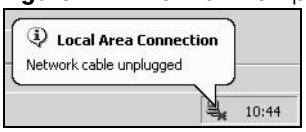
LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Choose File** to find it.
Choose File	Click this to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click this to begin the upload process.

Do not turn off the XMG while configuration file upload is in progress.

After the XMG configuration has been restored successfully, the login screen appears. Login again to restart the XMG.

The XMG automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

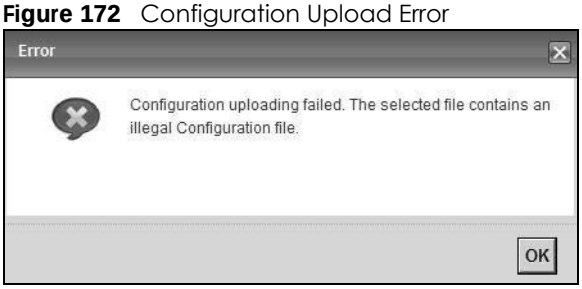
Figure 171 Network Temporarily Disconnected



If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default device IP address (192.168.200.1).

If the upload was not successful, the following screen will appear. Click **OK** to go back to the **Configuration** screen.

Figure 172 Configuration Upload Error



Reset to Factory Defaults

Click the **Reset** button to clear all user-entered configuration information and return the XMG to its factory defaults. The following warning screen appears.

Figure 173 Reset Warning Message

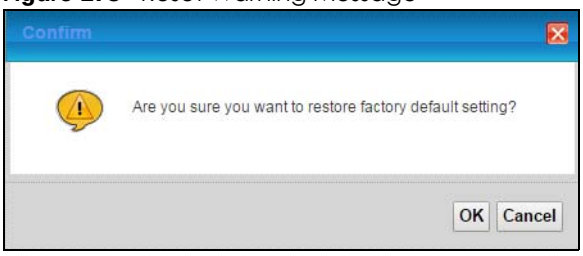
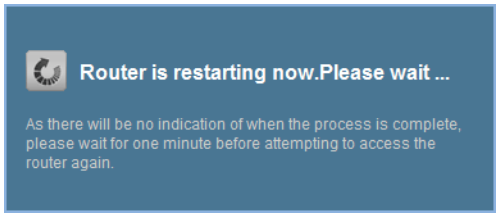


Figure 174 Reset In Process Message



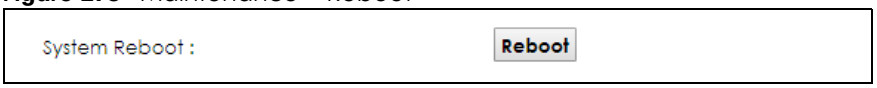
You can also press the **RESET** button on the rear panel to reset the factory defaults of your XMG. Refer to Section 1.5 on page 23 for more information on the **RESET** button.

39.3 The Reboot Screen

System restart allows you to reboot the XMG remotely without turning the power off. You may need to do this if the XMG hangs, for example.

Click **Maintenance > Reboot**. Click **Reboot** to have the XMG reboot. This does not affect the XMG's configuration.

Figure 175 Maintenance > Reboot



CHAPTER 40
Diagnostic

40.1 Overview

The **Diagnostic** screens display information to help you identify problems with the XMG.

The route between a CO VDSL switch and one of its CPE may go through switches owned by independent organizations. A connectivity fault point generally takes time to discover and impacts subscriber's network access. In order to eliminate the management and maintenance efforts, IEEE 802.1ag is a Connectivity Fault Management (CFM) specification which allows network administrators to identify and manage connection faults. Through discovery and verification of the path, CFM can detect, analyze and isolate connectivity faults in bridged LANs.

40.1.1 What You Can Do in this Chapter

- The **Ping & TraceRoute & NsLookup** screen lets you ping an IP address or trace the route packets take to a host (Section 40.3 on page 278).
- The **802.1ag** screen lets you perform CFM actions (Section 40.4 on page 278).
- The **OAM Ping** screen lets you send an ATM OAM (Operation, Administration and Maintenance) packet to verify the connectivity of a specific PVC. (Section 40.5 on page 279).

40.2 What You Need to Know

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

How CFM Works

A Maintenance Association (MA) defines a VLAN and associated Maintenance End Point (MEP) ports on the device under a Maintenance Domain (MD) level. An MEP port has the ability to send Connectivity Check Messages (CCMs) and get other MEP ports information from neighbor devices' CCMs within an MA.

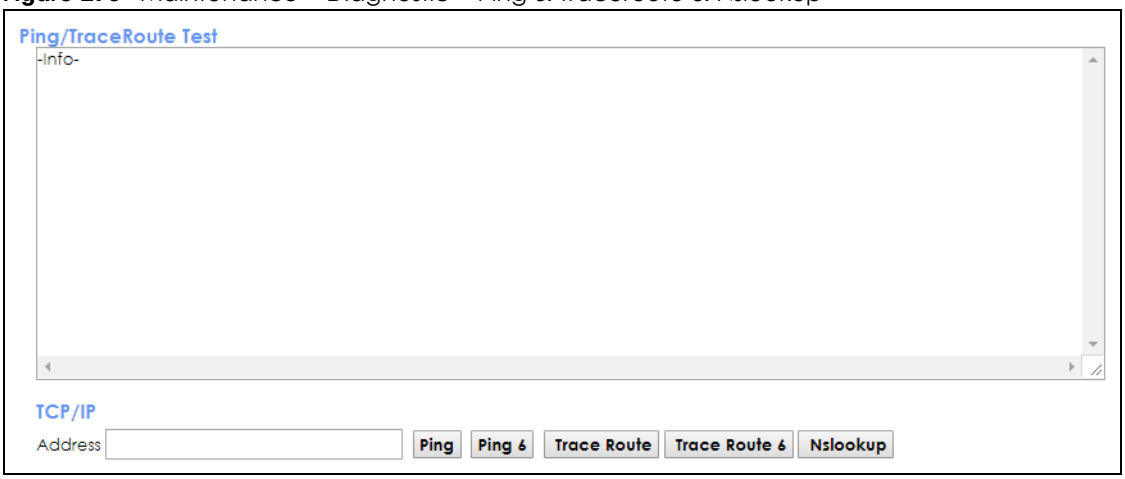
CFM provides two tests to discover connectivity faults.

- Loopback test - checks if the MEP port receives its Loop Back Response (LBR) from its target after it sends the Loop Back Message (LBM). If no response is received, there might be a connectivity fault between them.
- Link trace test - provides additional connectivity fault analysis to get more information on where the fault is. If an MEP port does not respond to the source MEP, this may indicate a fault. Administrators can take further action to check and resume services from the fault according to the line connectivity status report.

40.3 Ping & TraceRoute & NsLookup

Use this screen to ping, traceroute, or nslookup an IP address. Click **Maintenance > Diagnostic > Ping&TraceRoute&NsLookup** to open the screen shown next.

Figure 176 Maintenance > Diagnostic > Ping & Traceroute & Nslookup



The following table describes the fields in this screen.

