12

Port Binding

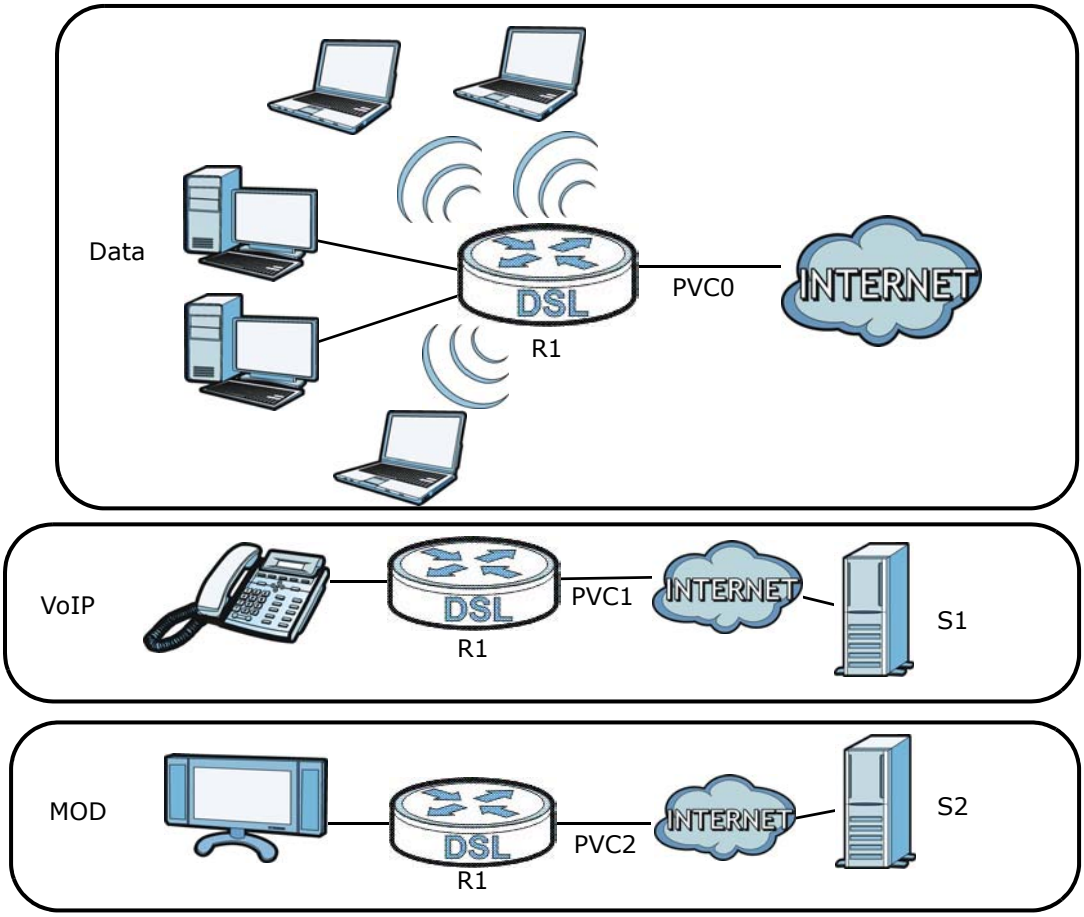
12.1 Overview

This chapter describes how to configure the port binding settings.

Port binding allows you to aggregate port connections into logical groups. You may bind WAN PVCs to Ethernet ports and WLANs to specify how traffic is forwarded. Different ATM QoS settings can be specified for each WAN PVC to meet bandwidth requirements for the type of traffic to be transferred.

For example, three port binding groups could be created on the device (R1) for three different WAN PVC connections. The first PVC (PVC0) is for non time-sensitive data traffic. The second and third PVCs (PVC1 and PVC2) are for time sensitive Media-On-Demand (MOD) video traffic and VoIP traffic, respectively.

Figure 73 Port Binding Groups



If a WAN PVC is bound to an ethernet port, traffic from the ethernet port will only be forwarded through the specified WAN PVC and vice versa. If a port is not in a port binding group, traffic to and from the port will be forwarded according to the routing table. See the tutorial section (Section on page 37) for more details on configuring port binding for multiple WAN connections.

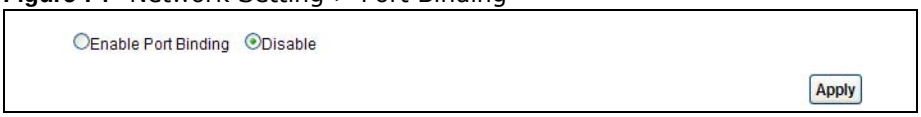
12.1.1 What You Can Do in the Port Binding Screens

- Use the **General** screen (Section 12.3 on page 162) to activate port binding.
- Use the **Port Binding** screen (Section 12.3 on page 162) to set up port binding groups.
- Use the **Port Binding Summary** screen (Section 12.3.1 on page 163) to view configured port binding groups.

12.2 The Port Binding General Screen

Use this screen to activate port binding and set up port binding groups. Click **Network Setting > Port Binding** to display the following screen.

Figure 74 Network Setting > Port Binding



The following table describes the labels in this screen.

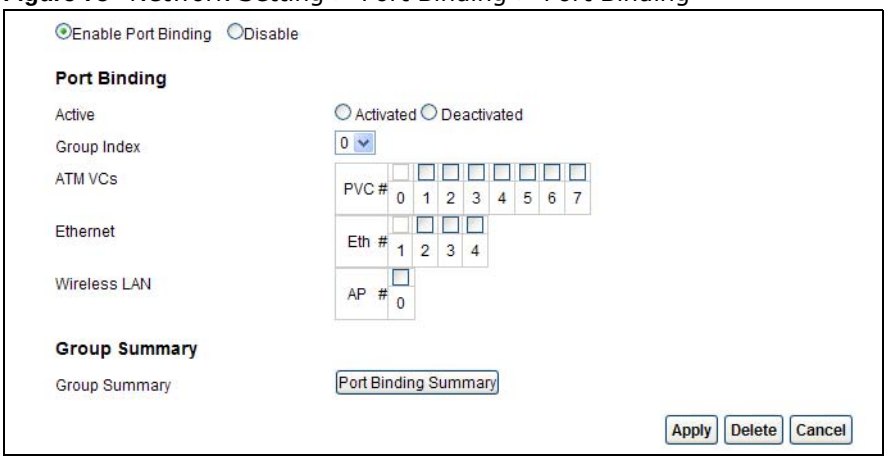
Table 54 Network Setting > Port Binding

LABEL	DESCRIPTION
Activated Port Binding	Activate or deactivate the port binding feature.
Apply	Add the selected port binding group configuration.

12.3 The Port Binding Screen

Use this screen to set up port binding groups. Click **Network Setting > Port Binding > Port Binding** to display the following screen.

Figure 75 Network Setting > Port Binding > Port Binding



The following table describes the labels in this screen.

Table 55 Network Setting > Port Binding > Port Binding

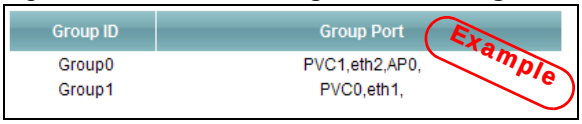
LABEL	DESCRIPTION
Port Binding	
Active	Activate or deactivate port binding for the port binding group.
Group Index	Select the index number for the port binding group. When a port is assigned to a port binding group, traffic will be forwarded to the other ports in the group, but not to ports in other groups. If a port is not included in any groups, traffic will be forwarded according to the routing table.
ATM VCs	Select the ATM VC (PVC) to include in the port binding group. Each ATM VC can only be bound to one group.
Ethernet	Select the Ethernet (Eth) ports to include in the port binding group. Each Ethernet port can only be bound to one group.
Wireless LAN	Select the WLAN (AP) connection to include in the port binding group. Additional APs can be enabled on the **More AP** screen (Section 7.3 on page 98).
Group Summary	
Port Binding Summary	Click this to view a summary of configured port binding groups.
Apply	Add the selected port binding group configuration.
Delete	Delete the selected port binding group configuration.
Cancel	Click this to restore your previously saved settings.

12.3.1 Port Binding Summary Screen

Use this screen to view configured port binding groups.

In the **Port Binding** screen, click the **Port Binding Summary** button in the **Group Summary** section to display the following screen.

Figure 76 Network Setting > Port Binding > Port Binding Summary



The following table describes the labels in this screen.

Table 56 Network Setting > Port Binding > Port Binding Summary

LABEL	DESCRIPTION
Group ID	This field displays the group index number.
Group port	This field displays the ports included in the group.

13

Dynamic DNS Setup

13.1 Overview

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.

13.1.1 What You Can Do in the DDNS Screen

Use the **Dynamic DNS** screen (Section 13.2 on page 165) to enable DDNS and configure the DDNS settings on the AMG1302/AMG1202-TSeries.

13.1.2 What You Need To Know About DDNS

DYNDNS Wildcard

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

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

13.2 The Dynamic DNS Screen

Use this screen to change your AMG1302/AMG1202-TSeries's DDNS. Click **Network Setting > Dynamic DNS**. The screen appears as shown.

Figure 77 Network Setting > Dynamic DNS

The following table describes the fields in this screen.

Table 57 Network Setting > Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Active Dynamic DNS	Select this check box to use dynamic DNS.
Service Provider	This is the website of your Dynamic DNS service provider.
Host Name	Type the domain name assigned to your AMG1302/AMG1202-TSeries by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
Username	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard Option	Select the check box to enable DynDNS Wildcard.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

14 Filters

14.1 Overview

This chapter introduces three types of filters supported by the AMG1302/AMG1202-TSeries. You can configure rules to restrict traffic by IP addresses, MAC addresses, IPv6 addresses and/or URLs.

14.1.1 What You Can Do in the Filter Screens

- Use the **IP/MAC Filter** screen (Section 14.2 on page 167) to create IP and MAC filter rules.
- Use the **IPv6/MAC Filter** screen (Section 14.3 on page 170) to create IPv6 and MAC filter rules.

14.1.2 What You Need to Know About Filtering

URL

The URL (Uniform Resource Locator) identifies and helps locates resources on a network. On the Internet the URL is the web address that you type in the address bar of your Internet browser, for example "http://www.zyxel.com".

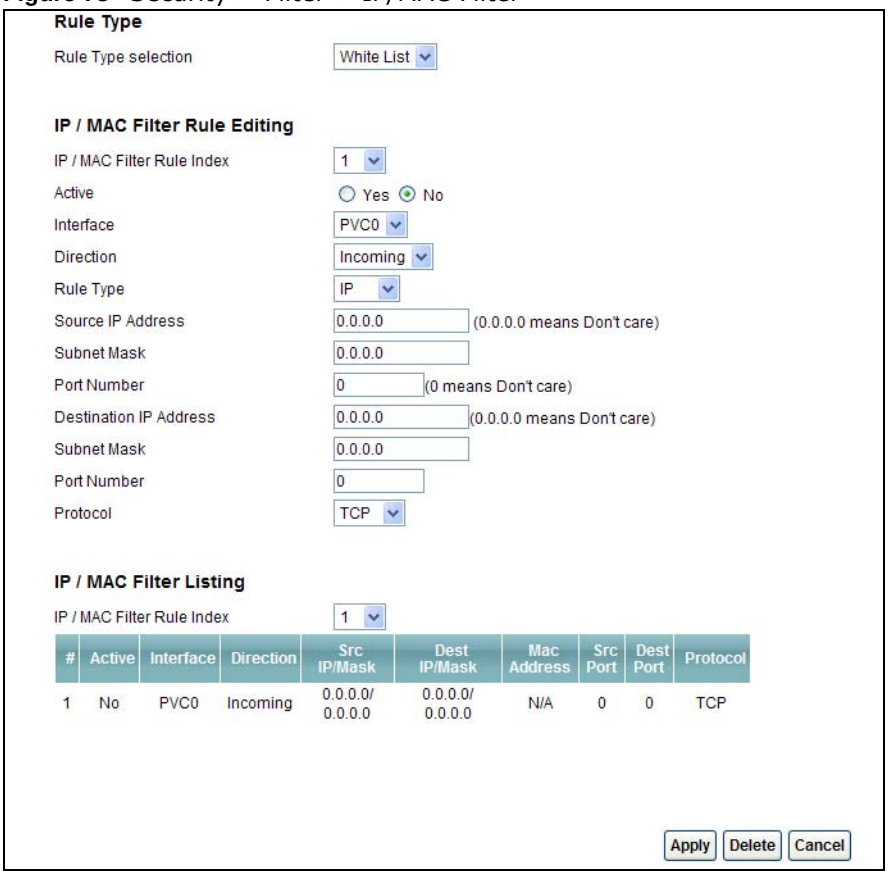
URL and IP Filter Structure

The URL, IP and IPv6 filters have individual rule indexes. The AMG1302/AMG1202-TSeries allows you to configure each type of filter with its own respective set of rules.

14.2 The IP/MAC Filter Screen

Use this screen to create and apply IP and MAC filters. Click **Security** > **Filter** > **IP/MAC Filter**. The screen appears as shown.

Figure 78 Security > Filter > IP/MAC Filter



The following table describes the labels in this screen.

Table 58 Security > Filter > IP/MAC Filter

LABEL	DESCRIPTION
Rule Type	
Rule Type selection	Select **White List** to specify traffic to allow and **Black List** to specify traffic to disallow.
IP / MAC Filter Rule Editing	
IP / MAC Filter Rule Index	Select the index number of the filter rule.
Active	Use this field to enable or disable the filter rule.
Interface	Select the PVC to which to apply the filter.
Direction	Apply the filter to **Incoming** or **Outgoing** traffic direction.
Rule Type	Select **IP** or **MAC** type to configure the rule. Use the **IP** Filter to block or allow traffic by IP addresses. Use the **MAC** Filter to block or allow traffic by MAC address.
Source IP Address	Enter the source IP address of the packets you wish to filter. This field is ignored if it is 0.0.0.0.
Subnet Mask	Enter the IP subnet mask for the source IP address
Port Number	Enter the source port of the packets that you wish to filter. The range of this field is 0 to 65535. This field is ignored if it is 0.
Destination IP Address	Enter the destination IP address of the packets you wish to filter. This field is ignored if it is 0.0.0.0.

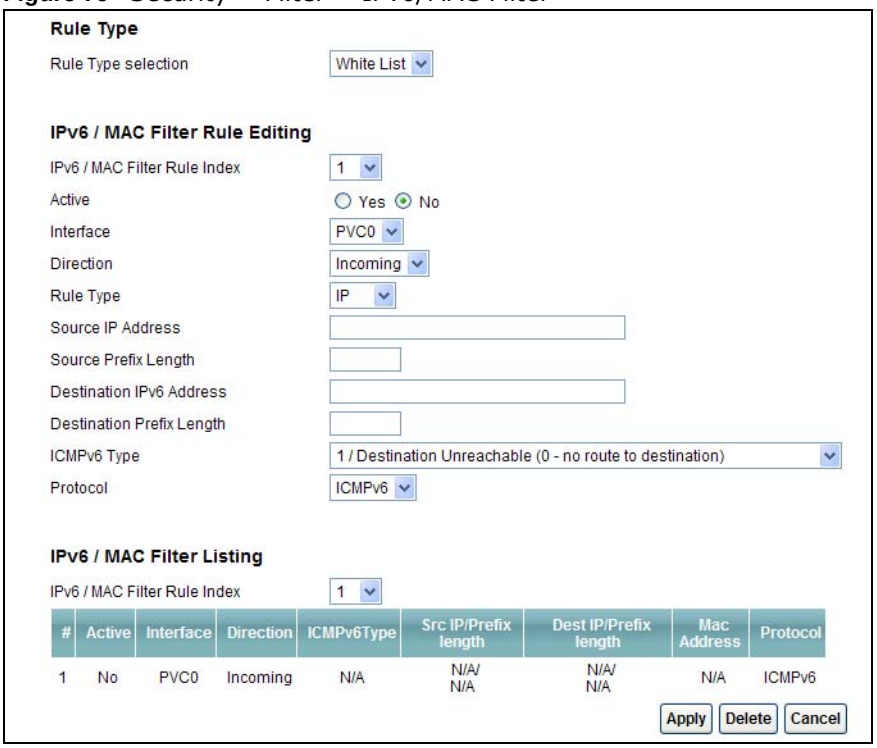
Table 58 Security > Filter > IP/MAC Filter (continued)

LABEL	DESCRIPTION
Subnet Mask	Enter the IP subnet mask for the destination IP address.
Port Number	Enter the destination port of the packets that you wish to filter. The range of this field is 0 to 65535. This field is ignored if it is 0.
Protocol	Select **ICMP**, **TCP** or **UDP** for the upper layer protocol.
IP / MAC Filter Listing	
IP / MAC Filter Rule Index	Select the index number of the filter set from the drop-down list box.
#	This is the index number of the rule in a filter set.
Active	This field shows whether the rule is activated.
Interface	This is the interface that the filter set applies to.
Direction	The filter set applies to this traffic direction.
Src IP/Mask	This is the source IP address and subnet mask when you select **IP** as the rule type.
Dest IP/Mask	This is the destination IP address and subnet mask.
Mac Address	This is the MAC address of the packets being filtered.
Src Port	This is the source port number.
Dest Port	This is the destination port number.
Protocol	This is the upper layer protocol.
Apply	Click this to apply your changes.
Delete	Click this to remove the filter rule.
Cancel	Click this to restore your previously saved settings.

14.3 IPv6/MAC Filter

Use this screen to create and apply IPv6 filters. Click **Security** > **Filter** > **IPv6 / MAC Filter**. The screen appears as shown.

Figure 79 Security > Filter > IPv6/MAC Filter



The following table describes the labels in this screen.

Table 59 Security > Filter > IPv6/MAC Filter

LABEL	DESCRIPTION
Rule Type	
Rule Type selection	Select **White List** to specify traffic to allow and **Black List** to specify traffic to block.
IPv6 / MAC Filter Rule Editing	
IPv6 / MAC Filter Rule Index	Select the index number of the filter rule.
Active	Use this field to enable or disable the filter rule.
Interface	Select the PVC to which to apply the filter.
Direction	Apply the filter to **Incoming** or **Outgoing** traffic direction.
Rule Type	Select **IP** or **MAC** type to configure the rule. Use the **IP** Filter to block or allow traffic by IPv6 addresses. Use the **MAC** Filter to block or allow traffic by MAC address.
Source IP Address	Enter the source IPv6 address of the packets you wish to filter. This field is ignored if it is ::.
Source Prefix Length	Enter the prefix length for the source IPv6 address
Destination IPv6 Address	Enter the destination IPv6 address of the packets you wish to filter. This field is ignored if it is ::.

Table 59 Security > Filter > IPv6/MAC Filter (continued)

LABEL	DESCRIPTION
Destination Prefix Length	Enter the prefix length for the destination IPv6 address.
ICMPv6 Type	Select the ICMPv6 message type to filter. The following message types can be selected: **1 / Destination Unreachable:** 0 **-** no route to destination; 1 - communication with destination administratively prohibited; 3 - address unreachable; 4 - port unreachable **2 / Packet Too Big** **3 / Time Exceeded:** 0 - hop limit exceeded in transit; 1 - fragment reassembly time exceeded **4 / Parameter Problem**: 0 - erroneous header field encountered; 1 - unrecognized Next Header type encountered; 2 - unrecognized IPv6 option encountered **128 / Echo Request** **129 / Echo Response** **130 / Listener Query -** Multicast listener query **131 / Listener Report -** Multicast listener report **132 / Listener Done** - Multicast listener done **143 / Listener Report v2 -** Multicast listener report v2 **133 / Router Solicitation** **134 / Router Advertisement** **135 / Neighbor Solicitation** **136 / Neighbor Advertisement** **137 / Redirect -** Redirect message
Protocol	This is the (upper layer) protocol that defines the service to which this rule applies. By default it is ICMPv6.
IPv6 / MAC Filter Listing	
IPv6 / MAC Filter Rule Index	Select the index number of the filter set from the drop-down list box.
#	This is the index number of the rule in a filter set.
Active	This field shows whether the rule is activated.
Interface	This is the interface that the rule applies to.
Direction	The filter set applies to this traffic direction.
ICMPv6 Type	The ICMPv6 message type to filter.
Src IP/PrefixLength	This displays the source IPv6 address and prefix length.
Dest IP/PrefixLength	This displays the destination IPv6 address and prefix length.
Mac Address	This is the MAC address of the packets being filtered.
Protocol	This is the (upper layer) protocol that defines the service to which this rule applies. By default it is ICMPv6.
Apply	Click this to apply your changes.
Delete	Click this to remove the filter rule.
Cancel	Click this to restore your previously saved settings.

15

Firewall

15.1 Overview

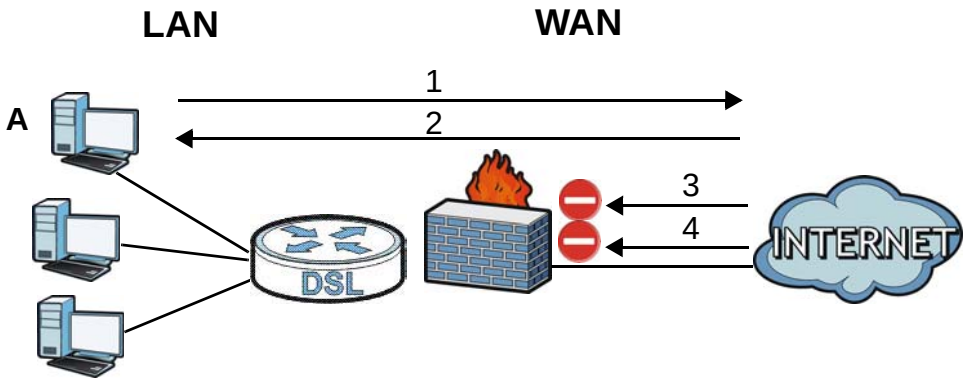
This chapter shows you how to enable the AMG1302/AMG1202-TSeries firewall. Use the firewall to protect your AMG1302/AMG1202-TSeries and network from attacks by hackers on the Internet and control access to it. The firewall:

- allows traffic that originates from your LAN computers to go to all other networks.
- blocks traffic that originates on other networks from going to the LAN.
- blocks SYN and port scanner attacks.

By default, the AMG1302/AMG1202-TSeries blocks DDOS, LAND and Ping of Death attacks whether the firewall is enabled or disabled.

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

Figure 80 Default Firewall Action



15.1.1 What You Can Do in the Firewall Screens

- Use the **General** screen (Section 15.2 on page 175) to select the firewall protection level on the AMG1302/AMG1202-TSeries.
- Use the **Default Action** screen (Section 15.3 on page 176) to set the default action that the firewall takes on packets that do not match any of the firewall rules.
- Use the **Rules** screen (Section 15.4 on page 178) to view the configured firewall rules and add, edit or remove a firewall rule.
- Use the **Dos** screen (Section 15.5 on page 184) to set the thresholds that the AMG1302/AMG1202-TSeries uses to determine when to start dropping sessions that do not become fully established (half-open sessions).

15.1.2 What You Need to Know About Firewall

SYN Attack

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

DoS

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 AMG1302/AMG1202-TSeries is pre-configured to automatically detect and thwart all known DoS attacks.

DDoS

A Distributed DoS (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 Local Area Network Denial (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.

RFC 4890 SPEC Traffic

RFC 4890 specifies the filtering policies for ICMPv6 messages. This is important for protecting against security threats including DoS, probing, redirection attacks and renumbering attacks that can be carried out through ICMPv6. Since ICMPv6 error messages are critical for establishing and maintaining communications, filtering policy focuses on ICMPv6 informational messages.

Anti-Probing

If an outside user attempts to probe an unsupported port on your AMG1302/AMG1202-TSeries, an ICMP response packet is automatically returned. This allows the outside user to know the AMG1302/AMG1202-TSeries exists. The AMG1302/AMG1202-TSeries supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your AMG1302/AMG1202-TSeries when unsupported ports are probed.

ICMP

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

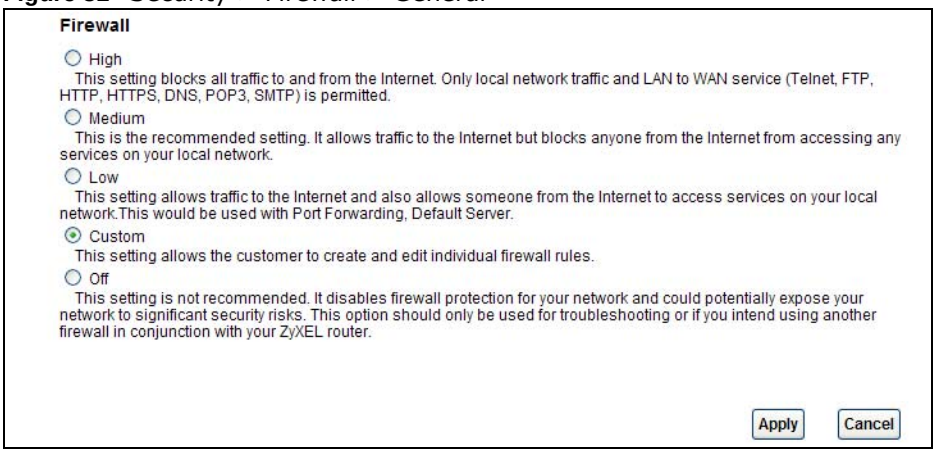
DoS Thresholds

For DoS attacks, the AMG1302/AMG1202-TSeries uses thresholds to determine when to drop sessions that do not become fully established. These thresholds apply globally to all sessions. You can use the default threshold values, or you can change them to values more suitable to your security requirements.

15.2 The Firewall General Screen

Use this screen to select the firewall protection level on the AMG1302/AMG1202-TSeries. Click **Security > Firewall > General** to display the following screen.

Figure 81 Security > Firewall > General



The following table describes the labels in this screen.

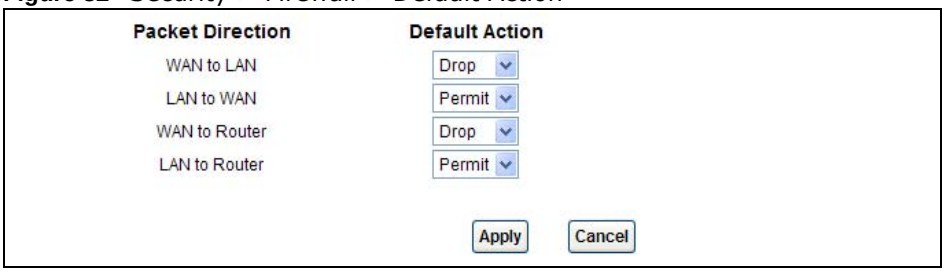
Table 60 Security > Firewall > General

LABEL	DESCRIPTION
High	This setting blocks all traffic to and from the Internet. Only local network traffic and LAN to WAN service (Telnet, FTP, HTTP, HTTPS, DNS, POP3, SMTP) is permitted.
Medium	This is the recommended setting. It allows traffic to the Internet but blocks anyone from the Internet from accessing any services on your local network.
Low	This setting allows traffic to the Internet and also allows someone from the Internet to access services on your local network. This would be used with Port Forwarding, Default Server.
Custom	This setting allows the customer to create and edit individual firewall rules. Firewall rules can be created in the Default Action screen (Section 15.3 on page 176) and Rules screen (Section 15.4 on page 178).
Off	This setting is not recommended. It disables firewall protection for your network and could potentially expose your network to significant security risks. This option should only be used for troubleshooting or if you intend using another firewall in conjunction with your ZyXEL router.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

15.3 The Default Action Screen

Use this screen to set the default action that the firewall takes on packets that do not match any of the firewall rules. Click **Security > Firewall > Default Action** to display the following screen.

Figure 82 Security > Firewall > Default Action



The following table describes the labels in this screen.

