VMG4380-B10A / VMG4325-B10A

DRAFT

Wireless N VDSL2 4-port Gateway with USB

User's Guide

Default Login Details

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

Version 1.00
Edition 1, 9/2012

ZyXEL

www.zyxel.com

IMPORTANT!

READ CAREFULLY BEFORE USE.

KEEP THIS GUIDE FOR FUTURE REFERENCE.

Note: This guide is a reference for a series of products. Therefore some features or options in this guide may not be available in your product.

Graphics in this book may differ slightly from the product due to differences in operating systems, operating system versions, or if you installed updated firmware/software for your device. Every effort has been made to ensure that the information in this manual is accurate.

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.

- ZyXEL Web Site

  Please refer to www.zyxel.com for additional support documentation and product certifications.

Contents Overview

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PART I

User's Guide

1

Introducing the Device

1.1 Overview

The Device is a wireless VDSL router and Gigabit Ethernet gateway. It has two DSL ports and Gigabit Ethernet 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 Device can be connected to two separate telephone jacks to provide increased throughput at longer distances. The 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 Device also provides IEEE 802.11b/g/n wireless networking to extend the range of your existing wired network without additional wiring. The VMG4380-B10A models also include Home Phoneline

- VMG4380-B10A has Home Phoneline Networking Alliance (HPNA) capability.

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

The Device has a USB port used to share files via a USB memory stick or a USB hard drive.

1.2 Ways to Manage the Device

Use any of the following methods to manage the Device.

- Web Configurator. This is recommended for everyday management of the 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 Device

Do the following things regularly to make the Device more secure and to manage the 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 Device to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the Device. You could simply restore your last configuration.

1.4 Applications for the Device

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

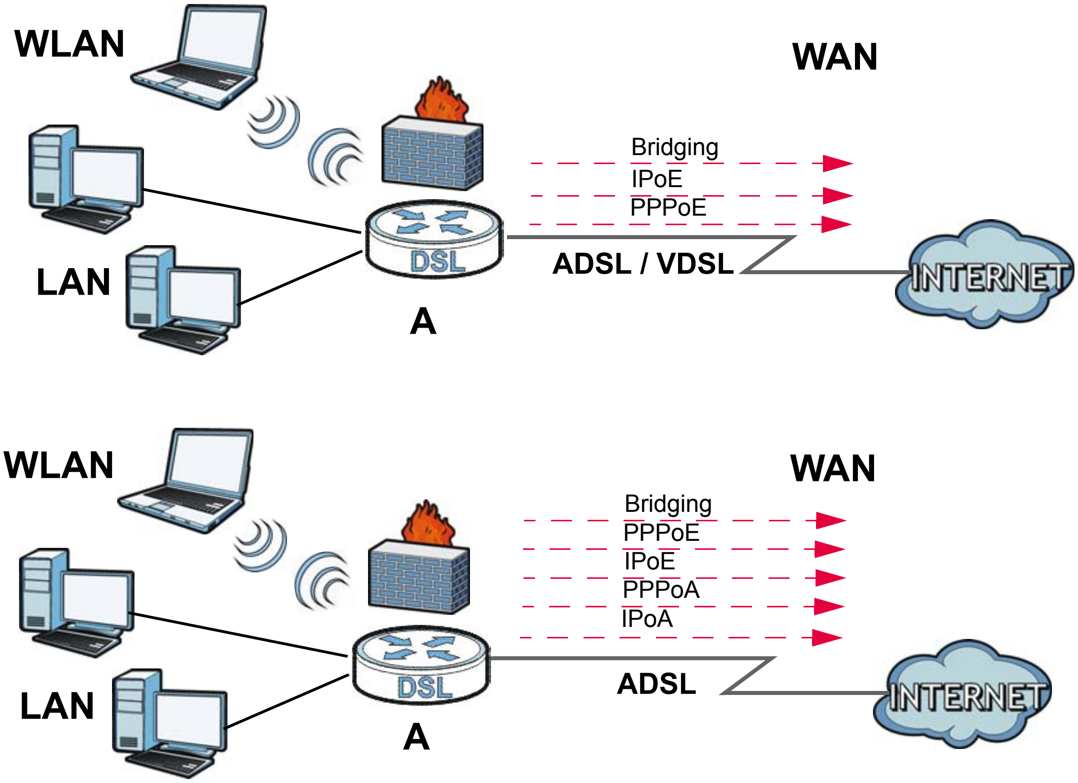
1.4.1 Internet Access

Your 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 multiple WAN services over one ADSL or VDSL. The Device cannot work in ADSL and VDSL mode at the same time.

Note: The ADSL and VDSL lines share the same WAN (layer-2) interfaces that you configure in the Device. Refer to Section 6.2 on page 78 for the **Network Setting > Broadband** screen.

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

Figure 1 Device’s Internet Access Application



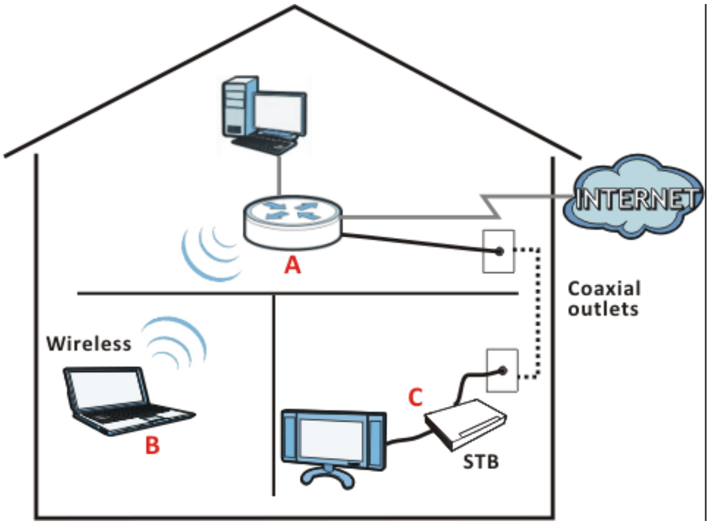
You can also configure IP filtering on the Device for secure Internet access. When the IP filter is on, all incoming traffic from the Internet to your network is blocked by default unless it is initiated from your network. This means that probes from the outside to your network are not allowed, but you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

1.4.2 HomePNA

Models with HPNA comply 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 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 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



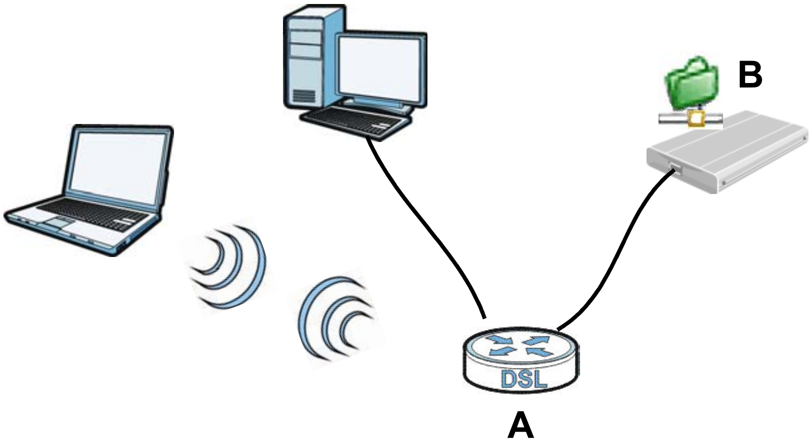
1.4.3 Device’s USB Support

The USB port of the Device is used for file-sharing.

File Sharing

Use the built-in USB 2.0 port to share files on a USB memory stick or a USB hard drive (**B**). You can connect one USB hard drive to the Device at a time. Use FTP to access the files on the USB device.

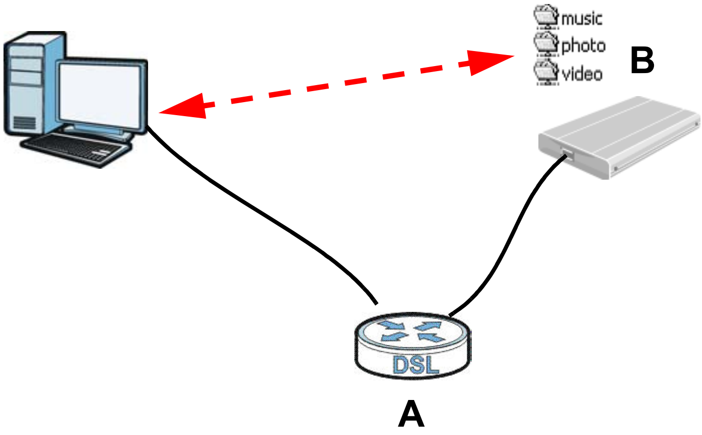
Figure 3 USB File Sharing Application



Media Server

You can also use the Device as a media server. This lets anyone on your network play video, music, and photos from a USB device (**B**) connected to the Device’s USB port (without having to copy them to another computer).

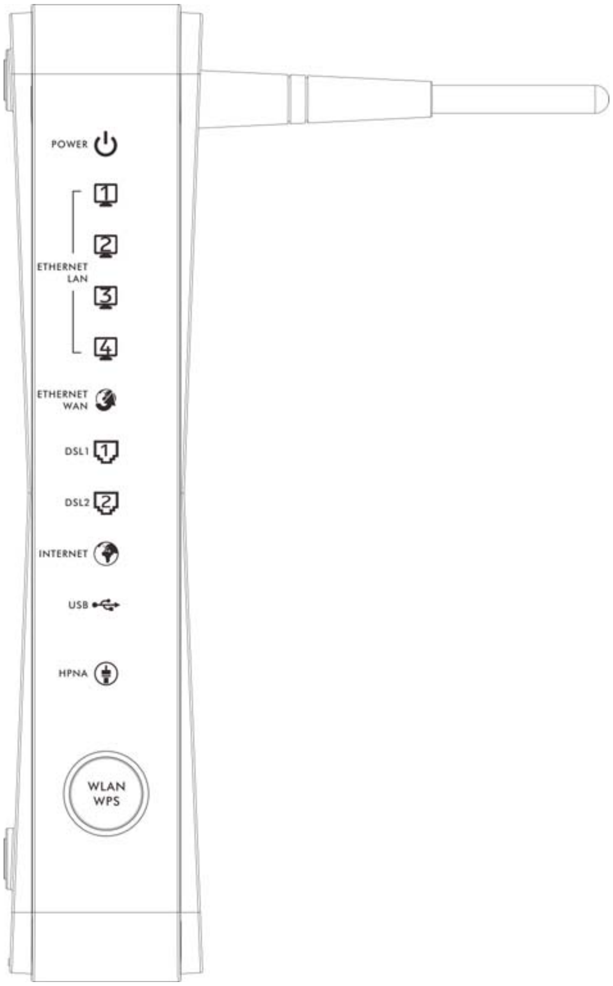
Figure 4 USB Media Server Application



1.5 LEDs (Lights)

The following graphic displays the labels of the LEDs.

Figure 5 LEDs on the Device



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

Table 1 LED Descriptions

LED	COLOR	STATUS	DESCRIPTION
POWER	Green	On	The Device is receiving power and ready for use.
		Blinking	The Device is self-testing.
	Red	On	The Device detected an error while self-testing, or there is a device malfunction.
		Off	The Device is not receiving power.
		Blinking	Firmware upgrade is in progress.
ETHERNET LAN 1-4	Green	On	The Device has a successful Ethernet connection with a device on the Local Area Network (LAN).
		Blinking	The Device is sending or receiving data to/from the LAN.
		Off	The 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 Device is sending or receiving data to/from the Gigabit Ethernet link.
		Off	There is no Gigabit Ethernet link.
DSL1,2	Green	On	The ADSL line is up.
		Blinking	The Device is initializing the ADSL line.
		Off	The ADSL line is down.
	Orange	On	The VDSL line is up.
		Blinking	The Device is initializing the VDSL line.
		Off	The VDSL line is down.
INTERNET	Green	On	The 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 Device is sending or receiving IP traffic.
		Off	There is no Internet connection or the gateway is in bridged mode.
USB	Green	On	The Device recognizes a USB connection.
		Blinking	The Device is sending/receiving data to /from the USB device connected to it.
		Off	The Device does not detect a USB connection.
HPNA	Green	On	The Device is connected to an HPNA-equipped device through the coaxial cable.[A]
		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 Device is communicating with other wireless clients.
	Green and Orange	Blinking	The Device is setting up a WPS connection.
		Off	The wireless network is not activated.

[A] HPNA-equipped models only.

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).

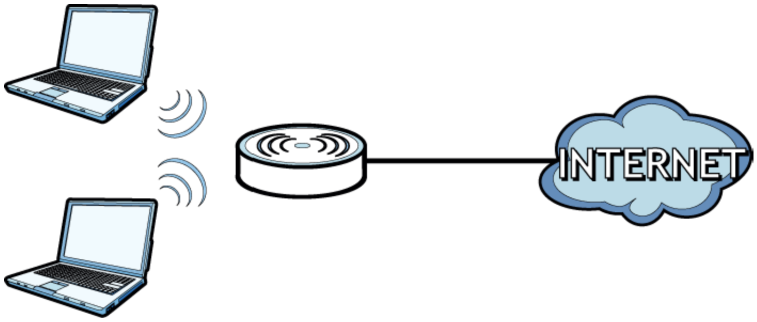
2 To set the device back to the factory default settings, press the **RESET** button for ten seconds or until the **POWER** LED begins to blink and then release it. When the **POWER** LED begins to blink, the defaults have been restored and the device restarts.

1.6 Wireless Access

The 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 6 Wireless Access Example



1.6.1 Using the WLAN/WPS Button

If the wireless network is turned off, press the **WLAN/WPS** button at the back of the Device for one second. 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 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 Device. The **WLAN/WPS** LED flashes orange while the 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 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 317 if you need to make sure these functions are allowed in Internet Explorer.

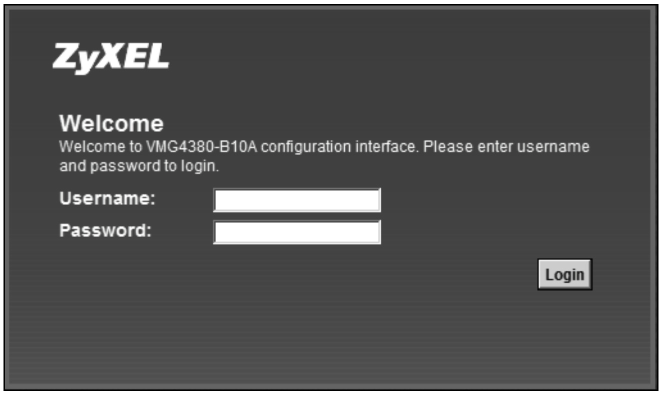
2.1.1 Accessing the Web Configurator

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

2 Launch your web browser. If the 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 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 253) 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**.

Figure 7 Password Screen



ZyXEL

Welcome

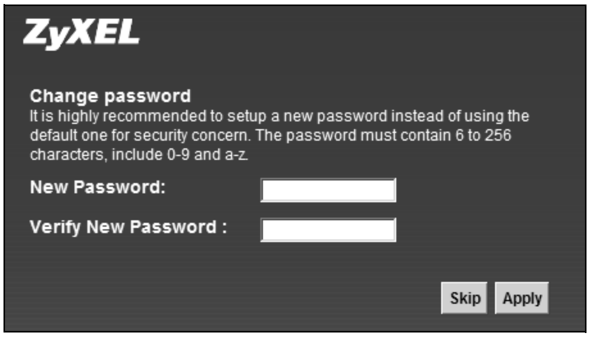
Welcome to VMG4380-B10A configuration interface. Please enter username and password to login.

Username:

Password:

4 The following screen displays if you have not yet changed your password. It is strongly recommended you change the default password. Enter a new password, retype it to confirm and click **Apply**; alternatively click **Skip** to proceed to the main menu if you do not want to change the password now.

Figure 8 Change Password Screen



ZyXEL

Change password

It is highly recommended to setup a new password instead of using the default one for security concern. The password must contain 6 to 256 characters, include 0-9 and a-z.

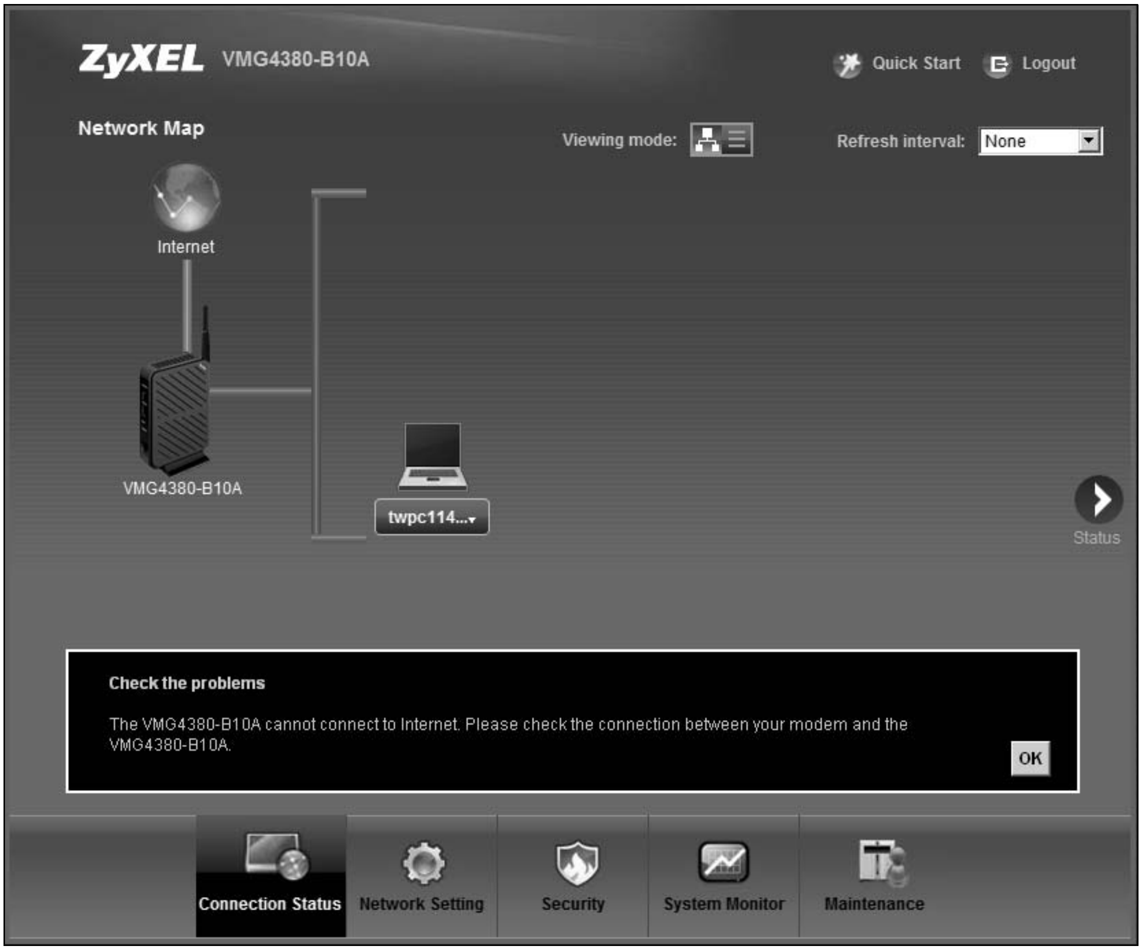
New Password:

Verify New Password :

5 The **Quick Start Wizard** screen appears. You can configure the Device's time zone, basic Internet access, and wireless settings. See Chapter 3 on page 33 for more information.

6 After you finished or closed the **Quick Start Wizard** screen, the **Network Map** page appears.

Figure 9 Network Map



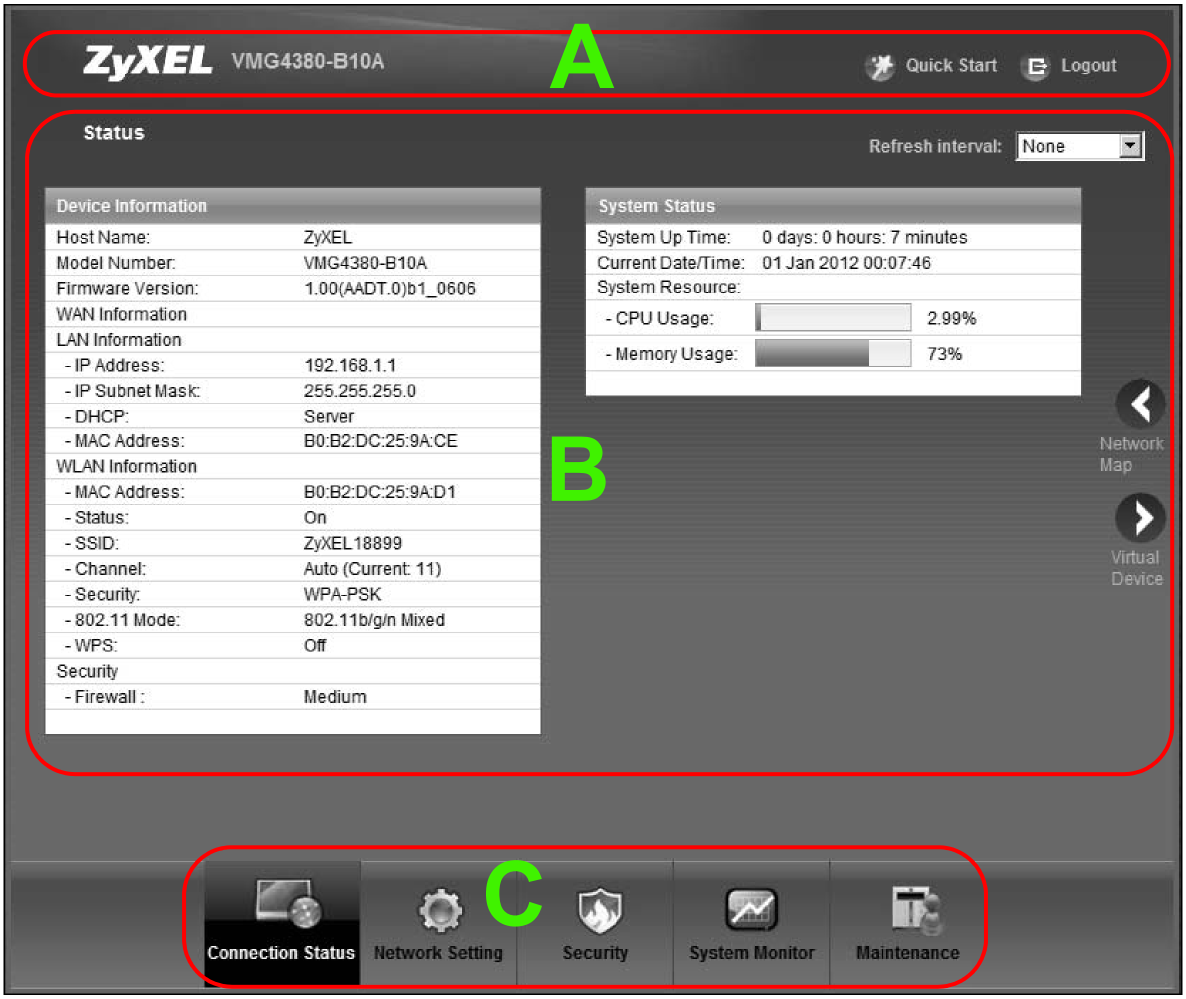
Check the problems

The VMG4380-B10A cannot connect to Internet. Please check the connection between your modem and the VMG4380-B10A.

7 Click **Status** to display the **Status** screen, where you can view the Device’s interface and system information.

2.2 Web Configurator Layout

Figure 10 Screen Layout



Device Information	
Host Name:	ZyXEL
Model Number:	VMG4380-B10A
Firmware Version:	1.00(AADT.0)b1_0606
WAN Information	
LAN Information	
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
- MAC Address:	B0:B2:DC:25:9A:CE
WLAN Information	
- MAC Address:	B0:B2:DC:25:9A:D1
- Status:	On
- SSID:	ZyXEL18899
- Channel:	Auto (Current: 11)
- Security:	WPA-PSK
- 802.11 Mode:	802.11b/g/n Mixed
- WPS:	Off
Security	
- Firewall :	Medium

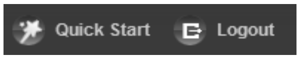
System Status	
System Up Time:	0 days: 0 hours: 7 minutes
Current Date/Time:	01 Jan 2012 00:07:46
System Resource:	
- CPU Usage:	2.99%
- Memory Usage:	73%

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

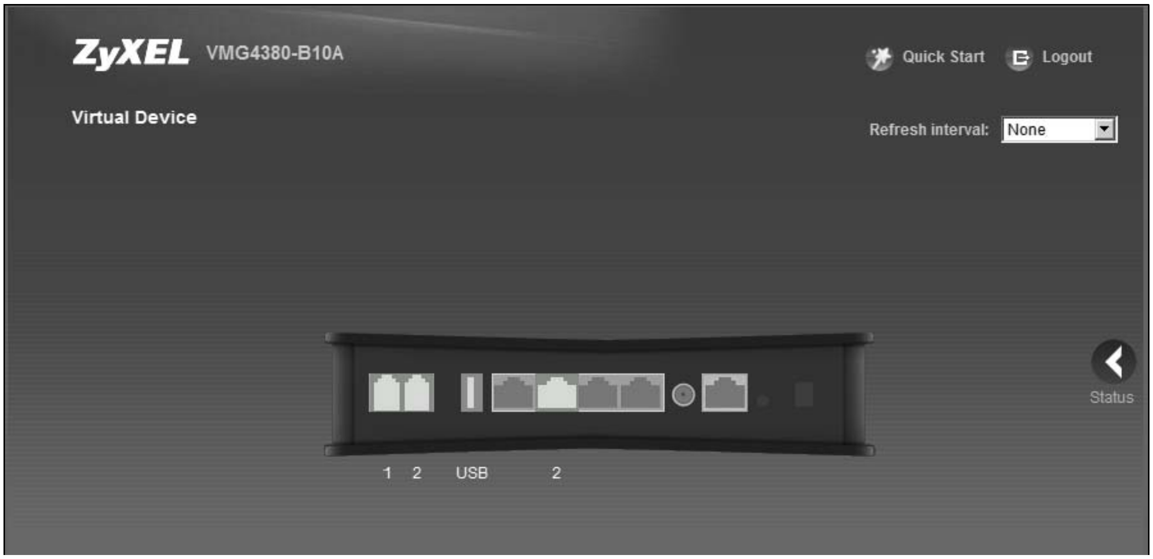
2.2.2 Main Window

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

After you click **Status** on the **Connection Status** page, the **Status** screen is displayed. See Chapter 5 on page 72 for more information about the **Status** screen.

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

Figure 11 Virtual Device



Refresh interval: None

2.2.3 Navigation Panel

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

Table 3 Navigation Panel Summary

LINK	TAB	FUNCTION
Connection Status		This screen shows the network status of the Device and computers/ devices connected to it.
Network Setting		

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
Broadband	Broadband	Use this screen to view and configure ISP parameters, WAN IP address assignment, and other advanced properties. You can also add new WAN connections.
	3G Backup	Use this screen to configure 3G WAN connection.
	Advanced	Use this screen to enable or disable PTM over ADSL, Annex M/Annex J, and DSL PhyR functions.
	8021x	Use this screen to view and configure the IEEE 802.1x settings on the Device.
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 Device.
	MAC Authentication	Use this screen to block or allow wireless traffic from wireless devices of certain SSIDs and MAC addresses to the Device.
	WPS	Use this screen to configure and view your WPS (Wi-Fi Protected Setup) settings.
	WMM	Use this screen to enable or disable Wi-Fi MultiMedia (WMM).
	WDS	Use this screen to set up Wireless Distribution System (WDS) links to other access points.
	Others	Use this screen to configure advanced wireless settings.
	Channel	Use this screen to scan wireless LAN channel noises and view the results.
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.
	Additional Subnet	Use this screen to configure IP alias and public static IP.
	STB Vendor ID	Use this screen to have the Device automatically create static DHCP entries for Set Top Box (STB) devices when they request IP addresses.
	5th Ethernet Port	Use this screen to configure the Ethernet WAN port as a LAN port.
Routing	Static Route	Use this screen to view and set up static routes on the Device.
	Policy Forwarding	Use this screen to configure policy routing on the 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.

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
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 Device.
	Port Triggering	Use this screen to change your 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.
	Address Mapping	Use this screen to change your Device's address mapping settings.
DNS	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.
Interface Group		Use this screen to map a port to a PVC or bridge group.
USB Device	File Sharing	Use this screen to enable file sharing via the Device.
	Media Server	Use this screen to use the Device as a media server.
	Printer Server	Use this screen to enable the print server on the Device and get the model name of the associated printer.
Security Settings		
Firewall	General	Use this screen to configure the security level of your firewall.
	Service	Use this screen to add Internet services and configure firewall rules.
	Access Control	Use this screen to enable specific traffic directions for network services.
	DoS	Use this screen to activate protection against Denial of Service (DoS) attacks.
MAC Filter		Use this screen to block or allow traffic from devices of certain MAC addresses to the Device.
Parental Control		Use this screen to block web sites with the specific URL.
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.
System Monitor		
Log	System Log	Use this screen to view the status of events that occurred to the Device. You can export or e-mail the logs.
	Security Log	Use this screen to view the login record of the 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 Device.
	LAN	Use this screen to view the status of all network traffic going through the LAN ports of the Device.
ARP Table		Use this screen to view the ARP table. It displays the IP and MAC address of each DHCP connection.
IGMP Group Status		Use this screen to view the status of all IGMP settings on the Device.
xDSL Statistics		Use this screen to view the Device's xDSL traffic statistics.

Table 3 Navigation Panel Summary (continued)

LINK	TAB	FUNCTION
Maintenance		
User Account		Use this screen to change user password on the Device.
Remote MGMT		Use this screen to enable specific traffic directions for network services.
TR-069 Client		Use this screen to configure the 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.
Time		Use this screen to change your Device's time and date.
Email Notification		Use this screen to configure up to two mail servers and sender addresses on the Device.
Log Setting		Use this screen to change your Device's log settings.
Firmware Upgrade		Use this screen to upload firmware to your device.
Configuration		Use this screen to backup and restore your device's configuration (settings) or reset the factory default settings.
Reboot		Use this screen to reboot the Device without turning the power off.
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	Use this screen to view information to help you identify problems with the DSL connection.

3

Quick Start

3.1 Overview

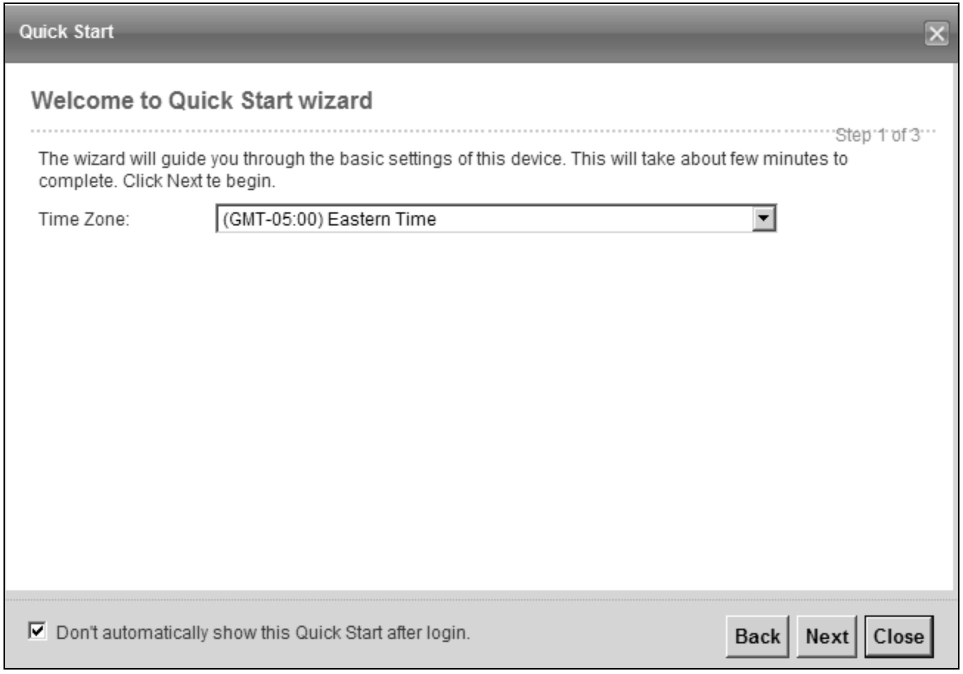
Use the Quick Start screens to configure the Device’s time zone, basic Internet access, and wireless settings.

Note: See the technical reference chapters (starting on page 69) for background information on the features in this chapter.

3.2 Quick Start Setup

1 The Quick Start Wizard appears automatically after login. Or you can 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 Device’s location and click **Next**.

Figure 12 Time Zone



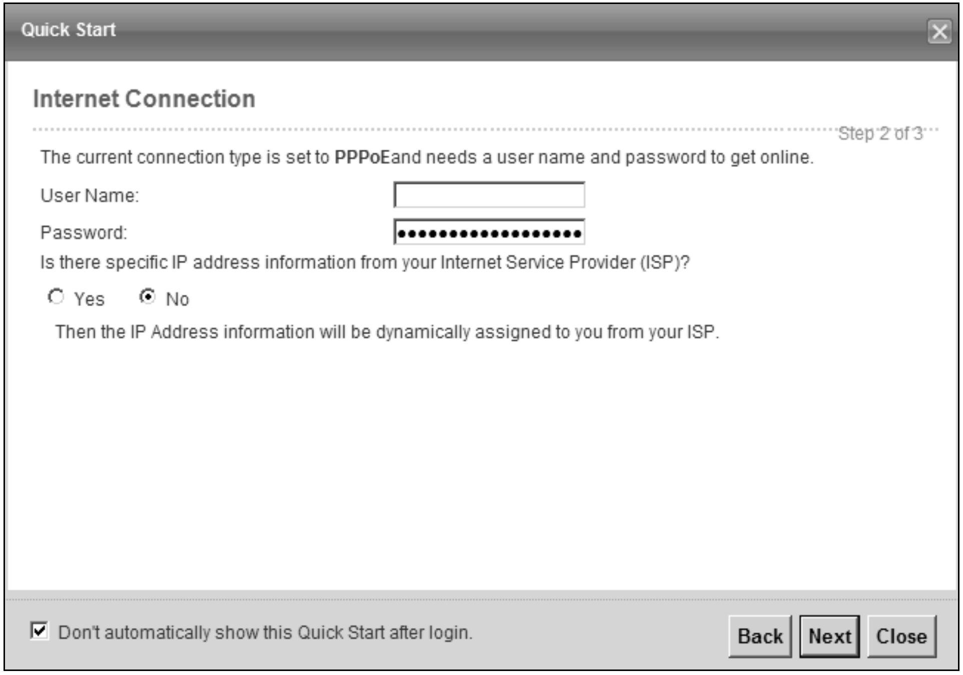
The wizard will guide you through the basic settings of this device. This will take about few minutes to complete. Click Next te begin.

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

☑ Don't automatically show this Quick Start after login.

2 Enter your Internet connection information in this screen. The screen and fields to enter may vary depending on your current connection type. Click **Next**. Click **Next**.

Figure 13 Internet Connection



Internet Connection

Step 2 of 3

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)?

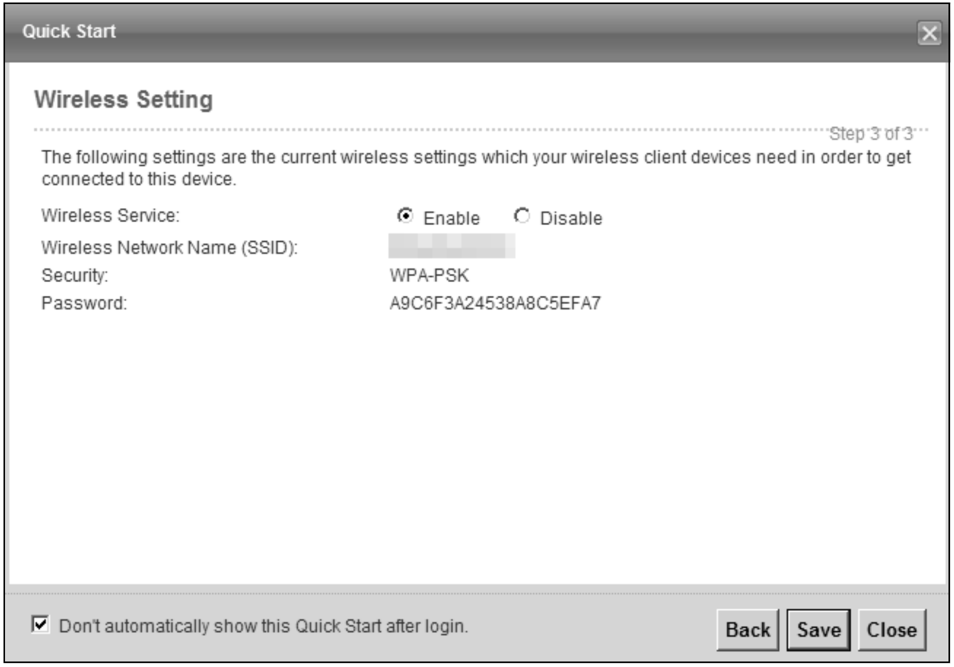
○ Yes ● No

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

☑ Don't automatically show this Quick Start after login.

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 Device. Click **Save**.

Figure 14 Internet Connection



Wireless Setting

Step 3 of 3

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): [redacted]

Security: WPA-PSK

Password: A9C6F3A24538A8C5EFA7

☑ Don't automatically show this Quick Start after login.

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

4

Tutorials

4.1 Overview

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

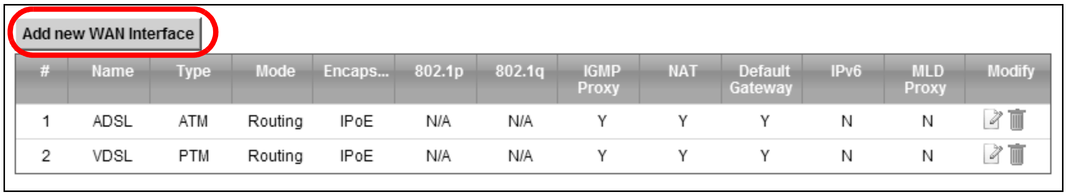
- Setting Up an ADSL PPPoE Connection, see page 35
- Setting Up a Secure Wireless Network, see page 38
- Setting Up Multiple Wireless Groups, see page 44
- Configuring Static Route for Routing to Another Network, see page 47
- Configuring QoS Queue and Class Setup, see page 50
- Access the Device Using DDNS, see page 53
- Configuring the MAC Address Filter, see page 55
- Access Your Shared Files From a Computer, see page 56
- Using the Media Server Feature, see page 57
- Using the Print Server Feature, see page 62

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 Device. Be sure to contact your service provider for any information you need to configure the **Broadband** screens.

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



#	Name	Type	Mode	Encaps...	802.1p	802.1q	IGMP Proxy	NAT	Default Gateway	IPv6	MLD Proxy	Modify
1	ADSL	ATM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑
2	VDSL	PTM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑

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

General	
Name	MyDSLConnection
Type	ADSL

Connection Mode	Routing
Encapsulation	PPPoE
IPv6/IPv4 Mode	IPv4
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.

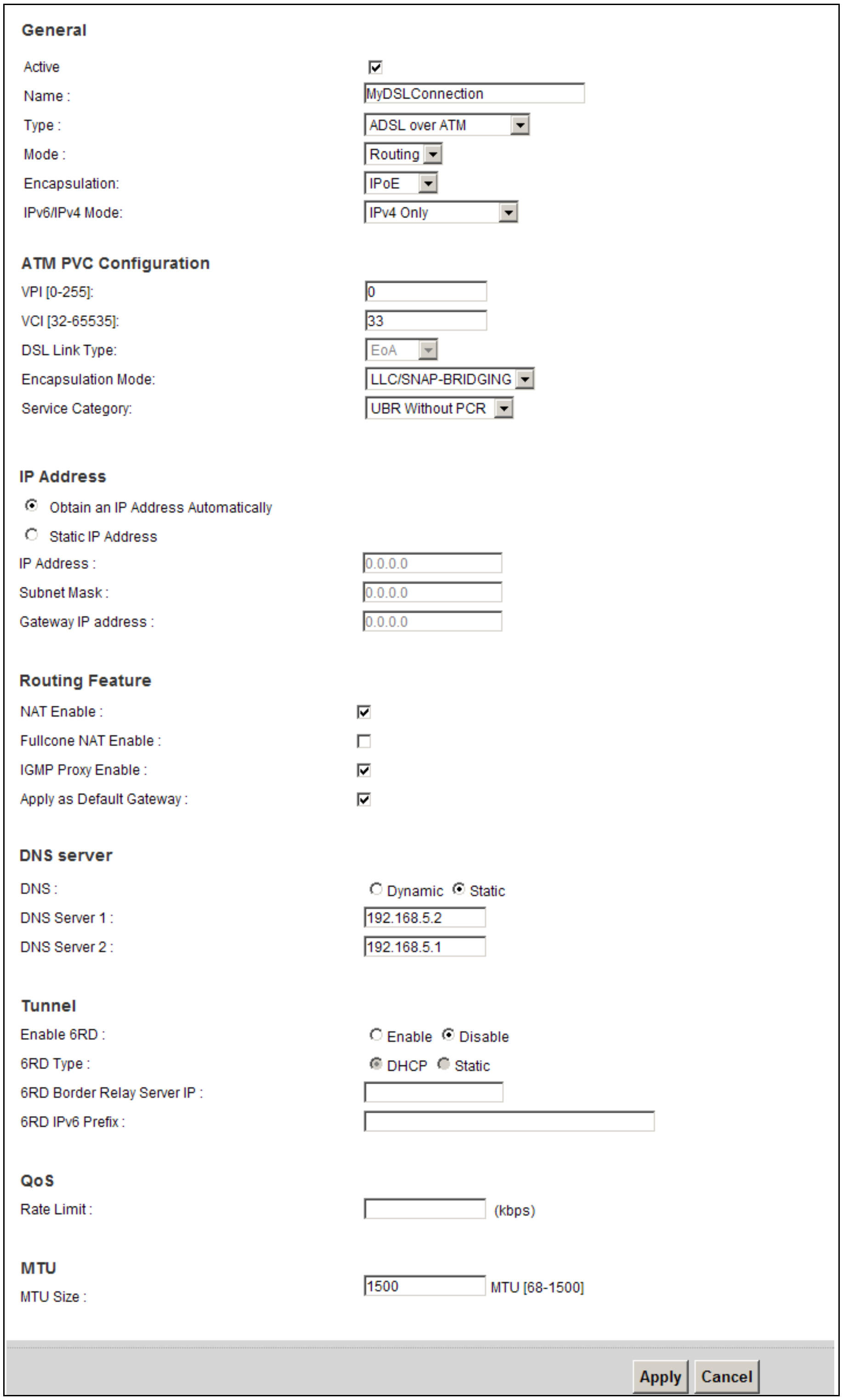
Set the **IPv6/IPv4 Mode** to **IPv4 Only**.