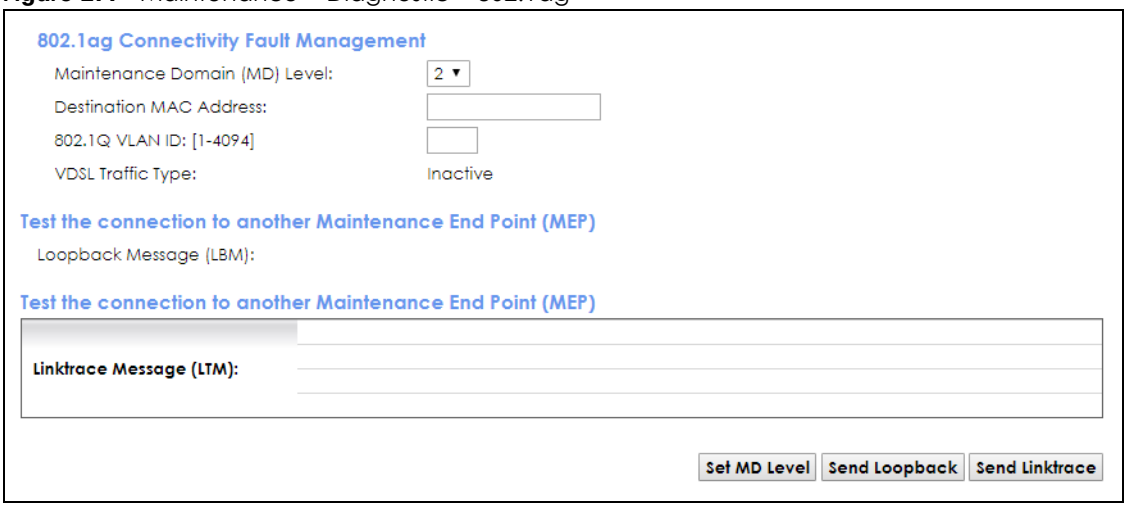
Table 138 Maintenance > Diagnostic > Ping & TraceRoute & NsLookup

LABEL	DESCRIPTION
URL or IP Address	Type the IP address of a computer that you want to perform ping, traceroute, or nslookup in order to test a connection.
Ping	Click this to ping the IPv4 address that you entered.
Ping	Click this to ping the IPv6 address that you entered.
TraceRoute	Click this to display the route path and transmission delays between the XMG to the IPv4 address that you entered.
TraceRoute	Click this to display the route path and transmission delays between the XMG to the IPv6 address that you entered.
Nslookup	Click this button to perform a DNS lookup on the IP address of a computer you enter.

40.4 802.1ag

Click **Maintenance > Diagnostic** > **802.1ag** to open the following screen. Use this screen to perform CFM actions.

Figure 177 Maintenance > Diagnostic > 802.1ag



The following table describes the fields in this screen.

Table 139 Maintenance > Diagnostic > 802.1ag

LABEL	DESCRIPTION
802.1ag Connectivity Fault Management	
Maintenance Domain (MD) Level	Select a level (0-7) under which you want to create an MA.
Destination MAC Address	Enter the target device's MAC address to which the XMG performs a CFM loopback test.
802.1Q VLAN ID	Type a VLAN ID (0-4095) for this MA.
VDSL Traffic Type	This shows whether the VDSL traffic is activated.
Loopback Message (LBM)	This shows how many Loop Back Messages (LBMs) are sent and if there is any inorder or outorder Loop Back Response (LBR) received from a remote MEP.
Linktrace Message (LTM)	This shows the destination MAC address in the Link Trace Response (LTR).
Set MD Level	Click this button to configure the MD (Maintenance Domain) level.
Send Loopback	Click this button to have the selected MEP send the LBM (Loop Back Message) to a specified remote end point.
Send Linktrace	Click this button to have the selected MEP send the LTMs (Link Trace Messages) to a specified remote end point.

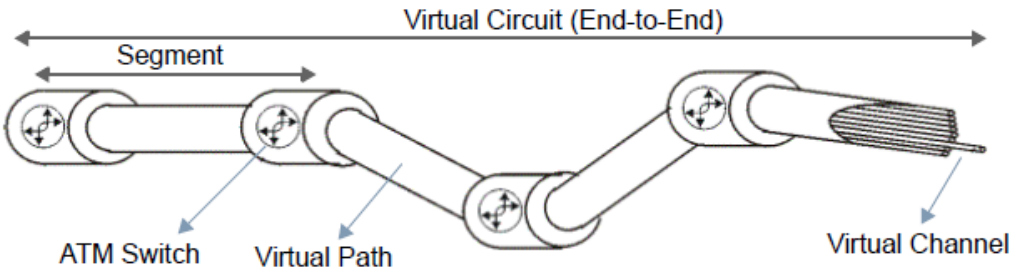
40.5 OAM Ping

Click **Maintenance > Diagnostic > OAM Ping** to open the screen shown next. Use this screen to perform an OAM (Operation, Administration and Maintenance) F4 or F5 loopback test on a PVC. The XMG sends an OAM F4 or F5 packet to the DSLAM or ATM switch and then returns it to the XMG. The test result then displays in the text box.

ATM sets up virtual circuits over which end systems communicate. The terminology for virtual circuits is as follows:

- Virtual Channel (VC) Logical connections between ATM devices
- Virtual Path (VP) A bundle of virtual channels
- Virtual Circuits A series of virtual paths between circuit end points

Figure 178 Virtual Circuit Topology



Think of a virtual path as a cable that contains a bundle of wires. The cable connects two points and wires within the cable provide individual circuits between the two points. In an ATM cell header, a VPI (Virtual Path Identifier) identifies a link formed by a virtual path; a VCI (Virtual Channel Identifier) identifies a channel within a virtual path. A series of virtual paths make up a virtual circuit.

F4 cells operate at the virtual path (VP) level, while F5 cells operate at the virtual channel (VC) level. F4 cells use the same VPI as the user data cells on VP connections, but use different predefined VCI values. F5 cells use the same VPI and VCI as the user data cells on the VC connections, and are distinguished from data cells by a predefinded Payload Type Identifier (PTI) in the cell header. Both F4 flows and F5 flows are bidirectional and have two types.

- segment F4 flows (VCI=3)
- end-to-end F4 flows (VCI=4)
- segment F5 flows (PTI=100)
- end-to-end F5 flows (PTI=101)

OAM F4 or F5 tests are used to check virtual path or virtual channel availability between two DSL devices. Segment flows are terminated at the connecting point which terminates a VP or VC segment. End-to-end flows are terminated at the end point of a VP or VC connection, where an ATM link is terminated. Segment loopback tests allow you to verify integrity of a PVC to the nearest neighboring ATM device. End-to-end loopback tests allow you to verify integrity of an end-to-end PVC.

Note: The DSLAM to which the XMG is connected must also support ATM F4 and/or F5 to use this test.

Note: This screen is available only when you configure an ATM layer-2 interface.

Figure 179 Maintenance > Diagnostic > OAM Ping

The following table describes the fields in this screen.

Table 140 Maintenance > Diagnostic > OAM Ping

LABEL	DESCRIPTION
	Select a PVC on which you want to perform the loopback test.
F4 segment	Press this to perform an OAM F4 segment loopback test.
F4 end-end	Press this to perform an OAM F4 end-to-end loopback test.
F5 segment	Press this to perform an OAM F5 segment loopback test.
F5 end-end	Press this to perform an OAM F5 end-to-end loopback test.

CHAPTER 41
Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- XMG Access and Login
- Internet Access
- Wireless Internet Access
- USB Device Connection
- UPnP

41.1 Power, Hardware Connections, and LEDs

The XMG does not turn on. None of the LEDs turn on.

1. Make sure the XMG is turned on.
2. Make sure you are using the power adaptor or cord included with the XMG.
3. Make sure the power adaptor or cord is connected to the XMG and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the XMG off and on.
5. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 1.4 on page 21.
2. Check the hardware connections.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4. Turn the XMG off and on.

5 If the problem continues, contact the vendor.

41.2 XMG Access and Login

I forgot the IP address for the XMG.

1 The default LAN IP address is 192.168.200.1.

2 If you changed the IP address and have forgotten it, you might get the IP address of the XMG by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the XMG (it depends on the network), so enter this IP address in your Internet browser.

3 If this does not work, you have to reset the device to its factory defaults. See Section 1.5 on page 23.

I forgot the password.