Table 61 Security > Firewall > Default Action

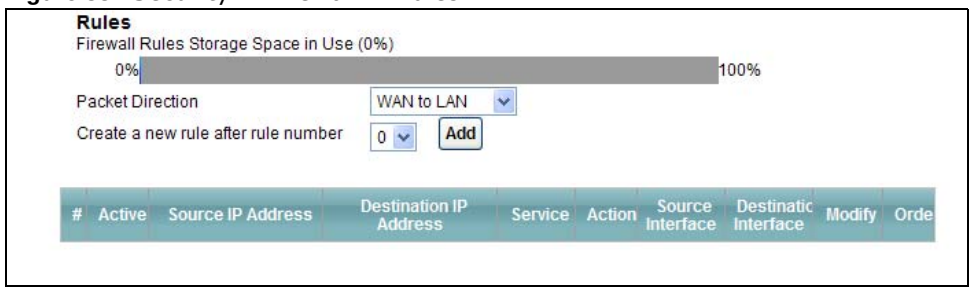
LABEL	DESCRIPTION
Packet Direction	This is the direction of travel of packets (**LAN to Router**, **LAN to WAN**, **WAN to Router**, **WAN to LAN**). Firewall rules are grouped based on the direction of travel of packets to which they apply. For example, **LAN to Router** means packets traveling from a computer/subnet on the LAN to the AMG1302/AMG1202-TSeries itself.
Default Action	Use the drop-down list boxes to select the default action that the firewall is to take on packets that are traveling in the selected direction and do not match any of the firewall rules. Select **Drop** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender. Select **Reject** to deny the packets and send a TCP reset packet (for a TCP packet) or an ICMP destination-unreachable message (for a UDP packet) to the sender. Select **Permit** to allow the passage of the packets.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

15.4 The Rules Screen

Click **Security > Firewall > Rules** to display the following screen. This screen displays a list of the configured firewall rules. Note the order in which the rules are listed.

Note: The firewall configuration screen shown in this section is specific to the following devices: P-The ordering of your rules is very important as rules are applied in turn.

Figure 83 Security > Firewall > Rules



The following table describes the labels in this screen.

Table 62 Security > Firewall > Rules

LABEL	DESCRIPTION
Firewall Rules Storage Space in Use	This read-only bar shows how much of the AMG1302/AMG1202-TSeries's memory for recording firewall rules it is currently using. When you are using 80% or less of the storage space, the bar is green. When the amount of space used is over 80%, the bar is red.
Packet Direction	Use the drop-down list box to select a direction of travel of packets for which you want to configure firewall rules.
Create a new rule after rule number	Select an index number and click **Add** to add a new firewall rule after the selected index number. For example, if you select "6", your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.
	The following read-only fields summarize the rules you have created that apply to traffic traveling in the selected packet direction. The firewall rules that you configure (summarized below) take priority over the general firewall action settings in the **General** screen.
#	This is your firewall rule number. The ordering of your rules is important as rules are applied in turn.
Active	This field displays whether a firewall is turned on or not. Select the check box to enable the rule. Clear the check box to disable the rule.
Source IP Address	This column displays the source addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Destination IP Address	This column displays the destination addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Service	This column displays the services to which this firewall rule applies. See Appendix F on page 305 for more information.
Action	This field displays whether the firewall silently discards packets (**Drop**), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (**Reject**) or allows the passage of packets (**Permit**).
Source Interface	This column displays the source interface to which this firewall rule applies. This is the interface through which the traffic entered the AMG1302/AMG1202-TSeries. Please note that a blank source interface is equivalent to **Any**.

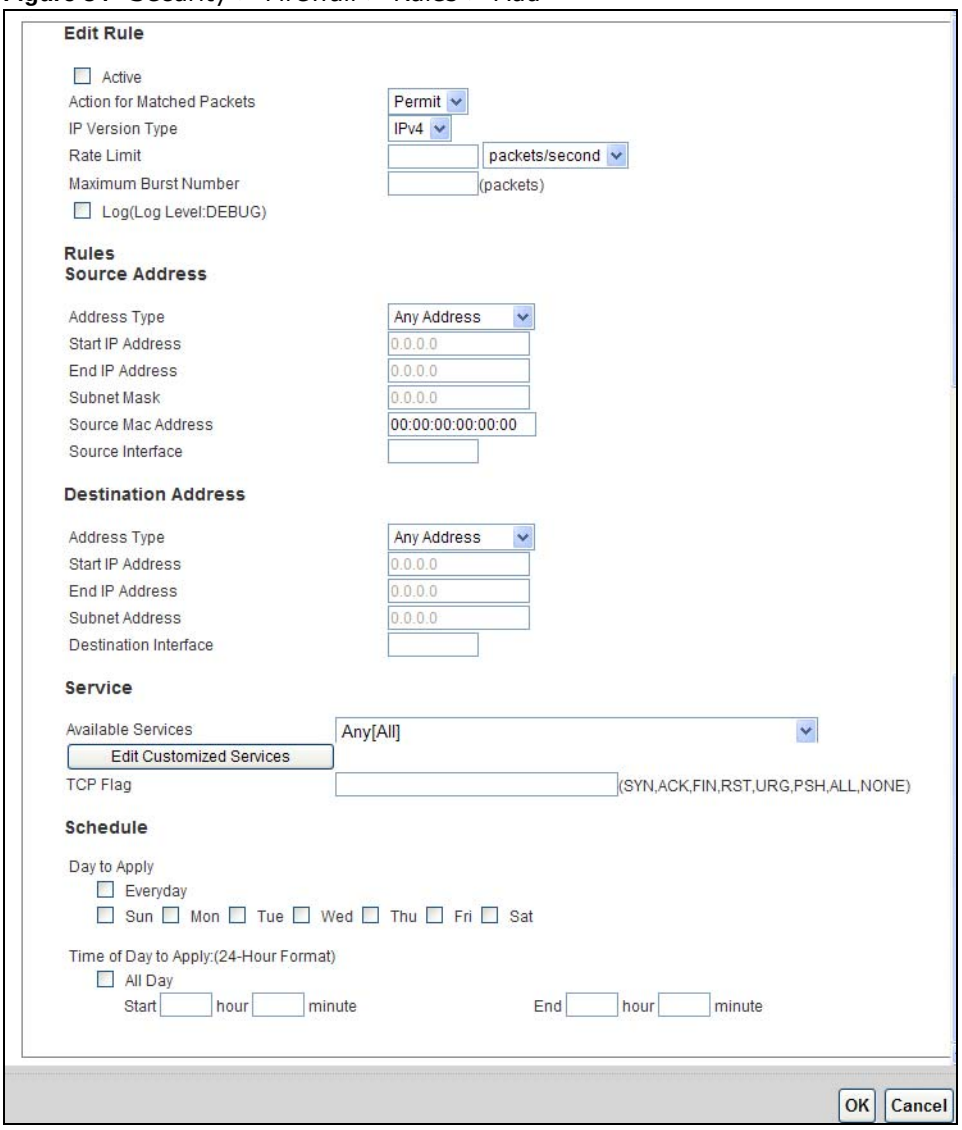
Table 62 Security > Firewall > Rules

LABEL	DESCRIPTION
Destination Interface	This column displays the destination interface to which this firewall rule applies. This is the interface through which the traffic is destined to leave the AMG1302/ AMG1202-TSeries. Please note that a blank source interface is equivalent to **Any**.
Modify	Click the **Edit** icon to go to the screen where you can edit the rule. Click the **Remove** icon to delete an existing firewall rule. A window displays asking you to confirm that you want to delete the firewall rule. Note that subsequent firewall rules move up by one when you take this action.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

15.4.1 The Rules Add Screen

Use this screen to configure firewall rules. In the **Rules** screen, select an index number and click **Add** or click a rule's **Edit** icon to display this screen and refer to the following table for information on the labels.

Figure 84 Security > Firewall > Rules > Add



The following table describes the labels in this screen.

Table 63 Security > Firewall > Rules > Add

LABEL	DESCRIPTION
Active	Select this option to enable this firewall rule.
Action for Matched Packets	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 (**Permit**) packets that match this rule.
IP Version Type	Select the IP version, **IPv4** or **IPv6**, to apply this firewall rule to.
Rate Limit	Set a maximum number of packets per second, minute, or hour to limit the throughput of traffic that matches this rule.
Maximum Burst Number	Set the maximum number of packets that can be sent at the peak rate.
Log	This field determines if a log for packets that match the rule is created or not.
Rules/Destination Address	

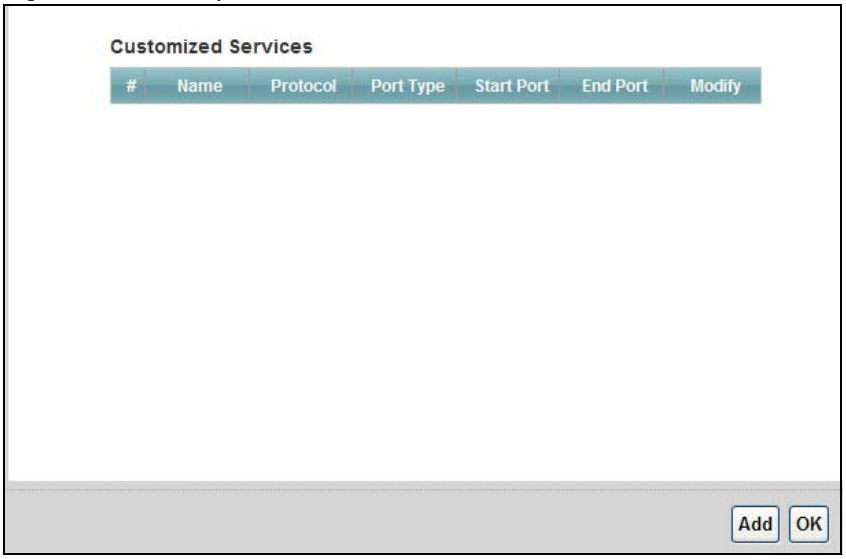
Table 63 Security > Firewall > Rules > Add

LABEL	DESCRIPTION
Address Type	Do you want your rule to apply to packets with a particular (single) IP, a range of IP addresses (for instance, 192.168.1.10 to 192.169.1.50), a subnet or any IP address? Select an option from the drop-down list box that includes: **Single Address**, **Range Address**, **Subnet Address** and **Any Address**.
Start IP Address	Enter the single IP address or the starting IP address in a range here.
End IP Address	Enter the ending IP address in a range here.
Subnet Mask	Enter the subnet mask here, if applicable.
Source Mac Address	Specify a source MAC address of traffic to which to apply this firewall rule applies. Please note that a blank source MAC address is equivalent to any.
Source Interface	Specify a source interface to which this firewall rule applies. This is the interface through which the traffic entered the AMG1302/AMG1202-TSeries. Please note that a blank source interface is equivalent to any.
Destination Interface	Specify a destination interface to which this firewall rule applies. This is the interface through which the traffic is destined to leave the AMG1302/AMG1202-TSeries. Please note that a blank source interface is equivalent to any.
Services	
Available Services	Please see Appendix F on page 305 for more information on services available. Select a service from the **Available Services** box.
Edit Customized Service	Click the **Edit Customized Service** button to bring up the screen that you use to configure a new custom service that is not in the predefined list of services.
TCP Flag	Specify any TCP flag bits the firewall rule is to check for.
Schedule	Select the days and time during which to apply the rule. Select **Everyday** and **All Day** to always apply the rule.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

15.4.2 Customized Services

Configure customized services and port numbers not predefined by the AMG1302/AMG1202-TSeries. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. See Appendix F on page 305 for some examples. Click the **Edit Customized Services** button while editing a firewall rule to configure a custom service port. This displays the following screen.

Figure 85 Security > Firewall > Rules: Edit: Edit Customized Services



The following table describes the labels in this screen.

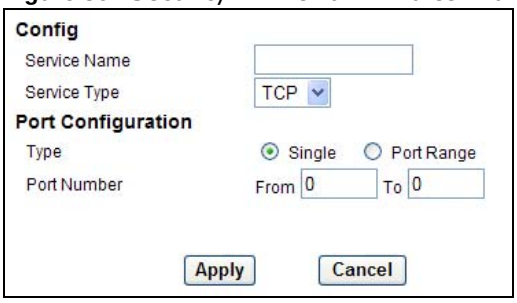
Table 64 Security > Firewall > Rules: Edit: Edit Customized Services

LABEL	DESCRIPTION
#	This is the number of your customized port.
Name	This is the name of your customized service.
Protocol	This shows the IP protocol (**TCP** or **UDP**) that defines your customized service.
Port Type	This is the port number or range that defines your customized service.
Start Port	This is a single port number or the starting port number of a range that defines your customized service.
End Port	This is a single port number or the ending port number of a range that defines your customized service.
Modify	Click this to edit a customized service.
Add	Click this to configure a customized service.
Back	Click this to return to the **Firewall Edit Rule** screen.

15.4.3 Customized Service Add/Edit

Use this screen to add a customized rule or edit an existing rule. Click **Add** or the **Edit** icon next to a rule number in the **Firewall Customized Services** screen to display the following screen.

Figure 86 Security > Firewall > Rules: Edit: Edit Customized Services: Add/Edit



The following table describes the labels in this screen.

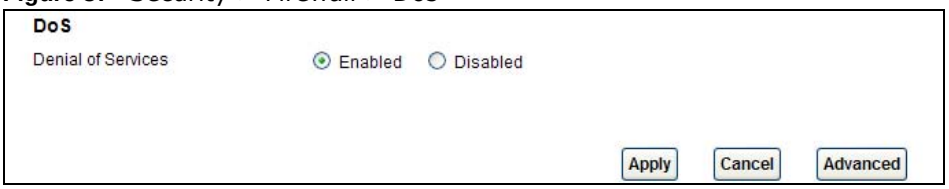
Table 65 Security > Firewall > Rules: Edit: Edit Customized Services: Add/Edit

LABEL	DESCRIPTION
Config	
Service Name	Type a unique name for your custom port.
Service Type	Choose the IP port (**TCP** or **UDP**) that defines your customized port from the drop down list box.
Port Configuration	
Type	Click **Single** to specify one port only or **Port Range** to specify a span of ports that define your customized service.
Port Number	Type a single port number or the range of port numbers that define your customized service.
Back	Click this to return to the previous screen without saving.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.
Delete	Click this to delete the current rule.

15.5 The DoS Screen

Use this screen to enable DoS protection. Click **Security > Firewall > Dos** to display the following screen.

Figure 87 Security > Firewall > Dos



The following table describes the labels in this screen.

Table 66 Security > Firewall > Dos

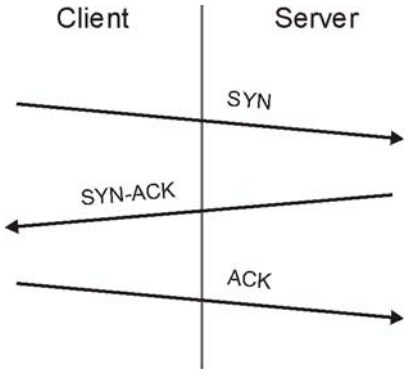
LABEL	DESCRIPTION
Denial of Services	Enable this to protect against DoS attacks. The AMG1302/AMG1202-TSeries will drop sessions that surpass maximum thresholds.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.
Advanced	Click this to go to a screen to specify maximum thresholds at which the AMG1302/ AMG1202-TSeries will start dropping sessions.

15.5.1 The DoS Advanced Screen

For DoS attacks, the AMG1302/AMG1202-TSeries uses thresholds to determine when to start dropping sessions that do not become fully established (half-open sessions). These thresholds apply globally to all sessions.

For TCP, half-open means that the session has not reached the established state-the TCP three-way handshake has not yet been completed. Under normal circumstances, the application that initiates a session sends a SYN (synchronize) packet to the receiving server. The receiver sends back an ACK (acknowledgment) packet and its own SYN, and then the initiator responds with an ACK (acknowledgment). After this handshake, a connection is established.

Figure 88 Three-Way Handshake



For UDP, half-open means that the firewall has detected no return traffic. An unusually high number (or arrival rate) of half-open sessions could indicate a DOS attack.

15.5.1.1 Threshold Values

If everything is working properly, you probably do not need to change the threshold settings as the default threshold values should work for most small offices. Tune these parameters when you believe the AMG1302/AMG1202-TSeries has been receiving DoS attacks that are not recorded in the logs or the logs show that the AMG1302/AMG1202-TSeries is classifying normal traffic as DoS attacks. Factors influencing choices for threshold values are:

1. The maximum number of opened sessions.
2. The minimum capacity of server backlog in your LAN network.
3. The CPU power of servers in your LAN network.
4. Network bandwidth.
5. Type of traffic for certain servers.

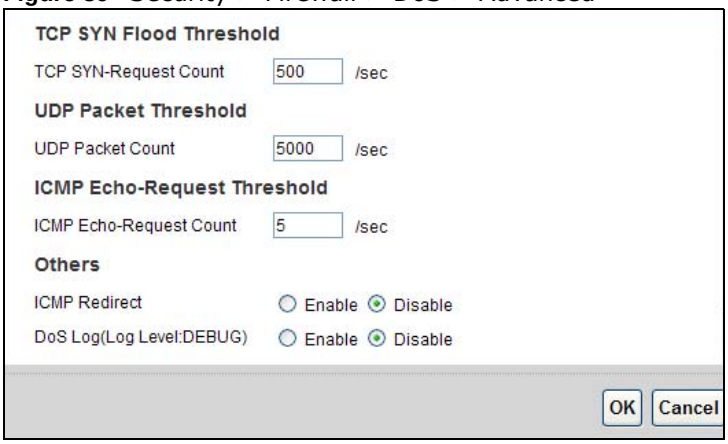
Reduce the threshold values if your network is slower than average for any of these factors (especially if you have servers that are slow or handle many tasks and are often busy).

- If you often use P2P applications such as file sharing with eMule or eDonkey, it's recommended that you increase the threshold values since lots of sessions will be established during a small period of time and the AMG1302/AMG1202-TSeries may classify them as DoS attacks.

15.5.2 Configuring Firewall Thresholds

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

Figure 89 Security > Firewall > DoS > Advanced



The following table describes the labels in this screen.

Table 67 Security > Firewall > DoS > Advanced

LABEL	DESCRIPTION
TCP SYN-Request Count	This is the rate of new TCP half-open sessions per second that causes the firewall to start deleting half-open sessions. When the rate of new connection attempts rises above this number, the AMG1302/AMG1202-TSeries deletes half-open sessions as required to accommodate new connection attempts.
UDP Packet Count	This is the rate of new UDP half-open sessions per second that causes the firewall to start deleting half-open sessions. When the rate of new connection attempts rises above this number, the AMG1302/AMG1202-TSeries deletes half-open sessions as required to accommodate new connection attempts.
ICMP Echo-Request Count	This is the rate of new ICMP Echo-Request half-open sessions per second that causes the firewall to start deleting half-open sessions. When the rate of new connection attempts rises above this number, the AMG1302/AMG1202-TSeries deletes half-open sessions as required to accommodate new connection attempts.
Back	Click this button to return to the previous screen.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

15.6 Firewall Technical Reference

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

15.6.1 Firewall Rules Overview

Your customized rules take precedence and override the AMG1302/AMG1202-TSeries's default settings. The AMG1302/AMG1202-TSeries checks the source IP address, destination IP address and IP protocol type of network traffic against the firewall rules (in the order you list them). When the traffic matches a rule, the AMG1302/AMG1202-TSeries takes the action specified in the rule.

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

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

Note: The LAN includes both the LAN port and the WLAN.

By default, the AMG1302/AMG1202-TSeries's stateful packet inspection allows packets traveling in the following directions:

- LAN to Router

  These rules specify which computers on the LAN can manage the AMG1302/AMG1202-TSeries (remote management).

Note: You can also configure the remote management settings to allow only a specific computer to manage the AMG1302/AMG1202-TSeries.

- LAN to WAN

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

By default, the AMG1302/AMG1202-TSeries's stateful packet inspection drops packets traveling in the following directions:

- WAN to LAN

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

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

- WAN to Router

  By default the AMG1302/AMG1202-TSeries stops computers on the WAN from managing the AMG1302/AMG1202-TSeries. You could configure one of these rules to allow a WAN computer to manage the AMG1302/AMG1202-TSeries.

Note: You also need to configure the remote management settings to allow a WAN computer to manage the AMG1302/AMG1202-TSeries.

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

For example, you may create rules to:

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

These custom rules work by comparing the source IP address, destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the AMG1302/AMG1202-TSeries's default rules.

15.6.2 Guidelines For Enhancing Security With Your Firewall

6 Change the default password via web configurator.

7 Think about access control before you connect to the network in any way.

8 Limit who can access your router.

9 Don't enable any local service (such as telnet or FTP) that you don't use. Any enabled service could present a potential security risk. A determined hacker might be able to find creative ways to misuse the enabled services to access the firewall or the network.

10 For local services that are enabled, protect against misuse. Protect by configuring the services to communicate only with specific peers, and protect by configuring rules to block packets for the services at specific interfaces.

11 Protect against IP spoofing by making sure the firewall is active.

12 Keep the firewall in a secured (locked) room.

15.6.3 Security Considerations

Note: Incorrectly configuring the firewall may block valid access or introduce security risks to the AMG1302/AMG1202-TSeries and your protected network. Use caution when creating or deleting firewall rules and test your rules after you configure them.

Consider these security ramifications before creating a rule:

1 Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC is blocked, are there users that require this service?

2 Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?

3 Does a rule that allows Internet users access to resources on the LAN create a security vulnerability? For example, if FTP ports (TCP 20, 21) are allowed from the Internet to the LAN, Internet users may be able to connect to computers with running FTP servers.

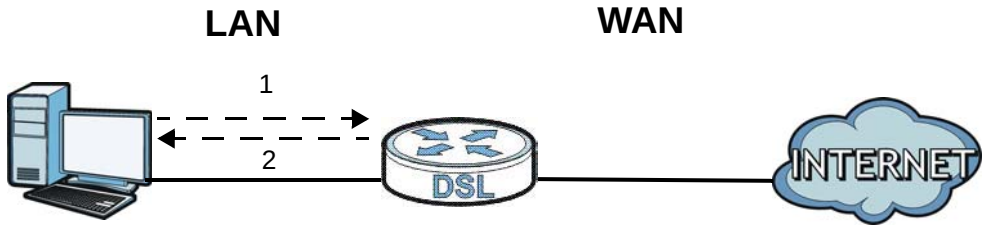
4 Does this rule conflict with any existing rules?

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

15.6.4 Triangle Route

When the firewall is on, your AMG1302/AMG1202-TSeries acts as a secure gateway between your LAN and the Internet. In an ideal network topology, all incoming and outgoing network traffic passes through the AMG1302/AMG1202-TSeries to protect your LAN against attacks.

Figure 90 Ideal Firewall Setup



15.6.4.1 The “Triangle Route” Problem

A traffic route is a path for sending or receiving data packets between two Ethernet devices. You may have more than one connection to the Internet (through one or more ISPs). If an alternate gateway is on the LAN (and its IP address is in the same subnet as the AMG1302/AMG1202-TSeries’s LAN IP address), the “triangle route” (also called asymmetrical route) problem may occur. The steps below describe the “triangle route” problem.

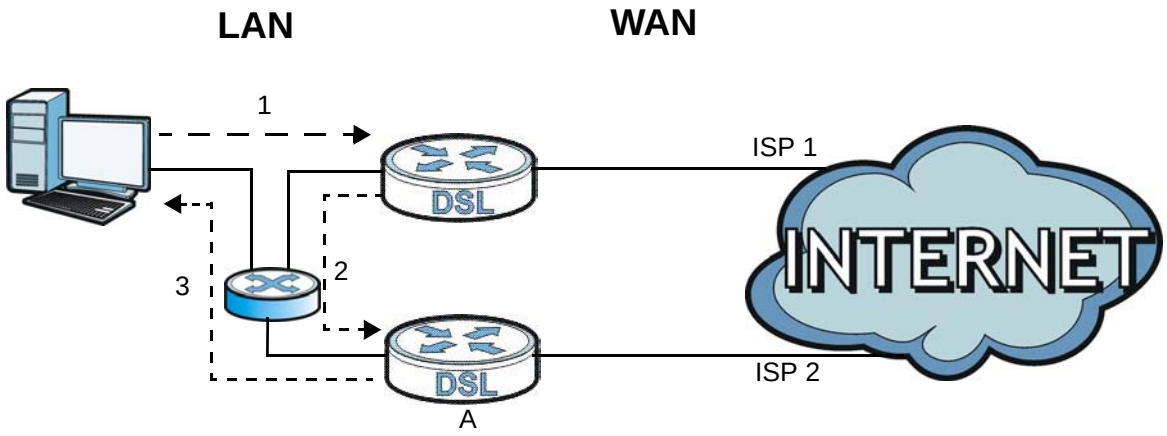
1 A computer on the LAN initiates a connection by sending out a SYN packet to a receiving server on the WAN.

2 The AMG1302/AMG1202-TSeries reroutes the SYN packet through Gateway **A** on the LAN to the WAN.

3 The reply from the WAN goes directly to the computer on the LAN without going through the AMG1302/AMG1202-TSeries.

As a result, the AMG1302/AMG1202-TSeries resets the connection, as the connection has not been acknowledged.

Figure 91 "Triangle Route" Problem



15.6.4.2 Solving the "Triangle Route" Problem

If you have the AMG1302/AMG1202-TSeries allow triangle route sessions, traffic from the WAN can go directly to a LAN computer without passing through the AMG1302/AMG1202-TSeries and its firewall protection.

Another solution is to use IP alias. IP alias allows you to partition your network into logical sections over the same Ethernet interface. Your AMG1302/AMG1202-TSeries supports up to three logical LAN interfaces with the AMG1302/AMG1202-TSeries being the gateway for each logical network.

It's like having multiple LAN networks that actually use the same physical cables and ports. By putting your LAN and Gateway **A** in different subnets, all returning network traffic must pass through the AMG1302/AMG1202-TSeries to your LAN. The following steps describe such a scenario.

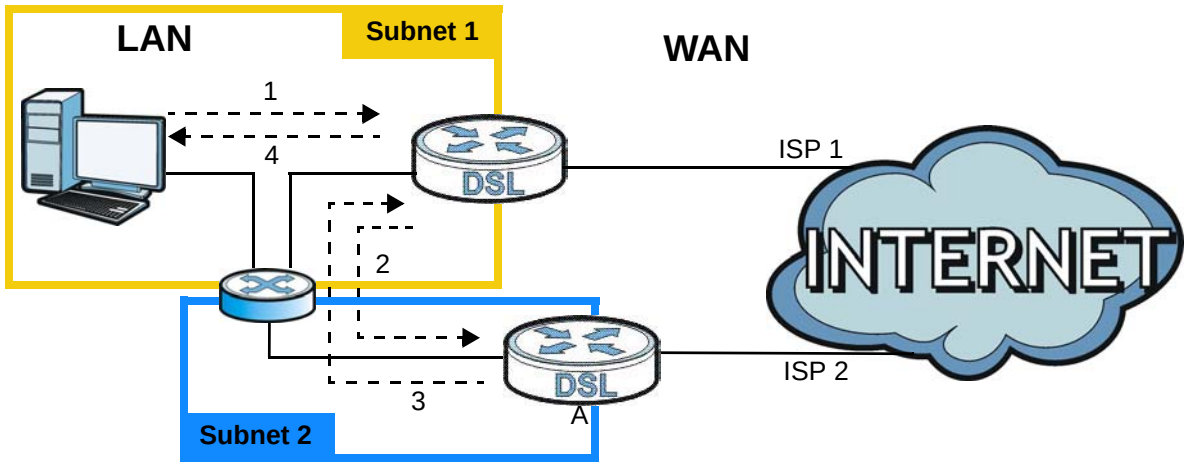
1 A computer on the LAN initiates a connection by sending a SYN packet to a receiving server on the WAN.

2 The AMG1302/AMG1202-TSeries reroutes the packet to Gateway A, which is in Subnet 2.

3 The reply from the WAN goes to the AMG1302/AMG1202-TSeries.

4 The AMG1302/AMG1202-TSeries then sends it to the computer on the LAN in Subnet 1.

Figure 92 IP Alias



16

Parental Control

16.1 Overview

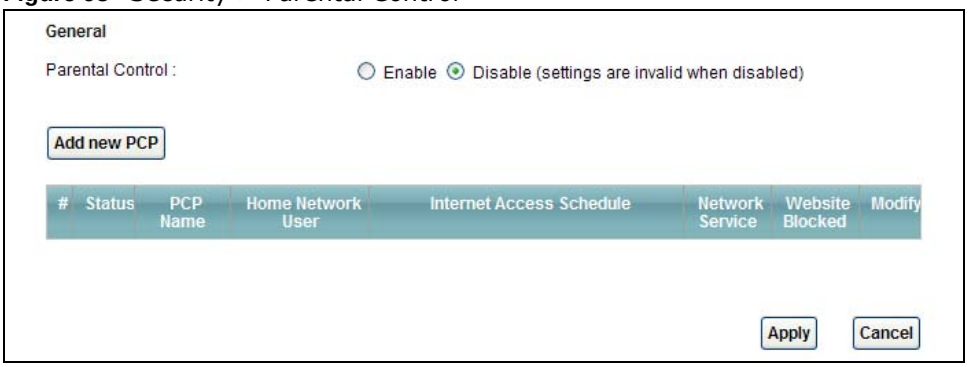
Parental control allows you to block web sites with the specific URL. You can also define time periods and days during which the AMG1302/AMG1202-TSeries performs parental control on a specific user.

