
PART I

User's Guide

CHAPTER 1

Introducing the Zyxel Device

1.1 Overview

The AX7501-B0 is an AON (Active Optical Network) or a PON (Passive Optical Network) router. They provide fast Internet access. They both have one 10 Gbps Multi-Gigabit Ethernet LAN port and four 1000 Mbps Ethernet LAN ports. They also support WiFi6 that is most suitable in areas with a high concentration of users. You can schedule WiFi usage using Parental Control. See [Section 7.1.2 on page 115](#) for more information on WiFi6.

The Zyxel Device also has one USB port that can be configured as a backup WAN port in case the Cellular/Fiber connection has a problem as well as for file sharing and as a media server. It has two phone ports to make Internet (VoIP) phone calls.

The following table describes the feature differences of the Zyxel Device by model.

Table 1 Zyxel Device Comparison Table

	AX7501-B0
WiFi6 Wireless Standard	Yes
2.4G WLAN	Yes
5G WLAN	Yes
2.5 Gbe WAN	No
SFP+ (Small Form-factor Pluggable) for AON	Yes
Subscriber Connector (SC) for PON	No
2.5 Gbe LAN	No
10 Gbe LAN	Yes
USB 3.0 Port for Cellular Backup, File Sharing and Media Server	Yes
DSL Port	No
Wall Mount	Yes

1.1.1 Multi-Gigabit Ethernet

A 10 Gigabit Ethernet port supports speeds of 10 Gbps if the connected device supports 10 Gbps and a Cat 6a (up to 100 m) or Cat 6 cable (up to 50 m) is used.

Some network devices such as gaming computers, servers, network attached storage (NAS) devices, or access points may have network cards that are capable of 2.5 Gbps or 5 Gbps connectivity.

If these devices are connected to a 1 Gbps or 10 Gbps Ethernet port, they can only transmit or receive up to 1 Gbps as speeds of 2.5 Gbps / 10 Gbps cannot be attained. Moreover, if network devices with 2.5 Gbps / 10 Gbps network cards are connected to a 2.5 Gbps / 10 Gbps Ethernet port, you must use Cat 5e / Cat 6A or better Ethernet cables to achieve 2.5 Gbps / 10 Gbps speeds. Most buildings, at the time of writing, use Cat 5e or Cat 6 Ethernet cables.

Multi-Gigabit Ethernet ports automatically allow connections up to the speed of the connected network device, (1 Gbps, 2.5 Gbps or 5 Gbps), and you just need to use a Cat 5, Cat 5e or Cat 6 Ethernet cable.

See the following table for the cables required and distance limitation to attain the corresponding speed.

Table 2 Ethernet Cable Types

CABLE	TRANSMISSION SPEED	MAXIMUM DISTANCE	BANDWIDTH CAPACITY
Category 5	100 Mbps	100 m	100 MHz
Category 5e	1 Gbps / 2.5 Gbps / 5 Gbps	100 m	100 MHz
Category 6	5 Gbps / 10 Gbps	50 m	250 MHz
Category 6a	10 Gbps	100 m	500 MHz
Category 7	10 Gbps	100 m	650 MHz

1.2 Example Applications

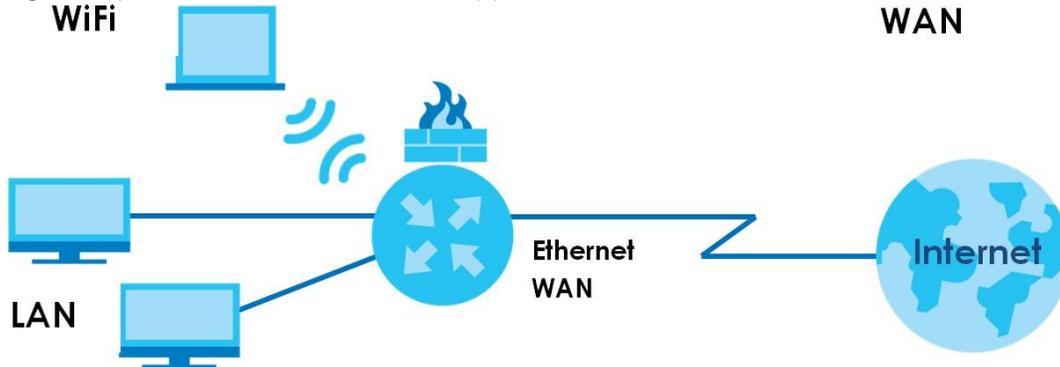
This section shows a few examples of using the Zyxel Device in various network environments. Note that the Zyxel Device in the figure is just an example Zyxel Device and not your actual Zyxel Device.

1.2.1 Internet Access

While the AX7501-B0 provides shared Internet access by connecting a fiber optic cable provided by the ISP to the PON port. It supports OMCI (ONU Management and Control Interface) to connect to the ISP's OLT (Optical Line Terminal).

Computers can connect to the Zyxel Device's LAN ports (or wirelessly) and access the Internet simultaneously.

Figure 1 Zyxel Device's Internet Access Application



You can also configure Firewall on the Zyxel Device for secure Internet access. When the Firewall 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.

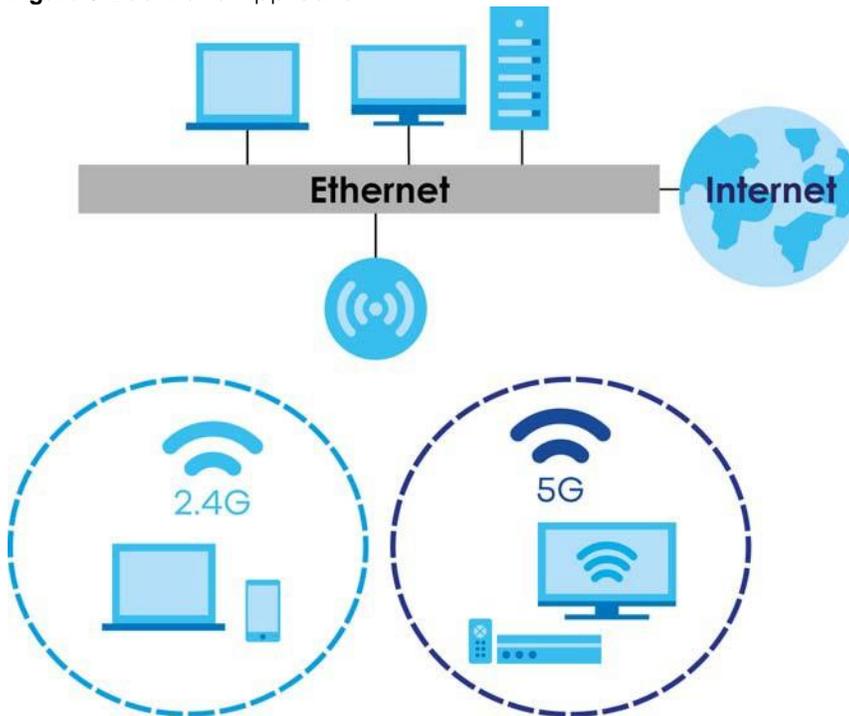
1.2.2 Dual-Band WiFi

By default, WiFi is enabled on the Zyxel Device. IEEE 802.11 a/b/g/n/ac/ax compliant clients can wirelessly connect to the Zyxel Device to access network resources.

The Zyxel Device is a dual-band gateway that can use both 2.4G and 5G networks at the same time. You could use the 2.4 GHz band for regular Internet surfing and downloading while using the 5 GHz

band for time sensitive traffic like high-definition video, music, and gaming.

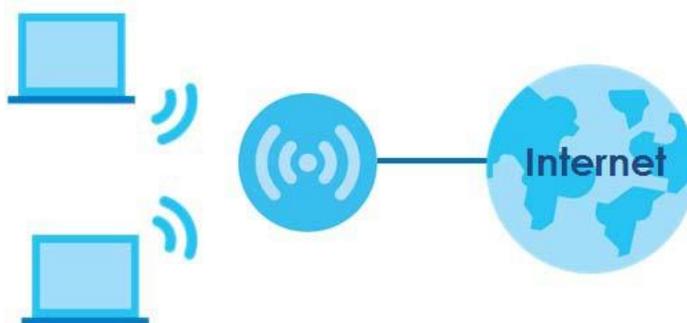
Figure 3 Dual-Band Application



The Zyxel Device is a wireless Access Point (AP) for IEEE 802.11b/g/n/a/ac/ax wireless clients, such as notebook computers, iPads, smartphones, and so on. It allows them to connect to the Internet without having to rely on inconvenient Ethernet cables.

Your Zyxel Device supports WiFi Protected Setup (WPS), which allows you to quickly set up a wireless network with strong security.

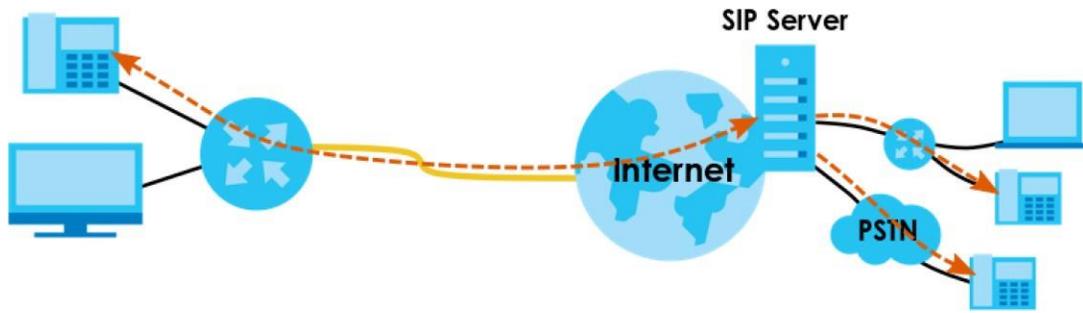
Figure 4 Wireless Access Example



1.2.3 VoIP Applications

The Zyxel Device's VoIP function allows you to register up to 2 SIP (Session Initiation Protocol) accounts and use the Zyxel Device to make and receive VoIP telephone calls. The Zyxel Device sends your call to a VoIP service provider's SIP server which forwards the calls to either VoIP or PSTN phones.

Figure 5 VoIP Application



1.3 Ways to Manage the Zyxel Device

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

- Web Configurator. This is recommended for management of the Zyxel Device using a (supported) web browser.

1.4 Good Habits for Managing the Zyxel Device

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

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

1.5 Hardware

This section describes the front and rear panels for each model. If your model is not shown here, refer to the Zyxel Device's Quick Start Guides to see the product drawings and how to make the hardware connections.

1.5.1 Top/ Front Panel

The LED indicators are located on the top or front panel.

Figure 6 LED Indicators AX7501-B0



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

Table 3 LED Descriptions

LED	COLOR	STATUS	DESCRIPTION
POWER	Green	On	The Zyxel Device is receiving power and ready for use.
		Blinking	The Zyxel Device is self-testing.
	Red	On	The Zyxel Device detected an error while self-testing, or there is a device malfunction.
		Blinking	The Zyxel Device is upgrading firmware.
		Off	The Zyxel Device is not receiving power.
FIBER	Green	On	The FIBER port is connected to the ISP's ONT and the Zyxel Device is receiving optical signals normally.
		Blinking	The Zyxel Device's FIBER port is trying to build a PON connection.
	Red	On	The optical power received (the strength of optical signals transmitted on the remote optical module) is too low.
		Off	The connection to the ISP's ONT is down.
INTERNET	Green	On	The Zyxel Device has an IP connection but no traffic. Your device has a WAN IP address (either static or assigned by a DHCP server), PPP negotiation was successfully completed (if used).
		Blinking	The Zyxel Device is sending or receiving IP traffic.
		Off	There is no Internet connection or the gateway is in Bridge mode.
	Red	On	The Zyxel Device attempted to make an IP connection but failed. Possible causes are no response from a DHCP server, no PPPoE response, PPPoE authentication failed.
10G LAN	Green	On	The Zyxel Device has a successful 10/100/10000 Mbps Ethernet connection with a device on the Local Area Network (LAN) via the 10G LAN port.
		Blinking	The Zyxel Device is sending or receiving data to/from the LAN at 10/100/10000 Mbps via the 10G LAN port.
		Off	The Zyxel Device does not have an Ethernet connection with the LAN via the 10G LAN port.
LAN1~4	Green	On	The Zyxel Device has a successful 10/100 Mbps Ethernet connection with a device on the Local Area Network (LAN) via the LAN1~4 ports.
		Blinking	The Zyxel Device is sending or receiving data to/from the LAN at 10/100 Mbps via the LAN1~4 ports.
		Off	The Zyxel Device does not have an Ethernet connection with the LAN via the LAN1~4 ports.

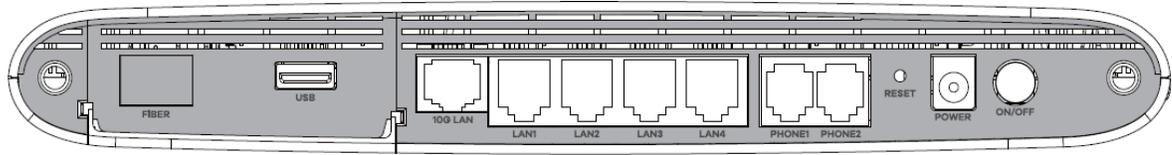
Table 3 LED Descriptions (continued)

LED	COLOR	STATUS	DESCRIPTION
WiFi 2.4G	Green	On	The 2.4G wireless network is activated.
		Blinking	The Zyxel Device is communicating with 2.4G wireless clients.
		Off	The 2.4G wireless network is not activated.
	Amber	Blinking	The Zyxel Device is setting up a WPS connection with a 2.4G wireless client.
WiFi 5Gi	Green	On	The 5G wireless network is activated.
		Blinking	The Zyxel Device is communicating with 5G wireless clients.
		Off	The 5G wireless network is not activated.
	Amber	Blinking	The Zyxel Device is setting up a WPS connection with a 5G wireless client.
PHONE	Green	On	A SIP account is registered for the phone port.
		Blinking	The telephone connected to this phone port has an incoming call or is off the hook.
		Off	The phone port does not have a SIP account registered.
	Amber	On	A SIP account is registered for the phone port, and there is a voice message in the corresponding SIP account.
		Blinking	The telephone connected to this phone port has an incoming call or is off the hook. There is a voice message in the corresponding SIP account.
USB	Green	On	The Zyxel Device recognizes a USB connection through the USB port.
		Blinking	The Zyxel Device is sending/receiving data to/from the USB device connected to it.
		Off	The Zyxel Device does not detect a USB connection through the USB port.

1.5.2 Bottom/ Back Panel

The connection ports are located on the bottom or back panel.

Figure 10 AX7501-B0 Bottom Panel



The following table describes the items on the bottom and side panels of EX5501, AX7501 and PX7501.

Table 5 Panel Ports and Buttons

LABEL	DESCRIPTION
2.5G WAN	Connect an Ethernet cable to the Ethernet WAN port for Internet access.
FIBER	For AX7501-B0 Insert a compatible SFP+ transceiver to the FIBER port and connect the fiber optic cable for Internet access.
USB	The USB port is used for cellular WAN backup, file-sharing, and media server.
LAN1 ~ LAN4 2.5G LAN 10G LAN	Connect computers or other Ethernet devices to Ethernet ports for Internet access.
PHONE1/2	Connect analog phones to the PHONE ports to make phone calls.
RESET	Press the button to return the Zyxel Device to the factory defaults.
POWER	Connect the power adapter and press the ON/OFF button to start the device.
WPS	Press the WPS button for more than 5 second AX7501-B0 to quickly set up a secure wireless connection between the device and a WPS-compatible client. Press more than 10 seconds to pair Sunrise STB.
WLAN	Press the WLAN button for more than 2 seconds to enable the wireless function.

Transceiver Installation

Use the following steps to install an SFP transceiver.

- 1 Locate the transmit (Tx) and the receive (Rx) markings on the SFP+ module to identify the top.
- 2 Insert the transceiver into the slot.
- 3 Press the transceiver firmly until it clicks into place.

- 4 The Zyxel Device automatically detects the installed transceiver. Check the LEDs to verify that it is functioning properly.
- 5 Close the transceiver's latch (the latch styles vary).
- 6 Connect the fiber optic cables to the transceiver.

Transceiver Removal

Use the following steps to remove an SFP transceiver.

- 1 Disconnect the fiber optic cables from the transceiver.
- 2 Open the transceiver's latch (the latch styles vary).
- 3 Pull the transceiver out of the slot.

1.5.3 WPS Button

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

To activate WPS:

- 1 Make sure the **POWER** LED is on and not blinking.
- 2 Press the **WPS** button for 5 seconds and release it.
- 3 Press the WPS button on another WPS-enabled device within range of the Zyxel Device within 120 seconds. The **WIFI 2.4G / WIFI 5G** LED flashes amber while the Zyxel Device sets up a WPS connection with the other wireless device.
- 4 Once the connection is successfully made, the **WIFI 2.4G / WIFI 5G** LED will light green.

1.5.4 RESET Button

If you forget your password or cannot access the Web Configurator, you will need to use the **RESET** button to reload the factory-default configuration file. This means that you will lose all configurations that you had previously. The password will be reset to the factory default (see the device label), and the LAN IP address will be "192.168.1.1".

- 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 more than 5 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.

CHAPTER 2

The Web Configurator

2.1 Overview

The Web Configurator is an HTML-based management interface that allows easy system setup and management via Internet browser. Use a browser that supports HTML5, such Internet Explorer 11, Mozilla Firefox, or Google Chrome. The recommended screen resolution is 1024 by 768 pixels.

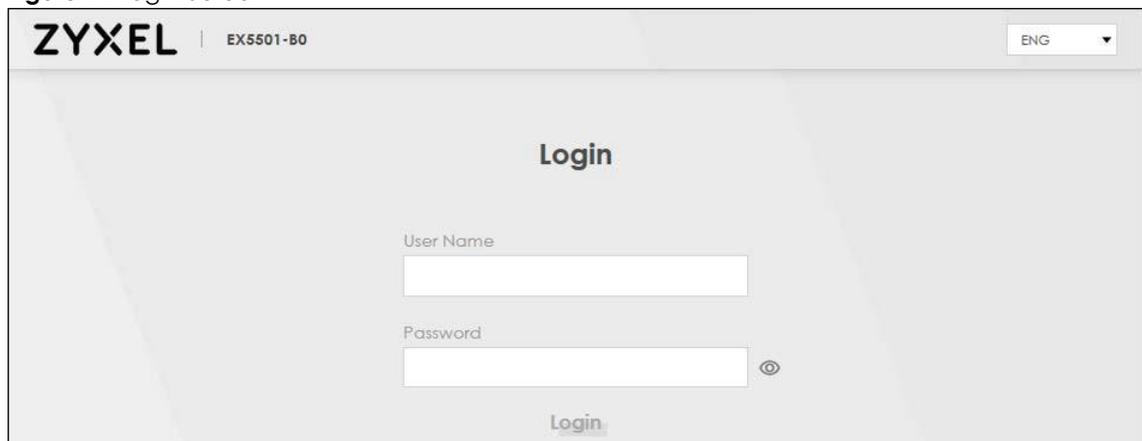
In order to use the Web Configurator you need to allow:

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

2.1.1 Accessing the Web Configurator

- 1 Make sure your Zyxel Device hardware is properly connected (refer to the Quick Start Guide).
- 2 Make sure your computer has an IP address in the same subnet as the Zyxel Device. Your computer should have an IP address from 192.168.1.2 to 192.168.1.254. See [Section 43.6 on page 364](#) for details.
- 3 Launch your web browser. If the Zyxel Device does not automatically re-direct you to the login screen, go to <http://192.168.1.1>.
- 4 A login screen displays. Select the language you prefer.
- 5 To access the administrative Web Configurator and manage the Zyxel Device, type the default username **admin** and the randomly assigned default password (see the device label) in the login screen and click **Login**. If you have changed the password, enter your password and click **Login**.

Figure 14 Login Screen

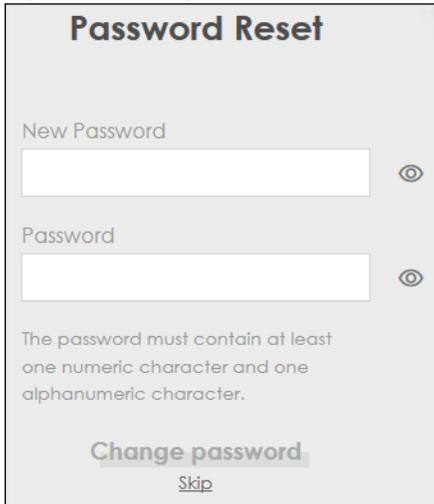


The screenshot shows the Zyxel Web Configurator login interface. At the top left, the Zyxel logo and model number 'EX5501-B0' are displayed. At the top right, there is a language selection dropdown menu currently set to 'ENG'. The central part of the page features a 'Login' heading. Below this heading are two text input fields: the first is labeled 'User Name' and the second is labeled 'Password'. To the right of the password field is a small eye icon for toggling password visibility. At the bottom center of the form area is a 'Login' button.

Note: The default allowable times that you can enter the **Password** is 3. If you entered the wrong password for the fourth time, by default the Web Configurator will lock itself for 5 minutes before you can try entering the correct **Password** again. You can change these settings in **Maintenance > User Account > Add New / Edit Account** (see [Section 34.2.1 on page 326](#)).

- 6 The following screen displays when you log into the Web Configurator for the first time. Enter a new password, retype it to confirm, and click **Change password**. If you prefer to use the default password, click **Skip**.

Figure 15 Change Password Screen



Password Reset

New Password 

Password 

The password must contain at least one numeric character and one alphanumeric character.

Change password

[Skip](#)

- 7 The **Wizard** screen displays when you log into the Web Configurator for the first time. Use the **Wizard** screens to configure the Zyxel Device's time zone, basic Internet access, and wireless settings. See [Chapter 3 on page 39](#) for more information about the **Wizard** screens.
- 8 The **Connection Status** page appears. Use this screen to configure basic Internet access, wireless settings, and parental control settings (see [Section 5.1 on page 66](#) for details).

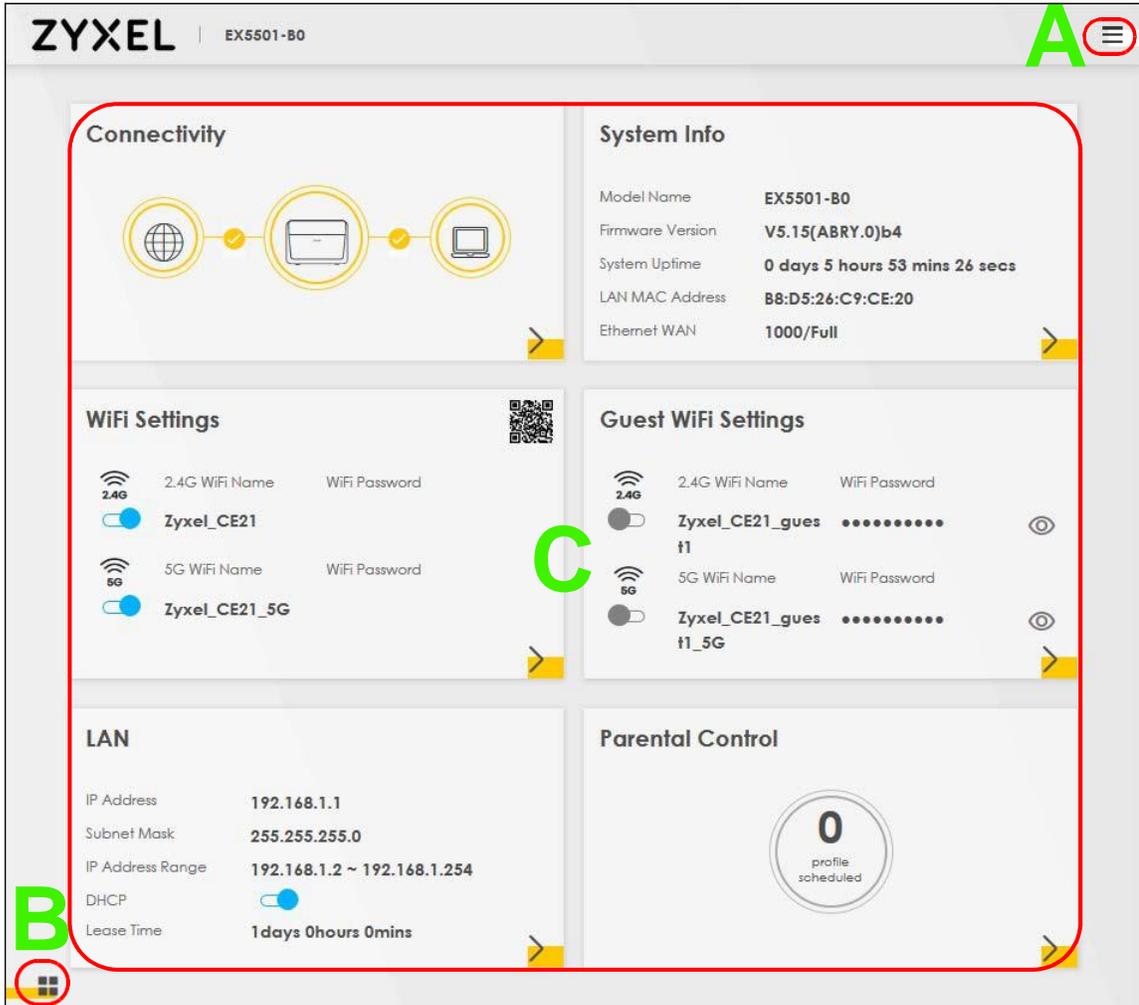
Figure 16 Connection Status

The screenshot displays the 'Connection Status' page of a web configurator, organized into six main sections:

- Connectivity:** Shows a network diagram with a globe, a laptop, and a tablet, all connected via yellow checkmarks. A yellow arrow points to the right.
- System Info:** Lists system details:
 - Model Name: **EX5501-B0**
 - Firmware Version: **V5.15(ABRY.0)b4**
 - System Uptime: **0 days 5 hours 50 mins 18 secs**
 - LAN MAC Address: **B8:D5:26:C9:CE:20**
 - Ethernet WAN: **1000/Full**
 A yellow arrow points to the right.
- WiFi Settings:** Includes a QR code and two WiFi profiles:
 - 2.4G WiFi:** Name: **ZyxeI_CE21**, Password: **WiFi Password**. The toggle is turned on.
 - 5G WiFi:** Name: **ZyxeI_CE21_5G**, Password: **WiFi Password**. The toggle is turned on.
 A yellow arrow points to the right.
- Guest WiFi Settings:** Shows two guest WiFi profiles:
 - 2.4G:** Name: **ZyxeI_CE21_gues t1**, Password: **WiFi Password**. The toggle is turned off.
 - 5G:** Name: **ZyxeI_CE21_gues t1_5G**, Password: **WiFi Password**. The toggle is turned off.
 A yellow arrow points to the right.
- LAN:** Displays network configuration:
 - IP Address: **192.168.1.1**
 - Subnet Mask: **255.255.255.0**
 - IP Address Range: **192.168.1.2 ~ 192.168.1.254**
 - DHCP:
 - Lease Time: **1 days 0 hours 0 mins**
 A yellow arrow points to the right.
- Parental Control:** Shows a large '0' in a circle with the text 'profile scheduled' below it. A yellow arrow points to the right.

2.2 Web Configurator Layout

Figure 17 Screen Layout

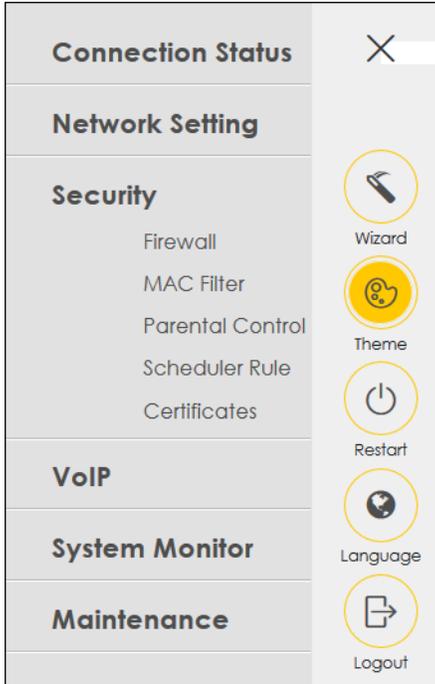


As illustrated above, the main screen is divided into these parts:

- **A** - Navigation Panel
- **B** - Layout Icon
- **C** - Main Window

2.2.1 Navigation Panel

Click the menu icon (☰) to display the navigation panel that contains configuration menus and icons (quick links). Click **X** to close the navigation panel.

Figure 18 Navigation Panel

2.2.1.1 Configuration Menus

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

Table 7 Configuration Menus Summary

LINK	TAB	FUNCTION
Connection Status		Use this screen to configure basic Internet access, wireless settings, and parental control settings. This screen also shows the network status of the Zyxel Device and computers/devices connected to it.
Network Setting		
Wireless	General	Use this screen to configure the WiFi settings and wireless LAN authentication/security settings.
	Guest/More AP	Use this screen to configure multiple BSSs on the Zyxel Device.
	MAC Authentication	Use this screen to block or allow wireless traffic from wireless devices of certain SSIDs and MAC addresses to the Zyxel Device.
	WPS	Use this screen to configure and view your WPS (WiFi Protected Setup) settings.
	WMM	Use this screen to enable or disable WiFi MultiMedia (WMM).
	Others	Use this screen to configure advanced wireless settings.
	Channel Status	Use this screen to scan WiFi channel noises and view the results.

Table 7 Configuration Menus Summary (continued)

LINK	TAB	FUNCTION
Home Networking	LAN Setup	Use this screen to configure LAN TCP/IP settings, and other advanced properties.
	Static DHCP	Use this screen to assign specific IP addresses to individual MAC addresses.
	UPnP	Use this screen to turn UPnP and UPnP NAT-T on or off.
	Additional Subnet	Use this screen to configure IP alias and public static IP.
	STB Vendor ID	Use this screen to configure the Vendor IDs of the connected Set Top Box (STB) devices, which have the Zyxel Device automatically create static DHCP entries for the STB devices when they request IP addresses.
	Wake on LAN	Use this screen to remotely turn on a device on the local network.
	TFTP Server Name	Use DHCP option 66 to identify a TFTP server name.
NAT	Port Forwarding	Use this screen to make your local servers visible to the outside world.
	Port Triggering	Use this screen to change your Zyxel Device's port triggering settings.
	DMZ	Use this screen to configure a default server which receives packets from ports that are not specified in the Port Forwarding screen.
	ALG	Use this screen to enable the ALGs (Application Layer Gateways) in the Zyxel Device to allow applications to operate through NAT.
	Address Mapping	Use this screen to change your Zyxel Device's address mapping settings.
	Sessions	Use this screen to configure the maximum number of NAT sessions each client host is allowed to have through the Zyxel Device.
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.
IGMP/MLD	IGMP/MLD	Use this screen to configure multicast settings (IGMP for IPv4 and MLD for IPv6 multicast groups) on the WAN.
VLAN Group	VLAN Group	Use this screen to group and tag VLAN IDs to outgoing traffic from the specified interface.
Interface Grouping	Interface Grouping	Use this screen to map a port to create multiple networks on the Zyxel Device.
USB Service	File Sharing	Use this screen to enable file sharing via the Zyxel Device.
	Media Server	Use this screen to use the Zyxel Device as a media server.
Security		

Table 7 Configuration Menus Summary (continued)

LINK	TAB	FUNCTION
Firewall	General	Use this screen to configure the security level of your firewall.
	Protocol	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	MAC Filter	Use this screen to block or allow traffic from devices of certain MAC addresses to the Zyxel Device.
Parental Control	Parental Control	Use this screen to block web sites with the specific URL.
Scheduler Rule	Scheduler Rule	Use this screen to configure the days and times when a configured restriction (such as parental control) is enforced.
Certificates	Local Certificates	Use this screen to view a summary list of certificates and manage certificates and certification requests.
	Trusted CA	Use this screen to view and manage the list of the trusted CAs.
VoIP		
Phone	Phone Device	Use this screen to control which SIP account(s) each phone uses to handle outgoing and incoming calls.
	Region	Use this screen to select your location and call service mode.
Call History	Call History	Use this screen to view detailed information for each outgoing call you made or each incoming call from someone calling you. You can also view a summary list of received, dialed and missed calls.
System Monitor		
Log	System Log	Use this screen to view the status of events that occurred to the Zyxel Device. You can export or e-mail the logs.
	Security Log	Use this screen to view all security related events. You can select level and category of the security events in their proper drop-down list window.
Traffic Status	WAN	Use this screen to view the status of all network traffic going through the WAN port of the Zyxel Device.
	LAN	Use this screen to view the status of all network traffic going through the LAN ports of the Zyxel Device.
	NAT	Use this screen to view NAT statistics for connected hosts.
VoIP Status	VoIP Status	Use this screen to view VoIP registration, current call status and phone numbers for the phone ports.
ARP Table	ARP Table	Use this screen to view the ARP table. It displays the IP and MAC address of each DHCP connection.
Routing Table	Routing Table	Use this screen to view the routing table on the Zyxel Device.
Multicast Status	IGMP Status	Use this screen to view the status of all IGMP settings on the Zyxel Device.
	MLD Status	Use this screen to view the status of all MLD settings on the Zyxel Device.

Table 7 Configuration Menus Summary (continued)

LINK	TAB	FUNCTION
WLAN Station Status	WLAN Station Status	Use this screen to view the wireless stations that are currently associated with the Zyxel Device.
Cellular Statistics	Cellular Statistics	Use this screen to look at the cellular Internet connection status.
GPON Status	GPON Status	Use this screen to view the fiber optical transceiver's TX power and RX power level and its temperature. Note: Not yet available as of this writing.
Maintenance		
System	System	Use this screen to set Device name and Domain name.
User Account	User Account	Use this screen to change user password on the Zyxel Device.
Backup/Restore	Backup/Restore	Use this screen to backup and restore your Zyxel Device's configuration (settings) or reset the factory default settings.
Reboot	Reboot	Use this screen to reboot the Zyxel Device without turning the power off.
Diagnostic	Diagnostic	Use this screen to identify problems with the Zyxel Device. You can use Ping, TraceRoute, or Nslookup to help you identify problems.
	Ping&Traceroute &Nslookup	Use this screen to identify problems with the Zyxel Device. 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.
	802.3ah	Use this screen to configure link OAM port parameters,

2.2.1.2 Icons

The navigation panel provides some icons on the right hand side.



The icons provide the following functions.

Table 8 Web Configurator Icons

ICON	DESCRIPTION
 Wizard	Wizard: Click this icon to open screens where you can configure the Zyxel Device's time zone Internet access, and wireless settings. See Chapter 3 on page 39 for more information about the Wizard screens.
 Theme	Theme: Click this icon to select a color that you prefer and apply it to the Web Configurator. 
 Language	Language: Select the language you prefer.
 Restart	Restart: Click this icon to reboot the Zyxel Device without turning the power off.
 Logout	Logout: Click this icon to log out of the Web Configurator.

CHAPTER 4

Tutorials

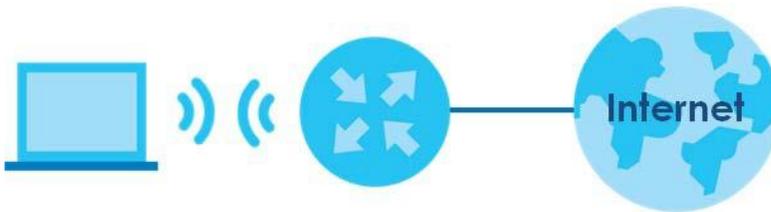
4.1 Overview

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

- [Setting Up a Secure Wireless Network](#), see page 44
- [Setting Up Multiple Wireless Groups](#), see page 51
- [Configuring Static Route for Routing to Another Network](#), see page 56
- [Configuring QoS Queue and Class Setup](#), see page 58
- [Access the Zyxel Device Using DDNS](#), see page 62
- [Configuring the MAC Address Filter](#), see page 64

4.2 Setting Up a Secure Wireless Network

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



Thomas has to configure the wireless network settings on the Zyxel Device. Then he can set up a wireless network using WPS ([Section 4.2.2 on page 46](#)) or manual configuration ([Section 4.2.3 on page 50](#)).

4.2.1 Configuring the Wireless Network Settings

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

SSID	Example
Security Mode	WPA2-PSK
Pre-Shared Key	DoNotStealMyWirelessNetwork
802.11 Mode	802.11b/g/n/ax Mixed

- 1 Click **Network Setting > Wireless** to open the **General** screen. Select **More Secure** as the security level and **WPA2-PSK** as the security mode. Configure the screen using the provided parameters (see page 44). Click **Apply**.

A Wireless network name (also known as SSID) and a security level are basic elements to start a wireless service. It is recommended to set a security level other than no security to protect your data from unauthorized access or damage via wireless network.

Wireless

Wireless Keep the same settings for 2.4G and 5G wireless networks

Wireless Network Setup

Band: 2.4GHz

Wireless:

Channel: Auto Current : / MHz

Bandwidth: 40MHz

Control Sideband: Lower

Wireless Network Settings

Wireless Network Name: Zyxel08787

Max Clients: 64

Hide SSID ! Hide SSID does not support WPS 2.0. You should disable WPS in WPS page.

Multicast Forwarding

Max. Upstream Bandwidth: Kbps

Max. Downstream Bandwidth: Kbps

Note

(1) Max. Upstream Bandwidth: This field allows you to configure the maximum bandwidth of this SSID to WAN.
 (2) Max. Downstream Bandwidth: This field allows you to configure the maximum bandwidth of WAN to this SSID.
 (3) If Max. Upstream/Downstream Bandwidth is empty, the device sets the value automatically.
 (4) Using Max. Upstream/Downstream Bandwidth will significantly decrease the wireless performance.

BSSID:

Security Level

No Security More Secure (Recommended)

▼

Security Mode: WPA2-PSK

Generate password automatically
 Enter 8-63 ASCII characters or 64 hexadecimal digits ("0-9", "A-F").

Password: 👁

Strength:

Encryption: AES

Timer: 3600 sec

Cancel Apply

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

The configurations below are the advanced wireless settings.

RTS/CTS Threshold	2347	
Fragmentation Threshold	2346	
Output Power	100%	
Beacon Interval	100	ms
DTIM Interval	1	ms
802.11 Mode	802.11b/g/n/ax Mixed	
802.11 Protection	Auto	
Preamble	Long	
Protected Management Frames	Capable	

Thomas can now use the WPS feature to establish a wireless connection between his notebook and the Zyxel Device (see [Section 4.2.2 on page 46](#)). He can also use the notebook's wireless client to search for the Zyxel Device (see [Section 4.2.3 on page 50](#)).

4.2.2 Using WPS

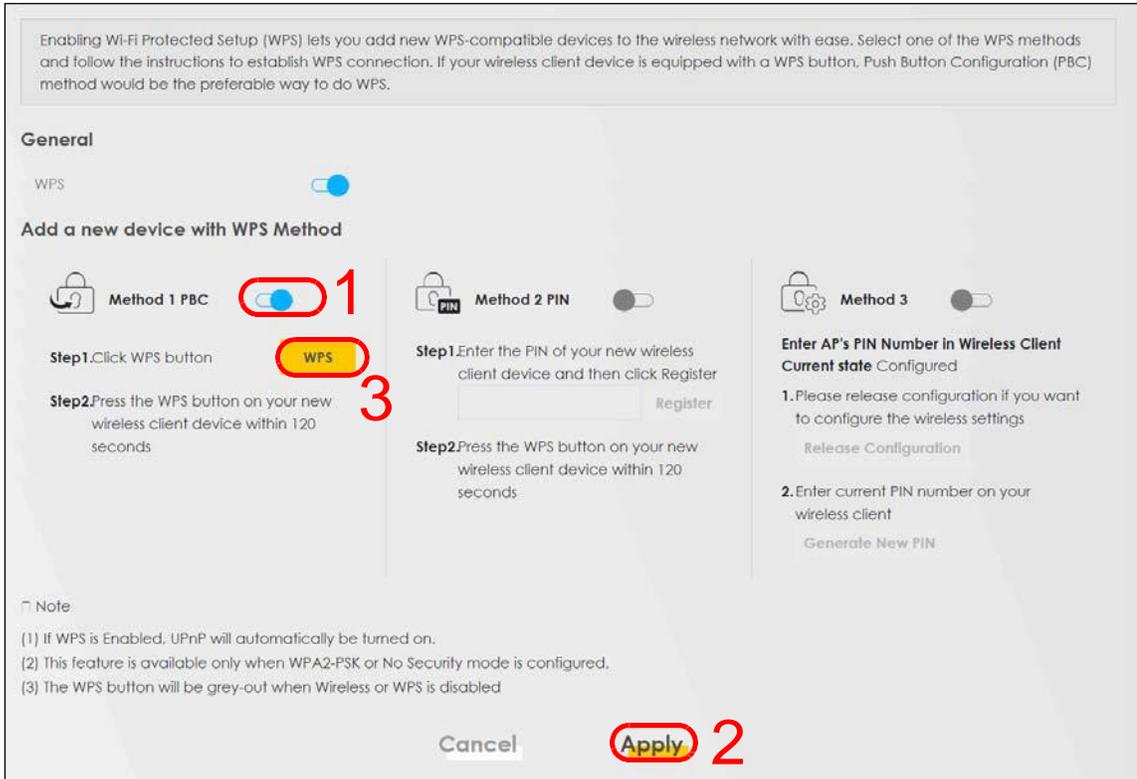
This section gives you an example of how to set up a wireless network using WPS. This example uses the Zyxel Device as the AP and a WPS-enabled Android smartphone as the wireless client.

There are two WPS methods for creating a secure connection. This tutorial shows you how to do both.

- **Push Button Configuration (PBC)** - create a secure wireless network simply by pressing a button. See [Push Button Configuration \(PBC\) on page 46](#). This is the easier method.
- **PIN Configuration** - create a secure wireless network simply by entering a wireless client's PIN (Personal Identification Number) in the Zyxel Device's interface. See [PIN Configuration on page 48](#). This is the more secure method, since one device can authenticate the other.

Push Button Configuration (PBC)

- Make sure that your Zyxel Device is turned on and your notebook is within the cover range of the wireless signal.
- Push and hold the **WPS** button on the EX5501 for 1 second. Push and hold the **WPS** button on the PX7501, AX7501, EX5301 and DX5301-B2/B3 for 5 seconds. Alternatively, you may log into the Zyxel Device's Web Configurator and go to the **Network Setting > Wireless > WPS** screen. Enable the WPS function for method 1 and click **Apply**. Then click the **Connect** button.



Note: Your ZyXel Device has a WPS button located on its side 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.