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 Leave the rest of the fields to the default settings.

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



General

Active	☑
Name :	MyDSLConnection
Type :	ADSL over ATM
Mode :	Routing
Encapsulation:	IPoE
IPv6/IPv4 Mode:	IPv4 Only

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

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 :	☑
Fullcone 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

Tunnel

Enable 6RD :	○ Enable ● Disable
6RD Type :	● DHCP ○ Static
6RD Border Relay Server IP :	
6RD IPv6 Prefix :	

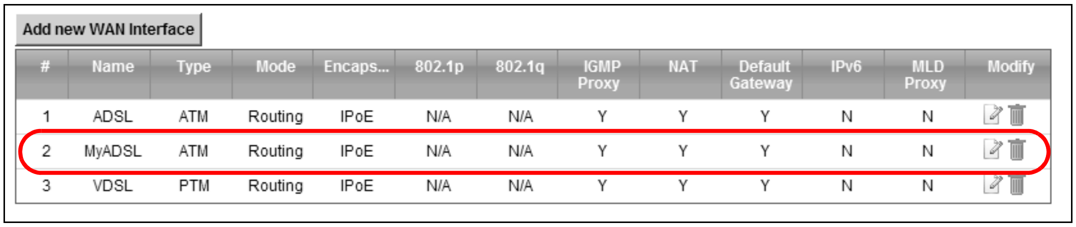
QoS

Rate Limit :	(kbps)

MTU

MTU Size :	1500 MTU [68-1500]

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



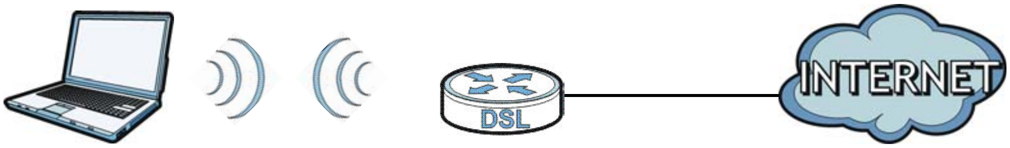
Add new WAN Interface

#	Name	Type	Mode	Encaps...	802.1p	802.1q	IGMP Proxy	NAT	Default Gateway	IPv6	MLD Proxy	Modify
1	ADSL	ATM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑
2	MyADSL	ATM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑
3	VDSL	PTM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑

Try to connect to a website 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 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 Device serves as an access point (AP), and the notebook is the wireless client. The wireless client can access the Internet through the AP.



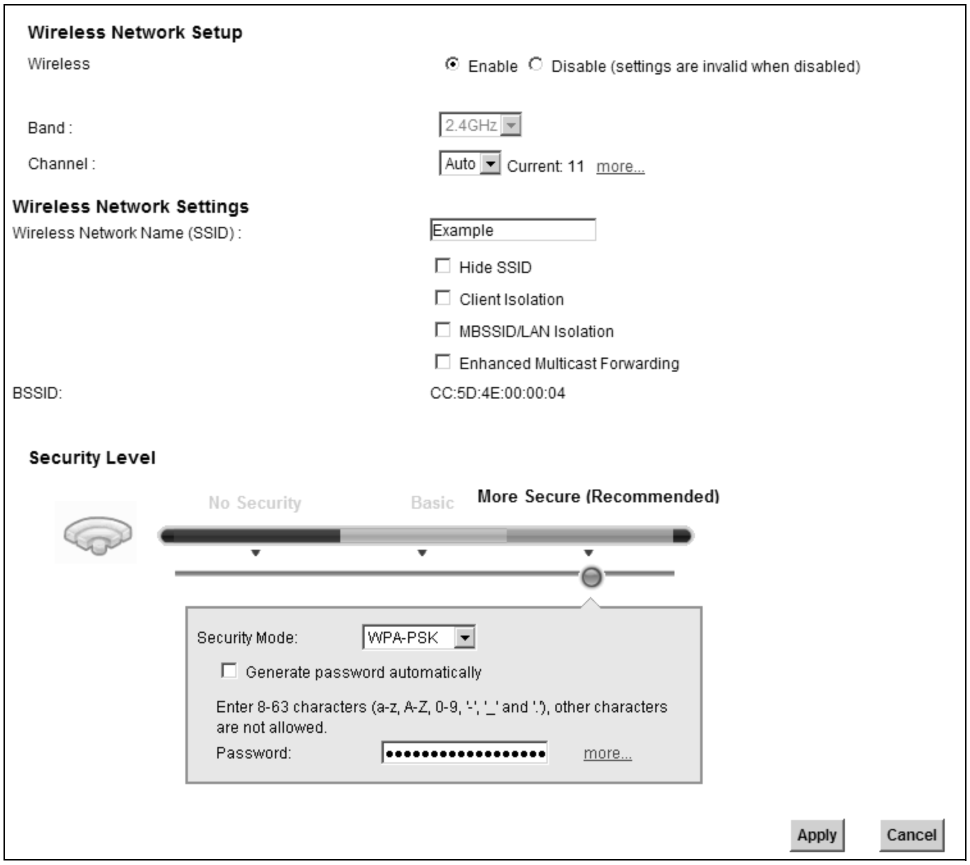
Thomas has to configure the wireless network settings on the Device. Then he can set up a wireless network using WPS (Section 4.3.2 on page 40) or manual configuration (Section 4.3.3 on page 43).

4.3.1 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 Setting** > **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 38). Click **Apply**.



Wireless Network Setup

Wireless ● Enable ○ Disable (settings are invalid when disabled)

Band : 2.4GHz

Channel : Auto Current: 11 more...

Wireless Network Settings

Wireless Network Name (SSID) : Example

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

BSSID: CC:5D:4E:00:00:04

Security Level

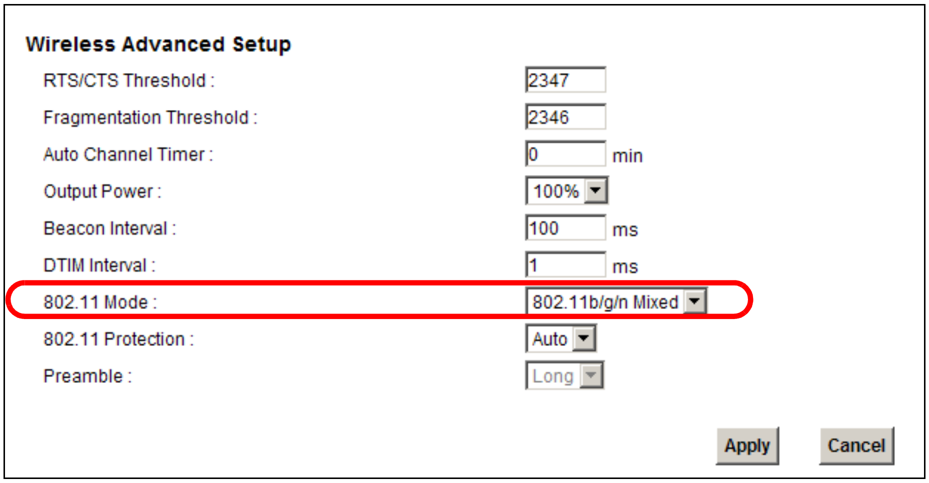
Security Mode: WPA-PSK

□ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

Password: •••••••••••••••••• more...

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
Auto Channel Timer :	0 min
Output Power :	100%
Beacon Interval :	100 ms
DTIM Interval :	1 ms
802.11 Mode :	802.11b/g/n Mixed
802.11 Protection :	Auto
Preamble :	Long

Thomas can now use the WPS feature to establish a wireless connection between his notebook and the Device (see Section 4.3.2 on page 40). He can also use the notebook's wireless client to search for the Device (see Section 4.3.3 on page 43).

4.3.2 Using WPS

This section shows you how to set up a wireless network using WPS. It uses the 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 Device. A wireless client must also use the same PIN in order to download the wireless network settings from the Device.

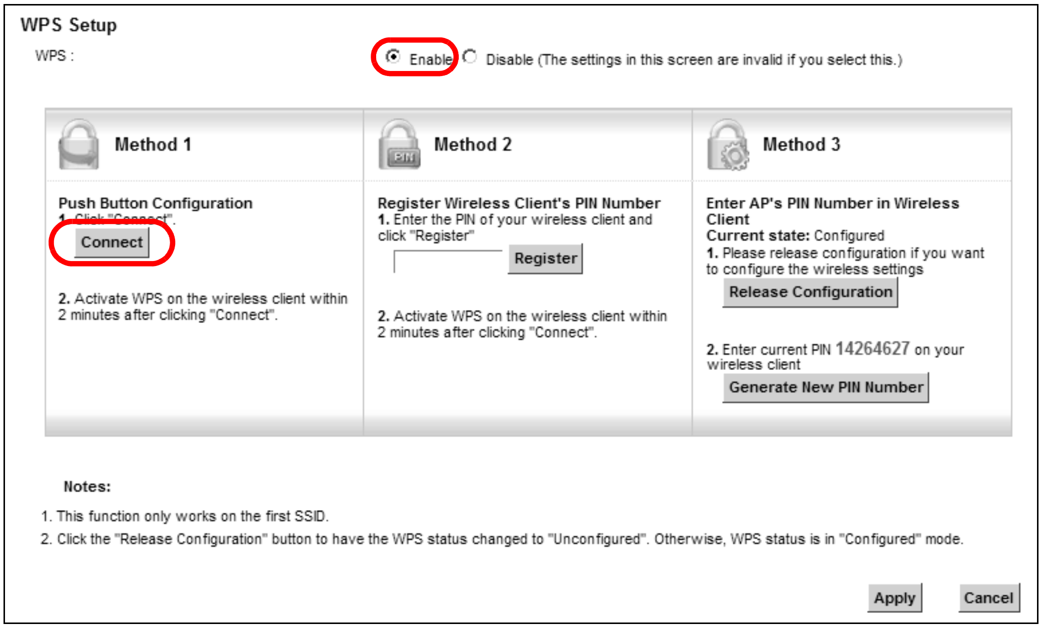
Push Button Configuration (PBC)

1 Make sure that your 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 Device's front panel for more than 5 seconds. Alternatively, you may log into Device's web configurator and go to the **Network Setting > 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 14264627 on your wireless client

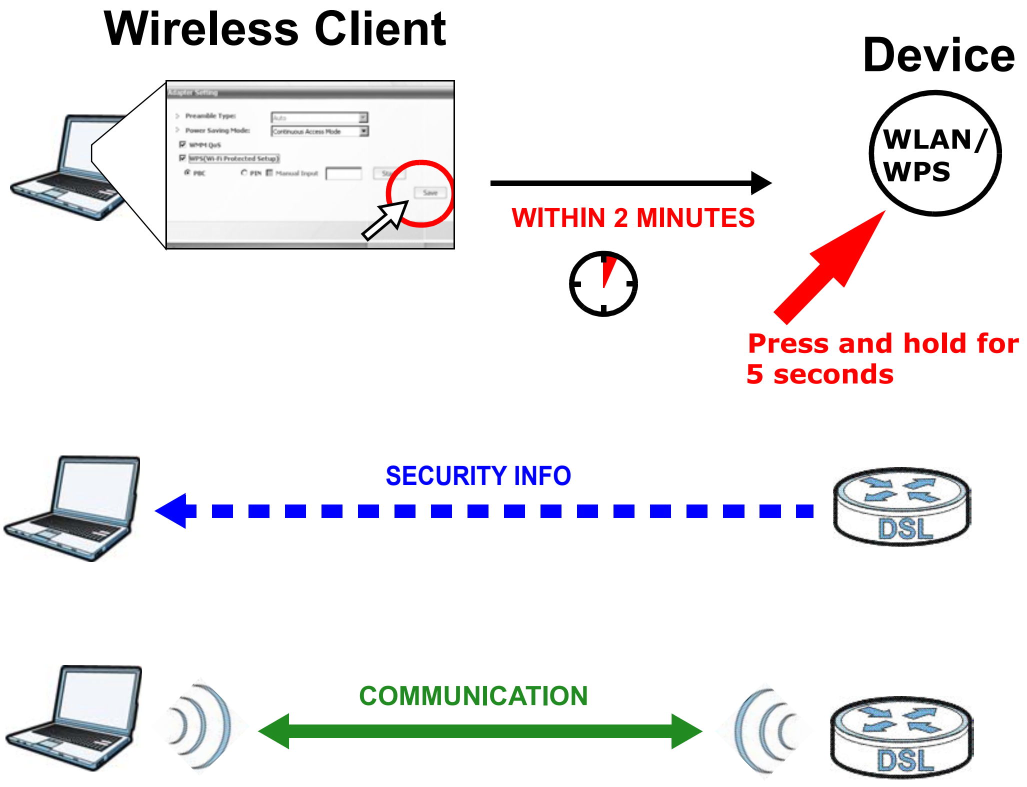
Notes:
1. This function only works on the first SSID.
2. Click the "Release Configuration" button to have the WPS status changed to "Unconfigured". Otherwise, WPS status is in "Configured" mode.

Note: Your 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 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 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 Device and wireless client.

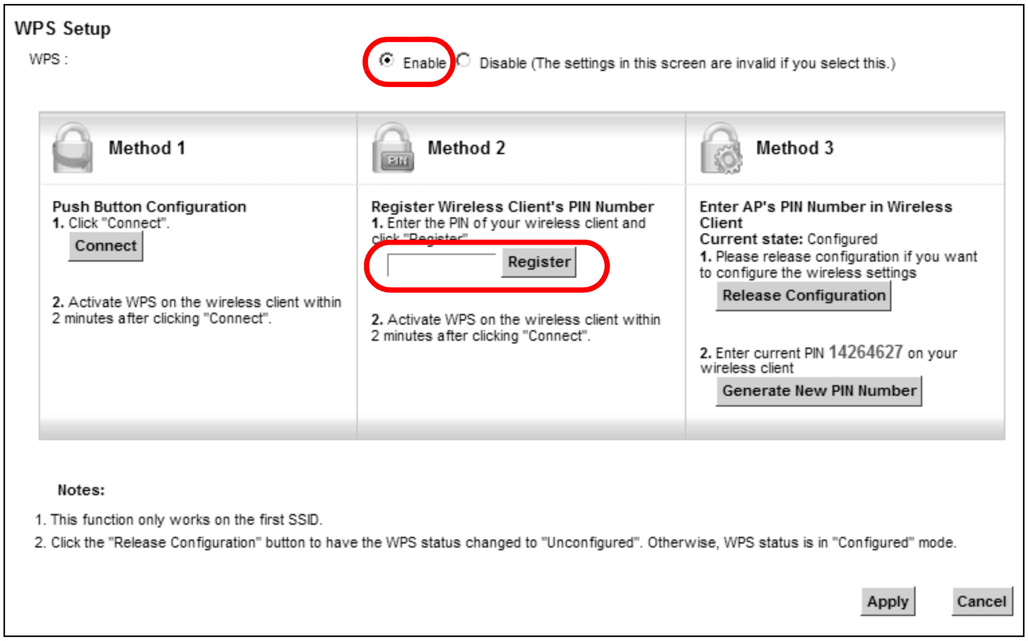


PIN Configuration

When you use the PIN configuration method, you need to use both the 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 Device’s web configurator and go to the **Network Setting > 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".
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

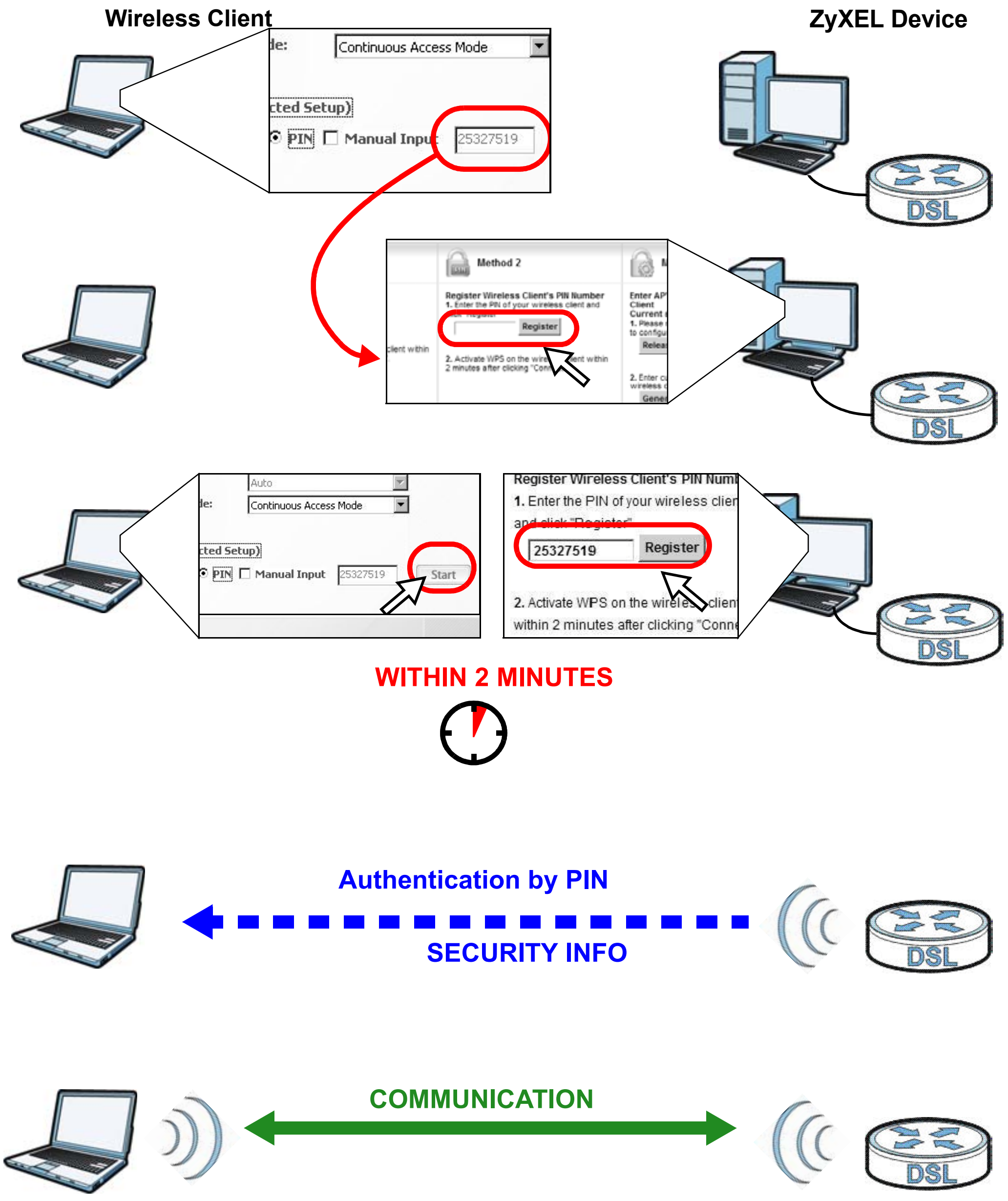
Enter AP's PIN Number in Wireless Client
Current state: Configured
1. Please release configuration if you want to configure the wireless settings
2. Enter current PIN 14264627 on your wireless client

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 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 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 Device securely.

The following figure shows you how to set up a wireless network and its security on a 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
Register
DSL
Auto
Continuous Access Mode
Start
Register Wireless Client's PIN Numb
1. Enter the PIN of your wireless clien
25327519 Register
2. Activate WPS on the wireless client within 2 minutes after clicking "Conn
WITHIN 2 MINUTES
Authentication by PIN
SECURITY INFO
COMMUNICATION

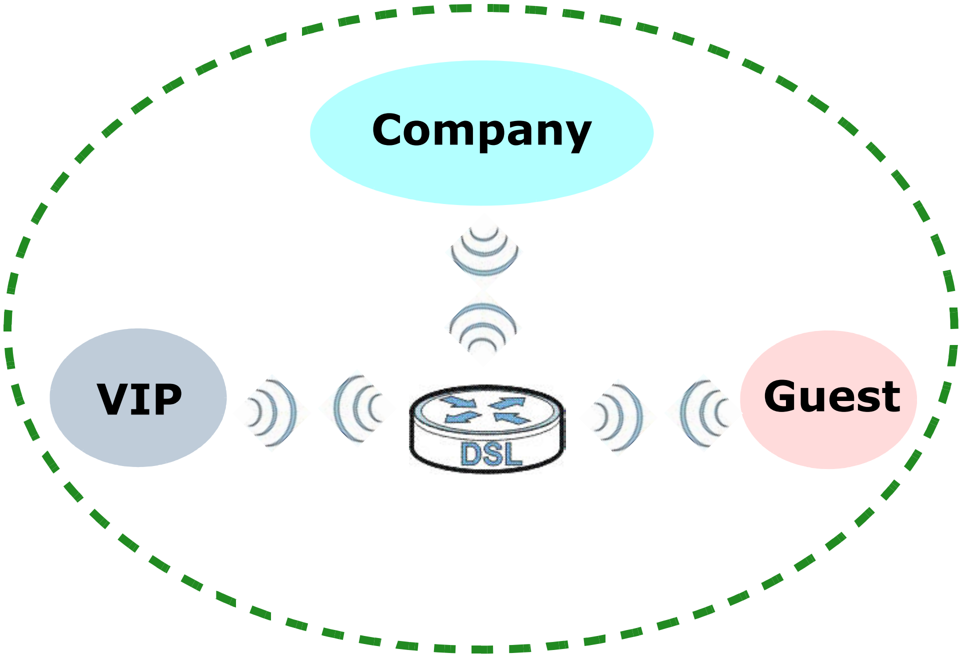
4.3.3 Without WPS

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 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.

4.4 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.

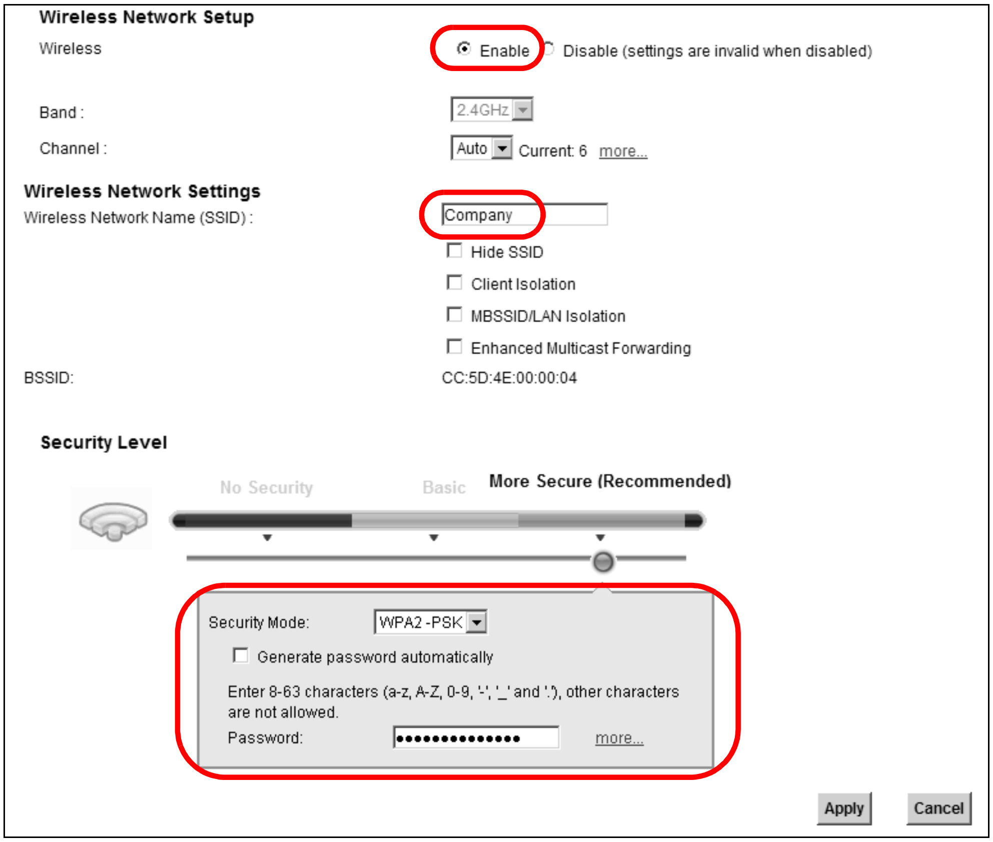


- Employees in Company A will use a general **Company** wireless network group.
- Higher management level and important visitors will use the **VIP** group.
- Visiting guests will use the **Guest** group, which has a lower security mode.

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	Guest12345678

1 Click **Network Setting > 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 (settings are invalid when disabled)

Band : 2.4GHz

Channel : Auto Current: 6 more...

Wireless Network Settings

Wireless Network Name (SSID) : Company

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

BSSID: CC:5D:4E:00:00:04

Security Level

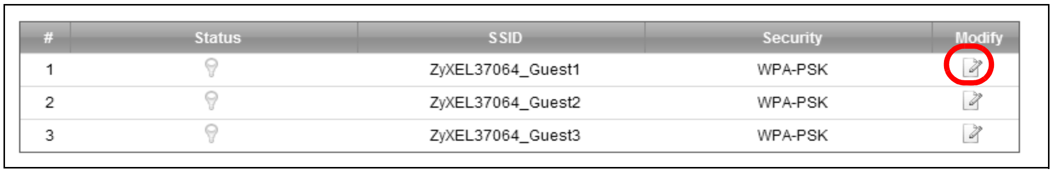
Security Mode: WPA2-PSK

□ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

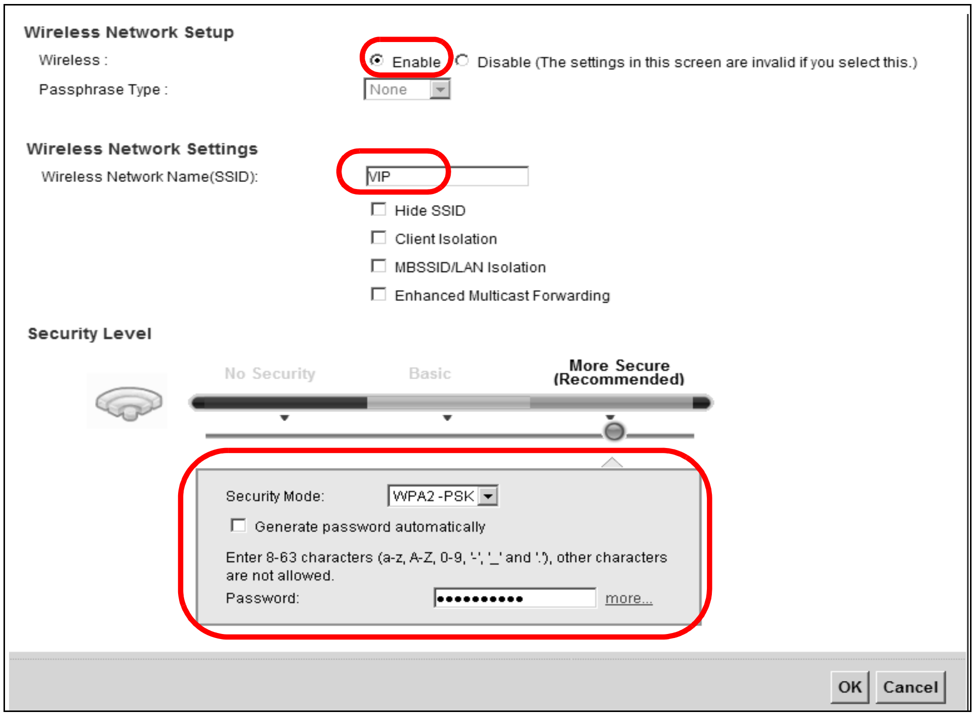
Password: ••••••••••••••• more...

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



#	Status	SSID	Security	Modify
1		ZyXEL37064_Guest1	WPA-PSK	
2		ZyXEL37064_Guest2	WPA-PSK	
3		ZyXEL37064_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.)

Passphrase Type : None

Wireless Network Settings

Wireless Network Name(SSID): VIP

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

Security Level

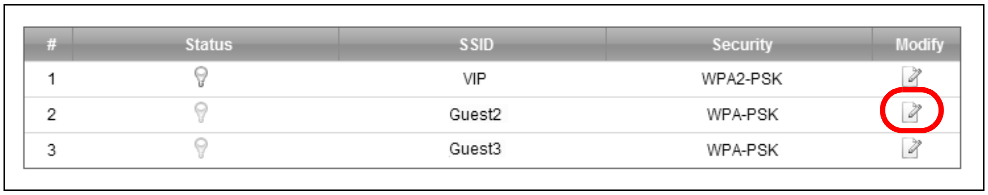
Security Mode: WPA2 -PSK

□ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

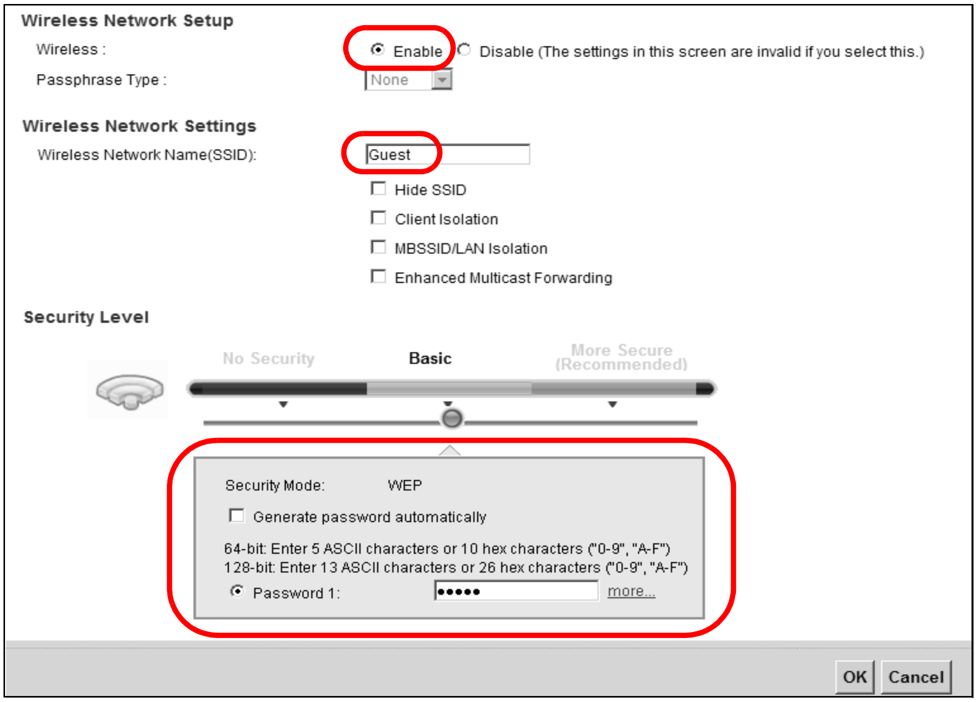
Password: ●●●●●●●●●●● more...

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



#	Status	SSID	Security	Modify
1	💡	VIP	WPA2-PSK	✎
2	💡	Guest2	WPA-PSK	✎
3	💡	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.)

Passphrase Type : None

Wireless Network Settings

Wireless Network Name(SSID): Guest

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

Security Level

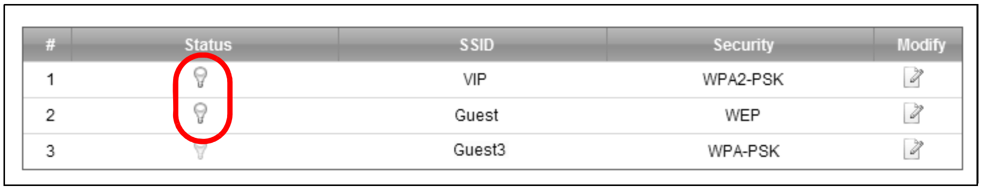
Security Mode: WEP

□ Generate password automatically

64-bit: Enter 5 ASCII characters or 10 hex characters ("0-9", "A-F")
128-bit: Enter 13 ASCII characters or 26 hex characters ("0-9", "A-F")

● 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.

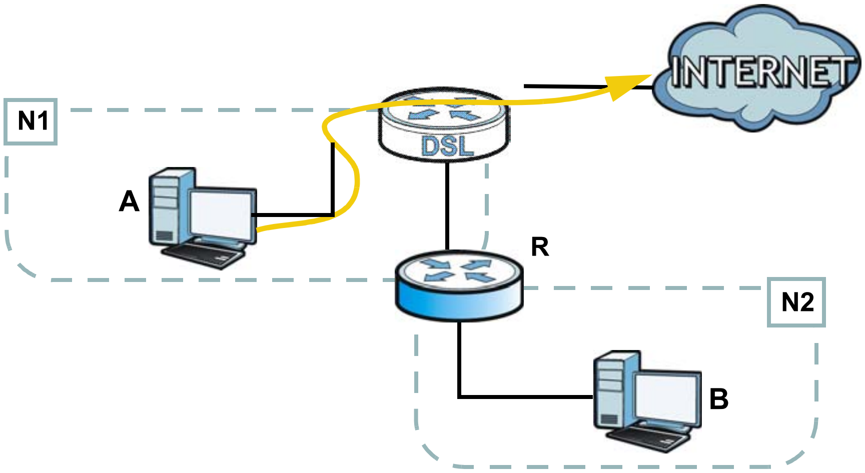


#	Status	SSID	Security	Modify
1	💡	VIP	WPA2-PSK	✎
2	💡	Guest	WEP	✎
3	💡	Guest3	WPA-PSK	✎

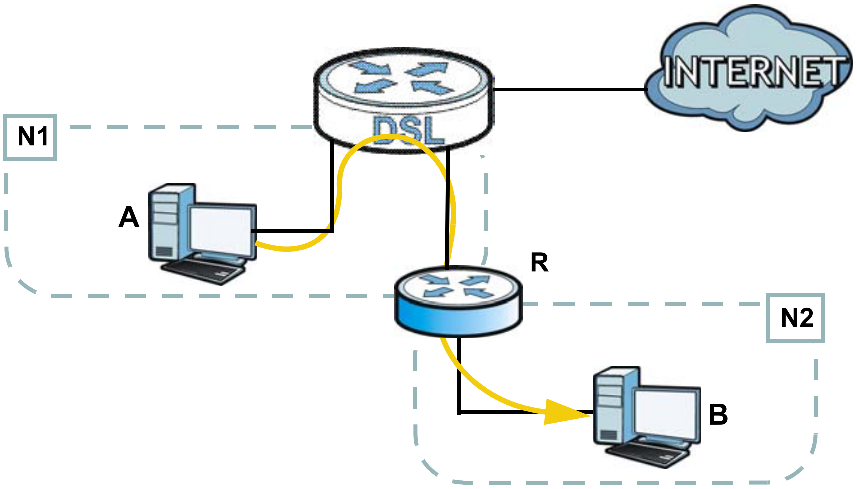
4.5 Configuring Static Route for Routing to Another Network

In order to extend your Intranet and control traffic flowing directions, you may connect a router to the 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 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 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 Device to specify **R** as the router in charge of forwarding traffic to **N2**. In this case, the 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 Device’s WAN	172.16.1.1
The Device’s LAN	192.168.1.1
IP Type	IPv4
Use Interface	ADSL/atm0
A	192.168.1.34
R’s N1	192.168.1.253

Table 4 IP Settings in this Tutorial

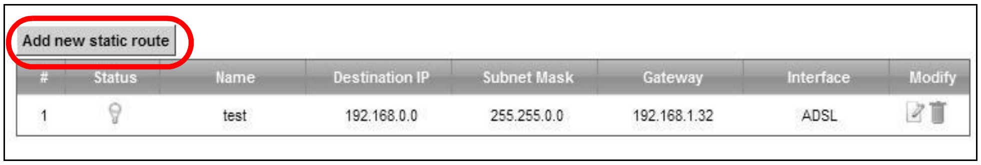
DEVICE / COMPUTER	IP ADDRESS
R's N2	192.168.10.2
B	192.168.10.33

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

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

2 Click **Network Setting** > **Routing**.

3 Click **Add new static route** in the **Static Route** screen.



Add new static route

#	Status	Name	Destination IP	Subnet Mask	Gateway	Interface	Modify
1		test	192.168.0.0	255.255.0.0	192.168.1.32	ADSL	

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

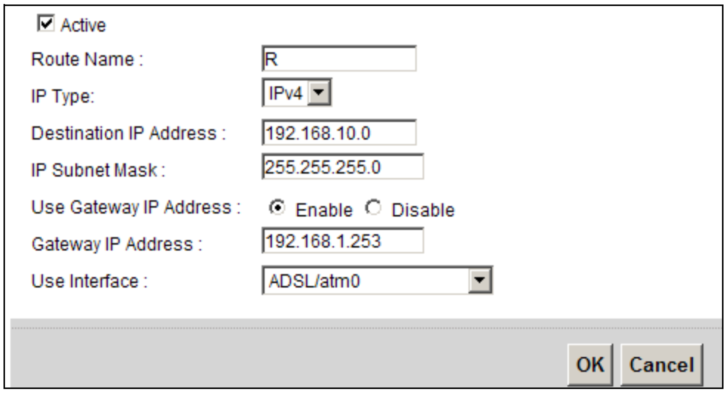
4a Select the **Active** check box. Enter the **Route Name** as **R**.

4b Set **IP Type** to **IPv4**.

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

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.

4e Select **ADSL/atm0** as the **Use Interface**.



☑ Active

Route Name : R

IP Type: IPv4

Destination IP Address : 192.168.10.0

IP Subnet Mask : 255.255.255.0

Use Gateway IP Address : ● Enable ○ Disable

Gateway IP Address : 192.168.1.253

Use Interface : ADSL/atm0

OK Cancel

4a Click **OK**.

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.

