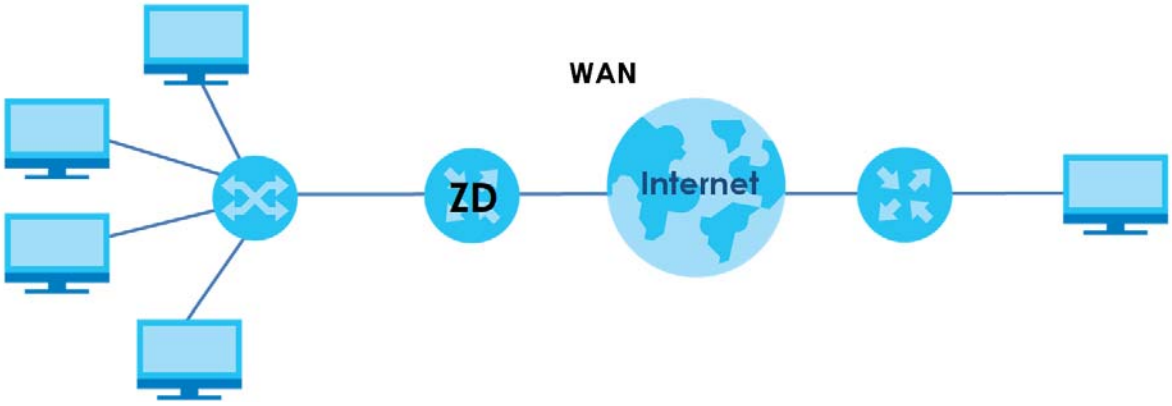
CHAPTER 7
Broadband

7.1 Broadband Overview

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

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

Figure 69 LAN and WAN



7.1.1 What You Can Do in this Chapter

- Use **Broadband** screens to view, remove or add a WAN interface. You can also configure the WAN settings on the Zyxel Device for Internet access.

  The **Broadband** screens for DSL routers and Ethernet/AON/PON routers are slightly different.
  For DSL routers, see Section 7.2 on page 129.
  For Ethernet, AON and PON routers, see Section 7.3 on page 139.
  See Section 1.1 on page 19 to see which router type your Zyxel Device belongs to.
- Use the **Cellular Backup** screen to configure cellular WAN connection (Section 7.4 on page 148).
- Use the **Advanced** screen to enable or disable PTM over ADSL, Annex M/Annex J, and DSL PhyR functions (Section 7.5 on page 154). Alternatively, use the **Advanced** screen to configure the Zyxel Device to reduce the power consumption.

Table 22 WAN Setup Overview

LAYER-2 INTERFACE	INTERNET CONNECTION		
CONNECTION	**MODE**	**ENCAPSULATION**	**CONNECTION SETTINGS**
Ethernet	Routing	PPPoE	PPP user name and password, WAN IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
		IPoE	WAN IPv4/IPv6 IP address, NAT, DNS server and routing feature
	Bridge	N/A	VLAN
Note: This table is for the Ethernet, AON and PON routers. See Section 1.1 on page 19 for more information.			

Table 23 WAN Setup Overview

LAYER-2 INTERFACE		INTERNET CONNECTION		
CONNECTION	**DSL LINK TYPE**	**MODE**	**ENCAPSULATION**	**CONNECTION SETTINGS**
ADSL/VDSL over PTM	N/A	Routing	PPPoE	PPP information, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
			IPoE	IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
		Bridge	N/A	VLAN and QoS
ADSL over ATM	EoA	Routing	PPPoE/PPPoA	ATM PVC configuration, PPP information, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
			IPoE/IPoA	ATM PVC configuration, IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
		Bridge	N/A	ATM PVC configuration, and QoS
Ethernet	N/A	Routing	PPPoE	PPP user name and password, WAN IPv4/IPv6 IP address, routing feature, DNS server, VLAN, QoS, and MTU
			IPoE	WAN IPv4/IPv6 IP address, NAT, DNS server and routing feature
		Bridge	N/A	VLAN and QoS
Note: This table is for the DSL routers. See Section 1.1 on page 19 for more information.				

7.1.2 What You Need to Know

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

WAN IP Address

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

If your ISP assigns you a static WAN IP address, they should also assign you the subnet mask and DNS server IP addresses.

ATM

Asynchronous Transfer Mode (ATM) is a WAN networking technology that provides high-speed data transfer. ATM uses fixed-size packets of information called cells. With ATM, a high QoS (Quality of Service) can be guaranteed. ATM uses a connection-oriented model and establishes a virtual circuit (VC).

PTM

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

IPv6 Introduction

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

IPv6 Addressing

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

IPv6 addresses can be abbreviated in two ways:

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

IPv6 Prefix and Prefix Length

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

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

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

IPv6 Subnet Masking

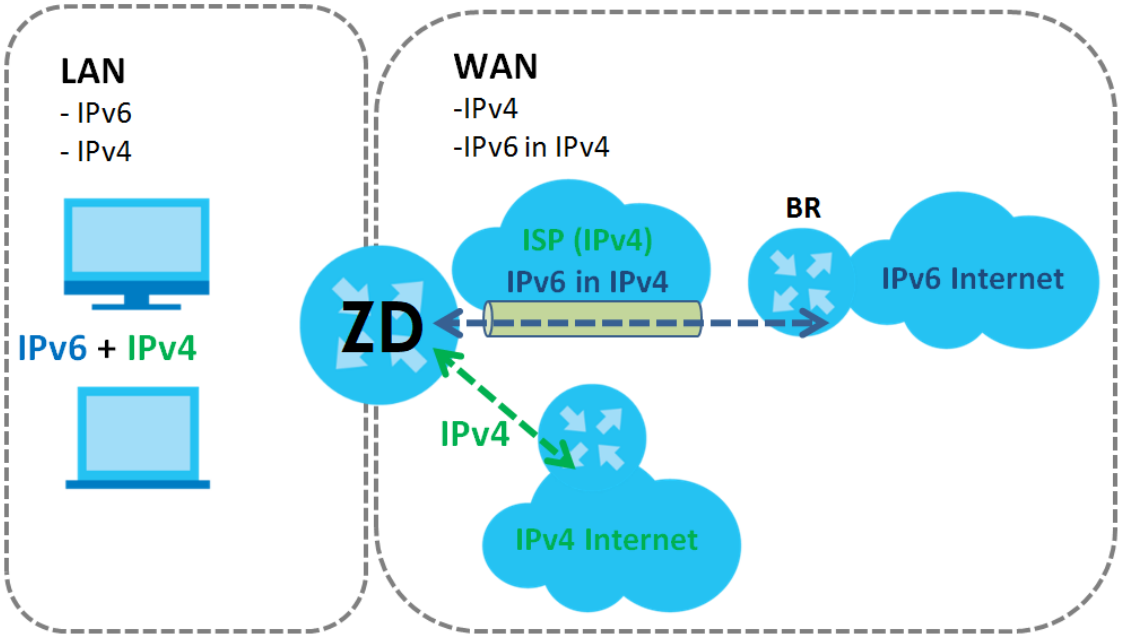
Both an IPv6 address and IPv6 subnet mask compose of 128-bit binary digits, which are divided into eight 16-bit blocks and written in hexadecimal notation. Hexadecimal uses four bits for each character (1 – 10, A – F). Each block's 16 bits are then represented by four hexadecimal characters. For example,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

IPv6 Rapid Deployment

Use IPv6 Rapid Deployment (6rd) when the local network uses IPv6 and the ISP has an IPv4 network. When the Zyxel Device has an IPv4 WAN address and you set **IPv6/IPv4 Mode** to **IPv4 Only**, you can enable 6rd to encapsulate IPv6 packets in IPv4 packets to cross the ISP's IPv4 network.

The Zyxel Device generates a global IPv6 prefix from its IPv4 WAN address and tunnels IPv6 traffic to the ISP's Border Relay router (BR in the figure) to connect to the native IPv6 Internet. The local network can also use IPv4 services. The Zyxel Device uses its configured IPv4 WAN IP to route IPv4 traffic to the IPv4 Internet.

Figure 70 IPv6 Rapid Deployment

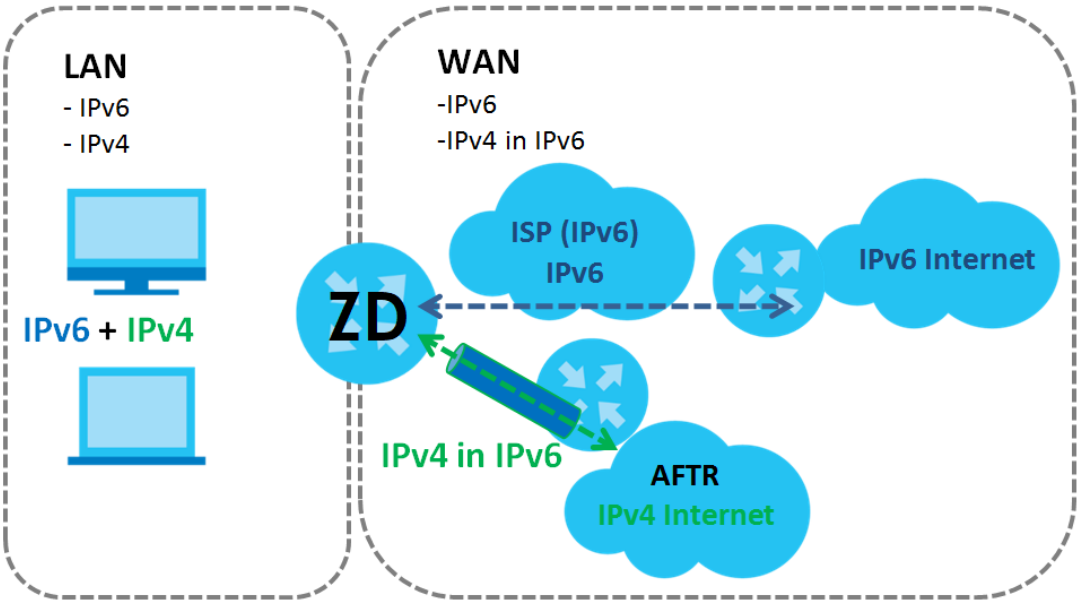


Dual Stack Lite

Use Dual Stack Lite when local network computers use IPv4 and the ISP has an IPv6 network. When the Zyxel Device has an IPv6 WAN address and you set **IPv6/IPv4 Mode** to **IPv6 Only**, you can enable Dual Stack Lite to use IPv4 computers and services.

The Zyxel Device tunnels IPv4 packets inside IPv6 encapsulation packets to the ISP's Address Family Transition Router (AFTR in the graphic) to connect to the IPv4 Internet. The local network can also use IPv6 services. The Zyxel Device uses its configured IPv6 WAN IP to route IPv6 traffic to the IPv6 Internet.

Figure 71 Dual Stack Lite



Carrier-Grade NAT (CGNAT)

CGNAT allows an Internet Service Provider (ISP) to use a single public WAN IP address for multiple customers with different Internet access devices.

7.1.3 Before You Begin

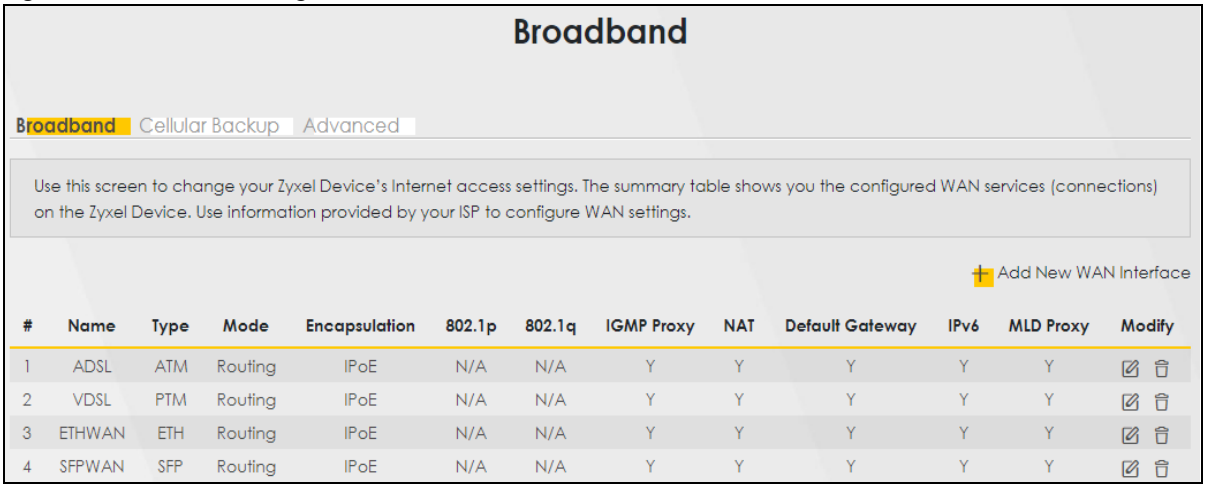
You need to know your Internet access settings such as encapsulation and WAN IP address. Get this information from your ISP.

7.2 Broadband Settings for DSL Routers

Use this screen to change your Zyxel Device's Internet access settings. The summary table shows you the configured WAN services (connections) on the Zyxel Device. Use information provided by your ISP to configure WAN settings.

Click **Network Setting** > **Broadband** to access this screen.

Figure 72 Network Setting > Broadband



The following table describes the labels in this screen.

Table 24 Network Setting > Broadband

LABEL	DESCRIPTION
Add New WAN Interface	Click this button to create a new connection.
#	This is the index number of the entry.
Name	This is the service name of the connection.
Type	This shows types of connections the router has.
Mode	This shows whether the connection is in routing or bridge mode.
Encapsulation	This is the method of encapsulation used by this connection.
802.1p	This indicates the 802.1p priority level assigned to traffic sent through this connection. This displays **N/A** when there is no priority level assigned.
802.1q	This indicates the VLAN ID number assigned to traffic sent through this connection. This displays **N/A** when there is no VLAN ID number assigned.
IGMP Proxy	This shows whether the Zyxel Device act as an IGMP proxy on this connection.
NAT	This shows whether NAT is activated or not for this connection.
Default Gateway	This shows whether the Zyxel Device use the WAN interface of this connection as the system default gateway.
IPv6	This shows whether IPv6 is activated or not for this connection. IPv6 is not available when the connection uses the bridging service.
MLD Proxy	This shows whether Multicast Listener Discovery (MLD) is activated or not for this connection. MLD is not available when the connection uses the bridging service.
Modify	Click the **Edit** icon to configure the WAN connection. Click the **Delete** icon to remove the WAN connection.

7.2.1 Add or Edit Internet Connection

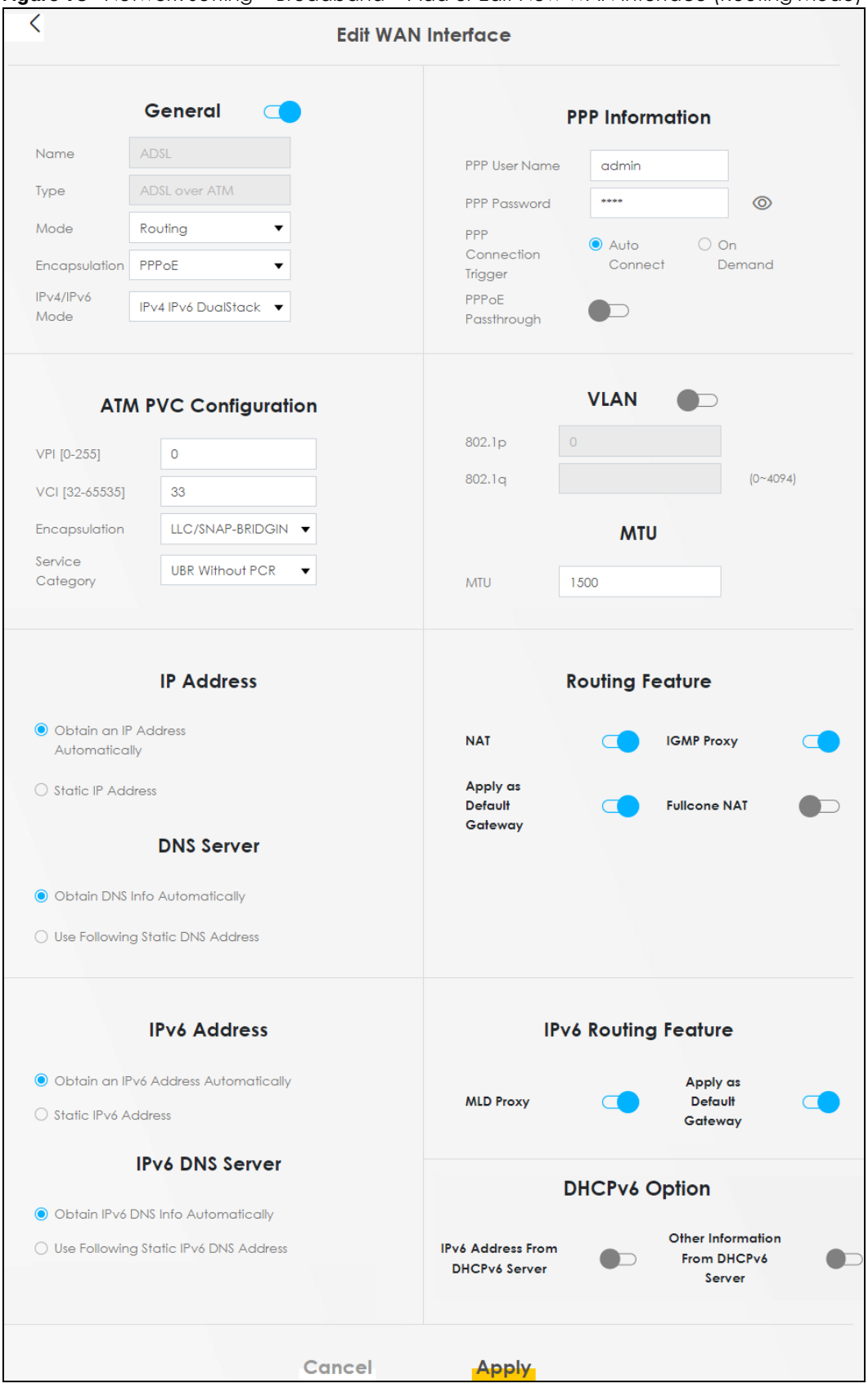
Click **Add New WAN Interface** in the **Broadband** screen or the Edit icon next to an existing WAN interface to open the following screen. Use this screen to configure a WAN connection. The screen varies depending on the mode, encapsulation, and IPv6 or IPv4 mode you select.

Routing Mode

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

The following example screen displays when you select the **Routing** mode and **PPPoE** encapsulation. The screen varies when you select other encapsulation and IPv6 or IPv4 mode.

Figure 73 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode)



The following table describes the labels in this screen.

Table 25 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode)

LABEL	DESCRIPTION
General Click the switch to enable this WAN interface.	
Name	Specify a descriptive name for this connection. You can use up to 15 alphanumeric (0-9, a-z, A-Z) and special characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed. This field is read-only if you are editing the WAN interface.
Type	This field shows the types of available connections. This field is read-only if you are editing the WAN interface.
Mode	Select **Routing** if your ISP give you one IP address only and you want multiple computers to share an Internet account.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. This option is available only when you select **Routing** in the **Mode** field. When you select **ADSL/VDSL over ATM** or **Ethernet**, the choices are **PPPoE** and **IPoE.** When you select **ADSL over ATM**, the choices are **PPPoE**, **IPoE**, **PPPoA** and **IPoA**.
IPv4/IPv6 Mode	Select **IPv4 Only** if you want the Zyxel Device to run IPv4 only. Select **IPv4 IPv6 DualStack** to allow the Zyxel Device to run IPv4 and IPv6 at the same time. Select **IPv6 Only** if you want the Zyxel Device to run IPv6 only.
PPP Information (This is available only when you select **Routing** in the **Mode** field and **PPPoE** or **PPPoA** in the **Encapsulation** field.)	
PPP User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
PPP Password	Enter the password associated with the user name above. Select **password unmask** to show your entered password in plain text.
PPP Connection Trigger	Select when to have the Zyxel Device establish the PPP connection. **Auto Connect** – select this to not let the connection time out. **On Demand** – select this to automatically bring up the connection when the Zyxel Device receives packets destined for the Internet.
Idle Timeout	This value specifies the time in minutes that elapses before the router automatically disconnects from the PPPoE server. This field is not available if you select **Auto Connect** in the **PPP Connection Trigger** field.
PPPoE Passthrough	This field is available when you select **PPPoE** encapsulation. In addition to the Zyxel Device's built-in PPPoE client, you can enable PPPoE pass through to allow up to ten hosts on the LAN to use PPPoE client software on their computers to connect to the ISP through the Zyxel Device. Each host can have a separate account and a public WAN IP address. PPPoE pass through is an alternative to NAT for application where NAT is not appropriate. Disable PPPoE pass through if you do not need to allow hosts on the LAN to use PPPoE client software on their computers to connect to the ISP.
ATM PVC Configuration (This is available only when you select **ADSL over ATM** in the **Type** field.)	
VPI [0-255]	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.
VCI [32-65535]	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.

Table 25 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
Encapsulation	Select the method of multiplexing used by your ISP from the drop-down list box. Choices are: • **LLC/SNAP-BRIDGING:** In LCC encapsulation, bridged PDUs are encapsulated by identifying the type of the bridged media in the SNAP header. • **VC/MUX:** In VC multiplexing, each protocol is carried on a single ATM virtual circuit (VC). To transport multiple protocols, the Zyxel Device needs separate VCs. There is a binding between a VC and the type of the network protocol carried on the VC. This reduces payload overhead since there is no need to carry protocol information in each Protocol Data Unit (PDU) payload.
Service Category	Select **UBR Without PCR** for applications that are non-time sensitive, such as email. Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **Non Realtime VBR** (non real-time Variable Bit Rate) for connections that do not require closely controlled delay and delay variation. Select **Realtime VBR** (real-time Variable Bit Rate) for applications with bursty connections that require closely controlled delay and delay variation.
Peak Cell Rate [cells/s]	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Type the PCR here.
Sustainable Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Type the SCR, which must be less than the PCR. Note that system default is 0 cells/sec.
Maximum Burst Size [cells]	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Type the MBS, which is less than 65535.
VLAN Click this switch to enable VLAN on this WAN interface. This field is not available if you select **ADSL over ATM** in the **Type** field and **PPPoA** or **IPoA** in the **Encapsulation** field.	
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level (from 0 to 7) to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number (from 0 to 4094) for traffic through this connection.
MTU (This is not available if you select **ADSL over ATM** in the **Type** field and **PPPoA** or **IPoA** in the **Encapsulation** field.)	
MTU	Enter the MTU (Maximum Transfer Unit) size for traffic through this connection.
IP Address (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select this if you have a dynamic IP address.
Static IP Address	Select this option If the ISP assigned a fixed IP address.
IP Address	Enter the static IP address provided by your ISP.
Subnet Mask	Enter the subnet mask provided by your ISP. This is available only when you set the **Encapsulation** to **IPoE** or **IPoA**.
Gateway IP Address	Enter the gateway IP address provided by your ISP. This is available only when you set the **Encapsulation** to **IPoE**.
DNS Server (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
Obtain DNS Info Automatically	Select **Obtain DNS Info Automatically** if you want the Zyxel Device to use the DNS server addresses assigned by your ISP.
Use Following Static DNS Address	Select **Use Following Static DNS Address** if you want the Zyxel Device to use the DNS server addresses you configure manually.

