P-873HNUP-51B

802.11n Wireless VDSL2 4-port Gateway

User's Guide

Default Login Details

IP Address	http://192.168.1.1
User Name	admin
Password	1234

Firmware Version 1.10
Edition 1, 5/2011

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the ZyXEL Device using the web configurator.

Related Documentation

- Quick Start Guide

  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.

- Support Disc

  Refer to the included CD for support documents.

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your device.

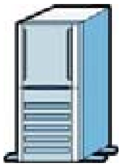
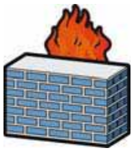
Note: Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The P-873HNUP-51B may be referred to as the “ZyXEL Device”, the “device”, the “system” or the “product” in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the “enter” or “return” key on your keyboard.
- “Enter” means for you to type one or more characters and then press the [ENTER] key. “Select” or “choose” means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the “metric” value or the “scientific” value. For example, “k” for kilo may denote “1000” or “1024”, “M” for mega may denote “1000000” or “1048576” and so on.
- “e.g.,” is a shorthand for “for instance”, and “i.e.,” means “that is” or “in other words”.

Icons Used in Figures

Figures in this User’s Guide may use the following generic icons. The ZyXEL Device icon is not an exact representation of your device.

ZyXEL Device 	Computer 	Notebook computer
Server 	Firewall 	Telephone
Router 	Switch 	

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).
- This product is for indoor use only (utilisation intérieure exclusivement).

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.

Contents Overview

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PART I

User's Guide

1

Introducing the P-873HNUP-51B

1.1 Overview

The P-873HNUP-51B is a wireless VDSL router and Gigabit Ethernet gateway with Home Phoneline Networking Alliance (HPNA) capability. It has two DSL ports and a Gigabit Ethernet port for super-fast Internet access over analog (POTS) telephone lines. If the DSLAM of the ISP supports bonding function, the two DSL ports on the P-873HNUP-51B can be connected to two separate telephone jacks to provide increased throughput at longer distances. The ZyXEL Device supports both Packet Transfer Mode (PTM) and Asynchronous Transfer Mode (ATM). It is backward compatible with ADSL, ADSL2 and ADSL2+ in case VDSL is not available. The P-873HNUP-51B also provides IEEE 802.11b/g/n wireless networking to extend the range of your existing wired network without additional wiring.

Please refer to the following description of the product name format.

- "H" denotes an integrated 4-port switch (hub).
- "N" denotes 802.11n draft 2.0. The "N" models support 802.11n wireless connection mode.
- "U" denotes a USB port. The ZyXEL Device supports a flash disk (FAT16/FAT32 format), which FTP clients can access.
- "P" denotes a device that has Home Phoneline Networking Alliance (HPNA) capability.
- Model names ending in "1", for example P-873HNUP-51, denote a device that works over the analog telephone system, POTS (Plain Old Telephone Service). The DSL RJ-14 connects to your ADSL-enabled telephone lines.

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

See Chapter 34 on page 273 for a full list of features.

1.2 Ways to Manage the ZyXEL Device

Use any of the following methods to manage the ZyXEL Device.

- Web Configurator. This is recommended for everyday management of the ZyXEL Device using a (supported) web browser.
- TR-069. This is an auto-configuration server used to remotely configure your device.

1.3 Good Habits for Managing the ZyXEL Device

Do the following things regularly to make the ZyXEL Device more secure and to manage the ZyXEL Device more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the ZyXEL Device to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the ZyXEL Device. You could simply restore your last configuration.

1.4 Applications for the ZyXEL Device

Here are some example uses for which the ZyXEL Device is well suited.

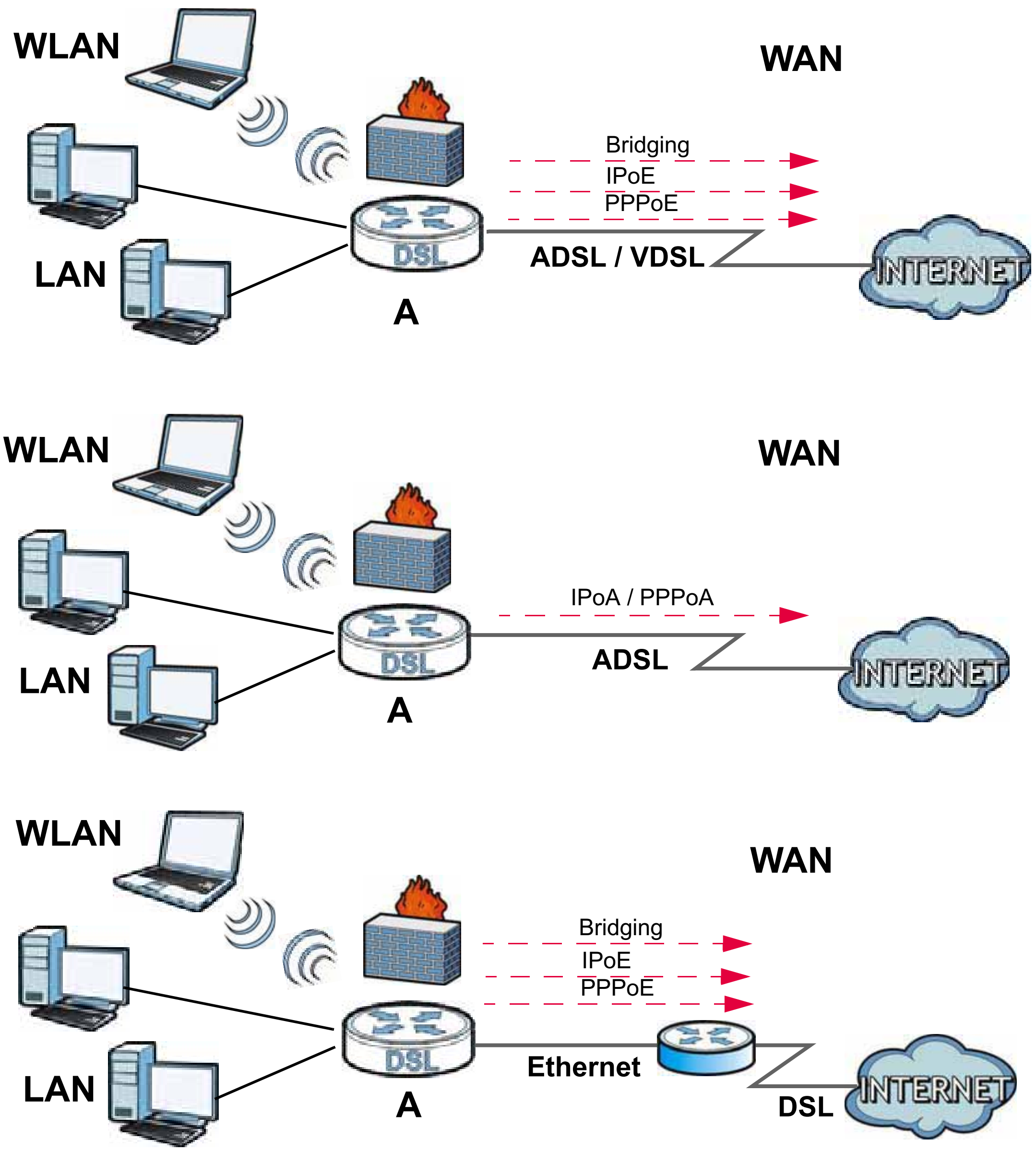
1.4.1 Internet Access

Your ZyXEL Device provides shared Internet access by connecting the DSL port to the **DSL** or **MODEM** jack on a splitter or your telephone jack. You can have up to eight WAN services over one ADSL, VDSL or Ethernet WAN line. The ZyXEL Device cannot work in ADSL, VDSL and Ethernet WAN mode at the same time.

Note: The ADSL, VDSL and Ethernet WAN lines share the same eight WAN (layer-3) interfaces that you configure in the ZyXEL Device. Refer to Section 6.2 on page 73 for the **Network Settings> Broadband** screen.

Computers can connect to the ZyXEL Device’s LAN ports (or wirelessly).

Figure 1 ZyXEL Device’s Internet Access Application



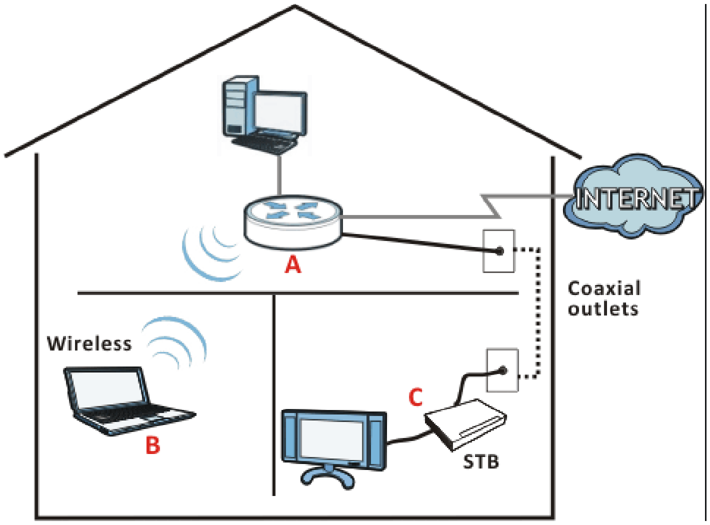
You can also configure IP filtering on the ZyXEL Device for secure Internet access. When the IP filter is on, all incoming traffic from the Internet to your network is blocked by default unless it is initiated from your network. This means that probes from the outside to your network are not allowed, but you can safely browse the Internet and download files.

1.4.2 HomePNA

The ZyXEL Device complies with HomePNA (Home Phoneline Networking Alliance, also known as HPNA) 3.1, a home networking technology for carrying data over existing coaxial cables and telephone wiring.

The figure below shows your ZyXEL Device (**A**) connecting to a phone line outlet for DSL Internet access and a coaxial outlet to relay Internet connectivity to other coaxial outlets in the building. The laptop (**B**) connects wirelessly to the ZyXEL Device. The set-up box (**C**) connects into a coaxial outlet in another part of the house for access to online videos.

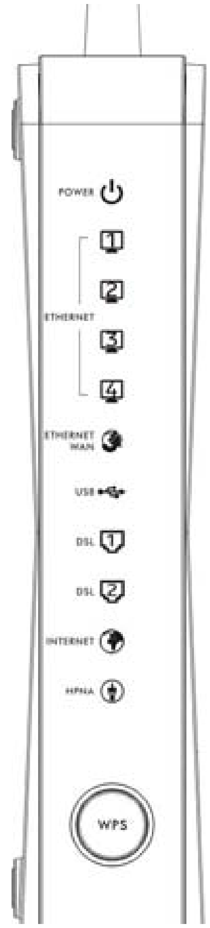
Figure 2 HomePNA Application



1.5 LEDs (Lights)

The following graphic displays the labels of the LEDs.

Figure 3 LEDs on the Device



None of the LEDs are on if the ZyXEL Device is not receiving power.

Table 1 LED Descriptions

LED	COLOR	STATUS	DESCRIPTION
POWER	Green	On	The ZyXEL Device is receiving power and ready for use.
		Blinking	The ZyXEL Device is self-testing.
	Red	On	The ZyXEL Device detected an error while self-testing, or there is a device malfunction.
		Off	The ZyXEL Device is not receiving power.
		Blinking	Firmware upgrade is in progress.
ETHERNET 1-4	Green	On	The ZyXEL Device has a successful 100 Mbps Ethernet connection with a device on the Local Area Network (LAN).
		Blinking	The ZyXEL Device is sending or receiving data to/from the LAN at 100 Mbps.
		Off	The ZyXEL Device does not have an Ethernet connection with the LAN.

Table 1 LED Descriptions (continued)

LED	COLOR	STATUS	DESCRIPTION
ETHERNET WAN	Green	On	The Gigabit Ethernet connection is working.
		Blinking	The ZyXEL Device is sending or receiving data to/from the Gigabit Ethernet link.
		Off	There is no Gigabit Ethernet link.
USB	Green	On	The ZyXEL Device recognizes a USB connection.
		Blinking	The ZyXEL Device is sending/receiving data to /from the USB device connected to it.
		Off	The ZyXEL Device does not detect a USB connection.
DSL1,2	Green	On	The ADSL line is up.
		Blinking	The ZyXEL Device is initializing the ADSL line.
		Off	The ADSL line is down.
	Orange	On	The VDSL line is up.
		Blinking	The ZyXEL Device is initializing the VDSL line.
		Off	The VDSL line is down.
INTERNET	Green	On	The ZyXEL Device has an IP connection but no traffic. Your device has a WAN IP address (either static or assigned by a DHCP server), PPP negotiation was successfully completed (if used) and the DSL connection is up.
		Blinking	The ZyXEL Device is sending or receiving IP traffic.
		Off	There is no Internet connection or the gateway is in bridged mode.
HPNA	Green	On	The ZyXEL Device is connected to an HPNA-equipped device through the coaxial cable.
		Blinking	Data is transmitting over the HPNA cable.
		Off	No HPNA device is connected.
WLAN/WPS	Green	On	The wireless network is activated.
		Blinking	The ZyXEL Device is communicating with other wireless clients.
	Green and Orange	Blinking	The ZyXEL Device is setting up a WPS connection.
		Off	The wireless network is not activated.

1.6 The RESET Button

If you forget your password or cannot access the web configurator, you will need to use the **RESET** button at the back of the device to reload the factory-default configuration file. This means that you will lose all configurations that you had previously and the password will be reset to “1234”.

1 Make sure the **POWER** LED is on (not blinking).

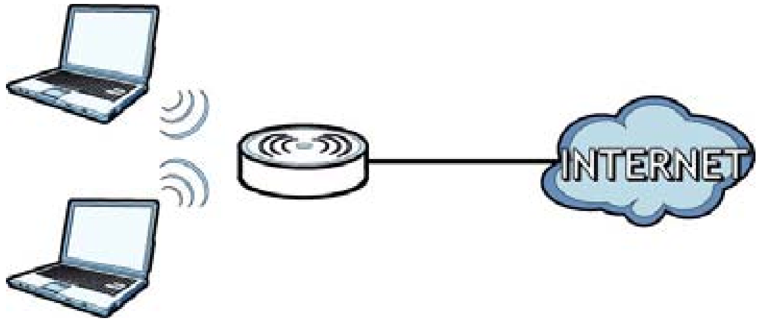
2 To set the device back to the factory default settings, press the **RESET** button for ten seconds or until the **POWER** LED begins to blink and then release it. When the **POWER** LED begins to blink, the defaults have been restored and the device restarts.

1.7 Wireless Access

The ZyXEL Device is a wireless Access Point (AP) for wireless clients, such as notebook computers or PDAs and iPads. It allows them to connect to the Internet without having to rely on inconvenient Ethernet cables.

You can configure your wireless network in either the built-in Web Configurator, or using the WPS button.

Figure 4 Wireless Access Example



1.7.1 Using the WLAN/WPS Button

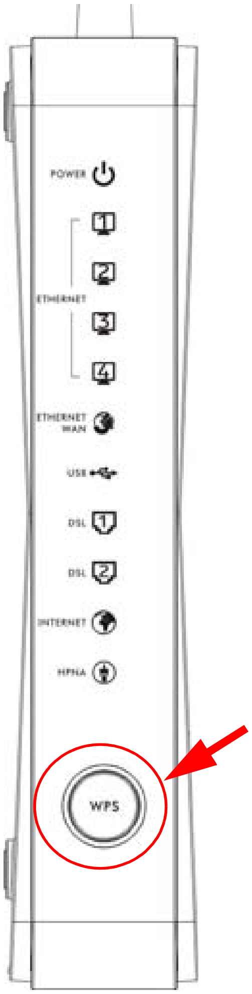
If the wireless network is turned off, press the **WLAN/WPS** button on the front of the ZyXEL Device for two seconds. Once the **WLAN/WPS** LED turns green, the wireless network is active.

You can also use the **WLAN/WPS** button to quickly set up a secure wireless connection between the ZyXEL Device and a WPS-compatible client by adding one device at a time.

To activate WPS:

1 Make sure the **POWER** LED is on and not blinking.

2 Press the **WLAN/WPS** button for five seconds and release it.



3 Press the WPS button on another WPS-enabled device within range of the ZyXEL Device. The **WLAN/WPS** LED flashes green and orange while the ZyXEL Device sets up a WPS connection with the other wireless device.

4 Once the connection is successfully made, the **WLAN/WPS** LED shines green.

To turn off the wireless network, press the **WLAN/WPS** button on the front of the ZyXEL Device for one to five seconds. The **WLAN/WPS** LED turns off when the wireless network is off.

The Web Configurator

2.1 Overview

The web configurator is an HTML-based management interface that allows easy device setup and management via Internet browser. Use Internet Explorer 6.0 and later versions or Mozilla Firefox 3 and later versions or Safari 2.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

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

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

See Appendix C on page 309 if you need to make sure these functions are allowed in Internet Explorer.

2.1.1 Accessing the Web Configurator

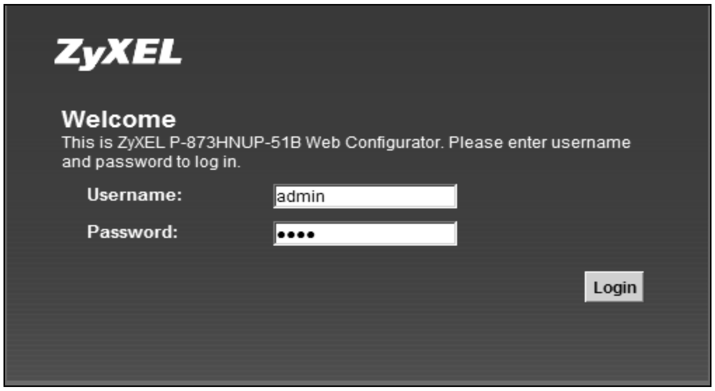
1 Make sure your ZyXEL Device hardware is properly connected (refer to the Quick Start Guide).

2 Launch your web browser. If the ZyXEL Device does not automatically re-direct you to the login screen, go to http://192.168.1.1.

3 A password screen displays. To access the administrative web configurator and manage the ZyXEL Device, type the default username **admin** and password **1234** in the password screen and click **Login**. If advanced account security is enabled (see Section 26.2 on page 241) the number of dots that appears when you type the password changes randomly to prevent anyone watching the

password field from knowing the length of your password. If you have changed the password, enter your password and click **Login**. For security reasons, you will be temporarily denied access to the ZyXEL Device for a period of time (15 minutes by default) if you have entered the incorrect username and password for a certain number of times (three times by default).

Figure 5 Password Screen



Welcome

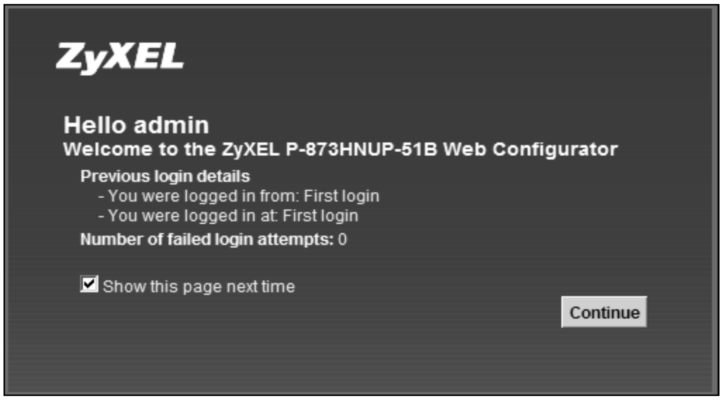
This is ZyXEL P-873HNUP-51B Web Configurator. Please enter username and password to log in.

Username: admin

Password: ●●●●

4 A welcome screen appears showing a summary of your last login, such as the time, number of failed login attempts, and when the password expires. It also shows if you are logged on from an IP address. Select **Show this page next time** to see the welcome screen on your next login. Otherwise, deselect it. Click **Continue**.

Figure 6 Welcome Screen



Hello admin

Welcome to the ZyXEL P-873HNUP-51B Web Configurator

Previous login details

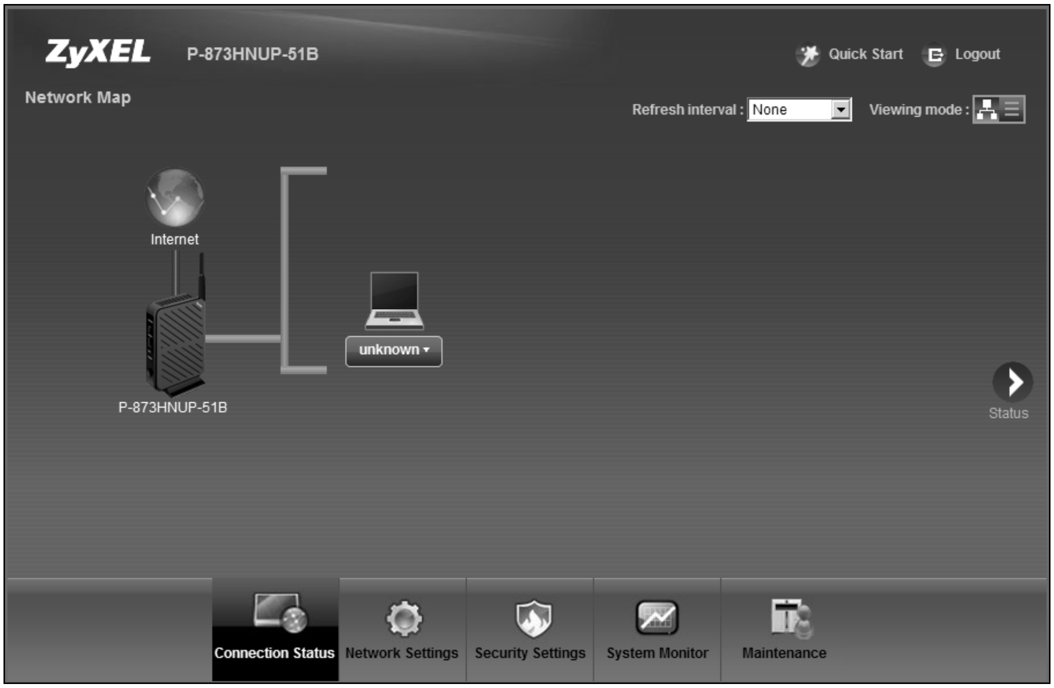
- You were logged in from: First login
- You were logged in at: First login

Number of failed login attempts: 0

☑ Show this page next time

5 The **Network Map** page appears.

Figure 7 Network Map



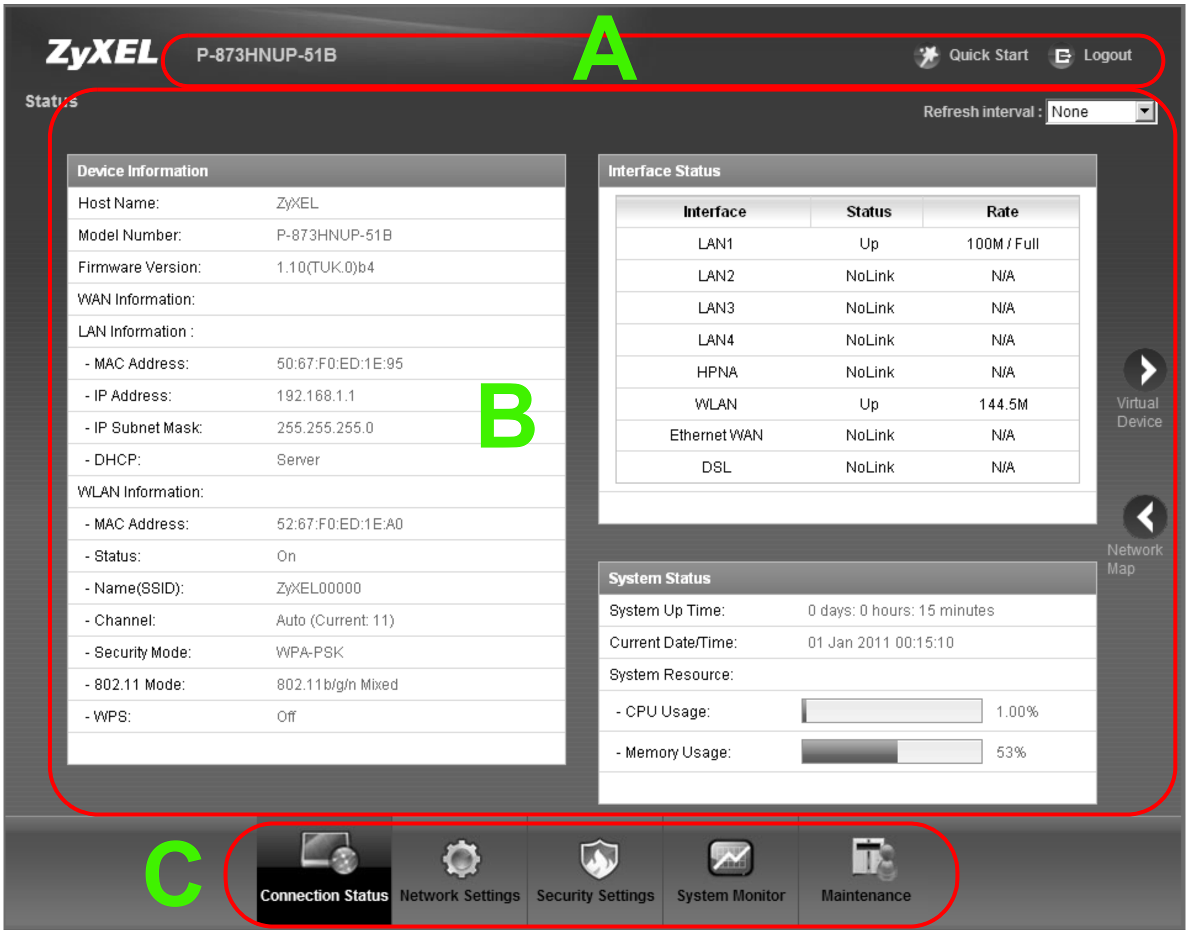
Note: For security reasons, the ZyXEL Device automatically logs you out if you do not use the web configurator for ten minutes (default). If this happens, log in again.

6 Click **Status** to display the **Status** screen, where you can view the ZyXEL Device's interface and system information.

Note: It is strongly recommended you change the default password. You can do so in the **Maintenance > Users Configuration** screen. See Chapter 26 on page 241 for more information.

2.2 Web Configurator Layout

Figure 8 Screen Layout



Device Information

Host Name:	ZyXEL
Model Number:	P-873HNUP-51B
Firmware Version:	1.10(TUK.0)b4
WAN Information:	
LAN Information :	
- MAC Address:	50:67:F0:ED:1E:95
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- MAC Address:	52:67:F0:ED:1E:A0
- Status:	On
- Name(SSID):	ZyXEL00000
- Channel:	Auto (Current: 11)
- Security Mode:	WPA-PSK
- 802.11 Mode:	802.11b/g/n Mixed
- WPS:	Off

Interface Status

Interface	Status	Rate
LAN1	Up	100M / Full
LAN2	NoLink	N/A
LAN3	NoLink	N/A
LAN4	NoLink	N/A
HPNA	NoLink	N/A
WLAN	Up	144.5M
Ethernet WAN	NoLink	N/A
DSL	NoLink	N/A

System Status

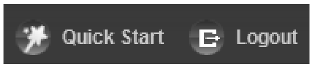
System Up Time:	0 days: 0 hours: 15 minutes
Current Date/Time:	01 Jan 2011 00:15:10
System Resource:	
- CPU Usage:	1.00%
- Memory Usage:	53%

As illustrated above, the main screen is divided into these parts:

- **A** - title bar
- **B** - main window
- **C** - navigation panel

2.2.1 Title Bar

The title bar provides some icons in the upper right corner.



The icons provide the following functions.

Table 2 Web Configurator Icons in the Title Bar

ICON	DESCRIPTION
	Quick Start: Click this icon to open screens where you can configure the ZyXEL Device's time zone Internet access, and wireless settings.
	Logout: Click this icon to log out of the web configurator.

2.2.2 Main Window

The main window displays information and configuration fields. It is discussed in the rest of this document.

After you click **Status** on the **Network Map** page, the **Status** screen is displayed. See Chapter 5 on page 67 for more information about the **Status** screen.

If you click **Virtual Device** on the **Status** screen, a visual graphic appears, showing the connection status of the ZyXEL Device's ports. The connected ports are in color and disconnected ports are gray.

If you click **Network Map** on the **Status** screen, the **Network Map** screen appears. See Chapter 5 on page 65 for more information about the **Network Map** screen.

2.2.3 Navigation Panel

Use the menu items on the navigation panel to open screens to configure ZyXEL Device features. The following tables describe each menu item.

Table 3 Navigation Panel Summary

LINK	TAB	FUNCTION
Network Map		This screen shows the network status of the ZyXEL Device and computers/ devices connected to it.
Network Settings		
Broadband	Broadband	Use this screen to enable PTM over ADSL, view and configure ISP parameters, WAN IP address assignment, and other advanced properties. You can also add new WAN connections.
	DSL	Use this screen to enable and configure the DSL bonding function.
Wireless	General	Use this screen to configure the wireless LAN settings and WLAN authentication/security settings.
	More AP	Use this screen to configure multiple BSSs on the ZyXEL Device.
	MAC Authentication	Use this screen to block or allow wireless traffic from wireless devices of certain SSIDs and MAC addresses to the ZyXEL Device.
	WPS	Use this screen to configure and view your WPS (Wi-Fi Protected Setup) settings.
	Others	Use this screen to configure advanced wireless settings.

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
Home Networking	LAN Setup	Use this screen to configure LAN TCP/IP settings, and other advanced properties.
	Static DHCP	Use this screen to assign specific IP addresses to individual MAC addresses.
	UPnP	Use this screen to turn UPnP and UPnP NAT-T on or off.
	STB Vendor ID	Use this screen to have the ZyXEL Device automatically create static DHCP entries for Set Top Box (STB) devices when they request IP addresses.
	HPNA	Use this screen to enable or disable the HPNA port.
	5th Ethernet Port	Use this screen to configure the Ethernet WAN port as a LAN port.
	LAN VLAN	Use this screen to control the VLAN ID and IEEE 802.1p priority tags of traffic sent out through individual LAN ports.
Routing	Static Route	Use this screen to view and set up static routes on the ZyXEL Device.
	Policy Forwarding	Use this screen to configure policy routing on the ZyXEL Device.
QoS	General	Use this screen to enable QoS and traffic prioritizing. You can also configure the QoS rules and actions.
	Queue Setup	Use this screen to configure QoS queues.
	Class Setup	Use this screen to define a classifier.
	Policer Setup	Use these screens to configure QoS policers.
	Monitor	Use this screen to view QoS packets statistics.
NAT	Port Forwarding	Use this screen to make your local servers visible to the outside world.
	Applications	Use this screen to configure servers behind the ZyXEL Device.
	Port Triggering	Use this screen to change your ZyXEL Device’s port triggering settings.
	DMZ	Use this screen to configure a default server which receives packets from ports that are not specified in the **Port Forwarding** screen.
	ALG	Use this screen to enable or disable SIP ALG.
	Sessions	Use this screen to limit the number of NAT sessions a single client can establish.
DNS Setting	DNS Entry	Use this screen to view and configure DNS routes.
	Dynamic DNS	Use this screen to allow a static hostname alias for a dynamic IP address.
IGMP Setting	General	Use this screen to configure general IGMP proxy and IGMP packet processing settings.
	IGMP Filter	Use this screen to control IGMP access.
	IGMP ACL	Use this screen to block or allow access to specific multicast media channels.
Interface Group	Interface Group	Use this screen to map a port to a PVC or bridge group.
Security Settings		
Firewall	General	Use this screen to configure the security level of your firewall.
	Protocol	Use this screen to add or remove predefined Internet services and configure firewall rules.
	Access Control	Use this screen to enable specific traffic directions for network services.
MAC Filter	MAC Filter	Use this screen to block or allow traffic from devices of certain MAC addresses to the ZyXEL Device.

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
Parental Control	Parental Control	Use this screen to block web sites with the specific URL.
Scheduler Rule	Scheduler Rule	Use this screen to configure the days and times when a configured restriction (such as parental control) is enforced.
Certificates	Local Certificates	Use this screen to view a summary list of certificates and manage certificates and certification requests.
	Trusted CA	Use this screen to view and manage the list of the trusted CAs.
Service Control	Service Control	Use this screen to control service access to the ZyXEL Device.
System Monitor		
ARP Table	ARP Table	Use this screen to view the ARP table. It displays the IP and MAC address of each DHCP connection.
Log	System Log	Use this screen to view the status of events that occurred to the ZyXEL Device. You can export or e-mail the logs.
	Security Log	Use this screen to view the login record of the ZyXEL Device. You can export or e-mail the logs.
Traffic Status	WAN	Use this screen to view the status of all network traffic going through the WAN port of the ZyXEL Device.
	LAN	Use this screen to view the status of all network traffic going through the LAN ports of the ZyXEL Device.
	HPNA	Use this screen to view the status of all network traffic going through the HPNA port of the ZyXEL Device.
IGMP Group Status	IGMP Group	Use this screen to view the status of all IGMP settings on the ZyXEL Device.
	IGMP Statistics	Use this screen to view the ZyXEL Device's IGMP multicast group and IGMP traffic statistics.
xDSL Statistics	xDSL Statistics	Use this screen to view the ZyXEL Device's xDSL traffic statistics.
Maintenance		
Users Configuration	Users Configuration	Use this screen to add and configure user accounts on the ZyXEL Device.
Remote MGMT	TR-069 Client	Use this screen to configure the ZyXEL Device to be managed by an Auto Configuration Server (ACS).
	TR-064 Client	Use this screen to enable management via TR-064 on the LAN.
	SNMP Agent	Use this screen to configure your ZyXEL Device's settings for Simple Network Management Protocol management.
Time Setting	Time Setting	Use this screen to change your ZyXEL Device's time and date.
Log Setting	Log Setting	Use this screen to change your ZyXEL Device's log settings.
Firmware Upgrade	Firmware Upgrade	Use this screen to upload firmware to your device.
Configuration	Configuration	Use this screen to backup and restore your device's configuration (settings) or reset the factory default settings.
Reboot	Reboot	Use this screen to reboot the ZyXEL Device without turning the power off.

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
Diagnostic	Ping & TraceRoute & NsLookup	Use this screen to identify problems with the DSL connection. You can use Ping, TraceRoute, or Nslookup to help you identify problems.
	802.1ag	Use this screen to configure CFM (Connectivity Fault Management) MD (maintenance domain) and MA (maintenance association), perform connectivity tests and view test reports.
	OAM Ping	These screen displays information to help you identify problems with the DSL connection.

Quick Start

3.1 Overview

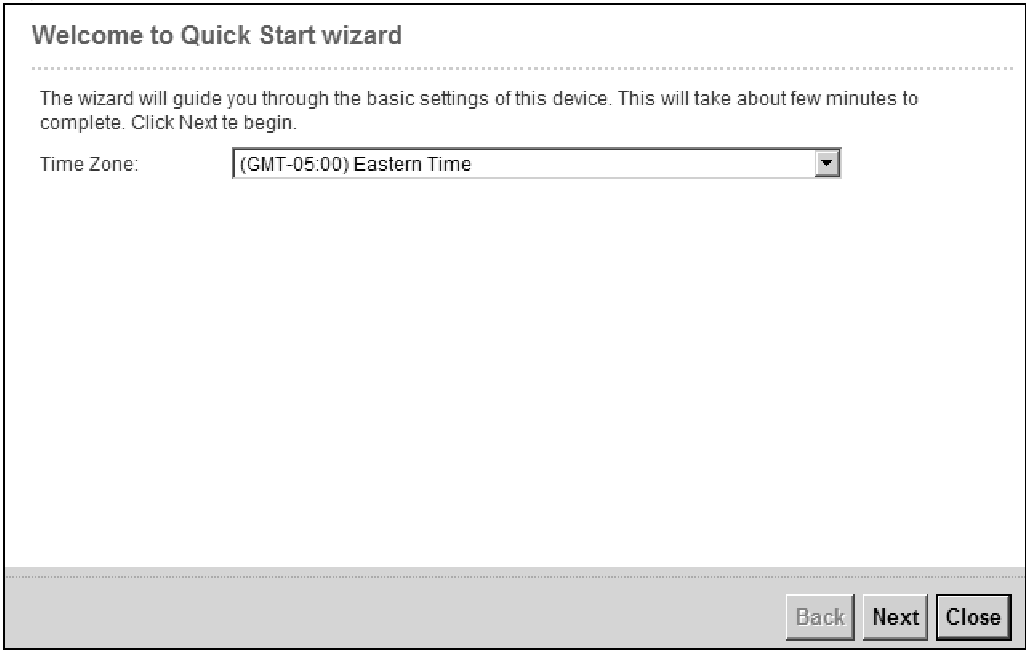
Use the Quick Start screens to configure the ZyXEL Device's time zone and basic Internet access and wireless settings.

Note: See the technical reference chapters (starting on page 63) for background information on the features in this chapter.

3.2 Quick Start Setup

1 Click the **Click Start** icon in the top right corner of the web configurator to open the quick start screens. Select the time zone of the ZyXEL Device's location and click **Next**.

Figure 9 Time Zone



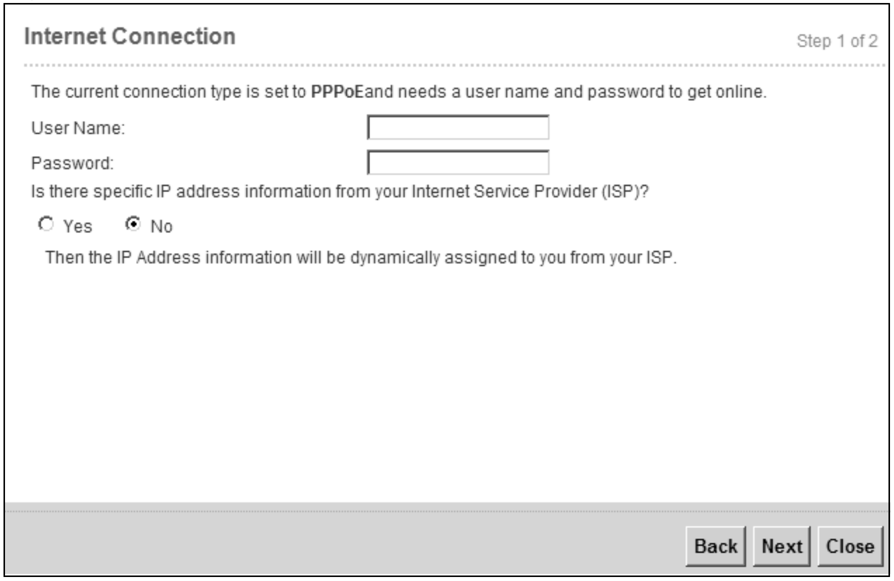
Welcome to Quick Start wizard

The wizard will guide you through the basic settings of this device. This will take about few minutes to complete. Click Next te begin.

Time Zone: (GMT-05:00) Eastern Time

2 Enter your PPPoE account's user name and password exactly as provided by your Internet Service Provider (ISP). If your ISP also gave you static IP address settings to use, select **Yes** and enter them in the fields that display. Click **Next**.

Figure 10 Internet Connection



Internet Connection

Step 1 of 2

The current connection type is set to **PPPoE**and needs a user name and password to get online.

User Name:

Password:

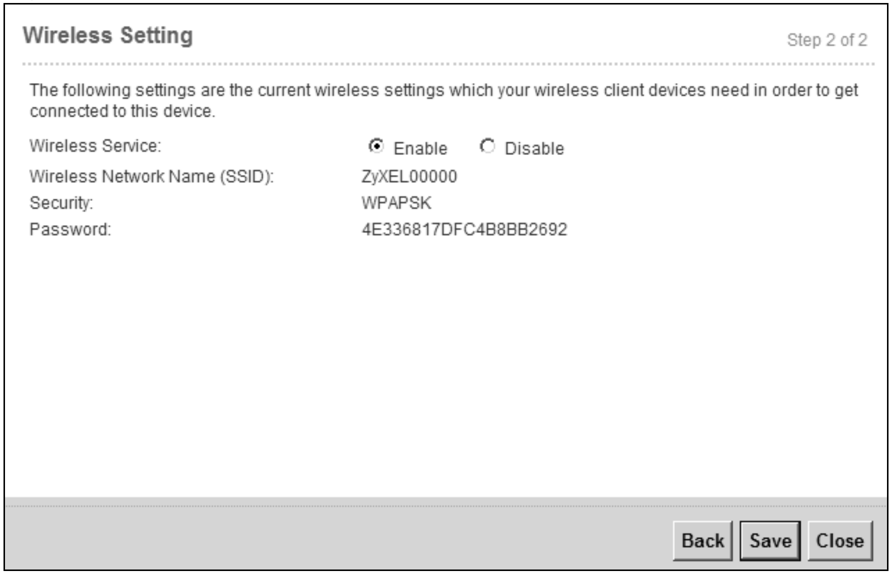
Is there specific IP address information from your Internet Service Provider (ISP)?

○ Yes ● No

Then the IP Address information will be dynamically assigned to you from your ISP.

3 Turn the wireless LAN on or off. If you keep it on, record the security settings so you can configure your wireless clients to connect to the ZyXEL Device. Click **Save**.

Figure 11 Internet Connection



Wireless Setting

Step 2 of 2

The following settings are the current wireless settings which your wireless client devices need in order to get connected to this device.

Wireless Service: ● Enable ○ Disable

Wireless Network Name (SSID): ZyXEL00000

Security: WPAPSK

Password: 4E336817DFC4B8BB2692

4 Your ZyXEL Device saves your settings and attempts to connect to the Internet.

4

Tutorials

4.1 Overview

This chapter shows you how to use the ZyXEL Device's various features.

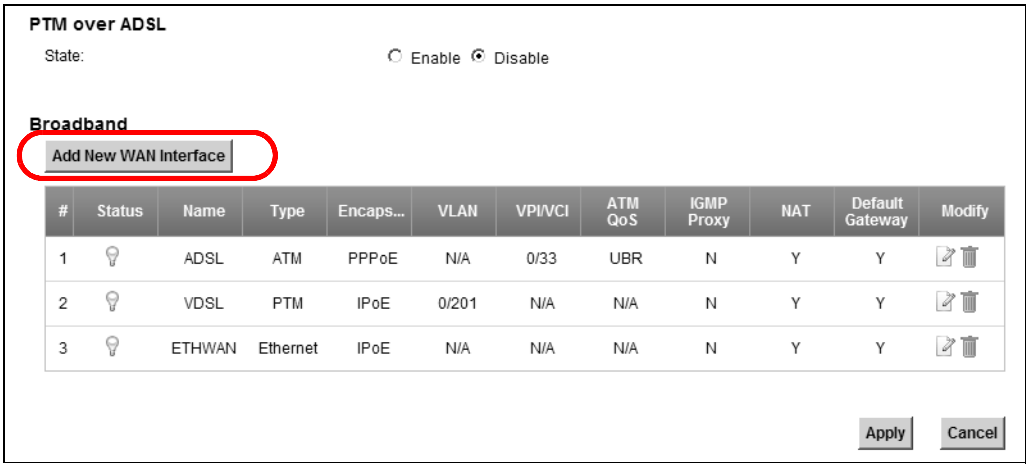
- Setting Up an ADSL PPPoE Connection, see page 39
- HomePNA Example Setup, see page 42
- Setting Up a Secure Wireless Network, see page 44
- Setting Up Multiple Wireless Groups, see page 50
- Setting Up NAT Port Forwarding, see page 53
- Configuring Static Route for Routing to Another Network, see page 55
- Configuring QoS Queue and Class Setup, see page 57
- Access the ZyXEL Device Using DDNS, see page 60

4.2 Setting Up an ADSL PPPoE Connection

This tutorial shows you how to set up your Internet connection using the Web Configurator.

If you connect to the Internet through an ADSL connection, use the information from your Internet Service Provider (ISP) to configure the ZyXEL Device. Be sure to contact your service provider for any information you need to configure the **Broadband** screens.

1 Click **Network Settings > Broadband** to open the following screen. Click **Add New WAN Interface**.



PTM over ADSL

State: ○ Enable ● Disable

Broadband

#	Status	Name	Type	Encaps...	VLAN	VPI/VCI	ATM QoS	IGMP Proxy	NAT	Default Gateway	Modify
1	💡	ADSL	ATM	PPPoE	N/A	0/33	UBR	N	Y	Y	✎ 🗑
2	💡	VDSL	PTM	IPoE	0/201	N/A	N/A	N	Y	Y	✎ 🗑
3	💡	ETHWAN	Ethernet	IPoE	N/A	N/A	N/A	N	Y	Y	✎ 🗑

2 In this example, the DSL connection has the following information.

General	
Connection Name	MyDSLConnection
Type	ADSL over ATM
Connection Mode	Routing
Encapsulation	PPPoE
ATM PVC Configuration	
VPI/VCI	36/48
Encapsulation Mode	LLC/SNAP-Bridging
Service Category	UBR without PCR
Account Information	
PPP User Name	1234@DSL-Ex.com
PPP Password	ABCDEF!
PPPoE Service Name	MyDSL
Static IP Address	192.168.1.32
Others	PPPoE Passthrough: Disabled NAT: Enabled IGMP Multicast Proxy: Enabled Apply as Default Gateway: Enabled

3 Select the **Active** check box. Enter the **General** and **ATM PVC Configuration** settings as provided above.

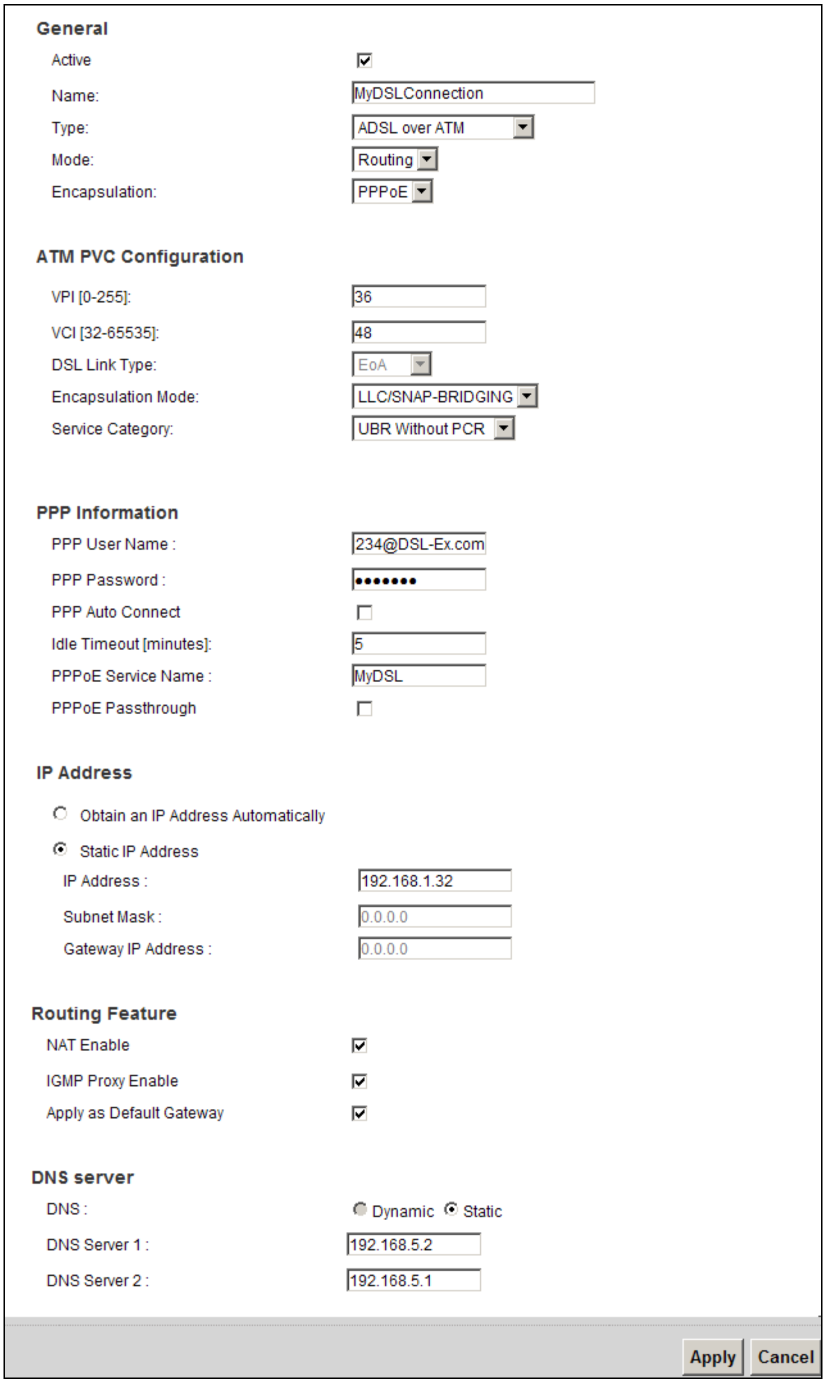
Set the **Type** to **ADSL over ATM**.

Choose the **Encapsulation** specified by your DSL service provider. For this example, the service provider requires a username and password to establish Internet connection. Therefore, select **PPPoE** as the WAN encapsulation type.

4 Enter the account information provided to you by your DSL service provider.

5 Configure this rule as your default Internet connection by selecting the **Apply as Default Gateway** check box. Then select DNS as **Static** and enter the DNS server addresses provided to you, such as **192.168.5.2** (DNS server1)/**192.168.5.1** (DNS server2).

6 Click **Apply** to save your settings.



General

Active ☑

Name: MyDSLConnection

Type: ADSL over ATM

Mode: Routing

Encapsulation: PPPoE

ATM PVC Configuration

VPI [0-255]: 36

VCI [32-65535]: 48

DSL Link Type: EoA

Encapsulation Mode: LLC/SNAP-BRIDGING

Service Category: UBR Without PCR

PPP Information

PPP User Name : 234@DSL-Ex.com

PPP Password : •••••••

PPP Auto Connect □

Idle Timeout [minutes]: 5

PPPoE Service Name : MyDSL

PPPoE Passthrough □

IP Address

○ Obtain an IP Address Automatically

● Static IP Address

IP Address : 192.168.1.32

Subnet Mask : 0.0.0.0

Gateway IP Address : 0.0.0.0

Routing Feature

NAT Enable ☑

IGMP Proxy Enable ☑

Apply as Default Gateway ☑

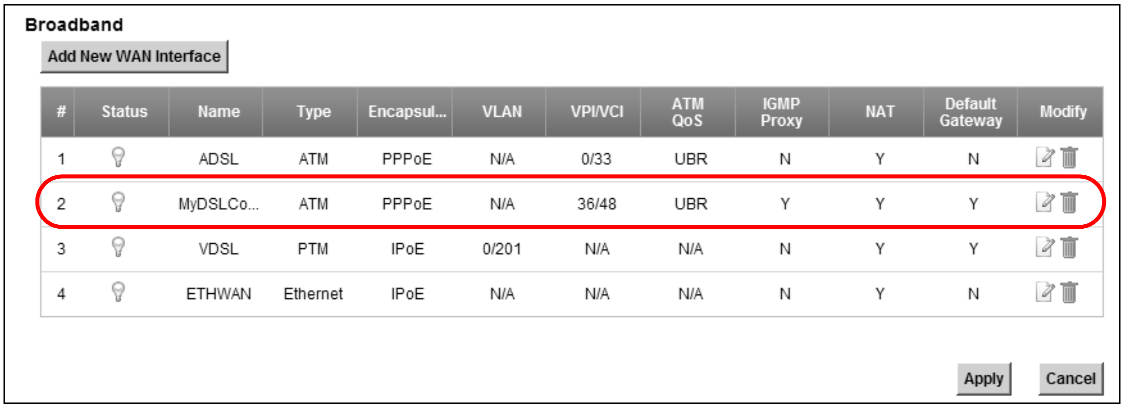
DNS server

DNS : ○ Dynamic ● Static

DNS Server 1 : 192.168.5.2

DNS Server 2 : 192.168.5.1

7 You should see a summary of your new DSL connection setup in the **Broadband** screen as follows.



Broadband

#	Status	Name	Type	Encapsul...	VLAN	VPI/VCI	ATM QoS	IGMP Proxy	NAT	Default Gateway	Modify
1	💡	ADSL	ATM	PPPoE	N/A	0/33	UBR	N	Y	N	✎ 🗑
2	💡	MyDSLCo...	ATM	PPPoE	N/A	36/48	UBR	Y	Y	Y	✎ 🗑
3	💡	VDSL	PTM	IPoE	0/201	N/A	N/A	N	Y	Y	✎ 🗑
4	💡	ETHWAN	Ethernet	IPoE	N/A	N/A	N/A	N	Y	N	✎ 🗑

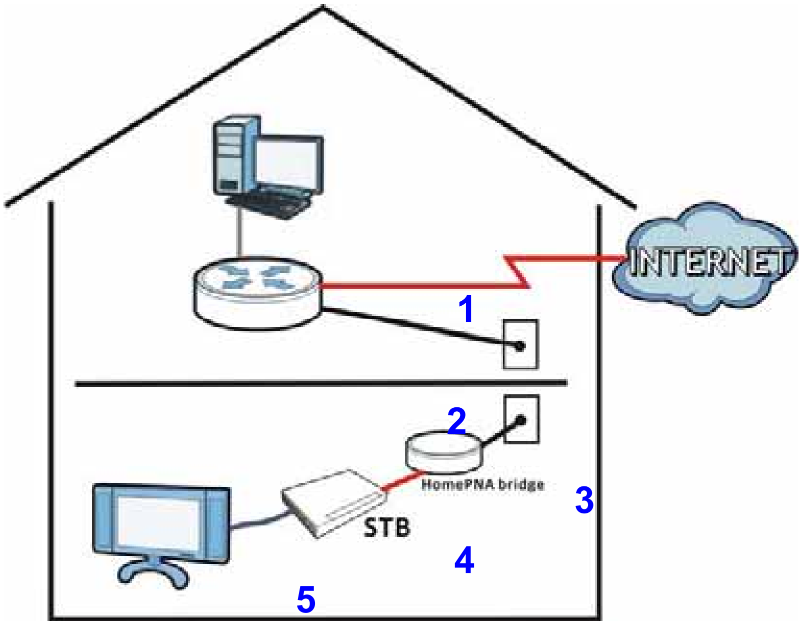
Try to connect to a website, such as zyxel.com to see if you have correctly set up your Internet connection. Be sure to contact your service provider for any information you need to configure the WAN screens.

4.3 HomePNA Example Setup

This tutorial shows you how you can use the ZyXEL Device’s HomePNA feature to connect a television in another part of the house to the Internet through the coaxial port. You will need:

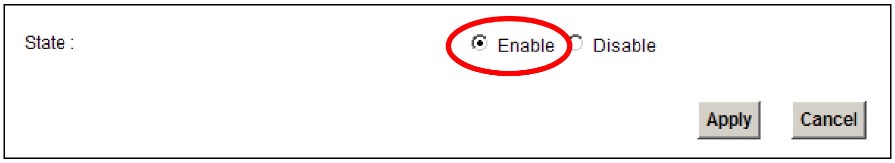
- a Set-Top Box (STB)
- HomePNA Ethernet Bridge
- a television; and
- an active Video On Demand (VOD)/Internet Protocol Television (IPTV) subscription

The figure below shows the hardware setup for this tutorial:



1 Log into the ZyXEL Device’s Web Configurator. Go to the **Network Settings > HPNA** screen.

2 Select **Enable** in the **State** field to enable your HPNA port.



State : ● Enable ○ Disable

3 Connect your ZyXEL Device to the Internet source. This could be either DSL or Ethernet.

4 Connect the ZyXEL Device’s coaxial port a coaxial outlet in your house. This relays Internet connectivity to other coaxial outlets in other parts of the house.

5 In the room where your television is located, connect the HomePNA bridge to a coaxial outlet.

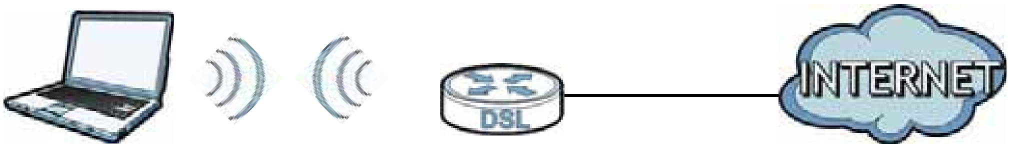
6 Using an Ethernet cable, connect the HomePNA bridge device to the STB. This grants Internet access to the STB.

7 Refer to the user’s guide of your STB for information on how to connect it to your television, as well as configure your account settings on it.

You should now be able to watch online videos in your television using your VOD or IPTV subscription.

4.4 Setting Up a Secure Wireless Network

Thomas wants to set up a wireless network so that he can use his notebook to access the Internet. In this wireless network, the ZyXEL Device serves as an access point (AP), and the notebook is the wireless client. The wireless client can access the Internet through the AP.



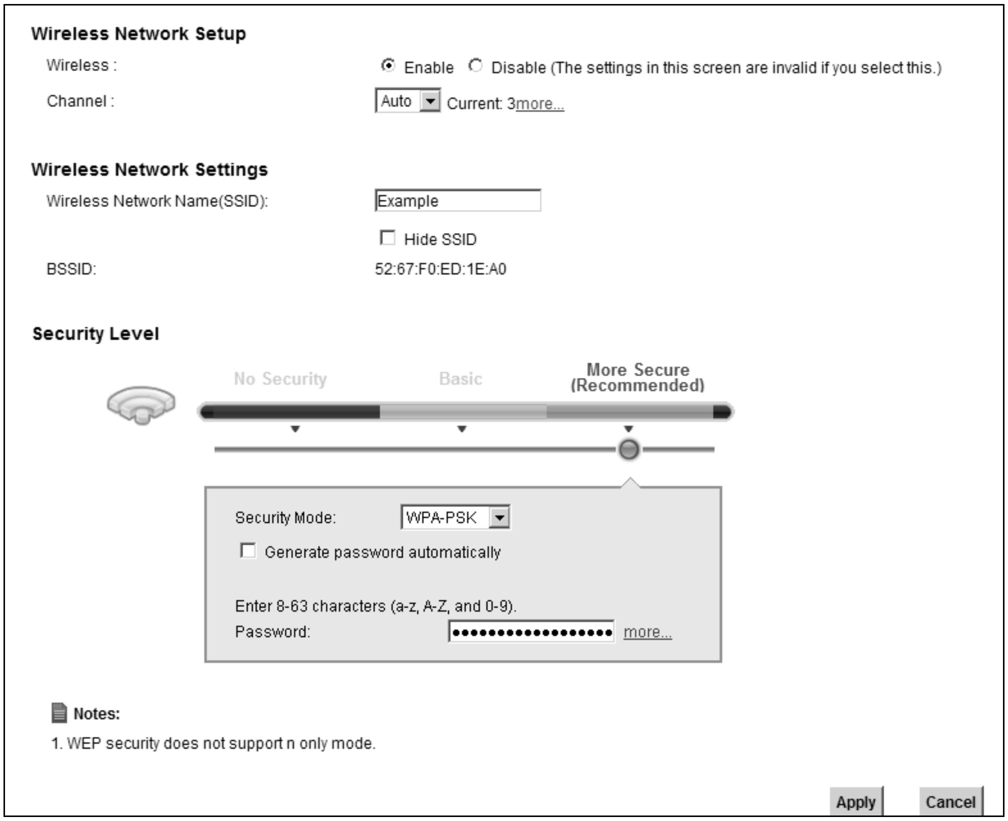
Thomas has to configure the wireless network settings on the ZyXEL Device. Then he can set up a wireless network using WPS (Section 4.4.2 on page 46) or manual configuration (Section 4.4.3 on page 49).

4.4.1 Configuring the Wireless Network Settings

This example uses the following parameters to set up a wireless network.

SSID	Example
Security Mode	WPA-PSK
Pre-Shared Key	DoNotStealMyWirelessNetwork
802.11 Mode	802.11b/g/n Mixed

1 Click **Network Settings** > **Wireless** to open the **General** screen. Select **More Secure** as the security level and **WPA-PSK** as the security mode. Configure the screen using the provided parameters (see page 44). Click **Apply**.



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Channel : Auto Current: 3more...

Wireless Network Settings

Wireless Network Name(SSID): Example

□ Hide SSID

BSSID: 52:67:F0:ED:1E:A0

Security Level

Security Mode: WPA-PSK

□ Generate password automatically

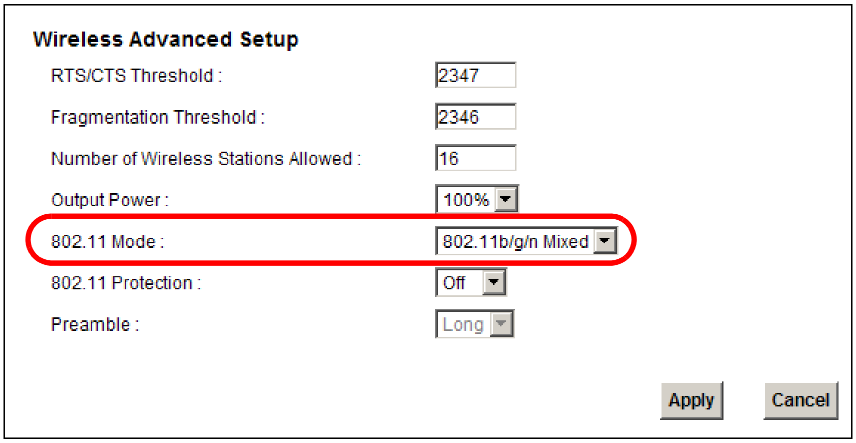
Enter 8-63 characters (a-z, A-Z, and 0-9).

Password: •••••••••••••••••• more...

Notes:

1. WEP security does not support n only mode.

2 Go to the **Wireless > Others** screen and select **802.11b/g/n Mixed** in the **802.11 Mode** field. Click **Apply**.



Wireless Advanced Setup

RTS/CTS Threshold : 2347

Fragmentation Threshold : 2346

Number of Wireless Stations Allowed : 16

Output Power : 100%

802.11 Mode : 802.11b/g/n Mixed

802.11 Protection : Off

Preamble : Long

Thomas can now use the WPS feature to establish a wireless connection between his notebook and the ZyXEL Device (see Section 4.4.2 on page 46). He can also use the notebook's wireless client to search for the ZyXEL Device (see Section 4.4.3 on page 49).

4.4.2 Using WPS

This section shows you how to set up a wireless network using WPS. It uses the ZyXEL Device as the AP and ZyXEL NWD210N as the wireless client which connects to the notebook.

Note: The wireless client must be a WPS-aware device (for example, a WPS USB adapter or PCMCIA card).

There are two WPS methods to set up the wireless client settings:

- **Push Button Configuration (PBC)** - simply press a button. This is the easier of the two methods.
- **PIN Configuration** - configure a Personal Identification Number (PIN) on the ZyXEL Device. A wireless client must also use the same PIN in order to download the wireless network settings from the ZyXEL Device.

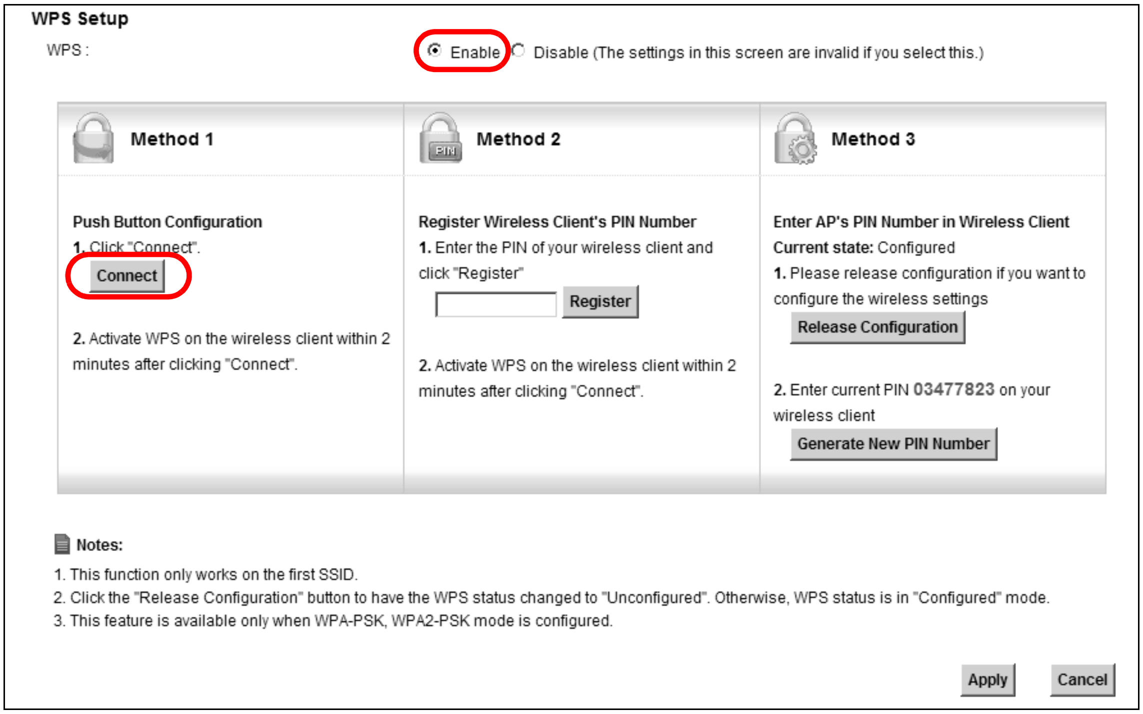
Push Button Configuration (PBC)

1 Make sure that your ZyXEL Device is turned on and your notebook is within the cover range of the wireless signal.

2 Make sure that you have installed the wireless client driver and utility in your notebook.

3 In the wireless client utility, go to the WPS setting page. Enable WPS and press the WPS button (**Start** or **WPS** button).

4 Push and hold the **WPS** button located on the ZyXEL Device's front panel for more than 5 seconds. Alternatively, you may log into ZyXEL Device's web configurator and go to the **Network Settings > Wireless > WPS** screen. Enable the WPS function and click **Apply**. Then click the **Connect** button.



WPS Setup

WPS : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Method 1

Push Button Configuration

1. Click "Connect".

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 2

Register Wireless Client's PIN Number

1. Enter the PIN of your wireless client and click "Register"

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 3

Enter AP's PIN Number in Wireless Client

Current state: Configured

1. Please release configuration if you want to configure the wireless settings

2. Enter current PIN **03477823** on your wireless client

Notes:

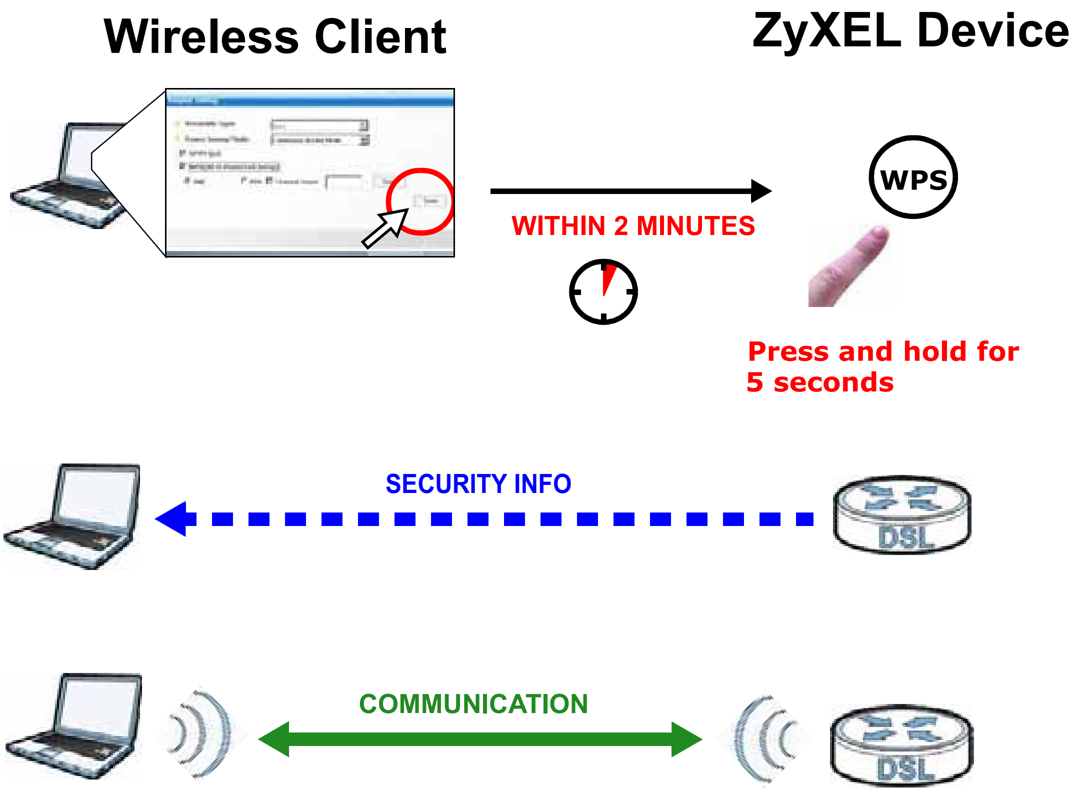
1. This function only works on the first SSID.
2. Click the "Release Configuration" button to have the WPS status changed to "Unconfigured". Otherwise, WPS status is in "Configured" mode.
3. This feature is available only when WPA-PSK, WPA2-PSK mode is configured.

Note: Your ZyXEL Device has a WPS button located on its front panel as well as a WPS button in its configuration utility. Both buttons have exactly the same function: you can use one or the other.

Note: It doesn't matter which button is pressed first. You must press the second button within two minutes of pressing the first one.

The ZyXEL Device sends the proper configuration settings to the wireless client. This may take up to two minutes. The wireless client is then able to communicate with the ZyXEL Device securely.

The following figure shows you an example of how to set up a wireless network and its security by pressing a button on both ZyXEL Device and wireless client.

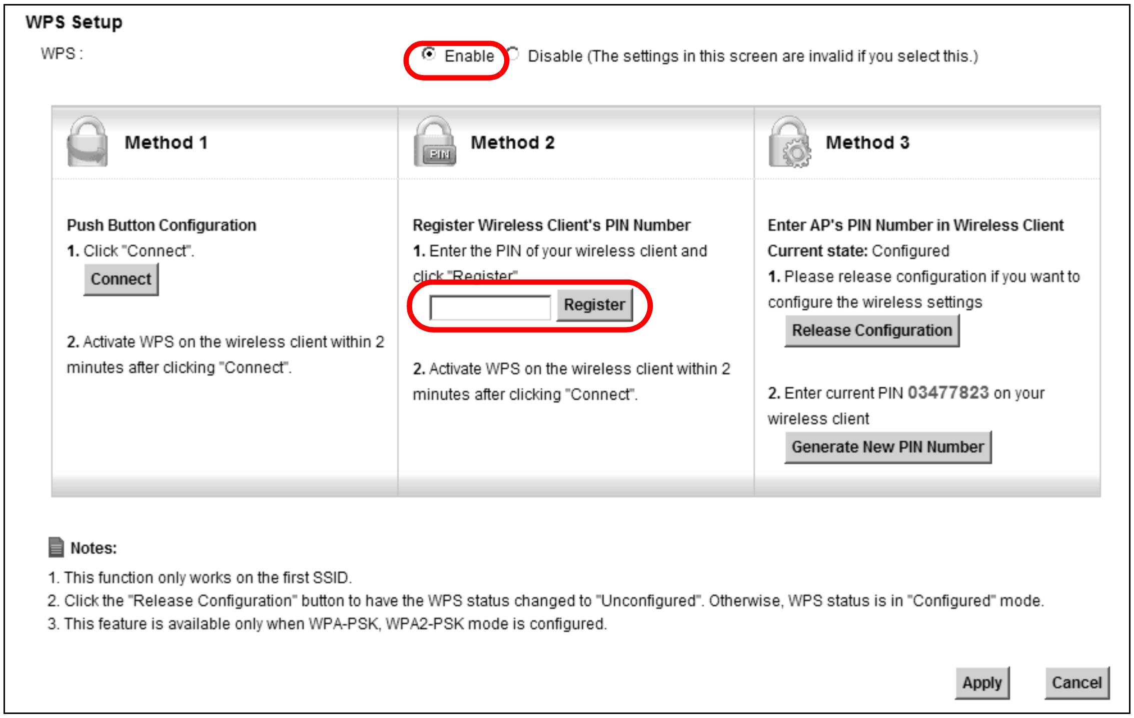


PIN Configuration

When you use the PIN configuration method, you need to use both the ZyXEL Device's web configurator and the wireless client's utility.

1 Launch your wireless client's configuration utility. Go to the WPS settings and select the PIN method to get a PIN number.

2 Log into ZyXEL Device's web configurator and go to the **Network Settings > Wireless > WPS** screen. Enable the WPS function and click **Apply**.



WPS Setup

WPS : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Method 1

Push Button Configuration

1. Click "Connect".

Connect

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 2

Register Wireless Client's PIN Number

1. Enter the PIN of your wireless client and click "Register".

Register

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 3

Enter AP's PIN Number in Wireless Client

Current state: Configured

1. Please release configuration if you want to configure the wireless settings

Release Configuration

2. Enter current PIN **03477823** on your wireless client

Generate New PIN Number

Notes:

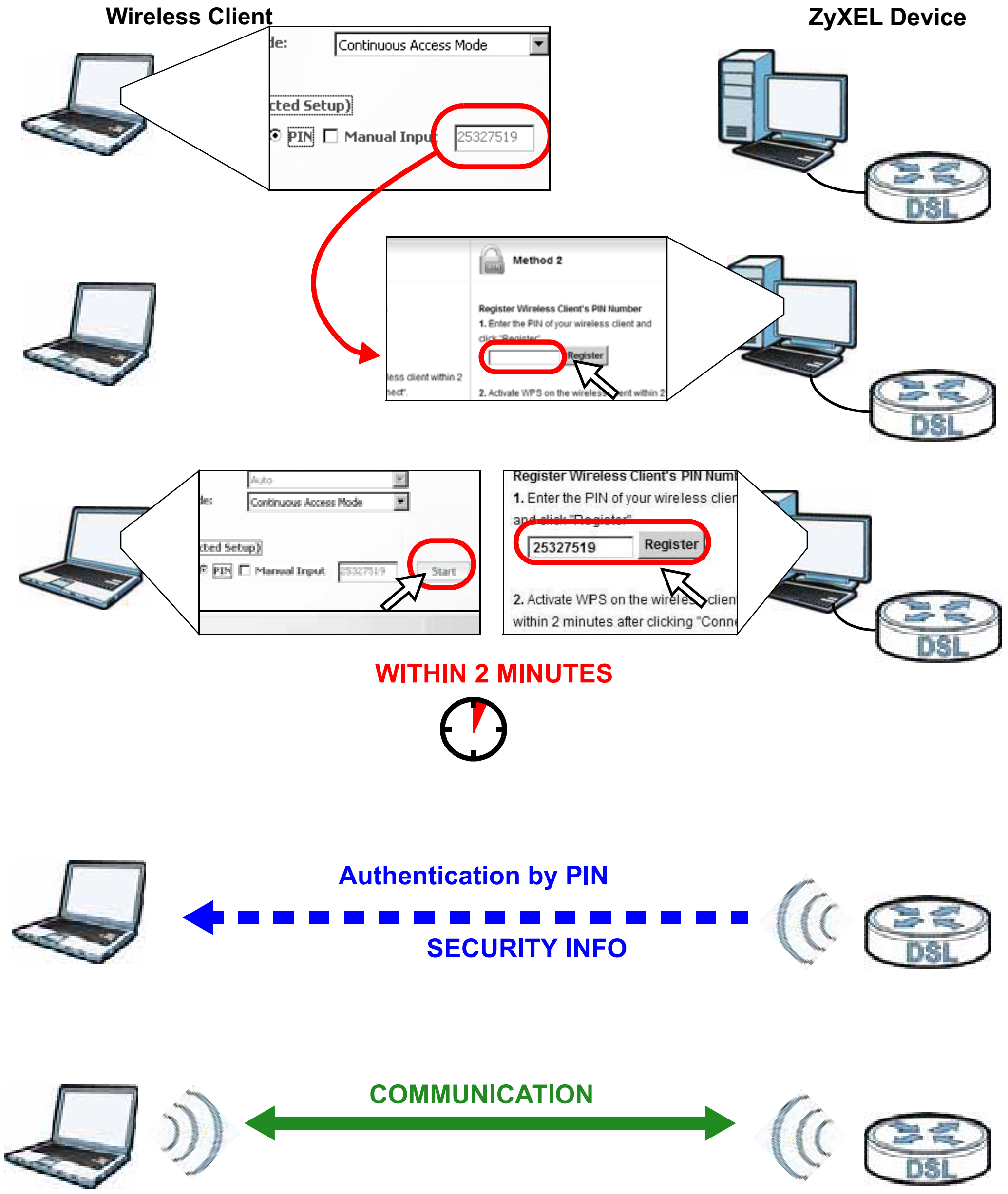
1. This function only works on the first SSID.
2. Click the "Release Configuration" button to have the WPS status changed to "Unconfigured". Otherwise, WPS status is in "Configured" mode.
3. This feature is available only when WPA-PSK, WPA2-PSK mode is configured.

Apply Cancel

3 Enter the PIN number of the wireless client and click the **Register** button. Activate WPS function on the wireless client utility screen within two minutes.

The ZyXEL Device authenticates the wireless client and sends the proper configuration settings to the wireless client. This may take up to two minutes. The wireless client is then able to communicate with the ZyXEL Device securely.

The following figure shows you how to set up a wireless network and its security on a ZyXEL Device and a wireless client by using PIN method.


Wireless Client
ZyXEL Device
de: Continuous Access Mode
cted Setup)
● PIN □ Manual Input 25327519
Method 2
Register Wireless Client's PIN Number
1. Enter the PIN of your wireless client and click "Register".
Register
2. Activate WPS on the wireless client within 2
Auto
Continuous Access Mode
Start
Register Wireless Client's PIN Numb
1. Enter the PIN of your wireless clien and click "Register"
25327519 Register
2. Activate WPS on the wireless clien within 2 minutes after clicking "Conn
DSL
WITHIN 2 MINUTES
Authentication by PIN
SECURITY INFO
COMMUNICATION

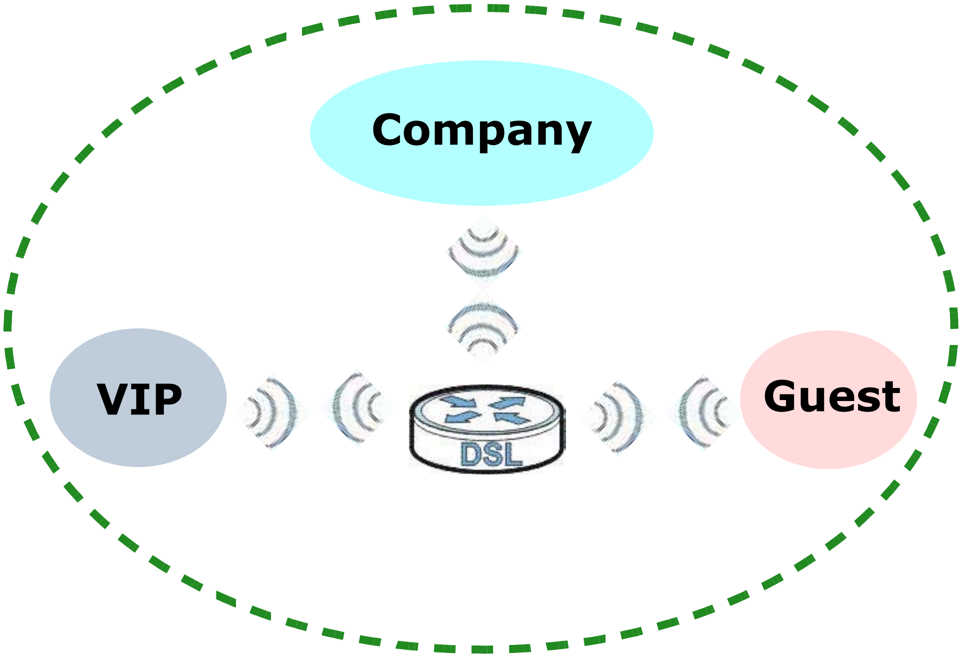
4.4.3 Without WPS

Use the wireless adapter's utility installed on the notebook to search for the "Example" SSID. Then enter the "DoNotStealMyWirelessNetwork" pre-shared key to establish an wireless Internet connection.