16.2 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 93 Security > Parental Control



The following table describes the fields in this screen.

Table 68 Security > Parental Control

LABEL	DESCRIPTION
Parental Control	Use this field to activate or deactivate parental control.
Add new PCP	Click this to create a new parental control rule.
#	This is 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	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.

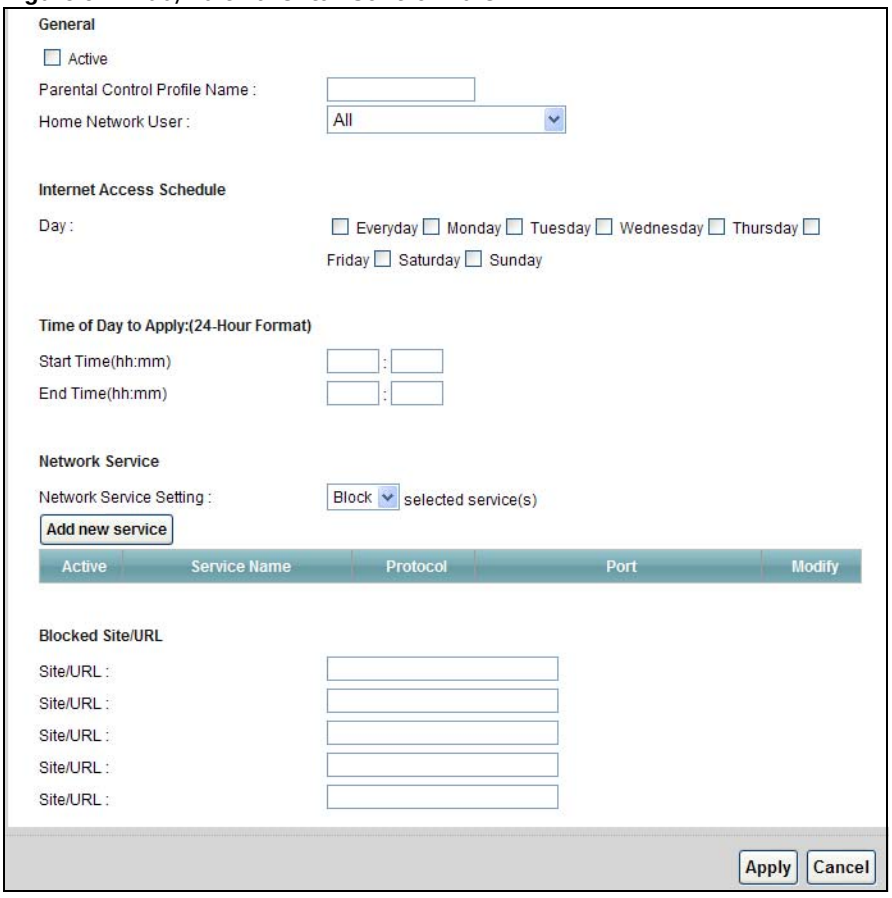
Table 68 Security > Parental Control (continued)

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.

16.2.1 Add/Edit Parental Control Rule

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 94 Add/Edit Parental Control Rule



The following table describes the fields in this screen.

Table 69 Parental Control: Add/Edit

LABEL	DESCRIPTION
General	
Active	Select the checkbox to activate this parental control rule.

Table 69 Parental Control: Add/Edit (continued)

LABEL	DESCRIPTION
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.
Internet Access Schedule	
Day	Select check boxes for the days that you want the AMG1302/AMG1202-TSeries to perform parental control.
Time of Day to Apply	Enter the starting and ending time that the LAN user is allowed access.
Network Service	
Network Service Setting	If you select **Block**, the AMG1302/AMG1202-TSeries prohibits the users from viewing the Web sites with the URLs listed below. If you select **Access**, the AMG1302/AMG1202-TSeries 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.
Active	This shows whether a configured service is activated or not.
Service Name	This shows the name of the rule.
Protocol	This shows the protocol of the rule.
Port	This shows 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.
Blocked Site/URL	Enter the URL of web sites or URL keywords to which the AMG1302/AMG1202-TSeries blocks access.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

17

Certificate

17.1 Overview

The AMG1302/AMG1202-TSeries 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.

17.1.1 What You Can Do in this Chapter

- Use the **Local Certificates** screen to view and import the AMG1302/AMG1202-TSeries's CA-signed certificates (Section 17.3 on page 195).
- The **Trusted CA** screen lets you save the certificates of trusted CAs to the AMG1302/AMG1202-TSeries (Section 17.4 on page 197).

17.2 What You Need to Know

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

Certification Authority

A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities. The certification authority uses its private key to sign certificates. Anyone can then use the certification authority's public key to verify the certificates. You can use the AMG1302/AMG1202-TSeries to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

Certificate File Format

The certification authority certificate that you want to import has to be in one of these file formats:

- PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses 64 ASCII characters to convert a binary X.509 certificate into a printable form.

17.3 Local Certificates

Use this screen to view the AMG1302/AMG1202-TSeries's summary list of certificates and certification requests. You can import the following certificates to your AMG1302/AMG1202-TSeries:

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

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

Figure 95 Security > Certificates > Local Certificates

The following table describes the labels in this screen.

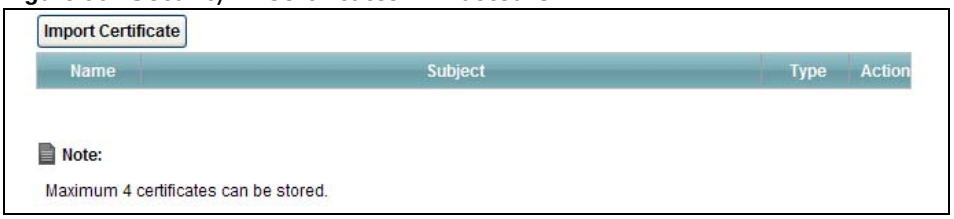
Table 70 Security > Certificates > Local Certificates

LABEL	DESCRIPTION
WebServer	Click **Browse...** to find the certificate file you want to upload.
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.
Cert	Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
SSH	Type in the location of the **SSH** certificate file you want to upload in this field or click **Browse** to find it.
Current File	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
Key Type	This field applies to the **SSH** certificate. This shows the file format of the current certificate.
Replace	Click this to replace the certificate(s) and save your changes back to the AMG1302/AMG1202-TSeries.
Reset	Click this to clear your settings.

17.4 The Trusted CA Screen

Use this screen to view a summary list of certificates of the certification authorities that you have set the AMG1302/AMG1202-TSeries to accept as trusted. The AMG1302/AMG1202-TSeries 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.
Click **Security > Certificates > Trusted CA** to open the **Trusted CA** screen.

Figure 96 Security > Certificates > Trusted CA



The following table describes the fields in this screen.

Table 71 Security > Certificates > Trusted CA

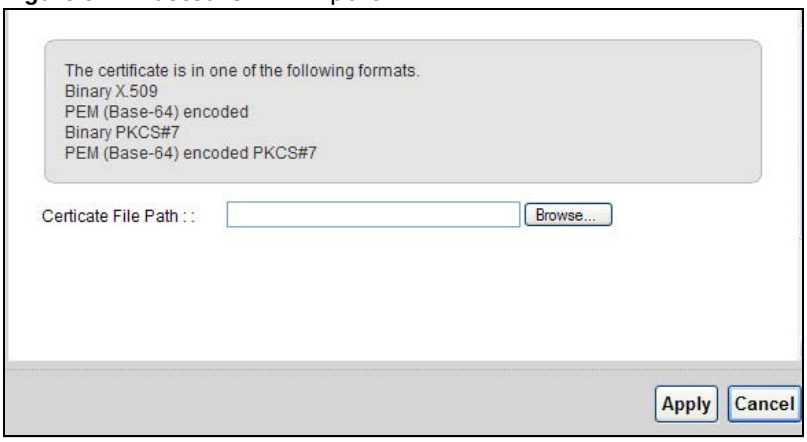
LABEL	DESCRIPTION
Import Certificate	Click this button to open a screen where you can save the certificate of a certification authority that you trust to the AMG1302/AMG1202-TSeries.
Name	This field displays the name used to identify this certificate.
Subject	This field displays information that identifies 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.
Action	Click **View** to open a screen with an in-depth list of information about the certificate. Click **Remove** to delete the certificate.

17.5 Trusted CA Import

Click **Import Certificate** in the **Trusted CA** screen to open the **Import Certificate** screen. You can save a trusted certification authority's certificate to the AMG1302/AMG1202-TSeries.

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

Figure 97 Trusted CA > Import



The following table describes the labels in this screen.

Table 72 Security > Certificates > Trusted CA > Import

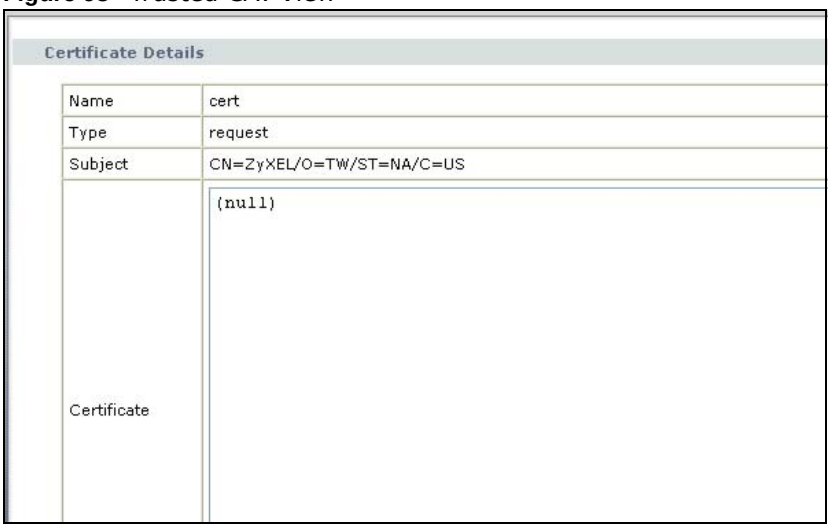
LABEL	DESCRIPTION
Certificate File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it.
Browse	Click **Browse** to find the certificate file you want to upload.
Apply	Click **Apply** to save the certificate on the AMG1302/AMG1202-TSeries.
Back	Click **Back** to return to the previous screen.

17.6 View Certificate

Use this screen to view in-depth information about the certification authority's certificate, change the certificate's name and set whether or not you want the AMG1302/AMG1202-TSeries to check a certification authority's list of revoked certificates before trusting a certificate issued by the certification authority.

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

Figure 98 Trusted CA: View



The following table describes the labels in this screen.

Table 73 Trusted CA: View

LABEL	DESCRIPTION
Certificate Name	This field displays the identifying name of this certificate. If you want to change the name, type up to 31 characters to identify this key certificate. You may use any character (not including spaces).
Certificate Detail	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses 64 ASCII characters to convert the binary certificate into a printable form. You can copy and paste the certificate into an 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 this to return to the previous screen.

18 Logs

18.1 Overview

The web configurator allows you to choose which categories of events and/or alerts to have the AMG1302/AMG1202-TSeries log and then display the logs or have the AMG1302/AMG1202-TSeries send them to an administrator (as e-mail) or to a syslog server.

18.1.1 What You Can Do in this Chapter

- Use the **Log** screen to see the system logs for the categories that you select (Section 18.2 on page 202).

18.1.2 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 74 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.
5	Notice: There is a normal but significant condition on the system.

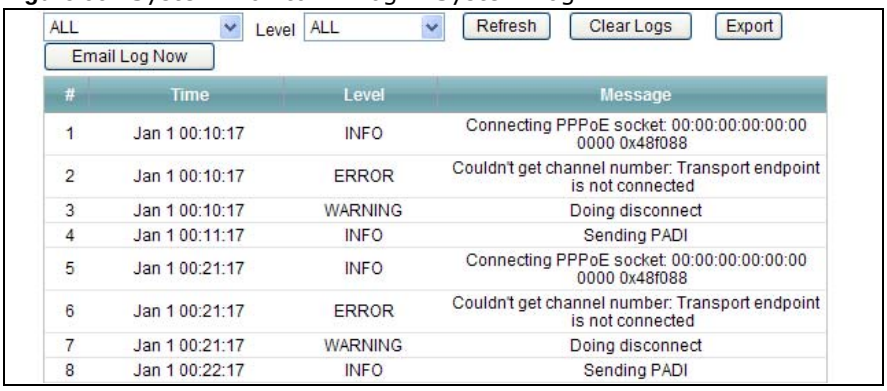
Table 74 Syslog Severity Levels

CODE	SEVERITY
6	Informational: The syslog contains an informational message.
7	Debug: The message is intended for debug-level purposes.

18.2 The System Log Screen

Click **System Monitor > Log** to open the **System Log** screen. Use the **System Log** screen to see the system logs for the categories that you select in the upper left drop-down list box.

Figure 99 System Monitor > Log > System Log



The following table describes the fields in this screen.

Table 75 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 AMG1302/AMG1202-TSeries searches through all logs of that severity or higher.
Refresh	Click this to renew the log screen.
Clear Logs	Click this to delete all the logs.
Export	Click this to download logs to a file on your computer.
Email Log Now	Click this to send logs to a specified e-mail address.
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Level	This field displays the severity level of the logs that the device is to send to this syslog server.
Message	This field states the reason for the log.

19

Traffic Status

19.1 Overview

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

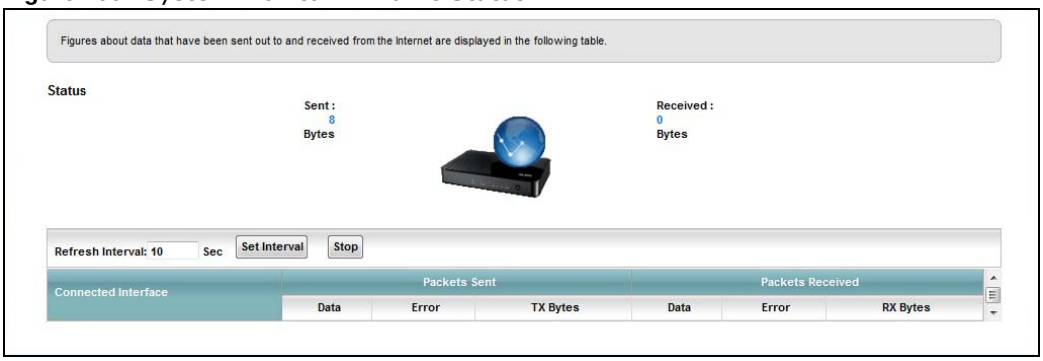
19.1.1 What You Can Do in this Chapter

- Use the **WAN** screen to view the WAN traffic statistics (Section 19.2 on page 203).
- Use the **LAN** screen to view the LAN traffic statistics (Section 19.3 on page 204).
- Use the **NAT** screen to view the NAT status of the AMG1302/AMG1202-TSeries's client(s) (Section 19.4 on page 205).

19.2 The WAN Status Screen

Click **System Monitor > Traffic Status** to open the **WAN** screen. You can view the WAN traffic statistics in this screen.

Figure 100 System Monitor > Traffic Status > WAN



The following table describes the fields in this screen.

Table 76 System Monitor > Traffic Status > WAN

LABEL	DESCRIPTION
Status	This shows the number of bytes received and sent through the WAN interface of the AMG1302/AMG1202-TSeries.
Refresh Interval	Select how often you want the AMG1302/AMG1202-TSeries to update this screen from the drop-down list box.
Connected Interface	This shows the name of the WAN interface that is currently connected.

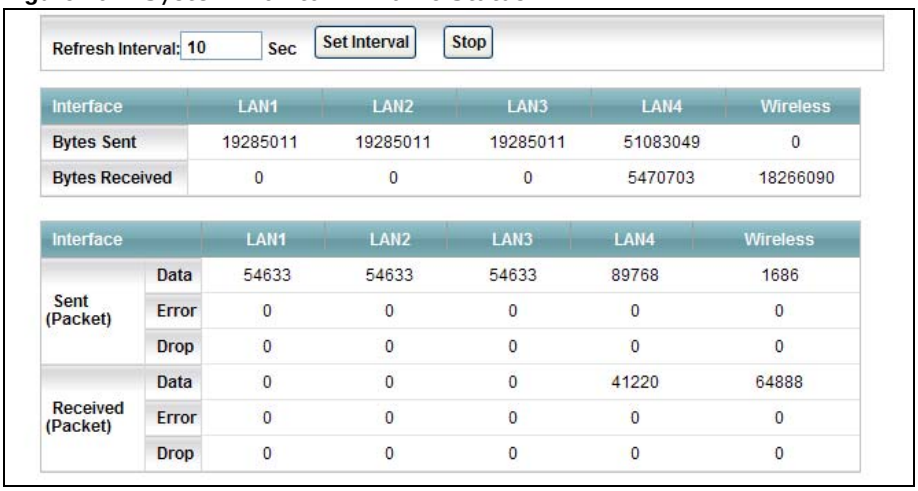
Table 76 System Monitor > Traffic Status > WAN (continued)

LABEL	DESCRIPTION
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.

19.3 The LAN Status Screen

Click **System Monitor > Traffic Status > LAN** to open the following screen. You can view the LAN traffic statistics in this screen.

Figure 101 System Monitor > Traffic Status > LAN



The following table describes the fields in this screen.

Table 77 System Monitor > Traffic Status > LAN

LABEL	DESCRIPTION
Refresh Interval(s)	Select how often you want the AMG1302/AMG1202-TSeries to update this screen from the drop-down list box.
Set Interval	Click this button to apply the new poll interval you entered in the **Refresh Interval** field.
Stop	Click **Stop** to stop refreshing statistics.
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 interface.
Sent (Packet)	

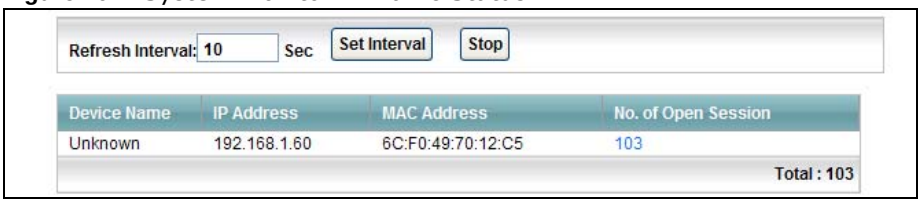
Table 77 System Monitor > Traffic Status > LAN (continued)

LABEL	DESCRIPTION
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 (Packet)	
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.

19.4 The NAT Screen

Click **System Monitor > Traffic Status > NAT** to open the following screen. You can view the NAT status of the AMG1302/AMG1202-TSeries's client(s) in this screen.

Figure 102 System Monitor > Traffic Status > NAT



The following table describes the fields in this screen.

Table 78 System Monitor > Traffic Status > NAT

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the AMG1302/AMG1202-TSeries to update this screen from the drop-down list box.
Set Interval	Click this button to apply the new poll interval you entered in the **Refresh Interval** field.
Stop	Click **Stop** to stop refreshing statistics.
Device Name	This shows the name of the client.
IP Address	This shows the IP address of the client.
MAC Address	This shows the MAC address of the client.
No. of Open Session	This shows the number of NAT sessions used by the client.

20

User Account

20.1 Overview

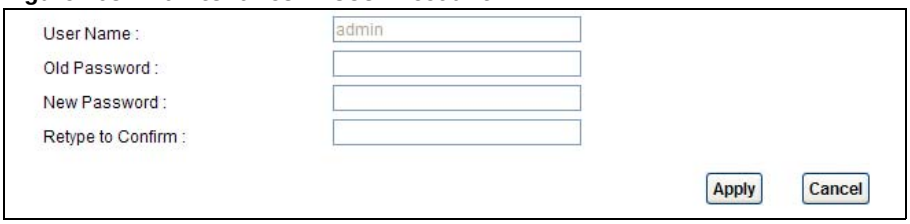
You can configure system password for different user accounts in the **User Account** screen.

20.2 The User Account Screen

Use the **User Account** screen to configure system password.

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

Figure 103 Maintenance > User Account



The following table describes the labels in this screen.

Table 79 Maintenance > User Account

LABEL	DESCRIPTION
User Name	You can configure the password for the **Power User** and **Admin** accounts.
Old Password	Type the default password or the existing password you use to access the system in this field.
New Password	Type your new system password (up to 30 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 AMG1302/AMG1202-TSeries.
Retype to Confirm	Type the new password again for confirmation.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

21

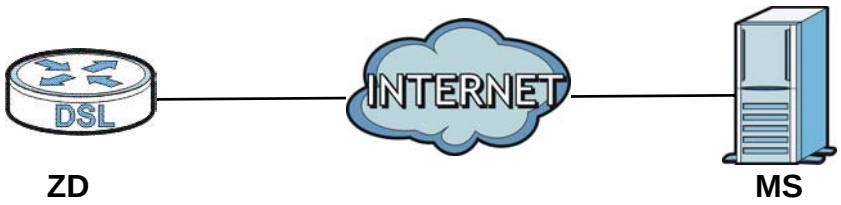
TR-069 Client

21.1 Overview

The AMG1302/AMG1202-TSeries supports TR-069 Amendment 1 (CPE WAN Management Protocol Release 2.0) and TR-069 Amendment 2 (CPE WAN Management Protocol v1.1, Release 3.0).

TR-069 is a protocol that defines how your AMG1302/AMG1202-TSeries (**ZD**) can be managed via a management server (**MS**) such as ZyXEL's Vantage Access.

Figure 104 LAN and WAN



An administrator can use a management server to remotely set up the AMG1302/AMG1202-TSeries, modify settings, perform firmware upgrades as well as monitor and diagnose the AMG1302/AMG1202-TSeries.

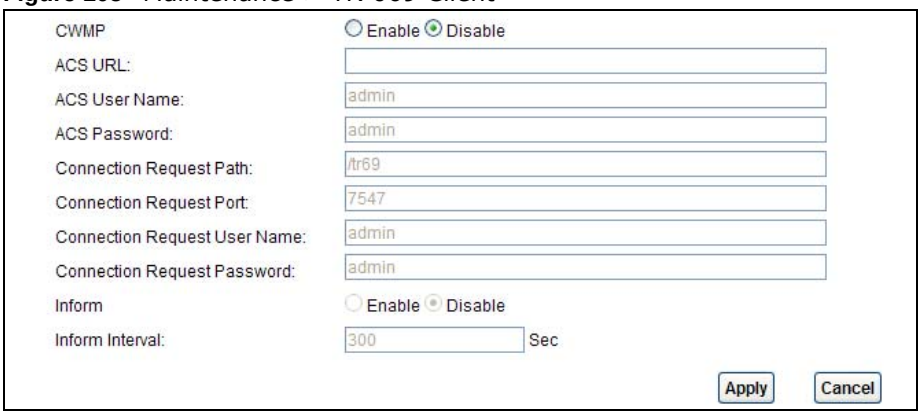
In order to use CWMP, you need to configure the following steps:

1. Activate CWMP
2. Specify the URL, username and password.
3. Activate periodic inform and specify an interval value.

21.2 The TR-069 Client Screen

Use this screen to configure your AMG1302/AMG1202-TSeries to be managed by a management server. Click **Maintenance** > **TR-069 Client** to display the following screen.

Figure 105 Maintenance > TR-069 Client



The following table describes the fields in this screen.

Table 80 Maintenance > TR-069 Client

LINK	DESCRIPTION
CWMP	Select **Enable** to allow the AMG1302/AMG1202-TSeries to be managed by a management server or select **Disable** to not allow the AMG1302/AMG1202-TSeries to be managed by a management server.
ACS URL	Type the IP address or domain name of the management server. If the AMG1302/AMG1202-TSeries is behind a NAT router that assigns it a private IP address, you will have to configure a NAT port forwarding rule on the NAT router.
ACS User Name	The user name is used to authenticate the AMG1302/AMG1202-TSeries when making a connection to the management server. This user name on the management server and the AMG1302/AMG1202-TSeries must be the same. Type a user name of up to 255 printable characters found on an English-language keyboard. Spaces and characters such as @#$%^&*()_+ are allowed.
ACS Password	The password is used to authenticate the AMG1302/AMG1202-TSeries when making a connection to the management server. This password on the management server and the AMG1302/AMG1202-TSeries must be the same. Type a password of up to 255 printable characters found on an English-language keyboard.
Connection Request Path	Type the IP address or domain name of the AMG1302/AMG1202-TSeries. The management server uses this path to verify the AMG1302/AMG1202-TSeries.
Connection Request Port	The default port for access to the AMG1302/AMG1202-TSeries from the management server is port 7547. If you change it, make sure it does not conflict with another port on your network and it is recommended to use a port number above 1024 (not a commonly used port). The management server should use this port to connect to the AMG1302/AMG1202-TSeries. You may need to alter your NAT port forwarding rules if they were already configured.
Connection Request UserName	The user name is used to authenticate the management server when connecting to the AMG1302/AMG1202-TSeries. Type a user name of up to 255 printable characters found on an English-language keyboard. Spaces and characters such as @#$%^&*()_+ are allowed.
Connection Request Password	The password is used to authenticate the management server when connecting to the AMG1302/AMG1202-TSeries. Type a password of up to 255 printable characters found on an English-language keyboard. Spaces are not allowed.
Inform	Select **Enable** to have the AMG1302/AMG1202-TSeries periodically send information to the management server (recommended if CWMP is enabled) or select **Disable** to not have the AMG1302/AMG1202-TSeries periodically send information to the management server
Inform Interval	The interval is the duration in seconds for which the AMG1302/AMG1202-TSeries must attempt to connect with the management server to send information and check for configuration updates. Enter a value between 1 and 86400 seconds.

Table 80 Maintenance > TR-069 Client (continued)

LINK	DESCRIPTION
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

22

System Settings

22.1 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.

22.1.1 What You Can Do in the System Settings Screens

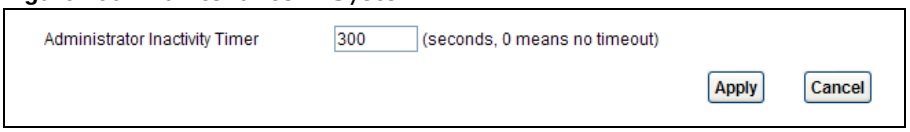
- Use the **System** screen (Section 22.2 on page 213) to configure system settings.
- Use the **Time Setting** screen (Section 22.3 on page 213) to set the system time.

22.2 The System Screen

Use this screen to configure system admin password.

Click **Maintenance > System** to open the screen as shown.

Figure 106 Maintenance > System



The following table describes the labels in this screen.

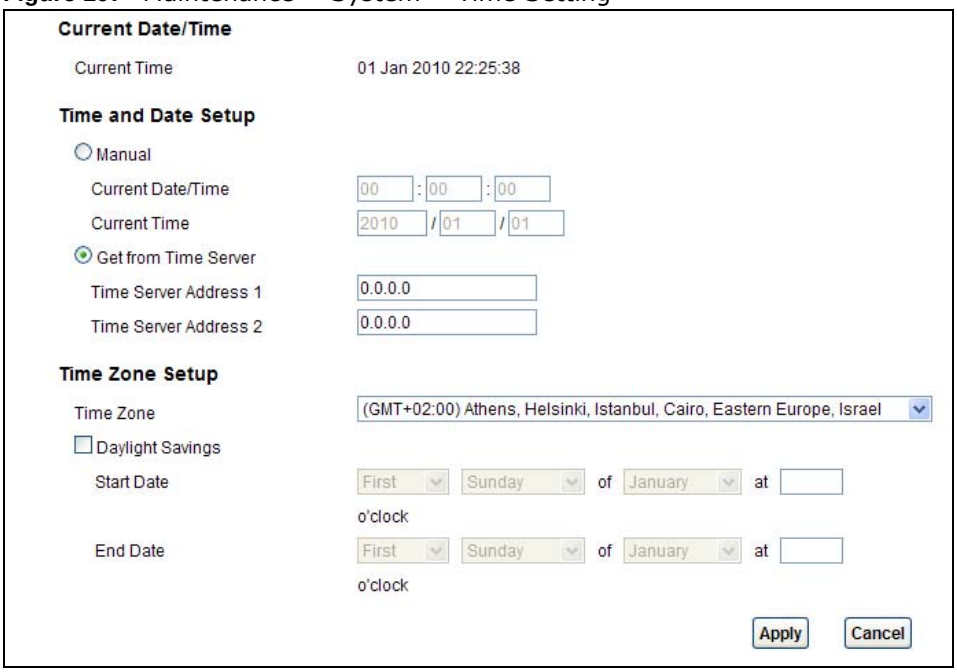
Table 81 Maintenance > System

LABEL	DESCRIPTION
Administrator Inactivity Timer	Type how many seconds a management session (either via the web configurator) can be left idle before the session times out and you have to log in again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

22.3 The Time Screen

Use this screen to configure the AMG1302/AMG1202-TSeries's time based on your local time zone. To change your AMG1302/AMG1202-TSeries's time and date, click **Maintenance > System > Time Setting**. The screen appears as shown.