Table 25 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
Primary DNS Server	Enter the first DNS server address assigned by the ISP.
Secondary DNS Server	Enter the second DNS server address assigned by the ISP.
Routing Feature (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
NAT	Click this switch to activate NAT on this connection.
IGMP Proxy	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. Click this switch to have the Zyxel Device act as an IGMP proxy on this connection. This allows the Zyxel Device to get subscribing information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Apply as Default Gateway	Click this switch to have the Zyxel Device use this WAN interface of this connection as the system default gateway.
Fullcone NAT	Click this switch to enable full cone NAT on this WAN connection. This field is available only when you activate **NAT**. In full cone NAT, the Zyxel Device maps all outgoing packets from an internal IP address and port to a single IP address and port on the external network. The Zyxel Device also maps packets coming to that external IP address and port to the internal IP address and port.
6RD The 6RD (IPv6 rapid deployment) fields display when you set the **IPv6/IPv4 Mode** field to **IPv4 Only**. See IPv6 Rapid Deployment on page 128 for more information. Click this switch to tunnel IPv6 traffic from the local network through the ISP's IPv4 network.	
Automatically configured by DHCPC	The **Automatically configured by DHCPC** option is configurable only when you set the method of encapsulation to **IPoE**.
Manually Configured	Select **Manually Configured** if you have the IPv4 address of the relay server. Otherwise, select **Automatically configured by DHCPC** to have the Zyxel Device detect it automatically through DHCP.
Service Provider IPv6 Prefix	Enter an IPv6 prefix for tunneling IPv6 traffic to the ISP's border relay router and connecting to the native IPv6 Internet.
IPv4 Mask Length	Enter the subnet mask number (1 – 32) for the IPv4 network.
Border Relay IPv4 Address	When you select **Manually Configured**, specify the relay server's IPv4 address in this field.
DHCPC Options (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field and **IPoE** in the **Encapsulation** field.) Note: The available DHCP options may differ by model.	
Request Options	Select **Option 42** to have the Zyxel Device get NTP time server information from DHCP packets sent from the DHCP server. Select **Option 43** to have the Zyxel Device get vendor specific information from DHCP packets sent from the DHCP server. Select **Option 120** to have the Zyxel Device get static route information from DHCP packets sent from the DHCP server. Select **Option 121** to have the Zyxel Device get SIP server information from DHCP packets sent from the DHCP server.
Sent Options	

Table 25 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
option 12	To identify the Zyxel Device to the DHCP server, select this to automatically add the hostname of the Zyxel Device in the DHCP discovery packets that go to the DHCP server.
option 60	Select this and enter the device identity you want the Zyxel Device to add in the DHCP discovery packets that go to the DHCP server.
Vendor ID	Enter the Vendor Class Identifier, such as the type of the hardware or firmware.
option 61	Select this and enter any string that identifies the device.
IAID	Enter the Identity Association Identifier (IAID) of the device, for example, the WAN connection index number.
DUID	Enter the hardware type, a time value and the MAC address of the device.
option 125	Select this to have the Zyxel Device automatically generate and add vendor specific parameters in the DHCP discovery packets that go to the DHCP server.
IPv6 Address (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field.)	
Obtain an IPv6 Address Automatically	Select **Obtain an IPv6 Address Automatically** if you want to have the Zyxel Device use the IPv6 prefix from the connected router's Router Advertisement (RA) to generate an IPv6 address.
Static IPv6 Address	Select **Static IPv6 Address** if you have a fixed IPv6 address assigned by your ISP. When you select this, the following fields appear.
IPv6 Address	Enter an IPv6 IP address that your ISP gave to you for this WAN interface.
Prefix Length	Enter the address prefix length to specify how many most significant bits in an IPv6 address compose the network address.
IPv6 Default Gateway	Enter the IP address of the next-hop gateway. The gateway is a router or switch on the same segment as your Zyxel Device's interfaces. The gateway helps forward packets to their destinations.
IPv6 DNS Server (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field. Configure the IPv6 DNS server in the following section.)	
Obtain IPv6 DNS Info Automatically	Select **Obtain IPv6 DNS Info Automatically** to have the Zyxel Device get the IPv6 DNS server addresses from the ISP automatically.
Use Following Static IPv6 DNS Address	Select **Use Following Static IPv6 DNS Address** to have the Zyxel Device use the IPv6 DNS server addresses you configure manually.
Primary DNS Server	Enter the first IPv6 DNS server address assigned by the ISP.
Secondary DNS Server	Enter the second IPv6 DNS server address assigned by the ISP.
IPv6 Routing Feature (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field. You can enable IPv6 routing features in the following section.)	
MLD Proxy Enable	Select this checkbox to have the Zyxel Device act as an MLD proxy on this connection. This allows the Zyxel Device to get subscription information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Apply as Default Gateway	Select this option to have the Zyxel Device use the WAN interface of this connection as the system default gateway.
DS-Lite	This is available only when you select **IPv6 Only** in the **IPv4/IPv6 Mode** field. Enable Dual Stack Lite to let local computers use IPv4 through an ISP's IPv6 network. See Dual Stack Lite on page 128 for more information. Click this switch to enable DS-Lite to let local computers use IPv4 through an ISP's IPv6 network.
Automatically configured by DHCPC	Select this to have the Zyxel Device detect the relay server automatically through DHCP.

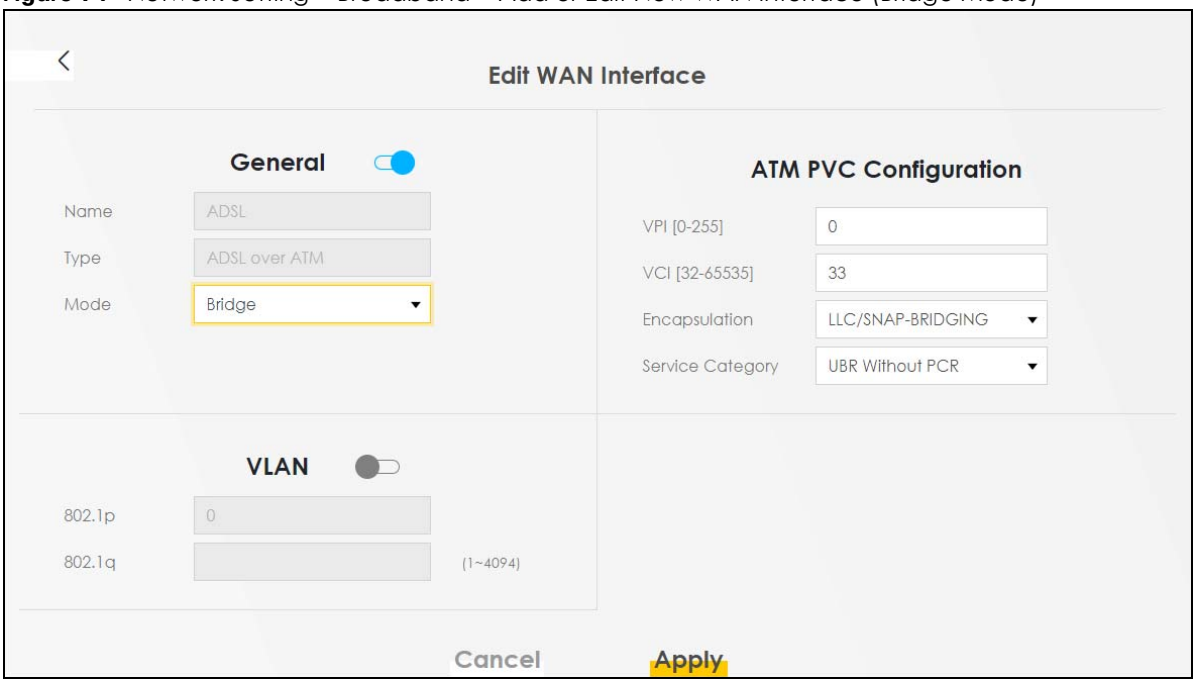
Table 25 Network Setting > Broadband > Add or Edit New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
Manually Configured	Select **Manually Configured** if you have the IPv6 address of the relay server. Otherwise, select **Automatically configured by DHCPC** to have the Zyxel Device detect it automatically through DHCP.
DS-Lite Relay Server IP	Specify the transition router's IPv6 address.
DHCPv6 Option (This is available only when you select **IPv6 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
IPv6 Address From DHCPv6 Server	Click the switch to let the Zyxel Device send DHCP requests to the DHCPv6 server to obtain an IPv6 address.
Other Information From DHCPv6 Server	Click the switch to have the Zyxel Device get other information, such as DNS information, from DHCPv6 packets sent from the DHCPv6 server. This will be enabled if **IPv6 Address From DHCPv6 Server** is enabled.
IPv6 MAP	This is available when you edit an IPv6 WAN interface. Slide the switch to the right to create an IPv6 map domain.
Transport Mode	Select **MAP-T** (Translation) or **MAP-E** (Encapsulation) based on the ISP deployment.
Setting Mode	Select **DHCP S46** or **Manual** to configure the following fields.
Note: The following Prefix/Address fields are used for the address mapping rule of MAP-T or MAP-E.	
BR IPv6 Prefix	This is the IPv6 network address/prefix assigned to the BR, including the prefix length.
Rule IPv6 Prefix	This is the IPv6 network prefix, including the prefix length.
Rule IPv4 Prefix	This is the IPv4 network prefix, including the prefix length.
Note: The following PSID fields are used for the port mapping rule of MAP-T or MAP-E.	
PSID Offset	The Port Set Identifier (PSID) offset specifies the excluded port range. The default **PSID Offset** is 6; port 0~1023 will be reserved for the system to use.
PSID Length	This specifies the number of sharing ratio. When **PSID Length** is set to 8, the ports will be separated and assigned for 2^8 MAP CEs to use.
PSID	A Port Set ID (**PSID**) identifies a set of ports assigned to a CE for mapping. **PSID** should be unique for each CE sharing the IPv4 address.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

Bridge Mode

Click the **Add new WAN Interface** in the **Network Setting** > **Broadband** screen or the **Edit** icon next to the connection you want to configure. The following example screen displays when you select **Bridge** mode.

Figure 74 Network Setting > Broadband > Add or Edit New WAN Interface (Bridge Mode)



The following table describes the fields in this screen.

Table 26 Network Setting > Broadband > Add/Edit New WAN Interface (Bridge Mode)

LABEL	DESCRIPTION
General Click this switch to enable the WAN interface.	
Name	Enter a service name of the connection. You can use up to 15 alphanumeric (0-9, a-z, A-Z) and special characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed. This field is read-only is you are editing the WAN interface.
Type	Select **VDSL over PTM**, **ADSL over ATM** or **Ethernet** as the WAN interface type. This field is read-only if you are editing the WAN interface.
Mode	Select **Bridge** when your ISP provides you more than one IP address and you want the connected computers to get individual IP address from ISP's DHCP server directly. If you select **Bridge**, you cannot use routing functions, such as QoS, Firewall, DHCP server and NAT on traffic from the selected LAN ports.
VLAN Click this switch to enable VLAN on this WAN interface.	
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level (from 0 to 7) to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number (from 0 to 4094) for traffic through this connection.
MTU	
MTU	Enter the MTU (Maximum Transfer Unit) size for traffic through this connection.
ATM PVC Configuration (This is available only when you select **ADSL over ATM** in the **Type** field.)	
VPI [0–255]	The valid range for the VPI is 0 to 255. Enter the VPI assigned to you.

Table 26 Network Setting > Broadband > Add/Edit New WAN Interface (Bridge Mode) (continued)

LABEL	DESCRIPTION
VCI [32–65535]	The valid range for the VCI is 32 to 65535 (0 to 31 is reserved for local management of ATM traffic). Enter the VCI assigned to you.
Encapsulation	Select the method of multiplexing used by your ISP from the drop-down list box. Choices are: • **LLC/SNAP-BRIDGING:** In LCC encapsulation, bridged PDUs are encapsulated by identifying the type of the bridged media in the SNAP header. • **VC/MUX:** In VC multiplexing, each protocol is carried on a single ATM virtual circuit (VC). To transport multiple protocols, the Zyxel Device needs separate VCs. There is a binding between a VC and the type of the network protocol carried on the VC. This reduces payload overhead since there is no need to carry protocol information in each Protocol Data Unit (PDU) payload.
Service Category	Select **UBR Without PCR** for applications that are non-time sensitive, such as email. Select **CBR** (Continuous Bit Rate) to specify fixed (always-on) bandwidth for voice or data traffic. Select **Non Realtime VBR** (non real-time Variable Bit Rate) for connections that do not require closely controlled delay and delay variation. Select **Realtime VBR** (real-time Variable Bit Rate) for applications with bursty connections that require closely controlled delay and delay variation.
Peak Cell Rate [cells/s]	Divide the DSL line rate (bps) by 424 (the size of an ATM cell) to find the Peak Cell Rate (PCR). This is the maximum rate at which the sender can send cells. Enter the PCR here. This is not available when you set the **Service Category** to **UBR Without PCR**.
Sustainable Cell Rate	The Sustain Cell Rate (SCR) sets the average cell rate (long-term) that can be transmitted. Enter the SCR, which must be less than the PCR. Note that system default is 0 cells/sec. This is not available when you set the **Service Category** to **UBR Without PCR** or **CBR**.
Maximum Burst Size [cells]	Maximum Burst Size (MBS) refers to the maximum number of cells that can be sent at the peak rate. Enter the MBS, which is less than 65535. This is not available when you set the **Service Category** to **UBR Without PCR** or **CBR**.
Cancel	Click **Cancel** to exit this screen without saving any changes.
Apply	Click **Apply** to save your changes.

7.3 Broadband Settings for Ethernet, AON and PON Routers

Use this screen to change your Zyxel Device's Internet access settings. The summary table shows you the configured WAN services (connections) on the Zyxel Device. Use information provided by your ISP to configure WAN settings.

Note: The differences of the broadband screens between Ethernet, AON and PON routers are the type of connections available.

Click **Network Setting** > **Broadband** to access this screen.

Figure 75 Network Setting > Broadband (Ethernet Routers)

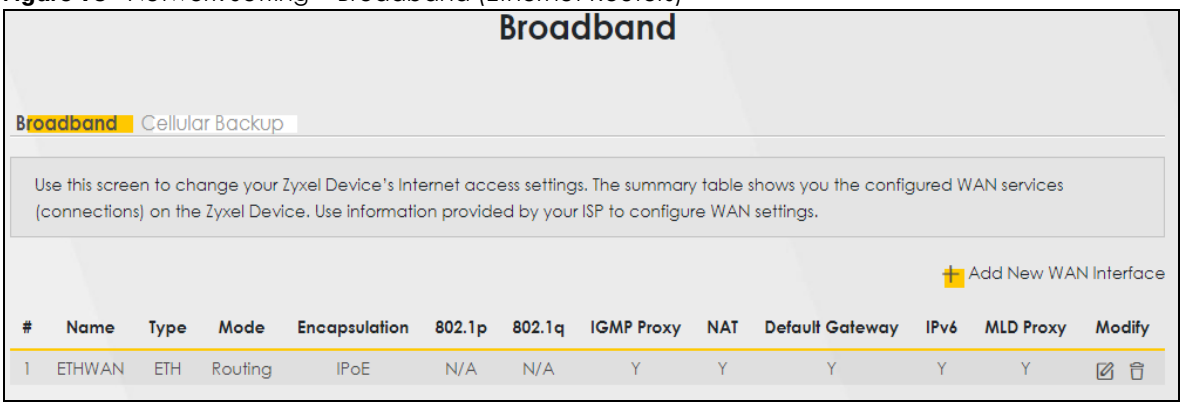
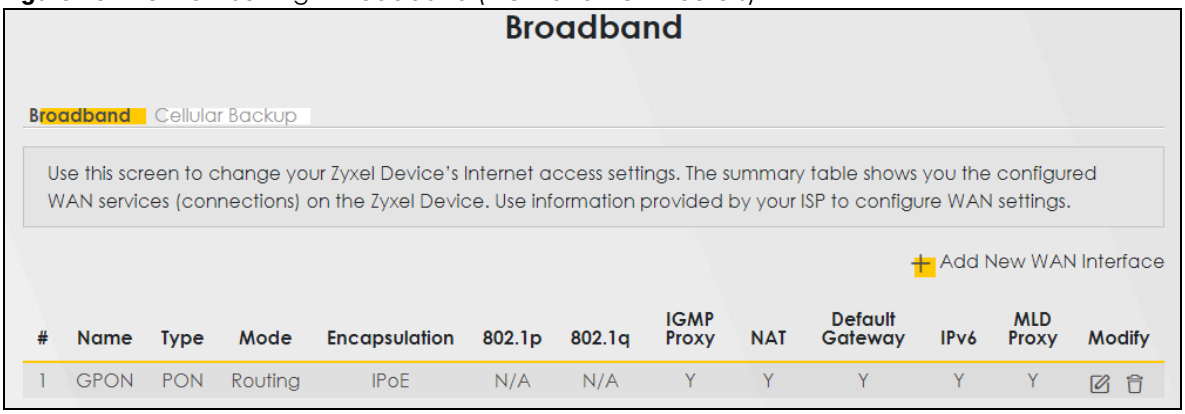


Figure 76 Network Setting > Broadband (AON and PON Routers)



The following table describes the labels in this screen.

Table 27 Network Setting > Broadband

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

Table 27 Network Setting > Broadband (continued)

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

7.3.1 Add or Edit Internet Connection

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

Routing Mode

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

The following example screen displays when you select the **Routing** mode and **PPPoE** encapsulation. The screen varies when you select other encapsulation and IPv6 or IPv4 mode.

Figure 77 Network Setting > Broadband > Add or Edit New WAN Interface (Ethernet Routers Routing Mode)

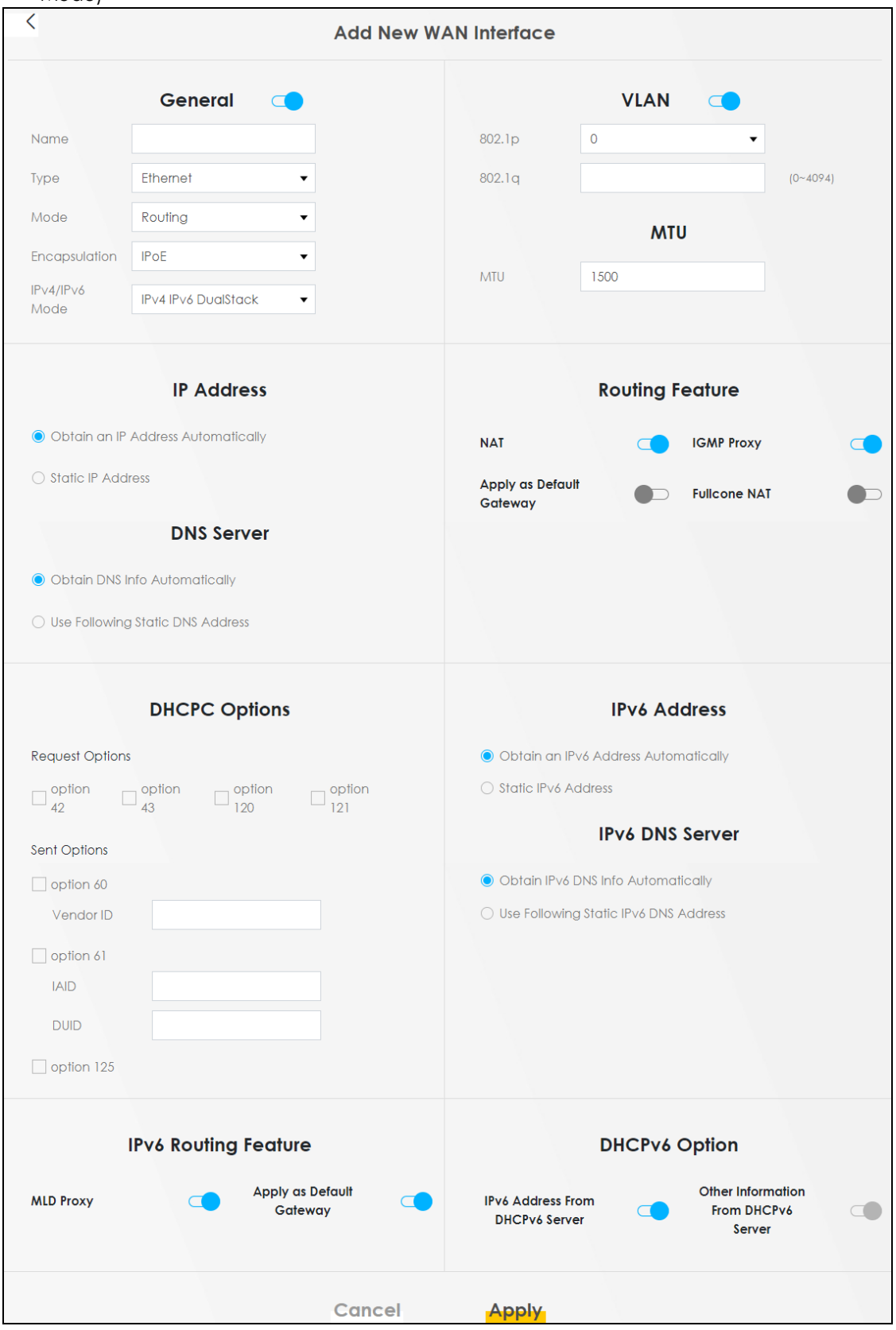
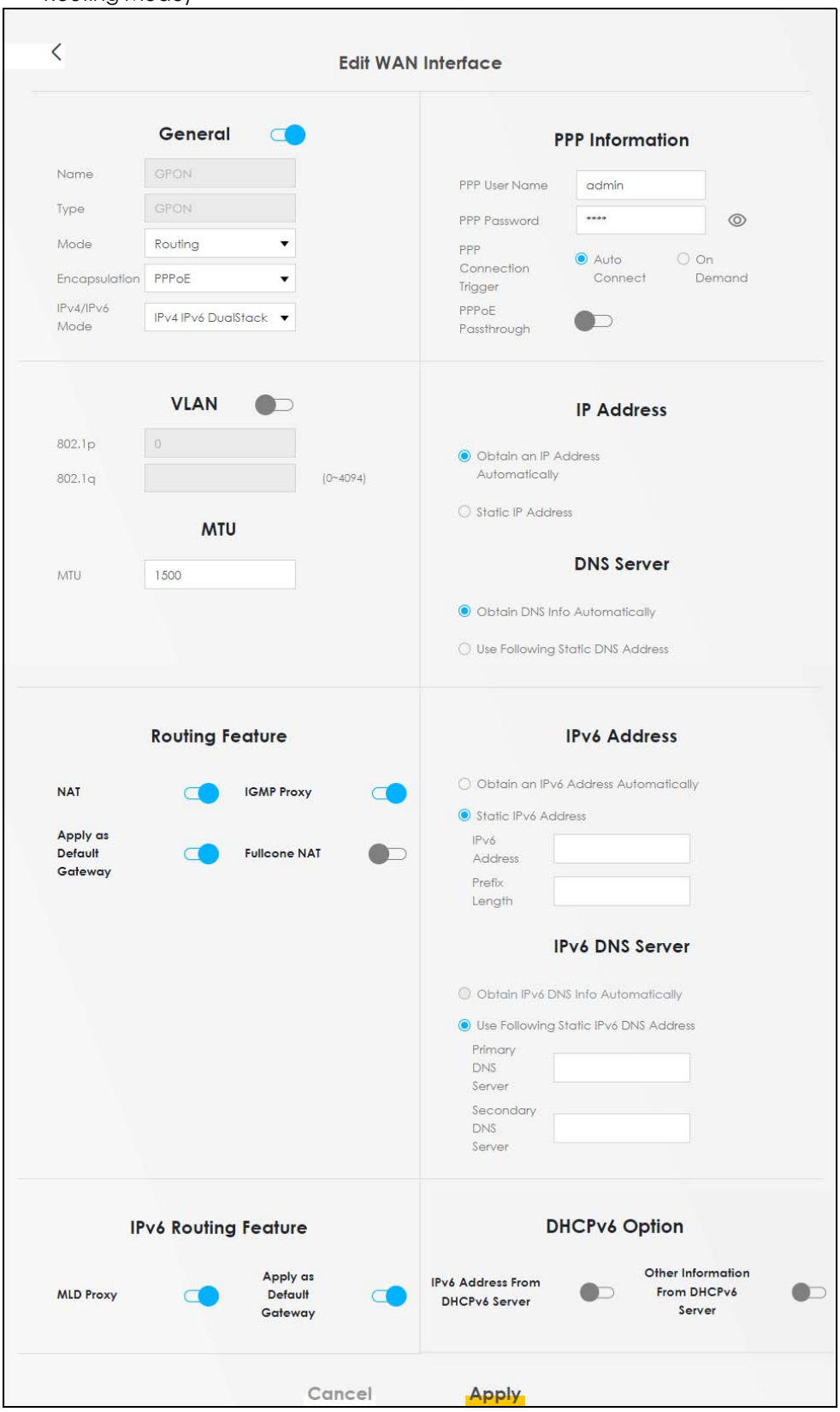


Figure 78 Network Setting > Broadband > Add or Edit New WAN Interface (AON and PON Routers Routing Mode)



The following table describes the labels in this screen.