Note: The ZyXEL Device supports IEEE 802.11b and IEEE 802.11g wireless clients. Make sure that your notebook or computer's wireless adapter supports one of these standards.

4.5 Setting Up Multiple Wireless Groups

Company A wants to create different wireless network groups for different types of users as shown in the following figure. Each group has its own SSID and security mode.

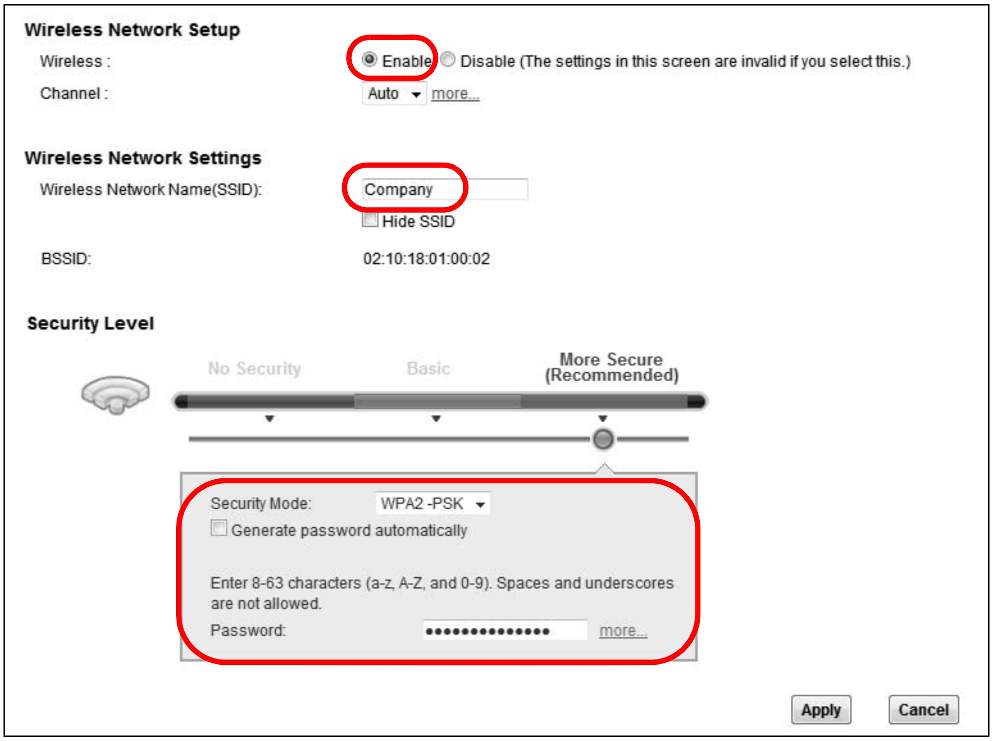


- Employees in Company A will use a general **Comapny** wireless network group.
- Higher management level and important visitors will use the **VIP** group.
- Visiting guests will use the **Guest** group, which has a lower security mode.

Company A will use the following parameters to set up the wireless network groups.

	COMPANY	VIP	GUEST
SSID	Company	VIP	Guest
Security Level	More Secure	More Secure	Basic
Security Mode	WPA2-PSK	WPA2-PSK	Static WEP
Pre-Shared Key	ForCompanyOnly	ForVIPOnly	Guest

1 Click **Network Settings > Wireless** to open the **General** screen. Use this screen to set up the company's general wireless network group. Configure the screen using the provided parameters and click **Apply**.



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Channel : Auto more...

Wireless Network Settings

Wireless Network Name(SSID): Company

□ Hide SSID

BSSID: 02:10:18:01:00:02

Security Level

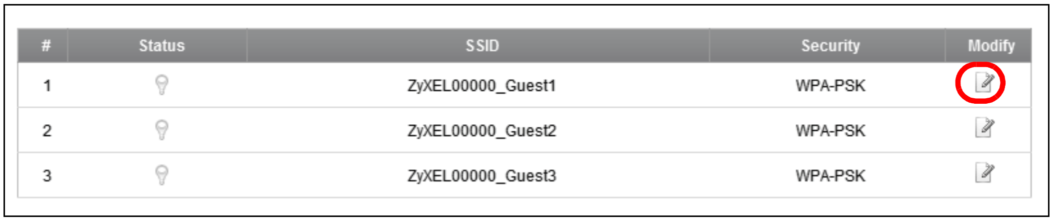
Security Mode: WPA2 -PSK

□ Generate password automatically

Enter 8-63 characters (a-z, A-Z, and 0-9). Spaces and underscores are not allowed.

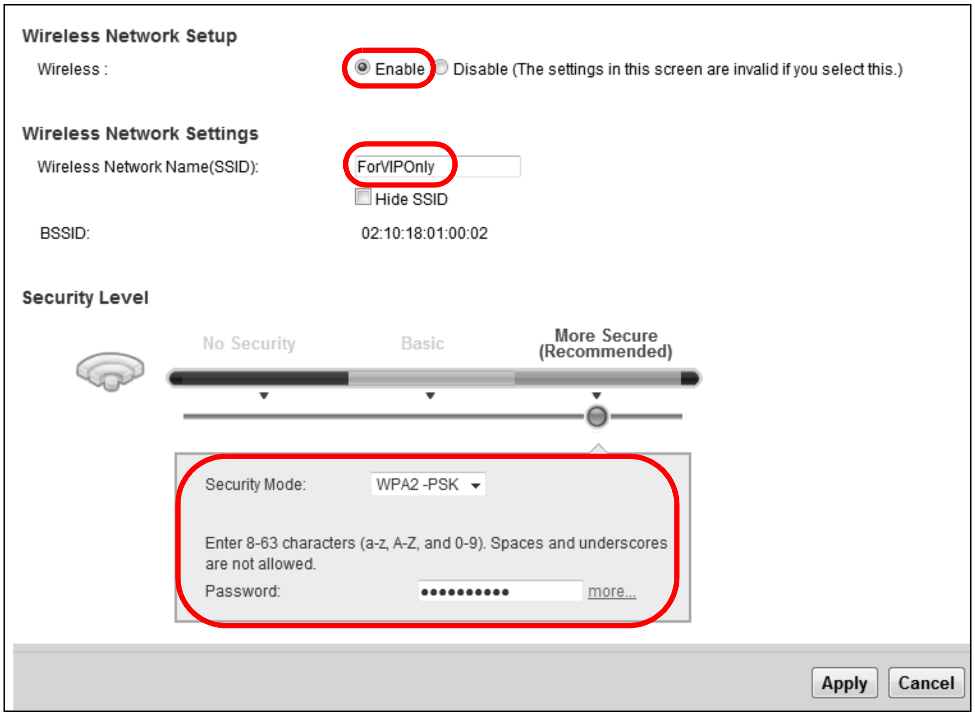
Password: ••••••••••••••• more...

2 Click **Network Settings > Wireless > More AP** to open the following screen. Click the **Edit** icon to configure the second wireless network group.



#	Status	SSID	Security	Modify
1		ZyXEL00000_Guest1	WPA-PSK	✎
2		ZyXEL00000_Guest2	WPA-PSK	✎
3		ZyXEL00000_Guest3	WPA-PSK	✎

3 Configure the screen using the provided parameters and click **Apply**.



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Wireless Network Settings

Wireless Network Name(SSID): ForVIPOnly

□ Hide SSID

BSSID: 02:10:18:01:00:02

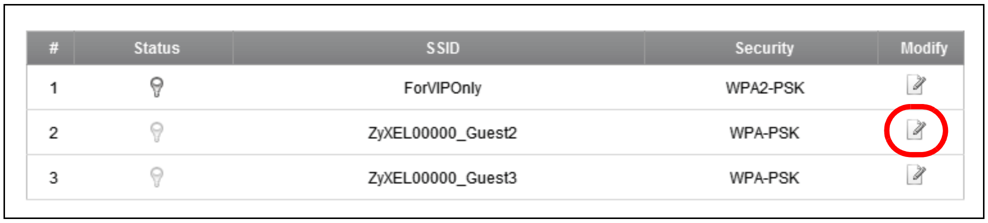
Security Level

Security Mode: WPA2 -PSK

Enter 8-63 characters (a-z, A-Z, and 0-9). Spaces and underscores are not allowed.

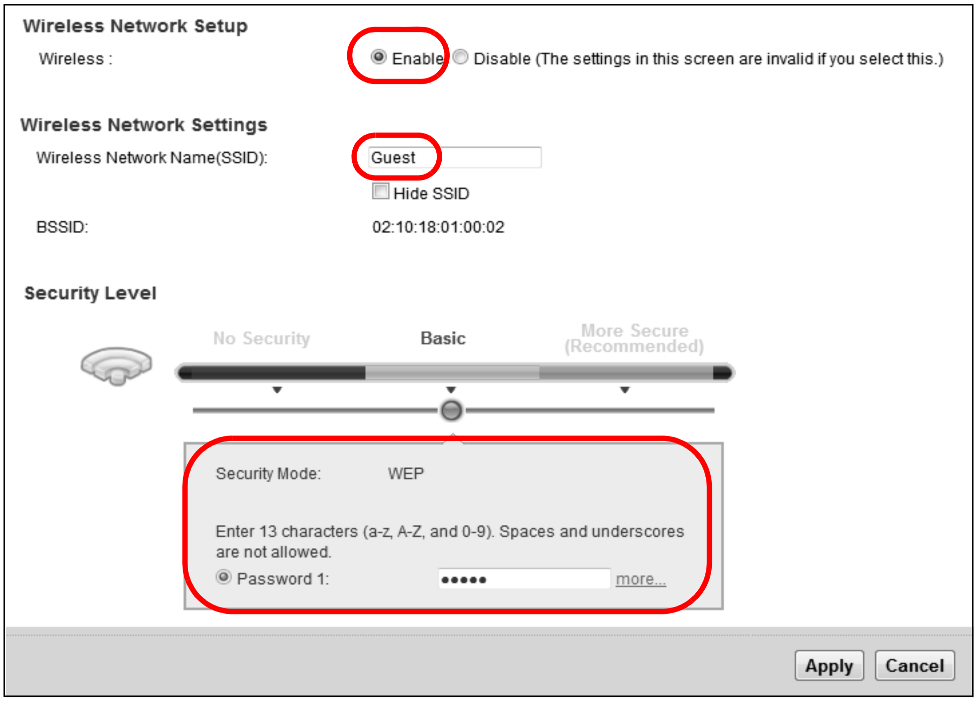
Password: ●●●●●●●●●●● more...

4 In the **More AP** screen, click the **Edit** icon to configure the third wireless network group.



#	Status	SSID	Security	Modify
1	💡	ForVIPOnly	WPA2-PSK	✎
2	💡	ZyXEL00000_Guest2	WPA-PSK	✎
3	💡	ZyXEL00000_Guest3	WPA-PSK	✎

5 Configure the screen using the provided parameters and click **Apply**.



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Wireless Network Settings

Wireless Network Name(SSID): Guest

□ Hide SSID

BSSID: 02:10:18:01:00:02

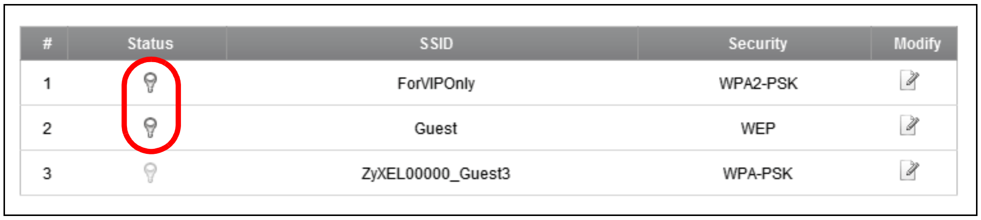
Security Level

Security Mode: WEP

Enter 13 characters (a-z, A-Z, and 0-9). Spaces and underscores are not allowed.

● Password 1: ●●●●● more...

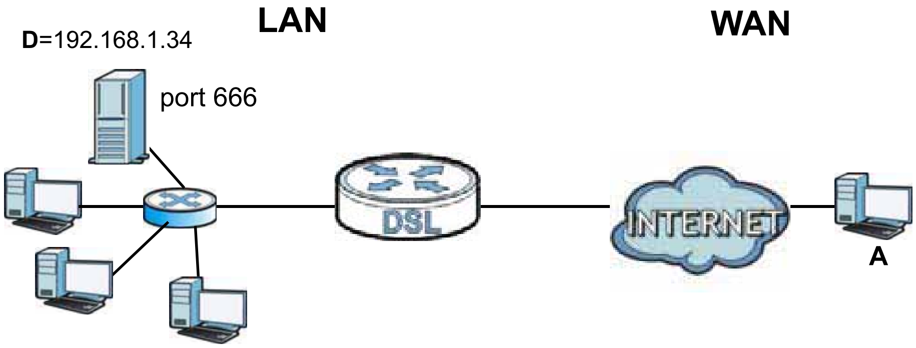
6 Check the status of **VIP** and **Guest** in the **More AP** screen. The yellow bulbs signify that the SSIDs are active and ready for wireless access.



#	Status	SSID	Security	Modify
1	💡	ForVIPOnly	WPA2-PSK	✎
2	💡	Guest	WEP	✎
3	💡	ZyXEL00000_Guest3	WPA-PSK	✎

4.6 Setting Up NAT Port Forwarding

Thomas manages the Doom server on a computer behind the ZyXEL Device. In order for players on the Internet (like **A** in the figure below) to communicate with the Doom server, Thomas needs to configure the port settings and IP address on the ZyXEL Device. Traffic should be forwarded to the port 666 of the Doom server computer which has an IP address of 192.168.1.34.

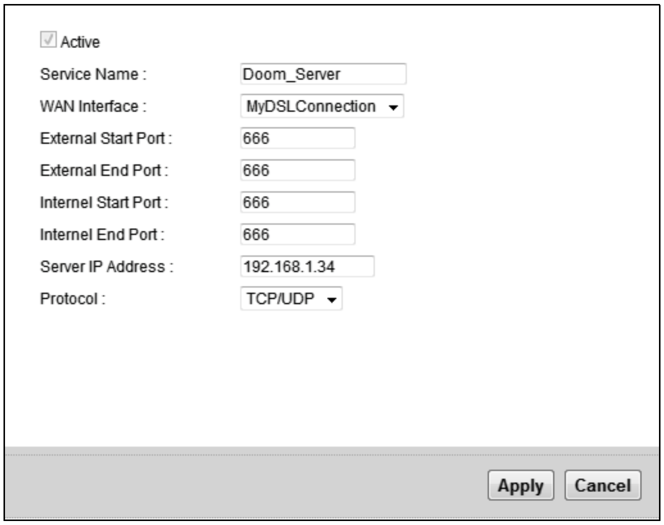


Thomas may set up the port settings by configuring the port settings for the Doom server computer (see Section 11.2 on page 160 for more information).

1 Click **Network Settings > NAT > Add new rule** and configure the screen with the following values:

Service Name	**Doom_Server**
WAN Interface	Select the WAN interface through which the Doom service is forwarded. This example uses **MyDSLConnection**.
External Port/s	Enter **666** as the **Start** and **End** port.
Server IP Address	Enter the IP address of the Doom server. This is **192.168.1.34** for this example.
Protocol	Select **TCP/UDP**. This should be the protocol supported by the Doom server.

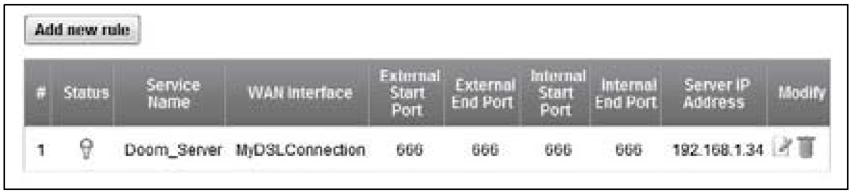
2 The screen should look as follows. Click **Apply**.



☑ Active

Service Name :	Doom_Server
WAN Interface :	MyDSLConnection ▾
External Start Port :	666
External End Port :	666
Internel Start Port :	666
Internel End Port :	666
Server IP Address :	192.168.1.34
Protocol :	TCP/UDP ▾

3 The port forwarding settings you configured appear in the table. The ZyXEL Device forwards port 666 traffic to the computer with IP address 192.168.1.34.



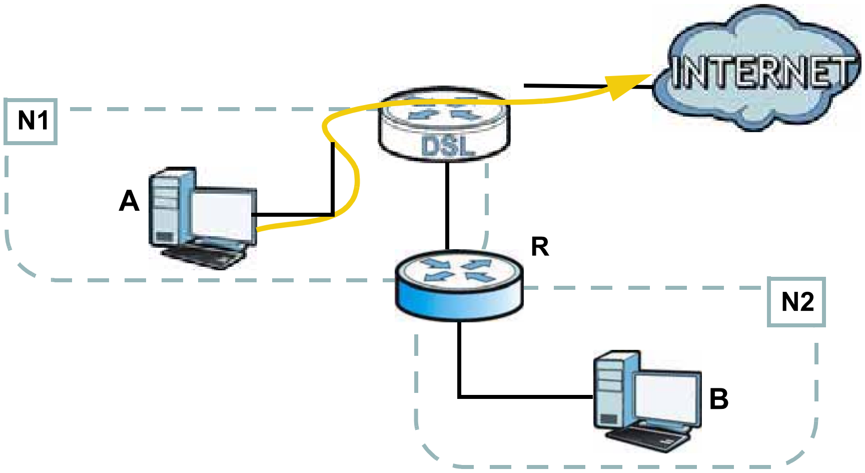
#	Status	Service Name	WAN Interface	External Start Port	External End Port	Internal Start Port	Internal End Port	Server IP Address	Modify
1	💡	Doom_Server	MyDSLConnection	666	666	666	666	192.168.1.34	✎ 🗑

Players on the Internet then can have access to Thomas' Doom server.

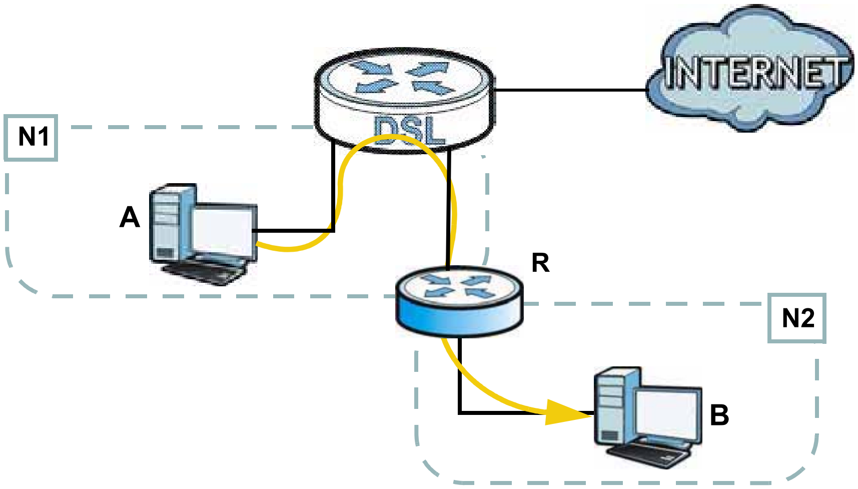
4.7 Configuring Static Route for Routing to Another Network

In order to extend your Intranet and control traffic flowing directions, you may connect a router to the ZyXEL Device's LAN. The router may be used to separate two department networks. This tutorial shows how to configure a static routing rule for two network routings.

In the following figure, router **R** is connected to the ZyXEL Device's LAN. **R** connects to two networks, **N1** (192.168.1.x/24) and **N2** (192.168.10.x/24). If you want to send traffic from computer **A** (in **N1** network) to computer **B** (in **N2** network), the traffic is sent to the ZyXEL Device's WAN default gateway by default. In this case, **B** will never receive the traffic.



You need to specify a static routing rule on the ZyXEL Device to specify **R** as the router in charge of forwarding traffic to **N2**. In this case, the ZyXEL Device routes traffic from **A** to **R** and then **R** routes the traffic to **B**.



This tutorial uses the following example IP settings:

Table 4 IP Settings in this Tutorial

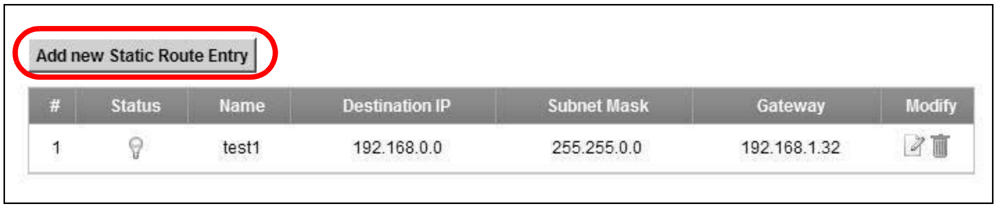
DEVICE / COMPUTER	IP ADDRESS
The ZyXEL Device's WAN	172.16.1.1
The ZyXEL Device's LAN	192.168.1.1
A	192.168.1.34
R's N1	192.168.1.253
R's N2	192.168.10.2
B	192.168.10.33

To configure a static route to route traffic from **N1** to **N2**:

1 Log into the ZyXEL Device's Web Configurator in advanced mode.

2 Click **Advanced** > **Routing**.

3 Click **Add New Static Route Entry** in the **Static Route** screen.



#	Status	Name	Destination IP	Subnet Mask	Gateway	Modify
1		test1	192.168.0.0	255.255.0.0	192.168.1.32	

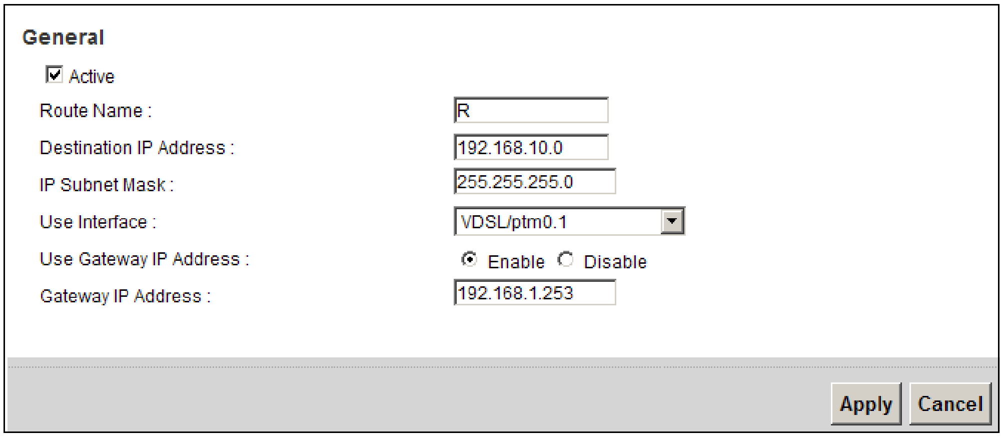
4 Configure the **Static Route Setup** screen using the following settings:

4a Select the **Active** check box. Enter the **Route Name** as **R**.

4b Type **192.168.10.0** and subnet mask **255.255.255.0** for the destination, **N2**.

4c Select the interface that is in use.

4d Select **Enable** in the **Use Gateway IP Address** field. Type **192.168.1.253** (**R**'s N1 address) in the **Gateway IP Address** field.



General

☑ Active

Route Name :	R
Destination IP Address :	192.168.10.0
IP Subnet Mask :	255.255.255.0
Use Interface :	VDSL/ptm0.1
Use Gateway IP Address :	● Enable ○ Disable
Gateway IP Address :	192.168.1.253

4a Click **Apply**.

Now **B** should be able to receive traffic from **A**. You may need to additionally configure **B**'s firewall settings to allow specific traffic to pass through.

4.8 Configuring QoS Queue and Class Setup

This section contains tutorials on how you can configure the QoS screen.

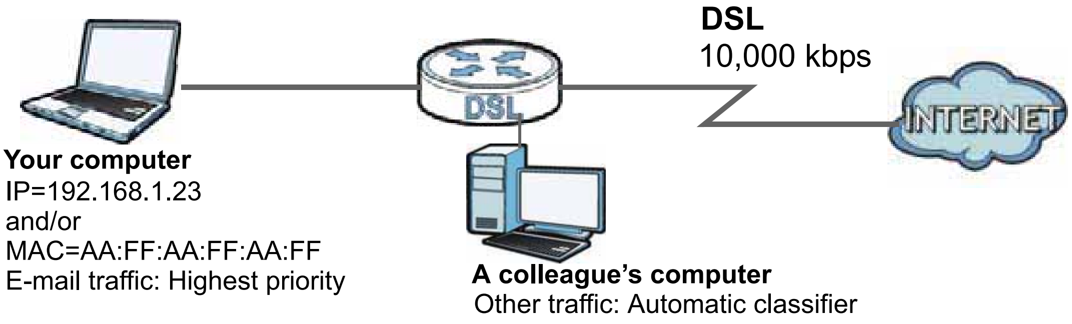
Let's say you are a team leader of a small sales branch office. You want to prioritize e-mail traffic because your task includes sending urgent updates to clients at least twice every hour. You also upload data files (such as logs and e-mail archives) to the FTP server throughout the day. Your colleagues use the Internet for research, as well as chat applications for communicating with other branch offices.

In the following figure, your Internet connection has an upstream transmission bandwidth of 10,000 kbps. For this example, you want to configure QoS so that e-mail traffic gets the highest priority with at least 5,000 kbps. You can do the following:

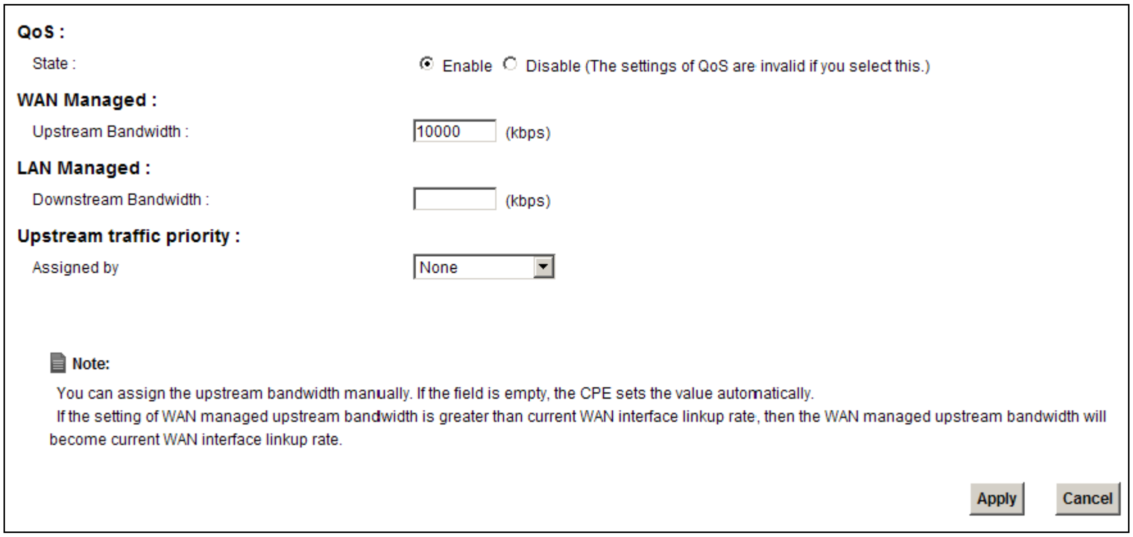
- Configure a queue to assign the highest priority queue (1) to e-mail traffic going to the WAN interface, so that e-mail traffic would not get delayed when there is network congestion.
- Note the IP address (192.168.1.23 for example) and/or MAC address (AA:FF:AA:FF:AA:FF for example) of your computer and map it to queue 7.

Note: QoS is applied to traffic flowing out of the ZyXEL Device.

Traffic that does not match this class is assigned a priority queue based on the internal QoS mapping table on the ZyXEL Device.



1 Click **Network Settings > QoS > General** and select **Active**. Set your **WAN Managed Upstream Bandwidth** to 10,000 kbps (or leave this blank to have the ZyXEL Device automatically determine this figure). Click **Apply**.



QoS :

State : ● Enable ○ Disable (The settings of QoS are invalid if you select this.)

WAN Managed :

Upstream Bandwidth : 10000 (kbps)

LAN Managed :

Downstream Bandwidth : (kbps)

Upstream traffic priority :

Assigned by None

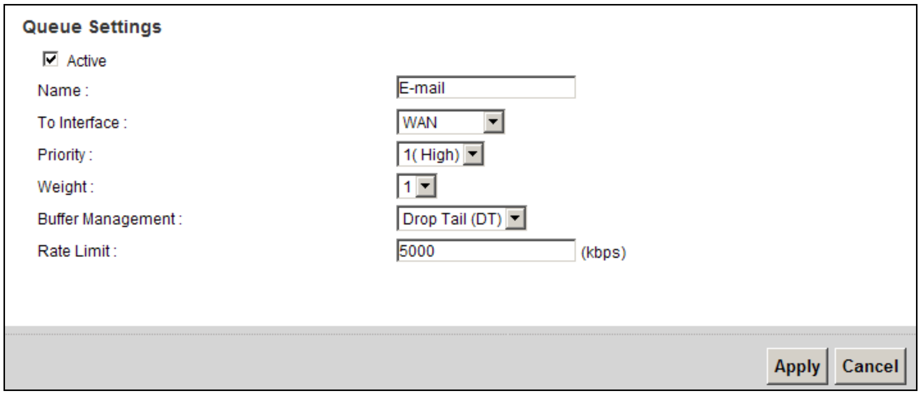
Note:

You can assign the upstream bandwidth manually. If the field is empty, the CPE sets the value automatically.
If the setting of WAN managed upstream bandwidth is greater than current WAN interface linkup rate, then the WAN managed upstream bandwidth will become current WAN interface linkup rate.

2 Click **Queue Setup > Add new Queue** to create a new queue. In the screen that opens, check **Active** and enter or select the following values:

- **Name**: E-mail
- **To Interface**: **WAN**
- **Priority**: 1 (High)
- **Weight**: 8

- **Rate Limit**: 5,000 (kbps)



Queue Settings

☑ Active

Name : E-mail

To Interface : WAN

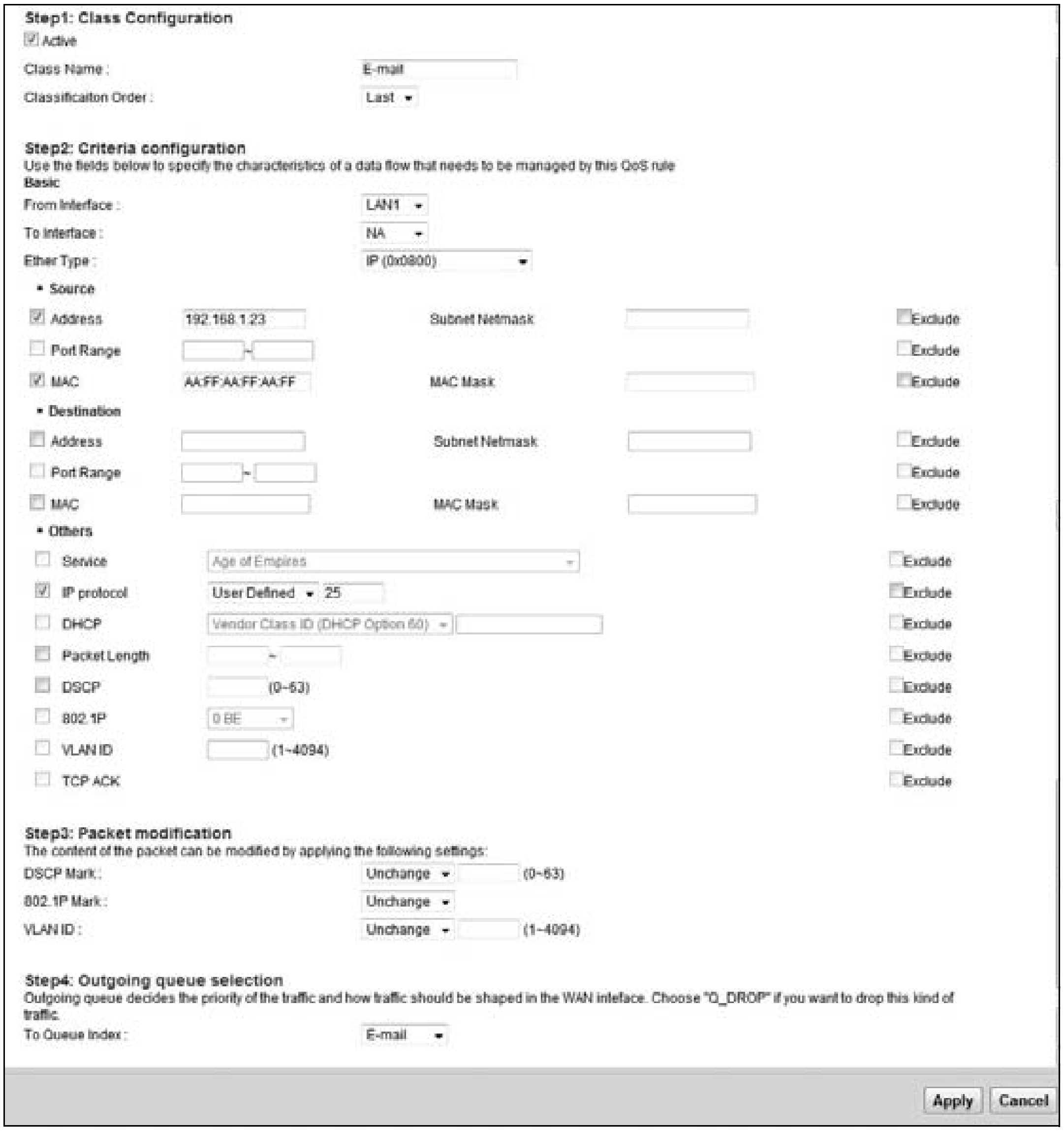
Priority : 1(High)

Weight : 1

Buffer Management : Drop Tail (DT)

Rate Limit : 5000 (kbps)

3 Click **Class Setup > Add new Classifier** to create a new class. Check **Active** and follow the settings as shown in the screen below.



Step1: Class Configuration

☑ Active

Class Name : E-mail

Classificaiton Order : Last

Step2: Criteria configuration

Use the fields below to specify the characteristics of a data flow that needs to be managed by this QoS rule

Basic

From Interface : LAN1

To Interface : NA

Ether Type : IP (0x0800)

- **Source**

☑ Address 192.168.1.23 Subnet Netmask ☐ Exclude

☐ Port Range ~ ☐ Exclude

☑ MAC AA:FF:AA:FF:AA:FF MAC Mask ☐ Exclude

- **Destination**

☐ Address Subnet Netmask ☐ Exclude

☐ Port Range ~ ☐ Exclude

☐ MAC MAC Mask ☐ Exclude

- **Others**

☐ Service Age of Empires ☐ Exclude

☑ IP protocol User Defined 25 ☐ Exclude

☐ DHCP Vendor Class ID (DHCP Option 60) ☐ Exclude

☐ Packet Length ~ ☐ Exclude

☐ DSCP (0~63) ☐ Exclude

☐ 802.1P 0 BE ☐ Exclude

☐ VLAN ID (1~4094) ☐ Exclude

☐ TCP ACK ☐ Exclude

Step3: Packet modification

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

DSCP Mark : Unchange (0~63)

802.1P Mark : Unchange

VLAN ID : Unchange (1~4094)

Step4: Outgoing queue selection

Outgoing queue decides the priority of the traffic and how traffic should be shaped in the WAN inteface. Choose "Q_DROP" if you want to drop this kind of traffic.

To Queue Index : E-mail

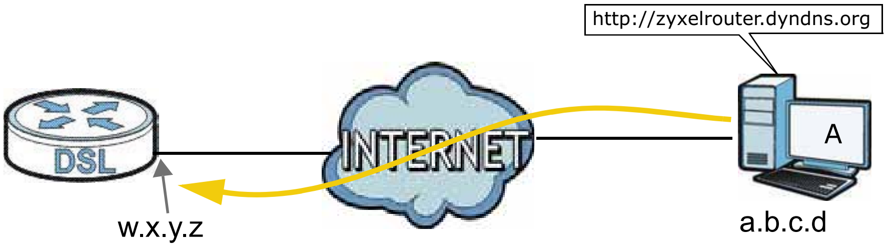
Class Name	Give a class name to this traffic, such as **E-mail** in this example.
From Interface	This is the interface from which the traffic will be coming from. Select **LAN1** for this example.
Ether Type	Select **IP** to identify the traffic source by its IP address or MAC address.
IP Address	Type the IP address of your computer - **192.168.1.23**. Type the **IP Subnet Mask** if you know it.
MAC Address	Type the MAC address of your computer - **AA:FF:AA:FF:AA:FF**. Type the **MAC Mask** if you know it.
To Queue Index	Link this to an item in the **Network Settings > QoS > Queue Setup** screen, which is the **E-mail** queue created in this example.

This maps e-mail traffic coming from port 25 to the highest priority, which you have created in the previous screen (see the **IP Protocol** field). This also maps your computer's IP address and MAC address to the **E-mail** queue (see the **Source** fields).

4 Verify that the queue setup works by checking **Network Settings > QoS > Monitor**. This shows the bandwidth allotted to e-mail traffic compared to other network traffic.

4.9 Access the ZyXEL Device Using DDNS

If you connect your ZyXEL Device to the Internet and it uses a dynamic WAN IP address, it is inconvenient for you to manage the device from the Internet. The ZyXEL Device's WAN IP address changes dynamically. Dynamic DNS (DDNS) allows you to access the ZyXEL Device using a domain name.



To use this feature, you have to apply for DDNS service at www.dyndns.org.

This tutorial covers:

- Registering a DDNS Account on www.dyndns.org
- Configuring DDNS on Your ZyXEL Device
- Testing the DDNS Setting

Note: If you have a private WAN IP address, then you cannot use DDNS.

4.9.1 Registering a DDNS Account on www.dyndns.org

1 Open a browser and type **http://www.dyndns.org**.

2 Apply for a user account. This tutorial uses **UserName1** and **12345** as the username and password.

3 Log into www.dyndns.org using your account.

4 Add a new DDNS host name. This tutorial uses the following settings as an example.

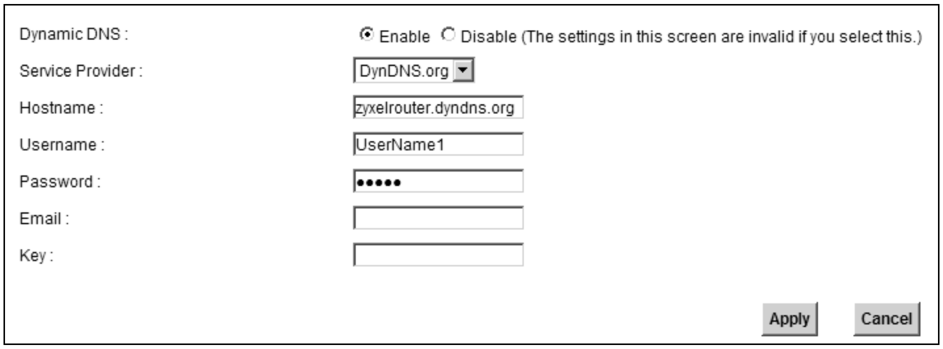
- Hostname: **zyxelrouter.dyndns.org**
- Service Type: **Host with IP address**
- IP Address: Enter the WAN IP address that your ZyXEL Device is currently using. You can find the IP address on the ZyXEL Device’s Web Configurator **Status** page.

Then you will need to configure the same account and host name on the ZyXEL Device later.

4.9.2 Configuring DDNS on Your ZyXEL Device

Configure the following settings in the **Advanced > DNS Setting > Dynamic DNS** screen.

- Select **Enable Dynamic DNS**.
- Select **DynDNS.org** as the service provider.
- Type **zyxelrouter.dyndns.org** in the **Host Name** field.
- Enter the user name (**UserName1**) and password (**12345**).



Dynamic DNS : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Service Provider : DynDNS.org

Hostname : zyxelrouter.dyndns.org

Username : UserName1

Password : •••••

Email :

Key :

Click **Apply**.

4.9.3 Testing the DDNS Setting

Now you should be able to access the ZyXEL Device from the Internet. To test this:

1 Open a web browser on the computer (using the IP address **a.b.c.d**) that is connected to the Internet.

2 Type **http://zyxelrouter.dyndns.org** and press [Enter].

3 The ZyXEL Device’s login page should appear. You can then log into the ZyXEL Device and manage it.

PART II

Technical Reference

Network Map and Status Screens

5.1 Overview

After you log into the Web Configurator, the **Network Map** screen appears. This shows the network connection status of the ZyXEL Device and clients connected to it.

You can use the **Status** screen to look at the current status of the ZyXEL Device, system resources, and interfaces (LAN, WAN, and WLAN).

5.2 The Network Map Screen

Use this screen to view the network connection status of the device and its clients. A warning message appears if there is a connection problem.

If you prefer to view the status in a list, click **List View** in the **Viewing Mode** selection box. You can configure how often you want the ZyXEL Device to update this screen in **Refresh Interval**.

Figure 12 Network Map: Icon Mode

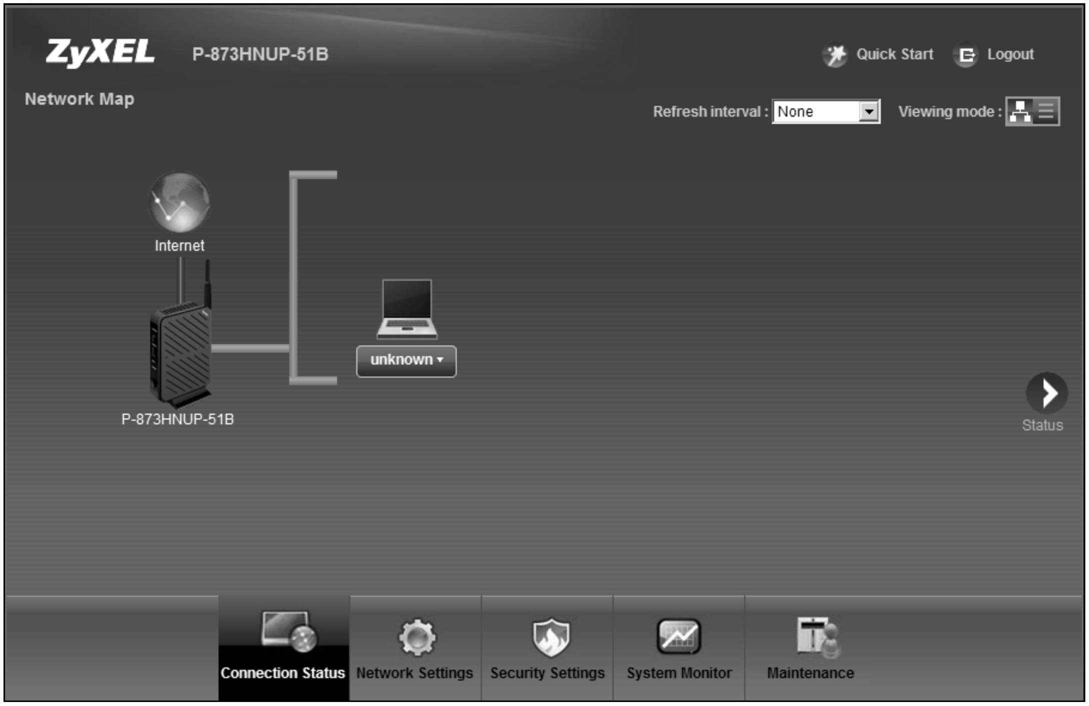
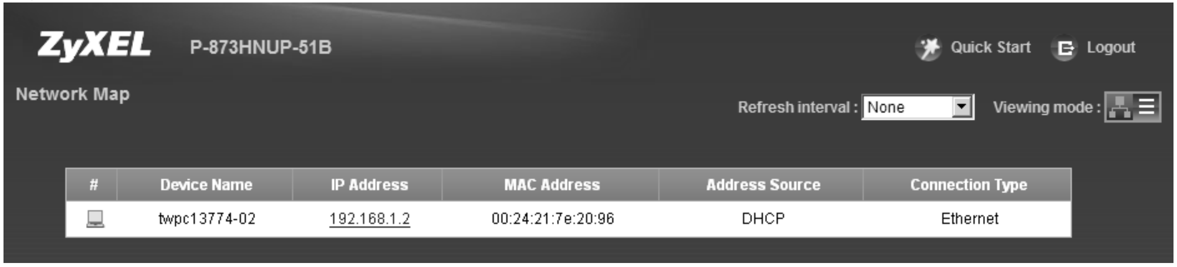


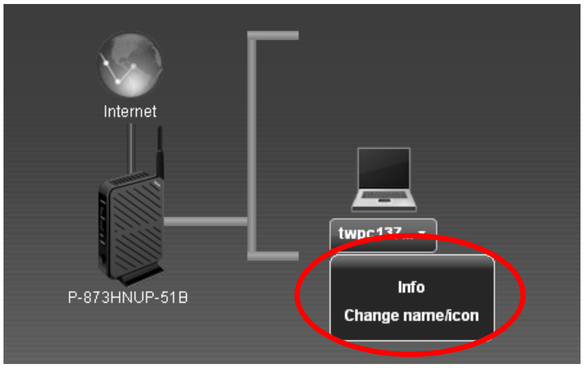
Figure 13 Network Map: List Mode



#	Device Name	IP Address	MAC Address	Address Source	Connection Type
▭	twpc13774-02	192.168.1.2	00:24:21:7e:20:96	DHCP	Ethernet

In **Icon Mode**, if you want to view information about a client, click the client's name and **Info**. Click the IP address if you want to change it. If you want to change the name or icon of the client, click **Change name/icon**.

Figure 14 Icon Mode: Change name/icon

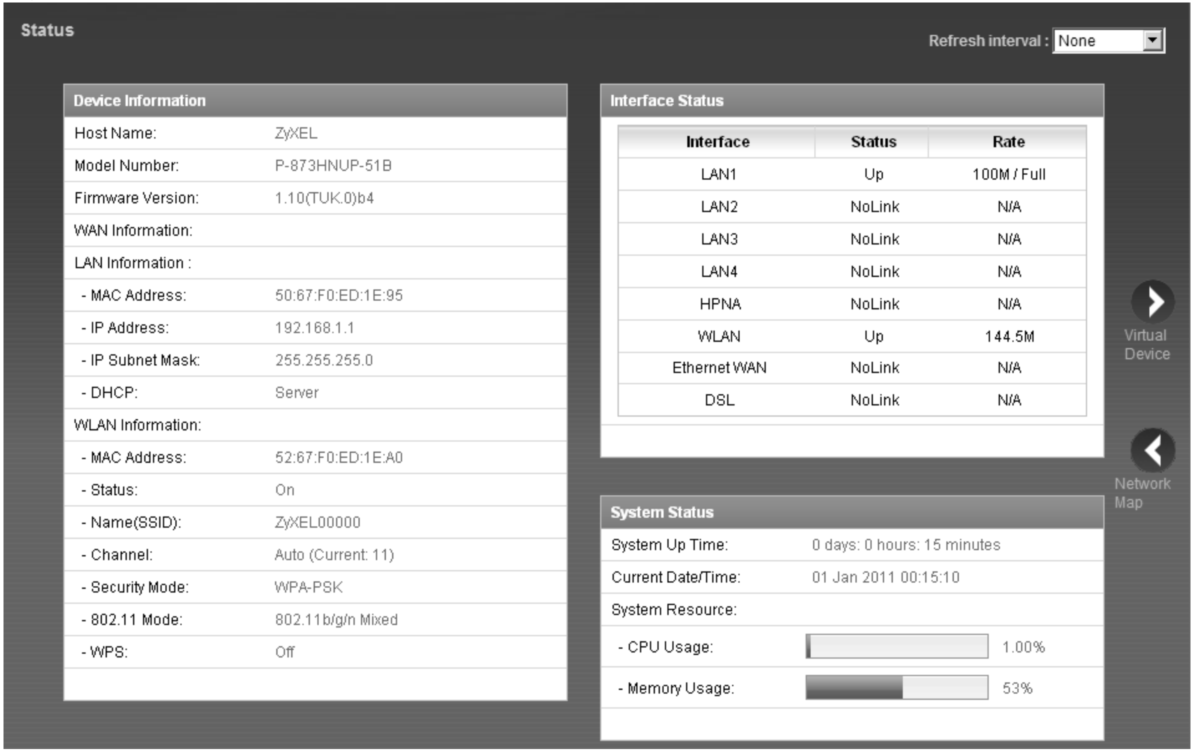


In **List Mode**, you can also view the client's information and click on the IP address if you want to change it.

5.3 The Status Screen

Use this screen to view the status of the ZyXEL Device. Click **Status** to open this screen.

Figure 15 Status Screen



Status

Refresh interval : None

Device Information

Host Name:	ZyXEL
Model Number:	P-873HNUP-51B
Firmware Version:	1.10(TUK.0)b4
WAN Information:	
LAN Information :	
- MAC Address:	50:67:F0:ED:1E:95
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- MAC Address:	52:67:F0:ED:1E:A0
- Status:	On
- Name(SSID):	ZyXEL00000
- Channel:	Auto (Current: 11)
- Security Mode:	WPA-PSK
- 802.11 Mode:	802.11b/g/n Mixed
- WPS:	Off

Interface Status

Interface	Status	Rate
LAN1	Up	100M / Full
LAN2	NoLink	N/A
LAN3	NoLink	N/A
LAN4	NoLink	N/A
HPNA	NoLink	N/A
WLAN	Up	144.5M
Ethernet WAN	NoLink	N/A
DSL	NoLink	N/A

System Status

System Up Time:	0 days: 0 hours: 15 minutes
Current Date/Time:	01 Jan 2011 00:15:10
System Resource:	
- CPU Usage:	1.00%
- Memory Usage:	53%

Each field is described in the following table.

Table 5 Status Screen

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the ZyXEL Device to update this screen.
Device Information	
Host Name	This field displays the ZyXEL Device system name. It is used for identification.
Model Number	This shows the model number of your ZyXEL Device.
Firmware Version	This is the current version of the firmware inside the device.
WAN Information (These fields display when you have a WAN connection.)	
MAC Address	This shows the WAN Ethernet adapter MAC (Media Access Control) Address of your device. This field is available only when your WAN type is **IPoE** or **PPPoE**.
IP Address	This field displays the current IP address of the ZyXEL Device in the WAN.
IP Subnet Mask	This field displays the current subnet mask in the WAN. This field is available only when your WAN type is **IPoE** or **IPoA**.
WAN Type	This field displays the current WAN connection type.
LAN Information	
MAC Address	This shows the LAN Ethernet adapter MAC (Media Access Control) Address of your device.

Table 5 Status Screen (continued)

LABEL	DESCRIPTION
IP Address	This is the current IP address of the ZyXEL Device in the LAN.
IP Subnet Mask	This is the current subnet mask in the LAN.
DHCP	This field displays what DHCP services the ZyXEL Device is providing to the LAN. Choices are: **Server** - The ZyXEL Device is a DHCP server in the LAN. It assigns IP addresses to other computers in the LAN. **Relay** - The ZyXEL Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. **None** - The ZyXEL Device is not providing any DHCP services to the LAN.
WLAN Information	
MAC Address	This shows the wireless adapter MAC (Media Access Control) Address of your device.
Status	This displays whether WLAN is activated.
Name (SSID)	This is the descriptive name used to identify the ZyXEL Device in a wireless LAN.
Channel	This is the channel number used by the ZyXEL Device now.
Security Mode	This displays the type of security mode the ZyXEL Device is using in the wireless LAN.
802.11 Mode	This displays the type of 802.11 mode the ZyXEL Device is using in the wireless LAN.
WPS	This displays whether WPS is activated.
Interface Status	
Interface	This column displays each interface the ZyXEL Device has.
Status	This field indicates whether or not the ZyXEL Device is using the interface. For the LAN interfaces, the Ethernet WAN interface, or the HPNA interface, this field displays **Up** when the ZyXEL Device is using the interface and **NoLink** when the line is disconnected. For the WLAN interface, it displays **Active** when WLAN is enabled or **InActive** when WLAN is disabled. For the DSL interface, this field displays **NoLink** (line is down), **Up** (line is up or connected) if you're using Ethernet encapsulation and **NoLink** (line is down), **Up** (line is up or connected), **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE encapsulation.
Rate	For the LAN interface, this displays the port speed and duplex setting. For the DSL interface, it displays the downstream and upstream transmission rate. For the WLAN interface, it displays the maximum transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
System Status	
System Up Time	This field displays how long the ZyXEL Device has been running since it last started up. The ZyXEL Device starts up when you plug it in, when you restart it (**Maintenance > Reboot**), or when you reset it.
Current Date/ Time	This field displays the current date and time in the ZyXEL Device. You can change this in **Maintenance> Time Setting**.
System Resource	

Table 5 Status Screen (continued)

LABEL	DESCRIPTION
CPU Usage	This field displays what percentage of the ZyXEL Device's processing ability is currently used. When this percentage is close to 100%, the ZyXEL Device is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using QoS; see Chapter 10 on page 139).
Memory Usage	This field displays what percentage of the ZyXEL Device's memory is currently used. Usually, this percentage should not increase much. If memory usage does get close to 100%, the ZyXEL Device is probably becoming unstable, and you should restart the device. See Section 31.2 on page 259, or turn off the device (unplug the power) for a few seconds.

6

Broadband

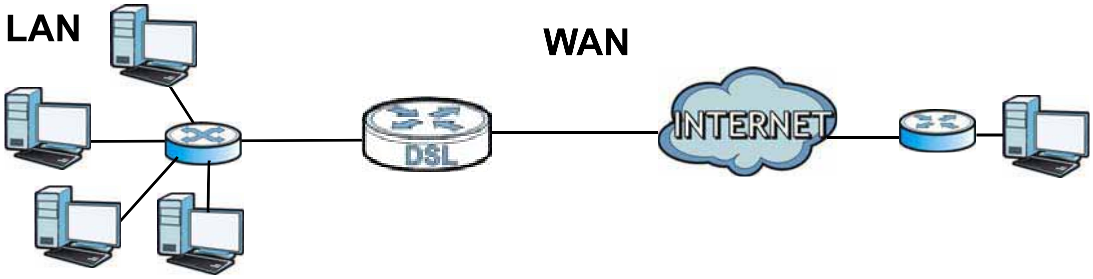
6.1 Overview

This chapter describes how to configure WAN settings from the **Broadband** screen. Use this screen to configure your ZyXEL Device for Internet access.

If the DSLAM of your ISP supports DSL bonding, you can connect the two DSL ports on the ZyXEL Device to two separate telephone jacks and enable the bonding feature in the **DSL** screen. The bonding feature provides increased throughput at longer distances.

A WAN (Wide Area Network) connection is an outside connection to another network or the Internet. It connects your private networks (such as a LAN (Local Area Network) and other networks, so that a computer in one location can communicate with computers in other locations.

Figure 16 LAN and WAN



6.1.1 What You Need to Know

Encapsulation Method

Encapsulation is used to include data from an upper layer protocol into a lower layer protocol. To set up a WAN connection to the Internet, you need to use the same encapsulation method used by your ISP (Internet Service Provider). If your ISP offers a dial-up Internet connection using PPPoE (PPP over Ethernet) or PPPoA, they should also provide a username and password (and service name) for user authentication.

WAN IP Address

The WAN IP address is an IP address for the ZyXEL Device, which makes it accessible from an outside network. It is used by the ZyXEL Device to communicate with other devices in other networks. It can be static (fixed) or dynamically assigned by the ISP each time the ZyXEL Device tries to access the Internet.

If your ISP assigns you a static WAN IP address, they should also assign you the subnet mask and DNS server IP address(es) (and a gateway IP address if you use the Ethernet encapsulation method).

ATM

Asynchronous Transfer Mode (ATM) is a LAN and WAN 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. ATM uses a connection-oriented model and establishes a virtual circuit (VC) between two endpoints before the actual data exchange begins.

PTM

Packet Transfer Mode (PTM) is packet-oriented and supported by the VDSL2 standard. In PTM, packets are encapsulated directly in the High-level Data Link Control (HDLC) frames. It is designed to provide a low-overhead, transparent way of transporting packets over DSL links, as an alternative to ATM.

Multicast

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender - 1 recipient) or Broadcast (1 sender - everybody on the network). Multicast delivers IP packets to a group of hosts on the network - not everybody and not just one.

IGMP

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. There are three versions of IGMP. IGMP version 2 and 3 are improvements over version 1, but IGMP version 1 is still in wide use.

Finding Out More

See Section 6.4 on page 82 for technical background information on WAN.

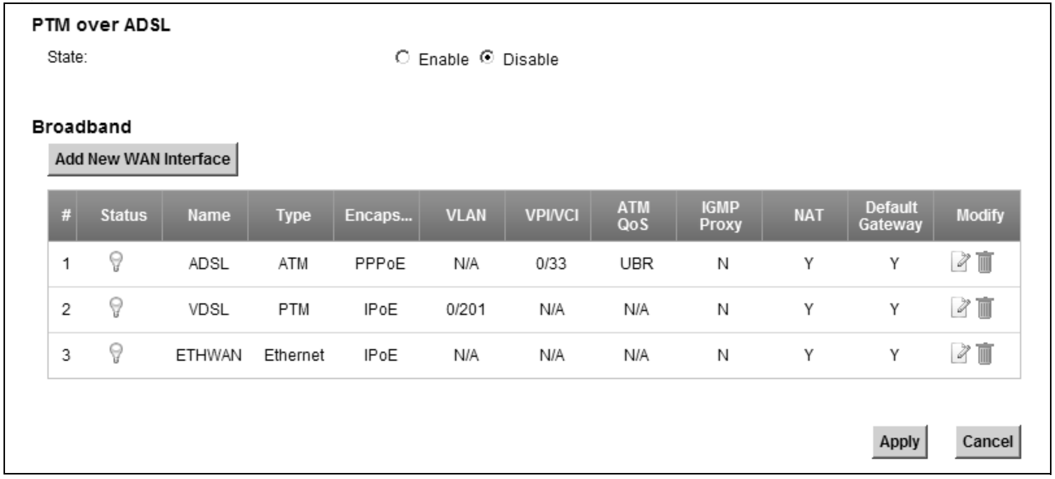
6.1.2 Before You Begin

You need to know your Internet access settings such as encapsulation and WAN IP address. Get this information from your ISP.

6.2 The Broadband Screen

Use this screen to change your ZyXEL Device’s Internet access settings. Click **Network Settings> Broadband** from the menu. The summary table shows you the configured WAN services (connections) on the ZyXEL Device.

Figure 17 Network Settings > Broadband



PTM over ADSL

State: ○ Enable ● Disable

Broadband

Add New WAN Interface

#	Status	Name	Type	Encaps...	VLAN	VPI/VCI	ATM QoS	IGMP Proxy	NAT	Default Gateway	Modify
1	💡	ADSL	ATM	PPPoE	N/A	0/33	UBR	N	Y	Y	✎🗑
2	💡	VDSL	PTM	IPoE	0/201	N/A	N/A	N	Y	Y	✎🗑
3	💡	ETHWAN	Ethernet	IPoE	N/A	N/A	N/A	N	Y	Y	✎🗑

Apply Cancel

The following table describes the labels in this screen.

Table 6 Network Settings > Broadband

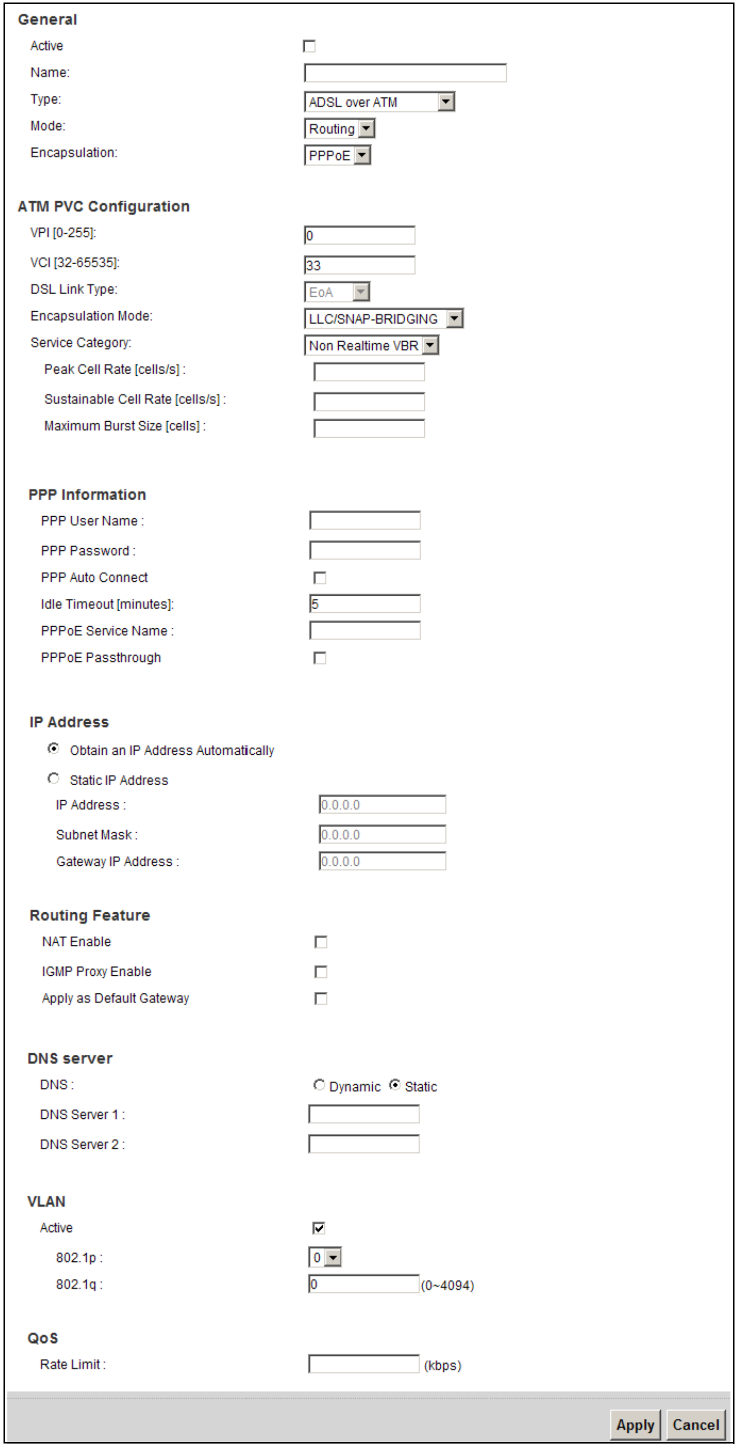
LABEL	DESCRIPTION
PTM over ADSL	Select **Enable** to use PTM over ADSL. Since PTM has less overhead than ATM, some ISPs use PTM over ADSL for better performance.
Add new WAN interface	Click this button to create a new connection.
#	This is the index number of the entry.
Status	This is the status of the connection.
Name	This is the service name of the connection.
Type	This shows whether it is a VDSL, ADSL, or Ethernet connection.
Encapsulation	This is the method of encapsulation used by this connection.
VLAN	This is the Virtual LAN (VLAN) number configured for this WAN connection.
VPI/VCI	This is the Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) numbers configured for this WAN connection.
ATM QoS	This is the type of ATM QoS of the connection.
IGMP Proxy	This shows whether the ZyXEL Device act as an IGMP proxy on this connection.
NAT	This shows whether NAT is activated or not for this connection.
Default Gateway	This shows whether the ZyXEL Device use the WAN interface of this connection as the system default gateway.
Modify	Click the **Edit** icon to configure the WAN connection. Click the **Delete** icon to remove the WAN connection.

6.2.1 Add/Edit Broadband

Click **Add new WAN interface** in the **Broadband** screen or the **Edit** icon next to an existing WAN interface to configure a WAN connection. The screen differs according to the mode and encapsulation you choose.

This screen displays when you select **Routing** mode and **PPPoE** encapsulation.

Figure 18 Broadband: Add/Edit: PPPoE Encapsulation



General

Active	□
Name:	
Type:	ADSL over ATM
Mode:	Routing
Encapsulation:	PPPoE

ATM PVC Configuration

VPI [0-255]:	0
VCI [32-65535]:	33
DSL Link Type:	EoA
Encapsulation Mode:	LLC/SNAP-BRIDGING
Service Category:	Non Realtime VBR
Peak Cell Rate [cells/s] :	
Sustainable Cell Rate [cells/s] :	
Maximum Burst Size [cells] :	

PPP Information

PPP User Name :	
PPP Password :	
PPP Auto Connect	□
Idle Timeout [minutes]:	5
PPPoE Service Name :	
PPPoE Passthrough	□

IP Address

● Obtain an IP Address Automatically

○ Static IP Address

IP Address :	0.0.0.0
Subnet Mask :	0.0.0.0
Gateway IP Address :	0.0.0.0

Routing Feature

NAT Enable	□
IGMP Proxy Enable	□
Apply as Default Gateway	□

DNS server

DNS :	○ Dynamic ● Static
DNS Server 1 :	
DNS Server 2 :	

VLAN

Active	☑
802.1p :	0
802.1q :	0 (0~4094)

QoS

Rate Limit :	(kbps)

The following table describes the labels in this screen.

Table 7 Broadband: Add/Edit: PPPoE Encapsulation

LABEL	DESCRIPTION
General	
Active	Select this to activate the WAN configuration settings.
Name	Specify a descriptive name for this connection. This field is view only if you are editing the WAN connection.
Type	Select whether it is **ADSL/VDSL over PTM**, **ADSL over ATM**, or **Ethernet** connection. • **ADSL/VDSL over PTM**: The ZyXEL Device uses the VDSL technology for data transmission over the DSL port. • **ADSL over ATM**: The ZyXEL Device uses the ADSL technology for data transmission over the DSL port. • **Ethernet**: The ZyXEL Device transmits data over the Ethernet WAN port. Select this if you have a DSL router or modem in your network already.
Mode	Select **Routing** (default) from the drop-down list box if your ISP give you one IP address only and you want multiple computers to share an Internet account.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. This option is available only when you select **Routing** in the **Mode** field. • **PPP over Ethernet (PPPoE)**: PPPoE (Point to Point Protocol over Ethernet) provides access control and billing functionality in a manner similar to dial-up services using PPP. Select this if you have a username and password for Internet access. • **IP over Ethernet (IPoE)**: In this type of Internet connection, IP packets are routed between the Ethernet interface and the WAN interface and then formatted so that they can be understood in a bridged environment. • **PPP over ATM (PPPoA)**: PPPoA allows just one PPPoA connection over a PVC. • **IP over ATM (IPoA)**: IPoA allows just one RFC 1483 routing connection over a PVC. If your connection type is **ADSL/VDSL over PTM** or **Ethernet**, the choices are **PPPoE** and **IPoE**. If your connection type is **ADSL over ATM**, the choices are **PPPoE**, **PPPoA**, **IPoE** and **IPoA**.
ATM PVC Configuration (These fields appear when the **Type** is set to **ADSL over ATM**.)	
VPI	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.
VCI	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.
DSL Link Type	This field is not editable. The selection depends on the setting in the **Encapsulation** field. **EoA** (Ethernet over ATM) uses an Ethernet header in the packet, so that you can have multiple services/connections over one PVC. You can set each connection to have its own MAC address or all connections share one MAC address but use different VLAN IDs for different services. EoA supports ENET ENCAP (IPoE), PPPoE and RFC1483/2684 bridging encapsulation methods. **PPPoA** (PPP over ATM) allows just one PPPoA connection over a PVC. **IPoA** (IP over ATM) allows just one RFC 1483 routing connection over a PVC.

Table 7 Broadband: Add/Edit: PPPoE Encapsulation (continued)

LABEL	DESCRIPTION
Encapsulation Mode	Select the method of multiplexing used by your ISP from the drop-down list box. Choices are: • **LLC/SNAP-BRIDGING:** In LCC encapsulation, bridged PDUs are encapsulated by identifying the type of the bridged media in the SNAP header. This is available only when you select **IPoE** or **PPPoE** in the Select DSL Link Type field. • **VC/MUX:** In VC multiplexing, each protocol is carried on a single ATM virtual circuit (VC). To transport multiple protocols, the ZyXEL Device needs separate VCs. There is a binding between a VC and the type of the network protocol carried on the VC. This reduces payload overhead since there is no need to carry protocol information in each Protocol Data Unit (PDU) payload. • **LLC/ENCAPSULATION:** More than one protocol can be carried over the same VC. This is available only when you select **PPPoA** in the **Encapsulation** field. • **LLC/SNAP-ROUTING:** In LCC encapsulation, an IEEE 802.2 Logical Link Control (LLC) header is prefixed to each routed PDU to identify the PDUs. The LCC header can be followed by an IEEE 802.1a SubNetwork Attachment Point (SNAP) header. This is available only when you select **IPoA** in the **Encapsulation** field.
Service Category	Select **UBR Without PCR** or **UBR With PCR** for applications that are non-time sensitive, such as e-mail. Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **Non Realtime VBR** (non real-time Variable Bit Rate) for connections that do not require closely controlled delay and delay variation. Select **Realtime VBR** (real-time Variable Bit Rate) for applications with bursty connections that require closely controlled delay and delay variation.
Peak Cell Rate	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Type the PCR here. This field is not available when you select **UBR Without PCR**.
Sustain Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Type the SCR, which must be less than the PCR. Note that system default is 0 cells/sec. This field is available only when you select **Non Realtime VBR** or **Realtime VBR**.
Maximum Burst Size	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Type the MBS, which is less than 65535. This field is available only when you select **Non Realtime VBR** or **Realtime VBR**.
PPP Information	This is available only when you select **PPPoE** or **PPPoA** in the **Mode** field.
PPP User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
PPP Password	Enter the password associated with the user name above.
PPP Auto Connect	Select this option if you do not want the connection to time out.
Idle Timeout	This value specifies the time in minutes that elapses before the router automatically disconnects from the PPPoE server. This field is not configurable if you select **PPP Auto Connect**.
PPPoE Service Name	Enter the name of your PPPoE service here.

Table 7 Broadband: Add/Edit: PPPoE Encapsulation (continued)

LABEL	DESCRIPTION
PPPoE Passthrough	This field is available when you select **PPPoE** encapsulation. In addition to the ZyXEL Device's built-in PPPoE client, you can enable PPPoE pass through to allow up to ten hosts on the LAN to use PPPoE client software on their computers to connect to the ISP via the ZyXEL Device. Each host can have a separate account and a public WAN IP address. PPPoE pass through is an alternative to NAT for application where NAT is not appropriate. Disable PPPoE pass through if you do not need to allow hosts on the LAN to use PPPoE client software on their computers to connect to the ISP.
IP Address	
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select this if you have a dynamic IP address.
Static IP Address	Select this option If the ISP assigned a fixed IP address.
IP Address	Enter the static IP address provided by your ISP.
IP Subnet Mask	Enter the subnet mask provided by your ISP.
Gateway IP Address	Enter the gateway IP address provided by your ISP.
Routing Feature	
NAT Enable	Select this option to activate NAT on this connection.
IGMP Proxy Enable	Internet Group Multicast Protocol (IGMP) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. Select this option to have the ZyXEL Device act as an IGMP proxy on this connection. This allows the ZyXEL Device to get subscribing information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Apply as Default Gateway	Select this option to have the ZyXEL Device use the WAN interface of this connection as the system default gateway.
DNS Server	This is available only when you select **Apply as Default Gateway** in the **Routing Feature** field.
DNS	Select **Dynamic** if you want the ZyXEL Device use the DNS server addresses assigned by your ISP. Select **Static** if you want the ZyXEL Device use the DNS server addresses you configure manually.
DNS Server 1	Enter the first DNS server address assigned by the ISP.
DNS Server 2	Enter the second DNS server address assigned by the ISP.
VLAN (These fields appear when the **Type** is set to **ADSL/VDSL over PTM** or **Ethernet**.)	
Active	Select this option to add the VLAN tag (specified below) to the outgoing traffic through this connection.
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number for traffic through this connection.
QoS	If you want to set a rate limit for the connection, enter it in the **Rate Limit** field. This is the maximum transmission rate allowed for traffic on this connection.

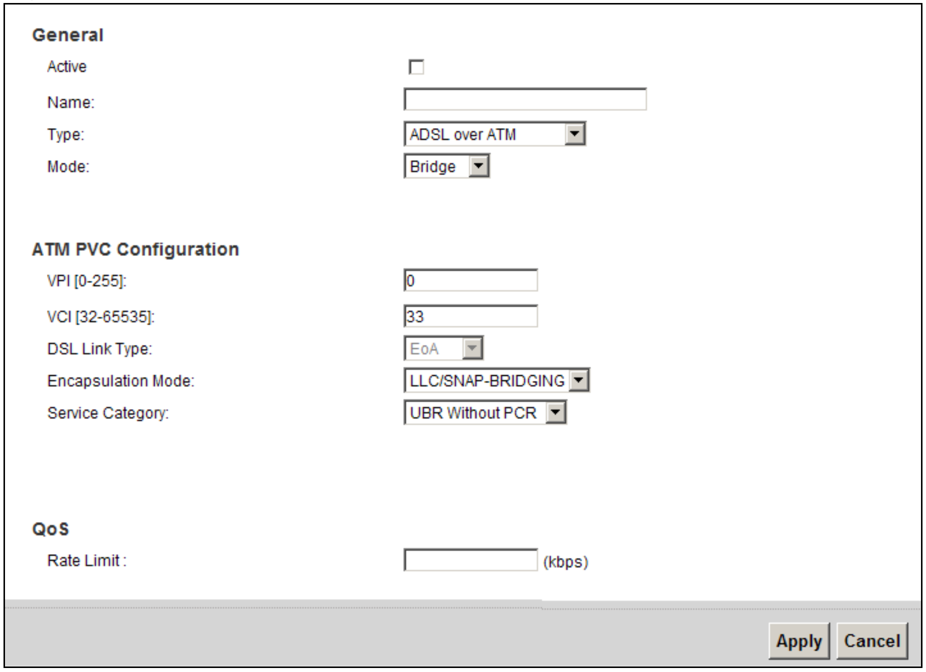
Table 7 Broadband: Add/Edit: PPPoE Encapsulation (continued)

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

6.2.1.1 Bridge

This screen displays when you select the **Bridge** mode.

Figure 19 Broadband: Add/Edit: Bridge Mode



General

Active □

Name:

Type: ADSL over ATM

Mode: Bridge

ATM PVC Configuration

VPI [0-255]: 0

VCI [32-65535]: 33

DSL Link Type: EoA

Encapsulation Mode: LLC/SNAP-BRIDGING

Service Category: UBR Without PCR

QoS

Rate Limit : (kbps)

The following table describes the labels in this screen.

Table 8 Broadband: Add/Edit: Bridge Mode

LABEL	DESCRIPTION
General	
Active	Select this to activate the WAN configuration settings.
Name	Specify a descriptive name for this connection.
Type	Select whether it is **ADSL/VDSL over PTM**, **ADSL over ATM**, or **Ethernet** connection. • **ADSL/VDSL over PTM**: The ZyXEL Device uses the VDSL technology for data transmission over the DSL port. • **ADSL over ATM**: The ZyXEL Device uses the ADSL technology for data transmission over the DSL port. • **Ethernet**: The ZyXEL Device transmits data over the Ethernet WAN port. Select this if you have a DSL router or modem in your network already.
Mode	Select **Bridge** when your ISP provides you more than one IP address and you want the connected computers to get individual IP address from ISP’s DHCP server directly. If you select **Bridge**, you cannot use routing functions, such as Firewall, DHCP server and NAT on traffic from the selected LAN port(s).
ATM PVC Configuration	
VPI	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.

Table 8 Broadband: Add/Edit: Bridge Mode (continued)

LABEL	DESCRIPTION
VCI	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.
DSL Link Type	This field is not editable. **EoA** (Ethernet over ATM) uses an Ethernet header in the packet, so that you can have multiple services/connections over one PVC. You can set each connection to have its own MAC address or all connections share one MAC address but use different VLAN IDs for different services.
Encapsulation Mode	Select the method of multiplexing used by your ISP from the drop-down list box. Choices are: • **LLC/SNAP-BRIDGING:** In LCC encapsulation, bridged PDUs are encapsulated by identifying the type of the bridged media in the SNAP header. • **VC/MUX:** In VC multiplexing, each protocol is carried on a single ATM virtual circuit (VC). To transport multiple protocols, the ZyXEL Device needs separate VCs. There is a binding between a VC and the type of the network protocol carried on the VC. This reduces payload overhead since there is no need to carry protocol information in each Protocol Data Unit (PDU) payload.
Service Category	Select **UBR Without PCR** or **UBR With PCR** for applications that are non-time sensitive, such as e-mail. Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **Non Realtime VBR** (non real-time Variable Bit Rate) for connections that do not require closely controlled delay and delay variation. Select **Realtime VBR** (real-time Variable Bit Rate) for applications with bursty connections that require closely controlled delay and delay variation.
Peak Cell Rate	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Type the PCR here. This field is not available when you select **UBR Without PCR**.
Sustain Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Type the SCR, which must be less than the PCR. Note that system default is 0 cells/sec. This field is available only when you select **Non Realtime VBR** or **Realtime VBR**.
Maximum Burst Size	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Type the MBS, which is less than 65535. This field is available only when you select **Non Realtime VBR** or **Realtime VBR**.
VLAN (These fields appear when the **Type** is set to **ADSL/VDSL over PTM** or **Ethernet**)	
Active	Select this option to add the VLAN tag (specified below) to the outgoing traffic through this connection.
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level (from 0 to 7) to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number (from 1 to 4094) for traffic through this connection.
QoS	If you want to set a rate limit for the connection, enter it in the **Rate Limit** field. This is the maximum transmission rate allowed for traffic on this connection.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

6.3 The DSL Screen

If the DSLAM of your ISP supports DSL bonding, you can connect the two DSL ports on the ZyXEL Device to two separate telephone jacks and enable the bonding feature in the **DSL** screen.

DSL signals have distance limitations. VDSL2 (profile 17a) supports greater speed but offer shorter distances (within 3000 ft). The farther away the subscribers are from the DSLAM, the slower the speed. VDSL (profile 12a) provides longer distance range (over 3000 ft) but at lower speeds. DSL bonding allows subscribers to use data streams spread over two DSL lines in order to (almost) double the speed at longer distances. You may choose to use DSL bonding if the DSLAM supports it and there are two DSL lines to the DSLAM.

The total available bandwidth for the subscriber then becomes the sum of the bandwidth available for each of the subscriber’s line connections. The data rate depends on the DSL type, its standard/ profile, and the standard/profile that the DSLAM supports. The table below shows the transmission data rate for single DSL line and DSL bonding.

Table 9 Comparison Table for Single DSL line and DSL Bonding

ITEM	VDSL2	VDSL BONDING	ADSL2+	ADSL(2+) BONDING
PROFILE/ STANDARD	G993.2 Profile 17a	G993.2 Profile 12a	G.992.5	G.992.5
MAX. DOWNSTREAM/ UPSTREAM	100/60 Mbps	50/25 x 2 = 100/50 Mbps	25/1 Mbps	25/1 x 2 = 50/2 Mbps
DISTANCE	within 3000 ft	over 3000 ft	over 5000 ft	5000 to 7000 ft

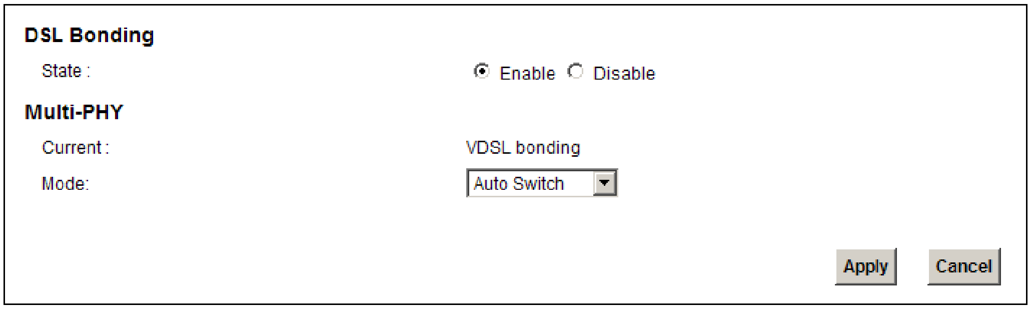
For a single VDSL line, the profile is 17a, which provides a maximum data rate of 100/60 Mbps (downstream/upstream). If VDSL bonding is used, the supported profile is 12a, which provides a maximum data rate of 50/25 Mbps for each VDSL line. The ideal total data rate for the bonded connection is 100/50 Mbps.

For a single ADSL line, the standard with the highest data rate supported is ADSL2+, which provides 25/1 Mbps data rate. When ADSL bonding is used, the data rate doubles to 50/2 Mbps.