Figure 107 Maintenance > System > Time Setting



The following table describes the fields in this screen.

Table 82 Maintenance > System > Time

LABEL	DESCRIPTION
Current Date/Time	
Current Time	This field displays the time and date of your AMG1302/AMG1202-TSeries. Each time you reload this page, the AMG1302/AMG1202-TSeries synchronizes the time and date with the time server.
Time and Date Setup	
Manual	Select this radio button to enter the time and date manually. If you configure a new time and date, Time Zone and Daylight Saving at the same time, the new time and date you entered has priority and the Time Zone and Daylight Saving settings do not affect it.
Current Date/Time	This field displays the last updated time (in hh:mm:ss format) from the time server or the last time configured manually. When you set **Time and Date Setup** to **Manual**, enter the new time in this field and then click **Apply**.
Current Time	This field displays the last updated date (in yyyy/mm/dd format) from the time server or the last date configured manually. When you set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**.
Get from Time Server	Select this radio button to have the AMG1302/AMG1202-TSeries get the time and date from the time server you specified below.
Time Server Address 1/2	Enter the IP address or URL (up to 20 extended ASCII characters in length) of your time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone Setup	
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).

Table 82 Maintenance > System > Time (continued)

LABEL	DESCRIPTION
Daylight Savings	Daylight saving 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. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Enable Daylight Saving**. The **o'clock** 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 you would select **Second**, **Sunday**, **March** and type 2 in the **o'clock** 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 select **Last**, **Sunday**, **March**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Enable Daylight Saving**. The **o'clock** 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 select **First**, **Sunday**, **November** and type 2 in the **o'clock** 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 select **Last**, **Sunday**, **October**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

23

Firmware Upgrade

23.1 Overview

This chapter explains how to upload new firmware to your AMG1302/AMG1202-TSeries. You can download new firmware releases from your nearest ZyXEL FTP site (or www.zyxel.com) to use to upgrade your device's performance.

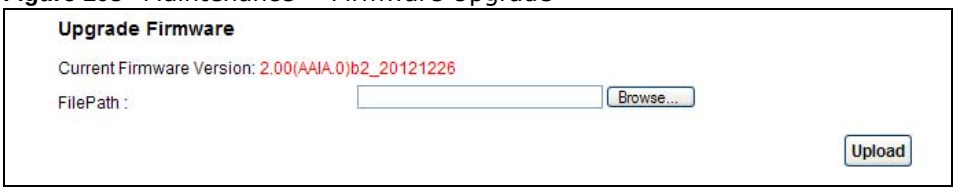
Only use firmware for your device's specific model. Refer to the label on the bottom of your AMG1302/AMG1202-TSeries.

23.2 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 AMG1302/AMG1202-TSeries while firmware upload is in progress!

Figure 108 Maintenance > Firmware Upgrade



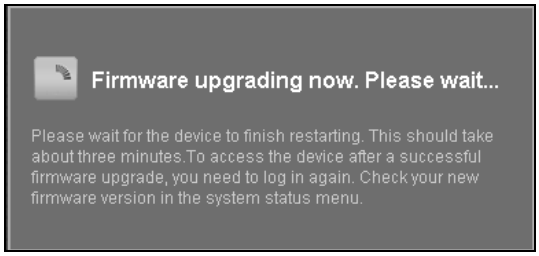
The following table describes the labels in this screen.

Table 83 Maintenance > Firmware Upgrade

LABEL	DESCRIPTION
Current Firmware Version	This is the present Firmware version.
File Path	Type in the location of the file you want to upload in this field or click **Browse...** to find it.
Browse...	Click this to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click this to begin the upload process. This process may take up to two minutes.

After you see the firmware updating screen, wait two minutes before logging into the AMG1302/AMG1202-TSeries again.

Figure 109 Firmware Uploading



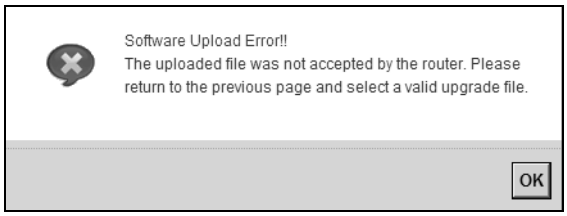
The AMG1302/AMG1202-TSeries automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 110 Network Temporarily Disconnected

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

If the upload was not successful, an error screen will appear. Click **OK** to go back to the **Firmware Upgrade** screen.

Figure 111 Error Message



24

Backup/Restore

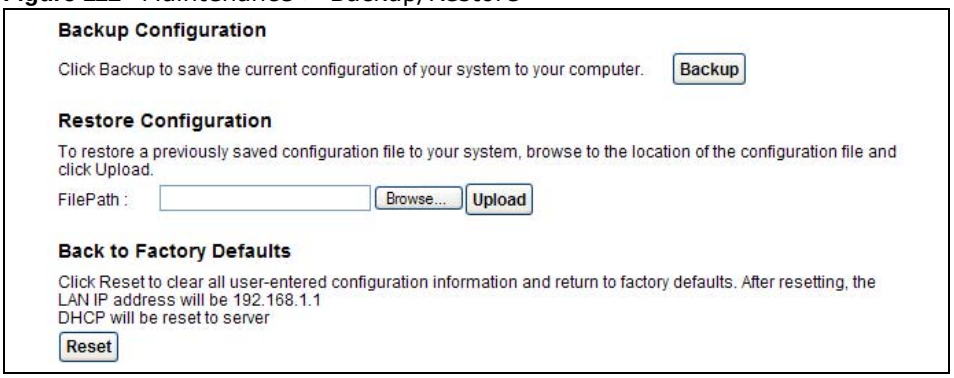
24.1 Overview

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

24.2 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 112 Maintenance > Backup/Restore



Backup Configuration

Backup Configuration allows you to back up (save) the AMG1302/AMG1202-TSeries's current configuration to a file on your computer. Once your AMG1302/AMG1202-TSeries 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 AMG1302/AMG1202-TSeries'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 AMG1302/AMG1202-TSeries.

Table 84 Restore Configuration

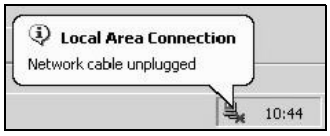
LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse...** to find it.
Browse...	Click this to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click this to begin the upload process.
Reset	Click this to reset your device settings back to the factory default.

Do not turn off the AMG1302/AMG1202-TSeries while configuration file upload is in progress.

After the AMG1302/AMG1202-TSeries configuration has been restored successfully, the login screen appears. Login again to restart the AMG1302/AMG1202-TSeries.

The AMG1302/AMG1202-TSeries automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 113 Network Temporarily Disconnected



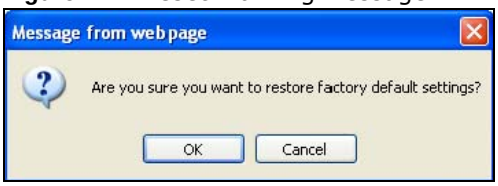
If you restore the default configuration, you may need to change the IP address of your computer to be in the same subnet as that of the default device IP address (192.168.1.1). See Appendix A on page 245 for details on how to set up your computer's IP address.

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

Reset to Factory Defaults

Click the **Reset** button to clear all user-entered configuration information and return the AMG1302/AMG1202-TSeries to its factory defaults. The following warning screen appears.

Figure 114 Reset Warning Message



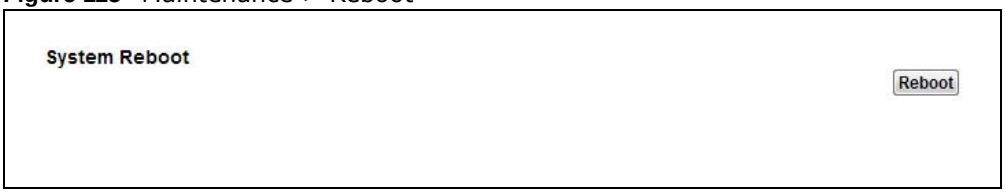
Wait until the AMG1302/AMG1202-TSeries's login screen appears. You can also press the **RESET** button on the rear panel to reset the factory defaults of your AMG1302/AMG1202-TSeries. Refer to Section 1.7 on page 19 for more information on the **RESET** button.

24.3 The Reboot Screen

System restart allows you to reboot the AMG1302/AMG1202-TSeries remotely without turning the power off. You may need to do this if the AMG1302/AMG1202-TSeries hangs, for example.

Click **Maintenance > Reboot**. Click the **Reboot** button to have the AMG1302/AMG1202-TSeries reboot. This does not affect the AMG1302/AMG1202-TSeries's configuration.

Figure 115 Maintenance > Reboot



25

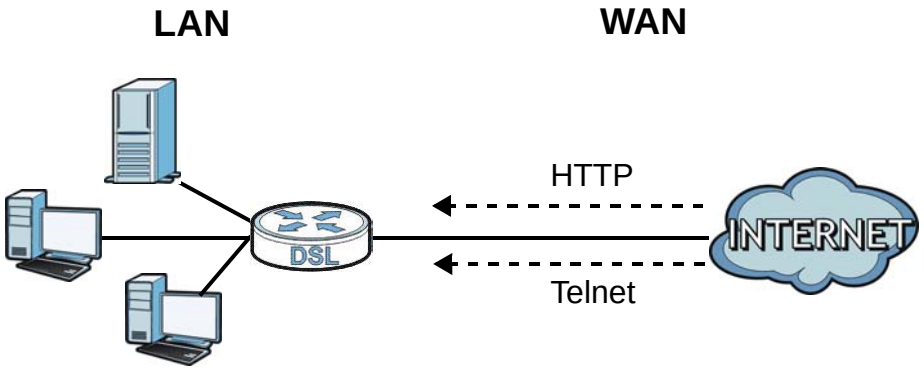
Remote Management

25.1 Overview

Remote management allows you to determine which services/protocols can access which AMG1302/AMG1202-TSeries interface (if any) from which computers.

The following figure shows remote management of the AMG1302/AMG1202-TSeries coming in from the WAN.

Figure 116 Remote Management From the WAN



Note: When you configure remote management to allow management from the WAN, you still need to configure a IP filter rule to allow access.

You may manage your AMG1302/AMG1202-TSeries from a remote location via:

- Internet (WAN only)
- LAN only
- LAN and WAN
- None (Disable)

To disable remote management of a service, select **Disable** in the corresponding **Service Access** field.

25.1.1 What You Can Do in the Remote Management Screens

- Use the **WWW** screen (Section 25.2 on page 224) to configure through which interface(s) and from which IP address(es) users can use HTTP to manage the AMG1302/AMG1202-TSeries.
- Use the **Telnet** screen (Section 25.3 on page 226) to configure through which interface(s) and from which IP address(es) users can use Telnet to manage the AMG1302/AMG1202-TSeries.
- Use the **FTP** screen (Section 25.4 on page 226) to configure through which interface(s) and from which IP address(es) users can use FTP to access the AMG1302/AMG1202-TSeries.

- Your AMG1302/AMG1202-TSeries can act as an SNMP agent, which allows a manager station to manage and monitor the AMG1302/AMG1202-TSeries through the network. Use the **SNMP** screen (see Section 25.5 on page 227) to configure through which interface(s) and from which IP address(es) users can use SNMP to access the AMG1302/AMG1202-TSeries.
- Use the **DNS** screen (Section 25.6 on page 230) to configure through which interface(s) and from which IP address(es) users can send DNS queries to the AMG1302/AMG1202-TSeries.
- Use the **ICMP** screen (Section 25.7 on page 230) to set whether or not your AMG1302/AMG1202-TSeries will respond to pings and probes for services that you have not made available.
- Use the **SSH** screen (Section 25.8 on page 231) to configure through which interface(s) and from which IP address(es) users can use SSH to manage the AMG1302/AMG1202-TSeries.

25.1.2 What You Need to Know About Remote Management

Remote Management Limitations

Remote management does not work when:

- You have not enabled that service on the interface in the corresponding remote management screen.
- You have disabled that service in one of the remote management screens.
- The IP address in the **Secured Client IP Address** field does not match the client IP address. If it does not match, the AMG1302/AMG1202-TSeries will disconnect the session immediately.
- There is a firewall rule that blocks it.

Remote Management and NAT

When NAT is enabled:

- Use the AMG1302/AMG1202-TSeries's WAN IP address when configuring from the WAN.
- Use the AMG1302/AMG1202-TSeries's LAN IP address when configuring from the LAN.

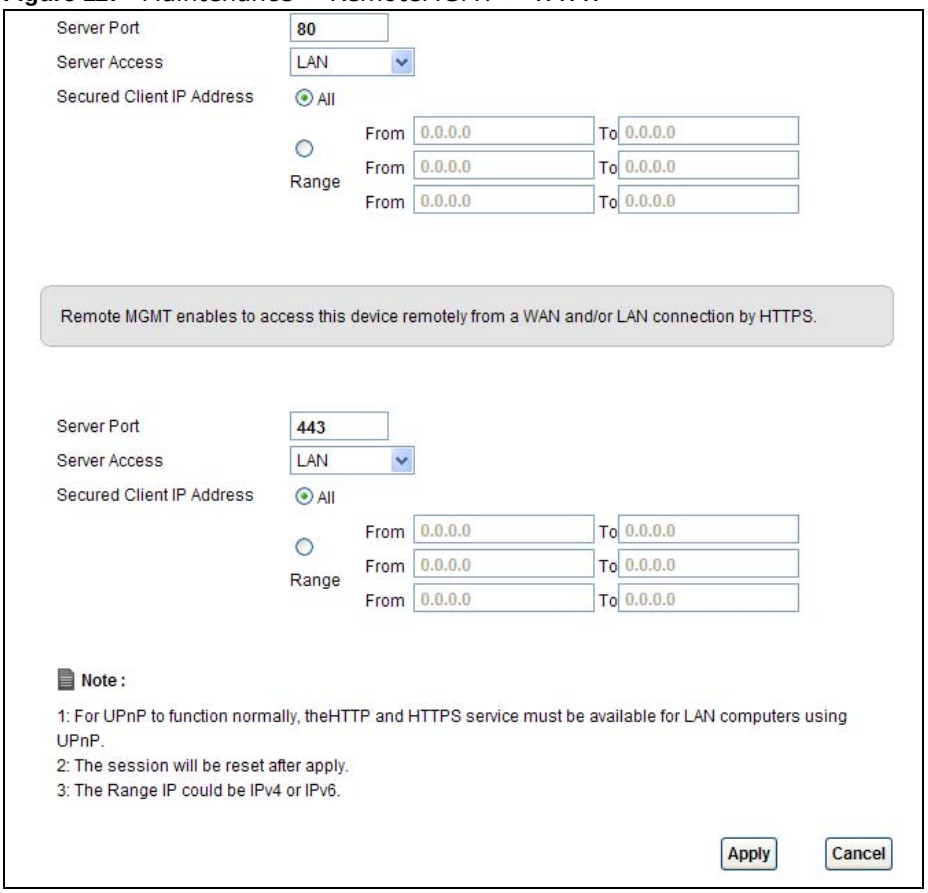
25.2 The WWW Screen

Use this screen to specify how to connect to the AMG1302/AMG1202-TSeries from a web browser, such as Internet Explorer.

25.2.1 Configuring the WWW Screen

Click **Maintenance > RemoteMGMT** to display the **WWW** screen.

Figure 117 Maintenance > RemoteMGMT > WWW



The following table describes the labels in this screen.

Table 85 Maintenance > RemoteMGMT > WWW

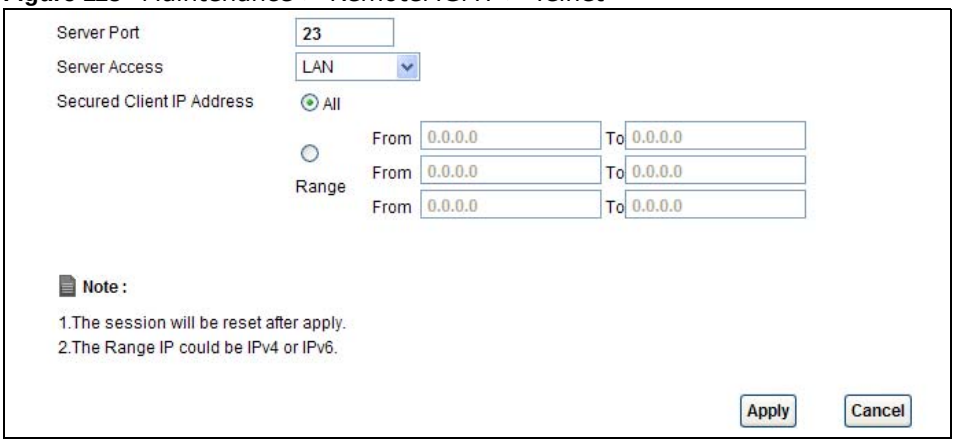
LABEL	DESCRIPTION
Server Port	This displays the service port number for accessing the AMG1302/AMG1202-TSeries using HTTP or HTTPS. If the number is grayed out, it is not editable.
Server Access	Select the interface(s) through which a computer may access the AMG1302/AMG1202-TSeries using this service. Note: It is recommended if you are allowing WAN access even temporarily to change the default password (in **Maintenance** > **User Account**). To allow access from the WAN, you will need to configure a WAN to Router firewall rule. See Section 4.1 on page 37 for information on configuring firewall rules.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the AMG1302/AMG1202-TSeries using this service. Select **All** to allow any computer to access the AMG1302/AMG1202-TSeries using this service. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to access the AMG1302/AMG1202-TSeries using this service.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.3 The Telnet Screen

You can use Telnet to access the AMG1302/AMG1202-TSeries's command line interface. Specify which interfaces allow Telnet access and from which IP address the access can come.

Click **Maintenance > RemoteMGMT** > **Telnet** tab to display the screen as shown.

Figure 118 Maintenance > RemoteMGMT > Telnet



The following table describes the labels in this screen.

Table 86 Maintenance > RemoteMGMT > Telnet

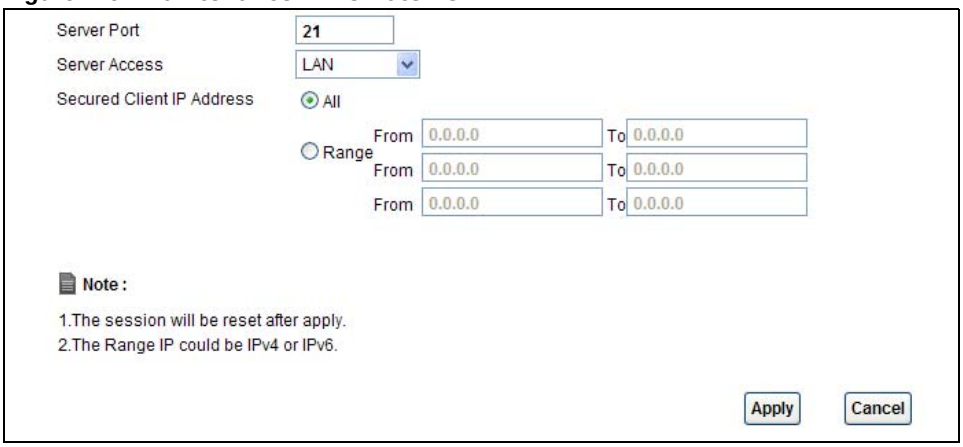
LABEL	DESCRIPTION
Server Port	This displays the service port number for accessing the AMG1302/AMG1202-TSeries. If the number is grayed out, it is not editable.
Server Access	Select the interface(s) through which a computer may access the AMG1302/AMG1202-TSeries using this service. Note: It is recommended if you are allowing WAN access even temporarily to change the default password (in **Maintenance** > **User Account**). To allow access from the WAN, you will need to configure a WAN to Router firewall rule. See Firewall Section on page 173 for information on configuring firewall rules.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the AMG1302/AMG1202-TSeries using this service. Select **All** to allow any computer to access the AMG1302/AMG1202-TSeries using this service. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to access the AMG1302/AMG1202-TSeries using this service.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.4 The FTP Screen

You can use FTP (File Transfer Protocol) to upload and download the AMG1302/AMG1202-TSeries's firmware and configuration files. Please see the User's Guide chapter on firmware and configuration file maintenance for details. To use this feature, your computer must have an FTP client.

Use this screen to specify which interfaces allow FTP access and from which IP address the access can come. To change your AMG1302/AMG1202-TSeries's FTP settings, click **Maintenance > RemoteMGMT** > **FTP**. The screen appears as shown.

Figure 119 Maintenance > RemoteMGMT > FTP



The following table describes the labels in this screen.

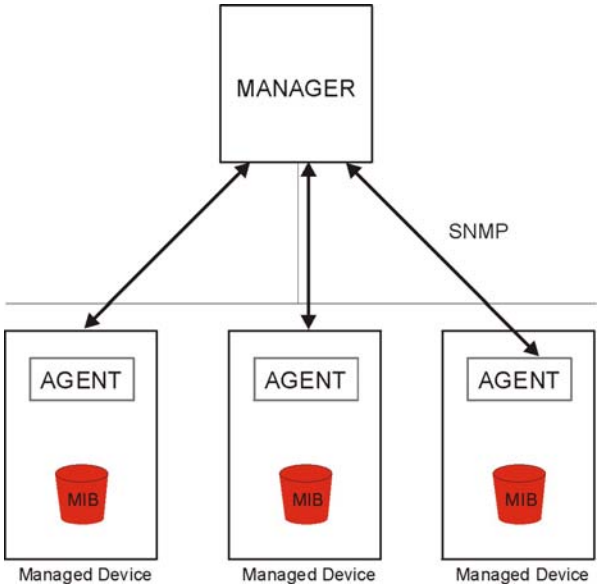
Table 87 Maintenance > RemoteMGMT > FTP

LABEL	DESCRIPTION
Server Port	This displays the service port number for accessing the AMG1302/AMG1202-TSeries. If the number is grayed out, it is not editable.
Server Access	Select the interface(s) through which a computer may access the AMG1302/AMG1202-TSeries using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the AMG1302/AMG1202-TSeries using this service. Select **All** to allow any computer to access the AMG1302/AMG1202-TSeries using this service. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to access the AMG1302/AMG1202-TSeries using this service.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.5 The SNMP Screen

Simple Network Management Protocol is a protocol used for exchanging management information between network devices. Your AMG1302/AMG1202-TSeries supports SNMP agent functionality, which allows a manager station to manage and monitor the AMG1302/AMG1202-TSeries through the network. The AMG1302/AMG1202-TSeries supports SNMP version one (SNMPv1) and version two (SNMPv2c). The next figure illustrates an SNMP management operation.

Figure 120 SNMP Management Model



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

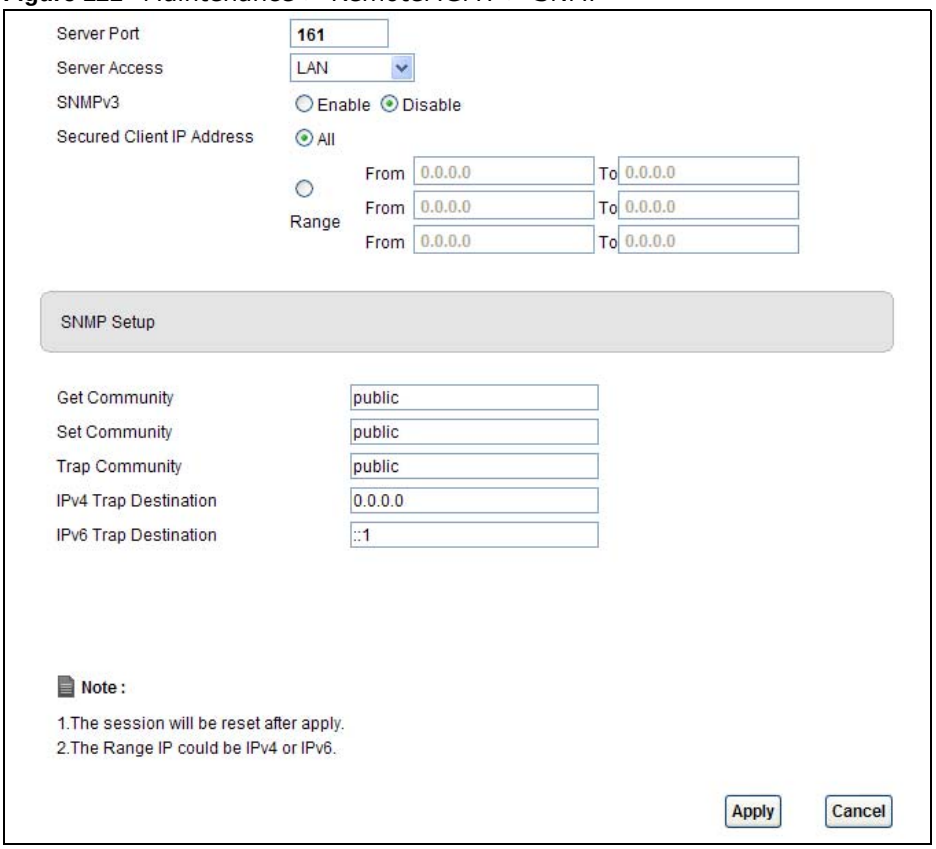
An agent is a management software module that resides in a managed device (the AMG1302/AMG1202-TSeries). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management 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.

25.5.1 Configuring SNMP

To change your AMG1302/AMG1202-TSeries's SNMP settings, click **Maintenance > RemoteMGMT > SNMP** tab. The screen appears as shown.

Figure 121 Maintenance > RemoteMGMT > SNMP



The following table describes the labels in this screen.

Table 88 Maintenance > RemoteMGMT > SNMP

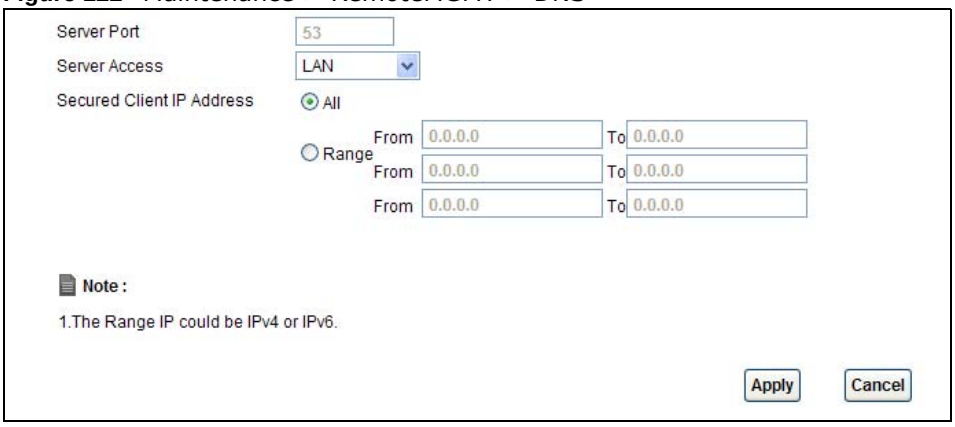
LABEL	DESCRIPTION
Server Port	This displays the port the SNMP agent listens on. If the number is grayed out, it is not editable.
Server Access	Select the interface(s) through which a computer may access the AMG1302/AMG1202-TSeries using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to access the SNMP agent on the AMG1302/AMG1202-TSeries. Select **All** to allow any computer to access the SNMP agent. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to access the AMG1302/AMG1202-TSeries using this service.
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station. The default is public and allows all requests.
Apply	Click **Apply** to save your changes back to the AMG1302/AMG1202-TSeries.
Cancel	Click **Cancel** to begin configuring this screen afresh.

25.6 The DNS Screen

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa.

Use this screen to set from which IP address the AMG1302/AMG1202-TSeries will accept DNS queries and on which interface it can send them your AMG1302/AMG1202-TSeries's DNS settings. This feature is not available when the AMG1302/AMG1202-TSeries is set to bridge mode. Click **Maintenance > RemoteMGMT** > **DNS** to change your AMG1302/AMG1202-TSeries's DNS settings.