Table 28 Network Setting > Broadband > Add or New WAN Interface (Routing Mode)

LABEL	DESCRIPTION
General	Click this switch to enable the WAN interface.
Name	Specify a descriptive name for this connection. You can use up to 15 alphanumeric (0-9, a-z, A-Z) and special characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed. This field is read-only is you are editing the WAN interface.
Type	This field shows **Ethernet** and indicates an Ethernet connection. This field is read-only is you are editing the WAN interface.
Mode	Select **Routing** if your ISP give you one IP address only and you want multiple computers to share an Internet account.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. This option is available only when you select **Routing** in the **Mode** field. The choices are **PPPoE** and **IPoE**.
IPv4/IPv6 Mode	Select **IPv4 Only** if you want the Zyxel Device to run IPv4 only. Select **IPv4 IPv6 DualStack** to allow the Zyxel Device to run IPv4 and IPv6 at the same time. Select **IPv6 Only** if you want the Zyxel Device to run IPv6 only.
PPP Information (This is available only when you select **PPPoE** in the **Encapsulation** field.)	
PPP User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
PPP Password	Enter the password associated with the user name above. Select **password unmask** to show your entered password in plain text.
PPP Connection Trigger	Select when to have the Zyxel Device establish the PPP connection. **Auto Connect** – select this to not let the connection time out. **On Demand** – select this to automatically bring up the connection when the Zyxel Device receives packets destined for the Internet.
Idle Timeout	This value specifies the time in minutes that elapses before the router automatically disconnects from the PPPoE server. This field is only available if you select **On Demand** in the **PPP Connection Trigger** field.
PPPoE Passthrough	This field is available when you select **PPPoE** encapsulation. In addition to the Zyxel Device's built-in PPPoE client, you can enable PPPoE pass through to allow up to ten hosts on the LAN to use PPPoE client software on their computers to connect to the ISP through the Zyxel Device. Each host can have a separate account and a public WAN IP address. PPPoE pass through is an alternative to NAT for application where NAT is not appropriate. Disable PPPoE pass through if you do not need to allow hosts on the LAN to use PPPoE client software on their computers to connect to the ISP.
VLAN	Click this switch to enable or disable VLAN on this WAN interface. When the switch goes to the right, the function is enabled. Otherwise, it is not.
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level (from 0 to 7) to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number (from 0 to 4094) for traffic through this connection.
MTU	

Table 28 Network Setting > Broadband > Add or New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
MTU	Enter the MTU (Maximum Transfer Unit) size for traffic through this connection.
IP Address (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select this if you have a dynamic IP address.
Static IP Address	Select this option If the ISP assigned a fixed IP address.
IP Address	Enter the static IP address provided by your ISP.
Subnet Mask	Enter the subnet mask provided by your ISP. This is available only when you set the **Encapsulation** to **IPoE**.
Gateway IP Address	Enter the gateway IP address provided by your ISP. This is available only when you set the **Encapsulation** to **IPoE**.
DNS Server (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
	Select **Obtain DNS Info Automically** if you want the Zyxel Device to use the DNS server addresses assigned by your ISP. Select **Use Following Static DNS Address** if you want the Zyxel Device to use the DNS server addresses you configure manually.
Primary DNS Server	Enter the first DNS server address assigned by the ISP.
Secondary DNS Server	Enter the second DNS server address assigned by the ISP.
Routing Feature (This is available only when you select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
NAT	Click this switch to activate or deactivate NAT on this connection. When the switch goes to the right, the function is enabled. Otherwise, it is not.
IGMP Proxy	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. Click this switch to have the Zyxel Device act as an IGMP proxy on this connection. When the switch goes to the right, the function is enabled. Otherwise, it is not. This allows the Zyxel Device to get subscribing information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Apply as Default Gateway	Click this switch to have the Zyxel Device use the WAN interface of this connection as the system default gateway. When the switch goes to the right, the function is enabled. Otherwise, it is not.
Fullcone NAT Enable	Click this switch to enable or disable full cone NAT on this connection. When the switch goes to the right, the function is enabled. Otherwise, it is not. This field is available only when you activate **NAT**. In full cone NAT, the Zyxel Device maps all outgoing packets from an internal IP address and port to a single IP address and port on the external network. The Zyxel Device also maps packets coming to that external IP address and port to the internal IP address and port.
DHCPC Options (This is available only when you set the **Encapsulation** to **IPoE** and select **IPv4 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.) Note: The available DHCP options may differ by model.	

Table 28 Network Setting > Broadband > Add or New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
Request Options	Select **Option 42** to have the Zyxel Device get NTP time server information from DHCP packets sent from the DHCP server. Select **Option 43** to have the Zyxel Device get vendor specific information from DHCP packets sent from the DHCP server. Select **Option 120** to have the Zyxel Device get static route information from DHCP packets sent from the DHCP server. Select **Option 121** to have the Zyxel Device get SIP server information from DHCP packets sent from the DHCP server.
Sent Options	
option 60	Select this and enter the device identity you want the Zyxel Device to add in the DHCP discovery packets that go to the DHCP server.
Vendor ID	Enter the Vendor Class Identifier, such as the type of the hardware or firmware.
option 61	Select this and enter any string that identifies the device.
IAID	Enter the Identity Association Identifier (IAID) of the device, for example, the WAN connection index number.
DUID	Enter the hardware type, a time value and the MAC address of the device.
option 125	Select this to have the Zyxel Device automatically generate and add vendor specific parameters in the DHCP discovery packets that go to the DHCP server.
IPv6 Address (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field.)	
Obtain an IPv6 Address Automatically	Select **Obtain an IPv6 Address Automatically** if you want to have the Zyxel Device use the IPv6 prefix from the connected router's Router Advertisement (RA) to generate an IPv6 address.
Static IPv6 Address	Select **Static IPv6 Address** if you have a fixed IPv6 address assigned by your ISP. When you select this, the following fields appear.
IPv6 Address	Enter an IPv6 IP address that your ISP gave to you for this WAN interface.
Prefix Length	Enter the address prefix length to specify how many most significant bits in an IPv6 address compose the network address.
IPv6 Default Gateway	Enter the IP address of the next-hop gateway. The gateway is a router or switch on the same segment as your Zyxel Device's interfaces. The gateway helps forward packets to their destinations.
IPv6 DNS Server (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field. Configure the IPv6 DNS server in the following section.)	
Obtain IPv6 DNS Info Automatically	Select **Obtain IPv6 DNS Info Automatically** to have the Zyxel Device get the IPv6 DNS server addresses from the ISP automatically.
Use Following Static IPv6 DNS Address	Select **Use Following Static IPv6 DNS Address** to have the Zyxel Device use the IPv6 DNS server addresses you configure manually.
Primary DNS Server	Enter the first IPv6 DNS server address assigned by the ISP.
Secondary DNS Server	Enter the second IPv6 DNS server address assigned by the ISP.
IPv6 Routing Feature (This is available only when you select **IPv4 IPv6 DualStack** or **IPv6 Only** in the **IPv4/IPv6 Mode** field. You can enable IPv6 routing features in the following section.)	
MLD Proxy Enable	Select this checkbox to have the Zyxel Device act as an MLD proxy on this connection. This allows the Zyxel Device to get subscription information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Apply as Default Gateway	Select this option to have the Zyxel Device use the WAN interface of this connection as the system default gateway.

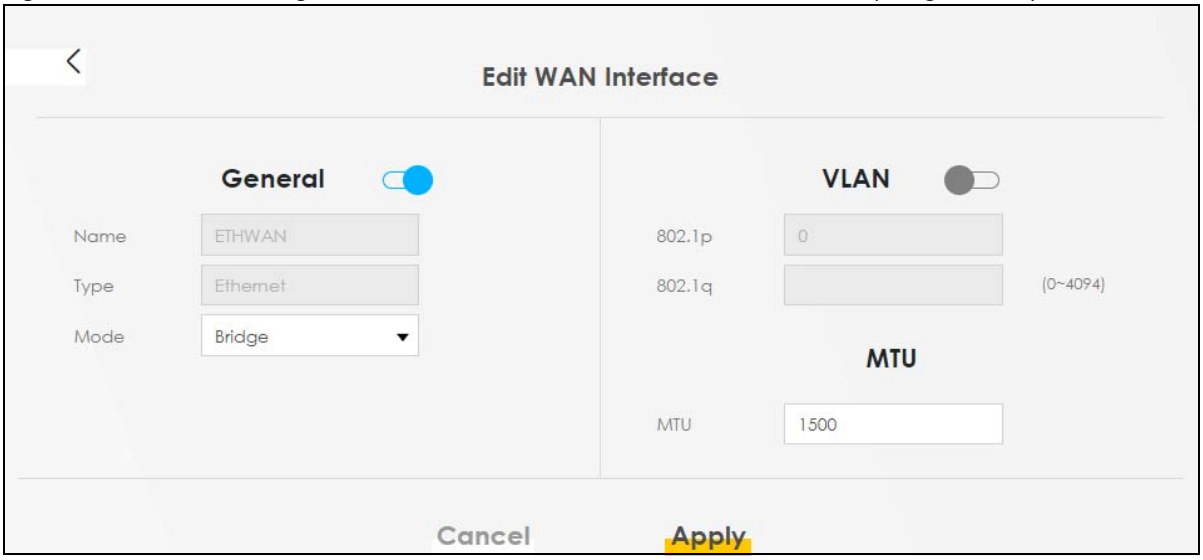
Table 28 Network Setting > Broadband > Add or New WAN Interface (Routing Mode) (continued)

LABEL	DESCRIPTION
DS-Lite	This is available only when you select **IPv6 Only** in the **IPv4/IPv6 Mode** field. Enable Dual Stack Lite to let local computers use IPv4 through an ISP's IPv6 network. See Dual Stack Lite on page 128 for more information. Click this switch to enable DS-Lite to let local computers use IPv4 through an ISP's IPv6 network.
DS-Lite Relay Server IP	Specify the transition router's IPv6 address.
6RD The 6RD (IPv6 rapid deployment) fields display when you set the **IPv6/IPv4 Mode** field to **IPv4 Only**. See IPv6 Rapid Deployment on page 128 for more information. Click this switch to tunnel IPv6 traffic from the local network through the ISP's IPv4 network.	
	Select **Manually Configured** if you have the IPv4 address of the relay server. Otherwise, select **Automatically configured by DHCPC** to have the Zyxel Device detect it automatically through DHCP. The **Automatically configured by DHCPC** option is configurable only when you set the method of encapsulation to **IPoE**.
Service Provider IPv6 Prefix	Enter an IPv6 prefix for tunneling IPv6 traffic to the ISP's border relay router and connecting to the native IPv6 Internet.
IPv4 Mask Length	Enter the subnet mask number (1 – 32) for the IPv4 network.
Border Relay IPv4 Address	When you select **Manually Configured**, specify the relay server's IPv4 address in this field.
DHCPv6 Option (This is available only when you select **IPv6 Only** or **IPv4 IPv6 DualStack** in the **IPv4/IPv6 Mode** field.)	
IPv6 Address From DHCPv6 Server	Click the switch (to the right) to let the Zyxel Device send DHCP requests to the DHCPv6 server to obtain an IPv6 address.
Other Information From DHCPv6 Server	Click the switch (to the right) to have the Zyxel Device get other information, such as DNS information, from DHCPv6 packets sent from the DHCPv6 server. This will be enabled if **IPv6 Address From DHCPv6 Server** is enabled.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

Bridge Mode

Click the **Add new WAN Interface** in the **Network Setting** > **Broadband** screen or the **Edit** icon next to the connection you want to configure. The following example screen displays when you select **Bridge** mode.

Figure 79 Network Setting > Broadband > Add or Edit New WAN Interface (Bridge Mode)



The following table describes the fields in this screen.

Table 29 Network Setting > Broadband > Add or Edit New WAN Interface (Bridge Mode)

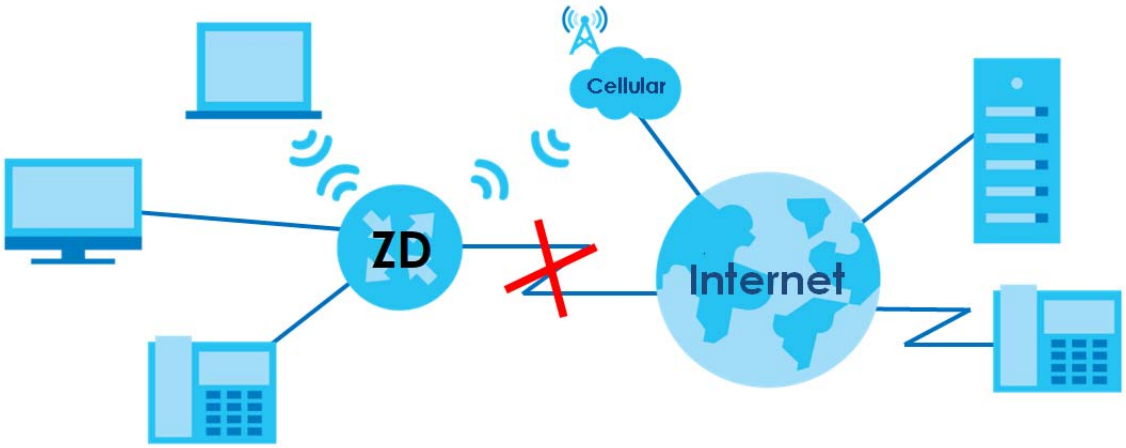
LABEL	DESCRIPTION
General	Click this switch to enable the interface.
Name	Enter a service name of the connection. You can use up to 15 alphanumeric (0-9, a-z, A-Z) and special characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed. This field is read-only is you are editing the WAN interface.
Type	This field shows **Ethernet** and indicates an Ethernet connection. This field is read-only is you are editing the WAN interface.
Mode	Select **Bridge** when your ISP provides you more than one IP address and you want the connected computers to get individual IP address from ISP's DHCP server directly. If you select **Bridge**, you cannot use routing functions, such as QoS, Firewall, DHCP server and NAT on traffic from the selected LAN ports.
VLAN	Click this switch to enable VLAN on this WAN interface.
802.1p	IEEE 802.1p defines up to 8 separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Select the IEEE 802.1p priority level (from 0 to 7) to add to traffic through this connection. The greater the number, the higher the priority level.
802.1q	Type the VLAN ID number (from 0 to 4094) for traffic through this connection.
Cancel	Click **Cancel** to exit this screen without saving any changes.
Apply	Click **Apply** to save your changes.

7.4 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 80 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.

Note: Entering a wrong PIN code three times will lock the SIM card in your cellular dongle.

Note: If you select **Drop** in the **Current Cellular Connection** field, the Zyxel Device will drop the cellular WAN connection when the **Time Budget** or **Data Budget** is reached. It may take some time for the cellular WAN connection to be disconnected when the **Time Budget** or **Data Budget** is reached.

Figure 81 Network Setting **>** Broadband > Cellular Backup

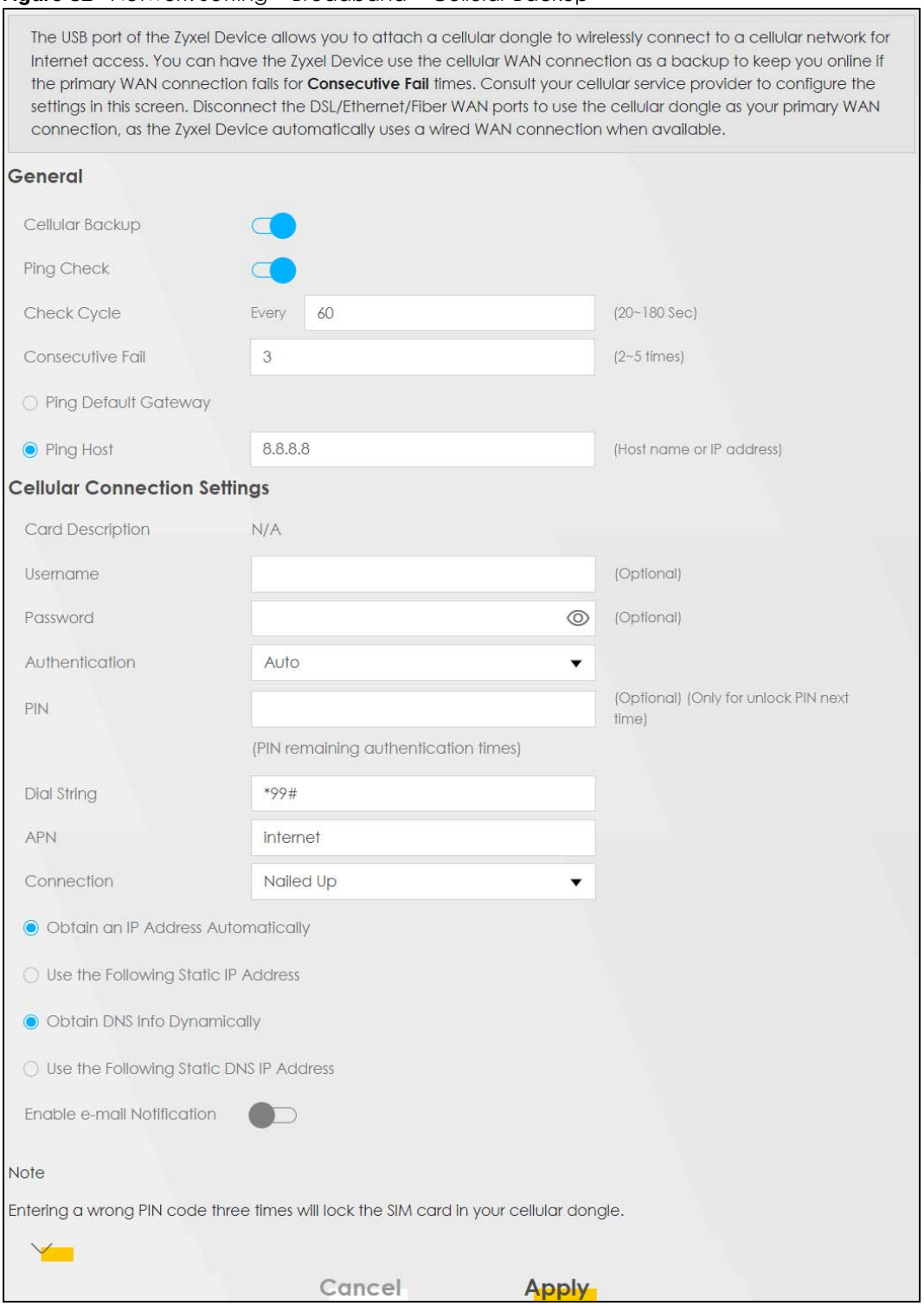
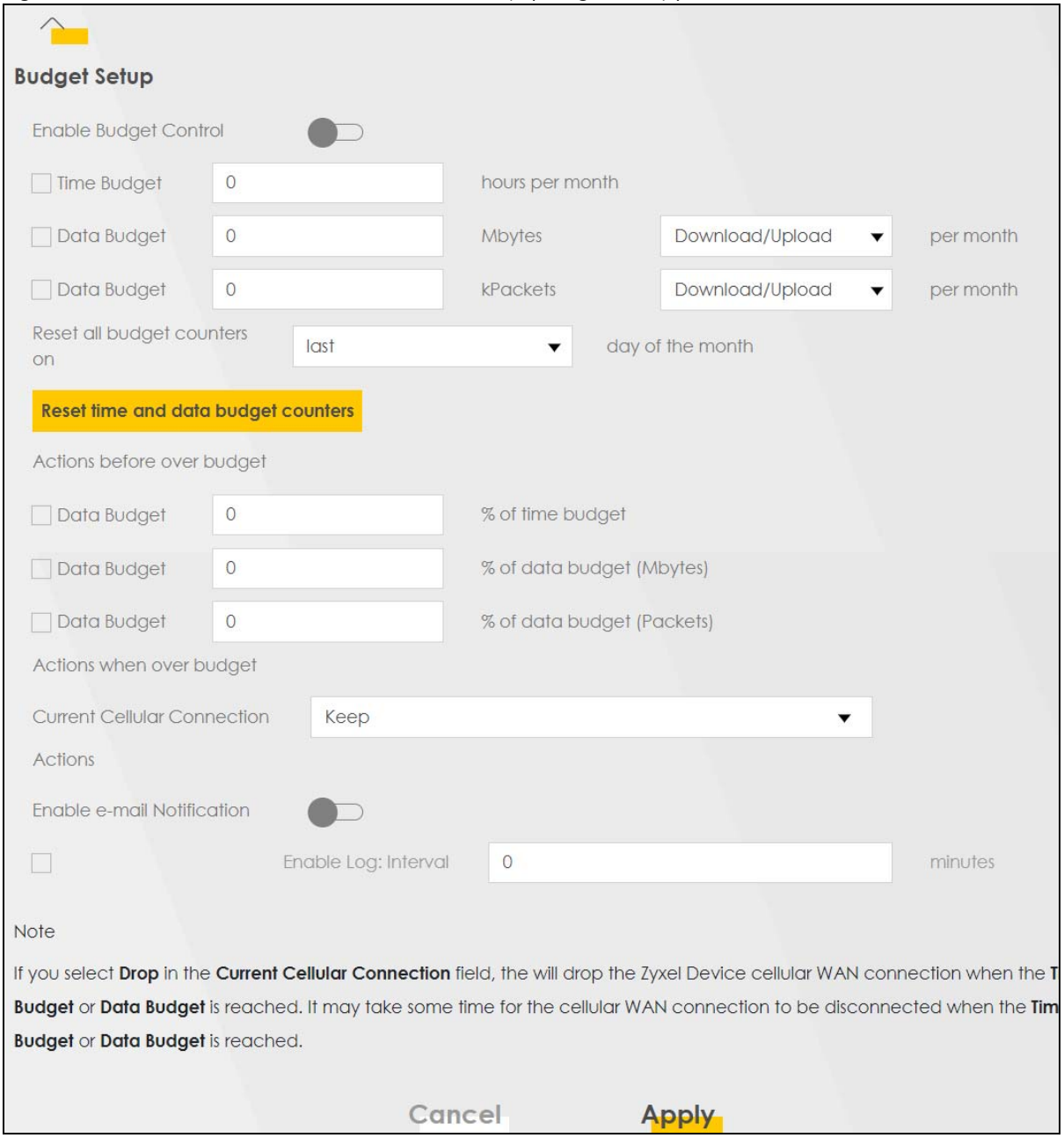


Figure 82 Network > Broadband > Cellular Backup (Budget Setup)



The following table describes the labels in this screen.