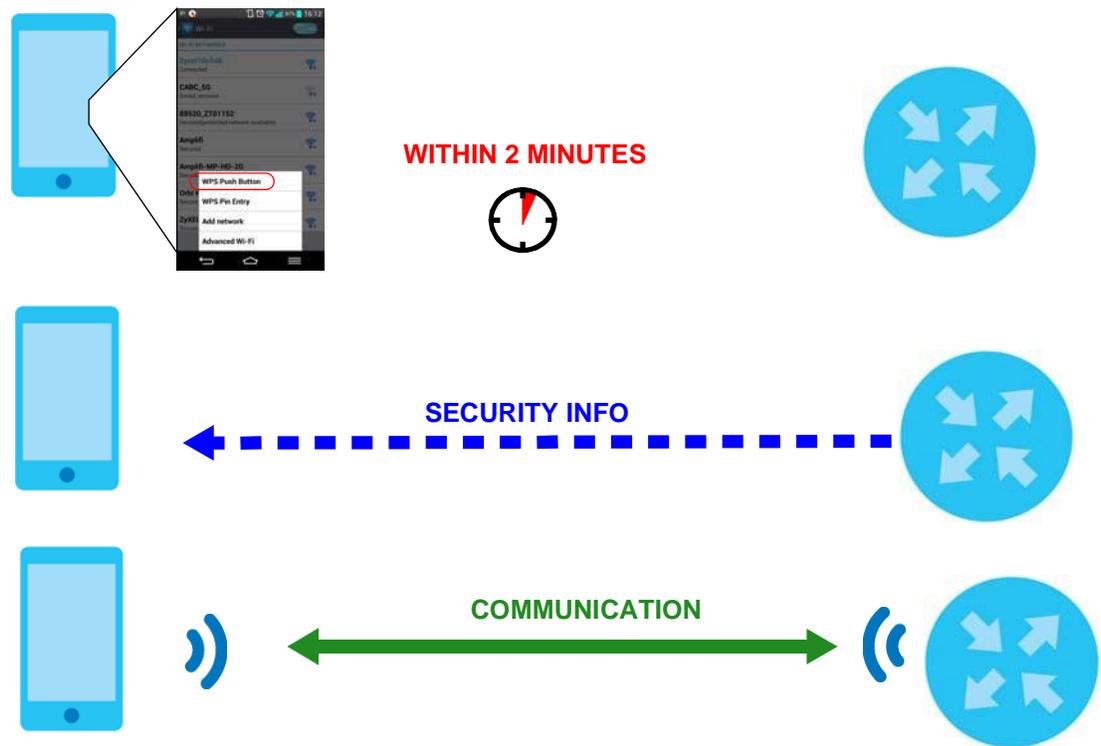
Note: It does not matter which button is pressed first. You must press the second button within two minutes of pressing the first one.

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

The following figure shows you how to set up wireless network and security by pressing a button on both ZyXel Device and wireless client (the Android phone in this example).

Figure 28 Example WPS Process: PBC Method

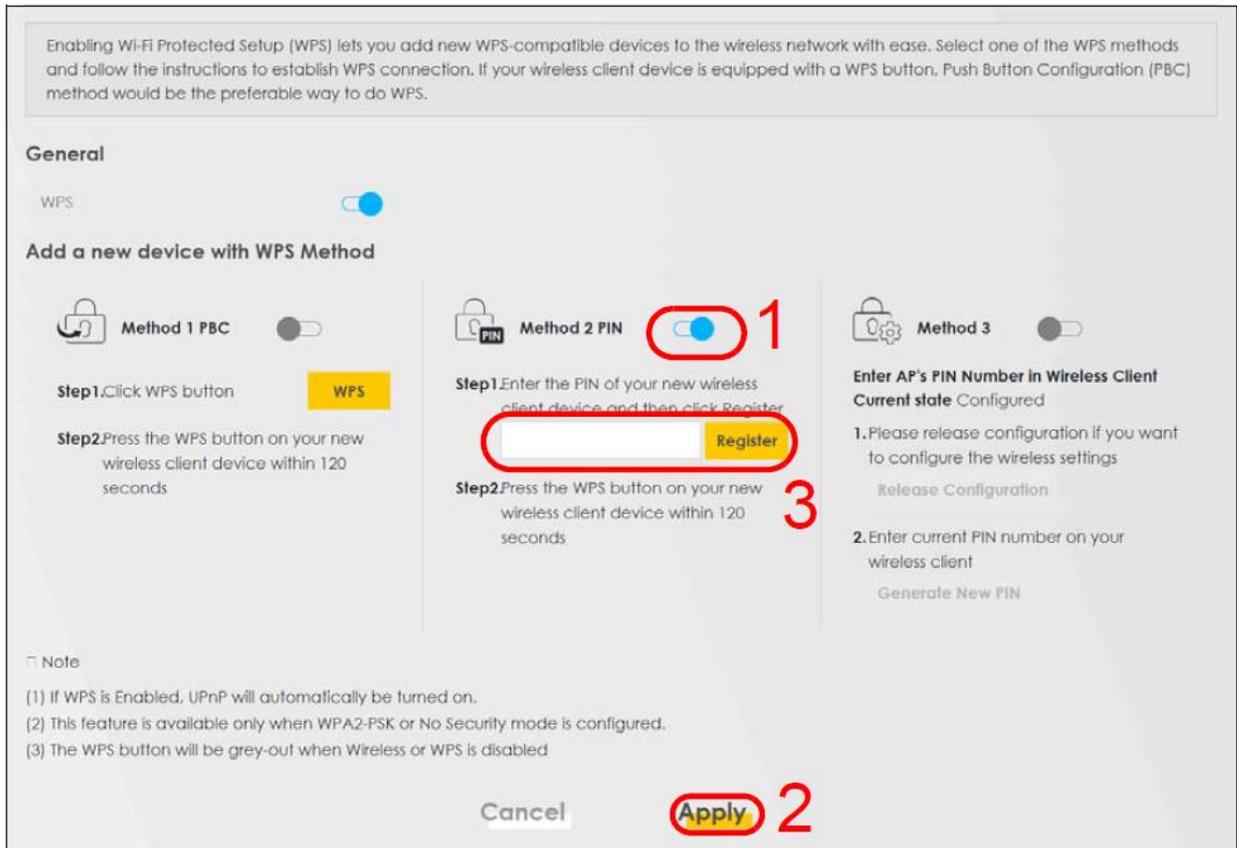
Wireless Client



PIN Configuration

When you use the PIN configuration method, you need to check the client's PIN number and use the Zyxel Device's configuration interface.

- 1 Go to your phone settings and turn on WiFi. Open the WiFi networks list and tap **WPS PIN Entry** to get a PIN number.
- 2 Log into Zyxel Device's Web Configurator and go to the **Network Setting > Wireless > WPS** screen. Enable the WPS function and click **Apply**.



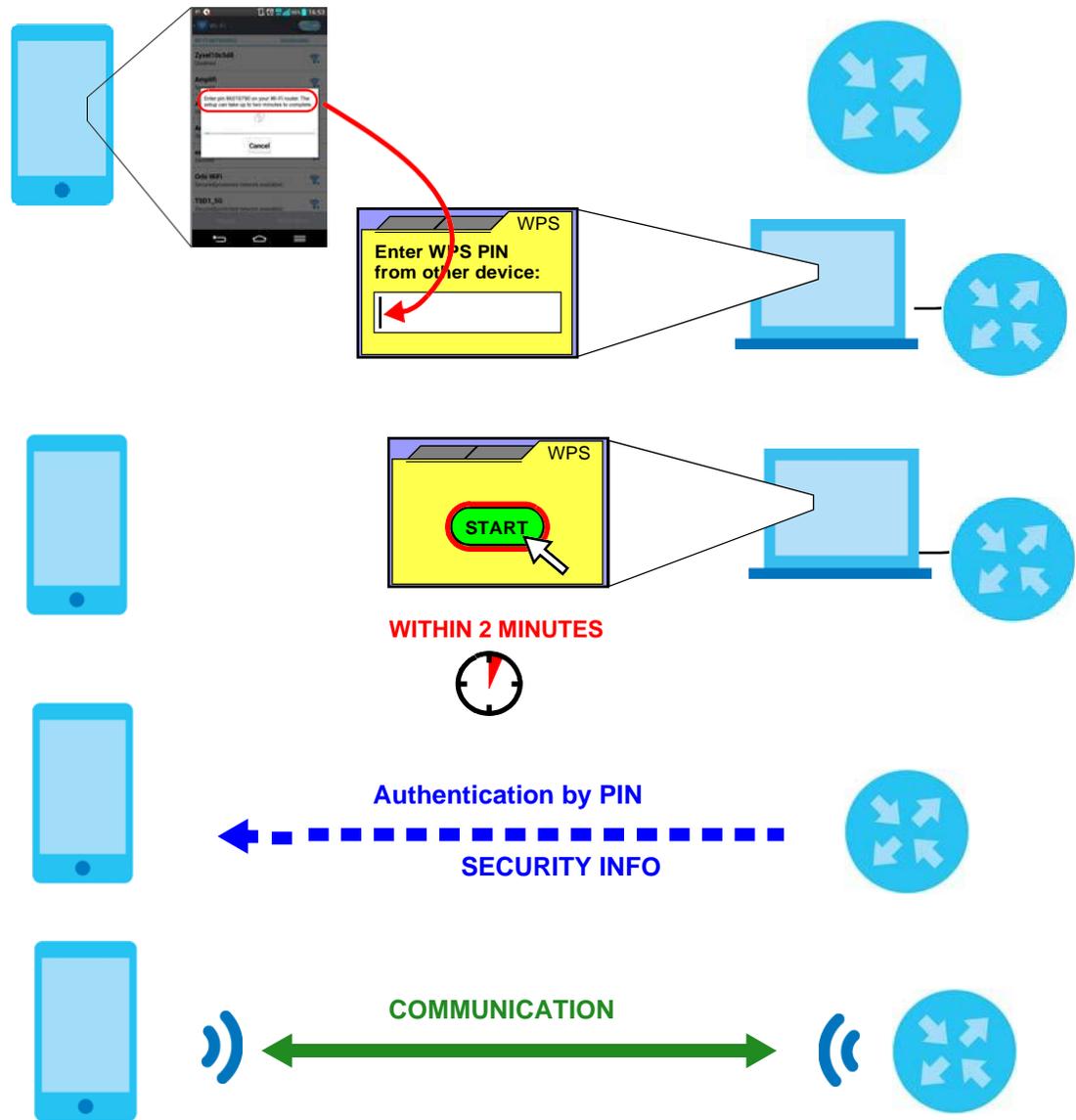
- 3 Enter the PIN number of the wireless client and click the **Register** button. Activate WPS function on the wireless client utility screen within two minutes.

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

The following figure shows you how to set up wireless network and security on ZyXel Device and wireless client (Android smartphone in this example) by using the PIN method.

Figure 29 Example WPS Process: PIN Method

Wireless Client



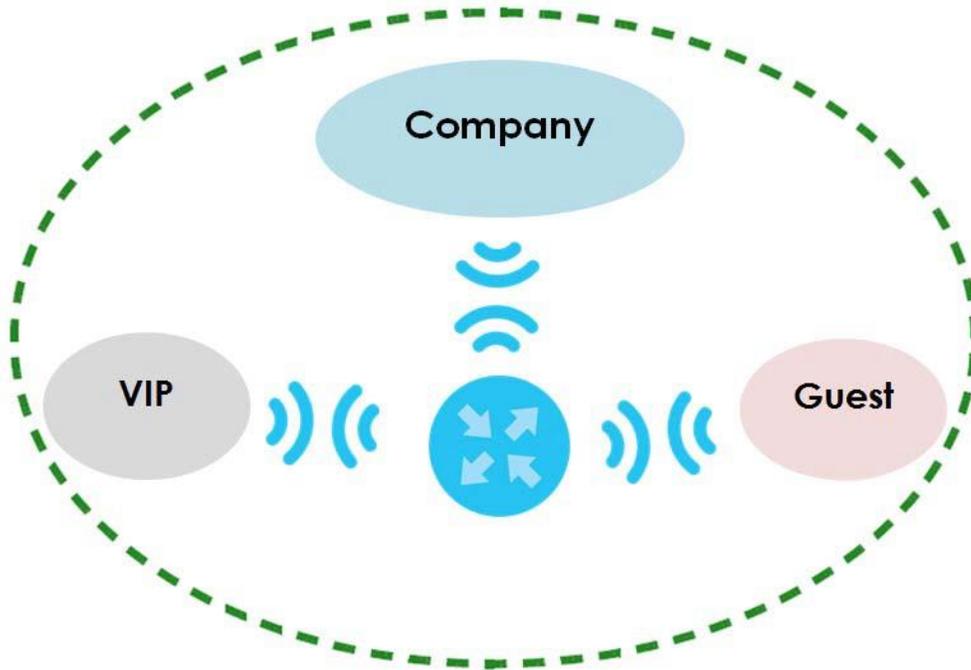
4.2.3 Without WPS

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 a wireless Internet connection.

Note: The Zyxel Device supports IEEE 802.11 a/b/g/n/ac/ax wireless clients. Make sure that your notebook or computer's wireless adapter supports one of these standards.

4.3 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 different SSID and password.

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	More Secure
Security Mode	WPA2-PSK	WPA2-PSK	WPA2-PSK
Pre-Shared Key	ForCompanyOnly	123456789	guest123

- 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**.

A Wireless network name (also known as SSID) and a security level are basic elements to start a wireless service. It is recommended to set a security level other than no security to protect your data from unauthorized access or damage via wireless network.

Wireless

Wireless Keep the same settings for 2.4G and 5G wireless networks

Wireless Network Setup

Band: 2.4GHz

Wireless:

Channel: Auto Current : / MHz

Bandwidth: 20MHz

Control Sideband: None

Wireless Network Settings

Wireless Network Name: Company

Max Clients: 32

Hide SSID Hide SSID does not support WPS 2.0. You should disable WPS in WPS page.

Multicast Forwarding

Max. Upstream Bandwidth: Kbps

Max. Downstream Bandwidth: Kbps

Note

- (1) Max. Upstream Bandwidth: This field allows you to configure the maximum bandwidth of this SSID to WAN.
- (2) Max. Downstream Bandwidth: This field allows you to configure the maximum bandwidth of WAN to this SSID.
- (3) If Max. Upstream/Downstream Bandwidth is empty, the device sets the value automatically.
- (4) Using Max. Upstream/Downstream Bandwidth will significantly decrease the wireless performance.

BSSID

Security Level

No Security More Secure (Recommended)

Security Mode: WPA2-PSK

Generate password automatically

Enter 8-63 ASCII characters or 64 hexadecimal digits ("0-9", "A-F").

Password: For CompanyOnly

Strength: strong

Cancel **Apply**

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

#	Status	SSID	Security	Guest WLAN	Modify
1		Zyxel_9DE5_guest1	WPA2-Personal	External Guest	
2		Zyxel_9DE5_guest2	WPA2-Personal	External Guest	
3		Zyxel_9DE5_guest3	WPA2-Personal	External Guest	

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

More AP Edit

Wireless security can protect the data from unauthorized access or damage via wireless network. You need a wireless network name (also known as SSID) and security mode to set up the wireless security.

Wireless Network Setup

Wireless

Security Level

Wireless Network Name

Hide SSID

Guest WLAN

Access Scenario

Max. Upstream Bandwidth Kbps

Max. Downstream Bandwidth Kbps

Note

(1) Max. Upstream Bandwidth: This field allows you to configure the maximum bandwidth of this SSID to WAN.
 (2) Max. Downstream Bandwidth: This field allows you to configure the maximum bandwidth of WAN to this SSID.
 (3) If Max. Upstream/Downstream Bandwidth is empty, the device sets the value automatically
 (4) Using Max. Upstream/Downstream Bandwidth will significantly decrease the wireless performance.

BSSID

SSID Subnet

Security Level

No Security More Secure (Recommended)

Security Mode

Generate password automatically

Enter 8-63 ASCII characters or 64 hexadecimal digits [0-9, A-F].

Password

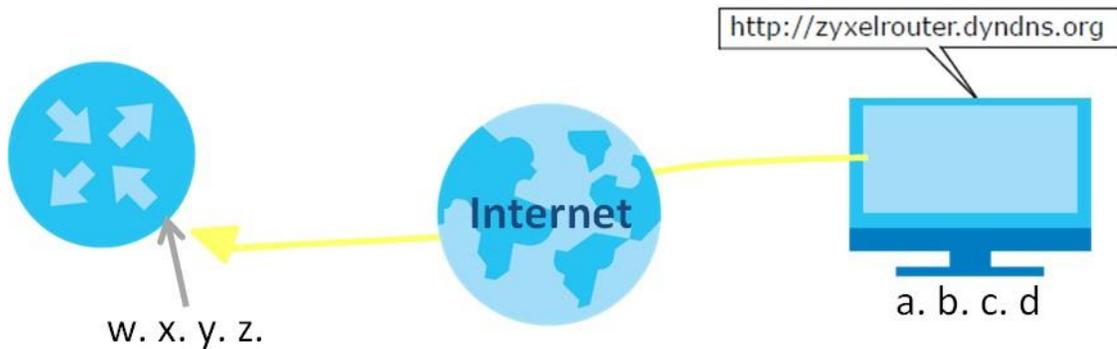
Strength medium

- 4 In the **Guest/More AP** screen, click the **Edit** icon to configure the third wireless network group. Configure the screen using the provided parameters and click **Apply**.
- 5 Check the status of **VIP** and **Guest** in the **Guest/More AP** screen. The yellow bulbs signify that the SSIDs are active and ready for wireless access.

#	Status	SSID	Security	Guest WLAN	Modify
1		Home&Life SuperWiFi-F0FD_guest1	WPA2-Personal	External Guest	
2		VIP	WPA2-Personal	External Guest	
3		Guest	WPA2-Personal	External Guest	

4.4 Access the Zyxel Device Using DDNS

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



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

This tutorial covers:

- [Registering a DDNS Account on \[www.dyndns.org\]\(http://www.dyndns.org\)](#)
- [Configuring DDNS on Your Zyxel Device](#)
- [Testing the DDNS Setting](#)

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

4.6.1 Registering a DDNS Account on www.dyndns.org

- 1 Open a browser and type <http://www.dyndns.org>.
- 2 Apply for a user account. This tutorial uses **UserName1** and **12345** as the username and password.
- 3 Log into www.dyndns.org using your account.

- 4 Add a new DDNS host name. This tutorial uses the following settings as an example.
 - Hostname: **zyxelrouter.dyndns.org**
 - Service Type: **Host with IP address**
 - IP Address: Enter the WAN IP address that your Zyxel Device is currently using. You can find the IP address on the Zyxel Device's Web Configurator **Status** page.

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

4.6.2 Configuring DDNS on Your Zyxel 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 can update your current dynamic IP into a hostname. Use the settings to set up dynamic DNS information.

Dynamic DNS Setup

Dynamic DNS Enable Disable (Settings are invalid when disable)

Service Provider

Host Name

Username

Password

Enable Wildcard Option

Enable Off Line Option (Only applies to custom DNS)

Dynamic DNS Status

User Authentication Result

Last Updated Time

Current Dynamic IP

Click **Apply**.

4.6.3 Testing the DDNS Setting

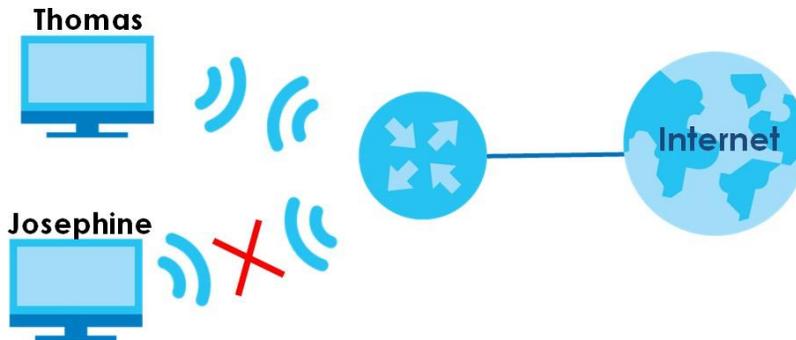
Now you should be able to access the Zyxel Device from the Internet. To test this:

- 1 Open a web browser on the computer (using the IP address **a.b.c.d**) that is connected to the Internet.
- 2 Type **http://zyxelrouter.dyndns.org** and press [Enter].
- 3 The Zyxel Device's login page should appear. You can then log into the Zyxel Device and manage it.

4.5 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 Zyxel 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**. Click **Add a new setting** to add a new entry. Then enter the host name and MAC address of Thomas' computer in this screen. Click **Apply**.

MAC Filter

Enable MAC filters and add the MAC addresses of LAN client in your home or office network to the following table, if you wish to allow or deny them to access your network. Sometimes, MAC Filter is considered a method to increase the security of your network.

MAC Address Filter Enable Disable (Settings are invalid when disable)

MAC Restrict Mode Allow Deny

+ Add New Rule

Set	Active	Host Name	MAC Address	Delete
1	<input checked="" type="checkbox"/>	Thomas	00 - 24 - 21 - AB - 1F - 00	

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 Zyxel Device.

PART II

Technical Reference

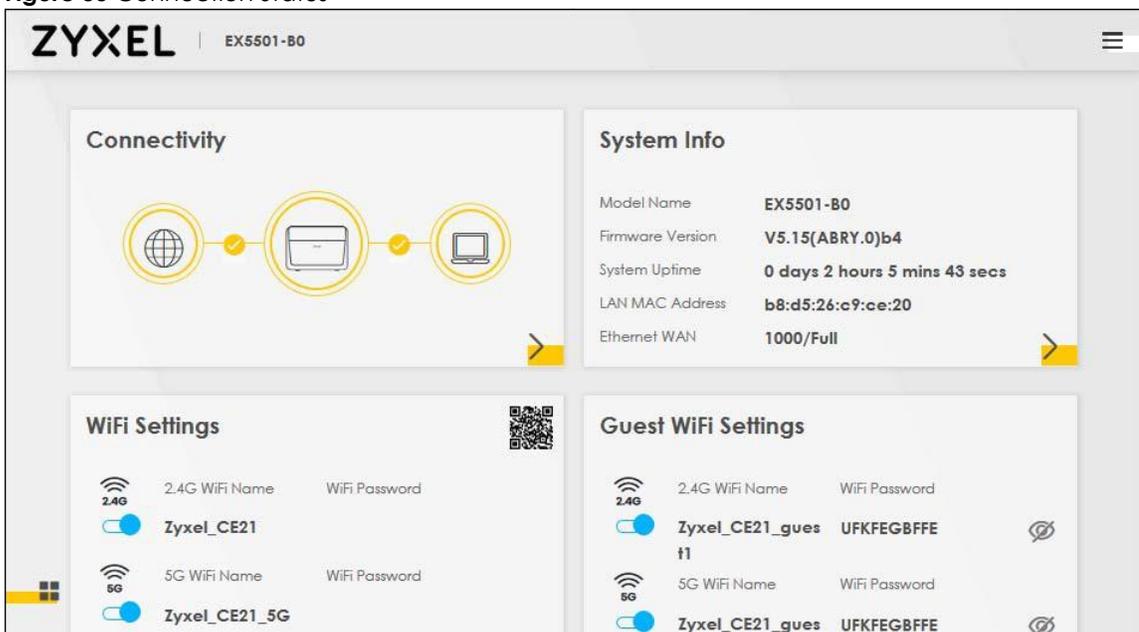
CHAPTER 5

Connection Status

5.1 Overview

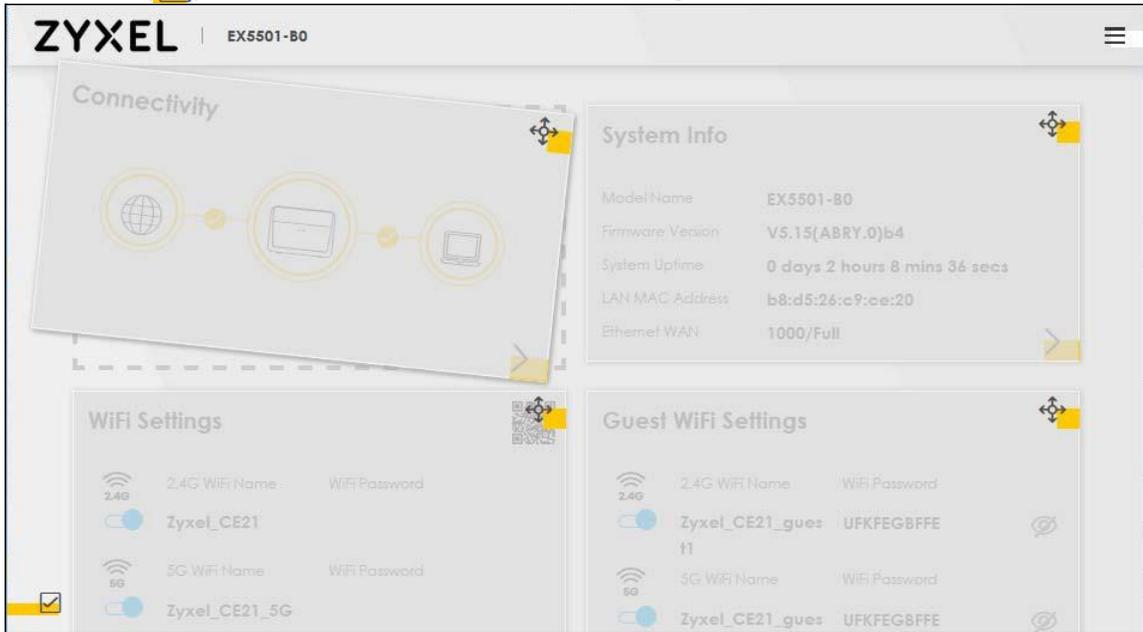
After you log into the Web Configurator, the **Connection Status** screen appears. You can configure basic Internet access, wireless settings, and parental control settings in this screen. It also shows the network status of the Zyxel Device and computers/devices connected to it.

Figure 30 Connection Status



5.1.1 Layout Icon

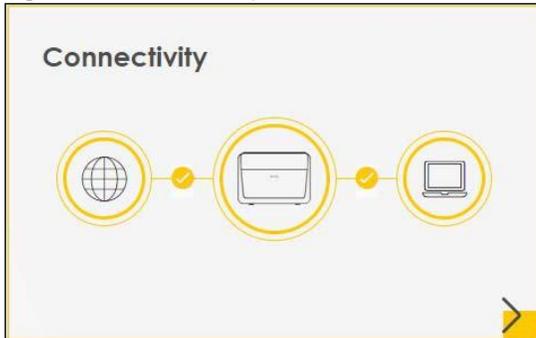
Click this icon () to arrange the screen order. Select a block and hold it to move around. Click the Check icon () in the lower left corner to save the changes.



5.1.2 Connectivity

Use this screen to view the network connection status of the Zyxel Device and its clients.

Figure 31 Connectivity



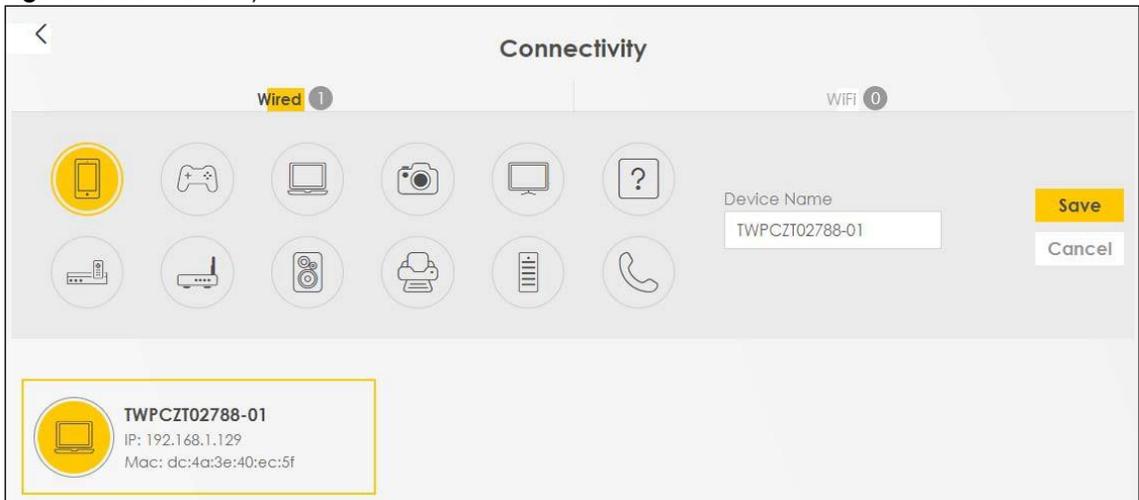
Click the Arrow icon () to open the following screen. Use this screen to view IP addresses and MAC addresses of the wireless and wired devices connected to the Zyxel Device.

Place your mouse within the device block, and an Edit icon () will appear. Click the Edit icon to change the icon and name of a connected device.

Figure 32 Connectivity: Connected Devices

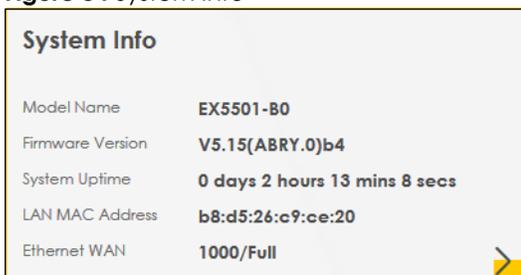
Icon and Device Name

You can change the icon and name of a connected device by clicking the device's Edit icon. Select an icon and/or enter a name in the **Device Name** field for a connected device. Click **Save** to save your changes.

Figure 33 Connectivity: Edit

5.1.3 System Info

Use this screen to view the basic system information of the Zyxel Device.

Figure 34 System Info

Click the Arrow icon (➤) to open the following screen. Use this screen to view more information on the status of your firewall and interfaces (WAN, LAN, and WiFi).

Figure 35 System Info: Detailed Information

System Info

Host Name: EX5501-B0
 Model Name: EX5501-B0
 Serial number: S190Y28038200
 Firmware Version: V5.15(ABRY.0)b4
 System Uptime: 0 days 2 hours 14 mins 57 secs

Interface Status

LAN1 LAN2 LAN3 LAN4 2.5G LAN WAN 3G(USB) WLAN 2.4G WLAN 5G
 - 1000M/Full - - - 1000M/Full No Device 573 Mbps 2401 Mbps

WAN Information (Ethernet WAN)

Name	ETHWAN
Encapsulation	IPoE
IP Address	172.21.40.29 Release
IP Subnet Mask	255.255.252.0
IPv6 Address	N/A
MAC Address	B8:D5:26:C9:CE:23
Primary DNS server	172.21.10.1
Secondary DNS server	172.21.5.1
Primary DNSv6 server	N/A
Secondary DNSv6 server	N/A

LAN Information

IP Address	192.168.1.1
Subnet Mask	255.255.255.0
IPv6 Address	N/A
IPv6 Link Local Address	fe80::bad5:2&ff:fec9:ce20
DHCP	Server

Security

Firewall	Medium
----------	--------

WLAN Information

	2.4GHz	5GHz
MAC Address	B8:D5:26:C9:CE:21	B8:D5:26:C9:CE:22
Status	On	On
SSID	Zyxel_CE21	Zyxel_CE21_5G
Channel	Auto(Current 1)	Auto(Current 36)
Security	None	None
802.11 Mode	802.11b/g/n/ax Mixed	802.11a/n/ac/ax Mixed
WPS	On	On

Each field is described in the following table.

Table 10 System Info: Detailed Information

LABEL	DESCRIPTION
Host Name	This field displays the ZyXel Device system name. It is used for identification.
Model Name	This shows the model number of your ZyXel Device.
Serial Number	This field displays the serial number of the ZyXel Device.
Firmware Version	This is the current version of the firmware on the ZyXel Device.
System Uptime	This field displays how long the ZyXel Device has been running since it last started up. The ZyXel Device starts up when you plug it in, when you restart it (Maintenance > Reboot), or when you reset it.
Interface Status	
Virtual ports are shown here. You can see whether the ports are in use and their transmission rate.	
WAN Information (Ethernet WAN) These fields display when you have an Internet connection.	

Table 10 System Info: Detailed Information (continued)

LABEL	DESCRIPTION
Names	This field displays the name given to the Internet connection.
Encapsulation	This field displays the current encapsulation method.
IP Address	This field displays the current IPv4 address of the Zyxel Device. Click the Release button to release the IP address provided by a DHCP server.
IP Subnet Mask	This field displays the current subnet mask in the WAN.
IPv6 Address	This field displays the current IPv6 address of the Zyxel Device.
MAC Address	This field displays the WAN Ethernet adapter MAC (Media Access Control) address of your Zyxel Device.
Primary DNS server	This field displays the first DNS server address assigned by the ISP.
Secondary DNS server	This field displays the second DNS server address assigned by the ISP.
Primary DNSv6 server	This field displays the first DNS server IPv6 address assigned by the ISP.
Secondary DNSv6 server	This field displays the second DNS server IPv6 address assigned by the ISP.
LAN Information (These fields display information about the LAN ports.)	
IP Address	This is the current IPv4 address of the Zyxel Device in the LAN.
Subnet Mask	This is the current subnet mask in the LAN.
IPv6 Address	This field displays the current IPv6 address of the Zyxel Device in the LAN.
IPv6 Link Local Address	This field displays the current link-local address of the Zyxel Device for the LAN interface.
DHCP	This field displays what DHCP services the Zyxel Device is providing to the LAN. The possible values are: Server - The Zyxel Device is a DHCP server in the LAN. It assigns IP addresses to other computers in the LAN. Relay - The Zyxel Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. None - The Zyxel Device is not providing any DHCP services to the LAN.
Security	
Firewall	This displays the firewall's current security level.
WLAN Information 2.4GHz / 5GHz	
MAC Address	This shows the wireless adapter MAC (Media Access Control) address of the wireless interface.
Status	This displays whether WiFi is activated.
SSID	This is the descriptive name used to identify the Zyxel Device in a wireless LAN.
Channel	This is the channel number used by the wireless interface now.
Security	This displays the type of security mode the wireless interface is using in the wireless LAN.
802.11 Mode	This displays the type of 802.11 mode the wireless interface is using in the wireless LAN.
WPS	This displays whether WPS is activated on the wireless interface.

5.2 WiFi Settings

Use this screen to enable or disable the main 2.4G and/or 5G wireless networks. When the switch goes to the right (), the function is enabled. Otherwise, it is not. You can use this screen or the QR code on the upper right corner to check the SSIDs (WiFi network name) and passwords of the main wireless networks. If you want to show or hide your WiFi passwords, click the Eye icon ().

Figure 36 WiFi Settings



Click the Arrow icon () to open the following screen. Use this screen to configure the SSIDs and/or passwords for your main wireless networks. Select **Keep 2.4G and 5G the same** to use the same SSID for 2.4 GHz and 5 GHz bands.

Figure 37 WiFi Settings: Configuration



Each field is described in the following table.

Table 11 WiFi Settings: Configuration

LABEL	DESCRIPTION
Keep 2.4G and 5G the same	Select this and the 2.4G and 5G wireless networks will use the same SSID. If you deselect this, the screen will change. You need to assign different SSIDs for the 2.4G and 5G wireless networks.
2.4G/5G WiFi	Click this switch to enable or disable the 2.4G and/or 5G wireless networks. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
WiFi Name	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 WiFi.
WiFi Password	If you selected Random Password , this field displays a pre-shared key generated by the Zyxel Device. If you did not select Random Password , you can manually type a pre-shared key from 8 to 64 case-sensitive keyboard characters.
	Click the Eye icon to show or hide the password for your wireless network. When the Eye icon is slashed  , you'll see the password in plain text. Otherwise, it is hidden.
Random Password	Select this option to have the Zyxel Device automatically generate a password. The WiFi Password field will not be configurable when you select this option.
Hide WiFi Name	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. Note: Disable WPS in the Network Setting > Wireless > WPS screen to hide the SSID.
Save	Click Save to save your changes.

5.3 Guest WiFi Settings

Use this screen to enable or disable the guest 2.4G and/or 5G wireless networks. When the switch goes to the right () , the function is enabled. Otherwise, it is not. You can check their SSIDs (WiFi network name) and passwords from this screen. If you want to show or hide your WiFi passwords, click the Eye icon.

Figure 38 Guest WiFi Settings



Click the Arrow icon () to open the following screen. Use this screen to configure the SSIDs and/or passwords for your guest wireless networks.

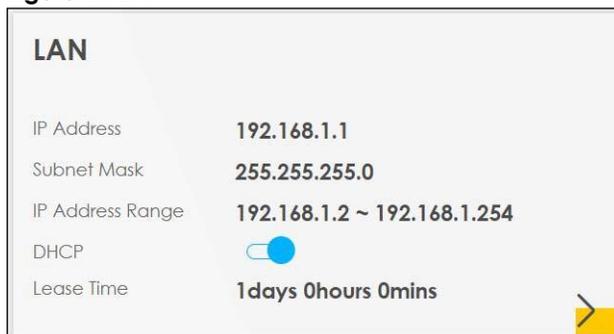
Table 12 WiFi Settings: Configuration (continued)

LABEL	DESCRIPTION
WiFi Password	If you selected Random Password , this field displays a pre-shared key generated by the Zyxel Device. If you did not select Random Password , you can manually type a pre-shared key from 8 to 64 case-sensitive keyboard characters.
	Click the Eye icon to show or hide the password of your wireless network. When the Eye icon is slashed  , you'll see the password in plain text. Otherwise, it is hidden.
Random Password	Select this option to have the Zyxel Device automatically generate a password. The WiFi Password field will not be configurable when you select this option.
Hide WiFi Name	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. Note: Disable WPS in the Network Setting > Wireless > WPS screen to hide the SSID.
Save	Click Save to save your changes.

5.4 LAN Settings

Use this screen to view the LAN IP address, subnet mask, and DHCP settings of your Zyxel Device.

Figure 41 LAN



Click the Arrow icon () to open the following screen. Use this screen to configure the LAN IP address and DHCP setting for your Zyxel Device.

Figure 42 LAN Setup

Each field is described in the following table.

Table 13 Status Screen

LABEL	DESCRIPTION
LAN IP Setup	
IP Address	Enter the LAN IPv4 address you want to assign to your Zyxel Device in dotted decimal notation, for example, 192.168.1.1 (factory default).
Subnet Mask	Type the subnet mask of your network in dotted decimal notation, for example 255.255.255.0 (factory default). Your Zyxel Device automatically computes the subnet mask based on the IP address you enter, so do not change this field unless you are instructed to do so.
IP Addressing Values	
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 State	
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.
Days/Hours/Minutes	Enter the lease time of the DHCP server.
Save	Click Save to save your changes.

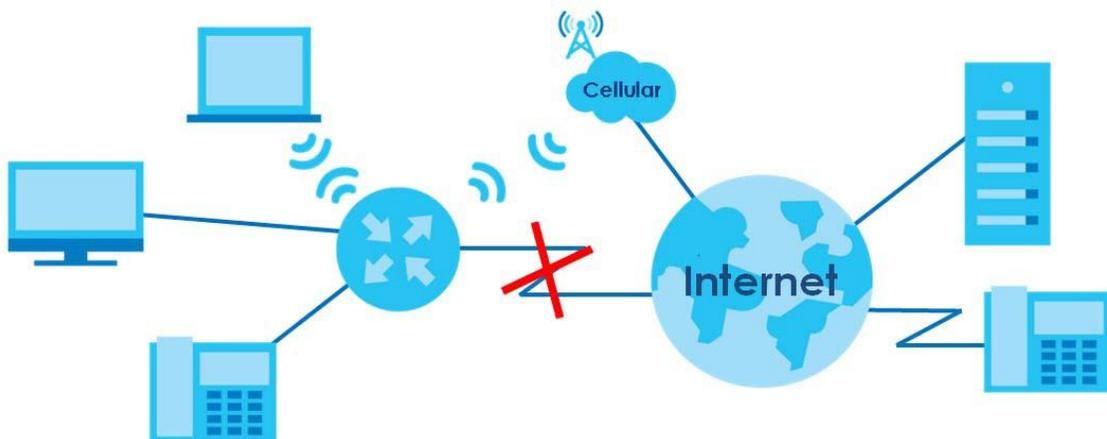
CHAPTER 6

Broadband

6.1 Cellular Backup

The USB port of the Zyxel Device allows you to attach a cellular dongle to wirelessly connect to a cellular network for Internet access. You can have the Zyxel Device use the cellular WAN connection as a backup to keep you online if the primary WAN connection fails for **Consecutive Fail** times. Consult your cellular service provider to configure the settings in this screen. Disconnect the Fiber port to use the cellular dongle as your primary WAN connection, as the Zyxel Device automatically uses a wired WAN connection when available.

Figure 59 Internet Access Application: Cellular WAN



Use this screen to configure your cellular settings. Click **Network Setting > Broadband > Cellular Backup**.

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

6.2 Technical Reference

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

Encapsulation

Be sure to use the encapsulation method required by your ISP. The Zyxel Device can work in bridge mode or routing mode. When the Zyxel 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 Zyxel Device encapsulates the PPP session based on RFC1483 and sends it through an ATM PVC (Permanent Virtual Circuit) to the Internet Service Provider's (ISP) DSLAM (digital 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, and so on) 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 Zyxel Device (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the Zyxel Device does that part of the task. Furthermore, with NAT, all of the LANs' computers will have access.

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.

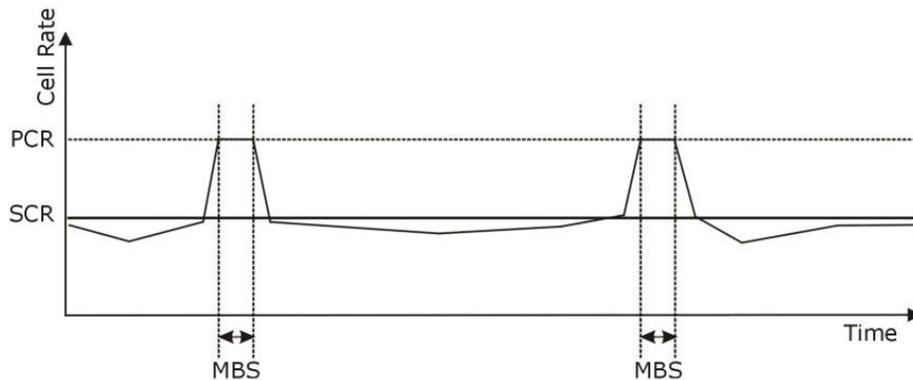
Sustained Cell Rate (SCR) is the mean cell rate of each bursty traffic source. It specifies the maximum average rate at which cells can be sent over the virtual connection. SCR may not be greater than the PCR.

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 63 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 Zyxel Device queries all directly connected networks to gather group membership. After that, the Zyxel 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 Zyxel 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 Zyxel 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.

CHAPTER 7

Wireless

7.1 Wireless Overview

This chapter describes the Zyxel Device's **Network Setting > Wireless** screens. Use these screens to set up your Zyxel Device's WiFi connection and security settings.

7.1.1 What You Can Do in this Chapter

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

- Use the **General** screen to enable WiFi, enter the SSID and select the wireless security mode ([Section 7.2 on page 116](#)).
- Use the **Guest/More AP** screen to set up multiple wireless networks on your Zyxel Device ([Section 7.3 on page 120](#)).
- Use the **MAC Authentication** screen to allow or deny wireless clients based on their MAC addresses from connecting to the Zyxel Device ([Section 7.4 on page 125](#)).
- Use the **WPS** screen to enable or disable WPS, view or generate a security PIN (Personal Identification Number) ([Section 7.5 on page 127](#)).
- Use the **WMM** screen to enable WiFi MultiMedia (WMM) to ensure quality of service in wireless networks for multimedia applications ([Section 7.6 on page 129](#)).
- Use the **Others** screen to configure wireless advanced features, such as the RTS/CTS Threshold ([Section 7.7 on page 131](#)).
- Use the **Channel Status** screen to scan WiFi channel noises and view the results ([Section 7.8 on page 133](#)).

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 are a number of wireless networking standards available with different methods of data encryption.

WiFi6 / IEEE 802.11ax

WiFi6 is backwards compatible with IEEE 802.11a/b/g/n/ac and is most suitable in areas with a high concentration of users. WiFi6 devices support Target Wakeup Time (TWT) allowing them to automatically power down when they are inactive.