4.6 Configuring QoS Queue and Class Setup

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

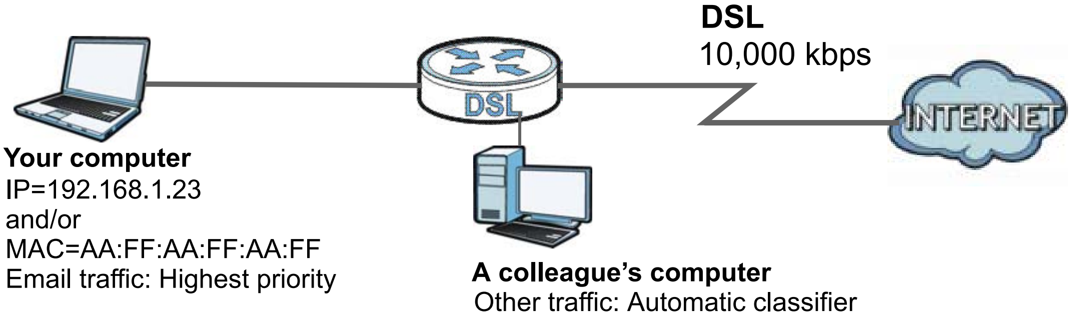
Let's say you are a team leader of a small sales branch office. You want to prioritize e-mail traffic because your task includes sending urgent updates to clients at least twice every hour. You also upload data files (such as logs and e-mail archives) to the FTP server throughout the day. Your colleagues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

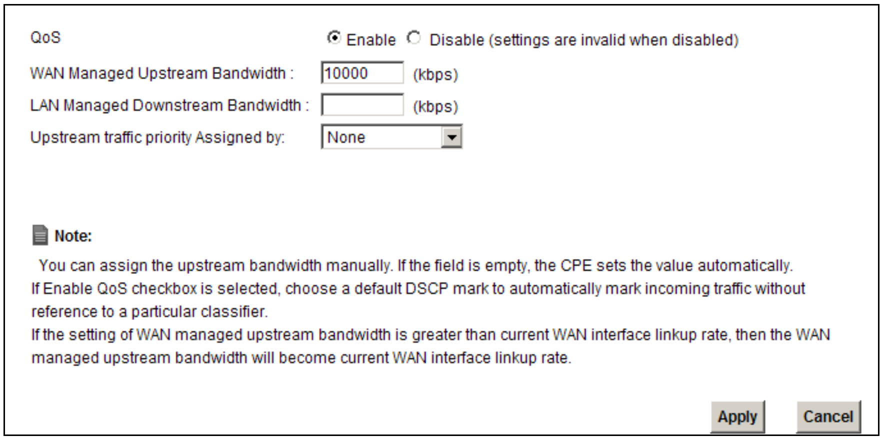
- Configure a queue to assign the highest priority queue (1) to e-mail traffic going to the WAN interface, so that e-mail traffic would not get delayed when there is network congestion.
- Note the IP address (192.168.1.23 for example) and/or MAC address (AA:FF:AA:FF:AA:FF for example) of your computer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

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

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



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



QoS ● Enable ○ Disable (settings are invalid when disabled)

WAN Managed Upstream Bandwidth : 10000 (kbps)

LAN Managed Downstream Bandwidth : (kbps)

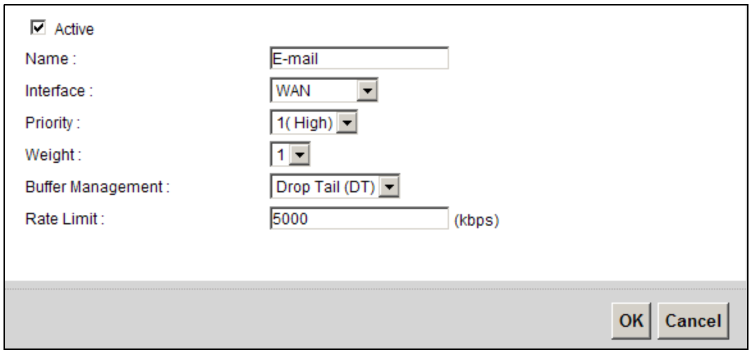
Upstream traffic priority Assigned by: None

Note:

You can assign the upstream bandwidth manually. If the field is empty, the CPE sets the value automatically.
If Enable QoS checkbox is selected, choose a default DSCP mark to automatically mark incoming traffic without reference to a particular classifier.
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
- **Interface**: **WAN**
- **Priority**: 1 (High)
- **Weight**: 8
- **Rate Limit**: 5,000 (kbps)



☑ Active

Name : E-mail

Interface : WAN

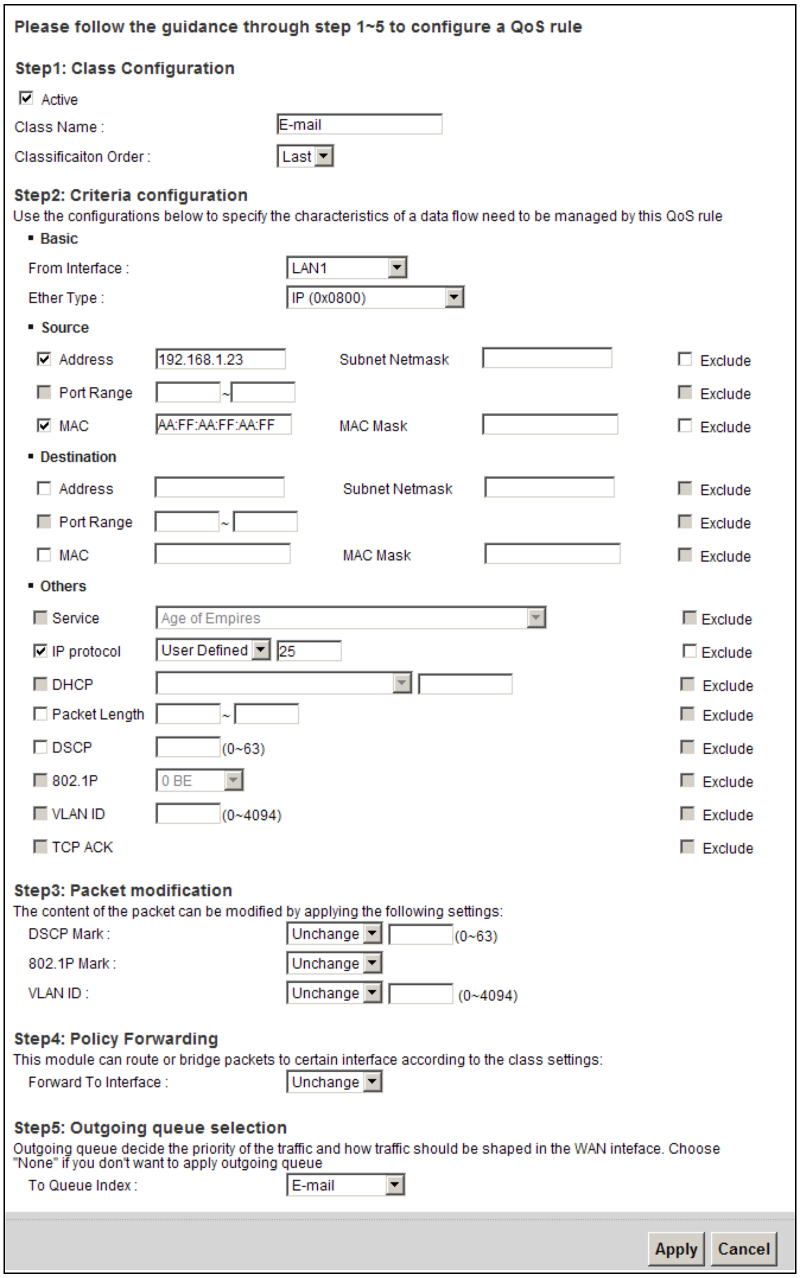
Priority : 1(High)

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.



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

Step1: Class Configuration

☑ Active

Class Name : E-mail

Classificaiton Order : Last

Step2: Criteria configuration

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

- **Basic**

From Interface : LAN1

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 ☐ Exclude

☐ Packet Length ~ ☐ Exclude

☐ DSCP (0~63) ☐ Exclude

☐ 802.1P 0 BE ☐ Exclude

☐ VLAN ID (0~4094) ☐ 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 (0~4094)

Step4: Policy Forwarding

This module can route or bridge packets to certain interface according to the class settings:

Forward To Interface : Unchange

Step5: Outgoing queue selection

Outgoing queue decide the priority of the traffic and how traffic should be shaped in the WAN inteface. Choose "None" if you don't want to apply outgoing queue

To Queue Index : E-mail

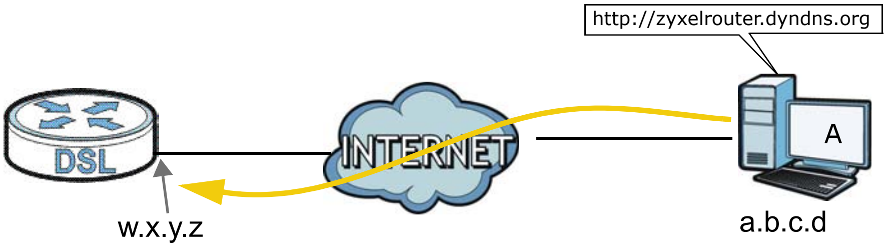
Class Name	Give a class name to this traffic, such as **E-mail** in this example.
From Interface	This is the interface from which the traffic will be coming from. Select **LAN1** for this example.
Ether Type	Select **IP** to identify the traffic source by its IP address or MAC address.
IP Address	Type 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 Setting > 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 Setting > QoS > Monitor**. This shows the bandwidth allotted to e-mail traffic compared to other network traffic.

4.7 Access the Device Using DDNS

If you connect your 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 Device's WAN IP address changes dynamically. Dynamic DNS (DDNS) allows you to access the 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 Device
- Testing the DDNS Setting

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

4.7.1 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.

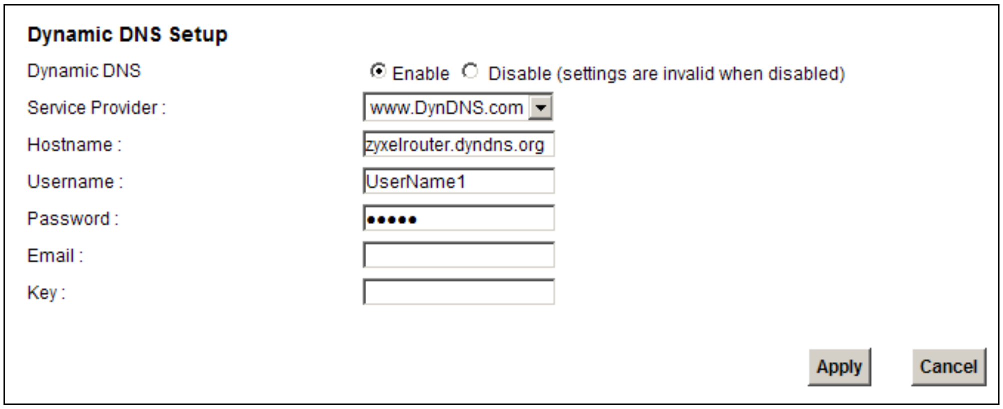
- Hostname: **zyxelrouter.dyndns.org**
- Service Type: **Host with IP address**
- IP Address: Enter the WAN IP address that your Device is currently using. You can find the IP address on the Device's Web Configurator **Status** page.

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

4.7.2 Configuring DDNS on Your Device

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

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



Dynamic DNS Setup

Dynamic DNS	● Enable ○ Disable (settings are invalid when disabled)
Service Provider :	www.DynDNS.com
Hostname :	zyxelrouter.dyndns.org
Username :	UserName1
Password :	●●●●●
Email :	
Key :	

Click **Apply**.

4.7.3 Testing the DDNS Setting

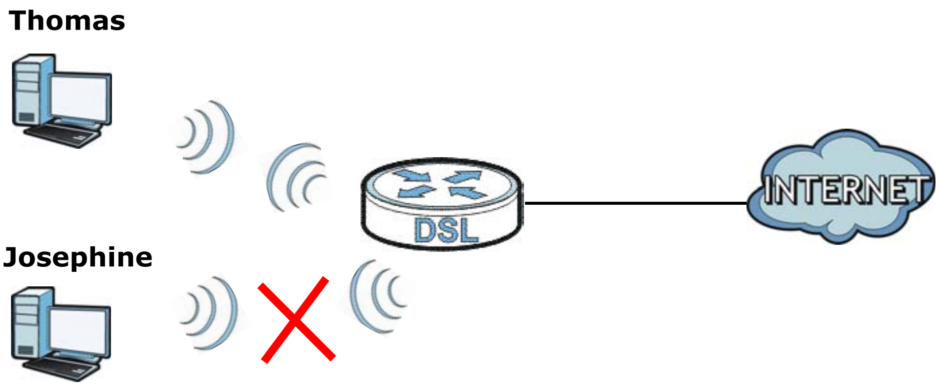
Now you should be able to access the Device from the Internet. To test this:

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

4.8 Configuring the MAC Address Filter

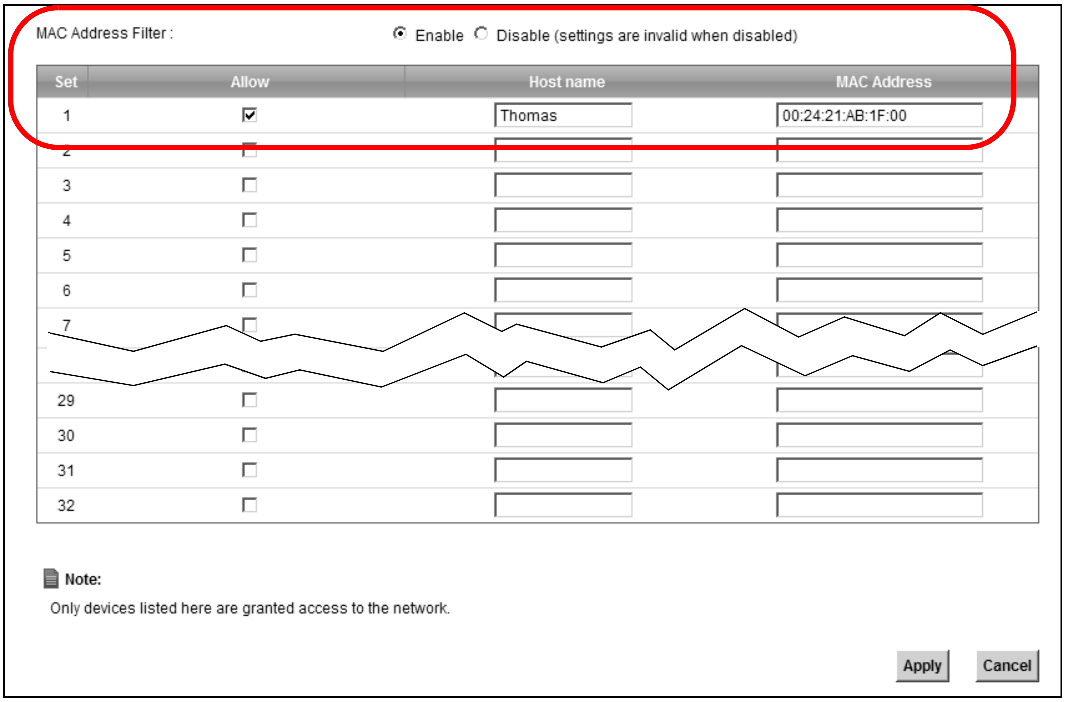
Thomas noticed that his daughter Josephine spends too much time surfing the web and downloading media files. He decided to prevent Josephine from accessing the Internet so that she can concentrate on preparing for her final exams.

Josephine's computer connects wirelessly to the Internet through the Device. Thomas decides to use the **Security > MAC Filter** screen to grant wireless network access to his computer but not to Josephine's computer.



1 Click **Security** > **MAC Filter** to open the **MAC Filter** screen. Select the **Enable** check box to activate MAC filter function.

2 Select **Allow**. Then enter the host name and MAC address of Thomas' computer in this screen. Click **Apply**.



MAC Address Filter : ● Enable ○ Disable (settings are invalid when disabled)

Set	Allow	Host name	MAC Address
1	☑	Thomas	00:24:21:AB:1F:00
2	□		
3	□		
4	□		
5	□		
6	□		
7	□		
29	□		
30	□		
31	□		
32	□		

Note:

Only devices listed here are granted access to the network.

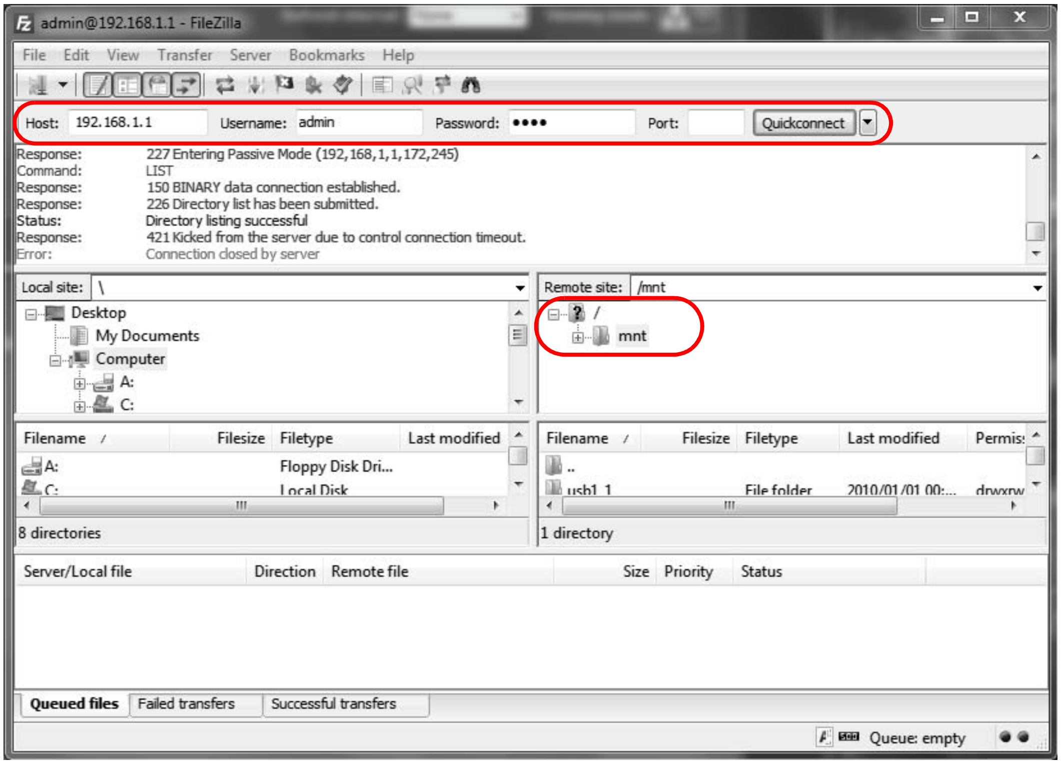
Thomas can also grant access to the computers of other members of his family and friends. However, Josephine and others not listed in this screen will no longer be able to access the Internet through the Device.

4.9 Access Your Shared Files From a Computer

Here is how to use an FTP program to access a file storage device connected to the Device’s USB port.

Note: This example uses the FileZilla FTP program to browse your shared files.

1 In FileZilla enter the IP address of the Device (the default is 192.168.1.1), your account’s user name and password and port 21 and click **Quickconnect**. A screen asking for password authentication appears.


admin@192.168.1.1 - FileZilla
File Edit View Transfer Server Bookmarks Help
Quickconnect
Queued files
Failed transfers
Successful transfers
Queue: empty

Host: 192.168.1.1 Username: admin Password: •••• Port:

```
Response:   227 Entering Passive Mode (192,168,1,1,172,245)
Command:    LIST
Response:   150 BINARY data connection established.
Response:   226 Directory list has been submitted.
Status:     Directory listing successful
Response:   421 Kicked from the server due to control connection timeout.
Error:      Connection closed by server
```

Local site: \

- Desktop
  - My Documents
  - Computer
    - A:
    - C:

Remote site: /mnt

- /
  - mnt

Filename /	Filesize	Filetype	Last modified
A:		Floppy Disk Dri...	
C:		Local Disk	

8 directories

Filename /	Filesize	Filetype	Last modified	Permis:
..				
usb1_1		File folder	2010/01/01 00:...	drwxrw

1 directory

Server/Local file	Direction	Remote file	Size	Priority	Status

2 Once you log in the USB device displays in the **mnt** folder.

4.10 Using the Media Server Feature

Use the media server feature to play files on a computer or on your television (using DMA-2500).

This section shows you how the media server feature works using the following media clients:

- Microsoft (MS) Windows Media Player

  Media Server works with Windows Vista and Windows 7. Make sure your computer is able to play media files (music, videos and pictures).
- ZyXEL DMA-2500, a digital media adapter

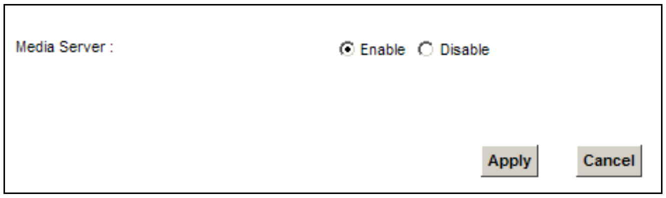
  You need to set up the DMA-2500 to work with your television (TV). Refer to the DMA-2500 Quick Start Guide for the correct hardware connections.

Before you begin, connect the USB storage device containing the media files you want to play to the USB port of your Device.

4.10.1 Configuring the Device

Note: The Media Server feature is enabled by default.

To use your Device as a media server, click **Network Setting > Home Networking > Media Server.**

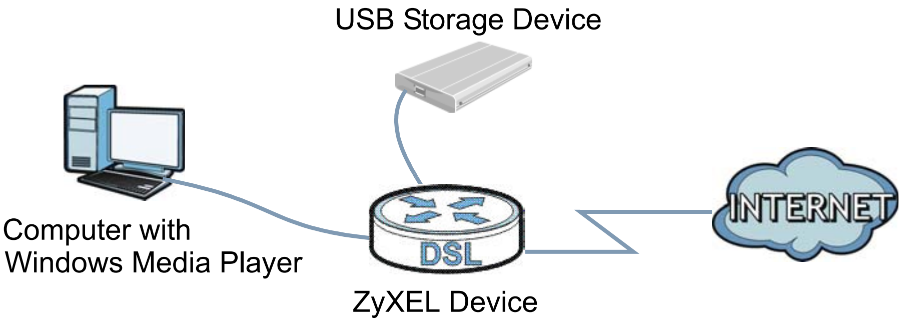


Media Server : ● Enable ○ Disable

Check **Enable Media Server** and click **Apply**. This enables DLNA-compliant media clients to play the video, music and image files in your USB storage device.

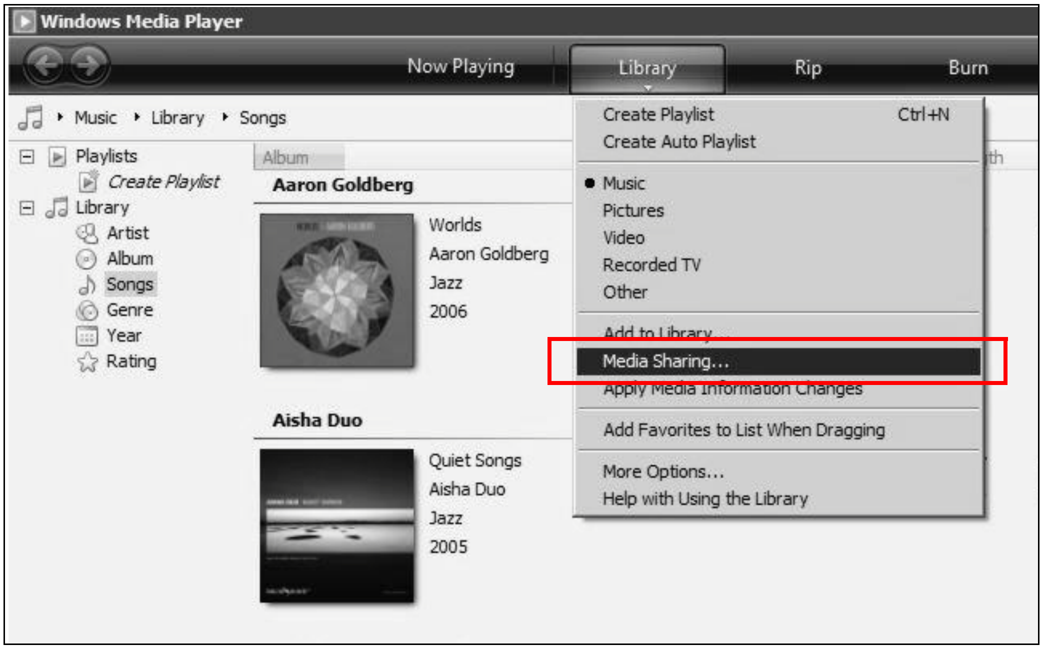
4.10.2 Using Windows Media Player

This section shows you how to play the media files on the USB storage device connected to your Device using Windows Media Player.

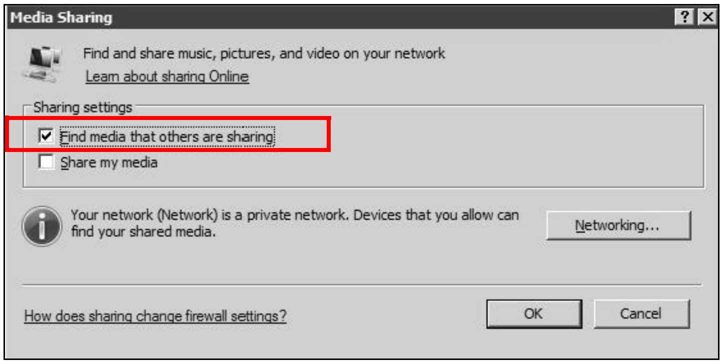


Windows Vista

1 Open Windows Media Player and click **Library > Media Sharing** as follows.



2 Check **Find media that others are sharing** in the following screen and click **OK**.


Media Sharing

Find and share music, pictures, and video on your network

Learn about sharing Online

Sharing settings

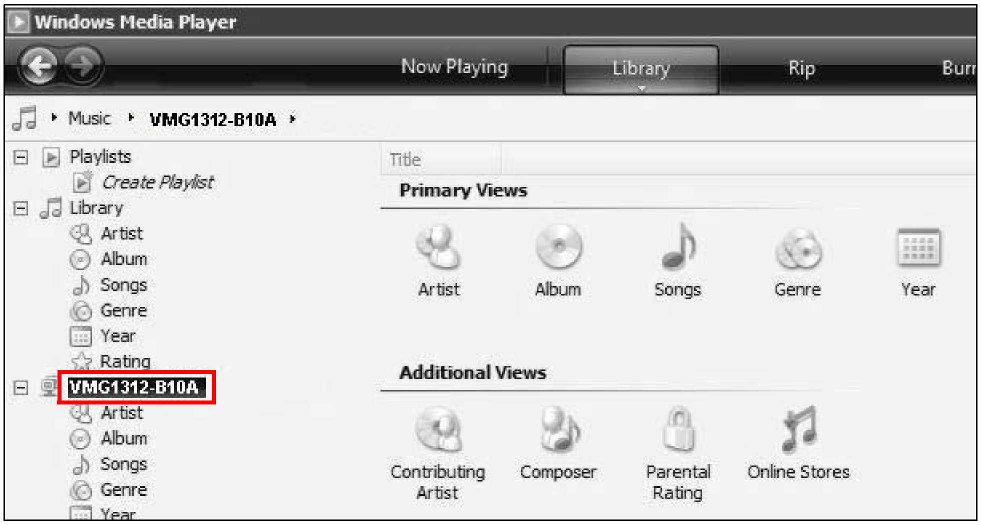
☑ Find media that others are sharing

□ Share my media

Your network (Network) is a private network. Devices that you allow can find your shared media.

How does sharing change firewall settings?

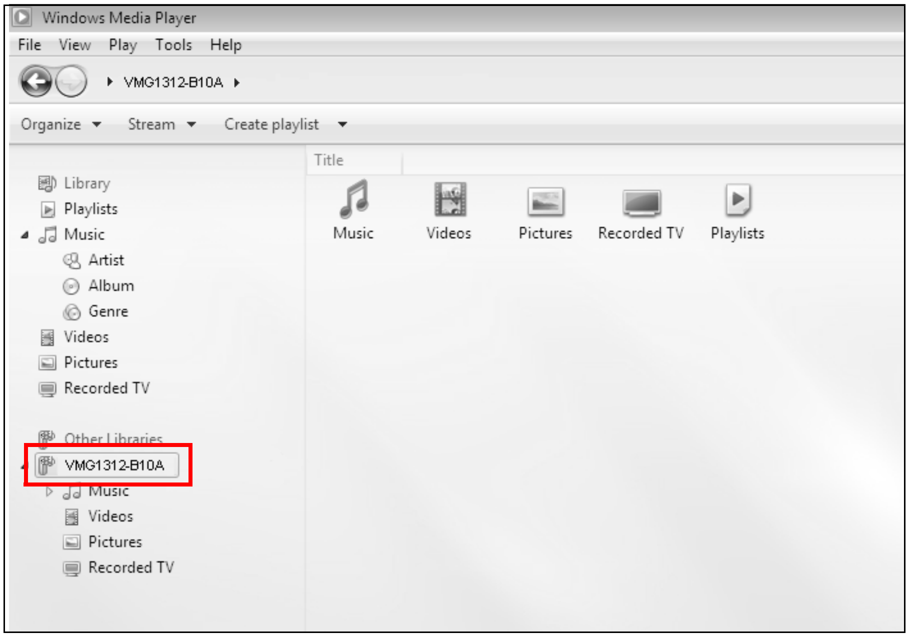
3 In the **Library** screen, check the left panel. The Windows Media Player should detect the Device.



The Device displays as a playlist. Clicking on the category icons in the right panel shows you the media files in the USB storage device attached to your Device.

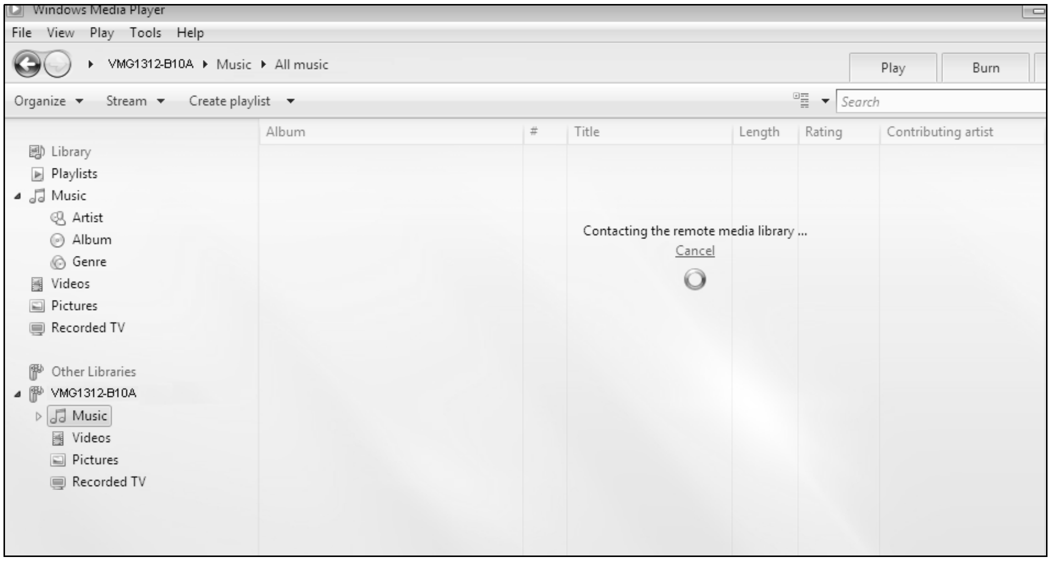
Windows 7

1 Open Windows Media Player. It should automatically detect the Device.



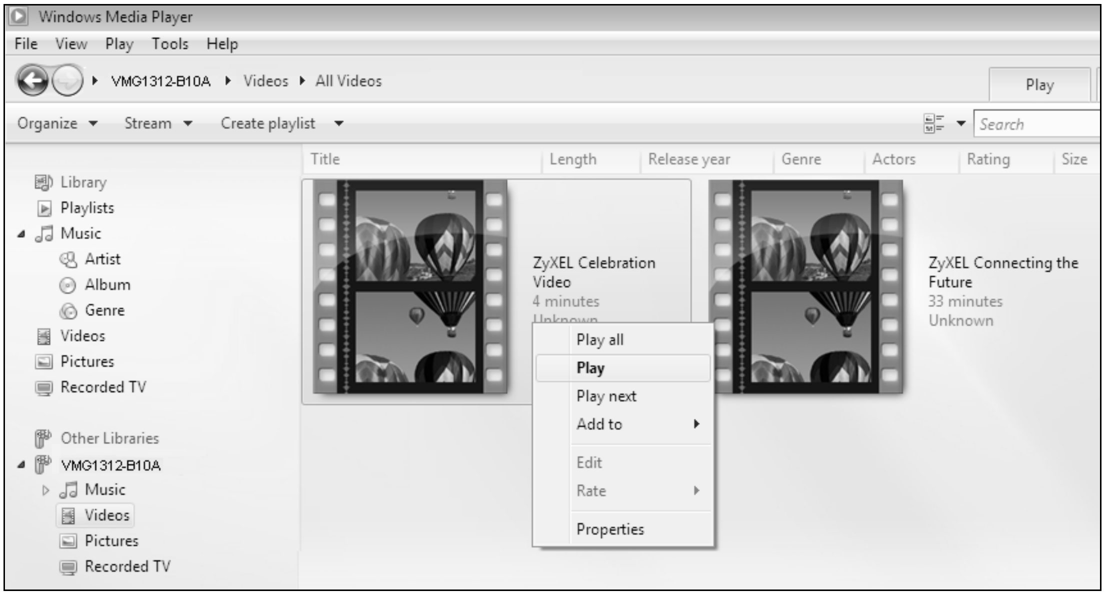
If you cannot see the Device in the left panel as shown above, right-click **Other Libraries > Refresh Other Libraries**.

2 Select a category in the left panel and wait for Windows Media Player to connect to the Device.



Contacting the remote media library ...

3 In the right panel, you should see a list of files available in the USB storage device.

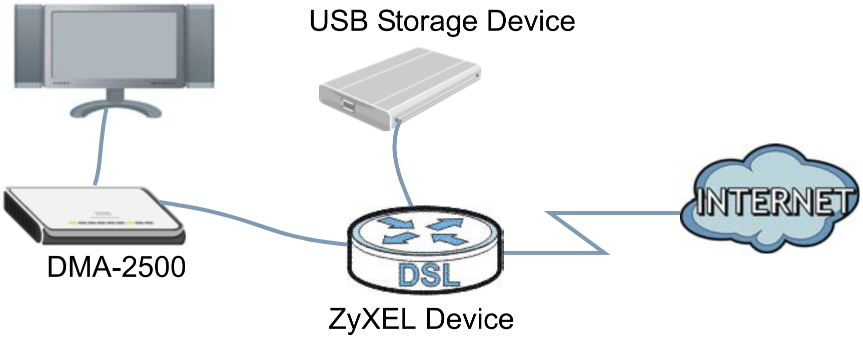


4.10.3 Using a Digital Media Adapter

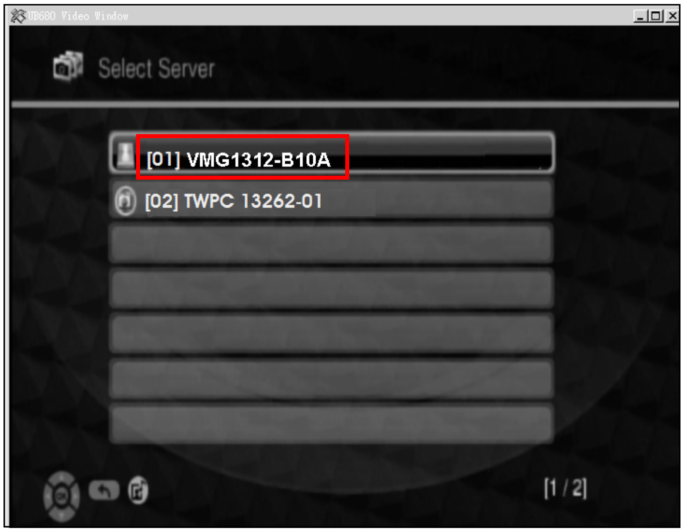
This section shows you how you can use the Device with a ZyXEL DMA-2500 to play media files stored in the USB storage device in your TV screen.

Note: For this tutorial, your DMA-2500 should already be set up with the TV according to the instructions in the DMA-2500 Quick Start Guide.

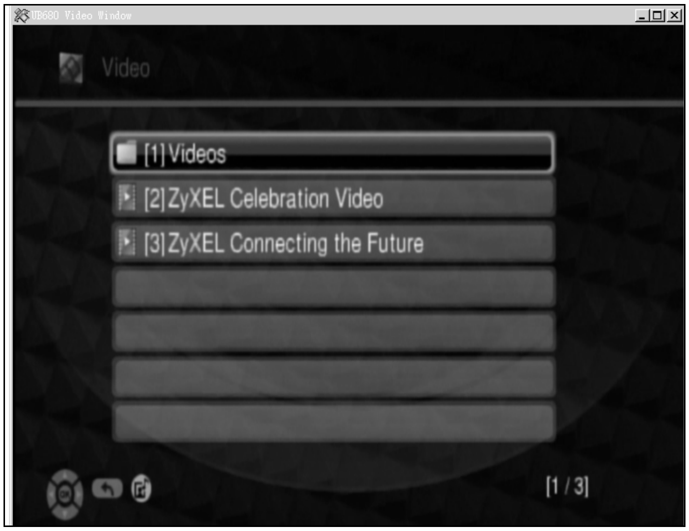
1 Connect the DMA-2500 to an available LAN port in your Device.



2 Turn on the TV and wait for the DMA-2500 **Home** screen to appear. Using the remote control, go to **MyMedia** to open the following screen. Select the Device as your media server.

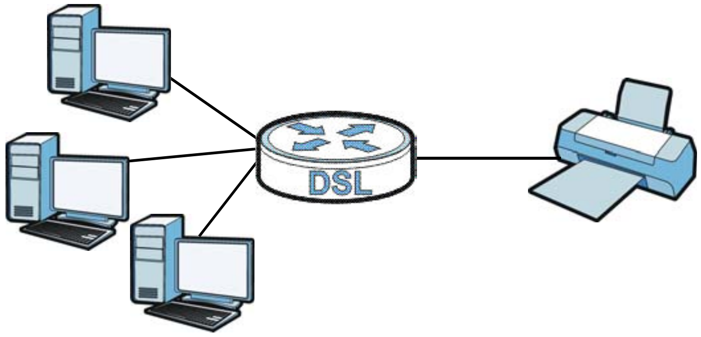


3 The screen shows you the list of available media files in the USB storage device. Select the file you want to open and push the **Play** button in the remote control.



4.11 Using the Print Server Feature

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



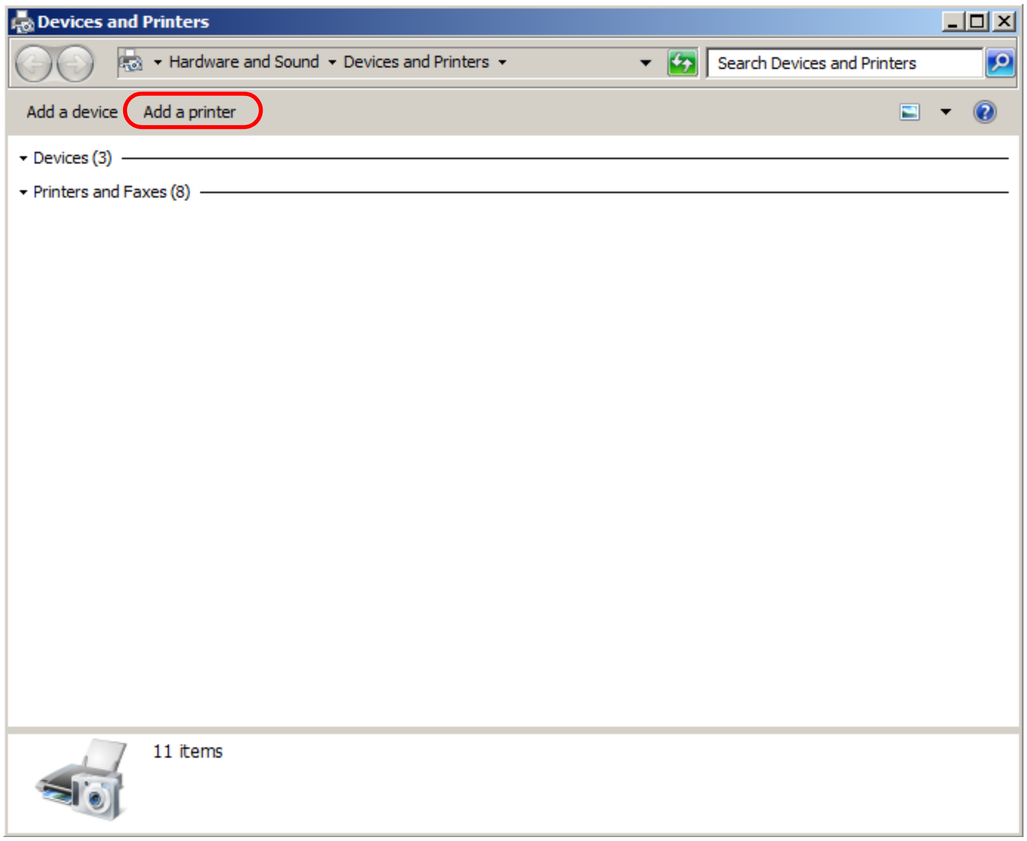
In this section you can:

- Add a New Printer Using Windows
- Add a New Printer Using Macintosh OS X

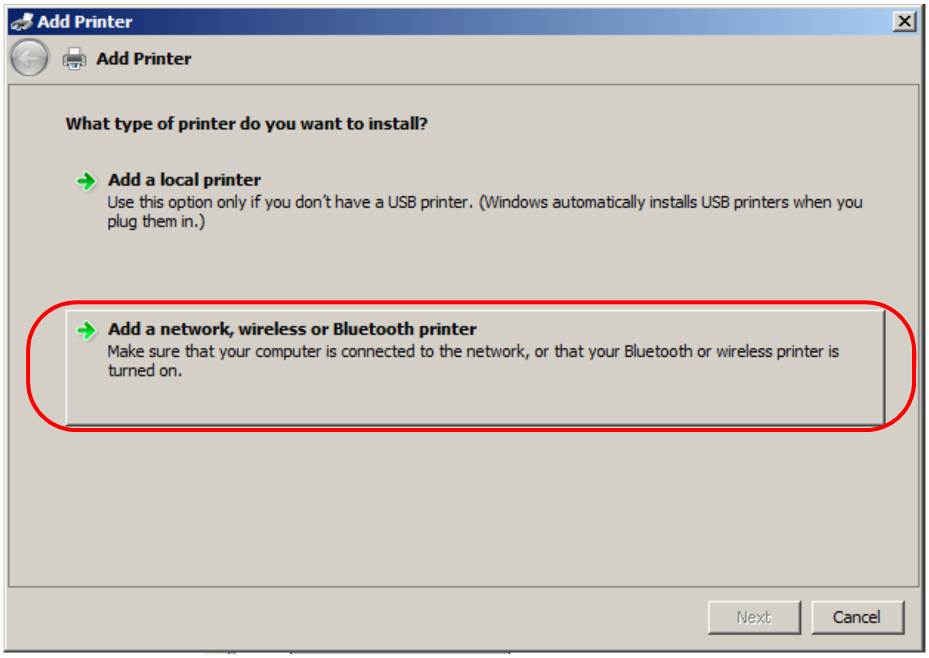
Add a New Printer Using Windows

This example shows how to connect a printer to your Device using the Windows 7 operating system. Some menu items may look different on your operating system.

1 Click **Start** > **Control Panel** > **Devices and Printers** to open the **Devices and Printers** screen. Click **Add a printer**.