Table 30 Network Setting > Broadband > Cellular Backup

LABEL	DESCRIPTION
General	
Cellular Backup	Click this switch to have the Zyxel Device use the cellular connection as your WAN or a backup when the wired WAN connection fails.
Ping Check	Click this switch to ping check the connection status of your WAN. You can configure the frequency of the ping check and number of consecutive failures before triggering cellular backup.
Check Cycle	Enter the frequency of the ping check in this field.

Table 30 Network Setting > Broadband > Cellular Backup (continued)

LABEL	DESCRIPTION
Consecutive Fail	Enter how many consecutive failures are required before cellular backup is triggered.
Ping Default Gateway	Select this to have the Zyxel Device ping the WAN interface's default gateway IP address.
Ping Host	Select this to have the Zyxel Device ping the particular host name or IP address you typed in this field.
Cellular Connection Settings	
Card Description	This field displays the manufacturer and model name of your cellular card if you inserted one in the Zyxel Device. Otherwise, it displays **N/A**.
Username	Enter the user name (of up to 64 alphanumeric (0-9, a-z, A-Z) and special characters, including spaces) given to you by your service provider.
Password	Enter the password (of up to 64 alphanumeric (0-9, a-z, A-Z) and special characters, including spaces) associated with the user name above.
Authentication	The Zyxel Device supports PAP (Password Authentication Protocol) and CHAP (Challenge Type Handshake Authentication Protocol). In PAP, peers identify themselves with a user name and password. In CHAP, additionally to user name and password the Zyxel Device sends regular challenges to make sure an intruder has not replaced a peer. CHAP is more secure than PAP; however, PAP is available on more platforms. Select an authentication protocol (Auto, CHAP or PAP). Contact your service provider for the correct authentication type.
PIN	A PIN (Personal Identification Number) code is a key to a cellular card. Without the PIN code, you cannot use the cellular card. If your ISP enabled PIN code authentication, enter the 4-digit PIN code (0000 for example) provided by your ISP. If you enter the PIN code incorrectly, the cellular card may be blocked by your ISP and you cannot use the account to access the Internet. If your ISP disabled PIN code authentication, leave this field blank.
Dial String	Enter the phone number (dial string) used to dial up a connection to your service provider's base station. Your ISP should provide the phone number. For example, *99# is the dial string to establish a GPRS or cellular connection in Taiwan.
APN	Enter the APN (Access Point Name) provided by your service provider. Connections with different APNs may provide different services (such as Internet access or MMS (Multi-Media Messaging Service)) and charge method. You can enter up to 32 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
Connection	Select **Nailed UP** if you do not want the connection to time out. Select **On Demand** if you do not want the connection up all the time and specify an idle time-out in the **Max Idle Timeout** field.
Max Idle Timeout	This value specifies the time in minutes that elapses before the Zyxel Device automatically disconnects from the ISP.
Obtain an IP Address Automatically	Select this option if your ISP did not assign you a fixed IP address.
Use the Following Static IP Address	Select this option if the ISP assigned a fixed IP address.
IP Address	Enter your WAN IP address in this field if you selected **Use the following static IP address**.
Subnet Mask	Enter the subnet mask of the IP address.
Obtain DNS Info Dynamically	Select this to have the Zyxel Device get the DNS server addresses from the ISP automatically.

Table 30 Network Setting > Broadband > Cellular Backup (continued)

LABEL	DESCRIPTION
Use the Following Static DNS IP Address	Select this to have the Zyxel Device use the DNS server addresses you configure manually.
Primary DNS Server	Enter the first DNS server address assigned by the ISP.
Secondary DNS Server	Enter the second DNS server address assigned by the ISP.
Enable e-mail Notification	Select this to enable the email notification function. The Zyxel Device will email you a notification when the cellular connection is up.
Mail Account	Select an email address you have configured in **Maintenance** > **E-mail Notification**. The Zyxel Device uses the corresponding mail server to send notifications. You must have configured a mail server already in the **Maintenance** > **E-mail Notification** screen.
Cellular Backup e-mail Title	Enter a title that you want to be in the subject line of the email notifications that the Zyxel Device sends.
Send Notification to E-mail	Notifications are sent to the email address specified in this field. If this field is left blank, notifications cannot be sent through email.
Click this to show the advanced cellular backup settings.	
Budget Setup	
Enable Budget Control	Click this switch to set a monthly limit for the user account of the installed cellular card. You can set a limit on the total traffic and/or call time. The Zyxel Device takes the actions you specified when a limit is exceeded during the month.
Time Budget	Select this and specify the amount of time (in hours) that the cellular connection can be used within one month. If you change the value after you configure and enable budget control, the Zyxel Device resets the statistics.
Data Budget (Mbytes)	Select this and specify how much downstream and/or upstream data (in Mega bytes) can be transmitted through the cellular connection within one month. Select **Download/Upload** to set a limit on the total traffic in both directions. Select **Download** to set a limit on the downstream traffic (from the ISP to the Zyxel Device). Select **Upload** to set a limit on the upstream traffic (from the Zyxel Device to the ISP). If you change the value after you configure and enable budget control, the Zyxel Device resets the statistics.
Data Budget (kPackets)	Select this and specify how much downstream and/or upstream data (in k Packets) can be transmitted through the cellular connection within one month. Select **Download/Upload** to set a limit on the total traffic in both directions. Select **Download** to set a limit on the downstream traffic (from the ISP to the Zyxel Device). Select **Upload** to set a limit on the upstream traffic (from the Zyxel Device to the ISP). If you change the value after you configure and enable budget control, the Zyxel Device resets the statistics.
Reset all budget counters on	Select the date on which the Zyxel Device resets the budget every month. Select **last** if you want the Zyxel Device to reset the budget on the last day of the month. Select **specific** and enter the number of the date you want the Zyxel Device to reset the budget.
Reset time and data budget counters	Click this button to reset the time and data budgets immediately. The count starts over with the cellular connection's full configured monthly time and data budgets. This does not affect the normal monthly budget restart; so if you configured the time and data budget counters to reset on the second day of the month and you use this button on the first, the time and data budget counters will still reset on the second.

Table 30 Network Setting > Broadband > Cellular Backup (continued)

LABEL	DESCRIPTION
Actions before over budget	Specify the actions the Zyxel Device takes before the time or data limit exceeds.
Data Budget % of time budget/data budget (Mbytes)/data budget (kPackets)	Select the checkboxes and enter a number from 1 to 99 in the percentage fields. If you change the value after you configure and enable budget control, the Zyxel Device resets the statistics.
Actions when over budget	Specify the actions the Zyxel Device takes when the time or data limit is exceeded.
Current Cellular Connection	Select **Keep** to maintain an existing cellular connection or **Drop** to disconnect it.
Actions	
Enable e-mail Notification	Click this switch to enable the email notification function. The Zyxel Device will email you a notification whenever over budget occurs.
Mail Account	Select an email address you have configured in **Maintenance** > **E-mail Notification**. The Zyxel Device uses the corresponding mail server to send notifications. You must have configured a mail server already in the **Maintenance** > **E-mail Notification** screen.
Cellular Backup e-mail Title	Enter a title that you want to be in the subject line of the email notifications that the Zyxel Device sends.
Send Notification to E-mail	Notifications are sent to the email address specified in this field. If this field is left blank, notifications cannot be sent through email.
Enable Log: Interval	Select this to and enter the **Interval** of how many minutes (1 – 9999) you want the Zyxel Device to email you.
Cancel	Click **Cancel** to discard any changes to the settings.
Apply	Click **Apply** to save your changes.

7.5 Broadband Advanced Screen for DSL Routers

Use the **Advanced** screen to enable or disable ADSL over PTM, Annex M, DSL PhyR, and SRA (Seamless Rate Adaptation) functions. The Zyxel Device supports the PhyR retransmission scheme. PhyR is a retransmission scheme designed to provide protection against noise on the DSL line. It improves voice, video and data transmission resilience by utilizing a retransmission buffer. It also lists ITU-T G.993.2 standard VDSL profiles you can comply with.

ITU-T G.993.2 standard defines a wide range of settings for various parameters, some of which are encompassed in profiles as shown in the next table.

Note: This features is not available on all models. See Section 1.1 on page 19 for more information.

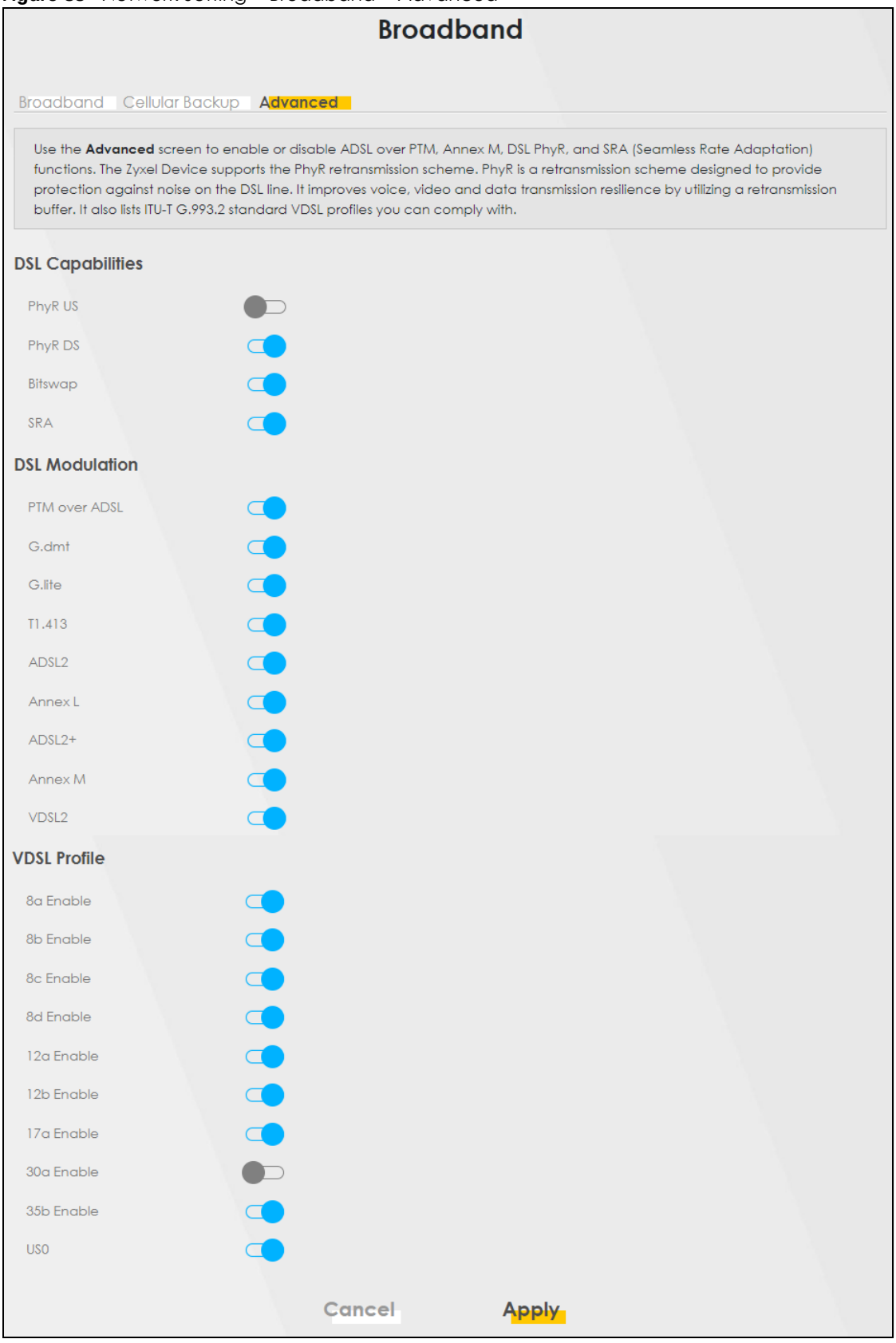
Note: If the settings in the screen are changed, the Zyxel Device will re-establish the DSL connections.

Table 31 VDSL Profiles

PROFILE	BANDWIDTH (MHZ)	NUMBER OF DOWNSTREAM CARRIERS	CARRIER BANDWIDTH (KHZ)	POWER (DBM)	MAX. DOWNSTREAM THROUGHPUT (MBIT/S)
8a	8.832	2048	4.3125	17.5	50
8b	8.832	2048	4.3125	20.5	50
8c	8.5	1972	4.3125	11.5	50
8d	8.832	2048	4.3125	14.5	50
12a	12	2783	4.3125	14.5	68
12b	12	2783	4.3125	14.5	68
17a	17.664	4096	4.3125	14.5	100
35a	30.000	3479	4.3125	14.5	100
35b	35.328	8192	4.3125	17.0	300

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

Figure 83 Network Setting > Broadband > Advanced



The following table describes the labels in this screen.

Table 32 Network Setting > Broadband > Advanced

LABEL	DESCRIPTION
DSL Capabilities	
PhyR US	Enable or disable **PhyR US** (upstream) for upstream transmission to the WAN. PhyR US should be enabled if data being transmitted upstream is sensitive to noise. However, enabling PhyR US can decrease the US line rate. Enabling or disabling PhyR will require the CPE to retrain. For PhyR to function, the DSLAM must also support PhyR and have it enabled.
PhyR DS	Enable or disable **PhyR DS** (downstream) for downstream transmission from the WAN. PhyR DS should be enabled if data being transmitted downstream is sensitive to noise. However, enabling PhyR DS can decrease the DS line rate. Enabling or disabling PhyR will require the CPE to retrain. For PhyR to function, the DSLAM must also support PhyR and have it enabled.
PhyR US/DS	Enable or disable **PhyR US/DS** (upstream/downstream) for both upstream and downstream transmission to the WAN. PhyR US should be enabled if data being transmitted upstream is sensitive to noise. However, enabling PhyR US can decrease the US line rate. Enabling or disabling PhyR will require the CPE to retrain. For PhyR to function, the DSLAM must also support PhyR and have it enabled.
Bitswap	Select **Enable** to allow the Zyxel Device to adapt to line changes when you are using G.dmt. Bit-swapping is a way of keeping the line more stable by constantly monitoring and redistributing bits between channels.
SRA	Enable or disable Seamless Rate Adaption (SRA). Select **Enable** to have the Zyxel Device automatically adjust the connection's data rate according to line conditions without interrupting service.
DSL Modulation	
PTM over ADSL	Select **Enable** to use PTM over ADSL. Since PTM has less overhead than ATM, some ISPs use this for better performance.
G.Dmt	ITU G.992.1 (better known as G.dmt) is an ITU standard for ADSL using discrete multitone modulation. G.dmt full-rate ADSL expands the usable bandwidth of existing copper telephone lines, delivering high-speed data communications at rates up to 8 Mbit/s downstream and 1.3 Mbit/s upstream.
G.lite	ITU G.992.2 (better known as G.lite) is an ITU standard for ADSL using discrete multitone modulation. G.lite does not strictly require the use of DSL filters, but like all variants of ADSL generally functions better with splitters.
T1.413	ANSI T1.413 is a technical standard that defines the requirements for the single asymmetric digital subscriber line (ADSL) for the interface between the telecommunications network and the customer installation in terms of their interaction and electrical characteristics.
ADSL2	It optionally extends the capability of basic ADSL in data rates to 12 Mbit/s downstream and, depending on Annex version, up to 3.5 Mbit/s upstream (with a mandatory capability of ADSL2 transceivers of 8 Mbit/s downstream and 800 kbit/s upstream).
Annex L	Annex L is an optional specification in the ITU-T ADSL2 recommendation G.992.3 titled Specific requirements for a Reach Extended ADSL2 (READSL2) system operating in the frequency band above POTS, therefore it is often referred to as Reach Extended ADSL2 or READSL2.The main difference between this specification and commonly deployed Annex A is the maximum distance that can be used. The power of the lower frequencies used for transmitting data is boosted up to increase the reach of this signal up to 7 kilometers (23,000 ft).
ADSL2+	ADSL2+ extends the capability of basic ADSL by doubling the number of downstream channels. The data rates can be as high as 24 Mbit/s downstream and up to 1.4 Mbit/s upstream depending on the distance from the DSLAM to the customer's premises.
Annex M	Annex M is an optional specification in ITU-T recommendations G.992.3 (ADSL2) and G.992.5 (ADSL2+), also referred to as ADSL2 M and ADSL2+ M. This specification extends the capability of commonly deployed Annex A by more than doubling the number of upstream bits. The data rates can be as high as 12 or 24 Mbit/s downstream and 3 Mbit/s upstream depending on the distance from the DSLAM to the customer's premises.

Table 32 Network Setting > Broadband > Advanced (continued)

LABEL	DESCRIPTION
Annex M/J	Annex M and Annex J are specified in ITU-T recommendations G.992.3 (ADSL2) and G.992.5 (ADSL2+). Annex M and Annex J enhance the capabilities of Annex A and Annex B by increasing the upstream transmission data rate, but slightly reduce the downstream data rates as a trade-off. Annex M supports data rates of up to 12 Mbit/s downstream and 3.5 Mbit/s upstream for ADSL2, and up to 24 Mbit/s downstream and 2.5 Mbit/s upstream for ADSL2+. Annex J supports data rates of up to 12 Mbit/s downstream and 3.5 Mbit/s upstream for ADSL2, and up to 24 Mbit/s downstream and 3.5 Mbit/s upstream for ADSL2+. However, the actual downstream/upstream data rates depend on the distance from the ISP DSLAM to the Zyxel Device and the quality of your telephone line. Click the switch to enable the Zyxel Device to use Annex M for Zyxel Device models that use POTS WAN connection, and use Annex J for Zyxel Device models that use ISDN WAN connection.
VDSL2	VDSL2 (Very High Speed Digital Subscriber Line 2) is the second generation of the VDSL standard (which is currently denoted VDSL1). VDSL2 allows a frequency band of up to 30MHz and transmission rates of up to 100 Mbps in each direction. VDSL2 is defined in G.993.2.
VDSL Profile	VDSL2 profiles differ in the width of the frequency band used to transmit the broadband signal. Profiles that use a wider frequency band can deliver higher maximum speeds.
8a, 8b, 8c, 8d, 12a, 12b, 17a, 30a, 35b US0	The G.993.2 VDSL standard defines a wide range of profiles that can be used in different VDSL deployment settings, such as in a central office, a street cabinet or a building. The Zyxel Device must comply with at least one profile specified in G.993.2. but compliance with more than one profile is allowed.
Cancel	Click **Cancel** to return to the previous configuration.
Apply	Click **Apply** to save your changes back to the Zyxel Device.

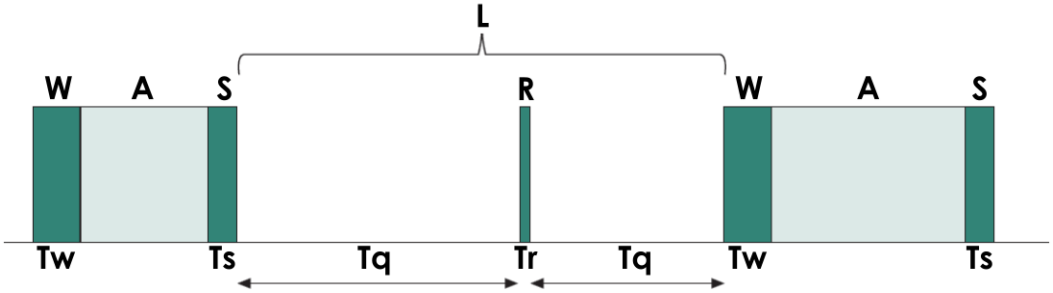
7.6 Broadband Advanced Screen for Ethernet Routers

Use the **Advanced** screen to configure the Zyxel Device to reduce the power consumption.

IEEE 802.3az Energy Efficient Ethernet (EEE)

If EEE is enabled, and there is no WAN/LAN traffic (**A**) on the Zyxel Device, the Zyxel Device enters low power idle (**L**) (or sleep (**S**)) mode. Transitioning to low power mode (**L**) requires (**Ts**) seconds. Low power idle (**L**) mode turns off some functions of the physical layer to save power. Periodically the Zyxel Device transmits a REFRESH (**R**) signal during short refresh intervals (**Tr**) to allow the connected WAN/LAN device to keep the link active. The Zyxel Device stays quiet during large intervals (**Tq**). When there is traffic to be sent, a WAKE (**W**) signal is sent to the connected WAN/LAN device to return the link to active mode (**A**). This wake (**W**) transition takes (**Tw**) seconds.

Figure 84 Transition Between the Active (A) and Low Power Idle (L) Modes in EEE

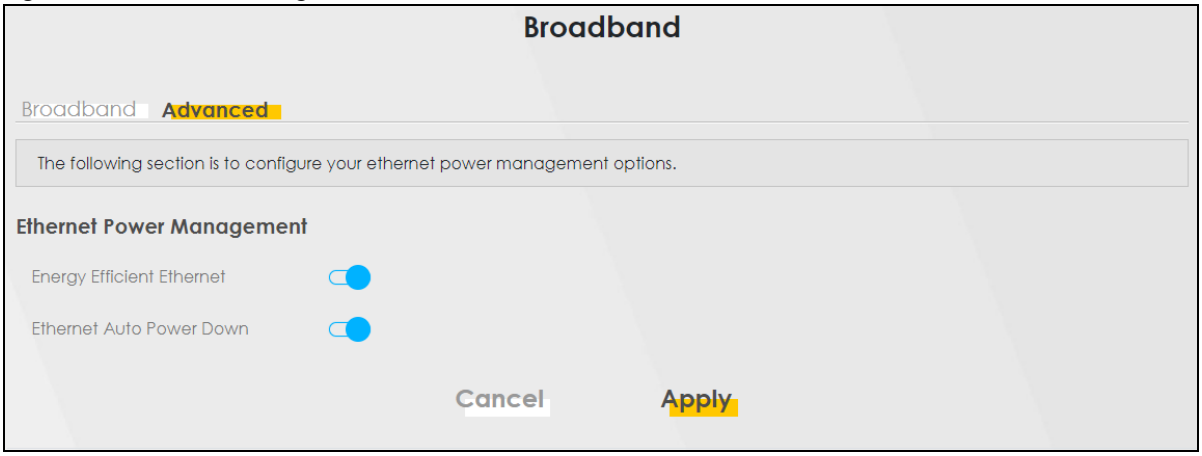


Auto Power Down

Auto Power Down turns off almost all functions of the Zyxel Device's physical layer when the link is down, so the Zyxel Device only uses power when there is a link up pulse from the connected WAN/LAN device. After the link up pulse is detected, the Zyxel Device wakes up from Auto Power Down and operates normally.