The following table displays the comparison of the different WiFi standards.

Table 28 WiFi Standards Comparison

WIFI STANDARD	MAXIMUM LINK RATE *	BAND	SIMULTANEOUS CONNECTIONS
802.11b	11 Mbps	2.4 GHz	1
802.11a/g	54 Mbps	2.4 GHz and 5 GHz	1
802.11n	600 Mbps	2.4 GHz and 5 GHz	1
802.11ac	6.93 Gbps	5 GHz	4
802.11ax	2.4 Gbps	2.4 GHz	128
	9.61 Gbps	5 GHz and 6 GHz	

* The maximum link rate is for reference under ideal conditions only.

7.2 Wireless General Settings

Use this screen to enable the Wireless LAN, enter the SSID and select the wireless security mode. We recommended that you select **More Secure** to enable **WPA2-PSK** data encryption.

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

Note: If upstream/downstream bandwidth is empty, the Zyxel Device sets the value automatically.

Note: Setting a maximum upstream/downstream bandwidth will significantly decrease wireless performance.

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

Figure 64 Network Setting > Wireless > General

Wireless

General
Guest/More AP
MAC Authentication
WPS
WMM
Others
Channel Status

Use this screen to enable the Wireless LAN, enter the SSID and select the wireless security mode. These are basic elements for starting a wireless service. It's recommended that you select **More Secure** to enable **WPA2-PSK** data encryption.

Wireless

Wireless Keep the same settings for 2.4G and 5G wireless networks

Wireless Network Setup

Band: 2.4GHz

Wireless:

Channel: Auto Current : 13 / 20 MHz

Bandwidth: 20/40MHz

Control Sideband: Lower

Wireless Network Settings

Wireless Network Name: Zyxel_0002

Max Clients: 32

Hide SSID i Hide SSID does not support WPS 2.0. You should disable WPS in WPS page.

Multicast Forwarding

Max. Upstream Bandwidth: Kbps

Max. Downstream Bandwidth: Kbps

Note

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

(2) If upstream/downstream bandwidth is empty, the Zyxel Device sets the value automatically. Setting a maximum upstream/downstream bandwidth will significantly decrease wireless performance.

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

Security Level

No Security
More Secure (Recommended)

Security Mode: WPA2-PSK

Generate password automatically

Enter 8-63 ASCII characters or 64 hexadecimal digits ("0-9", "A-F").

Password: 👁

Strength: medium

Cancel
Apply

The following table describes the general WiFi labels in this screen.

Table 29 Network Setting > Wireless > General

LABEL	DESCRIPTION
Wireless	
Wireless	Select Keep the same settings for 2.4G and 5G wireless networks and the 2.4 GHz and 5 GHz wireless networks will use the same SSID and wireless security settings.
Wireless Network Setup	
Band	This shows the wireless band which this radio profile is using. 2.4GHz is the frequency used by IEEE 802.11b/g/n/ax wireless clients while 5GHz is used by IEEE 802.11a/n/ac/ax wireless clients.
Wireless	Click this switch to enable or disable WiFi in this field. When the switch turns blue  , the function is enabled. Otherwise, it is not.
Channel	Select a channel from the drop-down list box. The options vary depending on the frequency band and the country you are in. Use Auto to have the Zyxel Device automatically determine a channel to use.
Bandwidth	Select whether the Zyxel Device uses a wireless channel width of 20MHz , 20/40MHz , 20/40/80MHz or 20/40/80/160MHz . A standard 20 MHz channel offers transfer speeds of up to 150 Mbps whereas a 40 MHz channel uses two standard channels and offers speeds of up to 300 Mbps. 40 MHz (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. An 80 MHz channel groups adjacent 40 MHz channels into pairs to increase bandwidth even higher. 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. Because not all devices support 40 MHz and/or 160 MHz channels, select 20/40MHz or 20/40/80/160MHz to allow the Zyxel Device to adjust the channel bandwidth automatically.
Control Sideband	This is available for some regions when you select a specific channel and set the Bandwidth field to 40MHz or 20/40MHz . Set whether the control channel (set in the Channel field) should be in the Lower or Upper range of channel bands.
Wireless Network Settings	
Wireless Network Name	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 WiFi.
Max Clients	Specify the maximum number of clients that can connect to this network at the same time.
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. This check box is grayed out if the WPS function is enabled in the Network Setting > Wireless > WPS screen.
Multicast Forwarding	Select this check box to allow the Zyxel Device to convert wireless multicast traffic into wireless unicast traffic.
Max. Upstream Bandwidth	Max. Upstream Bandwidth allows you to specify the maximum rate for upstream wireless traffic to the WAN from this wireless LAN in kilobits per second (Kbps).
Max. Downstream Bandwidth	Max. Upstream Bandwidth allows you to specify the maximum rate for downstream wireless traffic to this wireless LAN from the WAN in kilobits per second (Kbps).
BSSID	This shows the MAC address of the wireless interface on the Zyxel Device when WiFi is enabled.
Security Level	

Table 29 Network Setting > Wireless > General (continued)

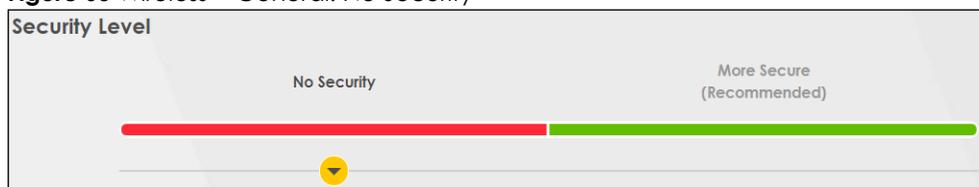
LABEL	DESCRIPTION
Security Mode	Select More Secure (Recommended) to add security on this wireless network. The wireless clients which want to associate to this network must have same wireless security settings as the Zyxel Device. When you select to use a security, additional options appears in this screen. Or you can select No Security to allow any client to associate this network without any data encryption or authentication. See the following sections for more details about this field.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

7.2.1 No Security

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

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

Figure 65 Wireless > General: No Security



The following table describes the labels in this screen.

Table 30 Wireless > General: No Security

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

7.2.2 More Secure (Recommended)

The WPA-PSK (WiFi Protected Access-Pre-Shared Key) security mode provides both improved data encryption and user authentication over WEP. Using a pre-shared key, both the Zyxel Device and the connecting client share a common password in order to validate the connection. This type of encryption, while robust, is not as strong as WPA, WPA2 or even WPA2-PSK. The WPA2-PSK security mode is a 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. The WPA3-SAE (Simultaneous Authentication of Equals handshake) security mode protects against dictionary attacks (password guessing attempts). It improves security by requiring a new encryption key every time a WPA3 connection is made. A handshake is the communication between the Zyxel Device and a connecting client at the beginning of a WiFi session.

Click **Network Setting > Wireless** to display the **General** screen. Select **More Secure** as the security level. Then select **WPA3-SAE** from the **Security Mode** list if your wireless client supports it. If you are not sure, select **WPA3-SAE/WPA2-PSK** or **WPA2-PSK**.

Figure 66 Wireless > General: More Secure: WPA2-PSK

The screenshot shows the 'Security Level' configuration page. At the top, there is a slider between 'No Security' and 'More Secure (Recommended)'. The 'More Secure' option is selected. Below the slider, the 'Security Mode' is set to 'WPA2-PSK'. The 'Generate password automatically' checkbox is checked. The 'Password' field is empty, and the 'Strength' indicator shows 'medium'. The 'Encryption' is set to 'AES' and the 'Timer' is set to '3600 sec'.

The following table describes the labels in this screen.

Table 31 Wireless > General: More Secure: WPA2-PSK

LABEL	DESCRIPTION
Security Level	Select More Secure to enable WPA2-PSK data encryption.
Security Mode	Select WPA2-SAE from the drop-down list box.
Generate password automatically	Select this option to have the Zyxel Device automatically generate a password. The password field will not be configurable when you select this option.
Password	Select Generate password automatically or enter a Password . The password has two uses. <ol style="list-style-type: none"> Manual. Manually enter the same password on the Zyxel Device and the client. Enter 8-63 ASCII characters or exactly 64 hexadecimal ('0-9', 'a-f') characters. WPS. When using WPS, the Zyxel Device sends this password to the client. Click the Eye icon to show or hide the password of your wireless network. When the Eye icon is slashed  , you'll see the password in plain text. Otherwise, it is hidden.
	Click this  to show more fields in this section. Click again to hide them.
Encryption	This field shows the AES (Advanced Encryption Standard) type of data encryption.
Timer	The Timer is the rate at which the RADIUS server sends a new group key out to all clients.

7.3 Guest/More AP

This screen allows you to configure a guest wireless network that allows access to the Internet only through the Zyxel Device.

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

The following table introduces the supported wireless networks.

Table 32 Supported Wireless Networks

WIRELESS NETWORKS	WHERE TO CONFIGURE
Main/1	Network Setting > Wireless > General screen
Guest/3	Network Setting > Wireless > Guest/More AP screen

Figure 67 Network Setting > Wireless > Guest/More AP



The following table describes the labels in this screen.

Table 33 Network Setting > Wireless > Guest/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, while a gray bulb signifies that this SSID is not active.
SSID	An SSID profile is the set of parameters relating to one of the Zyxel Device's BSSs. The SSID (Service Set Identifier) identifies the Service Set with which a wireless device is associated. This field displays the name of the wireless profile on the network. When a wireless client scans for an AP to associate with, this is the name that is broadcast and seen in the wireless client utility.
Security	This field indicates the security mode of the SSID profile.
Guest WLAN	This displays if the guest WiFi function has been enabled for this wireless LAN. If Home Guest displays, clients can connect to each other directly. If External Guest displays, clients are blocked from connecting to each other directly. N/A displays if guest wireless LAN is disabled.
Modify	Click the Edit icon to configure the SSID profile.

7.3.1 Edit Guest/More AP Settings

Use this screen to create Guest and additional wireless networks with different security settings.

Note: If upstream/downstream bandwidth is empty, the Zyxel Device sets the value automatically. Setting a maximum upstream/downstream bandwidth will significantly decrease wireless performance.

Click the **Edit** icon next to an SSID in the **Guest/More AP** screen. The following screen displays.

Figure 68 Network Setting > Wireless > Guest/More AP > Edit

Use this screen to create Guest and additional wireless networks with different security settings.

Wireless Network Setup

Wireless

Security Level

Wireless Network Name:

Hide SSID

Guest WLAN

Access Scenario: ⓘ

Max. Upstream Bandwidth: Kbps

Max. Downstream Bandwidth: Kbps

Note

If upstream/downstream bandwidth is empty, the Zyxel Device sets the value automatically. Setting a maximum upstream/downstream bandwidth will significantly decrease wireless performance.

BSSID:

SSID Subnet:

DHCP Start Address: . .

DHCP End Address: . .

SSID Subnet Mask: . .

LAN IP Address: . .

Security Level

No Security More Secure (Recommended)

Security Mode:

Generate password automatically
Enter 8-63 ASCII characters or 64 hexadecimal digits ("0-9", "A-F").

Password: ⓘ

Strength:

Encryption:

Timer: sec

The following table describes the fields in this screen.

Table 34 Network Setting > Wireless > Guest/More AP > Edit

LABEL	DESCRIPTION
Wireless Network Setup	
Wireless	Click this switch to enable or disable WiFi in this field. When the switch turns blue  , the function is enabled; otherwise, it is not.
Security Level	
Wireless Network Name	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 WiFi.
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.
Guest WLAN	Select this to create Guest WiFi's for home and external clients. Select the WiFi type in the Access Scenario field.
Access Scenario	If you select Home Guest , clients can connect to each other directly. If you select External Guest , clients are blocked from connecting to each other directly.
Max. Upstream Bandwidth	Specify the maximum rate for upstream wireless traffic to the WAN from this wireless LAN in kilobits per second (Kbps).
Max. Downstream Bandwidth	Specify the maximum rate for downstream wireless traffic to this wireless LAN from the WAN in kilobits per second (Kbps).
BSSID	This shows the MAC address of the wireless interface on the Zyxel Device when WiFi is enabled.
SSID Subnet	Click on this switch to Enable this function if you want the wireless network interface to assign DHCP IP addresses to the associated wireless clients. This option cannot be used if the WPS function is enabled in the Network Setting > Wireless > WPS screen or if the Keep the same settings for 2.4G and 5G wireless networks check box is selected in Network Setting > Wireless > General .
DHCP Start Address	Specify the first of the contiguous addresses in the DHCP IP address pool. The Zyxel Device assigns IP addresses from this DHCP pool to wireless clients connecting to the SSID.
DHCP End Address	Specify the last of the contiguous addresses in the DHCP IP address pool.
SSID Subnet Mask	Specify the subnet mask of the Zyxel Device for the SSID subnet.
LAN IP Address	Specify the IP address of the Zyxel Device for the SSID subnet.
Security Level	Select More Secure (Recommended) to add security on this wireless network. The wireless clients which want to associate to this network must have the same wireless security settings as the Zyxel Device. After you select to use a security, additional options appears in this screen. Or you can select No Security to allow any client to associate this network without any data encryption or authentication. See Section 7.2.1 on page 119 for more details about this field.
Security Mode	Select WPA2-PSK from the drop-down list box.
Generate password automatically	Select this option to have the Zyxel Device automatically generate a password. The password field will not be configurable when you select this option.

Table 34 Network Setting > Wireless > Guest/More AP > Edit (continued)

LABEL	DESCRIPTION
Password	<p>WPA2-PSK uses a simple common password, instead of user-specific credentials.</p> <p>If you did not select Generate password automatically, you can manually type a pre-shared key from 8 to 64 case-sensitive keyboard characters.</p> <p>Click the Eye icon to show or hide the password of your wireless network. When the Eye icon is slashed , you'll see the password in plain text. Otherwise, it is hidden.</p>
	Click this  to show more fields in this section. Click again to hide them.
Encryption	This field shows the AES type of data encryption.
Timer	The Timer is the rate at which the RADIUS server sends a new group key out to all clients.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

7.4 MAC Authentication

Use this screen to give exclusive access to specific devices (**Allow**) or exclude specific devices from accessing the Zyxel Device (**Deny**), based on the MAC address of each device. Every Ethernet device has a unique MAC (Media Access Control) address. It 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 device(s) you want to allow/deny to configure this screen.

Note: You can have up to 25 MAC authentication rules.

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

Figure 69 Network Setting> Wireless > MAC Authentication

Wireless

General Guest/More AP **MAC Authentication** WPS WMM Others Channel Status

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**) based on the device(s) MAC address. Every Ethernet device has a unique MAC (Media Access Control) address. It 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 device(s) you want to allow/deny to configure this screen.

General

SSID: Zyxel_0002

MAC Restrict Mode: Disable Deny Allow

MAC address List

+ Add new MAC address

#	MAC Address	Modify

Note
You can have up to 25 MAC authentication rules.

Cancel Apply

The following table describes the labels in this screen.

Table 35 Network Setting > Wireless > MAC Authentication

LABEL	DESCRIPTION
General	
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 Zyxel Device. MAC addresses not listed will be allowed to access the Zyxel Device. Select Allow to permit access to the Zyxel Device. MAC addresses not listed will be denied access to the Zyxel Device.
MAC Address List	
Add New MAC Address	This field is available when you select Deny or Allow in the MAC Restrict Mode field. Click this if you want to add a new MAC address entry to the MAC filter list below.
#	This is the index number of the entry.
MAC Address	This is the MAC addresses of the wireless devices that are allowed or denied access to the Zyxel Device.

Table 35 Network Setting > Wireless > MAC Authentication (continued)

LABEL	DESCRIPTION
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 delete the entry.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

7.4.1 Add/Edit MAC Addresses

Click **Add new MAC address** in the **Network Setting > Wireless > MAC Authentication** screen to add a new MAC address. You can also click the Edit icon next to a MAC authentication rule to edit the rule.

Enter the MAC addresses of the wireless devices that are allowed or denied access to the Zyxel Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.

Figure 70 Network Setting> Wireless > MAC Authentication > Add/Edit

7.5 WPS Settings

WiFi Protected Setup (WPS) allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Select one of the WPS methods and follow the instructions to establish a WPS connection. Your device must support WPS to use this feature. We recommend using Push Button Configuration (**PBC**) if your device supports it. See [Section 7.9.8.3 on page 142](#) for more information about WPS.

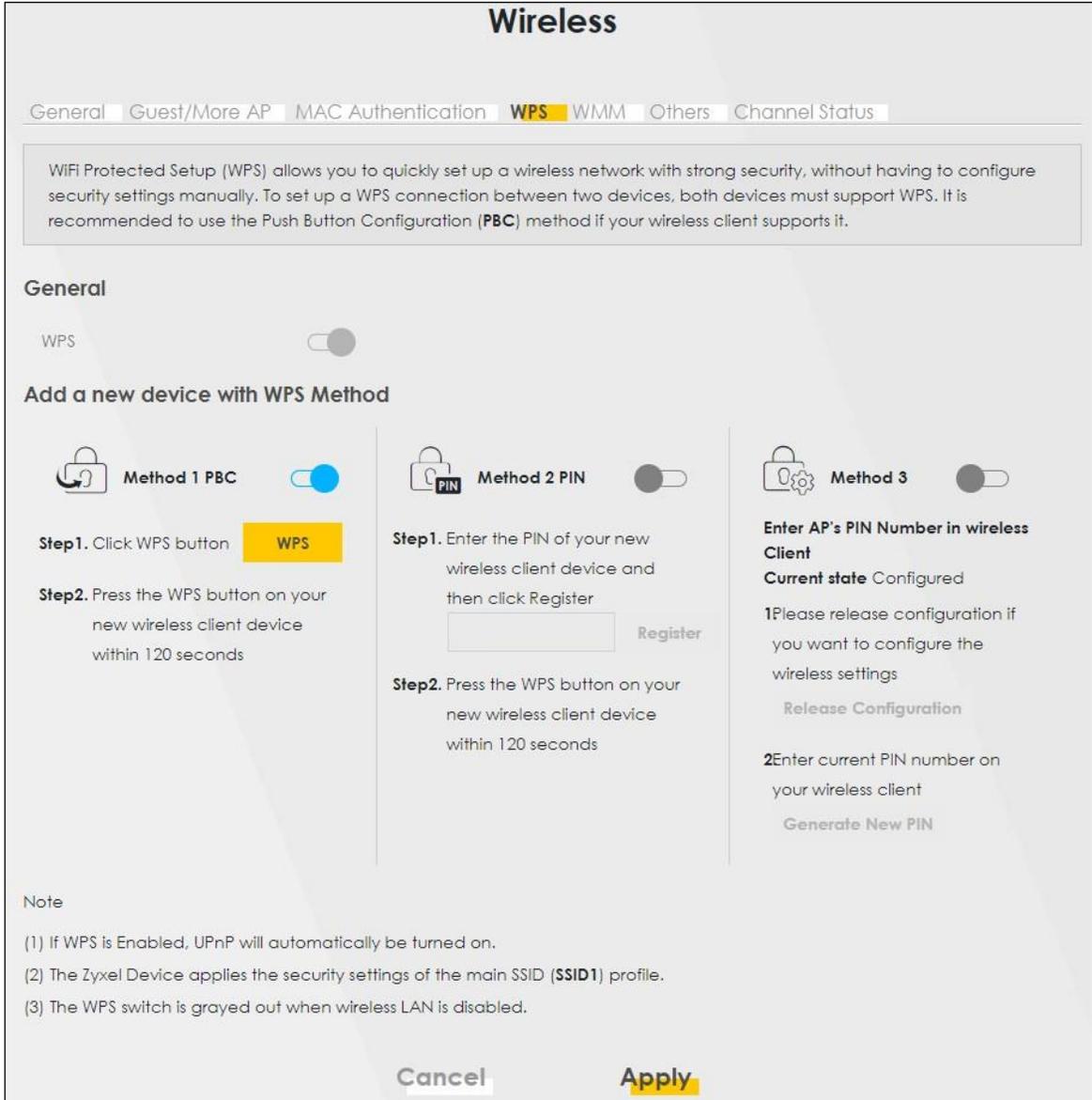
Note: The Zyxel Device applies the security settings of the main SSID (**SSID1**) profile to the WPS wireless connection.

Note: If WPS is enabled, UPnP will automatically be turned on.

Note: The WPS switch is grayed out when WiFi is disabled.

Click **Network Setting > Wireless > WPS**. The following screen displays. Click this switch and makes it turn blue. Click **Apply** to activate the WPS function. Then you can configure the WPS settings in this screen.

Figure 71 Network Setting > Wireless > WPS



The following table describes the labels in this screen.

Table 36 Network Setting > Wireless > WPS

LABEL	DESCRIPTION
General	
WPS	Click this switch to activate or deactivate WPS on this Zyxel Device. When the switch turns blue  , the function is enabled. Otherwise, it is not.
Add a new device with WPS Method	
Method 1	Use this section to set up a WPS wireless network using Push Button Configuration (PBC). Click this switch to make it turn blue. Click Apply to activate WPS method 1 on the Zyxel Device.

Table 36 Network Setting > Wireless > WPS (continued)

LABEL	DESCRIPTION
WPS	<p>Click this button to add another WPS-enabled wireless device (within wireless range of the Zyxel Device) to your wireless network. This button may either be a physical button on the outside of device, or a menu button similar to the WPS button on this screen.</p> <p>Note: You must press the other wireless device's WPS button within two minutes of pressing this button.</p>
Method 2	<p>Use this section to set up a WPS wireless network by entering the PIN of the client into the Zyxel Device. Click this switch and make it turn blue. Click Apply to activate WPS method 2 on the Zyxel Device.</p>
Register	<p>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.</p> <p>You can find the PIN either on the outside of the device, or by checking the device's settings.</p> <p>Note: You must also activate WPS on that device within two minutes to have it present its PIN to the Zyxel Device.</p>
Method 3	<p>Use this section to set up a WPS wireless network by entering the PIN of the Zyxel Device into the client. Click this switch and make it turn blue. Click Apply to activate WPS method 3 on the Zyxel Device.</p>
Release Configuration	<p>The default WPS status is configured.</p> <p>Click this button to remove all configured wireless and wireless security settings for WPS connections on the Zyxel Device.</p>
Generate New PIN	<p>If this method has been enabled, the PIN (Personal Identification Number) of the Zyxel Device is shown here. Enter this PIN in the configuration utility of the device you want to connect to using WPS.</p> <p>The PIN is not necessary when you use the WPS push-button method.</p> <p>Click the Generate New PIN button to have the Zyxel Device create a new PIN.</p>
Cancel	<p>Click Cancel to restore your previously saved settings.</p>
Apply	<p>Click Apply to save your changes.</p>

7.6 WMM Settings

Use this screen to enable WiFi MultiMedia (**WMM**) and **WMM Automatic Power Save (APSD)** in wireless networks for multimedia applications. **WMM** enhances data transmission quality, while **APSD** improves power management of wireless clients. This allows delay-sensitive applications, such as voice and video, to run more smoothly.

Click **Network Setting > Wireless > WMM** to display the following screen.

Figure 72 Network Setting > Wireless > WMM

Wireless

General Guest/More AP MAC Authentication WPS **WMM** Others Channel Status

Use this screen to enable Wi-Fi MultiMedia (**WMM**) and **WMM Automatic Power Save (APSD)** in wireless networks for multimedia applications. **WMM** enhances data transmission quality, while **APSD** improves power management of wireless clients. This allows delay-sensitive applications, such as voice and videos, to run more smoothly.

WMM of SSID1

WMM of SSID2

WMM of SSID3

WMM of SSID4

WMM Automatic Power Save Delivery (APSD)

Note

(1) **WMM** cannot be disabled if 802.11 mode includes 802.11n or 802.11ac.
 (2) APSD only affects SSID1. (For SSID2~4, APSD are always enabled.)

Cancel Apply

Note: **WMM** cannot be disabled if 802.11 mode includes 802.11n or 802.11ac.

Note: APSD only affects SSID1. For SSID2-SSID4, APSD is always enabled.

The following table describes the labels in this screen.

Table 37 Network Setting > Wireless > WMM

LABEL	DESCRIPTION
WMM of SSID1~4	Select On to have the Zyxel Device automatically give the wireless network (SSIDx) 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. If the 802.11 Mode in Network Setting > Wireless > Others is set to include 802.11n or 802.11ac, WMM cannot be disabled.
WMM Automatic Power Save Delivery (APSD)	Select this option to extend the battery life of your mobile devices (especially useful for small devices that are running multimedia applications). The Zyxel Device goes to sleep mode to save power when it is not transmitting data. The AP buffers the packets sent to the Zyxel Device until the Zyxel Device "wakes up". The Zyxel Device wakes up periodically to check for incoming data. Note: This works only if the wireless device to which the Zyxel Device is connected also supports this feature. APSD only affects SSID1. For SSID2~4, APSD is always enabled.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

7.7 Others Settings

Use this screen to configure advanced wireless settings, such as additional security settings, power saving, and data transmission settings. Click **Network Setting > Wireless > Others**. The screen appears as shown.

See [Section 7.9.2 on page 136](#) for detailed definitions of the terms listed in this screen.

Figure 73 Network Setting > Wireless > Others

The following table describes the labels in this screen.

Table 38 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.
Output Power	Set the output power of the Zyxel Device. If there is a high density of APs in an area, decrease the output power to reduce interference with other APs. Select one of the following: 20% , 40% , 60% , 80% or 100% .

Table 38 Network Setting > Wireless > Others (continued)

LABEL	DESCRIPTION
Beacon Interval	<p>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.</p> <p>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 from 50 ms to 1000 ms. A high value helps save current consumption of the access point.</p>
DTIM Interval	<p>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 255.</p>
802.11 Mode	<p>For 2.4 GHz frequency WiFi devices:</p> <ul style="list-style-type: none"> • Select 802.11b Only to allow only IEEE 802.11b compliant WiFi devices to associate with the Zyxel Device. • Select 802.11g Only to allow only IEEE 802.11g compliant WiFi devices to associate with the Zyxel Device. • Select 802.11n Only to allow only IEEE 802.11n compliant WiFi devices to associate with the Zyxel Device. • Select 802.11b/g Mixed to allow either IEEE 802.11b or IEEE 802.11g compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. • Select 802.11b/g/n Mixed to allow IEEE 802.11b, IEEE 802.11g or IEEE 802.11n compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. • Select 802.11b/g/n/ax Mixed to allow IEEE 802.11b, IEEE 802.11g, IEEE 802.11n or IEEE 802.11ax compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. <p>For 5 GHz frequency WiFi devices:</p> <ul style="list-style-type: none"> • Select 802.11a Only to allow only IEEE 802.11a compliant WiFi devices to associate with the Zyxel Device. • Select 802.11n Only to allow only IEEE 802.11n compliant WiFi devices to associate with the Zyxel Device. • Select 802.11ac Only to allow only IEEE 802.11ac compliant WiFi devices to associate with the Zyxel Device. • Select 802.11a/n Mixed to allow either IEEE 802.11a or IEEE 802.11n compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. • Select 802.11n/ac Mixed to allow either IEEE 802.11n or IEEE 802.11ac compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. • Select 802.11a/n/ac Mixed to allow IEEE 802.11a, IEEE 802.11n or IEEE 802.11ac compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced. • Select 802.11a/n/ac/ax Mixed to allow IEEE 802.11a, IEEE 802.11n, IEEE 802.11ac or IEEE 802.11ax compliant WiFi devices to associate with the Zyxel Device. The transmission rate of your Zyxel Device might be reduced.
802.11 Protection	<p>Enabling this feature can help prevent collisions in mixed-mode networks (networks with both IEEE 802.11b and IEEE 802.11g traffic).</p> <p>Select Auto to have the wireless devices transmit data after a RTS/CTS handshake. This helps improve IEEE 802.11g performance.</p> <p>Select Off to disable 802.11 protection. The transmission rate of your Zyxel Device might be reduced in a mixed-mode network.</p> <p>This field displays Off and is not configurable when you set 802.11 Mode to 802.11b Only.</p>
Preamble	<p>Select a preamble type from the drop-down list box. Choices are Long or Short. See Section 7.9.7 on page 139 for more information.</p> <p>This field is configurable only when you set 802.11 Mode to 802.11b or 802.11b/g Mixed.</p>

Table 38 Network Setting > Wireless > Others (continued)

LABEL	DESCRIPTION
Protected Management Frames	<p>This option is only available when using WPA2-PSK as the Security Mode and AES Encryption in Network Setting > Wireless > General. Management frame protection (MFP) helps prevent wireless DoS attacks.</p> <p>Select Disable if you do not want to use MFP.</p> <p>Select Capable to encrypt management frames of wireless clients that support MFP. Clients that do not support MFP will still be allowed to join the wireless network, but remain unprotected.</p> <p>Select Required to allow only clients that support MFP to join the wireless network.</p>
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

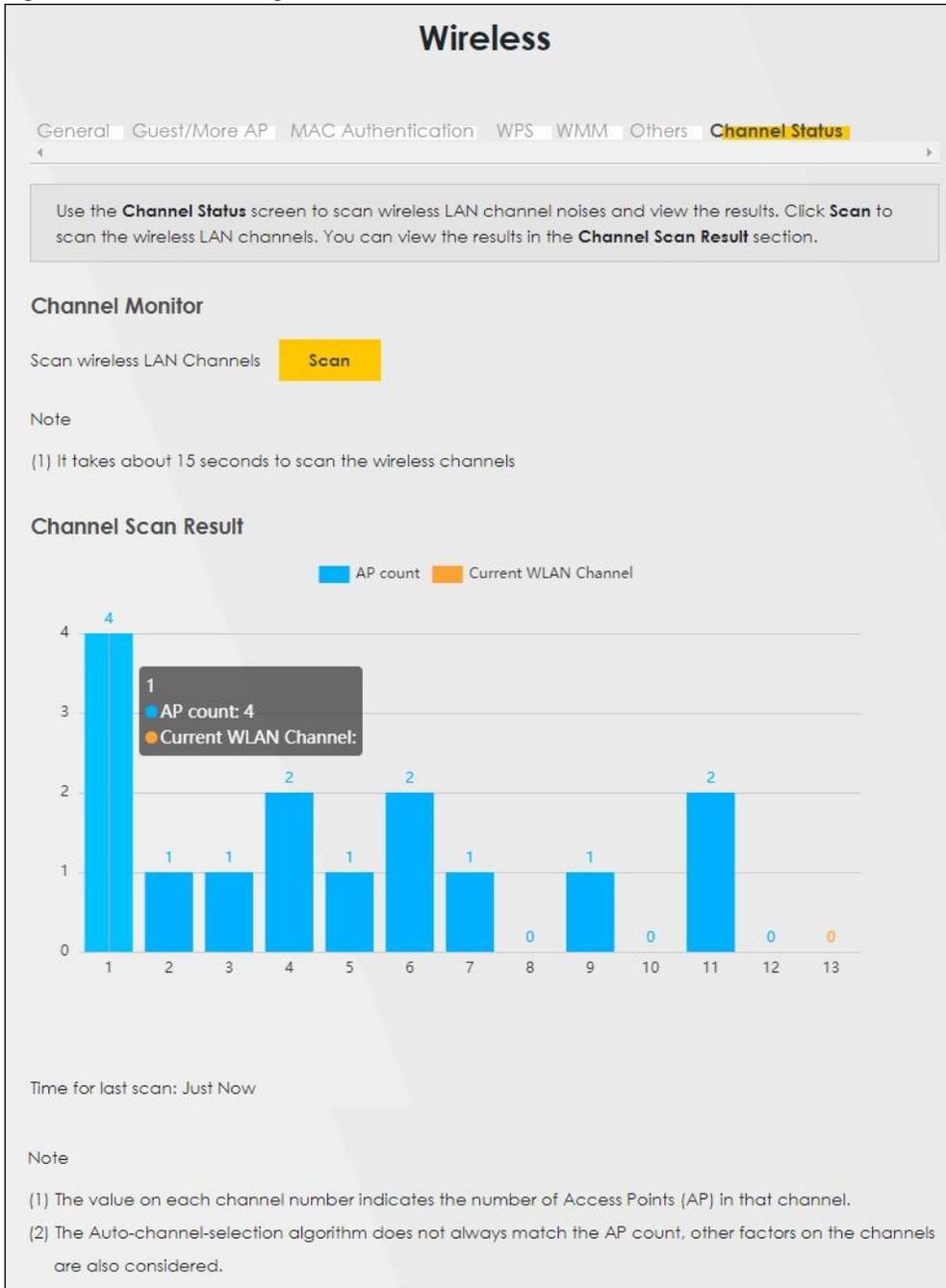
7.8 Channel Status Settings

Use this screen to scan for wireless LAN channel noise and view the results. Click **Scan** to start, and then view the results in the **Channel Scan Result** section.

Note: If the current channel is a DFS channel, the warning 'Channel scan process is denied because current channel is a DFS channel (Channel: 52~140). If you want to run channel scan, please select a non-DFS channel and try again.' appears.

Note: The value on each channel number indicates the number of Access Points (AP) using that channel.

Note: The Auto-channel-selection algorithm does not always directly follow the AP count; other factors about the channels are also considered.

Figure 74 Network Setting > Wireless > Channel Status

7.9 Technical Reference

This section discusses WiFi in depth. For more information, see [Appendix B on page 288](#).

7.9.1 Wireless Network Overview

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

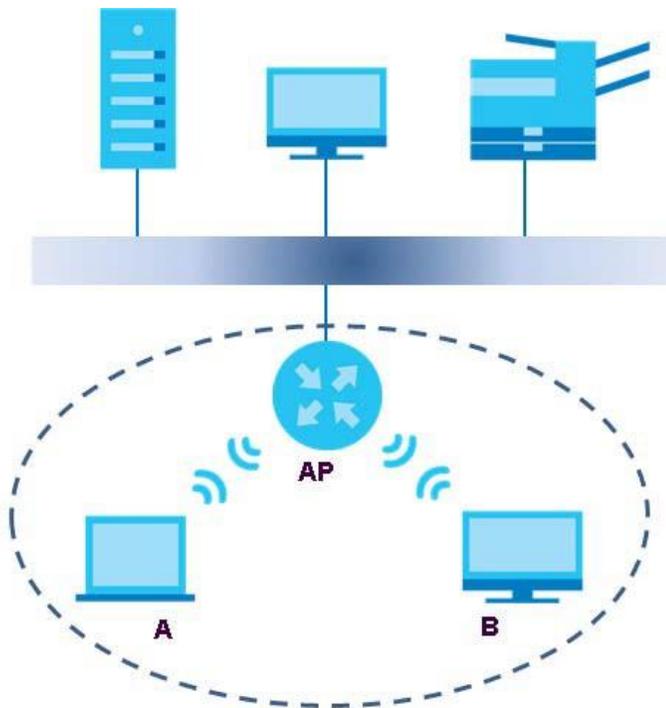
- A wireless client is a radio connected to a user's computer.
- An access point is a radio with a wired connection to a network, which can connect with numerous wireless clients and let them access the network.
- A bridge is a radio that relays communications between access points and wireless clients, 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 75 Example of a Wireless Network



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

Every wireless network must follow these basic guidelines.

- Every device in the same wireless network must use the same SSID.
The SSID is the name of the wireless network. It stands for Service Set Identifier.

- If two wireless networks overlap, they should use a different channel.
Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.
- Every device in the same wireless network must use security compatible with the AP.
Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

Radio Channels

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

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

7.9.2 Additional Wireless Terms

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

Table 39 Additional Wireless Terms

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

7.9.3 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.

7.9.3.1 SSID

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

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

7.9.3.2 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 characters²; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each device in the wireless network, see the device's User's Guide or other documentation.

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

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

-
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.

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

7.9.3.4 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.

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.

7.9.4 Signal Problems

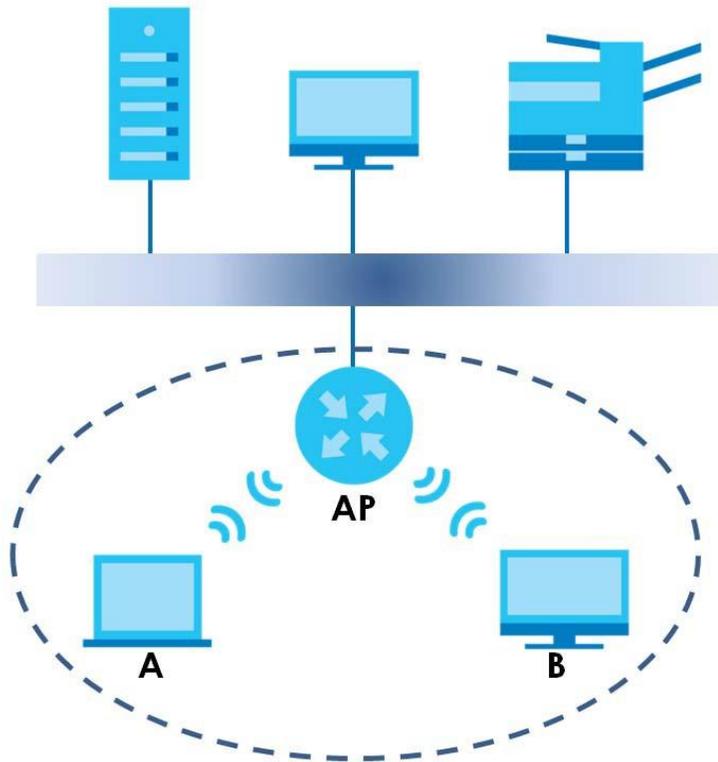
Because wireless networks are radio networks, their signals are subject to limitations of distance, interference and absorption.

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.

7.9.5 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 76 Basic Service Set

7.9.6 MBSSID

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

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

7.9.6.1 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.

7.9.7 Preamble Type

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

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

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

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

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the Zyxel Device uses long preamble.

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

7.9.8 WiFi Protected Setup (WPS)

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

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

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

7.9.8.1 Push Button Configuration

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

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

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

- 1 Ensure that the two devices you want to set up are within wireless range of one another.
- 2 Look for a WPS button on each device. If the device does not have one, log into its configuration utility and locate the button (see the device's User's Guide for how to do this - for the Zyxel Device, see [Section 7.6 on page 129](#)).
- 3 Press the button on one of the devices (it doesn't matter which). For the Zyxel Device you must press the WPS button for more than five seconds.
- 4 Within two minutes, press the button on the other device. The registrar sends the network name (SSID) and security key through a 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.

7.9.8.2 PIN Configuration

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

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

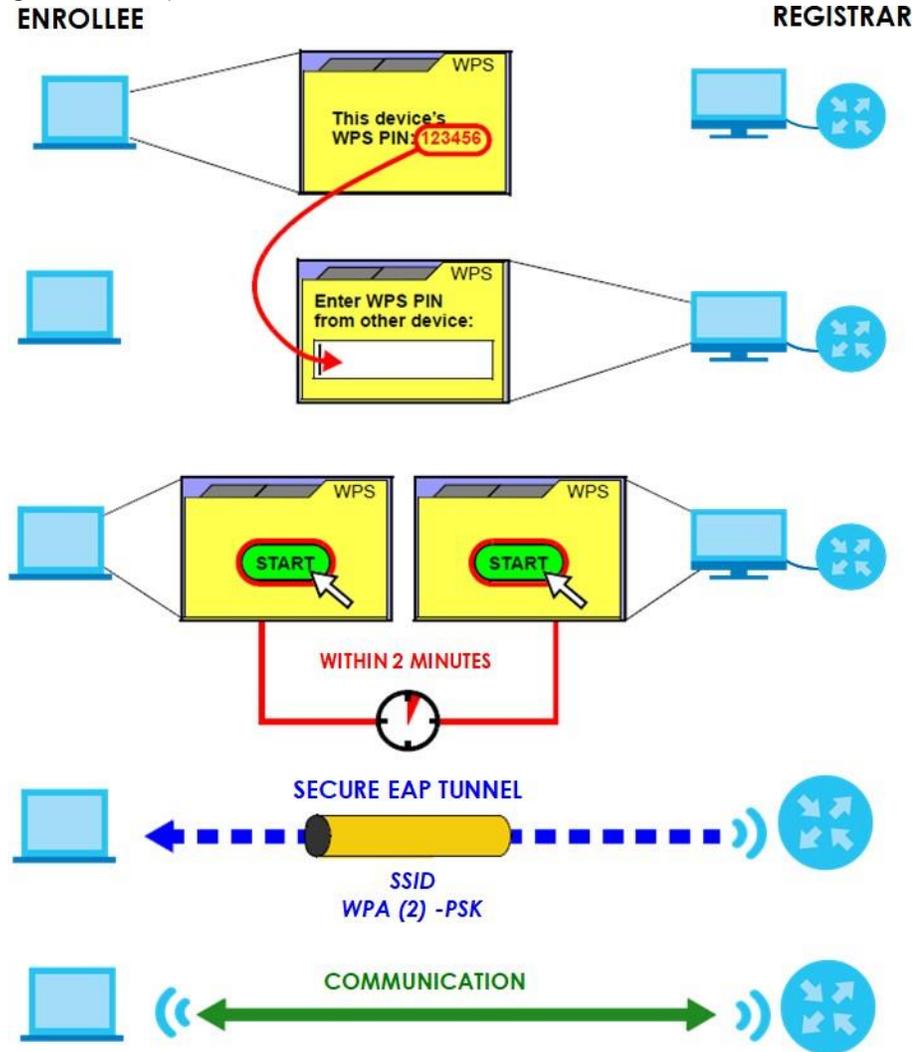
When you use the PIN method, you must enter the PIN from one device (usually the wireless client) into the second device (usually the Access Point or wireless router). Then, when WPS is activated on the first device, it presents its PIN to the second device. If the PIN matches, one device sends the network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

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

- 1 Ensure WPS is enabled on both devices.
- 2 Access the WPS section of the AP's configuration interface. See the device's User's Guide for how to do this.
- 3 Look for the client's WPS PIN; it will be displayed either on the device, or in the WPS section of the client's configuration interface (see the device's User's Guide for how to find the WPS PIN - for the Zyxel Device, see [Section 7.5 on page 127](#)).
- 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.

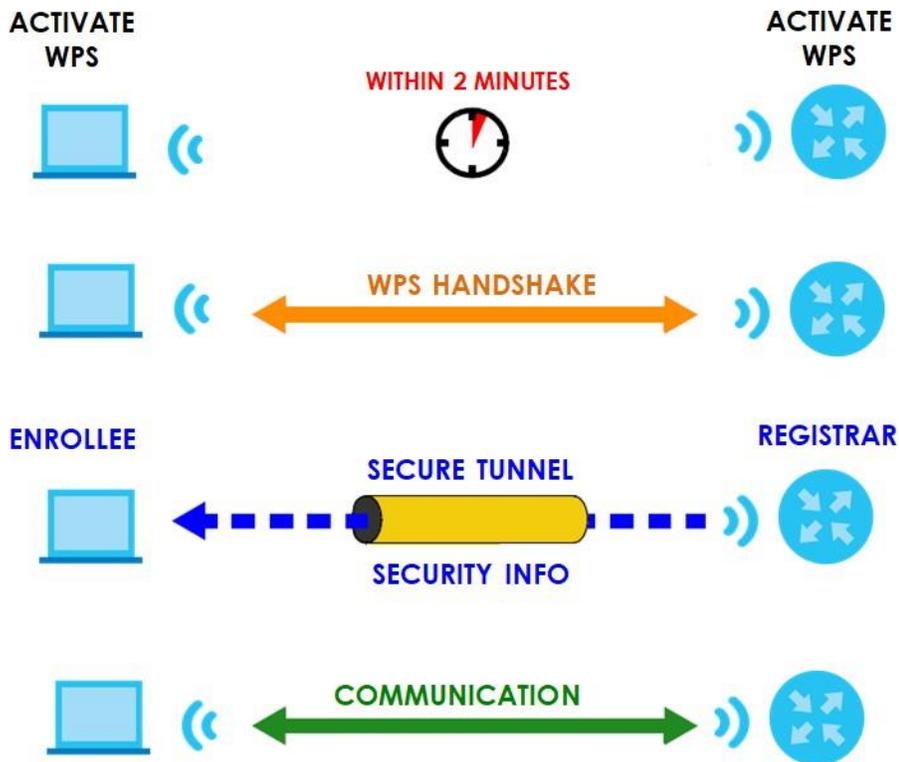
The following figure shows a WPS-enabled wireless client (installed in a notebook computer) connecting to the WPS-enabled AP via the PIN method.