1 See the cover page for the default login names and associated passwords.

2 If those do not work, you have to reset the device to its factory defaults. See Section 1.5 on page 23.

I cannot see or access the **Login** screen in the web configurator.

1 Make sure you are using the correct IP address.

- The default IP address is 192.168.200.1.
- If you changed the IP address (Section 8.2 on page 113), use the new IP address.
- If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the XMG.

2 Check the hardware connections, and make sure the LEDs are behaving as expected. See Section 1.4 on page 21.

3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled.

4 If it is possible to log in from another interface, check the service control settings for HTTP and HTTPS (**Maintenance > Remote MGMT**).

5 Reset the device to its factory defaults, and try to access the XMG with the default IP address. See Section 1.5 on page 23.

6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Make sure you have logged out of any earlier management sessions using the same user account even if they were through a different interface or using a different browser.
- Try to access the XMG using another service, such as Telnet. If you can access the XMG, check the remote management settings and firewall rules to find out why the XMG does not respond to HTTP.

I can see the **Login** screen, but I cannot log in to the XMG.

1 Make sure you have entered the password correctly. See the cover page for the default login names and associated passwords. The field is case-sensitive, so make sure [Caps Lock] is not on.

2 You cannot log in to the web configurator while someone is using Telnet to access the XMG. Log out of the XMG in the other session, or ask the person who is logged in to log out.

3 Turn the XMG off and on.

4 If this does not work, you have to reset the device to its factory defaults. See Section 41.1 on page 282.

I cannot Telnet to the XMG.

See the troubleshooting suggestions for I cannot see or access the **Login screen in the web configurator.** Ignore the suggestions about your browser.

I cannot use FTP to upload / download the configuration file. / I cannot use FTP to upload new firmware.

See the troubleshooting suggestions for I cannot see or access the **Login screen in the web configurator.** Ignore the suggestions about your browser.

41.3 Internet Access

I cannot access the Internet.

1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the **Quick Start Guide** and Section 1.4 on page 21.

2 Make sure you entered your ISP account information correctly in the **Network Setting > Broadband** screen. These fields are case-sensitive, so make sure [Caps Lock] is not on.

3 If you are trying to access the Internet wirelessly, make sure that you enabled the wireless LAN in the XMG and your wireless client and that the wireless settings in the wireless client are the same as the settings in the XMG.

4 Disconnect all the cables from your device and reconnect them.

5 If the problem continues, contact your ISP.

I cannot access the Internet through a DSL connection.

1 Make sure you have the **DSL WAN** port connected to a telephone jack (or the DSL or modem jack on a splitter if you have one).

2 Make sure you configured a proper DSL WAN interface (**Network Setting > Broadband** screen) with the Internet account information provided by your ISP and that it is enabled.

3 Check that the LAN interface you are connected to is in the same interface group as the DSL connection (**Network Setting > Interface Grouping**).

4 If you set up a WAN connection using bridging service, make sure you turn off the DHCP feature in the **LAN** screen to have the clients get WAN IP addresses directly from your ISP's DHCP server.

I cannot connect to the Internet using a second DSL connection.

ADSL and VDSL connections cannot work at the same time. You can only use one type of DSL connection, either ADSL or VDSL connection at one time.

I cannot connect to the Internet using an Ethernet connection.

1 Make sure you have the Ethernet WAN port connected to a modem or router.

2 Make sure you converted LAN port number four as WAN. Click **Enable** in **Network Setting** > **Broadband** > **Ethernet WAN** screen.

3 Make sure you configured a proper Ethernet WAN interface (**Network Setting > Broadband** screen) with the Internet account information provided by your ISP and that it is enabled.

4 Check that the LAN interface you are connected to is in the same interface group as the Ethernet WAN connection (**Network Setting > Interface Grouping**).

5 If you set up a WAN connection using bridging service, make sure you turn off the DHCP feature in the **LAN** screen to have the clients get WAN IP addresses directly from your ISP's DHCP server.

I cannot access the XMG anymore. I had access to the XMG, but my connection is not available anymore.

1. Your session with the XMG may have expired. Try logging into the XMG again.
2. Check the hardware connections, and make sure the LEDs are behaving as expected. See the **Quick Start Guide** and Section 1.4 on page 21.
3. Turn the XMG off and on.
4. If the problem continues, contact your vendor.

41.4 Wireless Internet Access

What factors may cause intermittent or unstabled wireless connection? How can I solve this problem?

The following factors may cause interference:

- Obstacles: walls, ceilings, furniture, and so on.
- Building Materials: metal doors, aluminum studs.
- Electrical devices: microwaves, monitors, electric motors, cordless phones, and other wireless devices.

To optimize the speed and quality of your wireless connection, you can:

- Move your wireless device closer to the AP if the signal strength is low.
- Reduce wireless interference that may be caused by other wireless networks or surrounding wireless electronics such as cordless phones.
- Place the AP where there are minimum obstacles (such as walls and ceilings) between the AP and the wireless client.
- Reduce the number of wireless clients connecting to the same AP simultaneously, or add additional APs if necessary.
- Try closing some programs that use the Internet, especially peer-to-peer applications. If the wireless client is sending or receiving a lot of information, it may have too many programs open that use the Internet.

What is a Server Set ID (SSID)?

An SSID is a name that uniquely identifies a wireless network. The AP and all the clients within a wireless network must use the same SSID.

41.5 USB Device Connection

The XMG fails to detect my USB device.

1. Disconnect the USB device.
2. Reboot the XMG.
3. If you are connecting a USB hard drive that comes with an external power supply, make sure it is connected to an appropriate power source that is on.
4. Re-connect your USB device to the XMG.

41.6 UPnP

When using UPnP and the XMG reboots, my computer cannot detect UPnP and refresh **My Network Places > Local Network**.

1. Disconnect the Ethernet cable from the XMG's LAN port or from your computer.
2. Re-connect the Ethernet cable.

The **Local Area Connection** icon for UPnP disappears in the screen.

Restart your computer.

PART III
Appendices

Appendices contain general information. Some information may not apply to your device.

APPENDIX A
Customer Support

In the event of problems that cannot be solved by using this manual, you should contact your vendor. If you cannot contact your vendor, then contact a Zyxel office for the region in which you bought the device.

See *http://www.zyxel.com/homepage.shtml* and also *http://www.zyxel.com/about_zyxel/zyxel_worldwide.shtml* for the latest information.

Please have the following information ready when you contact an office.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

Corporate Headquarters (Worldwide)

Taiwan

- Zyxel Communications Corporation
- http://www.zyxel.com

Asia

China

- Zyxel Communications (Shanghai) Corp.
  Zyxel Communications (Beijing) Corp.
  Zyxel Communications (Tianjin) Corp.
- http://www.zyxel.cn

India

- Zyxel Technology India Pvt Ltd
- http://www.zyxel.in

Kazakhstan

- Zyxel Kazakhstan
- http://www.zyxel.kz

Korea

- Zyxel Korea Corp.
- http://www.zyxel.kr

Malaysia

- Zyxel Malaysia Sdn Bhd.
- http://www.zyxel.com.my

Pakistan

- Zyxel Pakistan (Pvt.) Ltd.
- http://www.zyxel.com.pk

Philippines

- Zyxel Philippines
- http://www.zyxel.com.ph

Singapore

- Zyxel Singapore Pte Ltd.
- http://www.zyxel.com.sg

Taiwan

- Zyxel Communications Corporation
- http://www.zyxel.com/tw/zh/

Thailand

- Zyxel Thailand Co., Ltd
- http://www.zyxel.co.th

Vietnam

- Zyxel Communications Corporation-Vietnam Office
- http://www.zyxel.com/vn/vi

Europe

Austria

- Zyxel Deutschland GmbH
- http://www.zyxel.de

Belarus

- Zyxel BY
- http://www.zyxel.by

Belgium

- Zyxel Communications B.V.
- http://www.zyxel.com/be/nl/
- http://www.zyxel.com/be/fr/