In addition, DSL bonding supports ADSL bonding fallback. If a VDSL connection cannot be established, the ZyXEL Device tries to use ADSL. If the VDSL connection is re-established, the ZyXEL Device automatically switches back to VDSL. You must enable DSL bonding in order to use ADSL fallback.

Click **Broadband > DSL** to display the following screen.

Figure 20 Broadband > DSL



DSL Bonding

State : ● Enable ○ Disable

Multi-PHY

Current : VDSL bonding

Mode: Auto Switch ▼

The following table describes the labels in this screen.

Table 10 Broadband > DSL

LABEL	DESCRIPTION
DSL Bonding	
State	Select **Enable** to use the DSL bonding and ADSL fallback features. Make sure your ISP supports these functions.
Multi-PHY	
Current	This shows the current bonding mode the ZyXEL Device is using. You can change it in the **Mode** field.
Mode	Select whether you want to use **Auto Switch**, **VDSL Bonding**, or **ADSL Bonding**. If you select **Auto Switch**, the ZyXEL Device automatically switches to ADSL bonding when the VDSL bonding is not available. The bonding switches back to VSDL when it is re-established.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

6.4 Technical Reference

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

6.4.1 Encapsulation

Be sure to use the encapsulation method required by your ISP. The ZyXEL Device supports the following methods.

6.4.1.1 PPP over Ethernet

The ZyXEL Device supports PPPoE (Point-to-Point Protocol over Ethernet). PPPoE is an IETF Draft standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection. The PPPoE option is for a dial-up connection using PPPoE.

For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for example RADIUS).

One of the benefits of PPPoE is the ability to let you access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for individuals.

Operationally, PPPoE saves significant effort for both you and the ISP or carrier, as it requires no specific configuration of the broadband modem at the customer site.

By implementing PPPoE directly on the ZyXEL Device (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the ZyXEL Device does that part of the task. Furthermore, with NAT, all of the LANs' computers will have access.

6.4.1.2 PPPoA

PPPoA stands for Point to Point Protocol over ATM Adaptation Layer 5 (AAL5). A PPPoA connection functions like a dial-up Internet connection. The ZyXEL Device encapsulates the PPP session based on RFC1483 and sends it through an ATM PVC (Permanent Virtual Circuit) to the Internet Service Provider's (ISP) DSLAM (Digital Subscriber Line (DSL) Access Multiplexer). Please refer to RFC 2364 for more information on PPPoA. Refer to RFC 1661 for more information on PPP.

6.4.2 Multiplexing

There are two conventions to identify what protocols the virtual circuit (VC) is carrying. Be sure to use the multiplexing method required by your ISP.

VC-based Multiplexing

In this case, by prior mutual agreement, each protocol is assigned to a specific virtual circuit; for example, VC1 carries IP, etc. VC-based multiplexing may be dominant in environments where dynamic creation of large numbers of ATM VCs is fast and economical.

LLC-based Multiplexing

In this case one VC carries multiple protocols with protocol identifying information being contained in each packet header. Despite the extra bandwidth and processing overhead, this method may be advantageous if it is not practical to have a separate VC for each carried protocol, for example, if charging heavily depends on the number of simultaneous VCs.

6.4.3 VPI and VCI

Be sure to use the correct Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) numbers assigned to you. The valid range for the VPI is 0 to 255 and for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Please see the appendix for more information.

6.4.4 IP Address Assignment

A static IP is a fixed IP that your ISP gives you. A dynamic IP is not fixed; the ISP assigns you a different one each time. The Single User Account feature can be enabled or disabled if you have either a dynamic or static IP.

IP Assignment with PPPoA or PPPoE Encapsulation

If you have a dynamic IP, then the **IP Address** and **Gateway IP Address** fields are not applicable (N/A). If you have a static IP, then you only need to fill in the **IP Address** field and not the **Gateway IP Address** field.

6.4.5 NAT

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

6.4.6 Traffic Shaping

Traffic Shaping is an agreement between the carrier and the subscriber to regulate the average rate and fluctuations of data transmission over an ATM network. This agreement helps eliminate congestion, which is important for transmission of real time data such as audio and video connections.

Peak Cell Rate (PCR) is the maximum rate at which the sender can send cells. This parameter may be lower (but not higher) than the maximum line speed. 1 ATM cell is 53 bytes (424 bits), so a maximum speed of 832Kbps gives a maximum PCR of 1962 cells/sec. This rate is not guaranteed because it is dependent on the line speed.

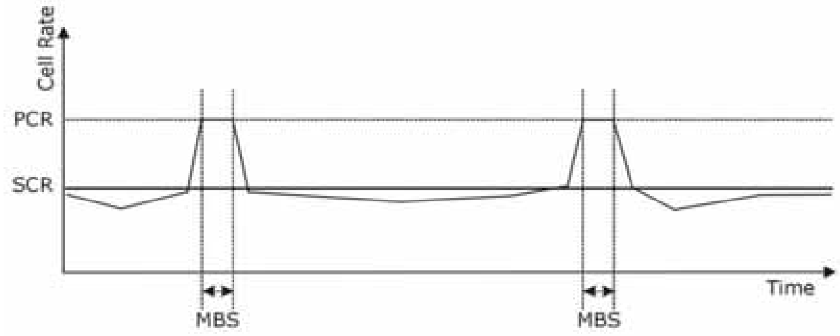
Sustained Cell Rate (SCR) is the mean cell rate of each bursty traffic source. It specifies the maximum average rate at which cells can be sent over the virtual connection. SCR may not be greater than the PCR.

Maximum Burst Size (MBS) is the maximum number of cells that can be sent at the PCR. After MBS is reached, cell rates fall below SCR until cell rate averages to the SCR again. At this time, more cells (up to the MBS) can be sent at the PCR again.

If the PCR, SCR or MBS is set to the default of "0", the system will assign a maximum value that correlates to your upstream line rate.

The following figure illustrates the relationship between PCR, SCR and MBS.

Figure 21 Example of Traffic Shaping



6.4.7 ATM Traffic Classes

These are the basic ATM traffic classes defined by the ATM Forum Traffic Management 4.0 Specification.

Constant Bit Rate (CBR)

Constant Bit Rate (CBR) provides fixed bandwidth that is always available even if no data is being sent. CBR traffic is generally time-sensitive (doesn't tolerate delay). CBR is used for connections that continuously require a specific amount of bandwidth. A PCR is specified and if traffic exceeds this rate, cells may be dropped. Examples of connections that need CBR would be high-resolution video and voice.

Variable Bit Rate (VBR)

The Variable Bit Rate (VBR) ATM traffic class is used with bursty connections. Connections that use the Variable Bit Rate (VBR) traffic class can be grouped into real time (VBR-RT) or non-real time (VBR-nRT) connections.

The VBR-RT (real-time Variable Bit Rate) type is used with bursty connections that require closely controlled delay and delay variation. It also provides a fixed amount of bandwidth (a PCR is specified) but is only available when data is being sent. An example of an VBR-RT connection would be video conferencing. Video conferencing requires real-time data transfers and the bandwidth requirement varies in proportion to the video image's changing dynamics.

The VBR-nRT (non real-time Variable Bit Rate) type is used with bursty connections that do not require closely controlled delay and delay variation. It is commonly used for "bursty" traffic typical on LANs. PCR and MBS define the burst levels, SCR defines the minimum level. An example of an VBR-nRT connection would be non-time sensitive data file transfers.

Unspecified Bit Rate (UBR)

The Unspecified Bit Rate (UBR) ATM traffic class is for bursty data transfers. However, UBR doesn't guarantee any bandwidth and only delivers traffic when the network has spare bandwidth. An example application is background file transfer.

6.4.8 Introduction to VLANs

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

In Multi-Tenant Unit (MTU) applications, VLAN is vital in providing isolation and security among the subscribers. When properly configured, VLAN prevents one subscriber from accessing the network resources of another on the same LAN, thus a user will not see the printers and hard disks of another user in the same building.

VLAN also increases network performance by limiting broadcasts to a smaller and more manageable logical broadcast domain. In traditional switched environments, all broadcast packets go to each and every individual port. With VLAN, all broadcasts are confined to a specific broadcast domain.

Introduction to IEEE 802.1Q Tagged VLAN

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges - they are not confined to the switch on which they were created. The

VLANs can be created statically by hand or dynamically through GVRP. The VLAN ID associates a frame with a specific VLAN and provides the information that switches need to process the frame across the network. A tagged frame is four bytes longer than an untagged frame and contains two bytes of TPID (Tag Protocol Identifier), residing within the type/length field of the Ethernet frame) and two bytes of TCI (Tag Control Information), starts after the source address field of the Ethernet frame).

The CFI (Canonical Format Indicator) is a single-bit flag, always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port. The remaining twelve bits define the VLAN ID, giving a possible maximum number of 4,096 VLANs. Note that user priority and VLAN ID are independent of each other. A frame with VID (VLAN Identifier) of null (0) is called a priority frame, meaning that only the priority level is significant and the default VID of the ingress port is given as the VID of the frame. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

TPID	User Priority	CFI	VLAN ID
2 Bytes	3 Bits	1 Bit	12 Bits

Wireless

7.1 Overview

This chapter describes the ZyXEL Device's **Network Settings > Wireless** screens. Use these screens to set up your ZyXEL Device's wireless connection.

7.1.1 What You Can Do in this Chapter

This section describes the ZyXEL Device's **Wireless** screens. Use these screens to set up your ZyXEL Device's wireless connection.

- Use the **General** screen to enable the Wireless LAN, enter the SSID and select the wireless security mode (Section 7.2 on page 88).
- Use the **More AP** screen to set up multiple wireless networks on your ZyXEL Device (Section 7.3 on page 95).
- Use the **MAC Authentication** screen to allow or deny wireless clients based on their MAC addresses from connecting to the ZyXEL Device (Section 7.4 on page 97).
- Use the **WPS** screen to enable or disable WPS, view or generate a security PIN (Personal Identification Number) (Section 7.5 on page 98).
- Use the **Others** screen to configure wireless advanced features, such as the RTS/CTS Threshold (Section 7.6 on page 100).

7.1.2 What You Need to Know

Wireless Basics

"Wireless" is essentially radio communication. In the same way that walkie-talkie radios send and receive information over the airwaves, wireless networking devices exchange information with one another. A wireless networking device is just like a radio that lets your computer exchange information with radios attached to other computers. Like walkie-talkies, most wireless networking devices operate at radio frequency bands that are open to the public and do not require a license to use. However, wireless networking is different from that of most traditional radio communications in that there a number of wireless networking standards available with different methods of data encryption.

Finding Out More

See Section 7.7 on page 101 for advanced technical information on wireless networks.

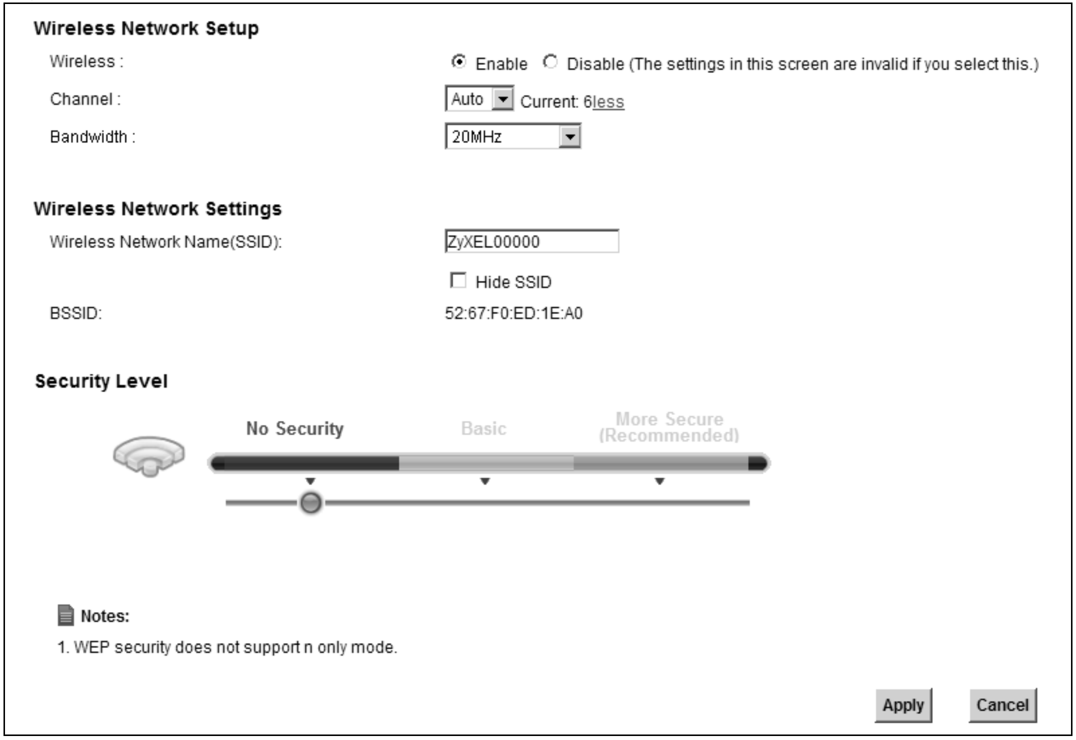
7.2 The General Screen

Use this screen to enable the Wireless LAN, enter the SSID and select the wireless security mode.

Note: If you are configuring the ZyXEL Device from a computer connected to the wireless LAN and you change the ZyXEL Device's SSID, channel or security settings, you will lose your wireless connection when you press **Apply** to confirm. You must then change the wireless settings of your computer to match the ZyXEL Device's new settings.

Click **Network Settings** > **Wireless** to open the **General** screen.

Figure 22 Network Settings > Wireless > General



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Channel : Auto Current: 6less

Bandwidth : 20MHz

Wireless Network Settings

Wireless Network Name(SSID): ZyXEL00000

□ Hide SSID

BSSID: 52:67:F0:ED:1E:A0

Security Level

Notes:

1. WEP security does not support n only mode.

The following table describes the general wireless LAN labels in this screen.

Table 11 Network Settings > Wireless > General

LABEL	DESCRIPTION
Wireless Network Setup	
Wireless	You can **Enable** or **Disable** the wireless LAN in this field.
Channel	Set the channel depending on your particular region. Select a channel or use **Auto** to have the ZyXEL Device automatically determine a channel to use. If you are having problems with wireless interference, changing the channel may help. Try to use a channel that is as many channels away from any channels used by neighboring APs as possible. The channel number which the ZyXEL Device is currently using then displays next to this field.
more.../less	Click **more...** to show more information. Click **less** to hide them.
Bandwidth	Select whether the ZyXEL Device uses a wireless channel width of **20MHz** or **20MHz/40MHz**. A standard 20MHz channel offers transfer speeds of up to 150Mbps whereas a 40MHz channel uses two standard channels and offers speeds of up to 300 Mbps. 40MHz (channel bonding or dual channel) bonds two adjacent radio channels to increase throughput. The wireless clients must also support 40 MHz. It is often better to use the 20 MHz setting in a location where the environment hinders the wireless signal. Select **20MHz** if you want to lessen radio interference with other wireless devices in your neighborhood or the wireless clients do not support channel bonding. Select **20MHz/40MHz** to allow the ZyXEL Device to adjust the channel bandwidth depending on network conditions.

Table 11 Network Settings > Wireless > General (continued)

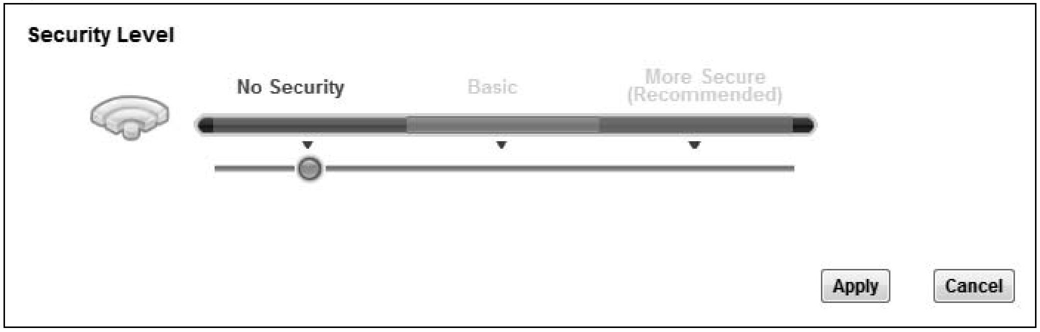
LABEL	DESCRIPTION
Wireless Network Settings	
Wireless Network Name (SSID)	The SSID (Service Set IDentity) identifies the service set with which a wireless device is associated. Wireless devices associating to the access point (AP) must have the same SSID. Enter a descriptive name (up to 32 English keyboard characters) for the wireless LAN.
Hide SSID	Select this check box to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool.
Client Isolation	Select this to keep the wireless clients in this SSID from communicating with each other through the ZyXEL Device.
MBSSID/LAN Isolation	Select this to keep the wireless clients in this SSID from communicating with clients in other SSIDs or wired LAN devices through the ZyXEL Device. Select both **Client Isolation** and **MBSSID/LAN Isolation** to allow this SSID's wireless clients to only connect to the Internet through the ZyXEL Device.
Enhanced Multicast Forwarding	Select this check box to allow the ZyXEL Device to convert wireless multicast traffic into wireless unicast traffic.
Security Level	
Security Mode	Select **Basic (WEP)** or **More Secure (WPA(2)-PSK, WPA(2))** to add security on this wireless network. The wireless clients which want to associate to this network must have same wireless security settings as the ZyXEL Device. When you select to use a security, additional options appears in this screen. Or you can select **No Security** to allow any client to associate this network without any data encryption or authentication. See the following sections for more details about this field.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.2.1 No Security

Select **No Security** to allow wireless stations to communicate with the access points without any data encryption or authentication.

Note: If you do not enable any wireless security on your ZyXEL Device, your network is accessible to any wireless networking device that is within range.

Figure 23 Wireless > General: No Security



The following table describes the labels in this screen.

Table 12 Wireless > General: No Security

LABEL	DESCRIPTION
Security Level	Choose **No Security** from the drop-down list box.

7.2.2 Basic (WEP Encryption)

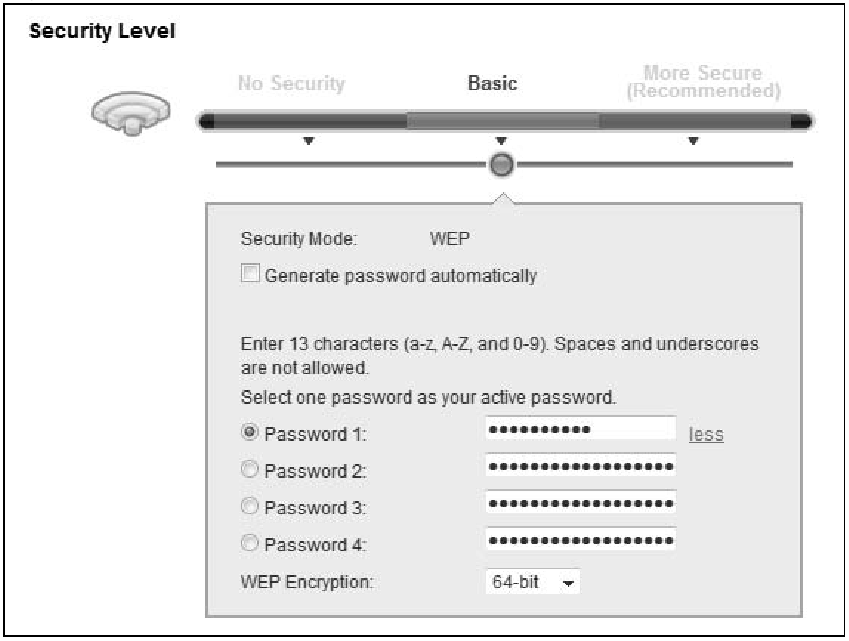
WEP encryption scrambles the data transmitted between the wireless stations and the access points (AP) to keep network communications private. Both the wireless stations and the access points must use the same WEP key.

Note: WEP is extremely insecure. Its encryption can be broken by an attacker, using widely-available software. It is strongly recommended that you use a more effective security mechanism. Use the strongest security mechanism that all the wireless devices in your network support. For example, use WPA-PSK or WPA2-PSK if all your wireless devices support it, or use WPA or WPA2 if your wireless devices support it and you have a RADIUS server. If your wireless devices support nothing stronger than WEP, use the highest encryption level available.

Your ZyXEL Device allows you to configure up to four 64-bit or 128-bit WEP keys but only one key can be enabled at any one time.

In order to configure and enable WEP encryption, click **Network Settings** > **Wireless** to display the **General** screen, then select **Basic** as the security level.

Figure 24 Wireless > General: Basic (WEP)



Security Level

Security Mode: WEP

☐ Generate password automatically

Enter 13 characters (a-z, A-Z, and 0-9). Spaces and underscores are not allowed.

Select one password as your active password.

● Password 1: •••••••••••

○ Password 2: •••••••••••••••••••

○ Password 3: •••••••••••••••••••

○ Password 4: •••••••••••••••••••

WEP Encryption: 64-bit

The following table describes the labels in this screen.

Table 13 Wireless > General: Basic (WEP)

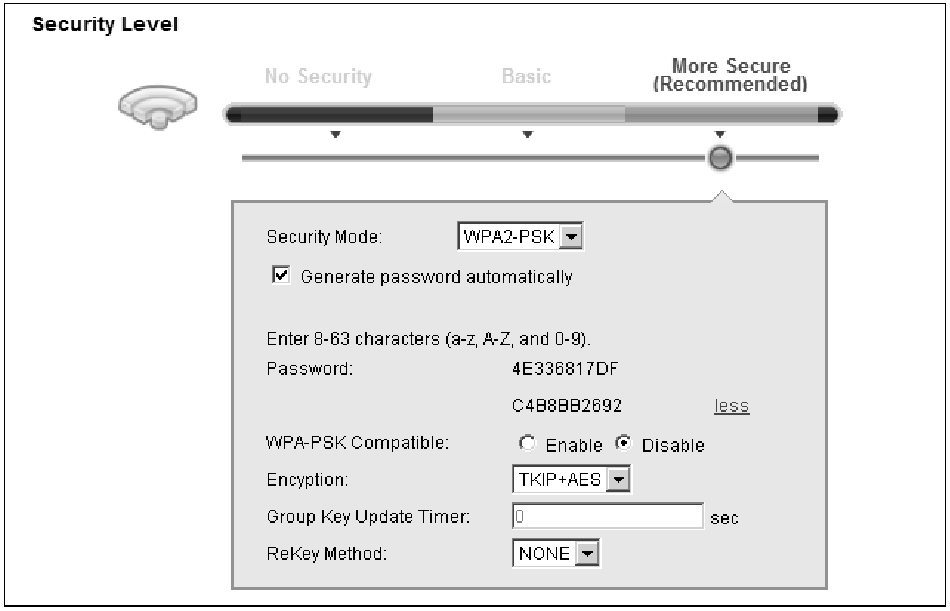
LABEL	DESCRIPTION
Security Level	Select **Basic** to enable WEP data encryption.
Generate password automatically	Select this option to have the ZyXEL Device automatically generate a password. The password field will not be configurable when you select this option.
Password 1~4	The password (WEP keys) are used to encrypt data. Both the ZyXEL Device and the wireless stations must use the same password (WEP key) for data transmission. If you chose **64-bit** WEP, then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F"). If you chose **128-bit** WEP, then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F"). You must configure at least one password, only one password can be activated at any one time.
more.../less	Click **more...** to show more fields in this section. Click **less** to hide them.
WEP Encryption	Select **64-bits** or **128-bits**. This dictates the length of the security key that the network is going to use.

7.2.3 More Secure (WPA(2)-PSK)

The WPA-PSK security mode provides both improved data encryption and user authentication over WEP. Using a Pre-Shared Key (PSK), both the ZyXEL Device and the connecting client share a common password in order to validate the connection. This type of encryption, while robust, is not as strong as WPA, WPA2 or even WPA2-PSK. The WPA2-PSK security mode is a newer, more robust version of the WPA encryption standard. It offers slightly better security, although the use of PSK makes it less robust than it could be.

Click **Network Settings** > **Wireless** to display the **General** screen. Select **More Secure** as the security level. Then select **WPA-PSK** or **WPA2-PSK** from the **Security Mode** list.

Figure 25 Wireless > General: More Secure: WPA(2)-PSK



Security Mode: WPA2-PSK

☑ Generate password automatically

Enter 8-63 characters (a-z, A-Z, and 0-9).

Password: 4E336817DF C4B8BB2692 less

WPA-PSK Compatible: ○ Enable ● Disable

Encyption: TKIP+AES

Group Key Update Timer: 0 sec

ReKey Method: NONE

The following table describes the labels in this screen.

Table 14 Wireless > General: More Secure: WPA(2)-PSK

LABEL	DESCRIPTION
Security Level	Select **More Secure** to enable WPA(2)-PSK data encryption.
Security Mode	Select **WPA-PSK** or **WPA2-PSK** from the drop-down list box.
Generate password automatically	Select this option to have the ZyXEL Device automatically generate a password. The password field will not be configurable when you select this option.
Password	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. Type a pre-shared key from 8 to 64 case-sensitive keyboard characters.
more.../less	Click **more...** to show more fields in this section. Click **less** to hide them.
WPA-PSK Compatible	This field appears when you choose **WPA-PSK2** as the **Security Mode**. Check this field to allow wireless devices using **WPA-PSK** security mode to connect to your ZyXEL Device. The ZyXEL Device supports WPA-PSK and WPA2-PSK simultaneously.

Table 14 Wireless > General: More Secure: WPA(2)-PSK (continued)

LABEL	DESCRIPTION
Encryption	Select the encryption type (**AES** or **TKIP+AES**) for data encryption. Select **AES** if your wireless clients can all use AES. Select **TKIP+AES** to allow the wireless clients to use either TKIP or AES.
Group Key Update Timer	The **Group Key Update Timer** is the rate at which the RADIUS server sends a new group key out to all clients.
ReKey Method	The ZyXEL Device can automatically disconnect a wireless station from the wired network after a period of inactivity or after a certain number of packets have been processed. The wireless station needs to enter the username and password again before access to the wired network is allowed. • Select **TIME** to have the ZyXEL Device automatically disconnects a wireless station from the wired network after a period of inactivity. • Select **NONE** if you do not want the connection between the ZyXEL Device and a wireless station to time out.

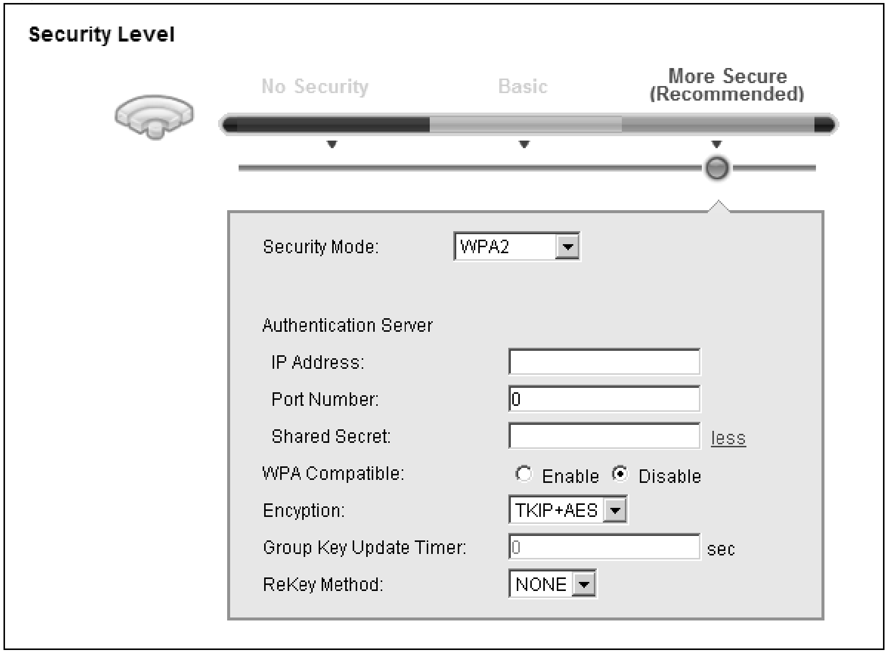
7.2.4 WPA(2) Authentication

The WPA2 security mode is currently the most robust form of encryption for wireless networks. It requires a RADIUS server to authenticate user credentials and is a full implementation the security protocol. Use this security option for maximum protection of your network. However, it is the least backwards compatible with older devices.

The WPA security mode is a security subset of WPA2. It requires the presence of a RADIUS server on your network in order to validate user credentials. This encryption standard is slightly older than WPA2 and therefore is more compatible with older devices.

Click **Network Settings** > **Wireless** to display the **General** screen. Select **More Secure** as the security level. Then select **WPA** or **WPA2** from the **Security Mode** list.

Figure 26 Wireless > General: More Secure: WPA(2)



Security Mode: WPA2

Authentication Server

IP Address:

Port Number: 0

Shared Secret: less

WPA Compatible: ○ Enable ● Disable

Encyption: TKIP+AES

Group Key Update Timer: 0 sec

ReKey Method: NONE

The following table describes the labels in this screen.

Table 15 Wireless > General: More Secure: WPA(2)

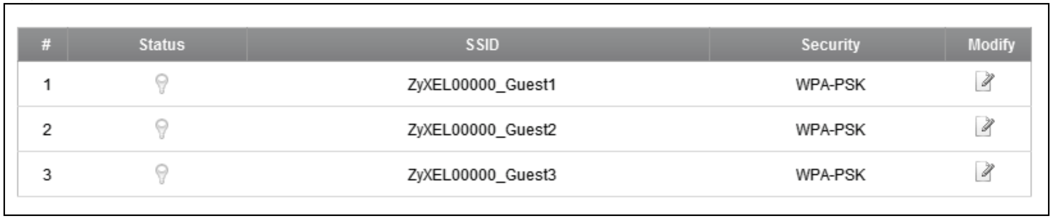
LABEL	DESCRIPTION
Security Level	Select **More Secure** to enable WPA(2)-PSK data encryption.
Security Mode	Choose **WPA** or **WPA2** from the drop-down list box.
Authentication Server	
IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external authentication server and the ZyXEL Device. The key must be the same on the external authentication server and your ZyXEL Device. The key is not sent over the network.
more.../less	Click **more...** to show more fields in this section. Click **less** to hide them.
WPA Compatible	This field is only available for WPA2. Select this if you want the ZyXEL Device to support WPA and WPA2 simultaneously.
Encryption	Select the encryption type (**AES** or **TKIP+AES**) for data encryption. Select **AES** if your wireless clients can all use AES. Select **TKIP+AES** to allow the wireless clients to use either TKIP or AES.
Group Key Update Timer	The **Group Key Update Timer** is the rate at which the RADIUS server sends a new group key out to all clients.
ReKey Method	The ZyXEL Device can automatically disconnect a wireless station from the wired network after a period of inactivity or after a certain number of packets have been processed. The wireless station needs to enter the username and password again before access to the wired network is allowed. • Select **TIME** to have the ZyXEL Device automatically disconnects a wireless station from the wired network after a period of inactivity. • Select **NONE** if you do not want the connection between the ZyXEL Device and a wireless station to time out.

7.3 The More AP Screen

This screen allows you to enable and configure multiple Basic Service Sets (BSSs) on the ZyXEL Device.

Click **Network Settings > Wireless** > **More AP**. The following screen displays.

Figure 27 Network Settings > Wireless > More AP



#	Status	SSID	Security	Modify
1	💡	ZyXEL00000_Guest1	WPA-PSK	✎
2	💡	ZyXEL00000_Guest2	WPA-PSK	✎
3	💡	ZyXEL00000_Guest3	WPA-PSK	✎

The following table describes the labels in this screen.

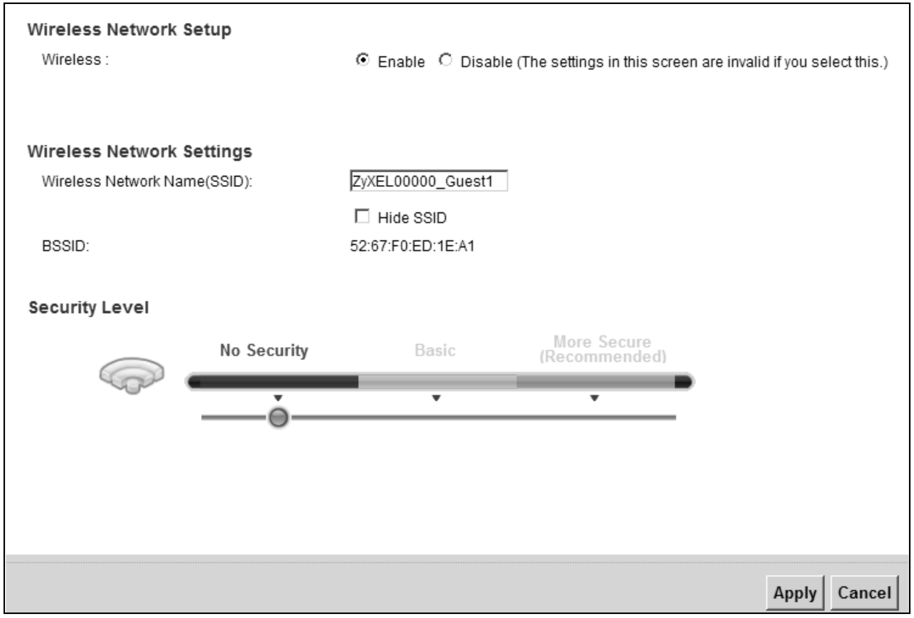
Table 16 Network Settings > Wireless > More AP

LABEL	DESCRIPTION
#	This is the index number of the entry.
Status	This field indicates whether this SSID is active. A yellow bulb signifies that this SSID is active. A gray bulb signifies that this SSID is not active.
SSID	An SSID profile is the set of parameters relating to one of the ZyXEL Device's BSSs. The SSID (Service Set IDentifier) identifies the Service Set with which a wireless device is associated. This field displays the name of the wireless profile on the network. When a wireless client scans for an AP to associate with, this is the name that is broadcast and seen in the wireless client utility.
Security	This field indicates the security mode of the SSID profile.
Modify	Click the **Edit** icon to configure the SSID profile.

7.3.1 Edit More AP

Use this screen to edit an SSID profile. Click the **Edit** icon next to an SSID in the **More AP** screen. The following screen displays.

Figure 28 More AP: Edit



Wireless Network Setup

Wireless : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Wireless Network Settings

Wireless Network Name(SSID): ZyXEL00000_Guest1

□ Hide SSID

BSSID: 52:67:F0:ED:1E:A1

Security Level

The following table describes the fields in this screen.

Table 17 More AP: Edit

LABEL	DESCRIPTION
Wireless Network Setup	
Wireless	You can **Enable** or **Disable** the wireless LAN in this field.
Wireless Network Settings	

Table 17 More AP: Edit (continued)

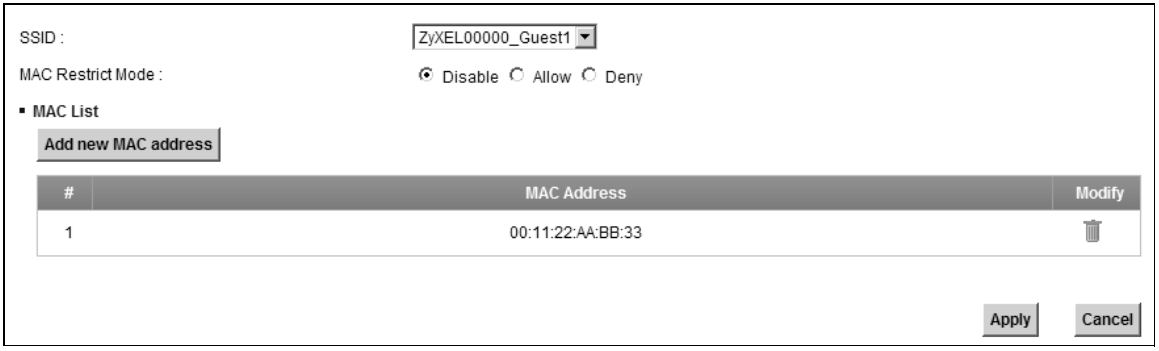
LABEL	DESCRIPTION
Wireless Network Name (SSID)	The SSID (Service Set IDentity) identifies the service set with which a wireless device is associated. Wireless devices associating to the access point (AP) must have the same SSID. Enter a descriptive name (up to 32 English keyboard characters) for the wireless LAN.
Hide SSID	Select this check box to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool.
Security Level	
Security Mode	Select **Basic (WEP)** or **More Secure (WPA(2)-PSK, WPA(2))** to add security on this wireless network. The wireless clients which want to associate to this network must have same wireless security settings as the ZyXEL Device. After you select to use a security, additional options appears in this screen. Or you can select **No Security** to allow any client to associate this network without any data encryption or authentication. See Section 7.2.1 on page 90 for more details about this field.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

7.4 MAC Authentication

This screen allows you to configure the ZyXEL Device to give exclusive access to specific devices **(Allow)** or exclude specific devices from accessing the ZyXEL Device **(Deny)**. Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC addresses of the devices to configure this screen.

Use this screen to view your ZyXEL Device’s MAC filter settings and add new MAC filter rules. Click **Wireless > MAC Authentication**. The screen appears as shown.

Figure 29 Wireless > MAC Authentication



SSID : ZyXEL00000_Guest1

MAC Restrict Mode : ● Disable ○ Allow ○ Deny

▪ MAC List

#	MAC Address	Modify
1	00:11:22:AA:BB:33	🗑

The following table describes the labels in this screen.

Table 18 Wireless > MAC Authentication

LABEL	DESCRIPTION
SSID	Select the SSID for which you want to configure MAC filter settings.
MAC List	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Disable** to turn off MAC filtering. Select **Allow** to permit access to the ZyXEL Device. MAC addresses not listed will be denied access to the ZyXEL Device. Select **Deny** to block access to the ZyXEL Device. MAC addresses not listed will be allowed to access the ZyXEL Device.
Add new MAC address	Click this if you want to add a new MAC address entry to the MAC filter list below. Enter the MAC addresses of the wireless devices that are allowed or denied access to the ZyXEL Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
#	This is the index number of the entry.
MAC Address	This is the MAC addresses of the wireless devices that are allowed or denied access to the ZyXEL Device.
Modify	Click the **Delete** icon to delete the entry.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

7.5 The WPS Screen

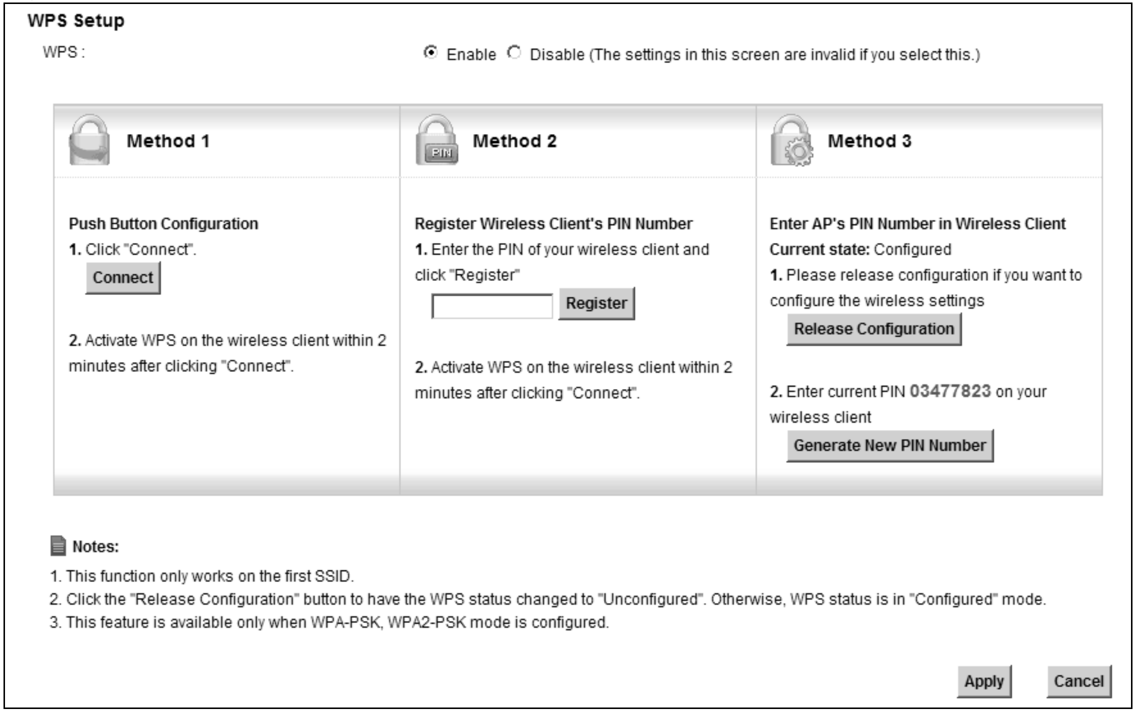
Use this screen to configure WiFi Protected Setup (WPS) on your ZyXEL Device.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Set up each WPS connection between two devices. Both devices must support WPS. See Section 7.7.8.3 on page 109 for more information about WPS.

Note: The ZyXEL Device applies the security settings of the **SSID1** profile (see Section 7.2 on page 88). If you want to use the WPS feature, make sure you have set the security mode of **SSID1** to **WPA-PSK**, **WPA2-PSK** or **No Security**.

Click **Network Settings > Wireless > WPS**. The following screen displays. Select **Enable** and click **Apply** to activate the WPS function. Then you can configure the WPS settings in this screen.

Figure 30 Network Settings > Wireless > WPS



WPS Setup

WPS : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Method 1

Push Button Configuration

1. Click "Connect".

Connect

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 2

Register Wireless Client's PIN Number

1. Enter the PIN of your wireless client and click "Register"

Register

2. Activate WPS on the wireless client within 2 minutes after clicking "Connect".

Method 3

Enter AP's PIN Number in Wireless Client

Current state: Configured

1. Please release configuration if you want to configure the wireless settings

Release Configuration

2. Enter current PIN **03477823** on your wireless client

Generate New PIN Number

Notes:

1. This function only works on the first SSID.
2. Click the "Release Configuration" button to have the WPS status changed to "Unconfigured". Otherwise, WPS status is in "Configured" mode.
3. This feature is available only when WPA-PSK, WPA2-PSK mode is configured.

The following table describes the labels in this screen.

Table 19 Network Settings > Wireless > WPS

LABEL	DESCRIPTION
Enable WPS	Select **Enable** to activate WPS on the ZyXEL Device.
Method 1	Use this section to set up a WPS wireless network using Push Button Configuration (PBC).
Connect	Click this button to add another WPS-enabled wireless device (within wireless range of the ZyXEL Device) to your wireless network. This button may either be a physical button on the outside of device, or a menu button similar to the **Connect** button on this screen. Note: You must press the other wireless device's WPS button within two minutes of pressing this button.
Method 2	Use this section to set up a WPS wireless network by entering the PIN of the client into the ZyXEL Device.
Register	Enter the PIN of the device that you are setting up a WPS connection with and click **Register** to authenticate and add the wireless device to your wireless network. You can find the PIN either on the outside of the device, or by checking the device's settings. Note: You must also activate WPS on that device within two minutes to have it present its PIN to the ZyXEL Device.
Method 3	Use this section to set up a WPS wireless network by entering the PIN of the ZyXEL Device into the client.

Table 19 Network Settings > Wireless > WPS (continued)

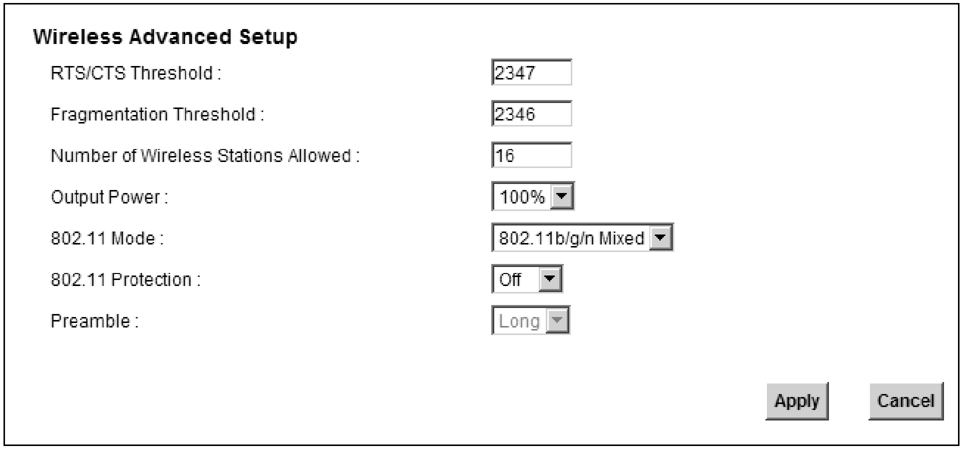
LABEL	DESCRIPTION
Release Configuration	The default WPS status is configured. Click this button to remove all configured wireless and wireless security settings for WPS connections on the ZyXEL Device.
Generate New PIN Number	The PIN (Personal Identification Number) of the ZyXEL Device is shown here. Enter this PIN in the configuration utility of the device you want to connect to using WPS. The PIN is not necessary when you use WPS push-button method. Click the **Generate New PIN Number** button to have the ZyXEL Device create a new PIN.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.6 The Others Screen

Use this screen to configure advanced wireless settings. Click **Network Settings > Wireless > Others**. The screen appears as shown.

See Section 7.7.2 on page 103 for detailed definitions of the terms listed in this screen.

Figure 31 Network Settings > Wireless > Others



Wireless Advanced Setup

RTS/CTS Threshold : 2347

Fragmentation Threshold : 2346

Number of Wireless Stations Allowed : 16

Output Power : 100%

802.11 Mode : 802.11b/g/n Mixed

802.11 Protection : Off

Preamble : Long

The following table describes the labels in this screen.

Table 20 Network Settings > Wireless > Others

LABEL	DESCRIPTION
RTS/CTS Threshold	Data with its frame size larger than this value will perform the RTS (Request To Send)/CTS (Clear To Send) handshake. Enter a value between 0 and 2347.
Fragmentation Threshold	This is the maximum data fragment size that can be sent. Enter a value between 256 and 2346.
Number of Wireless Stations Allowed	Specify the maximum number of the wireless stations that may connect to the ZyXEL Device.

Table 20 Network Settings > Wireless > Others (continued)

LABEL	DESCRIPTION
Output Power	Set the output power of the ZyXEL Device. If there is a high density of APs in an area, decrease the output power to reduce interference with other APs. Select one of the following: **20%**, **40%**, **60%**, **80%** or **100%**.
802.11 Mode	Select **802.11b Only** to allow only IEEE 802.11b compliant WLAN devices to associate with the ZyXEL Device. Select **802.11g Only** to allow only IEEE 802.11g compliant WLAN devices to associate with the ZyXEL Device. Select **802.11n Only** to allow only IEEE 802.11n compliant WLAN devices to associate with the ZyXEL Device. Select **802.11b/g Mixed** to allow either IEEE 802.11b or IEEE 802.11g compliant WLAN devices to associate with the ZyXEL Device. The transmission rate of your ZyXEL Device might be reduced. Select **802.11b/g/n Mixed** to allow IEEE 802.11b, IEEE 802.11g or IEEE802.11n compliant WLAN devices to associate with the ZyXEL Device. The transmission rate of your ZyXEL Device might be reduced.
802.11 Protection	Enabling this feature can help prevent collisions in mixed-mode networks (networks with both IEEE 802.11b and IEEE 802.11g traffic). Select **Auto** to have the wireless devices transmit data after a RTS/CTS handshake. This helps improve IEEE 802.11g performance. Select **Off** to disable 802.11 protection. The transmission rate of your ZyXEL Device might be reduced in a mixed-mode network. This field displays **Off** and is not configurable when you set **802.11 Mode** to **802.11b Only**.
Preamble	Select a preamble type from the drop-down list box. Choices are **Long** or **Short**. See Section 7.7.7 on page 107 for more information. This field is configurable only when you set 802.11 Mode to **802.11b Only** or **802.11b/g Mixed**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.7 Technical Reference

This section discusses wireless LANs in depth. For more information, see the appendix.

7.7.1 Wireless Network Overview

Wireless networks consist of wireless clients, access points and bridges.

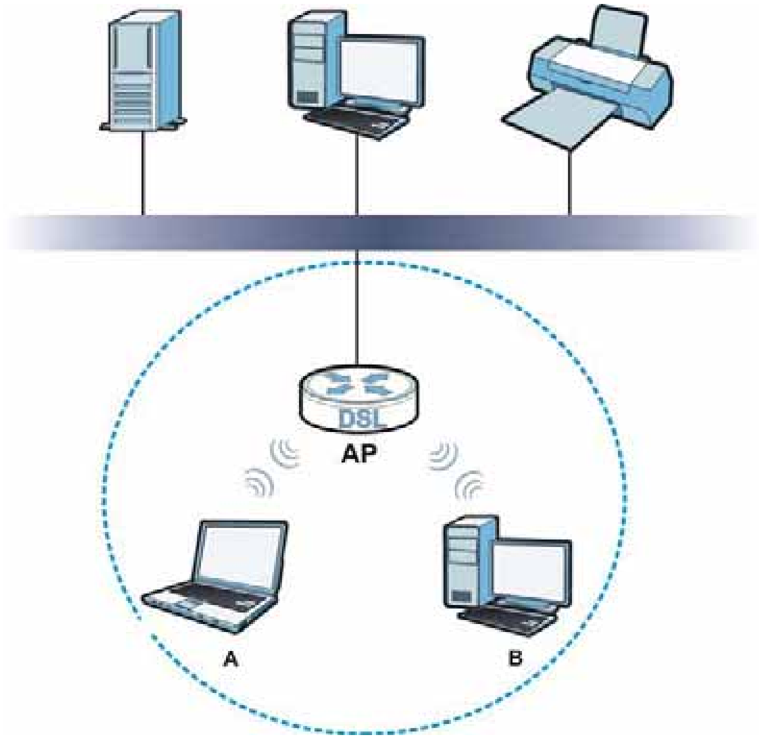
- A wireless client is a radio connected to a user’s computer.
- An access point is a radio with a wired connection to a network, which can connect with numerous wireless clients and let them access the network.
- A bridge is a radio that relays communications between access points and wireless clients, extending a network’s range.

Traditionally, a wireless network operates in one of two ways.

- An “infrastructure” type of network has one or more access points and one or more wireless clients. The wireless clients connect to the access points.
- An “ad-hoc” type of network is one in which there is no access point. Wireless clients connect to one another in order to exchange information.

The following figure provides an example of a wireless network.

Figure 32 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices **A** and **B** use the access point (**AP**) to interact with the other devices (such as the printer) or with the Internet. Your ZyXEL Device is the AP.

Every wireless network must follow these basic guidelines.

- Every device in the same wireless network must use the same SSID.

  The SSID is the name of the wireless network. It stands for Service Set IDentifier.
- If two wireless networks overlap, they should use a different channel.

  Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.
- Every device in the same wireless network must use security compatible with the AP.

  Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

Radio Channels

In the radio spectrum, there are certain frequency bands allocated for unlicensed, civilian use. For the purposes of wireless networking, these bands are divided into numerous channels. This allows a variety of networks to exist in the same place without interfering with one another. When you create a network, you must select a channel to use.

Since the available unlicensed spectrum varies from one country to another, the number of available channels also varies.

7.7.2 Additional Wireless Terms

The following table describes some wireless network terms and acronyms used in the ZyXEL Device's Web Configurator.

Table 21 Additional Wireless Terms

TERM	DESCRIPTION
RTS/CTS Threshold	In a wireless network which covers a large area, wireless devices are sometimes not aware of each other's presence. This may cause them to send information to the AP at the same time and result in information colliding and not getting through. By setting this value lower than the default value, the wireless devices must sometimes get permission to send information to the ZyXEL Device. The lower the value, the more often the devices must get permission. If this value is greater than the fragmentation threshold value (see below), then wireless devices never have to get permission to send information to the ZyXEL Device.
Preamble	A preamble affects the timing in your wireless network. There are two preamble modes: long and short. If a device uses a different preamble mode than the ZyXEL Device does, it cannot communicate with the ZyXEL Device.
Authentication	The process of verifying whether a wireless device is allowed to use the wireless network.
Fragmentation Threshold	A small fragmentation threshold is recommended for busy networks, while a larger threshold provides faster performance if the network is not very busy.

7.7.3 Wireless Security Overview

By their nature, radio communications are simple to intercept. For wireless data networks, this means that anyone within range of a wireless network without security can not only read the data passing over the airwaves, but also join the network. Once an unauthorized person has access to the network, he or she can steal information or introduce malware (malicious software) intended to compromise the network. For these reasons, a variety of security systems have been developed to ensure that only authorized people can use a wireless data network, or understand the data carried on it.

These security standards do two things. First, they authenticate. This means that only people presenting the right credentials (often a username and password, or a "key" phrase) can access the network. Second, they encrypt. This means that the information sent over the air is encoded. Only people with the code key can understand the information, and only people who have been authenticated are given the code key.

These security standards vary in effectiveness. Some can be broken, such as the old Wired Equivalent Protocol (WEP). Using WEP is better than using no security at all, but it will not keep a determined attacker out. Other security standards are secure in themselves but can be broken if a user does not use them properly. For example, the WPA-PSK security standard is very secure if you use a long key which is difficult for an attacker's software to guess - for example, a twenty-letter long string of apparently random numbers and letters - but it is not very secure if you use a short key which is very easy to guess - for example, a three-letter word from the dictionary.

Because of the damage that can be done by a malicious attacker, it's not just people who have sensitive information on their network who should use security. Everybody who uses any wireless network should ensure that effective security is in place.

A good way to come up with effective security keys, passwords and so on is to use obscure information that you personally will easily remember, and to enter it in a way that appears random and does not include real words. For example, if your mother owns a 1970 Dodge Challenger and her favorite movie is Vanishing Point (which you know was made in 1971) you could use "70dodchal71vanpoi" as your security key.

The following sections introduce different types of wireless security you can set up in the wireless network.

7.7.3.1 SSID

Normally, the ZyXEL Device acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the ZyXEL Device does not broadcast the SSID. In addition, you should change the default SSID to something that is difficult to guess.

This type of security is fairly weak, however, because there are ways for unauthorized wireless devices to get the SSID. In addition, unauthorized wireless devices can still see the information that is sent in the wireless network.

7.7.3.2 MAC Address Filter

Every device that can use a wireless network has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each device in the wireless network, see the device's User's Guide or other documentation.

You can use the MAC address filter to tell the ZyXEL Device which devices are allowed or not allowed to use the wireless network. If a device is allowed to use the wireless network, it still has to have the correct information (SSID, channel, and security). If a device is not allowed to use the wireless network, it does not matter if it has the correct information.

This type of security does not protect the information that is sent in the wireless network. Furthermore, there are ways for unauthorized wireless devices to get the MAC address of an authorized device. Then, they can use that MAC address to use the wireless network.

7.7.3.3 User Authentication

Authentication is the process of verifying whether a wireless device is allowed to use the wireless network. You can make every user log in to the wireless network before using it. However, every device in the wireless network has to support IEEE 802.1x to do this.

For wireless networks, you can store the user names and passwords for each user in a RADIUS server. This is a server used in businesses more than in homes. If you do not have a RADIUS server, you cannot set up user names and passwords for your users.

[1] Some wireless devices, such as scanners, can detect wireless networks but cannot use wireless networks. These kinds of wireless devices might not have MAC addresses.

[2] Hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

Unauthorized wireless devices can still see the information that is sent in the wireless network, even if they cannot use the wireless network. Furthermore, there are ways for unauthorized wireless users to get a valid user name and password. Then, they can use that user name and password to use the wireless network.

7.7.3.4 Encryption

Wireless networks can use encryption to protect the information that is sent in the wireless network. Encryption is like a secret code. If you do not know the secret code, you cannot understand the message.

The types of encryption you can choose depend on the type of authentication. (See Section 7.7.3.3 on page 104 for information about this.)

Table 22 Types of Encryption for Each Type of Authentication

	NO AUTHENTICATION	RADIUS SERVER
Weakest	No Security	WPA
↕	Static WEP	
	WPA-PSK	
Strongest	WPA2-PSK	WPA2

For example, if the wireless network has a RADIUS server, you can choose **WPA** or **WPA2**. If users do not log in to the wireless network, you can choose no encryption, **Static WEP**, **WPA-PSK**, or **WPA2-PSK**.

Usually, you should set up the strongest encryption that every device in the wireless network supports. For example, suppose you have a wireless network with the ZyXEL Device and you do not have a RADIUS server. Therefore, there is no authentication. Suppose the wireless network has two devices. Device A only supports WEP, and device B supports WEP and WPA. Therefore, you should set up **Static WEP** in the wireless network.

Note: It is recommended that wireless networks use **WPA-PSK**, **WPA**, or stronger encryption. The other types of encryption are better than none at all, but it is still possible for unauthorized wireless devices to figure out the original information pretty quickly.

When you select **WPA2** or **WPA2-PSK** in your ZyXEL Device, you can also select an option (**WPA compatible**) to support WPA as well. In this case, if some of the devices support WPA and some support WPA2, you should set up **WPA2-PSK** or **WPA2** (depending on the type of wireless network login) and select the **WPA compatible** option in the ZyXEL Device.

Many types of encryption use a key to protect the information in the wireless network. The longer the key, the stronger the encryption. Every device in the wireless network must have the same key.

7.7.4 Signal Problems

Because wireless networks are radio networks, their signals are subject to limitations of distance, interference and absorption.

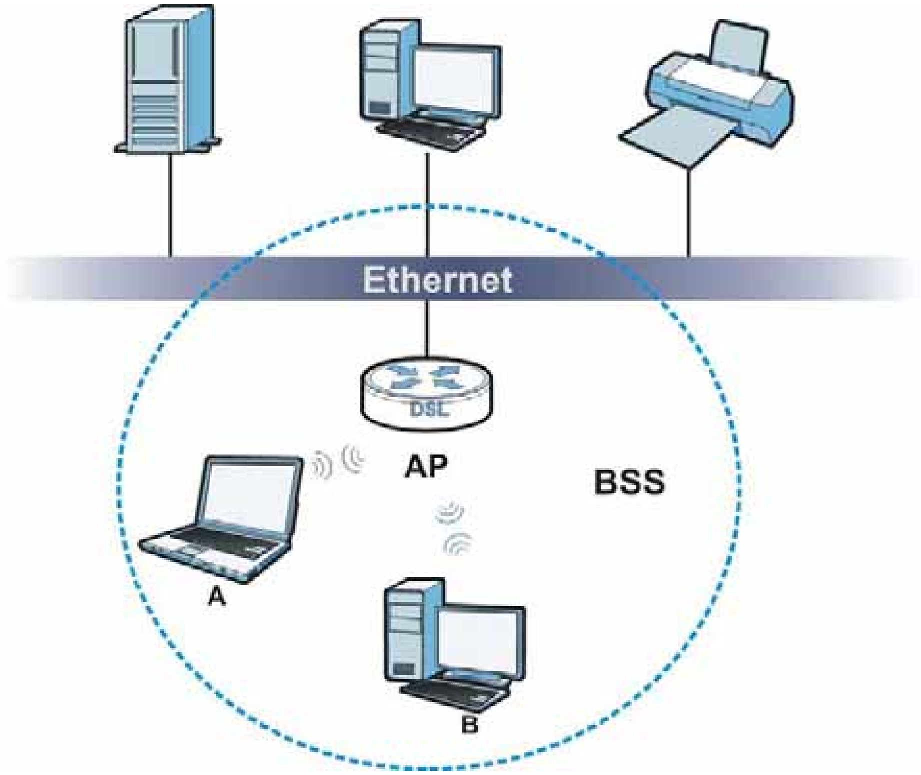
Problems with distance occur when the two radios are too far apart. Problems with interference occur when other radio waves interrupt the data signal. Interference may come from other radio transmissions, such as military or air traffic control communications, or from machines that are coincidental emitters such as electric motors or microwaves. Problems with absorption occur when physical objects (such as thick walls) are between the two radios, muffling the signal.

7.7.5 BSS

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

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

Figure 33 Basic Service set



7.7.6 MBSSID

Traditionally, you need to use different APs to configure different Basic Service Sets (BSSs). As well as the cost of buying extra APs, there is also the possibility of channel interference. The ZyXEL Device's MBSSID (Multiple Basic Service Set IDentifier) function allows you to use one access point to provide several BSSs simultaneously. You can then assign varying QoS priorities and/or security modes to different SSIDs.

Wireless devices can use different BSSIDs to associate with the same AP.

7.7.6.1 Notes on Multiple BSSs

- A maximum of eight BSSs are allowed on one AP simultaneously.
- You must use different keys for different BSSs. If two wireless devices have different BSSIDs (they are in different BSSs), but have the same keys, they may hear each other's communications (but not communicate with each other).
- MBSSID should not replace but rather be used in conjunction with 802.1x security.

7.7.7 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 ZyXEL Device uses long preamble.

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

7.7.8 WiFi Protected Setup (WPS)

Your ZyXEL Device supports WiFi Protected Setup (WPS), which is an easy way to set up a secure wireless network. WPS is an industry standard specification, defined by the WiFi Alliance.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Each WPS connection works between two devices. Both devices must support WPS (check each device's documentation to make sure).

Depending on the devices you have, you can either press a button (on the device itself, or in its configuration utility) or enter a PIN (a unique Personal Identification Number that allows one device to authenticate the other) in each of the two devices. When WPS is activated on a device, it has two minutes to find another device that also has WPS activated. Then, the two devices connect and set up a secure network by themselves.

7.7.8.1 Push Button Configuration

WPS Push Button Configuration (PBC) is initiated by pressing a button on each WPS-enabled device, and allowing them to connect automatically. You do not need to enter any information.

Not every WPS-enabled device has a physical WPS button. Some may have a WPS PBC button in their configuration utilities instead of or in addition to the physical button.

Take the following steps to set up WPS using the button.

1 Ensure that the two devices you want to set up are within wireless range of one another.

2 Look for a WPS button on each device. If the device does not have one, log into its configuration utility and locate the button (see the device's User's Guide for how to do this - for the ZyXEL Device, see Section 7.6 on page 100).

3 Press the button on one of the devices (it doesn't matter which). For the ZyXEL Device you must press the WPS button for more than three seconds.

4 Within two minutes, press the button on the other device. The registrar sends the network name (SSID) and security key through an secure connection to the enrollee.

If you need to make sure that WPS worked, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

7.7.8.2 PIN Configuration

Each WPS-enabled device has its own PIN (Personal Identification Number). This may either be static (it cannot be changed) or dynamic (in some devices you can generate a new PIN by clicking on a button in the configuration interface).

Use the PIN method instead of the push-button configuration (PBC) method if you want to ensure that the connection is established between the devices you specify, not just the first two devices to activate WPS in range of each other. However, you need to log into the configuration interfaces of both devices to use the PIN method.

When you use the PIN method, you must enter the PIN from one device (usually the wireless client) into the second device (usually the Access Point or wireless router). Then, when WPS is activated on the first device, it presents its PIN to the second device. If the PIN matches, one device sends the network and security information to the other, allowing it to join the network.

Take the following steps to set up a WPS connection between an access point or wireless router (referred to here as the AP) and a client device using the PIN method.

1 Ensure WPS is enabled on both devices.

2 Access the WPS section of the AP's configuration interface. See the device's User's Guide for how to do this.

3 Look for the client's WPS PIN; it will be displayed either on the device, or in the WPS section of the client's configuration interface (see the device's User's Guide for how to find the WPS PIN - for the ZyXEL Device, see Section 7.5 on page 98).

4 Enter the client's PIN in the AP's configuration interface.

5 If the client device's configuration interface has an area for entering another device's PIN, you can either enter the client's PIN in the AP, or enter the AP's PIN in the client - it does not matter which.

6 Start WPS on both devices within two minutes.

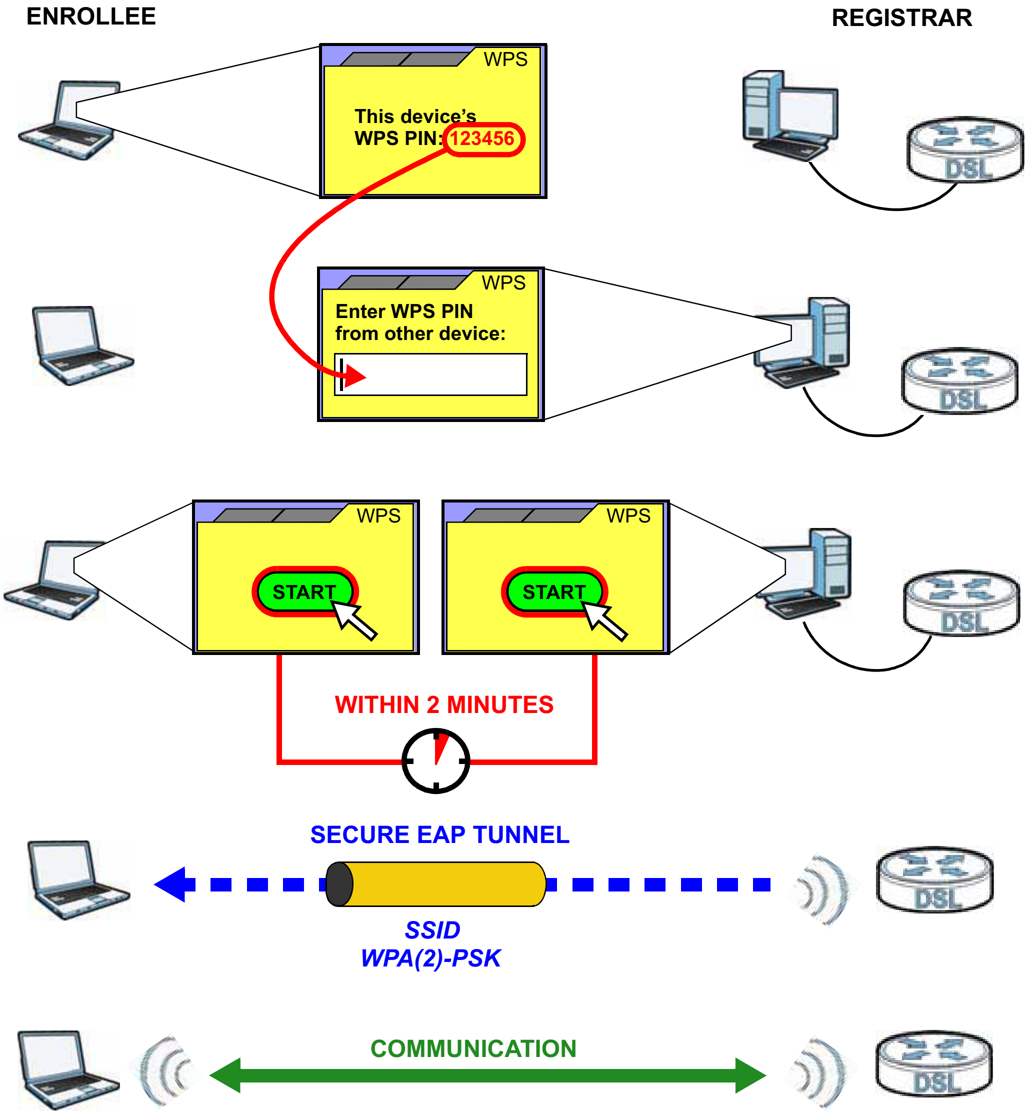
7 Use the configuration utility to activate WPS, not the push-button on the device itself.

8 On a computer connected to the wireless client, try to connect to the Internet. If you can connect, WPS was successful.

If you cannot connect, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

The following figure shows a WPS-enabled wireless client (installed in a notebook computer) connecting to the WPS-enabled AP via the PIN method.

Figure 34 Example WPS Process: PIN Method

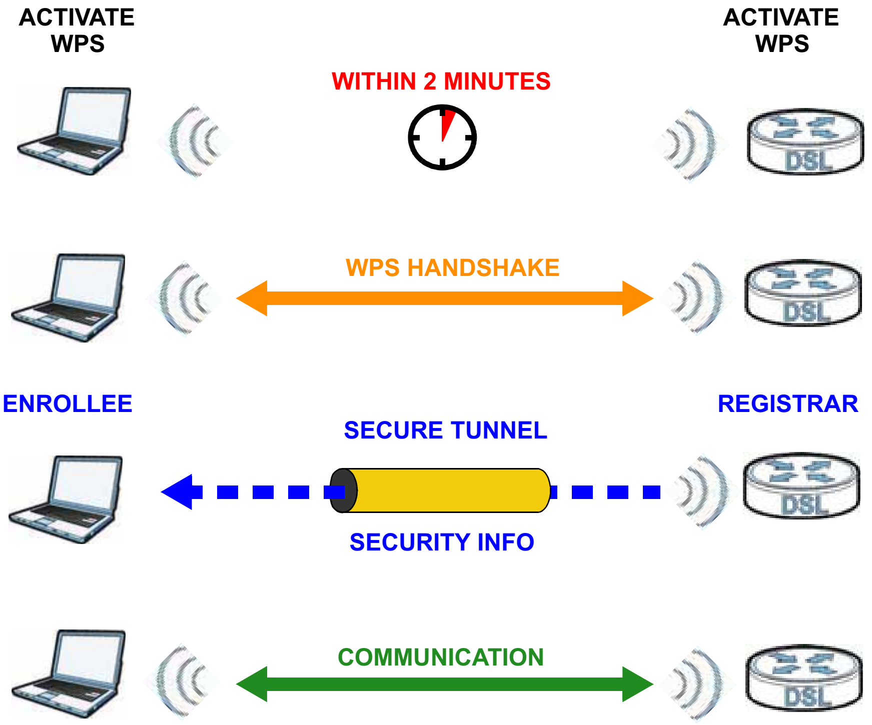


7.7.8.3 How WPS Works

When two WPS-enabled devices connect, each device must assume a specific role. One device acts as the registrar (the device that supplies network and security settings) and the other device acts as the enrollee (the device that receives network and security settings. The registrar creates a secure EAP (Extensible Authentication Protocol) tunnel and sends the network name (SSID) and the WPA-PSK or WPA2-PSK pre-shared key to the enrollee. Whether WPA-PSK or WPA2-PSK is used depends on the standards supported by the devices. If the registrar is already part of a network, it sends the existing information. If not, it generates the SSID and WPA(2)-PSK randomly.

The following figure shows a WPS-enabled client (installed in a notebook computer) connecting to a WPS-enabled access point.

Figure 35 How WPS works



The roles of registrar and enrollee last only as long as the WPS setup process is active (two minutes). The next time you use WPS, a different device can be the registrar if necessary.

The WPS connection process is like a handshake; only two devices participate in each WPS transaction. If you want to add more devices you should repeat the process with one of the existing networked devices and the new device.

Note that the access point (AP) is not always the registrar, and the wireless client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled wireless clients.

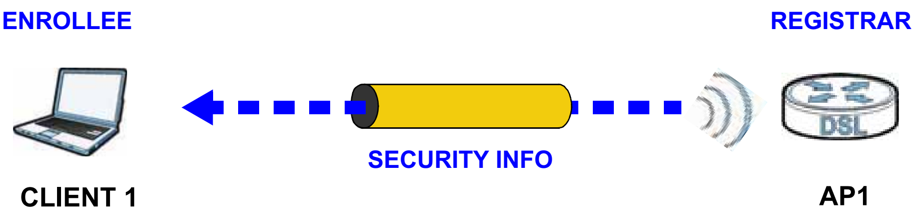
By default, a WPS devices is “unconfigured”. This means that it is not part of an existing network and can act as either enrollee or registrar (if it supports both functions). If the registrar is unconfigured, the security settings it transmits to the enrollee are randomly-generated. Once a WPS-enabled device has connected to another device using WPS, it becomes “configured”. A configured wireless client can still act as enrollee or registrar in subsequent WPS connections, but a configured access point can no longer act as enrollee. It will be the registrar in all subsequent WPS connections in which it is involved. If you want a configured AP to act as an enrollee, you must reset it to its factory defaults.

7.7.8.4 Example WPS Network Setup

This section shows how security settings are distributed in an example WPS setup.

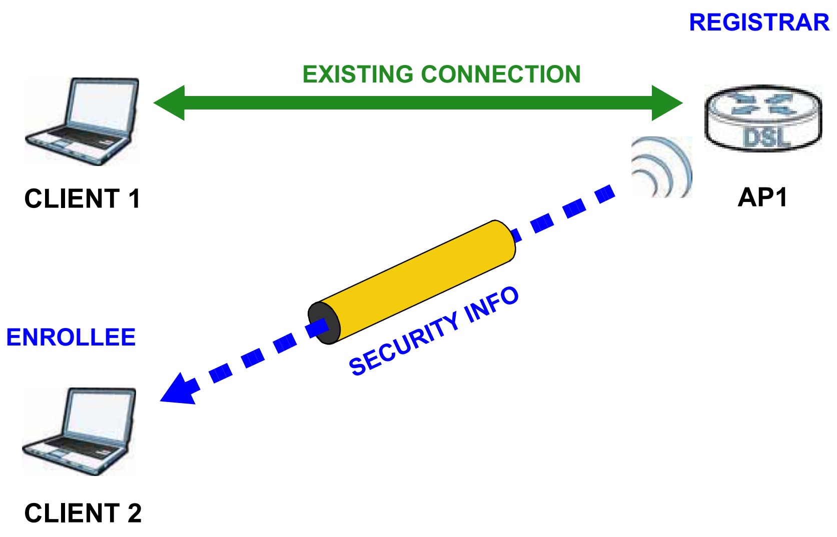
The following figure shows an example network. In step **1**, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information to set up the network, since it is unconfigured and has no existing information.

Figure 36 WPS: Example Network Step 1



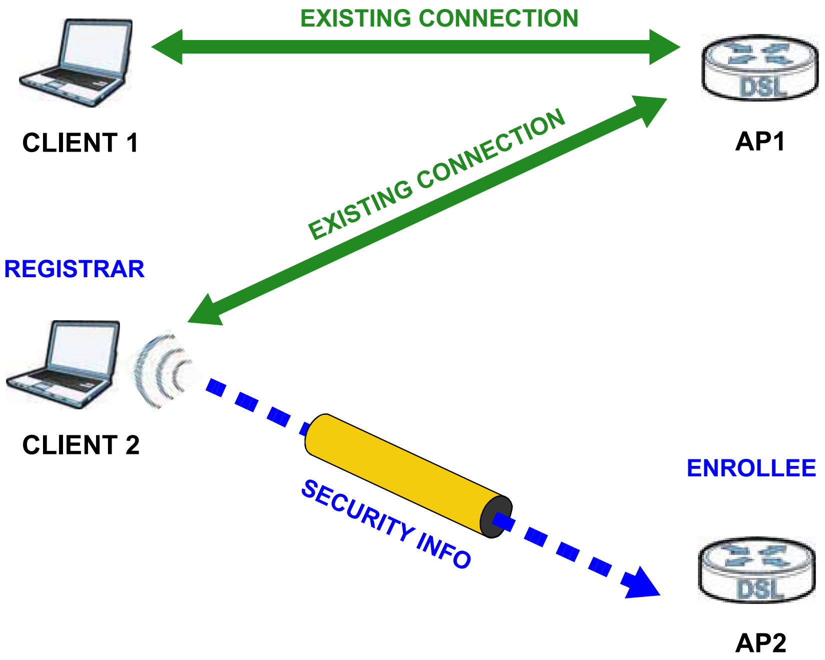
In step **2**, you add another wireless client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the registrar, since it is configured (it already has security information for the network). **AP1** supplies the existing security information to **Client 2**.

Figure 37 WPS: Example Network Step 2



In step 3, you add another access point (**AP2**) to your network. **AP2** is out of range of **AP1**, so you cannot use **AP1** for the WPS handshake with the new access point. However, you know that **Client 2** supports the registrar function, so you use it to perform the WPS handshake instead.

Figure 38 WPS: Example Network Step 3



7.7.8.5 Limitations of WPS

WPS has some limitations of which you should be aware.

- WPS works in Infrastructure networks only (where an AP and a wireless client communicate). It does not work in Ad-Hoc networks (where there is no AP).
- When you use WPS, it works between two devices only. You cannot enroll multiple devices simultaneously, you must enroll one after the other.

  For instance, if you have two enrollees and one registrar you must set up the first enrollee (by pressing the WPS button on the registrar and the first enrollee, for example), then check that it successfully enrolled, then set up the second device in the same way.
- WPS works only with other WPS-enabled devices. However, you can still add non-WPS devices to a network you already set up using WPS.

  WPS works by automatically issuing a randomly-generated WPA-PSK or WPA2-PSK pre-shared key from the registrar device to the enrollee devices. Whether the network uses WPA-PSK or WPA2-PSK depends on the device. You can check the configuration interface of the registrar device to discover the key the network is using (if the device supports this feature). Then, you can enter the key into the non-WPS device and join the network as normal (the non-WPS device must also support WPA-PSK or WPA2-PSK).

- When you use the PBC method, there is a short period (from the moment you press the button on one device to the moment you press the button on the other device) when any WPS-enabled device could join the network. This is because the registrar has no way of identifying the “correct” enrollee, and cannot differentiate between your enrollee and a rogue device. This is a possible way for a hacker to gain access to a network.

  You can easily check to see if this has happened. WPS works between only two devices simultaneously, so if another device has enrolled your device will be unable to enroll, and will not have access to the network. If this happens, open the access point’s configuration interface and look at the list of associated clients (usually displayed by MAC address). It does not matter if the access point is the WPS registrar, the enrollee, or was not involved in the WPS handshake; a rogue device must still associate with the access point to gain access to the network. Check the MAC addresses of your wireless clients (usually printed on a label on the bottom of the device). If there is an unknown MAC address you can remove it or reset the AP.

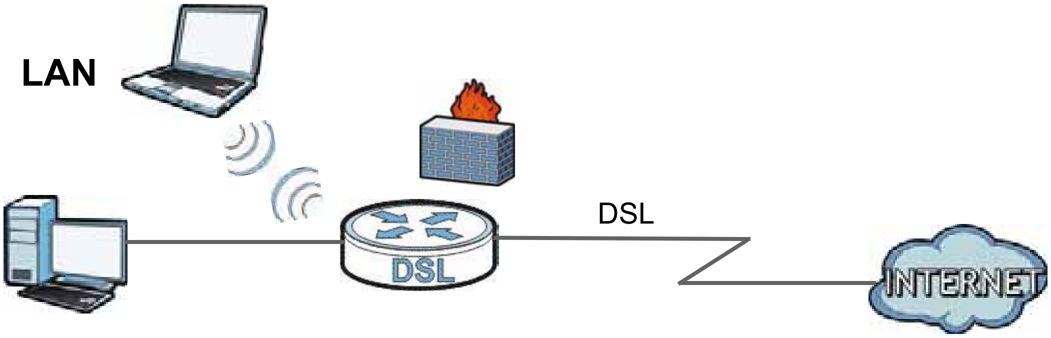
8

Home Networking

8.1 Overview

A Local Area Network (LAN) is a shared communication system to which many networking devices are connected. It is usually located in one immediate area such as a building or floor of a building.

Use the LAN screens to help you configure a LAN DHCP server and manage IP addresses.



8.1.1 What You Can Do in this Chapter

- Use the **LAN Setup** screen to set the LAN IP address, subnet mask, and DHCP settings of your ZyXEL device (Section 8.2 on page 117).
- Use the **Static DHCP** screen to assign IP addresses on the LAN to specific individual computers based on their MAC Addresses (Section 8.3 on page 119).
- Use the **UPnP** screen to enable UPnP and UPnP NAT traversal on the ZyXEL Device (Section 8.4 on page 121).
- Use the **STB Vendor ID** screen to have the ZyXEL Device automatically create static DHCP entries for Set Top Box (STB) devices when they request IP addresses (Section 8.7 on page 129).
- Use the **HPNA** screen to enable or disable the HPNA port (Section 8.8 on page 130).
- Use the **5th Ethernet Port** screen to configure the Ethernet WAN port as a LAN port (Section 8.9 on page 130).
- Use the **LAN VLAN** screen to control the VLAN ID and IEEE 802.1p priority tags of traffic sent out through individual LAN ports (Section 8.10 on page 131).

8.1.2 What You Need To Know

8.1.2.1 About LAN

IP Address

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 Mask

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.

DHCP

A DHCP (Dynamic Host Configuration Protocol) server can assign your ZyXEL Device an IP address, subnet mask, DNS and other routing information when it's turned on.

DNS

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

8.1.2.2 About UPnP

Identifying UPnP Devices

UPnP hardware is identified as an icon in the Network Connections folder (Windows XP). Each UPnP compatible device installed on your network will appear as a separate icon. Selecting the icon of a UPnP device will allow you to access the information and properties of that device.