Figure 122 Maintenance > RemoteMGMT > DNS



The following table describes the labels in this screen.

Table 89 Maintenance > RemoteMGMT > DNS

LABEL	DESCRIPTION
Server Port	This displays the service port number for accessing the AMG1302/AMG1202-TSeries. If the number is grayed out, it is not editable.
Access Status	Select the interface(s) through which a computer may send DNS queries to the AMG1302/AMG1202-TSeries.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to send DNS queries to the AMG1302/AMG1202-TSeries. Select **All** to allow any computer to send DNS queries to the AMG1302/AMG1202-TSeries. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to send DNS queries to the AMG1302/AMG1202-TSeries.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.7 The ICMP Screen

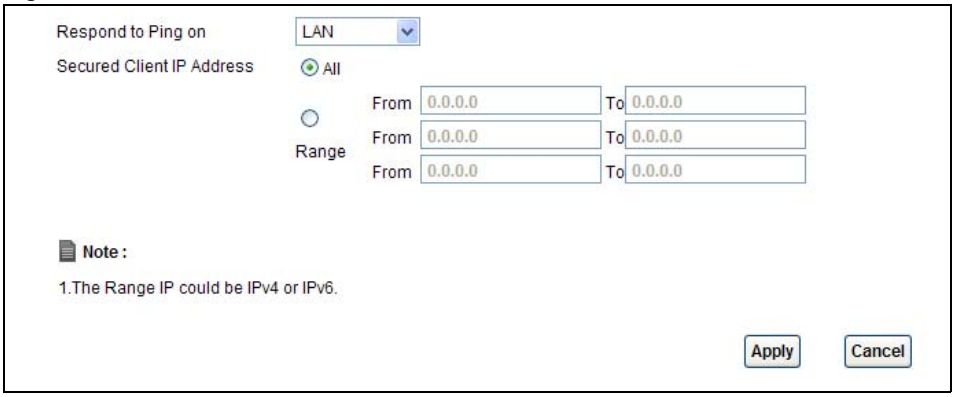
To change your AMG1302/AMG1202-TSeries's security settings, click **Maintenance > RemoteMGMT** > **ICMP**. The screen appears as shown.

If an outside user attempts to probe an unsupported port on your AMG1302/AMG1202-TSeries, an ICMP response packet is automatically returned. This allows the outside user to know the

AMG1302/AMG1202-TSeries exists. Your AMG1302/AMG1202-TSeries supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your AMG1302/AMG1202-TSeries when unsupported ports are probed.

Note: If you want your device to respond to pings and requests for unauthorized services, you will also need to configure the firewall accordingly by disabling SPI.

Figure 123 Maintenance > RemoteMGMT > ICMP



The following table describes the labels in this screen.

Table 90 Maintenance > RemoteMGMT > ICMP

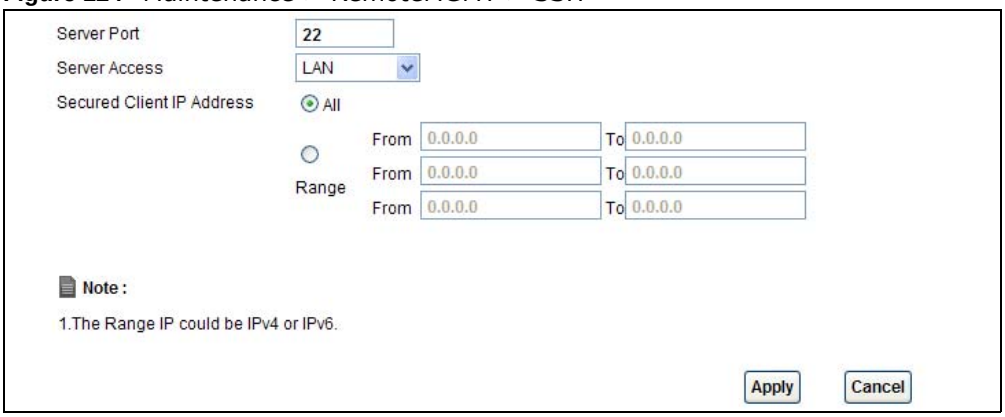
LABEL	DESCRIPTION
Respond to Ping on	The AMG1302/AMG1202-TSeries will not respond to any incoming Ping requests when **Disable** is selected. Select **LAN** to reply to incoming LAN Ping requests. Select **WAN** to reply to incoming WAN Ping requests. Otherwise select **LAN & WAN** to reply to both incoming LAN and WAN Ping requests.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to send Ping requests to the AMG1302/AMG1202-TSeries. Select **All** to allow any computer to send Ping requests to the AMG1302/AMG1202-TSeries. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to send Ping requests to the AMG1302/AMG1202-TSeries.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.8 The SSH Screen

You can use Secure SHell (SSH) to securely access the AMG1302/AMG1202-TSeries's command line interface. Specify which interfaces allow SSH access and from which IP address the access can come. SSH is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication between two hosts over an unsecured network.

Click **Maintenance > RemoteMGMT** > **SSH** tab to display the screen as shown.

Figure 124 Maintenance > RemoteMGMT > SSH



The following table describes the labels in this screen.

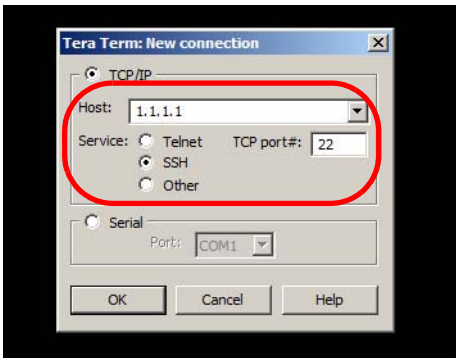
Table 91 Maintenance > RemoteMGMT > SSH

LABEL	DESCRIPTION
Server Port	This displays the service port number for accessing the AMG1302/AMG1202-TSeries. If the number is grayed out, it is not editable.
Server Access	Select the interface(s) through which a computer may access the AMG1302/AMG1202-TSeries using this service. Note: It is recommended if you are allowing WAN access even temporarily to change the default password (in **Maintenance** > **User Account**). To allow access from the WAN, you will need to configure a WAN to Router firewall rule. See Firewall Section on page 173 for information on configuring firewall rules.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the AMG1302/AMG1202-TSeries using this service. Select **All** to allow any computer to access the AMG1302/AMG1202-TSeries using this service. Choose **Range** to just allow the computer(s) with an IP address in the range that you specify to access the AMG1302/AMG1202-TSeries using this service.
Apply	Click this to save your changes.
Cancel	Click this to restore your previously saved settings.

25.8.1 SSH Example

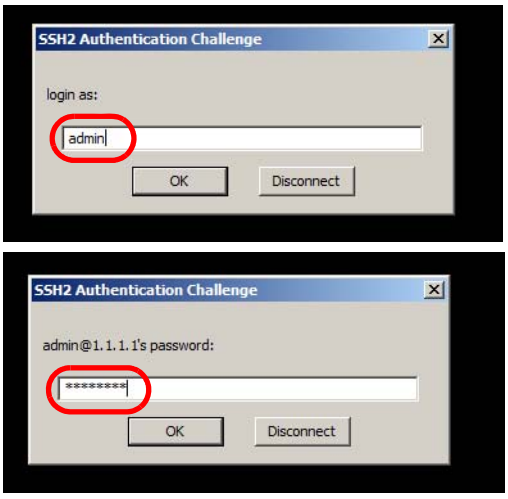
This section shows an example using a graphical interface SSH client program to remotely access the ZyXEL Device. The configuration and connection steps are similar for most SSH client programs. Refer to your SSH client program user's guide.

1 Enter the IP address and port number. Select **SSH**.

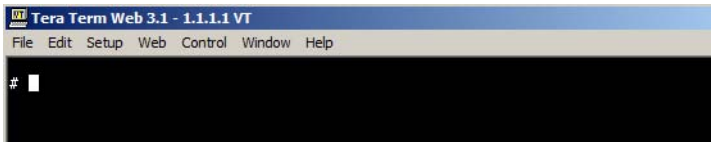


2 A window displays prompting you to store the host key in your computer. Click **Yes** to continue.

3 Enter your user name and password.



4 The command line interface displays.



26

Diagnostic

26.1 Overview

These read-only screens display information to help you identify problems with the AMG1302/AMG1202-TSeries.

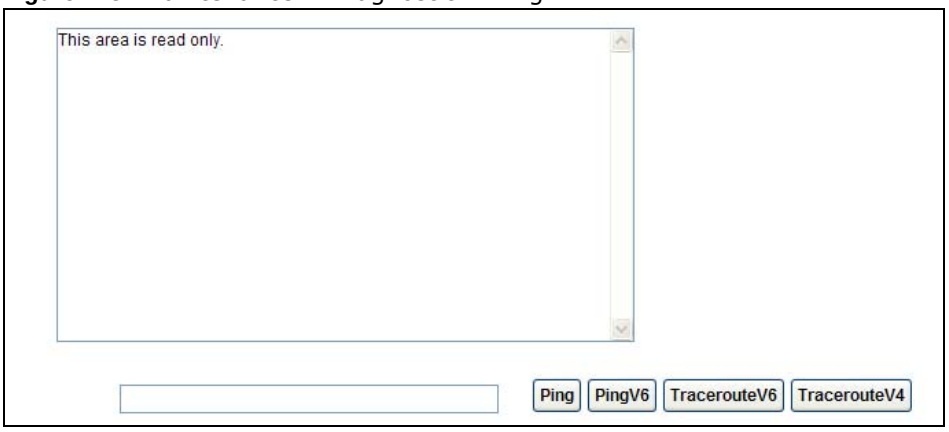
26.1.1 What You Can Do in the Diagnostic Screens

- Use the **Ping** screen (Section 26.2 on page 235) to ping an IP address.
- Use the **DSL Line** screen (Section 26.3 on page 236) to view the DSL line statistics and reset the ADSL line.

26.2 The General Screen

Use this screen to ping an IP address. Click **Maintenance > Diagnostic > Ping** to open the screen shown next.

Figure 125 Maintenance > Diagnostic > Ping



The following table describes the fields in this screen.

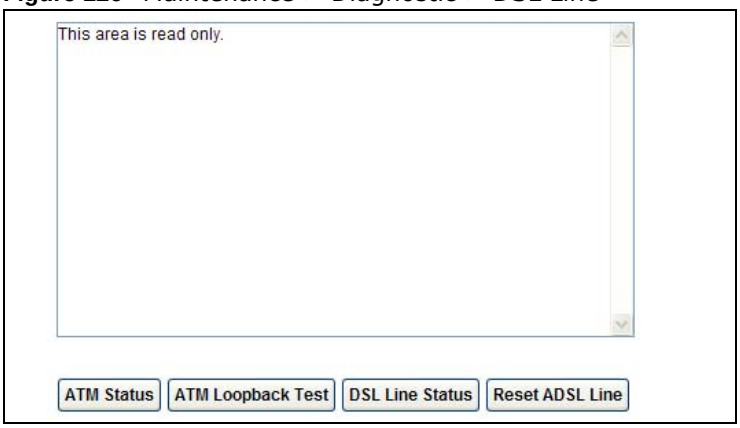
Table 92 Maintenance > Diagnostic > Ping

LABEL	DESCRIPTION
	Type the IP address of a computer that you want to ping in order to test a connection.
Ping	Click this to ping the IP address that you entered.
PingV6	Click this to ping the IPv6 address that you entered.
TracerouteV6	Click this to display the route path and transmission delays between the AMG1302/AMG1202-TSeries to the IPv6 address that you entered.

26.3 The DSL Line Screen

Use this screen to view the DSL line statistics and reset the ADSL line. Click **Maintenance > Diagnostic** > **DSL Line** to open the screen shown next.

Figure 126 Maintenance > Diagnostic > DSL Line



The following table describes the fields in this screen.

Table 93 Maintenance > Diagnostic > DSL Line

LABEL	DESCRIPTION
ATM Status	Click this to view your DSL connection's Asynchronous Transfer Mode (ATM) statistics. ATM is a networking technology that provides high-speed data transfer. ATM uses fixed-size packets of information called cells. With ATM, a high QoS (Quality of Service) can be guaranteed. The (Segmentation and Reassembly) SAR driver translates packets into ATM cells. It also receives ATM cells and reassembles them into packets. These counters are set back to zero whenever the device starts up. **inPkts** is the number of good ATM cells that have been received. **inDiscards** is the number of received ATM cells that were rejected. **inF4Pkts** is the number of ATM Operations, Administration, and Management (OAM) F4 cells that have been received. See ITU recommendation I.610 for more on OAM for ATM. **inF5Pkts** is the number of ATM OAM F5 cells that have been received. **outPkts** is the number of ATM cells that have been sent. **outDiscards** is the number of ATM cells sent that were rejected. **outF4Pkts** is the number of ATM OAM F4 cells that have been sent. **outF5Pkts** is the number of ATM OAM F5 cells that have been sent.
ATM Loopback Test	Click this to start the ATM loopback test. Make sure you have configured at least one PVC with proper VPIs/VCIs before you begin this test. The AMG1302/AMG1202-TSeries sends an OAM F5 packet to the DSLAM/ATM switch and then returns it (loops it back) to the AMG1302/AMG1202-TSeries. The ATM loopback test is useful for troubleshooting problems with the DSLAM and ATM network.

Table 93 Maintenance > Diagnostic > DSL Line (continued)

LABEL	DESCRIPTION
DSL Line Status	Click this to view statistics about the DSL connections. **noise margin downstream** is the signal to noise ratio for the downstream part of the connection (coming into the AMG1302/AMG1202-TSeries from the ISP). It is measured in decibels. The higher the number the more signal and less noise there is. **output power upstream** is the amount of power (in decibels) that the AMG1302/AMG1202-TSeries is using to transmit to the ISP. **attenuation downstream** is the reduction in amplitude (in decibels) of the DSL signal coming into the AMG1302/AMG1202-TSeries from the ISP. Discrete Multi-Tone (DMT) modulation divides up a line's bandwidth into sub-carriers (sub-channels) of 4.3125 KHz each called tones. The rest of the display is the line's bit allocation. This is displayed as the number (in hexadecimal format) of bits transmitted for each tone. This can be used to determine the quality of the connection, whether a given sub-carrier loop has sufficient margins to support certain ADSL transmission rates, and possibly to determine whether particular specific types of interference or line attenuation exist. Refer to the ITU-T G.992.1 recommendation for more information on DMT. The better (or shorter) the line, the higher the number of bits transmitted for a DMT tone. The maximum number of bits that can be transmitted per DMT tone is 15. There will be some tones without any bits as there has to be space between the upstream and downstream channels.

Reset ADSL Line	Click this to reinitialize the ADSL line. The large text box above then displays the progress and results of this operation, for example:
	
	`"Start to reset ADSL`
	
	`Loading ADSL modem F/W...`
	
	`Reset ADSL Line Successfully!"`

27

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
- AMG1302/AMG1202-TSeries Access and Login
- Internet Access

27.1 Power, Hardware Connections, and LEDs

The AMG1302/AMG1202-TSeries does not turn on. None of the LEDs turn on.

1. Make sure the AMG1302/AMG1202-TSeries is turned on.
2. Make sure you are using the power adaptor or cord included with the AMG1302/AMG1202-TSeries.
3. Make sure the power adaptor or cord is connected to the AMG1302/AMG1202-TSeries and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the AMG1302/AMG1202-TSeries 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. Section 1.5 on page 17

LABEL	DESCRIPTION
WPS LED	Green: successful connection
	Off: connection failure
WIFI LED	Green: WIFI active
	Off: WIFI inactive

2. Check the hardware connections.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.

4 Turn the AMG1302/AMG1202-TSeries off and on.

5 If the problem continues, contact the vendor.

27.2 AMG1302/AMG1202-TSeries Access and Login

I forgot the IP address for the AMG1302/AMG1202-TSeries.

1 The default IP address is **192.168.1.1**.

2 If you changed the IP address and have forgotten it, you might get the IP address of the AMG1302/AMG1202-TSeries 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 AMG1302/AMG1202-TSeries (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 1.7 on page 19.

I forgot the password.

1 The default admin user name and password can be found on the cover of this User's Guide.

2 If this does not work, you have to reset the device to its factory defaults. See Section 1.7 on page 19.

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

1 Make sure you are using the correct IP address.

- The default IP address is 192.168.1.1.
- If you changed the IP address (Section 8.2 on page 123), 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 AMG1302/AMG1202-TSeries.

2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide.

3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Appendix C on page 273.

4 Reset the device to its factory defaults, and try to access the AMG1302/AMG1202-TSeries with the default IP address. See Section 1.7 on page 19.

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

Advanced Suggestions

- Try to access the AMG1302/AMG1202-TSeries using another service, such as Telnet. If you can access the AMG1302/AMG1202-TSeries, check the remote management settings and firewall rules to find out why the AMG1302/AMG1202-TSeries does not respond to HTTP.
- If your computer is connected to the **DSL** port or is connected wirelessly, use a computer that is connected to a **ETHERNET** port.

I can see the **Login** screen, but I cannot log in to the AMG1302/AMG1202-TSeries.

1 Make sure you have entered the password correctly. The default user and default admin password can be found on the cover page of this User's Guide. 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 AMG1302/AMG1202-TSeries. Log out of the AMG1302/AMG1202-TSeries in the other session, or ask the person who is logged in to log out.

3 Turn the AMG1302/AMG1202-TSeries off and on.

4 If this does not work, you have to reset the device to its factory defaults. See Section 1.7 on page 19.

I cannot Telnet to the AMG1302/AMG1202-TSeries.

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

27.3 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 27.1 on page 225.
2. Make sure you entered your ISP account information correctly in the wizard. 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 the wireless settings in the wireless client are the same as the settings in the AP.
4. If you are trying to access the Internet wirelessly, make sure you enabled the wireless LAN and have selected the correct country and channel in which your AMG1302/AMG1202-TSeries operates in the **Wireless LAN > AP** screen.
5. Disconnect all the cables from your device, and follow the directions in the Quick Start Guide again.
6. If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the AMG1302/AMG1202-TSeries), but my Internet connection is not available anymore.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 27.1 on page 225.
2. Turn the AMG1302/AMG1202-TSeries off and on.
3. If the problem continues, contact your ISP.

The Internet connection is slow or intermittent.

1. There might be a lot of traffic on the network. Look at the LEDs, and check Section 27.1 on page 225. If the AMG1302/AMG1202-TSeries is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.
2. Check the signal strength. If the signal strength is low, try moving your computer closer to the AMG1302/AMG1202-TSeries if possible, and look around to see if there are any devices that might be interfering with the wireless network (for example, microwaves, other wireless networks, and so on).
3. Turn the AMG1302/AMG1202-TSeries off and on.

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

Advanced Suggestions

- Check the settings for QoS. If it is disabled, you might consider activating it. If it is enabled, you might consider raising or lowering the priority for some applications.

A

Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP/Vista, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

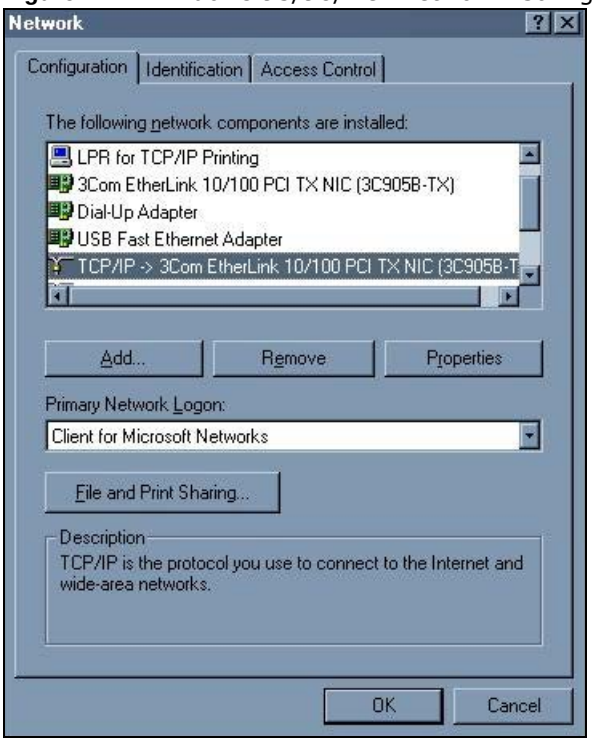
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the AMG1302/AMG1202-TSeries's LAN port.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window.

Figure 127 WIndows 95/98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

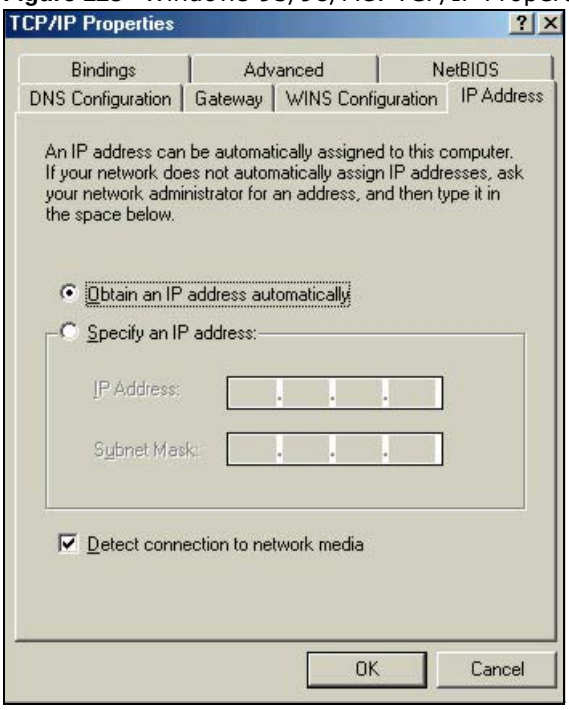
If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.
3. Select **Microsoft** from the list of manufacturers.
4. Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.
5. Restart your computer so the changes you made take effect.

Configuring

1. In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**
2. Click the **IP Address** tab.
   - If your IP address is dynamic, select **Obtain an IP address automatically**.
   - If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

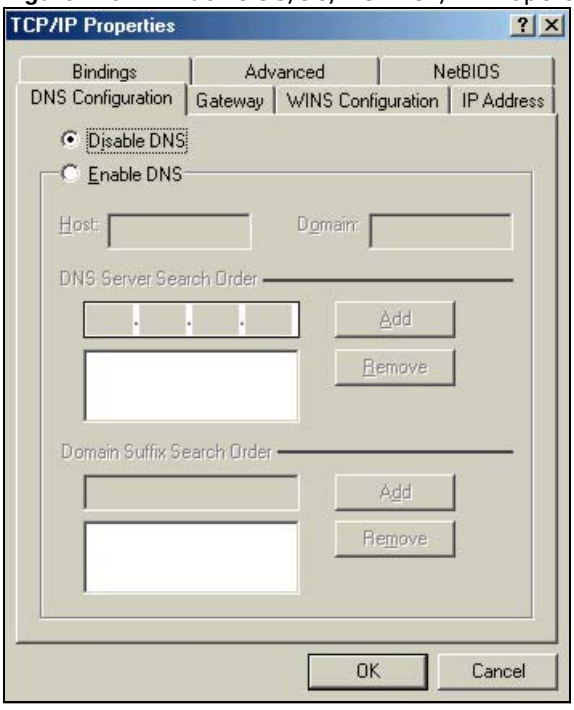
Figure 128 Windows 95/98/Me: TCP/IP Properties: IP Address



3 Click the **DNS** Configuration tab.

- If you do not know your DNS information, select **Disable DNS**.
- If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 129 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.

- If you do not know your gateway's IP address, remove previously installed gateways.
- If you have a gateway IP address, type it in the **New gateway field** and click **Add**.

5 Click **OK** to save and close the **TCP/IP Properties** window.

6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.

7 Turn on your AMG1302/AMG1202-TSeries and restart your computer when prompted.

Verifying Settings

1 Click **Start** and then **Run**.

2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.

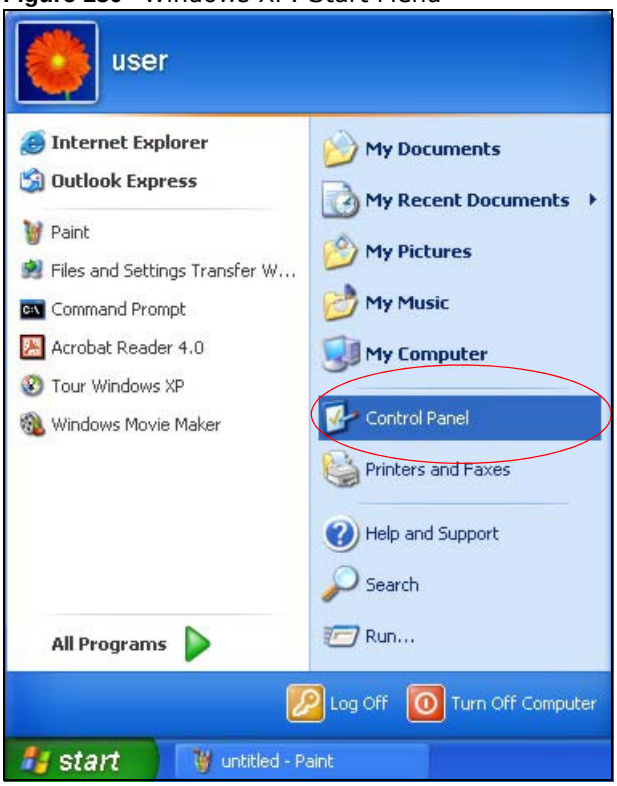
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

The following example figures use the default Windows XP GUI theme.

1 Click **start** (**Start** in Windows 2000/NT), **Settings**, **Control Panel**.

Figure 130 Windows XP: Start Menu

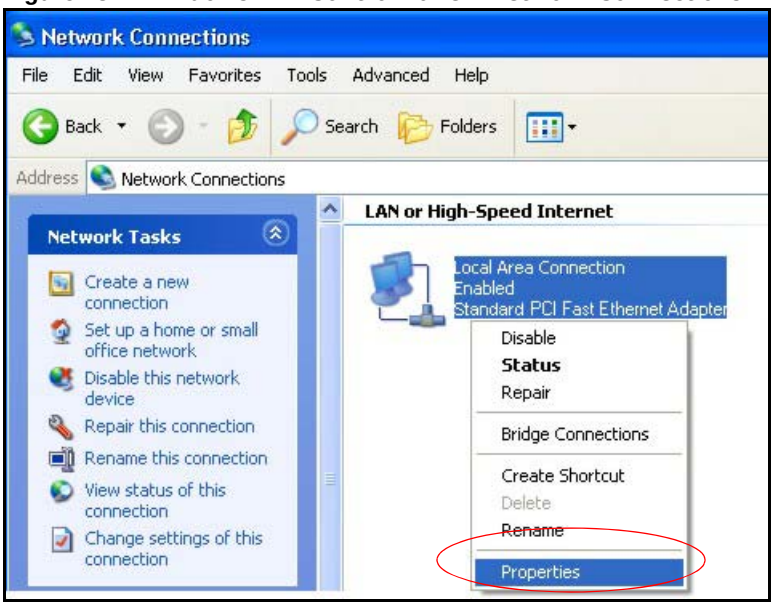


2 In the **Control Panel**, double-click **Network Connections** (**Network and Dial-up Connections** in Windows 2000/NT).

Figure 131 Windows XP: Control Panel

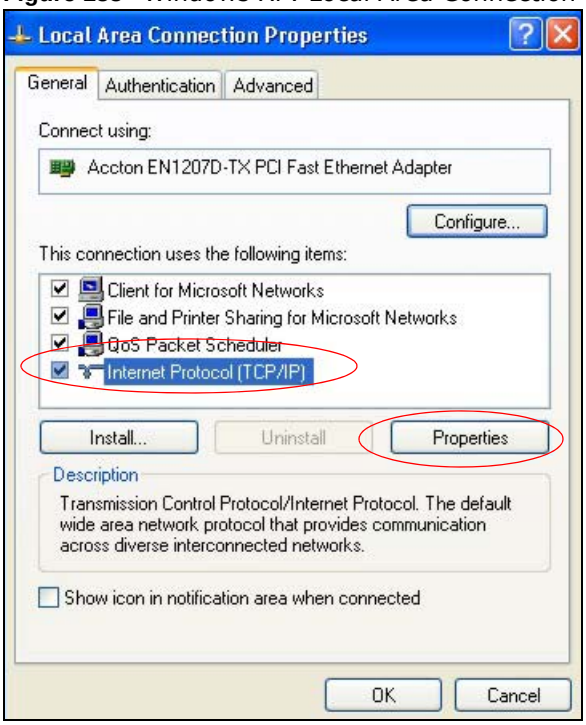
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 132 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and then click **Properties**.