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

Figure 85 Network Setting > Broadband > Advanced



The following table describes the labels in this screen.

Table 33 Network Setting > Broadband > Advanced

LABEL	DESCRIPTION
Ethernet Power Management	
Energy Efficient Ethernet	Slide the switch to the right to activate Energy Efficient Ethernet on the Zyxel Device.
Ethernet Auto Power Down	Slide the switch to the right to activate Auto Power Down on the Zyxel Device.
Cancel	Click **Cancel** to return to the previous configuration.
Apply	Click **Apply** to save your changes back to the Zyxel Device.

7.7 Backup WAN

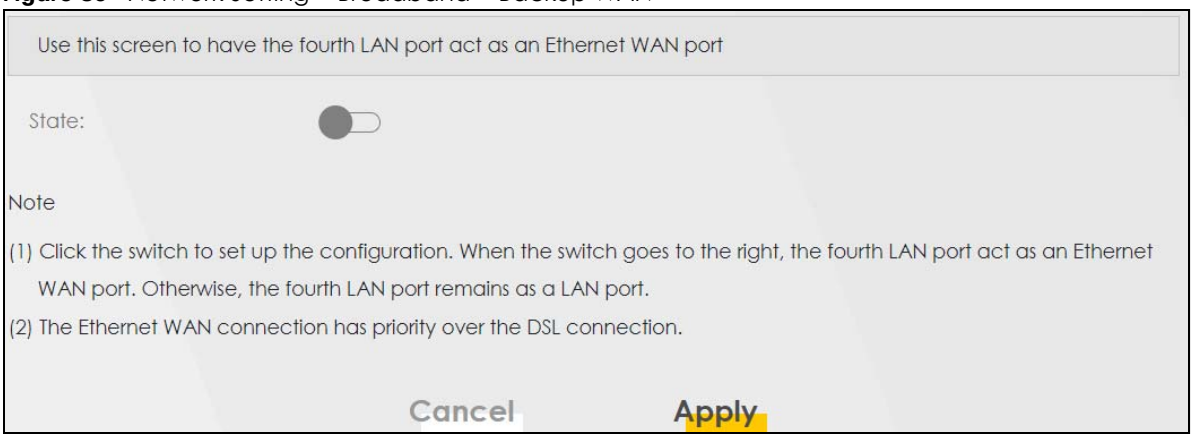
Use this screen to have the **LAN/WAN** port on the Zyxel Device ports panel to act as an Ethernet WAN port. The Ethernet WAN connection has priority over the DSL WAN connection.

It's not enough to just enable the fourth LAN port as a WAN port here. You must also go to **Network Setting** > **Broadband** screen and create a new interface for it with the **Type** as **Ethernet** and **Encapsulation** as **IPoE**. It's suggested to enable NAT.

Note: The Ethernet WAN connection has priority over the DSL connection. See Section 1.2.1 on page 21 for the Zyxel Device WAN priority.

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

Figure 86 Network Setting > Broadband > Backup WAN



The following table describes the fields in this screen.

Table 34 Network Setting > Broadband > Backup WAN

LABEL	DESCRIPTION
State:	Click this switch to enable backup WAN to have the **LAN/WAN** port act as an Ethernet WAN port. Otherwise, the **LAN/WAN** port remains as a LAN port.
Cancel	Click **Cancel** to exit this screen without saving any changes.
Apply	Click **Apply** to save your changes.

7.8 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, WiFi, 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.

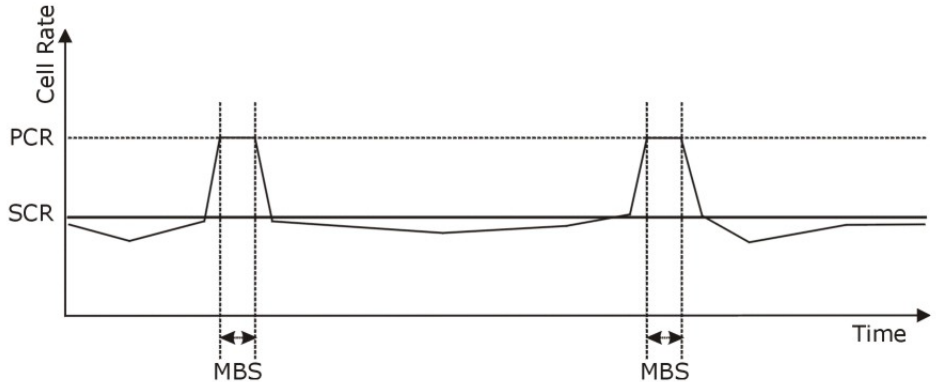
Sustained Cell Rate (SCR) is the mean cell rate of each bursty traffic source. It specifies the maximum average rate at which cells can be sent over the virtual connection. SCR may not be greater than the PCR.

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 87 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 (does not 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 does not 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 groups; 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 4 bytes longer than an untagged frame and contains 2 bytes of TPID (Tag Protocol Identifier), residing within the type/length field of the Ethernet frame) and 2 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 8
Wireless

8.1 Wireless Overview

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

8.1.1 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 WiFi connection.

- Use the **General** screen to enable the Wireless LAN, enter the SSID and select the WiFi security mode (Section 8.2 on page 167)
- Use the **Guest/More AP** screen to set up multiple WiFi networks on your Zyxel Device (Section 8.3 on page 174).
- Use the **MAC Authentication** screen to allow or deny WiFi clients based on their MAC addresses from connecting to the Zyxel Device (Section 8.4 on page 178).
- Use the **WPS** screen to enable or disable WPS, view or generate a security PIN (Personal Identification Number) (Section 8.5 on page 179).
- Use the **WMM** screen to enable WiFi MultiMedia (WMM) to ensure quality of service in WiFi networks for multimedia applications (Section 8.6 on page 181).
- Use the **Others** screen to configure WiFi advanced features, such as the RTS/CTS Threshold (Section 8.7 on page 182).
- Use the **Channel Status** screen to scan the number of accessing points and view the results (Section 8.8 on page 183).
- Use the **MESH** screen to enable or disable Mesh on your Zyxel Device (Section 8.9 on page 185).

8.1.2 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.

WiFi 6 / 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 35 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	

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

WiFi 6E (IEEE802.11ax – Extended Standard)

WiFi 6E is an extended standard of WiFi 6 (IEEE 802.11ax). WiFi 6E inherits all the WiFi 6 features and brings with an additional 6 GHz band. The 6 GHz band allows you to avoid possible congested traffic in the lower 2.4 GHz and 5 GHz bands. WiFi clients must support WiFi 6E to connect to the device using the 6 GHz band.

You must use WPA3 for security with WiFi 6E.

Note: Check your client device's product specification to see if your client device supports the 6 GHz band (WiFi 6E). If not, you should still use the 2.4/5 GHz bands for connection.

Finding Out More

See Section 8.10 on page 185 for advanced technical information on WiFi networks.

8.2 Wireless General Settings

Use this screen to enable the WiFi, enter the SSID and select the WiFi security mode. We recommend that you select **More Secure** to enable **WPA3-SAE** 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 WiFi connection when you press **Apply**. You must change the WiFi settings of your computer to match the new settings on the Zyxel Device.

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

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

Note: **Keep the same settings for 2.4G, 5G, 6G wireless networks** is enabled and cannot be disabled when you enable **Mesh** in the **Network** > **Wireless** > **MESH** screen. To see if your model supports 6 GHz, please see Section 1.1 on page 19 for more information.

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

Figure 88 Network Setting > Wireless > General (for 2.4G and 5G models)

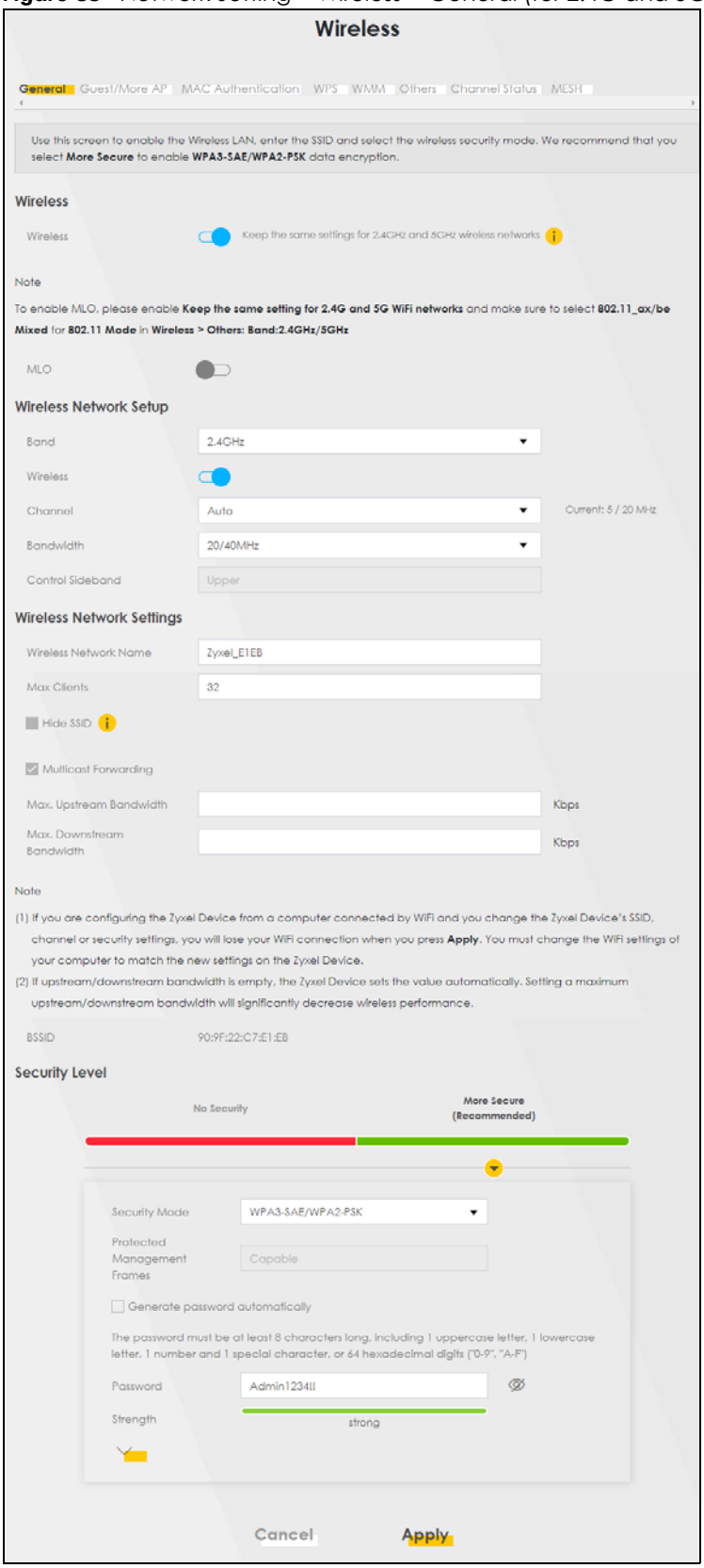
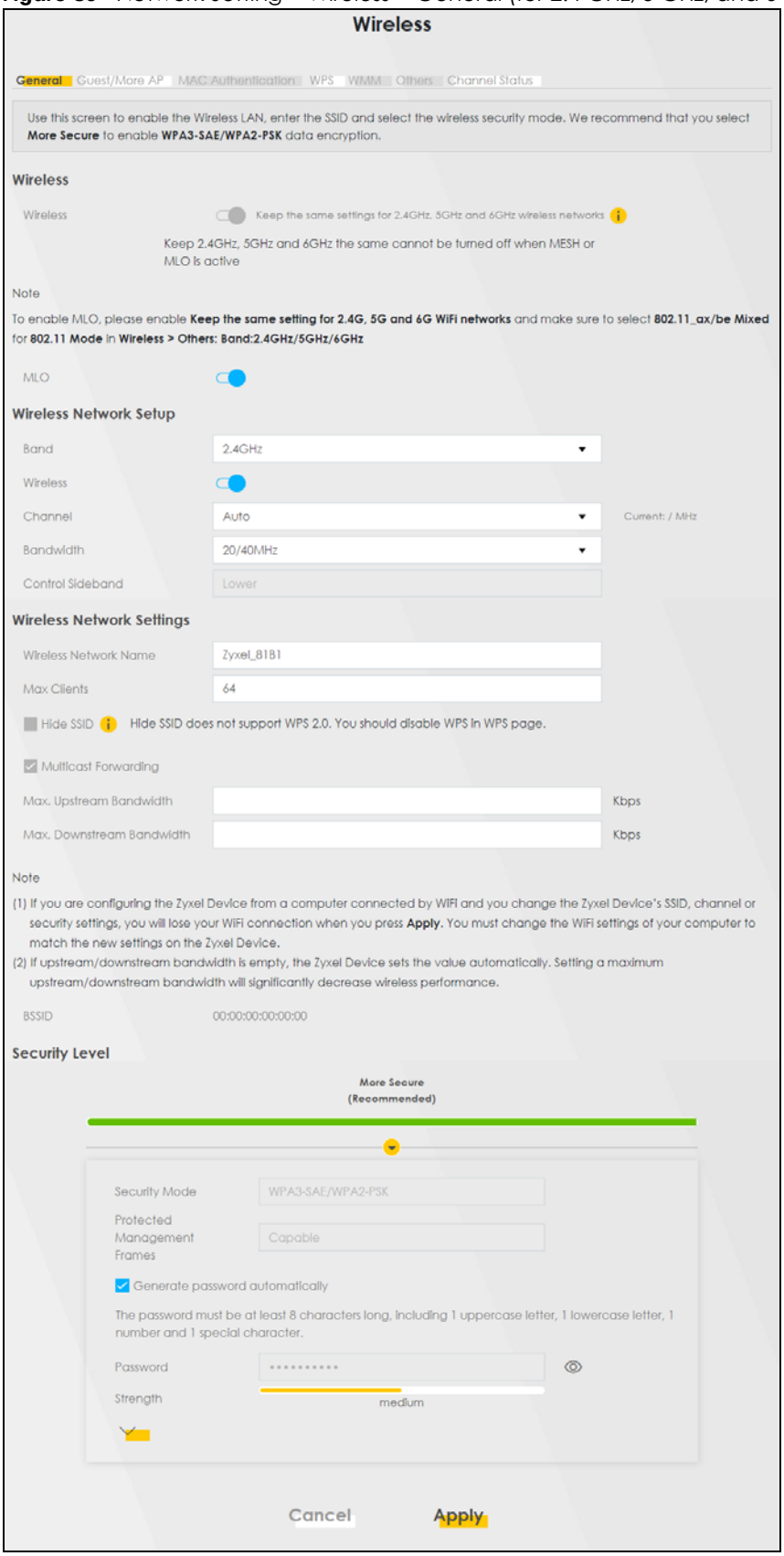


Figure 89 Network Setting > Wireless > General (for 2.4 GHz, 5 GHz, and 6 GHz models)



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

Table 36 Network Setting > Wireless > General

LABEL	DESCRIPTION
Wireless	
Wireless	Select **Keep the same settings for 2.4G, 5G and 6G wireless networks** and the 2.4 GHz, 5 GHz and 6 GHz WiFi networks will use the same SSID and wireless security settings. Note: To see if your model supports 6 GHz, please see Section 1.1 on page 19 for more information.
MLO	Select **MLO** to allow a WiFi 7 client to connect to the AP using multiple frequency bands simultaneously. This increases speed and improves reliability of the WiFi connection. MLO makes WiFi 7 ideal for streaming 4K / 8K videos, using augmented reality (AR), virtual reality (VR) applications and playing online games. Note: To enable MLO, select **Keep the same settings for 2.4G, 5G and 6G wireless networks**. Note: To use MLO, both the AP and the WiFi client have to support MLO. Note: To see if your model supports 6 GHz, please see Section 1.1 on page 19 for more information.
Wireless/WiFi Network Setup	
Band	This shows the WiFi band which this radio profile is using. **2.4GHz** is the frequency used by IEEE 802.11b/g/n/ax WiFi clients, **5GHz** is used by IEEE 802.11a/n/ac/ax WiFi clients. Note: To see if your model supports 6 GHz, please see Section 1.1 on page 19 for more information.
Wireless/WiFi	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	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 WiFi clients must also support 40 MHz. It is often better to use the 20 MHz setting in a location where the environment hinders the WiFi 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 WiFi clients do not support channel bonding. Not all Zyxel Devices support all channels. The Zyxel Device will choose the best bandwidth available automatically depending on the radio you chose and network conditions.
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/WiFi Network Settings	
Wireless/WiFi 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 for this WiFi network. You can use up to 32 printable characters, including spaces.

Table 36 Network Setting > Wireless > General (continued)

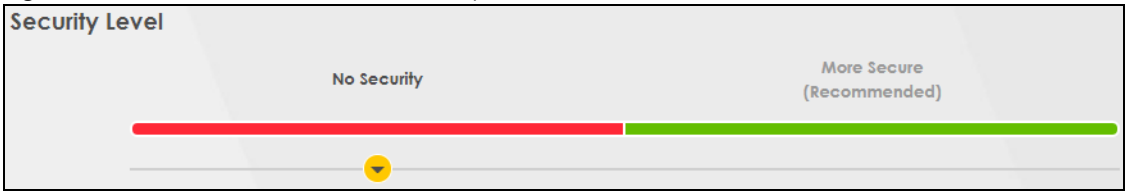
LABEL	DESCRIPTION
Max Clients	Specify the maximum number of clients that can connect to this network at the same time.
Hide SSID	Select this checkbox to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool. This checkbox is grayed out if the WPS function is enabled in the **Network Setting** > **Wireless** > **WPS** screen.
Multicast Forwarding	Select this checkbox 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	
Security Mode	Select **More Secure (Recommended)** to add security on this WiFi network. The WiFi clients which want to associate to this network must have same WiFi 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.

8.2.1 No Security

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

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

Figure 90 Wireless > General: No Security



The following table describes the labels in this screen.

Table 37 Wireless > General: No Security

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

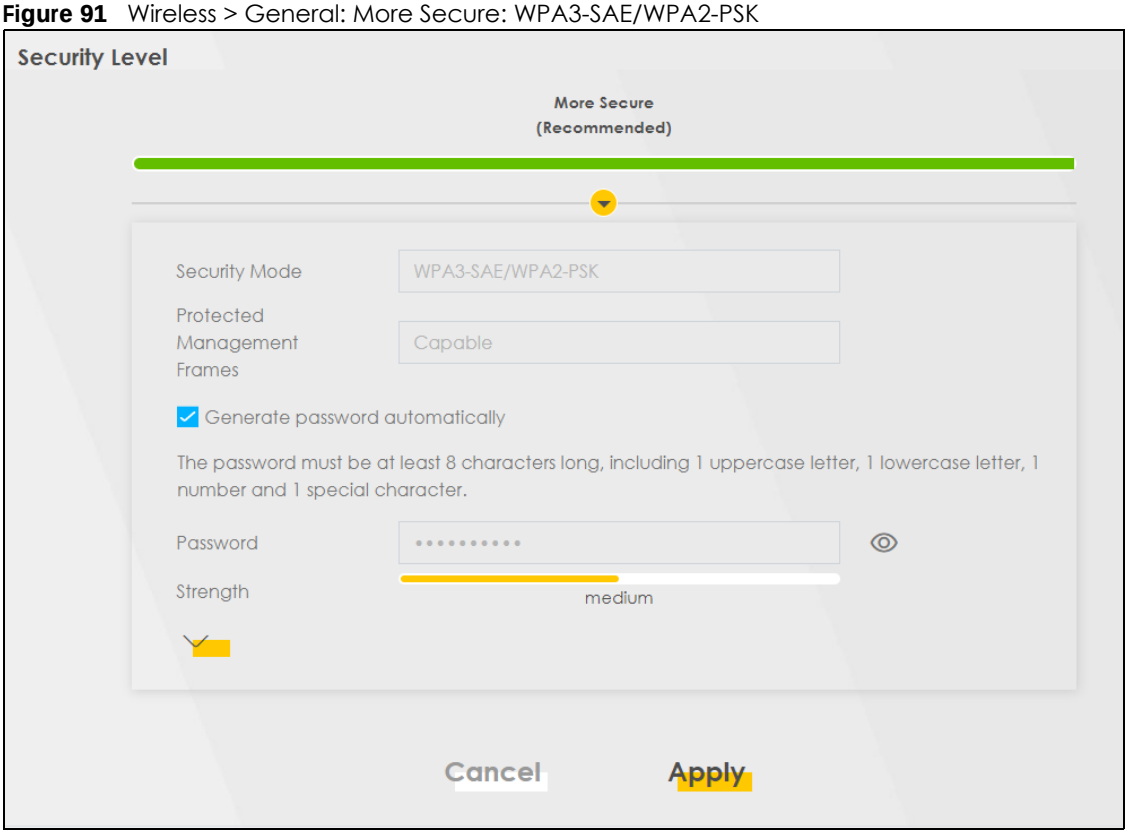
8.2.2 More Secure (Recommended)

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 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 WiFi client supports it. If you are not sure, select **WPA3-SAE/WPA2-PSK** or **WPA2-PSK**.

Figure 91 Wireless > General: More Secure: WPA3-SAE/WPA2-PSK



The following table describes the labels in this screen.

Table 38 Wireless > General: More Secure: WPA3-SAE/WPA2-PSK

LABEL	DESCRIPTION
Security Level	Select **More Secure** to enable data encryption.
Security Mode	Select a security mode from the drop-down list box.

Table 38 Wireless > General: More Secure: WPA3-SAE/WPA2-PSK (continued)

LABEL	DESCRIPTION
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. 1. Manual. Manually enter the same password on the Zyxel Device and the client. The password must be at least 8 characters long, including one uppercase letter, one lowercase letter, one number, and one special character. 2. WPS. When using WPS, the Zyxel Device sends this password to the client. Note: More than 63 hexadecimal characters are not accepted for WPS. Click the Eye icon to show or hide the password for your wireless network. When the Eye icon is slashed, you will see the password in plain text. Otherwise, it is hidden.
Strength	This displays the current password strength – **weak**, **medium**, **strong**.
Click this to show more fields in this section. Click this to hide them.	
Encryption	**AES** is the default data encryption type, which uses a 128-bit key. Select the encryption type (**AES** or **TKIP+AES**) for data encryption. Select **AES** if your WiFi clients can all use AES. Select **TKIP+AES** to allow the WiFi clients to use either TKIP or AES. Note: Not all models support **TKIP+AES** encryption.
Timer	This is the rate at which the RADIUS server sends a new group key out to all clients.