NAT Traversal

UPnP NAT traversal automates the process of allowing an application to operate through NAT. UPnP network devices can automatically configure network addressing, announce their presence in the network to other UPnP devices and enable exchange of simple product and service descriptions. NAT traversal allows the following:

- Dynamic port mapping
- Learning public IP addresses
- Assigning lease times to mappings

Windows Messenger is an example of an application that supports NAT traversal and UPnP.

See the Chapter 11 on page 159 for more information on NAT.

Cautions with UPnP

The automated nature of NAT traversal applications in establishing their own services and opening firewall ports may present network security issues. Network information and configuration may also be obtained and modified by users in some network environments.

When a UPnP device joins a network, it announces its presence with a multicast message. For security reasons, the ZyXEL Device allows multicast messages on the LAN only.

All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

UPnP and ZyXEL

ZyXEL has achieved UPnP certification from the Universal Plug and Play Forum UPnP™ Implementers Corp. (UIC). ZyXEL's UPnP implementation supports Internet Gateway Device (IGD) 1.0.

See Section 8.5 on page 121 for examples of installing and using UPnP.

Finding Out More

See Section 8.11 on page 132 for technical background information on LANs.

8.1.3 Before You Begin

Find out the MAC addresses of your network devices if you intend to add them to the DHCP Client List screen.

8.2 The LAN Setup Screen

Use this screen to set the Local Area Network IP address and subnet mask of your ZyXEL Device. Click **Network Settings > Home Networking** to open the **LAN Setup** screen.

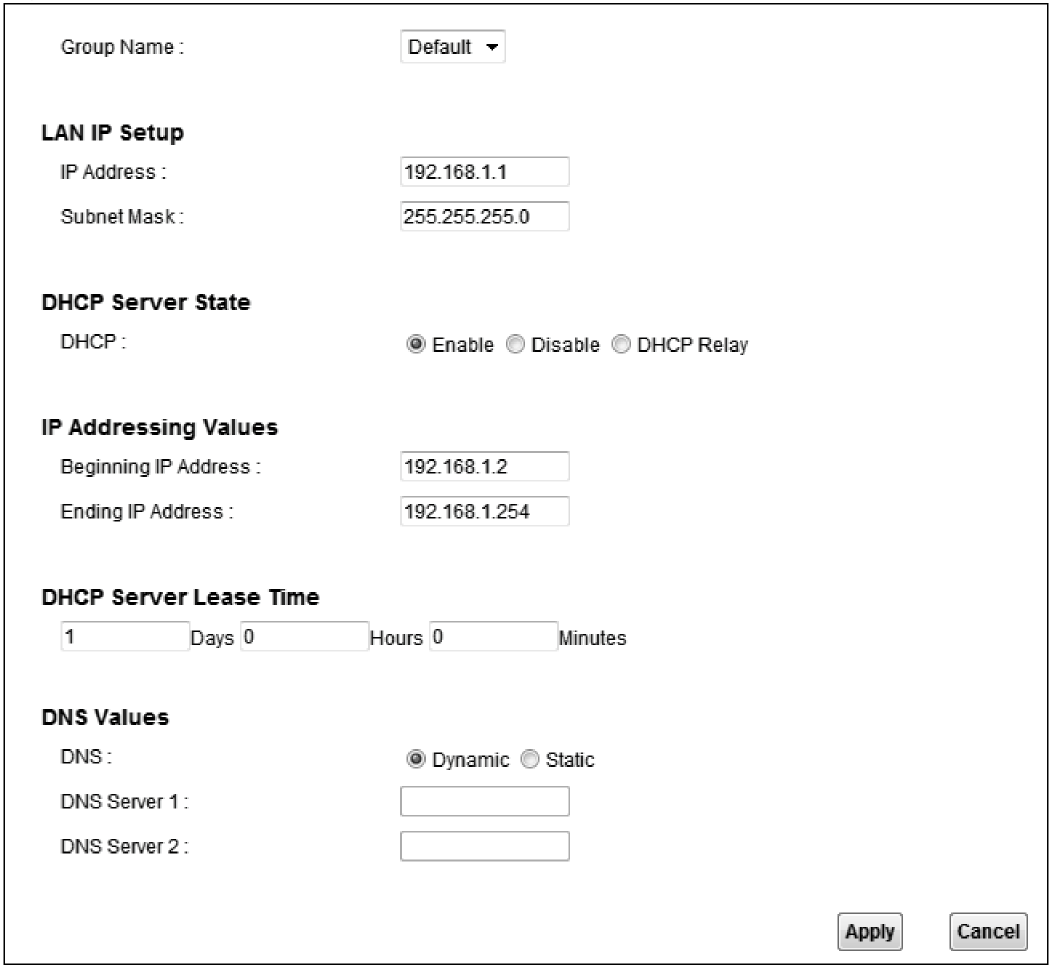
Follow these steps to configure your LAN settings.

1 Enter an IP address into the **IP Address** field. The IP address must be in dotted decimal notation. This will become the IP address of your ZyXEL Device.

2 Enter the IP subnet mask into the **IP Subnet Mask** field. Unless instructed otherwise it is best to leave this alone, the configurator will automatically compute a subnet mask based upon the IP address you entered.

3 Click **Apply** to save your settings.

Figure 39 Network Settings > Home Networking > LAN Setup



Group Name : Default

LAN IP Setup

IP Address : 192.168.1.1

Subnet Mask : 255.255.255.0

DHCP Server State

DHCP : ● Enable ○ Disable ○ DHCP Relay

IP Addressing Values

Beginning IP Address : 192.168.1.2

Ending IP Address : 192.168.1.254

DHCP Server Lease Time

1 Days 0 Hours 0 Minutes

DNS Values

DNS : ● Dynamic ○ Static

DNS Server 1 :

DNS Server 2 :

The following table describes the fields in this screen.

Table 23 Network Settings > Home Networking > LAN Setup

LABEL	DESCRIPTION
Group Name	Select the interface group name for which you want to configure LAN settings. See Chapter 14 on page 189 for how to create a new interface group.
LAN IP Setup	
IP Address	Enter the LAN IP address you want to assign to your ZyXEL Device in dotted decimal notation, for example, 192.168.1.1 (factory default).
Subnet Mask	Type the subnet mask of your network in dotted decimal notation, for example 255.255.255.0 (factory default). Your ZyXEL Device automatically computes the subnet mask based on the IP Address you enter, so do not change this field unless you are instructed to do so.
DHCP Server State	
DHCP	Select **Enable** to have the ZyXEL Device act as a DHCP server or DHCP relay agent. Select **Disable** to stop the DHCP server on the ZyXEL Device. Select **DHCP Relay** to have the ZyXEL Device forward DHCP request to the DHCP server.

Table 23 Network Settings > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
DHCP Relay Server Address	This field is only available when you select **DHCP Relay** in the **DHCP** field.
IP Address	Enter the IP address of the actual remote DHCP server in this field.
IP Addressing Values	This field is only available when you select **Enable** in the **DHCP** field.
Beginning IP Address	This field specifies the first of the contiguous addresses in the IP address pool.
Ending IP Address	This field specifies the last of the contiguous addresses in the IP address pool.
DHCP Server Lease Time	This is the period of time DHCP-assigned addresses is used. DHCP automatically assigns IP addresses to clients when they log in. DHCP centralizes IP address management on central computers that run the DHCP server program. DHCP leases addresses, for a period of time, which means that past addresses are "recycled" and made available for future reassignment to other systems. This field is only available when you select **Enable** in the **DHCP** field.
Days/Hours/ Minutes	Enter the lease time of the DHCP server.
DNS Values	This field is only available when you select **Enable** in the **DHCP** field.
DNS	Select the type of service that you are registered for from your Dynamic DNS service provider. Select **Dynamic** if you have the Dynamic DNS service. Select **Static** if you have the Static DNS service.
DNS Server 1 DNS Server 2	Enter the first and second DNS (Domain Name System) server IP address the ZyXEL Device passes to the DHCP clients.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

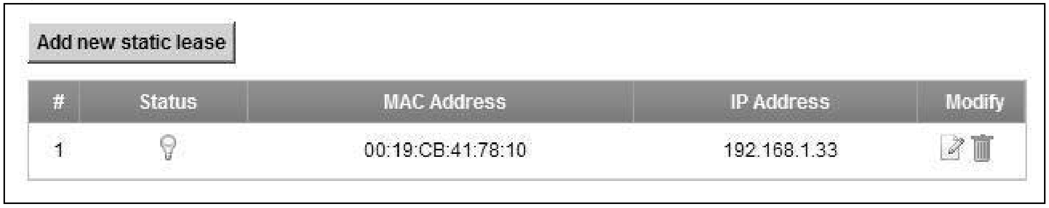
8.3 The Static DHCP Screen

This table allows you to assign IP addresses on the LAN to specific individual computers based on their MAC Addresses.

Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.

Use this screen to change your ZyXEL Device's static DHCP settings. Click **Network Settings > Home Networking > Static DHCP** to open the following screen.

Figure 40 Network Settings > Home Networking > Static DHCP



#	Status	MAC Address	IP Address	Modify
1	💡	00:19:CB:41:78:10	192.168.1.33	✎ 🗑

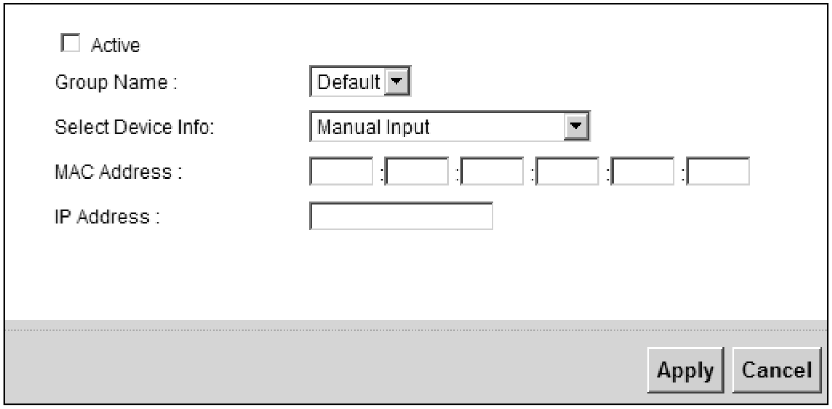
The following table describes the labels in this screen.

Table 24 Network Settings > Home Networking > Static DHCP

LABEL	DESCRIPTION
Add new static lease	Click this to add a new static DHCP entry.
#	This is the index number of the entry.
Status	This field displays whether the client is connected to the ZyXEL Device.
MAC Address	The MAC (Media Access Control) or Ethernet address on a LAN (Local Area Network) is unique to your computer (six pairs of hexadecimal notation). A network interface card such as an Ethernet adapter has a hardwired address that is assigned at the factory. This address follows an industry standard that ensures no other adapter has a similar address.
IP Address	This field displays the IP address relative to the # field listed above.
Modify	Click the **Edit** icon to have the IP address field editable and change it. Click the **Delete** icon to delete a static DHCP entry. A window displays asking you to confirm that you want to delete the selected entry.

If you click **Add new static lease** in the **Static DHCP** screen or the Edit icon next to a static DHCP entry, the following screen displays.

Figure 41 Static DHCP: Add/Edit



□ Active

Group Name :	Default
Select Device Info:	Manual Input
MAC Address :	: : : : :
IP Address :	

The following table describes the labels in this screen.

Table 25 Static DHCP: Add/Edit

LABEL	DESCRIPTION
Active	This field displays whether the client is connected to the ZyXEL Device.
Group Name	Select the interface group name for which you want to configure Static DHCP settings. See Chapter 14 on page 189 for how to create a new interface group.
Select Device Info	If you select **Manual Input**, you can manually type in the MAC address and IP address of a computer on your LAN. You can also choose the name of a computer from the drop list and have the MAC Address and IP Address auto-detected.
MAC Address	If you select **Manual Input** in the **Select Device Info** field, enter the MAC address of a computer on your LAN.
IP Address	If you select **Manual Input** in the **Select Device Info** field, enter the IP address that you want to assign to the computer on your LAN with the MAC address that you will also specify.

Table 25 Static DHCP: Add/Edit (continued)

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

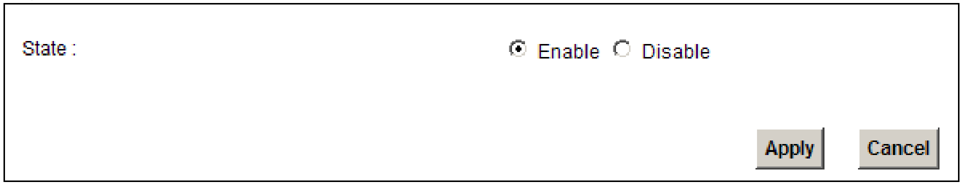
8.4 The UPnP Screen

Universal Plug and Play (UPnP) is a distributed, open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between devices. A UPnP device can dynamically join a network, obtain an IP address, convey its capabilities and learn about other devices on the network. In turn, a device can leave a network smoothly and automatically when it is no longer in use.

See page 116 for more information on UPnP.

Use the following screen to enable or disable the UPnP function on your ZyXEL Device. Click **Network Settings > Home Networking > UPnP** to display the screen shown next.

Figure 42 Network Settings > Home Networking > UPnP



State : ● Enable ○ Disable

The following table describes the labels in this screen.

Table 26 Network Settings > Home Networking > UPnP

LABEL	DESCRIPTION
State	Select **Enable** to activate UPnP. Be aware that anyone could use a UPnP application to open the web configurator's login screen without entering the ZyXEL Device's IP address (although you must still enter the password to access the web configurator).
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

8.5 Installing UPnP in Windows Example

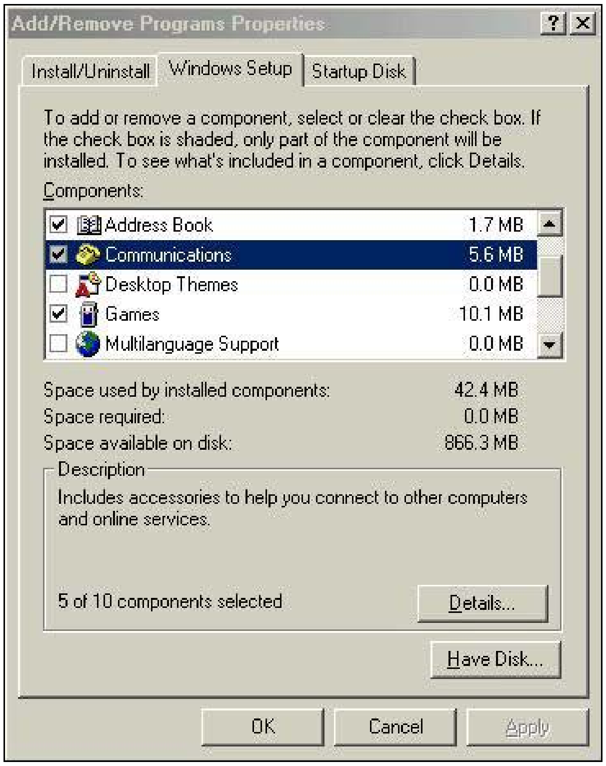
This section shows how to install UPnP in Windows Me and Windows XP.

Installing UPnP in Windows Me

Follow the steps below to install the UPnP in Windows Me.

1 Click **Start** and **Control Panel**. Double-click **Add/Remove Programs**.

2 Click on the **Windows Setup** tab and select **Communication** in the **Components** selection box. Click **Details**.



To add or remove a component, select or clear the check box. If the check box is shaded, only part of the component will be installed. To see what's included in a component, click Details.

Components:

☑	Address Book	1.7 MB
☑	Communications	5.6 MB
□	Desktop Themes	0.0 MB
☑	Games	10.1 MB
□	Multilanguage Support	0.0 MB

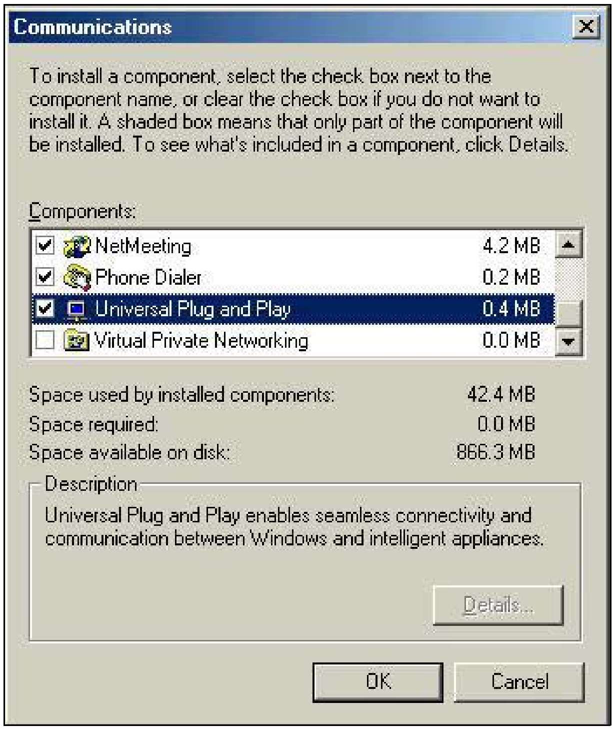
Space used by installed components:	42.4 MB
Space required:	0.0 MB
Space available on disk:	866.3 MB

Description

Includes accessories to help you connect to other computers and online services.

5 of 10 components selected

3 In the **Communications** window, select the **Universal Plug and Play** check box in the **Components** selection box.



To install a component, select the check box next to the component name, or clear the check box if you do not want to install it. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.

Components:

☑	NetMeeting	4.2 MB
☑	Phone Dialer	0.2 MB
☑	Universal Plug and Play	0.4 MB
□	Virtual Private Networking	0.0 MB

Space used by installed components:	42.4 MB
Space required:	0.0 MB
Space available on disk:	866.3 MB

Description

Universal Plug and Play enables seamless connectivity and communication between Windows and intelligent appliances.

4 Click **OK** to go back to the **Add/Remove Programs Properties** window and click **Next**.

5 Restart the computer when prompted.

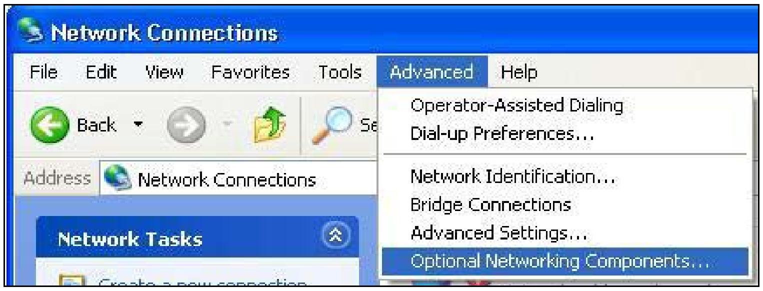
Installing UPnP in Windows XP

Follow the steps below to install the UPnP in Windows XP.

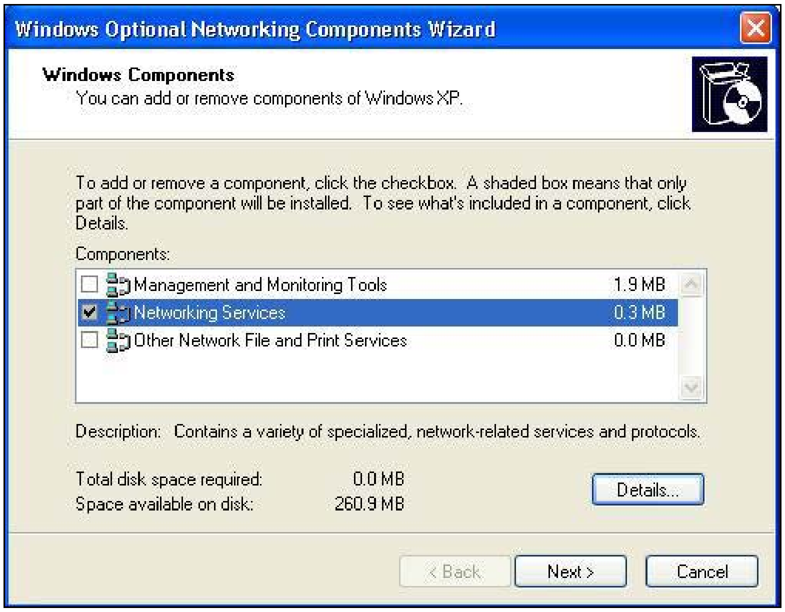
1 Click **Start** and **Control Panel**.

2 Double-click **Network Connections**.

3 In the **Network Connections** window, click **Advanced** in the main menu and select **Optional Networking Components ....**.



4 The **Windows Optional Networking Components Wizard** window displays. Select **Networking Service** in the **Components** selection box and click **Details**.



Windows Components
You can add or remove components of Windows XP.

To add or remove a component, click the checkbox. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.

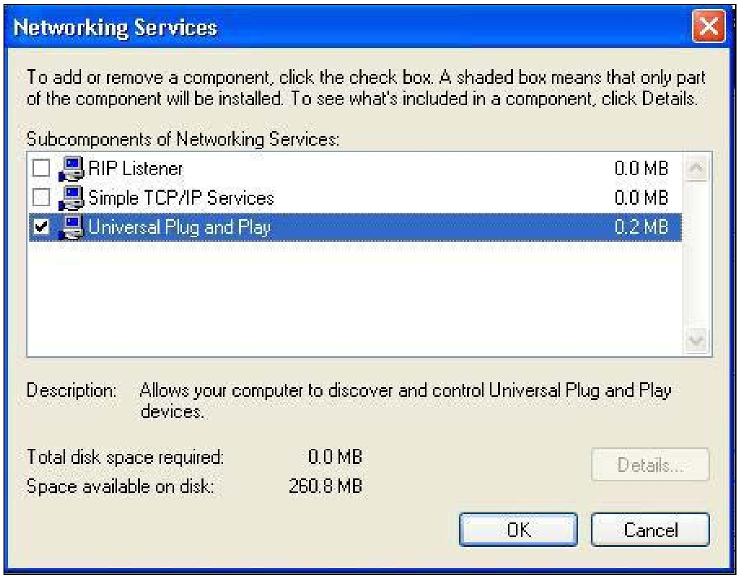
Components:

☐	Management and Monitoring Tools	1.9 MB
☑	Networking Services	0.3 MB
☐	Other Network File and Print Services	0.0 MB

Description: Contains a variety of specialized, network-related services and protocols.

Total disk space required: 0.0 MB
Space available on disk: 260.9 MB

5 In the **Networking Services** window, select the **Universal Plug and Play** check box.



Networking Services

To add or remove a component, click the check box. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.

Subcomponents of Networking Services:

☐ RIP Listener	0.0 MB
☐ Simple TCP/IP Services	0.0 MB
☑ Universal Plug and Play	0.2 MB

Description: Allows your computer to discover and control Universal Plug and Play devices.

Total disk space required: 0.0 MB

Space available on disk: 260.8 MB

6 Click **OK** to go back to the **Windows Optional Networking Component Wizard** window and click **Next**.

8.6 Using UPnP in Windows XP Example

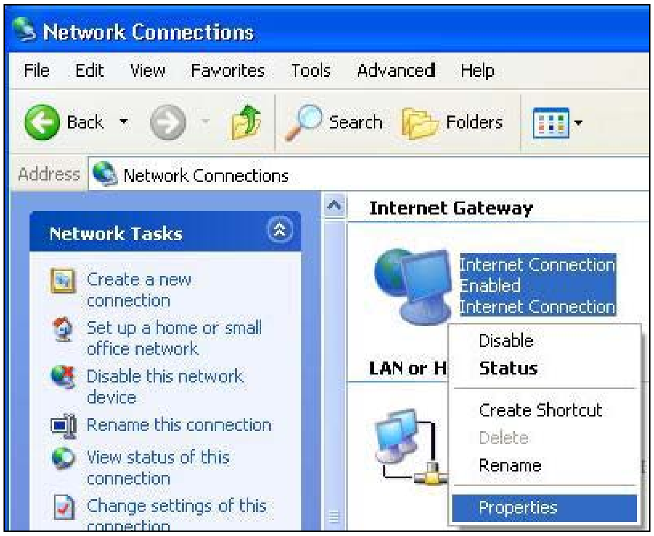
This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the ZyXEL Device.

Make sure the computer is connected to a LAN port of the ZyXEL Device. Turn on your computer and the ZyXEL Device.

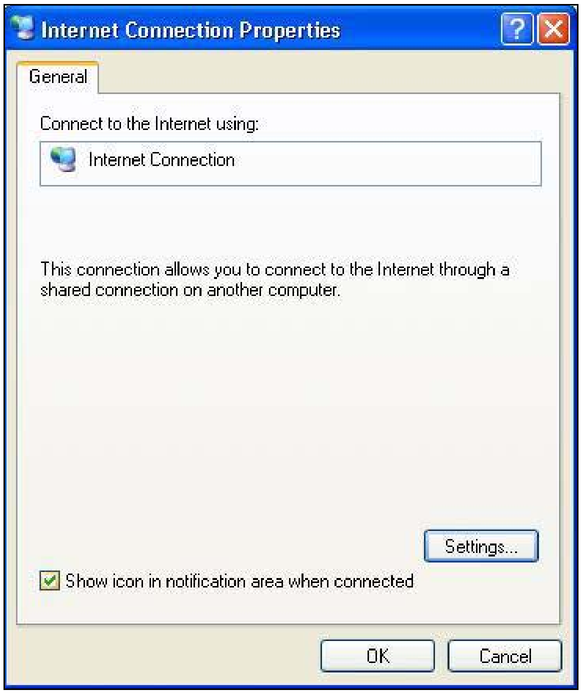
Auto-discover Your UPnP-enabled Network Device

1 Click **Start** and **Control Panel**. Double-click **Network Connections**. An icon displays under Internet Gateway.

2 Right-click the icon and select **Properties**.



3 In the **Internet Connection Properties** window, click **Settings** to see the port mappings there were automatically created.



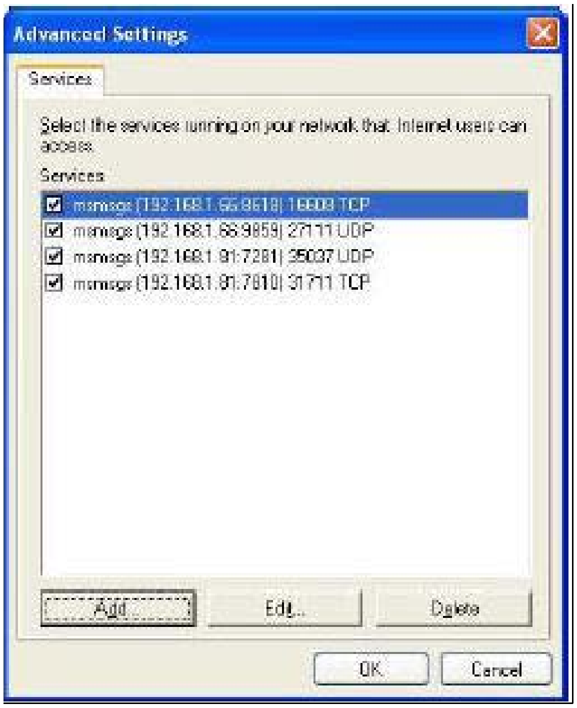
Connect to the Internet using:

Internet Connection

This connection allows you to connect to the Internet through a shared connection on another computer.

☑ Show icon in notification area when connected

4 You may edit or delete the port mappings or click **Add** to manually add port mappings.



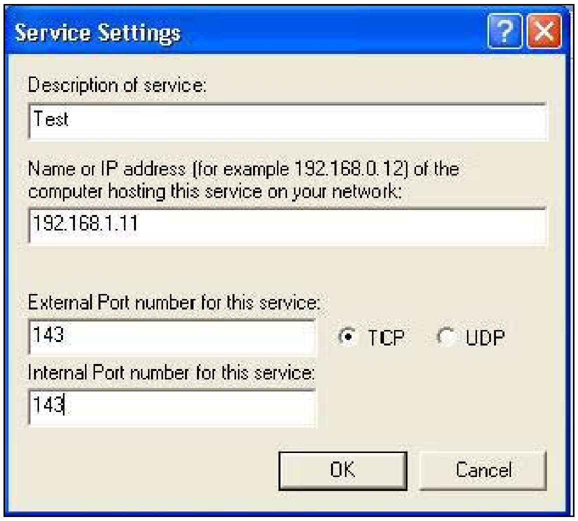
Advanced Settings

Services

Select the services running on your network that Internet users can access.

Services

☑ msmsgs (192.168.1.66:8618) 16608 TCP
☑ msmsgs (192.168.1.66:9859) 27111 UDP
☑ msmsgs (192.168.1.81:7281) 35037 UDP
☑ msmsgs (192.168.1.81:7810) 31711 TCP



Service Settings

Description of service:
Test

Name or IP address (for example 192.168.0.12) of the computer hosting this service on your network:
192.168.1.11

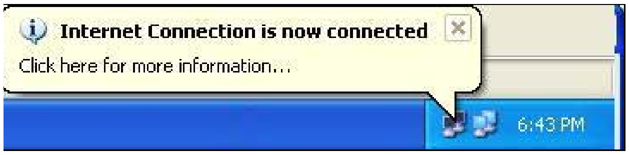
External Port number for this service:
143

● TCP ○ UDP

Internal Port number for this service:
143

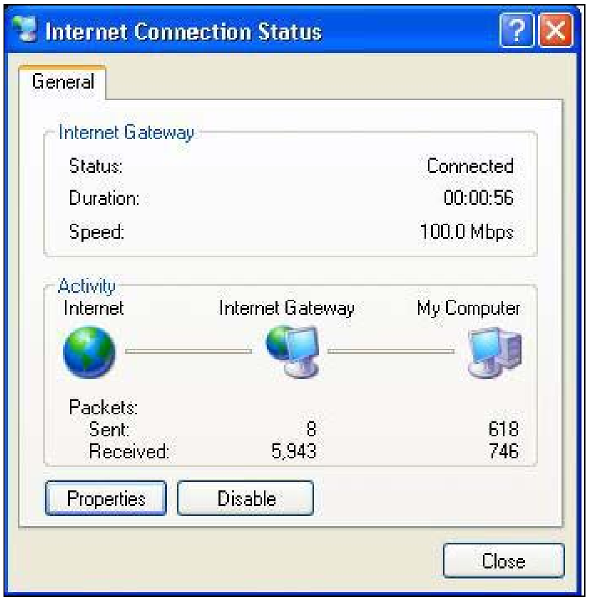
5 When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.

6 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.



Internet Connection is now connected
Click here for more information...

7 Double-click on the icon to display your current Internet connection status.



Internet Connection Status

General

Internet Gateway

Status: Connected

Duration: 00:00:56

Speed: 100.0 Mbps

Activity

	Internet	Internet Gateway	My Computer
Packets:			
Sent:		8	618
Received:		5,943	746

Web Configurator Easy Access

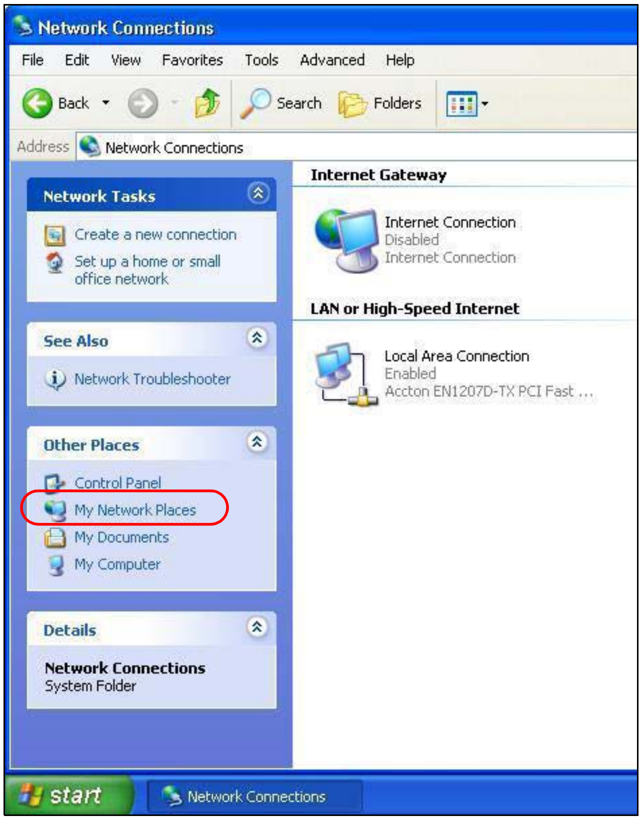
With UPnP, you can access the web-based configurator on the ZyXEL Device without finding out the IP address of the ZyXEL Device first. This comes helpful if you do not know the IP address of the ZyXEL Device.

Follow the steps below to access the web configurator.

1 Click **Start** and then **Control Panel**.

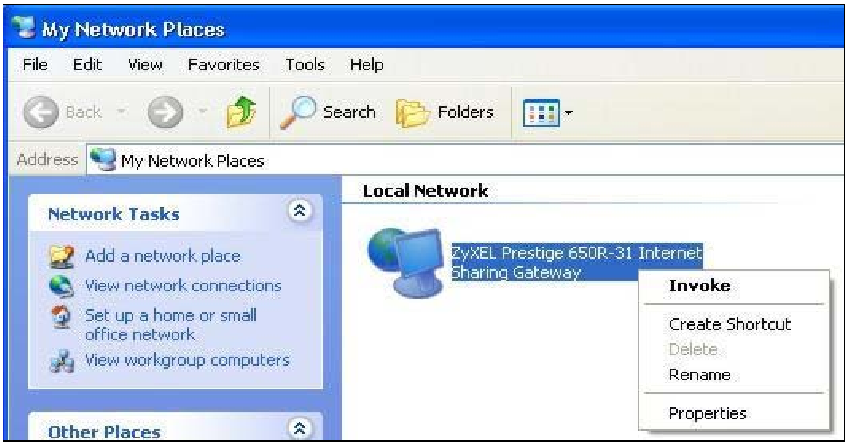
2 Double-click **Network Connections**.

3 Select **My Network Places** under **Other Places**.

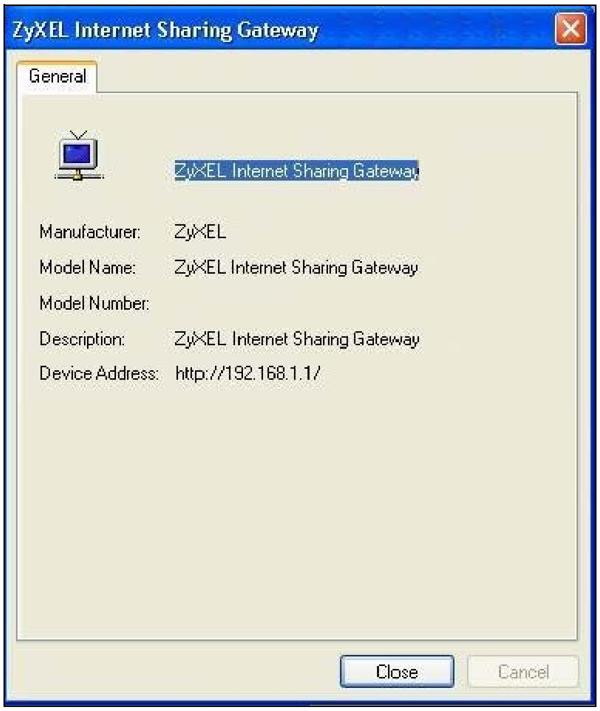


4 An icon with the description for each UPnP-enabled device displays under **Local Network**.

5 Right-click on the icon for your ZyXEL Device and select **Invoke**. The web configurator login screen displays.



6 Right-click on the icon for your ZyXEL Device and select **Properties**. A properties window displays with basic information about the ZyXEL Device.



ZyXEL Internet Sharing Gateway

General

ZyXEL Internet Sharing Gateway

Manufacturer: ZyXEL

Model Name: ZyXEL Internet Sharing Gateway

Model Number:

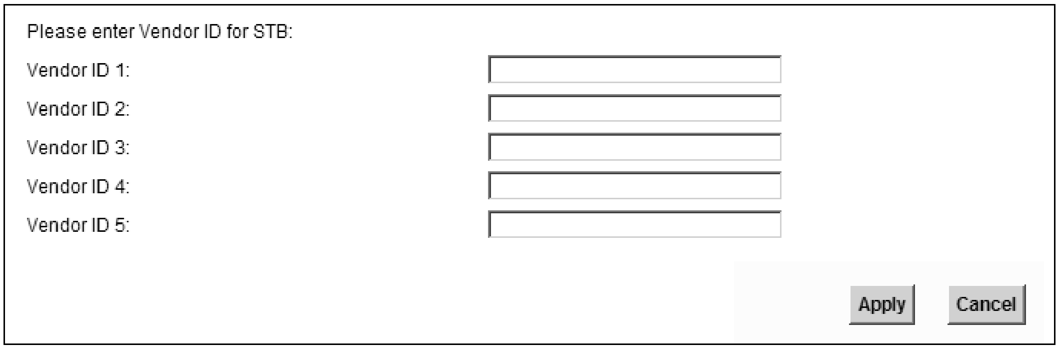
Description: ZyXEL Internet Sharing Gateway

Device Address: http://192.168.1.1/

8.7 The STB Vendor ID Screen

Click **Network Settings > Home Networking > STB Vendor ID** to open this screen. Set Top Box (STB) devices with dynamic IP addresses sometimes don't renew their IP addresses before the lease time expires. This could lead to IP address conflicts if the STB continues to use an IP address that gets assigned to another device. Use this screen to list the Vendor IDs of connected STBs to have the ZyXEL Device automatically create static DHCP entries for them when they request IP addresses.

Figure 43 Network Settings > Home Networking > STB Vendor ID



Please enter Vendor ID for STB:

Vendor ID 1:

Vendor ID 2:

Vendor ID 3:

Vendor ID 4:

Vendor ID 5:

The following table describes the fields in this screen.

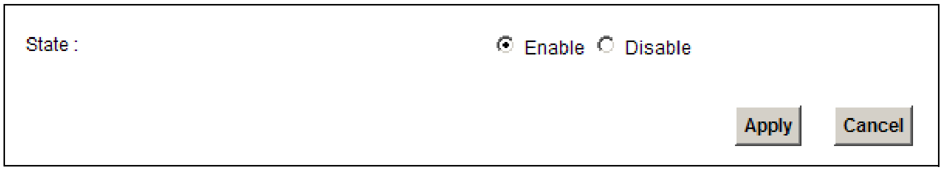
Table 27 Network Settings > Home Networking > STB Vendor ID

LABEL	DESCRIPTION
Vendor ID 1 ~ 5	Enter the STB's vendor ID.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

8.8 The HPNA Screen

Click **Network Settings > Home Networking > HPNA** to open this screen. Use this screen to enable or disable the HPNA port. See Chapter 1 on page 23 for more information on HPNA.

Figure 44 Network Settings > Home Networking > HPNA



State : ● Enable ○ Disable

The following table describes the fields in this screen.

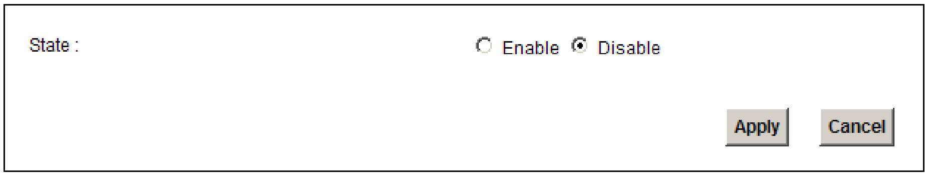
Table 28 Network Settings > Home Networking > HPNA

LABEL	DESCRIPTION
State	Select **Enable** to activate the HPNA port on the ZyXEL Device.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

8.9 The 5th Ethernet Port Screen

If you are using DSL connection, you can configure your Ethernet WAN port as an extra LAN port. This fifth Ethernet port provides faster speed since it is a Gigabit port. Click **Network Settings > Home Networking > 5th Ethernet Port** to open this screen.

Figure 45 Network Settings > Home Networking > 5th Ethernet Port



State : ○ Enable ● Disable

The following table describes the fields in this screen.

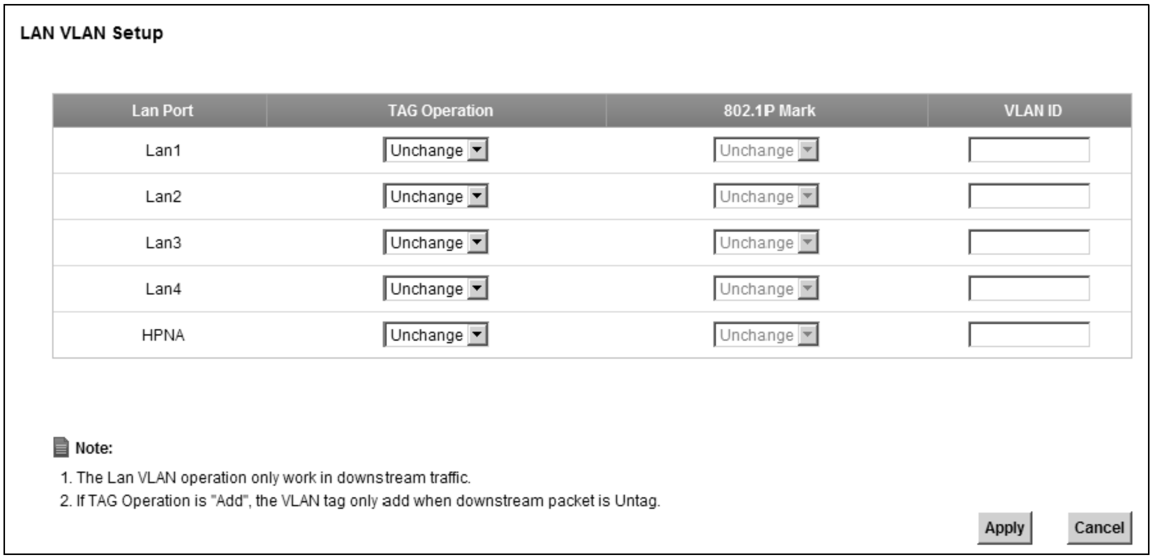
Table 29 Network Settings > Home Networking > 5th Ethernet Port

LABEL	DESCRIPTION
State	Select **Enable** to use the Ethernet WAN port as a LAN port on the ZyXEL Device.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

8.10 The LAN VLAN Screen

Click **Network Settings > Home Networking > LAN VLAN** to open this screen. Use this screen to control the VLAN ID and IEEE 802.1p priority tags of traffic sent out through individual LAN ports.

Figure 46 Network Settings > Home Networking > LAN VLAN



LAN VLAN Setup

Lan Port	TAG Operation	802.1P Mark	VLAN ID
Lan1	Unchange	Unchange	
Lan2	Unchange	Unchange	
Lan3	Unchange	Unchange	
Lan4	Unchange	Unchange	
HPNA	Unchange	Unchange	

Note:

1. The Lan VLAN operation only work in downstream traffic.
2. If TAG Operation is "Add", the VLAN tag only add when downstream packet is Untag.

The following table describes the fields in this screen.

Table 30 Network Settings > Home Networking > LAN VLAN

LABEL	DESCRIPTION
Lan Port	These represent the ZyXEL Device’s LAN ports.
Tag Operation	Select what you want the ZyXEL Device to do to the IEEE 802.1q VLAN ID and priority tags of downstream traffic before sending it out through this LAN port. • **Unchange** - Don’t do anything to the traffic’s VLAN ID and priority tags. • **Add** - Add VLAN ID and priority tags to untagged traffic. • **Remove** - Delete one tag from tagged traffic. If the frame has double tags, this removes the outer tag. This does not affect untagged traffic. • **Remark** - Change the value of the outer VLAN ID and priority tags.
802.1P Mark	Use this option to set what to do for the IEEE 802.1p priority tags when you add or remark the tags for a LAN port’s downstream traffic. Either select **Unchange** to not modify the traffic’s priority tags or select an priority from 0 to 7 to use. The larger the number, the higher the priority.

Table 30 Network Settings > Home Networking > LAN VLAN (continued)

LABEL	DESCRIPTION
VLAN ID	If you will add or remark tags for this LAN port's downstream traffic, specify the VLAN ID (from 0 to 4094) to use here.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

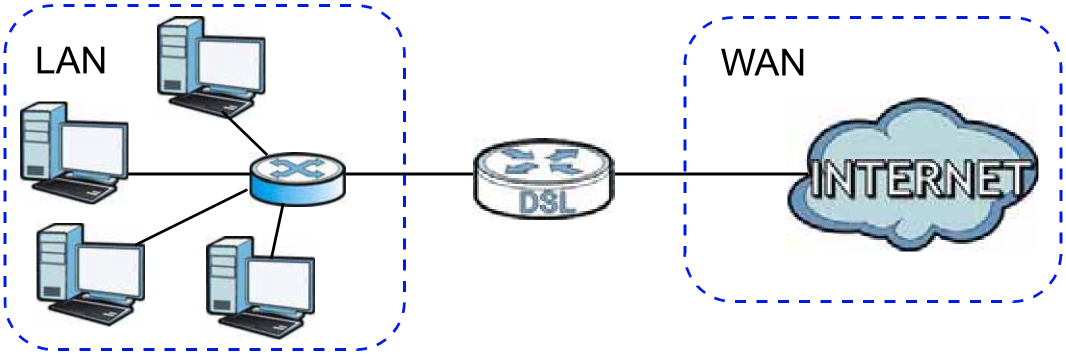
8.11 Technical Reference

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

8.11.1 LANs, WANs and the ZyXEL Device

The actual physical connection determines whether the ZyXEL Device ports are LAN or WAN ports. There are two separate IP networks, one inside the LAN network and the other outside the WAN network as shown next.

Figure 47 LAN and WAN IP Addresses



8.11.2 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the ZyXEL Device as a DHCP server or disable it. When configured as a server, the ZyXEL Device provides the TCP/IP configuration for the clients. If you turn DHCP service off, you must have another DHCP server on your LAN, or else the computer must be manually configured.

IP Pool Setup

The ZyXEL Device is pre-configured with a pool of IP addresses for the DHCP clients (DHCP Pool). See the product specifications in the appendices. Do not assign static IP addresses from the DHCP pool to your LAN computers.

8.11.3 DNS Server Addresses

DNS (Domain Name System) maps a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it. The DNS server addresses you enter when you set up DHCP are passed to the client machines along with the assigned IP address and subnet mask.

There are two ways that an ISP disseminates the DNS server addresses.

- The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the **DNS Server** fields in the **DHCP Setup** screen.
- Some ISPs choose to disseminate the DNS server addresses using the DNS server extensions of IPCP (IP Control Protocol) after the connection is up. If your ISP did not give you explicit DNS servers, chances are the DNS servers are conveyed through IPCP negotiation. The ZyXEL Device supports the IPCP DNS server extensions through the DNS proxy feature.

  Please note that DNS proxy works only when the ISP uses the IPCP DNS server extensions. It does not mean you can leave the DNS servers out of the DHCP setup under all circumstances. If your ISP gives you explicit DNS servers, make sure that you enter their IP addresses in the **DHCP Setup** screen.

8.11.4 LAN TCP/IP

The ZyXEL Device has built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, so too do computers on a LAN share one common network number.

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 and you must enable the Network Address Translation (NAT) feature of the ZyXEL Device. 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. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your ZyXEL Device, 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 ZyXEL Device 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 ZyXEL Device 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, for example, only between your two branch offices, 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.

Note: 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".

9

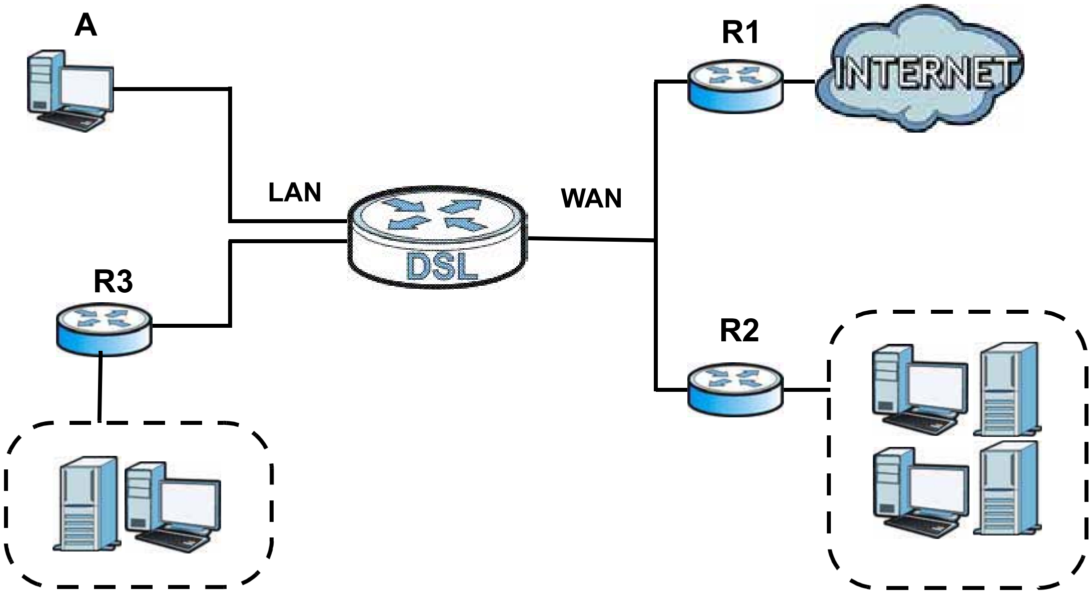
Static Routing

9.1 Overview

The ZyXEL Device usually uses the default gateway to route outbound traffic from computers on the LAN to the Internet. To have the ZyXEL Device send data to devices not reachable through the default gateway, use static routes.

For example, the next figure shows a computer (**A**) connected to the ZyXEL Device's LAN interface. The ZyXEL Device routes most traffic from **A** to the Internet through the ZyXEL Device's default gateway (**R1**). You create one static route to connect to services offered by your ISP behind router **R2**. You create another static route to communicate with a separate network behind a router **R3** connected to the LAN.

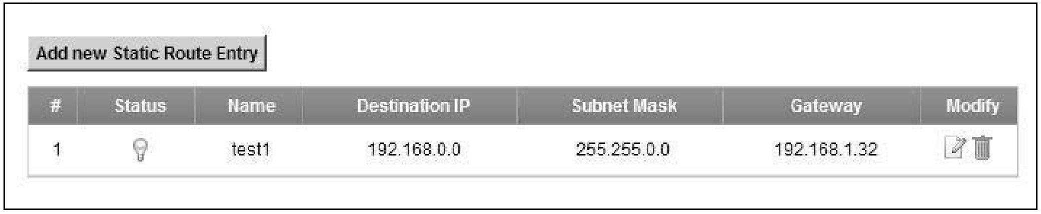
Figure 48 Example of Static Routing Topology



9.2 The Routing Screen

Use this screen to view and configure the static route rules on the ZyXEL Device. Click **Network Settings > Routing > Static Route** to open the following screen.

Figure 49 Network Settings > Routing > Static Route



#	Status	Name	Destination IP	Subnet Mask	Gateway	Modify
1		test1	192.168.0.0	255.255.0.0	192.168.1.32	

The following table describes the labels in this screen.

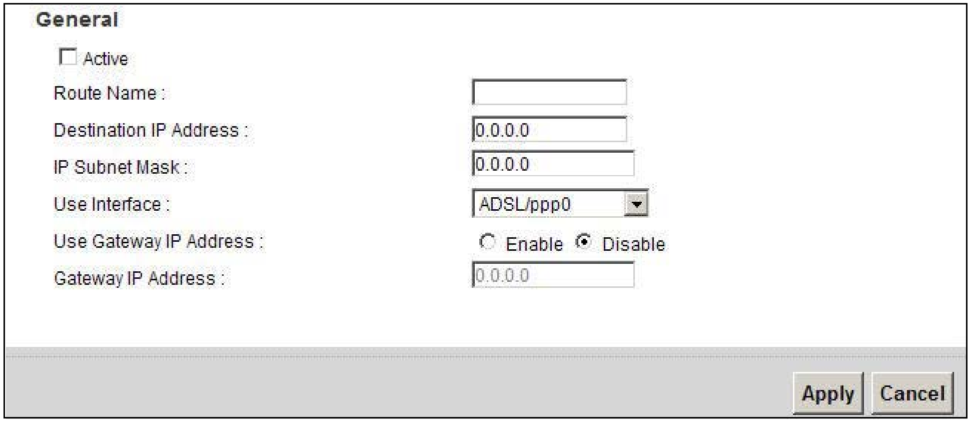
Table 31 Network Settings > Routing > Static Route

LABEL	DESCRIPTION
Add new Static Route Entry	Click this to configure a new static route.
#	This is the index number of the entry.
Status	This field displays whether the static route is active or not. A yellow bulb signifies that this route is active. A gray bulb signifies that this route is not active.
Name	This is the name that describes or identifies this route.
Destination IP	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Subnet Mask	This parameter specifies the IP network subnet mask of the final destination.
Gateway	This is the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Modify	Click the **Edit** icon to edit the static route on the ZyXEL Device. Click the **Delete** icon to remove a static route from the ZyXEL Device. A window displays asking you to confirm that you want to delete the route.

9.2.1 Add/Edit Static Route

Use this screen to add or edit a static route. Click **Add new Static Route Entry** in the **Routing** screen or the **Edit** icon next to the static route you want to edit. The screen shown next appears.

Figure 50 Routing: Add/Edit



General

□ Active

Route Name :

Destination IP Address : 0.0.0.0

IP Subnet Mask : 0.0.0.0

Use Interface : ADSL/ppp0

Use Gateway IP Address : ○ Enable ● Disable

Gateway IP Address : 0.0.0.0

The following table describes the labels in this screen.

Table 32 Routing: Add/Edit

LABEL	DESCRIPTION
Active	This field allows you to activate/deactivate this static route. Select this to enable the static route. Clear this to disable this static route without having to delete the entry.
Route Name	Enter a descriptive name for the static route.
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Enter the IP subnet mask here.
Use Interface	Select a WAN interface through which the traffic is sent. You must have the WAN interface(s) already configured in the **Broadband** screens.
Use Gateway IP Address	Select this option and enter the IP address of the next-hop gateway. The gateway is a router or switch on the same segment as your ZyXEL Device's interface(s). The gateway helps forward packets to their destinations.
Gateway IP Address	If you choose **Enable** in the **Use Gateway IP Address** field, enter the IP address of the gateway.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

10

Quality of Service (QoS)

10.1 Overview

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

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

1. Configure classifiers to sort traffic into different flows.
2. Assign priority and define actions to be performed for a classified traffic flow.

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

This chapter contains information about configuring QoS and editing classifiers.

10.1.1 What You Can Do in this Chapter

- The **General** screen lets you enable or disable QoS and set the upstream bandwidth (Section 10.3 on page 141).
- The **Queue Setup** screen lets you configure QoS queue assignment (Section 10.4 on page 143).
- The **Class Setup** screen lets you add, edit or delete QoS classifiers (Section 10.5 on page 145).
- The **Policer Setup** screen lets you add, edit or delete QoS policers (Section 10.5 on page 145).
- The **Monitor** screen lets you view the ZyXEL Device's QoS-related packet statistics (Section 10.7 on page 152).

10.2 What You Need to Know

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

QoS versus Cos

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

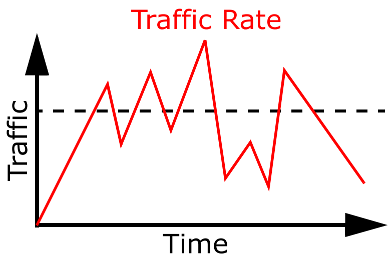
CoS technologies include IEEE 802.1p layer 2 tagging and DiffServ (Differentiated Services or DS). IEEE 802.1p tagging makes use of three bits in the packet header, while DiffServ is a new protocol and defines a new DS field, which replaces the eight-bit ToS (Type of Service) field in the IP header.

Tagging and Marking

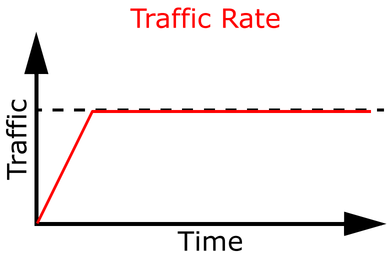
In a QoS class, you can configure whether to add or change the DSCP (DiffServ Code Point) value, IEEE 802.1p priority level and VLAN ID number in a matched packet. When the packet passes through a compatible network, the networking device, such as a backbone switch, can provide specific treatment or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

Traffic Shaping

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



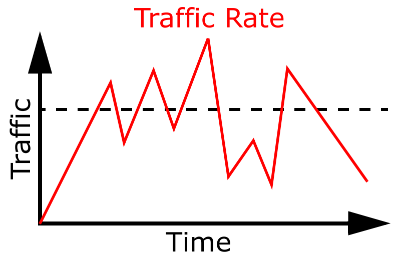
(Before Traffic Shaping)



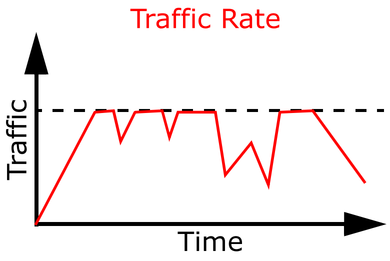
(After Traffic Shaping)

Traffic Policing

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



(Before Traffic Policing)



(After Traffic Policing)

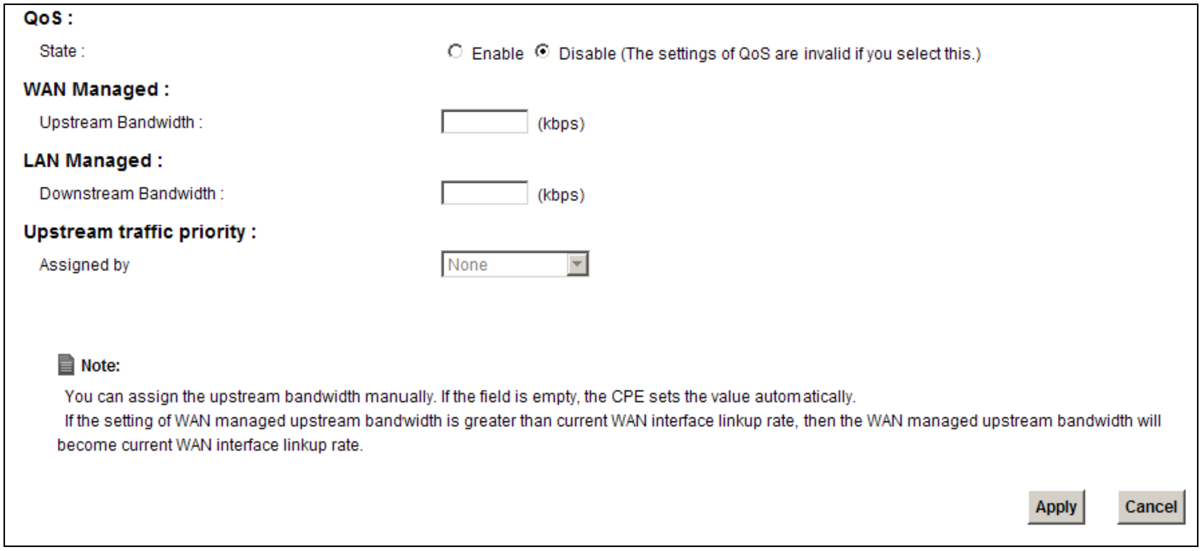
The ZyXEL Device supports three incoming traffic metering algorithms: Token Bucket Filter (TBF), Single Rate Two Color Maker (srTCM), and Two Rate Two Color Marker (trTCM). You can specify actions which are performed on the colored packets. See Section 10.8 on page 153 for more information on each metering algorithm.

10.3 The Quality of Service General Screen

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

Use this screen to enable or disable QoS and set the upstream bandwidth. See Section 10.1 on page 139 for more information.

Figure 51 Network Settings > QoS > General



QoS :

State : ○ Enable ● Disable (The settings of QoS are invalid if you select this.)

WAN Managed :

Upstream Bandwidth : (kbps)

LAN Managed :

Downstream Bandwidth : (kbps)

Upstream traffic priority :

Assigned by None

Note:

You can assign the upstream bandwidth manually. If the field is empty, the CPE sets the value automatically.

If the setting of WAN managed upstream bandwidth is greater than current WAN interface linkup rate, then the WAN managed upstream bandwidth will become current WAN interface linkup rate.

The following table describes the labels in this screen.

Table 33 Network Settings > QoS > General

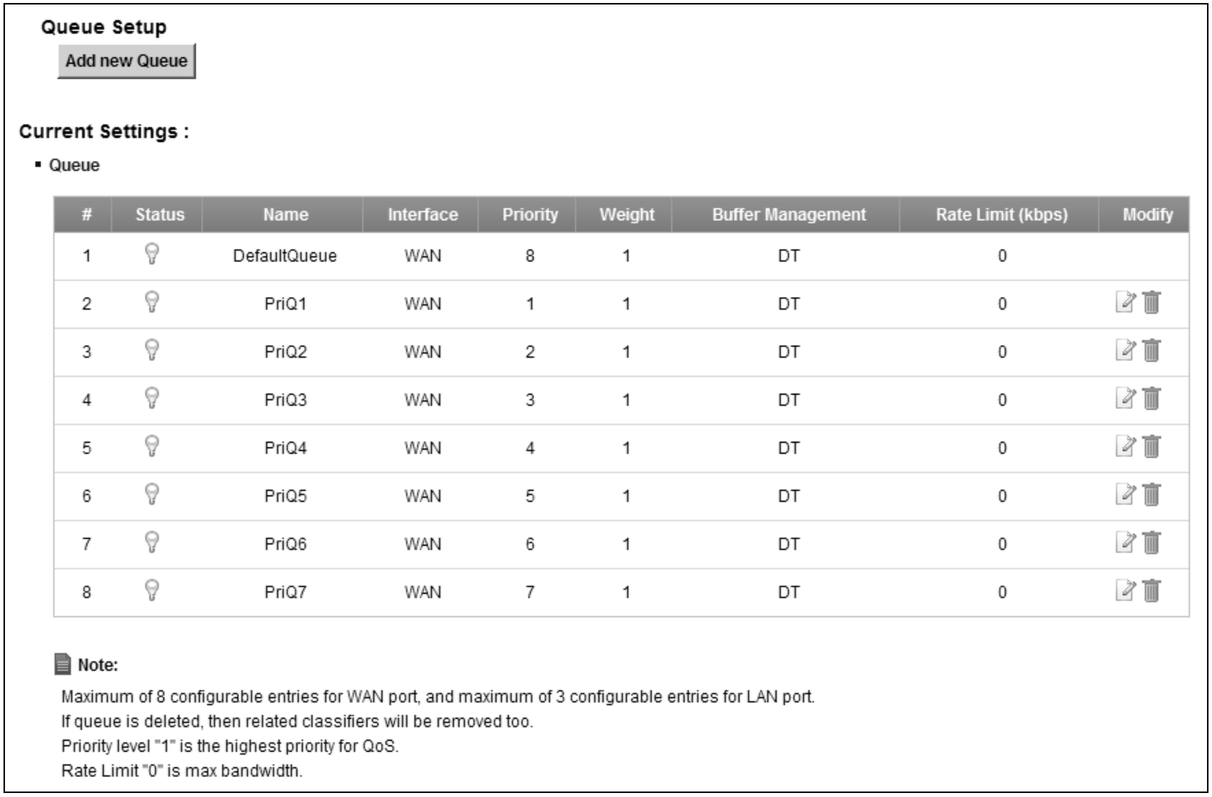
LABEL	DESCRIPTION
QoS	
State	Select the **Enable** check box to turn on QoS to improve your network performance.
WAN Managed	
Upstream Bandwidth	Enter the amount of upstream bandwidth for the WAN interfaces that you want to allocate using QoS. The recommendation is to set this speed to match the interfaces' actual transmission speed. For example, set the WAN interfaces' speed to 100000 kbps if your Internet connection has an upstream transmission speed of 100 Mbps. You can set this number higher than the interfaces' actual transmission speed. The ZyXEL Device uses up to 95% of the DSL port's actual upstream transmission speed even if you set this number higher than the DSL port's actual transmission speed. You can also set this number lower than the interfaces' actual transmission speed. This will cause the ZyXEL Device to not use some of the interfaces' available bandwidth. If you leave this field blank, the ZyXEL Device automatically sets this number to be 95% of the WAN interfaces' actual upstream transmission speed.
LAN Managed	
Downstream Bandwidth	Enter the amount of downstream bandwidth for the LAN interfaces (including HPNA and WLAN) that you want to allocate using QoS. The recommendation is to set this speed to match the WAN interfaces' actual transmission speed. For example, set the LAN managed downstream bandwidth to 100000 kbps if you use a 100 Mbps wired Ethernet WAN connection. You can also set this number lower than the WAN interfaces' actual transmission speed. This will cause the ZyXEL Device to not use some of the interfaces' available bandwidth. If you leave this field blank, the ZyXEL Device automatically sets this to the LAN interfaces' maximum supported connection speed.
Upstream traffic priority	
Assigned by	Select how the ZyXEL Device assigns priorities to various upstream traffic flows. • **None**: Disables auto priority mapping and has the ZyXEL Device put packets into the queues according to your classification rules. Traffic which does not match any of the classification rules is mapped into the default queue with the lowest priority. • **Ethernet Priority**: Automatically assign priority based on the IEEE 802.1p priority level. • **IP Precedence**: Automatically assign priority based on the first three bits of the TOS field in the IP header. • **Packet Length**: Automatically assign priority based on the packet size. Smaller packets get higher priority since control, signaling, VoIP, internet gaming, or other real-time packets are usually small while larger packets are usually best effort data packets like file transfers.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

10.4 The Queue Setup Screen

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

Use this screen to configure QoS queue assignment.

Figure 52 Network Settings > QoS > Queue Setup



Queue Setup

Current Settings :

- Queue

#	Status	Name	Interface	Priority	Weight	Buffer Management	Rate Limit (kbps)	Modify
1	💡	DefaultQueue	WAN	8	1	DT	0	
2	💡	PriQ1	WAN	1	1	DT	0	✎ 🗑
3	💡	PriQ2	WAN	2	1	DT	0	✎ 🗑
4	💡	PriQ3	WAN	3	1	DT	0	✎ 🗑
5	💡	PriQ4	WAN	4	1	DT	0	✎ 🗑
6	💡	PriQ5	WAN	5	1	DT	0	✎ 🗑
7	💡	PriQ6	WAN	6	1	DT	0	✎ 🗑
8	💡	PriQ7	WAN	7	1	DT	0	✎ 🗑

Note:

Maximum of 8 configurable entries for WAN port, and maximum of 3 configurable entries for LAN port.
If queue is deleted, then related classifiers will be removed too.
Priority level "1" is the highest priority for QoS.
Rate Limit "0" is max bandwidth.

The following table describes the labels in this screen.

Table 34 Network Settings > QoS > Queue Setup

LABEL	DESCRIPTION
Add new Queue	Click this button to create a new queue entry.
#	This is the index number of the entry.
Status	This field displays whether the queue is active or not. A yellow bulb signifies that this queue is active. A gray bulb signifies that this queue is not active.
Name	This shows the descriptive name of this queue.
Interface	This shows the name of the ZyXEL Device's interface through which traffic in this queue passes.
Priority	This shows the priority of this queue.
Weight	This shows the weight of this queue.
Buffer Management	This shows the queue management algorithm used for this queue. Queue management algorithms determine how the ZyXEL Device should handle packets when it receives too many (network congestion).

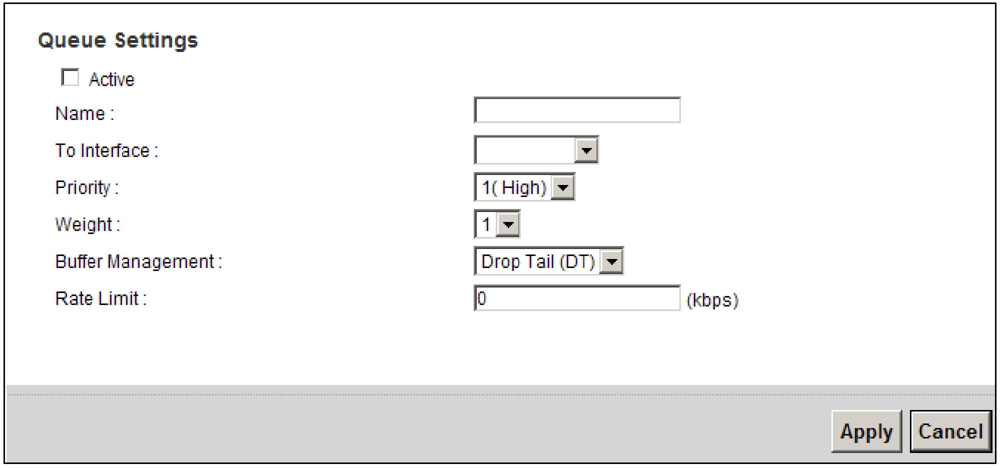
Table 34 Network Settings > QoS > Queue Setup (continued)

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

10.4.1 Adding a QoS Queue

Click **Add new Queue** or the edit icon in the **Queue Setup** screen to configure a queue.

Figure 53 Queue Setup: Add



Queue Settings

☐ Active

Name :

To Interface :

Priority : 1(High)

Weight : 1

Buffer Management : Drop Tail (DT)

Rate Limit : 0 (kbps)

The following table describes the labels in this screen.

Table 35 Queue Setup: Add

LABEL	DESCRIPTION
Active	Select to enable or disable this queue.
Name	Enter the descriptive name of this queue.
To Interface	Select the interface to which this queue is applied. This field is read-only if you are editing the queue.
Priority	Select the priority level (from 1 to 3) of this queue. The smaller the number, the higher the priority level. Traffic assigned to higher priority queues gets through faster while traffic in lower priority queues is dropped if the network is congested.
Weight	Select the weight (from 1 to 8) of this queue. If two queues have the same priority level, the ZyXEL Device divides the bandwidth across the queues according to their weights. Queues with larger weights get more bandwidth than queues with smaller weights.
Buffer Management	This field displays **Drop Tail (DT)**. **Drop Tail (DT)** is a simple queue management algorithm that allows the ZyXEL Device buffer to accept as many packets as it can until it is full. Once the buffer is full, new packets that arrive are dropped until there is space in the buffer again (packets are transmitted out of it).
Rate Limit	Specify the maximum transmission rate (in Kbps) allowed for traffic on this queue.

Table 35 Queue Setup: Add (continued)

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

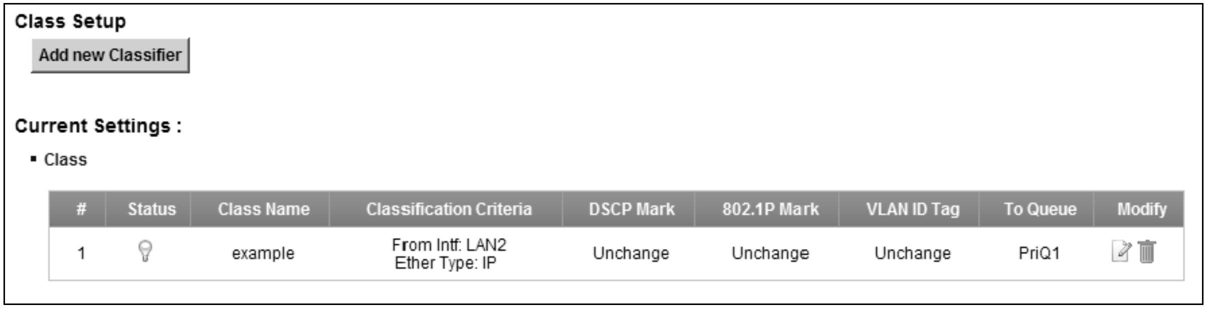
10.5 The Class Setup Screen

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

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

Click **Network Settings > QoS > Class Setup** to open the following screen.

Figure 54 Network Settings > QoS > Class Setup



Class Setup

Current Settings :

- Class

#	Status	Class Name	Classification Criteria	DSCP Mark	802.1P Mark	VLAN ID Tag	To Queue	Modify
1	💡	example	From Intf: LAN2 Ether Type: IP	Unchange	Unchange	Unchange	PriQ1	✎ 🗑

The following table describes the labels in this screen.

Table 36 Network Settings > QoS > Class Setup

LABEL	DESCRIPTION
Add new Classifier	Click this to create a new classifier.
#	This is the index number of the entry.
Status	This field displays whether the classifier is active or not. A yellow bulb signifies that this classifier is active. A gray bulb signifies that this classifier is not active.
Class Name	This is the name of the classifier.
Classification Criteria	This shows criteria specified in this classifier, for example the interface from which traffic of this class should come and the source MAC address of traffic that matches this classifier.
DSCP Mark	This is the DSCP number added to traffic of this classifier.
802.1P Mark	This is the IEEE 802.1p priority level assigned to traffic of this classifier.
VLAN ID Tag	This is the VLAN ID number assigned to traffic of this classifier.

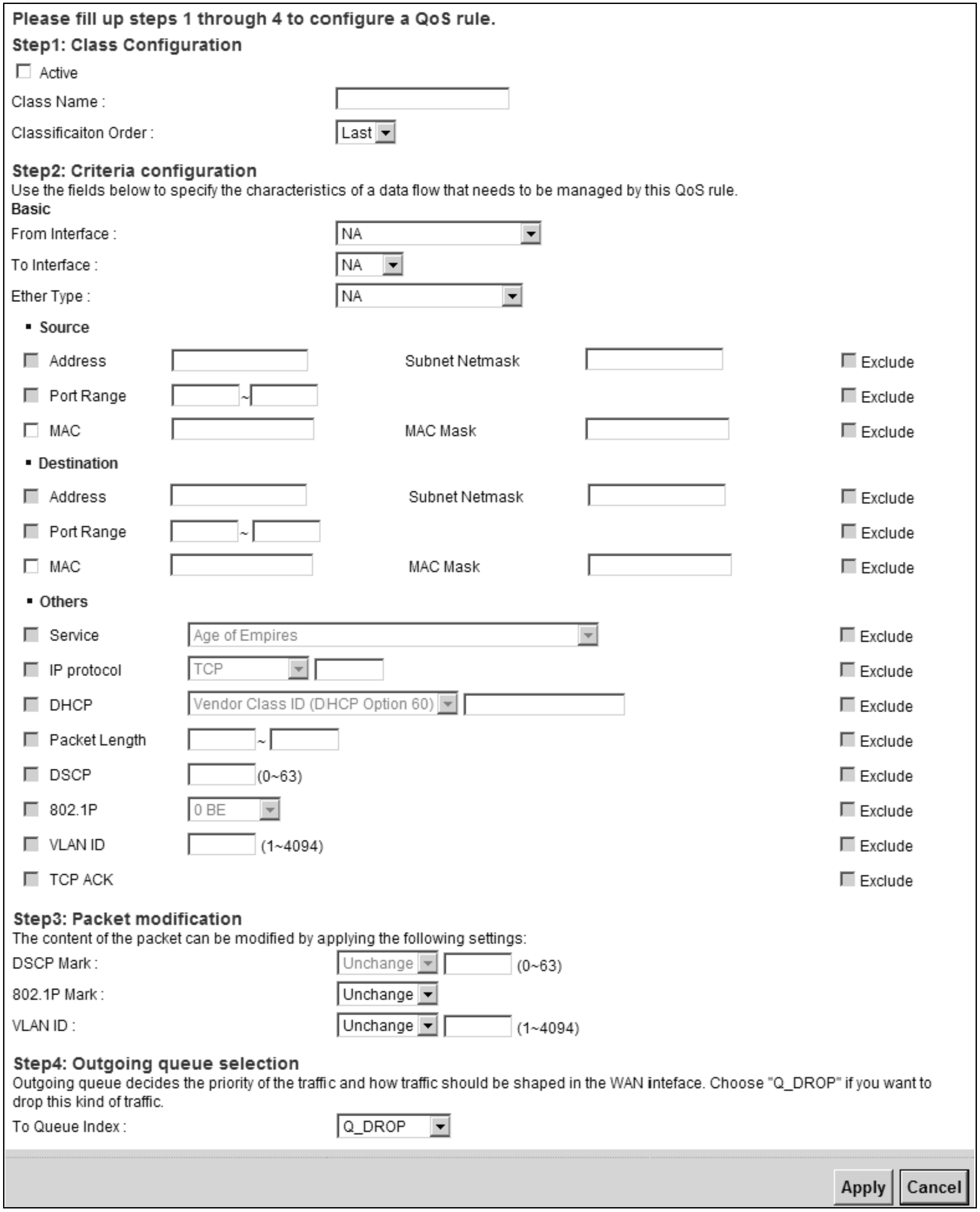
Table 36 Network Settings > QoS > Class Setup (continued)

LABEL	DESCRIPTION
To Queue	This is the name of the queue in which traffic of this classifier is put.
Modify	Click the **Edit** icon to edit the classifier. Click the **Delete** icon to delete an existing classifier. Note that subsequent rules move up by one when you take this action.

10.5.1 Add/Edit QoS Class

Click **Add new Classifier** in the **Class Setup** screen or the **Edit** icon next to a classifier to open the following screen.

Figure 55 Class Setup: Add/Edit



Please fill up steps 1 through 4 to configure a QoS rule.

Step1: Class Configuration

□ Active

Class Name :	
Classificaiton Order :	Last

Step2: Criteria configuration

Use the fields below to specify the characteristics of a data flow that needs to be managed by this QoS rule.

Basic

From Interface :	NA
To Interface :	NA
Ether Type :	NA

- **Source**

□ Address		Subnet Netmask		□ Exclude
□ Port Range	~			□ Exclude
□ MAC		MAC Mask		□ Exclude

- **Destination**

□ Address		Subnet Netmask		□ Exclude
□ Port Range	~			□ Exclude
□ MAC		MAC Mask		□ Exclude

- **Others**

□ Service	Age of Empires	□ Exclude
□ IP protocol	TCP	□ Exclude
□ DHCP	Vendor Class ID (DHCP Option 60)	□ Exclude
□ Packet Length	~	□ Exclude
□ DSCP	(0~63)	□ Exclude
□ 802.1P	0 BE	□ Exclude
□ VLAN ID	(1~4094)	□ Exclude
□ TCP ACK		□ Exclude

Step3: Packet modification

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

DSCP Mark :	Unchange (0~63)
802.1P Mark :	Unchange
VLAN ID :	Unchange (1~4094)

Step4: Outgoing queue selection

Outgoing queue decides the priority of the traffic and how traffic should be shaped in the WAN inteface. Choose "Q_DROP" if you want to drop this kind of traffic.

To Queue Index :	Q_DROP

The following table describes the labels in this screen.

Table 37 Class Setup: Add/Edit

LABEL	DESCRIPTION
Active	Select this to enable this classifier.
Class Name	Enter a descriptive name of up to 15 printable English keyboard characters, not including spaces.
Classification Order	Select an existing number for where you want to put this classifier to move the classifier to the number you selected after clicking **Apply**. Select **Last** to put this rule in the back of the classifier list.
From Interface	If you want to classify the traffic by an ingress interface, select an interface from the **From Interface** drop-down list box.
To Interface	If you want to classify the traffic by an egress interface, select an interface from the **To Interface** drop-down list box.
Ether Type	Select a predefined application to configure a class for the matched traffic. If you select **IP**, you also need to configure source or destination MAC address, IP address, DHCP options, DSCP value or the protocol type. If you select **802.1Q**, you can configure an 802.1p priority level.
Source	
Address	Select the check box and enter the source IP address in dotted decimal notation. A blank source IP address means any source IP address.
Subnet Netmask	Enter the source subnet mask.
Port Range	If you select **TCP** or **UDP** in the **IP Protocol** field, select the check box and enter the port number(s) of the source.
MAC	Select the check box and enter the source MAC address of the packet.
MAC Mask	Type the mask for the specified MAC address to determine which bits a packet's MAC address should match. Enter "f" for each bit of the specified source MAC address that the traffic's MAC address should match. Enter "0" for the bit(s) of the matched traffic's MAC address, which can be of any hexadecimal character(s). For example, if you set the MAC address to 00:13:49:00:00:00 and the mask to ff:ff:ff:00:00:00, a packet with a MAC address of 00:13:49:12:34:56 matches this criteria.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Destination	
Address	Select the check box and enter the source IP address in dotted decimal notation. A blank source IP address means any source IP address.
Subnet Netmask	Enter the source subnet mask.
Port Range	If you select **TCP** or **UDP** in the **IP Protocol** field, select the check box and enter the port number(s) of the source.
MAC	Select the check box and enter the source MAC address of the packet.
MAC Mask	Type the mask for the specified MAC address to determine which bits a packet's MAC address should match. Enter "f" for each bit of the specified source MAC address that the traffic's MAC address should match. Enter "0" for the bit(s) of the matched traffic's MAC address, which can be of any hexadecimal character(s). For example, if you set the MAC address to 00:13:49:00:00:00 and the mask to ff:ff:ff:00:00:00, a packet with a MAC address of 00:13:49:12:34:56 matches this criteria.