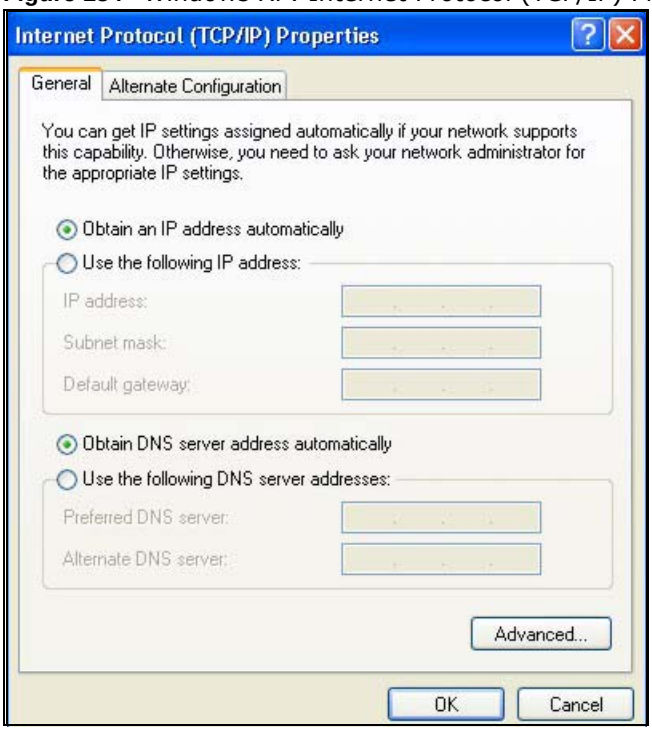
Figure 133 Windows XP: Local Area Connection Properties



5 The **Internet Protocol TCP/IP Properties** window opens (the **General tab** in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 134 Windows XP: Internet Protocol (TCP/IP) Properties

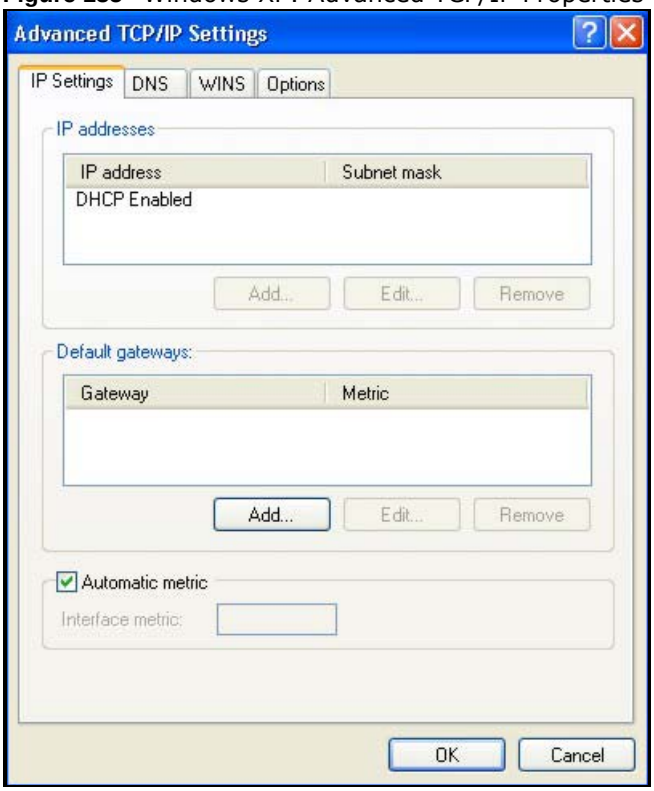


6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 135 Windows XP: Advanced TCP/IP Properties

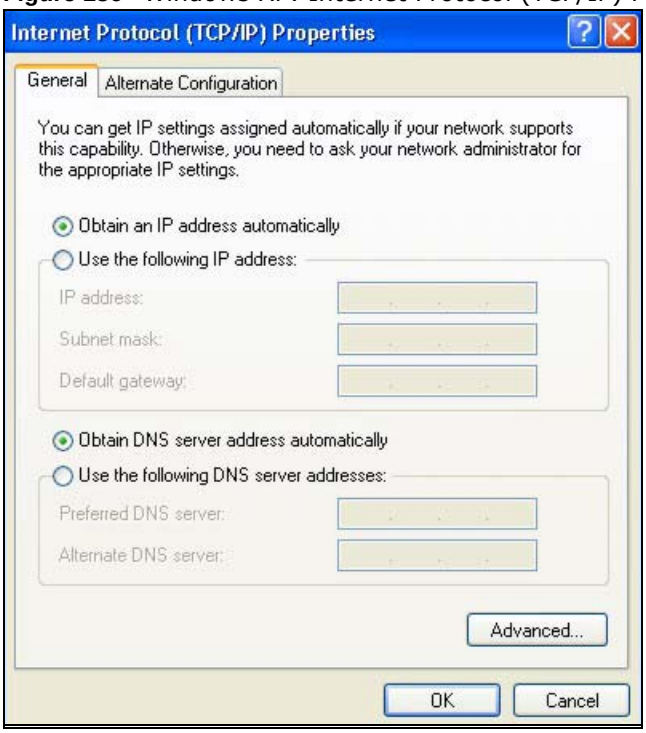


7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 136 Windows XP: Internet Protocol (TCP/IP) Properties



8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **Close** (**OK** in Windows 2000/NT) to close the **Local Area Connection Properties** window.

10 Close the **Network Connections** window (**Network and Dial-up Connections** in Windows 2000/NT).

11 Turn on your AMG1302/AMG1202-TSeries and restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

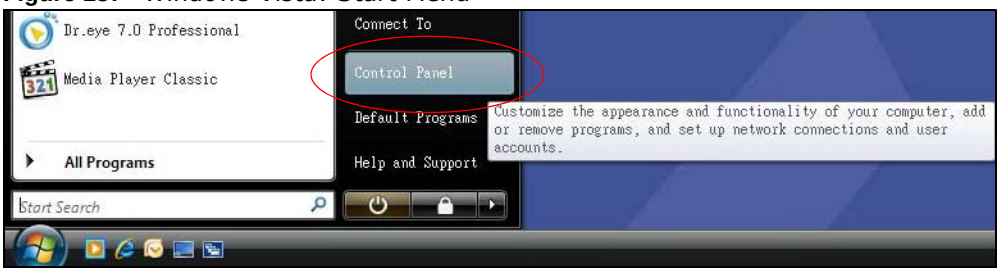
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Windows Vista

This section shows screens from Windows Vista Enterprise Version 6.0.

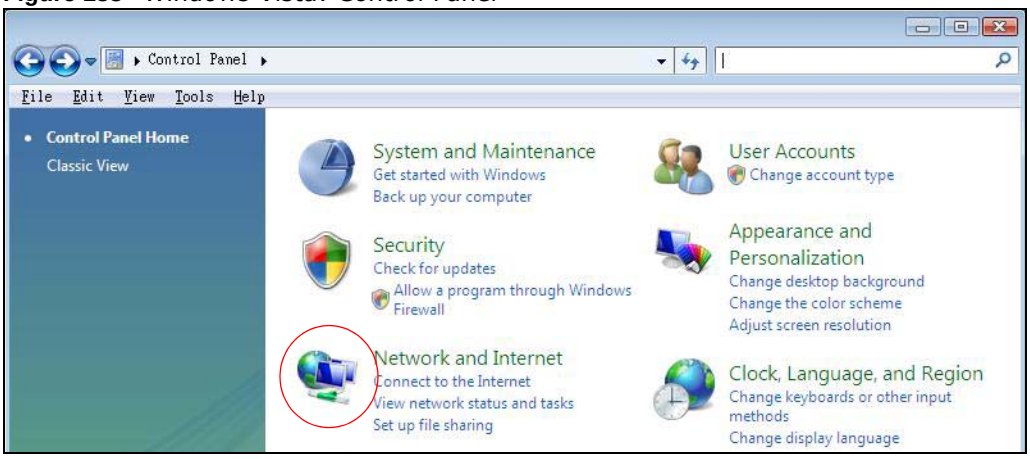
1 Click the **Start** icon, **Control Panel**.

Figure 137 Windows Vista: Start Menu



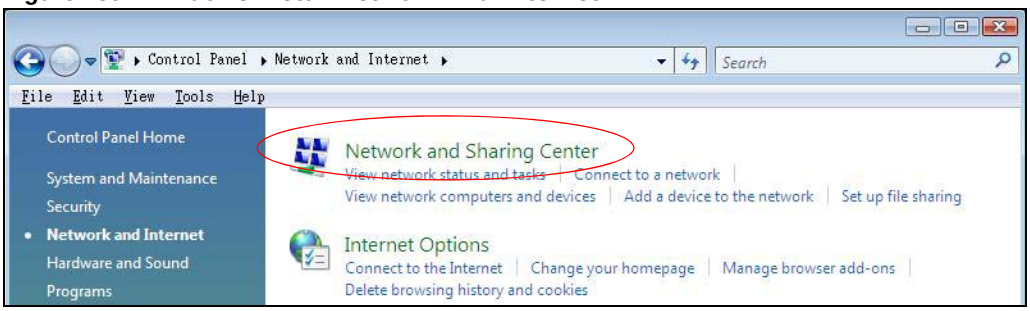
2 In the **Control Panel**, double-click **Network and Internet**.

Figure 138 Windows Vista: Control Panel



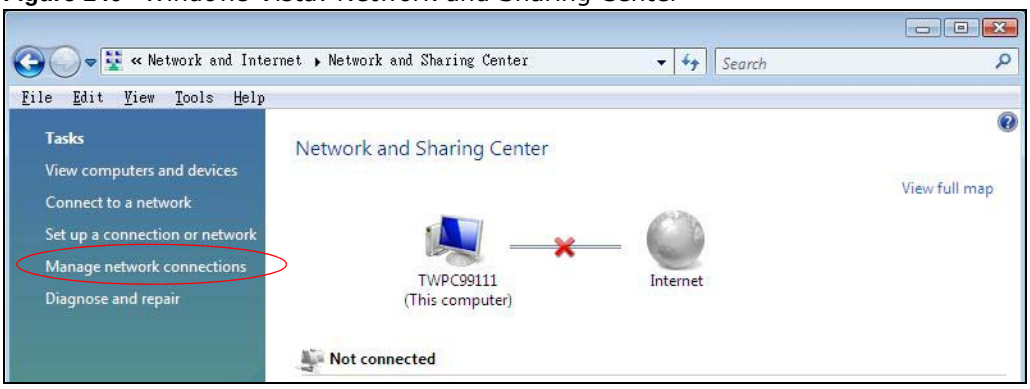
3 Click **Network and Sharing Center**.

Figure 139 Windows Vista: Network And Internet



4 Click **Manage network connections**.

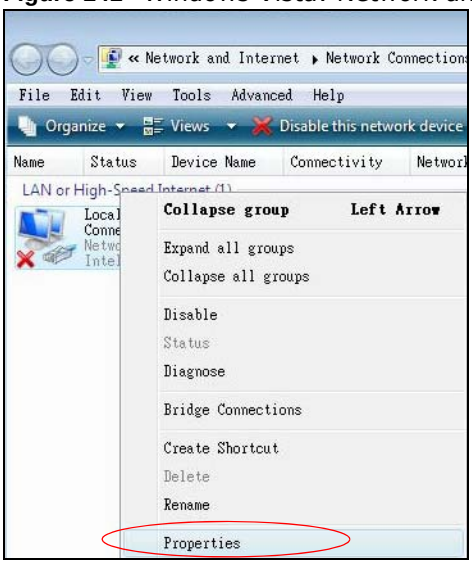
Figure 140 Windows Vista: Network and Sharing Center



5 Right-click **Local Area Connection** and then click **Properties**.

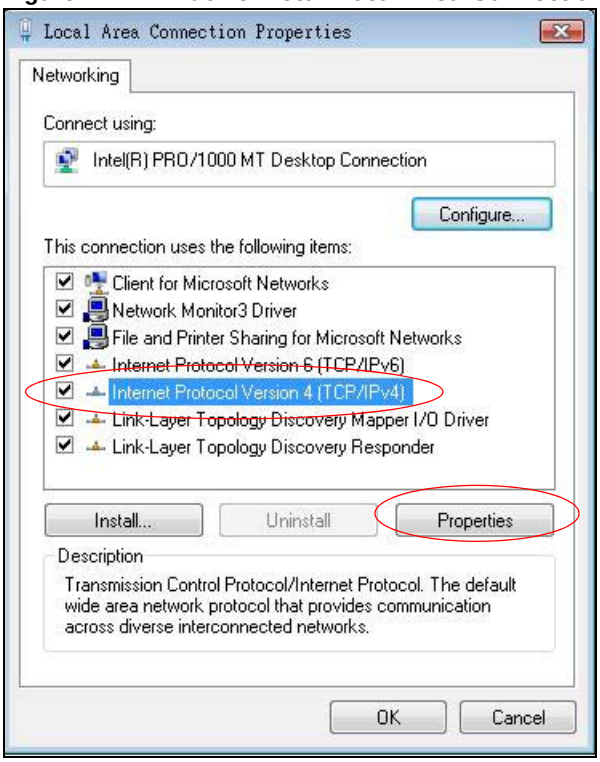
Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

Figure 141 Windows Vista: Network and Sharing Center



6 Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

Figure 142 Windows Vista: Local Area Connection Properties

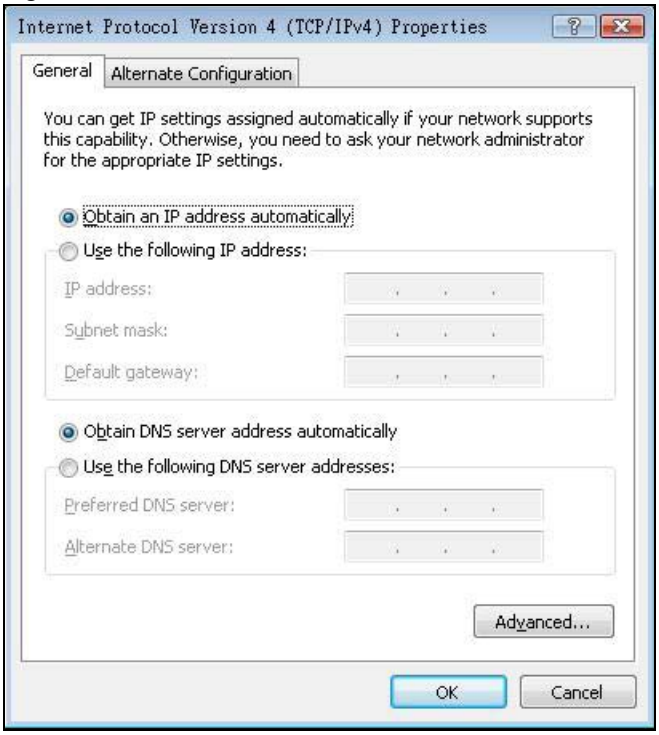


7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens (the **General tab**).

- If you have a dynamic IP address click **Obtain an IP address automatically**.

- If you have a static IP address click **Use the following IP address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 143 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties

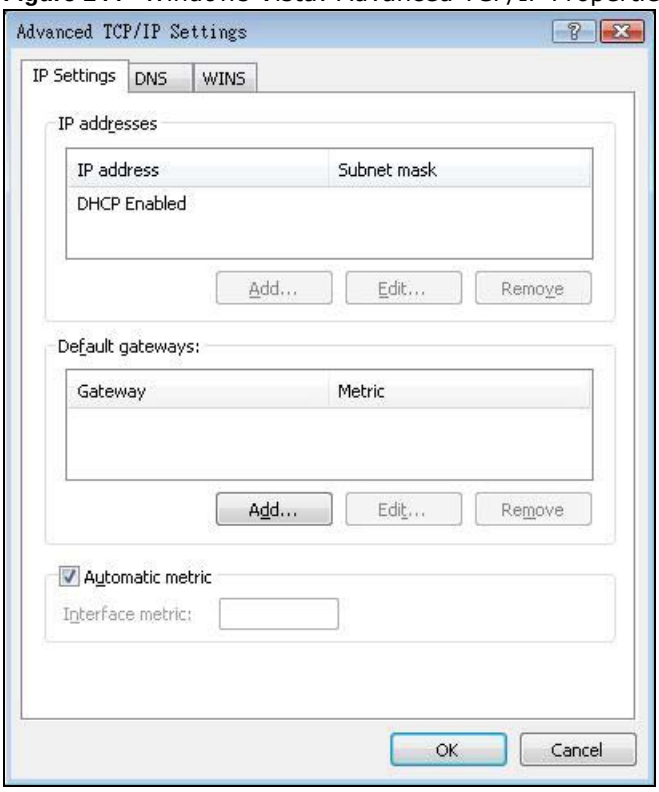


8 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 144 Windows Vista: Advanced TCP/IP Properties

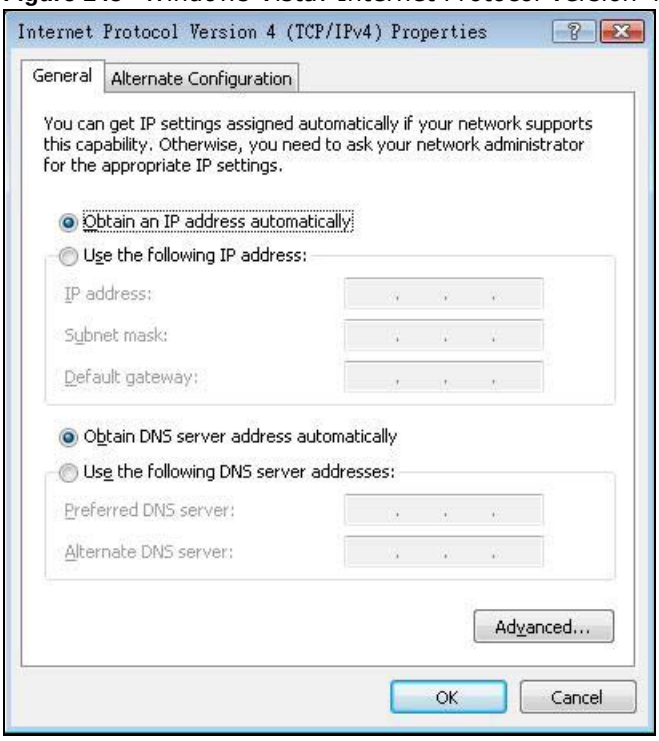


9 In the **Internet Protocol Version 4 (TCP/IPv4) Properties** window, (the **General tab**):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 145 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties



10 Click **OK** to close the **Internet Protocol Version 4 (TCP/IPv4) Properties** window.

11 Click **Close** to close the **Local Area Connection Properties** window.

12 Close the **Network Connections** window.

13 Turn on your AMG1302/AMG1202-TSeries and restart your computer (if prompted).

Verifying Settings

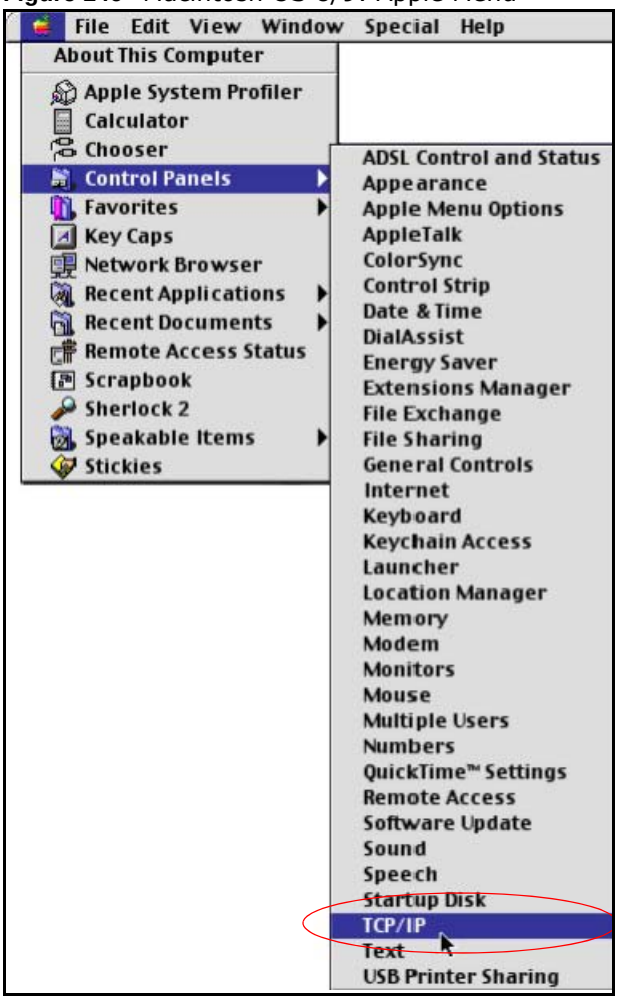
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Macintosh OS 8/9

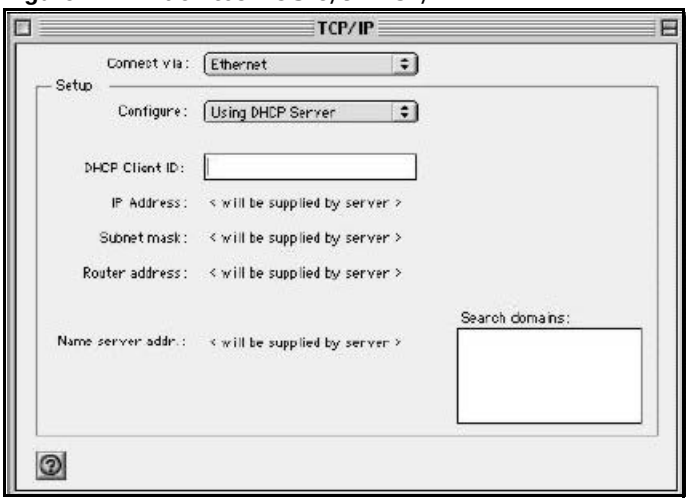
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 146 Macintosh OS 8/9: Apple Menu



2 Select **Ethernet built-in** from the **Connect via** list.

Figure 147 Macintosh OS 8/9: TCP/IP



3 For dynamically assigned settings, select **Using DHCP Server** from the **Configure:** list.

4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.
- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your AMG1302/AMG1202-TSeries in the **Router address** box.

5 Close the **TCP/IP Control Panel**.

6 Click **Save** if prompted, to save changes to your configuration.

7 Turn on your AMG1302/AMG1202-TSeries and restart your computer (if prompted).

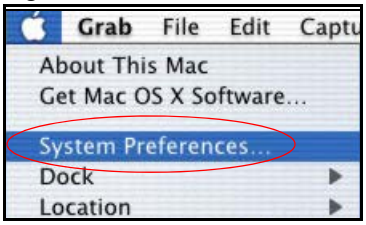
Verifying Settings

Check your TCP/IP properties in the **TCP/IP Control Panel** window.

Macintosh OS X

1 Click the **Apple** menu, and click **System Preferences** to open the **System Preferences** window.

Figure 148 Macintosh OS X: Apple Menu

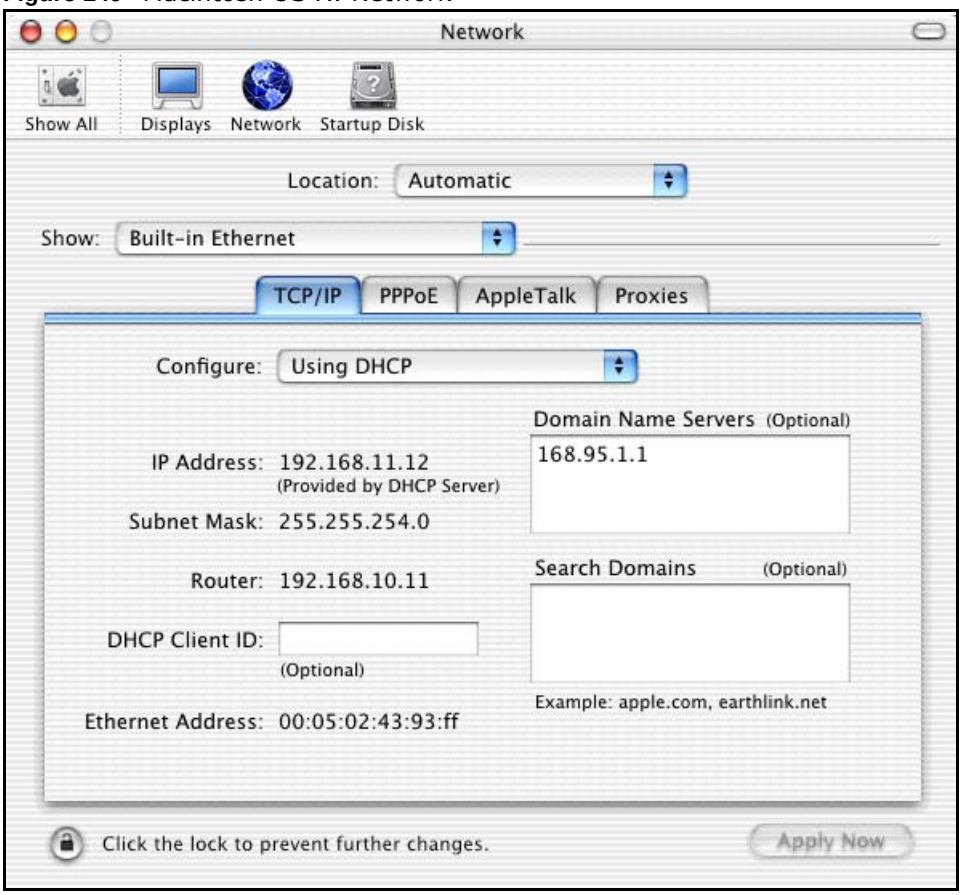


2 Click **Network** in the icon bar.

- Select **Automatic** from the **Location** list.
- Select **Built-in Ethernet** from the **Show** list.
- Click the **TCP/IP** tab.

3 For dynamically assigned settings, select **Using DHCP** from the **Configure** list.

Figure 149 Macintosh OS X: Network



4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.
- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your AMG1302/AMG1202-TSeries in the **Router address** box.

5 Click **Apply Now** and close the window.

6 Turn on your AMG1302/AMG1202-TSeries and restart your computer (if prompted).

Verifying Settings

Check your TCP/IP properties in the **Network** window.

Linux

This section shows you how to configure your computer's TCP/IP settings in Red Hat Linux 9.0. Procedure, screens and file location may vary depending on your Linux distribution and release version.

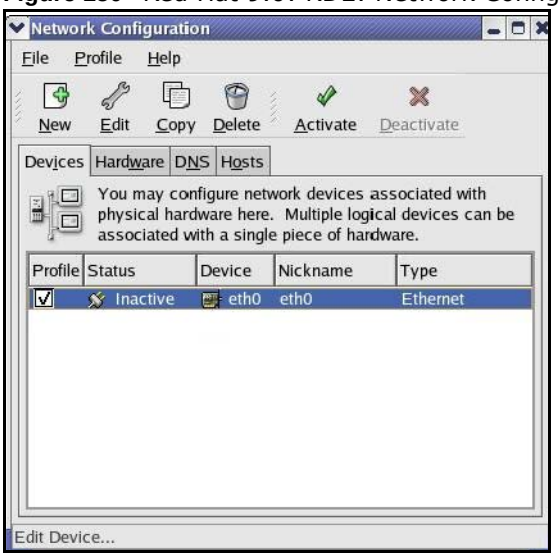
Note: Make sure you are logged in as the root administrator.

Using the K Desktop Environment (KDE)

Follow the steps below to configure your computer IP address using the KDE.

1 Click the Red Hat button (located on the bottom left corner), select **System Setting** and click **Network**.

Figure 150 Red Hat 9.0: KDE: Network Configuration: Devices



2 Double-click on the profile of the network card you wish to configure. The **Ethernet Device General** screen displays as shown.