2 The **Add Printer** wizard screen displays. Click **Add a network, wireless or Bluetooth printer**.

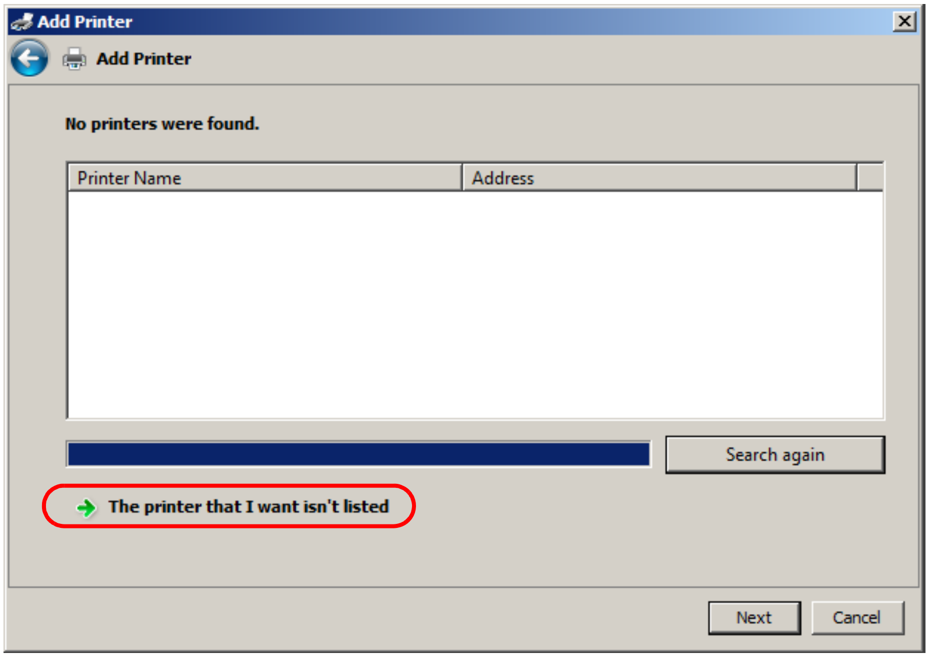


What type of printer do you want to install?

Add a local printer
Use this option only if you don't have a USB printer. (Windows automatically installs USB printers when you plug them in.)

Add a network, wireless or Bluetooth printer
Make sure that your computer is connected to the network, or that your Bluetooth or wireless printer is turned on.

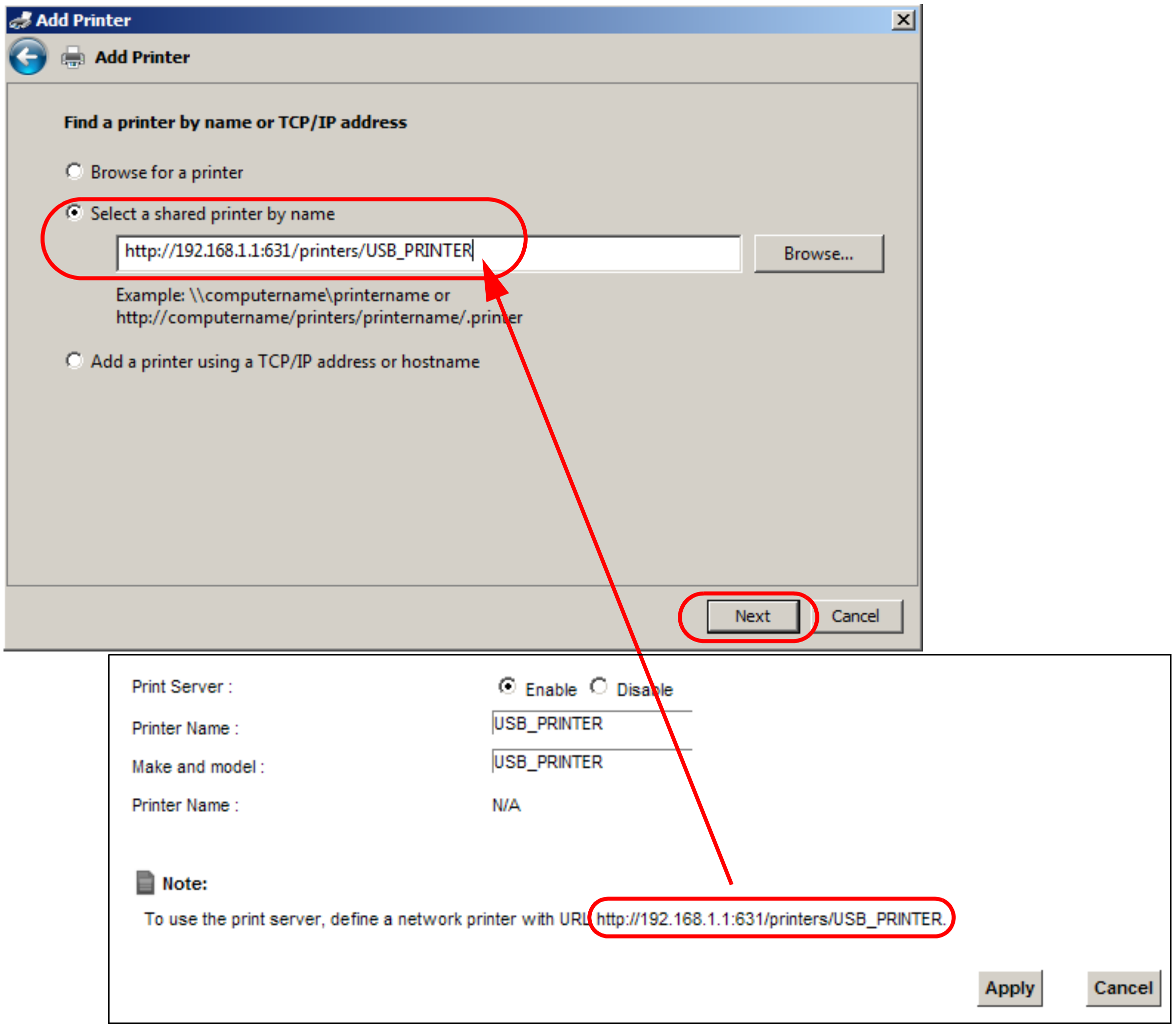
3 Click **The printer that I want isn’t listed**.



No printers were found.

Printer Name	Address

4 Select the **Select a shared printer by name** option. Enter the URL for your printer, **http://192.168.1.1:631/printers/USB_PRINTER**, in this example. This URL can be found in the Device's Web Configurator on the **Network Setting > USB Service > Printer Server** screen. Click **Next**.



Add Printer

Add Printer

Find a printer by name or TCP/IP address

○ Browse for a printer

● Select a shared printer by name

http://192.168.1.1:631/printers/USB_PRINTER

Example: \\computername\printername or
http://computername/printers/printername/.printer

○ Add a printer using a TCP/IP address or hostname

Print Server : ● Enable ○ Disable

Printer Name : USB_PRINTER

Make and model : USB_PRINTER

Printer Name : N/A

Note:

To use the print server, define a network printer with URL http://192.168.1.1:631/printers/USB_PRINTER.

5 Install the printer driver. Please check the Windows CD if it includes the printer driver. If not, please install the driver from the CD included with your printer or by downloading it from the printer vendor's website.

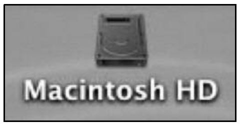
6 After the printer driver installs successfully, choose if you want to set this printer to be the default.

Add a New Printer Using Macintosh OS X

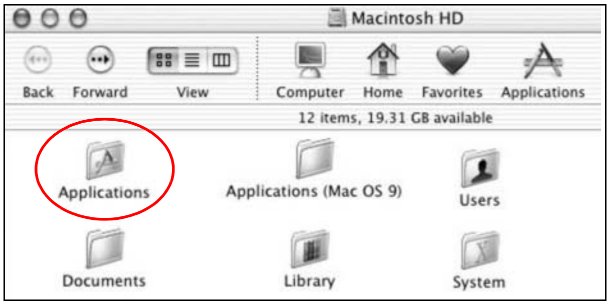
Complete the following steps to set up a print server driver on your Macintosh computer.

1 Click the **Print Center** icon located in the Macintosh Dock (a place holding a series of icons/ shortcuts at the bottom of the desktop). Proceed to step 6 to continue. If the **Print Center** icon is not in the Macintosh Dock, proceed to the next step.

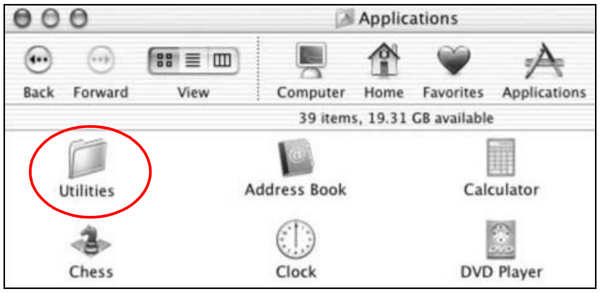
2 On your desktop, double-click the **Macintosh HD** icon to open the **Macintosh HD** window.



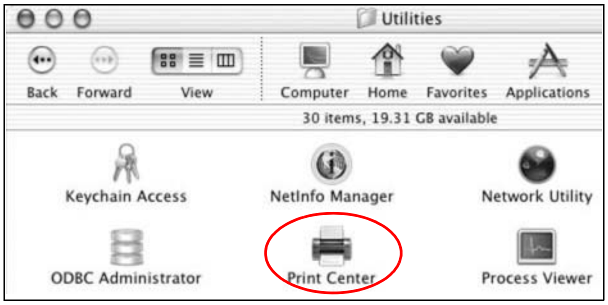
3 Double-click the **Applications** folder.



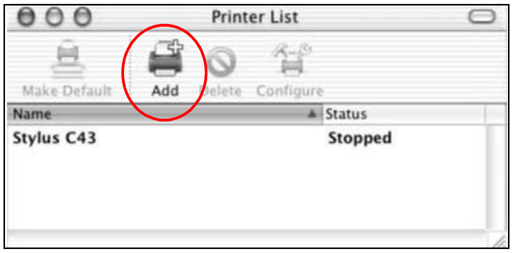
4 Double-click the **Utilities** folder.



5 Double-click the **Print Center** icon.



6 Click the **Add** icon at the top of the screen.



Name	Status
Stylus C43	Stopped

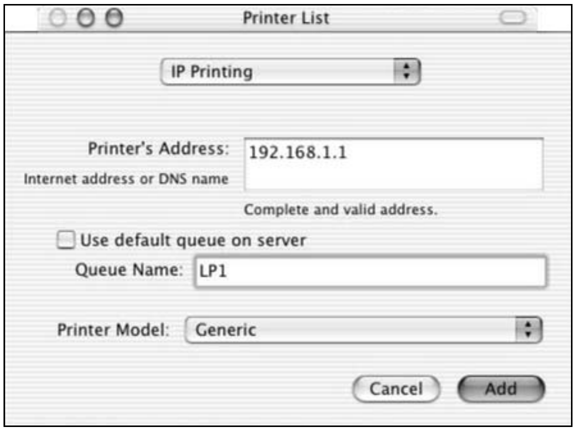
7 Set up your printer in the **Printer List** configuration screen. Select **IP Printing** from the drop-down list box.

8 In the **Printer’s Address** field, type the IP address of your Device.

9 Deselect the **Use default queue on server** check box.

10 Type **LP1** in the **Queue Name** field.

11 Select your **Printer Model** from the drop-down list box. If the printer's model is not listed, select **Generic**.


Printer List

IP Printing

Printer's Address: 192.168.1.1
Internet address or DNS name

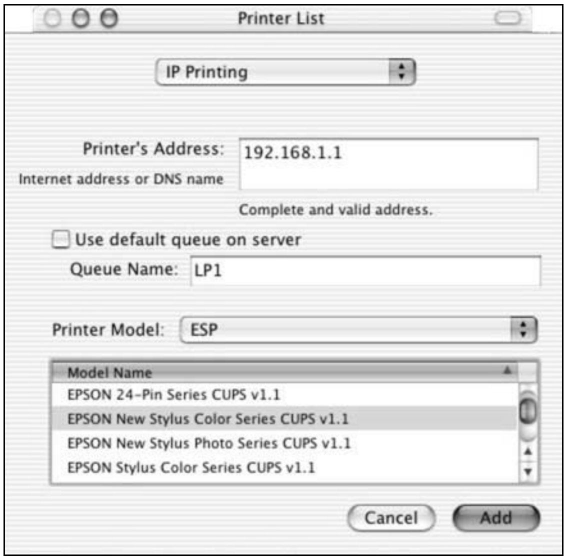
Complete and valid address.

□ Use default queue on server

Queue Name: LP1

Printer Model: Generic

12 Click **Add** to select a printer model, save and close the **Printer List** configuration screen.


Printer List

IP Printing

Printer's Address: 192.168.1.1
Internet address or DNS name

Complete and valid address.

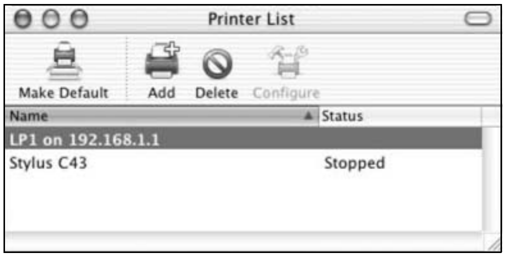
□ Use default queue on server

Queue Name: LP1

Printer Model: ESP

Model Name
EPSON 24-Pin Series CUPS v1.1
EPSON New Stylus Color Series CUPS v1.1
EPSON New Stylus Photo Series CUPS v1.1
EPSON Stylus Color Series CUPS v1.1

13 The **Name LP1 on 192.168.1.1** displays in the **Printer List** field. The default printer **Name** displays in bold type.


Printer List

Name	Status
LP1 on 192.168.1.1	
Stylus C43	Stopped

Your Macintosh print server driver setup is complete. You can now use the Device’s print server to print from a Macintosh computer.

PART II
Technical Reference

5

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 Device and clients connected to it.

You can use the **Status** screen to look at the current status of the 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 Device to update this screen in **Refresh Interval**.

Figure 15 Network Map: Icon Mode

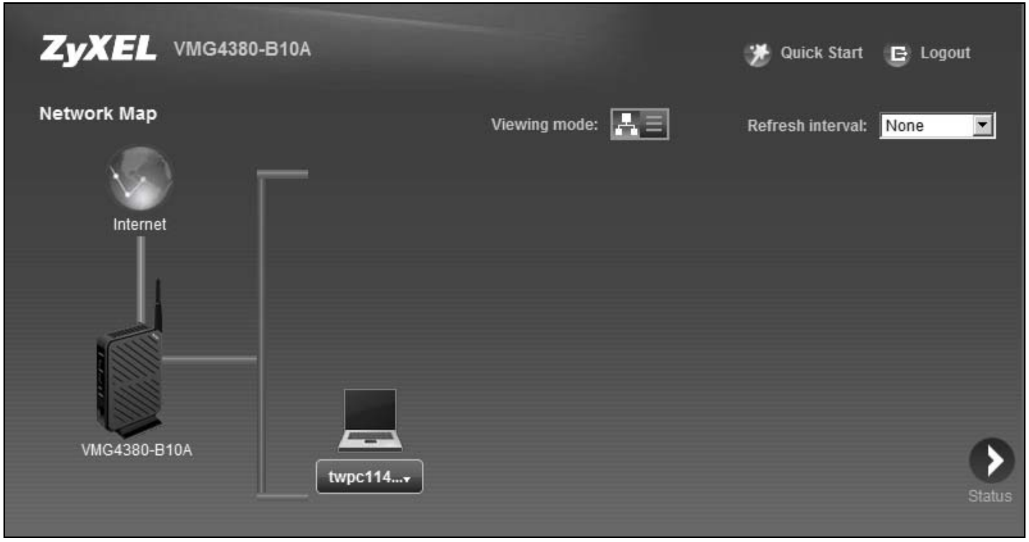
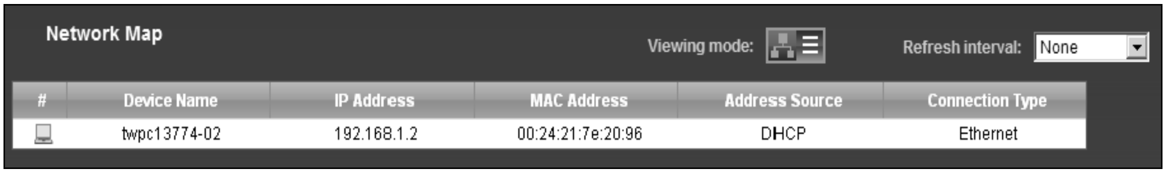


Figure 16 Network Map: List Mode



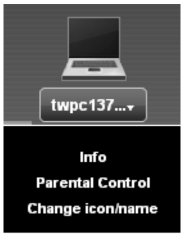
Network Map

Viewing mode:

Refresh interval: None

#	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 icon/name**.

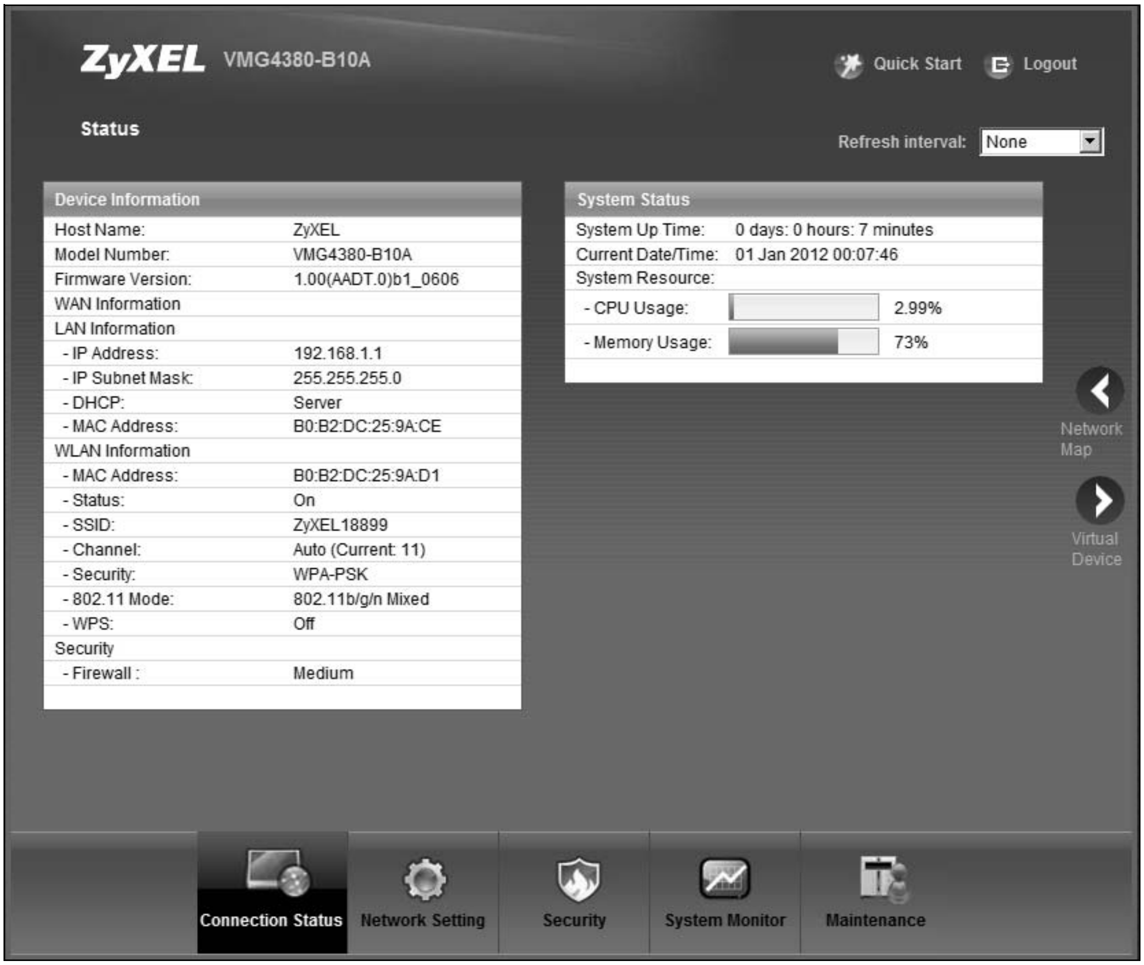


In **List Mode**, you can also view the client's information.

5.3 The Status Screen

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

Figure 17 Status Screen



Refresh interval: None

Device Information	
Host Name:	ZyXEL
Model Number:	VMG4380-B10A
Firmware Version:	1.00(AADT.0)b1_0606
WAN Information	
LAN Information	
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
- MAC Address:	B0:B2:DC:25:9A:CE
WLAN Information	
- MAC Address:	B0:B2:DC:25:9A:D1
- Status:	On
- SSID:	ZyXEL18899
- Channel:	Auto (Current: 11)
- Security:	WPA-PSK
- 802.11 Mode:	802.11b/g/n Mixed
- WPS:	Off
Security	
- Firewall :	Medium

System Status	
System Up Time:	0 days: 0 hours: 7 minutes
Current Date/Time:	01 Jan 2012 00:07:46
System Resource:	
- CPU Usage:	2.99%
- Memory Usage:	73%

Each field is described in the following table.

Table 5 Status Screen

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Device to update this screen.
Device Information	
Host Name	This field displays the Device system name. It is used for identification.
Model Number	This shows the model number of your 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.)	
WAN Type	This field displays the current WAN connection type.
MAC Address	This shows the WAN Ethernet adapter MAC (Media Access Control) Address of your Device.
IP Address	This field displays the current IP address of the Device in the WAN. Click **Release** to release your IP address to 0.0.0.0. If you want to renew your IP address, click **Renew**.
IP Subnet Mask	This field displays the current subnet mask in the WAN.
Encapsulation	This field displays the current encapsulation method.
LAN Information	
IP Address	This is the current IP address of the Device in the LAN.
IP Subnet Mask	This is the current subnet mask in the LAN.
DHCP	This field displays what DHCP services the Device is providing to the LAN. Choices are: **Server** - The Device is a DHCP server in the LAN. It assigns IP addresses to other computers in the LAN. **Relay** - The Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. **None** - The Device is not providing any DHCP services to the LAN.
MAC Address	This shows the LAN Ethernet adapter MAC (Media Access Control) Address of your Device.
WLAN Information	
MAC Address	This shows the wireless adapter MAC (Media Access Control) Address of your Device.
Status	This displays whether WLAN is activated.
SSID	This is the descriptive name used to identify the Device in a wireless LAN.
Channel	This is the channel number used by the Device now.
Security	This displays the type of security mode the Device is using in the wireless LAN.
802.11 Mode	This displays the type of 802.11 mode the Device is using in the wireless LAN.
WPS	This displays whether WPS is activated.
Security	
Firewall	This displays the firewall’s current security level.
System Status	
System Up Time	This field displays how long the Device has been running since it last started up. The 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 Device. You can change this in **Maintenance> Time Setting**.

Table 5 Status Screen (continued)

LABEL	DESCRIPTION
System Resource	
CPU Usage	This field displays what percentage of the Device's processing ability is currently used. When this percentage is close to 100%, the 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 159).
Memory Usage	This field displays what percentage of the Device's memory is currently used. Usually, this percentage should not increase much. If memory usage does get close to 100%, the Device is probably becoming unstable, and you should restart the device. See Section 34.2 on page 273, or turn off the device (unplug the power) for a few seconds.

6

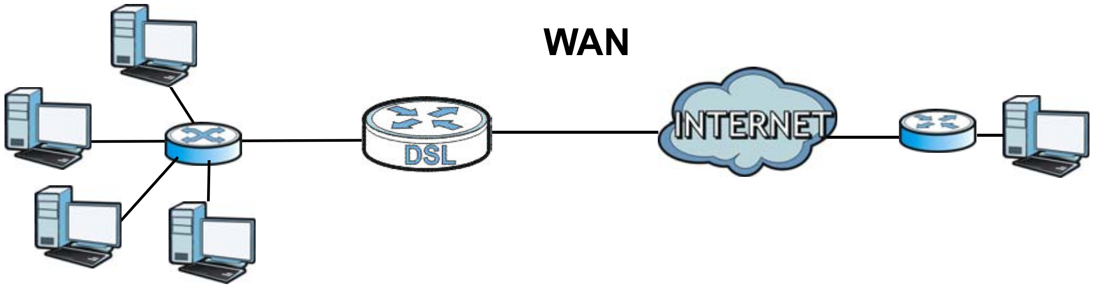
Broadband

6.1 Overview

This chapter discusses the Device’s **Broadband** screens. Use these screens to configure your Device for Internet access.

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.

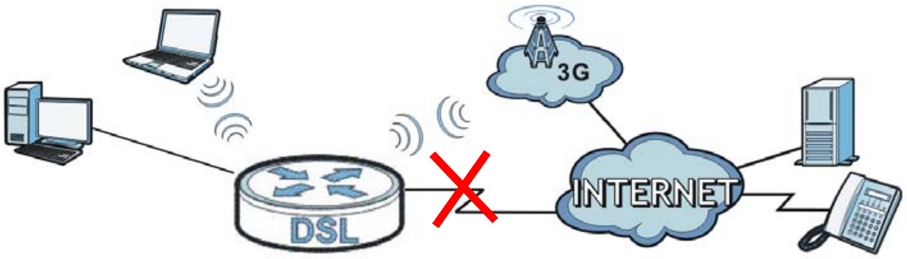
Figure 18 LAN and WAN



3G (third generation) standards for the sending and receiving of voice, video, and data in a mobile environment.

You can attach a 3G wireless adapter to the USB port and set the Device to use this 3G connection as your WAN or a backup when the wired WAN connection fails.

Figure 19 3G WAN Connection



6.1.1 What You Can Do in this Chapter

- Use the **Broadband** screen to view, remove or add a WAN interface. You can also configure the WAN settings on the Device for Internet access (Section 6.2 on page 78).
- Use the **3G Backup** screen to configure 3G WAN connection (Section 6.3 on page 86).

- Use the **Advanced** screen to enable or disable PTM over ADSL, Annex M/Annex J, and DSL PhyR functions (Section 6.4 on page 90).
- Use the **8021x** screen to view and configure the IEEE 802.1x settings on the Device (Section 6.5 on page 92).

Table 6 WAN Setup Overview

LAYER-2 INTERFACE		INTERNET CONNECTION		
CONNECTION	**DSL LINK TYPE**	**MODE**	**ENCAPSULATION**	**CONNECTION SETTINGS**
ADSL/VDSL over PTM	N/A	Routing	PPPoE	PPP information, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
			IPoE	IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
		Bridge	N/A	VLAN and QoS
ADSL over ATM	EoA	Routing	PPPoE/PPP0A	ATM PCV configuration, PPP information, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
			IPoE/IPoA	ATM PCV configuration, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
		Bridge	N/A	ATM PCV configuration, and QoS

6.1.2 What You Need to Know

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

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), 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 Device, which makes it accessible from an outside network. It is used by the Device to communicate with other devices in other networks. It can be static (fixed) or dynamically assigned by the ISP each time the 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).

ATM

Asynchronous Transfer Mode (ATM) is a 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 Finding Out More

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.

3G

3G (Third Generation) is a digital, packet-switched wireless technology. Bandwidth usage is optimized as multiple users share the same channel and bandwidth is only allocated to users when they send data. It allows fast transfer of voice and non-voice data and provides broadband Internet access to mobile devices.

IPv6 Introduction

IPv6 (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in IPv6 address size to 128 bits (from the 32-bit IPv4 address) allows up to 3.4 x 10^{38} IP addresses. The Device can use IPv4/IPv6 dual stack to connect to IPv4 and IPv6 networks, and supports IPv6 rapid deployment (6RD).

IPv6 Addressing

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

IPv6 addresses can be abbreviated in two ways:

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

IPv6 Prefix and Prefix Length

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

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

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

IPv6 Subnet Masking

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

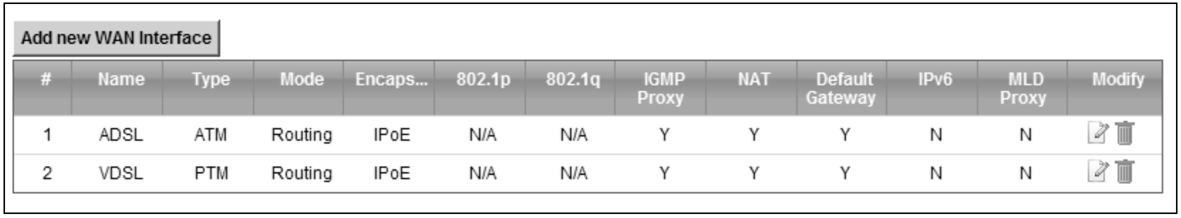
6.1.3 Before You Begin

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 Device's Internet access settings. Click **Network Setting > Broadband** from the menu. The summary table shows you the configured WAN services (connections) on the Device.

Figure 20 Network Setting > Broadband



Add new WAN Interface

#	Name	Type	Mode	Encaps...	802.1p	802.1q	IGMP Proxy	NAT	Default Gateway	IPv6	MLD Proxy	Modify
1	ADSL	ATM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑
2	VDSL	PTM	Routing	IPoE	N/A	N/A	Y	Y	Y	N	N	✎ 🗑

The following table describes the labels in this screen.

Table 7 Network Setting > Broadband

LABEL	DESCRIPTION
Add new WAN Interface	Click this button to create a new connection.
#	This is the index number of the entry.
Name	This is the service name of the connection.
Type	This shows whether it is an ATM, PTM, or Ethernet connection.
Mode	This shows whether the connection is in routing or bridge mode.
Encapsulation	This is the method of encapsulation used by this connection.
802.1p	This indicates the 802.1p priority level assigned to traffic sent through this connection. This displays **N/A** when there is no priority level assigned.
802.1q	This indicates the VLAN ID number assigned to traffic sent through this connection. This displays **N/A** when there is no VLAN ID number assigned.
IGMP Proxy	This shows whether the 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 Device use the WAN interface of this connection as the system default gateway.
IPv6	This shows whether IPv6 is activated or not for this connection. IPv6 is not available when the connection uses the bridging service.

Table 7 Network Setting > Broadband (continued)

LABEL	DESCRIPTION
MLD Proxy	This shows whether Multicast Listener Discovery (MLD) is activated or not for this connection. MLD is not available when the connection uses the bridging service.
Modify	Click the **Edit** icon to configure the WAN connection. Click the **Delete** icon to remove the WAN connection.

6.2.1 Add/Edit Internet Connection

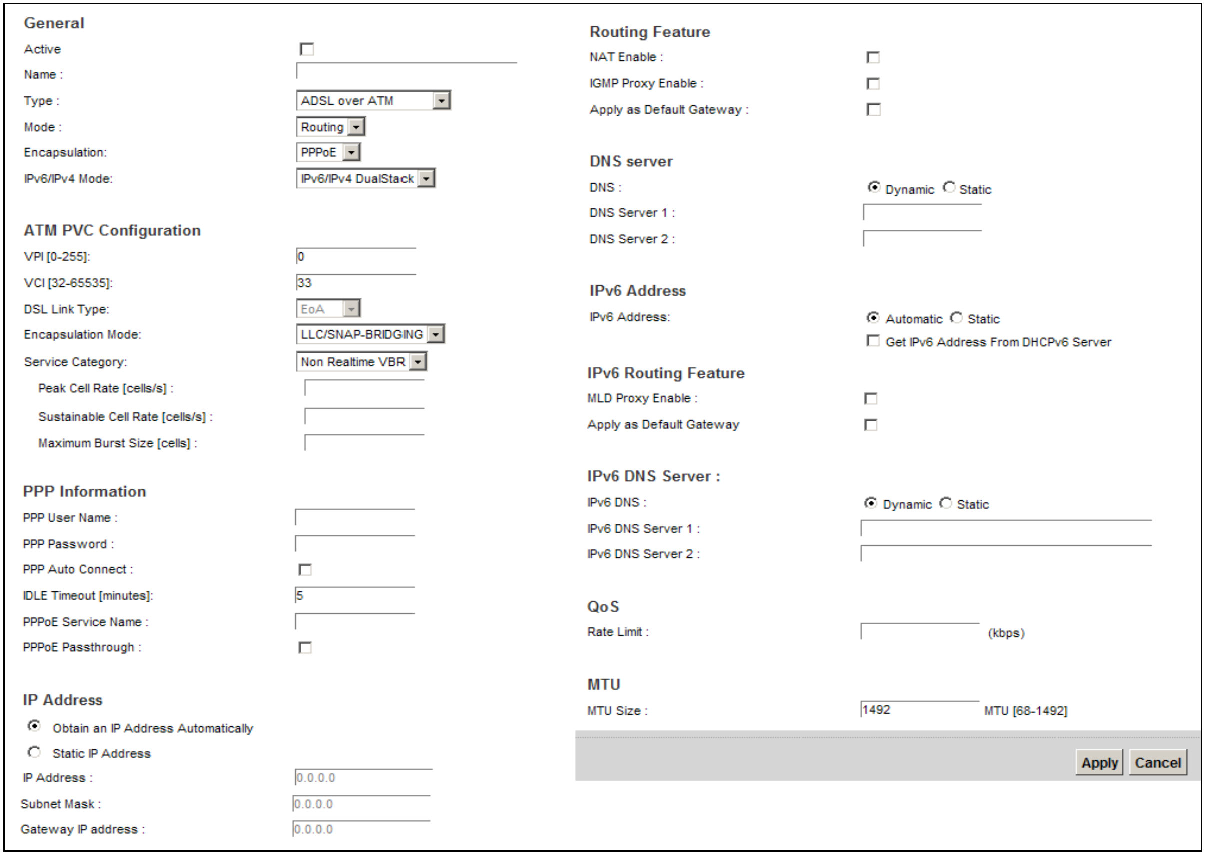
Click **Add new WAN Interface** in the **Broadband** screen or the **Edit** icon next to an existing WAN interface to configure a WAN connection. The screen varies depending on the interface type, mode, encapsulation, and IPv6/IPv4 mode you select.

6.2.1.1 Routing Mode

Use **Routing** mode if your ISP give you one IP address only and you want multiple computers to share an Internet account.

The following example screen displays when you select the **ADSL over ATM** connection type, **Routing** mode, and **PPPoE** encapsulation. The screen varies when you select other interface type, encapsulation, and IPv6/IPv4 mode.

Figure 21 Routing Mode



General

Active □

Name :

Type : ADSL over ATM

Mode : Routing

Encapsulation: PPPoE

IPv6/IPv4 Mode: IPv6/IPv4 DualStack

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 :

IPv6 Address

IPv6 Address: ● Automatic ○ Static

□ Get IPv6 Address From DHCPv6 Server

IPv6 Routing Feature

MLD Proxy Enable : □

Apply as Default Gateway □

IPv6 DNS Server :

IPv6 DNS : ● Dynamic ○ Static

IPv6 DNS Server 1 :

IPv6 DNS Server 2 :

QoS

Rate Limit : (kbps)

MTU

MTU Size : 1492 MTU [68-1492]

The following table describes the labels in this screen.

Table 8 Routing 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 an ADSL/VDSL over PTM or ADSL over ATM connection.
Mode	Select **Routing** 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. The choices depend on the connection type you selected. If your connection type is **ADSL/ VDSL over PTM**, the choices are **PPPoE** and **IPoE**. If your connection type is **ADSL over ATM**, the choices are **PPPoE**, **PPPoA**, **IPoE** and **IPoA**.
IPv6/IPv4 Mode	Select **IPv4 Only** if you want the Device to run IPv4 only. Select **IPv6/IPv4 DualStack** to allow the Device to run IPv4 and IPv6 at the same time. Select **IPv6 Only** if you want the Device to run IPv6 only.
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.
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 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.

Table 8 Routing Mode (continued)

LABEL	DESCRIPTION
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**.
Sustainable Cell Rate	The Sustainable 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.
PPPoE Passthrough	This field is available when you select **PPPoE** encapsulation. In addition to the 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 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	This is available only when you select **IPv4 Only** or **IPv6/IPv4 DualStack** in the **IPv6/ IPv4 Mode** field.
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.
Subnet Mask	Enter the subnet mask provided by your ISP.

Table 8 Routing Mode (continued)

LABEL	DESCRIPTION
Gateway IP Address	Enter the gateway IP address provided by your ISP.
Routing Feature	This is available only when you select **IPv4 Only** or **IPv6/IPv4 DualStack** in the **IPv6/ IPv4 Mode** field.
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 Device act as an IGMP proxy on this connection. This allows the 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 Device use the WAN interface of this connection as the system default gateway.
DNS Server	This is available only when you select **IPv4 Only** or **IPv6/IPv4 DualStack** in the **IPv6/ IPv4 Mode** field.
DNS	Select **Dynamic** if you want the Device use the DNS server addresses assigned by your ISP. Select **Static** if you want the 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.
IPv6 Address	This is available only when you select **IPv6/IPv4 DualStack** or **IPv6 Only** in the **IPv6/ IPv4 Mode** field.
IPv6 Address	Select **Automatic** if you want to have the Device use the IPv6 prefix from the connected router's Router Advertisement (RA) to generate an IPv6 address. Select the **Get IPv6 Address From DHCPv6 Server** checkbox if you want to obtain an IPv6 address from a DHCPv6 server. The IP address assigned by a DHCPv6 server has priority over the IP address automatically generated by the Device using the IPv6 prefix from an RA. This option is available only when you choose to get your IPv6 address automatically. Select **Static** if you have a fixed IPv6 address assigned by your ISP.
WAN IPv6 Address	Enter the IPv6 address assigned by your ISP.
Prefix Length	Enter the address prefix length to specify how many most significant bits in an IPv6 address compose the network address.
Next Hop	Enter the IP address of the next-hop gateway. The gateway is a router or switch on the same segment as your Device's interface(s). The gateway helps forward packets to their destinations.
IPv6 Routing Feature	You can enable IPv6 routing features in the following section.
MLD Proxy Enable	Select this checkbox to have the Device act as an MLD proxy on this connection. This allows the Device to get subscription 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 Device use the WAN interface of this connection as the system default gateway.
IPv6 DNS Server	Configure the IPv6 DNS server in the following section.

Table 8 Routing Mode (continued)

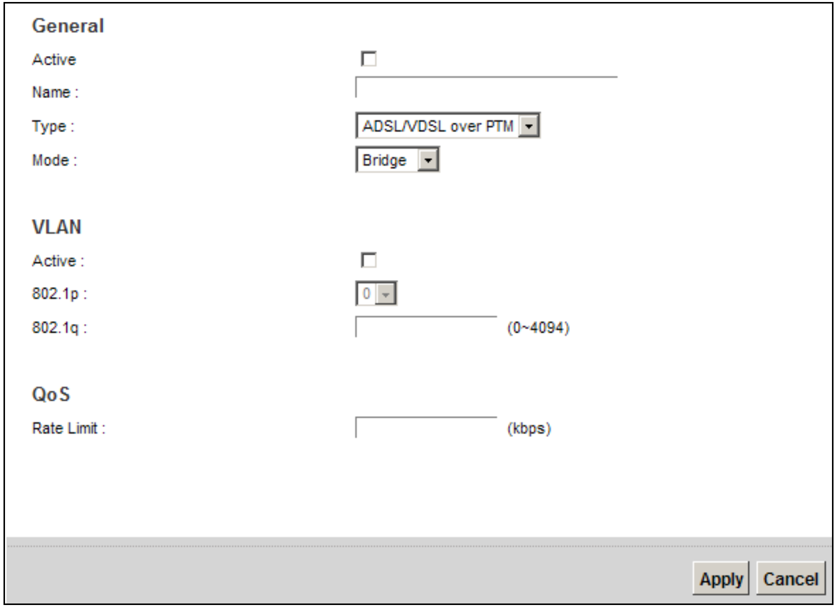
LABEL	DESCRIPTION
IPv6 DNS	Select **Dynamic** to have the Device get the IPv6 DNS server addresses from the ISP automatically. Select **Static** to have the Device use the IPv6 DNS server addresses you configure manually.
IPv6 DNS Server 1	Enter the first IPv6 DNS server address assigned by the ISP.
IPv6 DNS Server 2	Enter the second IPv6 DNS server address assigned by the ISP.
VLAN	These fields appear when the **Type** is set to **ADSL/VDSL over PTM**.
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	
Rate Limit	Enter the rate limit for the connection. This is the maximum transmission rate allowed for traffic on this connection.
MTU	
MTU Size	Enter the MTU (Maximum Transfer Unit) size for this traffic.
Apply	Click **Apply** to save your changes back to the Device.
Cancel	Click **Cancel** to exit this screen without saving.

6.2.1.2 Bridge Mode

Click the **Add new WAN Interface** in the **Network Setting > Broadband** screen or the **Edit** icon next to the connection you want to configure. Select **Bridge** as the encapsulation mode. The screen varies depending on the interface type you select.

If you select **ADSL/VDSL over PTM** as the interface type, the following screen appears.

Figure 22 Bridge Mode (ADSL/VDSL over PTM)



General

Active □

Name :

Type : ADSL/VDSL over PTM

Mode : Bridge

VLAN

Active : □

802.1p : 0

802.1q : (0~4094)

QoS

Rate Limit : (kbps)

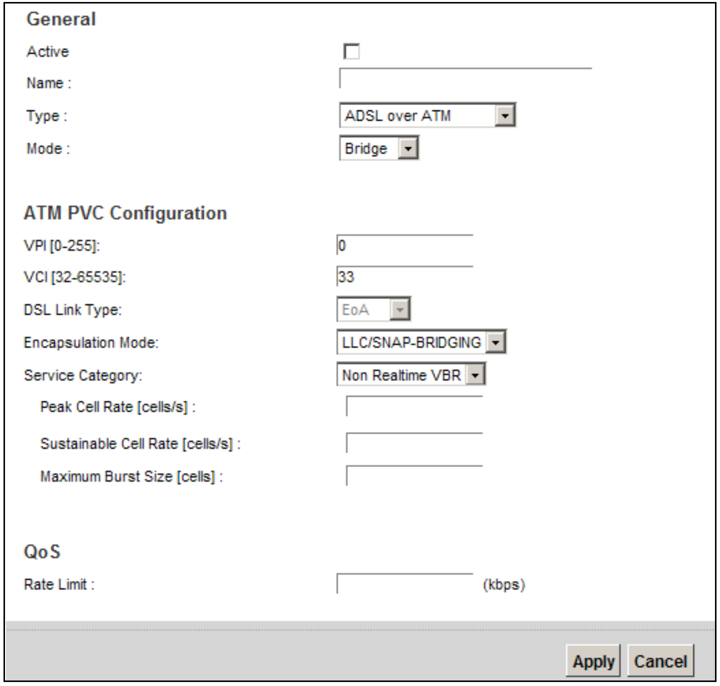
The following table describes the fields in this screen.