Figure 77 Example WPS Process: PIN Method

7.9.8.3 How WPS Works

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

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

Figure 78 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.

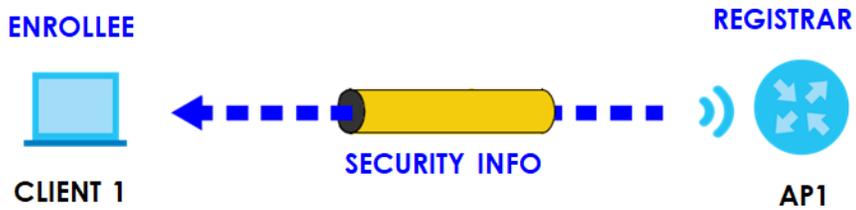
Note that the access point (AP) is not always the registrar, and the wireless client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled wireless clients.

By default, a WPS device 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.

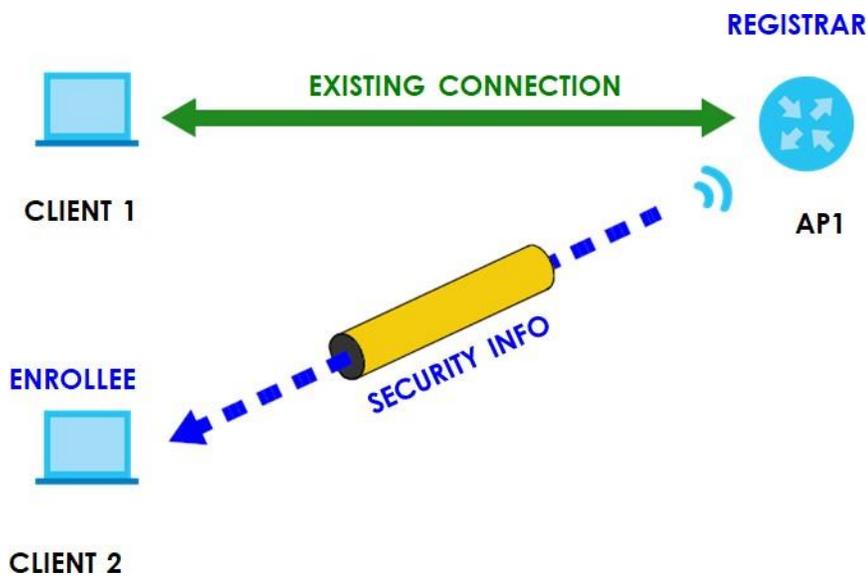
7.9.8.4 Example WPS Network Setup

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

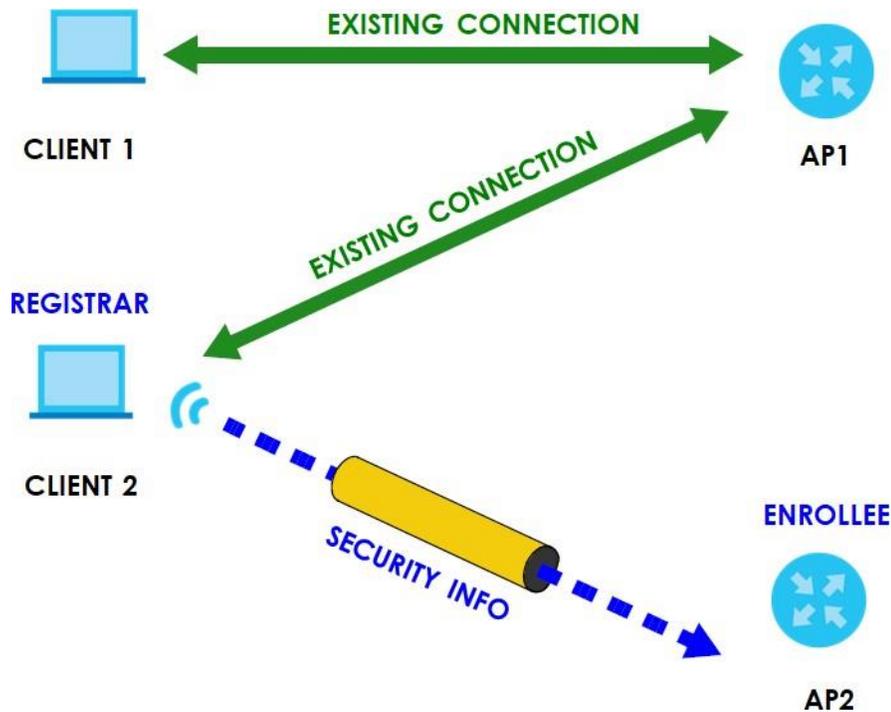
The following figure shows an example network. In step 1, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information to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

Figure 79 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 80 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 81 WPS: Example Network Step 3

7.9.8.5 Limitations of WPS

WPS has some limitations of which you should be aware.

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

For instance, if you have two enrollees and one registrar you must set up the first enrollee (by pressing the WPS button on the registrar and the first enrollee, for example), then check that it successfully enrolled, then set up the second device in the same way.

- WPS works only with other WPS-enabled devices. However, you can still add non-WPS devices to a network you already set up using WPS.

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

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

You can easily check to see if this has happened. WPS works between only two devices simultaneously, so if another device has enrolled your device will be unable to enroll, and will not have access to the network. If this happens, open the access point’s configuration interface and look at the list of associated clients (usually displayed by MAC address). It does not matter if the access

point is the WPS registrar, the enrollee, or was not involved in the WPS handshake; a rogue device must still associate with the access point to gain access to the network. Check the MAC addresses of your wireless clients (usually printed on a label on the bottom of the device). If there is an unknown MAC address you can remove it or reset the AP.

CHAPTER 8

Home Networking

8.1 Home Networking 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.

Figure 82 Home Networking Example



8.1.1 What You Can Do in this Chapter

- Use the **LAN Setup** screen to set the LAN IP address, subnet mask, and DHCP settings of your Zyxel Device ([Section 8.2 on page 149](#)).
- 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 154](#)).
- Use the **UPnP** screen to enable UPnP and UPnP NAT traversal on the Zyxel Device ([Section 8.4 on page 156](#)).
- Use the **Additional Subnet** screen to configure IP alias and public static IP ([Section 8.5 on page 162](#)).
- Use the **STB Vendor ID** screen to configure the Vendor IDs of the connected Set Top Box (STB) devices, which have the Zyxel Device automatically create static DHCP entries for the STB devices when they request IP addresses ([Section 8.6 on page 163](#)).
- Use the **Wake on LAN** screen to remotely turn on a device on the network. ([Section 8.7 on page 164](#)).
- Use the **TFTP Server Name** screen to identify a TFTP server for configuration file download using DHCP option 66. ([Section 8.8 on page 165](#)).

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, and so on) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet Mask

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

DHCP

A DHCP (Dynamic Host Configuration Protocol) server can assign your Zyxel Device an IP address, subnet mask, DNS and other routing information when it is 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 10). 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 198](#) for more information on NAT.

Cautions with UPnP

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

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

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

UPnP and Zyxel

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

See [Section 8.4.1 on page 158](#) for examples of installing and using UPnP.

Finding Out More

See [Section 8.9 on page 166](#) 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 LAN Setup

Use this screen to set the IP address and subnet mask of your Zyxel Device. Configure DHCP settings to have the Zyxel Device or a DHCP server assign IP addresses to devices. 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 Zyxel Device.
- 2 Enter the IP subnet mask into the **IP Subnet Mask** field. Unless instructed otherwise it is best to leave this alone, the configurator will automatically compute a subnet mask based upon the IP address you entered.
- 3 Click **Apply** to save your settings.

Figure 83 Network Setting > Home Networking > LAN Setup

Home Networking

LAN Setup Static DHCP SUPP Additional Subnet Enable Vendor ID Wake on LAN TFTP Server Name

Use this screen to set the Local Area Network IP address and subnet mask of your Zynol Device. Configure DHCP settings to have the Zynol Device or a DHCP server assign IP addresses to devices.

Interface Group

Group Name:

LAN IP Setup

IP Address:

Subnet Mask:

IGMP Snooping

Active:

IGMP Mode: Standard Mode Blocking Mode

DHCP Server State

DHCP: Enable Disable DHCP Relay

IP Addressing Values

Beginning IP Address:

Ending IP Address:

Auto reserve IP for the same host:

DHCP Server Lease Time

days hours minutes

DNS Values

DNS: DNS Proxy Static From ISP

LAN IPv6 Mode Setup

IPv6 Active:

Link Local Address Type

EUI64 Manual

LAN Global Identifier Type

EUI64 Manual

LAN IPv6 Prefix Setup

Delegate prefix from WAN:
 Static

MLD Snooping

Active:

MLD Mode: Standard Mode Blocking Mode

LAN IPv6 Address Assign Setup

LAN IPv6 DNS Assign Setup

DHCPv6 Configuration

DHCPv6 Active: DHCPv6 Server:

IPv6 Router Advertisement State

RADVD Active: Enable:

IPv6 DNS Values

IPv6 DNS Server 1:

IPv6 DNS Server 2:

IPv6 DNS Server 3:

DNS Query Scenario

The following table describes the fields in this screen.

Table 40 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 15 on page 226 for how to create a new interface group.
LAN IP Setup	
IP Address	Enter the LAN IPv4 IP address you want to assign to your Zyxel Device in dotted decimal notation, for example, 192.168.1.1 (factory default).
Subnet Mask	Type the subnet mask of your network in dotted decimal notation, for example 255.255.255.0 (factory default). Your Zyxel Device automatically computes the subnet mask based on the IP address you enter, so do not change this field unless you are instructed to do so.
IGMP Snooping	
Active	Select Enable to allow the Zyxel Device to passively learn multicast group.
IGMP Mode	Select Standard Mode to 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 block all unknown multicast packets from the WAN.
DHCP Server State	
DHCP	Select Enable to have the Zyxel Device act as a DHCP server or DHCP relay agent. Select Disable to stop the DHCP server on the Zyxel Device. Select DHCP Relay to have the Zyxel Device forward DHCP request to the DHCP server.
DHCP Relay Server Address	This field is only available when you select DHCP Relay in the DHCP field.
IP Address	Enter the IPv4 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.
Auto reserve IP for the same host	Click this switch to have the Zyxel Device record DHCP IP addresses with the MAC addresses the IP addresses are assigned to. When the switch goes to the right  , the function is enabled. Otherwise, it is not. The Zyxel Device assigns the same IP address to the same MAC address when the host requests an IP address again through DHCP.
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 DNS service provider (From ISP). Select DNS Proxy if you have the DNS proxy service. The Zyxel Device redirects clients' DNS queries to a DNS server for resolving domain names. Select Static if you have the static DNS service.

Table 40 Network Setting > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
DNS Server 1/2	Enter the first and second DNS (Domain Name System) server IP addresses the Zyxel Device passes to the DHCP clients.
LAN IPv6 Mode Setup	
IPv6 Active	Click this switch to enable or disable the IPv6 mode and configure IPv6 settings on the Zyxel Device. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
Link Local Address Type	
EUI64	Select this to have the Zyxel Device generate an interface ID for the LAN interface's link-local address using the EUI-64 format.
Manual	Select this to manually enter an interface ID for the LAN interface's link-local address.
LAN Global Identifier Type	
EUI64	Select this to have the Zyxel Device generate an interface ID using the EUI-64 format for its global address.
Manual	Select this to manually enter an interface ID for the LAN interface's global IPv6 address.
LAN IPv6 Prefix Setup	
Delegate prefix from WAN	Select this option and specify a WAN interface (connection) through which the Zyxel Device automatically obtains an IPv6 network prefix from the service provider or an uplink router.
Static	Select this option to configure a fixed IPv6 prefix for the Zyxel Device's LAN IPv6 address.
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.
Active	Click this switch to enable or disable MLD Snooping on the Zyxel Device. When the switch goes to the right  , the function is enabled. Otherwise, it is not. This allows the Zyxel Device to check MLD packets passing through it and learn the multicast group membership. It helps reduce multicast traffic.
MLD Mode	Select Standard Mode to 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 block all unknown multicast packets from the WAN.
LAN IPv6 Address Assign Setup	Select how you want to obtain an IPv6 address: <ul style="list-style-type: none">• Stateless: The Zyxel Device uses IPv6 stateless autoconfiguration. RADVD (Router Advertisement Daemon) is enabled to have the Zyxel Device send IPv6 prefix information in router advertisements periodically and in response to router solicitations. DHCPv6 server is disabled.• Stateful: The Zyxel Device uses IPv6 stateful autoconfiguration. The DHCPv6 server is enabled to have the Zyxel Device act as a DHCPv6 server and pass IPv6 addresses to DHCPv6 clients.
LAN IPv6 DNS Assign Setup	Select how the Zyxel Device provide DNS server and domain name information to the clients: <ul style="list-style-type: none">• From Router Advertisement: The Zyxel Device provides DNS information through router advertisements.• From DHCPv6 Server: The Zyxel Device provides DNS information through DHCPv6.• From RA & DHCPv6 Server: The Zyxel Device provides DNS information through both router advertisements and DHCPv6.
DHCPv6 Configuration	
DHCPv6 Active	This shows the status of the DHCPv6. DHCPv6 Server displays if you configured the Zyxel Device to act as a DHCPv6 server which assigns IPv6 addresses and/or DNS information to clients.
IPv6 Router Advertisement State	
RADVD Active	This shows whether RADVD is enabled or not.
IPv6 Address Values (This section is available only when you select Stateful in the LAN IPv6 Address Assign Setup field.)	

Table 40 Network Setting > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
IPv6 Start Address	Enter the first of the contiguous addresses in the IPv6 address pool.
IPv6 End Address	Enter the last of the contiguous addresses in the IPv6 address pool.
IPv6 Domain Name	Enter the domain name that is assigned to the DHCPv6 clients.
IPv6 DNS Values	
IPv6 DNS Server 1-3	<p>Select From ISP if your ISP dynamically assigns IPv6 DNS server information.</p> <p>Select User-Defined if you have the IPv6 address of a DNS server. Enter the DNS server IPv6 addresses the Zyxel Device passes to the DHCP clients.</p> <p>Select None if you do not want to configure IPv6 DNS servers.</p>
DNS Query Scenario	<p>Select how the Zyxel Device handles clients' DNS information requests.</p> <ul style="list-style-type: none"> • IPv4/IPv6 DNS Server: The Zyxel Device forwards the requests to both the IPv4 and IPv6 DNS servers and sends clients the first DNS information it receives. • IPv6 DNS Server Only: The Zyxel Device forwards the requests to the IPv6 DNS server and sends clients the DNS information it receives. • IPv4 DNS Server Only: The Zyxel Device forwards the requests to the IPv4 DNS server and sends clients the DNS information it receives. • IPv6 DNS Server First: The Zyxel Device forwards the requests to the IPv6 DNS server first and then the IPv4 DNS server. Then it sends clients the first DNS information it receives. • IPv4 DNS Server First: The Zyxel Device forwards the requests to the IPv4 DNS server first and then the IPv6 DNS server. Then it sends clients the first DNS information it receives.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

8.3 LAN Static DHCP

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

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

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

Figure 84 Network Setting > Home Networking > Static DHCP

The following table describes the labels in this screen.

Table 41 Network Setting > Home Networking > Static DHCP

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

If you click **Static DHCP Configuration** in the **Static DHCP** screen or the **Edit** icon next to a static DHCP entry, the following screen displays. Using a static DHCP means a client will always have the same IP address assigned to it by the DHCP server. Assign a fixed IP address to a device by selecting the interface group of this device and its IP address type and selecting the device/computer from a list or manually entering its MAC address and assigned IP address.

Figure 85 Static DHCP: Static DHCP Configuration/Edit

The screenshot shows the 'Static DHCP Configuration' interface. It includes a back arrow, a title, and several configuration options:

- Active:** A toggle switch that is currently turned on (blue).
- Group Name:** A dropdown menu set to 'Default'.
- IP Type:** A dropdown menu set to 'IPv4'.
- Select Device Info:** A dropdown menu with 'Sam Yu(192.168.1.13)' selected and highlighted by a yellow box.
- MAC Address:** A field containing 'dc - 4a - 3e - 40 - ec - 5f'.
- IP Address:** A field containing '192 . 168 . 1 . 13'.

 At the bottom, there are 'Cancel' and 'OK' buttons.

The following table describes the labels in this screen.

Table 42 Static DHCP: Static DHCP Configuration/Edit

LABEL	DESCRIPTION
Active	Click this switch to enable or disable the connection between the client and the Zyxel Device. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
Group Name	Select the interface group name for which you want to configure static DHCP settings. See Chapter 15 on page 226 for how to create a new interface group.
IP Type	This field displays IPv4 for the type of the DHCP IP address. At the time of writing, it is not allowed to select other type.
Select Device Info	Select a device or computer from the drop-down list or select Manual Input to manually enter a device's MAC address and IP address in the following fields.
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.
Cancel	Click Cancel to restore your previously saved settings.
OK	Click OK to save your changes.

8.4 UPnP Settings

Universal Plug and Play (UPnP) is an open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between networking devices or software applications which have UPnP enabled. A UPnP device can dynamically join a network, obtain an IP address, advertise its services, and learn about other devices on the network. A device can also leave a network automatically when it is no longer in use.

See [Section 8.4.1 on page 158](#) for more information on UPnP.

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

Note: To use **UPnP NAT-T**, enable **NAT** in the **Network Setting > Broadband > Edit/Add New WAN Interface** screen.

Figure 86 Network Setting > Home Networking > UPnP

Home Networking

LAN Setup | Static DHCP | **UPnP** | Additional Subnet | STB Vendor ID | Wake on LAN | TFTP Server Name

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. A device can then leave a network smoothly and automatically when it is no longer in use.

UPnP State

UPnP

UPnP NAT-T State

UPnP NAT-T

Note

To use **UPnP NAT-T**, enable **NAT** in the **Network Setting > Broadband > Edit/Add New WAN Interface** screen.

#	Description	Destination IP Address	External Port	Internal Port	Protocol
---	-------------	------------------------	---------------	---------------	----------

Cancel **Apply**

The following table describes the labels in this screen.

Table 43 Network Setting > Home Networking > UPnP

LABEL	DESCRIPTION
UPnP State	
UPnP	Click this switch to enable or disable UPnP. When the switch goes to the right , the function is enabled. Otherwise, it is not. Be aware that anyone could use a UPnP application to open the Web Configurator's login screen without entering the Zyxel Device's IP address (although you must still enter the password to access the Web Configurator).
UPnP NAT-T State	
UPnP NAT-T	Click this switch to allow UPnP-enabled applications to automatically configure the Zyxel Device so that they can communicate through the Zyxel Device by using NAT traversal. When the switch goes to the right , the function is enabled. Otherwise, it is not. 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. The table below displays the NAT port forwarding rules added automatically by UPnP NAT-T.
#	This is the index number of the UPnP NAT-T connection.

Table 43 Network Setting > Home Networking > UPnP (continued)

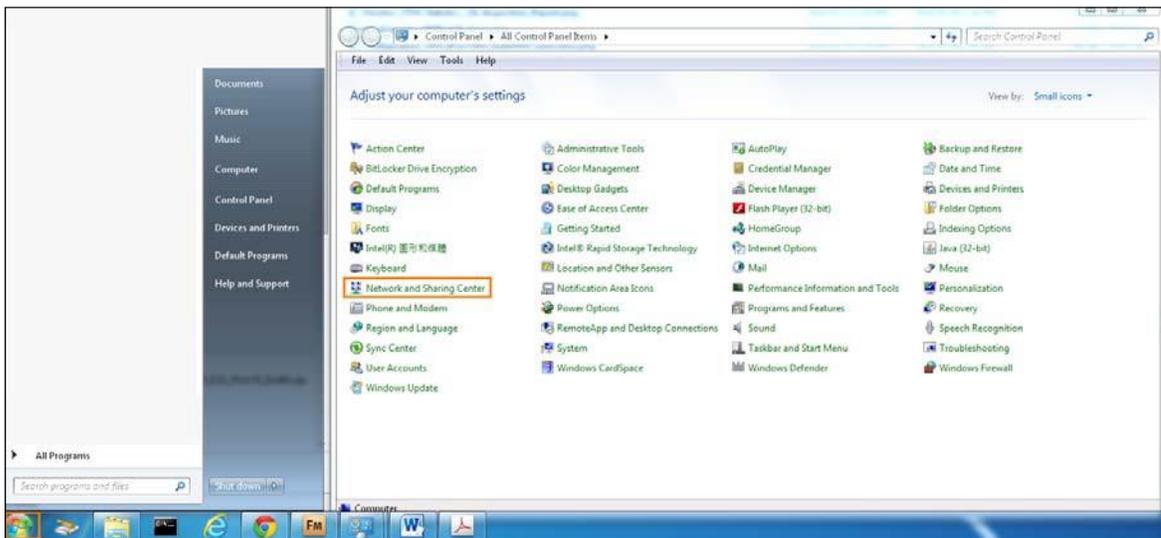
LABEL	DESCRIPTION
Description	This is the description of the UPnP NAT-T connection.
Destination IP Address	This is the IP address of the other connected UPnP-enabled device.
External Port	This is the external port number that identifies the service.
Internal Port	This is the internal port number that identifies the service.
Protocol	This is the transport layer protocol used for the service.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

8.4.1 Turning on UPnP in Windows 7 Example

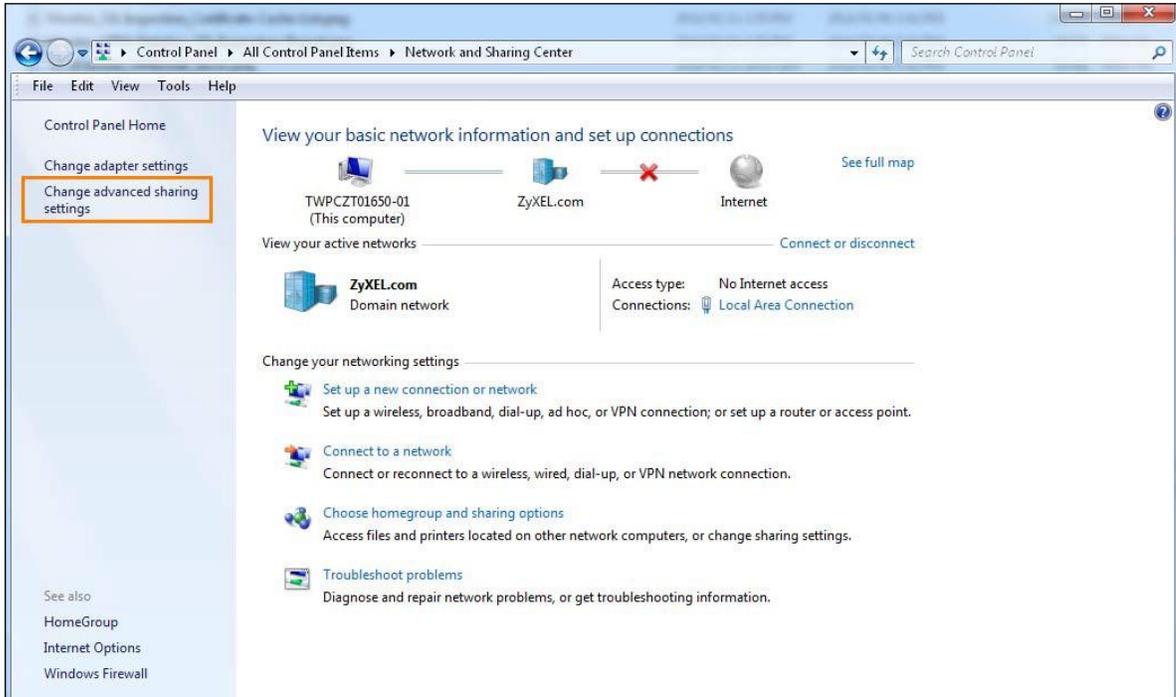
This section shows you how to use the UPnP feature in Windows 7. UPnP server is installed in Windows 7. Activate UPnP on the Zyxel Device in **Network Setting > Home Networking > UPnP**.

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

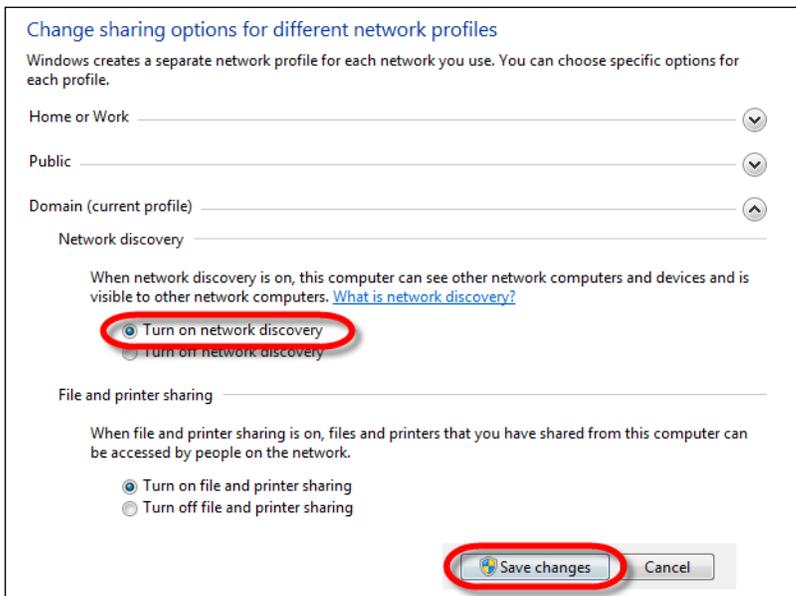
- 1 Click the start icon, **Control Panel** and then the **Network and Sharing Center**.



- 2 Click **Change Advanced Sharing Settings**.



- 3 Select **Turn on network discovery** and click **Save Changes**. Network discovery allows your computer to find other computers and devices on the network and other computers on the network to find your computer. This makes it easier to share files and printers.

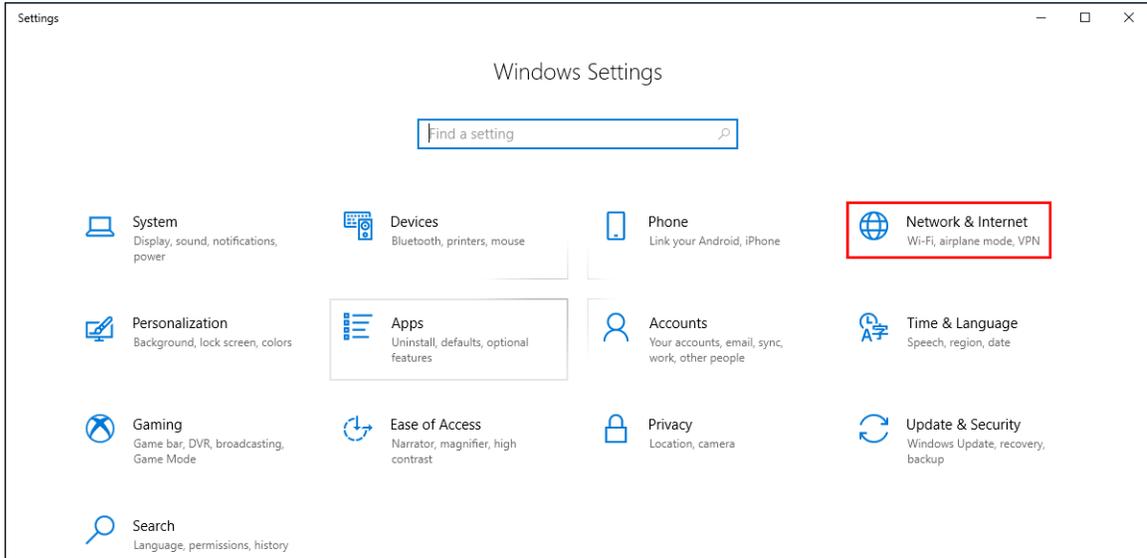


8.4.2 Turning on UPnP in Windows 10 Example

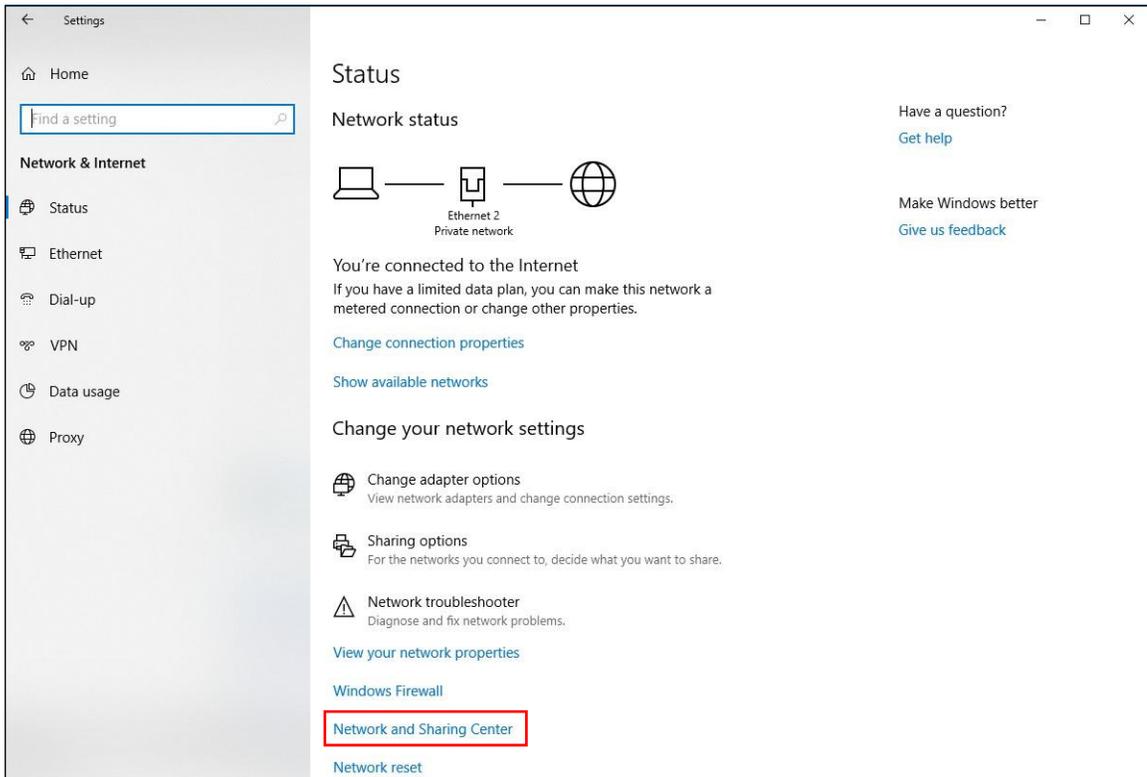
This section shows you how to use the UPnP feature in Windows 10. UPnP server is installed in Windows 10. Activate UPnP on the Zyxel Device in **Network Setting > Home Networking > UPnP**.

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

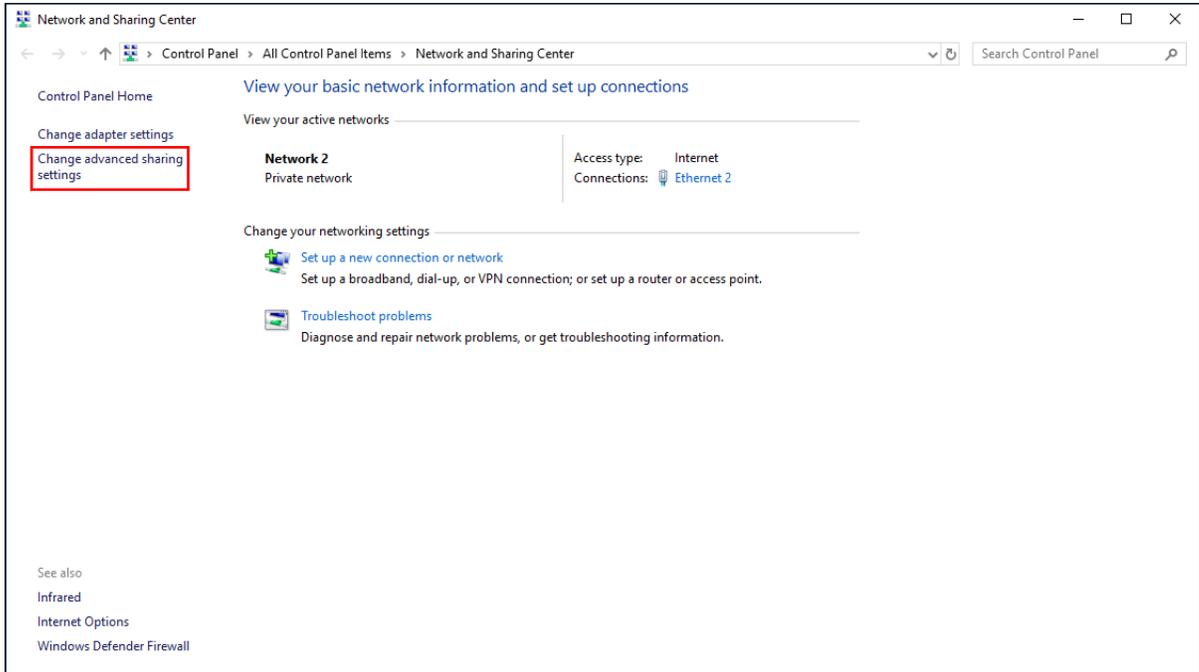
- 1 Click the start icon, **Settings** and then **Network & Internet**.



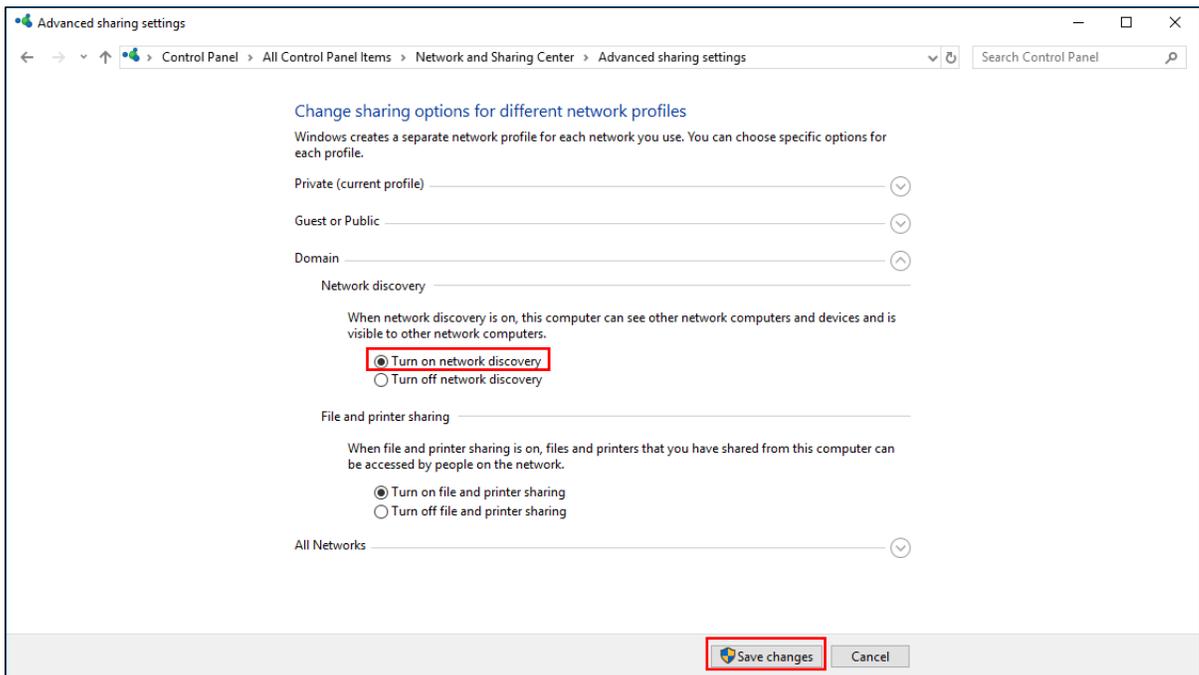
- 2 Click **Network and Sharing Center**.



- 3 Click **Change advanced sharing settings**.



- 4 Under **Domain**, select **Turn on network discovery** and click **Save Changes**. Network discovery allows your computer to find other computers and devices on the network and other computers on the network to find your computer. This makes it easier to share files and printers.



8.5 LAN Additional Subnet

Use this 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 Zyxel Device supports multiple logical LAN interfaces via its physical Ethernet interface with the Zyxel 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 Zyxel Device may use a LAN IP address that can be accessed from the WAN.

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

Figure 87 Network Setting > Home Networking > Additional Subnet

Home Networking

LAN Setup
Static DHCP
UPnP
Additional Subnet
STB Vendor ID
Wake on LAN
TFTP Server Name

Use this 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 Zyxel Device supports multiple logical LAN interfaces via its physical Ethernet interface with the Zyxel 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 Zyxel Device may use a LAN IP address that can be accessed from the WAN.

IP Alias Setup

Group Name:

Active:

IPv4 Address:

Subnet Mask:

Public LAN

Active:

IPv4 Address:

Subnet Mask:

Offer Public IP by DHCP:

Enable ARP Proxy:

Cancel
Apply

The following table describes the labels in this screen.

Table 44 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 15 on page 226 for how to create a new interface group.
Active	Click this switch to configure a LAN network for the Zyxel Device. When the switch goes to the right  , the following fields will be configurable. Otherwise, they are not.
IPv4 Address	Enter the IP address of your Zyxel Device in dotted decimal notation.
Subnet Mask	Your Zyxel Device will automatically calculate the subnet mask based on the IPv4 address that you assign. Unless you are implementing subnetting, use this value computed by the Zyxel Device.
Public LAN	
Active	Click this switch to enable or disable the Public LAN feature. When the switch goes to the right  , the function is enabled. Otherwise, it is not. Your ISP must support Public LAN and static IP.
IPv4 Address	Enter the public IP address provided by your ISP.
Subnet Mask	Enter the public IPv4 subnet mask provided by your ISP.
Offer Public IP by DHCP	Click this switch to enable or disable the Zyxel Device to provide public IP addresses by DHCP server. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
Enable ARP Proxy	Click this switch to enable or disable the ARP (Address Resolution Protocol) proxy. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

8.6 STB Vendor ID

Use this screen to configure the Vendor IDs of connected Set Top Boxes (STBs) so the Zyxel Device can 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 88 Network Setting > Home Networking > STB Vendor ID

The following table describes the labels in this screen.

Table 45 Network Setting > Home Networking > STB Vendor ID

LABEL	DESCRIPTION
Vendor ID 1~5	These are STB's Vendor Class Identifiers (DHCP option 60). A Vendor Class Identifier is usually used to inform the DHCP server a DHCP client's vendor and functionality.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

8.7 Wake on LAN

Wake on LAN (WoL) allows you to remotely turn on a device on the network, such as a computer, storage device or media server. To use this feature the remote hardware (for example the network adapter on a computer) must support Wake On LAN using the 'Magic Packet' method.

You need to know the MAC address of the LAN device. It may be on a label on the device or in its documentation.

Click **Network Setting > Home Networking > Wake on LAN** to open this screen.

Figure 89 Network Setting > Home Networking > Wake on LAN

The following table describes the labels in this screen.

Table 46 Network Setting > Home Networking > Wake on LAN

LABEL	DESCRIPTION
Wake by Address	Select Manual and enter the IP address or MAC address of the device to turn it on remotely. The drop-down list also lists the IP addresses that can be found in the Zyxel Device's ARP table. If you select an IP address, the MAC address of the device with the selected IP address then displays in the MAC Address field.
IP Address	Enter the IPv4 IP address of the device to turn it on. This field is not available if you select an IP address in the Wake by Address field.
MAC Address	Enter the MAC address of the device to turn it on. A MAC address consists of six hexadecimal character pairs.
Wake up	Click this to send a WoL magic packet to wake up the specified device.

8.8 TFTP Server Name

Use the **TFTP Server Name** screen to identify a TFTP server for configuration file download using DHCP option 66. RFC 2132 defines the option 66 open standard. DHCP option 66 supports the IP address or the host name of a single TFTP server.

Click **Network Setting > Home Networking > TFTP Server Name** to open this screen.

Figure 90 Network Setting > Home Networking > TFTP Server Name

The following table describes the labels in this screen.

Table 47 Network Setting > Home Networking > TFTP Server Name

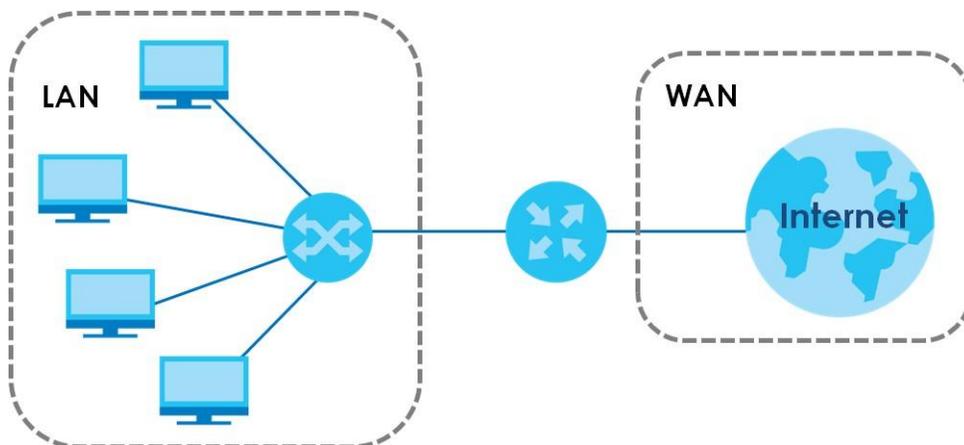
LABEL	DESCRIPTION
TFTP Server Name	Enter the IP address or the host name of a single TFTP server.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

8.9 Technical Reference

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

8.9.1 LANs, WANs and the Zyxel Device

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

Figure 91 LAN and WAN IP Addresses

8.9.2 DHCP Setup

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

IP Pool Setup

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

8.9.3 DNS Server Addresses

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

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

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

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

8.9.4 LAN TCP/IP

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

IP Address and Subnet Mask

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

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

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the Zyxel Device. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your Zyxel Device, but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your Zyxel Device will compute the subnet mask automatically based on the IP address that you entered. You do not need to change the subnet mask computed by the Zyxel Device unless you are instructed to do otherwise.