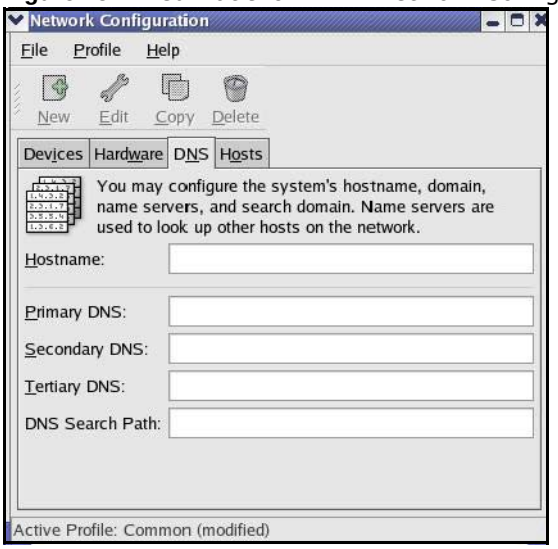
Figure 151 Red Hat 9.0: KDE: Ethernet Device: General

- If you have a dynamic IP address, click **Automatically obtain IP address settings with** and select **dhcp** from the drop down list.
- If you have a static IP address, click **Statically set IP Addresses** and fill in the **Address**, **Subnet mask**, and **Default Gateway Address** fields.

3 Click **OK** to save the changes and close the **Ethernet Device General** screen.

4 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Configuration** screen. Enter the DNS server information in the fields provided.

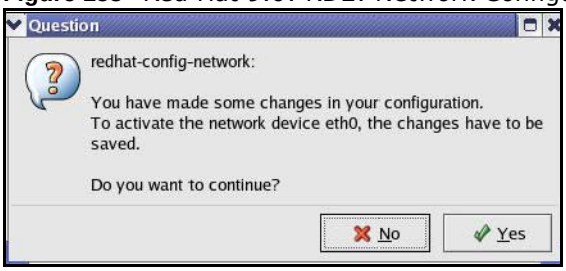
Figure 152 Red Hat 9.0: KDE: Network Configuration: DNS



5 Click the **Devices** tab.

6 Click the **Activate** button to apply the changes. The following screen displays. Click **Yes to save the changes in all screens.**

Figure 153 Red Hat 9.0: KDE: Network Configuration: Activate



7 After the network card restart process is complete, make sure the **Status** is **Active** in the **Network Configuration** screen.

Using Configuration Files

Follow the steps below to edit the network configuration files and set your computer IP address.

1 Assuming that you have only one network card on the computer, locate the `ifconfig-eth0` configuration file (where `eth0` is the name of the Ethernet card). Open the configuration file with any plain text editor.

- If you have a dynamic IP address, enter **dhcp** in the `BOOTPROTO=` field. The following figure shows an example.

Figure 154 Red Hat 9.0: Dynamic IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=dhcp
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

- If you have a static IP address, enter **static** in the BOOTPROTO= field. Type IPADDR= followed by the IP address (in dotted decimal notation) and type NETMASK= followed by the subnet mask. The following example shows an example where the static IP address is 192.168.1.10 and the subnet mask is 255.255.255.0.

Figure 155 Red Hat 9.0: Static IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=static
IPADDR=192.168.1.10
NETMASK=255.255.255.0
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

2 If you know your DNS server IP address(es), enter the DNS server information in the `resolv.conf` file in the `/etc` directory. The following figure shows an example where two DNS server IP addresses are specified.

Figure 156 Red Hat 9.0: DNS Settings in resolv.conf

```
nameserver 172.23.5.1
nameserver 172.23.5.2
```

3 After you edit and save the configuration files, you must restart the network card. Enter `./network restart` in the `/etc/rc.d/init.d` directory. The following figure shows an example.

Figure 157 Red Hat 9.0: Restart Ethernet Card

```
[root@localhost init.d]# network restart

Shutting down interface eth0:                [OK]
Shutting down loopback interface:            [OK]
Setting network parameters:                  [OK]
Bringing up loopback interface:              [OK]
Bringing up interface eth0:                  [OK]
```

Verifying Settings

Enter `ifconfig` in a terminal screen to check your TCP/IP properties.

Figure 158 Red Hat 9.0: Checking TCP/IP Properties

```
[root@localhost]# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:BA:72:5B:44
          inet addr:172.23.19.129  Bcast:172.23.19.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:717 errors:0 dropped:0 overruns:0 frame:0
          TX packets:13 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:730412 (713.2 Kb)  TX bytes:1570 (1.5 Kb)
          Interrupt:10 Base address:0x1000
[root@localhost]#
```

B

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

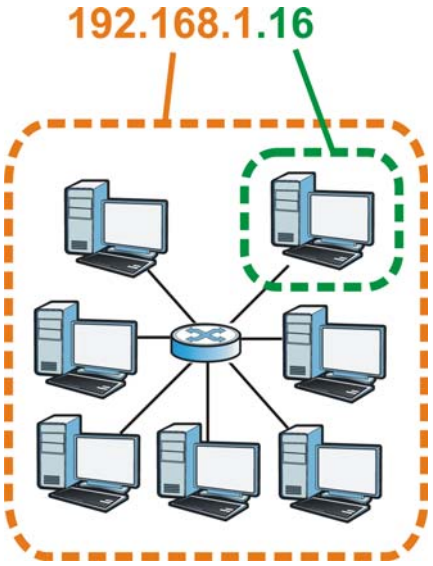
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 159 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 94 Subnet Masks

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 95 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 96 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 97 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128
255.255.255.192	/26	1100 0000	192

Table 97 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

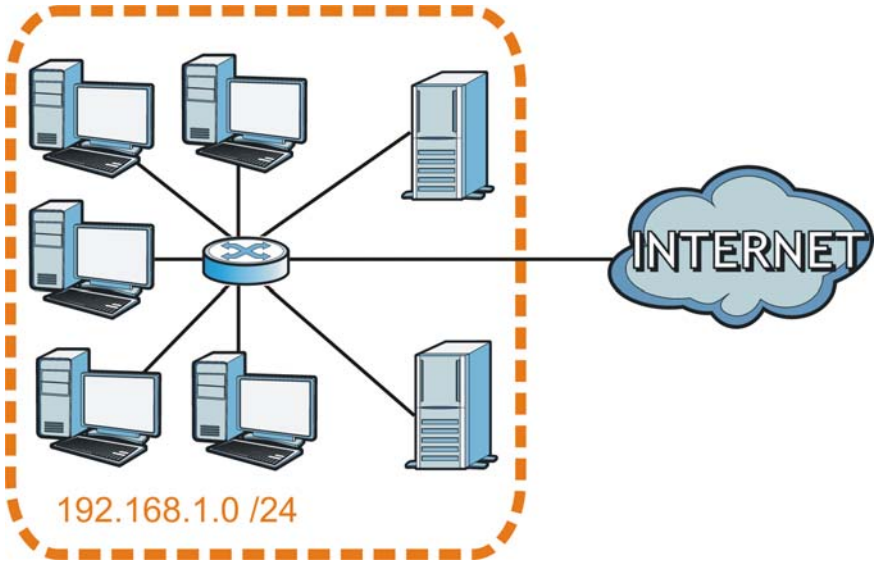
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of 2^8 – 2 or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 160 Subnetting Example: Before Subnetting

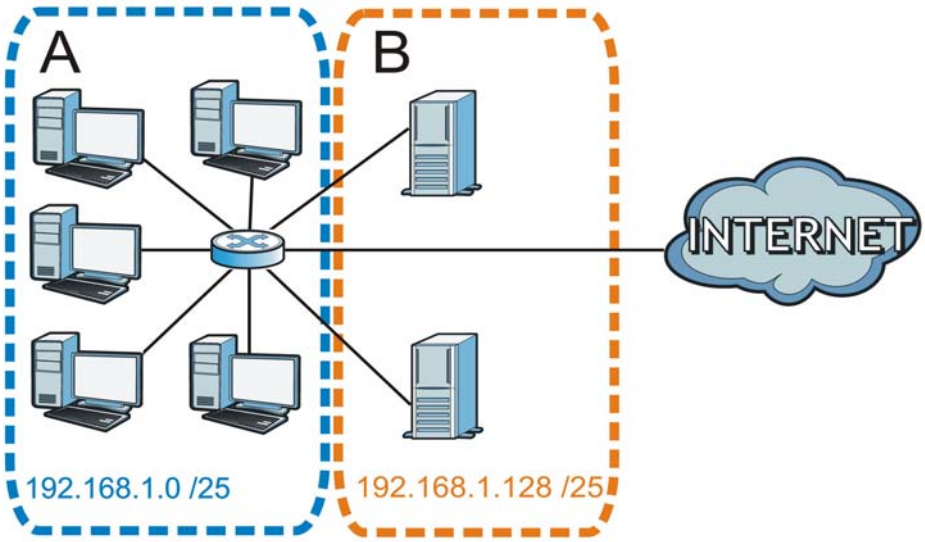


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 161 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of 2^7 – 2 or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 98 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 99 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 100 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 101 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 102 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 103 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 104 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the AMG1302/AMG1202-TSeries.

Once you have decided on the network number, pick an IP address for your AMG1302/AMG1202-TSeries that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your AMG1302/AMG1202-TSeries will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the AMG1302/AMG1202-TSeries unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, *Address Allocation for Private Internets* and RFC 1466, *Guidelines for Management of IP Address Space.*

C

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Note: Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

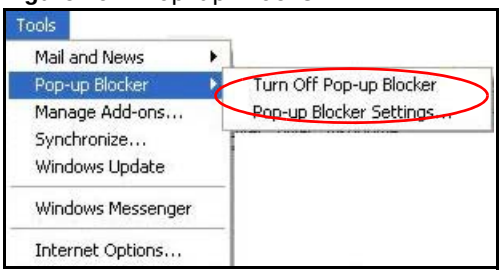
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable Pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 162 Pop-up Blocker



You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 163 Internet Options: Privacy

3 Click **Apply** to save this setting.

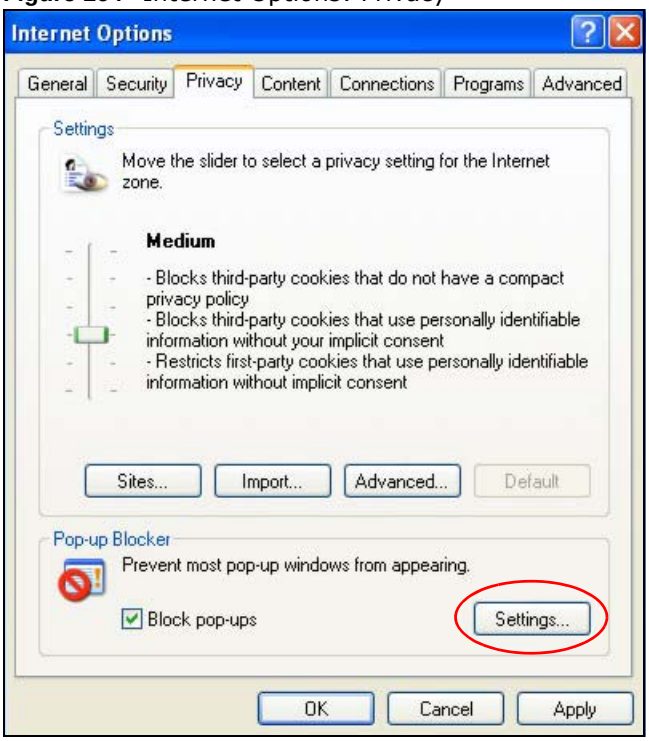
Enable Pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings...**to open the **Pop-up Blocker Settings** screen.

Figure 164 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 165 Pop-up Blocker Settings

5 Click **Close** to return to the **Privacy** screen.

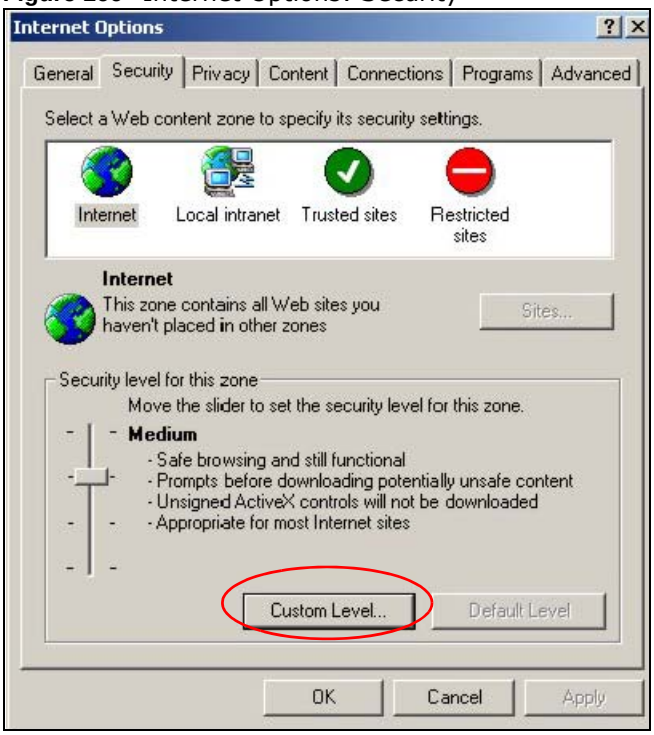
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 166 Internet Options: Security



2 Click the **Custom Level...** button.

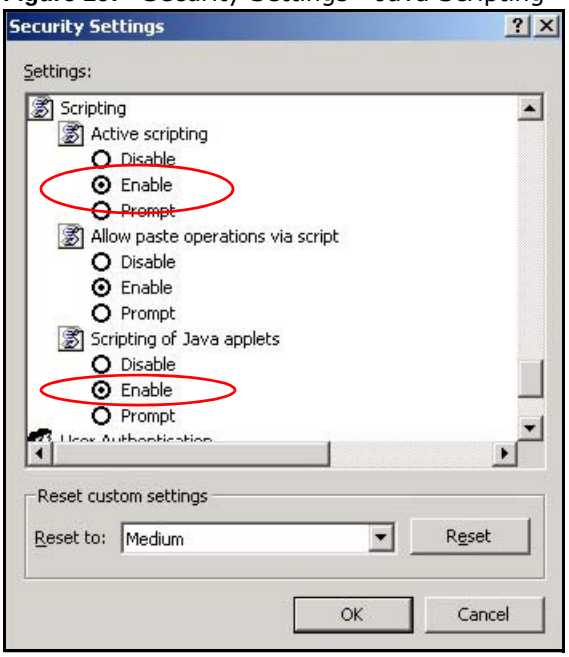
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

Figure 167 Security Settings - Java Scripting



Java Permissions

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

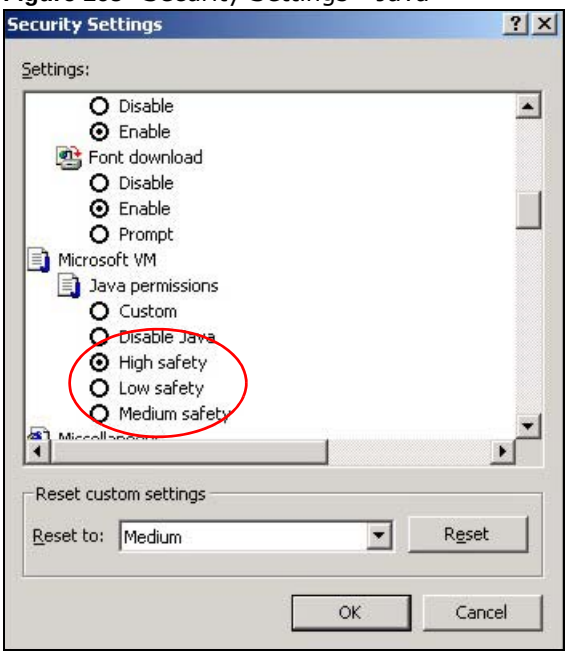
2 Click the **Custom Level...** button.

3 Scroll down to **Microsoft VM**.

4 Under **Java permissions** make sure that a safety level is selected.

5 Click **OK** to close the window.

Figure 168 Security Settings - Java



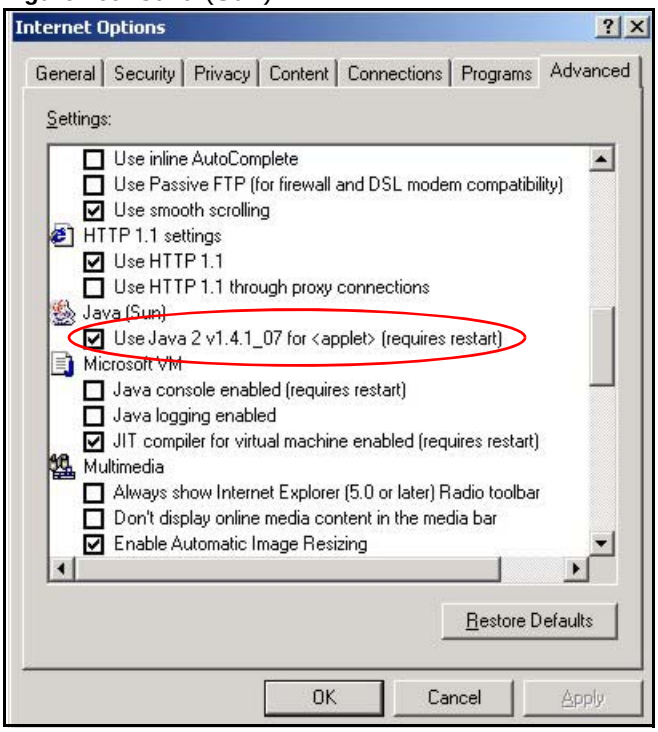
JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.

2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.

3 Click **OK** to close the window.

Figure 169 Java (Sun)

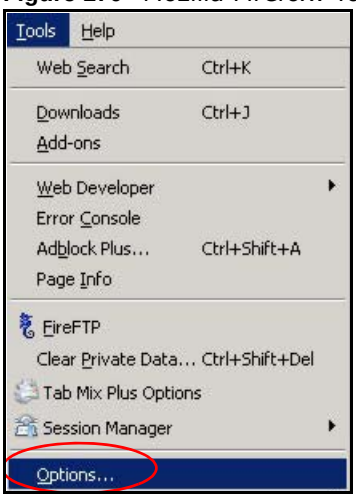


Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary.

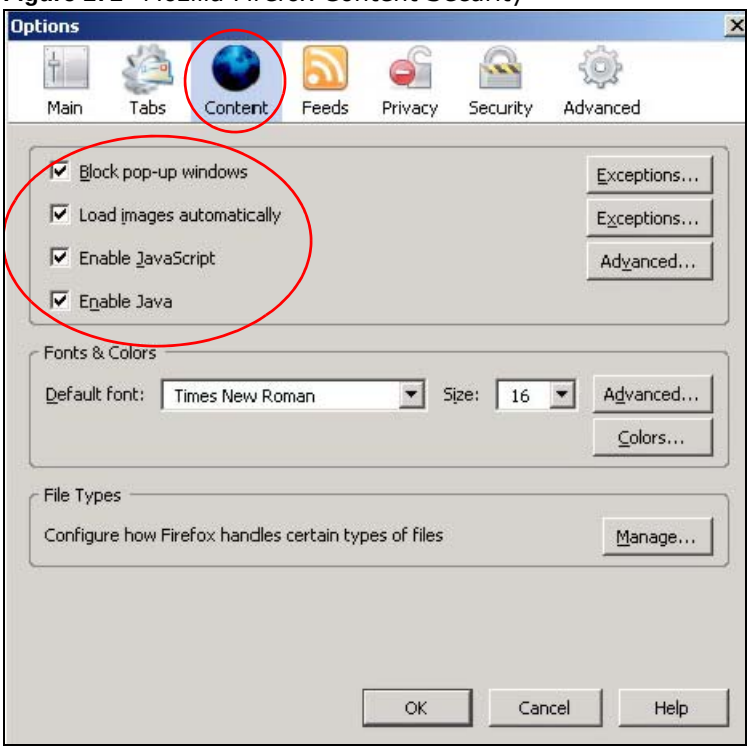
You can enable Java, Javascripts and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 170 Mozilla Firefox: Tools > Options



Click **Content** to show the screen below. Select the check boxes as shown in the following screen.

Figure 171 Mozilla Firefox Content Security



D

Wireless LANs

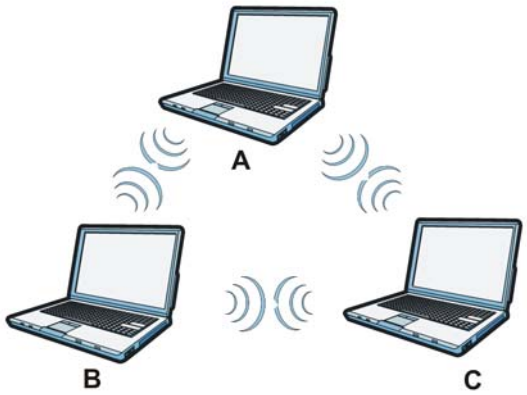
Wireless LAN Topologies

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 172 Peer-to-Peer Communication in an Ad-hoc Network

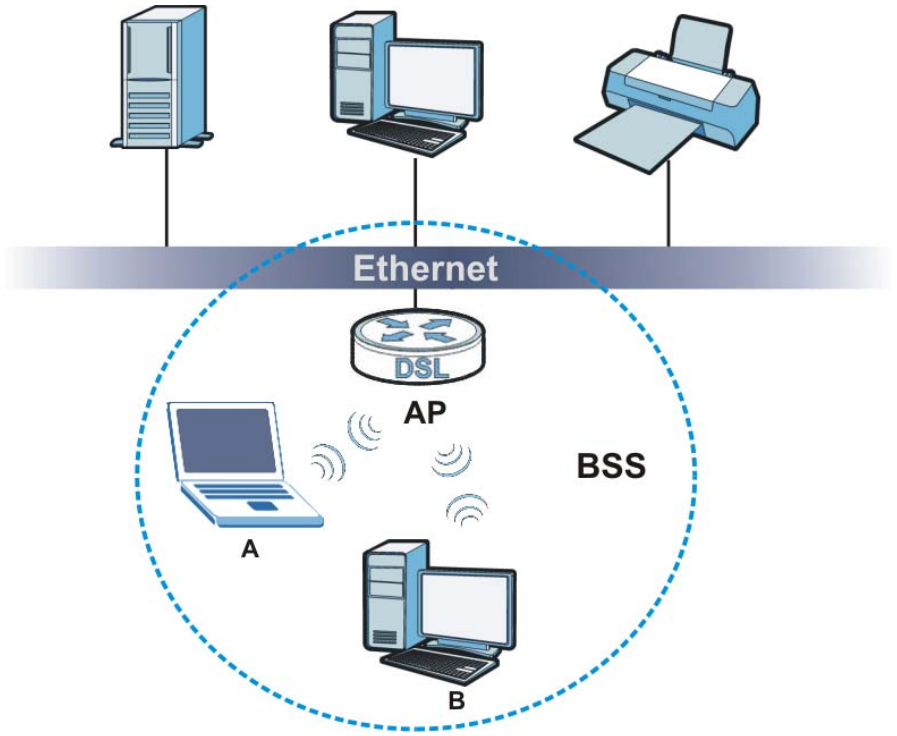


BSS

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 173 Basic Service Set



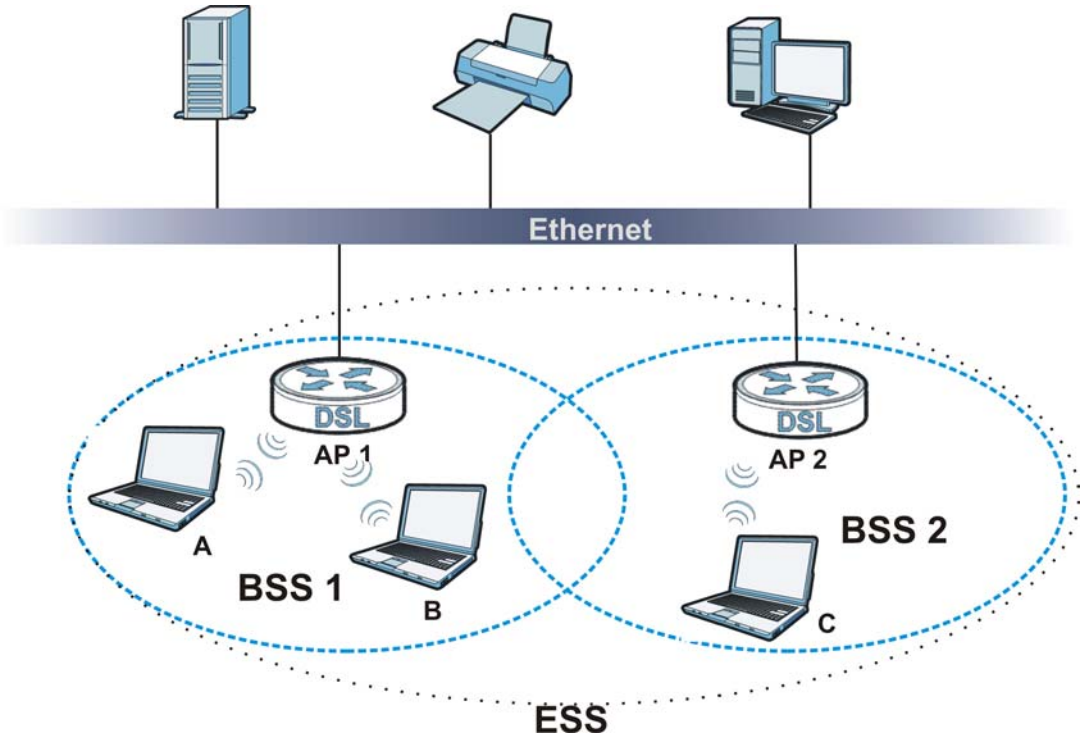
ESS

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 174 Infrastructure WLAN



Channel

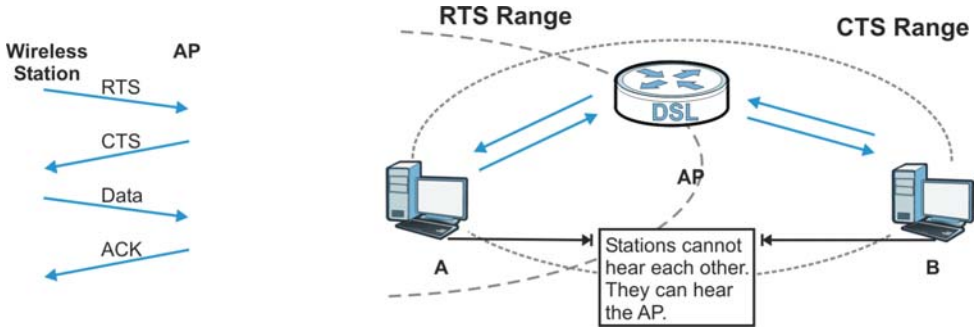
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference 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 175 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.

Preamble Type

Preamble is used to signal that data is coming to the receiver. Short and long refer to the length of the synchronization field in a packet.

Short preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11 compliant wireless adapters support long preamble, but not all support short preamble.

Use long preamble if you are unsure what preamble mode other wireless devices on the network support, and to provide more reliable communications in busy wireless networks.

Use short preamble if you are sure all wireless devices on the network support it, and to provide more efficient communications.

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the AMG1302/AMG1202-TSeries uses long preamble.

Note: The wireless devices MUST use the same preamble mode in order to communicate.

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 105 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 AMG1302/AMG1202-TSeries are data encryption, wireless client authentication, restricting access by device MAC address and hiding the AMG1302/AMG1202-TSeries identity.

The following figure shows the relative effectiveness of these wireless security methods available on your AMG1302/AMG1202-TSeries.

Table 106 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)
	WPA2
Most Secure	

Note: You must enable the same wireless security settings on the AMG1302/AMG1202-TSeries 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 107 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.

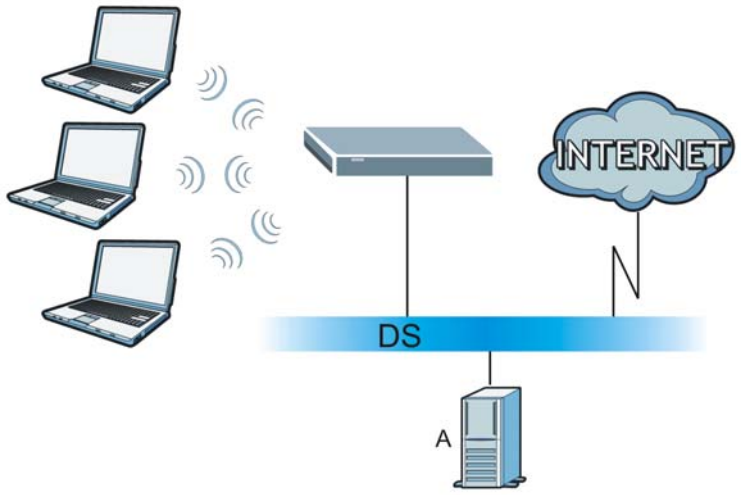
The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

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 176 WPA(2) with RADIUS Application Example



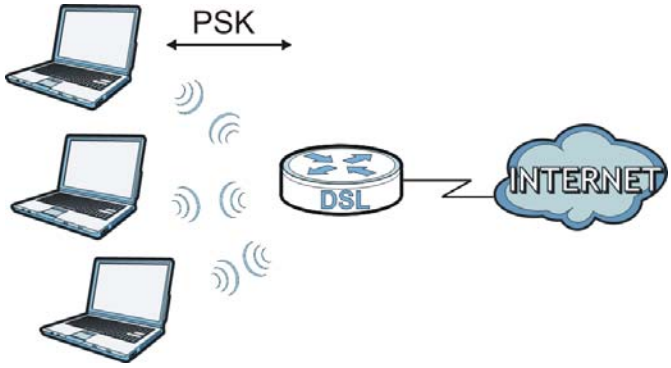
WPA(2)-PSK Application Example

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 177 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 108 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.