Table 9 Bridge Mode (ADSL/VDSL over PTM)

LABEL	DESCRIPTION
General	
Active	Select this to activate the WAN configuration settings.
Name	Enter a service name of the connection.
Type	Select **ADSL/VDSL over PTM** as the interface that you want to configure. The Device uses the VDSL technology for data transmission over the DSL port.
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 QoS, Firewall, DHCP server and NAT on traffic from the selected LAN port(s).
VLAN	This section is available only when you select **ADSL/VDSL over PTM** in the **Type** field.
Active	Select this 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 0 to 4094) for traffic through this connection.
QoS	
Rate Limit	Enter the rate limit for the connection. This is the maximum transmission rate allowed for traffic on this connection.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

If you select **ADSL over ATM** as the interface type, the following screen appears.

Figure 23 Bridge Mode (ADSL over ATM)



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: Non Realtime VBR

Peak Cell Rate [cells/s] :

Sustainable Cell Rate [cells/s] :

Maximum Burst Size [cells] :

QoS

Rate Limit : (kbps)

The following table describes the fields in this screen.

Table 10 Bridge Mode (ADSL over ATM)

LABEL	DESCRIPTION
General	
Active	Select this to activate the WAN configuration settings.
Name	Enter a service name of the connection.
Type	Select **ADSL over ATM** as the interface for which you want to configure here. The Device uses the ADSL technology for data transmission over the DSL port.
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 QoS, Firewall, DHCP server and NAT on traffic from the selected LAN port(s).
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 10 Bridge Mode (ADSL over ATM) (continued)

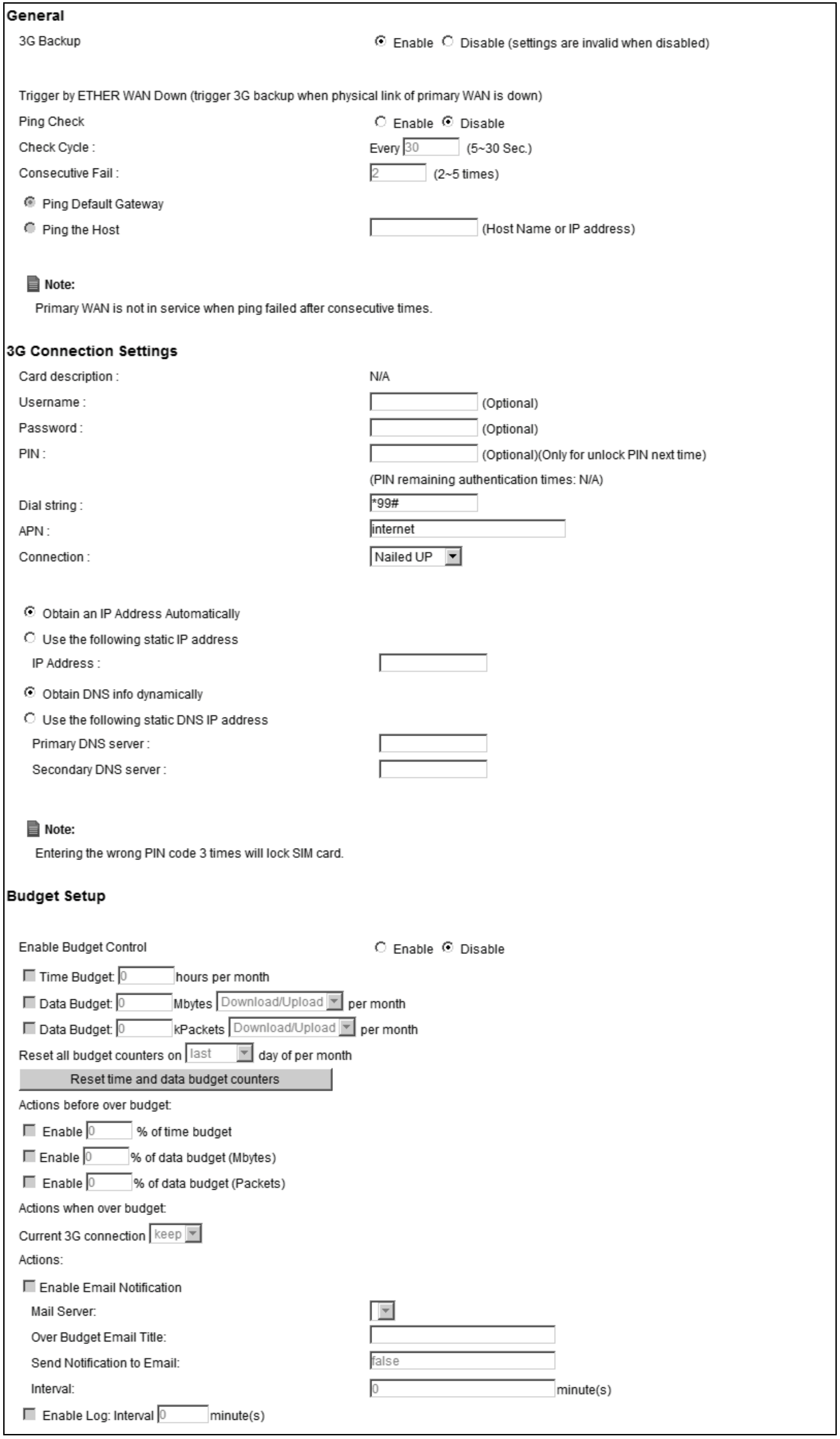
LABEL	DESCRIPTION
Encapsulation Mode	Select the method of multiplexing used by your ISP from the drop-down list box. Choices are: • **LLC/SNAP-BRIDGING:** In LCC encapsulation, bridged PDUs are encapsulated by identifying the type of the bridged media in the SNAP header. This is available only when you 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 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**.
Sustainable Cell Rate	The Sustainable 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**.
QoS	
Rate Limit	Enter the rate limit for the connection. This is the maximum transmission rate allowed for traffic on this connection.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

6.3 The 3G Backup Screen

Use this screen to configure your 3G settings. Click **Network Setting > Broadband > 3G Backup**.

Note: The actual data rate you obtain varies depending the 3G card you use, the signal strength to the service provider's base station, and so on.

Figure 24 Network Setting **>** Broadband > 3G Backup



General

3G Backup ● Enable ○ Disable (settings are invalid when disabled)

Trigger by ETHER WAN Down (trigger 3G backup when physical link of primary WAN is down)

Ping Check ○ Enable ● Disable

Check Cycle : Every 30 (5~30 Sec.)

Consecutive Fail : 2 (2~5 times)

● Ping Default Gateway

○ Ping the Host (Host Name or IP address)

Note:
Primary WAN is not in service when ping failed after consecutive times.

3G Connection Settings

Card description : N/A

Username : (Optional)

Password : (Optional)

PIN : (Optional)(Only for unlock PIN next time)

(PIN remaining authentication times: N/A)

Dial string : *99#

APN : internet

Connection : Nailed UP

● Obtain an IP Address Automatically

○ Use the following static IP address

IP Address :

● Obtain DNS info dynamically

○ Use the following static DNS IP address

Primary DNS server :

Secondary DNS server :

Note:
Entering the wrong PIN code 3 times will lock SIM card.

Budget Setup

Enable Budget Control ○ Enable ● Disable

☐ Time Budget: 0 hours per month

☐ Data Budget: 0 Mbytes Download/Upload per month

☐ Data Budget: 0 kPackets Download/Upload per month

Reset all budget counters on last day of per month

Reset time and data budget counters

Actions before over budget:

☐ Enable 0 % of time budget

☐ Enable 0 % of data budget (Mbytes)

☐ Enable 0 % of data budget (Packets)

Actions when over budget:

Current 3G connection keep

Actions:

☐ Enable Email Notification

Mail Server:

Over Budget Email Title:

Send Notification to Email: false

Interval: 0 minute(s)

☐ Enable Log: Interval 0 minute(s)

The following table describes the labels in this screen.

Table 11 Network Setting **>** Broadband > 3G Backup

LABEL	DESCRIPTION
General	
3G Backup	Select **Enable** to have the Device use the 3G connection as your WAN or a backup when the wired WAN connection fails.
Ping Check	Select **Enable** if you want the Device to ping check the connection status of your WAN. You can configure the frequency of the ping check and number of consecutive failures before triggering 3G backup.
Check Cycle	Enter the frequency of the ping check in this field.
Consecutive Fail	Enter how many consecutive failures are required before 3G backup is triggered.
Ping Default Gateway	Select this to have the Device ping the WAN interface's default gateway IP address.
Ping the Host	Select this to have the Device ping the particular host name or IP address you typed in this field.
3G Connection Settings	
Card description	This field displays the manufacturer and model name of your 3G card if you inserted one in the Device. Otherwise, it displays **N/A**.
Username	Type the user name (of up to 64 ASCII printable characters) given to you by your service provider.
Password	Type the password (of up to 64 ASCII printable characters) associated with the user name above.
PIN	A PIN (Personal Identification Number) code is a key to a 3G card. Without the PIN code, you cannot use the 3G card. If your ISP enabled PIN code authentication, enter the 4-digit PIN code (0000 for example) provided by your ISP. If you enter the PIN code incorrectly, the 3G card may be blocked by your ISP and you cannot use the account to access the Internet. If your ISP disabled PIN code authentication, leave this field blank.
Dial string	Enter the phone number (dial string) used to dial up a connection to your service provider's base station. Your ISP should provide the phone number. For example, *99# is the dial string to establish a GPRS or 3G connection in Taiwan.
APN	Enter the APN (Access Point Name) provided by your service provider. Connections with different APNs may provide different services (such as Internet access or MMS (Multi-Media Messaging Service)) and charge method. You can enter up to 32 ASCII printable characters. Spaces are allowed.
Connection	Select **Nailed UP** if you do not want the connection to time out. Select **on Demand** if you do not want the connection up all the time and specify an idle time-out in the **Max Idle Timeout** field.
Max Idle Timeout	This value specifies the time in minutes that elapses before the Device automatically disconnects from the ISP.
Obtain an IP Address Automatically	Select this option If your ISP did not assign you a fixed IP address.
Use the following static IP address	Select this option If the ISP assigned a fixed IP address.
IP Address	Enter your WAN IP address in this field if you selected **Use the following static IP address**.

Table 11 Network Setting **>** Broadband > 3G Backup (continued)

LABEL	DESCRIPTION
Obtain DNS info dynamically	Select this to have the Device get the DNS server addresses from the ISP automatically.
Use the following static DNS IP address	Select this to have the Device use the DNS server addresses you configure manually.
Primary DNS server	Enter the first DNS server address assigned by the ISP.
Secondary DNS server	Enter the second DNS server address assigned by the ISP.
Advanced	Click this to show the advanced 3G backup settings.
Budget Setup	
Enable Budget Control	Select **Enable** to set a monthly limit for the user account of the installed 3G card. You can set a limit on the total traffic and/or call time. The Device takes the actions you specified when a limit is exceeded during the month.
Time Budget	Select this and specify the amount of time (in hours) that the 3G connection can be used within one month. If you change the value after you configure and enable budget control, the Device resets the statistics.
Data Budget (Mbytes)	Select this and specify how much downstream and/or upstream data (in Mega bytes) can be transmitted via the 3G connection within one month. Select **Download/Upload** to set a limit on the total traffic in both directions. Select **Download** to set a limit on the downstream traffic (from the ISP to the Device). Select **Upload** to set a limit on the upstream traffic (from the Device to the ISP). If you change the value after you configure and enable budget control, the Device resets the statistics.
Data Budget (kPackets)	Select this and specify how much downstream and/or upstream data (in k Packets) can be transmitted via the 3G connection within one month. Select **Download/Upload** to set a limit on the total traffic in both directions. Select **Download** to set a limit on the downstream traffic (from the ISP to the Device). Select **Upload** to set a limit on the upstream traffic (from the Device to the ISP). If you change the value after you configure and enable budget control, the Device resets the statistics.
Reset all budget counters on	Select the date on which the Device resets the budget every month. Select **last** if you want the Device to reset the budget on the last day of the month. Select **specific** and enter the number of the date you want the Device to reset the budget
Reset time and data budget counters	Click this button to reset the time and data budgets immediately. The count starts over with the 3G connection’s full configured monthly time and data budgets. This does not affect the normal monthly budget restart; so if you configured the time and data budget counters to reset on the second day of the month and you use this button on the first, the time and data budget counters will still reset on the second.
Actions before over budget	Specify the actions the Device takes before the time or data limit exceeds.
Enable % of time budget/ data budget (Mbytes)/data budget (kPackets)	Select **Enable** and enter a number from 1 to 99 in the percentage fields. If you change the value after you configure and enable budget control, the Device resets the statistics.

Table 11 Network Setting **>** Broadband > 3G Backup (continued)

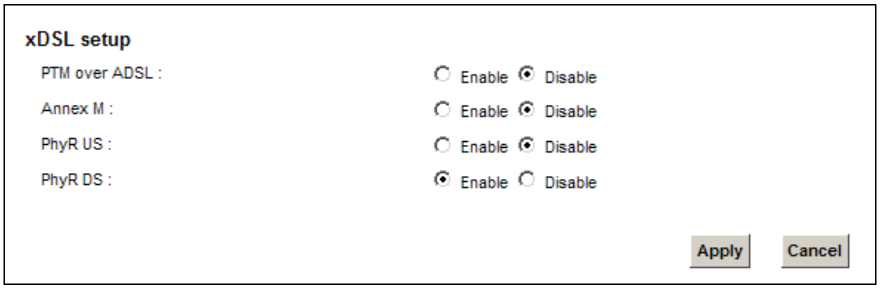
LABEL	DESCRIPTION
Actions when over budget	Specify the actions the Device takes when the time or data limit is exceeded.
Current 3G connection	Select **Keep** to maintain an existing 3G connection or **Drop** to disconnect it.
Enable Email Notification	Select this to enable the e-mail notification function. The Device will e-mail you a notification when there over budget occurs.
Mail Server	Select a mail server for the e-mail address specified below. If you do not select a mail server, e-mail notifications cannot be sent via e-mail. You must have configured a mail server already in the **Maintenance** > **Email Notification** screen.
Over Budget Email Title	Type a title that you want to be in the subject line of the e-mail notifications that the Device sends.
Send Notification to Email	Notifications are sent to the e-mail address specified in this field. If this field is left blank, notifications cannot be sent via e-mail.
Interval	Enter the interval of how many minutes you want the Device to e-mail you.
Enable Log	Select this to activate the logging function at the interval you set in this field.
Basic	Click this to hide the advanced settings of 3G backup.
Apply	Click **Apply** to save your changes back to the Device.
Cancel	Click **Cancel** to return to the previous configuration.

6.4 The Advanced Screen

Use the **Advanced** screen to enable or disable PTM over ADSL, Annex M/Annex J, and DSL PhyR functions. The Device supports the PhyR retransmission scheme. PhyR is a retransmission scheme designed to provide protection against noise on the DSL line. It improves voice, video and data transmission resilience by utilizing a retransmission buffer.

Click **Network Setting > Broadband** > **Advanced** to display the following screen.

Figure 25 Network Setting **>** Broadband > Advanced (VMG1312-B10A)



xDSL setup

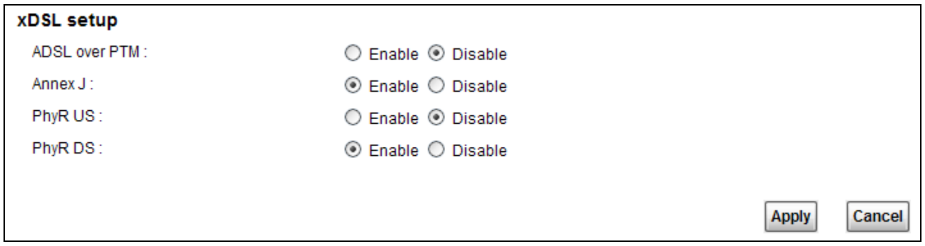
PTM over ADSL : ○ Enable ● Disable

Annex M : ○ Enable ● Disable

PhyR US : ○ Enable ● Disable

PhyR DS : ● Enable ○ Disable

Figure 26 Network Setting **>** Broadband > Advanced (VMG1312-B30A)



xDSL setup

ADSL over PTM : ○ Enable ● Disable

Annex J : ● Enable ○ Disable

PhyR US : ○ Enable ● Disable

PhyR DS : ● Enable ○ Disable

The following table describes the labels in this screen.

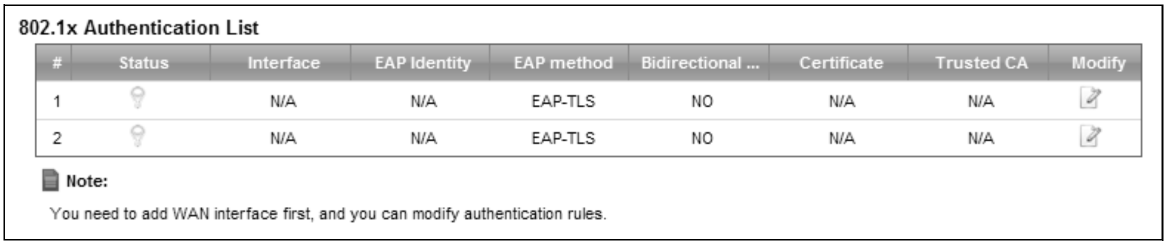
Table 12 Network Setting **>** Network Setting > Broadband

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.
Annex M Annex J	You can enable **Annex M** or **Annex J** for the Device to use double upstream mode to increase the maximum upstream transfer rate.
PhyR US	Enable or disable **PhyR US** (upstream) for upstream transmission to the WAN. PhyR US should be enabled if data being transmitted upstream is sensitive to noise. However, enabling PhyR US can decrease the US line rate. Enabling or disabling PhyR will require the CPE to retrain. For PhyR to function, the DSLAM must also support PhyR and have it enabled.
PhyR DS	Enable or disable **PhyR DS** (downstream) for downstream transmission from the WAN. PhyR DS should be enabled if data being transmitted downstream is sensitive to noise. However, enabling PhyR DS can decrease the DS line rate. Enabling or disabling PhyR will require the CPE to retrain. For PhyR to function, the DSLAM must also support PhyR and have it enabled.
Apply	Click **Apply** to save your changes back to the Device.
Cancel	Click **Cancel** to return to the previous configuration.

6.5 The 8021x Screen

You can view and configure the 802.1x authentication settings in the **8021x** screen. Click **Network Setting > Broadband** > **8021x** to display the following screen.

Figure 27 Network Setting **>** Broadband > 8021x



802.1x Authentication List

#	Status	Interface	EAP Identity	EAP method	Bidirectional ...	Certificate	Trusted CA	Modify
1	💡	N/A	N/A	EAP-TLS	NO	N/A	N/A	✎
2	💡	N/A	N/A	EAP-TLS	NO	N/A	N/A	✎

Note:

You need to add WAN interface first, and you can modify authentication rules.

The following table describes the labels in this screen.

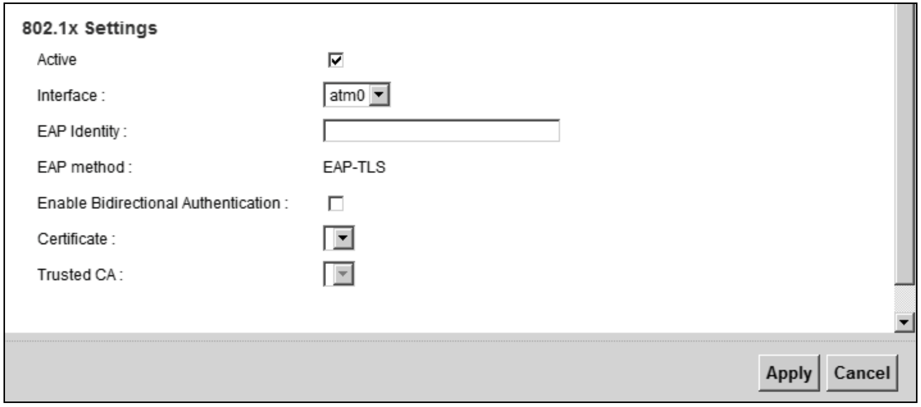
Table 13 Network Setting **>** Network Setting > 8021x

LABEL	DESCRIPTION
#	This is the index number of the entry.
Status	This field displays whether the authentication is active or not. A yellow bulb signifies that this authentication is active. A gray bulb signifies that this authentication is not active.
Interface	This is the interface that uses the authentication. This displays **N/A** when there is no interface assigned.
EAP Identity	This shows the EAP identity of the authentication. This displays **N/A** when there is no EAP identity assigned.
EAP method	This shows the EAP method used in the authentication. This displays **N/A** when there is no EAP method assigned.
Bidirectional Authentication	This shows whether bidirectional authentication is allowed.
Certificate	This shows the certificate used for this authentication. This displays **N/A** when there is no certificate assigned.
Trusted CA	This shows the Trusted CA used for this authentication. This displays **N/A** when there is no Trusted CA assigned.
Apply	Click **Apply** to save your changes back to the Device.
Cancel	Click **Cancel** to return to the previous configuration.

6.5.1 Edit 802.1x Settings

Use this screen to edit a 802.1x authentication's settings. Click the **Edit** icon next to the rule you want to edit. The screen shown next appears.

Figure 28 802.1x: Add/Edit



802.1x Settings

Active	☑
Interface :	atm0
EAP Identity :	
EAP method :	EAP-TLS
Enable Bidirectional Authentication :	□
Certificate :	
Trusted CA :	

The following table describes the labels in this screen.

Table 14 802.1x: Add/Edit

LABEL	DESCRIPTION
Active	This field allows you to activate/deactivate the authentication. Select this to enable the authentication. Clear this to disable this authentication without having to delete the entry.
Interface	Select the interface that uses the authentication.
EAP Identity	Enter the EAP identity of the authentication.
EAP method	This is the EAP method used for this authentication.
Enable Bidirectional Authentication	Select this to allow bidirectional authentication.
Certificate	Select the certificate you want to assign to the authentication. You need to import the certificate in the **Security** > **Certificates** > **Local Certificates** screen.
Trusted CA	Select the Trusted CA you want to assign to the authentication. You need to import the certificate in the **Security** > **Certificates** > **Trusted CA** screen.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

6.6 Technical Reference

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

Encapsulation

Be sure to use the encapsulation method required by your ISP. The Device can work in bridge mode or routing mode. When the Device is in routing mode, it supports the following methods.

IP over Ethernet

IP over Ethernet (IPoE) is an alternative to PPPoE. IP packets are being delivered across an Ethernet network, without using PPP encapsulation. They are routed between the Ethernet interface and the WAN interface and then formatted so that they can be understood in a bridged environment. For instance, it encapsulates routed Ethernet frames into bridged Ethernet cells.

PPP over ATM (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 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 access multiplexer). Please refer to RFC 2364 for more information on PPPoA. Refer to RFC 1661 for more information on PPP.

PPP over Ethernet (PPPoE)

Point-to-Point Protocol over Ethernet (PPPoE) provides access control and billing functionality in a manner similar to dial-up services using PPP. PPPoE is an IETF standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection.

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

RFC 1483

RFC 1483 describes two methods for Multiprotocol Encapsulation over ATM Adaptation Layer 5 (AAL5). The first method allows multiplexing of multiple protocols over a single ATM virtual circuit (LLC-based multiplexing) and the second method assumes that each protocol is carried over a separate ATM virtual circuit (VC-based multiplexing). Please refer to RFC 1483 for more detailed information.

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.

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.

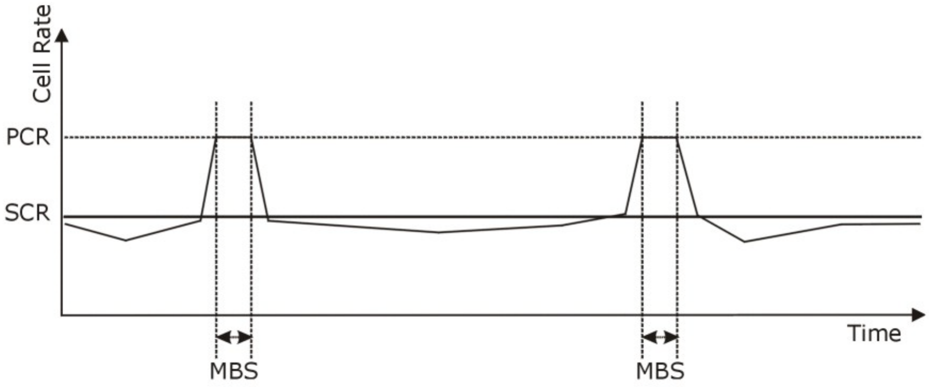
Sustained Cell Rate (SCR) is the mean cell rate of each bursty traffic source. It specifies the maximum average rate at which cells can be sent over the virtual connection. SCR may not be greater than the PCR.

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 29 Example of Traffic Shaping



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.

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. However the encapsulation method assigned influences your choices for IP address and default gateway.

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

Multicast

IP packets are transmitted in either one of 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 1.

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. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236. The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways). All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

At start up, the Device queries all directly connected networks to gather group membership. After that, the Device periodically updates this information.

DNS Server Address Assignment

Use Domain Name System (DNS) to map a domain name to its corresponding IP address and vice versa, for instance, the IP address of www.zyxel.com is 204.217.0.2. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it.

The Device can get the DNS server addresses in the following ways.

1 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, manually enter them in the DNS server fields.

2 If your ISP dynamically assigns the DNS server IP addresses (along with the Device’s WAN IP address), set the DNS server fields to get the DNS server address from the ISP.

IPv6 Addressing

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

IPv6 addresses can be abbreviated in two ways:

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

IPv6 Prefix and Prefix Length

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

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

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

Wireless

7.1 Overview

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

7.1.1 What You Can Do in this Chapter

This section describes the Device's **Wireless** screens. Use these screens to set up your 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 100).
- Use the **More AP** screen to set up multiple wireless networks on your Device (Section 7.3 on page 107).
- Use the **MAC Authentication** screen to allow or deny wireless clients based on their MAC addresses from connecting to the Device (Section 7.4 on page 109).
- Use the **WPS** screen to enable or disable WPS, view or generate a security PIN (Personal Identification Number) (Section 7.5 on page 110).
- Use the **WMM** screen to enable Wi-Fi MultiMedia (WMM) to ensure quality of service in wireless networks for multimedia applications (Section 7.6 on page 112).
- Use the **WDS** screen to set up a Wireless Distribution System, in which the Device acts as a bridge with other ZyXEL access points (Section 7.7 on page 113).
- Use the **Others** screen to configure wireless advanced features, such as the RTS/CTS Threshold (Section 7.8 on page 115).
- Use the **Channel Status** screen to scan wireless LAN channel noises and view the results (Section 7.9 on page 117).

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

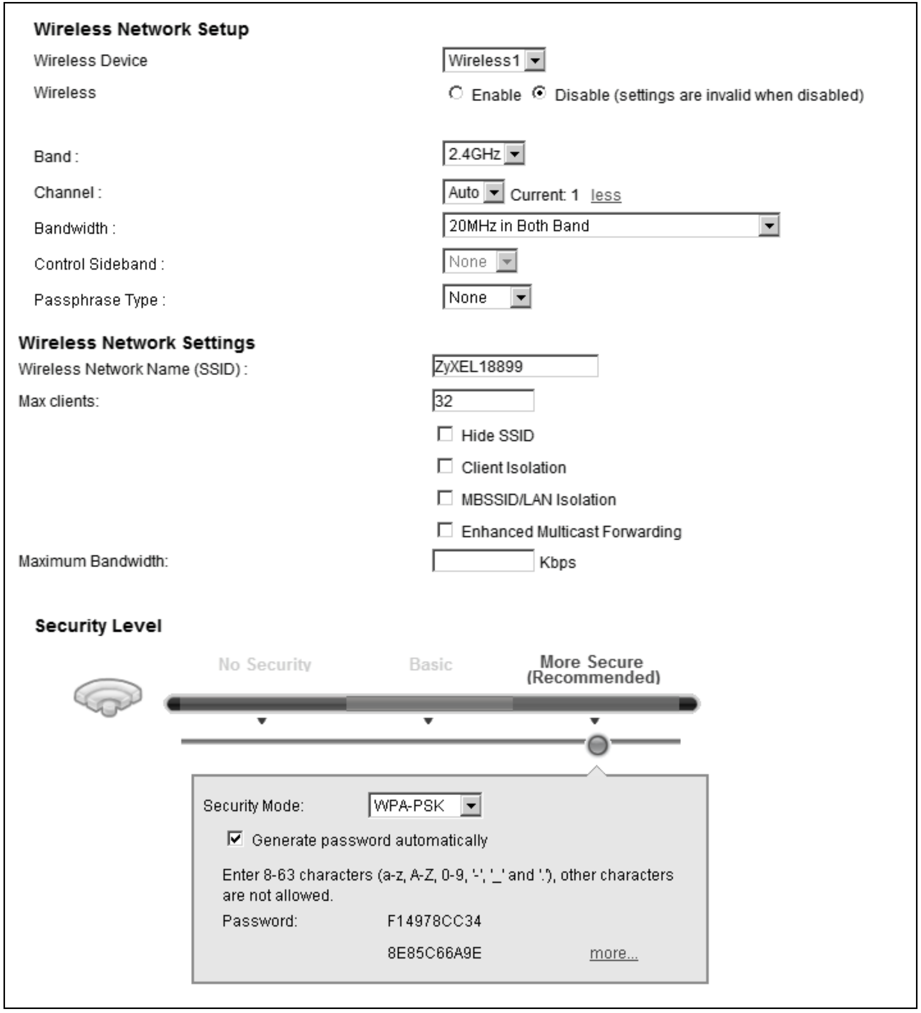
See Section 7.10 on page 117 for advanced technical information on wireless networks.

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 Device from a computer connected to the wireless LAN and you change the 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 Device’s new settings.

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



Wireless Network Setup

Wireless Device: Wireless1 ▾

Wireless: ○ Enable ● Disable (settings are invalid when disabled)

Band : 2.4GHz ▾

Channel : Auto ▾ Current: 1 less

Bandwidth : 20MHz in Both Band ▾

Control Sideband : None ▾

Passphrase Type : None ▾

Wireless Network Settings

Wireless Network Name (SSID) : ZyXEL18899

Max clients: 32

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

Maximum Bandwidth: Kbps

Security Level

Security Mode: WPA-PSK ▾

☑ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

Password: F14978CC34 8E85C66A9E

Figure 30 Network Setting > Wireless > General

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

Table 15 Network Setting > Wireless > General

LABEL	DESCRIPTION
Wireless Network Setup	
Wireless	You can **Enable** or **Disable** the wireless LAN in this field.
Band	This shows the wireless band which this radio profile is using. **2.4GHz** is the frequency used by IEEE 802.11b/g/n wireless clients.
Channel	Set the channel depending on your particular region. Select a channel or use **Auto** to have the 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 Device is currently using then displays next to this field.
more.../less	Click **more...** to show more information. Click **less** to hide them.

Table 15 Network Setting > Wireless > General (continued)

LABEL	DESCRIPTION
Bandwidth	Select whether the Device uses a wireless channel width of **20MHz** or **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.
Control Sideband	This is available for some regions when you select a specific channel and set the Bandwidth field to **40MHz**. Set whether the control channel (set in the **Channel** field) should be in the **Lower** or **Upper** range of channel bands.
Passphrase Type	If you set security for the wireless LAN and have the Device generate a password, the setting in this field determines how the Device generates the password. Select **None** to set the Device's password generation to not be based on a passphrase. Select **Fixed** to use a 16 character passphrase for generating a password. Select **Variable** to use a 16 to 63 character passphrase for generating a password.
Passphrase Key	For a fixed type passphrase enter 16 alphanumeric characters (0-9, A-Z, with no spaces). It must contain both letters and numbers and is case-sensitive. For a variable type passphrase enter 16 to 63 alphanumeric characters (0-9, A-Z, with no spaces). It must contain both letters and numbers and is case-sensitive.
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 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 Device. Select both **Client Isolation** and **MBSSID/LAN Isolation** to allow this SSID's wireless clients to only connect to the Internet through the Device.
Enhanced Multicast Forwarding	Select this check box to allow the Device to convert wireless multicast traffic into wireless unicast traffic.
BSSID	This shows the MAC address of the wireless interface on the Device when wireless LAN is enabled.
Maximum Bandwidth	Specify the maximum rate for wireless traffic in kilobits per second (Kbps).
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 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.

Table 15 Network Setting > Wireless > General (continued)

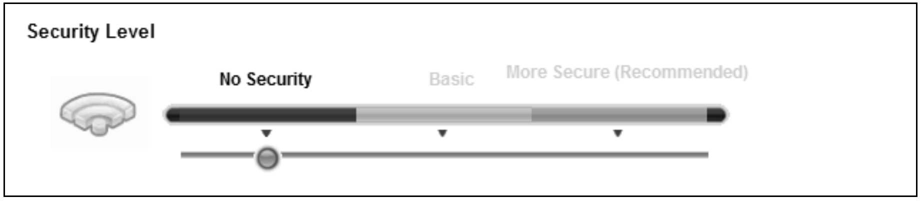
LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

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 Device, your network is accessible to any wireless networking device that is within range.

Figure 31 Wireless > General: No Security



Security Level

The following table describes the labels in this screen.

Table 16 Wireless > General: No Security

LABEL	DESCRIPTION
Security Level	Choose **No Security** to allow all wireless connections without data encryption or authentication.

7.2.2 Basic (WEP Encryption)

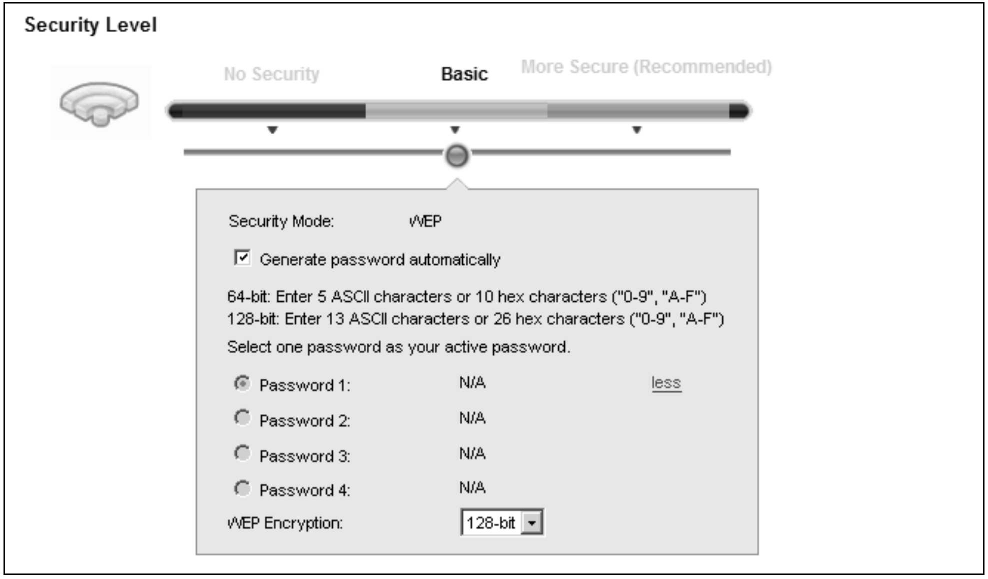
WEP encryption scrambles the data transmitted between the wireless stations and the access points (AP) to keep network communications private. Both the wireless stations and the access points must use the same WEP key.

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 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 Setting** > **Wireless** to display the **General** screen, then select **Basic** as the security level.

Figure 32 Wireless > General: Basic (WEP)



Security Mode: WEP

☑ Generate password automatically

64-bit: Enter 5 ASCII characters or 10 hex characters ("0-9", "A-F")
128-bit: Enter 13 ASCII characters or 26 hex characters ("0-9", "A-F")
Select one password as your active password.

● Password 1: N/A less
○ Password 2: N/A
○ Password 3: N/A
○ Password 4: N/A

WEP Encryption: 128-bit

The following table describes the labels in this screen.

Table 17 Wireless > General: Basic (WEP)

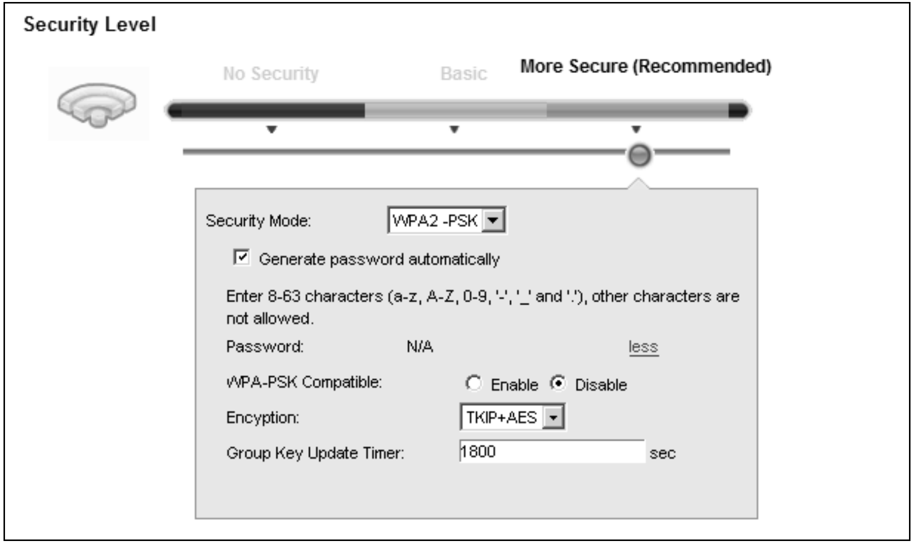
LABEL	DESCRIPTION
Security Level	Select **Basic** to enable WEP data encryption.
Generate password automatically	Select this option to have the Device automatically generate a password. The password field will not be configurable when you select this option.
Password 1~4	The password (WEP keys) are used to encrypt data. Both the 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. The default password is **Passowrd 1**.
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 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 Setting** > **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 33 Wireless > General: More Secure: WPA(2)-PSK



Security Mode: WPA2 -PSK

☑ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

Password: N/A less

WPA-PSK Compatible: ○ Enable ● Disable

Encryption: TKIP+AES

Group Key Update Timer: 1800 sec

The following table describes the labels in this screen.

Table 18 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 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. If you did not select **Generate password automatically**, you can manually 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 Device. The Device supports WPA-PSK and WPA2-PSK simultaneously.

Table 18 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.

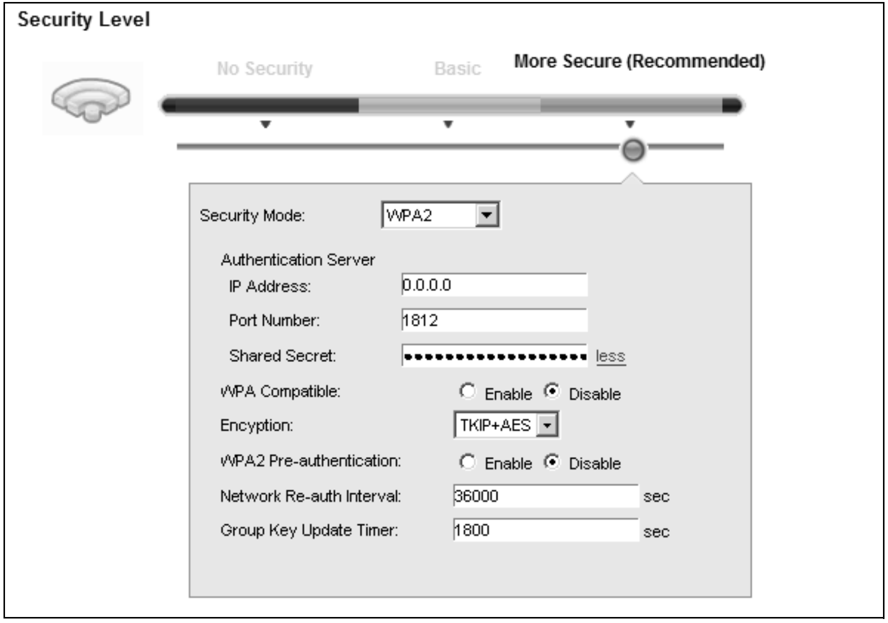
7.2.4 WPA(2) Authentication

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

Figure 34 Wireless > General: More Secure: WPA(2)



Security Mode: WPA2

Authentication Server

IP Address: 0.0.0.0

Port Number: 1812

Shared Secret: •••••••••••••••••• less

WPA Compatible: ○ Enable ● Disable

Encyption: TKIP+AES

WPA2 Pre-authentication: ○ Enable ● Disable

Network Re-auth Interval: 36000 sec

Group Key Update Timer: 1800 sec

The following table describes the labels in this screen.

Table 19 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	

Table 19 Wireless > General: More Secure: WPA(2) (continued)

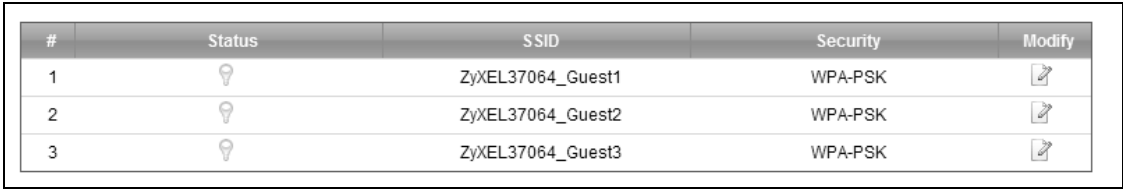
LABEL	DESCRIPTION
IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. The default port number is **1812**. You need not change this value unless your network administrator instructs 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 Device. The key must be the same on the external authentication server and your 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 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.
WPA2 Pre-Authentication	This field is available only when you select **WPA2**. 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. Select **Enabled** to turn on preauthentication in WAP2. Otherwise, select **Disabled**.
Network Re-auth Interval	Specify how often wireless stations have to resend usernames and passwords in order to stay connected. If wireless station authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.
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.