Bulgaria

- Zyxel България
- http://www.zyxel.com/bg/bg/

Czech Republic

- Zyxel Communications Czech s.r.o
- http://www.zyxel.cz

Denmark

- Zyxel Communications A/S
- http://www.zyxel.dk

Estonia

- Zyxel Estonia
- http://www.zyxel.com/ee/et/

Finland

- Zyxel Communications
- http://www.zyxel.fi

France

- Zyxel France
- http://www.zyxel.fr

Germany

- Zyxel Deutschland GmbH
- http://www.zyxel.de

Hungary

- Zyxel Hungary & SEE
- http://www.zyxel.hu

Italy

- Zyxel Communications Italy
- http://www.zyxel.it/

Latvia

- Zyxel Latvia
- http://www.zyxel.com/lv/lv/homepage.shtml

Lithuania

- Zyxel Lithuania
- http://www.zyxel.com/lt/lt/homepage.shtml

Netherlands

- Zyxel Benelux
- http://www.zyxel.nl

Norway

- Zyxel Communications
- http://www.zyxel.no

Poland

- Zyxel Communications Poland
- http://www.zyxel.pl

Romania

- Zyxel Romania
- http://www.zyxel.com/ro/ro

Russia

- Zyxel Russia
- http://www.zyxel.ru

Slovakia

- Zyxel Communications Czech s.r.o. organizacna zlozka
- http://www.zyxel.sk

Spain

- Zyxel Communications ES Ltd
- http://www.zyxel.es

Sweden

- Zyxel Communications
- http://www.zyxel.se

Switzerland

- Studerus AG

- http://www.zyxel.ch/

Turkey

- Zyxel Turkey A.S.
- http://www.zyxel.com.tr

UK

- Zyxel Communications UK Ltd.
- http://www.zyxel.co.uk

Ukraine

- Zyxel Ukraine
- http://www.ua.zyxel.com

Latin America

Argentina

- Zyxel Communication Corporation
- http://www.zyxel.com/ec/es/

Brazil

- Zyxel Communications Brasil Ltda.
- https://www.zyxel.com/br/pt/

Ecuador

- Zyxel Communication Corporation
- http://www.zyxel.com/ec/es/

Middle East

Israel

- Zyxel Communication Corporation
- http://il.zyxel.com/homepage.shtml

Middle East

- Zyxel Communication Corporation
- http://www.zyxel.com/me/en/

North America

USA

- Zyxel Communications, Inc. - North America Headquarters
- http://www.zyxel.com/us/en/

Oceania

Australia

- Zyxel Communications Corporation
- http://www.zyxel.com/au/en/

Africa

South Africa

- Nology (Pty) Ltd.
- http://www.zyxel.co.za

APPENDIX B
Wireless LANs

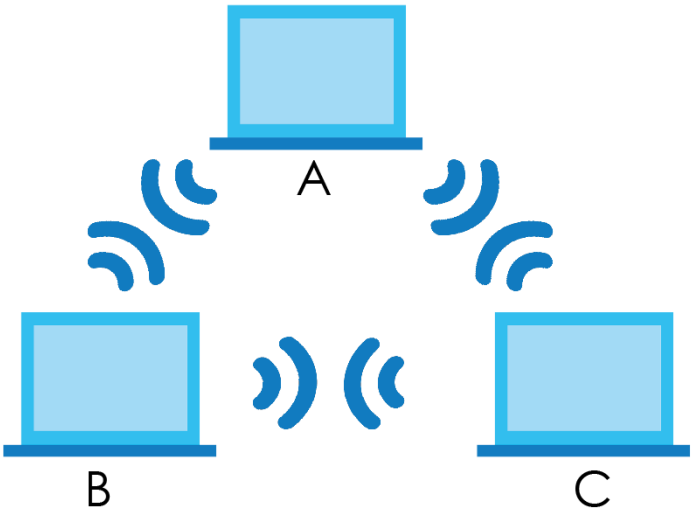
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

Figure 180 Peer-to-Peer Communication in an Ad-hoc Network

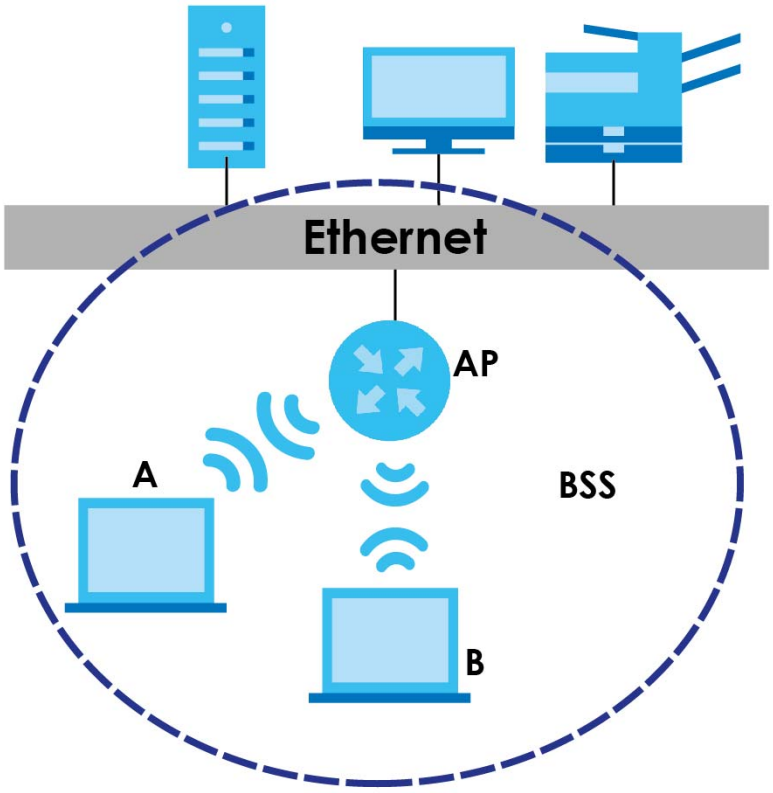


BSS

A Basic Service Set (BSS) exists when all communications between wireless clients or between a wireless client and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between wireless clients in the BSS. When Intra-BSS is enabled, wireless client **A** and **B** can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless client **A** and **B** can still access the wired network but cannot communicate with each other.

Figure 181 Basic Service Set



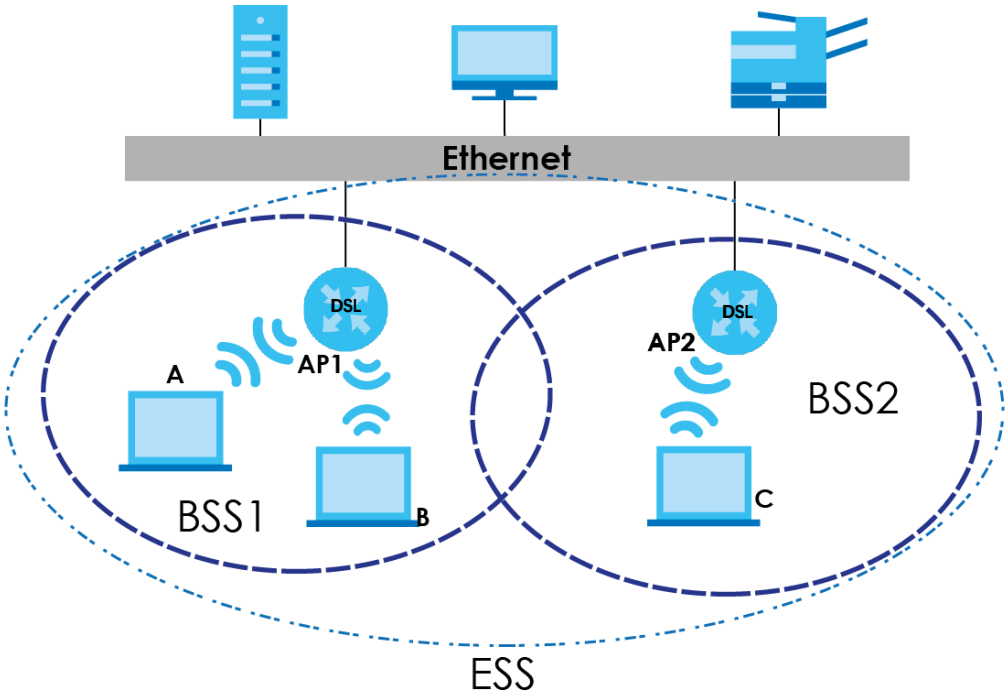
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless clients within the same ESS must have the same ESSID in order to communicate.