Table 37 Class Setup: Add/Edit (continued)

LABEL	DESCRIPTION
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Others	
Service	This field is available only when you select **IP** in the **Ether Type** field. This field simplifies classifier configuration by allowing you to select a predefined application. When you select a predefined application, you do not configure the rest of the filter fields.
IP Protocol	This field is available only when you select **IP** in the **Ether Type** field. Select this option and select the protocol (service type) from **TCP**, **UDP**, **ICMP** or **IGMP**. If you select **User defined**, enter the protocol (service type) number.
DHCP	This field is available only when you select **IP** in the **Ether Type** field. Select this option and select a DHCP option. If you select **Vendor Class ID (DHCP Option 60)**, enter the Vendor Class Identifier (Option 60) of the matched traffic, such as the type of the hardware or firmware. If you select **User Class ID (DHCP Option 77)**, enter a string that identifies the user's category or application type in the matched DHCP packets.
Packet Length	This field is available only when you select **IP** in the **Ether Type** field. Select this option and enter the minimum and maximum packet length (from 46 to 1500) in the fields provided.
DSCP	This field is available only when you select **IP** in the **Ether Type** field. Select this option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided.
802.1P	This field is available only when you select **802.1Q** in the **Ether Type** field. Select this option and select a priority level (between 0 and 7) from the drop-down list box. "0" is the lowest priority level and "7" is the highest.
VLAN ID	This field is available only when you select **802.1Q** in the **Ether Type** field. Select this option and specify a VLAN ID number.
TCP ACK	This field is available only when you select **IP** in the **Ether Type** field. If you select this option, the matched TCP packets must contain the ACK (Acknowledge) flag.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
DSCP Mark	This field is available only when you select **IP** in the **Ether Type** field. If you select **Mark**, enter a DSCP value with which the ZyXEL Device replaces the DSCP field in the packets. If you select **Unchange**, the ZyXEL Device keep the DSCP field in the packets.
802.1P Mark	Select a priority level with which the ZyXEL Device replaces the IEEE 802.1p priority field in the packets. If you select **Unchange**, the ZyXEL Device keep the 802.1p priority field in the packets.

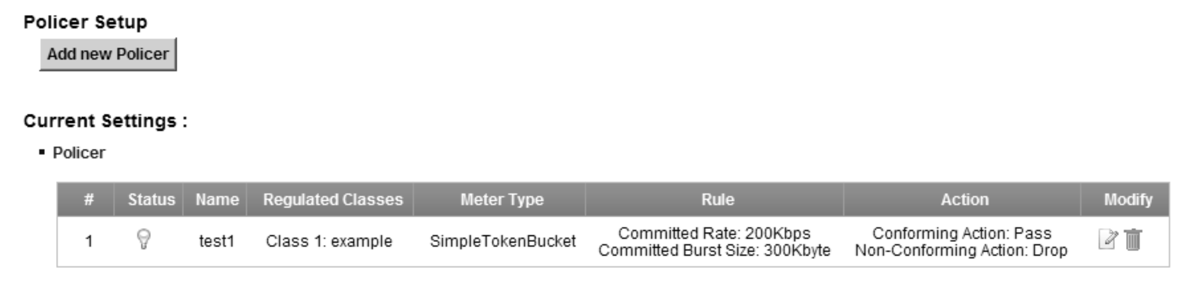
Table 37 Class Setup: Add/Edit (continued)

LABEL	DESCRIPTION
VLAN ID	If you select **Remark**, enter a VLAN ID number with which the ZyXEL Device replaces the VLAN ID of the frames. If you select **Remove**, the ZyXEL Device deletes the VLAN ID of the frames before forwarding them out. If you select **Add**, the ZyXEL Device treat all matched traffic untagged and add a second VLAN ID. If you select **Unchange**, the ZyXEL Device keep the VLAN ID in the packets.
To Queue Index	Select a queue that applies to this class. You should have configured a queue in the **Queue Setup** screen already.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

10.6 The QoS Policer Setup Screen

Use this screen to configure QoS policers that allow you to limit the transmission rate of incoming traffic. Click **Network Settings > QoS > Policer Setup**. The screen appears as shown.

Figure 56 Network Settings > QoS > Policer Setup



Policer Setup

Add new Policer

Current Settings :

▪ Policer

#	Status	Name	Regulated Classes	Meter Type	Rule	Action	Modify
1		test1	Class 1: example	SimpleTokenBucket	Committed Rate: 200Kbps Committed Burst Size: 300Kbyte	Conforming Action: Pass Non-Conforming Action: Drop	

The following table describes the labels in this screen.

Table 38 Network Settings > QoS > Policer Setup

LABEL	DESCRIPTION
Add new Policer	Click this to create a new entry.
#	This is the index number of the entry.
Status	This field displays whether the policer is active or not. A yellow bulb signifies that this policer is active. A gray bulb signifies that this policer is not active.
Name	This field displays the descriptive name of this policer.
Regulated Classes	This field displays the name of a QoS classifier
Meter Type	This field displays the type of QoS metering algorithm used in this policer.
Rule	These are the rates and burst sizes against which the policer checks the traffic of the member QoS classes.

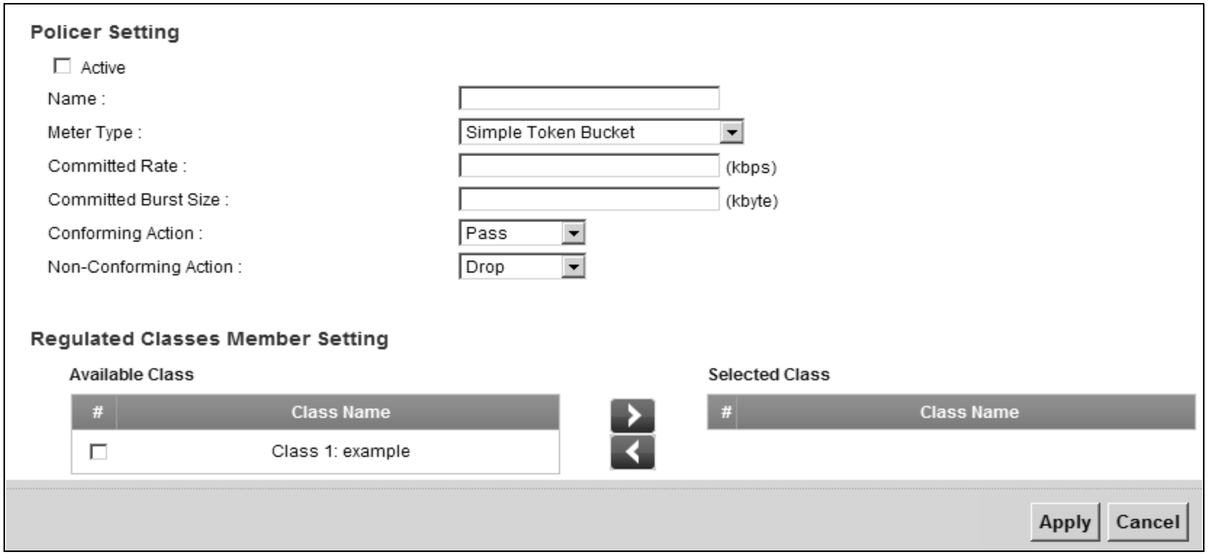
Table 38 Network Settings > QoS > Policer Setup (continued)

LABEL	DESCRIPTION
Action	This shows the how the policer has the ZyXEL Device treat different types of traffic belonging to the policer’s member QoS classes.
Modify	Click the **Edit** icon to edit the policer. Click the **Delete** icon to delete an existing policer. Note that subsequent rules move up by one when you take this action.

10.6.1 Add/Edit a QoS Policer

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

Figure 57 Policer Setup: Add/Edit



Policer Setting

☐ Active

Name :		
Meter Type :	Simple Token Bucket	
Committed Rate :		(kbps)
Committed Burst Size :		(kbyte)
Conforming Action :	Pass	
Non-Conforming Action :	Drop	

Regulated Classes Member Setting

Available Class

#	Class Name
☐	Class 1: example

Selected Class

#	Class Name

The following table describes the labels in this screen.

Table 39 Policer Setup: Add/Edit

LABEL	DESCRIPTION
Active	Select the check box to activate this policer.
Name	Enter the descriptive name of this policer.
Meter Type	Select how the policer shapes the traffic of the member QoS classes. The **Simple Token Bucket** algorithm uses tokens in a bucket to control when traffic can be transmitted. Each token represents one byte. The algorithm allows bursts of up to *b* bytes which is also the bucket size. The **Single Rate Three Color Marker** (srTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR), the Committed Burst Size (CBS) and the Excess Burst Size (EBS). The **Two Rate Three Color Marker** (trTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR) and the Peak Information Rate (PIR).
Committed Rate	Specify the committed rate. When the incoming traffic rate of the member QoS classes is less than the committed rate, the device applies the conforming action to the traffic.

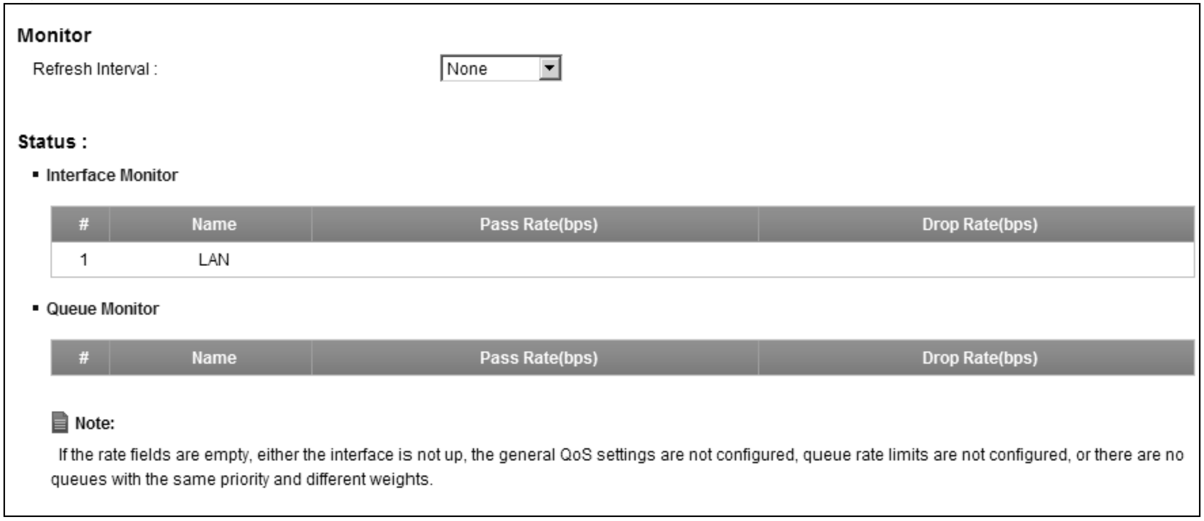
Table 39 Policer Setup: Add/Edit (continued)

LABEL	DESCRIPTION
Committed Burst Size	Specify the committed burst size for packet bursts. This must be equal to or less than the peak burst size (two rate three color) or excess burst size (single rate three color) if it is also configured. This is the maximum size of the (first) token bucket in a traffic metering algorithm.
Conforming Action	Specify what the ZyXEL Device does for packets within the committed rate and burst size (green-marked packets). • **Pass**: Send the packets without modification. • **DSCP Mark**: Change the DSCP mark value of the packets. Enter the DSCP mark value to use.
Non-Conforming Action	Specify what the ZyXEL Device does for packets that exceed the excess burst size or peak rate and burst size (red-marked packets). • **Drop**: Discard the packets. • **DSCP Mark**: Change the DSCP mark value of the packets. Enter the DSCP mark value to use. The packets may be dropped if there is congestion on the network.
Available Class Selected Class	Select a QoS classifier to apply this QoS policer to traffic that matches the QoS classifier. Highlight a QoS classifier in the **Available Class** box and use the **>** button to move it to the **Selected Class** box. To remove a QoS classifier from the **Selected Class** box, select it and use the **<** button.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

10.7 The QoS Monitor Screen

To view the ZyXEL Device’s QoS packet statistics, click **Network Settings > QoS > Monitor**. The screen appears as shown.

Figure 58 Network Settings > QoS > Monitor



Monitor

Refresh Interval : None

Status :

- Interface Monitor

#	Name	Pass Rate(bps)	Drop Rate(bps)
1	LAN		

- Queue Monitor

#	Name	Pass Rate(bps)	Drop Rate(bps)

Note:

If the rate fields are empty, either the interface is not up, the general QoS settings are not configured, queue rate limits are not configured, or there are no queues with the same priority and different weights.

The following table describes the labels in this screen.

Table 40 Network Settings > QoS > Monitor

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

10.8 Technical Reference

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

IEEE 802.1Q Tag

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

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

Table 41 IEEE 802.1p Priority Level and Traffic Type

PRIORITY LEVEL	TRAFFIC TYPE
Level 7	Typically used for network control traffic such as router configuration messages.
Level 6	Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay).
Level 5	Typically used for video that consumes high bandwidth and is sensitive to jitter.
Level 4	Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions.
Level 3	Typically used for “excellent effort” or better than best effort and would include important business traffic that can tolerate some delay.
Level 2	This is for “spare bandwidth”.

Table 41 IEEE 802.1p Priority Level and Traffic Type (continued)

PRIORITY LEVEL	TRAFFIC TYPE
Level 1	This is typically used for non-critical "background" traffic such as bulk transfers that are allowed but that should not affect other applications and users.
Level 0	Typically used for best-effort traffic.

DiffServ

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

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

DSCP and Per-Hop Behavior

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

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

DSCP (6 bits)	Unused (2 bits)

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

IP Precedence

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

Automatic Priority Queue Assignment

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

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

Table 42 Internal Layer2 and Layer3 QoS Mapping

PRIORITY QUEUE	LAYER 2	LAYER 3		
	IEEE 802.1P USER PRIORITY (ETHERNET PRIORITY)	TOS (IP PRECEDENCE)	DSCP	IP PACKET LENGTH (BYTE)
0	1	0	000000	
1	2			
2	0	0	000000	>1100
3	3	1	001110 001100 001010 001000	250~1100
4	4	2	010110 010100 010010 010000	
5	5	3	011110 011100 011010 011000	<250
6	6	4	100110 100100 100010 100000	
		5	101110 101000	
7	7	6	110000	
		7	111000	

Token Bucket

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

- A packet can be transmitted if the number of tokens in the bucket is equal to or greater than the size of the packet (in bytes).
- After a packet is transmitted, a number of tokens corresponding to the packet size is removed from the bucket.

- If there are no tokens in the bucket, the ZyXEL Device stops transmitting until enough tokens are generated.
- If not enough tokens are available, the ZyXEL Device treats the packet in either one of the following ways:

  In traffic shaping:

  - Holds it in the queue until enough tokens are available in the bucket.

  In traffic policing:

  - Drops it.
  - Transmits it but adds a DSCP mark. The ZyXEL Device may drop these marked packets if the network is overloaded.

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

Single Rate Three Color Marker

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

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

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

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

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

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

Two Rate Three Color Marker

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

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

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

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

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

- A packet arrives. If the number of tokens in the PBS bucket is less than the size of the packet (in bytes), the packet is marked red and may be dropped regardless of the CBS bucket. No tokens are removed if the packet is dropped.
- If the PBS bucket has enough tokens, the ZyXEL Device checks the CBS bucket. The packet is marked green and can be transmitted if the number of tokens in the CBS bucket is equal to or greater than the size of the packet (in bytes). Otherwise, the packet is marked yellow.

11

Network Address Translation (NAT)

11.1 Overview

This chapter discusses how to configure NAT on the ZyXEL Device. NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet, for example, the source address of an outgoing packet, used within one network to a different IP address known within another network.

11.1.1 What You Can Do in this Chapter

- Use the **Port Forwarding** screen to configure forward incoming service requests to the server(s) on your local network (Section 11.2 on page 160).
- Use the **Applications** screen to forward incoming service requests to the server(s) on your local network (Section 11.3 on page 163).
- Use the **Port Triggering** screen to add and configure the ZyXEL Device's trigger port settings (Section 11.4 on page 164).
- Use the **DMZ** screen to configure a default server (Section 11.5 on page 167).
- Use the **ALG** screen to enable and disable the SIP (VoIP) ALG in the ZyXEL Device (Section 11.6 on page 168).
- Use the **Sessions** screen to limit the number of concurrent NAT sessions all clients can use (Section 11.7 on page 169).

11.1.2 What You Need To Know

Inside/Outside

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

Global/Local

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

NAT

In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the

WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host.

Port Forwarding

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

Finding Out More

See Section 11.8 on page 169 for advanced technical information on NAT.

11.2 The Port Forwarding Screen

Use the **Port Forwarding** screen to forward incoming service requests to the server(s) on your local network.

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

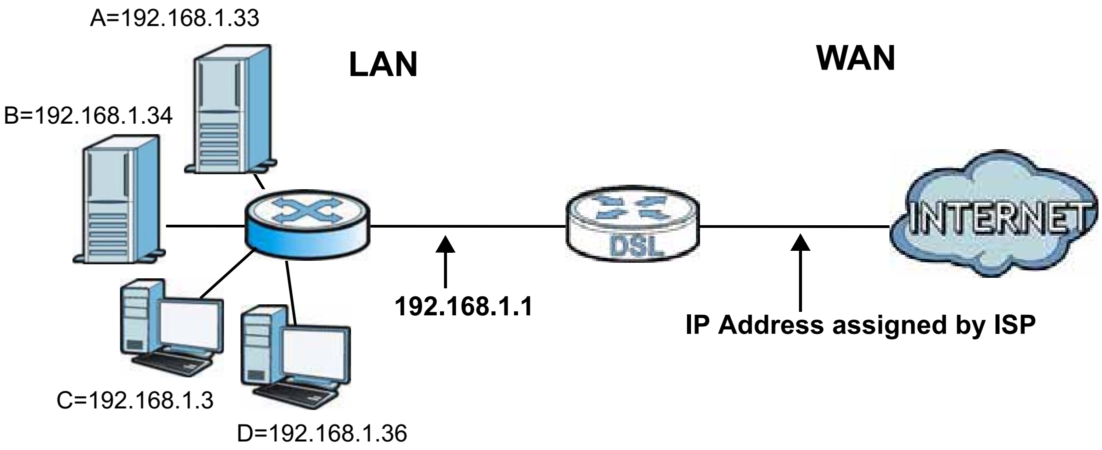
The most often used port numbers and services are shown in Appendix E on page 333. Please refer to RFC 1700 for further information about port numbers.

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

Configuring Servers Behind Port Forwarding (Example)

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

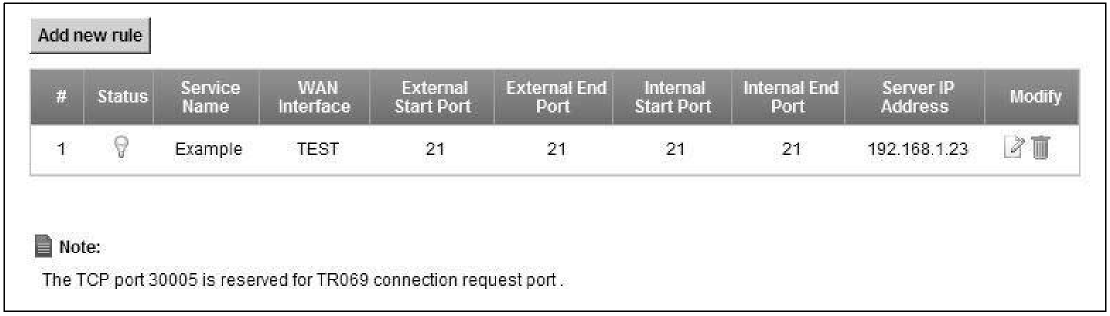
Figure 59 Multiple Servers Behind NAT Example



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

See Appendix E on page 333 for port numbers commonly used for particular services.

Figure 60 Network Settings > NAT > Port Forwarding


Add new rule

#	Status	Service Name	WAN Interface	External Start Port	External End Port	Internal Start Port	Internal End Port	Server IP Address	Modify
1	○	Example	TEST	21	21	21	21	192.168.1.23	

Note:
The TCP port 30005 is reserved for TR069 connection request port .

The following table describes the fields in this screen.

Table 43 Network Settings > NAT > Port Forwarding

LABEL	DESCRIPTION
Add new rule	Click this to add a new rule.
#	This is the index number of the entry.
Status	This field displays whether the NAT rule is active or not. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
Service Name	This shows the service’s name.
WAN Interface	This shows the WAN interface through which the service is forwarded.
External Start Port	This is the first external port number that identifies a service.
External End Port	This is the last external port number that identifies a service.
Internal Start Port	This is the first internal port number that identifies a service.
Internal End Port	This is the last internal port number that identifies a service.

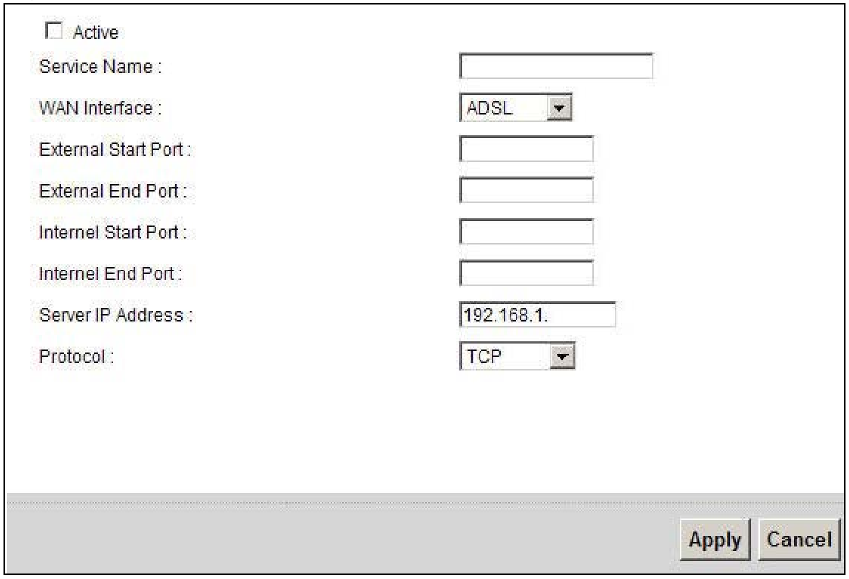
Table 43 Network Settings > NAT > Port Forwarding (continued)

LABEL	DESCRIPTION
Server IP Address	This is the server's IP address.
Modify	Click the **Edit** icon to edit this rule. Click the **Delete** icon to delete an existing rule.

11.2.1 Add/Edit Port Forwarding

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

Figure 61 Port Forwarding: Add/Edit



☐ Active	
Service Name :	
WAN Interface :	ADSL ▾
External Start Port :	
External End Port :	
Internel Start Port :	
Internel End Port :	
Server IP Address :	192.168.1.
Protocol :	TCP ▾

The following table describes the labels in this screen.

Table 44 Port Forwarding: Add/Edit

LABEL	DESCRIPTION
Active	Clear the check box to disable the rule. Select the check box to enable it. This field is read-only in the **Port Forwarding Configuration** screen.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on). This field is read-only in the **Port Forwarding Edit** screen.
WAN Interface	Select the WAN interface through which the service is forwarded. You must have already configured a WAN connection with NAT enabled.
External Start Port	Enter the original destination port for the packets. To forward only one port, enter the port number again in the **External End Port** field. To forward a series of ports, enter the start port number here and the end port number in the **External End Port** field.

Table 44 Port Forwarding: Add/Edit (continued)

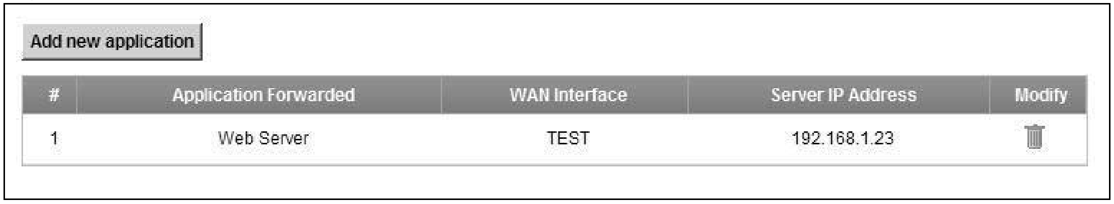
LABEL	DESCRIPTION
External End Port	Enter the last port of the original destination port range. To forward only one port, enter the port number in the **External Start Port** field above and then enter it again in this field. To forward a series of ports, enter the last port number in a series that begins with the port number in the **External Start Port** field above.
Internal Start Port	This shows the port number to which you want the ZyXEL Device to translate the incoming port. For a range of ports, enter the first number of the range to which you want the incoming ports translated.
Internal End Port	This shows the last port of the translated port range.
Server IP Address	Enter the inside IP address of the virtual server here.
Protocol	Select the protocol supported by this virtual server. Choices are **TCP**, **UDP**, or **TCP/UDP**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.3 The Applications Screen

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

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

Figure 62 Network Settings > NAT > Applications



#	Application Forwarded	WAN Interface	Server IP Address	Modify
1	Web Server	TEST	192.168.1.23	🗑

The following table describes the labels in this screen.

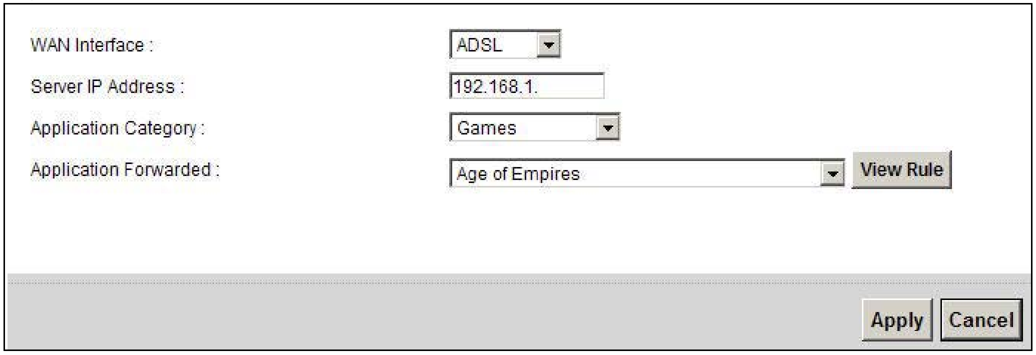
Table 45 Network Settings > NAT > Applications

LABEL	DESCRIPTION
Add new application	Click this to add a new NAT application rule.
Application Forwarded	This field shows the type of application that the service forwards.
WAN Interface	This field shows the WAN interface through which the service is forwarded.
Server IP Address	This field displays the destination IP address for the service.
Modify	Click the **Delete** icon to delete the rule.

11.3.1 Add New Application

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

Figure 63 Applications: Add



WAN Interface : ADSL

Server IP Address : 192.168.1.

Application Category : Games

Application Forwarded : Age of Empires

The following table describes the labels in this screen.

Table 46 Applications: Add

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

11.4 The Port Triggering Screen

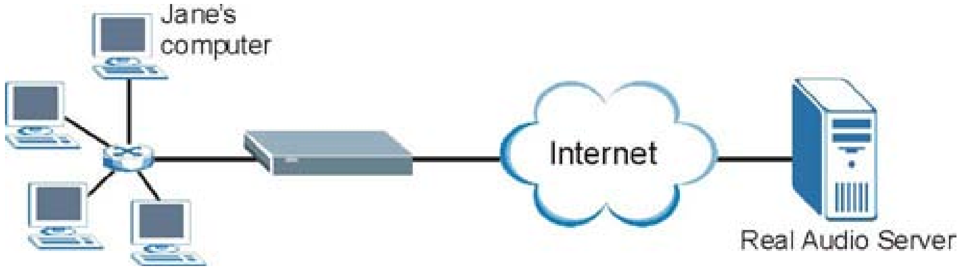
Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem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

Trigger port forwarding solves this problem by allowing computers on the LAN to dynamically take turns using the service. The ZyXEL Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the ZyXEL Device's WAN port receives a response with a specific port number and protocol ("open" port), the ZyXEL Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer’s connection for that service closes, another computer on the

LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

For example:

Figure 64 Trigger Port Forwarding Process: Example



1 Jane requests a file from the Real Audio server (port 7070).

2 Port 7070 is a "trigger" port and causes the ZyXEL Device to record Jane's computer IP address. The ZyXEL Device associates Jane's computer IP address with the "open" port range of 6970-7170.

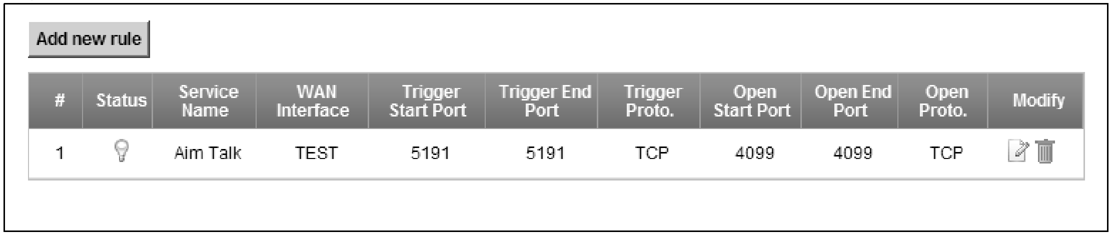
3 The Real Audio server responds using a port number ranging between 6970-7170.

4 The ZyXEL Device forwards the traffic to Jane's computer IP address.

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

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

Figure 65 Network Settings > NAT > Port Triggering



#	Status	Service Name	WAN Interface	Trigger Start Port	Trigger End Port	Trigger Proto.	Open Start Port	Open End Port	Open Proto.	Modify
1		Aim Talk	TEST	5191	5191	TCP	4099	4099	TCP	

The following table describes the labels in this screen.

Table 47 Network Settings > NAT > Port Triggering

LABEL	DESCRIPTION
Add new rule	Click this to create a new rule.
#	This is the index number of the entry.
Status	This field displays whether the port triggering rule is active or not. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
Service Name	This field displays the name of the service used by this rule.
WAN Interface	This field shows the WAN interface through which the service is forwarded.

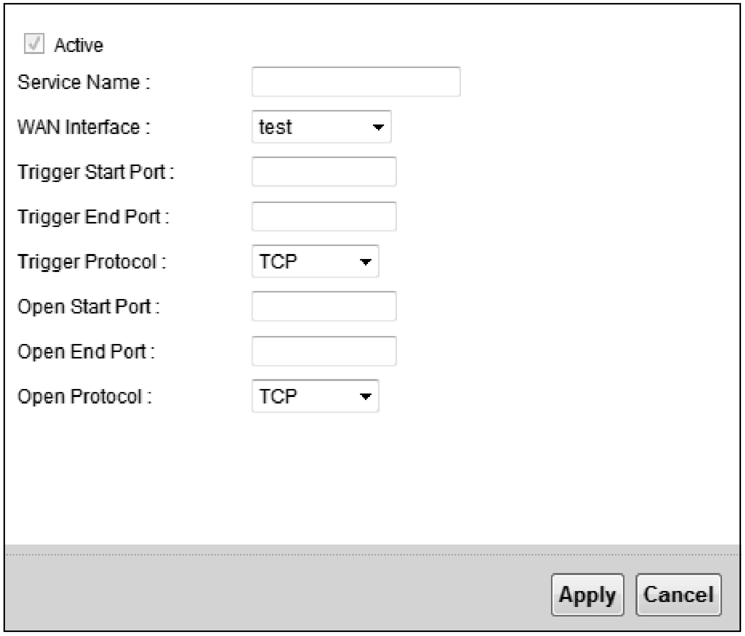
Table 47 Network Settings > NAT > Port Triggering (continued)

LABEL	DESCRIPTION
Trigger Port	The trigger port is a port (or a range of ports) that causes (or triggers) the ZyXEL Device to record the IP address of the LAN computer that sent the traffic to a server on the WAN.
Start	This is the first port number that identifies a service.
End	This is the last port number that identifies a service.
Trigger Proto.	This is the trigger transport layer protocol.
Open	The open port is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The ZyXEL Device forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service.
Start	This is the first port number that identifies a service.
End	This is the last port number that identifies a service.
Open Proto.	This is the open transport layer protocol.
Modify	Click the **Edit** icon to edit this rule. Click the **Delete** icon to delete an existing rule.

11.4.1 Add/Edit Port Triggering Rule

This screen lets you create new port triggering rules. Click **Add new rule** in the **Port Triggering** screen or click a rule’s **Edit** icon to open the following screen.

Figure 66 Port Triggering: Add/Edit



☑ Active

Service Name :	
WAN Interface :	test
Trigger Start Port :	
Trigger End Port :	
Trigger Protocol :	TCP
Open Start Port :	
Open End Port :	
Open Protocol :	TCP

The following table describes the labels in this screen.

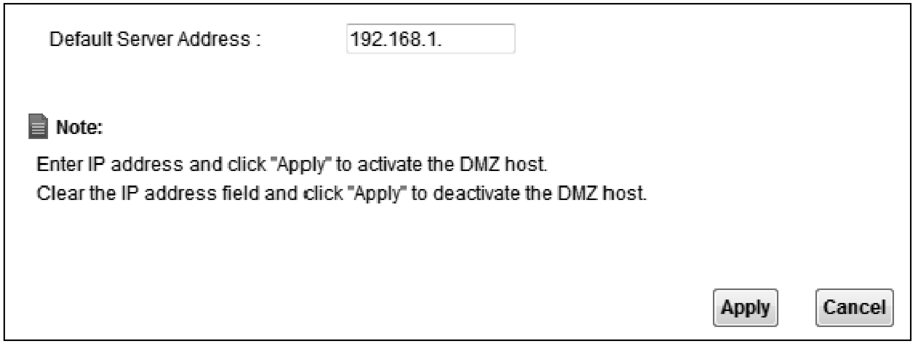
Table 48 Port Triggering: Configuration Add/Edit

LABEL	DESCRIPTION
Active	Select the check box to enable this rule. This field is read-only in the **Port Triggering Configuration** screen.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on). This field is read-only in the **Port Triggering Edit** screen.
WAN Interface	Select a WAN interface for which you want to configure port triggering rules.
Trigger Start Port	The trigger port is a port (or a range of ports) that causes (or triggers) the ZyXEL Device to record the IP address of the LAN computer that sent the traffic to a server on the WAN. Type a port number or the starting port number in a range of port numbers.
Trigger End Port	Type a port number or the ending port number in a range of port numbers.
Trigger Protocol	Select the transport layer protocol from **TCP**, **UDP**, or **TCP/UDP**.
Open Start Port	The open port is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The ZyXEL Device forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service. Type a port number or the starting port number in a range of port numbers.
Open End Port	Type a port number or the ending port number in a range of port numbers.
Open Protocol	Select the transport layer protocol from **TCP**, **UDP**, or **TCP/UDP**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

11.5 The DMZ Screen

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

Figure 67 Network Settings > NAT > DMZ



Default Server Address : 192.168.1.

Note:

Enter IP address and click "Apply" to activate the DMZ host.

Clear the IP address field and click "Apply" to deactivate the DMZ host.

The following table describes the fields in this screen.

Table 49 Network Settings > NAT > DMZ

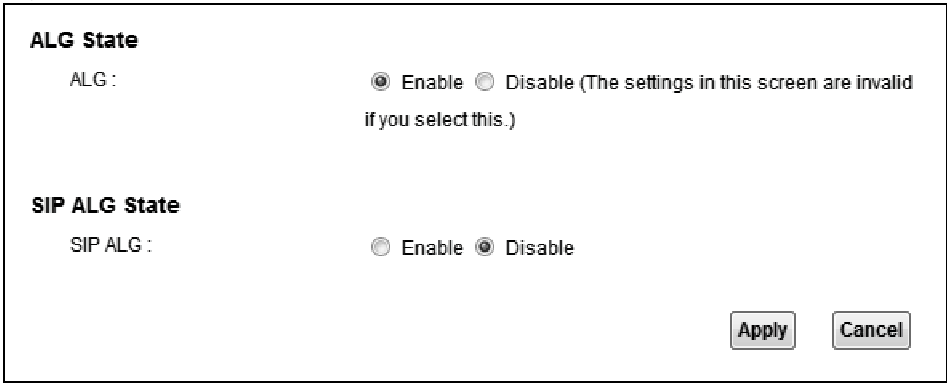
LABEL	DESCRIPTION
Default Server Address	Enter the IP address of the default server which receives packets from ports that are not specified in the **NAT Port Forwarding** screen. Note: If you do not assign a **Default Server Address**, the ZyXEL Device discards all packets received for ports that are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

11.6 The ALG Screen

Some NAT routers may include a SIP Application Layer Gateway (ALG). A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream. When the ZyXEL Device registers with the SIP register server, the SIP ALG translates the ZyXEL Device's private IP address inside the SIP data stream to a public IP address. You do not need to use STUN or an outbound proxy if your ZyXEL Device is behind a SIP ALG.

Use this screen to enable and disable the SIP (VoIP) ALG in the ZyXEL Device. To access this screen, click **Network Settings > NAT > ALG**.

Figure 68 Network Settings > NAT > ALG



ALG State

ALG : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

SIP ALG State

SIP ALG : ○ Enable ● Disable

The following table describes the fields in this screen.

Table 50 Network Settings > NAT > ALG

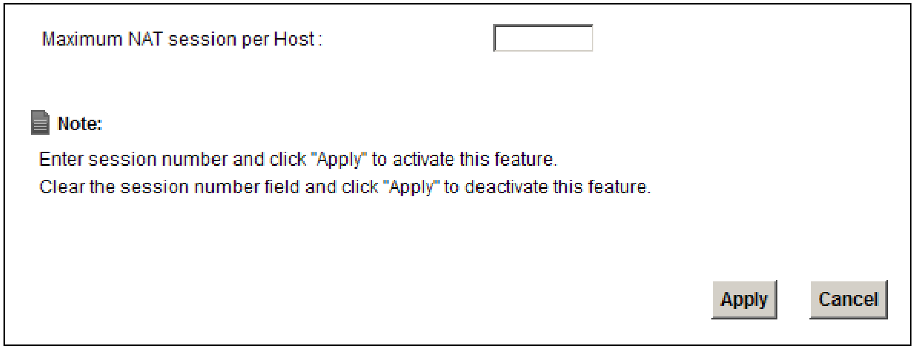
LABEL	DESCRIPTION
ALG	Enable this to make sure applications such as FTP and file transfer in IM applications work correctly with port-forwarding and address-mapping rules.
SIP ALG	Enable this to make sure SIP (VoIP) works correctly with port-forwarding and address-mapping rules.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

11.7 The Sessions Screen

Use the **Sessions** screen to limit the number of concurrent NAT sessions all clients can use.

Click **Network Settings > NAT > Sessions** to display the following screen.

Figure 69 Network Settings > NAT > Sessions



Maximum NAT session per Host :

Note:

Enter session number and click "Apply" to activate this feature.

Clear the session number field and click "Apply" to deactivate this feature.

The following table describes the fields in this screen.

Table 51 Network Settings > NAT > Sessions

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

11.8 Technical Reference

This part contains more information regarding NAT.

11.8.1 NAT Definitions

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

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

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

Table 52 NAT Definitions

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

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

11.8.2 What NAT Does

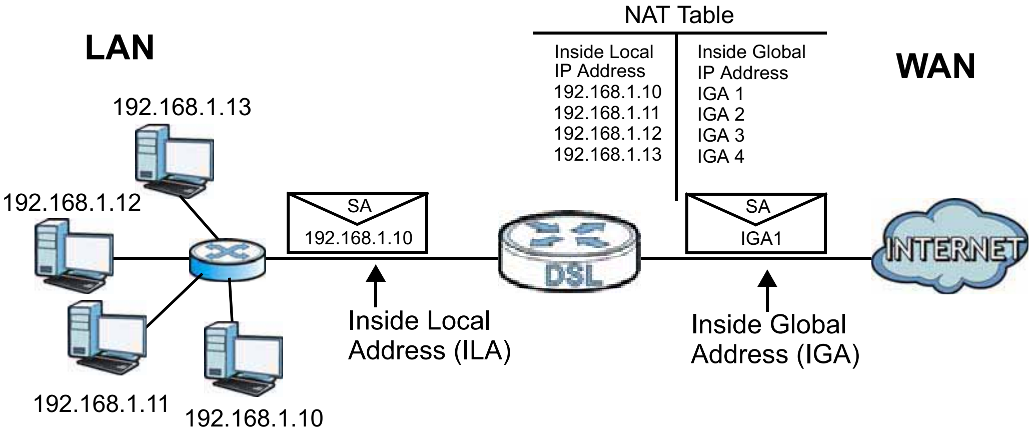
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address)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

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

11.8.3 How NAT Works

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

Figure 70 How NAT Works

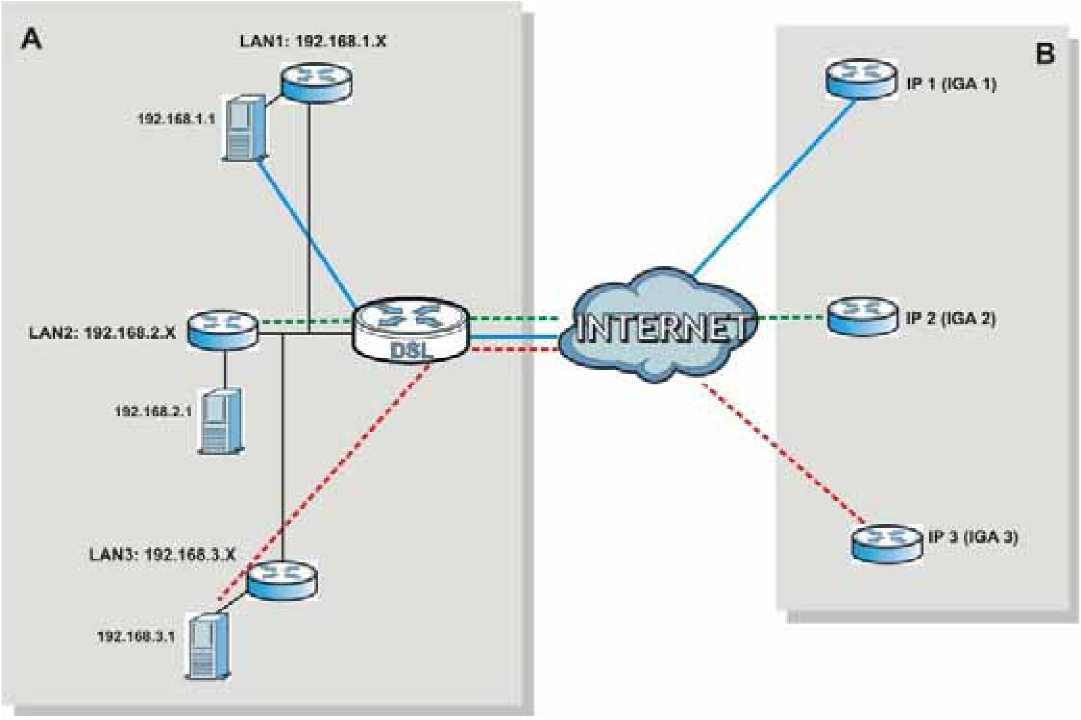


Inside Local IP Address	Inside Global IP Address
192.168.1.10	IGA 1
192.168.1.11	IGA 2
192.168.1.12	IGA 3
192.168.1.13	IGA 4

11.8.4 NAT Application

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

Figure 71 NAT Application With IP Alias



Port Forwarding: Services and Port Numbers

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

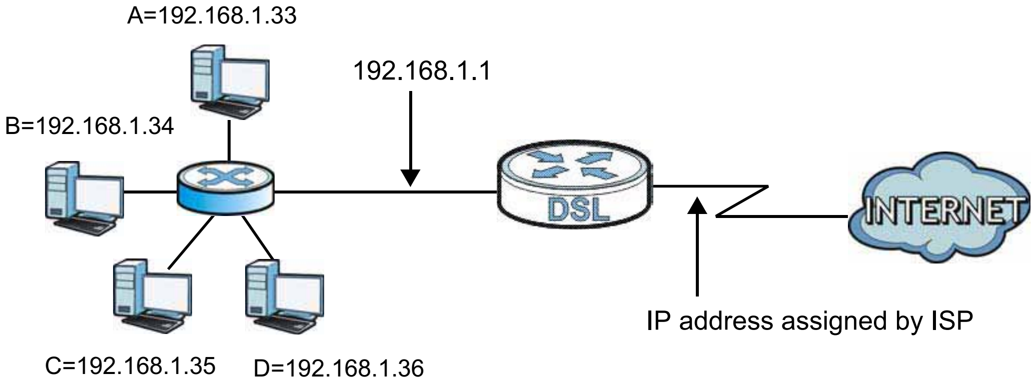
Table 53 Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
FTP (File Transfer Protocol)	21
SMTP (Simple Mail Transfer Protocol)	25
DNS (Domain Name System)	53
Finger	79
HTTP (Hyper Text Transfer protocol or WWW, Web)	80
POP3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

Port Forwarding Example

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

Figure 72 Multiple Servers Behind NAT Example



12

Dynamic DNS Setup

12.1 Overview

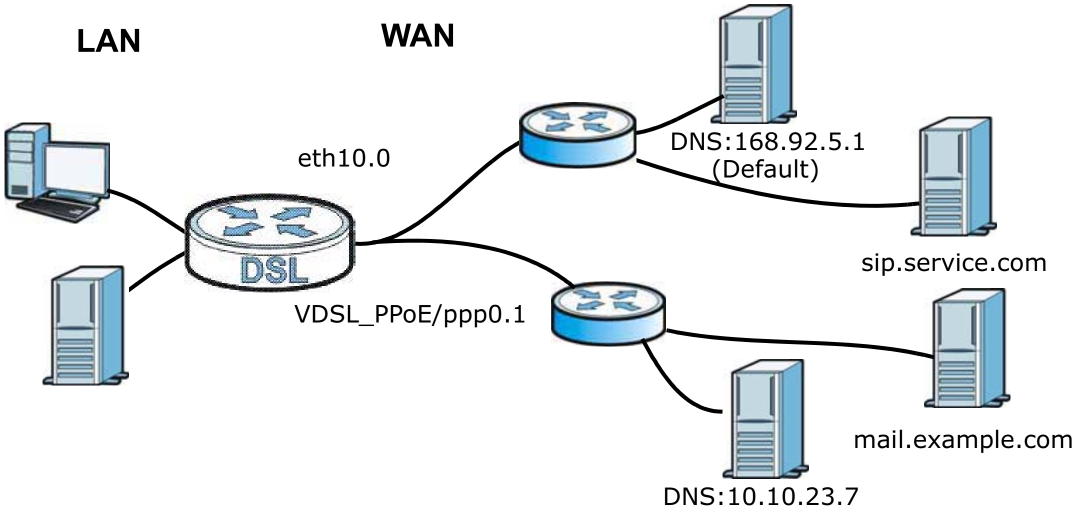
DNS

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

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

In the following example, the DNS server 168.92.5.1 obtained from the WAN interface eth10.0 is set to be the system DNS server. The DNS server 10.10.23.7 is obtained from the WAN interface VDSL_PoE/ppp0.1. You configure a DNS route for *example.com to have the ZyXEL Device forward DNS requests for the domain name mail.example.com through the WAN interface VDSL_PoE/ppp0.1 to the DNS server 10.10.23.7.

Figure 73 Example of DNS Routing Topology



Dynamic DNS

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

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

12.1.1 What You Can Do in this Chapter

- Use the **DNS Entry** screen to view, configure, or remove DNS routes (Section 12.2 on page 176).
- Use the **Dynamic DNS** screen to enable DDNS and configure the DDNS settings on the ZyXEL Device (Section 12.3 on page 178).

12.1.2 What You Need To Know

DYNDNS Wildcard

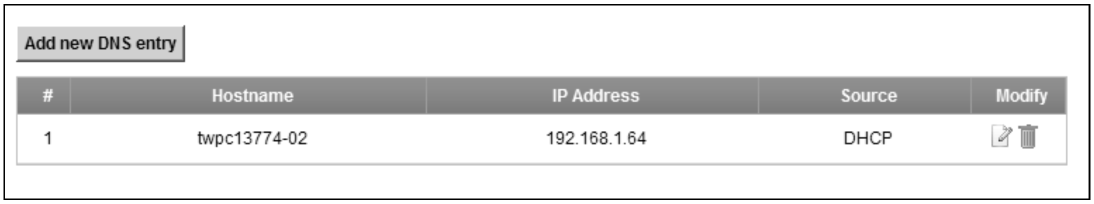
Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

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

12.2 The DNS Entry Screen

Use this screen to view and configure DNS routes on the ZyXEL Device. Click **Advanced > DNS Setting** to open the **DNS Entry** screen.

Figure 74 Advanced > DNS Setting > DNS Setting



#	Hostname	IP Address	Source	Modify
1	twpc13774-02	192.168.1.64	DHCP	

The following table describes the fields in this screen.

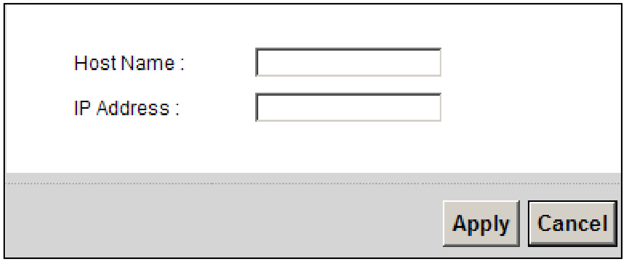
Table 54 Advanced > DNS Setting > DNS Setting

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

12.2.1 Add/Edit DNS Entry

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

Figure 75 DNS Entry: Add/Edit



The following table describes the labels in this screen.

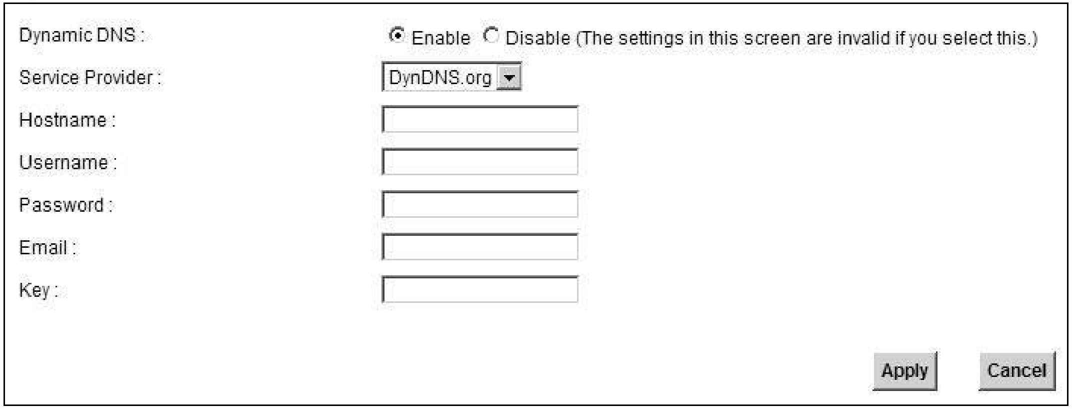
Table 55 DNS Entry: Add/Edit

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

12.3 The Dynamic DNS Screen

Use this screen to change your ZyXEL Device’s DDNS. Click **Advanced > DNS Setting > Dynamic DNS**. The screen appears as shown.

Figure 76 Advanced > DNS Setting > Dynamic DNS



Dynamic DNS : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Service Provider : DynDNS.org

Hostname :

Username :

Password :

Email :

Key :

The following table describes the fields in this screen.

Table 56 Advanced > DNS Setting > Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS	Select this check box to use dynamic DNS.
Service Provider	Select your Dynamic DNS service provider from the drop-down list box.
Hostname	Type the domain name assigned to your ZyXEL Device by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
User Name	Type your user name.
Password	Type the password assigned to you.
Email	If you select **TZO** in the **Service Provider** field, enter the user name you used to register for this service.
Key	If you select **TZO** in the **Service Provider** field, enter the password you used to register for this service.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

13

IGMP

13.1 Overview

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender to 1 recipient) or Broadcast (1 sender to everybody on the network). Multicast delivers IP packets to just a group of hosts on the network.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data. See RFC 1112, RFC 2236, and RFC 3376 for information on IGMP versions 1, 2, and 3 respectively.

13.1.1 What You Can Do in this Chapter

- Use the **General** screen to configure general IGMP proxy and IGMP packet processing settings (Section 13.2 on page 181).
- Use the **IGMP Filter** screens to control IGMP access (Section 13.3 on page 182).
- Use the **IGMP ACL** screens to block or allow access to specific multicast media channels (Section 13.4 on page 186).

13.1.2 What You Need to Know

IP Multicast Addresses

In IPv4, a multicast address allows a device to send packets to a specific group of hosts (multicast group) in a different sub-network. A multicast IP address represents a traffic receiving group, not individual receiving devices. IP addresses in the Class D range (224.0.0.0 to 239.255.255.255) are used for IP multicasting. Certain IP multicast numbers are reserved by IANA for special purposes (see the IANA web site for more information).

IGMP Snooping

A layer-2 switch can passively snoop on IGMP Query, Report and Leave (IGMP version 2) packets transferred between IP multicast routers/switches and IP multicast hosts to learn the IP multicast group membership. It checks IGMP packets passing through it, picks out the group registration information, and configures multicasting accordingly. IGMP snooping allows the ZyXEL Device to learn multicast groups without you having to manually configure them.

The ZyXEL Device forwards multicast traffic destined for multicast groups (that it has learned from IGMP snooping or that you have manually configured) to ports that are members of that group. The ZyXEL Device discards multicast traffic destined for multicast groups that it does not know. IGMP snooping generates no additional network traffic, allowing you to significantly reduce multicast traffic passing through your device.

IGMP Proxy

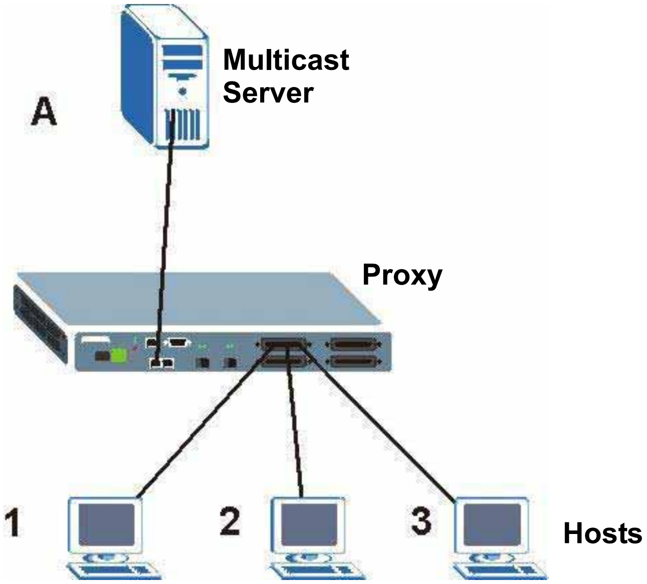
To allow better network performance, you can use IGMP proxy instead of a multicast routing protocol in a simple tree network topology.

Note: Your ZyXEL Device is an IGMP proxy.

In IGMP proxy, an upstream interface is the port that is closer to the source (or the root of the multicast tree) and is able to receive multicast traffic. There should only be one upstream interface (also known as the query port) for one query VLAN on the ZyXEL Device. A downstream interface is a port that connects to a host (such as a computer).

The following figure shows a network example where **A** is the multicast source while computers 1, 2 and 3 are the receivers. In the figure **A** is connected to the upstream interface and 1, 2 and 3 are connected to the downstream interface.

Figure 77 IGMP Proxy Network Example



The ZyXEL Device will not respond to IGMP join and leave messages on the upstream interface. The ZyXEL Device only responds to IGMP query messages on the upstream interface. The ZyXEL Device sends IGMP query messages to the hosts that are members of the query VLAN.

The ZyXEL Device only sends an IGMP leave message via the upstream interface when the last host leaves a multicast group.

Router Alert Option

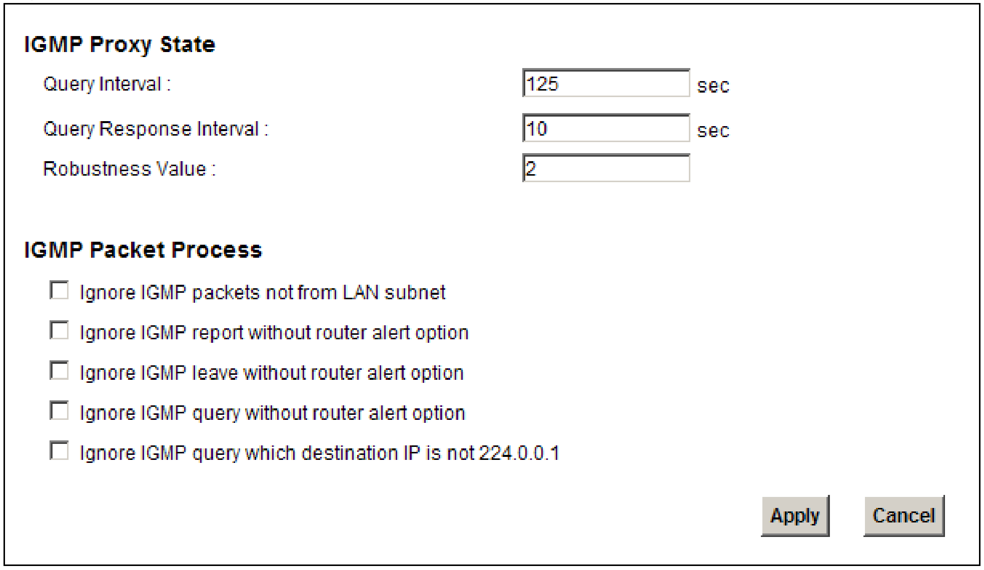
The router alert option provides a way to let routers intercept packets not addressed to them directly, without incurring any significant performance penalty. The router alert option in the IP header of an IGMP control packet tells the router to examine the packet more closely for routing information. Regular data packets do not receive the extra checking and are forwarded with little or no performance penalty. IGMP v2 and IGMP v3 both require the router alert option while IGMP v1 does not use it at all. See RFC 2113 for more information.

13.2 The IGMP General Screen

Use the **General** screen to configure general IGMP proxy and IGMP packet processing settings.

Click **Network Settings > IGMP Setting > General** to open the following screen.

Figure 78 Network Settings > IGMP Setting > General



IGMP Proxy State

Query Interval : 125 sec

Query Response Interval : 10 sec

Robustness Value : 2

IGMP Packet Process

□ Ignore IGMP packets not from LAN subnet

□ Ignore IGMP report without router alert option

□ Ignore IGMP leave without router alert option

□ Ignore IGMP query without router alert option

□ Ignore IGMP query which destination IP is not 224.0.0.1

The following table describes the fields in this screen.

Table 57 Network Settings > IGMP Setting > General

LABEL	DESCRIPTION
IGMP Proxy State	
Query Interval	Specify how many seconds since the last query the ZyXEL Device waits before it queries all directly connected networks to gather multicast group membership.
Query Response Interval	Specify how many seconds the host allots for gathering membership information from directly connected networks before it sends a report.
Robustness Value	This is the number of times the host sends a report to the ZyXEL Device when the ZyXEL Device queries for the host's status.
IGMP Packet Process	Select one or more of these fields to increase the IGMP network's security or control which types of IGMP packets the ZyXEL Device forwards.
Ignore IGMP packets not from LAN subnet	Select this to discard IGMP packets from IP addresses other than the LAN subnet.
Ignore IGMP report without router alert option	Select this to discard IGMP report packets that do not include a router alert option.
Ignore IGMP leave without router alert option	Select this to discard IGMP leave packets that do not include a router alert option.
Ignore IGMP query without router alert option	Select this to discard IGMP query packets that do not include a router alert option.

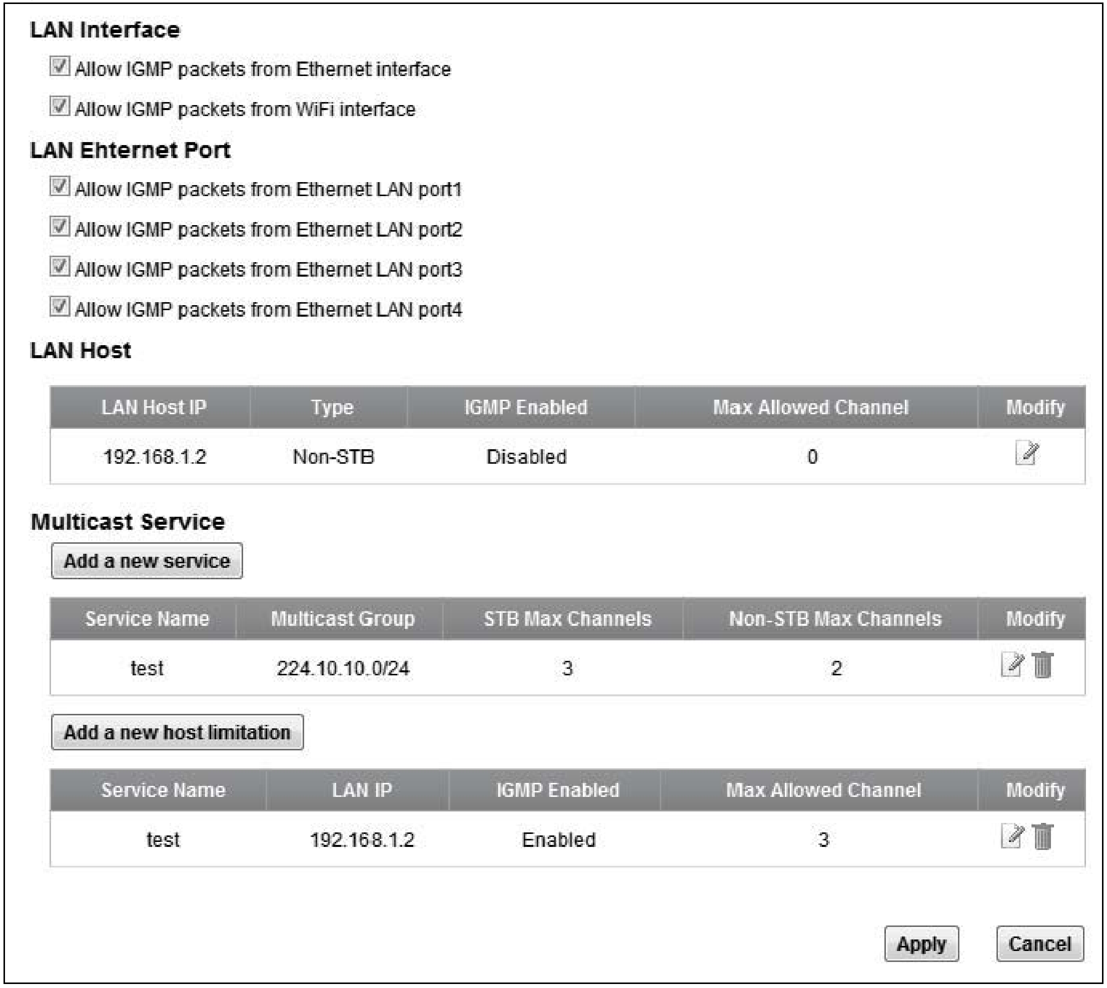
Table 57 Network Settings > IGMP Setting > General (continued)

LABEL	DESCRIPTION
Ignore IGMP query which destination IP is not 224.0.0.1	Select this to discard IGMP query packets with a destination IP address other than 224.0.0.1, the all-hosts multicast address.
Apply	Click this button to save your settings back to the ZyXEL Device.
Cancel	Click **Cancel** to restore your previously saved settings.

13.3 IGMP Filter Configuration

Use this screen to control IGMP access. Click **Network Settings > IGMP Setting > IGMP Filter** to open the following screen.

Figure 79 Network Settings > IGMP Setting > IGMP Filter



LAN Interface

☑ Allow IGMP packets from Ethernet interface

☑ Allow IGMP packets from WiFi interface

LAN Ehternet Port

☑ Allow IGMP packets from Ethernet LAN port1

☑ Allow IGMP packets from Ethernet LAN port2

☑ Allow IGMP packets from Ethernet LAN port3

☑ Allow IGMP packets from Ethernet LAN port4

LAN Host

LAN Host IP	Type	IGMP Enabled	Max Allowed Channel	Modify
192.168.1.2	Non-STB	Disabled	0	✎

Multicast Service

Service Name	Multicast Group	STB Max Channels	Non-STB Max Channels	Modify
test	224.10.10.0/24	3	2	✎ 🗑

Service Name	LAN IP	IGMP Enabled	Max Allowed Channel	Modify
test	192.168.1.2	Enabled	3	✎ 🗑

The following table describes the fields in this screen.

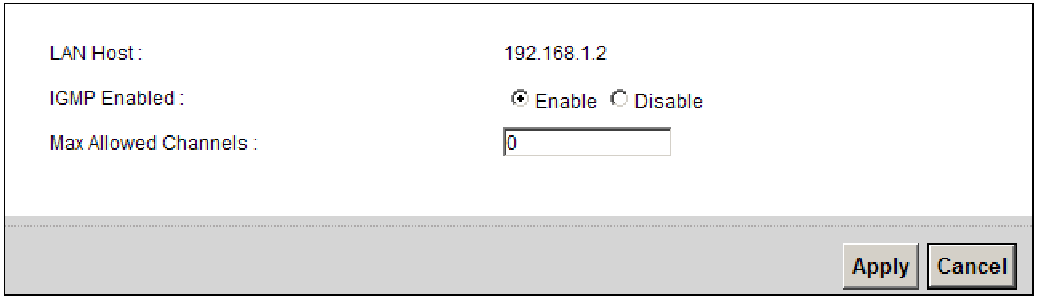
Table 58 Network Settings > IGMP Setting > IGMP Filter

LABEL	DESCRIPTION
Allow IGMP packets from Ethernet interface	Select this to accept IGMP packets received on any of the LAN Ethernet ports. Clear this to discard IGMP packets received on any of the LAN Ethernet ports.
Allow IGMP packets from WiFi interface	Select this to accept IGMP packets received through the wireless LAN interface. Clear this to discard IGMP packets received through the wireless LAN interface.
Allow IGMP packets from Ethernet LAN port1 ~ 4	Select specific LAN Ethernet ports upon which to accept IGMP packets. Clear individual LAN Ethernet port options to discard IGMP packets received on those ports.
LAN Host	This table lists the LAN computers the ZyXEL Device has detected.
LAN Host IP	This is the IP address of a computer on the ZyXEL Device's LAN.
Type	This shows whether or not the LAN device is a Set Top Box (STB).
IGMP Enabled	This shows whether or not the LAN device is allowed to access IGMP services through the ZyXEL Device.
Max Allowed Channel	This is how many IGMP channels the LAN device is allowed to subscribe to.
Modify	Click the **Edit** icon to change the entry.
Multicast Service	Use this section to limit access to IGMP multicast service domains.
Add a new service	Click this to add a new IGMP multicast service domain.
Service Name	This is the name of an IGMP multicast service domain.
Multicast Group	This is the multicast address and subnet that the service domain uses.
STB Max Channels	This is to how many of the service domain's IGMP channels a LAN STB device is allowed to subscribe.
Non-STB Max Channels	This is to how many of the service domain's IGMP channels LAN devices other than STBs are allowed to subscribe.
Modify	Click the **Edit** icon to change the entry. Click the **Delete** icon to delete the entry.
Add a new host limitation	Click this to limit a LAN host's IGMP access.
Service Name	This is the name of an IGMP multicast service domain.
LAN IP	This is the IP address of a computer on the ZyXEL Device's LAN.
IGMP Enabled	This shows whether or not the LAN device using the specified IP address is allowed to use the IGMP multicast service domain.
Max Allowed Channel	This shows to how many of the IGMP multicast service domain's channels the LAN device using the specified IP address can subscribe.
Modify	Click the **Edit** icon to change the entry. Click the **Delete** icon to delete the entry.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

13.3.1 IGMP Host Limitation Edit

Use this screen to control a LAN host's access to IGMP services through the ZyXEL Device. Click **Network Settings > IGMP Setting > IGMP Filter** and then a LAN host's **Edit** icon to open the following screen.

Figure 80 Network Settings > IGMP Setting > IGMP Filter > LAN Host Edit



LAN Host : 192.168.1.2

IGMP Enabled : ● Enable ○ Disable

Max Allowed Channels : 0

The following table describes the fields in this screen.

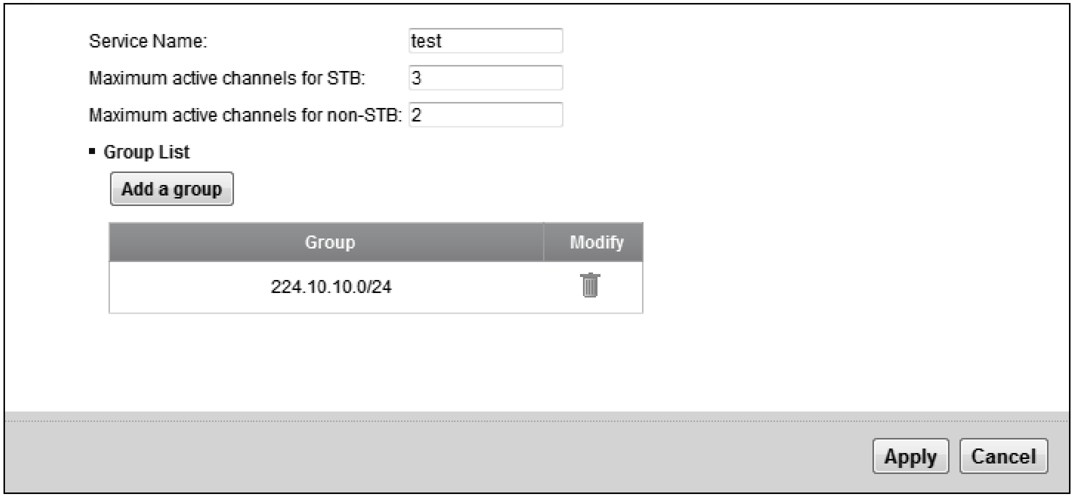
Table 59 Network Settings > IGMP Setting > IGMP Filter > LAN Host Edit

LABEL	DESCRIPTION
LAN Host	This is the IP address of one of the ZyXEL Device's LAN hosts.
IGMP Enabled	Select whether or not the LAN device using the specified IP address is allowed to access IGMP services through the ZyXEL Device.
Max Allowed Channels	Specify to how many IGMP channels the LAN device is allowed to subscribe.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

13.3.2 IGMP Service Add

Use this screen to add or edit an IGMP multicast service domain. Click **Network Settings > IGMP Setting > IGMP Filter > Add a new rule** to open the following screen.

Figure 81 Network Settings > IGMP Setting > IGMP Filter > Add a new service



Service Name: test

Maximum active channels for STB: 3

Maximum active channels for non-STB: 2

- Group List

Group	Modify
224.10.10.0/24	🗑

The following table describes the fields in this screen.

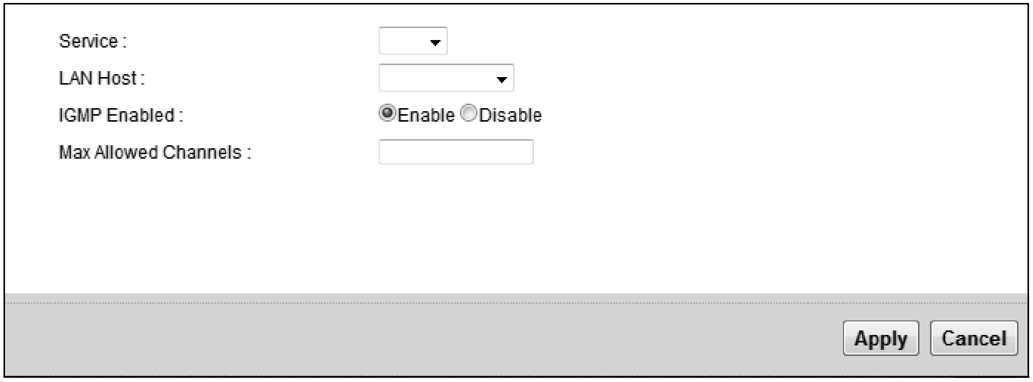
Table 60 Network Settings > IGMP Setting > IGMP Filter > Add a new service

LABEL	DESCRIPTION
Service Name	Specify a name to identify the IGMP service domain. You can enter up to 30 characters. You can use letters, numbers, hyphens (-) and underscores (_). Spaces are not allowed.
Maximum active channels for STB	Specify to how many of the service domain's IGMP channels a LAN STB device is allowed to subscribe.
Maximum active channels for Non-STB	Specify to how many of the service domain's IGMP channels LAN devices other than STBs are is allowed to subscribe.
Group List	Use this section to specify the multicast groups and subnet masks for this IGMP service domain.
Add a group	Click this to add a multicast group and subnet mask to this IGMP service domain.
Group	This column lists the multicast groups and subnet masks for this IGMP service domain.
Modify	Click the **Delete** icon to delete the entry.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

13.3.3 IGMP Host Limitation Add

Use this screen to control a LAN host's access to an IGMP multicast service domain. Click **Network Settings > IGMP Setting > IGMP Filter > Add a new host limitation** to open the following screen.

Figure 82 Network Settings > IGMP Setting > IGMP Filter > Add a new host limitation



Service :

LAN Host :

IGMP Enabled : ● Enable ○ Disable

Max Allowed Channels :

The following table describes the fields in this screen.

Table 61 Network Settings > IGMP Setting > IGMP Filter > Add a new host limitation

LABEL	DESCRIPTION
Service	Specify the name of the IGMP multicast service domain to which you want to block or allow access.
LAN Host	Select the IP address of one of the ZyXEL Device's LAN hosts.
IGMP Enabled	Select whether or not the LAN device using the specified IP address is allowed to use the IGMP multicast service domain.

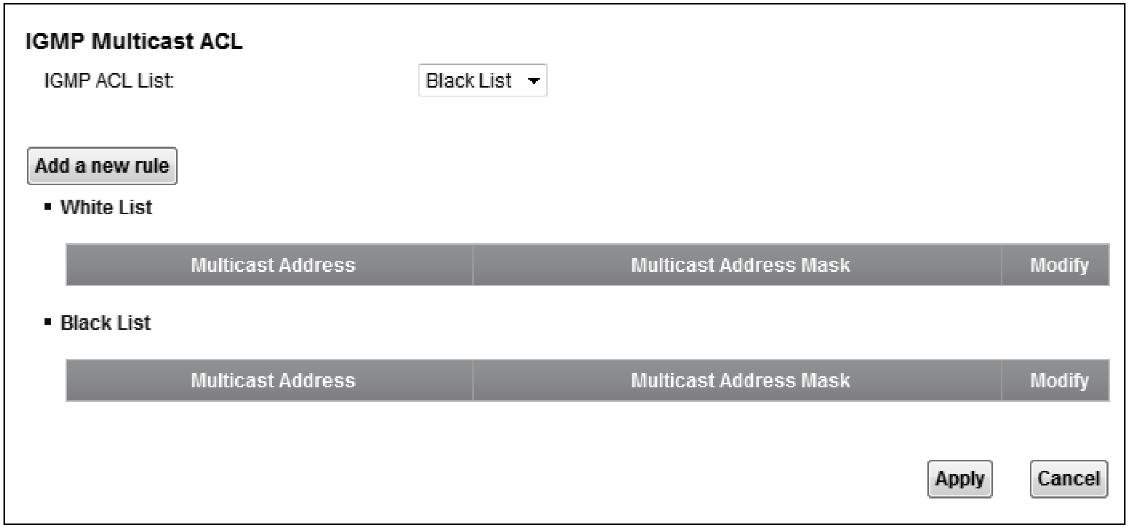
Table 61 Network Settings > IGMP Setting > IGMP Filter > Add a new host limitation (continued)

LABEL	DESCRIPTION
Max Allowed Channels	This shows to how many of the IGMP multicast service domain's channels the LAN device using the specified IP address can subscribe.
IGMP Enabled	Select whether or not the LAN device is allowed to access IGMP services through the ZyXEL Device.
Max Allowed Channels	Specify to how many IGMP channels the LAN device is allowed to subscribe.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

13.4 IGMP ACL Configuration

Use the IGMP Access Control List (ACL) to block or allow access to specific multicast media channels. Click **Network Settings > IGMP Setting > IGMP ACL** to open the following screen.

Figure 83 Network Settings > IGMP Setting > IGMP ACL



IGMP Multicast ACL

IGMP ACL List: Black List

The following table describes the fields in this screen.

Table 62 Network Settings > IGMP Setting > IGMP ACL

LABEL	DESCRIPTION
IGMP ACL List	Select **Black List** to block access to specific multicast channels and allow access to other multicast channels. Select **White List** to allow access to only specific multicast channels and block access to other multicast channels. Select **Disabled** to have the ZyXEL Device not restrict which multicast channels the multimedia devices on the LAN can access.
Add a new rule	Click this to create a new IGMP ACL rule.
White List	These rules are for allowing access to specified multicast IP addresses.
Multicast Address	This is the multicast IP address of a multicast media channel to which you want to allow access.

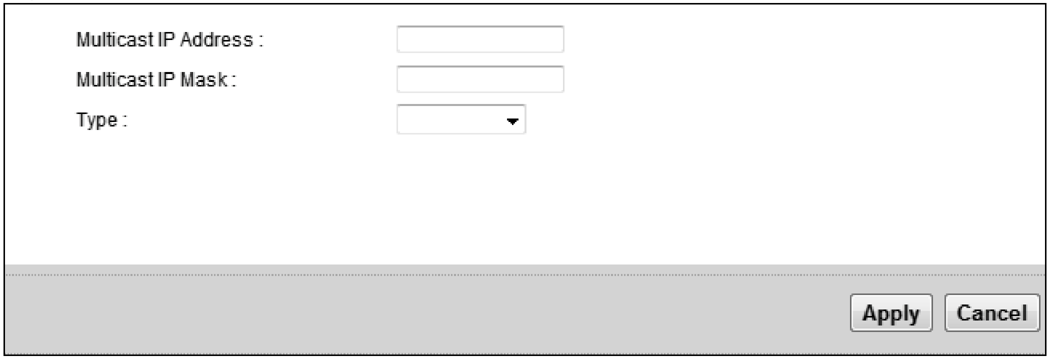
Table 62 Network Settings > IGMP Setting > IGMP ACL (continued)

LABEL	DESCRIPTION
Multicast Address Mask	This is the subnet mask of the multicast IP address.
Black List	These rules are for blocking access to specific multicast IP addresses.
Multicast Address	This is the multicast IP address of a multicast media channel to which you want to block access.
Multicast Address Mask	This is the subnet mask of the multicast IP address.
Modify	Click the **Edit** icon to change the entry. Click the **Delete** icon to delete the entry.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

13.4.1 IGMP ACL Add

Use this screen to configure the multicast IP address of a multicast media channel to which you want to block or allow access. Click **Network Settings > IGMP Setting > IGMP ACL > Add a new rule** to open the following screen.

Figure 84 Network Settings > IGMP Setting > IGMP ACL > Add a new rule



Multicast IP Address :

Multicast IP Mask :

Type :

The following table describes the fields in this screen.

Table 63 Network Settings > IGMP Setting > IGMP ACL > Add a new rule

LABEL	DESCRIPTION
Multicast IP Address	Enter the multicast IP address of a multicast media channel to which you want to block or allow access.
Multicast IP Mask	Enter the subnet mask of the multicast IP address.
Type	Select **Black List** to have this entry block access to the specified multicast IP address. Select **White List** to have this entry allow access to the specified multicast IP address.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

14

Interface Group

14.1 Overview

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

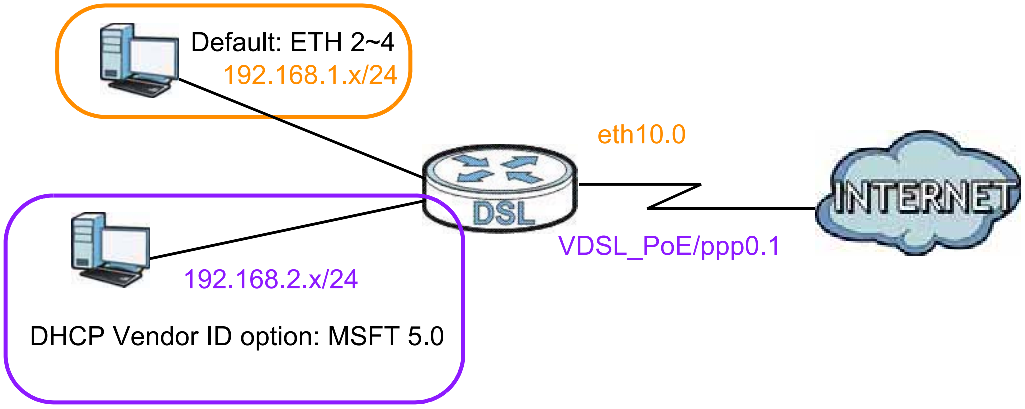
14.2 The Interface Group Screen

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

Use the **LAN** screen to configure the private IP addresses the DHCP server on the ZyXEL Device assigns to the clients in the default and/or user-defined groups. If you set the ZyXEL Device to assign IP addresses based on the client's DHCP Vendor ID option information, you must enable DHCP server and configure LAN TCP/IP settings for both the default and user-defined groups. See Chapter 8 on page 115 for more information.