7.3 The More AP Screen

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

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

Figure 35 Network Setting > Wireless > More AP



#	Status	SSID	Security	Modify
1	💡	ZyXEL37064_Guest1	WPA-PSK	✎
2	💡	ZyXEL37064_Guest2	WPA-PSK	✎
3	💡	ZyXEL37064_Guest3	WPA-PSK	✎

The following table describes the labels in this screen.

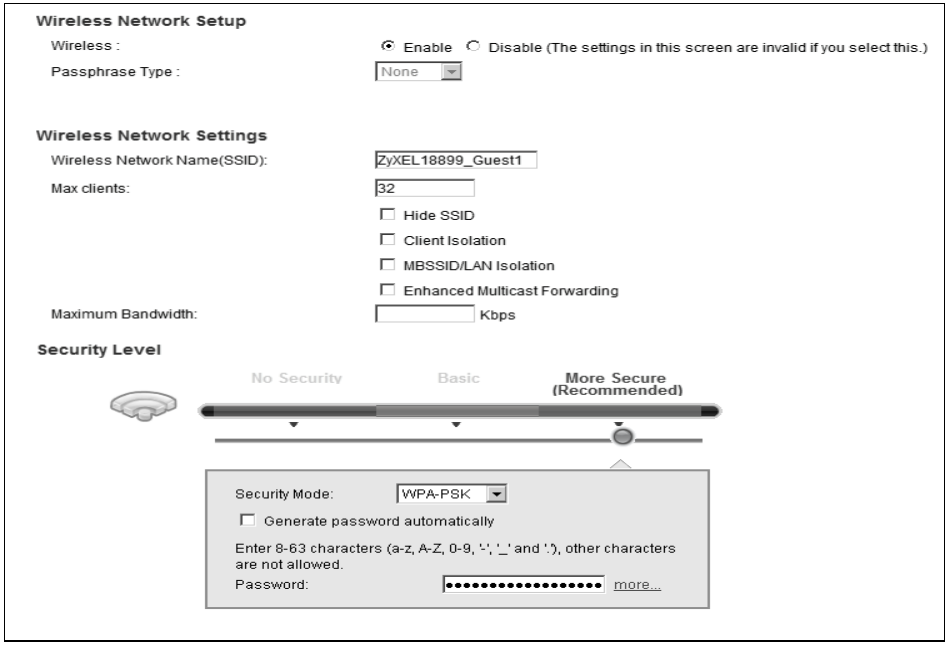
Table 20 Network Setting > Wireless > More AP

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 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 36 More AP: Edit



Wireless Network Setup

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

Passphrase Type : None

Wireless Network Settings

Wireless Network Name(SSID): ZyXEL18899_Guest1

Max clients: 32

□ Hide SSID

□ Client Isolation

□ MBSSID/LAN Isolation

□ Enhanced Multicast Forwarding

Maximum Bandwidth: Kbps

Security Level

Security Mode: WPA-PSK

□ Generate password automatically

Enter 8-63 characters (a-z, A-Z, 0-9, '-', '_' and '.'), other characters are not allowed.

Password: ●●●●●●●●●●●●●●●●●● more...

The following table describes the fields in this screen.

Table 21 More AP: Edit

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

Table 21 More AP: Edit (continued)

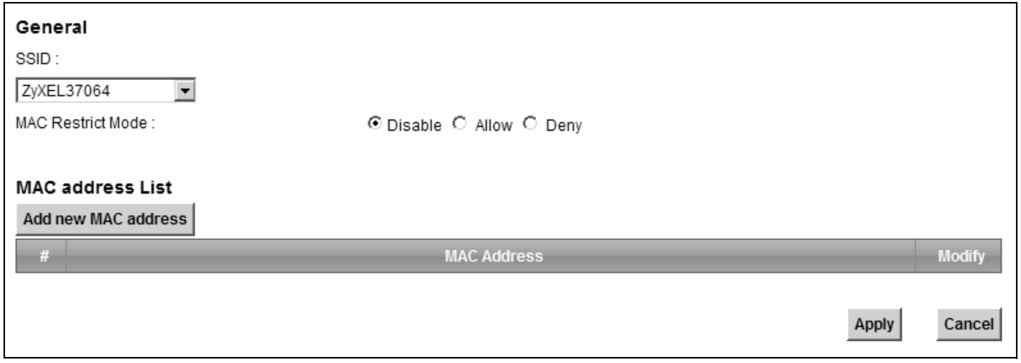
LABEL	DESCRIPTION
Passphrase Type	If you set security for the wireless LAN and have the Device generate a password, the setting in this field determines how the Device generates the password. Select **None** to set the Device's password generation to not be based on a passphrase. Select **Fixed** to use a 16 character passphrase for generating a password. Select **Variable** to use a 16 to 63 character passphrase for generating a password.
Passphrase Key	For a fixed type passphrase enter 16 alphanumeric characters (0-9, A-Z, with no spaces). It must contain both letters and numbers and is case-sensitive. For a variable type passphrase enter 16 to 63 alphanumeric characters (0-9, A-Z, with no spaces). It must contain both letters and numbers and is case-sensitive.
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.
MBSSID/LAN Isolation	Select this to keep the wireless clients in this SSID from communicating with clients in other SSIDs or LAN devices.
Enhanced Multicast Forwarding	Select this check box to allow the Device to convert wireless multicast traffic into wireless unicast traffic.
Maximum Bandwidth	Specify the maximum rate for wireless traffic in kilobits per second (Kbps).
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 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 103 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 Device's MAC filter settings and add new MAC filter rules. Click **Network Setting > Wireless > MAC Authentication**. The screen appears as shown.

Figure 37 Wireless > MAC Authentication



General

SSID : ZyXEL37064

MAC Restrict Mode : ● Disable ○ Allow ○ Deny

MAC address List

#	MAC Address	Modify

The following table describes the labels in this screen.

Table 22 Wireless > MAC Authentication

LABEL	DESCRIPTION
SSID	Select the SSID for which you want to configure MAC filter settings.
MAC Restrict Mode	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Disable** to turn off MAC filtering. Select **Deny** to block access to the Device. MAC addresses not listed will be allowed to access the Device. Select **Allow** to permit access to the Device. MAC addresses not listed will be denied access to the 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 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 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

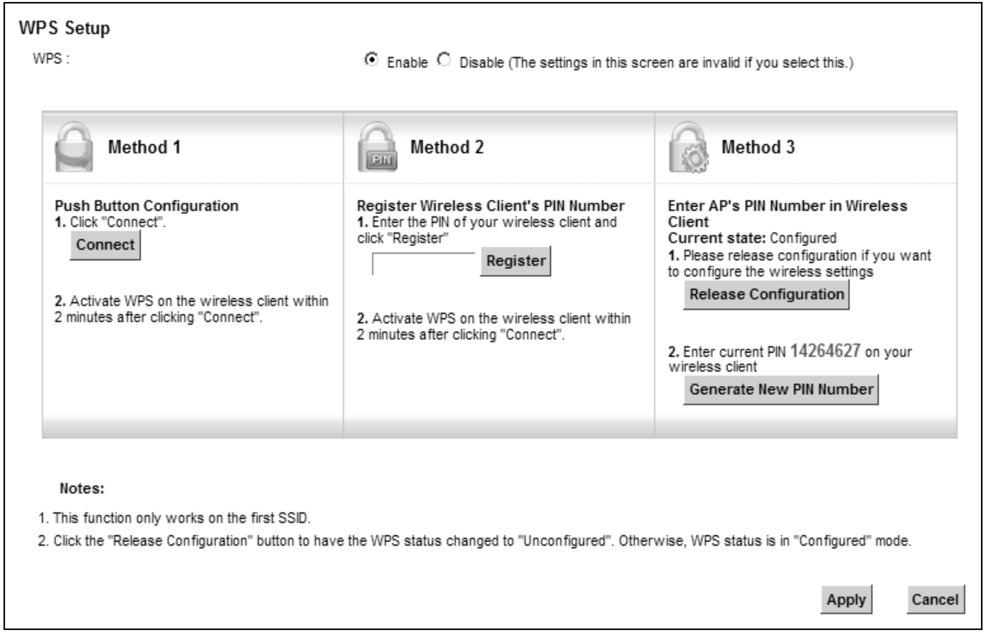
Use this screen to configure WiFi Protected Setup (WPS) on your Device.

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 7.10.9.3 on page 126 for more information about WPS.

Note: The Device applies the security settings of the **SSID1** profile (see Section 7.2 on page 100). 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 Setting > 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 38 Network Setting > 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 14264627 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.

Apply Cancel

The following table describes the labels in this screen.

Table 23 Network Setting > Wireless > WPS

LABEL	DESCRIPTION
WPS	Select **Enable** to activate WPS on the 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 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 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 Device.
Method 3	Use this section to set up a WPS wireless network by entering the PIN of the Device into the client.

Table 23 Network Setting > Wireless > WPS (continued)

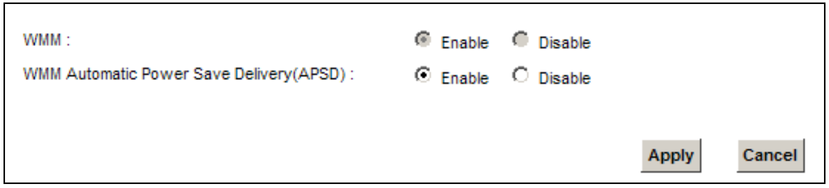
LABEL	DESCRIPTION
Release Configuration	The default WPS status is configured. Click this button to remove all configured wireless and wireless security settings for WPS connections on the Device.
Generate New PIN Number	The PIN (Personal Identification Number) of the Device is shown here. Enter this 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 Device create a new PIN.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.6 The WMM Screen

Use this screen to enable Wi-Fi MultiMedia (WMM) and WMM Power Save in wireless networks for multimedia applications.

Click **Network Setting > Wireless > WMM**. The following screen displays.

Figure 39 Network Setting > Wireless > WMM



WMM : ● Enable ○ Disable

WMM Automatic Power Save Delivery(APSD) : ● Enable ○ Disable

The following table describes the labels in this screen.

Table 24 Network Setting > Wireless > WMM

LABEL	DESCRIPTION
WMM	Select **On** to have the Device automatically give a service a priority level according to the ToS value in the IP header of packets it sends. WMM QoS (Wifi MultiMedia Quality of Service) gives high priority to voice and video, which makes them run more smoothly.
WMM Automatic Power Save Delivery	Select this option to extend the battery life of your mobile devices (especially useful for small devices that are running multimedia applications). The Device goes to sleep mode to save power when it is not transmitting data. The AP buffers the packets sent to the Device until the Device "wakes up". The Device wakes up periodically to check for incoming data. Note: Note: This works only if the wireless device to which the Device is connected also supports this feature.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.7 The WDS Screen

An AP using the Wireless Distribution System (WDS) can function as a wireless network bridge allowing you to wirelessly connect two wired network segments. The **WDS** screen allows you to configure the Device to connect to two or more APs wirelessly when WDS is enabled.

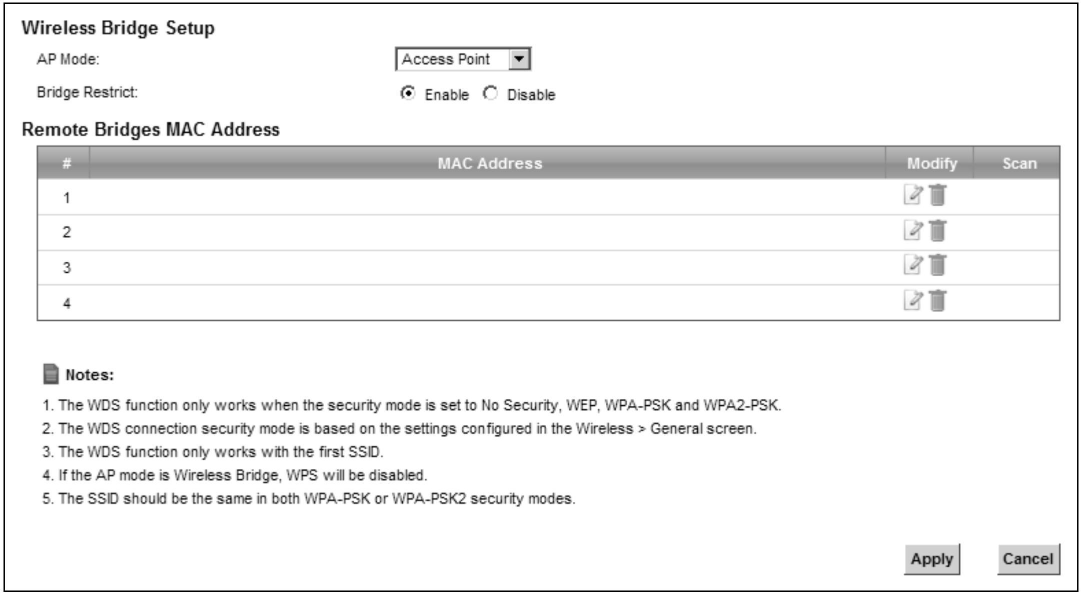
Use this screen to set up your WDS (Wireless Distribution System) links between the Device and other wireless APs. You need to know the MAC address of the peer device. Once the security settings of peer sides match one another, the connection between devices is made.

Note: WDS security is independent of the security settings between the Device and any wireless clients.

Note: At the time of writing, WDS is compatible with other ZyXEL APs only. Not all models support WDS links. Check your other AP’s documentation.

Click **Network Setting > Wireless > WDS**. The following screen displays.

Figure 40 Network Setting > Wireless > WDS



Wireless Bridge Setup

AP Mode: Access Point

Bridge Restrict: ● Enable ○ Disable

Remote Bridges MAC Address

#	MAC Address	Modify	Scan
1		✎ 🗑	
2		✎ 🗑	
3		✎ 🗑	
4		✎ 🗑	

Notes:

1. The WDS function only works when the security mode is set to No Security, WEP, WPA-PSK and WPA2-PSK.
2. The WDS connection security mode is based on the settings configured in the Wireless > General screen.
3. The WDS function only works with the first SSID.
4. If the AP mode is Wireless Bridge, WPS will be disabled.
5. The SSID should be the same in both WPA-PSK or WPA-PSK2 security modes.

The following table describes the labels in this screen.

Table 25 Network Setting > Wireless > WDS

LABEL	DESCRIPTION
Wireless Bridge Setup	
AP Mode	Select the operating mode for your Device. • **Access Point** - The Device functions as a bridge and access point simultaneously. • **Wireless Bridge** - The Device acts as a wireless network bridge and establishes wireless links with other APs. In this mode, clients cannot connect to the Device wirelessly.
Bridge Restrict	This field is available only when you set operating mode to **Access Point**. Select **Enabled** to turn on WDS and enter the peer device’s MAC address manually in the table below. Select **Disable** to turn off WDS.

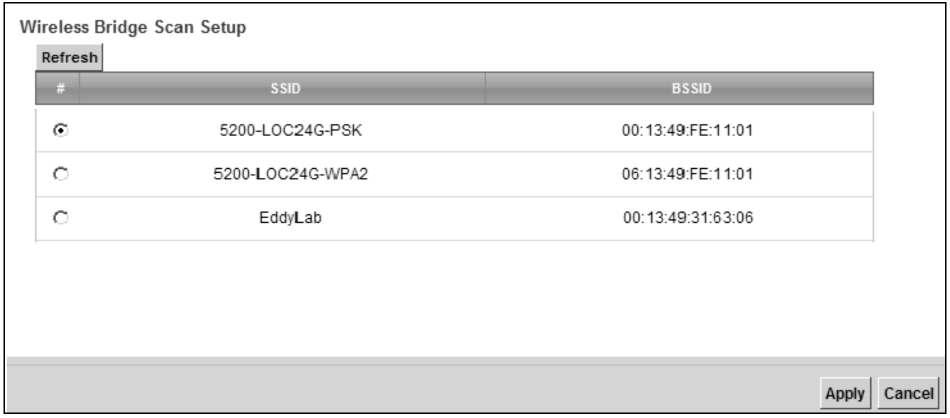
Table 25 Network Setting > Wireless > WDS (continued)

LABEL	DESCRIPTION
Remote Bridge MAC Address	You can enter the MAC address of the peer device by clicking the **Edit** icon under **Modify**.
#	This is the index number of the entry.
MAC Address	This shows the MAC address of the peer device. You can connect to up to 4 peer devices.
Modify	Click the **Edit** icon and type the MAC address of the peer device in a valid MAC address format (six hexadecimal character pairs, for example 12:34:56:78:9a:bc). Click the **Delete** icon to remove this entry.
Scan	Click the **Scan** icon to search and display the available APs within range.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.7.1 WDS Scan

You can click the **Scan** icon in **Wireless > WDS** to have the Device automatically search and display the available APs within range. Select an AP and click **Apply** to have the Device establish a wireless link with the selected wireless device.

Figure 41 WDS: Scan



Wireless Bridge Scan Setup

#	SSID	BSSID
●	5200-LOC24G-PSK	00:13:49:FE:11:01
○	5200-LOC24G-WPA2	06:13:49:FE:11:01
○	EddyLab	00:13:49:31:63:06

The following table describes the labels in this screen.

Table 26 WDS: Scan

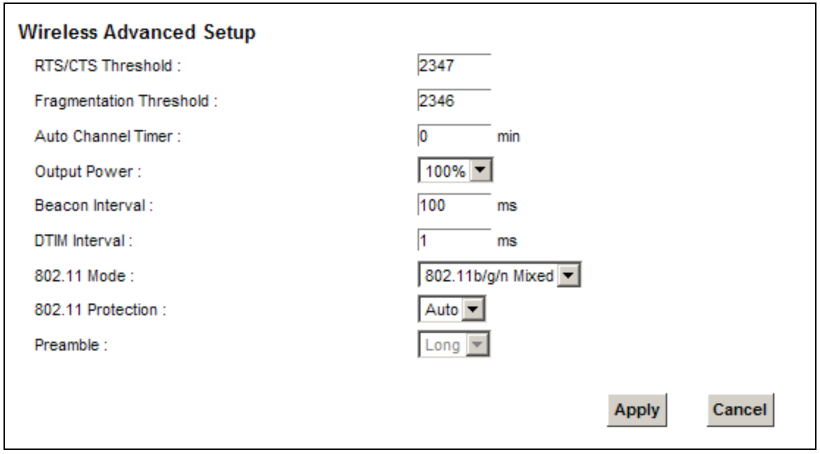
LABEL	DESCRIPTION
Wireless Bridge Scan Setup	
Refresh	Click **Refresh** to update the table.
#	This is the index number of the entry.
SSID	This shows the SSID of the available wireless device within range.
BSSID	This shows the MAC address of the available wireless device within range.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.8 The Others Screen

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

See Section 7.10.2 on page 119 for detailed definitions of the terms listed in this screen.

Figure 42 Network Setting > Wireless > Others



Wireless Advanced Setup

RTS/CTS Threshold : 2347

Fragmentation Threshold : 2346

Auto Channel Timer : 0 min

Output Power : 100%

Beacon Interval : 100 ms

DTIM Interval : 1 ms

802.11 Mode : 802.11b/g/n Mixed

802.11 Protection : Auto

Preamble : Long

The following table describes the labels in this screen.

Table 27 Network Setting > 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.
Auto Channel Timer	If you set the channel to **Auto** in the **Network Setting > Wireless > General** screen, specify the interval in minutes for how often the Device scans for the best channel. Enter 0 to disable the periodical scan.
Output Power	Set the output power of the 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%**.
Beacon Interval	When a wirelessly networked device sends a beacon, it includes with it a beacon interval. This specifies the time period before the device sends the beacon again. The interval tells receiving devices on the network how long they can wait in low power mode before waking up to handle the beacon. This value can be set from20ms to 1000ms. A high value helps save current consumption of the access point.
DTIM Interval	Delivery Traffic Indication Message (DTIM) is the time period after which broadcast and multicast packets are transmitted to mobile clients in the Power Saving mode. A high DTIM value can cause clients to lose connectivity with the network. This value can be set from 1 to 100.

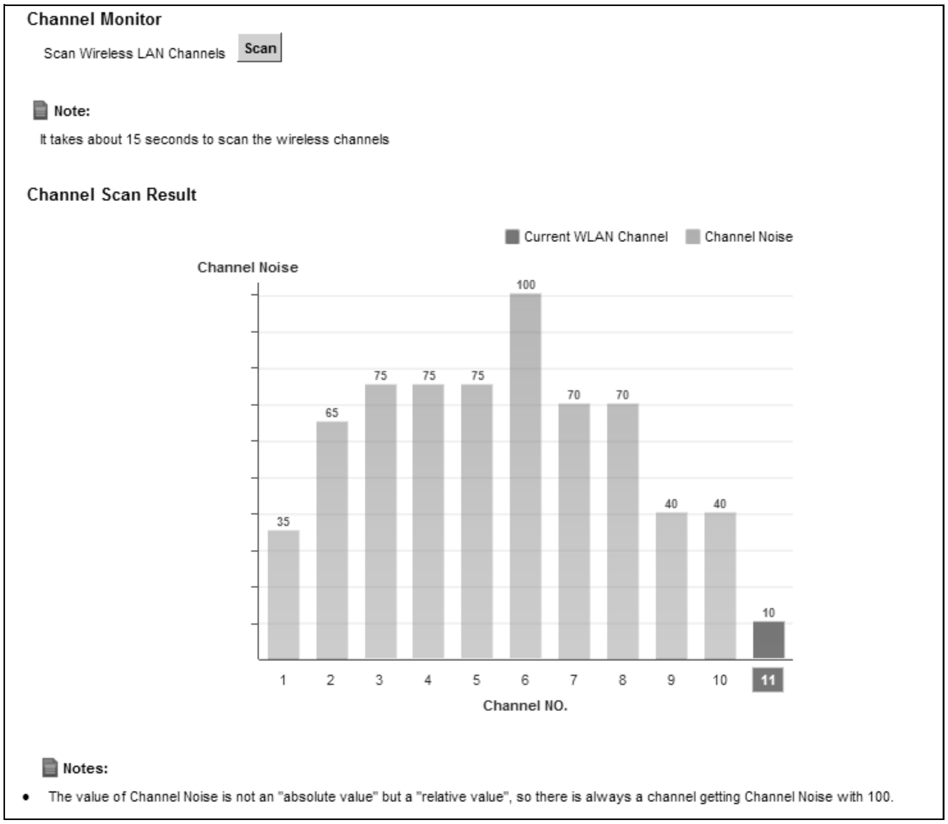
Table 27 Network Setting > Wireless > Others (continued)

LABEL	DESCRIPTION
802.11 Mode	Select **802.11b Only** to allow only IEEE 802.11b compliant WLAN devices to associate with the Device. Select **802.11g Only** to allow only IEEE 802.11g compliant WLAN devices to associate with the Device. Select **802.11n Only** to allow only IEEE 802.11n compliant WLAN devices to associate with the Device. Select **802.11b/g Mixed** to allow either IEEE 802.11b or IEEE 802.11g compliant WLAN devices to associate with the Device. The transmission rate of your 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 Device. The transmission rate of your 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 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 7.10.7 on page 123 for more information. This field is configurable only when you set 802.11 Mode to **802.11b**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

7.9 The Channel Status Screen

Use the **Channel Status** screen to scan wireless LAN channel noises and view the results. Click **Network Setting > Wireless > Channel Status**. The screen appears as shown. Click **Scan** to scan the wireless LAN channels. You can view the results in the **Channel Scan Result** section.

Figure 43 Network Setting > Wireless > Channel Status



Channel Monitor

Scan Wireless LAN Channels Scan

Note:

It takes about 15 seconds to scan the wireless channels

Channel Scan Result

Notes:

- The value of Channel Noise is not an "absolute value" but a "relative value", so there is always a channel getting Channel Noise with 100.

7.10 Technical Reference

This section discusses wireless LANs in depth. For more information, see Appendix D on page 327.

7.10.1 Wireless Network Overview

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

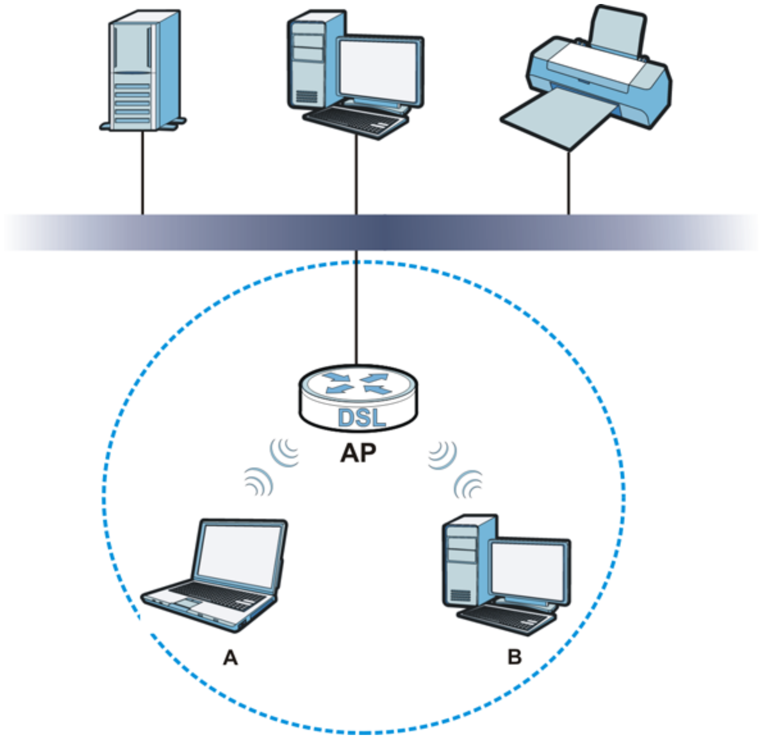
- A wireless client is a radio connected to a user’s computer.
- An access point is a radio with a wired connection to a network, which can connect with numerous wireless clients and let them access the network.
- A bridge is a radio that relays communications between access points and wireless clients, 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 44 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 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.

7.10.2 Additional Wireless Terms

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

Table 28 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 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 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 Device does, it cannot communicate with the 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.

7.10.3 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.

7.10.3.1 SSID

Normally, the Device acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the 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.

7.10.3.2 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 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.

7.10.3.3 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.

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

[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.

wireless users to get a valid user name and password. Then, they can use that user name and password to use the wireless network.

7.10.3.4 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 7.10.3.3 on page 120 for information about this.)

Table 29 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 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 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 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.

7.10.4 Signal Problems

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

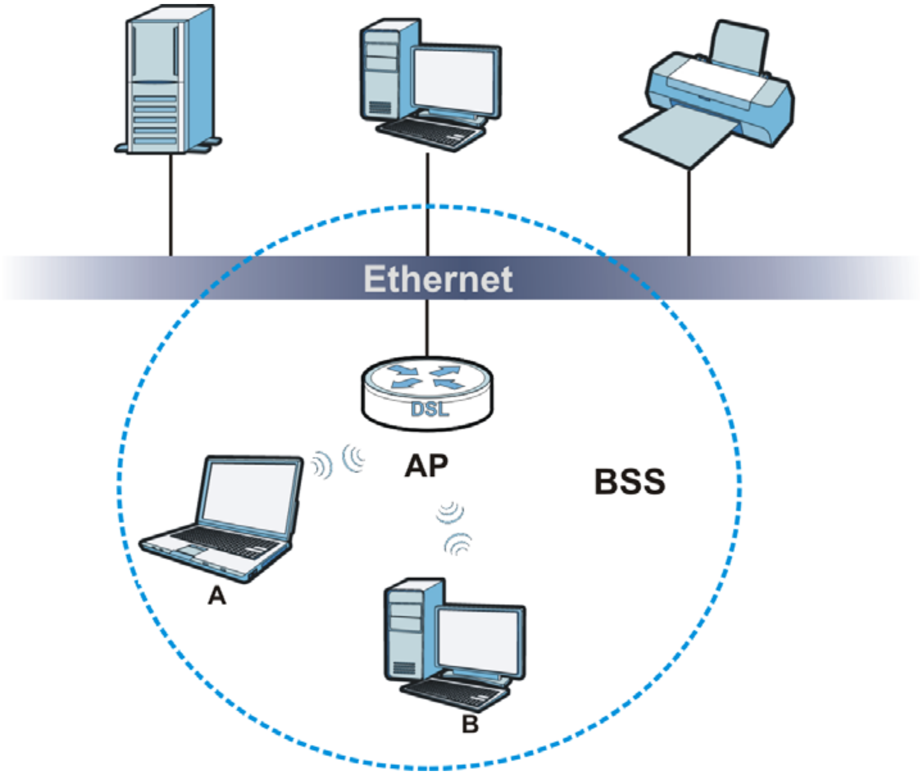
Problems with distance occur when the two radios are too far apart. Problems with interference occur when other radio waves interrupt the data signal. Interference may come from other radio transmissions, such as military or air traffic control communications, or from machines that are coincidental emitters 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.

7.10.5 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 45 Basic Service set



7.10.6 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 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.

7.10.6.1 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.

7.10.7 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 Device uses long preamble.

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

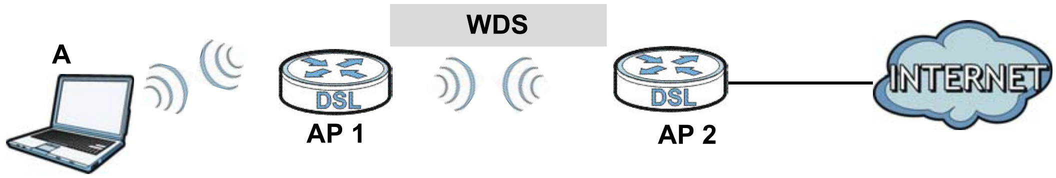
7.10.8 Wireless Distribution System (WDS)

The Device can act as a wireless network bridge and establish WDS (Wireless Distribution System) links with other APs. You need to know the MAC addresses of the APs you want to link to. Once the security settings of peer sides match one another, the connection between devices is made.

At the time of writing, WDS security is compatible with other ZyXEL access points only. Refer to your other access point's documentation for details.

The following figure illustrates how WDS link works between APs. Notebook computer **A** is a wireless client connecting to access point **AP 1**. **AP 1** has no wired Internet connection, but it can establish a WDS link with access point **AP 2**, which has a wired Internet connection. When **AP 1** has a WDS link with **AP 2**, the notebook computer can access the Internet through **AP 2**.

Figure 46 WDS Link Example



7.10.9 WiFi Protected Setup (WPS)

Your 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.

7.10.9.1 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 Device, see Section 7.6 on page 112).
3. Press the button on one of the devices (it doesn't matter which). For the 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.

7.10.9.2 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 Device, see Section 7.5 on page 110).

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.

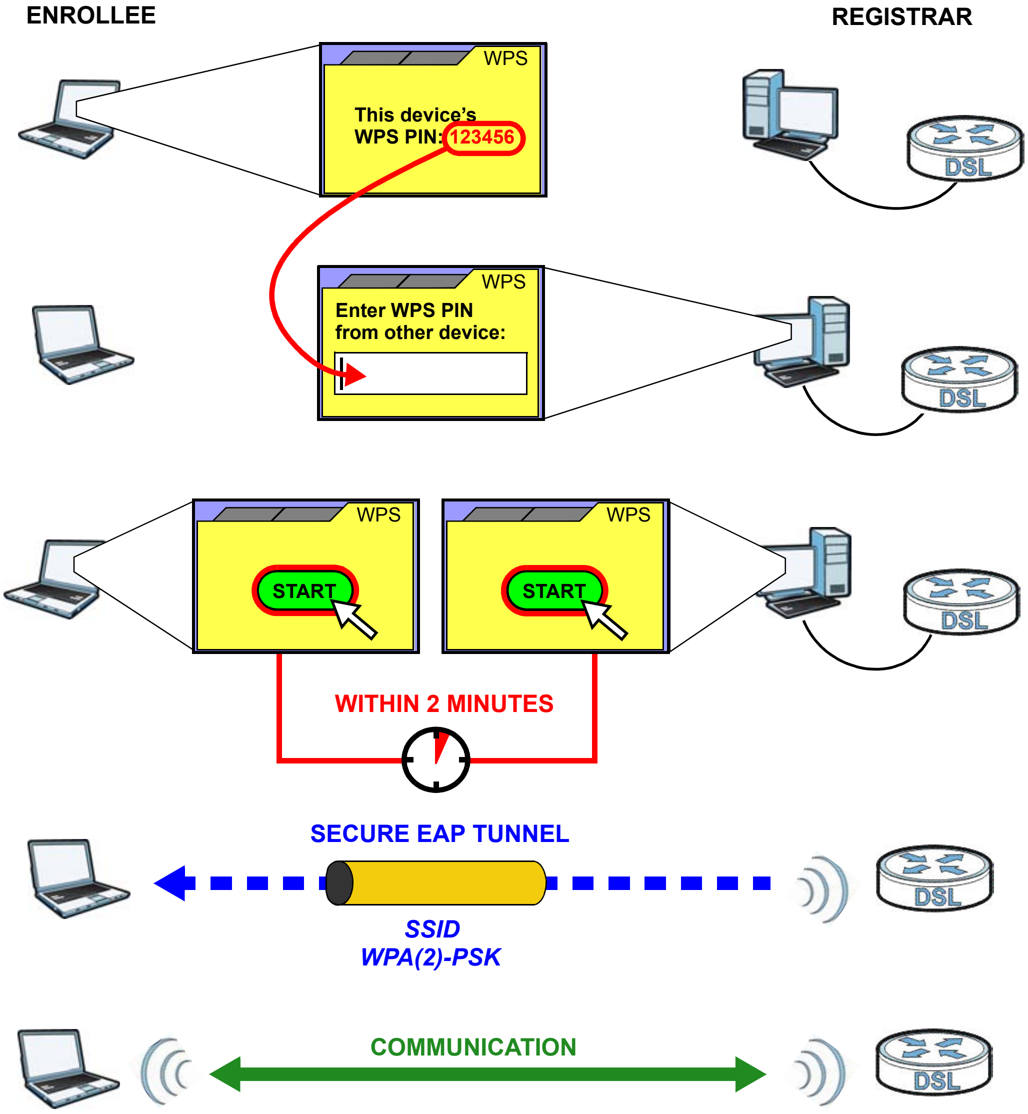
7 Use the configuration utility to activate WPS, not the push-button on the device itself.

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 47 Example WPS Process: PIN Method

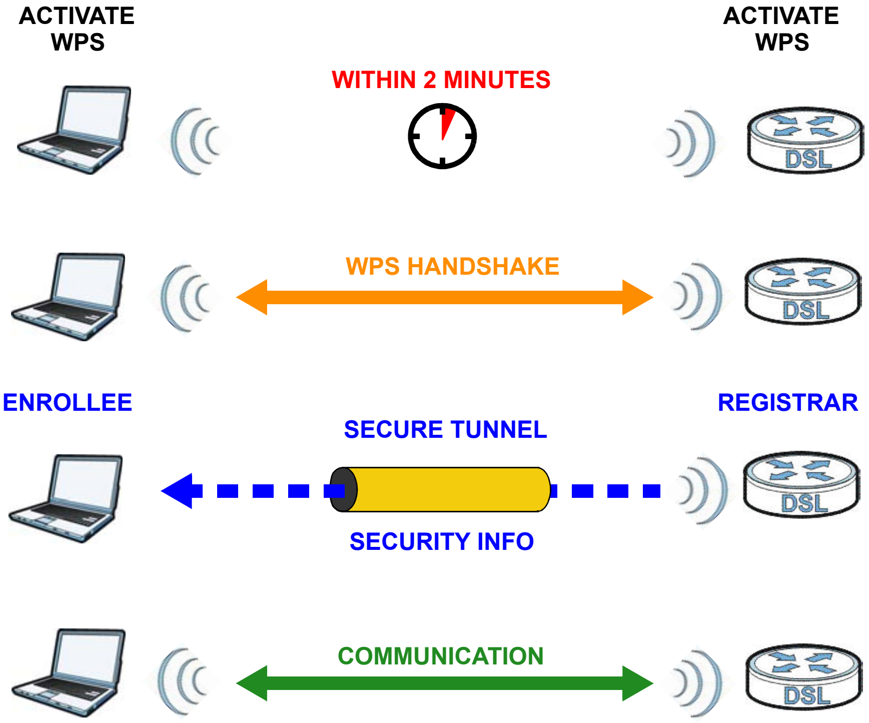


7.10.9.3 How WPS Works

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 48 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.

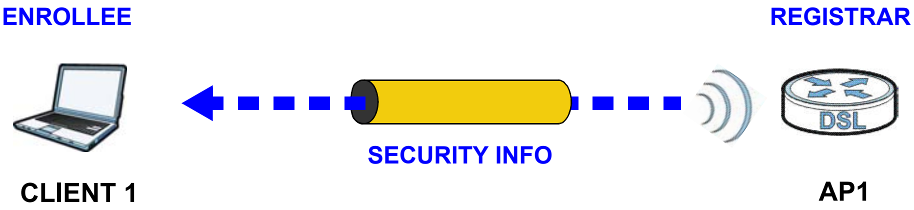
By default, a WPS devices is “unconfigured”. This means that it is not part of an existing network and can act as either enrollee or registrar (if it supports both functions). If the registrar is unconfigured, the security settings it transmits to the enrollee are randomly-generated. Once a WPS-enabled 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.

7.10.9.4 Example WPS Network Setup

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

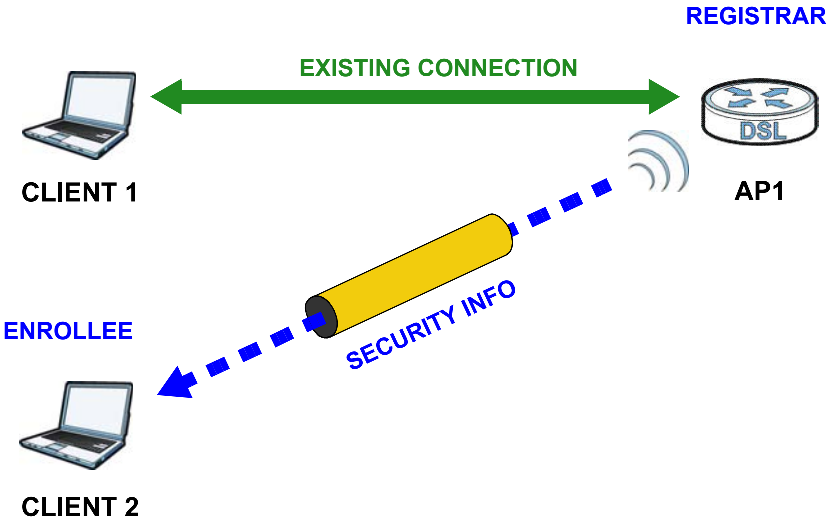
The following figure shows an example network. In step **1**, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information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

Figure 49 WPS: Example Network Step 1



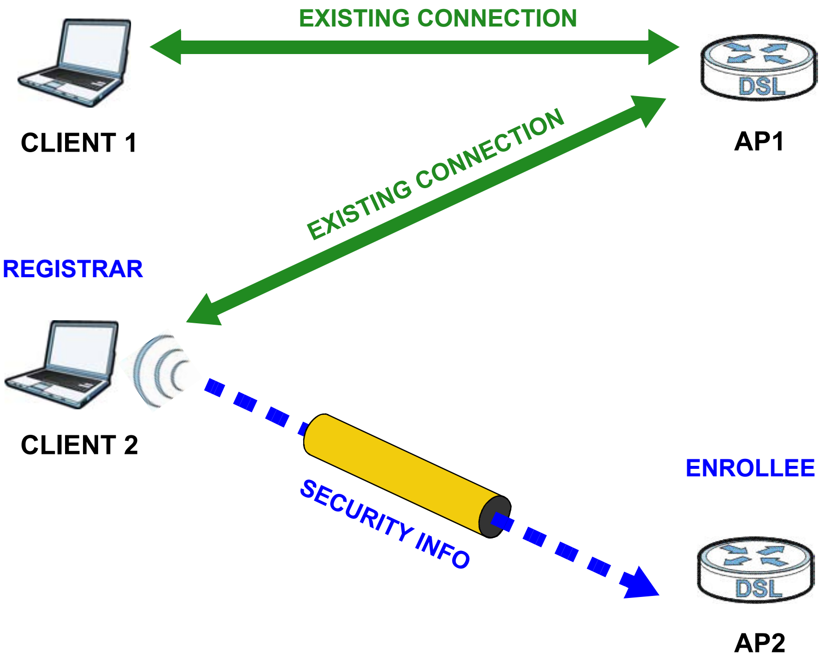
In step **2**, you add another wireless client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the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

Figure 50 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 51 WPS: Example Network Step 3



7.10.9.5 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.