Private IP Addresses

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

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

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

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

CHAPTER 11

Network Address Translation (NAT)

11.1 NAT Overview

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

11.1.1 What You Can Do in this Chapter

- Use the **Port Forwarding** screen to configure forward incoming service requests to the server(s) on your local network ([Section 11.2 on page 199](#)).
- Use the **Port Triggering** screen to add and configure the Zyxel Device's trigger port settings ([Section 11.3 on page 203](#)).
- Use the **DMZ** screen to configure a default server ([Section 11.4 on page 207](#)).
- Use the **ALG** screen to enable and disable the ALGs in the Zyxel Device ([Section 11.5 on page 208](#)).
- Use the **Address Mapping** screen to configure the Zyxel Device's address mapping settings ([Section 11.6 on page 209](#)).
- Use the **Sessions** screen to configure the Zyxel Device's maximum number of NAT sessions ([Section 11.6 on page 209](#)).

11.1.2 What You Need To Know

Inside/Outside

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

Global/Local

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

NAT

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

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

Port Forwarding

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

Finding Out More

See [Section 11.8 on page 211](#) for advanced technical information on NAT.

11.2 Port Forwarding

Use **Port Forwarding** to forward incoming service requests from the Internet to the server(s) on your local network. Port forwarding is commonly used when you want to host online gaming, P2P file sharing, or other servers on your network.

You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 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 C on page 381](#). Please refer to RFC 1700 for further information about port numbers.

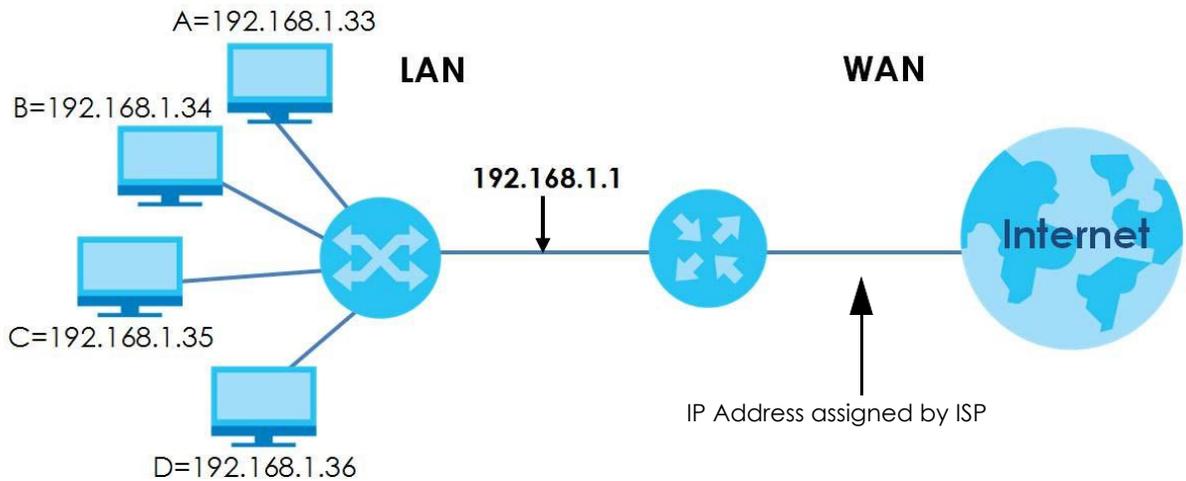
Note: TCP port 7547 is reserved for system use.

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 109 Multiple Servers Behind NAT Example



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

Figure 110 Network Setting > NAT > Port Forwarding

The screenshot shows the NAT configuration interface. At the top, there are tabs for "Port Forwarding", "Port Triggering", "DMZ", "ALG", "Address Mapping", and "Sessions". Below the tabs is a text box explaining that "Port Forwarding" is used to forward incoming service requests from the Internet to servers on the local network. An "Add New Rule" button is located to the right. Below this is a table with the following columns: #, Status, Service Name, Originating IP, WAN Interface, Server IP Address, Start Port, End Port, Translation Start Port, Translation End Port, Protocol, and Modify. A note at the bottom states "TCP port 7547 is reserved for system use."

The following table describes the fields in this screen.

Table 66 Network Setting > NAT > Port Forwarding

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

Table 66 Network Setting > NAT > Port Forwarding (continued)

LABEL	DESCRIPTION
End Port	This is the last external port number that identifies a service.
Translation Start Port	This is the first internal port number that identifies a service.
Translation End Port	This is the last internal port number that identifies a service.
Protocol	This 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. Specify either a port or a range of ports, a server IP address, and a protocol to configure a port forwarding rule.

Note: To configure port forwarding, you need to have the same configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

Note: To configure port translation, you need to have different configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

Note: TCP port 7547 is reserved for system use.

Figure 111 Port Forwarding: Add/Edit

Add New Rule

Active

Service Name

WAN Interface Default ▼

Start Port

End Port

Translation Start Port

Translation End Port

Server IP Address

Configure Originating IP Enable

Protocol TCP ▼

Note

1.To configure port forwarding, you need to have the same configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

To configure port translation, you need to have different configurations in the **Start Port**, **End Port**, **Translation Start Port**, and **Translation End Port** fields.

Here's an example to configure port translation. Configure **Start Port** to 100, **End Port** to 120, **Translation Start Port** to 200, and **Translation End Port** to 220.

2.TCP port 7547 is reserved for system use.

Cancel OK

The following table describes the labels in this screen.

Table 67 Port Forwarding: Add/Edit

LABEL	DESCRIPTION
Active	Click this switch to enable or disable the rule. When the switch goes to the right  , the function is enabled. Otherwise, it is not.
Service Name	Enter a name to identify this rule using keyboard characters (A-Z, a-z, 1-2 and so on).
WAN Interface	Select the WAN interface through which the service is forwarded. You must have already configured a WAN connection with NAT enabled.
Start Port	Enter the original destination port for the packets. To forward only one port, enter the port number again in the End Port field. To forward a series of ports, enter the start port number here and the end port number in the End Port field.

Table 67 Port Forwarding: Add/Edit (continued)

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

11.3 Port Triggering

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

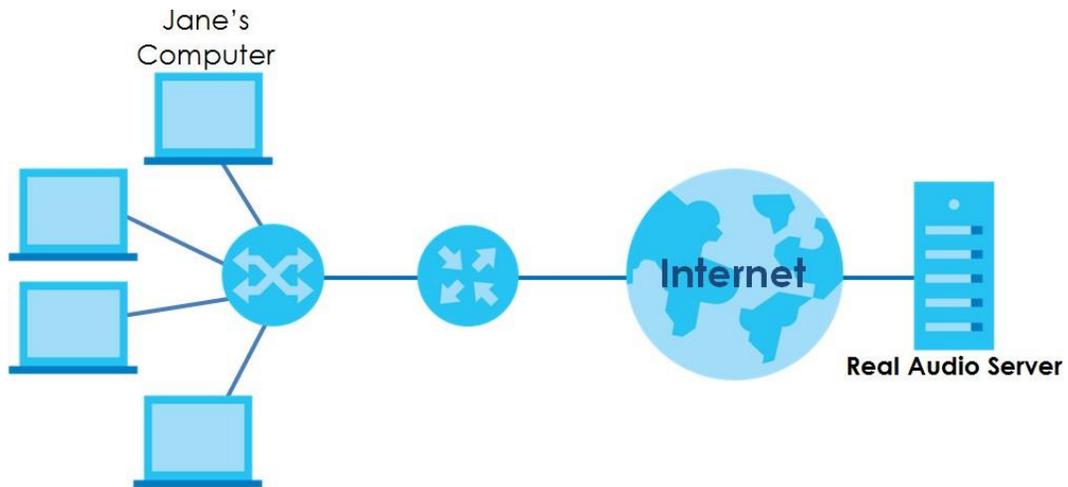
Trigger port forwarding addresses this problem. Trigger port forwarding allows computers on the LAN to dynamically take turns using the service. The Zyxel Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the Zyxel Device's WAN port receives a response with a specific port number and protocol ("open" port), the Zyxel Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

Note: TCP port 7547 is reserved for system use.

Note: The maximum number of trigger ports for a single rule or all rules is 999.

Note: The maximum number of open ports for a single rule or all rules is 999.

For example:

Figure 112 Trigger Port Forwarding Process: Example

- 1 Jane requests a file from the Real Audio server (port 7070).
- 2 Port 7070 is a "trigger" port and causes the Zyxel Device to record Jane's computer IP address. The Zyxel Device associates Jane's computer IP address with the "open" port range of 6970-7170.
- 3 The Real Audio server responds using a port number ranging between 6970-7170.
- 4 The Zyxel Device forwards the traffic to Jane's computer IP address.
- 5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The Zyxel Device times out in three minutes with UDP (User Datagram Protocol) or two hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

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

Figure 113 Network Setting > NAT > Port Triggering

NAT

Port Forwarding **Port Triggering** DMZ ALG Address Mapping Sessions

Trigger port forwarding allows computers on the LAN to dynamically take turns using the service. The Zyxel Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the Zyxel Device's WAN port receives a response with a specific port number and protocol ("open" port), the Zyxel Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

 Add New Rule

#	Status	Service Name	WAN Interface	Trigger Start Port	Trigger End Port	Trigger Proto.	Open Start Port	Open End Port	Open Protocol	Modify
Note										
(1) The maximum number of trigger ports for a single rule or all rules is 999.										
(2) The maximum number of open ports for a single rule or all rules is 999.										
(3) TCP port 7547 is reserved for system use.										

The following table describes the labels in this screen.

Table 68 Network Setting > NAT > Port Triggering

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
#	This is the index number of the entry.
Status	This field displays whether the port triggering rule is active or not. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
Service Name	This field displays the name of the service used by this rule.
WAN Interface	This field shows the WAN interface through which the service is forwarded.
Trigger Start Port	The trigger port is a port (or a range of ports) that causes (or triggers) the Zyxel Device to record the IP address of the LAN computer that sent the traffic to a server on the WAN. This is the first port number that identifies a service.
Trigger End Port	This is the last port number that identifies a service.
Trigger Proto.	This is the trigger transport layer protocol.
Open Start Port	The open port is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The Zyxel Device forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service. This is the first port number that identifies a service.
Open End Port	This is the last port number that identifies a service.
Open Proto.	This is the open transport layer protocol.
Modify	Click the Edit icon to edit this rule. Click the Delete icon to delete an existing rule.

11.3.1 Add/Edit Port Triggering Rule

This screen lets you create new port triggering rules. Click **Add new rule** in the **Port Triggering** screen or click a rule's **Edit** icon to open the following screen. Use this screen to configure a port or range of ports and protocols for sending out requests and for receiving responses.

Figure 114 Port Triggering: Add/Edit

The following table describes the labels in this screen.

Table 69 Port Triggering: Configuration Add/Edit

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

11.4 DMZ Settings

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

You can put public servers, such as email, web, and FTP servers, on the DMZ to provide services on both the WAN and LAN. To use this feature, you first need to assign a DMZ host.

Note: Use an IPv4 address for the DMZ server.

Note: Enter the IP address of the default server in the **Default Server Address** field, and click **Apply** to activate the DMZ host. Otherwise, clear the IP address in the **Default Server Address** field, and click **Apply** to deactivate the DMZ host.

Figure 115 Network Setting > NAT > DMZ

The following table describes the fields in this screen.

Table 70 Network Setting > NAT > DMZ

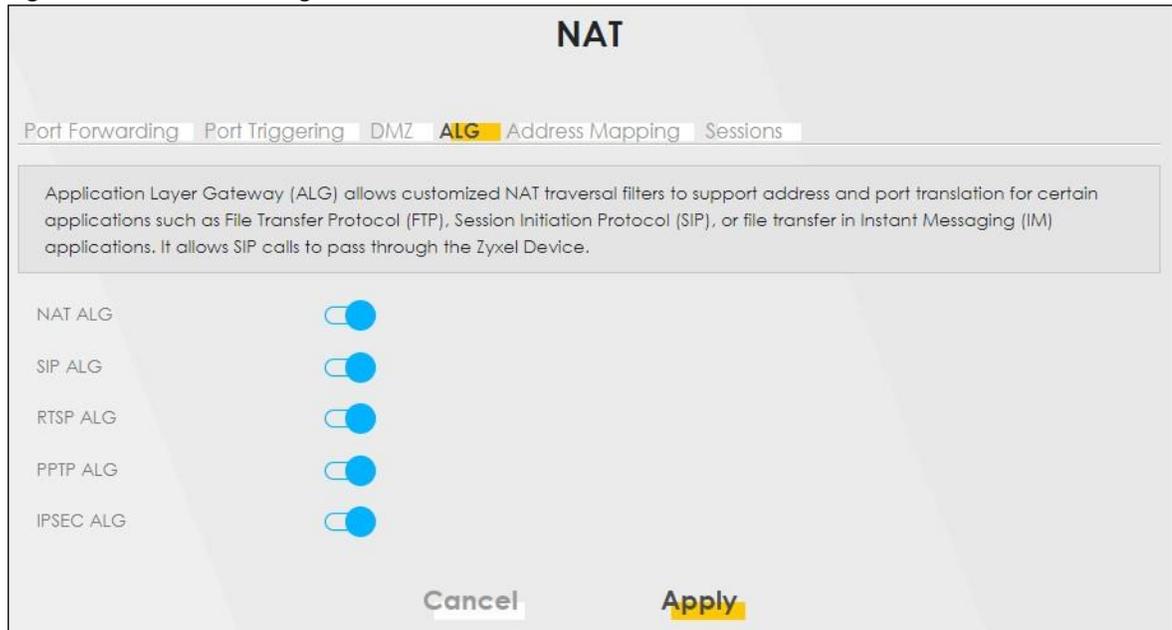
LABEL	DESCRIPTION
Default Server Address	Enter the IP address of the default server which receives packets from ports that are not specified in the NAT Port Forwarding screen. Note: If you do not assign a Default Server Address , the Zyxel Device discards all packets received for ports that are not specified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

11.5 ALG Settings

Application Layer Gateway (ALG) allows customized NAT traversal filters to support address and port translation for certain applications such as File Transfer Protocol (FTP), Session Initiation Protocol (SIP), or file transfer in Instant Messaging (IM) applications. It allows SIP calls to pass through the Zyxel Device. When the Zyxel Device registers with the SIP register server, the SIP ALG translates the Zyxel Device's private IP address inside the SIP data stream to a public IP address. You do not need to use STUN or an outbound proxy if your Zyxel Device is behind a SIP ALG.

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

Figure 116 Network Setting > NAT > ALG



The following table describes the fields in this screen.

Table 71 Network Setting > NAT > ALG

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

11.6 Address Mapping

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

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

Figure 117 Network Setting > NAT > Address Mapping



The following table describes the fields in this screen.

Table 72 Network Setting > NAT > Address Mapping

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
Rule Name	This is the name of the rule.
Local Start IP	This is the starting Inside Local IP Address (ILA).
Local End IP	This is the ending Inside Local IP Address (ILA). If the rule is for all local IP addresses, then this field displays 0.0.0.0 as the Local Start IP address and 255.255.255.255 as the Local End IP address. This field is blank for One-to-One mapping types.
Global Start IP	This is the starting Inside Global IP Address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP. You can only do this for the Many-to-One mapping type.
Global End IP	This is the ending Inside Global IP Address (IGA). This field is blank for One-to-One and Many-to-One mapping types.
Type	This is the address mapping type. One-to-One: This mode maps one local IP address to one global IP address. Note that port numbers do not change for the One-to-one NAT mapping type. Many-to-One: This mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (for example, PAT, port address translation), the Zyxel Device's Single User Account feature that previous routers supported only. Many-to-Many: This mode maps multiple local IP addresses to shared global IP addresses.
WAN Interface	This is the WAN interface to which the address mapping rule applies.
Modify	Click the Edit icon to go to the screen where you can edit the address mapping rule. Click the Delete icon to delete an existing address mapping rule. Note that subsequent address mapping rules move up by one when you take this action.

11.6.1 Add/Edit Address Mapping Rule

To add or edit an address mapping rule, click **Add new rule** or the rule's edit icon in the **Address Mapping** screen to display the screen shown next. Specify the NAT mapping type, the local and global IP address(es), and a WAN interface in this screen.

Figure 118 Address Mapping: Add/Edit

The following table describes the fields in this screen.

Table 73 Address Mapping: Add/Edit

LABEL	DESCRIPTION
Rule Name	Type up to 20 alphanumeric characters for the name of this rule.
Type	Choose the IP/port mapping type from one of the following. One-to-One: This mode maps one local IP address to one global IP address. Note that port numbers do not change for the One-to-one NAT mapping type. Many-to-One: This mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (for example, PAT, port address translation), the Zyxel Device's Single User Account feature that previous routers supported only. Many-to-Many: This mode maps multiple local IP addresses to shared global IP addresses.
Local Start IP	Enter the starting Inside Local IP Address (ILA).
Local End IP	Enter the ending Inside Local IP Address (ILA). If the rule is for all local IP addresses, then this field displays 0.0.0.0 as the Local Start IP address and 255.255.255.255 as the Local End IP address. This field is blank for One-to-One mapping types.
Global Start IP	Enter the starting Inside Global IP Address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP. You can only do this for the Many-to-One mapping type.
Global End IP	Enter the ending Inside Global IP Address (IGA). This field is blank for One-to-One and Many-to-One mapping types.
WAN Interface	Select a WAN interface to which the address mapping rule applies.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

11.7 NAT Sessions

Use this screen to limit the number of concurrent NAT sessions a client can use, to ensure that no single client uses up too many available NAT sessions. Some applications, such as P2P file sharing, demand a greater number of NAT sessions in order to get a better uploading and downloading rate. Click **Network Setting > NAT > Sessions** to display the following screen.

Note: Enter a number of concurrent NAT sessions in the **MAX NAT Session Per Host** field, and click **Apply** to limit the number of concurrent NAT sessions a client can use. Otherwise, clear the number in the **MAX NAT Session Per Host** field. Click **Apply** and there's no limit for concurrent NAT sessions a client can use.

Figure 119 Network Setting > NAT > Sessions

The following table describes the fields in this screen.

Table 74 Network Setting > NAT > Sessions

LABEL	DESCRIPTION
MAX NAT Session Per Host (0 ~ 20480)	Use this field to set a limit to the number of concurrent NAT sessions each client host can have. If only a few clients use peer to peer applications, you can raise this number to improve their performance. With heavy peer-to-peer application use, lower this number to ensure no single client uses too many of the available NAT sessions.
Cancel	Click this to restore your previously saved.
Apply	Click this to save your changes on this screen.

11.8 Technical Reference

This part contains more information regarding NAT.

11.8.1 NAT Definitions

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

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

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

Table 75 NAT Definitions

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

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

11.8.2 What NAT Does

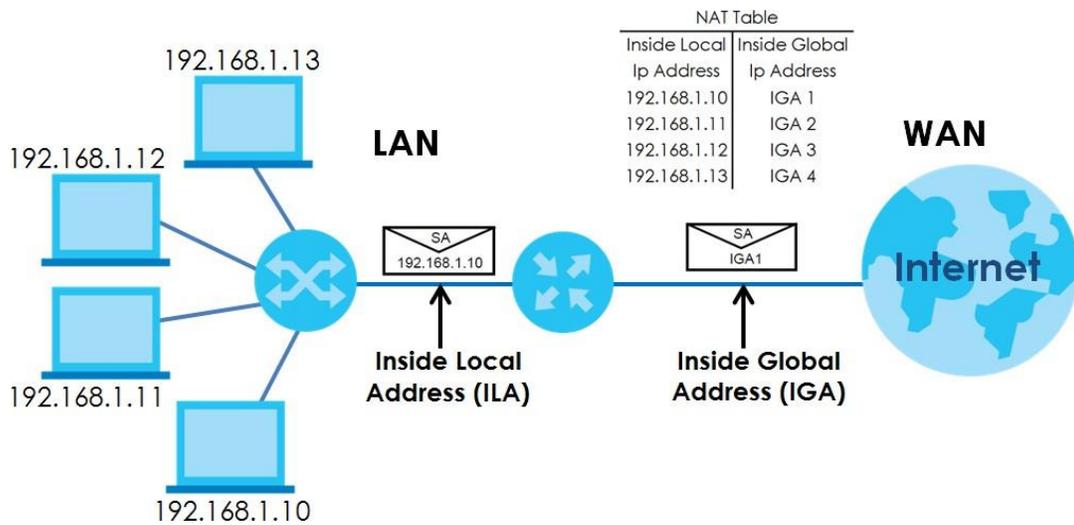
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address)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

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

11.8.3 How NAT Works

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

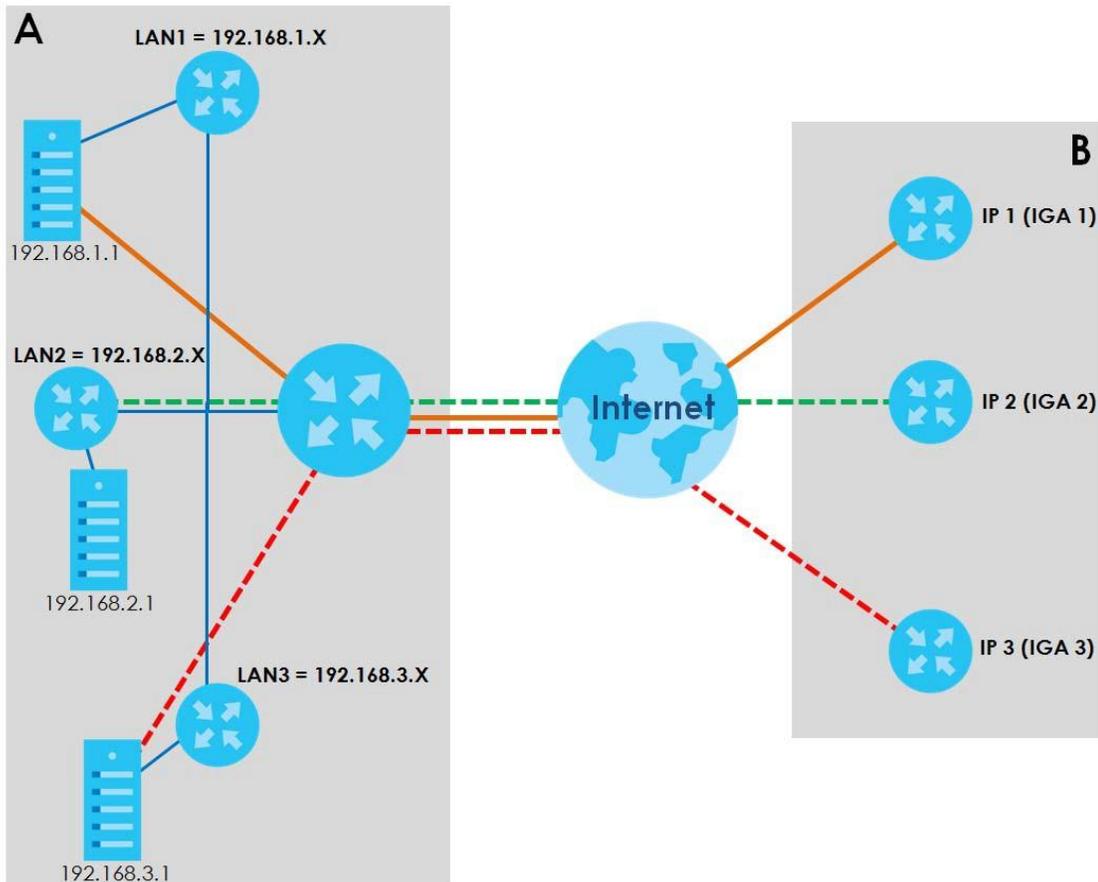
Figure 120 How NAT Works



11.8.4 NAT Application

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

Figure 121 NAT Application With IP Alias



Port Forwarding: Services and Port Numbers

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

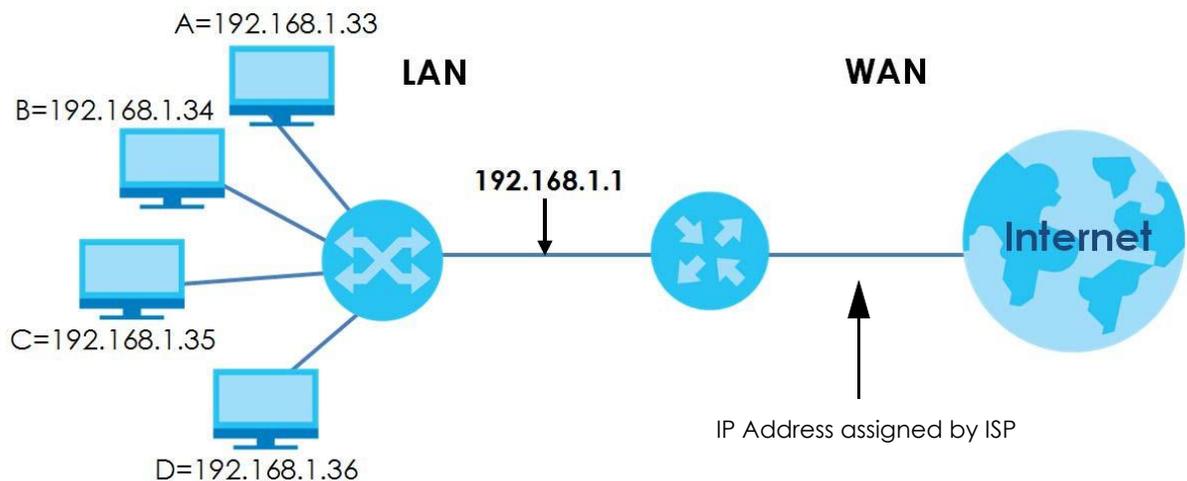
Table 76 Services and Port Numbers

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

Port Forwarding Example

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

Figure 122 Multiple Servers Behind NAT Example



CHAPTER 12

Dynamic DNS Setup

12.1 DNS Overview

DNS

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

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

Dynamic DNS

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

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

12.1.1 What You Can Do in this Chapter

- Use the **DNS Entry** screen to view, configure, or remove DNS routes ([Section 12.2 on page 216](#)).
- Use the **Dynamic DNS** screen to enable DDNS and configure the DDNS settings on the Zyxel Device ([Section 12.3 on page 217](#)).

12.1.2 What You Need To Know

DYNDNS Wildcard

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

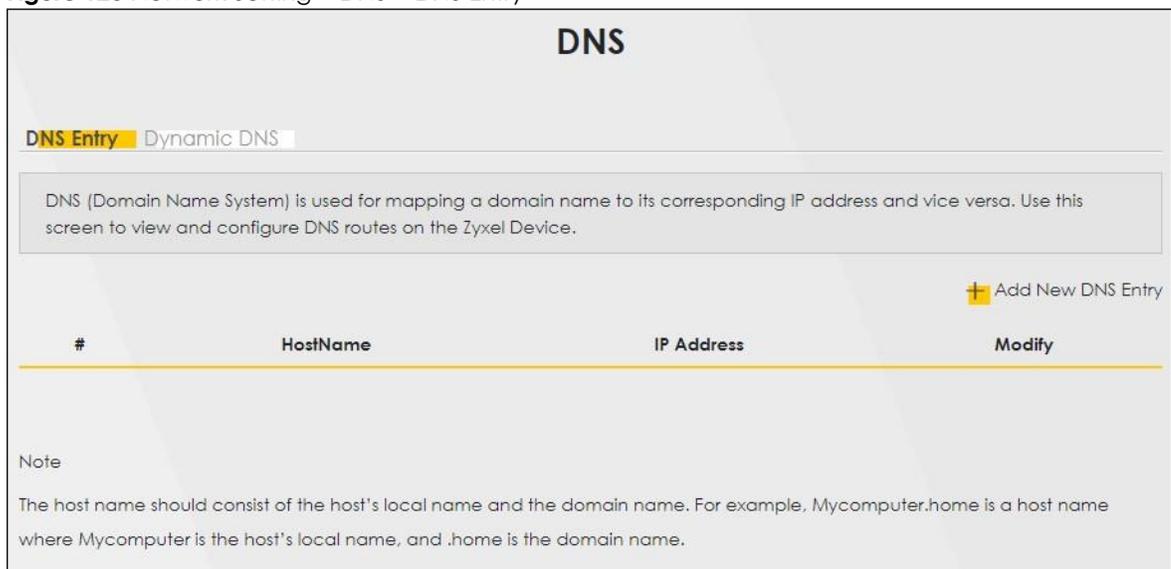
If you have a private WAN IP address, then you cannot use Dynamic DNS.

12.2 DNS Entry

DNS (Domain Name System) is used for mapping a domain name to its corresponding IP address and vice versa. Use this screen to view and configure DNS routes on the Zyxel Device. Click **Network Setting > DNS** to open the **DNS Entry** screen.

Note: The host name should consist of the host's local name and the domain name. For example, Mycomputer.home is a host name where Mycomputer is the host's local name, and .home is the domain name.

Figure 123 Network Setting > DNS > DNS Entry



The following table describes the fields in this screen.

Table 77 Network Setting > DNS > DNS Entry

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

12.2.1 Add/Edit DNS Entry

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

Figure 124 DNS Entry: Add/Edit

The following table describes the labels in this screen.

Table 78 DNS Entry: Add/Edit

LABEL	DESCRIPTION
Host Name	Enter the host name of the DNS entry.
IP Address	Enter the IP address of the DNS entry.
Cancel	Click Cancel to restore your previously saved settings.
OK	Click OK to save your changes.

12.3 Dynamic DNS

Dynamic DNS can update your current dynamic IP address mapping to a hostname. Use this screen to configure a DDNS service provider on your Zyxel Device. Click **Network Setting > DNS > Dynamic DNS**. The screen appears as shown.

Figure 125 Network Setting > DNS > Dynamic DNS

DNS

DNS Entry **Dynamic DNS**

Dynamic DNS can update your current dynamic IP address mapping to a hostname. Use this screen to configure a DDNS service provider on your Zyxel Device.

Dynamic DNS Setup

Dynamic DNS Enable Disable (Settings are invalid when disable)

Service Provider

Host Name

Username

Password

Enable Wildcard Option

Enable Off Line Option (Only applies to custom DNS)

Dynamic DNS Status

User Authentication Result

Last Updated Time

Current Dynamic IP

The following table describes the fields in this screen.

Table 79 Network Setting > DNS > > Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Dynamic DNS	Select Enable to use dynamic DNS.
Service Provider	Select your Dynamic DNS service provider from the drop-down list box.
Host Name	Type the domain name assigned to your Zyxel Device by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
Username	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard Option	Select the check box to enable DynDNS Wildcard.
Enable Off Line Option (Only applies to custom DNS)	Check with your Dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
Dynamic DNS Status	

Table 79 Network Setting > DNS > > Dynamic DNS (continued)

LABEL	DESCRIPTION
User Authentication Result	This shows Success if the account is correctly set up with the Dynamic DNS provider account.
Last Updated Time	This shows the last time the IP address the Dynamic DNS provider has associated with the hostname was updated.
Current Dynamic IP	This shows the IP address your Dynamic DNS provider has currently associated with the hostname.
Cancel	Click Cancel to exit this screen without saving any changes.
Apply	Click Apply to save your changes.

CHAPTER 16

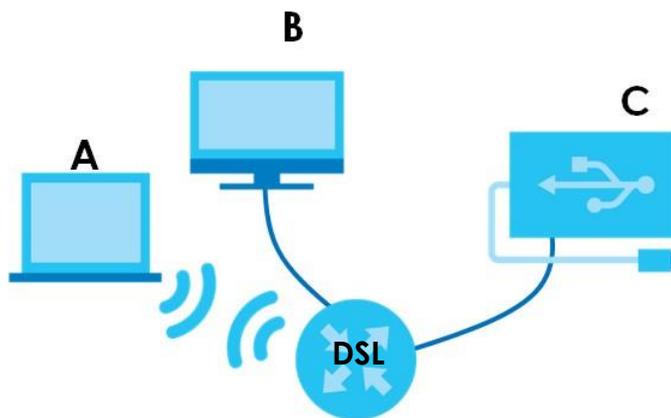
USB Service

16.1 USB Service Overview

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

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

Figure 135 File Sharing Overview



The Zyxel Device will not be able to join the workgroup if your local area network has restrictions set up that do not allow devices to join a workgroup. In this case, contact your network administrator.

16.1.1 What You Can Do in this Chapter

- Use the **File Sharing** screen to enable file-sharing server ([Section 16.1.3 on page 234](#)).
- Use the **Media Server** screen to enable or disable the sharing of media files ([Section 16.3 on page 237](#)).

16.1.2 What You Need To Know

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

16.1.2.1 About File Sharing

Workgroup name

This is the name given to a set of computers that are connected on a network and share resources such as a printer or files. Windows automatically assigns the workgroup name when you set up a network.

Shares

When settings are set to default, each USB device connected to the Zyxel Device is given a folder, called a "share". If a USB hard drive connected to the Zyxel Device has more than one partition, then each partition will be allocated a share. You can also configure a "share" to be a sub-folder or file on the USB device.

File Systems

A file system is a way of storing and organizing files on your hard drive and storage device. Often different operating systems such as Windows or Linux have different file systems. The file sharing feature on your Zyxel Device supports File Allocation Table (FAT) and FAT32.

Common Internet File System

The Zyxel Device uses Common Internet File System (CIFS) protocol for its file sharing functions. CIFS compatible computers can access the USB file storage devices connected to the Zyxel Device. CIFS protocol is supported on Microsoft Windows, Linux Samba and other operating systems (refer to your systems specifications for CIFS compatibility).

16.1.3 Before You Begin

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

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

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

16.2 File Sharing

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

Figure 136 Network Setting > USB Service > File Sharing

USB Service

File Sharing / Media Server

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

Use this screen to set up file sharing through the Zyxel Device. The Zyxel Device's LAN users can access the shared folder (or share) from the USB device inserted in the Zyxel Device.

Information

Volume	Capacity	Used Space
usb1_sda1	3851 MB	514 MB

Server Configuration

File Sharing Services

Share Directory List

[+ Add New Share](#)

Active	Status	Share Name	Share Path	Share Description	Modify
<input type="checkbox"/>	<input type="checkbox"/>				

Account Management

[+ Add New User](#)

Status	User Name
<input checked="" type="checkbox"/>	admin

Note: **Share Directory List** field appears when you connect a USB device to the USB port. Otherwise, it does not.

Each field is described in the following table.

Table 85 Network Setting > USB Service > File Sharing

LABEL	DESCRIPTION
Information	
Volume	This is the volume name the Zyxel Device gives to an inserted USB device.
Capacity	This is the total available memory size (in megabytes) on the USB device.
Used Space	This is the memory size (in megabytes) already used on the USB device.
Server Configuration	
File Sharing Services	Click this switch to enable or disable file sharing through the Zyxel Device. When the switch goes to the right , the function is enabled. Otherwise, it is not.
Share Directory List	
Add New Share	Click this to set up a new share on the Zyxel Device.
Active	Select this to allow the share to be accessed.



Table 85 Network Setting > USB Service > File Sharing

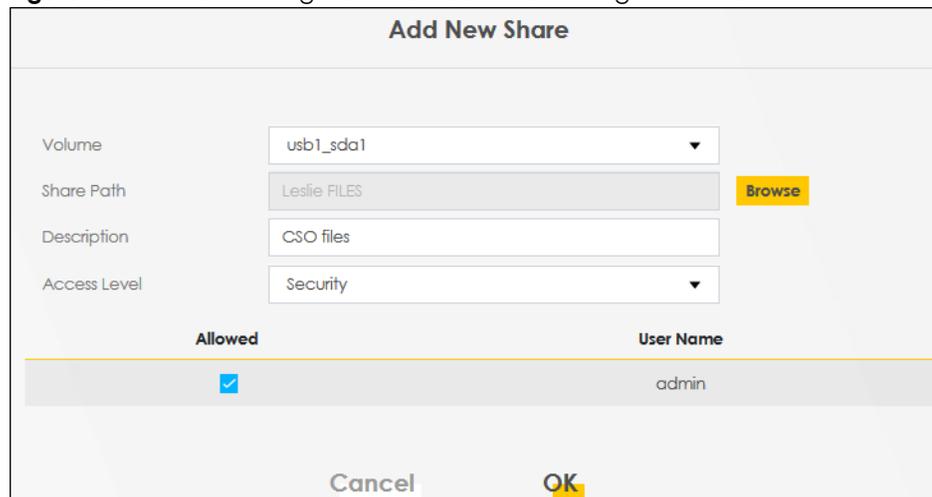
LABEL	DESCRIPTION
Status	This field shows the status of the share  : The share is not activated.  : The share is activated.
Share Name	This field displays the share name on the PON device.
Share Path	This field displays the path for the share directories (folders) on the PON Device. These are the directories (folders) on your USB storage device.
Share Description	This field displays information about the share.
Modify	Click the Edit icon to change the settings of an existing share. Click the Delete icon to delete this share in the list.
Account Management	
Add New User	Click this button to create a user account to access the secured shares. This button redirects you to Maintenance > User Account .
Status	This field shows the status of the user.  : The user account is not activated for the share.  : The user account is activated for the share.
User Name	This is the name of a user who is allowed to access the secured shares on the USB device.
Cancel	Click this to restore your previously saved settings.
Apply	Click this to save your changes to the Zyxel Device.

16.2.1 Add New Share

Use this screen to set up a new share or edit an existing share on the Zyxel Device. Click **Add new share** in the **File Sharing** screen or click the **Edit** icon next to an existing share.

Please note that you need to set up your shares in the USB before enabling file sharing in the Zyxel Device. Also, spaces and the following special characters listed in the brackets [" < > ^ \$ | & ; \ / : * ? '] are not allowed for the USB share name.

Figure 137 Network Setting > USB Service > File Sharing > Add New Sharer



Add New Share

Volume: usb1_sda1

Share Path: Leslie FILES Browse

Description: CSO files

Access Level: Security

Allowed	User Name
<input checked="" type="checkbox"/>	admin

Cancel OK

The following table describes the labels in this menu.

Table 86 Network Setting > USB Service > Media Server

LABEL	DESCRIPTION
Volume	Select the volume in the USB storage device that you want to add as a share in the Zyxel Device. This field is read-only when you are editing the share.
Share Path	Manually enter the file path for the share, or click the Browse button and select the folder that you want to add as a share. This field is read-only when you are editing the share.
Description	You can either enter a short description of the share, or leave this field blank.
Access Level	Select Public if you want the share to be accessed by users connecting to the Zyxel Device. Otherwise, select Security .
Allowed	If Security is selected in the Access Level field, select this check box to allow/prohibit access to the share.
User Name	This field specifies the user for which the Allowed setting applies. Users can be added or modified in Maintenance > User Account .
Cancel	Click Cancel to return to the previous screen.
OK	Click OK to save any changes.

16.2.2 Add New User

Once you click the **Add New User** button, you'll be directed to the **User Account** screen. To create a user account that can access the secured shares on the USB device, click the **Add New Account** button in the **Network Setting > Maintenance > User Account** screen.

Please see [Chapter 34 on page 325](#), for detailed information about **User Account** screen.

16.3 Media Server

The media server feature lets anyone on your network play video, music, and photos from the USB storage device connected to your Zyxel Device without having to copy them to another computer. The Zyxel Device can function as a DLNA-compliant media server, where the Zyxel Device streams files to DLNA-compliant media clients like Windows Media Player. The Digital Living Network Alliance (DLNA) is a group of personal computer and electronics companies that works to make products compatible in a home network.

The Zyxel Device media server enables you to:

- Publish all shares for everyone to play media files in the USB storage device connected to the Zyxel Device.
- Use hardware-based media clients like the DMA-2500 to play the files.

Note: Anyone on your network can play the media files in the published shares. No user name and password or other form of security is used. The media server is enabled by default with the video, photo, and music shares published.

To change your Zyxel Device's media server settings, click **Network Setting > USB Service > Media Server**. The screen appears as shown.

Figure 138 Network Setting > USB Service > Media Server

USB Service

File Sharing **Media Server**

The media server feature lets anyone on your network play video, music, and photos from the USB storage device connected to your Zyxel Device without having to copy them to another computer. The Zyxel Device can function as a DLNA-compliant media server, where the Zyxel Device streams files to DLNA-compliant media clients like Windows Media Player. The Digital Living Network Alliance (DLNA) is a group of personal computer and electronics companies that works to make products compatible in a home network.

Media Server

Interface

Media Library Path

Cancel **Apply**

The following table describes the labels in this menu.

Table 87 Network Setting > USB Service > Media Server

LABEL	DESCRIPTION
Media Server	Click this switch to have the Zyxel Device function as a DLNA-compliant media server. When the switch goes to the right  , the function is enabled. Otherwise, it is not. Enable the media server to let (DLNA-compliant) media clients on your network play media files located in the shares.
Interface	Select an interface on which you want to enable the media server function. An interface can be added or modified in Network Setting > Interface Grouping .
Media Library Path	Enter the path clients use to access the media files on a USB storage device connected to the Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

CHAPTER 17

Firewall

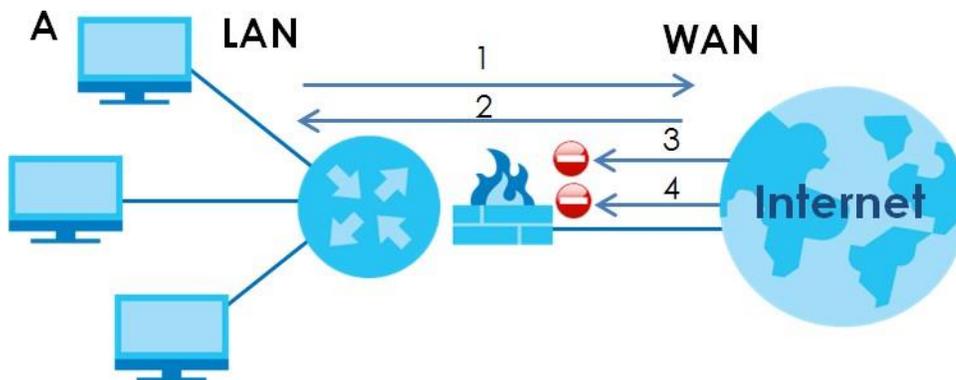
17.1 Firewall Overview

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

- allows traffic that originates from your LAN computers to go to all other networks.
- blocks traffic that originates on other networks from going to the LAN.

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

Figure 139 Default Firewall Action



17.1.1 What You Can Do in this Chapter

- Use the **General** screen to configure the security level of the firewall on the Zyxel Device ([Section 17.2 on page 240](#)).
- Use the **Protocol** screen to add or remove predefined Internet services and configure firewall rules ([Section 17.3 on page 242](#)).
- Use the **Access Control** screen to view and configure incoming/outgoing filtering rules ([Section 17.4 on page 243](#)).
- Use the **DoS** screen to activate protection against Denial of Service (DoS) attacks ([Section 17.5 on page 246](#)).

17.1.2 What You Need to Know

SYN Attack

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

DoS

Denials of Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to network resources. The Zyxel Device is pre-configured to automatically detect and thwart all known DoS attacks.

DDoS

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

LAND Attack

In a LAND attack, hackers flood SYN packets into the network with a spoofed source IP address of the target system. This makes it appear as if the host computer sent the packets to itself, making the system unavailable while the target system tries to respond to itself.

Ping of Death

Ping of Death uses a 'ping' utility to create and send an IP packet that exceeds the maximum 65,536 bytes of data allowed by the IP specification. This may cause systems to crash, hang or reboot.