Figure 182 Infrastructure WLAN



Channel

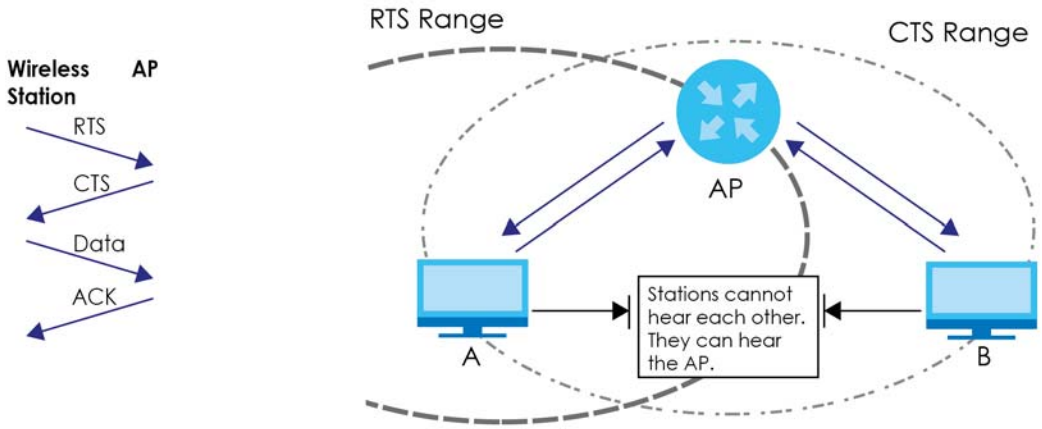
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 183 RTS/CTS



When station **A** sends data to the AP, it might not know that the station **B** is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Note: Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 141 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless clients, access points and the wired network.

Wireless security methods available on the XMG are data encryption, wireless client authentication, restricting access by device MAC address and hiding the XMG identity.

The following figure shows the relative effectiveness of these wireless security methods available on your XMG.

Table 142 Wireless Security Levels

SECURITY LEVEL	SECURITY TYPE
Least Secure	Unique SSID (Default)
	Unique SSID with Hide SSID Enabled
	MAC Address Filtering
	WEP Encryption
	IEEE802.1x EAP with RADIUS Server Authentication
	Wi-Fi Protected Access (WPA)
Most Secure	WPA2

Note: You must enable the same wireless security settings on the XMG and on all wireless clients that you want to associate with it.

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.

- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless clients.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication

  Determines the identity of the users.
- Authorization

  Determines the network services available to authenticated users once they are connected to the network.
- Accounting

  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless client and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request

  Sent by an access point requesting authentication.
- Access-Reject

  Sent by a RADIUS server rejecting access.
- Access-Accept

  Sent by a RADIUS server allowing access.
- Access-Challenge

  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request

  Sent by the access point requesting accounting.
- Accounting-Response

  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x.

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless client. The wireless client 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless clients for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2

and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the wireless security configuration screen. You may still configure and store keys, but they will not be used while dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 143 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA or WPA2 and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

WPA improves data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA2 also uses TKIP when required for compatibility reasons, but offers stronger encryption than TKIP with Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP).

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless clients using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

Wireless Client WPA Supplicants

A wireless client supplicant is the software that runs on an operating system instructing the wireless client how to use WPA. At the time of writing, the most widely available supplicant is the WPA patch for Windows XP, Funk Software's Odyssey client.

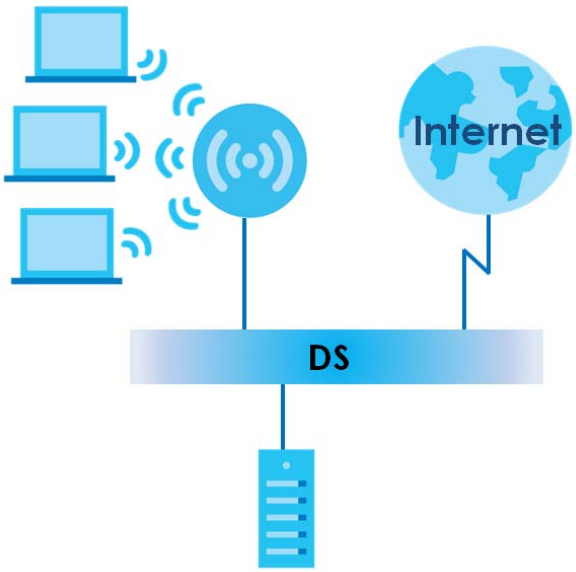
The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

WPA(2) with RADIUS Application Example

To set up WPA(2), you need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

1. The AP passes the wireless client's authentication request to the RADIUS server.
2. The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
3. A 256-bit Pairwise Master Key (PMK) is derived from the authentication process by the RADIUS server and the client.
4. The RADIUS server distributes the PMK to the AP. The AP then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys. The keys are used to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 184 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

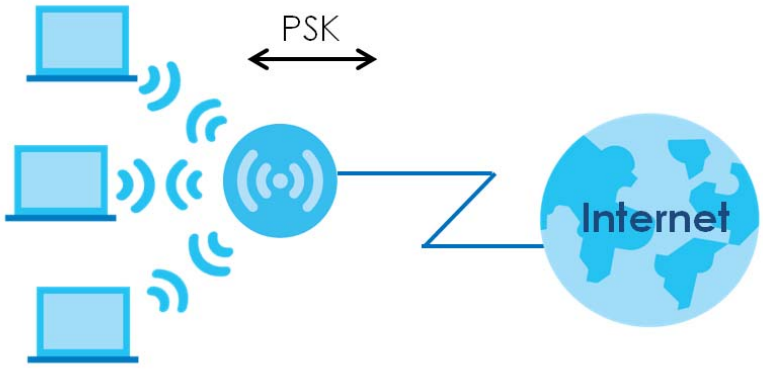
1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).

2 The AP checks each wireless client's password and allows it to join the network only if the password matches.

3 The AP and wireless clients generate a common PMK (Pairwise Master Key). The key itself is not sent over the network, but is derived from the PSK and the SSID.

4 The AP and wireless clients use the TKIP or AES encryption process, the PMK and information exchanged in a handshake to create temporal encryption keys. They use these keys to encrypt data exchanged between them.

Figure 185 WPA(2)-PSK Authentication



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each authentication method or key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 144 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

Antenna Overview

An antenna couples RF signals onto air. A transmitter within a wireless device sends an RF signal to the antenna, which propagates the signal through the air. The antenna also operates in reverse by capturing RF signals from the air.

Positioning the antennas properly increases the range and coverage area of a wireless LAN.

Antenna Characteristics

Frequency

An antenna in the frequency of 2.4GHz (IEEE 802.11b and IEEE 802.11g) or 5GHz (IEEE 802.11a) is needed to communicate efficiently in a wireless LAN

Radiation Pattern

A radiation pattern is a diagram that allows you to visualize the shape of the antenna's coverage area.