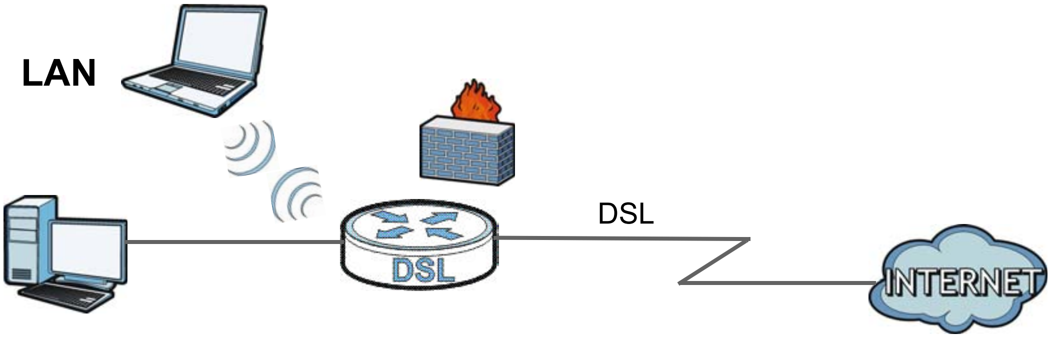
8

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 Device (Section 8.2 on page 133).
- 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 136).
- Use the **UPnP** screen to enable UPnP and UPnP NAT traversal on the Device (Section 8.4 on page 138).
- Use the **Additional Subnet** screen to configure IP alias and public static IP (Section 8.5 on page 139).
- Use the **STB Vendor ID** screen to have the Device automatically create static DHCP entries for Set Top Box (STB) devices when they request IP addresses (Section 8.8 on page 148)
- Use the **5th Ethernet Port** screen to configure the Ethernet WAN port as a LAN port (Section 8.9 on page 148).
- 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 149).

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 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.

RADVD (Router Advertisement Daemon)

When an IPv6 host sends a Router Solicitation (RS) request to discover the available routers, RADVD with Router Advertisement (RA) messages in response to the request. It specifies the minimum and maximum intervals of RA broadcasts. RA messages containing the address prefix. IPv6 hosts can be generated with the IPv6 prefix an IPv6 address.

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 177 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 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 139 for examples of installing and using UPnP.

Finding Out More

See Section 8.11 on page 150 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 Device. Click **Network Setting > Home Networking** to open the **LAN Setup** screen.

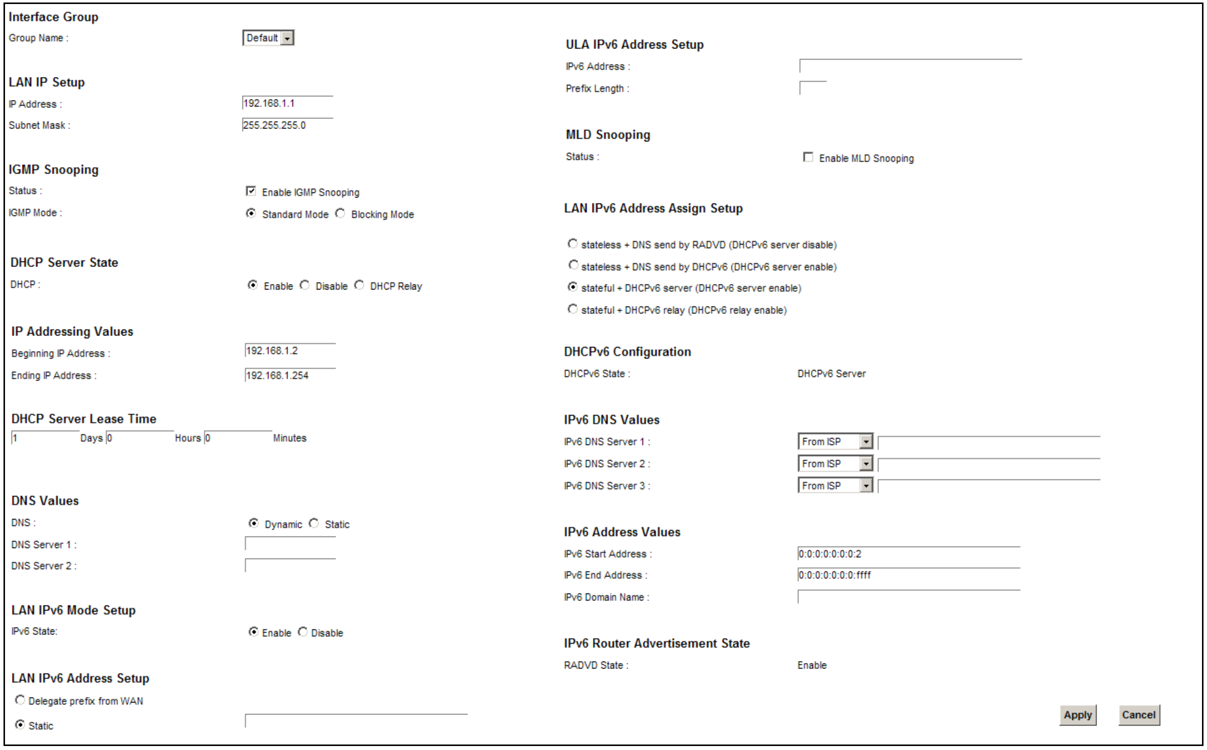
Follow these steps to configure your LAN settings.

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 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 52 Network Setting > Home Networking > LAN Setup



Interface Group

Group Name : Default ▾

LAN IP Setup

IP Address : 192.168.1.1

Subnet Mask : 255.255.255.0

IGMP Snooping

Status : ☑ Enable IGMP Snooping

IGMP Mode : ● Standard Mode ○ Blocking Mode

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 :

LAN IPv6 Mode Setup

IPv6 State: ● Enable ○ Disable

LAN IPv6 Address Setup

○ Delegate prefix from WAN

● Static

ULA IPv6 Address Setup

IPv6 Address :

Prefix Length :

MLD Snooping

Status : □ Enable MLD Snooping

LAN IPv6 Address Assign Setup

○ stateless + DNS send by RADVD (DHCPv6 server disable)

○ stateless + DNS send by DHCPv6 (DHCPv6 server enable)

● stateful + DHCPv6 server (DHCPv6 server enable)

○ stateful + DHCPv6 relay (DHCPv6 relay enable)

DHCPv6 Configuration

DHCPv6 State : DHCPv6 Server

IPv6 DNS Values

IPv6 DNS Server 1 : From ISP ▾

IPv6 DNS Server 2 : From ISP ▾

IPv6 DNS Server 3 : From ISP ▾

IPv6 Address Values

IPv6 Start Address : 0:0:0:0:0:0:0:2

IPv6 End Address : 0:0:0:0:0:0:0:ffff

IPv6 Domain Name :

IPv6 Router Advertisement State

RADVD State : Enable

The following table describes the fields in this screen.

Table 30 Network Setting > Home Networking > LAN Setup

LABEL	DESCRIPTION
Interface Group	
Group Name	Select the interface group name for which you want to configure LAN settings. See Chapter 13 on page 197 for how to create a new interface group.
LAN IP Setup	
IP Address	Enter the LAN IP address you want to assign to your 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 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.
IGMP Snooping	
Status	Select the **Enable IGMP Snooping** checkbox to allows the Device to passively learn multicast group.
IGMP Mode	Select **Standard Mode** to have the Device forward multicast packets to a port that joins the multicast group and broadcast unknown multicast packets from the WAN to all LAN ports. Select **Blocking Mode** to have the Device block all unknown multicast packets from the WAN.
DHCP Server State	
DHCP	Select **Enable** to have the Device act as a DHCP server or DHCP relay agent. Select **Disable** to stop the DHCP server on the Device. Select **DHCP Relay** to have the Device forward DHCP request to the DHCP server.

Table 30 Network Setting > 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 Device passes to the DHCP clients.
LAN IPv6 Mode Setup	
IPv6 State	Select **Enable** to activate the IPv6 mode and configure IPv6 settings on the Device.
LAN IPv6 Address Setup	
Delegate prefix from WAN	Select this option to automatically obtain an IPv6 network prefix from the service provider or an uplink router.
Static	Select this option to configure a fixed IPv6 address for the Device's LAN IPv6 address.
ULA IPv6 Address Setup	
IPv6 Address	If you select static IPv6 address, enter the IPv6 address prefix that the Device uses for the LAN IPv6 address.
Prefix Length	If you select static IPv6 address, enter the IPv6 prefix length that the Device uses to generate the LAN IPv6 address. An IPv6 prefix length specifies how many most significant bits (starting from the left) in the address compose the network address. This field displays the bit number of the IPv6 subnet mask.
MLD Snooping	Multicast Listener Discovery (MLD) allows an IPv6 switch or router to discover the presence of MLD hosts who wish to receive multicast packets and the IP addresses of multicast groups the hosts want to join on its network. Select **Enable MLD Snooping** to activate MLD Snooping on the Device. This allows the Device to check MLD packets passing through it and learn the multicast group membership. It helps reduce multicast traffic.

Table 30 Network Setting > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
LAN IPv6 Address Assign Setup	Select how you want to obtain an IPv6 address: • **stateless + DNS send by RADVD:** The Device uses IPv6 stateless autoconfiguration. RADVD (Router Advertisement Daemon) is enabled to have the Device send IPv6 prefix information in router advertisements periodically and in response to router solicitations. DHCPv6 server is disabled. (See page 132 for more information on RADVD.) • **stateless + DNS send by DHCPv6**: The Device uses IPv6 stateless autoconfiguration. The DNS is provided by a DHCPv6 server. • **stateful + DHCPv6 server:** The Device uses IPv6 stateful autoconfiguration. The DHCPv6 server is enabled to have the Device act as a DHCPv6 server and pass IPv6 addresses, DNS server and domain name information to DHCPv6 clients. • **stateful + DHCPv6 relay:** The Device uses IPv6 stateful autoconfiguration. **DHCPv6 Relay** is enabled to have the Device relay client DHCPv6 requests.
DHCPv6 Configuration	
DHCPv6 State	This shows the status of the DHCPv6.
IPv6 DNS Values	
IPv6 DNS Server 1-3	Select **From ISP** if your ISP dynamically assigns IPv6 DNS server information. Select **User-Defined** if you have the IPv6 address of a DNS server. Enter the DNS server IPv6 addresses the Device passes to the DHCP clients. Select **None** if you do not want to configure IPv6 DNS servers.
IPv6 Address Values	
IPv6 Start Address	If DHCPv6 is enabled, specify the first IPv6 address in the pool of addresses that can be assigned to DHCPv6 clients.
IPv6 End Address	If DHCPv6 is enabled, specify the last IPv6 address in the pool of addresses that can be assigned to DHCPv6 clients.
IPv6 Domain Name	If DHCPv6 is enabled, specify the domain name to be assigned to DHCPv6 clients.
IPv6 Router Advertisement State	
RADVD State	This shows the status of RADVD.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

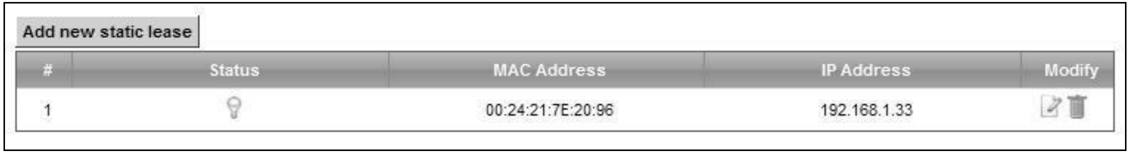
8.3 The Static DHCP Screen

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 Device’s static DHCP settings. Click **Network Setting > Home Networking > Static DHCP** to open the following screen.

Figure 53 Network Setting > Home Networking > Static DHCP



#	Status	MAC Address	IP Address	Modify
1	💡	00:24:21:7E:20:96	192.168.1.33	✎ 🗑

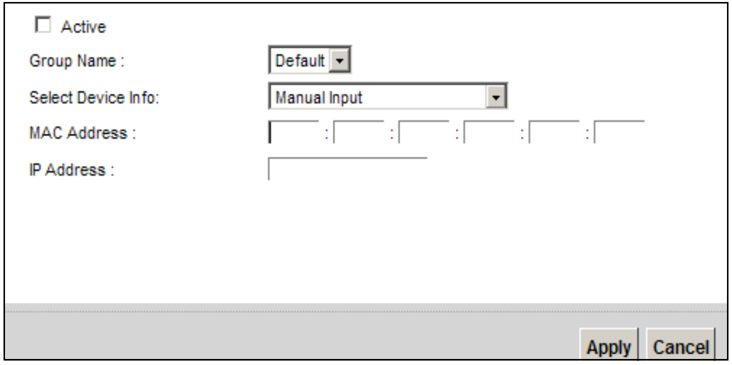
The following table describes the labels in this screen.

Table 31 Network Setting > 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 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 54 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 32 Static DHCP: Add/Edit

LABEL	DESCRIPTION
Active	Select this to activate the connection between the client and the Device.
Group Name	Select the interface group name for which you want to configure static DHCP settings. See Chapter 13 on page 197 for how to create a new interface group.

Table 32 Static DHCP: Add/Edit (continued)

LABEL	DESCRIPTION
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**, enter the MAC address of a computer on your LAN.
IP Address	If you select **Manual Input**, enter the IP address that you want to assign to the computer on your LAN with the MAC address that you will also specify.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

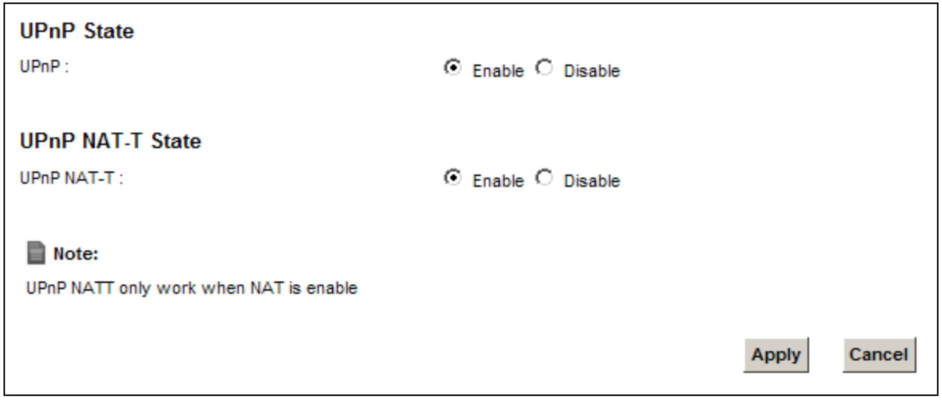
8.4 The UPnP Screen

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 132 for more information on UPnP.

Use the following screen to configure the UPnP settings on your Device. Click **Network Setting > Home Networking > UPnP** to display the screen shown next.

Figure 55 Network Setting > Home Networking > UPnP



UPnP State

UPnP : ● Enable ○ Disable

UPnP NAT-T State

UPnP NAT-T : ● Enable ○ Disable

Note:

UPnP NATT only work when NAT is enable

The following table describes the labels in this screen.

Table 33 Network Setting > Home Networking > UPnP

LABEL	DESCRIPTION
UPnP	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 Device's IP address (although you must still enter the password to access the web configurator).
UPnP NAT-T	Select **Enable** to allow UPnP-enabled applications to automatically configure the Device so that they can communicate through the Device by using NAT traversal. UPnP applications automatically reserve a NAT forwarding port in order to communicate with another UPnP enabled device; this eliminates the need to manually configure port forwarding for the UPnP enabled application.

Table 33 Network Setting > Home Networking > UPnP (continued)

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

8.5 Installing UPnP in Windows Example

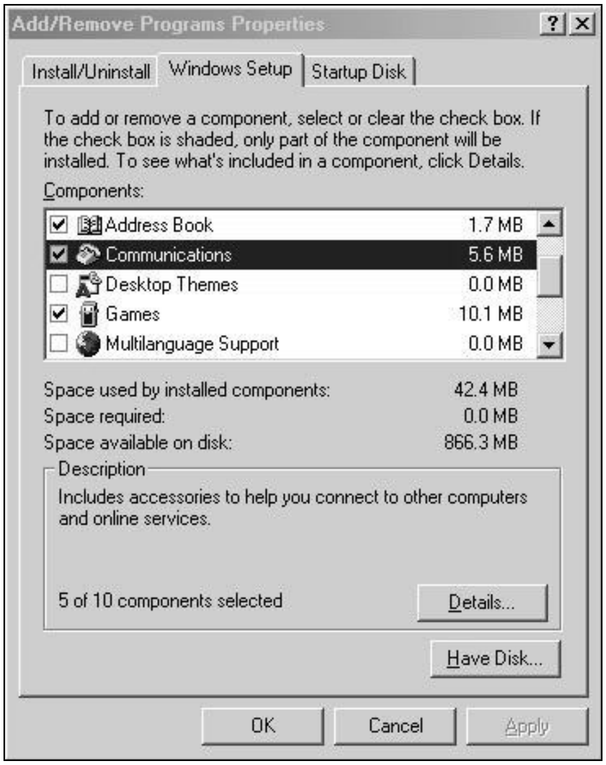
This section shows how to install UPnP in Windows Me and Windows XP.

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

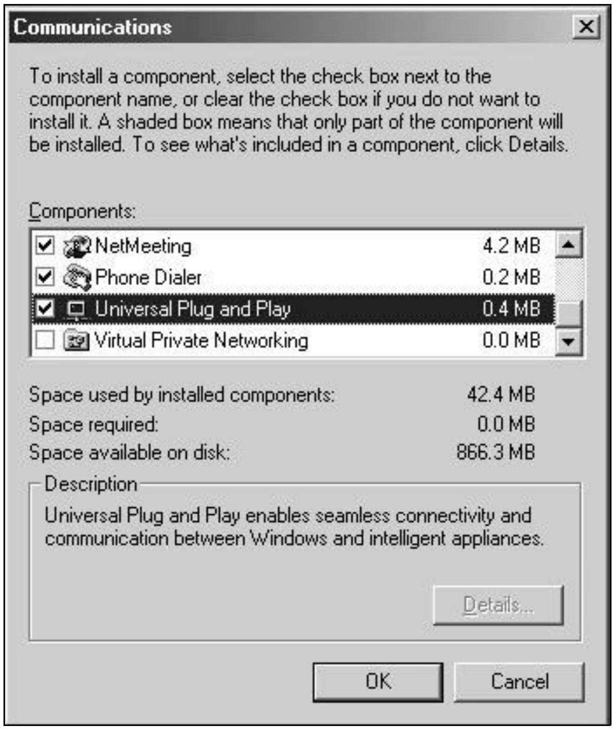
Space used by installed components:	42.4 MB
Space required:	0.0 MB
Space available on disk:	866.3 MB

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.

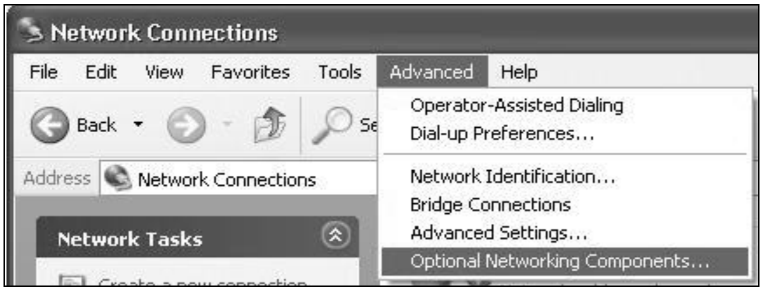
Installing UPnP in Windows XP

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

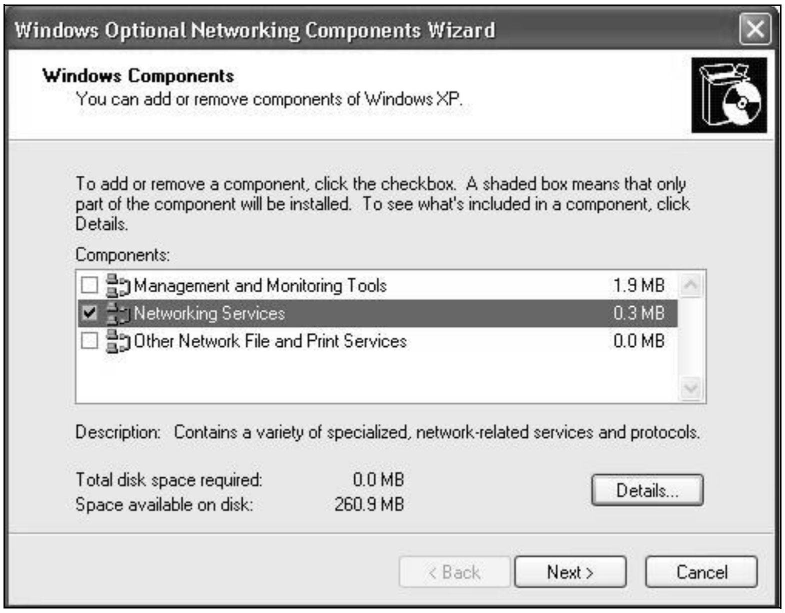
1 Click **Start** and **Control Panel**.

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 Optional Networking Components Wizard

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:

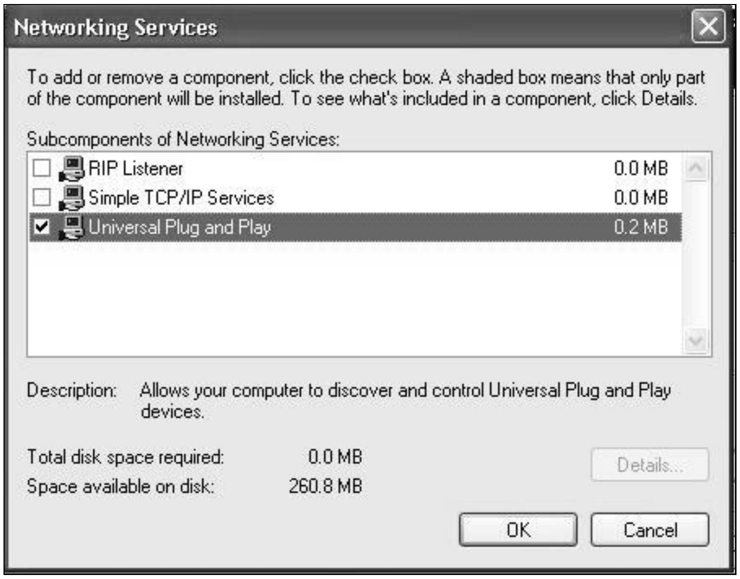
□	Management and Monitoring Tools	1.9 MB
☑	Networking Services	0.3 MB
□	Other Network File and Print Services	0.0 MB

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

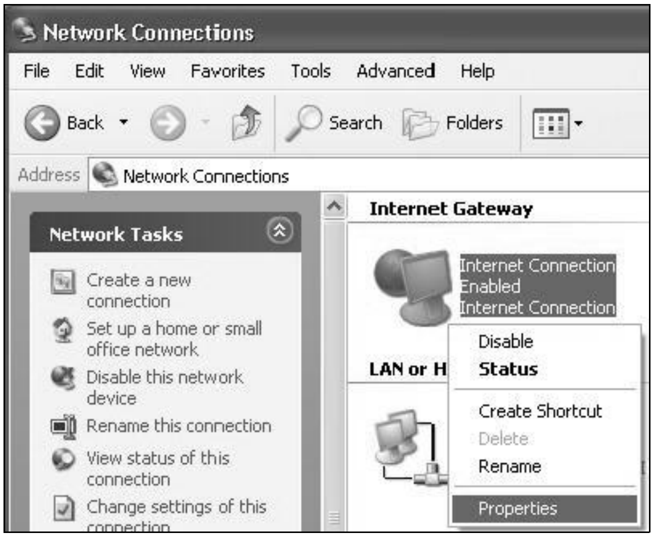
This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the Device.

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

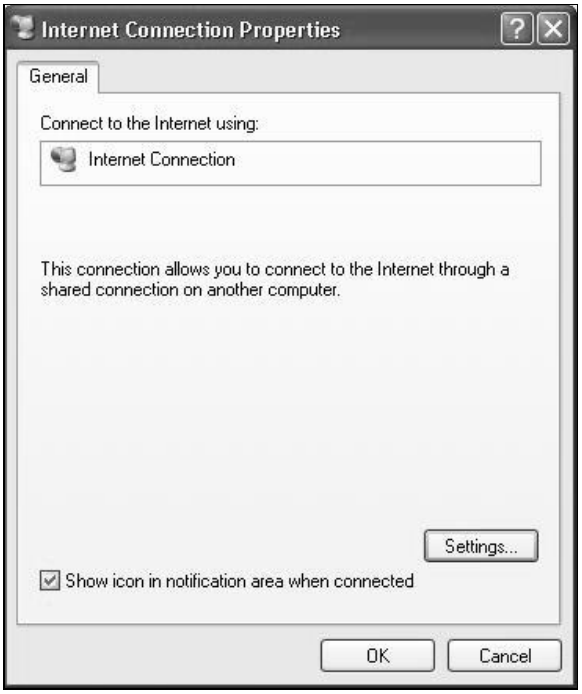
Auto-discover Your UPnP-enabled Network Device

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.



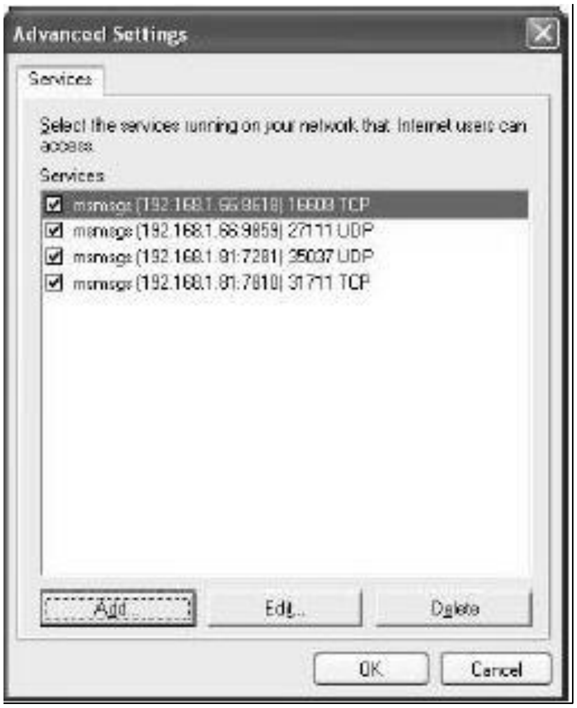
Connect to the Internet using:

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

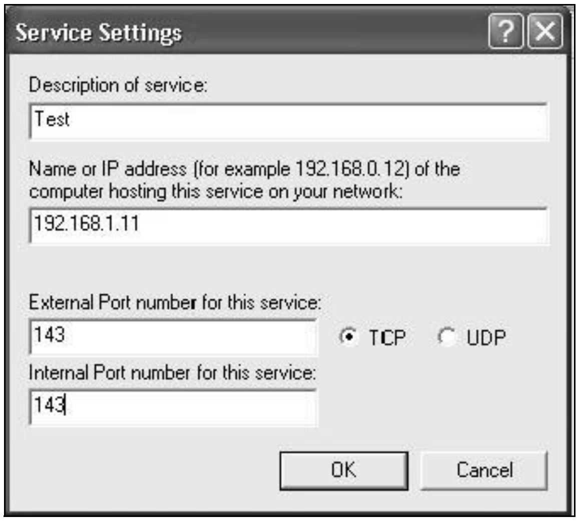
4 You may edit or delete the port mappings or click **Add** to manually add port mappings.



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

Services

☑ msmsgs (192.168.1.66:9618) 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



Description of service: Test

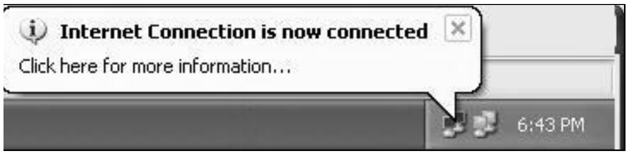
Name or IP address (for example 192.168.0.12) of the computer hosting this service on your network: 192.168.1.11

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.

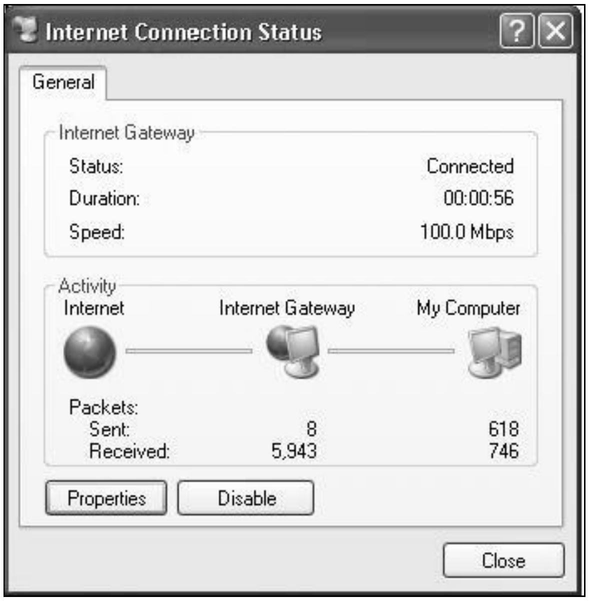
6 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.



Internet Connection is now connected

Click here for more information...

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



Status:		Connected
Duration:		00:00:56
Speed:		100.0 Mbps
Packets:		
Sent:	8	618
Received:	5,943	746

Web Configurator Easy Access

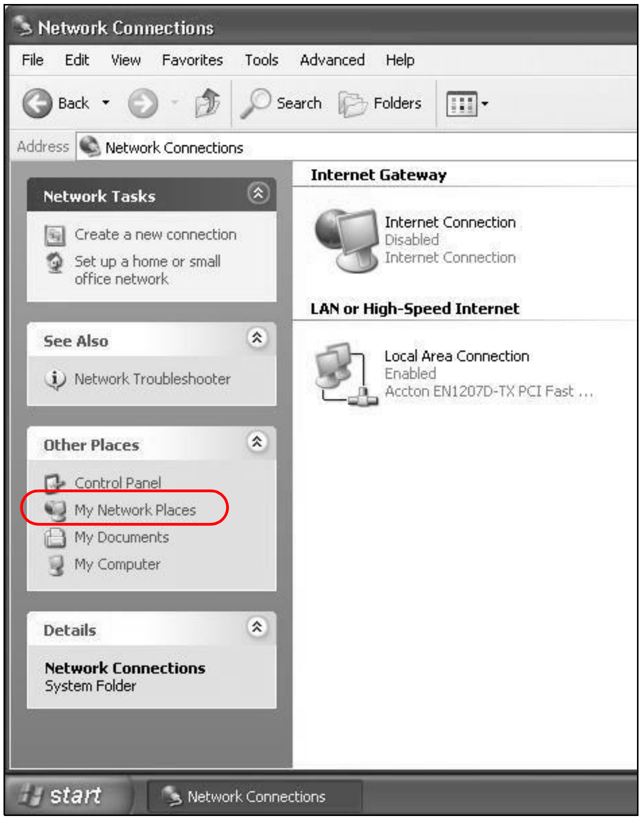
With UPnP, you can access the web-based configurator on the Device without finding out the IP address of the Device first. This comes helpful if you do not know the IP address of the Device.

Follow the steps below to access the web configurator.

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

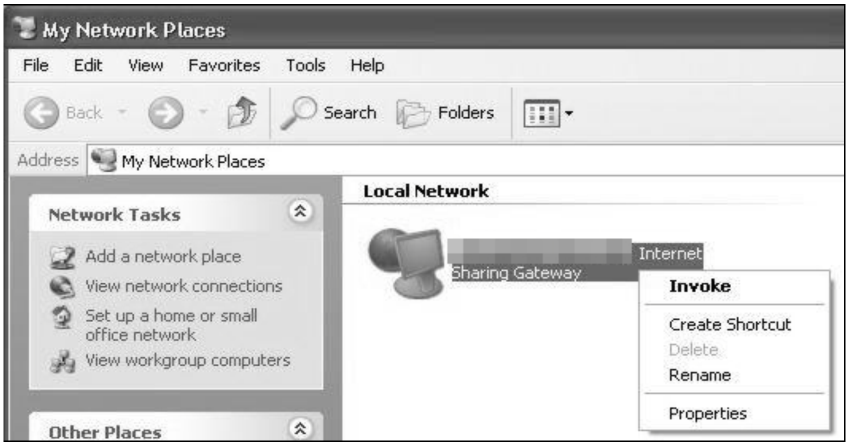
2 Double-click **Network Connections**.

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

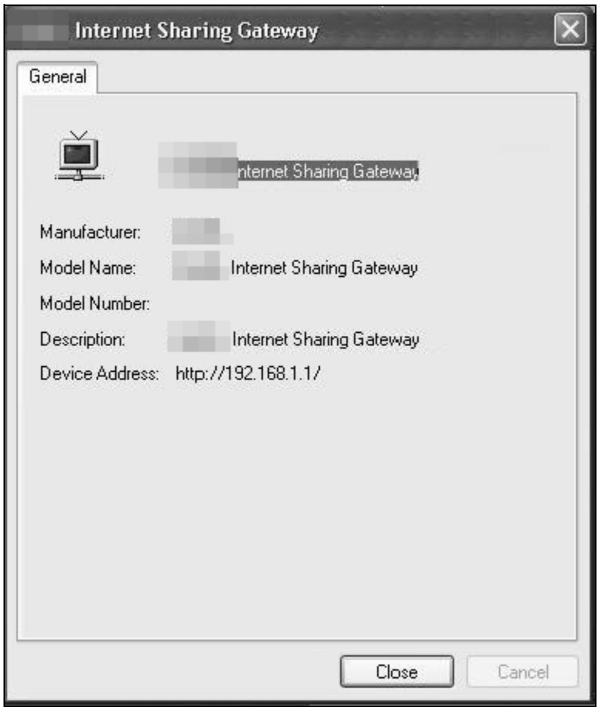


4 An icon with the description for each UPnP-enabled device displays under **Local Network**.

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



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



[redacted] Internet Sharing Gateway

[redacted] Internet Sharing Gateway

Manufacturer: [redacted]

Model Name: [redacted] Internet Sharing Gateway

Model Number:

Description: [redacted] Internet Sharing Gateway

Device Address: http://192.168.1.1/

8.7 The Additional Subnet Screen

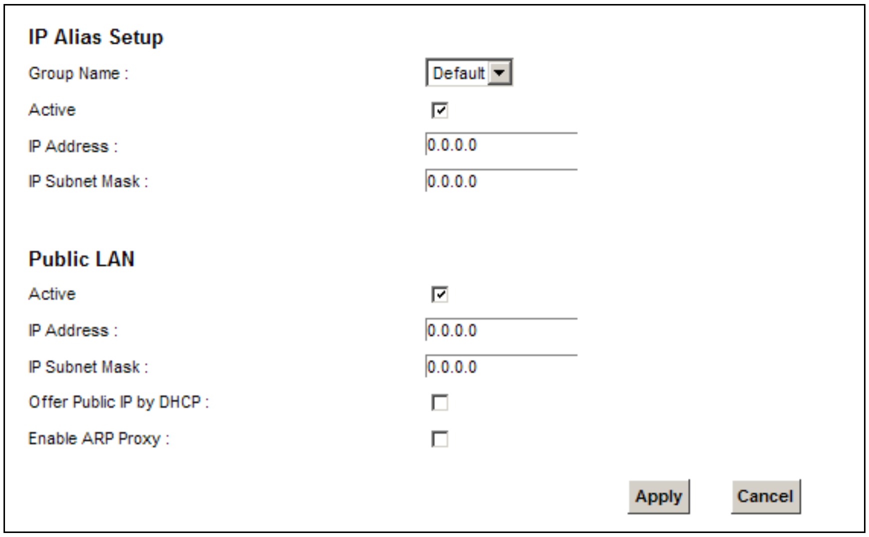
Use the **Additional Subnet** screen to configure IP alias and public static IP.

IP alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The Device supports multiple logical LAN interfaces via its physical Ethernet interface with the Device itself as the gateway for the LAN network. When you use IP alias, you can also configure firewall rules to control access to the LAN's logical network (subnet).

If your ISP provides the Public LAN service, the Device may use an LAN IP address that can be accessed from the WAN.

Click **Network Setting > Home Networking > Additional Subnet** to display the screen shown next.

Figure 56 Network Setting > Home Networking > Additional Subnet



IP Alias Setup

Group Name :	Default
Active	☑
IP Address :	0.0.0.0
IP Subnet Mask :	0.0.0.0

Public LAN

Active	☑
IP Address :	0.0.0.0
IP Subnet Mask :	0.0.0.0
Offer Public IP by DHCP :	☐
Enable ARP Proxy :	☐

The following table describes the labels in this screen.

Table 34 Network Setting > Home Networking > Additional Subnet

LABEL	DESCRIPTION
IP Alias Setup	
Group Name	Select the interface group name for which you want to configure the IP alias settings. See Chapter 13 on page 197 for how to create a new interface group.
Active	Select the checkbox to configure a LAN network for the Device.
IP Address	Enter the IP address of your Device in dotted decimal notation.
IP Subnet Mask	Your Device will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the Device.
Public LAN	
Active	Select the checkbox to enable the Public LAN feature. Your ISP must support Public LAN and Static IP.
IP Address	Enter the public IP address provided by your ISP.
IP Subnet Mask	Enter the public IP subnet mask provided by your ISP.

Table 34 Network Setting > Home Networking > Additional Subnet (continued)

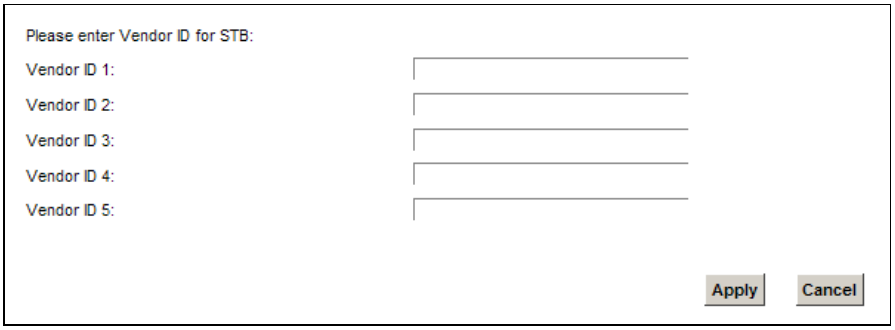
LABEL	DESCRIPTION
Offer Public IP by DHCP	Select the checkbox to enable the Device to provide public IP addresses by DHCP server.
Enable ARP Proxy	Select the checkbox to enable the ARP (Address Resolution Protocol) proxy.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

8.8 The STB Vendor ID 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 Device automatically create static DHCP entries for them when they request IP addresses.

Click **Network Setting** > **Home Networking** > **STB Vendor ID** to open this screen.

Figure 57 Network Setting > 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 labels in this screen.

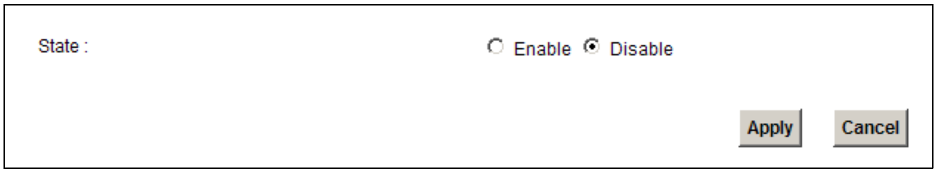
Table 35 Network Setting > Home Networking > STB Vendor ID

LABEL	DESCRIPTION
Vendor ID 1 ~ 5	Enter the STB's vendor ID.
Apply	Click **Apply** to save your changes.
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 is a Gigabit port. Click **Network Settings > Home Networking > 5th Ethernet Port** to open this screen.

Figure 58 Network Settings > Home Networking > 5th Ethernet Port



State : ○ Enable ● Disable

The following table describes the fields in this screen.

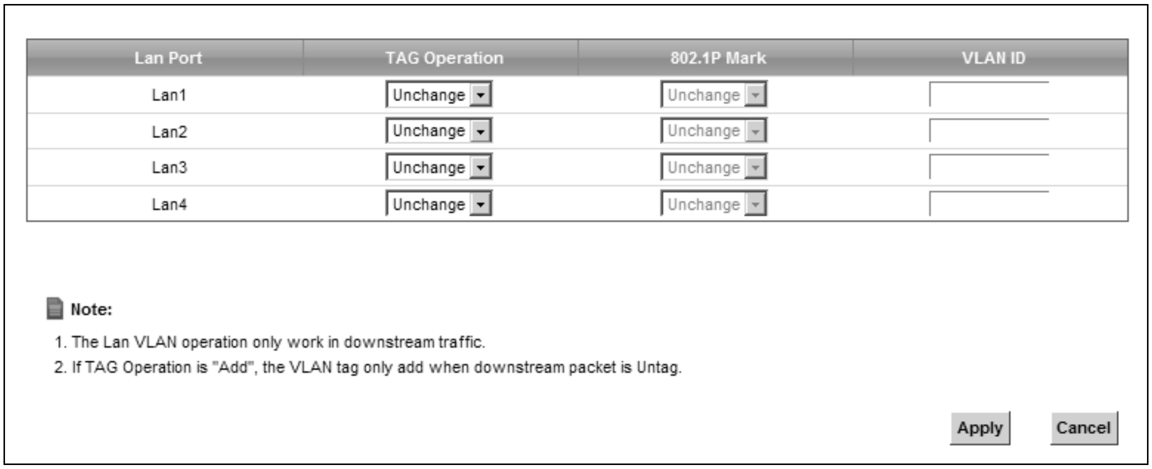
Table 36 Network Settings > Home Networking > 5th Ethernet Port

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

8.10 The LAN VLAN Screen

Click **Network Setting** > **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 59 Network Setting > Home Networking > LAN VLAN



Lan Port	TAG Operation	802.1P Mark	VLAN ID
Lan1	Unchange	Unchange	
Lan2	Unchange	Unchange	
Lan3	Unchange	Unchange	
Lan4	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 labels in this screen.

Table 37 Network Setting > Home Networking > LAN VLAN

LABEL	DESCRIPTION
Lan Port	These represent the Device's LAN ports.
Tag Operation	Select what you want the 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.

Table 37 Network Setting > Home Networking > LAN VLAN (continued)

LABEL	DESCRIPTION
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.
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.
Cancel	Click **Cancel** to exit this screen without saving.