8.3 Guest/More AP Screen

Use this screen to configure a guest WiFi network that allows access to the Internet through the Zyxel Device. You can use one access point to provide several BSSs simultaneously. You can then assign varying security types to different SSIDs. WiFi clients can use different SSIDs to associate with the same access point.

Click **Network Setting** > **Wireless** > **Guest/More AP**.

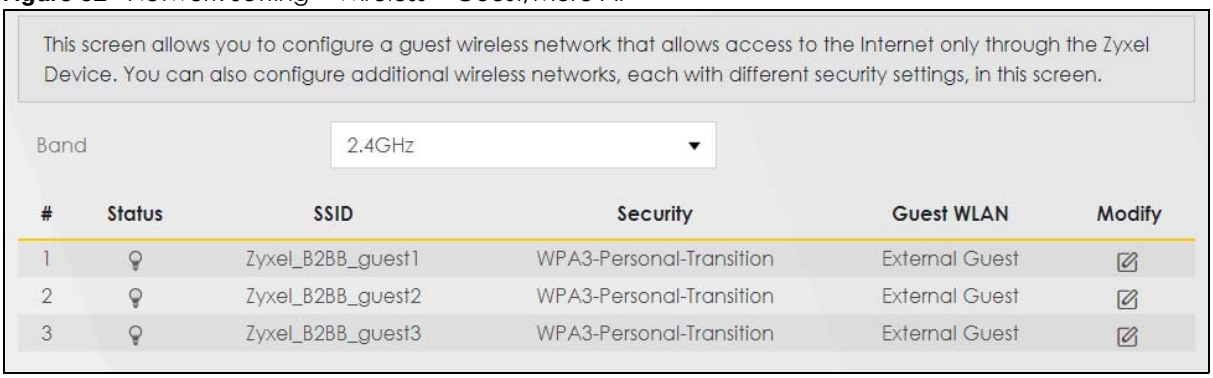
The following table introduces the supported WiFi networks.

Table 39 Supported WiFi Networks

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

The following screen displays.

Figure 92 Network Setting > Wireless > Guest/More AP



The following table describes the labels in this screen.

Table 40 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.
Security	This field indicates the security mode of the SSID profile.
Guest WLAN	This displays if the guest WLAN function has been enabled for this WLAN. A **Home Guest** can access the Internet, LAN wired devices connected to the Zyxel Device, and other Home Guest WiFi clients. An **External Guest** can just access the Internet through the Zyxel Device. **N/A** displays if guest WLAN is disabled.
Modify	Click the **Edit** icon of an SSID profile to configure the SSID profile.

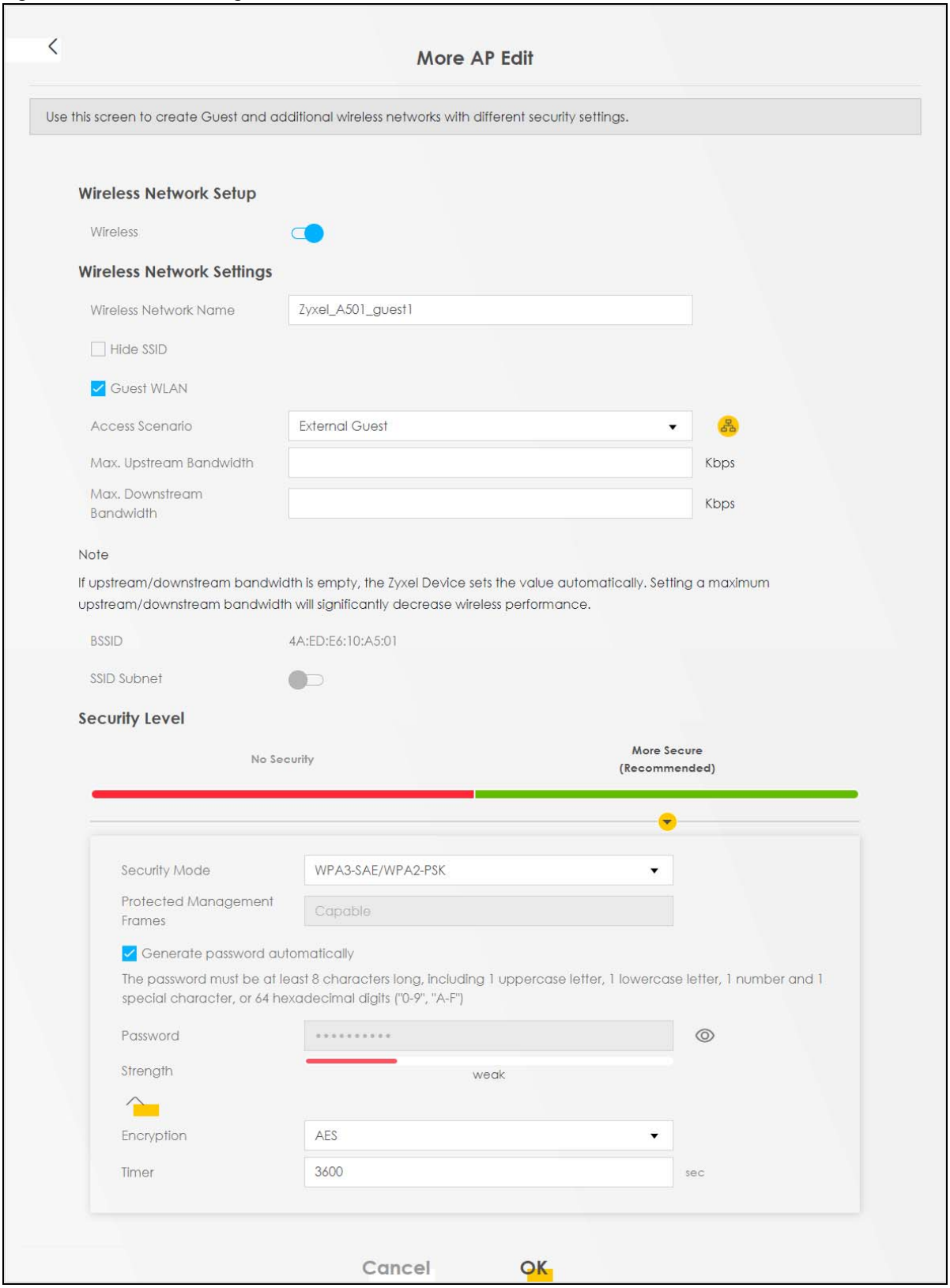
8.3.1 The Edit Guest/More AP Screen

Use this screen to create Guest and additional WiFi 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 WiFi performance.

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

Figure 93 Network Setting > Wireless > Guest/More AP > Edit



The following table describes the fields in this screen.

Table 41 Network Setting > Wireless > Guest/More AP > Edit

LABEL	DESCRIPTION
WiFi/Wireless Network Setup	
WiFi/Wireless	Click this switch to enable or disable the WiFi in this field. When the switch turns blue, the function is enabled; otherwise, it is not.
WiFi/Wireless Network Settings	
WiFi/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 for the WiFi. You can use up to 32 printable characters, including spaces.
Hide SSID	Select this checkbox 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 WLANs for home and external clients. Select the WLAN type in the **Access Scenario** field.
Access Scenario	Select **Home Guest** or **External Guest** to provide different levels of access to the Zyxel Device and the other WiFi clients. A **Home Guest** can access the Internet, LAN wired devices connected to the Zyxel Device, and other Home Guest WiFi clients. An **External Guest** can just access the Internet through the Zyxel Device.
BSSID	This shows the MAC address of the WiFi interface on the Zyxel Device when WiFi is enabled.
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 WiFi 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	
Security Mode	Select **More Secure (Recommended)** to add security on this WiFi network. The WiFi clients which want to associate to this network must have the same WiFi 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 8.2.1 on page 172 for more details about this field.
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	WPA2-PSK uses a simple common password, instead of user-specific credentials. 1. If you did not select **Generate password automatically**, you can manually enter a pre-shared key at least 8 characters long, including one uppercase letter, one lowercase letter, one number, and one special character. Click the Eye icon to show or hide the password of your WiFi network. When the Eye icon is slashed, you will see the password in plain text. Otherwise, it is hidden.
Strength	This displays the current password strength – **weak**, **medium**, **strong**.
Click this to show more fields in this section. Click again to hide them.	

Table 41 Network Setting > Wireless > Guest/More AP > Edit (continued)

LABEL	DESCRIPTION
Encryption	Select the encryption type (**AES** or **TKIP+AES**) for data encryption. Select **AES** if your WiFi clients can all use AES. Select **TKIP+AES** to allow the WiFi clients to use either TKIP or AES. Not all models support the **TKIP+AES** option.
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.
OK	Click **OK** to save your changes.

8.4 MAC Authentication

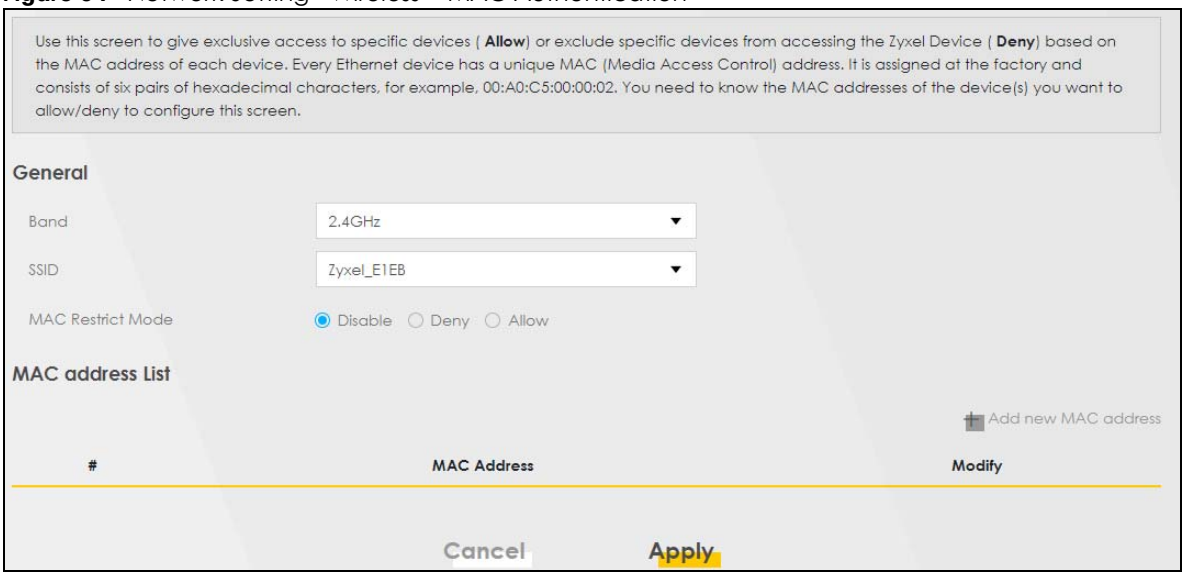
Use this screen to give exclusive access to specific connected devices **(Allow)** or exclude specific devices from accessing the Zyxel Device **(Deny),** based on the MAC address of each connected device. Every Ethernet device has a unique factory-assigned MAC (Media Access Control) address, which consists of six pairs of hexadecimal characters, for example: 00:A0:C5:00:00:02. You need to know the MAC addresses of the connected device you want to allow/deny to configure this screen.

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

Note: This screen is not available when Mesh is enabled in the **Network Setting** > **Wireless** > **MESH** screen.

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 94 Network Setting> Wireless > MAC Authentication



The following table describes the labels in this screen.

Table 42 Network Setting > Wireless > MAC Authentication

LABEL	DESCRIPTION
General	
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	
#	This is the index number of the entry.
MAC Address	This is the MAC addresses of the devices that are allowed or denied access to the Zyxel Device.
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 exit this screen without saving.
Apply	Click **Apply** to save your changes.

8.5 WPS

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

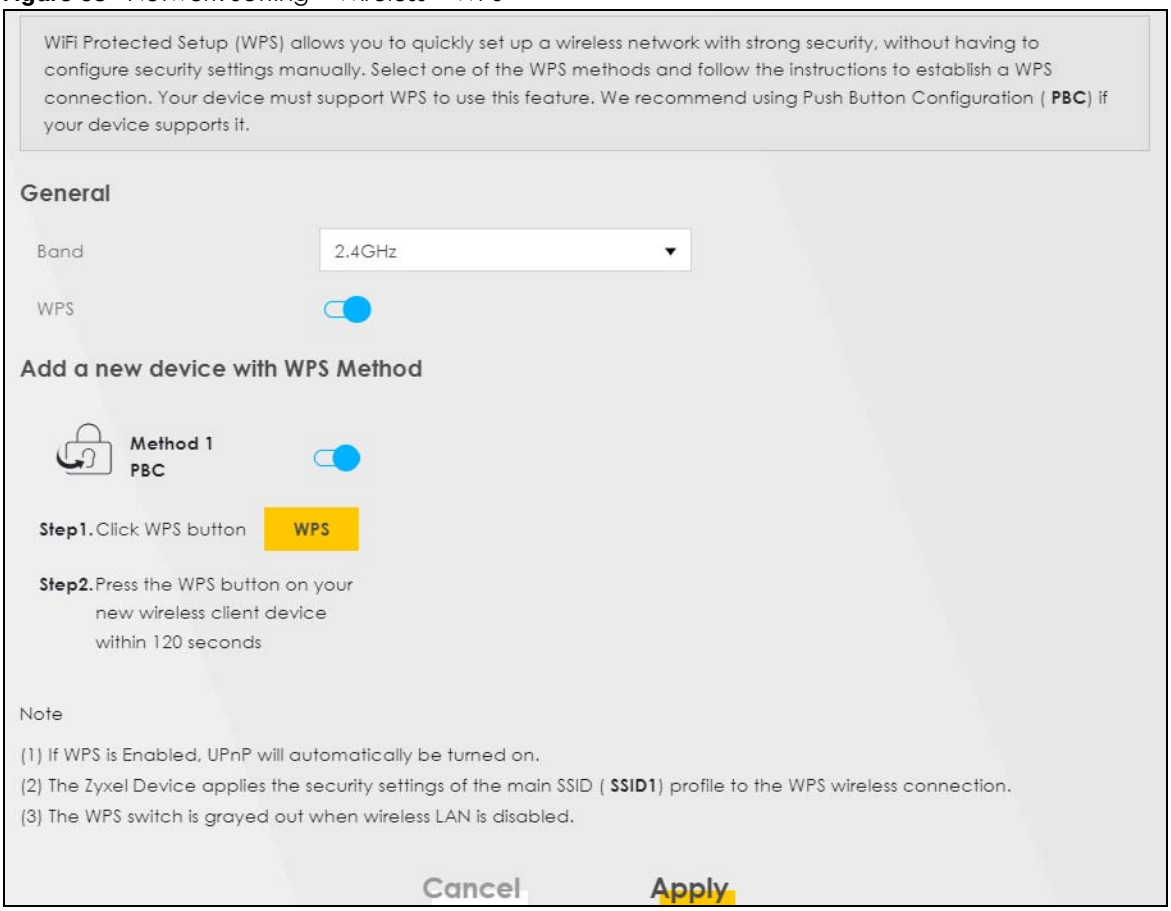
WiFi Protected Setup (WPS) allows you to quickly set up a WiFi network with strong security, without having to configure security settings manually. Select one of the WPS methods and follow the instructions to establish a WPS connection.Your WiFi devices must support WPS to use this feature. We recommend using Push Button Configuration (**PBC**) if your WiFi device supports it.

Note: The Zyxel Device applies the security settings of the main SSID (**SSID1**) profile to the WPS wireless connection (see Section 8.2.2 on page 173). Some models support more than one SSID profile, check the supported number on the **Network Setting** > **Wireless** > **General** screen.

Note: The WPS switch is unavailable if the WiFi is disabled.
If WPS is enabled, UPnP will automatically be turned on.

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

Figure 95 Network Setting > Wireless > WPS



The following table describes the labels in this screen.

Table 43 Network Setting > Wireless > WPS

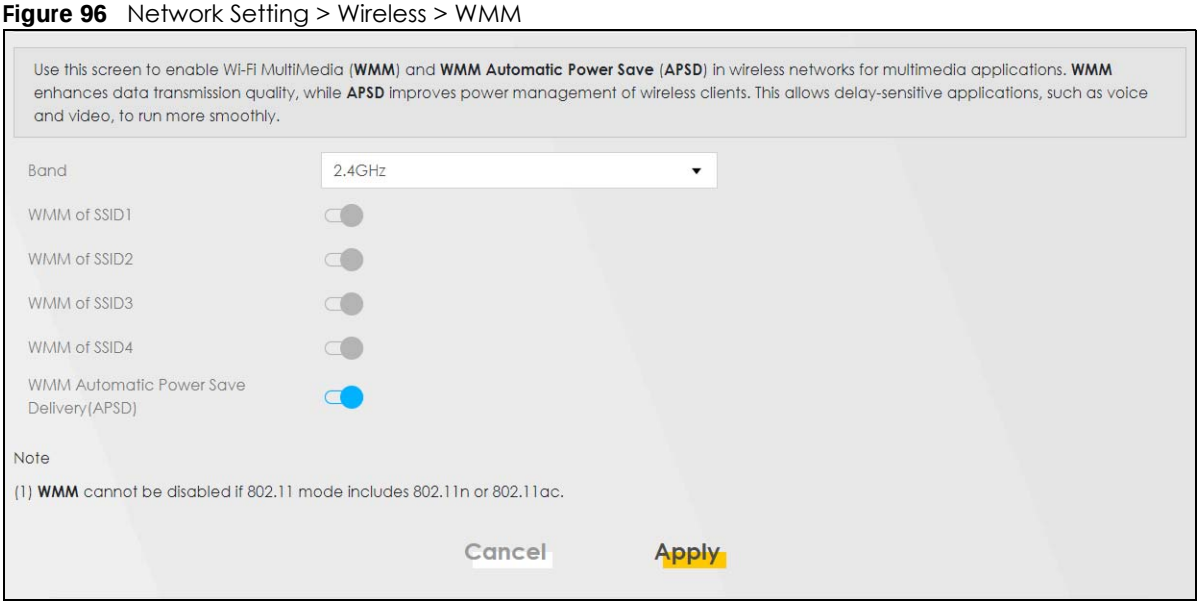
LABEL	DESCRIPTION
General	
WPS	Slide this to the right to enable and have the Zyxel Device activate WPS. Otherwise, it is disabled.
Add a new device with WPS Method	
Method 1 PBC	Use this section to set up a WPS network using Push Button Configuration (PBC). Click this switch to make it turn blue. Click **Apply** to activate WPS method 1 on the Zyxel Device.
WPS	Click this button to add another WPS-enabled device (within range of the Zyxel Device) to your network. This button may either be a physical button on the outside of a WiFi device, or a menu button similar to the **WPS button** on this screen. Note: You must press the other device's WPS button within 2 minutes of pressing this button.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

8.6 WMM

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

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

Figure 96 Network Setting > Wireless > WMM



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.

Note: This screen is not available when Mesh is enabled in the **Network Setting** > **Wireless** > **MESH** screen.

The following table describes the labels in this screen.

Table 44 Network Setting > Wireless > WMM

LABEL	DESCRIPTION
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 device to which the Zyxel Device is connected also supports this feature.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

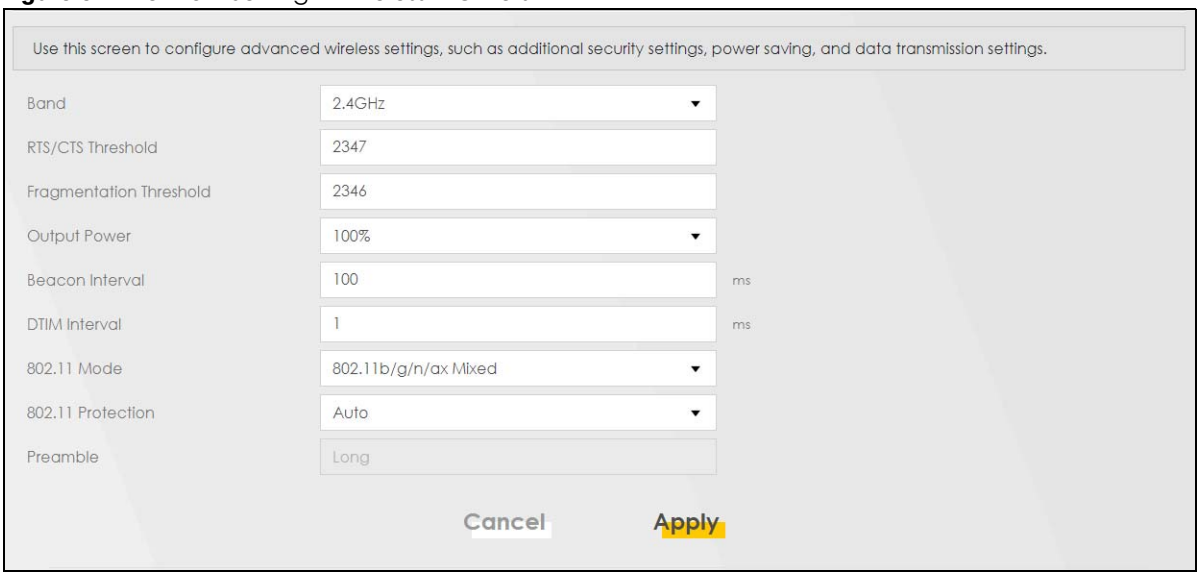
8.7 Others

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

Note: This screen is not available when Mesh is enabled in the **Network Setting** > **Wireless** > **MESH** screen.

See Section 8.10.2 on page 187 for detailed definitions of the terms listed here.

Figure 97 Network Setting > Wireless > Others



The following table describes the labels in this screen.

Table 45 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%**.
Beacon Interval	When a wirelessly networked device sends a beacon, it includes with it a beacon interval. This specifies the time period before the device sends the beacon again. The interval tells receiving devices on the network how long they can wait in low power mode before waking up to handle the beacon. This value can be set from 50 ms to 1000 ms. A high value helps save current consumption of the access point.
DTIM Interval	Delivery Traffic Indication Message (DTIM) is the time period after which broadcast and Multicast packets are transmitted to mobile clients in the Power Saving mode. A high DTIM value can cause clients to lose connectivity with the network. This value can be set from 1 to 255.