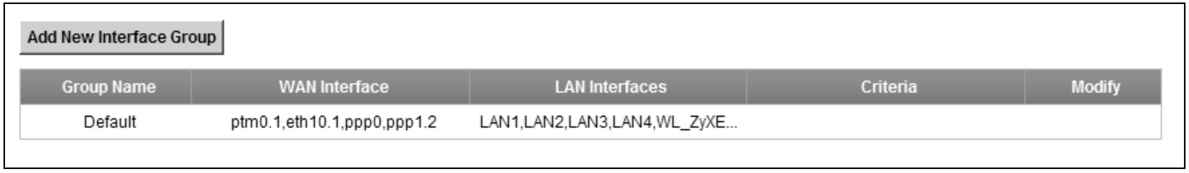
In the following example, the client that sends packets with the DHCP Vendor ID option set to MSFT 5.0 (meaning it is a Windows 2000 DHCP client) is assigned the IP address 192.168.2.2 and uses the WAN VDSL_PoE/ppp0.1 interface.

Figure 85 Interface Grouping Application



Click **Network Settings > Interface Group** to open the following screen.

Figure 86 Network Settings > Interface Group



Group Name	WAN Interface	LAN Interfaces	Criteria	Modify
Default	ptm0.1,eth10.1,ppp0,ppp1.2	LAN1,LAN2,LAN3,LAN4,WL_ZyXE...		

The following table describes the fields in this screen.

Table 64 Network Settings > Interface Group

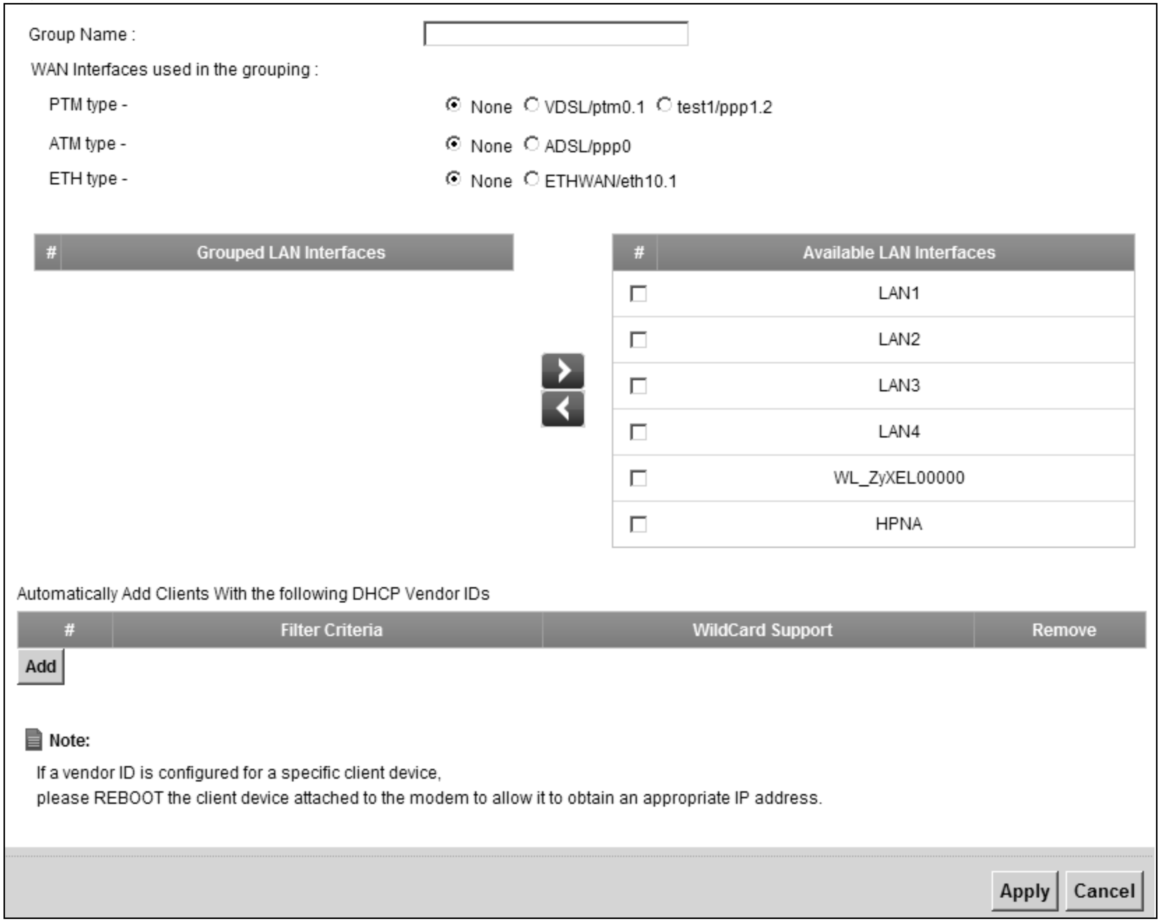
LABEL	DESCRIPTION
Add New Interface Group	Click this button to create a new interface group.
Group Name	This shows the descriptive name of the group.
WAN Interface	This shows the WAN interfaces in the group.
LAN Interfaces	This shows the LAN interfaces in the group.
Criteria	This shows the filtering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

14.2.1 Interface Group Configuration

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

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

Figure 87 Interface Group Configuration



Group Name :

WAN Interfaces used in the grouping :

PTM type - ● None ○ VDSL/ptm0.1 ○ test1/ppp1.2

ATM type - ● None ○ ADSL/ppp0

ETH type - ● None ○ ETHWAN/eth10.1

#	Grouped LAN Interfaces

#	Available LAN Interfaces
□	LAN1
□	LAN2
□	LAN3
□	LAN4
□	WL_ZyXEL00000
□	HPNA

Automatically Add Clients With the following DHCP Vendor IDs

#	Filter Criteria	WildCard Support	Remove

Add

Note:

If a vendor ID is configured for a specific client device,
please REBOOT the client device attached to the modem to allow it to obtain an appropriate IP address.

The following table describes the fields in this screen.

Table 65 Interface Group Configuration

LABEL	DESCRIPTION
Group Name	Enter a name to identify this group. You can enter up to 30 characters. You can use letters, numbers, hyphens (-) and underscores (_). Spaces are not allowed.
WAN Interface used in the grouping	Select the WAN interface this group uses. The group can have up to one PTM interface and up to one ATM interface. Select **No Interface/None** to not add a WAN interface to this group.
Grouped LAN Interfaces Available LAN Interfaces	Select one or more LAN interfaces (Ethernet LAN, HPNA or wireless LAN) in the **Available LAN Interfaces** list and use the left arrow to move them to the **Grouped LAN Interfaces** list to add the interfaces to this group. To remove a LAN or wireless LAN interface from the **Grouped LAN Interfaces**, use the right-facing arrow.
Automatically Add Clients With the following DHCP Vendor IDs	Click **Add** to identify LAN hosts to add to the interface group by criteria such as the type of the hardware or firmware. See Section 14.2.2 on page 192 for more information.
#	This shows the index number of the rule.

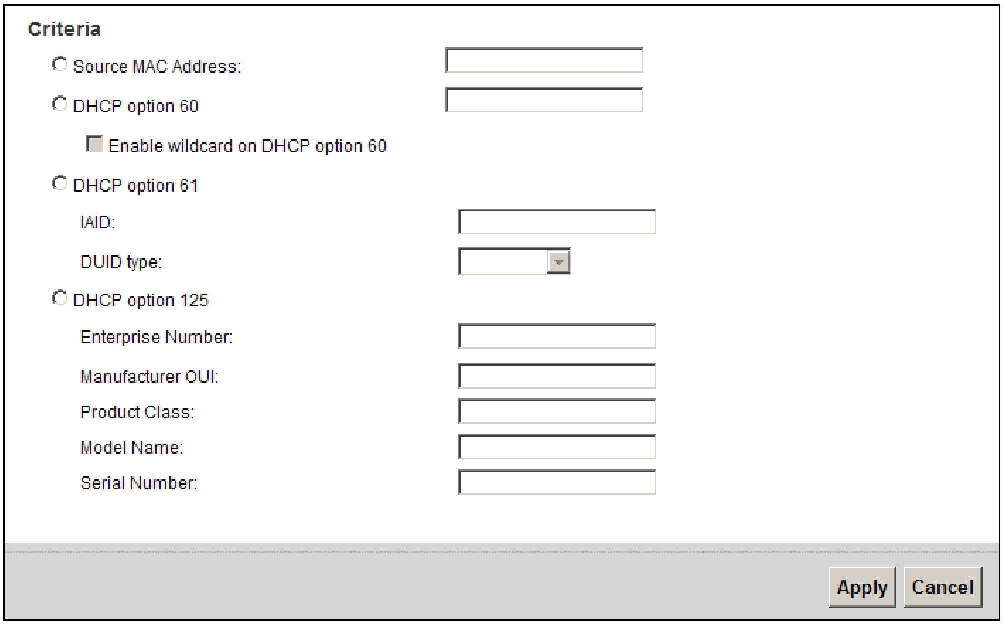
Table 65 Interface Group Configuration (continued)

LABEL	DESCRIPTION
Filter Criteria	This shows the filtering criteria. The LAN interface on which the matched traffic is received will belong to this group automatically.
WildCard Support	This shows if wildcard on DHCP option 60 is enabled.
Remove	Click the **Remove** icon to delete this rule from the ZyXEL Device.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

14.2.2 Interface Grouping Criteria

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

Figure 88 Interface Grouping Criteria



The following table describes the fields in this screen.

Table 66 Interface Grouping Criteria

LABEL	DESCRIPTION
Source MAC Address	Enter the source MAC address of the packet.
DHCP Option 60	Select this option and enter the Vendor Class Identifier (Option 60) of the matched traffic, such as the type of the hardware or firmware.
Enable wildcard on DHCP option 60 option	Select this option to be able to use wildcards in the Vendor Class Identifier configured for DHCP option 60.
DHCP Option 61	Select this and enter the device identity of the matched traffic.
IAID	Enter the Identity Association Identifier (IAID) of the device, for example, the WAN connection index number.

Table 66 Interface Grouping Criteria (continued)

LABEL	DESCRIPTION
DUID type	Select **DUID-LLT** (DUID Based on Link-layer Address Plus Time) to enter the hardware type, a time value and the MAC address of the device. Select **DUID-EN** (DUID Assigned by Vendor Based upon Enterprise Number) to enter the vendor’s registered enterprise number. Select **DUID-LL** (DUID Based on Link-layer Address) to enter the device’s hardware type and hardware address (MAC address) in the following fields. Select **Other** to enter any string that identifies the device in the DUID field.
DHCP Option 125	Select this and enter vendor specific information of the matched traffic.
Enterprise Number	Enter the vendor’s 32-bit enterprise number registered with the IANA (Internet Assigned Numbers Authority).
Manufacturer OUI	Specify the vendor’s OUI (Organization Unique Identifier). It is usually the first three bytes of the MAC address.
Product Class	Enter the product class of the device.
Model Name	Enter the model name of the device.
Serial Number	Enter the serial number of the device.
WildCard Support	This shows if wildcard on DHCP option 60 is enabled.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to exit this screen without saving.

Firewall

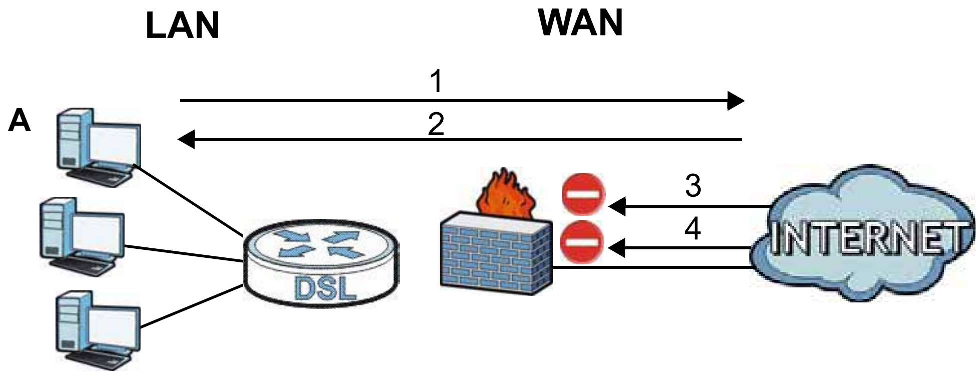
15.1 Overview

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

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

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

Figure 89 Default Firewall Action



15.1.1 What You Can Do in this Chapter

- Use the **Firewall** screen to configure the security level of the firewall on the ZyXEL Device (Section 15.2 on page 197).
- Use the **Protocol** screen to add or remove predefined Internet services and configure firewall rules (Section 15.3 on page 197).
- Use the **Access Control** screen to view and configure incoming/outgoing filtering rules (Section 15.4 on page 200).

15.1.2 What You Need to Know

SYN Attack

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

DoS

Denials of Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to network resources. The ZyXEL Device is pre-configured to automatically detect and thwart all known DoS attacks.

DDoS

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

LAND Attack

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

Ping of Death

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

SPI

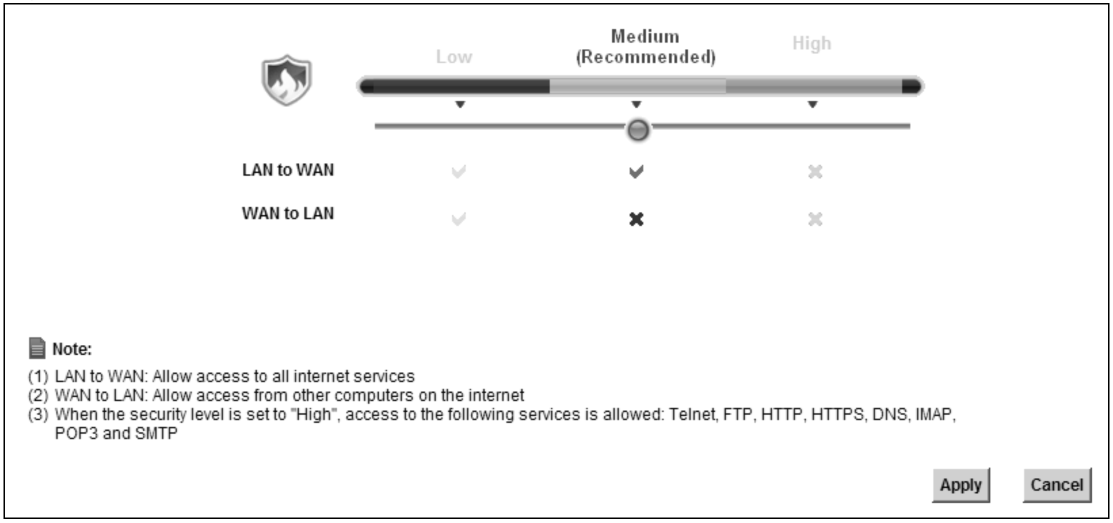
Stateful Packet Inspection (SPI) tracks each connection crossing the firewall and makes sure it is valid. Filtering decisions are based not only on rules but also context. For example, traffic from the WAN may only be allowed to cross the firewall in response to a request from the LAN.

15.2 The Firewall Screen

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

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

Figure 90 Security Settings > Firewall



Note:
(1) LAN to WAN: Allow access to all internet services
(2) WAN to LAN: Allow access from other computers on the internet
(3) When the security level is set to "High", access to the following services is allowed: Telnet, FTP, HTTP, HTTPS, DNS, IMAP, POP3 and SMTP

The following table describes the labels in this screen.

Table 67 Security Settings > Firewall

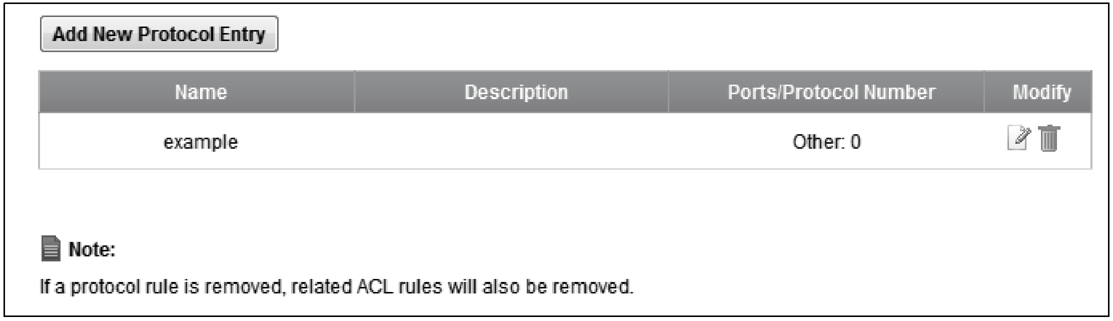
LABEL	DESCRIPTION
Low	Select **Low** to allow LAN to WAN and WAN to LAN packet directions.
Medium	Select **Medium** to allow LAN to WAN but deny WAN to LAN packet directions.
High	Select **High** to deny LAN to WAN and WAN to LAN packet directions.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

15.3 The Protocol Screen

You can configure customized services and port numbers in the **Protocol** screen. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. See Appendix E on page 333 for some examples.

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

Figure 91 Security Settings > Firewall > Protocol



Name	Description	Ports/Protocol Number	Modify
example		Other: 0	

Note:

If a protocol rule is removed, related ACL rules will also be removed.

The following table describes the labels in this screen.

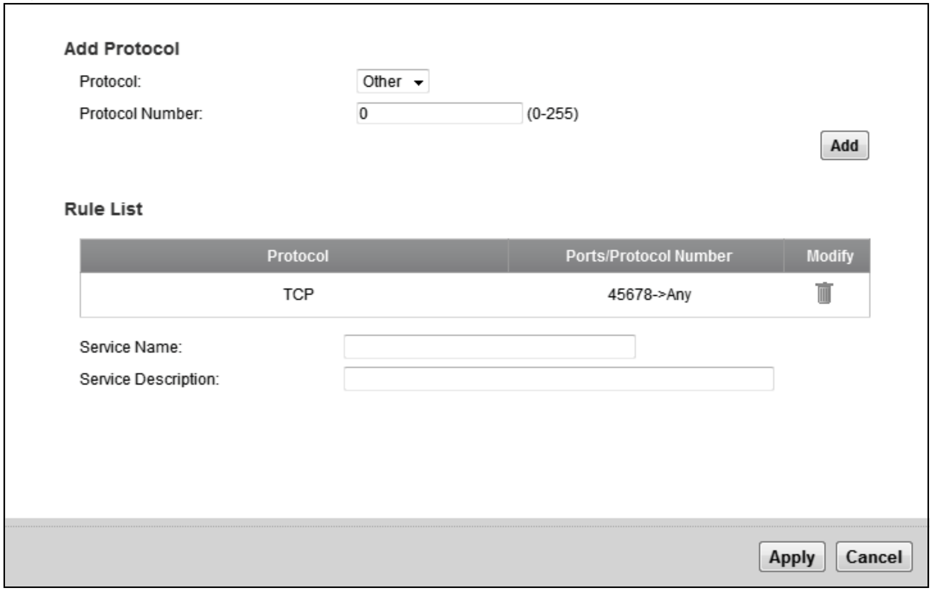
Table 68 Security Settings > Firewall > Protocol

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

15.3.1 Add a Protocol

Use this screen to add a customized service rule that you can use in the firewall’s ACL rule configuration. Click **Add New Protocol Entry** in the **Protocol** screen to display the following screen.

Figure 92 Security Settings > Firewall > Protocol > Add



Add Protocol

Protocol: Other

Protocol Number: 0 (0-255)

Rule List

Protocol	Ports/Protocol Number	Modify
TCP	45678->Any	🗑

Service Name:

Service Description:

The following table describes the labels in this screen.

Table 69 Security Settings > Firewall > Protocol > Add

LABEL	DESCRIPTION
Add Protocol	
Protocol	Choose the IP protocol (**TCP**, **UDP**, **ICMP**, or **Other**) that defines your customized port from the drop-down list box. Select **Other** to be able to enter a protocol number.
Source/ Destination Port	These fields are displayed if you select **TCP** or **UDP** as the IP port. Select **Single** to specify one port only or **Range** to specify a span of ports that define your customized service. If you select **Any**, the service is applied to all ports. Type a single port number or the range of port numbers that define your customized service.
Protocol Number	This field is displayed if you select **Other** as the protocol. Enter the protocol number of your customized port.
Add	Click this to add the protocol to the **Rule List** below.
Rule List	
Protocol	This is the IP port (**TCP**, **UDP**, **ICMP**, or **Other**) that defines your customized port.
Ports/Protocol Number	For **TCP**, **UDP**, **ICMP**, or **TCP/UDP** protocol rules this shows the port number or range that defines the custom service. For other IP protocol rules this shows the protocol number.
Modify	Click the **Delete** icon to remove the rule.
Service Name	Enter a unique name (up to 32 printable English keyboard characters, including spaces) for your customized port.

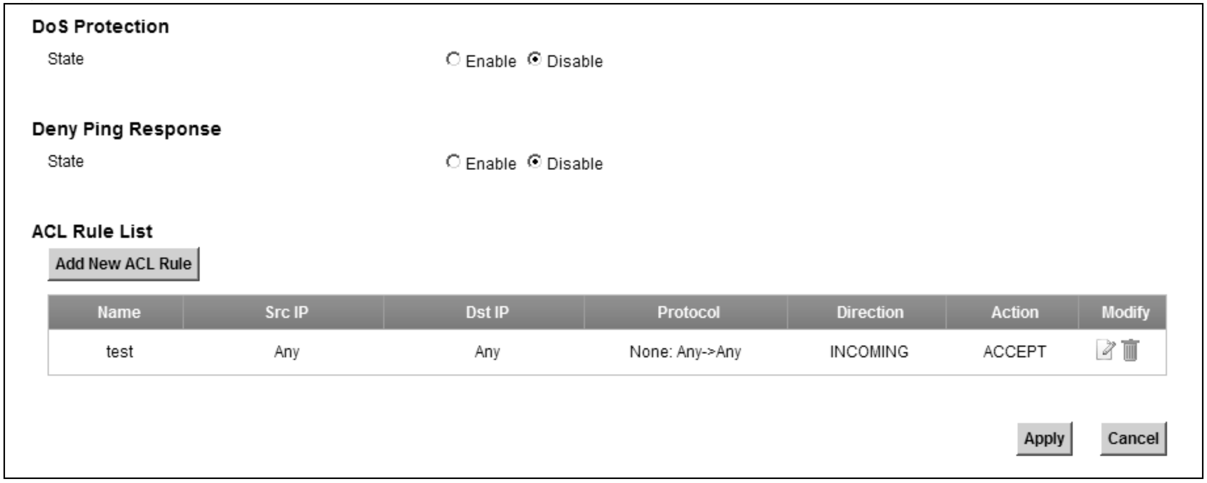
Table 69 Security Settings > Firewall > Protocol > Add (continued)

LABEL	DESCRIPTION
Service Description	Enter a description for your customized port.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

15.4 The Access Control Screen

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

Figure 93 Security Settings > Firewall > Access Control



DoS Protection

State ○ Enable ● Disable

Deny Ping Response

State ○ Enable ● Disable

ACL Rule List

Name	Src IP	Dst IP	Protocol	Direction	Action	Modify
test	Any	Any	None: Any->Any	INCOMING	ACCEPT	

The following table describes the labels in this screen.

Table 70 Security Settings > Firewall > Access Control

LABEL	DESCRIPTION
DoS Protection	DoS (Denial of Service) attacks can flood your Internet connection with invalid packets and connection requests, using so much bandwidth and so many resources that Internet access becomes unavailable.
State	Select the **Enable** check box to enable protection against DoS attacks.
Deny Ping Response	You can block ping request packets by enabling this function.
State	Select the **Enable** check box to block ping packets.
Add New ACL Rule	Click this to go to add a filter rule for incoming or outgoing IP traffic.
Name	This displays the name of the rule.
Src IP	This displays the source IP addresses to which this rule applies. Please note that a blank source address is equivalent to **Any**.
Dst IP	This displays the destination IP addresses to which this rule applies. Please note that a blank destination address is equivalent to **Any**.
Protocol	This displays the transport layer protocol that defines the service to which this rule applies.

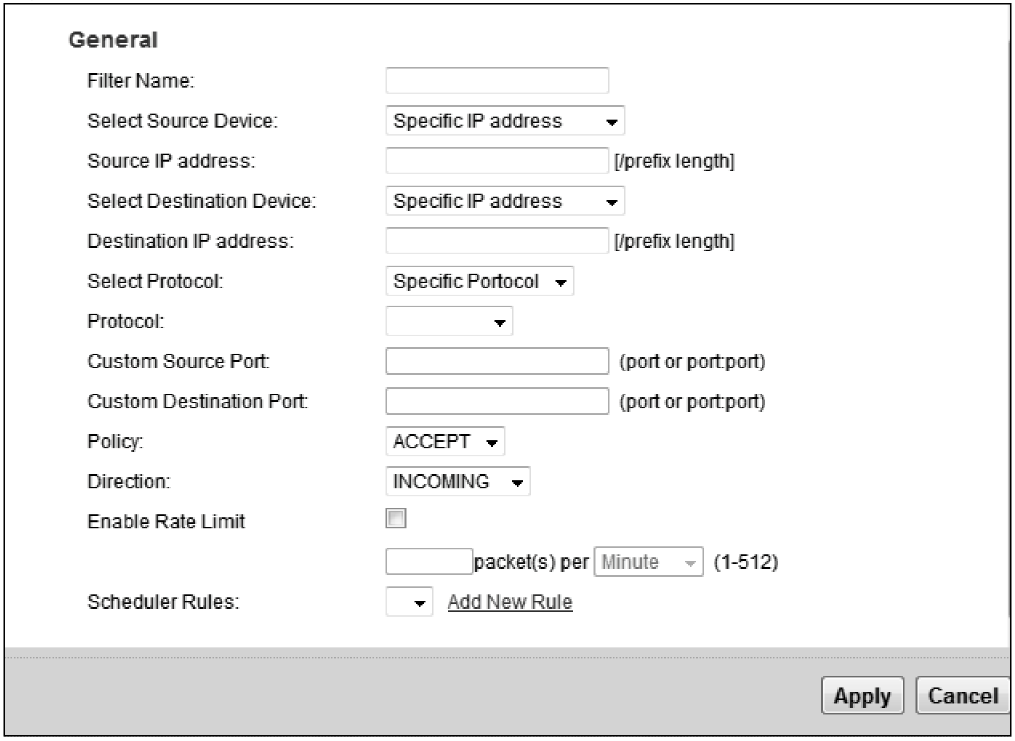
Table 70 Security Settings > Firewall > Access Control (continued)

LABEL	DESCRIPTION
Direction	This displays the direction of traffic to which this rule applies.
Action	This field displays whether the rule silently discards packets (**DROP**), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (**REJECT**) or allows the passage of packets (**ACCEPT**).
Modify	Click the **Edit** icon to edit the rule. Click the **Delete** icon to delete an existing rule. Note that subsequent rules move up by one when you take this action.
Apply	Click **Apply** to save the DoS Protection settings.
Cancel	Click **Cancel** to restore your previously saved settings.

15.4.1 Add/Edit an ACL Rule

Click **Add New ACL Rule** or the **Edit** icon next to an existing ACL rule in the **Access Control** screen. The following screen displays.

Figure 94 Security Settings > Firewall > Access Control > Add/Edit



General

Filter Name:

Select Source Device: Specific IP address

Source IP address: [/prefix length]

Select Destination Device: Specific IP address

Destination IP address: [/prefix length]

Select Protocol: Specific Portocol

Protocol:

Custom Source Port: (port or port:port)

Custom Destination Port: (port or port:port)

Policy: ACCEPT

Direction: INCOMING

Enable Rate Limit ☐

packet(s) per Minute (1-512)

Scheduler Rules: Add New Rule

The following table describes the labels in this screen.

Table 71 Security Settings > Firewall > Access Control > Add/Edit

LABEL	DESCRIPTION
General	
Filter Name	Enter a descriptive name of up to 16 alphanumeric characters, not including spaces, underscores, and dashes. You must enter the filter name to add an ACL rule. This field is read-only if you are editing the ACL rule.

Table 71 Security Settings > Firewall > Access Control > Add/Edit (continued)

LABEL	DESCRIPTION
Select Source Device	Select the source device to which the ACL rule applies. If you select **Specific IP Address**, enter the source IP address in the field below.
Source IP Address	Enter the source IP address.
Select Destination Device	Select the destination device to which the ACL rule applies. If you select **Specific IP Address**, enter the destiniation IP address in the field below.
Destination IP Address	Enter the destination IP address.
Select Protocol	Select the transport layer protocol that defines your customized port from the drop-down list box. The specific protocol rule sets you add in the **Security Settings > Firewall > Protocol > Add** screen display in this list. If you want to configure a customized protocol, select **Specific Protocol**.
Protocol	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Choose the IP port (**TCP/UDP**, **TCP**, **UDP**, or **ICMP**) that defines your customized port from the drop-down list box.
Custom Source Port	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Enter a single port number or the range of port numbers of the source.
Custom Destination Port	This field is displayed only when you select **Specific Protocol** in **Select Protocol**. Enter a single port number or the range of port numbers of the destination.
Policy	Use the drop-down list box to select whether to discard (**DROP**), deny and send an ICMP destination-unreachable message to the sender of (**REJECT**) or allow the passage of (**ACCEPT**) packets that match this rule.
Direction	Use the drop-down list box to select the direction of traffic to which this rule applies.
Enable Rate Limit	Select this check box to set a limit on the upstream/downstream transmission rate for the specified protocol. Specify how many packets per minute or second the transmission rate is.
Scheduler Rules	Select a schedule rule for this ACL rule form the drop-down list box. You can configure a new schedule rule by click **Add new rule**. This will bring you to the **Security Settings > Scheduler Rules** screen.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

16

MAC Filter

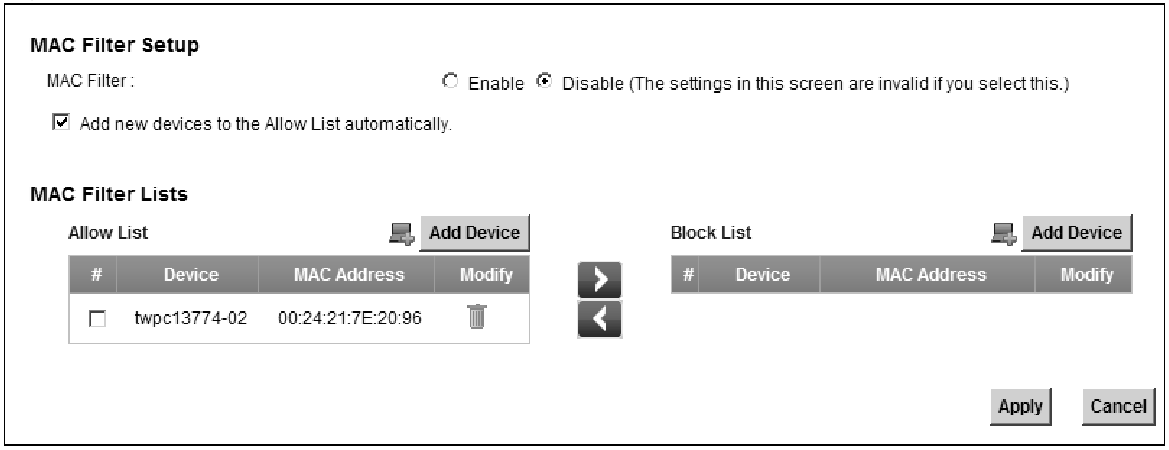
16.1 Overview

This screen allows you to configure the ZyXEL Device to give exclusive access to specific devices or exclude specific devices from accessing the ZyXEL Device. Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC addresses of the devices to configure this screen.

16.2 The MAC Filter Screen

Use this screen to change your ZyXEL Device's MAC filter settings. Click **Security Settings** > **MAC Filter**. The screen appears as shown.

Figure 95 Security Settings > MAC Filter



MAC Filter Setup

MAC Filter : ○ Enable ● Disable (The settings in this screen are invalid if you select this.)

☑ Add new devices to the Allow List automatically.

MAC Filter Lists

Allow List

#	Device	MAC Address	Modify
□	twpc13774-02	00:24:21:7E:20:96	🗑

Block List

#	Device	MAC Address	Modify

The following table describes the labels in this screen.

Table 72 Security Settings > MAC Filter

LABEL	DESCRIPTION
MAC Filter Setup	
MAC Filter	Select **Enable** to activate the MAC filter function. Otherwise, select **Disable**.
Add new devices to the Allow List automatically	Select this check box if you want the ZyXEL Device to automatically add the newly connected devices to the **Allow List**.
MAC Filter Lists	

Table 72 Security Settings > MAC Filter (continued)

LABEL	DESCRIPTION
Allow List Block List	The devices in this list are permitted or denied access to the ZyXEL Device. Select an entry from the **Allow List** and use the **>** button to add it to the **Block List**. Select an entry from the **Block List** and use the **<** button to add it to the **Allow List**.
Add Device	Select this to display the **Add Device** screen which you can add a device to the MAC filter **Allow List**. Enter the device's MAC address and click **OK**.
#	This is the index number of the entry.
Device	This is the name of the device that is allowed access to the ZyXEL Device.
MAC Address	This is the MAC address of the device that is allowed access to the ZyXEL Device.
Modify	Select the entry(ies) that you want to delete in the **Remove** column, then click the **Delete** icon.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

17

Parental Control

17.1 Overview

Parental control allows you to permit or block access to certain web sites from home network computers.

You can define time periods and days during which the ZyXEL Device performs parental control on a specific user in the **Security Settings > Scheduler Rules** screen (see Chapter 18 on page 209 for detailed information).

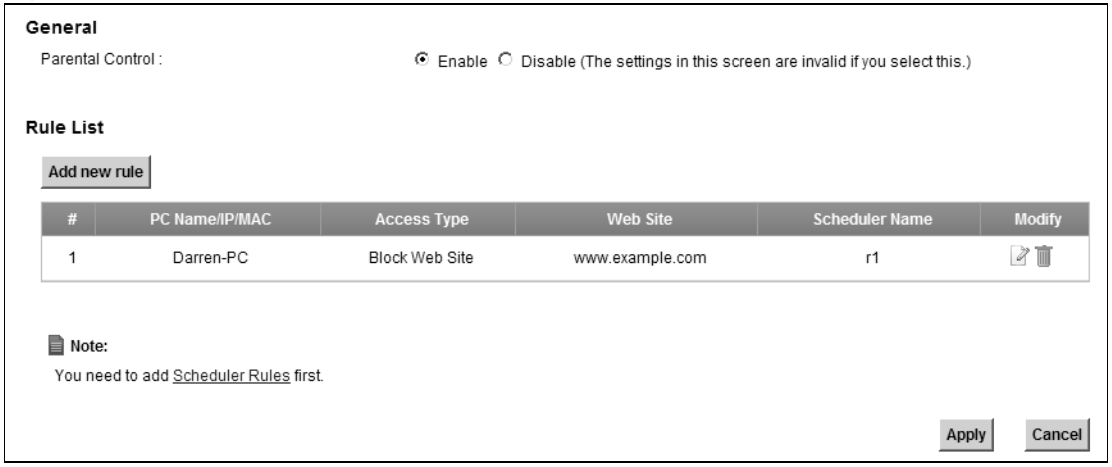
17.2 The Parental Control Screen

Use this screen to configure parental control settings to block the users on your network from accessing certain web sites.

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

Note: You must configure a scheduler rule in the **Advanced > Scheduler Rule** screen (Section 18.2 on page 209) before the parental control function can be enabled. Click **Scheduler Rule** in the note to go to the **Scheduler Rule** screen for configurations.

Figure 96 Parental Control



General

Parental Control : ● Enable ○ Disable (The settings in this screen are invalid if you select this.)

Rule List

#	PC Name/IP/MAC	Access Type	Web Site	Scheduler Name	Modify
1	Darren-PC	Block Web Site	www.example.com	r1	

Note:

You need to add Scheduler Rules first.

The following table describes the fields in this screen.

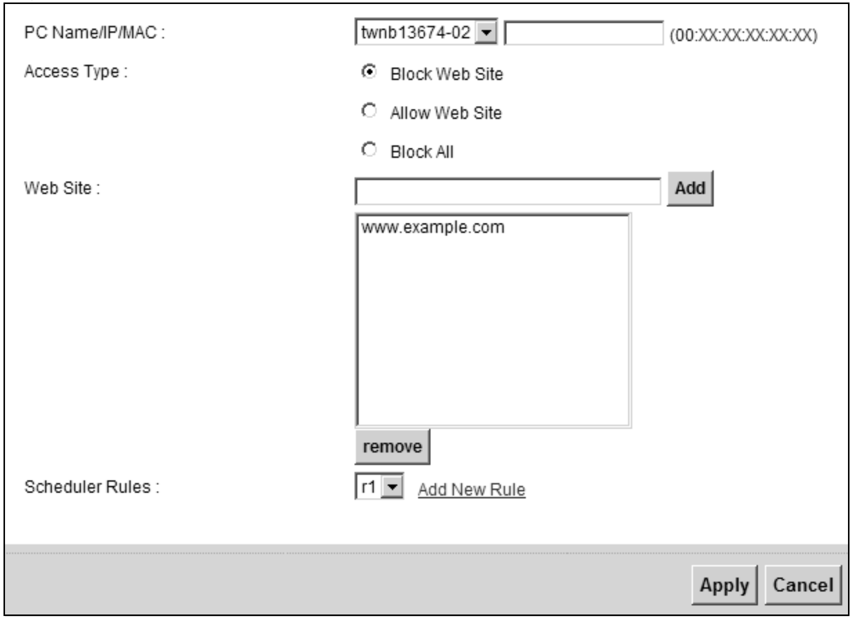
Table 73 Parental Control

LABEL	DESCRIPTION
Add new rule	Click this to create a new parental control rule.
#	This is the index number of the rule.
PC Name/IP/MAC	The ZyXEL Device allows or prohibits the users from viewing the Web sites with the URLs listed below.
Access Type	This shows the access type that is applied on the user to the web site of this rule.
Web Site	This is the URL of the web site in this rule.
Scheduler Name	This is the name of the schedule rule that is applied.
Modify	Click the **Edit** icon to 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.

17.2.1 Add/Edit Parental Control Rule

Click **Add new rule** in the **Parental Control** screen or click the **Edit** icon next to a rule to open the following screen.

Figure 97 Parental Control: Add/Edit



PC Name/IP/MAC : twnb13674-02 (00:XX:XX:XX:XX:XX)

Access Type : ● Block Web Site ○ Allow Web Site ○ Block All

Web Site : www.example.com

Scheduler Rules : r1

The following table describes the fields in this screen.

Table 74 Parental Control: Add/Edit

LABEL	DESCRIPTION
PC Name/IP/MAC	Select the user that you want to apply this rule to from the drop-down list box. If you want to add an user that is not listed, select **User Defined** and enter its MAC address. This field is read-only if you are editing the parental control rule.
Access Type	Select the access type that is applied on the user to the web site of this rule. If you select **Block Web Site**, the ZyXEL Device prohibits the users from viewing the web sites with the URLs listed below. If you select **Allow Web Site**, the ZyXEL Device blocks access to all URLs except ones listed below. If you select **Block All**, the ZyXEL Device blocks access to all URLs.
Web Site	Enter the URL of web site to which the ZyXEL Device blocks or allows access. Click **Add** to add this URL to the list below.
Remove	Select an URL from the list and click **Remove** to delete it.
Scheduler Rule	Select the scheduler rule that you want to apply from the drop-down list box. If you have not configured a scheduler rule or want to add a new one, click the **Add New Rule** button to go to the **Scheduler Rule** screen. See Chapter 18 on page 209 for more information.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

18

Scheduler Rules

18.1 Overview

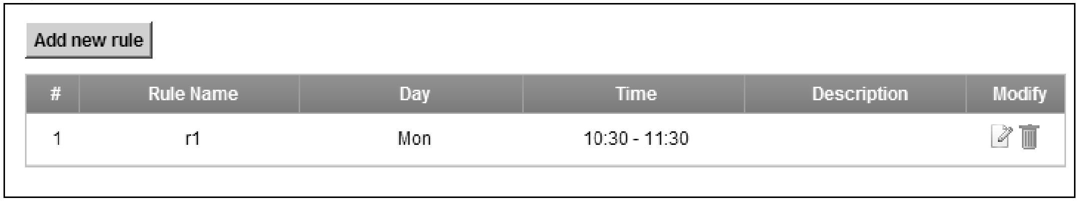
You can define time periods and days during which the ZyXEL Device performs scheduled rules of certain features (such as Firewall Access Control, Parental Control) on a specific user in the **Scheduler Rules** screen.

18.2 The Scheduler Rules Screen

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

Click **Advanced > Scheduler Rules** to open the following screen.

Figure 98 Advanced > Scheduler Rules



#	Rule Name	Day	Time	Description	Modify
1	r1	Mon	10:30 - 11:30		✎ 🗑

The following table describes the fields in this screen.

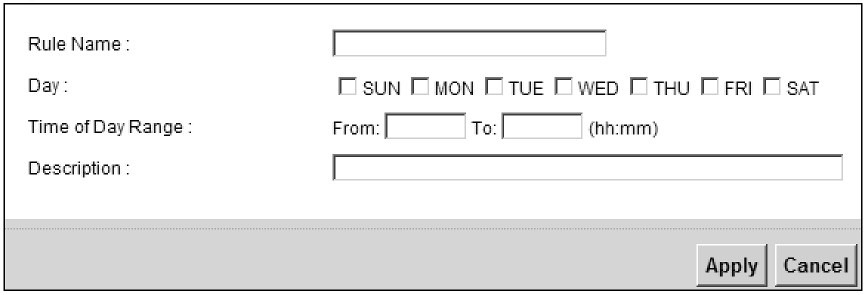
Table 75 Advanced > Scheduler Rules

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

18.2.1 Add/Edit a Schedule

Click the **Add** button in the **Scheduler Rules** screen or click the **Edit** icon next to a schedule rule to open the following screen. Use this screen to configure a restricted access schedule for a specific user on your network.

Figure 99 Scheduler Rules: Add/Edit



Rule Name :

Day : □ SUN □ MON □ TUE □ WED □ THU □ FRI □ SAT

Time of Day Range : From: To: (hh:mm)

Description :

The following table describes the fields in this screen.

Table 76 Scheduler Rules: Add/Edit

LABEL	DESCRIPTION
Rule Name	Enter a name (up to 31 printable English keyboard characters, not including spaces) for this schedule.
Day	Select check boxes for the days that you want the ZyXEL Device to perform this scheduler rule.
Time if Day Range	Enter the time period of each day, in 24-hour format, during which parental control will be enforced.
Description	Enter a description for this scheduler rule.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

19

Certificates

19.1 Overview

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

19.1.1 What You Can Do in this Chapter

- The **Local Certificates** screen lets you generate certification requests and import the ZyXEL Device's CA-signed certificates (Section 19.4 on page 219).
- The **Trusted CA** screen lets you save the certificates of trusted CAs to the ZyXEL Device (Section 19.4 on page 219).

19.2 What You Need to Know

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

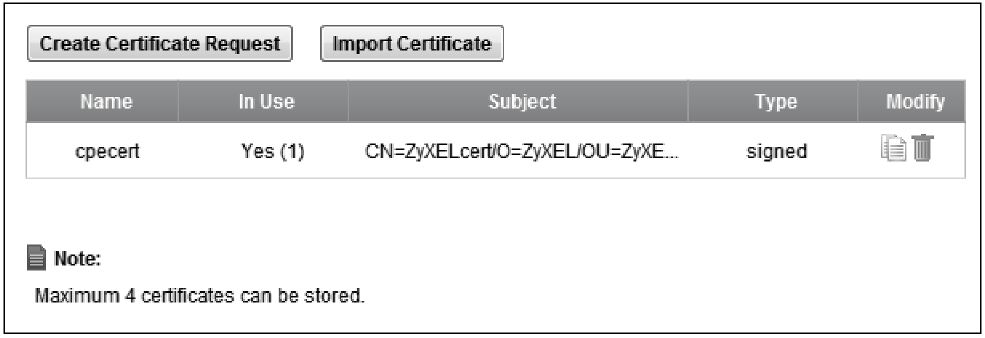
Certification Authority

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

19.3 The Local Certificates Screen

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

Figure 100 Security Settings > Certificates > Local Certificates



Name	In Use	Subject	Type	Modify
cpecert	Yes (1)	CN=ZyXELcert/O=ZyXEL/OU=ZyXE...	signed	

Note:

Maximum 4 certificates can be stored.

The following table describes the labels in this screen.

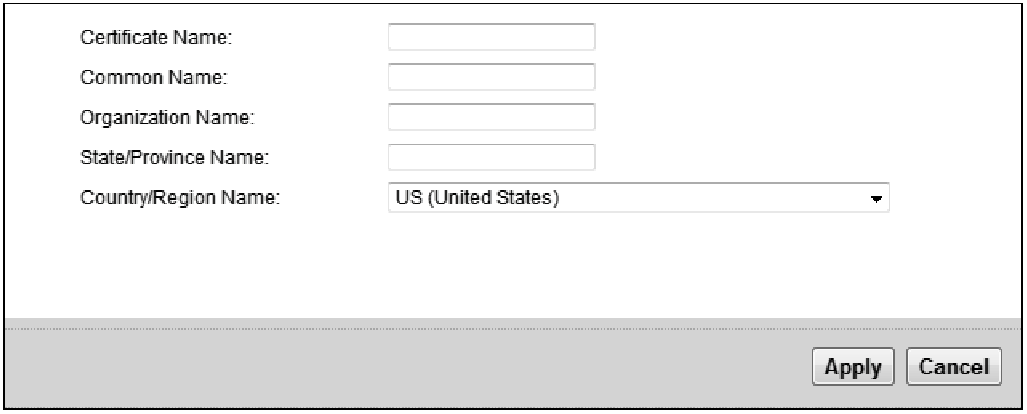
Table 77 Security Settings > Certificates > Local Certificates

LABEL	DESCRIPTION
Create Certificate Request	Click this button to go to the screen where you can have the ZyXEL Device generate a certification request.
Import Certificate	Click this button to open a screen where you can save the certificate that you have enrolled from a certification authority from your computer to the ZyXEL Device.
Name	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
In Use	This field displays whether the certificate is in use and how many applications use the certificate.
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.
Type	This field displays what kind of certificate this is. **request** represents a certification request and is not yet a valid certificate. Send a certification request to a certification authority, which then issues a certificate. Use the **Load Certificate** screen to import the certificate and replace the request. **signed** represents a certificate issued by a certification authority.
Modify	Click the **View** icon to open a screen with an in-depth list of information about the certificate (or certification request). For a certification request, click **Load Signed** to import the signed certificate. Click the **Remove** icon to delete the certificate (or certification request). You cannot delete a certificate that one or more features is configured to use.

19.3.1 Create Certificate Request

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

Figure 101 Create Certificate Request



Certificate Name:

Common Name:

Organization Name:

State/Province Name:

Country/Region Name: US (United States)

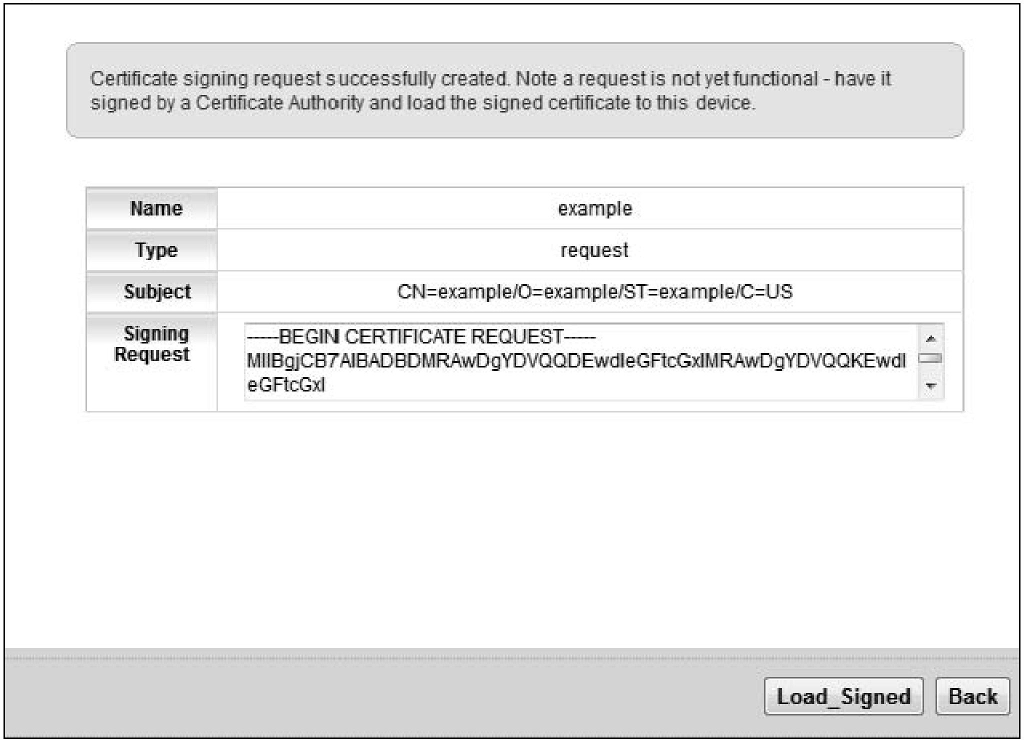
The following table describes the labels in this screen.

Table 78 Create Certificate Request

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

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

Figure 102 Certificate Request Created



Certificate signing request successfully created. Note a request is not yet functional - have it signed by a Certificate Authority and load the signed certificate to this device.

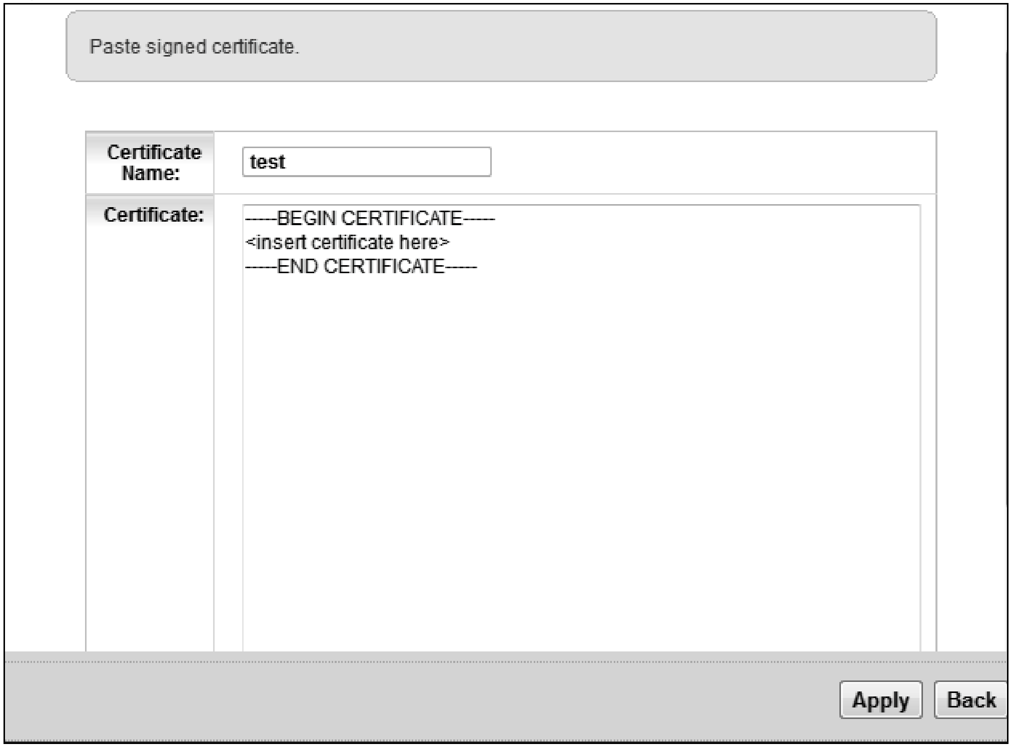
Name	example
Type	request
Subject	CN=example/O=example/ST=example/C=US
Signing Request	-----BEGIN CERTIFICATE REQUEST----- MIIBgjCB7AIBADBDMRAwDgYDVQQDEwdleGFtcGxlMRAwDgYDVQQKEwdl eGFtcGxl

19.3.2 Load Signed Certificate

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

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

Figure 103 Load Signed Certificate



Paste signed certificate.

Certificate Name: test

Certificate:

```
-----BEGIN CERTIFICATE-----
<insert certificate here>
-----END CERTIFICATE-----
```

The following table describes the labels in this screen.

Table 79 Load Signed Certificate

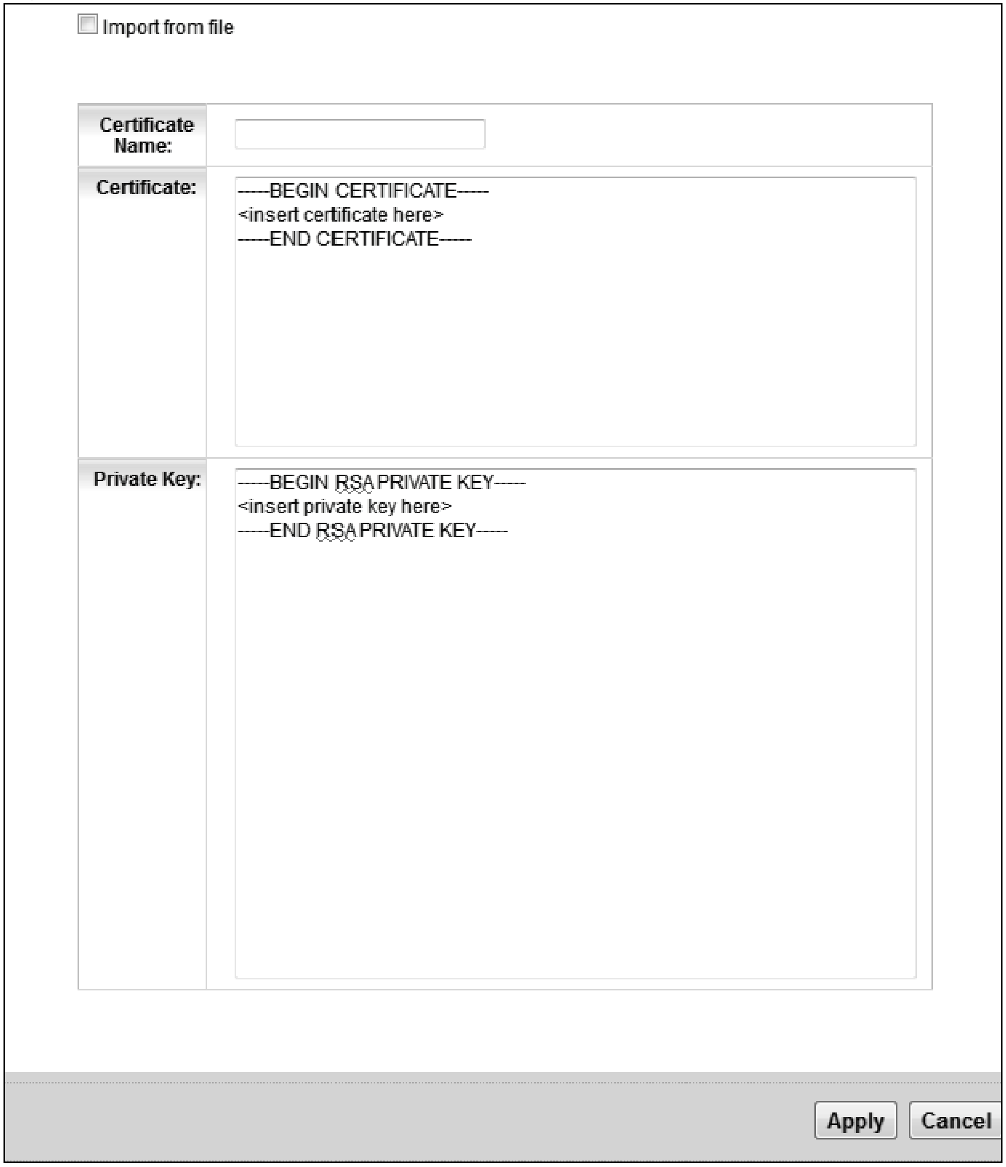
LABEL	DESCRIPTION
Certificate Name	This is the name of the signed certificate.
Certificate	Copy and paste the signed certificate into the text box to store it on the ZyXEL Device.
Apply	Click **Apply** to save your changes.
Back	Click **Back** to return to the previous screen.

19.3.3 Import Certificate

Click **Security Settings > Local Certificates** and then **Import Certificate** to open the **Import Local Certificate** screen. Follow the instructions in this screen to save an existing certificate to the ZyXEL Device.

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

Figure 104 Import Local Certificate



□ Import from file

Certificate Name:

Certificate:

```
-----BEGIN CERTIFICATE-----
<insert certificate here>
-----END CERTIFICATE-----
```

Private Key:

```
-----BEGIN RSA PRIVATE KEY-----
<insert private key here>
-----END RSA PRIVATE KEY-----
```

The following table describes the labels in this screen.

Table 80 Import Local Certificate

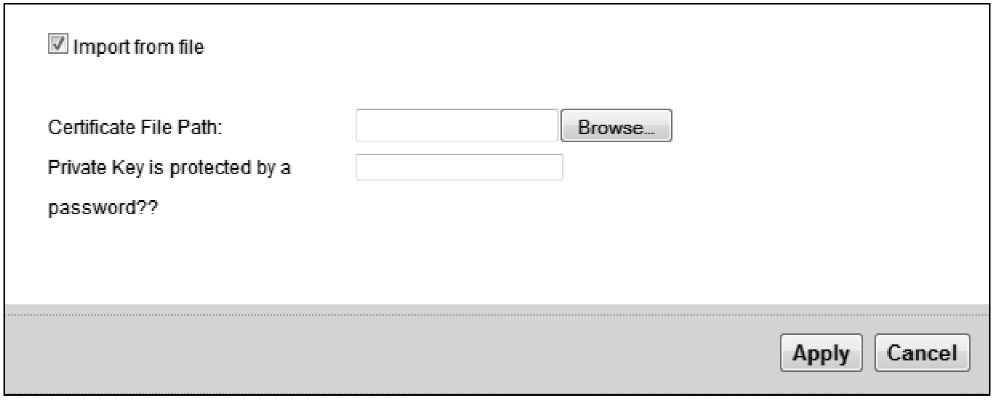
LABEL	DESCRIPTION
Import from file	Click this check box to open a screen where you can save the certificate of a certification authority that you trust, from your computer to the ZyXEL Device.
Certificate Name	Type up to 63 ASCII characters (not including spaces) to identify this certificate.
Certificate	Copy and paste the certificate into the text box to store it on the ZyXEL Device.
Private Key	Copy and paste the private key into the text box to store it on the ZyXEL Device.

Table 80 Import Local Certificate (continued)

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

If you click **Import from file** in the **Import Local Certificate** screen, the following screen is displayed.

Figure 105 Import Local Certificate > Import from file



☑ Import from file

Certificate File Path:

Private Key is protected by a password??

The following table describes the labels in this screen.

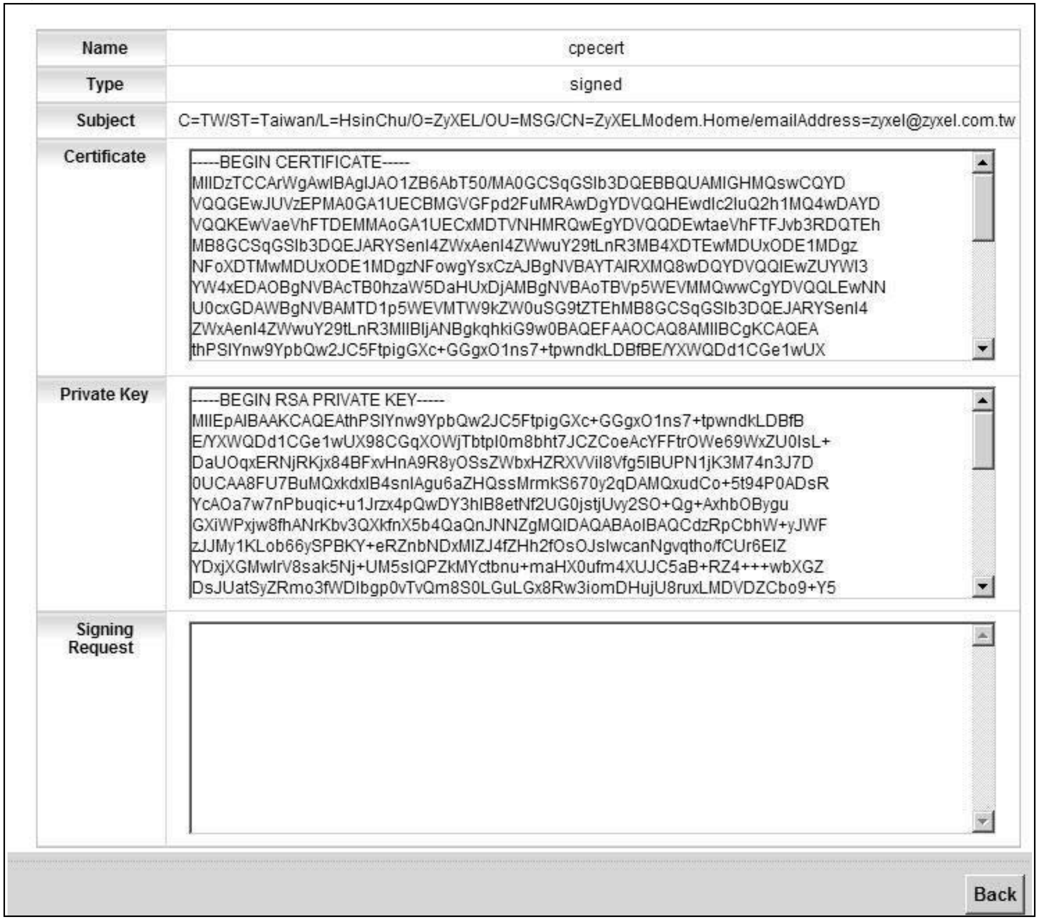
Table 81 Import Local Certificate > Import from file

LABEL	DESCRIPTION
Certificate File Path	Type in the location of the certificate you want to upload in this field or click **Browse ...** to find it.
Private Key is protected by a password?	Enter the private key into the text box to store it on the ZyXEL Device. The private key should not exceed 63 ASCII characters (not including spaces).
Apply	Click **Apply** to save your changes.
Back	Click **Back** to return to the previous screen.

19.3.4 Certificate Details

Click **Security Settings> Certificates > Local Certificates** to open the **My Certificates** screen. Click the **View** icon to open the **Certificate Details** screen. Use this screen to view in-depth certificate information and change the certificate’s name.

Figure 106 Certificate Details



Name	cpecert
Type	signed
Subject	C=TW/ST=Taiwan/L=HsinChu/O=ZyXEL/OU=MSG/CN=ZyXELModem.Home/emailAddress=zyxel@zyxel.com.tw

Certificate

```
-----BEGIN CERTIFICATE-----
MIIDzTCCArWgAwIBAgIJAO1ZB6AbT50/MA0GCSqGSIb3DQEBBQUAMIGHMQswCQYD
VQQGEwJUVzEPMA0GA1UECBMGVGFpd2FuMRAwDgYDVQQHEwdIc2luQ2h1MQ4wDAYD
VQQKEwVaeVhFTDEMMAoGA1UECxMDTVNHMRQwEgYDVQQDEwtaeVhFTFJvb3RDQTEh
MB8GCSqGSIb3DQEJARYSenl4ZWxAenl4ZWwuY29tLnR3MB4XDTEwMDUxODE1MDgz
NFoXDTMwMDUxODE1MDgzNFowgYsxCzAJBgNVBAYTAlRXMQ8wDQYDVQQIEwZUYWl3
YW4xEDAOBgNVBAcTB0hzaW5DaHUxDjAMBgNVBAoTBVp5WEVMMQwwCgYDVQQLEwNN
U0cxGDAWBgNVBAMTD1p5WEVMTW9kZW0uSG9tZTEhMB8GCSqGSIb3DQEJARYSenl4
ZWxAenl4ZWwuY29tLnR3MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEA
thPSIYnw9YpbQw2JC5FtpigGXc+GGgxO1ns7+tpwndkLDBfBE/YXWQDd1CGe1wUX
```

Private Key

```
-----BEGIN RSA PRIVATE KEY-----
MIIEpAIBAAKCAQEAthPSIYnw9YpbQw2JC5FtpigGXc+GGgxO1ns7+tpwndkLDBfB
E/YXWQDd1CGe1wUX98CGqXOWjTbtpI0m8bht7JCZCoeAcYFFtrOWe69WxZU0IsL+
DaUOqxERNjRKjx84BFxvHnA9R8yOSsZWbxHZRXVVil8Vfg5IBUPN1jK3M74n3J7D
0UCAA8FU7BuMQxkdxlB4snIAgu6aZHQssMrmkS670y2qDAMQxudCo+5t94P0ADsR
YcAOa7w7nPbuqic+u1Jrzx4pQwDY3hIB8etNf2UG0jstjUvy2SO+Qg+AxhbOBygu
GXiWPxjw8fhANrKbv3QXkfnX5b4QaQnJNNZgMQIDAQABAoIBAQCdzRpCbhW+yJWF
zJJMy1KLob66ySPBKY+eRZnbNDxMIZJ4fZHh2fOsOJsIwcanNgvqtho/fCUr6EIZ
YDxjXGMwlrV8sak5Nj+UM5sIQPZkMYctbnu+maHX0ufm4XUJC5aB+RZ4+++wbXGZ
DsJUatSyZRmo3fWDIbgp0vTvQm8S0LGuLGx8Rw3iomDHujU8ruxLMDVDZCbo9+Y5
```

Signing Request

The following table describes the labels in this screen.

Table 82 Certificate Details

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate. If you want to change the name, type up to 63 characters to identify this certificate. You may use any character (not including spaces).
Type	This field displays general information about the certificate. **signed** means that a Certification Authority signed the certificate. **request** means this is a certification request.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organization (O), State (ST) and Country (C).
Certificate	This read-only text box displays the certificate in Privacy Enhanced Mail (PEM) format. PEM uses base 64 to convert the binary certificate into a printable form. This displays **null** in a certification request. 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).

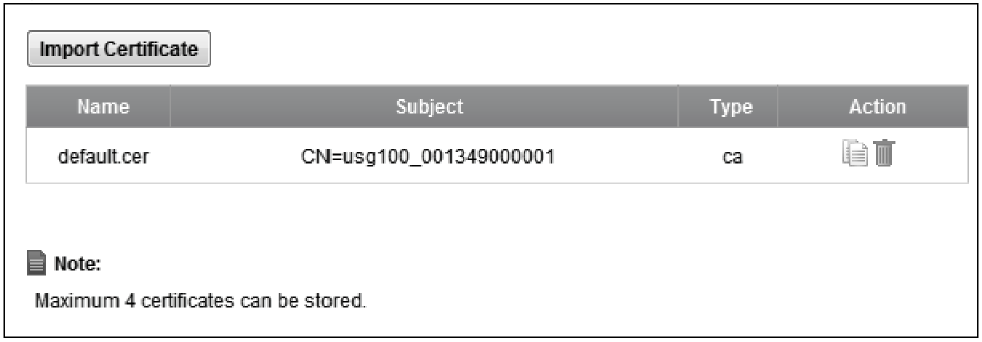
Table 82 Certificate Details (continued)

LABEL	DESCRIPTION
Private Key	This read-only text box displays the private key in Privacy Enhanced Mail (PEM) format. PEM uses base 64 to convert the binary certificate into a printable form. You can copy and paste the private key 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).
Signing Request	This read-only text box displays the request information in Privacy Enhanced Mail (PEM) format. PEM uses base 64 to convert the binary certificate into a printable form. This displays **null** in a signed certificate.
Back	Click **Back** to return to the previous screen.

19.4 The Trusted CA Screen

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

Figure 107 Security Settings > Certificates > Trusted CA



Name	Subject	Type	Action
default.cer	CN=usg100_001349000001	ca	

Note:

Maximum 4 certificates can be stored.

The following table describes the fields in this screen.

Table 83 Security Settings > 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 ZyXEL Device.
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.

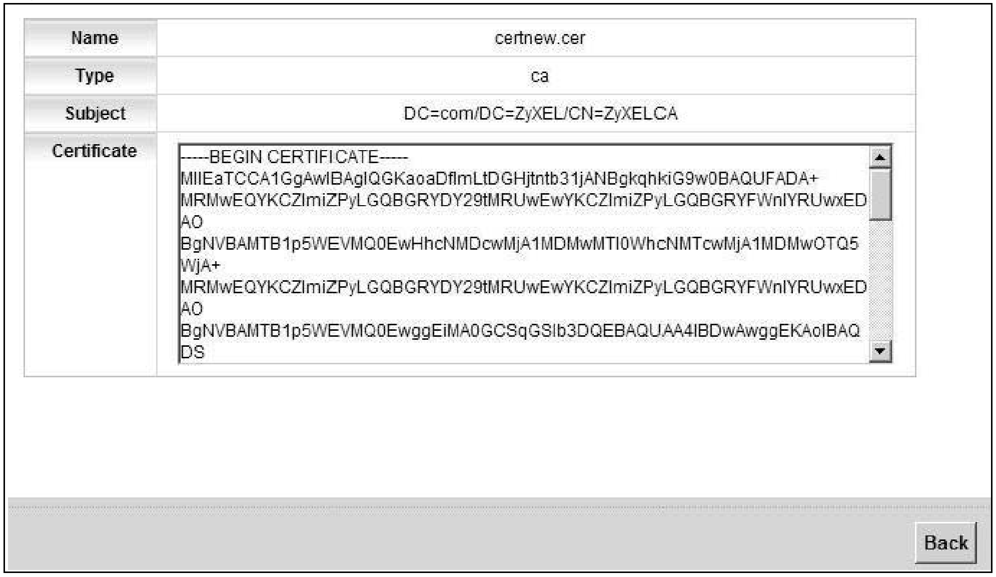
Table 83 Security Settings > Certificates > Trusted CA (continued)

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

19.4.1 View Trusted CA Certificate

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

Figure 108 Trusted CA: View



Name	certnew.cer
Type	ca
Subject	DC=com/DC=ZyXEL/CN=ZyXELCA
Certificate	

```
-----BEGIN CERTIFICATE-----
MIIEaTCCA1GgAwIBAgIQGKaoaDflmLtDGHjtntb31jANBgkqhkiG9w0BAQUFADA+
MRMwEQYKCZImiZPyLGQBGRYDY29tMRUwEwYKCZImiZPyLGQBGRYFWnlYRUwxED
AO
BgNVBAMTB1p5WEVMQ0EwHhcNMDcwMjA1MDMwMTI0WhcNMTcwMjA1MDMwOTQ5
WjA+
MRMwEQYKCZImiZPyLGQBGRYDY29tMRUwEwYKCZImiZPyLGQBGRYFWnlYRUwxED
AO
BgNVBAMTB1p5WEVMQ0EwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQ
DS
```

The following table describes the fields in this screen.

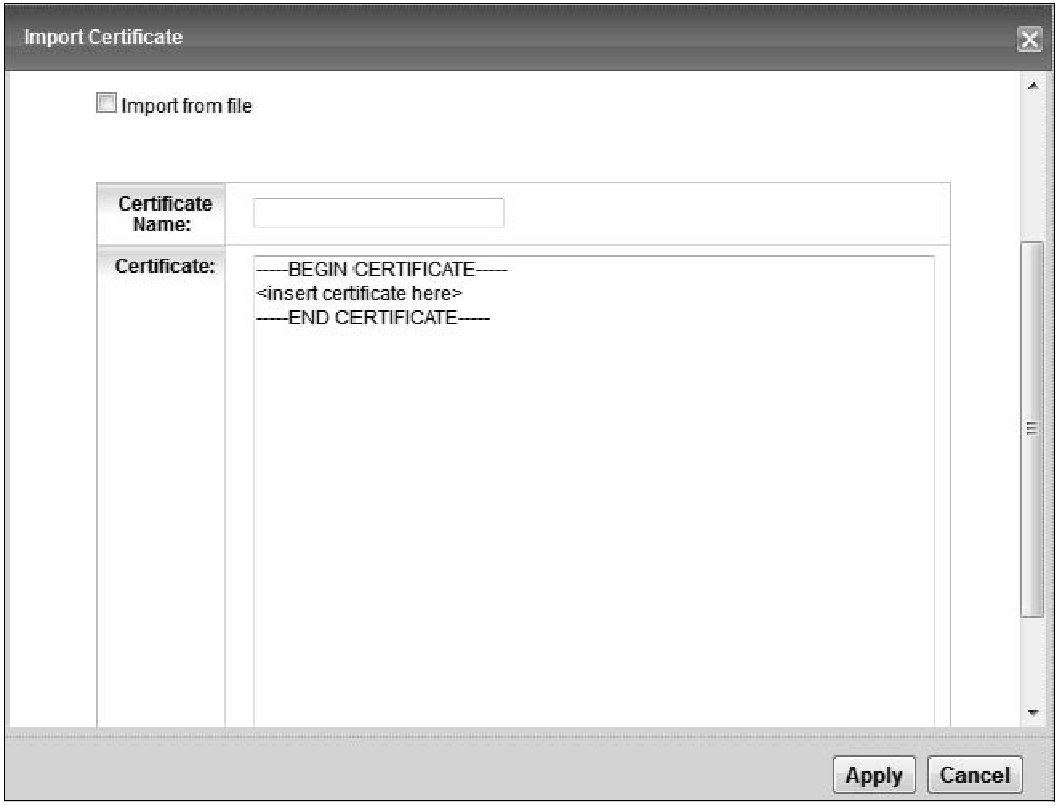
Table 84 Trusted CA: View

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate.
Type	This field displays general information about the certificate. **ca** means that a Certification Authority signed the certificate.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Certificate	This read-only text box displays the certificate in Privacy Enhanced Mail (PEM) format. PEM uses base 64 to convert the binary certificate into a printable form. You can copy and paste the certificate into an e-mail to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Back	Click **Back** to return to the previous screen.

19.4.2 Import Trusted CA Certificate

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

Figure 109 Trusted CA: Import Certificate



Import Certificate

□ Import from file

Certificate Name:

Certificate:

-----BEGIN CERTIFICATE-----
<insert certificate here>
-----END CERTIFICATE-----

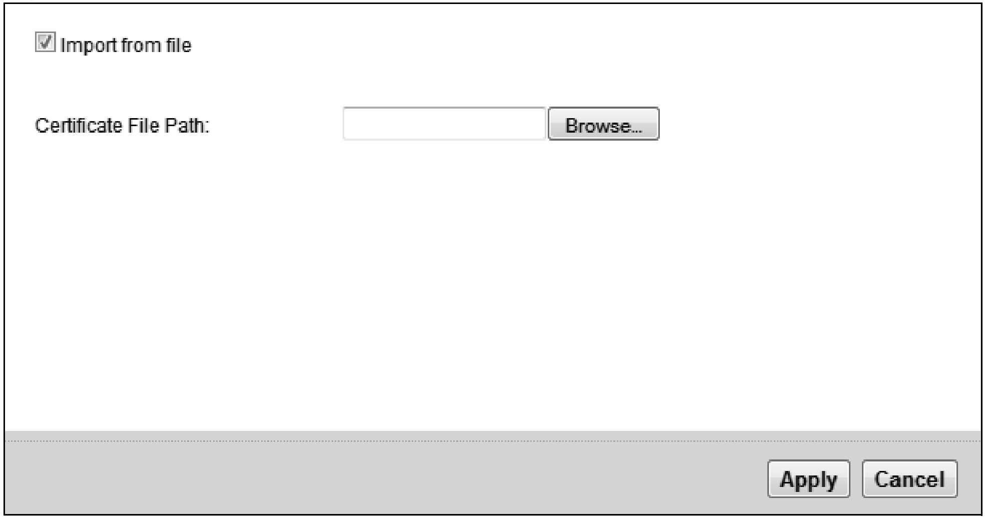
The following table describes the fields in this screen.

Table 85 Trusted CA: Import Certificate

LABEL	DESCRIPTION
Import from file	Click this check box to open a screen where you can save the certificate of a certification authority that you trust, from your computer to the ZyXEL Device.
Certificate Name	Enter the name that identifies this certificate. The certificate name should not exceed 63 ASCII characters (not including spaces).
Certificate	Copy and paste the certificate into the text box to store it on the ZyXEL Device.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

If you click **Import from file** in the **Import Local Certificate** screen, the following screen is displayed.

Figure 110 Trusted CA: Import Certificate > Import from file



☑ Import from file

Certificate File Path:

The following table describes the labels in this screen.

Table 86 Import Local Certificate

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

20

Service Control

20.1 Overview

This chapter provides information on the Service Control screens.

Service Control allows you to manage your ZyXEL Device from a remote location through the following interfaces:

- LAN
- WAN

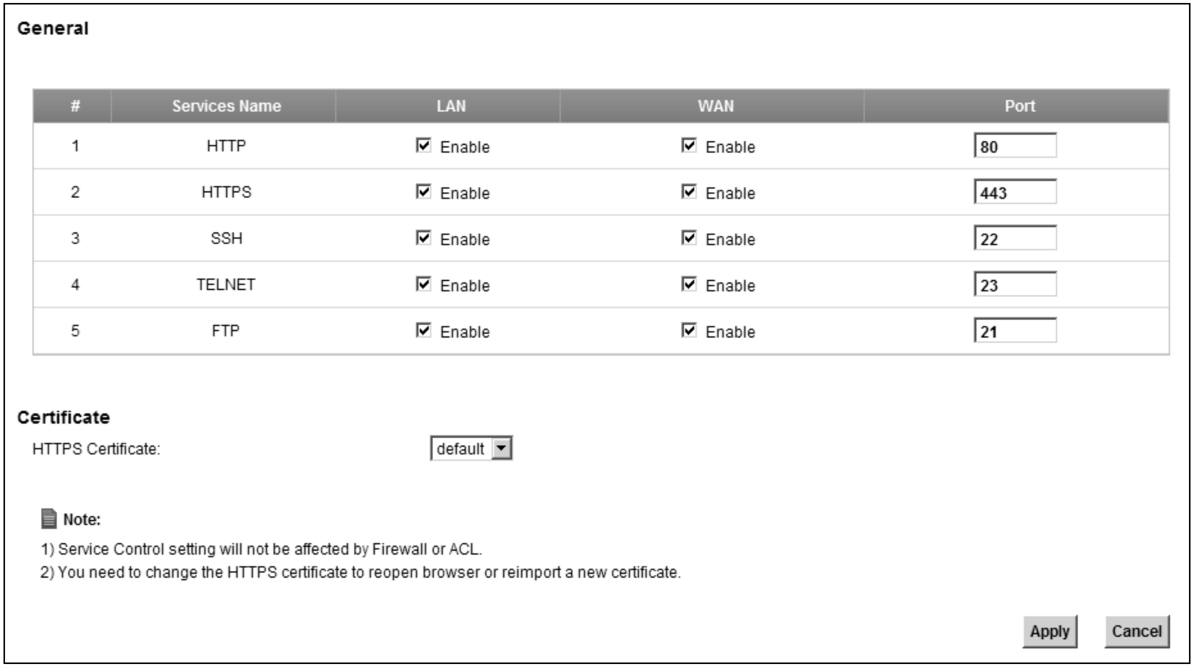
Note: The ZyXEL Device is managed using the Web Configurator.

20.2 The Service Control Screen

Use this screen to configure through which interface(s) users can use which service(s) to manage the ZyXEL Device.

Click **Security Settings > Service Control** to open the following screen.