E

IPv6

Overview

IPv6 (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in IPv6 address size to 128 bits (from the 32-bit IPv4 address) allows up to 3.4 x 10^{38} IP addresses.

IPv6 Addressing

The 128-bit IPv6 address is written as eight 16-bit hexadecimal blocks separated by colons (:). This is an example IPv6 address `2001:0db8:1a2b:0015:0000:0000:1a2f:0000`.

IPv6 addresses can be abbreviated in two ways:

- Leading zeros in a block can be omitted. So `2001:0db8:1a2b:0015:0000:0000:1a2f:0000` can be written as `2001:db8:1a2b:15:0:0:1a2f:0`.
- Any number of consecutive blocks of zeros can be replaced by a double colon. A double colon can only appear once in an IPv6 address. So `2001:0db8:0000:0000:1a2f:0000:0000:0015` can be written as `2001:0db8::1a2f:0000:0000:0015`, `2001:0db8:0000:0000:1a2f::0015`, `2001:db8::1a2f:0:0:15` or `2001:db8:0:0:1a2f::15`.

Prefix and Prefix Length

Similar to an IPv4 subnet mask, IPv6 uses an address prefix to represent the network address. An IPv6 prefix length specifies how many most significant bits (start from the left) in the address compose the network address. The prefix length is written as "/x" where x is a number. For example,

```
2001:db8:1a2b:15::1a2f:0/32
```

means that the first 32 bits (`2001:db8`) is the subnet prefix.

Link-local Address

A link-local address uniquely identifies a device on the local network (the LAN). It is similar to a "private IP address" in IPv4. You can have the same link-local address on multiple interfaces on a device. A link-local unicast address has a predefined prefix of fe80::/10. The link-local unicast address format is as follows.

Table 109 Link-local Unicast Address Format

1111 1110 10	0	Interface ID
10 bits	54 bits	64 bits

Global Address

A global address uniquely identifies a device on the Internet. It is similar to a "public IP address" in IPv4. A global unicast address starts with a 2 or 3.

Unspecified Address

An unspecified address (0:0:0:0:0:0:0:0 or ::) is used as the source address when a device does not have its own address. It is similar to "0.0.0.0" in IPv4.

Loopback Address

A loopback address (0:0:0:0:0:0:0:1 or ::1) allows a host to send packets to itself. It is similar to "127.0.0.1" in IPv4.

Multicast Address

In IPv6, multicast addresses provide the same functionality as IPv4 broadcast addresses. Broadcasting is not supported in IPv6. A multicast address allows a host to send packets to all hosts in a multicast group.

Multicast scope allows you to determine the size of the multicast group. A multicast address has a predefined prefix of ff00::/8. The following table describes some of the predefined multicast addresses.

Table 110 Predefined Multicast Address

MULTICAST ADDRESS	DESCRIPTION
FF01:0:0:0:0:0:0:1	All hosts on a local node.
FF01:0:0:0:0:0:0:2	All routers on a local node.
FF02:0:0:0:0:0:0:1	All hosts on a local connected link.
FF02:0:0:0:0:0:0:2	All routers on a local connected link.
FF05:0:0:0:0:0:0:2	All routers on a local site.
FF05:0:0:0:0:0:1:3	All DHCP severs on a local site.

The following table describes the multicast addresses which are reserved and can not be assigned to a multicast group.

Table 111 Reserved Multicast Address

MULTICAST ADDRESS
FF00:0:0:0:0:0:0:0
FF01:0:0:0:0:0:0:0
FF02:0:0:0:0:0:0:0
FF03:0:0:0:0:0:0:0
FF04:0:0:0:0:0:0:0
FF05:0:0:0:0:0:0:0
FF06:0:0:0:0:0:0:0
FF07:0:0:0:0:0:0:0

Table 111 Reserved Multicast Address (continued)

MULTICAST ADDRESS
FF08:0:0:0:0:0:0:0
FF09:0:0:0:0:0:0:0
FF0A:0:0:0:0:0:0:0
FF0B:0:0:0:0:0:0:0
FF0C:0:0:0:0:0:0:0
FF0D:0:0:0:0:0:0:0
FF0E:0:0:0:0:0:0:0
FF0F:0:0:0:0:0:0:0

Subnet Masking

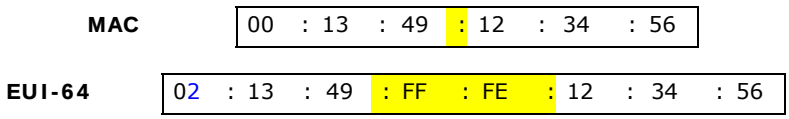
Both an IPv6 address and IPv6 subnet mask compose of 128-bit binary digits, which are divided into eight 16-bit blocks and written in hexadecimal notation. Hexadecimal uses four bits for each character (1 ~ 10, A ~ F). Each block's 16 bits are then represented by four hexadecimal characters. For example, FFFF:FFFF:FFFF:FFFF:FC00:0000:0000:0000.

Interface ID

In IPv6, an interface ID is a 64-bit identifier. It identifies a physical interface (for example, an Ethernet port) or a virtual interface (for example, the management IP address for a VLAN). One interface should have a unique interface ID.

EUI-64

The EUI-64 (Extended Unique Identifier) defined by the IEEE (Institute of Electrical and Electronics Engineers) is an interface ID format designed to adapt with IPv6. It is derived from the 48-bit (6-byte) Ethernet MAC address as shown next. EUI-64 inserts the hex digits fffe between the third and fourth bytes of the MAC address and complements the seventh bit of the first byte of the MAC address. See the following example.



Stateless Autoconfiguration

With stateless autoconfiguration in IPv6, addresses can be uniquely and automatically generated. Unlike DHCPv6 (Dynamic Host Configuration Protocol version six) which is used in IPv6 stateful autoconfiguration, the owner and status of addresses don't need to be maintained by a DHCP server. Every IPv6 device is able to generate its own and unique IP address automatically when IPv6 is initiated on its interface. It combines the prefix and the interface ID (generated from its own Ethernet MAC address, see Interface ID and EUI-64) to form a complete IPv6 address.

When IPv6 is enabled on a device, its interface automatically generates a link-local address (beginning with fe80).

When the interface is connected to a network with a router and the AMG1302/AMG1202-TSeries is set to automatically obtain an IPv6 network prefix from the router for the interface, it generates

[3]another address which combines its interface ID and global and subnet information advertised from the router. This is a routable global IP address.

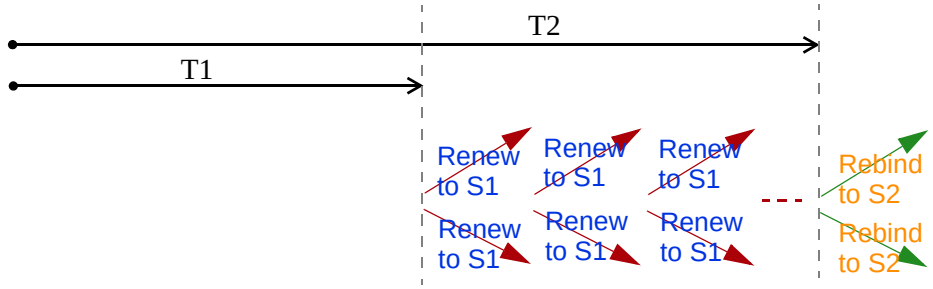
DHCPv6

The Dynamic Host Configuration Protocol for IPv6 (DHCPv6, RFC 3315) is a server-client protocol that allows a DHCP server to assign and pass IPv6 network addresses, prefixes and other configuration information to DHCP clients. DHCPv6 servers and clients exchange DHCP messages using UDP.

Each DHCP client and server has a unique DHCP Unique IDentifier (DUID), which is used for identification when they are exchanging DHCPv6 messages. The DUID is generated from the MAC address, time, vendor assigned ID and/or the vendor's private enterprise number registered with the IANA. It should not change over time even after you reboot the device.

Identity Association

An Identity Association (IA) is a collection of addresses assigned to a DHCP client, through which the server and client can manage a set of related IP addresses. Each IA must be associated with exactly one interface. The DHCP client uses the IA assigned to an interface to obtain configuration from a DHCP server for that interface. Each IA consists of a unique IAID and associated IP information.
The IA type is the type of address in the IA. Each IA holds one type of address. IA_NA means an identity association for non-temporary addresses and IA_TA is an identity association for temporary addresses. An IA_NA option contains the T1 and T2 fields, but an IA_TA option does not. The DHCPv6 server uses T1 and T2 to control the time at which the client contacts with the server to extend the lifetimes on any addresses in the IA_NA before the lifetimes expire. After T1, the client sends the server (**S1**) (from which the addresses in the IA_NA were obtained) a Renew message. If the time T2 is reached and the server does not respond, the client sends a Rebind message to any available server (**S2**). For an IA_TA, the client may send a Renew or Rebind message at the client's discretion.



DHCP Relay Agent

A DHCP relay agent is on the same network as the DHCP clients and helps forward messages between the DHCP server and clients. When a client cannot use its link-local address and a well-known multicast address to locate a DHCP server on its network, it then needs a DHCP relay agent to send a message to a DHCP server that is not attached to the same network.

The DHCP relay agent can add the remote identification (remote-ID) option and the interface-ID option to the Relay-Forward DHCPv6 messages. The remote-ID option carries a user-defined string,

3. In IPv6, all network interfaces can be associated with several addresses.

such as the system name. The interface-ID option provides slot number, port information and the VLAN ID to the DHCPv6 server. The remote-ID option (if any) is stripped from the Relay-Reply messages before the relay agent sends the packets to the clients. The DHCP server copies the interface-ID option from the Relay-Forward message into the Relay-Reply message and sends it to the relay agent. The interface-ID should not change even after the relay agent restarts.

Prefix Delegation

Prefix delegation enables an IPv6 router to use the IPv6 prefix (network address) received from the ISP (or a connected uplink router) for its LAN. The AMG1302/AMG1202-TSeries uses the received IPv6 prefix (for example, 2001:db2::/48) to generate its LAN IP address. Through sending Router Advertisements (RAs) regularly by multicast, the AMG1302/AMG1202-TSeries passes the IPv6 prefix information to its LAN hosts. The hosts then can use the prefix to generate their IPv6 addresses.

ICMPv6

Internet Control Message Protocol for IPv6 (ICMPv6 or ICMP for IPv6) is defined in RFC 4443. ICMPv6 has a preceding Next Header value of 58, which is different from the value used to identify ICMP for IPv4. ICMPv6 is an integral part of IPv6. IPv6 nodes use ICMPv6 to report errors encountered in packet processing and perform other diagnostic functions, such as "ping".

Multicast Listener Discovery

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

MLD allows an IPv6 switch or router to discover the presence of MLD listeners who wish to receive multicast packets and the IP addresses of multicast groups the hosts want to join on its network.

MLD snooping and MLD proxy are analogous to IGMP snooping and IGMP proxy in IPv4.

MLD filtering controls which multicast groups a port can join.

MLD Messages

A multicast router or switch periodically sends general queries to MLD hosts to update the multicast forwarding table. When an MLD host wants to join a multicast group, it sends an MLD Report message for that address.

An MLD Done message is equivalent to an IGMP Leave message. When an MLD host wants to leave a multicast group, it can send a Done message to the router or switch. The router or switch then sends a group-specific query to the port on which the Done message is received to determine if other devices connected to this port should remain in the group.

Transition Techniques

IPv6 Over IPv4 Tunnelling

To route traffic between two IPv6 networks over an IPv4 network, an IPv6 over IPv4 tunnel has to be used.

On the AMG1302/AMG1202-TSeries, you can either set up a configured tunnel or an automatic 6to4 tunnel. The following describes each method.

Configured Tunnel

A configured tunnel is a point-to-point tunnelling mechanism that encapsulates an IPv6 address with an IPv4 address. Routers (**A** and **B**) on both IPv6 networks (**1** and **2**) each must have an interface that connects to the IPv4 network (with an IPv4 address). This allows the router to send and receive IPv6 data over the IPv4 network.

In this case, you must specify **B**'s public IPv4 address on **A** (similarly, specify **A**'s public IPv4 address on **B**) in order for packets to arrive at the intended destination through the IPv4 network.

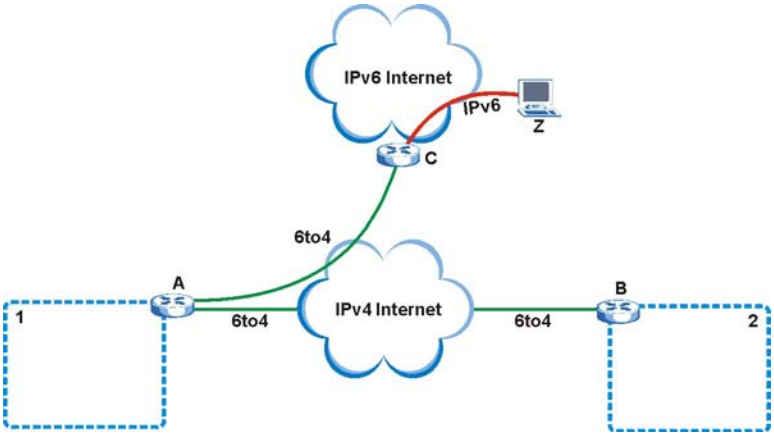
Figure 178 Configured Tunnel Example

6to4 Tunnel

A 6to4 tunnel is an automatic tunnelling mechanism that provides connection between IPv6 networks across an IPv4 network. To transmit IPv6 packets over an IPv4 network, the IPv6 packets are encapsulated inside IPv4 packets.

The following figure shows a network example.

Figure 179 6to4 Relay Router Network Example



In a 6to4 tunnel, 6to4 routers (**A** and **B** in the example network) forward these packets between IPv6 networks (**1** and **2**) over the IPv4 Internet. A 6to4 relay router (**C**) connects to both an IPv6

and IPv4 network. A 6to4 relay router is used to forward packets between 6to4 routers in an IPv4 Internet and an IPv6 device (**Z**) on the IPv6 Internet.

To transmit packets, a 6to4 address is used with a special IPv6 prefix of `2002::` to encode a given IPv4 address. A 6to4 address has the following format:

2002:IPv4 address:subnet ID:host ID/64

For example, if you have an IPv4 address of 192.168.1.1 (first converted to binary notation and then to the colon hexadecimal representation of `c0a8:0101`), then the 6to4 addresses is `2002:c0a8:0101::1/64`.

Example - Enabling IPv6 on Windows XP/2003/Vista

By default, Windows XP and Windows 2003 support IPv6. This example shows you how to use the `ipv6 install` command on Windows XP/2003 to enable IPv6. This also displays how to use the `ipconfig` command to see auto-generated IP addresses.

```
C:\>ipv6 install
Installing...
Succeeded.

C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 10.1.1.46
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        IP Address. . . . . . . . . . . . : fe80::2d0:59ff:feb8:103c%4
        Default Gateway . . . . . . . . . : 10.1.1.254
```

IPv6 is installed and enabled by default in Windows Vista. Use the `ipconfig` command to check your automatic configured IPv6 address as well. You should see at least one IPv6 address available for the interface on your computer.

Example - Enabling DHCPv6 on Windows XP

Windows XP does not support DHCPv6. If your network uses DHCPv6 for IP address assignment, you have to additionally install a DHCPv6 client software on your Windows XP. (Note: If you use static IP addresses or Router Advertisement for IPv6 address assignment in your network, ignore this section.)

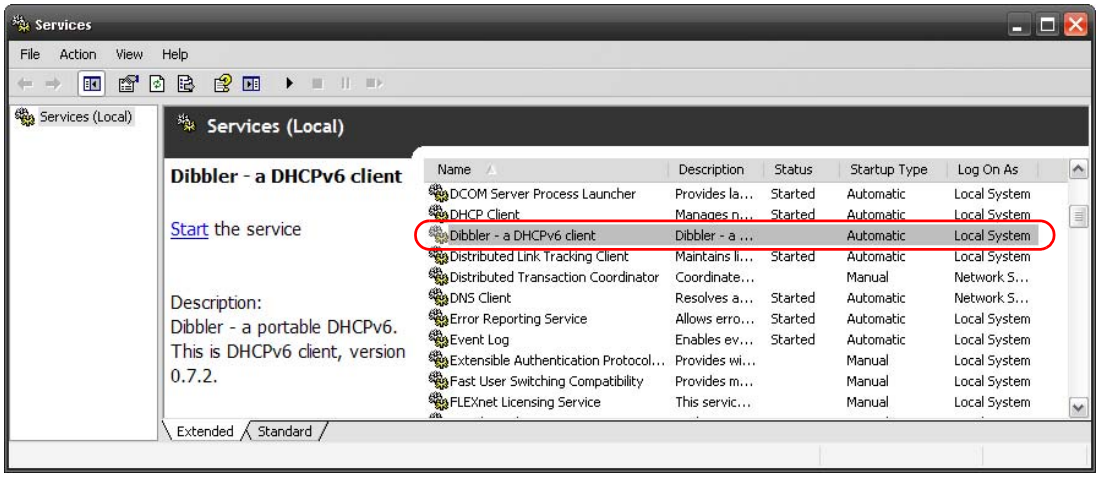
This example uses Dibbler as the DHCPv6 client. To enable DHCPv6 client on your computer:

1 Install Dibbler and select the DHCPv6 client option on your computer.

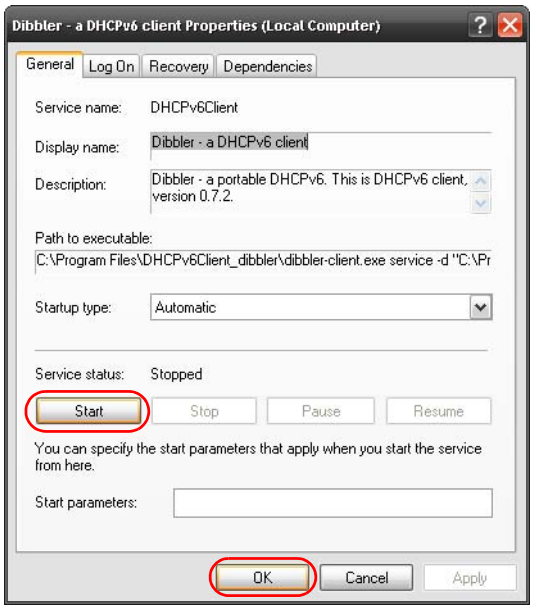
2 After the installation is complete, select **Start** > **All Programs** > **Dibbler-DHCPv6** > **Client Install as service**.

3 Select **Start** > **Control Panel** > **Administrative Tools** > **Services**.

4 Double click **Dibbler - a DHCPv6 client**.



5 Click **Start** and then **OK**.



6 Now your computer can obtain an IPv6 address from a DHCPv6 server.

Example - Enabling IPv6 on Windows 7

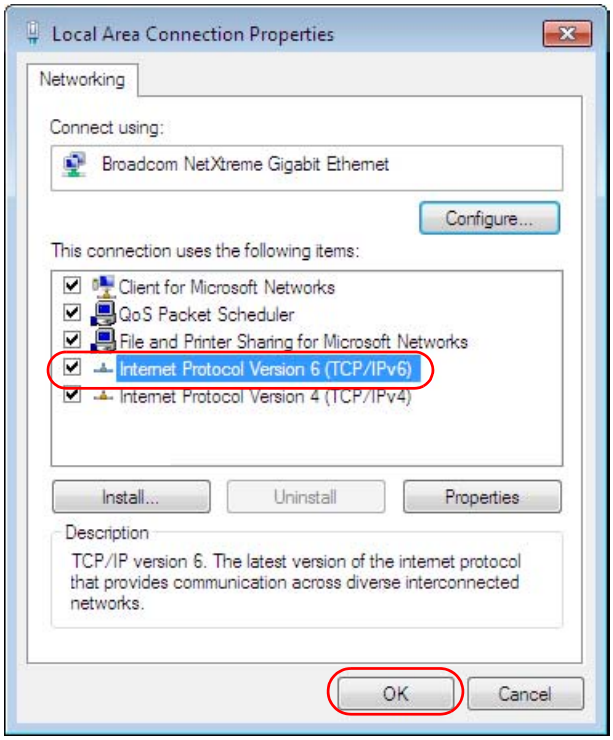
Windows 7 supports IPv6 by default. DHCPv6 is also enabled when you enable IPv6 on a Windows 7 computer.

To enable IPv6 in Windows 7:

1 Select **Control Panel** > **Network and Sharing Center** > **Local Area Connection**.

2 Select the **Internet Protocol Version 6 (TCP/IPv6)** checkbox to enable it.

3 Click **OK** to save the change.



4 Click **Close** to exit the **Local Area Connection Status** screen.

5 Select **Start** > **All Programs** > **Accessories** > **Command Prompt**.

6 Use the `ipconfig` command to check your dynamic IPv6 address. This example shows a global address (2001:b021:2d::1000) obtained from a DHCP server.

```
C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:b021:2d::1000
   Link-local IPv6 Address . . . . . : fe80::25d8:dcab:c80a:5189%11
   IPv4 Address. . . . . . . . . . . : 172.16.100.61
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::213:49ff:feaa:7125%11
                                       172.16.100.254
```

F

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 112 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.

Table 112 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
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).

Table 112 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
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.
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.

G

Legal Information

Copyright

Disclaimer

ZyXEL does not assume any liability arising out of the application or use of any products, or software described herein. Neither does it convey any license under its patent rights nor the patent rights of others. ZyXEL further reserves the right to make changes in any products described herein without notice. This publication is subject to change without notice.

Trademarks

ZyNOS (ZyXEL Network Operating System) is a registered trademark of ZyXEL Communications, Inc. Other trademarks mentioned in this publication are used for identification purposes only and may be properties of their respective owners.

Certifications

Federal Communications Commission (FCC) Interference Statement

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

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operations.

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this device does cause harmful interference to radio/television reception, which can be determined 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:

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

FCC Radiation Exposure Statement

- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- IEEE 802.11b, 802.11g or 802.11n(20MHz) operation of this product in the U.S.A. is firmware-limited to channels 1 through 11. IEEE 802.11n(40MHz) operation of this product in the U.S.A. is firmware-limited to channels 3 through 9.
- To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

Note: only channels 1 to 11 (frequency band 2.412 GHz to 2.462 GHz) are available for use in the United States of America.

注意 ！

依據　低功率電波輻射性電機管理辦法

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，指依電信規定作業之無線電信。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。

本機限在不干擾合法電臺與不受被干擾保障條件下於室內使用。
減少電磁波影響，請妥適使用。

Notices

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Viewing Certifications

Go to www.zyxel.com to view the product's documents and certifications.

ZyXEL Limited Warranty

ZyXEL warrants to the original end user (purchaser) that this product is free from any defects in materials or workmanship for a period of up to two years from the date of purchase. 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 ZyXEL's Service Center for your Return Material Authorization number (RMA). Products must be returned Postage Prepaid. It is recommended that the unit be insured when shipped. Any returned products without proof of purchase or those with an out-dated warranty will be repaired or replaced (at the discretion of ZyXEL) and the customer will be billed for parts and labor. All repaired or replaced products will be shipped by ZyXEL to the corresponding return address, Postage Paid. This warranty gives you specific legal rights, and you may also have other rights that vary from country to country.

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.

Regulatory Information

European Union

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

Declaration of Conformity with Regard to EU Directive 1999/5/EC (R&TTE Directive)

Compliance Information for 2.4GHz and 5GHz Wireless Products Relevant to the EU and Other Countries Following the EU Directive 1999/5/EC (R&TTE Directive)

[Czech]	ZyXEL tímto prohlašuje, že tento zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/EC.
[Danish]	Undertegnede ZyXEL erklærer herved, at følgende udstyr udstyr overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
[German]	Hiermit erklärt ZyXEL, dass sich das Gerät Ausstattung in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EU befindet.
[Estonian]	Käesolevaga kinnitab ZyXEL seadme seadmed vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
English	Hereby, ZyXEL declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
[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 1999/5/CE.
[Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ ZyXEL ΔΗΛΩΝΕΙ ΟΤΙ εξοπλισμός ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕC.
[French]	Par la présente ZyXEL déclare que l'appareil équipements est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/EC.
[Italian]	Con la presente ZyXEL dichiara che questo attrezzatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
[Latvian]	Ar šo ZyXEL deklarē, ka iekārtas atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
[Lithuanian]	Šiuo ZyXEL deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
[Dutch]	Hierbij verklaart ZyXEL dat het toestel uitrusting in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EC.
[Maltese]	Hawnhekk, ZyXEL, jiddikjara li dan tagħmir jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.

[Hungarian]	Alulírott, ZyXEL nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EK irányelv egyéb elõírásainak.
[Polish]	Niniejszym ZyXEL oświadcza, że sprzęt jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
[Portuguese]	ZyXEL declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/EC.
[Slovenian]	ZyXEL izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/EC.
[Slovak]	ZyXEL týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/EC.
[Finnish]	ZyXEL vakuuttaa täten että laitteet tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
[Swedish]	Härmed intygar ZyXEL att denna utrustning står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EC.
[Bulgarian]	С настоящото ZyXEL декларира, че това оборудване е в съответствие със съществените изисквания и другите приложими разпоредбите на Директива 1999/5/EC.
[Icelandic]	Hér með lýsir, ZyXEL því yfir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði tilskipunar 1999/5/EC.
[Norwegian]	Erklærer herved ZyXEL at dette utstyret er I samsvar med de grunnleggende kravene og andre relevante bestemmelser I direktiv 1999/5/EF.
[Romanian]	Prin prezenta, ZyXEL declară că acest echipament este în conformitate cu cerinţele esenţiale şi alte prevederi relevante ale Directivei 1999/5/EC.

CE

National Restrictions

This product may be used in all EU countries (and other countries following the EU directive 1999/5/EC) without any limitation except for the countries mentioned below:

Ce produit peut être utilisé dans tous les pays de l'UE (et dans tous les pays ayant transposés la directive 1999/5/CE) sans aucune limitation, excepté pour les pays mentionnés ci-dessous:

Questo prodotto è utilizzabile in tutte i paesi EU (ed in tutti gli altri paesi che seguono le direttive EU 1999/5/EC) senza nessuna limitazione, eccetto per i paesii menzionati di seguito:

Das Produkt kann in allen EU Staaten ohne Einschränkungen eingesetzt werden (sowie in anderen Staaten die der EU Direktive 1995/5/CE folgen) mit Außnahme der folgenden aufgeführten Staaten:

In the majority of the EU and other European countries,the 2,4- and 5-GHz 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 inwhich 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 both the 2,4- and 5-GHz wireless LANs.

The following countries have restrictions and/or requirements in addition to those given in the table labeled "*Overview of Regulatory Requirements for Wireless LANs*":.

Overview of Regulatory Requirements for Wireless LANs			
Frequency Band (MHz)	Max Power Level (EIRP)[1] (mW)	Indoor ONLY	Indoor and Outdoor
2400-2483.5	100		V
5150-5350	200	V	
5470-5725	1000		V

Belgium

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.

Denmark

In Denmark, the band 5150 - 5350 MHz is also allowed for outdoor usage.

I Danmark må frekvensbåndet 5150 - 5350 også anvendes udendørs.

Italy

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.

Latvia

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.

Notes:

1. Although Norway, Switzerland and Liechtenstein are not EU member states, the EU Directive 1999/5/EC 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).

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 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.
- Use ONLY an appropriate power adaptor or cord for your device.
- Connect the power adaptor or cord to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- 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.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. 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.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- Use only No. 26 AWG (American Wire Gauge) or larger telecommunication line cord.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).

Your product is marked with this symbol, which is known as the WEEE mark. WEEE stands for Waste Electronics and Electrical Equipment. It means that used electrical and electronic products should not be mixed with general waste. Used electrical and electronic equipment should be treated separately.

Index

Numbers

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

V

W