SPI

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

17.2 Firewall Settings

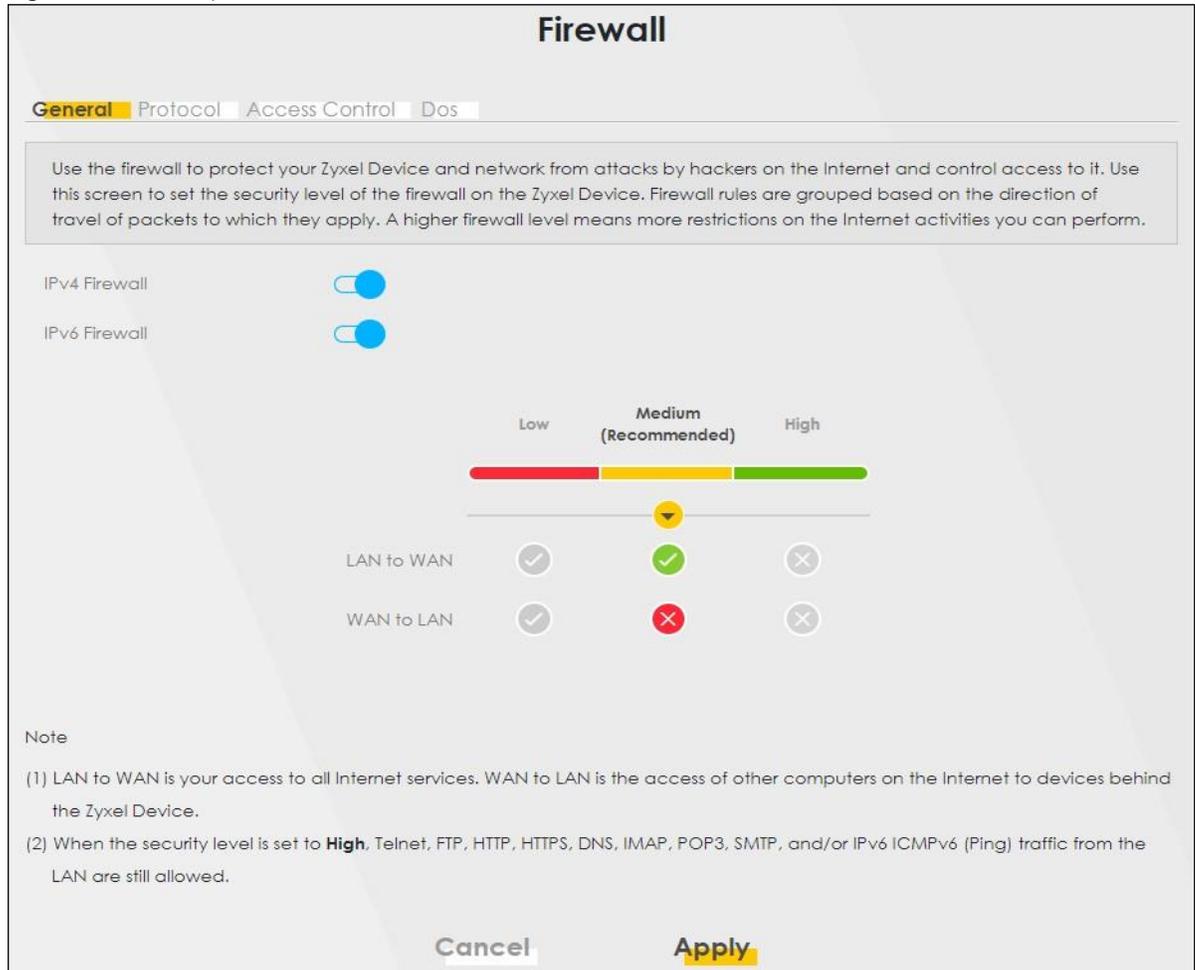
Use this screen to set the security level of the firewall on the Zyxel Device. Firewall rules are grouped based on the direction of travel of packets to which they apply. A higher firewall level means more restrictions on the Internet activities you can perform.

Note: LAN to WAN is your access to all Internet services. WAN to LAN is the access of other computers on the Internet to devices behind the Zyxel Device.

Note: When the security level is set to **High**, Telnet, FTP, HTTP, HTTPS, DNS, IMAP, POP3, SMTP, and/or IPv6 ICMPv6 (Ping) traffic from the LAN are still allowed.

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

Figure 140 Security > Firewall > General



The following table describes the labels in this screen.

Table 88 Security > Firewall > General

LABEL	DESCRIPTION
IPv4 Firewall	Use the switch to turn on or off the firewall feature on the Zyxel Device for IPv4 traffic. When the switch goes to the right  , the function is enabled. Otherwise, it is disabled.
IPv6 Firewall	Use the switch to turn on or off the firewall feature on the Zyxel Device for IPv6 traffic. When the switch goes to the right  , the function is enabled. Otherwise, it is disabled.
Low	Select Low to allow traffic from LAN to WAN or from WAN to LAN.
Medium	Select Medium to allow traffic from LAN to WAN but deny traffic from WAN to LAN.
High	Select High to deny both directions of travel of packets (LAN to WAN and WAN to LAN).
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

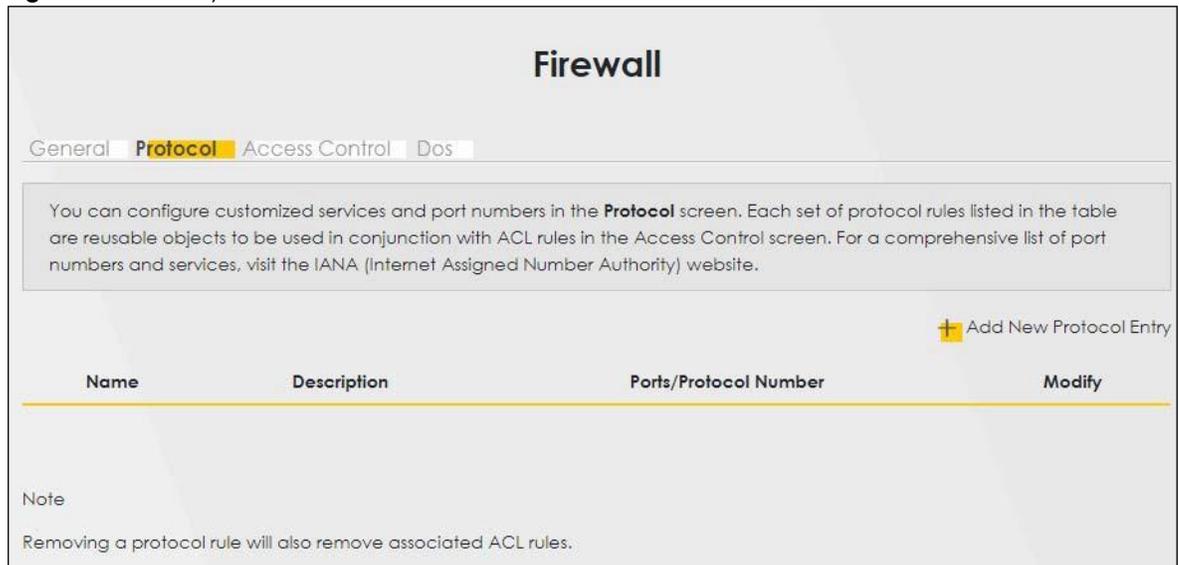
17.3 Protocol Settings

You can configure customized services and port numbers in the **Protocol** screen. Each set of protocol rules listed in the table are reusable objects to be used in conjunction with ACL rules in the Access Control screen. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. See [Appendix C on page 381](#) for some examples.

Note: Removing a protocol rule will also remove associated ACL rules.

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

Figure 141 Security > Firewall > Protocol



The following table describes the labels in this screen.

Table 89 Security > Firewall > Protocol

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

17.3.1 Add New/Edit Protocol Entry

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

Figure 142 Protocol Entry: Add New/Edit

The following table describes the labels in this screen.

Table 90 Security > Firewall > Protocol: Add/Edit

LABEL	DESCRIPTION
Service Name	Enter a unique name (up to 32 printable English keyboard characters, including spaces) for your customized port.
Description	Enter a description for your customized port.
Protocol	Choose the IP protocol (TCP , UDP , ICMP , ICMPv6 , or Other) that defines your customized port from the drop-down list box. Select Other to be able to enter a protocol number.
Protocol Number	This field is displayed if you select Other as the protocol. Enter the protocol number of your customized port.
Source Port	This field is displayed if you select either the TCP or UDP protocol. You may set it to Any , Single , or Range and enter the Port Number or range of Port Numbers for your source port.
Destination Port	This field is displayed if you select either the TCP or UDP protocol. You may set it to Any , Single , or Range and enter the Port Number or range of Port Numbers for your destination port.
ICMPv6type	This field is displayed if you select the ICMPv6 protocol. From the drop-down menu, select which type value you would like to use.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

17.4 Access Control

Click **Security > Firewall > Access Control** to display the following screen. An Access Control List (ACL) rule is a manually-defined rule that can accept, reject, or drop incoming or outgoing packets from your network. This screen displays a list of the configured incoming or outgoing filtering rules.

Figure 143 Security > Firewall > Access Control

The following table describes the labels in this screen.

Table 91 Security > Firewall > Access Control

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

17.4.1 Add/Edit an ACL Rule

Click **Add new ACL rule** or the **Edit** icon next to an existing ACL rule in the **Access Control** screen. The following screen displays. Use this screen to accept, reject, or drop packets based on specified parameters, such as source and destination IP address, IP Type, service, and direction. You can also specify a limit as to how many packets this rule applies to at a certain period of time or specify a schedule for this rule.

Figure 144 Access Control: Add/Edit

The following table describes the labels in this screen.

Table 92 Access Control: Add/Edit

LABEL	DESCRIPTION
Active	Click the Active button to enable this ACL rule. When the switch goes to the right ( , the function is enabled.
Filter Name	Enter a descriptive name of up to 16 alphanumeric characters, not including spaces, underscores, and dashes. You must enter the filter name to add an ACL rule. This field is read-only if you are editing the ACL rule.
Order	Select the order of the ACL rule.
Select Source IP Address	Select the source device to which the ACL rule applies. If you select Specific IP Address , enter the source IP address in the field below.
Source IP Address	Enter the source IP address.

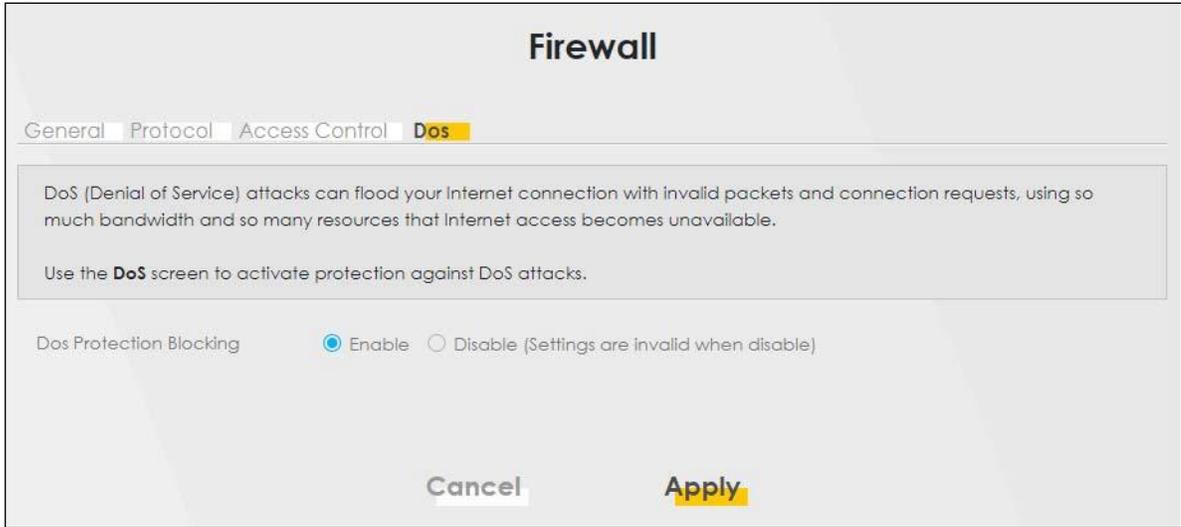
Table 92 Access Control: Add/Edit (continued)

LABEL	DESCRIPTION
Select Destination Device	Select the destination device to which the ACL rule applies. If you select Specific IP Address , enter the destination IP address in the field below.
Destination IP Address	Enter the destination IP address.
MAC Address	Enter the MAC addresses of the wireless or LAN clients that are allowed access to the Zyxel Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
IP Type	Select whether your IP type is IPv4 or IPv6 .
Select Service	Select the transport layer protocol that defines your customized port from the drop-down list box. The specific protocol rule sets you add in the Security > Firewall > Protocol > Add screen display in this list. If you want to configure a customized protocol, select Specific Service .
Protocol	This field is displayed only when you select Specific Service in Select Service . Choose the IP port (TCP/UDP , TCP , UDP , ICMP , or ICMPv6) that defines your customized port from the drop-down list box.
Custom Source Port	This field is displayed only when you select Specific Service in Select Service and have either TCP or UDP in the Protocol field. Enter a single port number or the range of port numbers of the source.
Custom Destination Port	This field is displayed only when you select Specific Service in Select Service and have either TCP or UDP in the Protocol field. Enter a single port number or the range of port numbers of the destination.
Policy	Use the drop-down list box to select whether to discard (DROP), deny and send an ICMP destination-unreachable message to the sender of (REJECT) or allow the passage of (ACCEPT) packets that match this rule.
Direction	Use the drop-down list box to select the direction of traffic to which this rule applies.
Enable Rate Limit	Select this check box to set a limit on the upstream/downstream transmission rate for the specified protocol. Specify how many packets per minute or second the transmission rate is.
Scheduler Rules	Select a schedule rule for this ACL rule from the drop-down list box. You can configure a new schedule rule by click Add New Rule . This will bring you to the Security > Scheduler Rules screen.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

17.5 DoS Settings

DoS (Denial of Service) attacks can flood your Internet connection with invalid packets and connection requests, using so much bandwidth and so many resources that Internet access becomes unavailable.

Use the **DoS** screen to activate protection against DoS attacks. Click **Security > Firewall > DoS** to display the following screen.

Figure 145 Security > Firewall > DoS

The following table describes the labels in this screen.

Table 93 Security > Firewall > DoS

LABEL	DESCRIPTION
DoS Protection Blocking	Select Enable to enable protection against DoS attacks.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

CHAPTER 18

MAC Filter

18.1 MAC Filter Overview

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

18.2 MAC Filter Settings

Enable **MAC Address Filter** and add the host name and MAC address of a LAN client to the table if you wish to allow or deny them access to your network. Click **Security > MAC Filter**. The screen appears as shown.

Figure 146 Security > MAC Filter

MAC Filter

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

Enable **MAC Address Filter** and add the host name and MAC address of a LAN client to the table if you wish to allow or deny them access to your network. You can choose to enable or disable the filters per entry; make sure that the check box under **Active** is selected if you want to use a filter.

MAC Address Filter Enable Disable (Settings are invalid when disable)

MAC Restrict Mode Allow Deny

[+ Add New Rule](#)

Set	Active	Host Name	MAC Address	Delete
-----	--------	-----------	-------------	--------

[Cancel](#) [Apply](#)

You can choose to enable or disable the filters per entry; make sure that the check box under **Active** is selected if you want to use a filter, as shown in the example below.

Figure 147 Enabling individual MAC Filters

Set	Active	Host Name	MAC Address	Delete
1	<input type="checkbox"/>		- - - - -	

The following table describes the labels in this screen.

Table 94 Security > MAC Filter

LABEL	DESCRIPTION
MAC Address Filter	Select Enable to activate the MAC filter function.
MAC Restrict Mode	Select Allow to only permit the listed MAC addresses access to the Zyxel Device. Select Deny to permit anyone access to the Zyxel Device except the listed MAC addresses.
Add New Rule	Click this button to create a new entry.
Set	This is the index number of the MAC address.
Active	Select Active to enable the MAC filter rule. The rule will not be applied if Allow is not selected.
Host Name	Enter the host name of the wireless or LAN clients that are allowed access to the Zyxel Device.
MAC Address	Enter the MAC addresses of the wireless or LAN clients that are allowed access to the Zyxel Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Delete	Click the Delete icon to delete an existing rule.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

CHAPTER 19

Parental Control

19.1 Parental Control Overview

Parental control allows you to limit the time a user can access the Internet and prevent users from viewing inappropriate content or participating in specified online activities.

19.2 Parental Control Settings For AX7501

Use this screen to enable parental control and view parental control rules and schedules. You can limit the time a user can access the Internet and prevent users from viewing inappropriate content or participating in specified online activities. These rules are defined in a Parental Control Profile (PCP).

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

Figure 152 Security > Parental Control

Parental Control

Parental control allows you to limit the time a user can access the Internet and prevent users from viewing inappropriate content or participating in specified online activities.

Use this screen to enable parental control and view parental control rules and schedules. You can limit the time a user can access the Internet and prevent users from viewing inappropriate content or participating in specified online activities. These rules are defined in a Parental Control Profile (PCP).

General

Parental Control Enable Disable (Settings are invalid when disable)

Parental Control Profile (PCP)

+ Add New PCP

#	Status	PCP Name	Home Network User MAC	Internet Access Schedule	Network Service	Website Blocked	Modify

Cancel
Apply

The following table describes the fields in this screen.

Table 99 Security > Parental Control

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

Table 99 Security > Parental Control

LABEL	DESCRIPTION
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Delete icon to delete an existing rule.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

19.2.1 Add/Edit a Parental Control Profile

Click **Add new PCP** in the **Parental Control** screen to add a new rule or click the **Edit** icon next to an existing rule to edit it. Use this screen to configure a restricted access schedule and/or URL filtering settings to block the users on your network from accessing certain web sites.

Figure 153 Security > Parental Control > Add/Edit PCP (General, Rule List & Internet Access Schedule)

Add New PCP

General

Active Enable Disable (Settings are invalid when disable)

Parental Control Profile Name

Home Network User Custom ▼ Add

- - - - -

Rule List

User MAC Address	Delete

Internet Access Schedule

Day
Mon
Tue
Wed
Thu
Fri
Sat
Sun

+ Add New Time

Time (Start-End)
00:00
24:00

Figure 154 Security > Parental Control > Add/Edit PCP (Network Service & Site/URL Keyword)

The following table describes the fields in this screen.

Table 100 Security > Parental Control > Add/Edit PCP

LABEL	DESCRIPTION
General	
Active	Select Enable or Disable to activate or deactivate the parental control rule.
Parental Control Profile Name	Enter a descriptive name for the rule.
Home Network User	Select the LAN user that you want to apply this rule to from the drop-down list box. If you select Custom , enter the LAN user's MAC address. If you select All , the rule applies to all LAN users.
Rule List	In Home Network User , select Custom , enter the LAN user's MAC address, then click the Add icon to enter a computer MAC address for this PCP. Up to five are allowed. Click the Delete icon to remove one.
Internet Access Schedule	
Day	Select check boxes for the days that you want the Zyxel Device to perform parental control.
Time	Drag the time bar to define the time that the LAN user is allowed access (Authorized access) or denied access (No access).
Add New Service	Click this to add a new time bar. Up to three are allowed.
Network Service	
Network Service Setting	If you select Block , the Zyxel Device prohibits the users from viewing the web sites with the URLs listed below. If you select Allow , the Zyxel Device blocks access to all URLs except ones listed below.
Add New Service	Click this to show a screen in which you can add a new service rule. You can configure the Service Name , Protocol , and Port of the new rule, as shown in Figure 156 .
#	This shows the index number of the rule.

Table 100 Security > Parental Control > Add/Edit PCP (continued)

LABEL	DESCRIPTION
Service Name	This shows the name of the rule.
Protocol:Port	This shows the protocol and the port of the rule.
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Delete icon to delete an existing rule.
Site/URL Keyword	
Block or Allow the Web Site	If you select Block the Web URLs , the Zyxel Device prohibits the users from viewing the Web sites with the URLs listed below. If you select Allow the Web URLs , the Zyxel Device blocks access to all URLs except ones listed below.
Add	Click Add to show a screen to enter the URL of web site or URL keyword to which the Zyxel Device blocks or allows access.
#	This shows the index number of the rule.
Website	This shows the URL of web site or URL keyword to which the Zyxel Device blocks or allows access.
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Delete icon to delete an existing rule.
Redirect blocked site to Zyxel Family Safety page	Select this to redirect users who access any blocked websites listed above to the Zyxel Family Safety page as shown next. Figure 155 Zyxel Family Safety Page Example 
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

Add New Service

Use this screen to add a new service rule.

Figure 156 Security > Parental Control > Add/Edit PCP > Add New Service

The following table describes the fields in this screen.

Table 101 Security > Parental Control > Add/Edit PCP > Add New Service

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

Add Site/URL Keyword

Click **Add** in the **Site/URL Keyword** section of the **Edit/Add new PCP** screen to open the following screen.

Note: Do not include "HTTP" or "HTTPS" in the keyword. HTTPS connections cannot be blocked by Parental Control.

Figure 157 Security > Parental Control > Add/Edit PCP > Add Keyword

The following table describes the fields in this screen.

Table 102 Security > Parental Control > Add/Edit PCP > Add Keyword

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

CHAPTER 20

Scheduler Rule

20.1 Scheduler Rule Overview

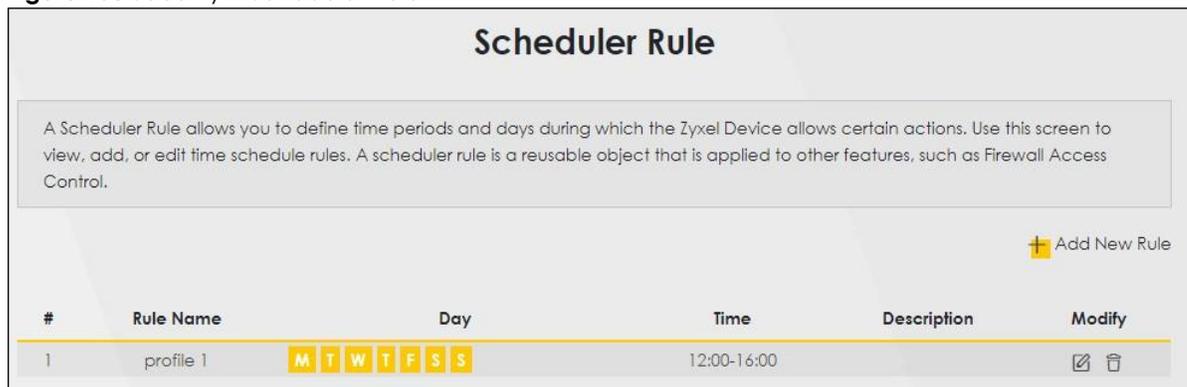
A Scheduler Rule allows you to define time periods and days during which the Zyxel Device allows certain actions.

20.2 Scheduler Rule Settings

Use this screen to view, add, or edit time schedule rules. A scheduler rule is a reusable object that is applied to other features, such as Firewall Access Control.

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

Figure 158 Security > Scheduler Rule



The following table describes the fields in this screen.

Table 103 Security > Scheduler Rule

LABEL	DESCRIPTION
Add New Rule	Click this to create a new rule.
#	This is the index number of the entry.
Rule Name	This shows the name of the rule.
Day	This shows the day(s) on which this rule is enabled.
Time	This shows the period of time on which this rule is enabled.
Description	This shows the description of this rule.
Modify	Click the Edit icon to edit the schedule. Click the Delete icon to delete a scheduler rule. Note: You cannot delete a scheduler rule once it is applied to a certain feature.

20.2.1 Add/Edit a Schedule Rule

Click the **Add New Rule** button in the **Scheduler Rule** screen or click the **Edit** icon next to a schedule rule to open the following screen. Use this screen to configure a schedule rule.

Figure 159 Scheduler Rule: Add/Edit

The following table describes the fields in this screen.

Table 104 Scheduler Rule: Add/Edit

LABEL	DESCRIPTION
Rule Name	Enter a name (up to 31 printable English keyboard characters, not including spaces) for this schedule.
Day	Select check boxes for the days that you want the Zyxel Device to perform this scheduler rule.
Time of Day Range	Enter the time period of each day, in 24-hour format, during which the rule will be enforced.
Description	Enter a description for this scheduler rule.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

CHAPTER 22

VoIP

22.1 Overview

You can make calls over the Internet using VoIP technology. For this, you first need to set up a SIP account with a SIP service provider.

Use this chapter to:

- Connect an analog phone to the Zyxel Device.

22.1.1 What You Can Do in this Chapter

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

- Use the **Phone Device** screen ([Section 22.5 on page 280](#)) to control which SIP account(s) each phone uses to handle outgoing and incoming calls.
- Use the **Call History** screen ([Section 22.8 on page 284](#)) to view detailed information for each outgoing call you made or each incoming call from someone calling you. You can also view the summary list of received, dialed and missed calls.

You do not necessarily need to use all these screens to set up your account. In fact, if your service provider did not supply information on a particular field in a screen, it is usually best to leave it at its default setting.

22.1.2 What You Need to Know About VoIP

VoIP

VoIP stands for Voice over IP. IP is the Internet Protocol, which is the message-carrying standard the Internet runs on. So, Voice over IP is the sending of voice signals (speech) over the Internet (or another network that uses the Internet Protocol).

SIP

SIP stands for Session Initiation Protocol. SIP is a signaling standard that lets one network device (like a computer or the Zyxel Device) send messages to another. In VoIP, these messages are about phone calls over the network. For example, when you dial a number on your Zyxel Device, it sends a SIP message over the network asking the other device (the number you dialed) to take part in the call.

SIP Accounts

A SIP account is a type of VoIP account. It is an arrangement with a service provider that lets you make phone calls over the Internet. When you set the Zyxel Device to use your SIP account to make calls, the Zyxel Device is able to send all the information about the phone call to your service provider on the Internet.

Strictly speaking, you don't need a SIP account. It is possible for one SIP device (like the Zyxel Device) to call another without involving a SIP service provider. However, the networking difficulties involved in doing this make it tremendously impractical under normal circumstances. Your SIP account provider removes these difficulties by taking care of the call routing and setup - figuring out how to get your call to the right place in a way that you and the other person can talk to one another.

SIP Address

A SIP address is a URI (Uniform Resource Identifier) that resembles an email address, using the format: user@domain. It uniquely identifies a telephone extension over a VoIP system. A SIP address of 123-45-67@voip-provider.net tells a client to connect to voip-provider.net and request a connection to 123-45-67. While VoIP can only send voice messages over the Internet, SIP (though strictly speaking is a type of VoIP) can send voice, data, video, and other media. VoIP phones also need to be connected to a computer to function, whereas SIP phones only need to be connected to a modem.

How to Find Out More

See [Section 22.9 on page 286](#) for advanced technical information on SIP.

22.2 Phone Device

Use this screen to view detailed information on phones used for Internet phone calls (SIP). You can define which phone(s) will ring when a specific SIP address receives an incoming call, and which SIP address will be used when an outgoing call is made with a specific phone. To access this screen, click

VoIP > Phone > Phone Device.

Figure 170 VoIP > Phone > Phone Device

Phone

Phone Device

Use this screen to view detailed information on phones used for Internet phone calls (SIP). You can define which phone(s) will ring when a specific SIP address receives an incoming call, and which SIP address will be used when an outgoing call is made with a specific phone.

Analog Phone

#	Phone ID	Internal Number	Incoming SIP Number	Outgoing SIP Number	Modify
1	PHONE1	**11	ChangeMe	ChangeMe	
2	PHONE2	**12	ChangeMe	ChangeMe	

Each field is described in the following table.

Table 115 VoIP > Phone > Phone Device

LABEL	DESCRIPTION
#	This displays the index number of the phone device.
Phone ID	This field displays the name of a phone port on the Zyxel Device.
Internal Number	This field displays the internal call prefix of a phone port on the Zyxel Device.
Incoming SIP Number	This field displays the SIP address that you use to receive calls on this phone port.
Outgoing SIP Number	This field displays the SIP address that you use to make calls on this phone port.
Modify	Click the Edit icon to configure the SIP account.

22.5.1 Phone Device Edit

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

Figure 171 VoIP > Phone > Phone Device > Edit

Each field is described in the following table.

Table 116 VoIP > Phone > Phone Device > Edit

LABEL	DESCRIPTION
SIP Account to Make Outgoing Call	Select the SIP account you want to use when making outgoing calls with the analog phone connected to this phone port.
SIP Account(s) to Receive Incoming Call	Select a SIP account if you want to receive phone calls for the selected SIP account on this phone port. If you select more than one SIP account for incoming calls, there is no way to distinguish between them when you receive phone calls. If you do not select a source for incoming calls, you cannot receive any calls on this phone port.
Immediate Dial Enable	Select this if you want to use the pound key (#) to tell the Zyxel Device to make the phone call immediately, instead of waiting for the number of second you selected in the Dialing Interval Selection field of the VoIP > SIP > SIP Service Provider > Add New Provider/Edit screen. If you select this, dial the phone number, and then press the pound key. The Zyxel Device makes the call immediately instead of waiting. You can still wait, if you want.
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

22.3 Phone Region

Use this screen to configure settings that depend on which region of the world the Zyxel Device is in. Selecting the region where the device is physically located improves the quality of phone calls. To access this screen, click **VoIP > Phone > Region**.

Note: You need to reboot the device after changing the region settings for it to take effect.

Figure 172 VoIP > Phone > Region

Phone

Phone Device > **Region**

Use this screen to maintain settings that depend on which region of the world the Zyxel Device is in. Selecting the region where the device is physically located improves the quality of phone calls.

Region Setting: NOR - Norway

Call Service Mode: Europe Type

Note
You need to reboot the device after changing the region settings for it to take effect.

Cancel **Apply**

Each field is described in the following table.

Table 117 VoIP > Phone > Region

LABEL	DESCRIPTION
Region Setting	Select the place in which the Zyxel Device is located.
Call Service Mode	Select the mode for supplementary phone services (call hold, call waiting, call transfer and three-way conference calls) that your VoIP service provider supports. Europe Type - use supplementary phone services in European mode USA Type - use supplementary phone services American mode You might have to subscribe to these services to use them. Contact your VoIP service provider.
Cancel	Click this to set every field in this screen to its last-saved value.
Apply	Click this to save your changes and to apply them to the Zyxel Device.

22.4 Call History

The Zyxel Device logs calls to or from your SIP addresses. This screen allows you to view a summary of received, dialed and missed calls, and a call history list. You can also view detailed information on each outgoing and incoming call.

Click **VoIP > Call History > Call History**. The following screen displays.

Figure 174 VoIP > Call History > Call History

Each field is described in the following table.

Table 119 VoIP > Call History > Call History

LABEL	DESCRIPTION
Clear	Click this button to remove all entries from the call history list.
Refresh	Click this button to renew the call history list.
Summary	
Date	This is the date when the calls were made.
Total Calls	This displays the total number of calls from or to your SIP addresses that day.
Outgoing Calls	This displays how many calls originated from you that day.
Incoming Calls	This displays how many calls you received that day.
Missing Calls	This displays how many incoming calls were not answered that day.
Total Duration (hh:mm:ss)	This displays how long all calls lasted that day.
Classify	Select the type of the calls. The call types are: All , Incoming , Outgoing and Missed .
Type	This displays the type of the calls.
Date/Time	This displays the date and time when the calls were made.
Peer Number	This displays the SIP address that called you or you called.
Phone Number	This displays the SIP address you used to make outgoing calls or receive calls.

Table 119 VoIP > Call History > Call History

LABEL	DESCRIPTION
Duration (hh:mm:ss)	This displays how long the call lasted.
Delete	Click the Delete icon to remove the call history.

22.5 Technical Reference

This section contains background material relevant to the **VoIP** screens.

VoIP

VoIP is the sending of voice signals over Internet Protocol. This allows you to make phone calls and send faxes over the Internet at a fraction of the cost of using the traditional circuit-switched telephone network. You can also use servers to run telephone service applications like PBX services and voice mail. Internet Telephony Service Provider (ITSP) companies provide VoIP service.

Circuit-switched telephone networks require 64 kilobits per second (Kbps) in each direction to handle a telephone call. VoIP can use advanced voice coding techniques with compression to reduce the required bandwidth.

SIP

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet.

SIP signaling is separate from the media for which it handles sessions. The media that is exchanged during the session can use a different path from that of the signaling. SIP handles telephone calls and can interface with traditional circuit-switched telephone networks.

SIP Identities

A SIP account uses an identity (sometimes referred to as a SIP address). A complete SIP identity is called a SIP URI (Uniform Resource Identifier). A SIP account's URI identifies the SIP account in a way similar to the way an e-mail address identifies an e-mail account. The format of a SIP identity is SIP-Number@SIP-Service-Domain.

SIP Number

The SIP number is the part of the SIP URI that comes before the "@" symbol. A SIP number can use letters like in an email address (johndoe@your-ITSP.com for example) or numbers like a telephone number (1122334455@VoIP-provider.com for example).

SIP Service Domain

The SIP service domain of the VoIP service provider is the domain name in a SIP URI. For example, if the SIP address is 1122334455@VoIP-provider.com, then "VoIP-provider.com" is the SIP service domain.

SIP Registration

Each Zyxel Device is an individual SIP User Agent (UA). To provide voice service, it has a public IP address for SIP and RTP protocols to communicate with other servers.

A SIP user agent has to register with the SIP registrar and must provide information about the users it represents, as well as its current IP address (for the routing of incoming SIP requests). After successful registration, the SIP server knows that the users (identified by their dedicated SIP URIs) are represented by the UA, and knows the IP address to which the SIP requests and responses should be sent.

Registration is initiated by the User Agent Client (UAC) running in the VoIP gateway (the Zyxel Device). The gateway must be configured with information letting it know where to send the REGISTER message, as well as the relevant user and authorization data.

A SIP registration has a limited lifespan. The User Agent Client must renew its registration within this lifespan. If it does not do so, the registration data will be deleted from the SIP registrar's database and the connection broken.

The Zyxel Device attempts to register all enabled subscriber ports when it is switched on. When you enable a subscriber port that was previously disabled, the Zyxel Device attempts to register the port immediately.

Authorization Requirements

SIP registrations (and subsequent SIP requests) require a username and password for authorization. These credentials are validated via a challenge / response system using the HTTP digest mechanism (as detailed in RFC 3261, "SIP: Session Initiation Protocol").

SIP Servers

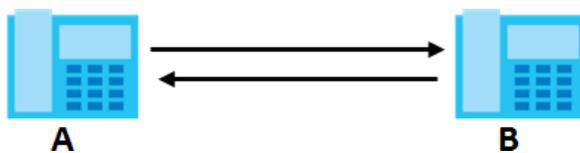
SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

When you use SIP to make a VoIP call, it originates at a client and terminates at a server. A SIP client could be a computer or a SIP phone. One device can act as both a SIP client and a SIP server.

SIP User Agent

A SIP user agent can make and receive VoIP telephone calls. This means that SIP can be used for peer-to-peer communications even though it is a client-server protocol. In the following figure, either **A** or **B** can act as a SIP user agent client to initiate a call. **A** and **B** can also both act as a SIP SIP user agent to receive the call.

Figure 175 SIP User Agent



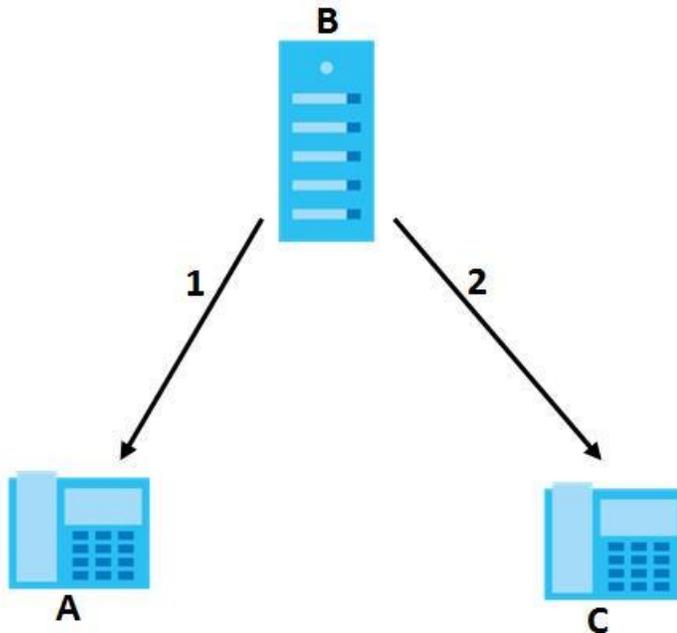
SIP Proxy Server

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

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

- 1 The client device (**A** in the figure) sends a call invitation to the SIP proxy server (**B**).
- 2 The SIP proxy server forwards the call invitation to **C**.

Figure 176 SIP Proxy Server

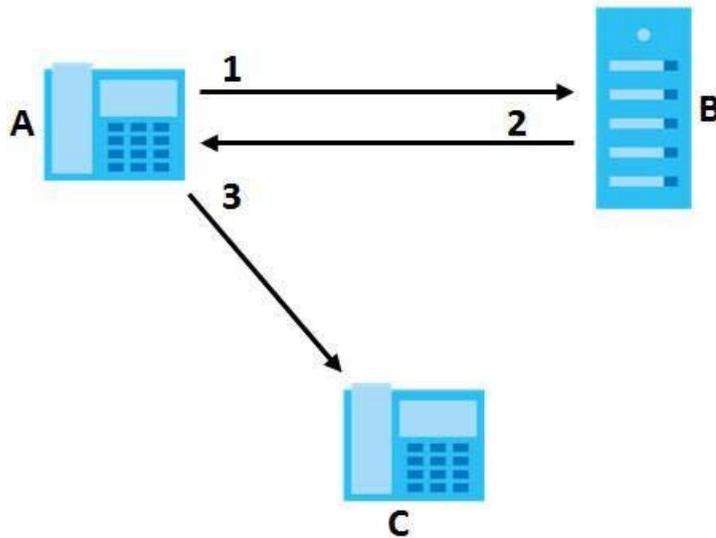


SIP Redirect Server

A SIP redirect server accepts SIP requests, translates the destination address to an IP address and sends the translated IP address back to the device that sent the request. Then the client device that originally sent the request can send requests to the IP address that it received back from the redirect server. Redirect servers do not initiate SIP requests.

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

- 1 Client device **A** sends a call invitation for **C** to the SIP redirect server (**B**).
- 2 The SIP redirect server sends the invitation back to **A** with **C**'s IP address (or domain name).
- 3 Client device **A** then sends the call invitation to client device **C**.

Figure 177 SIP Redirect Server

SIP Register Server

A SIP register server maintains a database of SIP identity-to-IP address (or domain name) mapping. The register server checks your user name and password when you register.

RTP

When you make a VoIP call using SIP, the RTP (Real time Transport Protocol) is used to handle voice data transfer. See RFC 1889 for details on RTP.

Pulse Code Modulation

Pulse Code Modulation (PCM) measures analog signal amplitudes at regular time intervals and converts them into bits.

SIP Call Progression

The following figure displays the basic steps in the setup and tear down of a SIP call. A calls B.

Table 120 SIP Call Progression

A		B
1. INVITE	→	
	←	2. Ringing
	←	3. OK
4. ACK	→	
		5. Dialogue (voice traffic)
6. BYE	→	
	←	7. OK

- 1 **A** sends a SIP INVITE request to **B**. This message is an invitation for **B** to participate in a SIP telephone call.
- 2 **B** sends a response indicating that the telephone is ringing.
- 3 **B** sends an OK response after the call is answered.
- 4 **A** then sends an ACK message to acknowledge that **B** has answered the call.
- 5 Now **A** and **B** exchange voice media (talk).
- 6 After talking, **A** hangs up and sends a BYE request.
- 7 **B** replies with an OK response confirming receipt of the BYE request and the call is terminated.

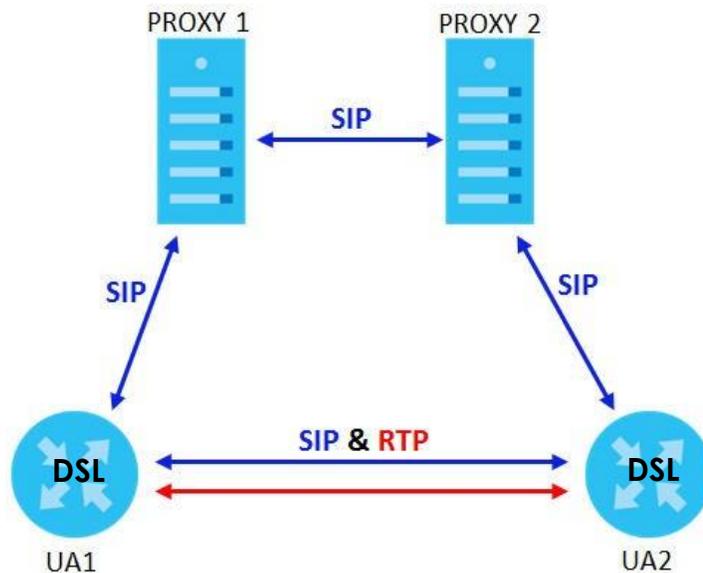
SIP Call Progression Through Proxy Servers

Usually, the SIP UAC sets up a phone call by sending a request to the SIP proxy server. Then, the proxy server looks up the destination to which the call should be forwarded (according to the URI requested by the SIP UAC). The request may be forwarded to more than one proxy server before arriving at its destination.

The response to the request goes to all the proxy servers through which the request passed, in reverse sequence. Once the session is set up, session traffic is sent between the UAs directly, bypassing all the proxy servers in between.

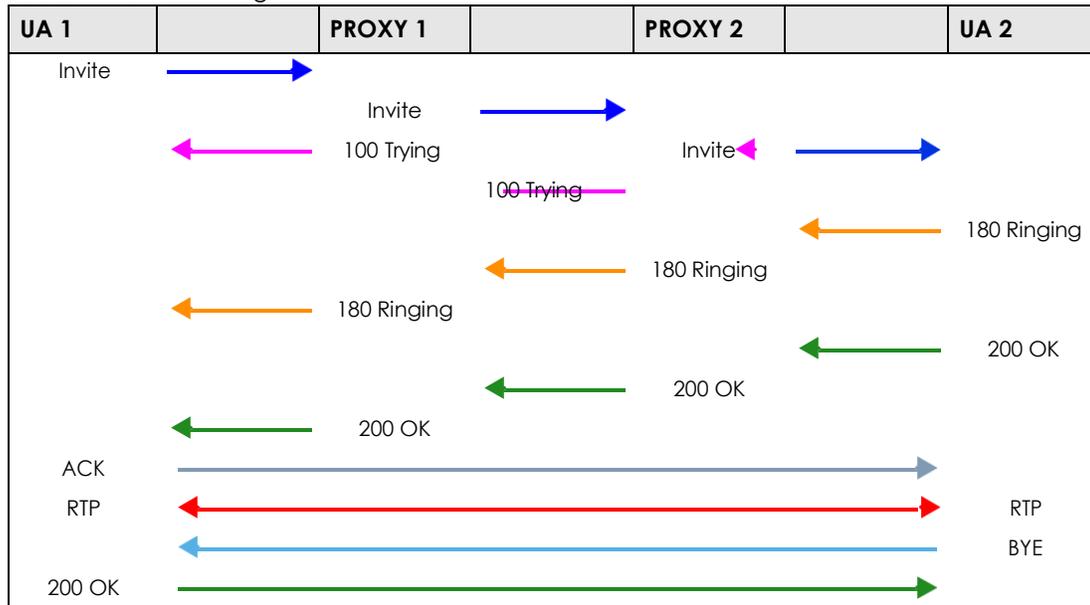
The following figure shows the SIP and session traffic flow between the user agents (**UA 1** and **UA 2**) and the proxy servers (this example shows two proxy servers, **PROXY 1** and **PROXY 2**).

Figure 178 SIP Call Through Proxy Servers



The following table shows the SIP call progression.