Figure 111 Security Settings > Service Control



General

#	Services Name	LAN	WAN	Port
1	HTTP	☑ Enable	☑ Enable	80
2	HTTPS	☑ Enable	☑ Enable	443
3	SSH	☑ Enable	☑ Enable	22
4	TELNET	☑ Enable	☑ Enable	23
5	FTP	☑ Enable	☑ Enable	21

Certificate

HTTPS Certificate: default

Note:

1) Service Control setting will not be affected by Firewall or ACL.

2) You need to change the HTTPS certificate to reopen browser or reimport a new certificate.

The following table describes the fields in this screen.

Table 87 Security Settings > Service Control

LABEL	DESCRIPTION
General	
#	This is the index number of the entry.
Services Name	This is the service you may use to access the ZyXEL Device.
LAN	Select the **Enable** check box for the corresponding services that you want to allow access to the ZyXEL Device from the LAN.
WAN	Select the **Enable** check box for the corresponding services that you want to allow access to the ZyXEL Device from the WAN.
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Certificate	
HTTPS Certificate	Select a certificate the HTTPS server (the ZyXEL Device) uses to authenticate itself to the HTTPS client. You must have certificates already configured in the **Certificates** screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to restore your previously saved settings.

ARP Table

21.1 Overview

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

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

21.1.1 How ARP Works

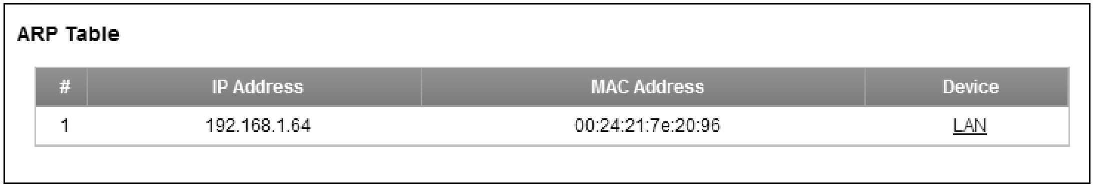
When an incoming packet destined for a host device on a local area network arrives at the device, the device's ARP program looks in the ARP Table and, if it finds the address, sends it to the device.

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

21.2 ARP Table Screen

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

Figure 112 System Monitor > ARP Table



ARP Table

#	IP Address	MAC Address	Device
1	192.168.1.64	00:24:21:7e:20:96	LAN

The following table describes the labels in this screen.

Table 88 System Monitor > ARP Table

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

22

Logs

22.1 Overview

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

22.1.1 What You Can Do in this Chapter

- Use the **System Log** screen to see the system logs for the categories that you select (Section 22.2 on page 228).
- Use the **Security Log** screen to see the security-related logs for the categories that you select (Section 22.3 on page 229).

22.1.2 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 89 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.

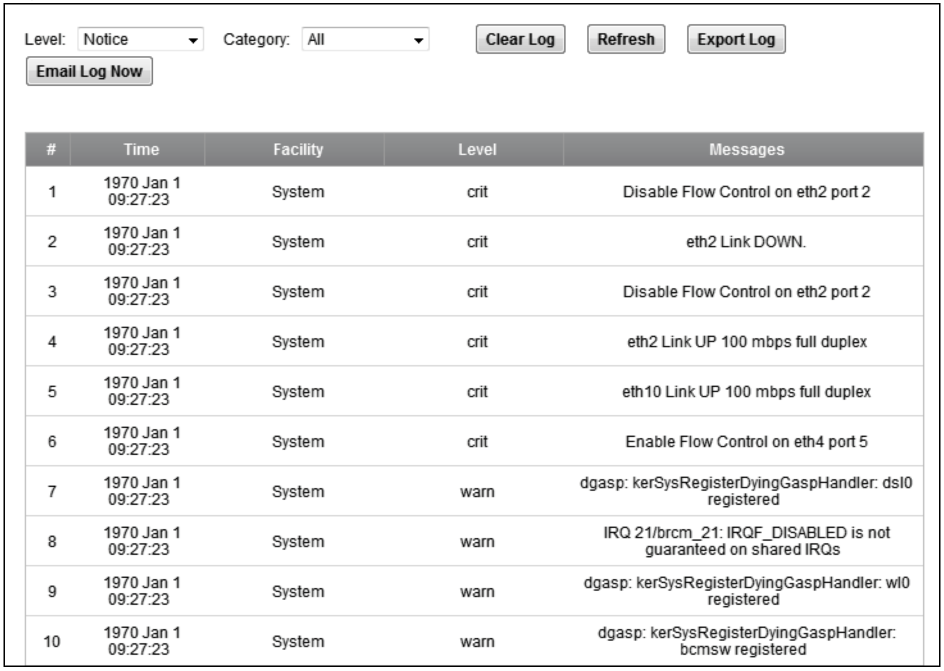
Table 89 Syslog Severity Levels (continued)

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

22.2 The System Log Screen

Use the **System Log** screen to see the system logs for the categories that you select in **Maintenance > Log Setting**. Click **System Monitor > Log** to open the **System Log** screen.

Figure 113 System Monitor > Log > System Log



Level: Notice   Category: All

#	Time	Facility	Level	Messages
1	1970 Jan 1 09:27:23	System	crit	Disable Flow Control on eth2 port 2
2	1970 Jan 1 09:27:23	System	crit	eth2 Link DOWN.
3	1970 Jan 1 09:27:23	System	crit	Disable Flow Control on eth2 port 2
4	1970 Jan 1 09:27:23	System	crit	eth2 Link UP 100 mbps full duplex
5	1970 Jan 1 09:27:23	System	crit	eth10 Link UP 100 mbps full duplex
6	1970 Jan 1 09:27:23	System	crit	Enable Flow Control on eth4 port 5
7	1970 Jan 1 09:27:23	System	warn	dgasp: kerSysRegisterDyingGaspHandler: dsl0 registered
8	1970 Jan 1 09:27:23	System	warn	IRQ 21/brcm_21: IRQF_DISABLED is not guaranteed on shared IRQs
9	1970 Jan 1 09:27:23	System	warn	dgasp: kerSysRegisterDyingGaspHandler: wl0 registered
10	1970 Jan 1 09:27:23	System	warn	dgasp: kerSysRegisterDyingGaspHandler: bcmsw registered

The following table describes the fields in this screen.

Table 90 System Monitor > Log > System Log

LABEL	DESCRIPTION
Level	Select a severity level from the drop-down list box. This filters search results according to the severity level you have selected. When you select a severity, the ZyXEL Device searches through all logs of that severity or higher.
Category	Select the type of logs to display.
Clear Log	Click this to delete all the logs.
Refresh	Click this to renew the log screen.
Export Log	Click this to export the selected log(s).
Email Log Now	Click this to send the log file(s) to the E-mail address you specify in the **Maintenance > Logs Setting** screen.
System Log	

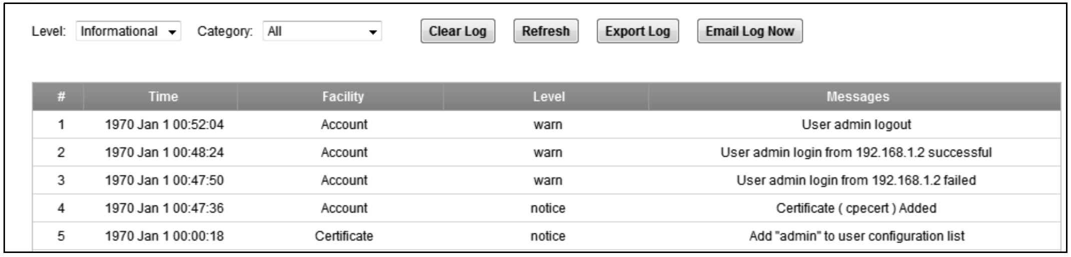
Table 90 System Monitor > Log > System Log (continued)

LABEL	DESCRIPTION
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Level	This field displays the severity level of the logs that the device is to send to this syslog server.
Messages	This field states the reason for the log.

22.3 The Security Log Screen

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

Figure 114 System Monitor > Log > Security Log



Level: Informational
Category: All

#	Time	Facility	Level	Messages
1	1970 Jan 1 00:52:04	Account	warn	User admin logout
2	1970 Jan 1 00:48:24	Account	warn	User admin login from 192.168.1.2 successful
3	1970 Jan 1 00:47:50	Account	warn	User admin login from 192.168.1.2 failed
4	1970 Jan 1 00:47:36	Account	notice	Certificate (cpecert) Added
5	1970 Jan 1 00:00:18	Certificate	notice	Add "admin" to user configuration list

The following table describes the fields in this screen.

Table 91 System Monitor > Log > Security Log

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

23

Traffic Status

23.1 Overview

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

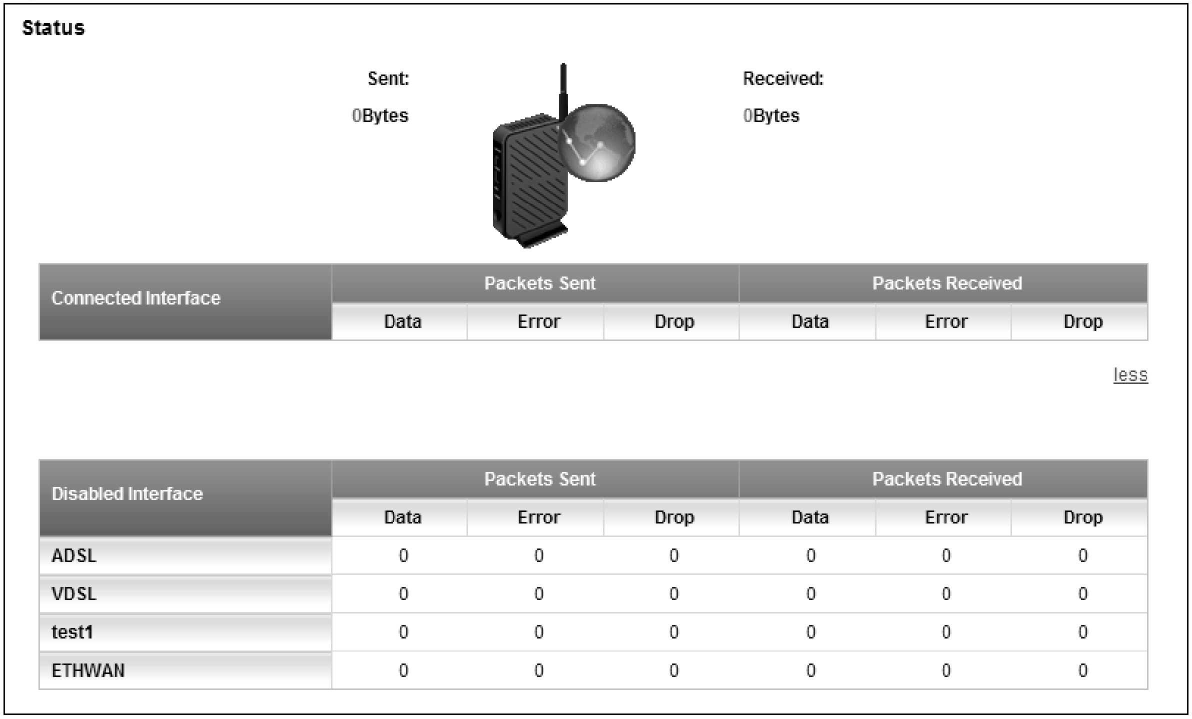
23.1.1 What You Can Do in this Chapter

- Use the **WAN** screen to view the WAN traffic statistics (Section 23.2 on page 231).
- Use the **LAN** screen to view the LAN traffic statistics (Section 23.3 on page 233).
- Use the **HPNA** screen to view the HPNA traffic statistics (Section 23.4 on page 234).

23.2 The WAN Status Screen

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

Figure 115 System Monitor > Traffic Status > WAN



Status

Sent:
0Bytes

Received:
0Bytes

Connected Interface	Packets Sent			Packets Received		
	Data	Error	Drop	Data	Error	Drop

less

Disabled Interface	Packets Sent			Packets Received		
	Data	Error	Drop	Data	Error	Drop
ADSL	0	0	0	0	0	0
VDSL	0	0	0	0	0	0
test1	0	0	0	0	0	0
ETHWAN	0	0	0	0	0	0

The following table describes the fields in this screen.

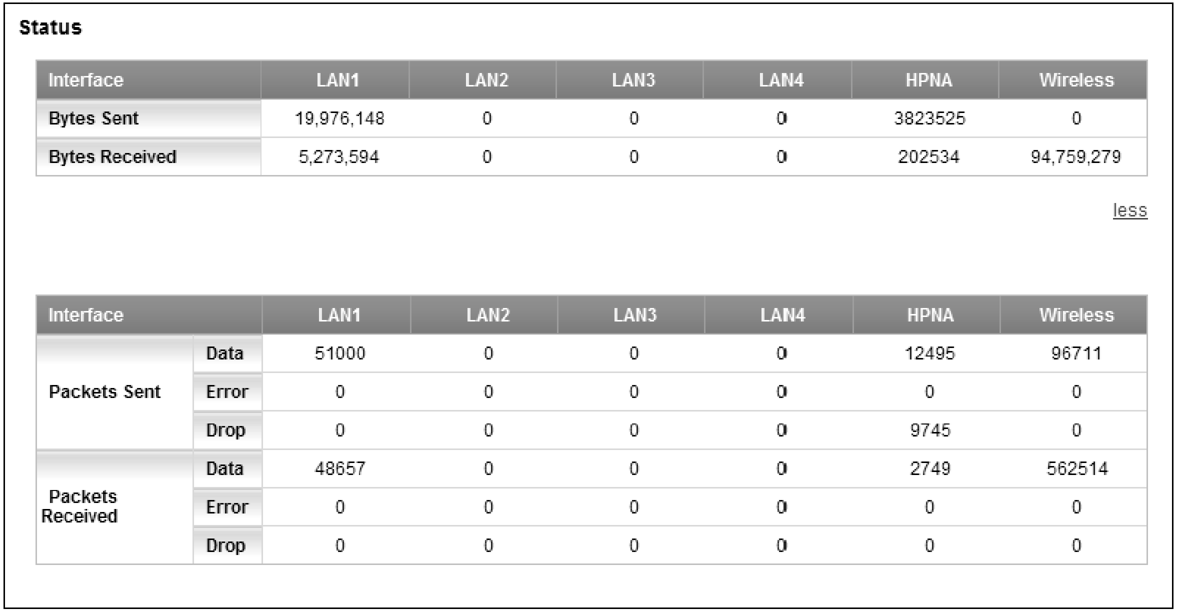
Table 92 System Monitor > Traffic Status > WAN

LABEL	DESCRIPTION
Connected Interface	This shows the name of the WAN interface that is currently connected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.
more.../less	Click **more...** to show more information. Click **less** to hide them.
Disabled Interface	This shows the name of the WAN interface that is currently disconnected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

23.3 The LAN Status Screen

Click **System Monitor > Traffic Status > LAN** to open the following screen.

Figure 116 System Monitor > Traffic Status > LAN



Status

Interface	LAN1	LAN2	LAN3	LAN4	HPNA	Wireless
Bytes Sent	19,976,148	0	0	0	3823525	0
Bytes Received	5,273,594	0	0	0	202534	94,759,279

less

Interface		LAN1	LAN2	LAN3	LAN4	HPNA	Wireless
Packets Sent	Data	51000	0	0	0	12495	96711
	Error	0	0	0	0	0	0
	Drop	0	0	0	0	9745	0
Packets Received	Data	48657	0	0	0	2749	562514
	Error	0	0	0	0	0	0
	Drop	0	0	0	0	0	0

The following table describes the fields in this screen.

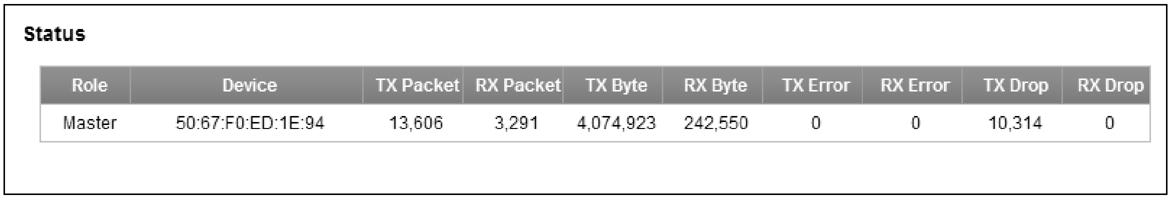
Table 93 System Monitor > Traffic Status > LAN

LABEL	DESCRIPTION
Polls Interval(s)	Select how often you want the ZyXEL Device to update this screen.
Interface	This shows the LAN or WLAN interface.
Bytes Sent	This indicates the number of bytes transmitted on this interface.
Bytes Received	This indicates the number of bytes received on this interface.
more.../less	Click **more...** to show more information. Click **less** to hide them.
Interface	This shows the LAN or WLAN interface.
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.

23.4 The HPNA Status Screen

Click **System Monitor > Traffic Status > HPNA** to open the following screen.

Figure 117 System Monitor > Traffic Status > HPNA



Status

Role	Device	TX Packet	RX Packet	TX Byte	RX Byte	TX Error	RX Error	TX Drop	RX Drop
Master	50:67:F0:ED:1E:94	13,606	3,291	4,074,923	242,550	0	0	10,314	0

The following table describes the fields in this screen.

Table 94 System Monitor > Traffic Status > HPNA

LABEL	DESCRIPTION
Role	This shows the role of the client connected to the ZyXEL Device's HPNA port.
Device	This shows the MAC address of the client connected to the ZyXEL Device's HPNA port.
TX Packet	This indicates the number of packets transmitted by this client.
RX Packet	This indicates the number of packets received by this client.
TX Byte	This indicates the number of bytes transmitted on this interface.
RX Byte	This indicates the number of bytes received on this interface.
TX Error	This indicates the number of frames with errors transmitted on this interface.
RX Error	This indicates the number of frames with errors received on this interface.
TX Drop	This indicates the number of outgoing packets dropped on this interface.
RX Drop	This indicates the number of received packets dropped on this interface.

IGMP Status

24.1 Overview

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

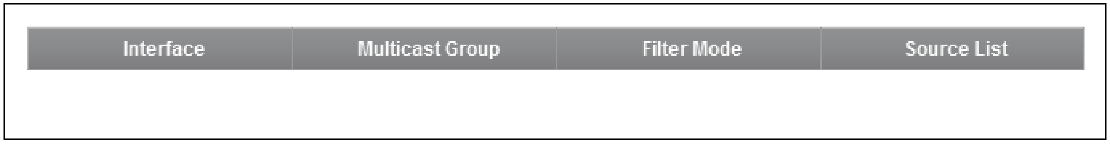
24.1.1 What You Can Do in this Chapter

- Use the **IGMP Group** screen to look at the current list of multicast groups the ZyXEL Device has joined and which ports have joined each (Section 24.2 on page 235.
- Use the **IGMP Statistics** screen to look at the current number of IGMP-related packets received for each IGMP multicast group and from each LAN host (Section 24.3 on page 236).

24.2 The IGMP Group Screen

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

Figure 118 System Monitor > IGMP Group Status > IGMP Group



Interface	Multicast Group	Filter Mode	Source List

The following table describes the labels in this screen.

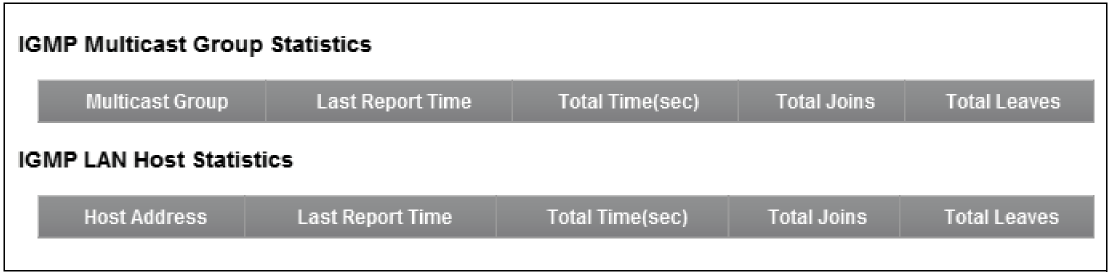
Table 95 System Monitor > IGMP Group Status > IGMP Group

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

24.3 IGMP Statistics Screen

Use this screen to look at the current number of IGMP-related packets received for each IGMP multicast group and from each LAN host. To open this screen, click **System Monitor > IGMP Group Status > IGMP Statistics**.

Figure 119 System Monitor > IGMP Group Status > IGMP Statistics



IGMP Multicast Group Statistics

Multicast Group	Last Report Time	Total Time(sec)	Total Joins	Total Leaves

IGMP LAN Host Statistics

Host Address	Last Report Time	Total Time(sec)	Total Joins	Total Leaves

The following table describes the labels in this screen.

Table 96 System Monitor > IGMP Group Status > IGMP Statistics

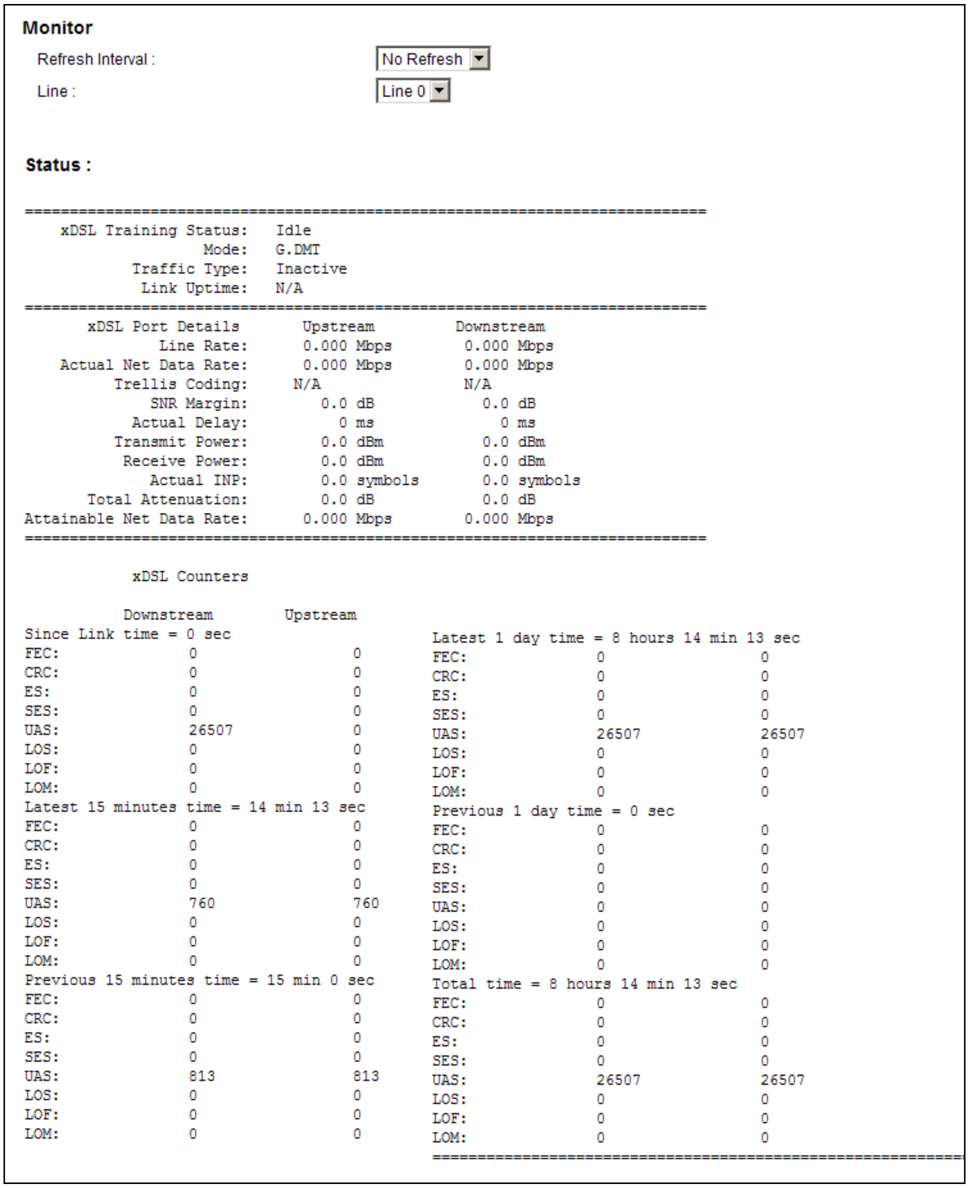
LABEL	DESCRIPTION
IGMP Multicast Group Statistics	This section shows statistics about the number of IGMP-related packets received for each IGMP multicast group.
Multicast Group	This field displays the name of the IGMP multicast group for which the ZyXEL Device received IGMP-related packets.
Last Report Time	This field displays when the ZyXEL Device received the latest packet for this IGMP multicast group.
Total Time (sec)	This field displays the total amount of time the ZyXEL Device counted from when the IGMP multicast group was joined to when it was left.
Total Joins	This field displays the total number of Join packets the ZyXEL Device has received for this IGMP multicast group.
Total Leaves	This field displays the total number of Leave packets the ZyXEL Device has received for this IGMP multicast group.
IGMP LAN Host Statistics	This section shows statistics about the number of IGMP-related packets received from each LAN host.
Host Address	This field displays the IP address of a LAN computer that has sent the ZyXEL Device IGMP-related packets.
Last Report Time	This field displays when the ZyXEL Device received the latest packet from this LAN IP address for this IGMP multicast group.
Total Time (sec)	This field displays the total amount of time the ZyXEL Device counted from when the LAN IP address joined the IGMP multicast group to when it left.
Total Joins	This field displays the total number of Join packets the ZyXEL Device has received from this LAN IP address.
Total Leaves	This field displays the total number of Leave packets the ZyXEL Device has received from this LAN IP address.

xDSL Statistics

25.1 The xDSL Statistics Screen

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

Figure 120 System Monitor > xDSL Statistics



Monitor

Refresh Interval : No Refresh

Line : Line 0

Status :

```
============================================================================
    xDSL Training Status:   Idle
                    Mode:   G.DMT
            Traffic Type:   Inactive
             Link Uptime:   N/A
============================================================================
       xDSL Port Details       Upstream         Downstream
               Line Rate:      0.000 Mbps        0.000 Mbps
    Actual Net Data Rate:      0.000 Mbps        0.000 Mbps
          Trellis Coding:     N/A                N/A
              SNR Margin:        0.0 dB            0.0 dB
            Actual Delay:          0 ms              0 ms
          Transmit Power:        0.0 dBm           0.0 dBm
           Receive Power:        0.0 dBm           0.0 dBm
              Actual INP:        0.0 symbols       0.0 symbols
       Total Attenuation:        0.0 dB            0.0 dB
Attainable Net Data Rate:      0.000 Mbps        0.000 Mbps
============================================================================
```

```
            xDSL Counters

           Downstream         Upstream
Since Link time = 0 sec                      Latest 1 day time = 8 hours 14 min 13 sec
FEC:              0                 0        FEC:              0                 0
CRC:              0                 0        CRC:              0                 0
ES:               0                 0        ES:               0                 0
SES:              0                 0        SES:              0                 0
UAS:              26507             0        UAS:              26507             26507
LOS:              0                 0        LOS:              0                 0
LOF:              0                 0        LOF:              0                 0
LOM:              0                 0        LOM:              0                 0
Latest 15 minutes time = 14 min 13 sec       Previous 1 day time = 0 sec
FEC:              0                 0        FEC:              0                 0
CRC:              0                 0        CRC:              0                 0
ES:               0                 0        ES:               0                 0
SES:              0                 0        SES:              0                 0
UAS:              760               760      UAS:              0                 0
LOS:              0                 0        LOS:              0                 0
LOF:              0                 0        LOF:              0                 0
LOM:              0                 0        LOM:              0                 0
Previous 15 minutes time = 15 min 0 sec      Total time = 8 hours 14 min 13 sec
FEC:              0                 0        FEC:              0                 0
CRC:              0                 0        CRC:              0                 0
ES:               0                 0        ES:               0                 0
SES:              0                 0        SES:              0                 0
UAS:              813               813      UAS:              26507             26507
LOS:              0                 0        LOS:              0                 0
LOF:              0                 0        LOF:              0                 0
LOM:              0                 0        LOM:              0                 0
                                             ===========================================================
```

The following table describes the labels in this screen.

Table 97 Status > xDSL Statistics

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

Table 97 Status > xDSL Statistics (continued)

LABEL	DESCRIPTION
Attainable Net Data Rate	These are the highest theoretically possible transfer rates at which the port could send and receive payload data without transport layer protocol headers and traffic.
xDSL Counters	
Downstream	These are the statistics for the traffic direction coming into the port from the service provider.
Upstream	These are the statistics for the traffic direction going out from the port to the service provider.
FEC	This is the number of Far End Corrected blocks.
CRC	This is the number of Cyclic Redundancy Checks.
ES	This is the number of Errored Seconds meaning the number of seconds containing at least one errored block or at least one defect.
SES	This is the number of Severely Errored Seconds meaning the number of seconds containing 30% or more errored blocks or at least one defect. This is a subset of ES.
UAS	This is the number of UnAvailable Seconds.
LOS	This is the number of Loss Of Signal seconds.
LOF	This is the number of Loss Of Frame seconds.
LOM	This is the number of Loss of Margin seconds.

Users Configuration

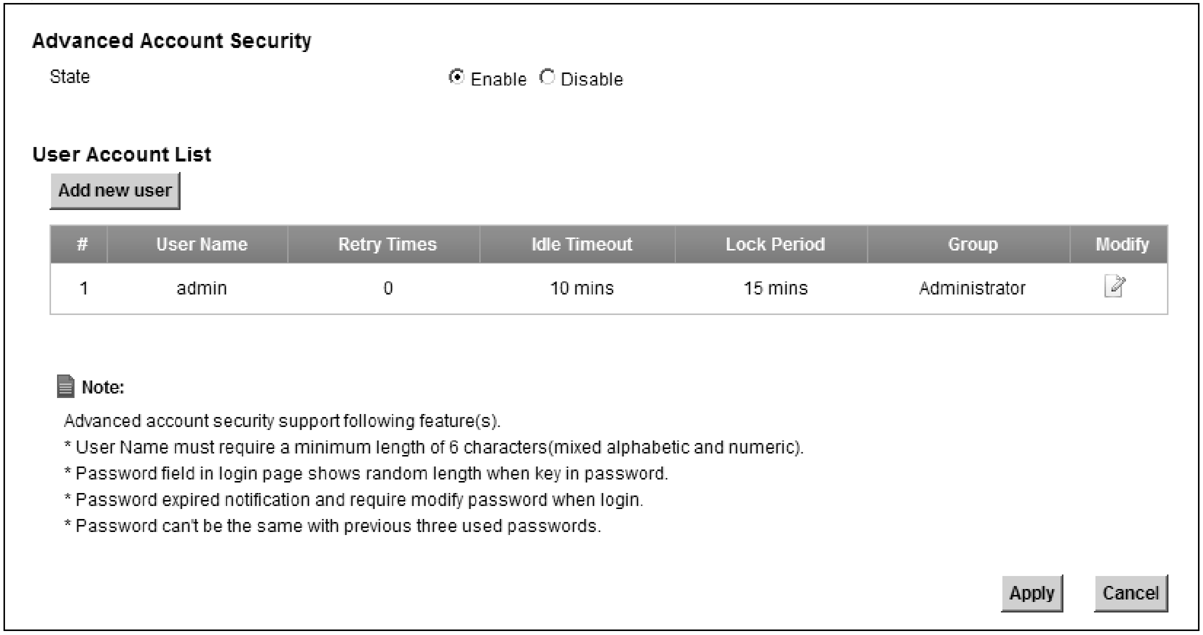
26.1 Overview

In the **Users Configuration** screen, you can view, add, and configure user accounts of the ZyXEL Device.

26.2 The Users Configuration Screen

Click **Maintenance > Users Configuration** to open the following screen.

Figure 121 Maintenance > Users Configuration



Advanced Account Security

State ● Enable ○ Disable

User Account List

#	User Name	Retry Times	Idle Timeout	Lock Period	Group	Modify
1	admin	0	10 mins	15 mins	Administrator	✎

Note:

Advanced account security support following feature(s).
* User Name must require a minimum length of 6 characters(mixed alphabetic and numeric).
* Password field in login page shows random length when key in password.
* Password expired notification and require modify password when login.
* Password can't be the same with previous three used passwords.

The following table describes the labels in this screen.

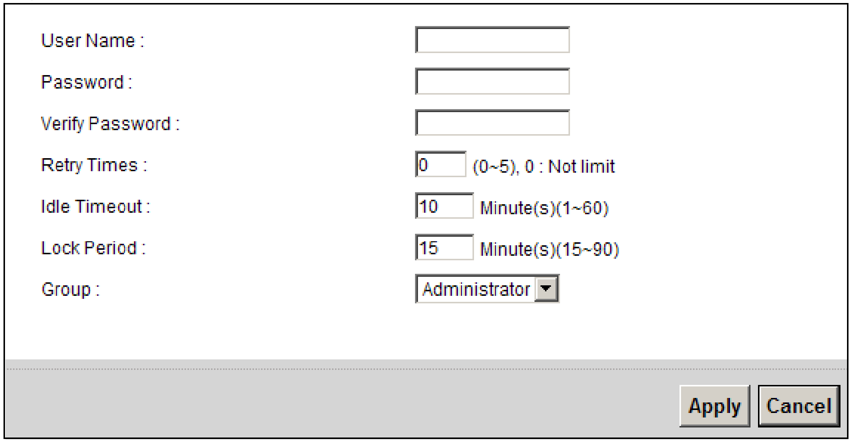
Table 98 Maintenance > Users Configuration

LABEL	DESCRIPTION
Advanced Account Security	Select **Enable** to turn on advanced account security to enforce tighter security for the ZyXEL Device's user accounts. This includes: • The user names must be a minimum length of six characters and include both letters and numbers. • The number of dots that appears when you type the password in the login screen's password field changes randomly to prevent anyone watching the password field from knowing the length of your password. • The ZyXEL Device notifies users when their passwords expire and forces them to change to a new one in order to log in. • The new password the user selects cannot match any of the user's three previously used passwords.
Add new user	Click this to configure a new user account.
#	This is the index number of the entry.
User Name	This field displays the name of the user.
Retry Times	This field indicates how many times a user can re-enter his/her account information before the ZyXEL Device locks the user out.
Idle Timeout	This field indicates the number of minutes that the system can idle before being logged out.
Lock Period	This field indicates the number of minutes for the lockout period. A user cannot log into the ZyXEL Device during the lockout period, even if he/she enters correct account information.
Group	This field displays the login account type of the user. Different login account types have different privilege levels. The web configurator screens and privileges vary depending on which account type you use to log in.
Modify	Click the **Edit** icon to edit this user account.

26.2.1 Add/Edit a Users Account

Use this screen to add or edit a users account. Click **Add new user** in the **Users Configuration** screen or the **Edit** icon next to the user account you want to edit. The screen shown next appears.

Figure 122 Users Configuration: Add/Edit



User Name :	
Password :	
Verify Password :	
Retry Times :	0 (0~5), 0 : Not limit
Idle Timeout :	10 Minute(s)(1~60)
Lock Period :	15 Minute(s)(15~90)
Group :	Administrator

The following table describes the labels in this screen.

Table 99 Users Configuration: Add/Edit

LABEL	DESCRIPTION
User Name	This field is read-only if you are editing the user account. Enter a descriptive name for the user account. The user name can be up to 15 alphanumeric characters (0-9, A-Z, a-z, -, _ with no spaces). With advanced account security enabled, the user names must be a minimum length of six characters and include both letters and numbers.
Password	Specify the password associated to this account. The password can be 6 to 15 alphanumeric characters (0-9, A-Z, a-z, -, _ with no spaces), not containing the user name. It must contain both letters and numbers. The characters are displayed as asterisks (*) in this field.
Verify Password	Enter the exact same password that you just entered in the above field.
Verify New Password	This field is displayed only when you are editing the user account. Enter the exact same password that you just entered in the above field.
Retry Times	The ZyXEL Device can lock a user out if you use a wrong user name or password to log in the ZyXEL Device. Enter up to how many times a user can re-enter his/her account information before the ZyXEL Device locks the user out.
Idle Timeout	Enter the number of minutes that the system can idle before being logged out.
Lock Period	Enter the number of minutes for the lockout period. A user cannot log into the ZyXEL Device during the lockout period, even if he/she enters correct account information.
Group	This field is read-only if you are editing the user account. Select a type of login account. The web configurator screens and privileges vary depending on which account type you use to log in. **Administrator** accounts can configure the ZyXEL Device while **User** accounts can only view some status information. Users logged in with either type of account can access the Internet.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

27

Remote Management

27.1 Overview

This chapter explains how to configure the ZyXEL Device's TR-069 and TR-064 auto-configuration settings.

27.1.1 What You Can Do in this Chapter

- The **TR-069** screen lets you configure the ZyXEL Device's TR-069 auto-configuration settings (Section 27.2 on page 245).
- The **TR-064** screen lets you enable management via TR-064 on the ZyXEL Device (Section 27.3 on page 247).
- Your ZyXEL Device can act as an SNMP agent, which allows a manager station to manage and monitor the ZyXEL Device through the network. Use the **SNMP Agent** screen to configure through which interface(s) and from which IP address(es) users can use SNMP to access the ZyXEL Device.

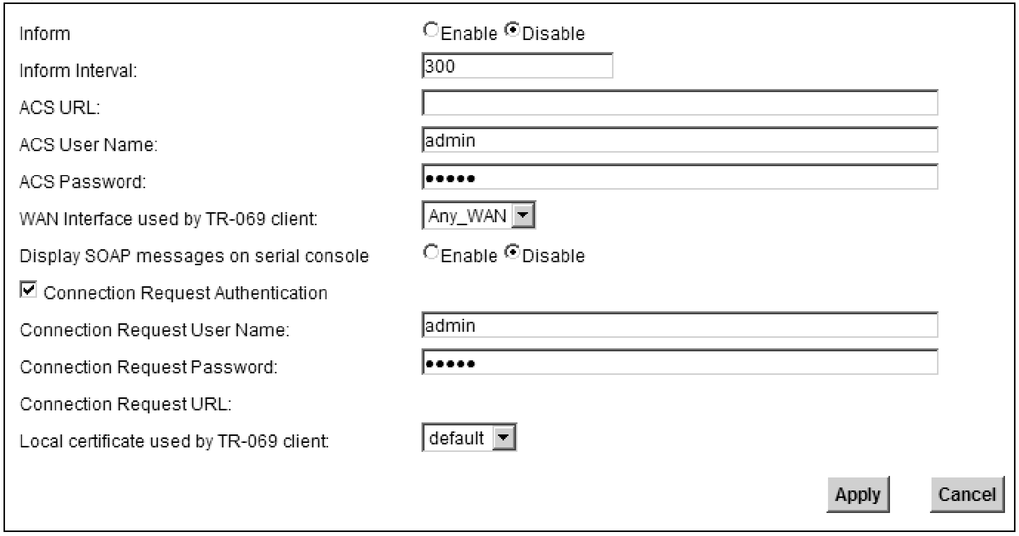
27.2 The TR-069 Clients Screen

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

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

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

Figure 123 Maintenance > Remote MGMT > TR-069 Client



Inform	○ Enable ● Disable
Inform Interval:	300
ACS URL:	
ACS User Name:	admin
ACS Password:	•••••
WAN Interface used by TR-069 client:	Any_WAN
Display SOAP messages on serial console	○ Enable ● Disable
☑ Connection Request Authentication	
Connection Request User Name:	admin
Connection Request Password:	•••••
Connection Request URL:	
Local certificate used by TR-069 client:	default

The following table describes the fields in this screen.

Table 100 Maintenance > Remote MGMT > TR-069 Client

LABEL	DESCRIPTION
Inform	Select **Enable** for the ZyXEL Device to send periodic inform via TR-069 on the WAN. Otherwise, select **Disable**.
Inform Interval	Enter the time interval (in seconds) at which the ZyXEL Device sends information to the auto-configuration server.
ACS URL	Enter the URL or IP address of the auto-configuration server.
ACS User Name	Enter the TR-069 user name for authentication with the auto-configuration server.
ACS Password	Enter the TR-069 password for authentication with the auto-configuration server.
WAN Interface used by TR-069 client	Select a WAN interface through which the TR-069 traffic passes. If you select **Any_WAN**, you should also select the pre-configured WAN connection(s).
Display SOAP messages on serial console	Select **Enable** to show the SOAP messages on the console.
Connection Request Authentication	Select this option to enable authentication when there is a connection request from the ACS.
Connection Request User Name	Enter the connection request user name. When the ACS makes a connection request to the ZyXEL Device, this user name is used to authenticate the ACS.
Connection Request Password	Enter the connection request password. When the ACS makes a connection request to the ZyXEL Device, this password is used to authenticate the ACS.
Connection Request URL	This shows the connection request URL. The ACS can use this URL to make a connection request to the ZyXEL Device.

Table 100 Maintenance > Remote MGMT > TR-069 Client (continued)

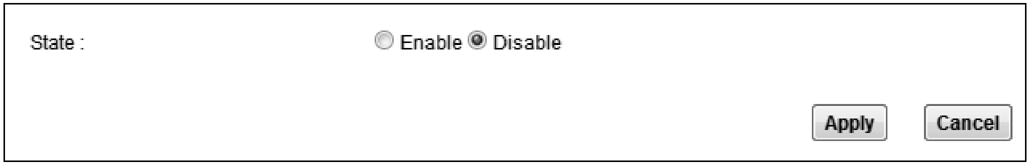
LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

27.3 The TR-064 Screen

TR-064 is a LAN-Side DSL CPE Configuration protocol defined by the DSL Forum. TR-064 is built on top of UPnP. It allows the users to use a TR-064 compliant CPE management application on their computers from the LAN to discover the CPE and configure user-specific parameters, such as the username and password.

Click **Maintenance > Remote MGMT > TR-064 Client** to open the following screen.

Figure 124 Maintenance > Remote MGMT > TR-064 Client



State : ○ Enable ● Disable

The following table describes the fields in this screen.

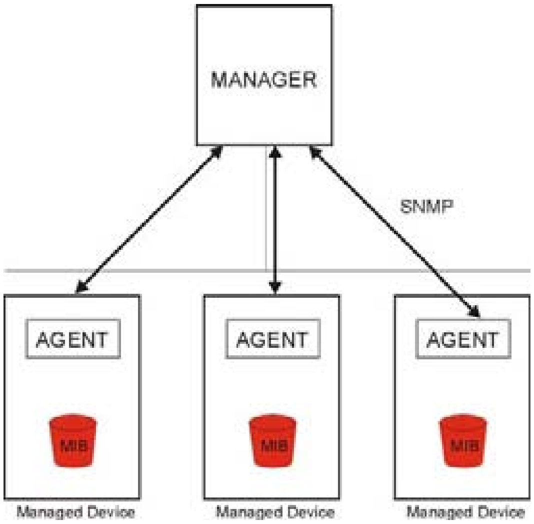
Table 101 Maintenance > Remote MGMT > TR-064 Client

LABEL	DESCRIPTION
Enable TR064	Select the check box to activate management via TR-064 on the LAN.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

27.4 The SNMP Agent Screen

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

Figure 125 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 ZyXEL Device). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

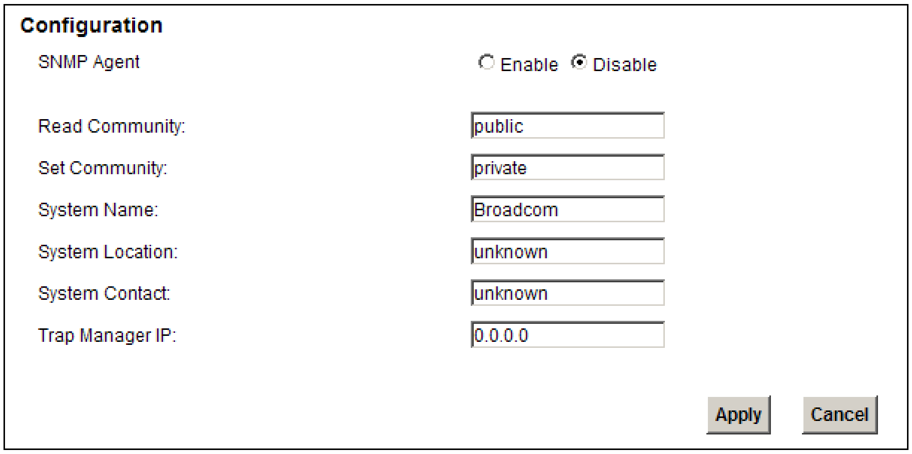
The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows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

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

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

Click **Maintenance > Remote MGMT > SNMP** to open the following screen. Use this screen to configure the ZyXEL Device SNMP settings.

Figure 126 Maintenance > Remote MGMT > SNMP



Configuration

SNMP Agent ○ Enable ● Disable

Read Community: public

Set Community: private

System Name: Broadcom

System Location: unknown

System Contact: unknown

Trap Manager IP: 0.0.0.0

The following table describes the fields in this screen.

Table 102 Maintenance > Remote MGMT > SNMP

LABEL	DESCRIPTION
SNMP Agent	Select **Enable** to allow a manager station to manage and monitor the ZyXEL Device through the network via SNMP. Otherwise, select **Disable**.
Read Community	Enter 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.
System Name	Enter the system name of the ZyXEL Device.
System Location	Specify the geographic location of the ZyXEL Device.
System Contact	Enter the name of the person in charge of the ZyXEL Device.
Trap Manager IP	Type the IP address of the station to send your SNMP traps to.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to restore your previously saved settings.

28

Time Settings

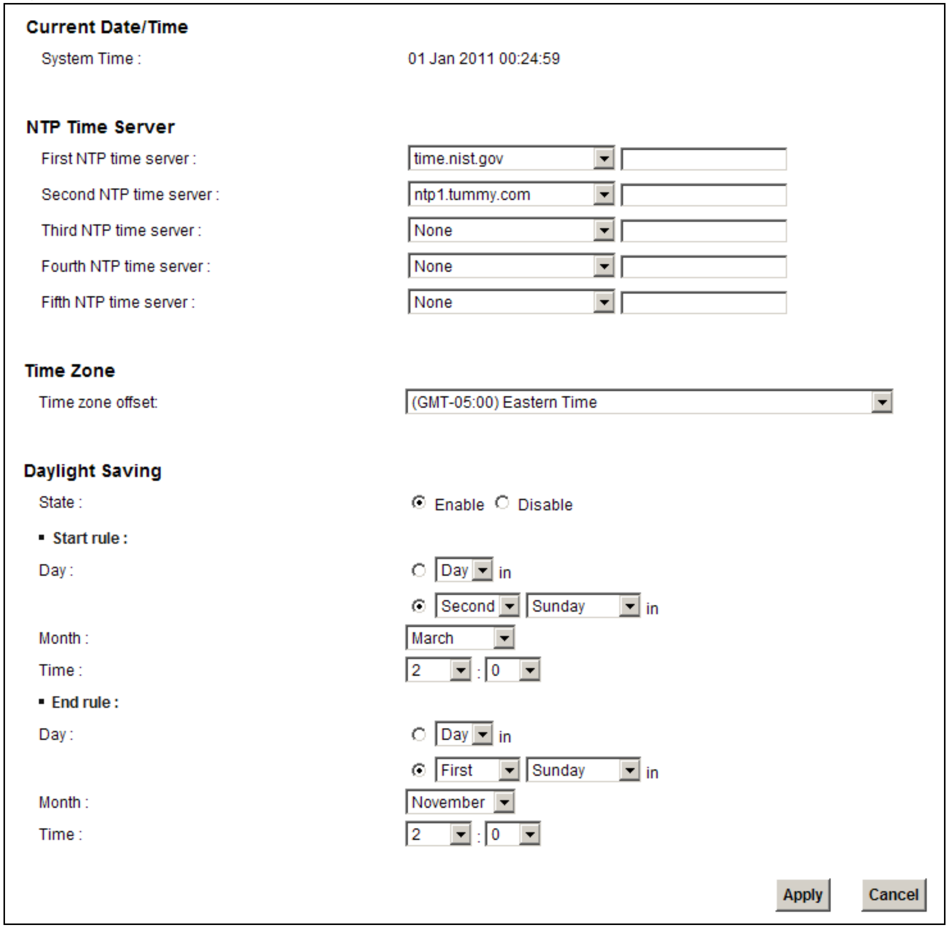
28.1 Overview

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

28.2 The Time Setting Screen

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

Figure 127 Maintenance > Time Setting



Current Date/Time

System Time :	01 Jan 2011 00:24:59

NTP Time Server

First NTP time server :	time.nist.gov	
Second NTP time server :	ntp1.tummy.com	
Third NTP time server :	None	
Fourth NTP time server :	None	
Fifth NTP time server :	None	

Time Zone

Time zone offset:	(GMT-05:00) Eastern Time

Daylight Saving

State :	● Enable ○ Disable
▪ **Start rule :**	
Day :	○ Day in ● Second Sunday in
Month :	March
Time :	2 : 0
▪ **End rule :**	
Day :	○ Day in ● First Sunday in
Month :	November
Time :	2 : 0

The following table describes the fields in this screen.

Table 103 Maintenance > Time Setting

LABEL	DESCRIPTION
Current Date/Time	
System Time	This field displays the time and fate of your ZyXEL Device. Each time you reload this page, the ZyXEL Device synchronizes the time and date with the time server.
NTP Time Server	
First ~ Fifth NTP time server	Select an NTP time server from the drop-down list box. Otherwise, select **Other** and enter the IP address or URL (up to 29 extended ASCII characters in length) of your time server. Select **None** if you don't want to configure the time server. Check with your ISP/network administrator if you are unsure of this information.
Time zone offset	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Saving	Daylight Saving Time is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
State	Select **Enable** if you use Daylight Saving Time.
Start rule:	Configure the day and time when Daylight Saving Time starts if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The **Time** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States, set the day to **Second**, **Sunday**, the month to **March** and the time to **2** in the **Hour** field. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to **Last**, **Sunday** and the month to **March**. The time you select in the **o'clock** field depends on your time zone. In Germany for instance, you would select **2** in the **Hour** field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End rule	Configure the day and time when Daylight Saving Time ends if you enabled Daylight Saving. You can select a specific date in a particular month or a specific day of a specific week in a particular month. The **Time** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would set the day to **First**, **Sunday**, the month to **November** and the time to **2** in the **Hour** field. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would set the day to **Last**, **Sunday**, and the month to **October**. The time you select in the **o'clock** field depends on your time zone. In Germany for instance, you would select **2** in the **Hour** field because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

29

Logs Setting

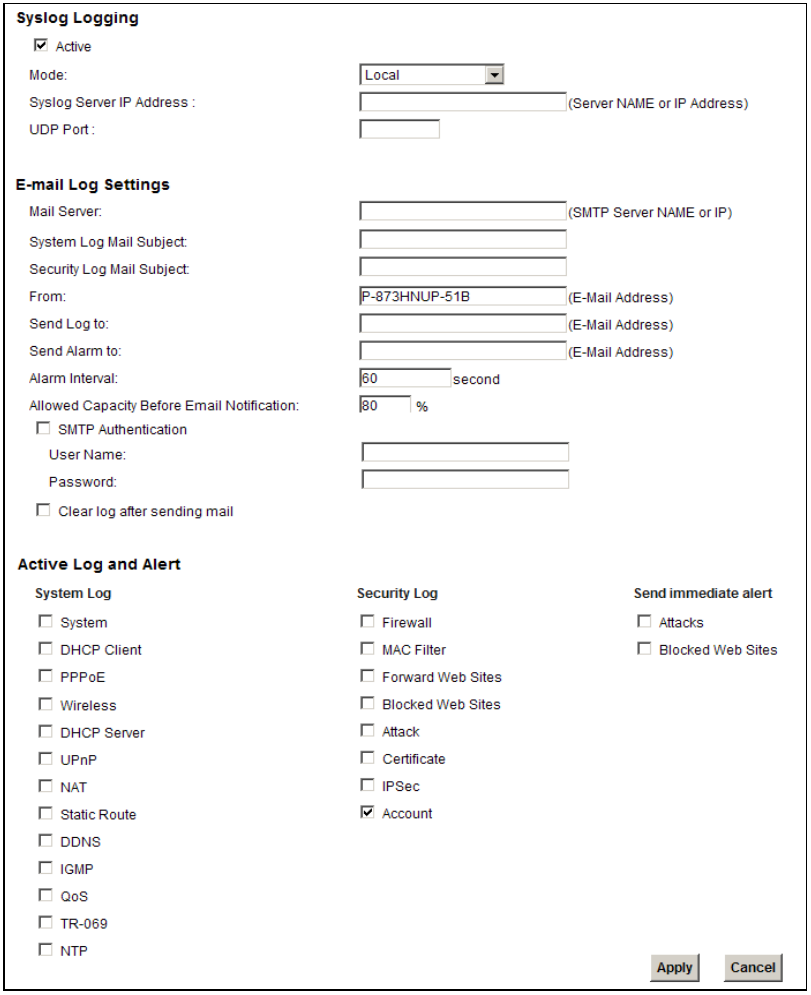
29.1 Overview

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

29.2 The Logs Setting Screen

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

Figure 128 Maintenance > Logs Setting



Syslog Logging

☑ Active

Mode:	Local
Syslog Server IP Address :	(Server NAME or IP Address)
UDP Port :	

E-mail Log Settings

Mail Server:	(SMTP Server NAME or IP)
System Log Mail Subject:	
Security Log Mail Subject:	
From:	P-873HNUP-51B (E-Mail Address)
Send Log to:	(E-Mail Address)
Send Alarm to:	(E-Mail Address)
Alarm Interval:	60 second
Allowed Capacity Before Email Notification:	80 %

□ SMTP Authentication

User Name:	
Password:	

□ Clear log after sending mail

Active Log and Alert

System Log	Security Log	Send immediate alert
□ System	□ Firewall	□ Attacks
□ DHCP Client	□ MAC Filter	□ Blocked Web Sites
□ PPPoE	□ Forward Web Sites	
□ Wireless	□ Blocked Web Sites	
□ DHCP Server	□ Attack	
□ UPnP	□ Certificate	
□ NAT	□ IPSec	
□ Static Route	☑ Account	
□ DDNS		
□ IGMP		
□ QoS		
□ TR-069		
□ NTP		

The following table describes the fields in this screen.

Table 104 Maintenance > Logs Setting

LABEL	DESCRIPTION
Syslog Logging	The ZyXEL Device sends a log to an external syslog server.
Active	Select the **Active** check box to enable syslog logging.
Mode	Select the syslog destination from the drop-down list box. If you select **Remote**, the log(s) will be sent to a remote syslog server. If you select **Local File**, the log(s) will be saved in a local file. If you want to send the log(s) to a remote syslog server and save it in a local file, select **Local File and Remote**.
Syslog Server IP Address	Enter the server name or IP address of the syslog server that will log the selected categories of logs.
UDP Port	Enter the port number used by the syslog server.
E-mail Log Settings	
Mail Server	Enter the server name or the IP address of the mail server for the e-mail addresses specified below. If this field is left blank, logs and alert messages will not be sent via E-mail.
System Log Mail Subject	Type a title that you want to be in the subject line of the system log e-mail message that the ZyXEL Device sends.
Security Log Mail Subject	Type a title that you want to be in the subject line of the security log e-mail message that the ZyXEL Device sends.
From	Specify where the logs are sent from.
Send Log to	The ZyXEL Device sends logs to the e-mail address specified in this field. If this field is left blank, the ZyXEL Device does not send logs via E-mail.
Send Alarm to	Alerts are real-time notifications that are sent as soon as an event, such as a DoS attack, system error, or forbidden web access attempt occurs. Enter the E-mail address where the alert messages will be sent. Alerts include system errors, attacks and attempted access to blocked web sites. If this field is left blank, alert messages will not be sent via E-mail.
Alarm Interval	Specify how often the alarm should be updated.
Allowed Capacity Before Email	Set what percent of the ZyXEL Device’s log storage space can be filled before the ZyXEL Device sends a log e-mail.
SMTP Authentication	SMTP (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. Select the check box to activate SMTP authentication. If mail server authentication is needed but this feature is disabled, you will not receive the E-mail logs.
User Name	Enter the user name (up to 32 characters) (usually the user name of a mail account).
Password	Enter the password associated with the user name above.
Clear log after sending mail	Select this to delete all the logs after the ZyXEL Device sends an E-mail of the logs.
Active Log and Alert	
System Log	Select the categories of system logs that you want to record.
Security Log	Select the categories of security logs that you want to record.
Send immediate alert	Select log categories for which you want the ZyXEL Device to send E-mail alerts immediately.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

29.2.1 Example E-mail Log

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

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

Figure 129 E-mail Log Example

```
Subject:
        Firewall Alert From
   Date:
        Fri, 07 Apr 2000 10:05:42
   From:
        user@zyxel.com
     To:
        user@zyxel.com
  1|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |default policy  |forward
   | 09:54:03 |UDP     src port:00520 dest port:00520  |<1,00>          |
  2|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |default policy  |forward
   | 09:54:17 |UDP     src port:00520 dest port:00520  |<1,00>          |
  3|Apr  7 00 |From:192.168.1.6     To:10.10.10.10 |match           |forward
   | 09:54:19 |UDP     src port:03516 dest port:00053  |<1,01>          |
..................................{snip}.....................................
..................................{snip}.....................................
126|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:00 |UDP     src port:00520 dest port:00520  |<1,02>          |
127|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |match           |forward
   | 10:05:17 |UDP     src port:00520 dest port:00520  |<1,02>          |
128|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:30 |UDP     src port:00520 dest port:00520  |<1,02>          |
End of Firewall Log
```

Firmware Upgrade

30.1 Overview

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

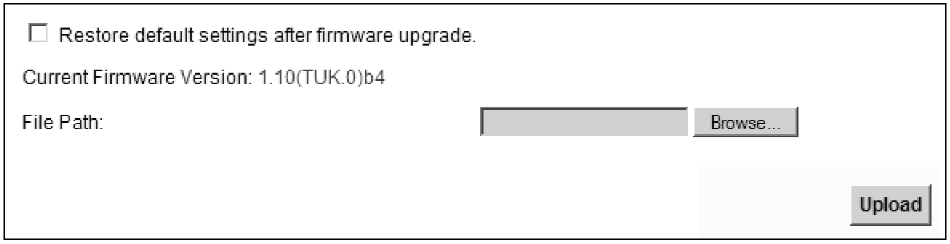
Only use firmware for your device's specific model. Refer to the label on the bottom of your ZyXEL Device.

30.2 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 ZyXEL Device while firmware upload is in progress!

Figure 130 Maintenance > Firmware Upgrade



☐ Restore default settings after firmware upgrade.

Current Firmware Version: 1.10(TUK.0)b4

File Path:

The following table describes the labels in this screen.

Table 105 Maintenance > Firmware Upgrade

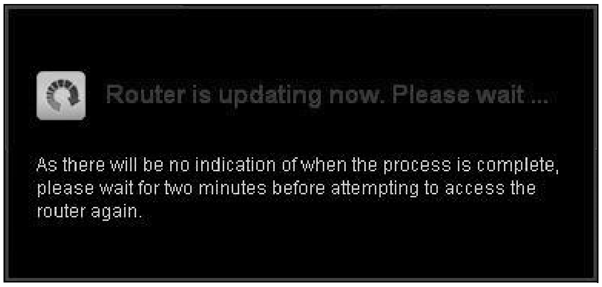
LABEL	DESCRIPTION
Restore default settings after firmware upgrade	Select this if you want the ZyXEL Device to restore to its default settings after firmware upgrade.
Current Firmware Version	This is the present Firmware version and the date created.
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.

Table 105 Maintenance > Firmware Upgrade (continued)

LABEL	DESCRIPTION
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 ZyXEL Device again.

Figure 131 Firmware Uploading

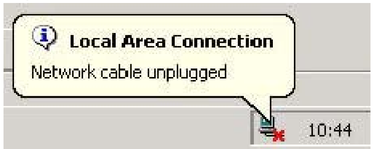


Router is updating now. Please wait ...

As there will be no indication of when the process is complete, please wait for two minutes before attempting to access the router again.

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

Figure 132 Network Temporarily Disconnected



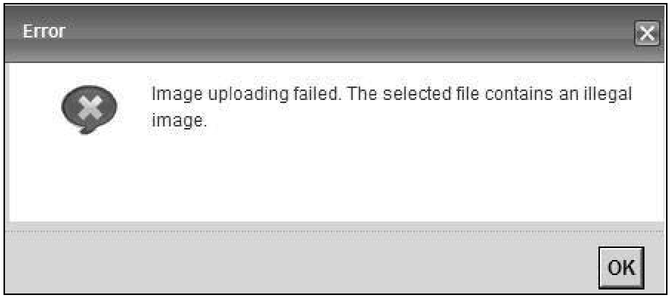
Local Area Connection

Network cable unplugged

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

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

Figure 133 Error Message



Error

Image uploading failed. The selected file contains an illegal image.

Configuration

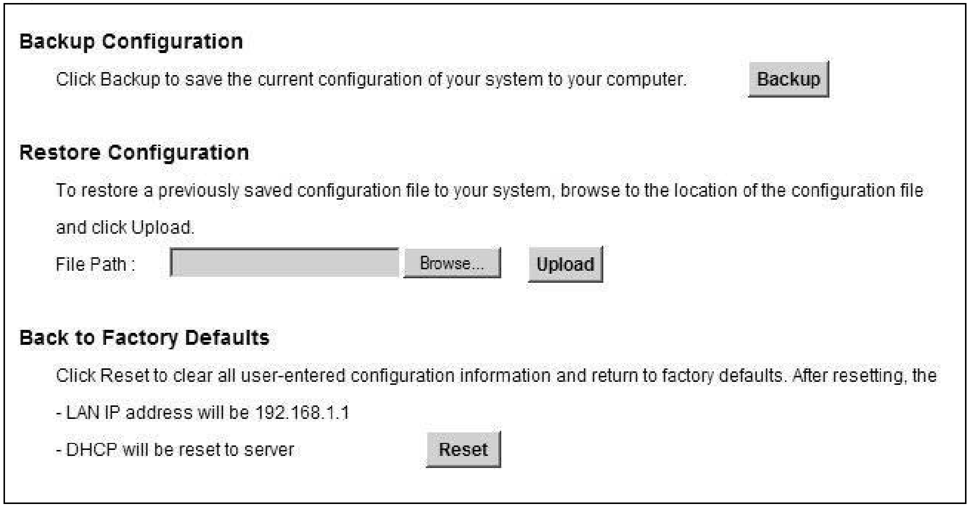
31.1 Overview

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

31.2 The Configuration Screen

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

Figure 134 Maintenance > Configuration



Backup Configuration

Click Backup to save the current configuration of your system to your computer.

Restore Configuration

To restore a previously saved configuration file to your system, browse to the location of the configuration file and click Upload.

File Path :

Back to Factory Defaults

Click Reset to clear all user-entered configuration information and return to factory defaults. After resetting, the

- LAN IP address will be 192.168.1.1

- DHCP will be reset to server

Backup Configuration

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

Click **Backup** to save the ZyXEL Device’s current configuration to your computer.

Restore Configuration

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

Table 106 Restore Configuration

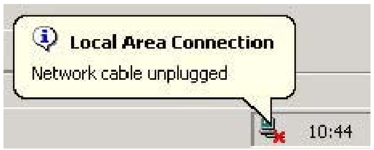
LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.
Browse...	Click this to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click this to begin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

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

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

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

Figure 135 Network Temporarily Disconnected



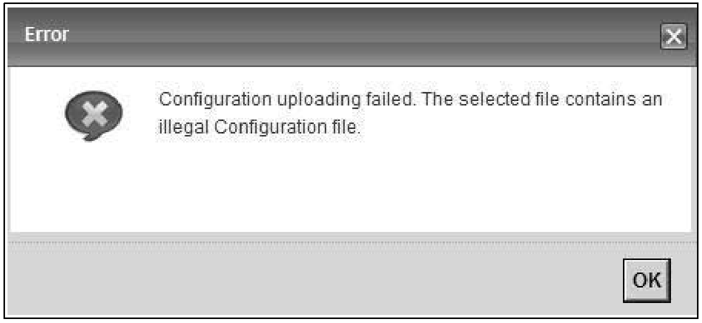
Local Area Connection

Network cable unplugged

If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default device IP address (192.168.1.1). See Appendix A on page 279 for details on how to set up your computer's IP address.

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

Figure 136 Configuration Upload Error



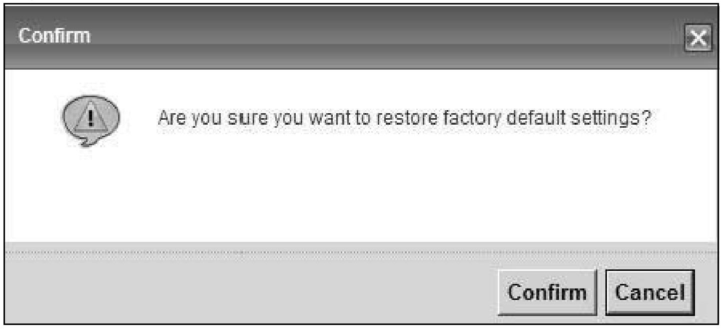
Error

Configuration uploading failed. The selected file contains an illegal Configuration file.

Reset to Factory Defaults

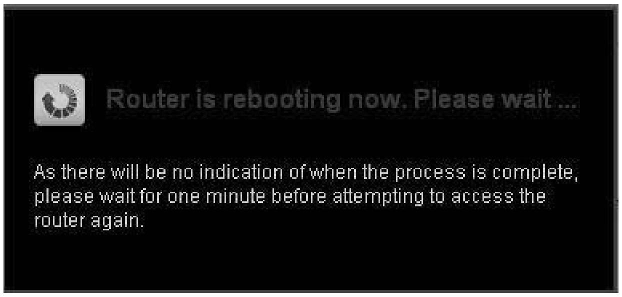
Click the **Reset** button to clear all user-entered configuration information and return the ZyXEL Device to its factory defaults. The following warning screen appears.

Figure 137 Reset Warning Message



Are you sure you want to restore factory default settings?

Figure 138 Reset In Process Message



Router is rebooting now. Please wait ...

As there will be no indication of when the process is complete, please wait for one minute before attempting to access the router again.

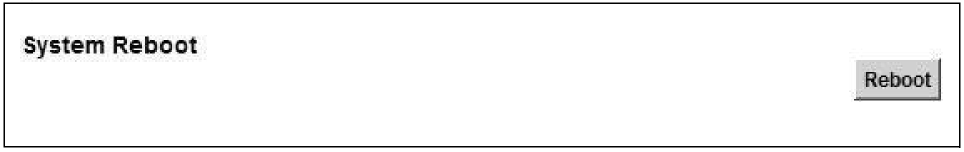
You can also press the **RESET** button on the rear panel to reset the factory defaults of your ZyXEL Device. Refer to Section 1.6 on page 26 for more information on the **RESET** button.

31.3 The Reboot Screen

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

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

Figure 139 Maintenance > Reboot



32

Diagnostic

32.1 Overview

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

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

32.1.1 What You Can Do in this Chapter

- The **Ping & TraceRoute & NsLookup** screen lets you ping an IP address or trace the route packets take to a host (Section 32.3 on page 263).
- The **802.1ag** screen lets you perform CFM actions (Section 32.5 on page 265).
- The **OAM Ping Test** screen lets you send an ATM OAM (Operation, Administration and Maintenance) packet to verify the connectivity of a specific PVC. (Section 32.5 on page 265).

32.2 What You Need to Know

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

How CFM Works

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

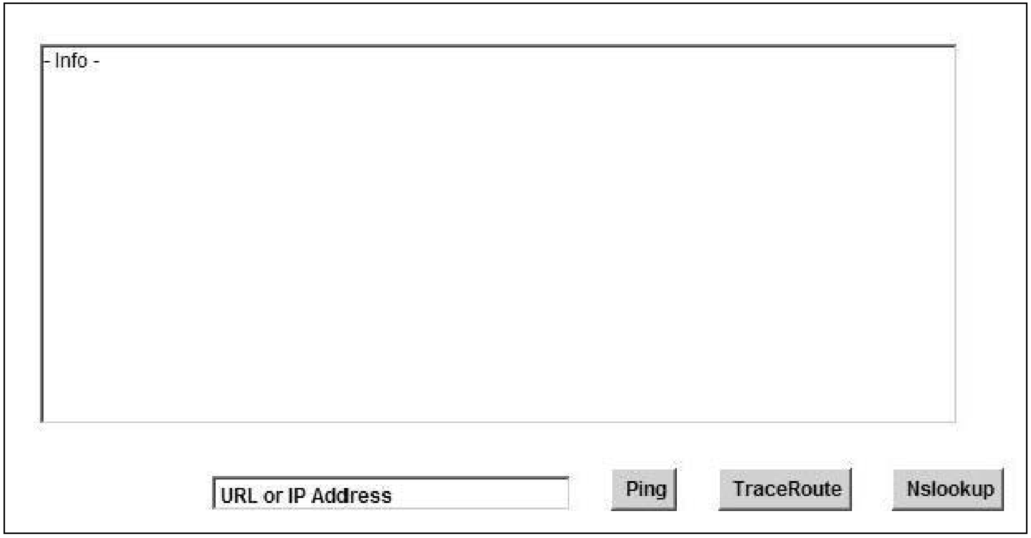
CFM provides two tests to discover connectivity faults.

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

32.3 Ping & TraceRoute & NsLookup

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

Figure 140 Maintenance > Diagnostic > Ping & TraceRoute & NsLookup



The following table describes the fields in this screen.

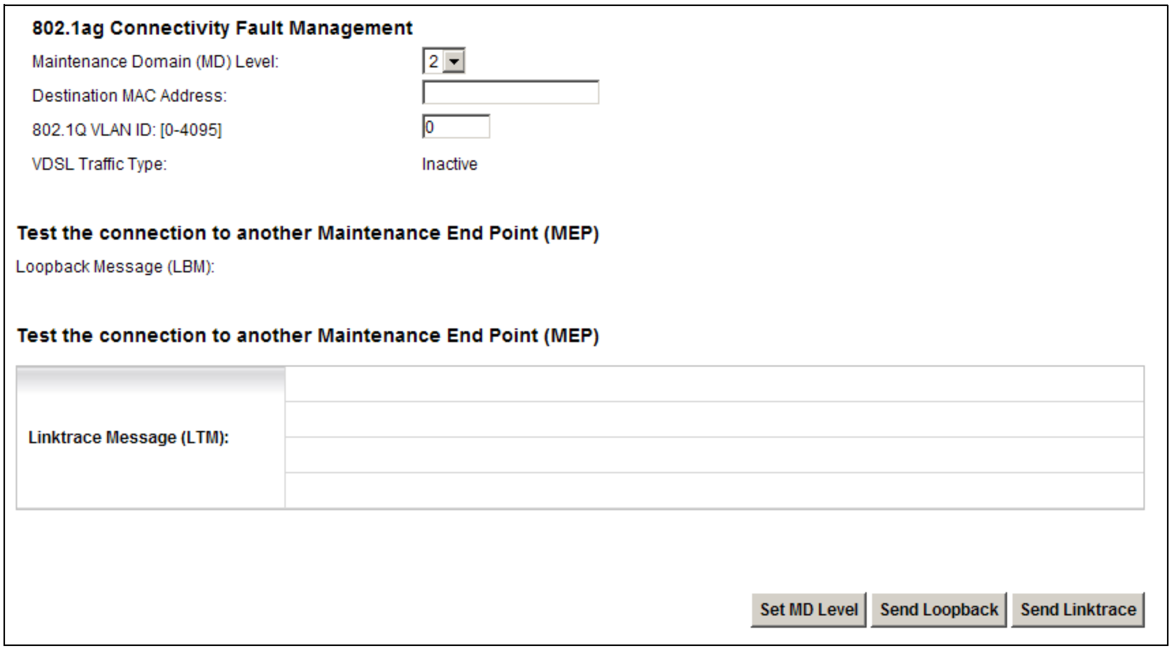
Table 107 Maintenance > Diagnostic > Ping & TraceRoute & NsLookup

LABEL	DESCRIPTION
URL or IP Address	Type the IP address of a computer that you want to perform ping, traceroute, or nslookup in order to test a connection.
Ping	Click this to ping the IP address that you entered.
TraceRoute	Click this button to perform the traceroute function. This determines the path a packet takes to the specified computer.
Nslookup	Click this button to perform a DNS lookup on the IP address of a computer you enter.

32.4 802.1ag

Click **Maintenance > Diagnostic** > **8.2.1ag** to open the following screen. Use this screen to perform CFM actions.

Figure 141 802.1ag



802.1ag Connectivity Fault Management

Maintenance Domain (MD) Level: 2

Destination MAC Address:

802.1Q VLAN ID: [0-4095] 0

VDSL Traffic Type: Inactive

Test the connection to another Maintenance End Point (MEP)

Loopback Message (LBM):

Test the connection to another Maintenance End Point (MEP)

Linktrace Message (LTM):

The following table describes the fields in this screen.

Table 108 Maintenance > Diagnostic > 802.1ag

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

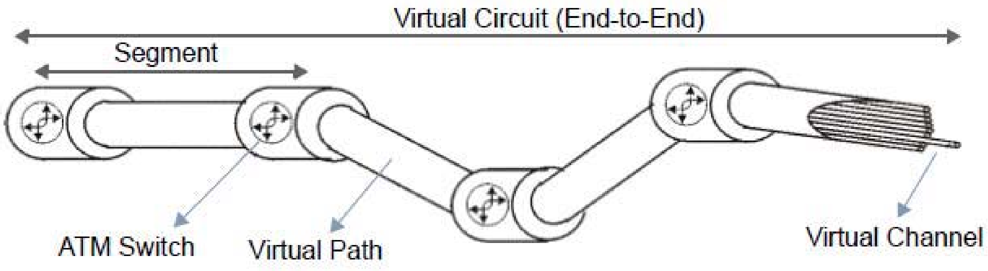
32.5 OAM Ping Test

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

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

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

Figure 142 Virtual Circuit Topology



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

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

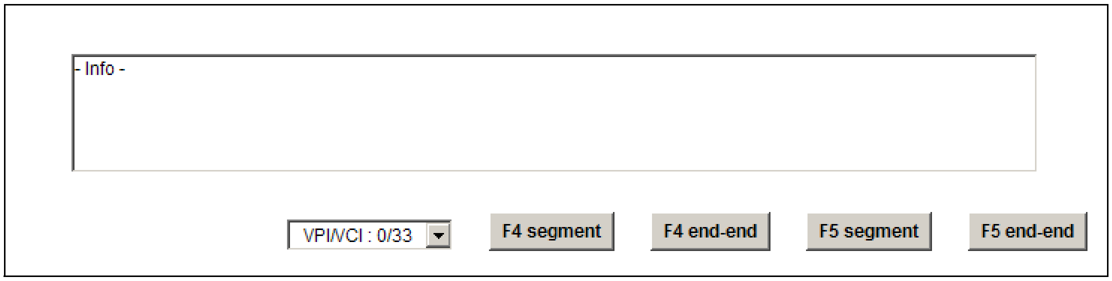
- segment F4 flows (VCI=3)
- end-to-end F4 flows (VCI=4)
- segment F5 flows (PTI=100)
- end-to-end F5 flows (PTI=101)

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

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

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

Figure 143 Maintenance > Diagnostic > OAM Ping Test



The following table describes the fields in this screen.

Table 109 Maintenance > Diagnostic > OAM Ping Test

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

33

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
- ZyXEL Device Access and Login
- Internet Access

33.1 Power, Hardware Connections, and LEDs

The ZyXEL Device does not turn on. None of the LEDs turn on.

1 Make sure the ZyXEL Device is turned on.

2 Make sure you are using the power adaptor or cord included with the ZyXEL Device.

3 Make sure the power adaptor or cord is connected to the ZyXEL Device and plugged in to an appropriate power source. Make sure the power source is turned on.

4 Turn the ZyXEL Device off and on.

5 If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1 Make sure you understand the normal behavior of the LED. See Section 1.5 on page 25.

2 Check the hardware connections.

3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.

4 Turn the ZyXEL Device off and on.

5 If the problem continues, contact the vendor.

33.2 ZyXEL Device Access and Login

I forgot the IP address for the ZyXEL Device.

1 The default LAN 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 ZyXEL Device 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 ZyXEL Device (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 1.6 on page 26.

I forgot the password.

1 The default admin password is **1234**.

2 If this does not work, you have to reset the device to its factory defaults. See Section 1.6 on page 26.

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

1 Make sure you are using the correct IP address.

- The default IP address is 192.168.1.1.
- If you changed the IP address (Section 8.2 on page 117), 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 ZyXEL Device.

2 Check the hardware connections, and make sure the LEDs are behaving as expected. See Section 1.5 on page 25.

3 Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled. See Appendix C on page 309.

4 Reset the device to its factory defaults, and try to access the ZyXEL Device with the default IP address. See Section 1.6 on page 26.

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

Advanced Suggestions

- Make sure you have logged out of any earlier management sessions using the same user account even if they were through a different interface or using a different browser.
- Try to access the ZyXEL Device using another service, such as Telnet. If you can access the ZyXEL Device, check the remote management settings and firewall rules to find out why the ZyXEL Device does not respond to HTTP.
- If your computer is connected to the **WAN** port or is connected wirelessly, use a computer that is connected to an **ETHERNET** port.\

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

1 Make sure you have entered the password correctly. The default admin password is **1234**. 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 ZyXEL Device. Log out of the ZyXEL Device in the other session, or ask the person who is logged in to log out.

3 Turn the ZyXEL Device off and on.

4 If this does not work, you have to reset the device to its factory defaults. See Section 33.1 on page 267.

I cannot Telnet to the ZyXEL Device.

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

2 Check the service control settings for Telnet. See Chapter 20 on page 223.

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

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

2 Check the service control settings for FTP. See Chapter 20 on page 223.

33.3 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 for hardware connections information and Section 1.5 on page 25 for LED behaviors.

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

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

4 Disconnect all the cables from your device, and follow the directions in the Quick Start Guide to connect them again.

5 If the problem continues, contact your ISP.

I cannot access the Internet through a DSL connection.

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

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

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

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

I cannot access the Internet through an Ethernet WAN connection.

1 Make sure you have the **ETHERNET WAN** port connected to a broadband modem or router in your network.

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

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

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

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

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

I cannot access the Internet anymore. I had access to the Internet (with the ZyXEL Device), but my Internet connection is not available anymore.

1 Your session with the ZyXEL Device may have expired. Try logging into the ZyXEL Device again.

2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide for hardware connections information and Section 1.5 on page 25 for LED behaviors.

3 Turn the ZyXEL Device off and on.

4 If the problem continues, contact your ISP.

33.4 Wireless Internet Access

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

The following factors may cause interference:

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

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

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

What wireless security modes does my ZyXEL Device support?

Wireless security is vital to your network. It protects communications between wireless stations, access points and the wired network.

The available security modes in your ZyXEL device are as follows:

- **WPA2-PSK:** (recommended) This uses a pre-shared key with the WPA2 standard.
- **WPA-PSK:** This has the device use either WPA-PSK or WPA2-PSK depending on which security mode the wireless client uses.
- **WPA2:** WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA. It requires the use of a RADIUS server and is mostly used in business networks.
- **WPA:** Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. It requires the use of a RADIUS server and is mostly used in business networks.
- **WEP:** Wired Equivalent Privacy (WEP) encryption scrambles the data transmitted between the wireless stations and the access points to keep network communications private.

Product Specifications

The following tables summarize the ZyXEL Device’s hardware and firmware features.