Table 45 Network Setting > Wireless > Others (continued)

LABEL	DESCRIPTION
802.11 Protection	Enabling this feature can help prevent collisions in mixed-mode networks (networks with both IEEE 802.11b and IEEE 802.11g traffic). Select **Auto** to have the wireless devices transmit data after a RTS/CTS handshake. This helps improve IEEE 802.11g performance. Select **Off** to disable 802.11 protection. The transmission rate of your Zyxel Device might be reduced in a mixed-mode network. This field displays **Off** and is not configurable when you set **802.11 Mode** to **802.11b Only**.
Preamble	Select a preamble type from the drop-down list box. Choices are **Long** or **Short**. See Section 8.10.7 on page 190 for more information. This field is configurable only when you set 802.11 Mode to **802.11b**.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

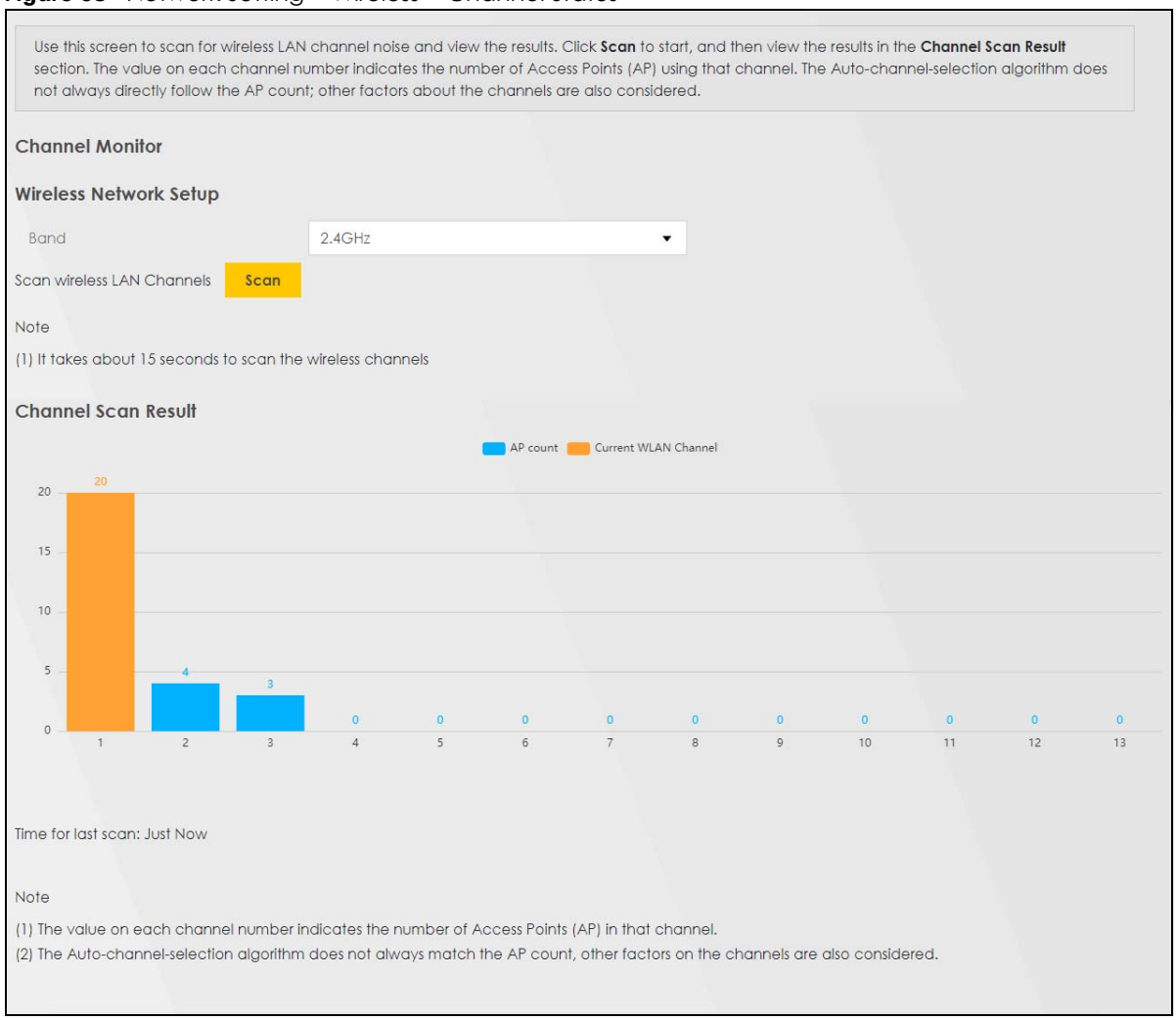
8.8 Channel Status

Use this screen to scan for WiFi channel noise and view the results. Click **Scan** to start, and then view the results in the **Channel Scan Result** section. The value on each channel number indicates the number of Access Points (AP) using that channel. The Auto-channel-selection algorithm does not always directly follow the AP count; other factors about the channels are also considered. Click **Network Setting** > **Wireless** > **Channel Status**. The screen appears as shown.

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 AP count may not be a real-time value.

Figure 98 Network Setting > Wireless > Channel Status



The following table describes the labels in this screen.

Table 46 Network Setting > Wireless > Channel Status

LABEL	DESCRIPTION
Channel Monitor	
Wireless Network Setup	
Band	Select a **2.4 GHz**, **5 GHz or 6 GHz** frequency band on which you want to conduct a channel scan.
Scan WiFi LAN Channels	Click the **Scan** button to scan WiFi channels.
Channel Scan Result	This displays the results of the channel scan. The blue bar displays the number of access points (**AP count**) in the WiFi channel. The orange bar displays the WiFi channel that the Zyxel Device is now using.

8.9 MESH

The Zyxel Device supports Mesh to manage your WiFi network. Mesh is the Zyxel implantation of WiFi-Alliance Easy Mesh. It supports AP steering, band steering, auto-configuration and other advances for your WiFi network.

The Zyxel Device can function as a controller to automatically configure WiFi settings on extenders in the network as well as optimize bandwidth usage.

The Zyxel Device optimizes bandwidth usage by directing WiFi clients to an extender (AP steering) or a 2.4GHz/ 5GHz band (band steering) that is less busy.

See Section 1.3 on page 27 for the complete tutorials with the Zyxel One app.

- Setting up your Mesh network with the Zyxel Device and an Mesh extender,
- setting up your general/guest WiFi,
- basic configurations.

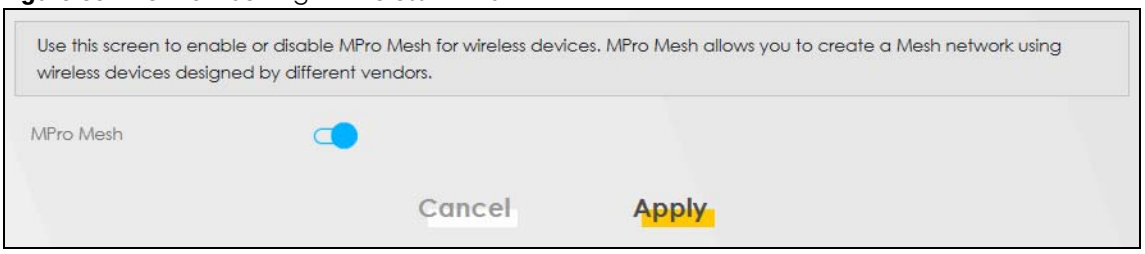
8.9.1 MPro Mesh

Use this screen to enable or disable the Mesh on theZyxel Device.

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

Note: When Mesh is enabled, the SSID and WiFi password of the main 2.4 GHz WiFi network will be copied to the main 5 GHz WiFi network.

Figure 99 Network Setting > Wireless > MESH



The following table describes the labels in this screen.

Table 47 Network Setting > Wireless > MESH

LABEL	DESCRIPTION
MPro Mesh	Click the button (to the right) to enable the Mesh feature on the Zyxel Device and set up your Mesh network.

8.10 Technical Reference

This section discusses WiFi in depth.

8.10.1 WiFi Network Overview

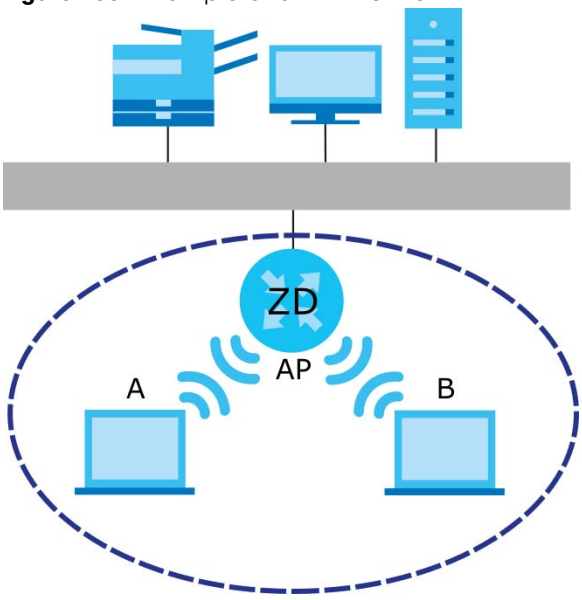
WiFi networks consist of WiFi clients, access points and bridges.

- A WiFi 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 WiFi clients and let them access the network.
- A bridge is a radio that relays communications between access points and WiFi clients, extending a network's range.

Normally, a WiFi network operates in an "infrastructure" type of network. An "infrastructure" type of network has one or more access points and one or more WiFi clients. The WiFi clients connect to the access points.

The following figure provides an example of a WiFi network.

Figure 100 Example of a WiFi Network



The WiFi network is the part in the blue circle. In this WiFi 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 WiFi network must follow these basic guidelines.

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

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

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

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

8.10.2 Additional WiFi Terms

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

Table 48 Additional Terms

TERM	DESCRIPTION
RTS/CTS Threshold	In a network which covers a large area, 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 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 devices never have to get permission to send information to the Zyxel Device.
Preamble	A preamble affects the timing in your network. There are two preamble modes: long and short. If a WiFi 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 device is allowed to use the 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.

8.10.3 WiFi Security Overview

By their nature, radio communications are simple to intercept. For WiFi data networks, this means that anyone within range of a WiFi 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 WiFi 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 is not just people who have sensitive information on their network who should use security. Everybody who uses any WiFi 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 WiFi security you can set up in the WiFi network.

8.10.3.1 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 WiFi devices to get the SSID. In addition, unauthorized WiFi devices can still see the information that is sent in the WiFi network.

8.10.3.2 MAC Address Filter

Every device that can use a WiFi network has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each WiFi device in the WiFi network, see the WiFi 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 WiFi network. If a WiFi device is allowed to use the WiFi network, it still has to have the correct information (SSID, channel, and security). If a WiFi device is not allowed to use the WiFi 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 WiFi network. Furthermore, there are ways for unauthorized WiFi devices to get the MAC address of an authorized WiFi device. Then, they can use that MAC address to use the WiFi network.

8.10.3.3 Encryption

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

The types of encryption you can choose depend on the type of authentication. (See Section 8.10.3.3 on page 188 for information about this.)

Table 49 Types of Encryption for Each Type of Authentication

	NO AUTHENTICATION	RADIUS SERVER
Weakest	No Security	WPA
↕	WPA-PSK	
	WPA2	WPA2
Strongest	WPA3-SAE	WPA3 (server certificate validation)

1. Some devices, such as scanners, can detect networks but cannot use 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.

For example, if the WiFi network has a RADIUS server, you can choose **WPA**, **WPA2**, or **WPA3**. If users do not log in to the WiFi network, you can choose no encryption, **WPA2-PSK**, or **WPA3-SAE**.

Note: It is recommended that WiFi networks use **WPA3-SAE**, **WPA2-PSK**, or stronger encryption. The other types of encryption are better than none at all, but it is still possible for unauthorized WiFi devices to figure out the original information pretty quickly.

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

8.10.4 Signal Problems

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

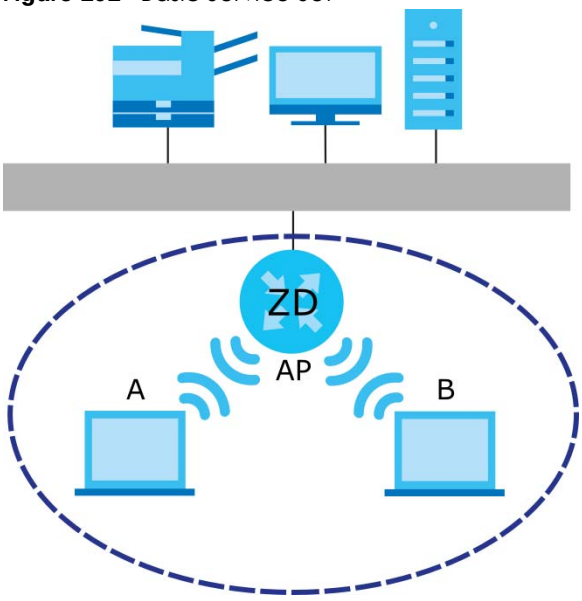
Problems with distance occur when the two radios are too far apart. Problems with interference occur when other radio waves interrupt the data signal. Interference may come from other radio transmissions, such as military or air traffic control communications, or from machines that are coincidental emitters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

8.10.5 BSS

A Basic Service Set (BSS) exists when all communications between wireless stations 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 101 Basic Service Set



8.10.6 MBSSID

Traditionally, you need to use different APs to configure different Basic Service Sets (BSSs). As well as the cost of buying extra APs, there is also the possibility of channel interference. The 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.

8.10.6.1 Notes on Multiple BSSs

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

8.10.7 Preamble Type

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

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

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

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

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

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

8.10.8 WiFi Protected Setup (WPS)

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

WPS allows you to quickly set up a WiFi 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 2 minutes to find another device that also has WPS activated. Then, the two devices connect and set up a secure network by themselves.

8.10.8.1 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 WiFi 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).
3. Press the button on one of the devices (it does not matter which). For the Zyxel Device you must press the **WiFi** button for more than 5 seconds.
4. Within 2 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.

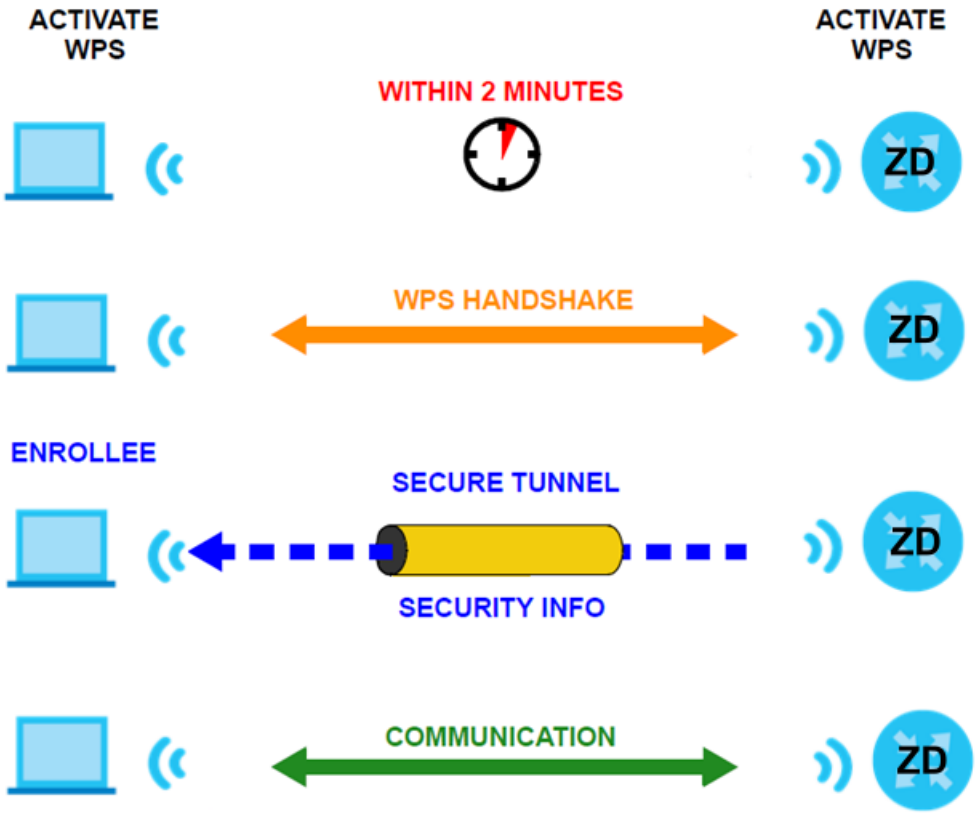
   If you need to make sure that WPS worked, check the list of associated WiFi clients in the AP's configuration utility. If you see the WiFi client in the list, WPS was successful.

8.10.8.2 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 102 How WPS Works



The roles of registrar and enrollee last only as long as the WPS setup process is active (2 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 WiFi client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled WiFi clients.

By default, a WPS device is 'un-configured'. 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 un-configured, 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 WiFi 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.

8.10.8.3 Example WPS Network Setup

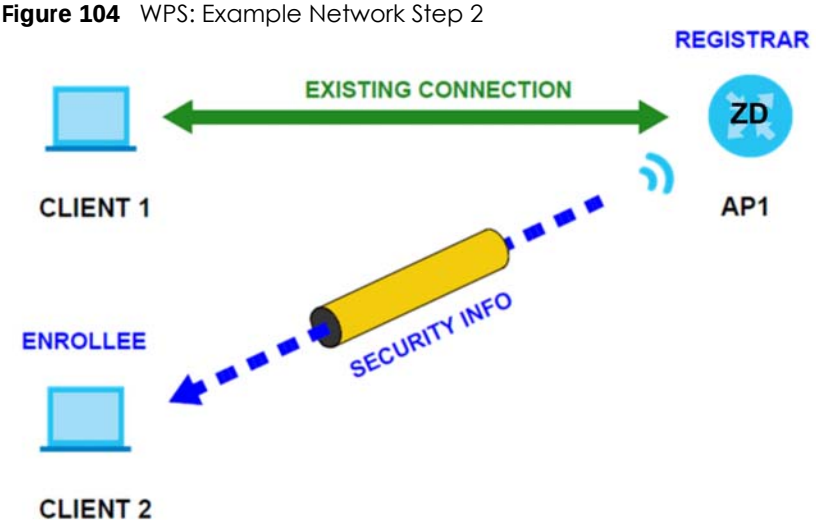
This section shows how security settings are distributed in a sample WPS setup.

The following figure shows a sample network. In step 1, both **AP1** and **Client 1** are un-configured. 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 un-configured and has no existing information.

Figure 103 WPS: Example Network Step 1

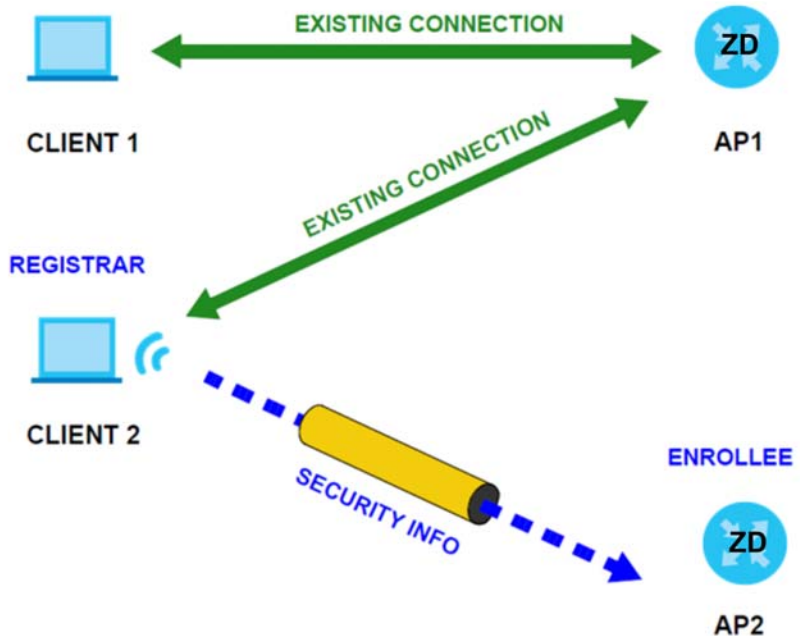
In step 2, you add another WiFi client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the registrar,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

Figure 104 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 105 WPS: Example Network Step 3



8.10.8.4 Limitations of WPS

WPS has some limitations of which you should be aware.

- 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 was 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 only works simultaneously between two devices, 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 WiFi 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.

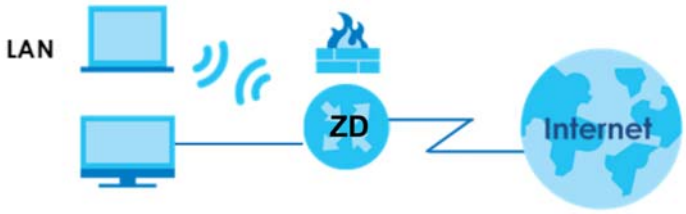
CHAPTER 9
Home Networking

9.1 Home Networking Overview

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

The LAN screens can help you configure a LAN DHCP server and manage IP addresses.

Figure 106 Home Networking Example



9.1.1 What You Can Do in this Chapter

- Use the **LAN Setup** screen to set the LAN IP address, subnet mask, and DHCP settings (Section 9.2 on page 197).
- Use the **Static DHCP** screen to assign IP addresses on the LAN to specific individual computers based on their MAC addresses (Section 9.3 on page 202).
- Use the **UPnP** screen to enable UPnP (Section 9.4 on page 204).
- Use the **Additional Subnet** screen to configure IP alias and public static IP (Section 9.5 on page 205).
- 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 9.6 on page 207).
- Use the **Wake on LAN** screen to remotely turn on a device on the network. (Section 9.7 on page 208).
- Use the **TFTP Server Name** screen to identify a TFTP server for configuration file download using DHCP option 66. (Section 9.8 on page 209).

9.1.2 What You Need To Know

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

9.1.2.1 About LAN

IP Address

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. This is known as an Internet Protocol address.

Subnet Mask

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.

DHCP

DHCP (Dynamic Host Configuration Protocol) allows clients to obtain TCP/IP configuration at start-up from a server. This Zyxel Device has a built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

DNS

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.

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.

9.1.2.2 About UPnP

How do I know if I am using UPnP?

UPnP hardware is identified as an icon in the Network Connections folder (Windows 7). 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.

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).

See Section 9.11 on page 214 for examples on installing and using UPnP.

9.1.3 Before You Begin

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

9.2 LAN Setup

A LAN IP address is the IP address of a networking device in the LAN. You can use the Zyxel Device's LAN IP address to access its Web Configurator from the LAN. The DHCP server settings define the rules on assigning IP addresses to LAN clients on your network.