Table 121 SIP Call Progression



- User Agent 1** sends a SIP INVITE request to **Proxy 1**. This message is an invitation to **User Agent 2** to participate in a SIP telephone call. **Proxy 1** sends a response indicating that it is trying to complete the request.
- Proxy 1** sends a SIP INVITE request to **Proxy 2**. **Proxy 2** sends a response indicating that it is trying to complete the request.
- Proxy 2** sends a SIP INVITE request to **User Agent 2**.
- User Agent 2** sends a response back to **Proxy 2** indicating that the phone is ringing. The response is relayed back to **User Agent 1** via **Proxy 1**.
- User Agent 2** sends an OK response to **Proxy 2** after the call is answered. This is also relayed back to **User Agent 1** via **Proxy 1**.
- User Agent 1** and **User Agent 2** exchange RTP packets containing voice data directly, without involving the proxies.
- When **User Agent 2** hangs up, he sends a BYE request.
- User Agent 1** replies with an OK response confirming receipt of the BYE request, and the call is terminated.

Voice Coding

A codec (coder/decoder) codes analog voice signals into digital signals and decodes the digital signals back into analog voice signals. The Zyxel Device supports the following codecs.

- G.711 is a Pulse Code Modulation (PCM) waveform codec. PCM measures analog signal amplitudes at regular time intervals and converts them into digital samples. G.711 provides very good sound quality but requires 64 kbps of bandwidth.

- G.726 is an Adaptive Differential PCM (ADPCM) waveform codec that uses a lower bitrate than standard PCM conversion. ADPCM converts analog audio into digital signals based on the difference between each audio sample and a prediction based on previous samples. The more similar the audio sample is to the prediction, the less space needed to describe it. G.726 operates at 16, 24, 32 or 40 kbps.
- G.729 is an Analysis-by-Synthesis (AbS) hybrid waveform codec that uses a filter based on information about how the human vocal tract produces sounds. G.729 provides good sound quality and reduces the required bandwidth to 8 kbps.

Voice Activity Detection/Silence Suppression

Voice Activity Detection (VAD) detects whether or not speech is present. This lets the Zyxel Device reduce the bandwidth that a call uses by not transmitting "silent packets" when you are not speaking.

Comfort Noise Generation

When using VAD, the Zyxel Device generates comfort noise when the other party is not speaking. The comfort noise lets you know that the line is still connected as total silence could easily be mistaken for a lost connection.

Echo Cancellation

G.168 is an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.

MWI (Message Waiting Indication)

Enable Message Waiting Indication (MWI) enables your phone to give you a message-waiting (beeping) dial tone when you have a voice message(s). Your VoIP service provider must have a messaging system that sends message waiting status SIP packets as defined in RFC 3842.

Custom Tones (IVR)

IVR (Interactive Voice Response) is a feature that allows you to use your telephone to interact with the Zyxel Device. The Zyxel Device allows you to record custom tones for the **Early Media** and **Music On Hold** functions. The same recordings apply to both the caller ringing and on hold tones.

Table 122 Custom Tones Details

LABEL	DESCRIPTION
Total Time for All Tones	900 seconds for all custom tones combined
Maximum Time per Individual Tone	180 seconds
Total Number of Tones Recordable	5 You can record up to 5 different custom tones but the total time must be 900 seconds or less.

Recording Custom Tones

Use the following steps if you would like to create new tones or change your tones:

- 1 Pick up the phone and press “****” on your phone's keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1101~1105 on your phone followed by the “#” key.
- 3 Play your desired music or voice recording into the receiver's mouthpiece. Press the “#” key.
- 4 You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Listening to Custom Tones

Do the following to listen to a custom tone:

- 1 Pick up the phone and press “****” on your phone's keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1201~1208 followed by the “#” key to listen to the tone.
- 3 You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Deleting Custom Tones

Do the following to delete a custom tone:

- 1 Pick up the phone and press “****” on your phone's keypad and wait for the message that says you are in the configuration menu.
- 2 Press a number from 1301~1308 followed by the “#” key to delete the tone of your choice. Press 14 followed by the “#” key if you wish to clear all your custom tones.

You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

22.9.1 Quality of Service (QoS)

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to provide bandwidth for real-time multimedia applications.

Type of Service (ToS)

Network traffic can be classified by setting the ToS (Type of Service) values at the data source (for example, at the Zyxel Device) so a server can decide the best method of delivery, that is the least cost, fastest route and so on.

DiffServ

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCP) indicating the level of service desired.

This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.³

DSCP and Per-Hop Behavior

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

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

Figure 179 DiffServ: Differentiated Service Field

DSCP (6-bit)	Unused (2-bit)
-----------------	-------------------

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

22.9.2 Phone Services Overview

Supplementary services such as call hold, call waiting, and call transfer, are generally available from your VoIP service provider. The Zyxel Device supports the following services:

- Call Return
- Call Hold
- Call Waiting
- Making a Second Call
- Call Transfer
- Call Forwarding
- Three-Way Conference
- Internal Calls
- Call Park and Pickup
- Do not Disturb
- IVR
- Call Completion
- CCBS
- Outgoing SIP

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

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

22.9.2.1 Flash Key

Flashing means to press the hook for a short period of time (a few hundred milliseconds) before releasing it. On newer telephones, there should be a "flash" key (button) that generates the signal electronically. If the flash key is not available, you can tap (press and immediately release) the hook by hand to achieve the same effect. However, using the flash key is preferred since the timing is much more precise. With manual tapping, if the duration is too long, it may be interpreted as hanging up by the Zyxel Device.

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

22.9.2.2 Europe Type Supplementary Phone Services

This section describes how to use supplementary phone services with the **Europe Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 123 European Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. Switch back to the call (if there is no second call).
Flash	0	Drop the call presently on hold or reject an incoming call which is waiting for answer.
Flash	1	Disconnect the current phone connection and answer the incoming call or resume with caller presently on hold.
Flash	2	1. Switch back and forth between two calls. 2. Put a current call on hold to answer an incoming call. 3. Separate the current three-way conference call into two individual calls (one is on-line, the other is on hold).
Flash	3	Create three-way conference connection.
Flash	*98#	Transfer the call to another phone.

European Call Hold

Call hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key and then "2" to switch back and forth between caller **A** and **B** by putting either one on hold.

Press the flash key and then "0" to disconnect the call presently on hold and keep the current call on line.

Press the flash key and then "1" to disconnect the current call and resume the call on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

European Call Waiting

This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to a telephone number, you will hear a call waiting tone. Take one of the following actions.

- Reject the second call.
Press the flash key and then press "0".
- Disconnect the first call and answer the second call.
Either press the flash key and press "1", or just hang up the phone and then answer the phone after it rings.
- Put the first call on hold and answer the second call.
Press the flash key and then "2".

European Call Transfer

Do the following to transfer an incoming call (that you have answered) to another phone.

- 1 Press the flash key to put the caller on hold.
- 2 When you hear the dial tone, dial "*98#" followed by the number to which you want to transfer the call.
- 3 After you hear the ring signal or the second party answers it, hang up the phone.

European Three-Way Conference

Use the following steps to make three-way conference calls.

- 1 When you are on the phone talking to someone, press the flash key to put the caller on hold and get a dial tone.
- 2 Dial a phone number directly to make another call.
- 3 When the second call is answered, press the flash key and press "3" to create a three-way conversation.
- 4 Hang up the phone to drop the connection.
- 5 If you want to separate the activated three-way conference into two individual connections (one is on-line, the other is on hold), press the flash key and press "2".

22.9.2.3 Phone Functions Summary

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

Table 125 Phone Functions Summary

ACTION	FUNCTION	DESCRIPTION
*98#	Call transfer	Transfer a call to another phone. See Section 22.9.2.2 on page 295 (Europe type) and Section 22.9.2.3 on page 296 (USA type).

Chapter 22 VoIP

*66#	Call return	Place a call to the last person who called you.
*95#	Enable Do Not Disturb	Use these to set your phone not to ring when someone calls you, or to turn this function off.
#95#	Disable Do Not Disturb	
*41#	Enable Call Waiting	Use these to allow you to put a call on hold when you are answering another, or to turn this function off.
#41#	Disable Call Waiting	
****	IVR	Use these to set up Interactive Voice Response (IVR). IVR allows you to record custom caller ringing tones (the sound a caller hears before you pick up the phone) and on hold tones (the sound someone hears when you put their call on hold).
####	Internal Call	Call the phone(s) connected to the Zyxel Device.
*82	One Shot Caller Display Call	Activate or deactivate caller ID for the next call only.
*67	One Shot Caller Hidden Call	

CHAPTER 23

Log

23.1 Log Overview

These screens allow you to determine the categories of events that the Zyxel Device logs and then display these logs or have the Zyxel Device send them to an administrator (through e-mail) or to a syslog server.

23.1.1 What You Can Do in this Chapter

- Use the **System Log** screen to see the system logs ([Section 23.2 on page 300](#)).
- Use the **Security Log** screen to see the security-related logs for the categories that you select ([Section 23.3 on page 301](#)).

23.1.2 What You Need To Know

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

Alerts and Logs

An alert is a type of log that warrants more serious attention. They include system errors, attacks (access control) and attempted access to blocked web sites. Some categories such as **System Errors** consist of both logs and alerts. You may differentiate them by their color in the **View Log** screen. Alerts display in red and logs display in black.

Syslog Overview

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

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

Table 126 Syslog Severity Levels

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

Table 126 Syslog Severity Levels

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

23.2 System Log

Use the **System Log** screen to see the system logs. You can filter the entries by selecting a severity level and/or category. Click **System Monitor > Log > System Log** to open the **System Log** screen.

Figure 180 System Monitor > Log > System Log

The following table describes the fields in this screen.

Table 127 System Monitor > Log > System Log

LABEL	DESCRIPTION
Level	Select a severity level from the drop-down list box. This filters search results according to the severity level you have selected. When you select a severity, the Zyxel Device searches through all logs of that severity or higher.
Category	Select the type of logs to display.
Clear Log	Click this to delete all the logs.
Refresh	Click this to renew the log screen.
Export Log	Click this to save the current list of logs to your computer.
E-mail Log Now	Click this to send the log file(s) to the e-mail address you specify in the Maintenance > E-mail Notification screen.
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Level	This field displays the severity level of the log.
Category	This field displays the type of the log.
Messages	This field states the reason for the log.

23.3 Security Log

Use the **Security Log** screen to see the security-related logs for the categories that you select. You can filter the entries by selecting a severity level and/or category. Click **System Monitor > Log > Security Log** to open the following screen.

Figure 181 System Monitor > Log > Security Log

The following table describes the fields in this screen.

Table 128 System Monitor > Log > Security Log

LABEL	DESCRIPTION
Level	Select a severity level from the drop-down list box. This filters search results according to the severity level you have selected. When you select a severity, the Zyxel Device searches through all logs of that severity or higher.
Category	Select the type of logs to display.
Clear Log	Click this to delete all the logs.
Refresh	Click this to renew the log screen.
Export Log	Click this to save the current list of logs to your computer.
E-mail Log Now	Click this to send the log file(s) to the e-mail address you specify in the Maintenance > E-mail Notification screen.
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Level	This field displays the severity level of the log.
Category	This field displays the type of the log.
Messages	This field states the reason for the log.

CHAPTER 24

Traffic Status

24.1 Traffic Status Overview

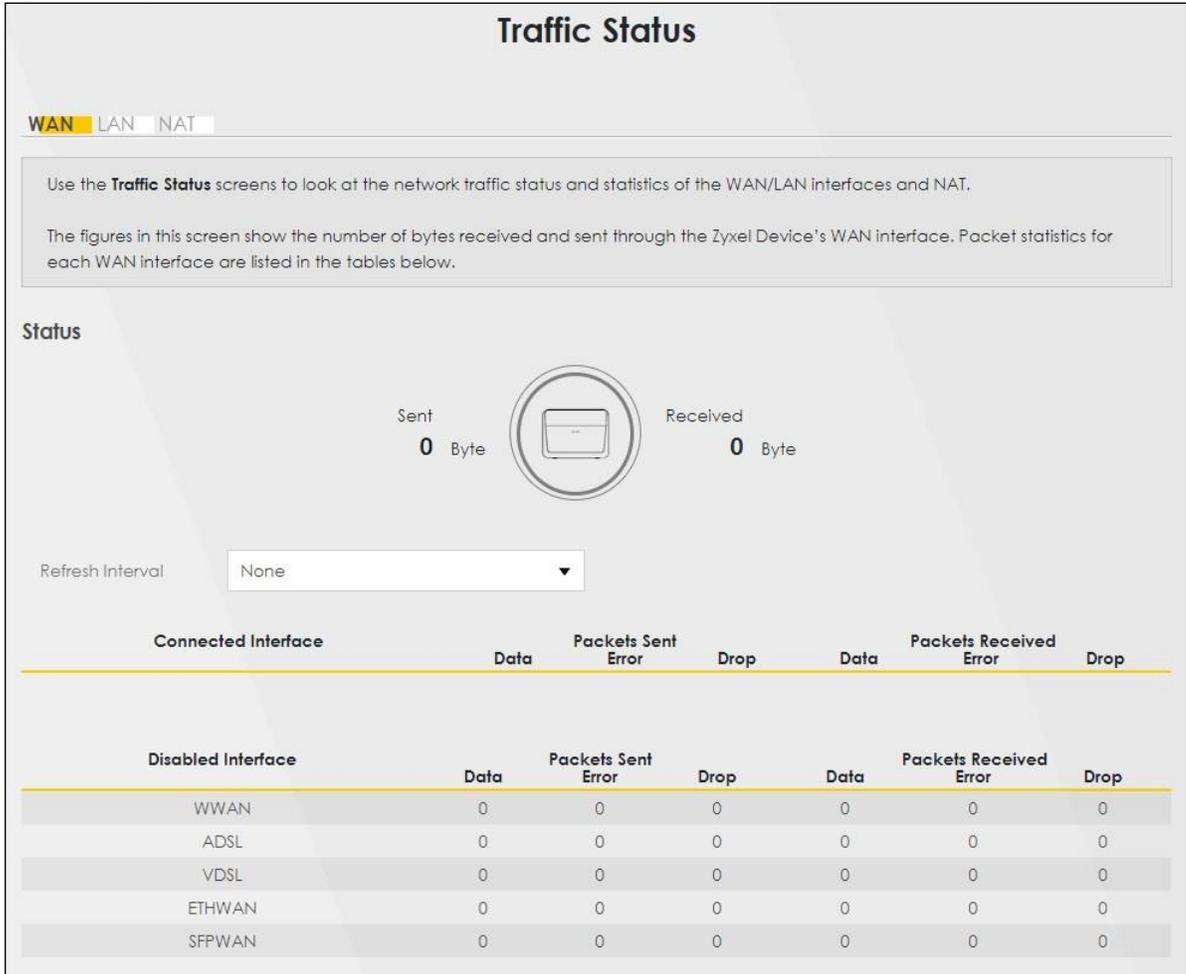
Use the **Traffic Status** screens to look at the network traffic status and statistics of the WAN/LAN interfaces and NAT.

24.1.1 What You Can Do in this Chapter

- Use the **WAN** screen to view the WAN traffic statistics ([Section 24.2 on page 302](#)).
- Use the **LAN** screen to view the LAN traffic statistics ([Section 24.3 on page 304](#)).
- Use the **NAT** screen to view the NAT status of the Zyxel Device's client(s) ([Section 24.4 on page 305](#)).

24.2 WAN Status

Click **System Monitor > Traffic Status** to open the **WAN** screen. The figures in this screen show the total number of bytes received and sent through the Zyxel Device's WAN interface(s). Packet statistics for each WAN interface are listed in the tables below.

Figure 182 System Monitor > Traffic Status > WAN

The following table describes the fields in this screen.

Table 129 System Monitor > Traffic Status > WAN

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen.
Connected Interface	This shows the name of the WAN interface that is currently connected.
Packets Sent	
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.
Disabled Interface	This shows the name of the WAN interface that is currently disabled.
Packets Sent	

Table 129 System Monitor > Traffic Status > WAN (continued)

LABEL	DESCRIPTION
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Packets Received	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

24.3 LAN Status

Click **System Monitor > Traffic Status > LAN** to open the following screen. This screen allows you to view packet statistics for each LAN or WLAN interface on the Zyxel Device.

Figure 183 System Monitor > Traffic Status > LAN

Traffic Status

WAN **LAN** NAT

This screen allows you to view packet statistics for each LAN or WLAN interface on the Zyxel Device.

Refresh Interval:

Interface	LAN1	LAN2	LAN3	LAN4	2.4G WLAN	5G WLAN
Bytes Sent	0	0	0	472091	1095638	2208002
Bytes Received	0	0	0	220093	0	0

Interface		LAN1	LAN2	LAN3	LAN4	2.4G WLAN	5G WLAN
Sent (Packet)	Data	0	0	0	2157	12662	25397
	Error	0	0	0	0	272	0
	Drop	0	0	0	0	272	0
Received (Packet)	Data	0	0	0	1740	0	0
	Error	0	0	0	0	0	8
	Drop	0	0	0	65	0	0

The following table describes the fields in this screen.

Table 130 System Monitor > Traffic Status > LAN

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen.
Interface	This shows the LAN or wireless LAN interface on the Zyxel Device.
Bytes Sent	This indicates the number of bytes transmitted on this interface.
Bytes Received	This indicates the number of bytes received on this interface.
Interface	This shows the LAN or wireless LAN interfaces on the Zyxel Device.
Sent (Packets)	

Table 130 System Monitor > Traffic Status > LAN (continued)

LABEL	DESCRIPTION
Data	This indicates the number of transmitted packets on this interface.
Error	This indicates the number of frames with errors transmitted on this interface.
Drop	This indicates the number of outgoing packets dropped on this interface.
Received (Packets)	
Data	This indicates the number of received packets on this interface.
Error	This indicates the number of frames with errors received on this interface.
Drop	This indicates the number of received packets dropped on this interface.

24.4 NAT Status

Click **System Monitor > Traffic Status > NAT** to open the following screen. This screen lists the devices that have received an IP address from the Zyxel Device LAN or WLAN interface(s) and have ever established a session with the Zyxel Device.

Figure 184 System Monitor > Traffic Status > NAT

Traffic Status

WAN LAN **NAT**

This screen lists the devices that have received an IP address from the Zyxel Device's LAN or WLAN interface(s) and have ever established a session with the Zyxel Device.

Refresh Interval:

Device Name	IPv4 Address	MAC Address	NO. of Open Sessions
TWP CNT03116-01	192.168.1.199	dc:4a:3e:40:ec:67	20

Total: 0.20%

The following table describes the fields in this screen.

Table 131 System Monitor > Traffic Status > NAT

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

CHAPTER 25

VoIP Status

25.1 VoIP Status Settings

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

Figure 185 System Monitor > VoIP Status

VoIP Status

This screen displays VoIP registration status, current call status and other related information for each SIP account. You can also see the phone port to which the SIP account is mapped for outgoing or incoming calls in this screen.

Poll seconds [Set Interval](#) [Stop](#)

Interval(s)

SIP Status

Account	Register Action	Registration	Registration Time	URI	Message Waiting	Last Incoming Number	Last Outgoing Number
1	<input type="checkbox"/>	Disabled		ChangeMe@ChangeMe	No		
2	<input type="checkbox"/>	Disabled		ChangeMe@ChangeMe	No		

Call Status

Account	Duration	Status	Call Type	Codec	From Phone Port Type	To Phone Port Type	Peer Number
No active calls							

Phone Status

Phone	Outgoing Number	Incoming Number	Hook Status
Phone 1	ChangeMe	ChangeMe	On-hook
Phone 2	ChangeMe	ChangeMe	On-hook

The following table describes the fields in this screen.

Table 132 System Monitor > VoIP Status

LABEL	DESCRIPTION
Poll Interval(s)	Enter the number of seconds the Zyxel Device needs to wait before updating this screen and then click Set Interval . Click Stop to have the Zyxel Device stop updating this screen.
SIP Status	

Table 132 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
Account	This column displays the index number of each SIP account that has already configured in the Zyxel Device.
Register Action	<p>The switch is grayed out and cannot be configured if the SIP account is disabled.</p> <p>If the SIP account is not registered, you can click the switch to turn it on  to have the Zyxel Device attempt to register the SIP account with the SIP server.</p> <p>If the SIP account is already registered with a SIP server, setting the switch to off  will delete the SIP account's registration in the SIP server. This does not cancel your SIP account, but it deletes the mapping between your SIP identity and your IP address or domain name.</p>
Registration	<p>This field displays the current registration status of the SIP account.</p> <p>Registered - The SIP account is activated and has been registered with a SIP server. You can use it to make a VoIP call.</p> <p>Unregistered - The SIP account is activated, but the last time the Zyxel Device tried to register the SIP account with the SIP server, the attempt failed. Use the Register Action switch to register the account again. The Zyxel Device will also automatically try to register the SIP account again after a period of time that you configured in VoIP > SIP > SIP Service Provider > Add/Edit > SIP Register Fail Re-Try Timer.</p> <p>Disabled - The SIP account is not active. Make sure the corresponding SIP Service Provider and SIP Account are both enabled in VoIP > SIP > SIP Service Provider > Add/Edit and VoIP > SIP > SIP Account > Add/Edit.</p>
Registration Time	This field displays the last time the Zyxel Device successfully registered the SIP account with the SIP server. The field is blank if this account is never successfully registered.
URI	This field displays the account number and service domain of the SIP account. You can change these in the VoIP > SIP > SIP Service Provider > Add/Edit and VoIP > SIP > SIP Account > Add/Edit screens.
Message Waiting	This field indicates whether or not there are any new voice messages in the SIP account. You have to enable the MWI function in the VoIP > SIP > SIP Account > Add/Edit screen, and your VoIP service provider should also support the voice mail system and MWI feature.
Last Incoming Number	This field displays the last SIP number the peer device used to call the SIP account. The field is blank if there is never an incoming call for the SIP account.
Last Outgoing Number	<p>This field displays the last SIP number that you called via this SIP account. The field is blank if you never dialed a number using the SIP account.</p> <p>Note: An outgoing number is recorded only after SIP outgoing call signaling procedure starts.</p>
Call Status (This table displays the status of all active and ongoing calls only.)	
Account	This field displays the SIP number used to make an Outgoing Call or receive an Incoming Call through a SIP server. It shows the phone port number for an Internal call without a SIP server.
Duration	<p>This field displays how long the current call has lasted.</p> <p>Note: The time calculation starts from the beginning of the call setup signaling procedure, rather than the moment when the call is successfully established.</p>
Status	<p>This field displays the current call progress or state of the phone call.</p> <p>Calling - The Zyxel Device sends an INVITE request to make an Outgoing Call or Internal Call. The callee's phone is ringing.</p> <p>Ringing - There is an Incoming call. The phone attached to the Zyxel Device's phone port associated with the SIP account is ringing.</p> <p>InCall - There is a call in progress. Voice data is exchanged between both parties.</p> <p>Hold - An Outgoing Call or Incoming Call is placed on hold.</p>

Table 132 System Monitor > VoIP Status (continued)

LABEL	DESCRIPTION
Call Type	<p>This field displays the type of the current VoIP call.</p> <p>Outgoing Call - This is a call that you originated using a SIP account.</p> <p>Incoming Call - This is a call that you received for a SIP account.</p> <p>Internal Call - This is a VoIP call between two phone ports without a SIP server. When you have phones attached to both of the Zyxel Device's phone ports, you can dial "#####" to place a call to the phone(s) connected to the other port.</p>
Codec	<p>This field displays what voice codec is being used for a current VoIP call through a phone port. It shows Unknown when Status is Calling or Ringing (before both parties agree on a codec).</p>
From Phone Port Type	<p>This field displays the phone port type used to originate the current VoIP call. It shows SIP for an Incoming Call and FXS for an Outgoing Call or Internal Call.</p>
To Phone Port Type	<p>This field displays the phone port type used to receive the current VoIP call. It shows SIP for an Outgoing Call and FXS for an Incoming Call or Internal Call. When an Incoming Call's Status is Ringing, the phone port type is Unknown.</p>
Peer Number	<p>This field displays the SIP number of the party that is currently engaged in a VoIP call through a phone port. It shows ##### for an Internal Call.</p>
<p>Phone Status (This table displays the name and the SIP account binding relationship of different local phone ports. The SIP account binding relationship can be configured in VoIP > Phone > Phone Device.)</p>	
Phone	<p>This field displays the name of each phone port on the Zyxel Device.</p>
Outgoing Number	<p>This field displays the SIP number that you use to make outgoing calls on this phone port.</p>
Incoming Number	<p>This field displays the SIP number that you use to receive incoming calls on this phone port.</p>
Hook Status	<p>This field displays the current state of use of the phone.</p> <p>On-hook - The phone attached to the Zyxel Device's phone port is not in use.</p> <p>Off-hook - The phone attached to the Zyxel Device's phone port is in use</p>

CHAPTER 26

ARP Table

26.1 ARP Table Overview

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

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

26.1.1 How ARP Works

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

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

26.2 ARP Table Settings

Use the ARP table to view the IPv4-to-MAC address mappings for each device connected to the Zyxel Device. The neighbor table shows the IPv6-to-MAC address mappings of each neighbor. To open this screen, click **System Monitor > ARP Table**.

Figure 186 System Monitor > ARP Table

ARP Table			
<p>Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network.</p> <p>An IP (version 4) address is 32 bits long. MAC addresses are 48 bits long. The ARP Table maintains an association between each MAC address and its corresponding IP address.</p> <p>Use the ARP table to view the IPv4-to-MAC address mapping(s) for each device connected to the Zyxel Device. The neighbor table shows the IPv6-to-MAC address mapping(s) of each neighbor.</p>			
IPv4 ARP Table			
#	IPv4 Address	MAC Address	Device
1	192.168.1.199	dc:4a:3e:40:ec:67	br0
IPv6 Neighbour Table			
#	IPv6 Address	MAC Address	Device
1	fe80::4087:e9cd:15e7:221e	dc:4a:3e:40:ec:67	br0

The following table describes the labels in this screen.

Table 133 System Monitor > ARP Table

LABEL	DESCRIPTION
#	This is the index number of the ARP or neighbor table entry.
IPv4/IPv6 Address	This is the learned IPv4 or IPv6 IP address of a device connected to a port on the Zyxel Device.
MAC Address	This is the MAC address of the device with the listed IP address.
Device	This is the name of Zyxel Device's interface to which the device is connected.

CHAPTER 27

Routing Table

27.1 Routing Table Overview

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

27.2 Routing Table Settings

The table below shows IPv4 and IPv6 routing information. The IPv4 subnet mask is '255.255.255.255' for a host destination and '0.0.0.0' for the default route. The gateway address is written as '*' (IPv4) / '::' (IPv6) if none is set.

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

Figure 187 System Monitor > Routing Table

Routing Table						
Routing is based on the destination address only and the Zyxel Device takes the shortest path to forward a packet.						
The table below shows IPv4 and IPv6 routing information. The IPv4 subnet mask is '255.255.255.255' for a host destination and '0.0.0.0' for the default route. The gateway address is written as '*' (IPv4) / ':' (IPv6) if none is set.						
Destination: This indicates the destination IPv4 address or IPv6 address and prefix of this route.						
Gateway: This indicates the IPv4 address or IPv6 address of the gateway that helps forward this route's traffic.						
Subnet Mask: This indicates the destination subnet mask of the IPv4 route.						
Flag: This indicates the route status.						
U-Up: The route is up.						
I-Reject: The route is blocked and will force a route lookup to fail.						
G-Gateway: The route uses a gateway to forward traffic.						
H-Host: The target of the route is a host.						
R-Reinstate: The route is reinstated for dynamic routing.						
D-Dynamic (redirect): The route is dynamically installed by a routing daemon or redirect.						
M-Modified (redirect): The route is modified from a routing daemon or redirect.						
Metric: The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". The smaller the number, the lower the "cost".						
Interface: This indicates the name of the interface through which the route is forwarded.						
IPv4 Routing Table						
Destination	Gateway	Subnet Mask	Flag	Metric	Interface	
192.168.1.0	0.0.0.0	255.255.255.0	U	0	br0	
239.0.0.0	0.0.0.0	255.0.0.0	U	0	br0	
IPv6 Routing Table						
Destination	Gateway	Flag	Metric	Interface		
fe80::/64	::	U	256	br0		
fe80::/64	::	U	256	eth3.0		
fe80::/64	::	U	256	wl0.5		
::1/128	::	U	0	lo		
fe80::/128	::	U	0	lo		
fe80::/128	::	U	0	lo		
fe80::/128	::	U	0	lo		
fe80::10:18ff:fe01:1/128	::	U	0	lo		
fe80::10:18ff:fe01:1/128	::	U	0	lo		
fe80::6010:18ff:fe01:0/128	::	U	0	lo		
ff02::1/128	::	UC	0	br0		
ff02::16/128	::	UC	0	br0		
ff00::/8	::	U	256	br0		
ff00::/8	::	U	256	eth3.0		
ff00::/8	::	U	256	wl0.5		

The following table describes the labels in this screen.

Table 134 System Monitor > Routing Table

LABEL	DESCRIPTION
IPv4/IPv6 Routing Table	
Destination	This indicates the destination IPv4 address or IPv6 address and prefix of this route.
Gateway	This indicates the IPv4 address or IPv6 address of the gateway that helps forward this route's traffic.
Subnet Mask	This indicates the destination subnet mask of the IPv4 route.

Table 134 System Monitor > Routing Table (continued)

LABEL	DESCRIPTION
Flag	<p>This indicates the route status.</p> <p>U-Up: The route is up.</p> <p>!-Reject: The route is blocked and will force a route lookup to fail.</p> <p>G-Gateway: The route uses a gateway to forward traffic.</p> <p>H-Host: The target of the route is a host.</p> <p>R-Reinstate: The route is reinstated for dynamic routing.</p> <p>D-Dynamic (redirect): The route is dynamically installed by a routing daemon or redirect.</p> <p>M-Modified (redirect): The route is modified from a routing daemon or redirect.</p>
Metric	<p>The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". The smaller the number, the lower the "cost".</p>
Interface	<p>This indicates the name of the interface through which the route is forwarded.</p> <p>brx indicates a LAN interface where x can be 0~3 to represent LAN1 to LAN4 respectively.</p> <p>ethx indicates an Ethernet WAN interface using IPoE or in bridge mode.</p> <p>ppp0 indicates a WAN interface using PPPoE.</p> <p>wlx indicates a wireless interface where x can be 0~1. For some models, wl1 indicates 5 GHz wireless interface, and wl0 indicates 2.4 GHz wireless interface. For the other models, wl1 indicates 5 GHz wireless interface, and wl0 indicates 2.4 GHz wireless interface.</p>

CHAPTER 28

Multicast Status

28.1 Multicast Status Overview

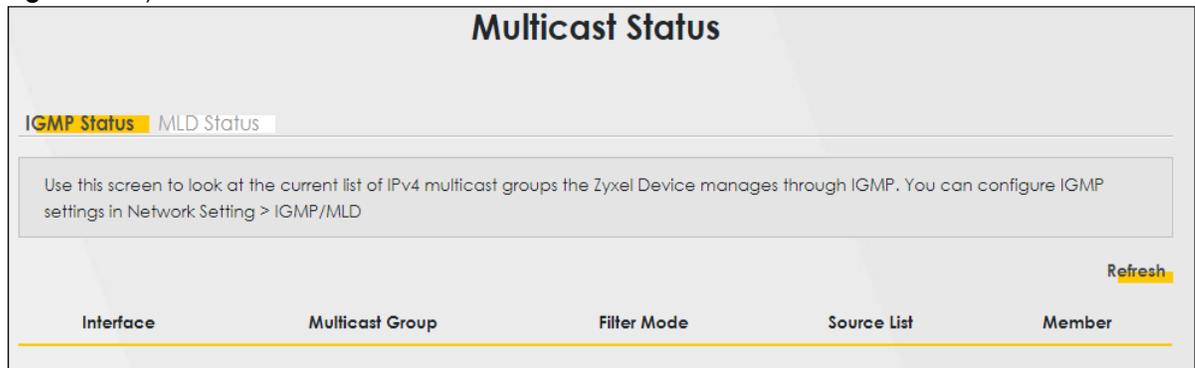
Use the **Multicast Status** screens to view IPv4 or IPv6 multicast group information.

28.2 IGMP Status

Use this screen to look at the current list of IPv4 multicast groups the Zyxel Device manages through IGMP. 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. You can configure IGMP settings in **Network Setting > IGMP/MLD**.

To open this screen, click **System Monitor > Multicast Status > IGMP Status**.

Figure 188 System Monitor > Multicast Status > IGMP Status



The following table describes the labels in this screen.

Table 135 System Monitor > Multicast Status > IGMP Status

LABEL	DESCRIPTION
Refresh	Click this button to update the information on this screen.
Interface	This field displays the name of the Zyxel Device interface that belongs to an IGMP multicast group.
Multicast Group	This field displays the address of the IGMP multicast group to which the interface belongs.
Filter Mode	<p>INCLUDE means that only the IP addresses in the Source List get to receive the multicast group's traffic.</p> <p>EXCLUDE means that the IP addresses in the Source List are not allowed to receive the multicast group's traffic but other IP addresses can.</p>

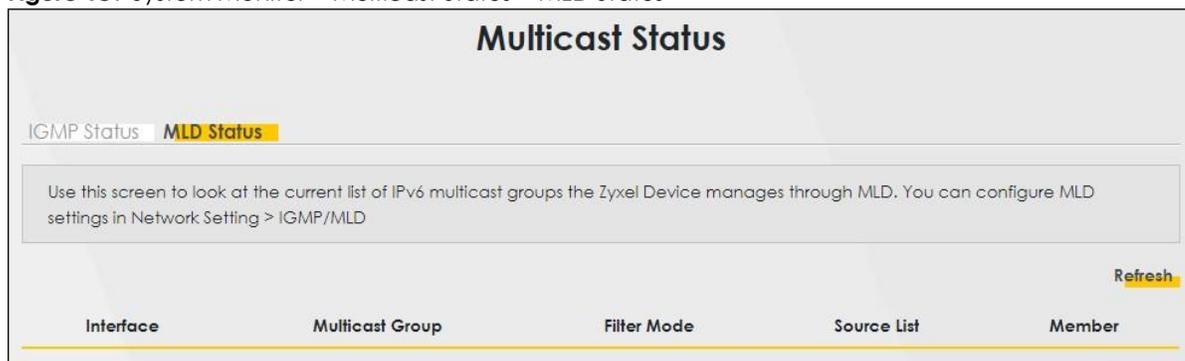
Table 135 System Monitor > Multicast Status > IGMP Status (continued)

LABEL	DESCRIPTION
Source List	This lists the IP addresses that are allowed or not allowed to receive the multicast group's traffic depending on the filter mode.
Member	This lists the IP address of members currently in the multicast group.

28.3 MLD Status

Use this screen to look at the current list of IPv6 multicast groups the Zyxel Device manages through MLD. 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. MLDv1 is equivalent to IGMPv2 and MLDv2 is equivalent to IGMPv3. You can configure MLD settings in **Network Setting > IGMP/MLD**. To open this screen, click **System Monitor > Multicast Status > MLD Status**.

Figure 189 System Monitor > Multicast Status > MLD Status



The following table describes the labels in this screen.

Table 136 System Monitor > Multicast Status > MLD Status

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

CHAPTER 29

WLAN Station Status

29.1 WLAN Station Status Overview

Click **System Monitor > WLAN Station Status** to open the following screen. Use this screen to view information and status of the wireless stations (wireless clients) that are currently associated with the Zyxel Device. Being associated means that a wireless client (for example, your network or computer with a wireless network card installed) has connected successfully to an AP (or wireless router) using the same SSID, channel, and WiFi security settings.

Figure 190 System Monitor > WLAN Station Status

The screenshot shows the 'WLAN Station Status' interface. At the top, there is a title 'WLAN Station Status' and a descriptive paragraph: 'Use this screen to view information and status of the wireless stations (wireless clients) that are currently associated with the Zyxel Device. Being associated means that a wireless client (for example, your network or computer with a wireless network card installed) has connected successfully to an AP (or wireless router) using the same SSID, channel, and WiFi security settings.' Below this, there are two sections: 'WLAN 2.4G Station Status' and 'WLAN 5G Station Status'. Each section contains a table with the following columns: '#', 'MAC Address', 'Rate (Mbps)', 'RSSI (dBm)', 'SNR', and 'Level'. The tables are currently empty.

The following table describes the labels in this screen.

Table 137 System Monitor > WLAN Station Status

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
MAC Address	This field displays the MAC address of an associated wireless station.
Rate (Mbps)	This field displays the transmission rate of the WiFi traffic between an associated wireless station and the Zyxel Device.
RSSI (dBm)	The RSSI (Received Signal Strength Indicator) field shows the WiFi signal strength of the station's wireless connection. The normal range is -30dBm to -79dBm. If the value drops below -80dBm, try moving the associated wireless station closer to the Zyxel Device to get better signal strength.

Table 137 System Monitor > WLAN Station Status (continued)

LABEL	DESCRIPTION
SNR	<p>The Signal-to-Noise Ratio (SNR) is the ratio between the received signal power and the received noise power.</p> <p>The normal range is 15 to 40. If the value drops below 15, try moving the associated wireless station closer to the Zyxel Device to get better quality WiFi.</p>
Level	<p>This field displays a number which represents the strength of the WiFi signal between an associated wireless station and the Zyxel Device. The Zyxel Device uses the RSSI and SNR values to determine the strength of the WiFi signal.</p> <p>5 means the Zyxel Device is receiving an excellent WiFi signal.</p> <p>4 means the Zyxel Device is receiving a very good WiFi signal.</p> <p>3 means the Zyxel Device is receiving a weak WiFi signal.</p> <p>2 means the Zyxel Device is receiving a very weak WiFi signal.</p> <p>1 means the Zyxel Device is not receiving a WiFi signal.</p>

CHAPTER 30

Cellular Statistics

30.1 Cellular Statistics Overview

Use the **Cellular Statistics** screens to look at cellular Internet connection status. By default, a cellular WAN connection is used as a backup for the wired DSL/Ethernet WAN connections.

30.2 Cellular Statistics Settings

To open this screen, click **System Monitor > Cellular Statistics**. Cellular information is available on this screen only when you insert a compatible cellular dongle in the USB port on the Zyxel Device.

Figure 191 System Monitor > Cellular Statistics

Cellular Statistics

Use the **Cellular Statistics** screens to look at cellular Internet connection status. By default, a cellular WAN connection is used as a backup for the wired DSL/Ethernet WAN connections.

Cellular information is available on this screen only when you insert a compatible cellular dongle in the USB port on the Zyxel Device.

Monitor

Refresh Interval None ▼

Status

Cellular Status	No Device
Service Provider	N/A
Signal Strength	N/A
Connection Uptime	N/A
Cellular Card Manufacturer	N/A
Cellular Card Model	N/A
Cellular Card F/W Version	N/A
SIM Card IMSI	N/A
VID/PID	N/A

The following table describes the labels in this screen.

Table 138 System Monitor > Cellular Statistics

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the Zyxel Device to update this screen. Select No Refresh to stop refreshing.
Cellular Status	This field displays the status of the cellular Internet connection. This field can display: GSM - Global System for Mobile Communications, 2G GPRS - General Packet Radio Service, 2.5G EDGE - Enhanced Data rates for GSM Evolution, 2.75G WCDMA - Wideband Code Division Multiple Access, 3G HSDPA - High-Speed Downlink Packet Access, 3.5G HSUPA - High-Speed Uplink Packet Access, 3.75G HSPA - HSDPA+HSUPA, 3.75G
Service Provider	This field displays the name of the service provider.
Signal Strength	This field displays the strength of the signal in dBm.
Connection Uptime	This field displays the time the connection has been up.
Cellular Card Manufacturer	This field displays the manufacturer of the cellular card.
Cellular Card Model	This field displays the model name of the cellular card.
Cellular Card F/W Version	This field displays the firmware version of the cellular card.
SIM Card IMSI	The International Mobile Subscriber Identity or IMSI is a unique identification number associated with all cellular networks. This number is provisioned in the SIM card.
VID/PID	This field displays the USB Vendor ID and Product ID of the cellular card.

CHAPTER 32

xPON Status

32.1 Overview

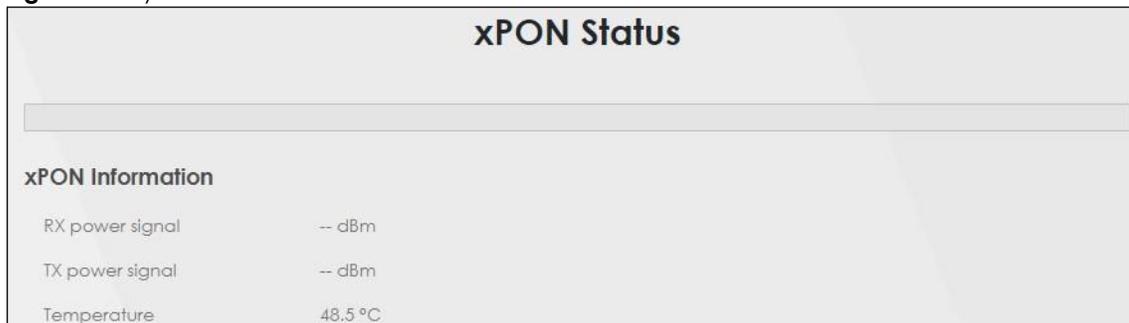
You can view the real-time optical transceiver information and operating parameters on the PON port. The parameters include, for example, transmitting and receiving power, and module temperature.

32.2 xPON Status Screen

Click **System Monitor > xPON Status** to open the following screen. Use this screen to view the current PON transceiver status.

Note: You can only see this screen if you are using AX7501.

Figure 193 System Monitor > xPON Status



xPON Status	
xPON Information	
RX power signal	-- dBm
TX power signal	-- dBm
Temperature	48.5 °C

The following table describes the labels in this screen.

Table 140 System Monitor > xPON Status

LABEL	DESCRIPTION
xPON Information	
RX power signal	This displays the amount of power (in dBm) the PON transceiver is receiving from the fiber optic cable.
TX power signal	This displays the amount of power (in dBm) the PON transceiver is transmitting.
Temperature	This displays the temperature inside the PON transceiver in degrees Celsius.

CHAPTER 33

System

33.1 System Overview

Use this screen to name your Zyxel Device (Host) and give it an associated domain name for identification purposes.

Assign a unique name to the Zyxel Device so it can be easily recognized on your network. You can use up to 30 characters, including spaces.

33.2 System Settings

Click **Maintenance > System** to open the following screen. Assign a unique name to the Zyxel Device so it can be easily recognized on your network. You can use up to 30 characters, including spaces.

Figure 194 Maintenance > System

System

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

Assign a unique name to the Zyxel Device so it can be easily recognized on your network. You can use up to 30 characters, including spaces.

Host Name

Domain Name

Cancel **Apply**

The following table describes the labels in this screen.

Table 141 Maintenance > System

LABEL	DESCRIPTION
Host Name	Type a host name for your Zyxel Device. Enter a descriptive name of up to 16 alphanumeric characters, not including spaces, underscores, and dashes.
Domain Name	Type a Domain name for your host Zyxel Device.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

CHAPTER 34

User Account

34.1 User Account Overview

In the **User Account** screen, you can view the settings of the 'admin' and other user accounts that you use to log into the Zyxel Device to manage it.

34.2 User Account Settings

Click **Maintenance > User Account** to open the following screen. Use this screen to create or manage user accounts and their privileges on the Zyxel Device.