34.1 Hardware Specifications

Table 110 Hardware Specifications

Dimensions	210 (L) x 154 (W) x 40 (H) mm (without external antenna)
Weight	495g (without external antenna)
Power Adaptor Output	12 V 1.5 A
Power Adaptor Input	100-240V AC, 50/60Hz
RESET Button	Restores factory defaults
WLAN/WPS Button	If the wireless network is turned off, press the **WLAN/WPS** button on the front of the ZyXEL Device for two seconds. Once the **WLAN/WPS** LED turns green, the wireless network is active. While the **WLAN/WPS** LED is green press the **WLAN/WPS** button for five seconds and release it to enable WPS (Wi-Fi Protected Setup). To turn off the wireless network, press the **WLAN/WPS** button on the front of the ZyXEL Device for one to five seconds. The **WLAN/WPS** LED turns off when the wireless network is off.
Antennas	Two: One detachable external, 2dBi antenna and one internal, 2dBi antenna.
Built-in Switch	Four auto-negotiating, auto MDI/MDI-X 10/100 Mbps RJ-45 Ethernet ports
DSL Port	One RJ-11 connector for DSL over POTS
Gigabit Ethernet WAN Port	One RJ-45 connector for GBE WAN
HomePNA Coaxial Port	One port for HPNA v3.1 access, coax F type connector
USB Ports	One USB v2.0 port for file sharing
Operation Temperature	0º C ~ 40º C
Storage Temperature	-20º ~ 60º C
Operation Humidity	20% ~ 85% RH (non-condensing)
Storage Humidity	20% ~ 90% RH (non-condensing)

34.2 Firmware Specifications

Table 111 Firmware Specifications

Default IP Address	192.168.1.1
Default Subnet Mask	255.255.255.0 (24 bits)
Default User Name	admin
Default Password	1234
DHCP Server IP Pool	192.168.1.2 to 192.168.1.254
Static Routes	16
Device Management	Use the web configurator to easily configure the rich range of features on the ZyXEL Device.
Wireless Functionality (wireless devices only)	Allow the IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n wireless clients to connect to the ZyXEL Device wirelessly. Enable wireless security (WEP, WPA(2), WPA(2)-PSK) and/or MAC filtering to protect your wireless network.
Firmware Upgrade	Download new firmware (when available) from the web site and use the web configurator to put it on the ZyXEL Device. Note: Only upload firmware for your specific model!
Configuration Backup & Restoration	Make a copy of the ZyXEL Device's configuration. You can put it back on the ZyXEL Device later if you decide to revert back to an earlier configuration.
HomePNA (Home Phoneline Networking Alliance, also known as HPNA) 3.1	Extend your Internet connection to the coaxial outlets in your house. HPNA is a home networking technology for carrying data over existing coaxial cables and telephone wiring.
Port Forwarding	If you have a server (mail or web server for example) on your network, you can use this feature to let people access it from the Internet.
DHCP (Dynamic Host Configuration Protocol)	Use this feature to have the ZyXEL Device assign IP addresses, an IP default gateway and DNS servers to computers on your network. Your device can also act as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.
Dynamic DNS Support	With Dynamic DNS (Domain Name System) support, you can use a fixed URL with a dynamic IP address. You must register for this service with a Dynamic DNS service provider.
IP Multicast	IP multicast is used to send traffic to a specific group of computers. The ZyXEL Device supports versions 2 and 3 of IGMP (Internet Group Management Protocol) used to join multicast groups (see RFC 2236).
Time and Date	Get the current time and date from an external server when you turn on your ZyXEL Device. You can also set the time manually. These dates and times are then used in logs.
Logs	Use logs for troubleshooting. You can send logs from the ZyXEL Device to an external syslog server.
Universal Plug and Play (UPnP)	A UPnP-enabled device can dynamically join a network, obtain an IP address and convey its capabilities to other devices on the network.
QoS (Quality of Service)	You can efficiently manage traffic on your network by reserving bandwidth and giving priority to certain types of traffic and/or to particular computers.

Table 111 Firmware Specifications (continued)

Remote Management	This allows you to decide whether a service (HTTPS or FTP traffic for example) from a computer on a network (LAN or WAN for example) can access the ZyXEL Device.
PPPoE Support (RFC2516)	PPPoE (Point-to-Point Protocol over Ethernet) emulates a dial-up connection. It allows your ISP to use their existing network configuration with newer broadband technologies such as ADSL. The PPPoE driver on your device is transparent to the computers on the LAN, which see only Ethernet and are not aware of PPPoE thus saving you from having to manage PPPoE clients on individual computers.
Other PPPoE Features	PPPoE idle time out PPPoE dial on demand
Packet Filters	Your device’s packet filtering function allows added network security and management.
VDSL Standards	• ITU-T G.993.2 (VDSL2) • ITU-T G.993.1 (VDSL1) • ITU-T G.994.1 (G.hs) • ITU-T G.997.1 • Pass TR-114(Still Need test for Single pair) • Support VDSL band plan, Annex A, Annex B, 997, 998 • Support VDSL profiles, 8a/b/c/d, 12a/b and 17a • Support U0 band for long reach • Maximum data rate (DS/US): 100Mbps/45Mbps • Rate adaption • SRA (Seamless Rate Adaption) • UPBO (Upstream power back-off) • VDSL OAM communication channels • INP value up to 16 • Trellis coding • Erasure and Broadcom PhyR PHY Level Retransmission Technology • PTM mode
ADSL Standards	• G.992.1(G.dmt) Annex A, B compliant • G.992.2(G.lite), Annex A compliant • ANSI T1.413 compliant • G.992.3(ADSL2) compliant, Annex A, B, L and M • G.992.5(ADSL2+) compliant, Annex A, B, and M • I.432 ATM physical layer compliant • Reach-Extended ADSL (RE ADSL), • SRA (Seamless Rate Adaptation) • Rate adaptation • ADSL physical connection ATM AAL5 (ATM Adaptation Layer type 5) • Support multi-protocol over AAL5 (RFC2684/1483) • PPP over ATM AAL5 (RFC2364) • PPPoE (RFC 2516) • MAC Encapsulation Routing • Support VC-based and LLC-based multiplexing • Support up to 8 PVCs • ATM traffic shaping (CBR, VBR-rt/nrt, UBR) • I.610 F4/F5 OAM • Upstream power backoff (UPBO) • Broadcom PhyR, PHY Level Retransmission Technology • Broadcom Nitro mode, ATM header compression

Table 111 Firmware Specifications (continued)

Other Protocol Support	PPP (Point-to-Point Protocol) link layer protocol Transparent bridging for unsupported network layer protocols RIP I/RIP II ICMP ATM QoS IP Multicasting IGMP v2 and v3 IGMP Proxy
Management	Embedded Web Configurator Remote Firmware Upgrade Embedded FTP/TFTP Server for firmware upgrade and configuration file backup and restore Syslog TR-069 TR-064

The following list, which is not exhaustive, illustrates the standards supported in the ZyXEL Device.

Table 112 Standards Supported

STANDARD	DESCRIPTION
RFC 1058	RIP-1 (Routing Information Protocol)
RFC 1112	IGMP v1
RFC 1305	Network Time Protocol (NTP version 3)
RFC 1483	Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 1631	IP Network Address Translator (NAT)
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1723	RIP-2 (Routing Information Protocol)
RFC 2236	Internet Group Management Protocol, Version 2.
RFC 2364	PPP over AAL5 (PPP over ATM over ADSL)
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 2766	Network Address Translation - Protocol
IEEE 802.11	Also known by the brand Wi-Fi, denotes a set of Wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN Standards Committee (IEEE 802).
IEEE 802.11b	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11g	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11d	Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges
IEEE 802.11x	Port Based Network Access Control.
IEEE 802.11e QoS	IEEE 802.11 e Wireless LAN for Quality of Service
ANSI T1.413, Issue 2	Asymmetric Digital Subscriber Line (ADSL) standard.
G dmt(G.992.1)	G.992.1 Asymmetrical Digital Subscriber Line (ADSL) Transceivers
ITU G.992.1 (G.DMT)	ITU standard for ADSL using discrete multitone modulation.

Table 112 Standards Supported (continued)

STANDARD	DESCRIPTION
ITU G.992.2 (G. Lite)	ITU standard for ADSL using discrete multitone modulation.
ITU G.992.3 (G.dmt.bis)	ITU standard (also referred to as ADSL2) that extends the capability of basic ADSL in data rates.
ITU G.992.4 (G.lite.bis)	ITU standard (also referred to as ADSL2) that extends the capability of basic ADSL in data rates.
ITU G.992.5 (ADSL2+)	ITU standard (also referred to as ADSL2+) that extends the capability of basic ADSL by doubling the number of downstream bits.
ITU-T G.993.2 (VDSL2)	ITU standard that defines VDSL2.
TR-069	DSL Forum Standard for CPE Wan Management.
TR-064	DSL Forum LAN-Side DSL CPE Configuration

A

Setting up Your Computer’s IP Address

All computers must have a 10M or 100M Ethernet adapter card 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.

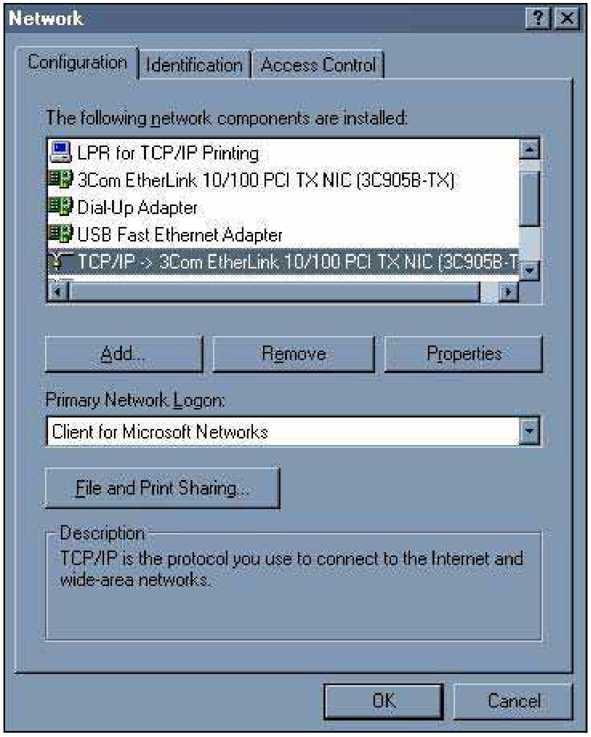
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

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 ZyXEL Device’s LAN port.

Windows 95/98/Me

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

Figure 144 WIndows 95/98/Me: Network: Configuration



The following network components are installed:

- LPR for TCP/IP Printing
- 3Com EtherLink 10/100 PCI TX NIC (3C905B-TX)
- Dial-Up Adapter
- USB Fast Ethernet Adapter
- TCP/IP -> 3Com EtherLink 10/100 PCI TX NIC (3C905B-T

Primary Network Logon: Client for Microsoft Networks

Description

TCP/IP is the protocol you use to connect to the Internet and wide-area networks.

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

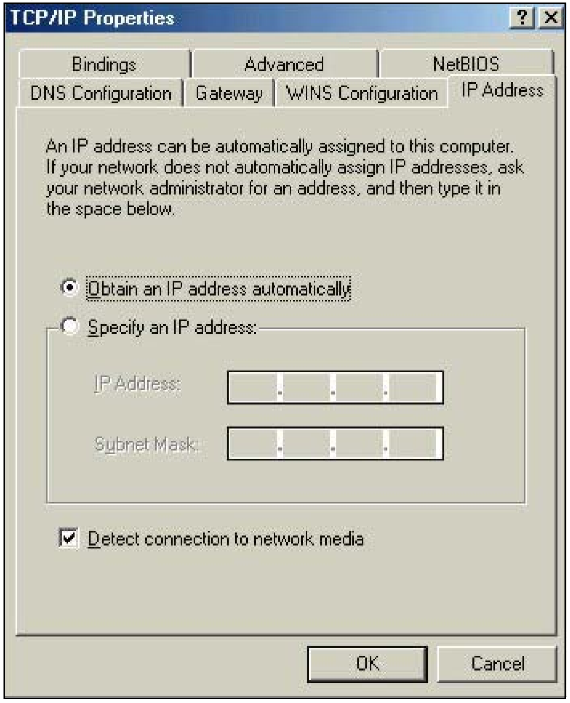
1 In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**

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 145 Windows 95/98/Me: TCP/IP Properties: IP Address



An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.

● Obtain an IP address automatically

○ Specify an IP address:

IP Address: . . .

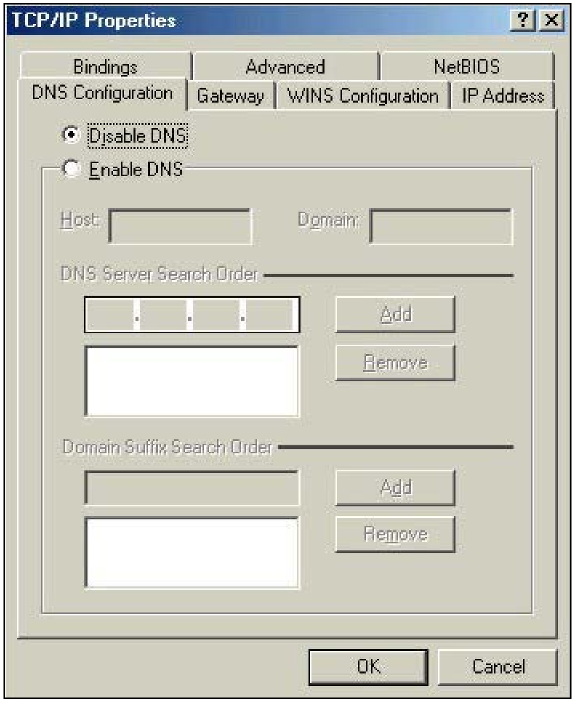
Subnet Mask: . . .

☑ Detect connection to network media

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 146 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



● Disable DNS

○ Enable DNS

Host:

Domain:

DNS Server Search Order

. . .

Domain Suffix Search Order

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 ZyXEL Device 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.

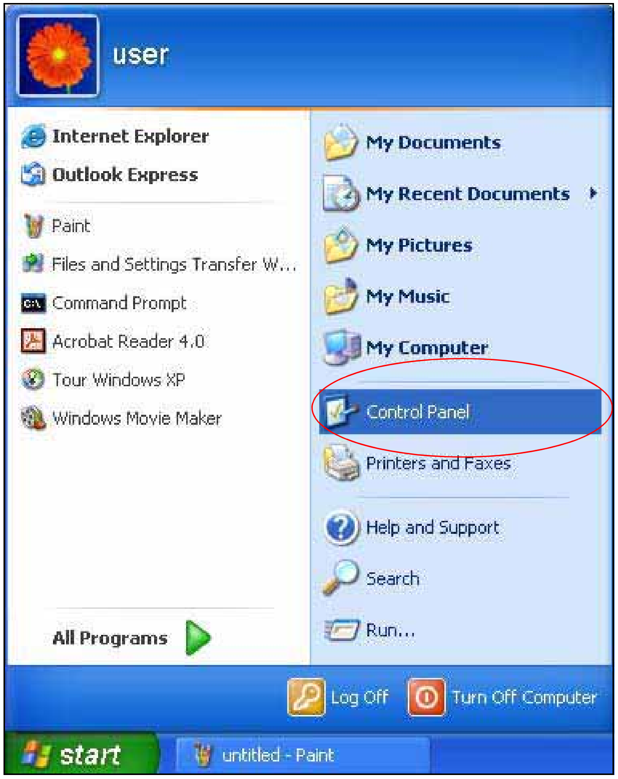
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

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

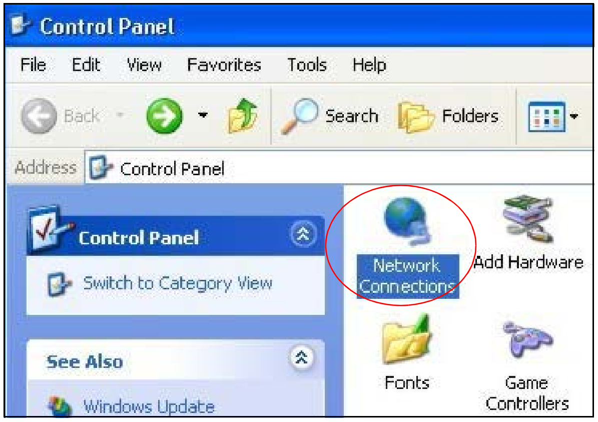
1 Click **start** (**Start** in Windows 2000/NT), **Settings**, **Control Panel**.

Figure 147 Windows XP: Start Menu



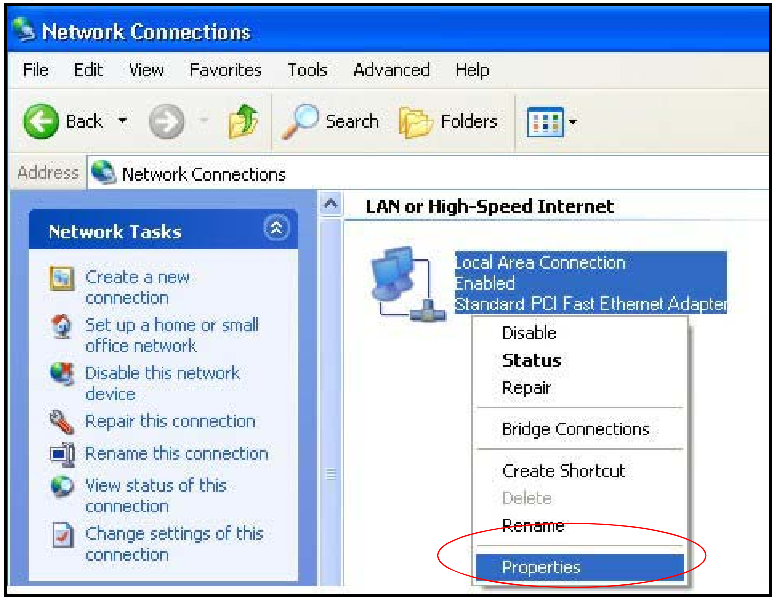
2 In the **Control Panel**, double-click **Network Connections** (**Network and Dial-up Connections** in Windows 2000/NT).

Figure 148 Windows XP: Control Panel



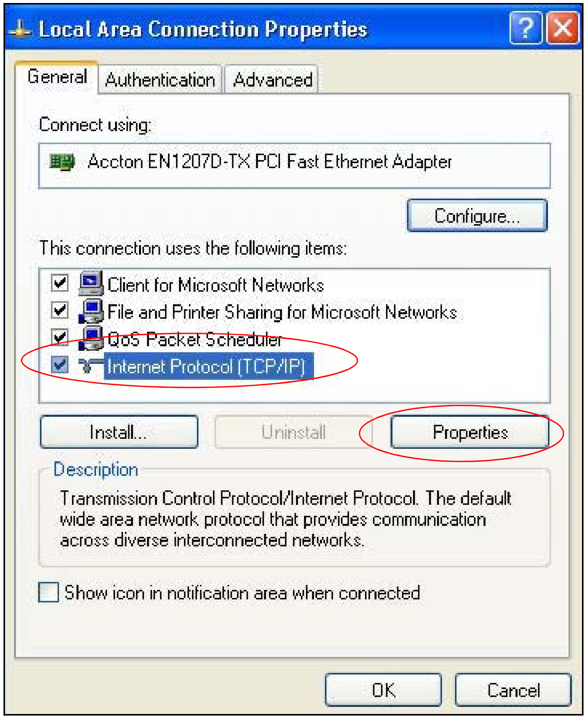
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 149 Windows XP: Control Panel: Network Connections: Properties


Network Connections
File Edit View Favorites Tools Advanced Help
Back Search Folders
Address Network Connections
Network Tasks
Create a new connection
Set up a home or small office network
Disable this network device
Repair this connection
Rename this connection
View status of this connection
Change settings of this connection
LAN or High-Speed Internet
Local Area Connection
Enabled
Standard PCI Fast Ethernet Adapter
Disable
Status
Repair
Bridge Connections
Create Shortcut
Delete
Rename
Properties

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

Figure 150 Windows XP: Local Area Connection Properties



Connect using:

Accton EN1207D-TX PCI Fast Ethernet Adapter

This connection uses the following items:

☑ Client for Microsoft Networks
☑ File and Printer Sharing for Microsoft Networks
☑ QoS Packet Scheduler
☑ Internet Protocol (TCP/IP)

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

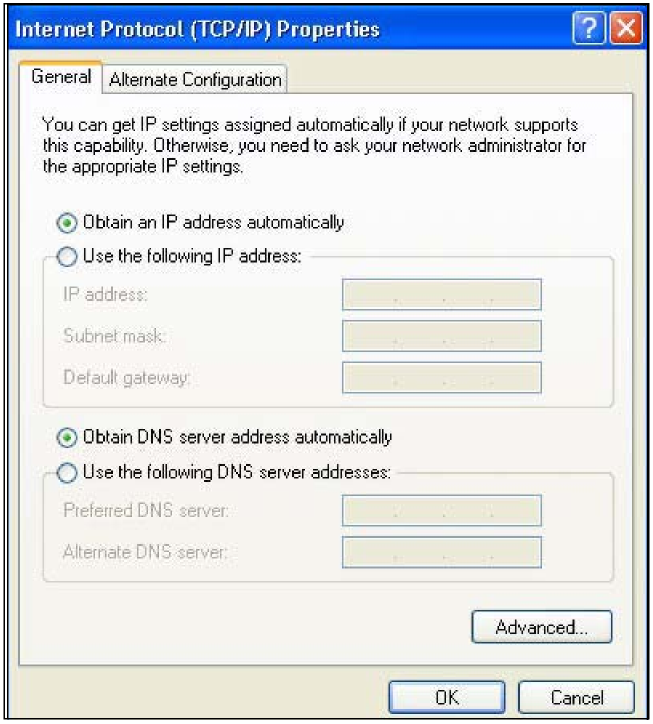
□ Show icon in notification area when connected

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 151 Windows XP: Internet Protocol (TCP/IP) Properties



Internet Protocol (TCP/IP) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address:

Subnet mask:

Default gateway:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server:

Alternate DNS server:

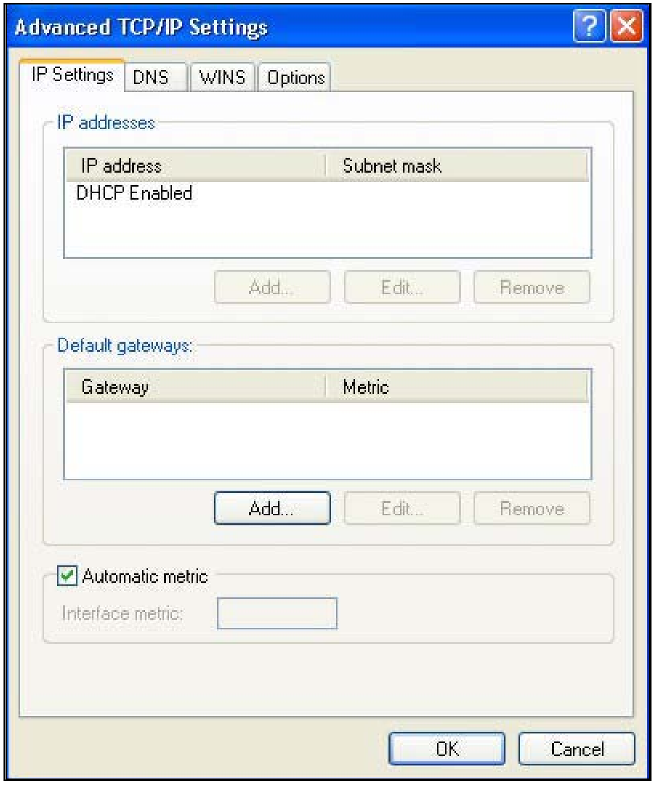
6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

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 152 Windows XP: Advanced TCP/IP Properties



IP address	Subnet mask
DHCP Enabled	

Gateway	Metric

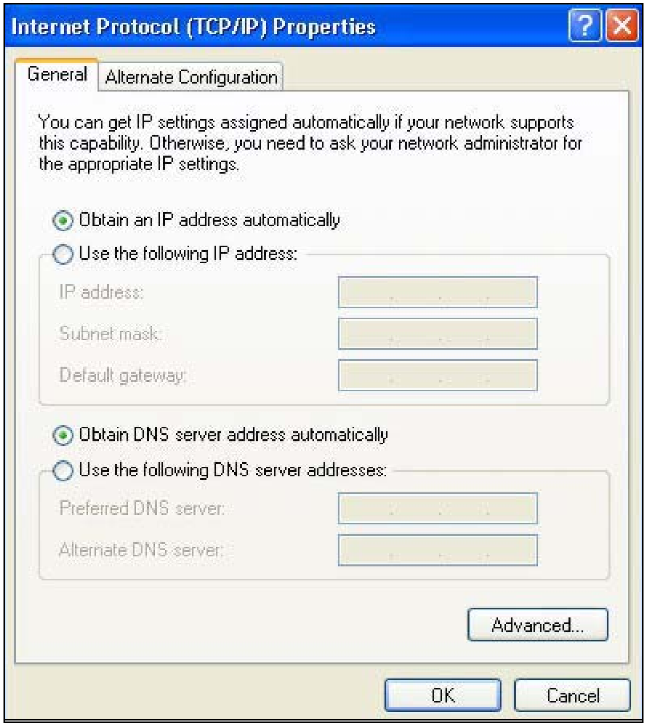
☑ Automatic metric

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 153 Windows XP: Internet Protocol (TCP/IP) Properties



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

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 ZyXEL Device and restart your computer (if prompted).

Verifying Settings

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

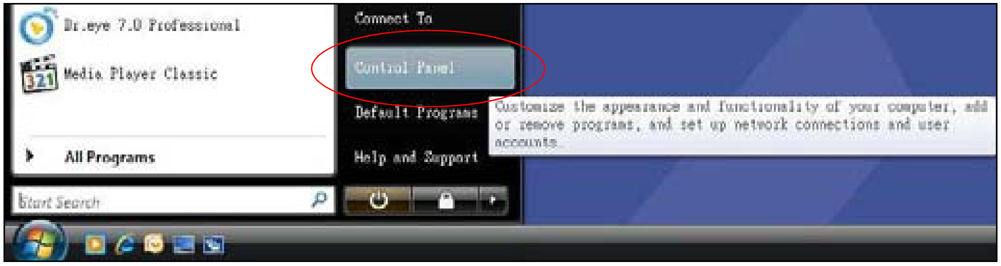
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Windows Vista

This section shows screens from Windows Vista Enterprise Version 6.0.

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

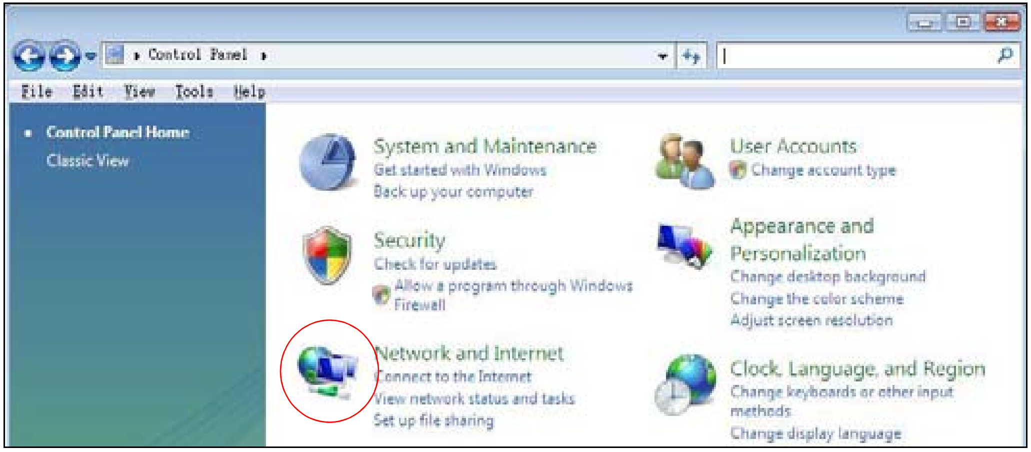
Figure 154 Windows Vista: Start Menu



Customize the appearance and functionality of your computer, add or remove programs, and set up network connections and user accounts.

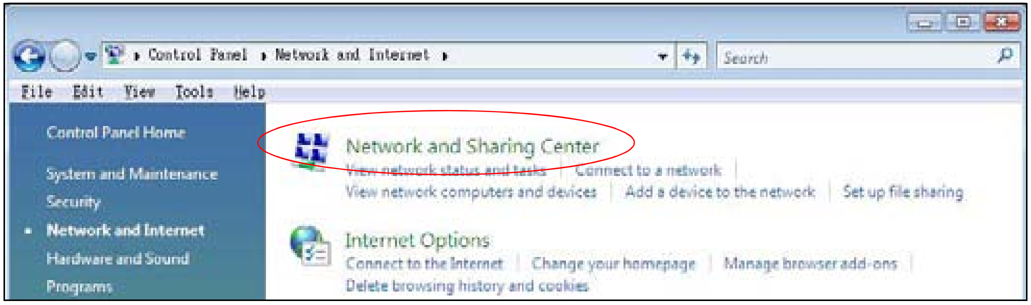
2 In the **Control Panel**, double-click **Network and Internet**.

Figure 155 Windows Vista: Control Panel



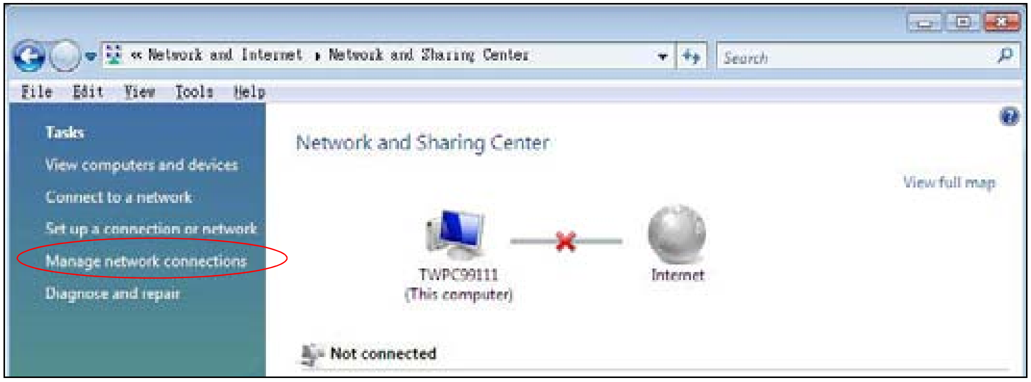
3 Click **Network and Sharing Center**.

Figure 156 Windows Vista: Network And Internet



4 Click **Manage network connections**.

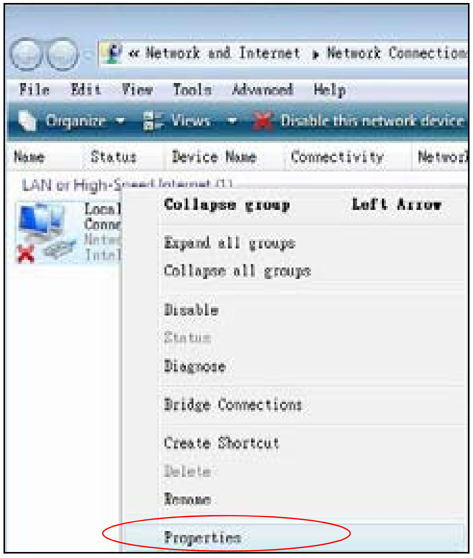
Figure 157 Windows Vista: Network and Sharing Center


« Network and Internet ▸ Network and Sharing Center
Search
File Edit View Tools Help
Tasks
View computers and devices
Connect to a network
Set up a connection or network
Manage network connections
Diagnose and repair
Network and Sharing Center
View full map
TWPC99111
(This computer)
Internet
Not connected

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

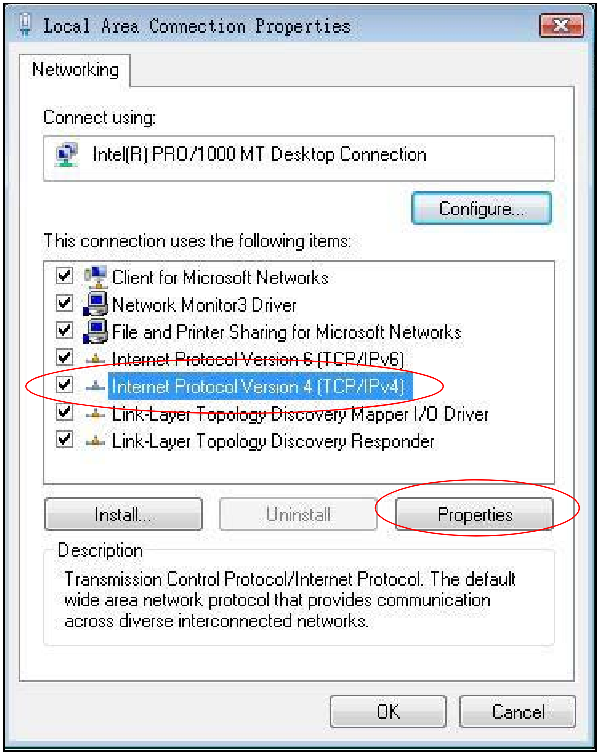
Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

Figure 158 Windows Vista: Network and Sharing Center


« Network and Internet ▸ Network Connection
File Edit View Tools Advanced Help
Organize Views Disable this network device
Name Status Device Name Connectivity Network
LAN or High-Speed Internet (1)
Local Conne
Collapse group Left Arrow
Expand all groups
Collapse all groups
Disable
Status
Diagnose
Bridge Connections
Create Shortcut
Delete
Rename
Properties

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

Figure 159 Windows Vista: Local Area Connection Properties



Local Area Connection Properties

Networking

Connect using:

Intel(R) PRO/1000 MT Desktop Connection

This connection uses the following items:

☑ Client for Microsoft Networks
☑ Network Monitor3 Driver
☑ File and Printer Sharing for Microsoft Networks
☑ Internet Protocol Version 6 (TCP/IPv6)
☑ Internet Protocol Version 4 (TCP/IPv4)
☑ Link-Layer Topology Discovery Mapper I/O Driver
☑ Link-Layer Topology Discovery Responder

Description

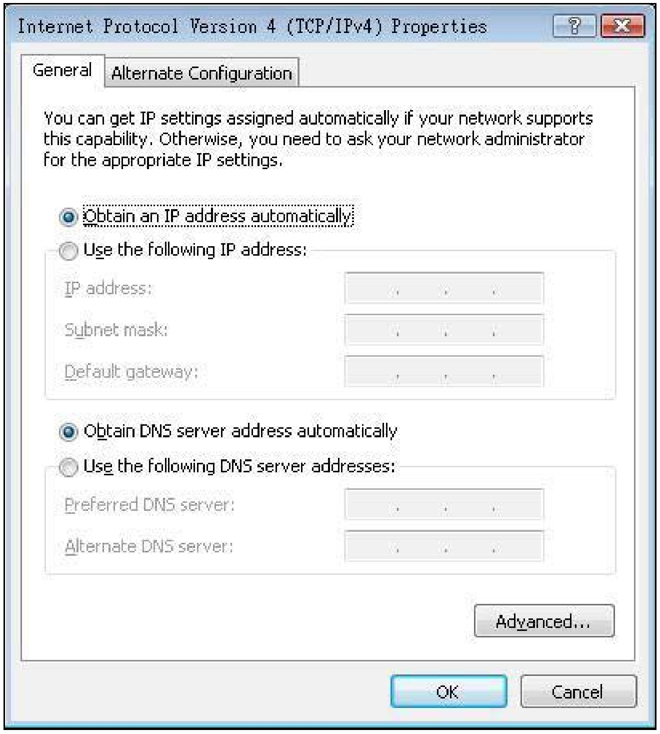
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

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



Internet Protocol Version 4 (TCP/IPv4) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address:

Subnet mask:

Default gateway:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server:

Alternate DNS server:

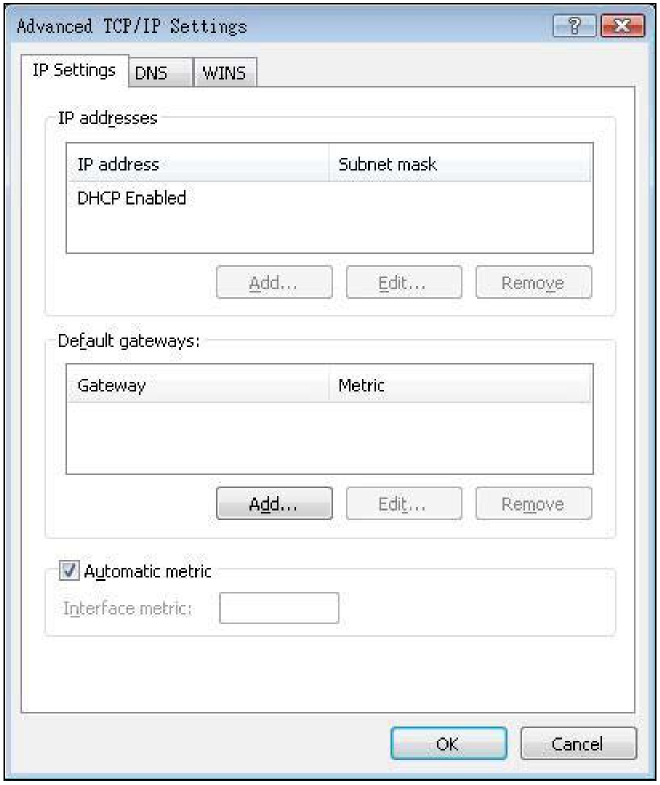
8 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

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 161 Windows Vista: Advanced TCP/IP Properties



IP address	Subnet mask
DHCP Enabled	

Gateway	Metric

☑ Automatic metric

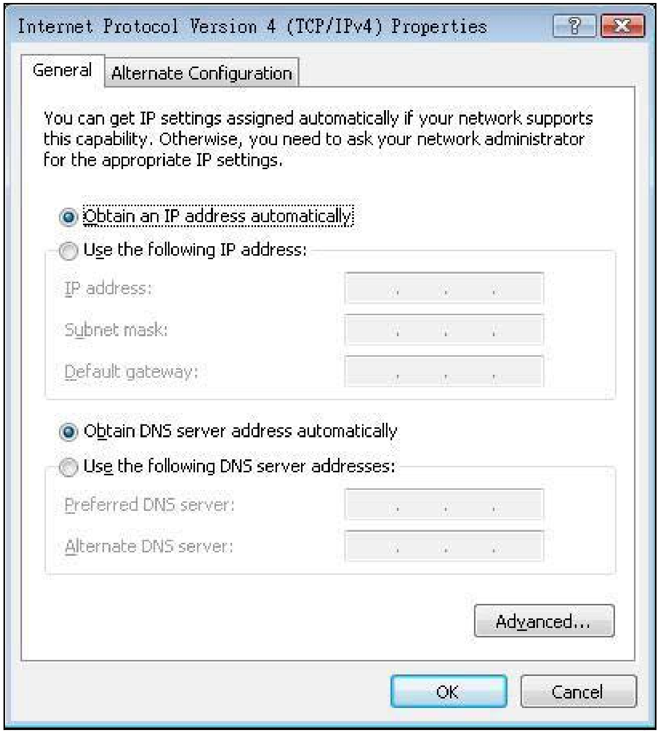
Interface metric:

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



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

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 ZyXEL Device and restart your computer (if prompted).

Verifying Settings

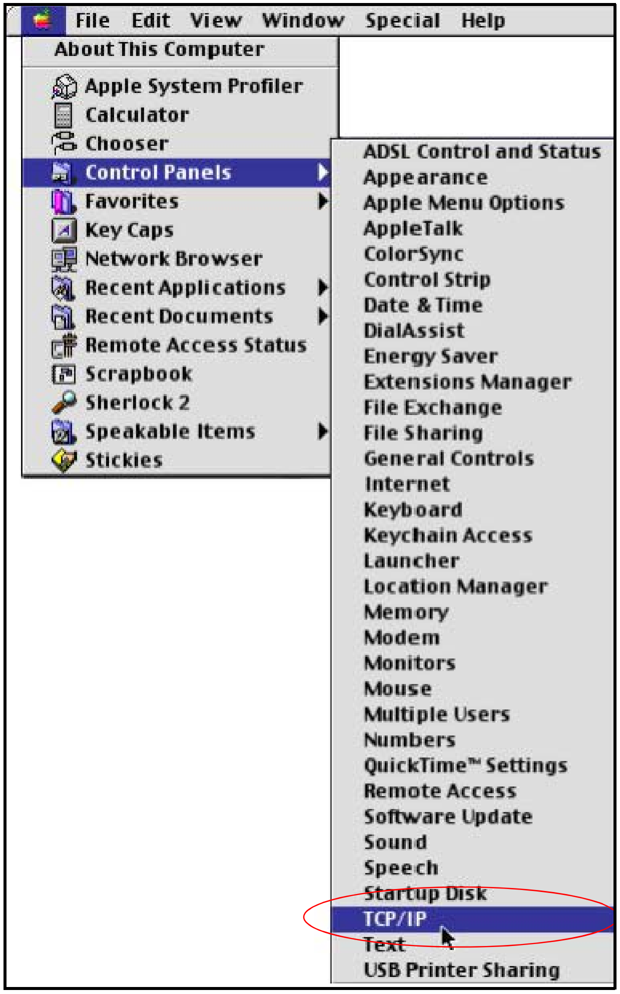
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

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

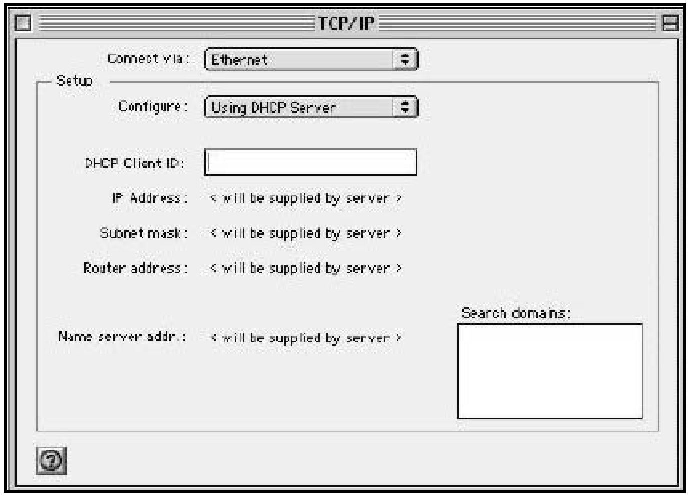
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 163 Macintosh OS 8/9: Apple Menu



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

Figure 164 Macintosh OS 8/9: TCP/IP



TCP/IP

Connect via: Ethernet

Setup

Configure: Using DHCP Server

DHCP Client ID:

IP Address: < will be supplied by server >

Subnet mask: < will be supplied by server >

Router address: < will be supplied by server >

Name server addr.: < will be supplied by server >

Search domains:

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 ZyXEL Device 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 ZyXEL Device and restart your computer (if prompted).

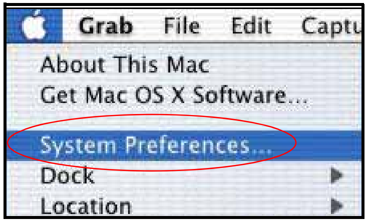
Verifying Settings

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 165 Macintosh OS X: Apple Menu



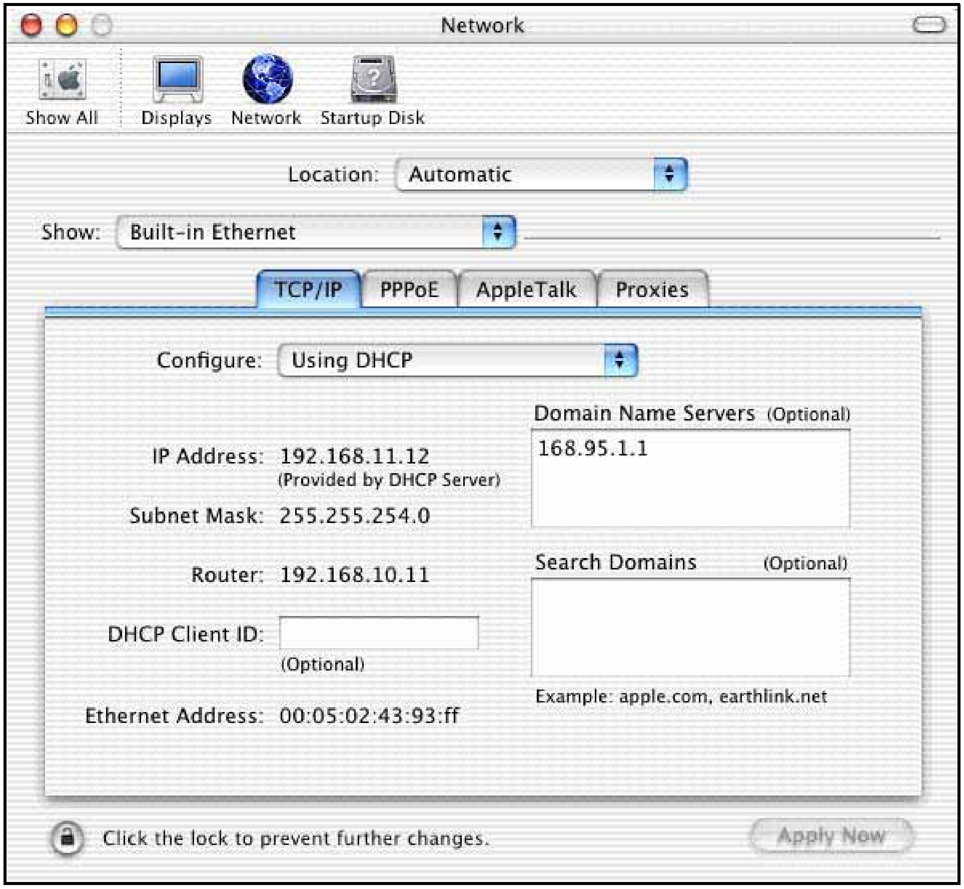
2 Click **Network** in the icon bar.

- 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 166 Macintosh OS X: Network



Location: Automatic

Show: Built-in Ethernet

Configure: Using DHCP

Domain Name Servers (Optional)

168.95.1.1

IP Address: 192.168.11.12
(Provided by DHCP Server)

Subnet Mask: 255.255.254.0

Router: 192.168.10.11

Search Domains (Optional)

DHCP Client ID:
(Optional)

Example: apple.com, earthlink.net

Ethernet Address: 00:05:02:43:93:ff

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 ZyXEL Device in the **Router address** box.

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

6 Turn on your ZyXEL Device 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.

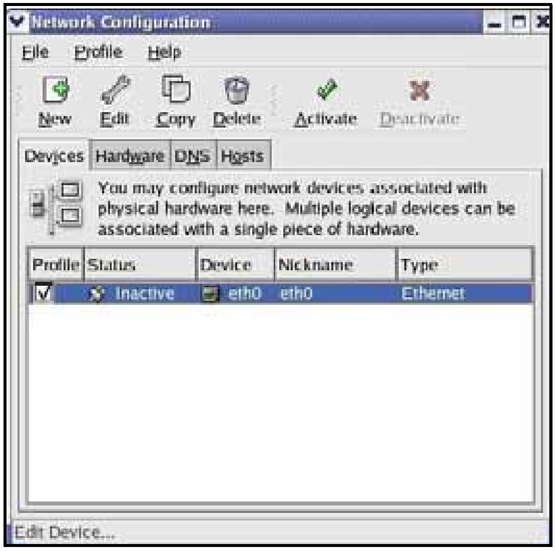
Note: Make sure you are logged in as the root administrator.

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 167 Red Hat 9.0: KDE: Network Configuration: Devices

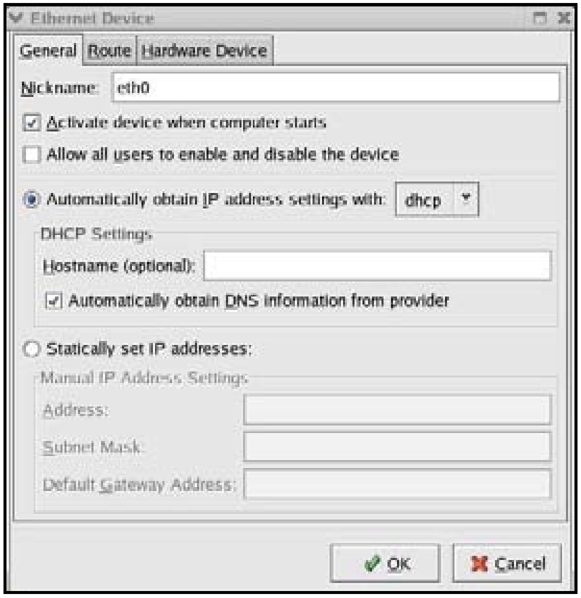


You may configure network devices associated with physical hardware here. Multiple logical devices can be associated with a single piece of hardware.

Profile	Status	Device	Nickname	Type
☑	Inactive	eth0	eth0	Ethernet

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

Figure 168 Red Hat 9.0: KDE: Ethernet Device: General



Nickname: eth0

☑ Activate device when computer starts

☐ Allow all users to enable and disable the device

● Automatically obtain IP address settings with: dhcp

DHCP Settings

Hostname (optional):

☑ Automatically obtain DNS information from provider

○ Statically set IP addresses:

Manual IP Address Settings

Address:

Subnet Mask:

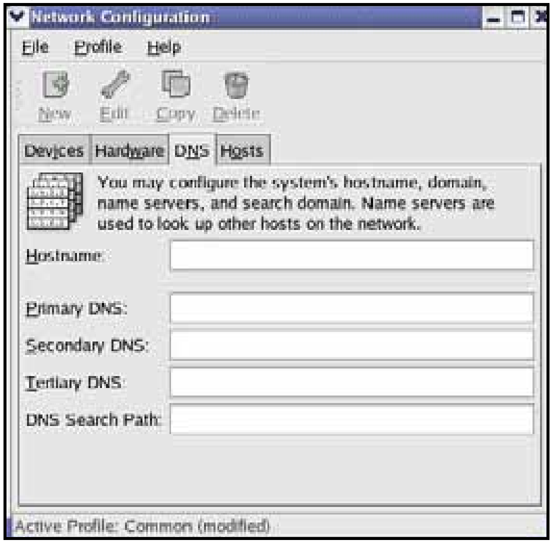
Default Gateway Address:

- 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 169 Red Hat 9.0: KDE: Network Configuration: DNS



You may configure the system's hostname, domain, name servers, and search domain. Name servers are used to look up other hosts on the network.

Hostname:

Primary DNS:

Secondary DNS:

Tertiary DNS:

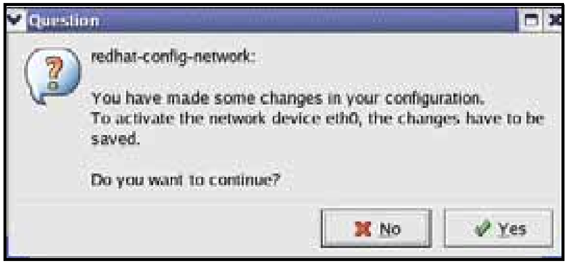
DNS Search Path:

Active Profile: Common (modified)

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 170 Red Hat 9.0: KDE: Network Configuration: Activate



redhat-config-network:

You have made some changes in your configuration.
To activate the network device eth0, the changes have to be saved.

Do you want to continue?

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 171 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 172 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 173 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 174 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 175 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]#
```

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.

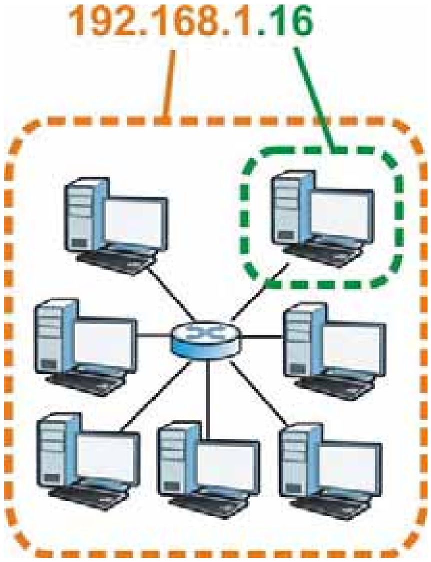
Structure

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 176 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 113 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 114 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 115 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 116 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
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

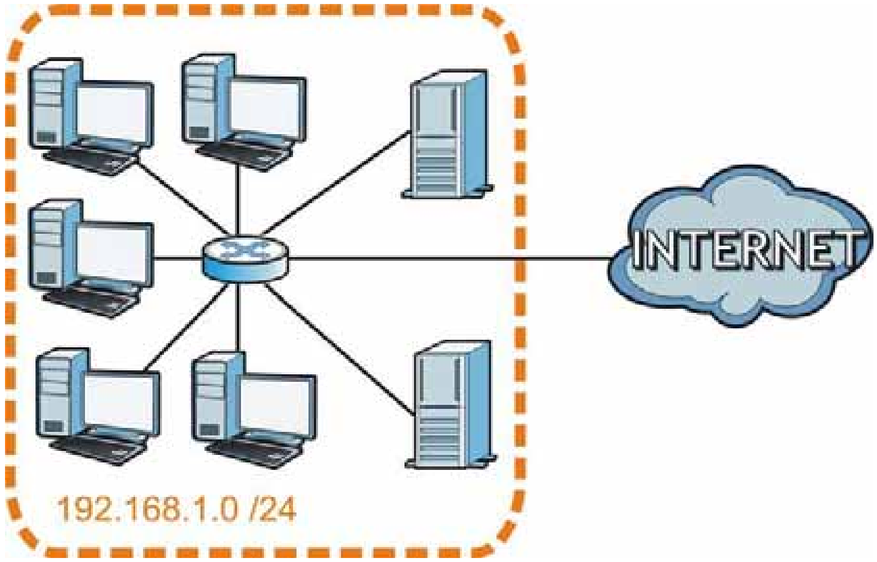
Subnetting

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 177 Subnetting Example: Before Subnetting

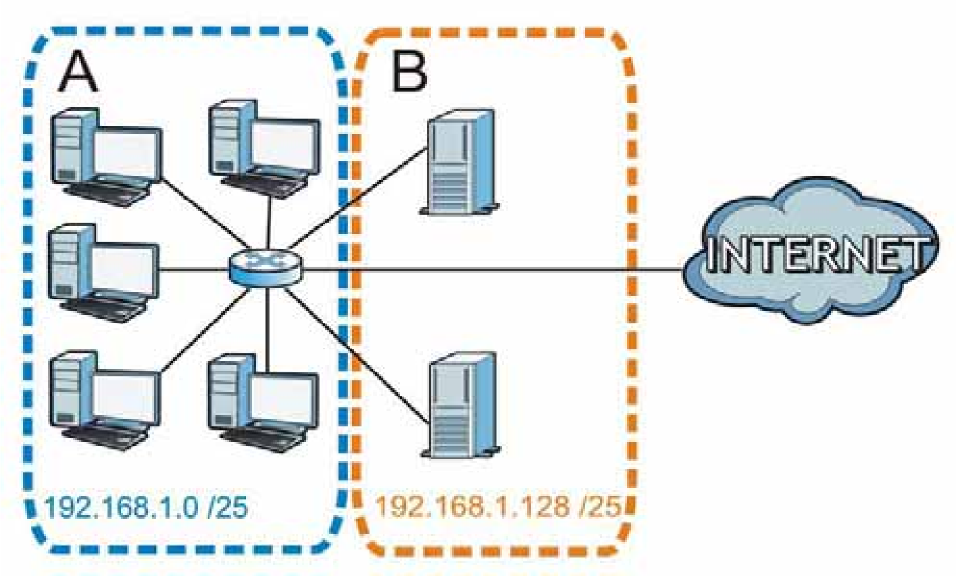


You can “borrow” one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

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 178 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 117 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

Table 117 Subnet 1 (continued)

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
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 118 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 119 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 120 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 121 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63

Table 121 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
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 122 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 123 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 ZyXEL Device.

Once you have decided on the network number, pick an IP address for your ZyXEL Device 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 ZyXEL Device 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 ZyXEL Device 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.*

Pop-up Windows, JavaScript and Java Permissions

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

- Web browser pop-up windows from your device.
- JavaScript (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

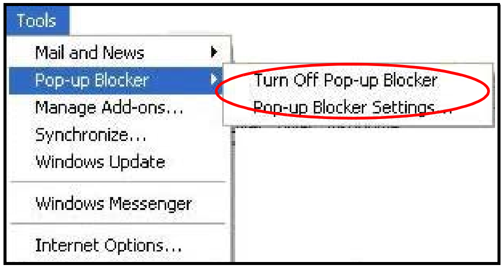
You may have to disable pop-up blocking to log into your device.

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 179 Pop-up Blocker

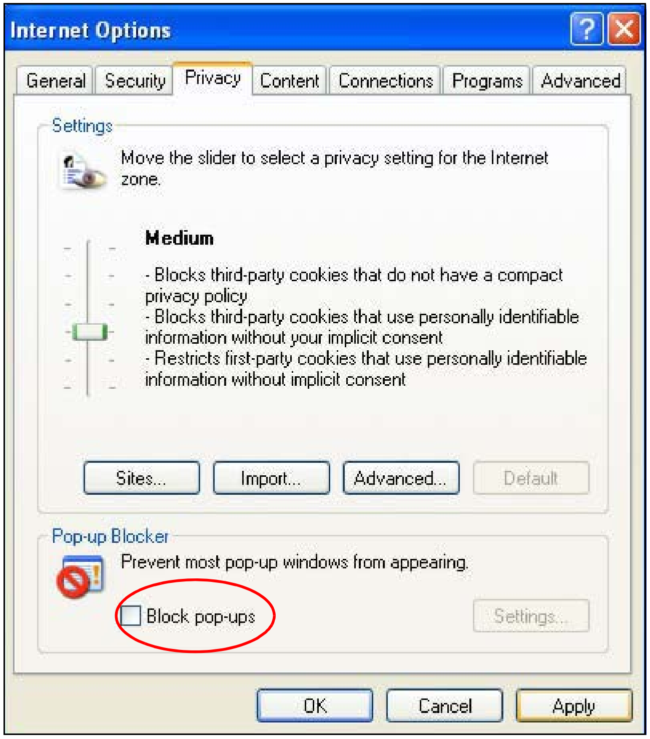


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

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 180 Internet Options: Privacy



Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Prevent most pop-up windows from appearing.

□ Block pop-ups

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

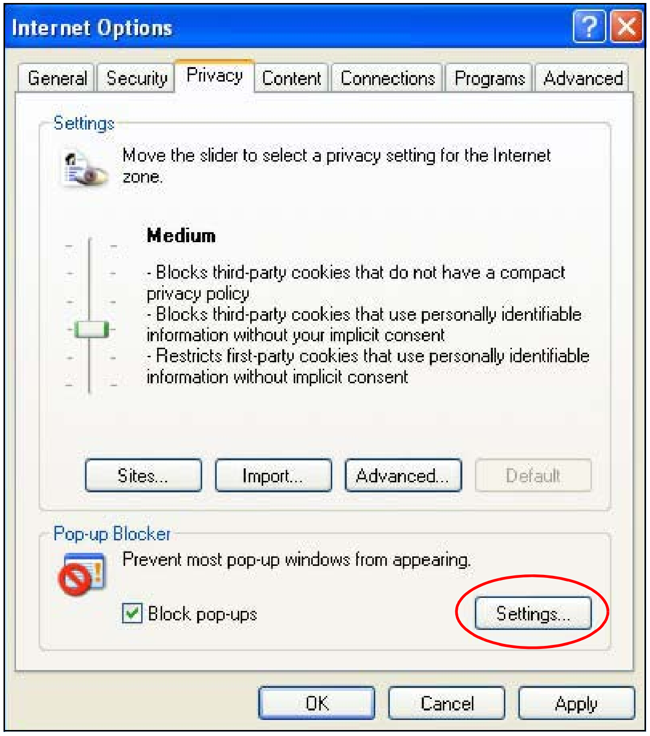
Enable Pop-up Blockers with Exceptions

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 181 Internet Options: Privacy



Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

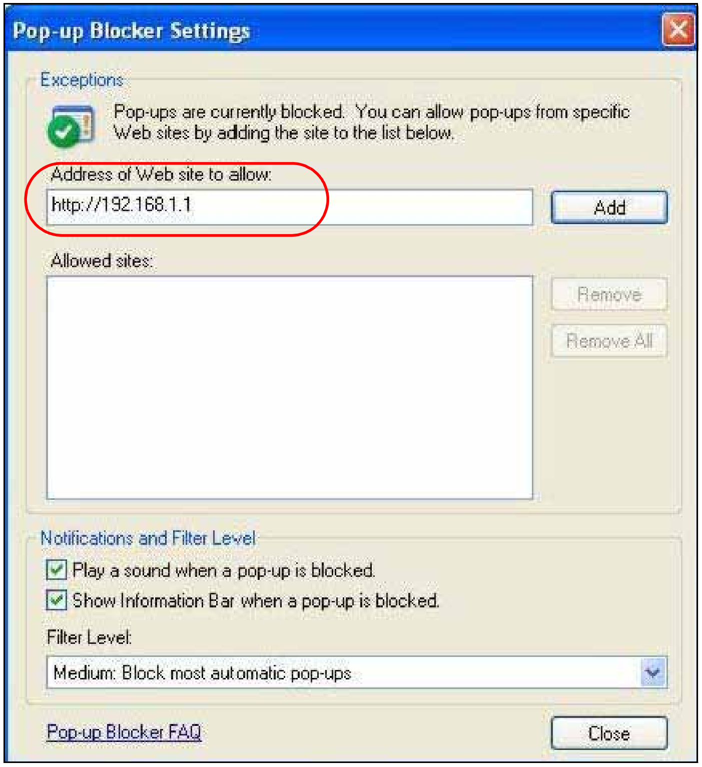
Prevent most pop-up windows from appearing.

☑ Block pop-ups

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 182 Pop-up Blocker Settings



Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.

Address of Web site to allow: http://192.168.1.1

☑ Play a sound when a pop-up is blocked.

☑ Show Information Bar when a pop-up is blocked.

Filter Level: Medium: Block most automatic pop-ups

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

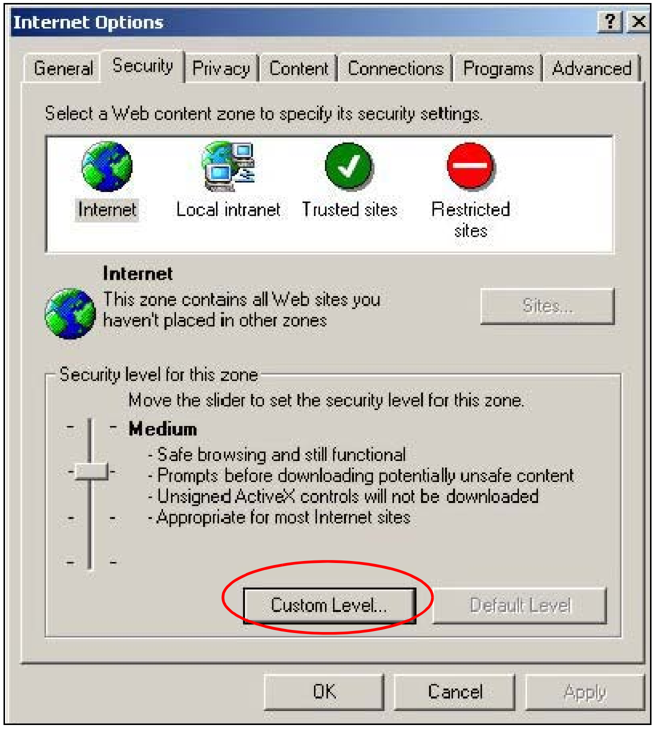
6 Click **Apply** to save this setting.

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 183 Internet Options: Security



Select a Web content zone to specify its security settings.

Internet

This zone contains all Web sites you haven't placed in other zones

Security level for this zone

Move the slider to set the security level for this zone.

Medium

- Safe browsing and still functional
- Prompts before downloading potentially unsafe content
- Unsigned ActiveX controls will not be downloaded
- Appropriate for most Internet sites

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

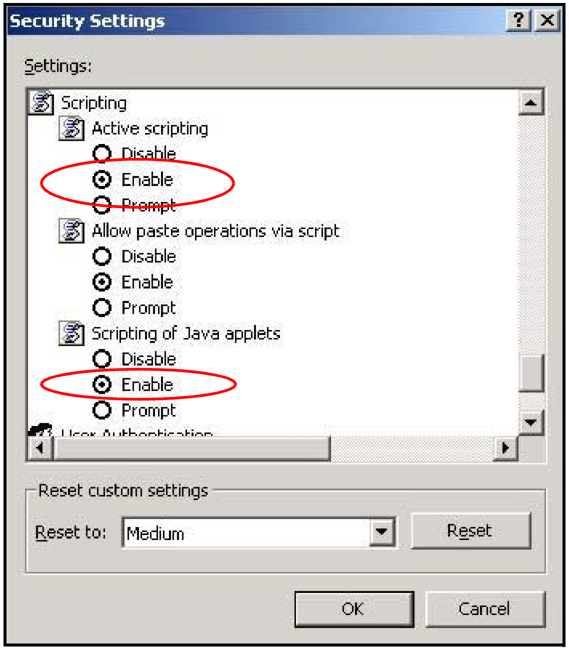
3 Scroll down to **Scripting**.

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 184 Security Settings - Java Scripting



Security Settings

Settings:

- Scripting
  - Active scripting
    - ○ Disable
    - ● Enable
    - ○ Prompt
  - Allow paste operations via script
    - ○ Disable
    - ● Enable
    - ○ Prompt
  - Scripting of Java applets
    - ○ Disable
    - ● Enable
    - ○ Prompt
- User Authentication

Reset custom settings

Reset to: Medium

Java Permissions

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

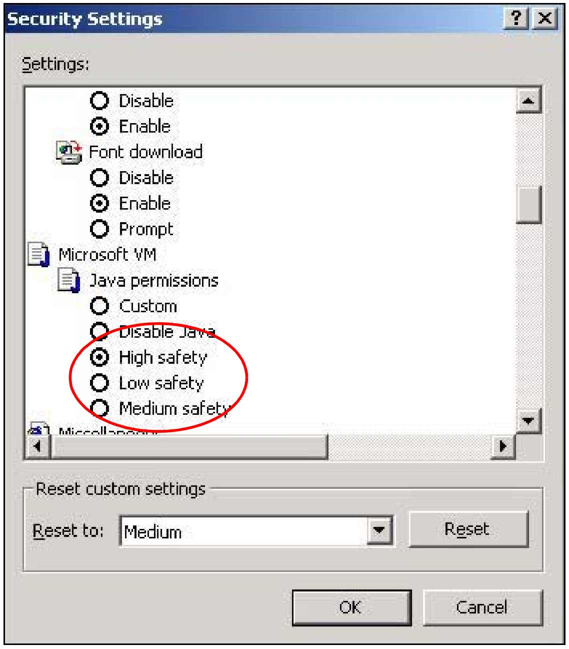
2 Click the **Custom Level...** button.

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 185 Security Settings - Java



Settings:

○ Disable
● Enable
Font download
○ Disable
● Enable
○ Prompt
Microsoft VM
Java permissions
○ Custom
○ Disable Java
● High safety
○ Low safety
○ Medium safety

Reset custom settings

Reset to: Medium

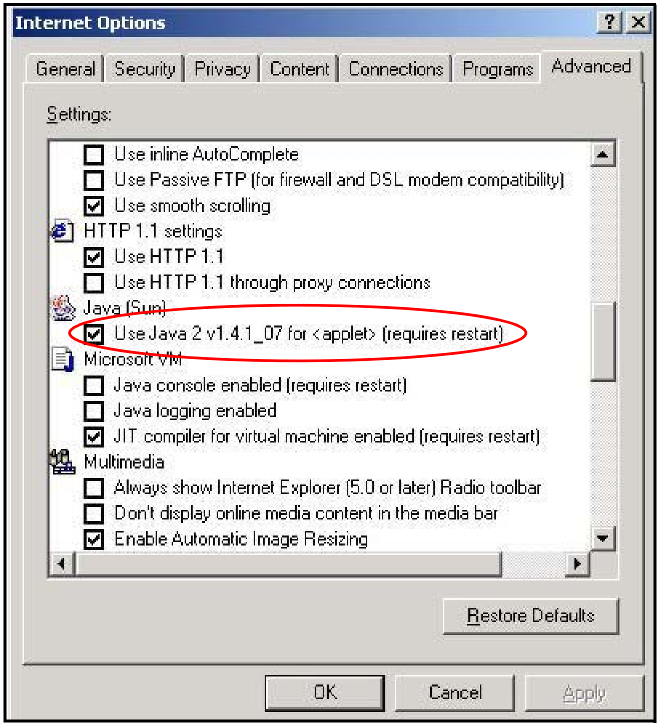
JAVA (Sun)

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 186 Java (Sun)



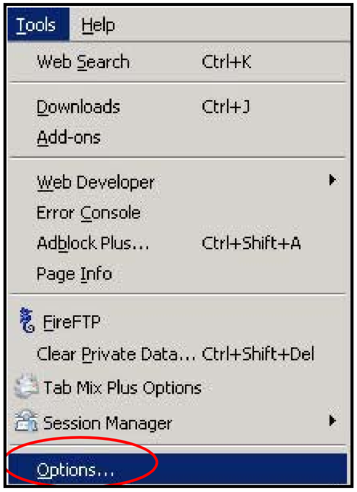
☐ Use inline AutoComplete
☐ Use Passive FTP (for firewall and DSL modem compatibility)
☑ Use smooth scrolling
HTTP 1.1 settings
☑ Use HTTP 1.1
☐ Use HTTP 1.1 through proxy connections
Java (Sun)
☑ Use Java 2 v1.4.1_07 for <applet> (requires restart)
Microsoft VM
☐ Java console enabled (requires restart)
☐ Java logging enabled
☑ JIT compiler for virtual machine enabled (requires restart)
Multimedia
☐ Always show Internet Explorer (5.0 or later) Radio toolbar
☐ Don't display online media content in the media bar
☑ Enable Automatic Image Resizing

Mozilla Firefox

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

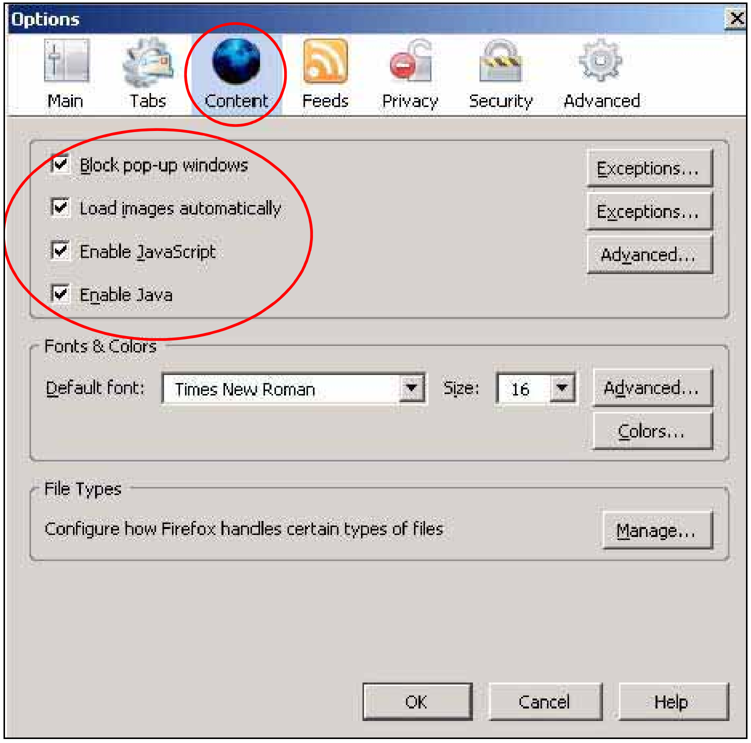
You can enable Java, Javascript and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 187 Mozilla Firefox: Tools > Options



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

Figure 188 Mozilla Firefox Content Security



☑ Block pop-up windows

☑ Load images automatically

☑ Enable JavaScript

☑ Enable Java

Default font: Times New Roman   Size: 16

Configure how Firefox handles certain types of files

Wireless LANs

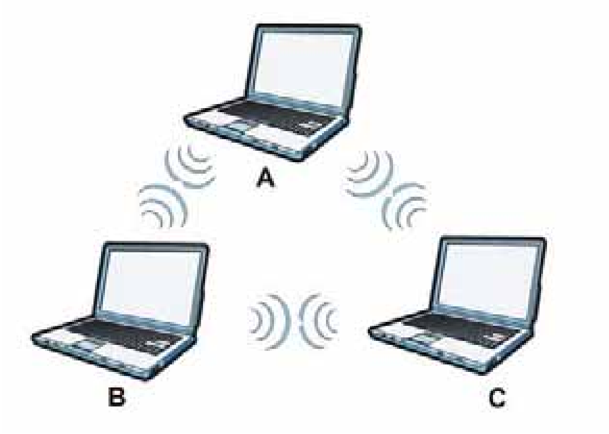
Wireless LAN Topologies

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

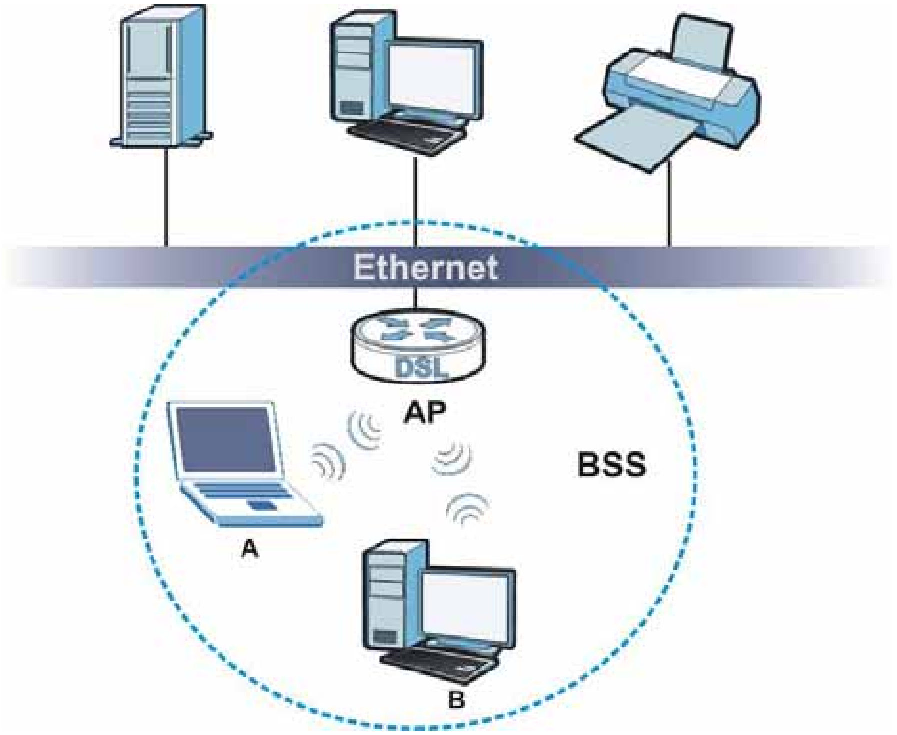


BSS

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 190 Basic Service Set



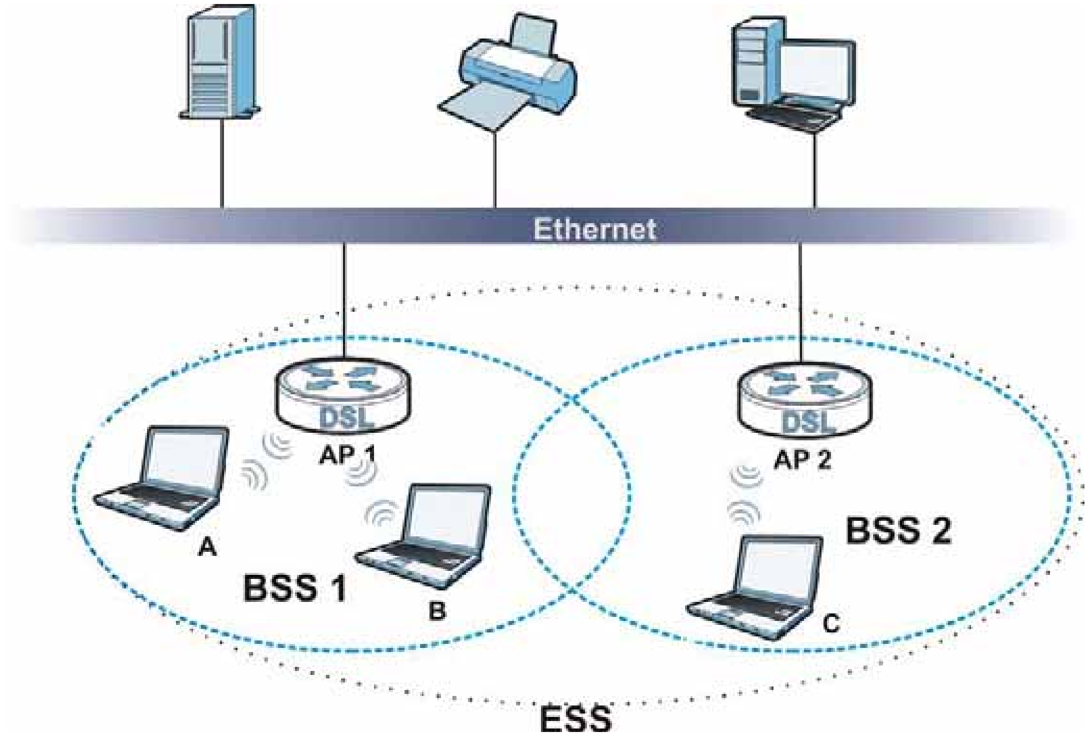
ESS

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 191 Infrastructure WLAN



Channel

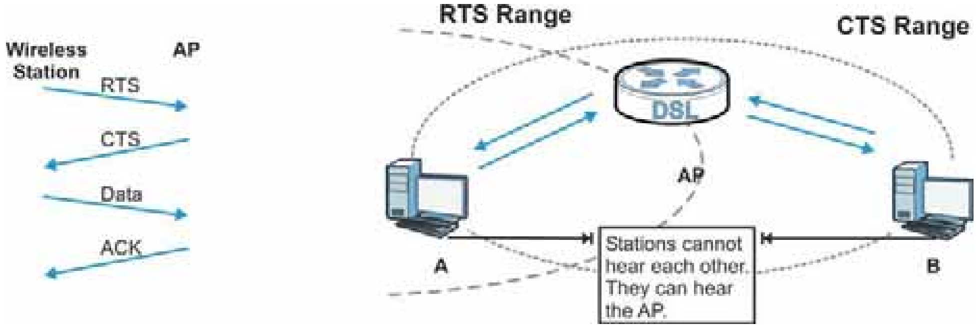
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference 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 192 RTS/CTS



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

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

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

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

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

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

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

Fragmentation Threshold

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

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

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

IEEE 802.11g Wireless LAN

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

Table 124 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 ZyXEL Device are data encryption, wireless client authentication, restricting access by device MAC address and hiding the ZyXEL Device identity.

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

Table 125 Wireless Security Levels

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

Note: You must enable the same wireless security settings on the ZyXEL Device 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 126 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.

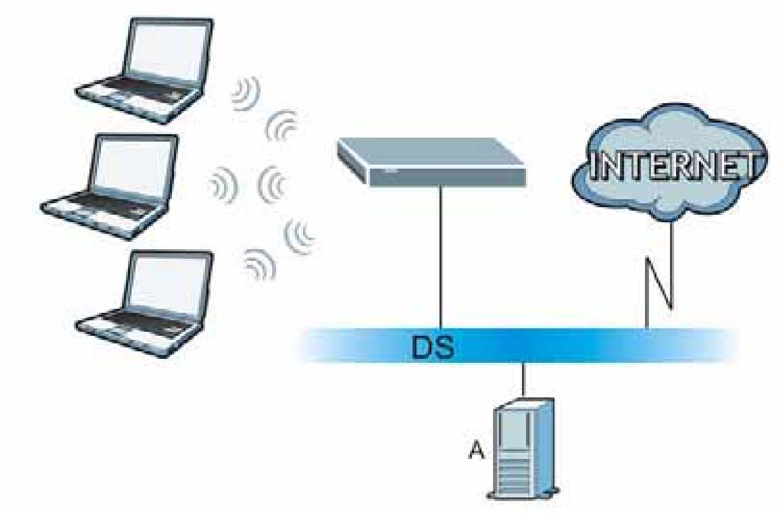
WPA(2) with RADIUS Application Example

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 193 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

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

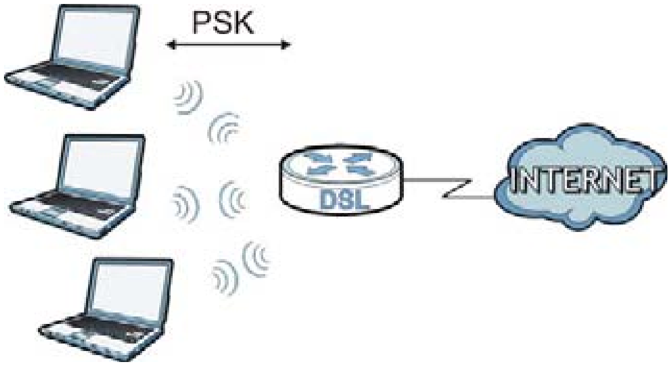
1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).

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 194 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 127 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTIO N 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.

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 128 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 128 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 news group 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 128 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.

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3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
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3 Select the certification you wish to view from this page.

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.

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