Antenna Gain

Antenna gain, measured in dB (decibel), is the increase in coverage within the RF beam width. Higher antenna gain improves the range of the signal for better communications.

For an indoor site, each 1 dB increase in antenna gain results in a range increase of approximately 2.5%. For an unobstructed outdoor site, each 1dB increase in gain results in a range increase of approximately 5%. Actual results may vary depending on the network environment.

Antenna gain is sometimes specified in dBi, which is how much the antenna increases the signal power compared to using an isotropic antenna. An isotropic antenna is a theoretical perfect antenna that sends out radio signals equally well in all directions. dBi represents the true gain that the antenna provides.

Types of Antennas for WLAN

There are two types of antennas used for wireless LAN applications.

- Omni-directional antennas send the RF signal out in all directions on a horizontal plane. The coverage area is torus-shaped (like a donut) which makes these antennas ideal for a room environment. With a wide coverage area, it is possible to make circular overlapping coverage areas with multiple access points.
- Directional antennas concentrate the RF signal in a beam, like a flashlight does with the light from its bulb. The angle of the beam determines the width of the coverage pattern. Angles typically range from 20 degrees (very directional) to 120 degrees (less directional). Directional antennas are ideal for hallways and outdoor point-to-point applications.

Positioning Antennas

In general, antennas should be mounted as high as practically possible and free of obstructions. In point-to–point application, position both antennas at the same height and in a direct line of sight to each other to attain the best performance.

For omni-directional antennas mounted on a table, desk, and so on, point the antenna up. For omni-directional antennas mounted on a wall or ceiling, point the antenna down. For a single AP application, place omni-directional antennas as close to the center of the coverage area as possible.

For directional antennas, point the antenna in the direction of the desired coverage area.

APPENDIX C
Services

The following table lists some commonly-used services and their associated protocols and port numbers.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 145 Examples of Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM	TCP	5190	AOL's Internet Messenger service.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP/UDP TCP/UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for instance www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Protocol, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Multicast Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IMAP4	TCP	143	The Internet Message Access Protocol is used for e-mail.
IMAP4S	TCP	993	This is a more secure version of IMAP4 that runs over SSL.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NetBIOS	TCP/UDP TCP/UDP TCP/UDP TCP/UDP	137 138 139 445	The Network Basic Input/Output System is used for communication between computers in a LAN.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.

Table 145 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
NFS	UDP	2049	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
POP3S	TCP	995	This is a more secure version of POP3 that runs over SSL.
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
ROADRUNNER	TCP/UDP	1026	This is an ISP that provides services mainly for cable modems.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	The Simple File Transfer Protocol is an old way of transferring files between computers.
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SMTPS	TCP	465	This is a more secure version of SMTP that runs over SSL.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSDP	UDP	1900	The Simple Service Discovery Protocol supports Universal Plug-and-Play (UPnP).
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.

Table 145 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
VDOLIVE	TCP UDP	7000 user-defined	A videoconferencing solution. The UDP port number is specified in the application.

APPENDIX D
Legal Information

Copyright

Disclaimer

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Regulatory Notice and Statement

UNITED STATES of AMERICA

The following information applies if you use the product within USA area.

FCC EMC Statement

- The device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

  (1) This device may not cause harmful interference, and

  (2) This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the device.
- This product has been tested and complies with the specifications for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used according to the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
- If this device does cause harmful interference to radio or television reception, which is found by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving antenna
  - Increase the separation between the devices
  - Connect the equipment to an outlet other than the receiver's
  - Consult a dealer or an experienced radio/TV technician for assistance
  - Operation of this device is restricted to indoor use only

The following information applies if you use the product with RF function within USA area.

FCC Radiation Exposure Statement

- This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.
- This transmitter must be at least 20 cm from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Part 68 Statement

a) This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. On the back of this equipment is a label that contains, among other information, a product identifier in the format US: 1RODL01AXMG3512. If requested, this number must be provided to the telephone company.

b) List all applicable certification jack Universal Service Order Codes ("USOC") for the equipment. USOC JACK: RJ14C(Depend on EUT interface)

c) A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. A compliant telephone cord and modular plug is provided with this product. It is designed to be connected to a compatible modular jack that is also compliant. See installation instructions for details.

d) The REN is used to determine the number of devices that may be connected to a telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of RENs should not exceed five (5.0). To be

certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company. For products approved after July 23, 2001, the REN for this product is part of the product identifier that has the format US:AAAEQ##TXXXX. The digits represented by ## are the REN without a decimal point (e.g., 03 is a REN of 0.3). For earlier products, the REN is separately shown on the label.

e) If this equipment US: 1RODL01AXMG3512(part 68 ID) causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

f) The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

g) If trouble is experienced with this equipment US: 1RODL01AXMG3512, for repair or warranty information, please contact Zyxel Communication Inc.; 1130 N Miller street Anaheim, CA 92806-2001, USA ;TEL: 002 +1 714-6320882. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

h) Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

i) If your home has specially wired alarm equipment connected to the telephone line, ensure the installation of this US: 1RODL01AXMG3512 does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

CANADA

The following information applies if you use the product within Canada area.

Industry Canada ICES Statement

CAN ICES-3 (B)/NMB-3(B)

Industry Canada CS-03 Statement

- This product meets the applicable Innovation, Science and Economic Development Canada technical specifications.
- The Ringer Equivalence Number (REN) indicates the maximum number of devices allowed to be connected to a telephone interface. The termination of an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices not exceed five.

Déclaration de conformité

- Le présent produit est conforme aux spécifications techniques applicables d'Innovation, Sciences et Développement économique Canada.
- L'indice d'équivalence de la sonnerie (IES) sert à indiquer le nombre maximal de dispositifs qui peuvent être raccordés à une interface téléphonique. La terminaison d'une interface peut consister en une combinaison quelconque de dispositifs, à la seule condition que la somme des IES de tous les dispositifs n'excède pas cinq.

Industry Canada RSS-GEN & RSS-247 statement

- This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- This radio transmitter has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antenna Information

TYPE	MANUFACTURER	GAIN	CONNECTOR
Dipole	ACON	-0.54	Ipex

If the product with 5G wireless function operating in 5150-5250 MHz and 5725-5850 MHz, the following attention must be paid,

- The device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.
- For devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate; and
- The worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in Section 6.2.2(3) of RSS 247 shall be clearly indicated.

If the product with 5G wireless function operating in 5250-5350 MHz and 5470-5725 MHz , the following attention must be paid.

- For devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit.

- Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
- Le présent émetteur radio de modèle s'il fait partie du matériel de catégoriel) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Informations Antenne

TYPE	FABRICANT	GAIN	CONNECTEUR
Dipole	ACON	-0.54	Ipex

Lorsque la fonction sans fil 5G fonctionnant en 5150-5250 MHz and 5725-5850 MHz est activée pour ce produit , il est nécessaire de porter une attention particulière aux choses suivantes

- Les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
- Pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée pour l'exploitation point à point et l'exploitation non point à point, selon le cas;
- Les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, et énoncée à la section 6.2.2 3) du CNR-247, doivent être clairement indiqués.

Lorsque la fonction sans fil 5G fonctionnant en 5250-5350 MHz et 5470-5725 MHz est activée pour ce produit , il est nécessaire de porter une attention particulière aux choses suivantes.

- Pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.

Industry Canada radiation exposure statement

This device complies with IC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

EUROPEAN UNION

The following information applies if you use the product within the European Union.