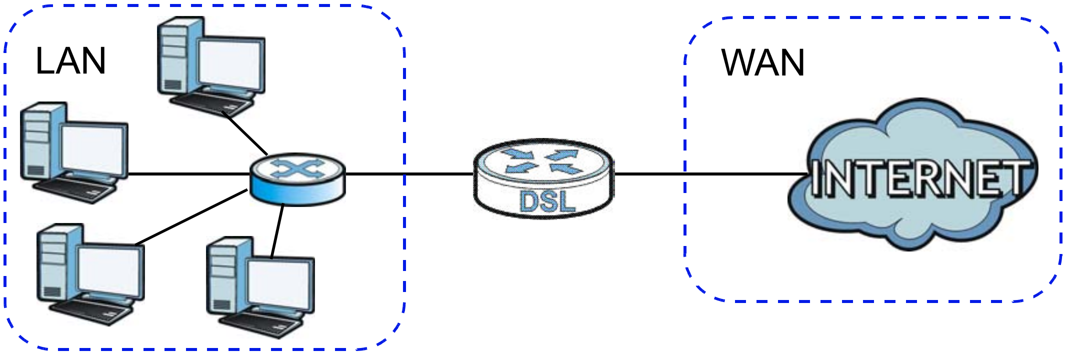
8.11 Technical Reference

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

8.11.1 LANs, WANs and the Device

The actual physical connection determines whether the 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 60 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 Device as a DHCP server or disable it. When configured as a server, the 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 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 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 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 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 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 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 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

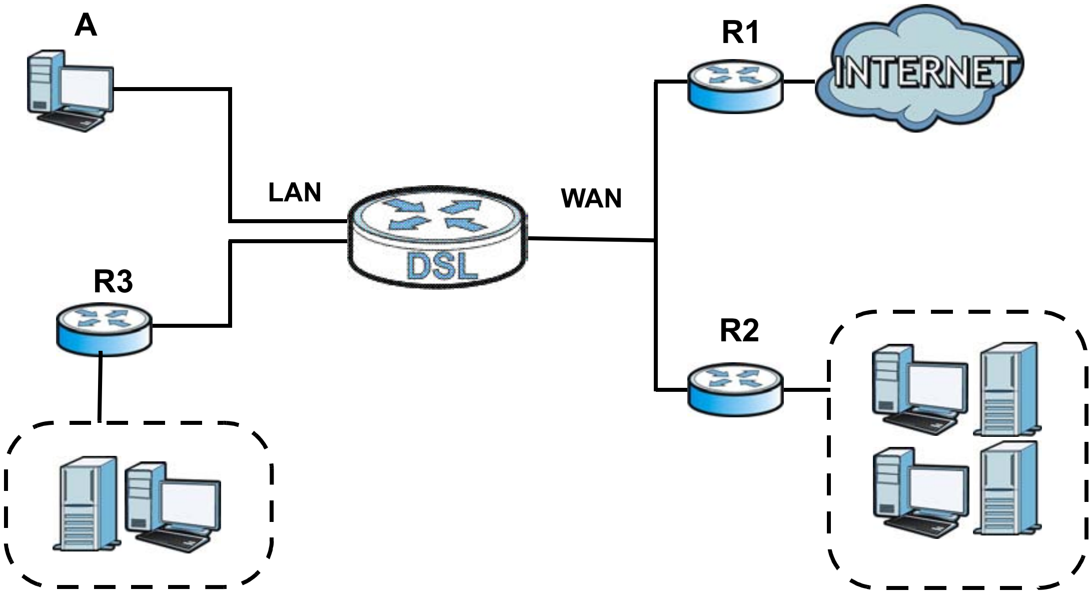
Routing

9.1 Overview

The Device usually uses the default gateway to route outbound traffic from computers on the LAN to the Internet. To have the 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 Device's LAN interface. The Device routes most traffic from **A** to the Internet through the 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 61 Example of Routing Topology



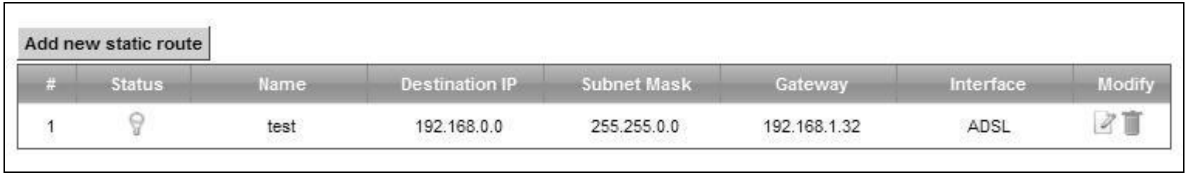
9.1.1 What You Can Do in this Chapter

- Use the **Static Route** screen to view and set up static routes on the Device (Section 9.2 on page 154).
- Use the **Policy Forwarding** screen to configure policy routing on the Device. (Section 9.3 on page 155).
- Use the **RIP** screen to set up RIP settings on the Device. (Section 9.4 on page 157).

9.2 The Routing Screen

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

Figure 62 Network Setting > Routing > Static Route



#	Status	Name	Destination IP	Subnet Mask	Gateway	Interface	Modify
1		test	192.168.0.0	255.255.0.0	192.168.1.32	ADSL	

The following table describes the labels in this screen.

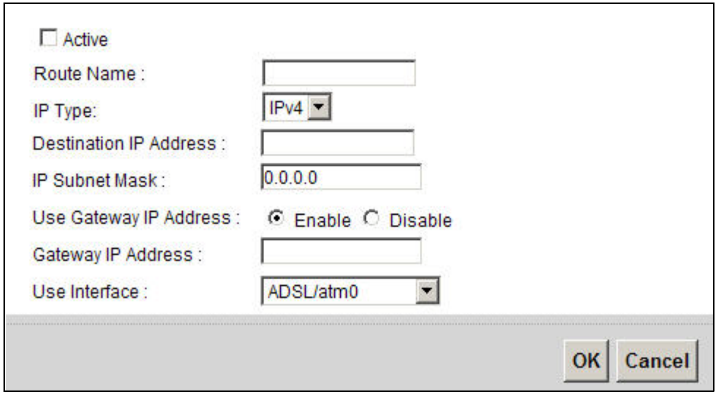
Table 38 Network Setting > Routing > Static Route

LABEL	DESCRIPTION
Add new static route	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.
Interface	This is the WAN interface used for this static route.
Modify	Click the **Edit** icon to edit the static route on the Device. Click the **Delete** icon to remove a static route from the 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** in the **Routing** screen or the **Edit** icon next to the static route you want to edit. The screen shown next appears.

Figure 63 Routing: Add/Edit



□ Active

Route Name :

IP Type: IPv4

Destination IP Address :

IP Subnet Mask : 0.0.0.0

Use Gateway IP Address : ● Enable ○ Disable

Gateway IP Address :

Use Interface : ADSL/atm0

The following table describes the labels in this screen.

Table 39 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.
IP Type	Select whether your IP type is **IPv4** or **IPv6**.
Destination IP Address	Enter the IPv4 or IPv6 network address of the final destination.
IP Subnet Mask	If you are using IPv4 and 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. Enter the IP subnet mask here.
Use Gateway IP Address	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. If you want to use the gateway IP address, select **Enable**.
Gateway IP Address	Enter the IP address of the gateway.
Use Interface	Select the WAN interface you want to use for this static route.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

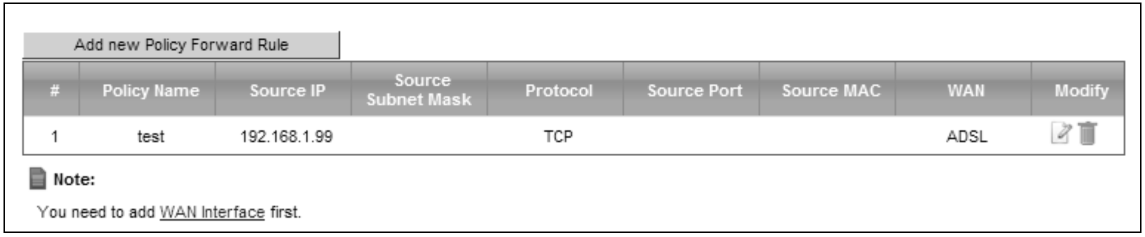
9.3 The Policy Forwarding Screen

Traditionally, routing is based on the destination address only and the Device takes the shortest path to forward a packet. Policy forwarding allows the Device to override the default routing behavior and alter the packet forwarding based on the policy defined by the network administrator. Policy-based routing is applied to outgoing packets, prior to the normal routing.

You can use source-based policy forwarding to direct traffic from different users through different connections or distribute traffic among multiple paths for load sharing.

The **Policy Forwarding** screen let you view and configure routing policies on the Device. Click **Network Setting > Routing > Policy Forwarding** to open the following screen.

Figure 64 Network Setting > Routing > Policy Forwarding



#	Policy Name	Source IP	Source Subnet Mask	Protocol	Source Port	Source MAC	WAN	Modify
1	test	192.168.1.99		TCP			ADSL	✎ 🗑

Note:

You need to add WAN Interface first.

The following table describes the labels in this screen.

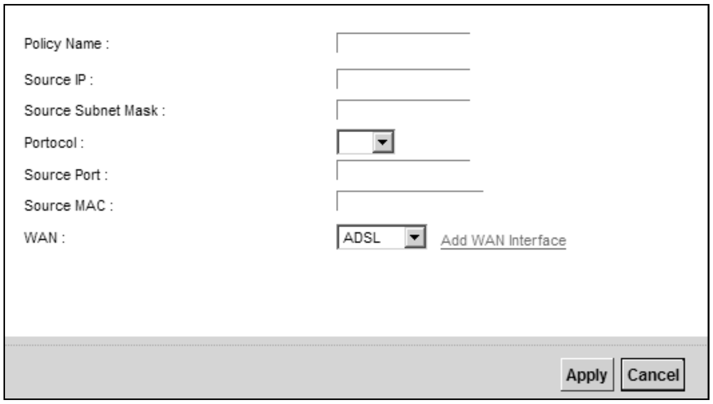
Table 40 Network Setting > Routing >Policy Forwarding

LABEL	DESCRIPTION
Add new Policy Forward Rule	Click this to create a new policy forwarding rule.
#	This is the index number of the entry.
Policy Name	This is the name of the rule.
Source IP	This is the source IP address.
Source Subnet Mask	his is the source subnet mask address.
Protocol	This is the transport layer protocol.
Source Port	This is the source port number.
WAN	This is the WAN interface through which the traffic is routed.
Modify	Click the **Edit** icon to edit this policy. Click the **Delete** icon to remove a policy from the Device. A window displays asking you to confirm that you want to delete the policy.

9.3.1 Add/Edit Policy Forwarding

Click **Add new Policy Forward Rule** in the **Policy Forwarding** screen or click the **Edit** icon next to a policy. Use this screen to configure the required information for a policy route.

Figure 65 Policy Forwarding: Add/Edit



WAN : ADSL

The following table describes the labels in this screen.

Table 41 Policy Forwarding: Add/Edit

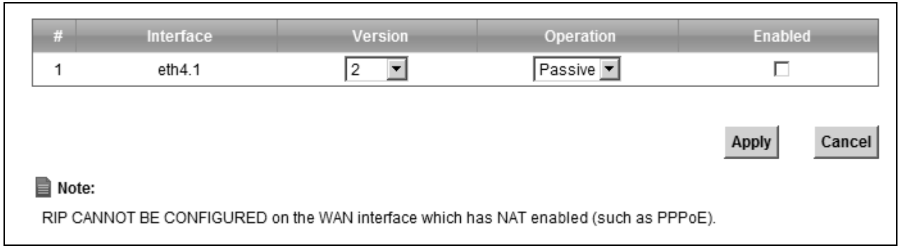
LABEL	DESCRIPTION
Policy Name	Enter a descriptive name of up to 8 printable English keyboard characters, not including spaces.
Source IP	Enter the source IP address.
Source Subnet Mask	Enter the source subnet mask address.
Protocol	Select the transport layer protocol (**TCP** or **UDP**).
Source Port	Enter the source port number.
Source MAC	Enter the source MAC address.
WAN	Select a WAN interface through which the traffic is sent. You must have the WAN interface(s) already configured in the **Broadband** screens.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

9.4 The RIP Screen

Routing Information Protocol (RIP, RFC 1058 and RFC 1389) allows a device to exchange routing information with other routers.

Click **Network Setting > Routing > RIP** to open the **RIP** screen.

Figure 66 RIP



#	Interface	Version	Operation	Enabled
1	eth4.1	2	Passive	□

Note:

RIP CANNOT BE CONFIGURED on the WAN interface which has NAT enabled (such as PPPoE).

The following table describes the labels in this screen.

Table 42 RIP

LABEL	DESCRIPTION
Interface	This is the name of the interface in which the RIP setting is used.
Version	The RIP version controls the format and the broadcasting method of the RIP packets that the Device sends (it recognizes both formats when receiving). RIP version **1** is universally supported but RIP version **2** carries more information. RIP version **1** is probably adequate for most networks, unless you have an unusual network topology.
Operation	Select **Passive** to have the Device update the routing table based on the RIP packets received from neighbors but not advertise its route information to other routers in this interface. Select **Active** to have the Device advertise its route information and also listen for routing updates from neighboring routers.
Enabled	Select the check box to activate the settings.
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 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 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 161).
- The **Queue Setup** screen lets you configure QoS queue assignment (Section 10.4 on page 162).
- The **Class Setup** screen lets you add, edit or delete QoS classifiers (Section 10.5 on page 164).
- The **Policer Setup** screen lets you add, edit or delete QoS policers (Section 10.5 on page 164).
- The **Monitor** screen lets you view the Device's QoS-related packet statistics (Section 10.7 on page 171).

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.

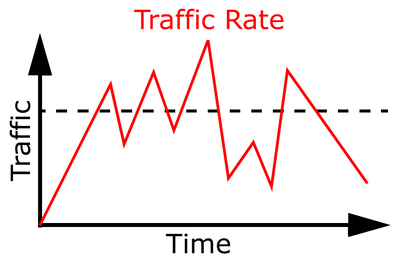
CoS technologies include IEEE 802.1p layer 2 tagging and DiffServ (Differentiated Services or DS). IEEE 802.1p tagging makes use of three bits in the packet header, while DiffServ is a new protocol and defines a new DS field, which replaces the eight-bit ToS (Type of Service) field in the IP header.

Tagging and Marking

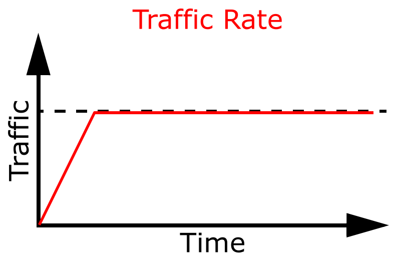
In a QoS class, you can configure whether to add or change the DSCP (DiffServ Code Point) value, IEEE 802.1p priority level and VLAN ID number in a matched packet. When the packet passes through a compatible network, the networking device, such as a backbone switch, can provide specific treatment or 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 Device uses the Token Bucket algorithm to allow a certain amount of large bursts while keeping a limit at the average rate.



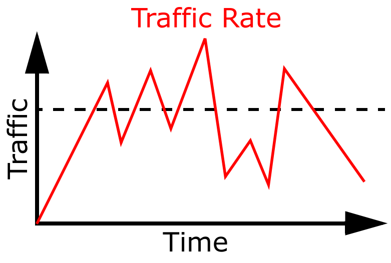
(Before Traffic Shaping)



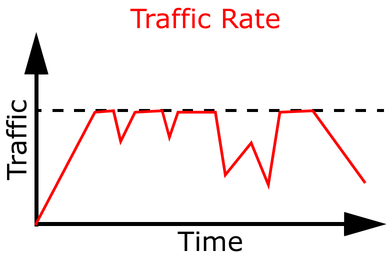
(After Traffic Shaping)

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)

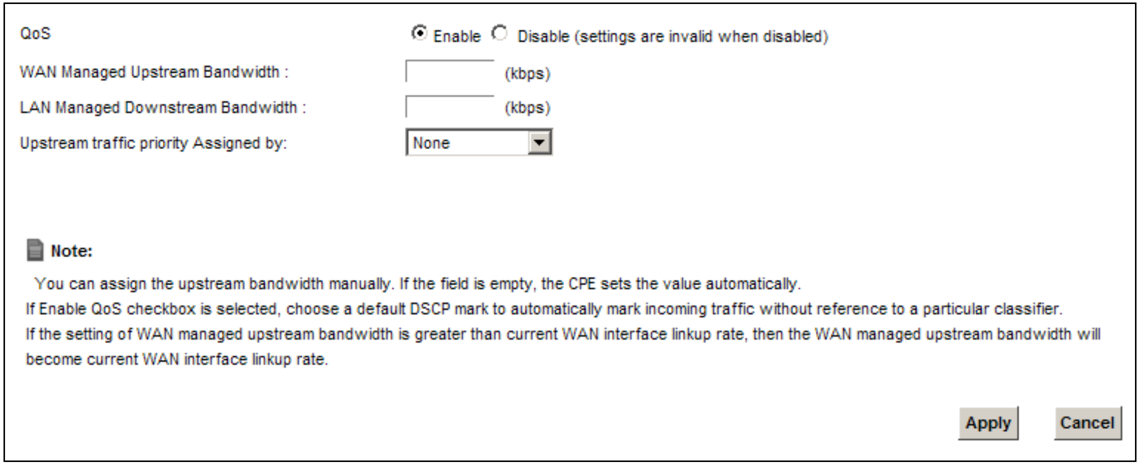
The Device supports three incoming traffic metering algorithms: Token Bucket Filter (TBF), Single Rate Two Color Maker (srTCM), and Two Rate Two Color Marker (trTCM). You can specify actions which are performed on the colored packets. See Section 10.8 on page 172 for more information on each metering algorithm.

10.3 The Quality of Service General Screen

Click **Network Setting > 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 159 for more information.

Figure 67 Network Settings > QoS > General



QoS ● Enable ○ Disable (settings are invalid when disabled)

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 Enable QoS checkbox is selected, choose a default DSCP mark to automatically mark incoming traffic without reference to a particular classifier.

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 43 Network Setting > QoS > General

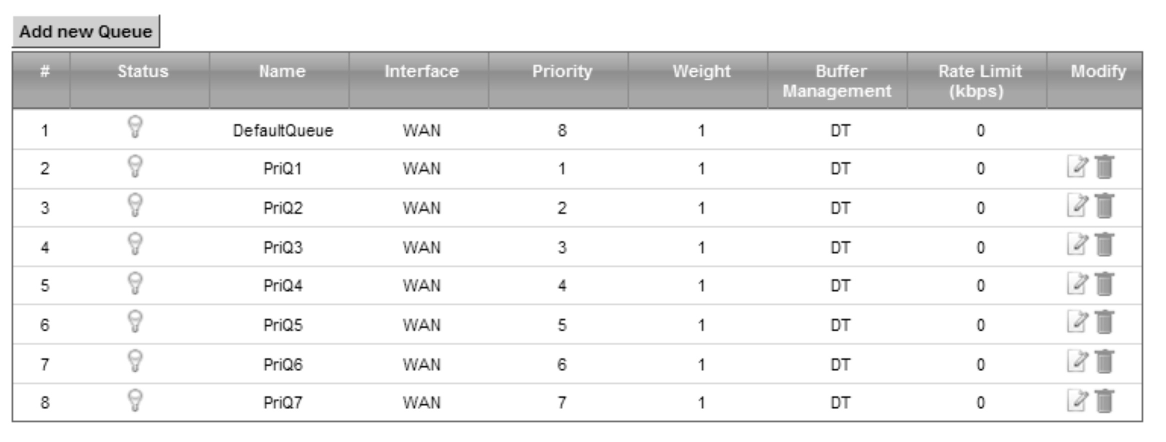
LABEL	DESCRIPTION
QoS	Select the **Enable** check box to turn on QoS to improve your network performance.
WAN Managed Upstream Bandwidth	Enter the amount of upstream bandwidth for the WAN interfaces that you want to allocate using QoS. The recommendation is to set this speed to match the interfaces' 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 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 Device to not use some of the interfaces' available bandwidth. If you leave this field blank, the 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 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 Device to not use some of the interfaces' available bandwidth. If you leave this field blank, the Device automatically sets this to the LAN interfaces' maximum supported connection speed.
Upstream traffic priority Assigned by	Select how the Device assigns priorities to various upstream traffic flows. • **None:** Disables auto priority mapping and has the 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 Setting > QoS > Queue Setup** to open the screen as shown next.

Use this screen to configure QoS queue assignment.

Figure 68 Network Setting > QoS > Queue Setup



Add new 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	✎ 🗑

The following table describes the labels in this screen.

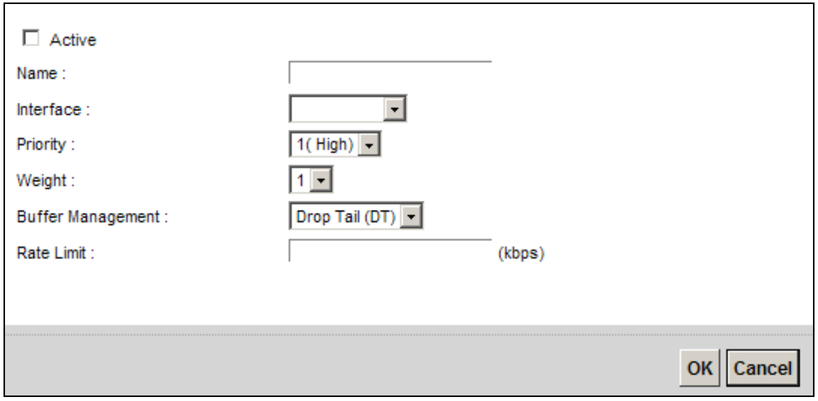
Table 44 Network Setting > QoS > Queue Setup

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 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 Device should handle packets when it receives too many (network congestion).
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 69 Queue Setup: Add



□ Active	
Name :	
Interface :	
Priority :	1(High)
Weight :	1
Buffer Management :	Drop Tail (DT)
Rate Limit :	(kbps)

The following table describes the labels in this screen.

Table 45 Queue Setup: Add

LABEL	DESCRIPTION
Active	Select to enable or disable this queue.
Name	Enter the descriptive name of this queue.
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 7) 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 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 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.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

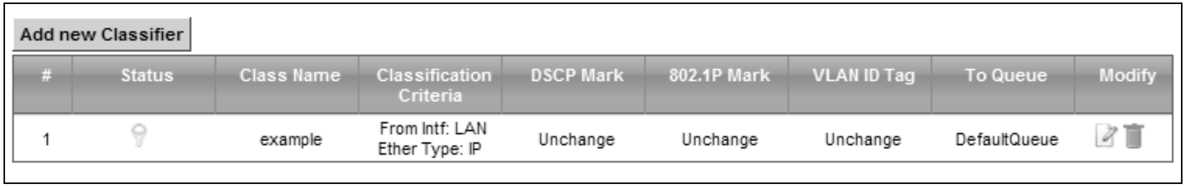
10.5 The Class Setup Screen

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 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 Setting > QoS > Class Setup** to open the following screen.

Figure 70 Network Setting > QoS > Class Setup



#	Status	Class Name	Classification Criteria	DSCP Mark	802.1P Mark	VLAN ID Tag	To Queue	Modify
1		example	From Intf: LAN Ether Type: IP	Unchange	Unchange	Unchange	DefaultQueue	

The following table describes the labels in this screen.

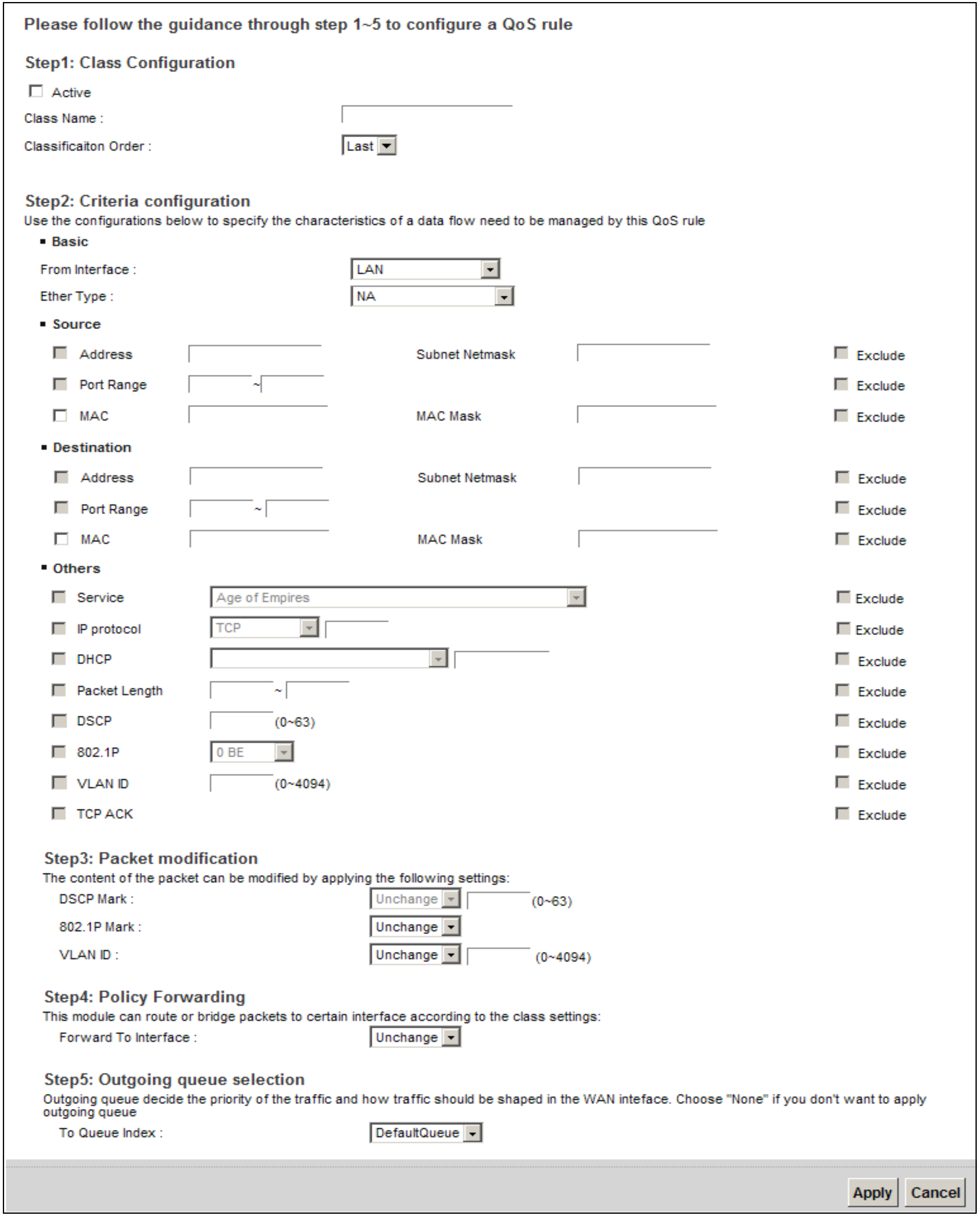
Table 46 Network Setting > QoS > Class Setup

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.
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 71 Class Setup: Add/Edit



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

Step1: Class Configuration

□ Active

Class Name :

Classificaiton Order : Last

Step2: Criteria configuration

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

- Basic

From Interface : LAN

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 — □ Exclude

□ Packet Length ~ — □ Exclude

□ DSCP (0~63) — □ Exclude

□ 802.1P — 0 BE — □ Exclude

□ VLAN ID (0~4094) — □ 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 (0~4094)

Step4: Policy Forwarding

This module can route or bridge packets to certain interface according to the class settings:

Forward To Interface : Unchange

Step5: Outgoing queue selection

Outgoing queue decide the priority of the traffic and how traffic should be shaped in the WAN inteface. Choose "None" if you don't want to apply outgoing queue

To Queue Index : DefaultQueue

The following table describes the labels in this screen.

Table 47 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.
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.
Exclude	Select this option to exclude the packets that match the specified criteria from this classifier.
Others	

Table 47 Class Setup: Add/Edit (continued)

LABEL	DESCRIPTION
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 Device replaces the DSCP field in the packets. If you select **Unchange**, the Device keep the DSCP field in the packets.
802.1P Mark	Select a priority level with which the Device replaces the IEEE 802.1p priority field in the packets. If you select **Unchange**, the Device keep the 802.1p priority field in the packets.
VLAN ID	If you select **Remark**, enter a VLAN ID number with which the Device replaces the VLAN ID of the frames. If you select **Remove**, the Device deletes the VLAN ID of the frames before forwarding them out. If you select **Add**, the Device treat all matched traffic untagged and add a second VLAN ID. If you select **Unchange**, the Device keep the VLAN ID in the packets.
Forward to Interface	Select a WAN interface through which traffic of this class will be forwarded out. If you select **Unchange**, the Device forward traffic of this class according to the default routing table.

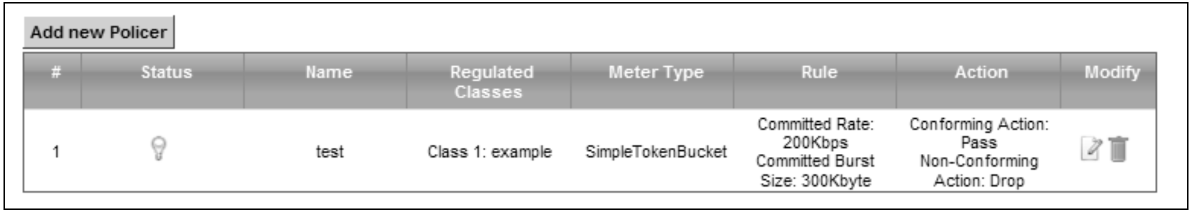
Table 47 Class Setup: Add/Edit (continued)

LABEL	DESCRIPTION
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 Setting > QoS > Policer Setup**. The screen appears as shown.

Figure 72 Network Setting > QoS > Policer Setup



#	Status	Name	Regulated Classes	Meter Type	Rule	Action	Modify
1	💡	test	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.

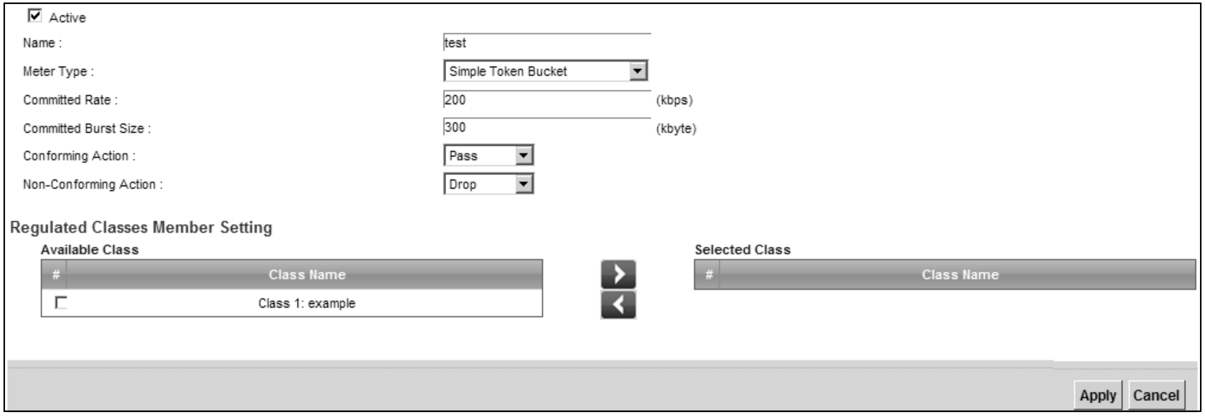
Table 48 Network Setting > QoS > Policer Setup

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

Figure 73 Policer Setup: Add/Edit



☑ Active

Name :	test	
Meter Type :	Simple Token Bucket	
Committed Rate :	200	(kbps)
Committed Burst Size :	300	(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 49 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	This shows the traffic metering algorithm used in this policer. The **Simple Token Bucket** algorithm uses tokens in a bucket to control when traffic can be transmitted. Each token represents one byte. The algorithm allows bursts of up to *b* bytes which is also the bucket size. The **Single Rate Three Color Marker** (srTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR), the Committed Burst Size (CBS) and the Excess Burst Size (EBS). The **Two Rate Three Color Marker** (trTCM) is based on the token bucket filter and identifies packets by comparing them to the Committed Information Rate (CIR) and the Peak Information Rate (PIR).
Committed Rate	Specify the committed rate. When the incoming traffic rate of the member QoS classes is less than the committed rate, the device applies the conforming action to the traffic.
Committed Burst Size	Specify the committed burst size for packet bursts. This must be equal to or less than the peak burst size (two rate three color) or excess burst size (single rate three color) if it is also configured. This is the maximum size of the (first) token bucket in a traffic metering algorithm.
Conforming Action	Specify what the 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 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.

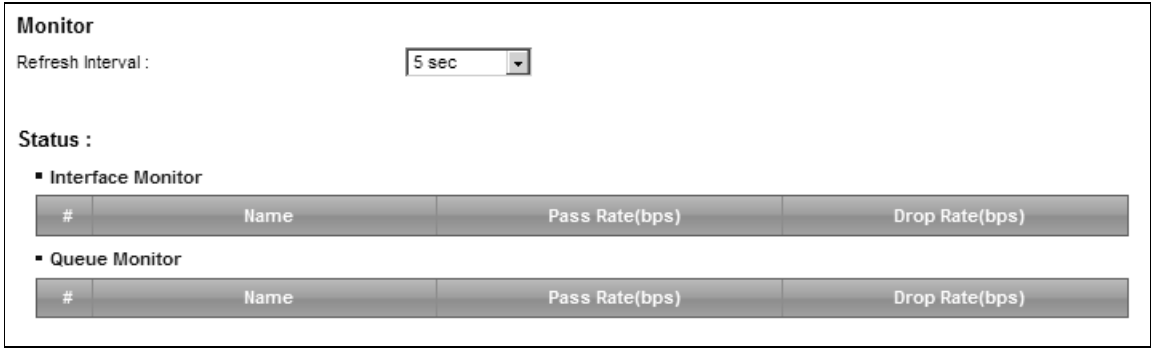
Table 49 Policer Setup: Add/Edit

LABEL	DESCRIPTION
Available Class Selected Class	Select a QoS classifier to apply this QoS policer to traffic that matches the QoS classifier. Highlight a QoS classifier in the **Available Class** box and use the **>** button to move it to the **Selected Class** box. To remove a QoS classifier from the **Selected Class** box, select it and use the **<** button.
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 Device's QoS packet statistics, click **Network Setting > QoS > Monitor**. The screen appears as shown.

Figure 74 Network Setting > QoS > Monitor



Monitor

Refresh Interval : 5 sec

Status :

- Interface Monitor

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

- Queue Monitor

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

The following table describes the labels in this screen.

Table 50 Network Setting > QoS > Monitor

LABEL	DESCRIPTION
Refresh Interval	Enter how often you want the Device to update this screen. Select **No Refresh** to stop refreshing statistics.
Interface Monitor	
#	This is the index number of the entry.
Name	This shows the name of the interface on the 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 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 51 IEEE 802.1p Priority Level and Traffic Type

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

DiffServ

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

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

DSCP and Per-Hop Behavior

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

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

DSCP (6 bits)	Unused (2 bits)

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

IP Precedence

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

Automatic Priority Queue Assignment

If you enable QoS on the Device, the 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 Device. On the Device, traffic assigned to higher priority queues gets through faster while traffic in lower index queues is dropped if the network is congested.

Table 52 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

Table 52 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)
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 Device stops transmitting until enough tokens are generated.
- If not enough tokens are available, the 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 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 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 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.

Network Address Translation (NAT)

11.1 Overview

This chapter discusses how to configure NAT on the 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 178).
- Use the **Applications** screen to forward incoming service requests to the server(s) on your local network (Section 11.3 on page 181).
- Use the **Port Triggering** screen to add and configure the Device's trigger port settings (Section 11.4 on page 182).
- Use the **DMZ** screen to configure a default server (Section 11.5 on page 185).
- Use the **ALG** screen to enable and disable the NAT and SIP (VoIP) ALG in the Device (Section 11.6 on page 186).
- Use the **Address Mapping** screen to configure the Device's address mapping settings (Section 11.7 on page 186).

11.1.2 What You Need To Know

Inside/Outside

Inside/outside denotes where a host is located relative to the 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 188 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.

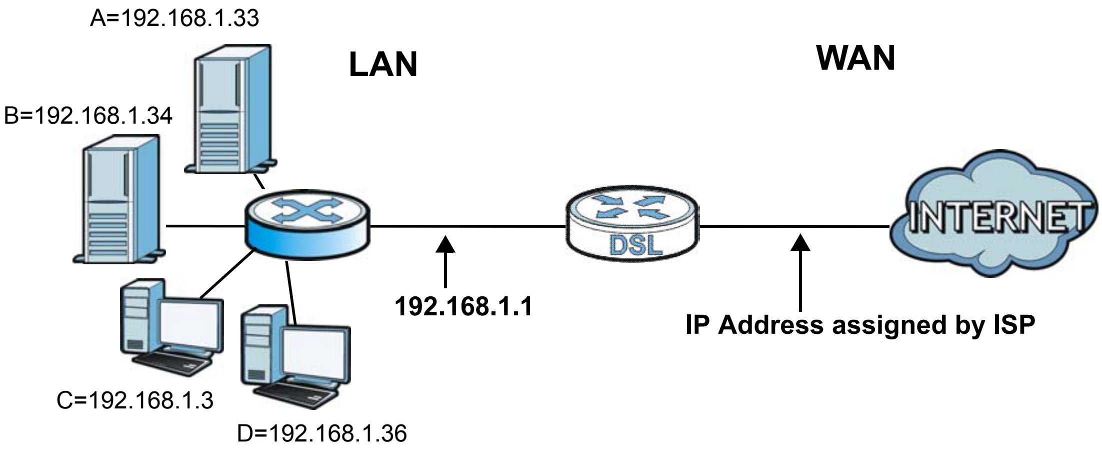
The most often used port numbers and services are shown in Appendix F on page 349. Please refer to RFC 1700 for further information about port numbers.

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.

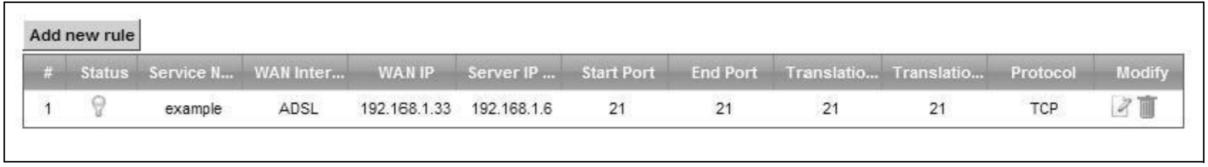
Figure 75 Multiple Servers Behind NAT Example



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

See Appendix F on page 349 for port numbers commonly used for particular services.

Figure 76 Network Setting > NAT > Port Forwarding



#	Status	Service N...	WAN Inter...	WAN IP	Server IP ...	Start Port	End Port	Translatio...	Translatio...	Protocol	Modify
1	💡	example	ADSL	192.168.1.33	192.168.1.6	21	21	21	21	TCP	

The following table describes the fields in this screen.

Table 53 Network Setting > NAT > Port Forwarding

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

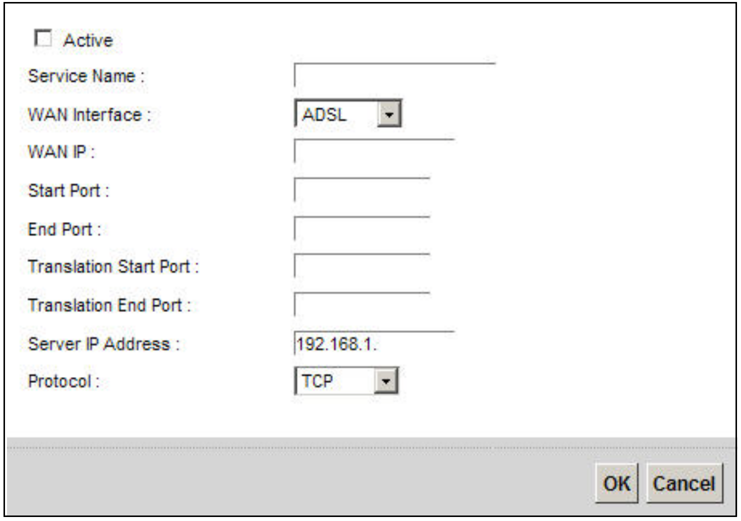
Table 53 Network Setting > NAT > Port Forwarding (continued)

LABEL	DESCRIPTION
Protocol	This shows the IP protocol supported by this virtual server, whether it is **TCP**, **UDP**, or **TCP/ UDP**.
Modify	Click the **Edit** icon to edit this rule. Click the **Delete** icon to delete an existing rule.

11.2.1 Add/Edit Port Forwarding

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

Figure 77 Port Forwarding: Add/Edit



☐ Active

Service Name :	
WAN Interface :	ADSL
WAN IP :	
Start Port :	
End Port :	
Translation Start Port :	
Translation End Port :	
Server IP Address :	192.168.1.
Protocol :	TCP

The following table describes the labels in this screen.

Table 54 Port Forwarding: Add/Edit

LABEL	DESCRIPTION
Active	Clear the checkbox to disable the rule. Select the check box to enable it.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on).
WAN Interface	Select the WAN interface through which the service is forwarded. You must have already configured a WAN connection with NAT enabled.
WAN IP	Enter the WAN IP address for which the incoming service is destined. If the packet's destination IP address doesn't match the one specified here, the port forwarding rule will not be applied.
Start Port	Enter the original destination port for the packets. To forward only one port, enter the port number again in the **End Port** field. To forward a series of ports, enter the start port number here and the end port number in the **End Port** field.