Figure 195 Maintenance > User Account

#	Active	User Name	Retry Times	Idle Timeout	Lock Period	Group	Modify
1	<input checked="" type="checkbox"/>	admin	3	60	5	Administrator	
2	<input checked="" type="checkbox"/>	user	3	5	5	User	

The following table describes the labels in this screen.

Table 142 Maintenance > User Account

LABEL	DESCRIPTION
Add New Account	Click this button to add a new user account.
#	This is the index number of the user account.
Active	This field indicates whether the user account is active or not. Clear the check box to disable the user account. Select the check box to enable it.
User Name	This field displays the name of the account used to log into the Zyxel Device Web Configurator.

Table 142 Maintenance > User Account (continued)

LABEL	DESCRIPTION
Retry Times	This field displays the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	This field displays the length of inactive time before the Zyxel Device will automatically log the user out of the Web Configurator.
Lock Period	This field displays the length of time a user must wait before attempting to log in again after a number if consecutive wrong passwords have been entered as defined in Retry Times .
Group	This field displays whether this user has Administrator or User privileges.
Modify	Click the Edit icon to configure the entry. Click the Delete icon to remove the entry.
Cancel	Click Cancel to restore your previously saved settings.
Apply	Click Apply to save your changes.

34.2.1 User Account Add/Edit

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

Figure 196 Maintenance > User Account > Add/Edit

The following table describes the labels in this screen.

Table 143 Maintenance > User Account > Add/Edit

LABEL	DESCRIPTION
Active	Select Enable or Disable to activate or deactivate the user account.
User Name	Enter a new name for the account. The User Name must contain 1 to 15 characters, including 0 to 9, a to z, and !@#%*()-_+=~,.,{}[]\ . Spaces are not allowed.

Table 143 Maintenance > User Account > Add/Edit (continued)

LABEL	DESCRIPTION
Password	Type your new system password (up to 256 characters). The Password must contain 6 to 64 characters, including 0 to 9 and a to z. Note that as you type a password, the screen displays a (*) for each character you type. After you change the password, use the new password to access the Zyxel Device.
Verify New Password	Type the new password again for confirmation.
Retry Times	Enter the number of times consecutive wrong passwords can be entered for this account. 0 means there is no limit.
Idle Timeout	Enter the length of inactive time before the Zyxel Device will automatically log the user out of the Web Configurator.
Lock Period	Enter the length of time a user must wait before attempting to log in again after a number of consecutive wrong passwords have been entered as defined in Retry Times .
Group	Specify whether this user will have Administrator or User privileges. The following menu items will only display when you log in as an Administrator . <ul style="list-style-type: none"> • Quick Start Wizard • Network Setting • Security settings • Maintenance > System • Maintenance > SNMP
Cancel	Click Cancel to exit this screen without saving any changes.
OK	Click OK to save your changes.

CHAPTER 41

Backup/Restore

41.1 Backup/Restore Overview

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

41.2 Backup/Restore Settings

Click **Maintenance > Backup/Restore**. Information related to factory default settings and backup configuration are shown in this screen. You can also use this to restore previous device configurations.

Figure 209 Maintenance > Backup/Restore

Backup/Restore

Information related to factory default settings and backup configuration are shown in this screen. You can also use this to restore previous device configurations.

Backup Configuration allows you to back up (save) the Zyxel Device's current configuration to a file on your computer. Once your Zyxel Device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes.

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

Backup Configuration

Click Backup to save the current configuration of your system to your computer.

Backup

Restore Configuration

To restore a previously saved configuration file to your system, browse to the location of the configuration file and click Upload.

File Path No file chosen **Upload**

Back to Factory Default Settings

Click Reset to clear all user-entered configuration information and return to factory default settings. After resetting, the

- Password is printed on a label on the bottom of the device, written after the text "Password".
- LAN IP address will be 192.168.1.1
- DHCP will be reset to default setting

Reset

Backup Configuration

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

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

Restore Configuration

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

Table 153 Restore Configuration

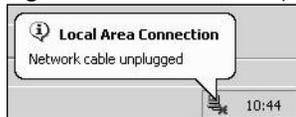
LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click Choose File / Browse to find it.
Choose File / Browse	Click this to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click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

Do NOT turn off the Zyxel Device while configuration file upload is in progress.

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

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

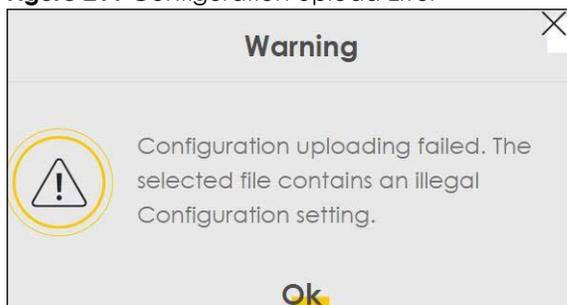
Figure 210 Network Temporarily Disconnected



If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default device IP address (192.168.1.1).

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

Figure 211 Configuration Upload Error



Reset to Factory Defaults

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

Figure 212 Reset Warning Message

You can also press the **RESET** button on the rear panel to reset the factory defaults of your Zyxel Device. Refer to [Section 1.5.4 on page 29](#) for more information on the **RESET** button.

41.3 Reboot

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

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

Figure 213 Maintenance > Reboot

CHAPTER 42

Diagnostic

42.1 Diagnostic Overview

The **Diagnostic** screen displays information to help you identify problems with the Zyxel Device.

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

42.1.1 What You Can Do in this Chapter

- The **Diagnostic** or **Ping & TraceRoute & NsLookup** screen lets you ping an IP address or trace the route packets take to a host ([Section 42.3 on page 352](#)).
- The **802.1ag** screen lets you perform CFM actions ([Section 42.4 on page 353](#)).
- The **802.3ah** screen lets you configure link OAM port parameters([Section 42.5 on page 354](#)).

42.2 What You Need to Know

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

How CFM Works

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

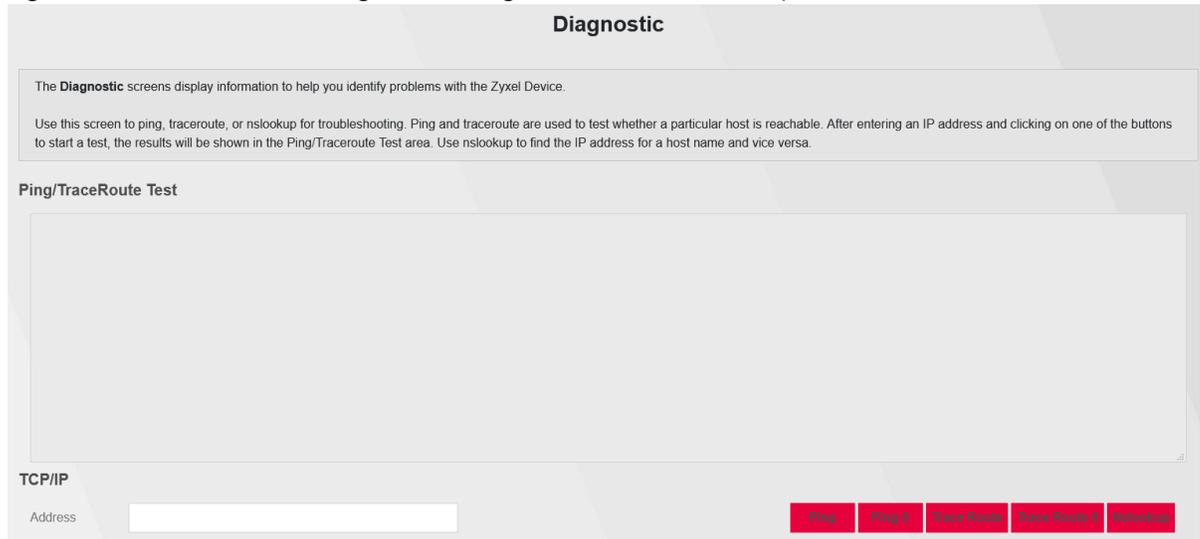
CFM provides two tests to discover connectivity faults.

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

42.3 Diagnostic Settings or Ping & TraceRoute & NsLookup

Use this screen use ping, traceroute, or nslookup for troubleshooting. Ping and traceroute are used to test whether a particular host is reachable. After entering an IP address and clicking on one of the buttons to start a test, the results will be shown in the Ping/Traceroute Test area. Use nslookup to find the IP address for a host name and vice versa. Click **Maintenance > Diagnostic > Ping & TraceRoute & NsLookup** to open the screen shown next.

Figure 214 Maintenance > Diagnostic > Ping&TraceRoute&NsLookup



The following table describes the fields in this screen.

Table 154 Maintenance > Diagnostic

LABEL	DESCRIPTION
Address	Type the IP address of a computer that you want to perform ping, traceroute, or nslookup in order to test a connection.
Ping	Click this to ping the IPv4 address that you entered.
Ping 6	Click this to ping the IPv6 address that you entered.
Trace Route	Click this to display the route path and transmission delays between the Zyxel Device to the IPv4 address that you entered.
Trace Route 6	Click this to display the route path and transmission delays between the Zyxel Device to the IPv6 address that you entered.
Nslookup	Click this button to perform a DNS lookup on the IP address of a computer you enter.

PART III

Troubleshooting and Appendices

Appendices contain general information. Some information may not apply to your Zyxel Device.

CHAPTER 43

Troubleshooting

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

- [Power, Hardware Connections, and LEDs](#)
- [Zyxel Device Access and Login](#)
- [Internet Access](#)
- [Wireless Internet Access](#)
- [UPnP](#)
- [IP Address Setup](#)

43.1 Power, Hardware Connections, and LEDs

[The Zyxel Device does not turn on. None of the LEDs turn on.](#)

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

[One of the LEDs does not behave as expected.](#)

- 1 Make sure you understand the normal behavior of the LED. See [Table 3 on page 23](#).
- 2 Check the hardware connections.
- 3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.
- 4 Turn the Zyxel Device off and on.

- 5 If the problem continues, contact the vendor.

43.2 Zyxel Device Access and Login

I forgot the IP address for the Zyxel Device.

- 1 The default LAN IP address is 192.168.1.1.
- 2 If you changed the IP address and have forgotten it, you might get the IP address of the Zyxel Device by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the Zyxel Device (it depends on the network), so enter this IP address in your Internet browser.
- 3 If this does not work, you have to reset the device to its factory defaults. See [Section 1.5.4 on page 29](#).

I forgot the password.

- 1 See the cover page for the default login names and associated passwords.
- 2 If those do not work, you have to reset the device to its factory defaults. See [Section 1.5.4 on page 29](#).

I cannot see or access the **Login** screen in the Web Configurator.

- 1 Make sure you are using the correct IP address.
 - The default IP address is [192.168.1.1](#).
 - If you changed the IP address ([Section 8.2 on page 149](#)), use the new IP address.
 - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for [I forgot the IP address for the Zyxel Device](#).
 - Make sure your computer has an IP address in the same subnet as the Zyxel Device. Your computer should have an IP address from 192.168.1.2 to 192.168.1.254. See [Section 43.6 on page 364](#).
- 2 Check the hardware connections, and make sure the LEDs are behaving as expected. See [Table 3 on page 23](#).
- 3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled.
- 4 If it is possible to log in from another interface, check the service control settings for HTTP and HTTPS (**Maintenance > Remote Management**).

- 5 Reset the device to its factory defaults, and try to access the Zyxel Device with the default IP address. See [Section 1.5.4 on page 29](#).
- 6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

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

[I can see the Login screen, but I cannot log in to the Zyxel Device.](#)

- 1 Make sure you have entered the password correctly. See the cover page for the default login names and associated passwords. The field is case-sensitive, so make sure [Caps Lock] is not on.
- 2 You cannot log in to the Web Configurator while someone is using Telnet to access the Zyxel Device. Log out of the Zyxel Device in the other session, or ask the person who is logged in to log out.
- 3 Turn the Zyxel Device off and on.
- 4 If this does not work, you have to reset the device to its factory defaults. See [Section 43.1 on page 359](#).

[I cannot Telnet to the Zyxel Device.](#)

See the troubleshooting suggestions for [I cannot see or access the Login screen in the Web Configurator](#). Ignore the suggestions about your web browser.

[I cannot use FTP to upload/download the configuration file. / I cannot use FTP to upload new firmware.](#)

See the troubleshooting suggestions for [I cannot see or access the Login screen in the Web Configurator](#). Ignore the suggestions about your browser.

43.3 Internet Access

[I cannot access the Internet.](#)

- 1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the **Quick Start Guide** and [Table 3 on page 23](#).
- 2 Make sure you entered your ISP account information correctly in the **Network Setting > Broadband** screen. These fields are case-sensitive, so make sure [Caps Lock] is not on.
- 3 If you are trying to access the Internet wirelessly, make sure that you enabled WiFi in the Zyxel Device and your wireless client and that the wireless settings in the wireless client are the same as the settings in the Zyxel Device.
- 4 Disconnect all the cables from your device and reconnect them.
- 5 If the problem continues, contact your ISP.

[I cannot connect to the Internet using a/an Ethernet/Fiber connection.](#)

- 1 (EX5501-B0, EX5301-B3 and DX5301-B2/B3)
Make sure you have the Ethernet WAN port connected to a Modem or Router.
(AX7501-B0)
Make sure the Fiber port has a compatible SFP+ transceiver installed with a fiber optic cable connected to it.
(PX7501-B0)
Make sure you have the Fiber port connected to a fiber optic cable.
- 2 Make sure you configured a proper Ethernet WAN interface (**Network Setting > Broadband** screen) with the Internet account information provided by your ISP and that it is enabled.
- 3 Check that the WAN interface you are connected to is in the same interface group as the Ethernet connection (**Network Setting > Interface Group**).
- 4 If you set up a WAN connection using bridging service, make sure you turn off the DHCP feature in the **Network Setting > Home Networking > LAN Setup** screen to have the clients get WAN IP addresses directly from your ISP's DHCP server.

[I cannot access the Zyxel Device anymore. I had access to the Zyxel Device, but my connection is not available anymore.](#)

- 1 Your session with the Zyxel Device may have expired. Try logging into the Zyxel Device again.
- 2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the **Quick Start Guide** and [Table 3 on page 23](#).
- 3 Turn the Zyxel Device off and on.
- 4 If the problem continues, contact your vendor.

43.4 Wireless Internet Access

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

The following factors may cause interference:

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

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

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

What is a Server Set ID (SSID)?

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

43.5 UPnP

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

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

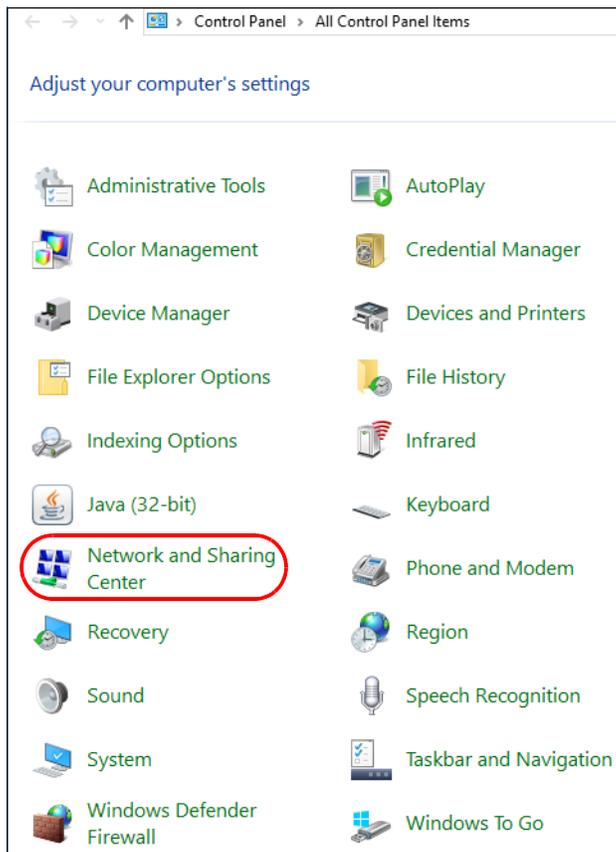
The **Local Area Connection** icon for UPnP disappears in the screen.

Restart your computer.

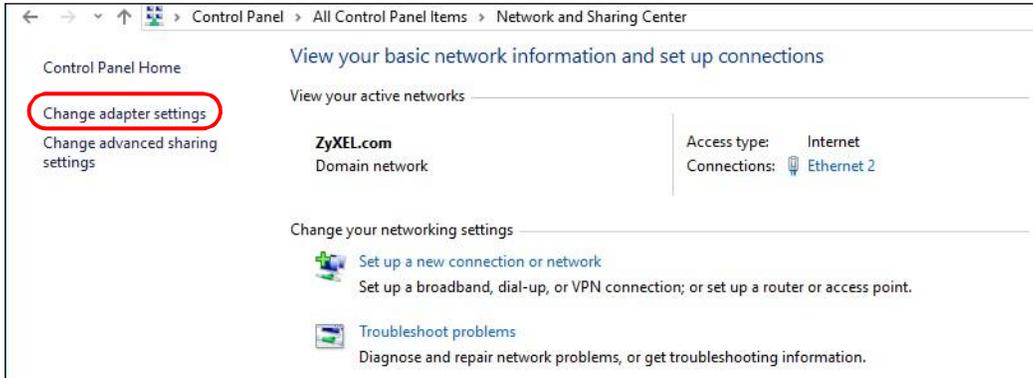
43.6 IP Address Setup

I need to set the computer's IP address to be in the same subnet as the Zyxel Device.

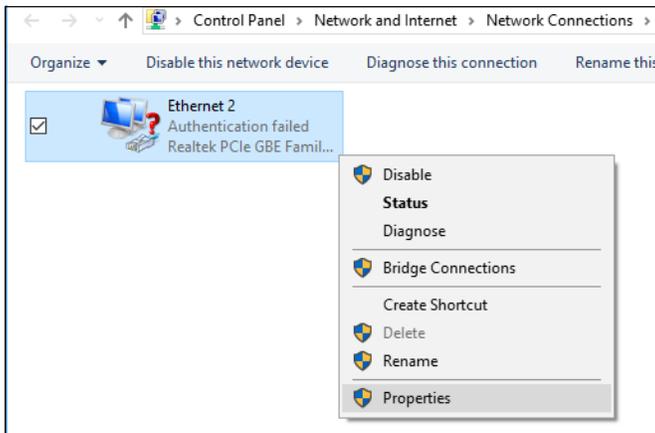
- 1 In Windows 10, open the **Control Panel**.
- 2 Click **Network and Internet** (this field may be missing in your version) > **Network and Sharing Center**.



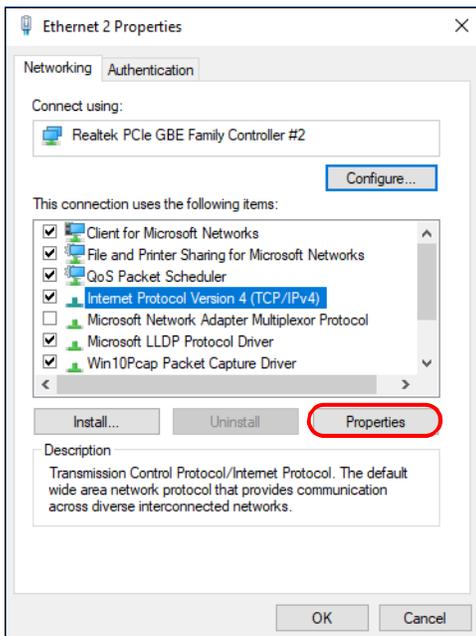
- 3 Click **Change adapter settings**.



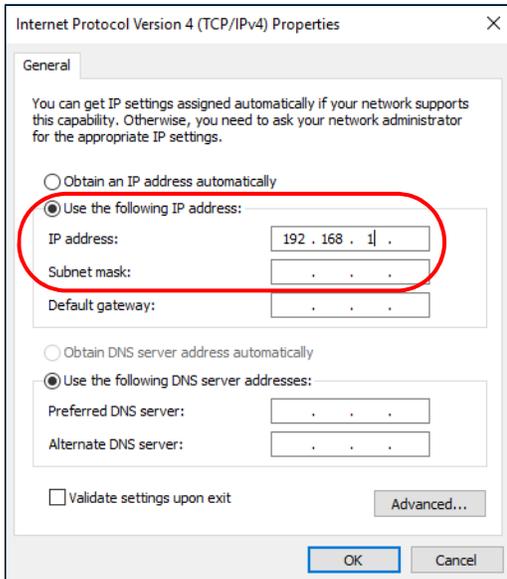
- 4 Right-click the **Ethernet** icon, and then select **Properties**.



- 5 Click **Internet Protocol Version 4 (TCP/IPv4)** and then click **Properties**.



- 6 Select **Use the following IP address** and enter an **IP address** from **192.168.1.2** to **192.168.1.254**. The **Subnet mask** will be entered automatically.



- 7 Click **OK** when you are done and close all windows.

APPENDIX B

IPv6

Overview

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

IPv6 Addressing

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

IPv6 addresses can be abbreviated in two ways:

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

Prefix and Prefix Length

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

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

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

Link-local Address

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

Table 158 Link-local Unicast Address Format

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

Global Address

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

Unspecified Address

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

Loopback Address

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

Multicast Address

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

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

Table 159 Predefined Multicast Address

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

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

Table 160 Reserved Multicast Address

MULTICAST ADDRESS
FF00:0:0:0:0:0:0
FF01:0:0:0:0:0:0
FF02:0:0:0:0:0:0
FF03:0:0:0:0:0:0
FF04:0:0:0:0:0:0
FF05:0:0:0:0:0:0
FF06:0:0:0:0:0:0
FF07:0:0:0:0:0:0
FF08:0:0:0:0:0:0
FF09:0:0:0:0:0:0
FF0A:0:0:0:0:0:0
FF0B:0:0:0:0:0:0
FF0C:0:0:0:0:0:0
FF0D:0:0:0:0:0:0

Table 160 Reserved Multicast Address (continued)

MULTICAST ADDRESS
FF0E:0:0:0:0:0:0
FF0F:0:0:0:0:0:0

Subnet Masking

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

Interface ID

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

EUI-64

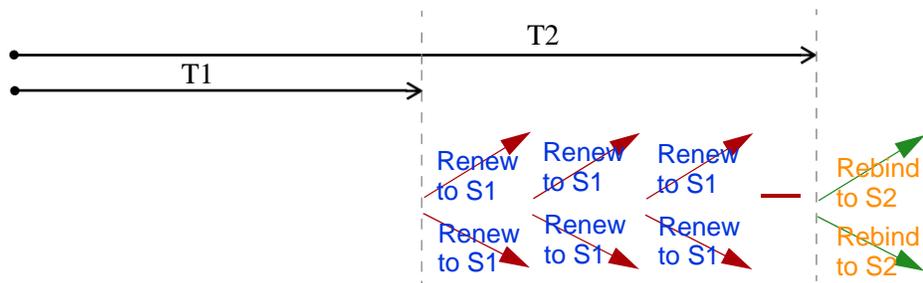
The EUI-64 (Extended Unique Identifier) defined by the IEEE (Institute of Electrical and Electronics Engineers) is an interface ID format designed to adapt with IPv6. It is derived from the 48-bit (6-byte) Ethernet MAC address as shown next. EUI-64 inserts the hex digits ffe between the third and fourth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

MAC	00 : 13 : 49 : 12 : 34 : 56
EUI-64	02 : 13 : 49 : FF : FE : 12 : 34 : 56

Identity Association

An Identity Association (IA) is a collection of addresses assigned to a DHCP client, through which the server and client can manage a set of related IP addresses. Each IA must be associated with exactly one interface. The DHCP client uses the IA assigned to an interface to obtain configuration from a DHCP server for that interface. Each IA consists of a unique IAID and associated IP information.

The IA type is the type of address in the IA. Each IA holds one type of address. IA_NA means an identity association for non-temporary addresses and IA_TA is an identity association for temporary addresses. An IA_NA option contains the T1 and T2 fields, but an IA_TA option does not. The DHCPv6 server uses T1 and T2 to control the time at which the client contacts with the server to extend the lifetimes on any addresses in the IA_NA before the lifetimes expire. After T1, the client sends the server (**S1**) (from which the addresses in the IA_NA were obtained) a Renew message. If the time T2 is reached and the server does not respond, the client sends a Rebind message to any available server (**S2**). For an IA_TA, the client may send a Renew or Rebind message at the client's discretion.



DHCP Relay Agent

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

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

Prefix Delegation

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

ICMPv6

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

Neighbor Discovery Protocol (NDP)

The Neighbor Discovery Protocol (NDP) is a protocol used to discover other IPv6 devices and track neighbor's reachability in a network. An IPv6 device uses the following ICMPv6 messages types:

- Neighbor solicitation: A request from a host to determine a neighbor's link-layer address (MAC address) and detect if the neighbor is still reachable. A neighbor being "reachable" means it responds to a neighbor solicitation message (from the host) with a neighbor advertisement message.
- Neighbor advertisement: A response from a node to announce its link-layer address.
- Router solicitation: A request from a host to locate a router that can act as the default router and forward packets.

- Router advertisement: A response to a router solicitation or a periodical multicast advertisement from a router to advertise its presence and other parameters.

IPv6 Cache

An IPv6 host is required to have a neighbor cache, destination cache, prefix list and default router list. The Zyxel Device maintains and updates its IPv6 caches constantly using the information from response messages. In IPv6, the Zyxel Device configures a link-local address automatically, and then sends a neighbor solicitation message to check if the address is unique. If there is an address to be resolved or verified, the Zyxel Device also sends out a neighbor solicitation message. When the Zyxel Device receives a neighbor advertisement in response, it stores the neighbor's link-layer address in the neighbor cache. When the Zyxel Device uses a router solicitation message to query for a router and receives a router advertisement message, it adds the router's information to the neighbor cache, prefix list and destination cache. The Zyxel Device creates an entry in the default router list cache if the router can be used as a default router.

When the Zyxel Device needs to send a packet, it first consults the destination cache to determine the next hop. If there is no matching entry in the destination cache, the Zyxel Device uses the prefix list to determine whether the destination address is on-link and can be reached directly without passing through a router. If the address is un-link, the address is considered as the next hop. Otherwise, the Zyxel Device determines the next-hop from the default router list or routing table. Once the next hop IP address is known, the Zyxel Device looks into the neighbor cache to get the link-layer address and sends the packet when the neighbor is reachable. If the Zyxel Device cannot find an entry in the neighbor cache or the state for the neighbor is not reachable, it starts the address resolution process. This helps reduce the number of IPv6 solicitation and advertisement messages.

Multicast Listener Discovery

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

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

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

MLD filtering controls which multicast groups a port can join.

MLD Messages

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

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

Example - Enabling IPv6 on Windows XP/2003/Vista

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

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

C:\>ipconfi
g

Windows IP Configuration

Ethernet adapter Local Area Connection:

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

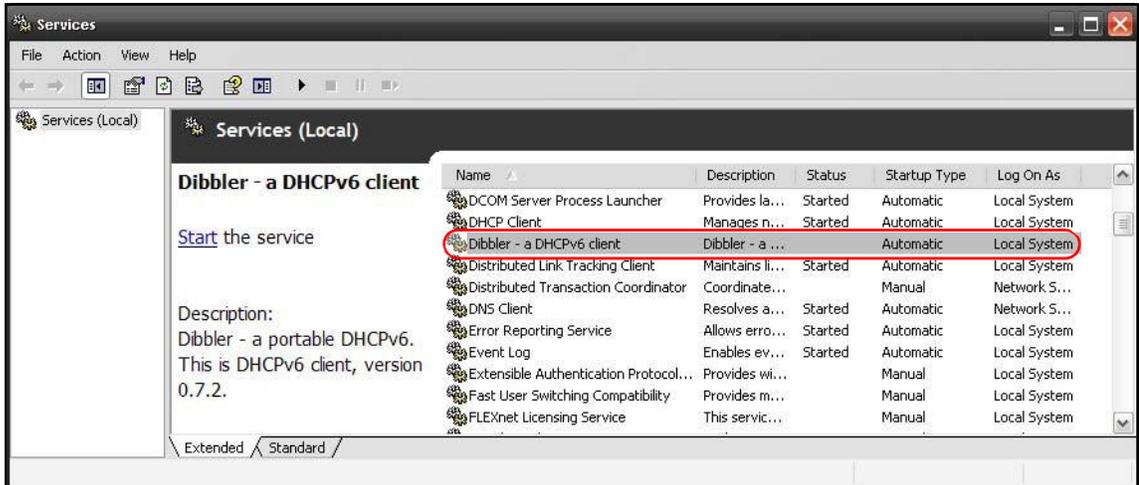
IPv6 is installed and enabled by default in Windows Vista. Use the `ipconfig` command to check your automatic configured IPv6 address as well. You should see at least one IPv6 address available for the interface on your computer.

Example - Enabling DHCPv6 on Windows XP

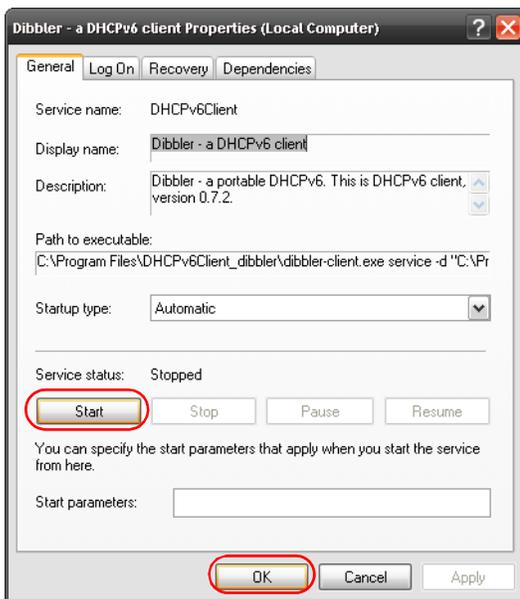
Windows XP does not support DHCPv6. If your network uses DHCPv6 for IP address assignment, you have to additionally install a DHCPv6 client software on your Windows XP. (Note: If you use static IP addresses or Router Advertisement for IPv6 address assignment in your network, ignore this section.)

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

- 1 Install Dibbler and select the DHCPv6 client option on your computer.
- 2 After the installation is complete, select **Start > All Programs > Dibbler-DHCPv6 > Client Install as service.**
- 3 Select **Start > Control Panel > Administrative Tools > Services.**
- 4 Double click **Dibbler - a DHCPv6 client.**



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



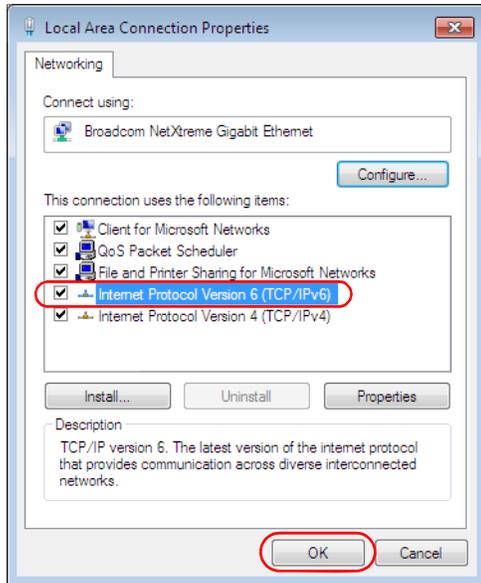
- 6 Now your computer can obtain an IPv6 address from a DHCPv6 server.

Example - Enabling IPv6 on Windows 7

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

To enable IPv6 in Windows 7:

- 1 Select **Control Panel > Network and Sharing Center > Local Area Connection**.
- 2 Select the **Internet Protocol Version 6 (TCP/IPv6)** checkbox to enable it.
- 3 Click **OK** to save the change.



- 4 Click **Close** to exit the **Local Area Connection Status** screen.
- 5 Select **Start > All Programs > Accessories > Command Prompt**.
- 6 Use the `ipconfig` command to check your dynamic IPv6 address. This example shows a global address (2001:b021:2d::1000) obtained from a DHCP server.

```
C:\>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

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

APPENDIX C

Services

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

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

Table 161 Examples of Services

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

Table 161 Examples of Services (continued)

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

Table 161 Examples of Services (continued)

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

APPENDIX D

Legal Information

Copyright

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Regulatory Notice and Statement

EUROPEAN UNION (All Models)



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

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

- Compliance information for wireless products relevant to the EU and other Countries following the EU Directive 2014/53/EU (RED). And this product may be used in all EU countries (and other countries following the EU Directive 2014/53/EU) without any limitation except for the countries mentioned below table:
- In the majority of the EU and other European countries, the 5GHz bands have been made available for the use of wireless local area networks (LANs). Later in this document you will find an overview of countries in which additional restrictions or requirements or both are applicable. The requirements for any country may evolve. Zyxel recommends that you check with the local authorities for the latest status of their national regulations for the 5GHz wireless LANs.
- If this device for operation in the band 5150-5350 MHz, it is for indoor use only.
- This equipment should be installed and operated with a minimum distance of 20cm between the radio equipment and your body.
- The maximum RF power operating for each band as follows:
- AX7501-B0
 - The band 2,400-2,483.5 MHz is 96.38 mW
 - The band 5150-5350 MHz is 184.50 mW
 - The band 5470-5725 MHz is 905.73 mW

Български (Bulgarian)	<p>С настоящото Zyxel декларира, че това оборудване е в съответствие със съществените изисквания и другите приложими разпоредбите на Директива 2014/53/ЕС.</p> <p>National Restrictions</p> <ul style="list-style-type: none">• The Belgian Institute for Postal Services and Telecommunications (BIPT) must be notified of any outdoor wireless link having a range exceeding 300 meters. Please check http://www.bipt.be for more details.• Draadloze verbindingen voor buitengebruik en met een reikwijdte van meer dan 300 meter dienen aangemeld te worden bij het Belgisch Instituut voor postdiensten en telecommunicatie (BIPT). Zie http://www.bipt.be voor meer gegevens.• Les liaisons sans fil pour une utilisation en extérieur d'une distance supérieure à 300 mètres doivent être notifiées à l'Institut Belge des services Postaux et des Télécommunications (IBPT). Visitez http://www.ibpt.be pour de plus amples détails.
Español (Spanish)	<p>Por medio de la presente Zyxel declara que el equipo cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/UE.</p>

Čeština (Czech)	Zyxel tímto prohlašuje, že tento zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU.
Dansk (Danish)	Undertegnede Zyxel erklærer herved, at følgende udstyr overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EU. National Restrictions <ul style="list-style-type: none">In Denmark, the band 5150 - 5350 MHz is also allowed for outdoor usage.I Danmark må frekvensbåndet 5150 - 5350 også anvendes udendørs.
Deutsch (German)	Hiermit erkläre Zyxel, dass sich das Gerät Ausstattung in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EU befindet.
Eesti keel (Estonian)	Käesolevaga kinnitab Zyxel seadme seadme vastavust direktiivi 2014/53/EL põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
Ελληνικά (Greek)	ΜΕ ΤΗΝ ΠΑΡΟΥΣΙΑ Ζyxel ΔΗΛΩΝΕΙ ΟΤΙ ΕΞΟΠΛΙΣΜΟΣ ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/ΕΕ.
English	Hereby, Zyxel declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
Français (French)	Par la présente Zyxel déclare que l'appareil équipements est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/UE.
Hrvatski (Croatian)	Zyxel ovime izjavljuje da je radijska oprema tipa u skladu s Direktivom 2014/53/UE.
Íslenska (Icelandic)	Hér með lýsir, Zyxel því yfir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði tilskipunar 2014/53/UE.
Italiano (Italian)	Con la presente Zyxel dichiara che questo attrezzatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/UE. National Restrictions <ul style="list-style-type: none">This product meets the National Radio Interface and the requirements specified in the National Frequency Allocation Table for Italy. Unless this wireless LAN product is operating within the boundaries of the owner's property, its use requires a "general authorization." Please check http://www.sviluppoeconomico.gov.it/ for more details.Questo prodotto è conforme alla specifiche di interfaccia Radio Nazionali e rispetta il Piano Nazionale di ripartizione delle frequenze in Italia. Se non viene installato all'interno del proprio fondo, l'utilizzo di prodotti Wireless LAN richiede una "Autorizzazione Generale". Consultare http://www.sviluppoeconomico.gov.it/ per maggiori dettagli.
Latviešu valoda (Latvian)	Ar šo Zyxel deklarē, ka iekārtas atbilst Direktīvas 2014/53/ES būtiskajām prasībām un citiem ar to saistītajiem noteikumiem. National Restrictions <ul style="list-style-type: none">The outdoor usage of the 2.4 GHz band requires an authorization from the Electronic Communications Office. Please check http://www.esd.lv for more details.2.4 GHz frekvenču joslas izmantošanai ārpus telpām nepieciešama atļauja no Elektronisko sakaru direkcijas. Vairāk informācijas: http://www.esd.lv.
Lietuvių kalba (Lithuanian)	Šiuo Zyxel deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 2014/53/ES Direktyvos nuostatas.
Magyar (Hungarian)	Alulírott, Zyxel nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvető követelményeknek és az 2014/53/EU irányelv egyéb előírásainak.
Malti (Maltese)	Hawnhekk, Zyxel, jiddikjara li dan taghmir jikkonforma mal-ftigijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Direttiva 2014/53/UE.
Nederlands (Dutch)	Hierbij verklaart Zyxel dat het toestel uitrusting in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.
Polski (Polish)	Niniejszym Zyxel oświadcza, że sprzęt jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/UE.
Português (Portuguese)	Zyxel declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/UE.
Română (Romanian)	Prin prezenta, Zyxel declară că acest echipament este în conformitate cu cerințele esențiale și alte prevederi relevante ale Directivei 2014/53/UE.
Slovenčina (Slovak)	Zyxel týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/EÚ.
Slovenščina (Slovene)	Zyxel izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.
Suomi (Finnish)	Zyxel vakuuttaa täten että laitteet tyyppinen laite on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svenska (Swedish)	Härmed intygar Zyxel att denna utrustning står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.
Norsk (Norwegian)	Erklærer herved Zyxel at dette utstyret er i samsvar med de grunnleggende kravene og andre relevante bestemmelser i direktiv 2014/53/EU.

Notes:

- Although Norway, Switzerland and Liechtenstein are not EU member states, the EU Directive 2014/53/EU has also been implemented in those countries.
- The regulatory limits for maximum output power are specified in EIRP. The EIRP level (in dBm) of a device can be calculated by adding the gain of the antenna used (specified in dBi) to the output power available at the connector (specified in dBm).

List of national codes

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

Safety Warnings

- Do not use this product near water, for example, in a wet basement or near a swimming pool.
- Do not expose your device to dampness, dust or corrosive liquids.
- Do not store things on the device.
- Do not obstruct the device ventilation slots as insufficient airflow may harm your device. For example, do not place the device in an enclosed space such as a box or on a very soft surface such as a bed or sofa.
- Do not install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do not open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks.
- Only qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Do not remove the plug and connect it to a power outlet by itself; always attach the plug to the power adaptor first before connecting it to a power outlet.
- Do not allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Please use the provided or designated connection cables/power cables/adaptors. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe). If the power adaptor or cord is damaged, it might cause electrocution. Remove it from the device and the power source, repairing the power adaptor or cord is prohibited. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- CAUTION: Risk of explosion if battery is replaced by an incorrect type, dispose of used batteries according to the instruction. Dispose them at the applicable collection point for the recycling of electrical and electronic devices. For detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the store where you purchased the product.
- The following warning statements apply, where the disconnect device is not incorporated in the device or where the plug on the power supply cord is intended to serve as the disconnect device.
 - For permanently connected devices, a readily accessible disconnect device shall be incorporated external to the device;
 - For pluggable devices, the socket-outlet shall be installed near the device and shall be easily accessible.
- For optical transceiver:
 PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11
 PRODUIT CONFORME SELON 21CFR 1040.10 ET 1040.11
 CLASS I LASER PRODUCT
 APPAREIL À LASER DE CLASSE 1

Important Safety Instructions

- Caution! The RJ-45 jacks are not used for telephone line connection.
- Caution! Do not use this product near water, for example a wet basement or near a swimming pool.
- Caution! Avoid using this product (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Caution! Always disconnect all telephone lines from the wall outlet before servicing or disassembling this product.
- Attention: Les prises RJ-45 ne sont pas utilisés pour la connexion de la ligne téléphonique.

- Attention: Ne pas utiliser ce produit près de l'eau, par exemple un sous-sol humide ou près d'une piscine.
- Attention: Évitez d'utiliser ce produit (autre qu'un type sans fil) pendant un orage. Il peut y avoir un risque de choc électrique de la foudre.
- Attention: Toujours débrancher toutes les lignes téléphoniques de la prise murale avant de réparer ou de démonter ce produit.

Environment Statement

ErP (Energy-related Products)

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

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

(Wireless setting, please refer to the chapter about wireless settings for more detail.)

European Union - Disposal and Recycling Information

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

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

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

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

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

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



台灣

以下訊息僅適用於產品具有無線功能且銷售至台灣地區

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

以下訊息僅適用於產品屬於專業安裝並銷售至台灣地區

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

安全警告 - 為了您的安全，請先閱讀以下警告及指示：

- 請勿將此產品接近水、火焰或放置在高溫的環境。
- 避免設備接觸：
 - 任何液體 - 切勿讓設備接觸水、雨水、高濕度、污水腐蝕性的液體或其他水份。
 - 灰塵及污物 - 切勿接觸灰塵、污物、沙土、食物或其他不適合的材料。
- 雷雨天氣時，不要安裝，使用或維修此設備。有遭受電擊的風險。
- 切勿重摔或撞擊設備，並勿使用不正確的電源變壓器。
- 若接上不正確的電源變壓器會有爆炸的風險。
- 請勿隨意更換產品內的電池。
- 如果更換不正確之電池型式，會有爆炸的風險，請依製造商說明書處理使用過之電池。
- 請將廢電池丟棄在適當的電器或電子設備回收處。
- 請勿將設備解體。
- 請勿阻礙設備的散熱孔，空氣對流不足將會造成設備損害。
- 請插在正確的電壓供給插座（如：北美 / 台灣電壓 110V AC，歐洲是 230V AC）。
- 假若電源變壓器或電源變壓器的纜線損壞，請從插座拔除，若您還繼續插電使用，會有觸電死亡的風險。
- 請勿試圖修理電源變壓器或電源變壓器的纜線，若有毀損，請直接聯絡您購買的店家，購買一個新的電源變壓器。
- 請勿將此設備安裝於室外，此設備僅適合放置於室內。
- 請勿隨一般垃圾丟棄。
- 請參閱產品背貼上的設備額定功率。
- 請參考產品型錄或是彩盒上的作業溫度。
- 產品沒有斷電裝置或者採用電源線的插頭視為斷電裝置的一部分，以下警語將適用：
 - 對永久連接之設備，在設備外部須安裝可觸及之斷電裝置；
 - 對插接式之設備，插座必須接近安裝之地點而且是易於觸及的。

About the Symbols

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

Explanation of the Symbols

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

Viewing Certifications

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

Zyxel Limited Warranty

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

Note

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

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

Registration

Register your product online at www.zyxel.com to receive e-mail notices of firmware upgrades and related information.

Open Source Licenses

This product may contain in part some free software distributed under GPL license terms and/or GPL like licenses. Open source licenses are provided with the firmware package. You can download the latest firmware at www.zyxel.com. If you cannot find it there, contact your vendor or Zyxel Technical Support at support@zyxel.com.tw. To obtain the source code covered under those Licenses, please contact your vendor or Zyxel Technical Support at support@zyxel.com.