Declaration of Conformity with Regard to EU Directive 2014/53/EU (Radio Equipment Directive, RED)

- Compliance information for 2.4GHz and/or 5GHz wireless products relevant to the EU and other Countries following the EU Directive 2014/53/EU (RED). And this product may be used in all EU countries (and other countries following the EU Directive 2014/53/EU) without any limitation except for the countries mentioned below table:
- In the majority of the EU and other European countries, the 5GHz bands have been made available for the use of wireless local area networks (LANs). Later in this document you will find an overview of countries in which additional restrictions or requirements or both are applicable. The requirements for any country may evolve. Zyxel recommends that you check with the local authorities for the latest status of their national regulations for the 5GHz wireless LANs.
- If this device for operation in the band 5150-5350 MHz, it is for indoor use only.
- This equipment should be installed and operated with a minimum distance of 20cm between the radio equipment and your body.
-

Български (Bulgarian)	С настоящото Zyxel декларира, че това оборудване е в съответствие със съществените изисквания и другите приложими разпоредбите на Директива 2014/53/ЕС. **National Restrictions** • The Belgian Institute for Postal Services and Telecommunications (BIPT) must be notified of any outdoor wireless link having a range exceeding 300 meters. Please check http://www.bipt.be for more details. • Draadloze verbindingen voor buitengebruik en met een reikwijdte van meer dan 300 meter dienen aangemeld te worden bij het Belgisch Instituut voor postdiensten en telecommunicatie (BIPT). Zie http://www.bipt.be voor meer gegevens. • Les liaisons sans fil pour une utilisation en extérieur d'une distance supérieure à 300 mètres doivent être notifiées à l'Institut Belge des services Postaux et des Télécommunications (IBPT). Visitez http://www.ibpt.be pour de plus amples détails.
Español (Spanish)	Por medio de la presente Zyxel declara que el equipo cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/UE..
Čeština (Czech)	Zyxel tímto prohlašuje, že tento zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU.

Dansk (Danish)	Undertegnede Zyxel erklærer herved, at følgende udstyr udstyr overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EU. **National Restrictions** • In Denmark, the band 5150 - 5350 MHz is also allowed for outdoor usage. • I Danmark må frekvensbåndet 5150 - 5350 også anvendes udendørs.
Deutsch (German)	Hiermit erklärt Zyxel, dass sich das Gerät Ausstattung in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EU befindet.
Eesti keel (Estonian)	Käesolevaga kinnitab Zyxel seadme seadmed vastavust direktiivi 2014/53/EL põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
Ελληνικά (Greek)	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ Zyxel ΔΗΛΩΝΕΙ ΟΤΙ εξοπλισμός ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/ΕΕ.
English	Hereby, Zyxel declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
Français (French)	Par la présente Zyxel déclare que l'appareil équipements est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/UE.
Hrvatski (Croatian)	Zyxel ovime izjavljuje da je radijska oprema tipa u skladu s Direktivom 2014/53/UE.
Íslenska (Icelandic)	Hér með lýsir, Zyxel því yfir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði tilskipunar 2014/53/UE.
Italiano (Italian)	Con la presente Zyxel dichiara che questo attrezzatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/UE. **National Restrictions** • This product meets the National Radio Interface and the requirements specified in the National Frequency Allocation Table for Italy. Unless this wireless LAN product is operating within the boundaries of the owner's property, its use requires a "general authorization." Please check http://www.sviluppoeconomico.gov.it/ for more details. • Questo prodotto è conforme alla specifiche di Interfaccia Radio Nazionali e rispetta il Piano Nazionale di ripartizione delle frequenze in Italia. Se non viene installato all 'interno del proprio fondo, l'utilizzo di prodotti Wireless LAN richiede una "Autorizzazione Generale". Consultare http://www.sviluppoeconomico.gov.it/ per maggiori dettagli.
Latviešu valoda (Latvian)	Ar šo Zyxel deklarē, ka iekārtas atbilst Direktīvas 2014/53/ES būtiskajām prasībām un citiem ar to saistītajiem noteikumiem. **National Restrictions** • The outdoor usage of the 2.4 GHz band requires an authorization from the Electronic Communications Office. Please check http://www.esd.lv for more details. • 2.4 GHz frekvenèu joslas izmantoðanai ârpus telpâm nepiecieðama atïauja no Elektronisko sakaru direkcijas. Vairâk informâcijas: http://www.esd.lv.
Lietuvių kalba (Lithuanian)	Šiuo Zyxel deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 2014/53/ES Direktyvos nuostatas.
Magyar (Hungarian)	Alulírott, Zyxel nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvetõ követelményeknek és az 2014/53/EU irányelv egyéb elõírásainak.
Malti (Maltese)	Hawnhekk, Zyxel, jiddikjara li dan tagħmir jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 2014/53/UE.
Nederlands (Dutch)	Hierbij verklaart Zyxel dat het toestel uitrusting in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.
Polski (Polish)	Niniejszym Zyxel oświadcza, że sprzęt jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/UE.
Português (Portuguese)	Zyxel declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/UE.
Română (Romanian)	Prin prezenta, Zyxel declară că acest echipament este în conformitate cu cerinţele esenţiale şi alte prevederi relevante ale Directivei 2014/53/UE.
Slovenčina (Slovak)	Zyxel týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/EÚ.
Slovenščina (Slovene)	Zyxel izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.
Suomi (Finnish)	Zyxel vakuuttaa täten että laitteet tyyppinen laite on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svenska (Swedish)	Härmed intygar Zyxel att denna utrustning står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.
Norsk (Norwegian)	Erklærer herved Zyxel at dette utstyret er I samsvar med de grunnleggende kravene og andre relevante bestemmelser I direktiv 2014/53/EU.

Notes:

1. Although Norway, Switzerland and Liechtenstein are not EU member states, the EU Directive 2014/53/EU has also been implemented in those countries.

2. The regulatory limits for maximum output power are specified in EIRP. The EIRP level (in dBm) of a device can be calculated by adding the gain of the antenna used (specified in dBi) to the output power available at the connector (specified in dBm).

List of national codes

COUNTRY	ISO 3166 2 LETTER CODE	COUNTRY	ISO 3166 2 LETTER CODE
Austria	AT	Liechtenstein	LI
Belgium	BE	Lithuania	LT
Bulgaria	BG	Luxembourg	LU
Croatia	HR	Malta	MT
Cyprus	CY	Netherlands	NL
Czech Republic	CZ	Norway	NO
Denmark	DK	Poland	PL
Estonia	EE	Portugal	PT
Finland	FI	Romania	RO
France	FR	Serbia	RS
Germany	DE	Slovakia	SK
Greece	GR	Slovenia	SI
Hungary	HU	Spain	ES
Iceland	IS	Switzerland	CH
Ireland	IE	Sweden	SE
Italy	IT	Turkey	TR
Latvia	LV	United Kingdom	GB

Safety Warnings

- Do not use this product near water, for example, in a wet basement or near a swimming pool.
- Do not expose your device to dampness, dust or corrosive liquids.
- Do not store things on the device.
- Do not obstruct the device ventilation slots as insufficient airflow may harm your device. For example, do not place the device in an enclosed space such as a box or on a very soft surface such as a bed or sofa.
- Do not install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do not open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks.
- Only qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Do not remove the plug and connect it to a power outlet by itself; always attach the plug to the power adaptor first before connecting it to a power outlet.
- Do not allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Please use the provided or designated connection cables/power cables/ adaptors. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe). If the power adaptor or cord is damaged, it might cause electrocution. Remove it from the device and the power source, repairing the power adapter or cord is prohibited. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- CAUTION: Risk of explosion if battery is replaced by an incorrect type, dispose of used batteries according to the instruction. Dispose them at the applicable collection point for the recycling of electrical and electronic devices. For detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the store where you purchased the product.
- The following warning statements apply, where the disconnect device is not incorporated in the device or where the plug on the power supply cord is intended to serve as the disconnect device,

  - For permanently connected devices, a readily accessible disconnect device shall be incorporated external to the device;

  - For pluggable devices, the socket-outlet shall be installed near the device and shall be easily accessible.

Environment Statement

ErP (Energy-related Products)

Zyxel products put on the EU market in compliance with the requirement of the European Parliament and the Council published Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products (recast), so called as "ErP Directive (Energy-related Products directive) as well as ecodesign requirement laid down in applicable implementing measures, power consumption has satisfied regulation requirements which are:

- Network standby power consumption < 8W, and/or
- Off mode power consumption < 0.5W, and/or
- Standby mode power consumption < 0.5W.

(Wireless setting, please refer to "Wireless" chapter for more detail.)

European Union - Disposal and Recycling Information

The symbol below means that according to local regulations your product and/or its battery shall be disposed of separately from domestic waste. If this product is end of life, take it to a recycling station designated by local authorities. At the time of disposal, the separate collection of your product and/or its battery will help save natural resources and ensure that the environment is sustainable development.

Die folgende Symbol bedeutet, dass Ihr Produkt und/oder seine Batterie gemäß den örtlichen Bestimmungen getrennt vom Hausmüll entsorgt werden muss. Wenden Sie sich an eine Recyclingstation, wenn dieses Produkt das Ende seiner Lebensdauer erreicht hat. Zum Zeitpunkt der Entsorgung wird die getrennte Sammlung von Produkt und/oder seiner Batterie dazu beitragen, natürliche Ressourcen zu sparen und die Umwelt und die menschliche Gesundheit zu schützen.

El símbolo de abajo indica que según las regulaciones locales, su producto y/o su batería deberán depositarse como basura separada de la doméstica. Cuando este producto alcance el final de su vida útil, llévelo a un punto limpio. Cuando llegue el momento de desechar el producto, la recogida por separado éste y/o su batería ayudará a salvar los recursos naturales y a proteger la salud humana y medioambiental.

Le symbole ci-dessous signifie que selon les réglementations locales votre produit et/ou sa batterie doivent être éliminés séparément des ordures ménagères. Lorsque ce produit atteint sa fin de vie, amenez-le à un centre de recyclage. Au moment de la mise au rebut, la collecte séparée de votre produit et/ou de sa batterie aidera à économiser les ressources naturelles et protéger l'environnement et la santé humaine.

Il simbolo sotto significa che secondo i regolamenti locali il vostro prodotto e/o batteria deve essere smaltito separatamente dai rifiuti domestici. Quando questo prodotto raggiunge la fine della vita di servizio portarlo a una stazione di riciclaggio. Al momento dello smaltimento, la raccolta separata del vostro prodotto e/o della sua batteria aiuta a risparmiare risorse naturali e a proteggere l'ambiente e la salute umana.

Symbolen innebär att enligt lokal lagstiftning ska produkten och/eller dess batteri kastas separat från hushållsavfallet. När den här produkten når slutet av sin livslängd ska du ta den till en återvinningsstation. Vid tiden för kasseringen bidrar du till en bättre miljö och mänsklig hälsa genom att göra dig av med den på ett återvinningsställe.

台灣

以下訊息僅適用於產品具有無線功能且銷售至台灣地區

- 第十二條 經型式認證合格之低功率射頻電機，非經許可，公司，商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。
- 第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。 低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。
-
- 無線資訊傳輸設備忍受合法通信之干擾且不得干擾合法通信；如造成干擾，應立即停用， 俟無干擾之虞，始得繼續使用。
- 無線資訊傳設備的製造廠商應確保頻率穩定性，如依製造廠商使用手冊上所述正常操作， 發射的信號應維持於操作頻帶中

以下訊息僅適用於產品操作於 5.25-5.35 秭赫頻帶內並銷售至台灣地區

- 在 5.25-5.35 秭赫頻帶內操作之無線資訊傳輸設備，限於室內使用。

以下訊息僅適用於產品屬於專業安裝並銷售至台灣地區

- 本器材須經專業工程人員安裝及設定，始得設置使用，且不得直接販售給一般消費者。

安全警告 - 為了您的安全，請先閱讀以下警告及指示：

- 請勿將此產品接近水、火焰或放置在高溫的環境。
- 避免設備接觸：
  - 任何液體 - 切勿讓設備接觸水、雨水、高濕度、污水腐蝕性的液體或其他水份。
  - 灰塵及污物 - 切勿接觸灰塵、污物、沙土、食物或其他不合適的材料。
- 雷雨天氣時，不要安裝，使用或維修此設備。有遭受電擊的風險。
- 切勿重摔或撞擊設備，並勿使用不正確的電源變壓器。
- 若接上不正確的電源變壓器會有爆炸的風險。

- 請勿隨意更換產品內的電池。
- 如果更換不正確之電池型式，會有爆炸的風險，請依製造商說明書處理使用過之電池。
- 請將廢電池丟棄在適當的電器或電子設備回收處。
- 請勿將設備解體。
- 請勿阻礙設備的散熱孔，空氣對流不足將會造成設備損害。
- 請插在正確的電壓供給插座 (如：北美 / 台灣電壓 110V AC，歐洲是 230V AC)。
- 假若電源變壓器或電源變壓器的纜線損壞，請從插座拔除，若您還繼續插電使用，會有觸電死亡的風險。
- 請勿試圖修理電源變壓器或電源變壓器的纜線，若有毀損，請直接聯絡您購買的店家，購買一個新的電源變壓器。
- 請勿將此設備安裝於室外，此設備僅適合放置於室內。
- 請勿隨一般垃圾丟棄。
- 請參閱產品背貼上的設備額定功率。
- 請參考產品型錄或是彩盒上的作業溫度。
- 產品沒有斷電裝置或者採用電源線的插頭視為斷電裝置的一部分，以下警語將適用：
  - 對永久連接之設備， 在設備外部須安裝可觸及之斷電裝置；
  - 對插接式之設備， 插座必須接近安裝之地點而且是易於觸及的。

About the Symbols

Various symbols are used in this product to ensure correct usage, to prevent danger to the user and others, and to prevent property damage. The meaning of these symbols are described below. It is important that you read these descriptions thoroughly and fully understand the contents.

Explanation of the Symbols

SYMBOL	EXPLANATION
	Alternating current (AC): AC is an electric current in which the flow of electric charge periodically reverses direction.
	Direct current (DC): DC if the unidirectional flow or movement of electric charge carriers.
	Earth; ground: A wiring terminal intended for connection of a Protective Earthing Conductor.
	Class II equipment: The method of protection against electric shock in the case of class II equipment is either double insulation or reinforced insulation.

Viewing Certifications

Go to http://www.zyxel.com to view this product's documentation and certifications.

Zyxel Limited Warranty

Zyxel warrants to the original end user (purchaser) that this product is free from any defects in material or workmanship for a specific period (the Warranty Period) from the date of purchase. The Warranty Period varies by region. Check with your vendor and/or the authorized Zyxel local distributor for details about the Warranty Period of this product. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, Zyxel will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal or higher value, and will be solely at the discretion of Zyxel. This warranty shall not apply if the product has been modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

Note

Repair or replacement, as provided under this warranty, is the exclusive remedy of the purchaser. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular use or purpose. Zyxel shall in no event be held liable for indirect or consequential damages of any kind to the purchaser.

To obtain the services of this warranty, contact your vendor. You may also refer to the warranty policy for the region in which you bought the device at http://www.zyxel.com/web/support_warranty_info.php.

Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com for global products, or at www.us.zyxel.com for North American products.

Open Source Licenses

This product contains in part some free software distributed under GPL license terms and/or GPL like licenses. Open source licenses are provided with the firmware package. You can download the latest firmware at www.zyxel.com. To obtain the source code covered under those Licenses, please contact support@zyxel.com.tw to get it.

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