Use this screen to set the Local Area Network 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 107 Network Setting > Home Networking > LAN Setup

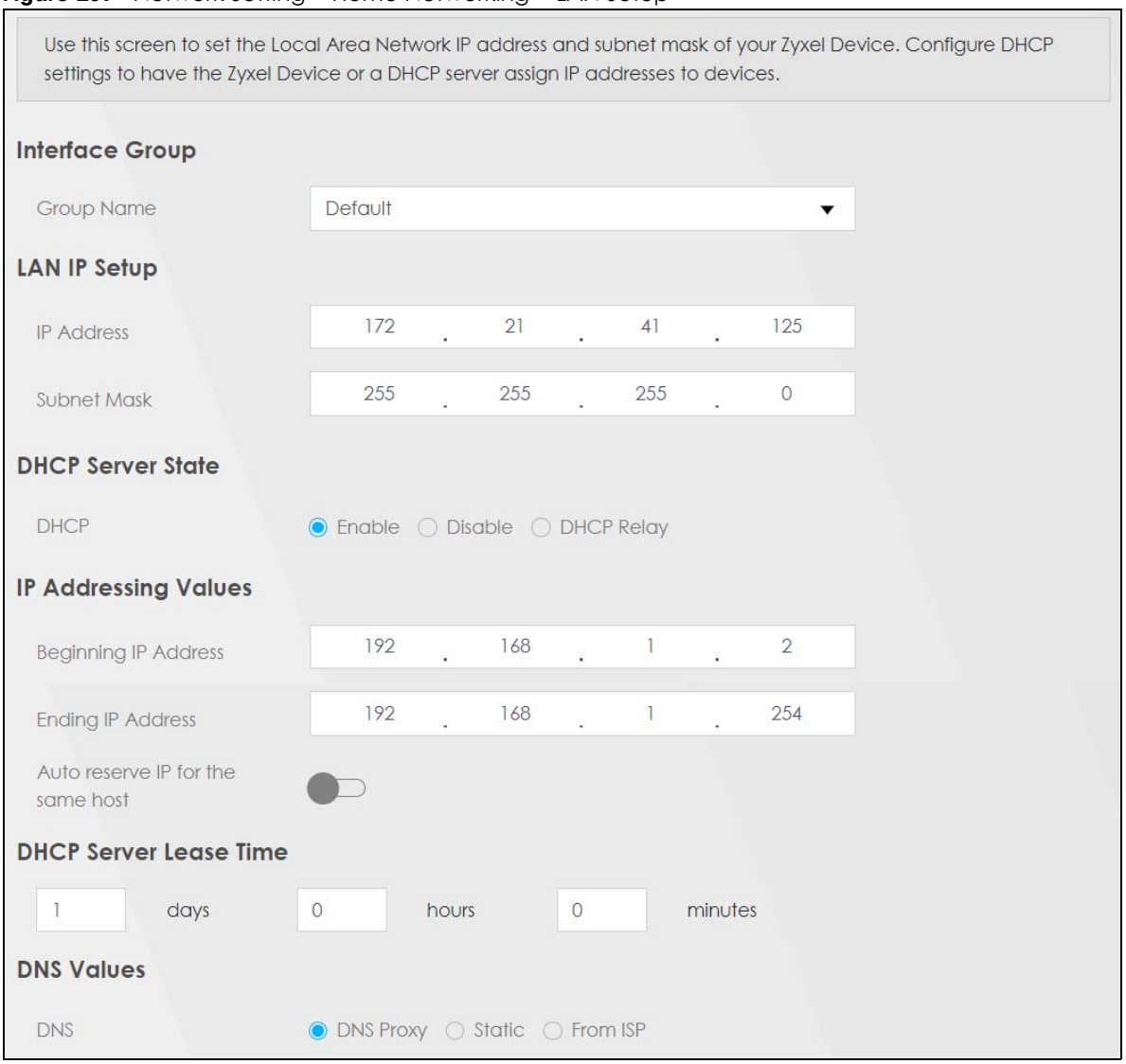
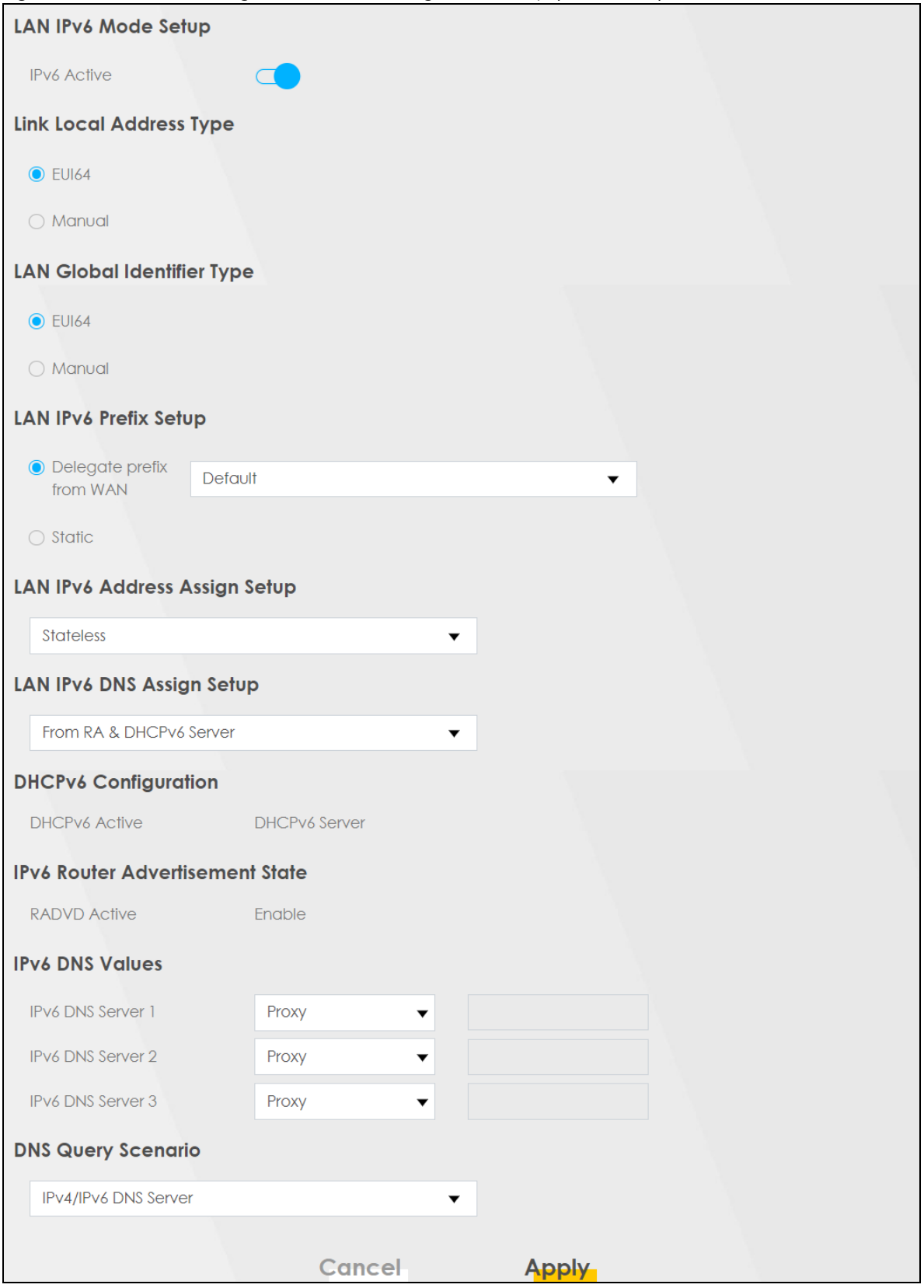


Figure 108 Network Setting > Home Networking > LAN Setup (Continued)



The following table describes the fields in this screen.

Table 50 Network Setting > Home Networking > LAN Setup

LABEL	DESCRIPTION
Interface Group	
Group Name	Select the interface group that you want to configure its LAN settings.
LAN IP Setup	
IP Address	Enter the LAN IP address you want to assign to your Zyxel Device in dotted decimal notation, for example, (factory default).
Subnet Mask	Enter the subnet mask of your network in dotted decimal notation, for example 255.255.255.0 (factory default). Your Zyxel Device automatically computes the subnet mask based on the IP address you enter, so do not change this field unless you are instructed to do so.
DHCP Server State	
DHCP	Select **Enable** to have your Zyxel Device assign IP addresses, an IP default gateway and DNS servers to LAN computers and other devices that are DHCP clients. If you select **Disable**, you need to manually configure the IP addresses of the computers and other devices on your LAN. If you select **DHCP Relay**, the Zyxel Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients.
IP Addressing Values The **IP Addressing Values** fields appear only 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	Enable this if you want to reserve the IP address for the same host.
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	DHCP server leases an address to a new client device for a period of time, called the DHCP lease time. When the lease expires, the DHCP server might assign the IP address to a different client device.
DNS Values This field appears only when you select **Enable** in the **DHCP** field.	
DNS	The Zyxel Device supports DNS proxy by default. The Zyxel Device sends out its own LAN IP address to the DHCP clients as the first DNS server address. DHCP clients use this first DNS server to send domain-name queries to the Zyxel Device. The Zyxel Device sends a response directly if it has a record of the domain-name to IP address mapping. If it does not, the Zyxel Device queries an outside DNS server and relays the response to the DHCP client. Select **DNS Proxy** to have the DHCP clients use the Zyxel Device's own LAN IP address. The Zyxel Device works as a DNS relay. Select **Static** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. Select **From ISP** if your ISP dynamically assigns DNS server information (and the Zyxel Device's WAN IP address).

Table 50 Network Setting > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
LAN IPv6 Mode Setup	
IPv6 Active	Use this to enable or disable IPv6 on the Zyxel Device. When IPv6 is used, the following fields need to be set.
Link Local Address Type	A link-local address uniquely identifies a device on the local network (the LAN). It is similar to a "private IP address" in IPv6. 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. Select **EUI64** to allow the Zyxel Device to generate an interface ID for the LAN interface's link-local address using the EUI-64 format. Otherwise, enter an interface ID for the LAN interface's link-local address if you select **Manual**. Link-local Unicast Address Format 1111 1110 10 | 0 | Interface ID 10 bits | 54 bits | 64 bits
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	Select **EUI64** to have the Zyxel Device generate an interface ID using the EUI-64 format for its global address. Select **Manual** to manually enter an interface ID for the LAN interface's global IPv6 address.
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	Select **Delegate prefix from WAN** to automatically obtain an IPv6 network prefix from the service provider or an uplink router. Select **Static** to configure a fixed IPv6 address for the Zyxel Device's LAN IPv6 address.
Delegate prefix from WAN	Select this option to automatically obtain an IPv6 network prefix from the service provider or an uplink router.
Static	Select this option to configure a fixed IPv6 address for the Zyxel Device's LAN IPv6 address.
LAN IPv6 Address Assign Setup	Select how you want to obtain an IPv6 address: **Stateless**: The Zyxel Device uses IPv6 stateless auto-configuration. 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 auto-configuration. 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: **From RA & DHCPv6 Server**: The Zyxel Device provides DNS information through both router advertisements and DHCPv6. **From DHCPv6 Server**: The Zyxel Device provides DNS information through DHCPv6. **From Router Advertisement**: The Zyxel Device provides DNS information through router advertisements.
DHCPv6 Configuration	
DHCPv6 Active	This shows the status of the DHCPv6. **DHCP 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	

Table 50 Network Setting > Home Networking > LAN Setup (continued)

LABEL	DESCRIPTION
RADVD Active	This shows whether RADVD is enabled or not.
IPv6 DNS Values	
IPv6 DNS Server 1 – 3	Specify the IP addresses up to three DNS servers for the DHCP clients to use. Use one of the following ways to specify these IP addresses. **User Defined** – Select this if you have the IPv6 address of a DNS server. Enter the DNS server IPv6 addresses the Zyxel Device passes to the DHCP clients. **From ISP** – Select this if your ISP dynamically assigns IPv6 DNS server information. **Proxy** – Select this if the DHCP clients use the IP address of this interface and the Zyxel Device works as a DNS relay. Otherwise, select **None** if you do not want to configure IPv6 DNS servers.
DNS Query Scenario	Select how the Zyxel Device handles clients' DNS information requests. **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.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

9.3 Static DHCP

When any of the LAN clients in your network want an assigned fixed IP address, add a static lease for each LAN client. Knowing the LAN client's MAC addresses is necessary. This table allows you to assign IP addresses on the LAN to individual computers based on their MAC addresses.

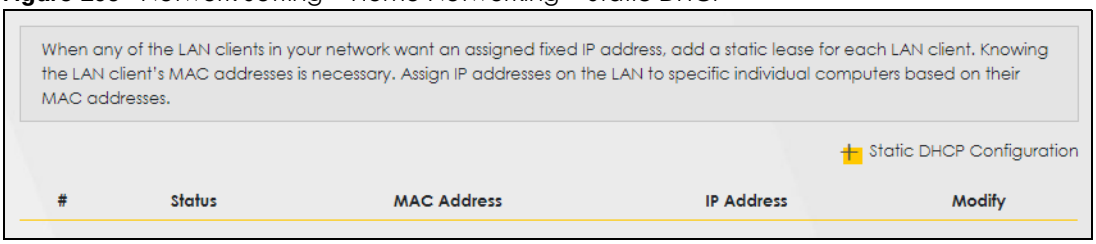
Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.

9.3.1 Before You Begin

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

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 109 Network Setting > Home Networking > Static DHCP



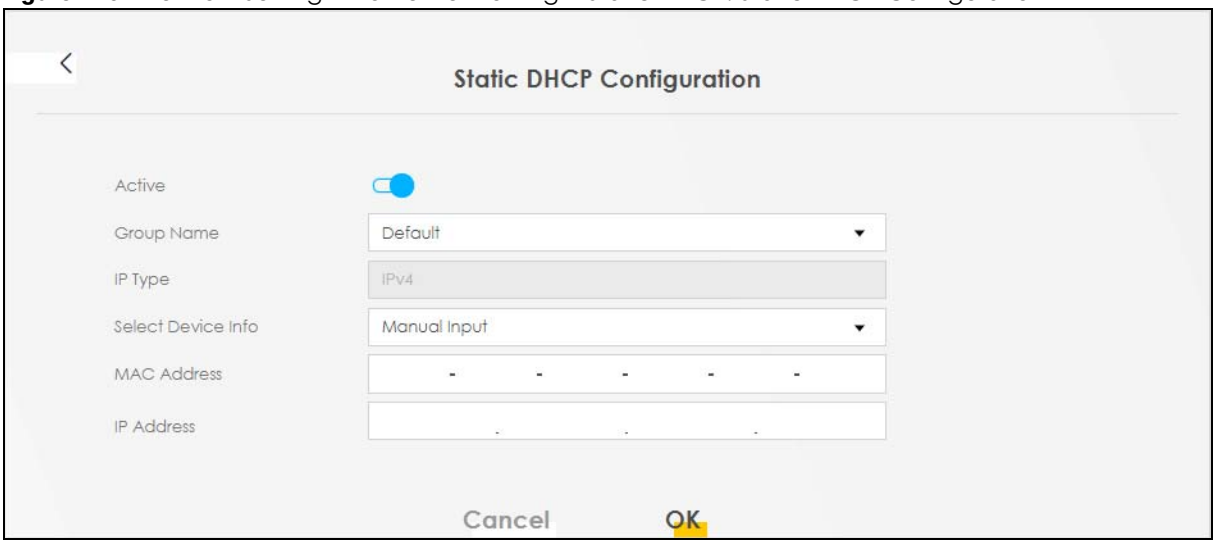
The following table describes the labels in this screen.

Table 51 Network Setting > Home Networking > Static DHCP

LABEL	DESCRIPTION
Static DHCP Configuration	Click this to configure a 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 configure the connection. Click the **Delete** icon to remove the connection.

If you click **Static DHCP Configuration** in the **Static DHCP** screen, the following screen displays. Using a static DHCP means a LAN client will always have the same IP address assigned to it by the DHCP server. Assign a fixed IP address to a client device by selecting the interface group of this client 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 110 Network Setting > Home Networking > Static DHCP: Static DHCP Configuration



The following table describes the labels in this screen.

Table 52 Network Setting > Home Networking > Static DHCP: Configuration

LABEL	DESCRIPTION
Active	Select **Enable** to activate static DHCP in your
Group Name	Select the interface group for which you want to configure the static DHCP settings.
IP Type	The **IP Type** is normally **IPv4** (non-configurable).
Select Device Info	Select between **Manual Input** which allows you to enter the next two fields (**MAC Address** and **IP Address**); or select an existing
MAC Address	Enter the MAC address of a computer on your LAN if you select **Manual Input** in the previous field.
IP Address	Enter the IP address that you want to assign to the computer on your LAN with the MAC address that you will also specify if you select **Manual Input** in the previous field.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to exit this screen without saving.

9.4 UPnP

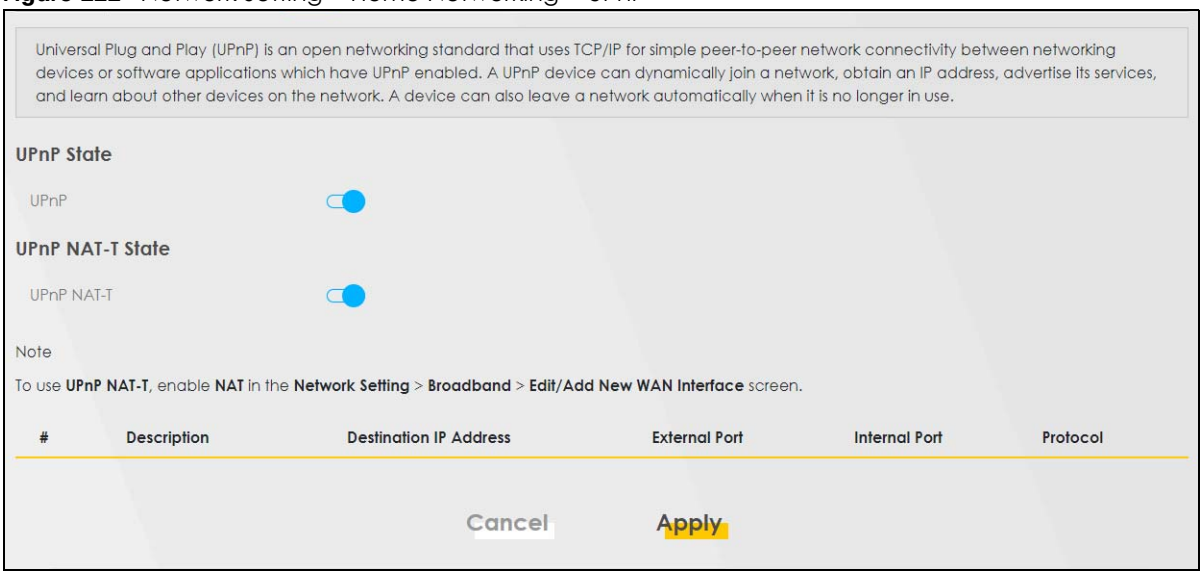
Universal Plug and Play (UPnP) is an open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between networking devices or software applications which have UPnP enabled. A UPnP device can dynamically join a network, obtain an IP address, advertise its services, and learn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

See Section 9.11 on page 214 for more information on UPnP.

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

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.

Figure 111 Network Setting > Home Networking > UPnP



The following table describes the labels in this screen.

Table 53 Network Settings > Home Networking > UPnP

LABEL	DESCRIPTION
UPnP State	
UPnP	Select **Enable** to activate UPnP. Be aware that anyone could use a UPnP application to open the Web Configurator's login screen without entering the Zyxel Device's IP address (although you must still enter the password to access the Web Configurator).
UPnP NAT-T State	
UPnP NAT-T	Select **Enable** to activate UPnP with NAT enabled. 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.
#	This field displays the index number of the entry.
Description	This field displays the description of the UPnP NAT-T connection.
Destination IP Address	This field displays the IP address of the other connected UPnP-enabled device.
External Port	This field displays the external port number that identifies the service.
Internal Port	This field displays the internal port number that identifies the service.
Protocol	This field displays the protocol of the NAT mapping rule. Choices are **TCP** or **UDP**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to restore your previously saved settings.

9.5 LAN Additional Subnet

Use this screen to configure IP alias and public static IP.

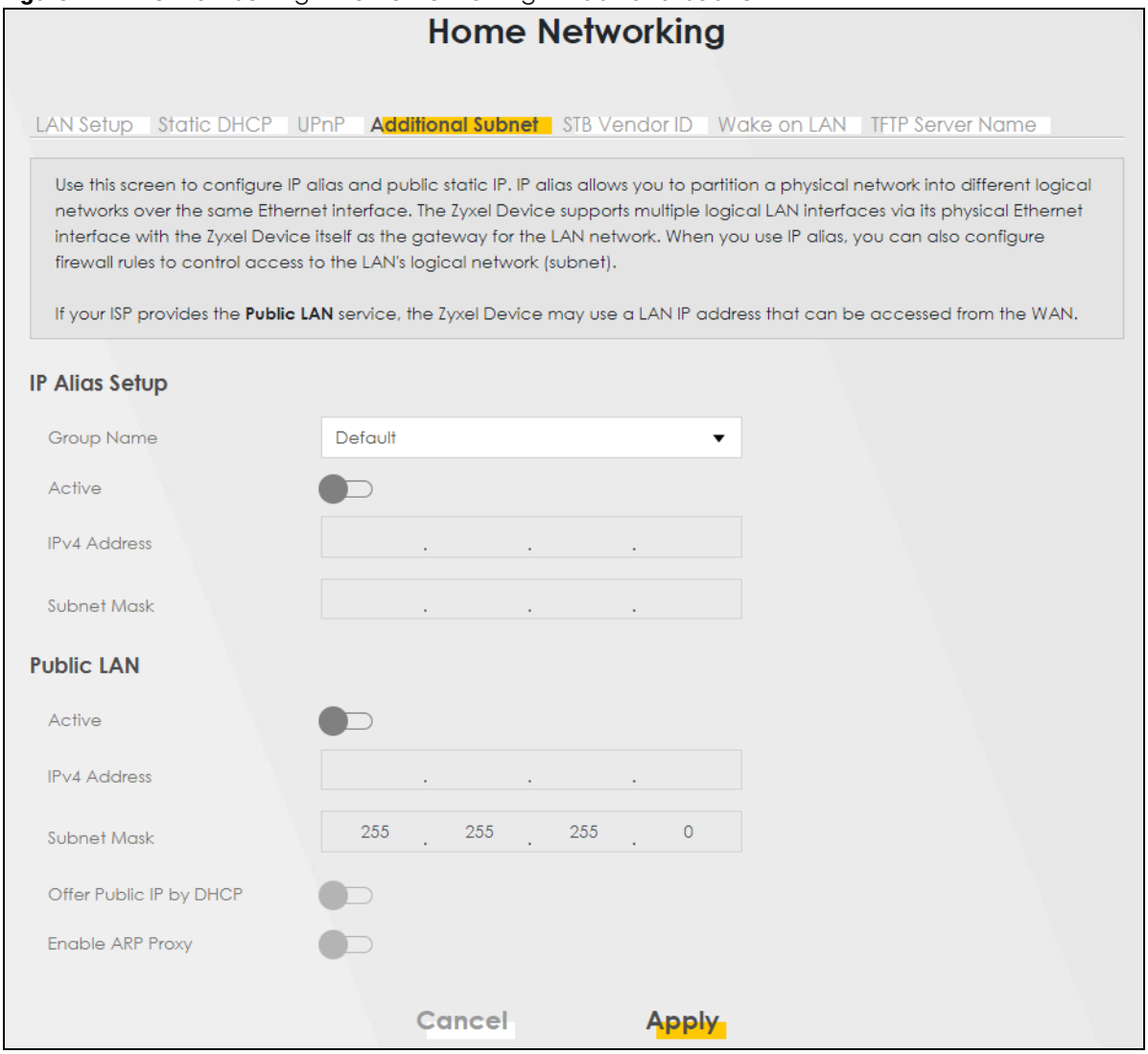
IP alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The Zyxel Device supports multiple logical LAN interfaces through its physical Ethernet

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 112 Network Setting > Home Networking > Additional Subnet



The following table describes the labels in this screen.

Table 54 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.
Active	Click this switch to enable a logical LAN for the Zyxel Device. When this is enabled, the following fields will be configurable.
IPv4 Address	Enter the IP address of your Zyxel Device in dotted decimal notation.

Table 54 Network Setting > Home Networking > Additional Subnet (continued)

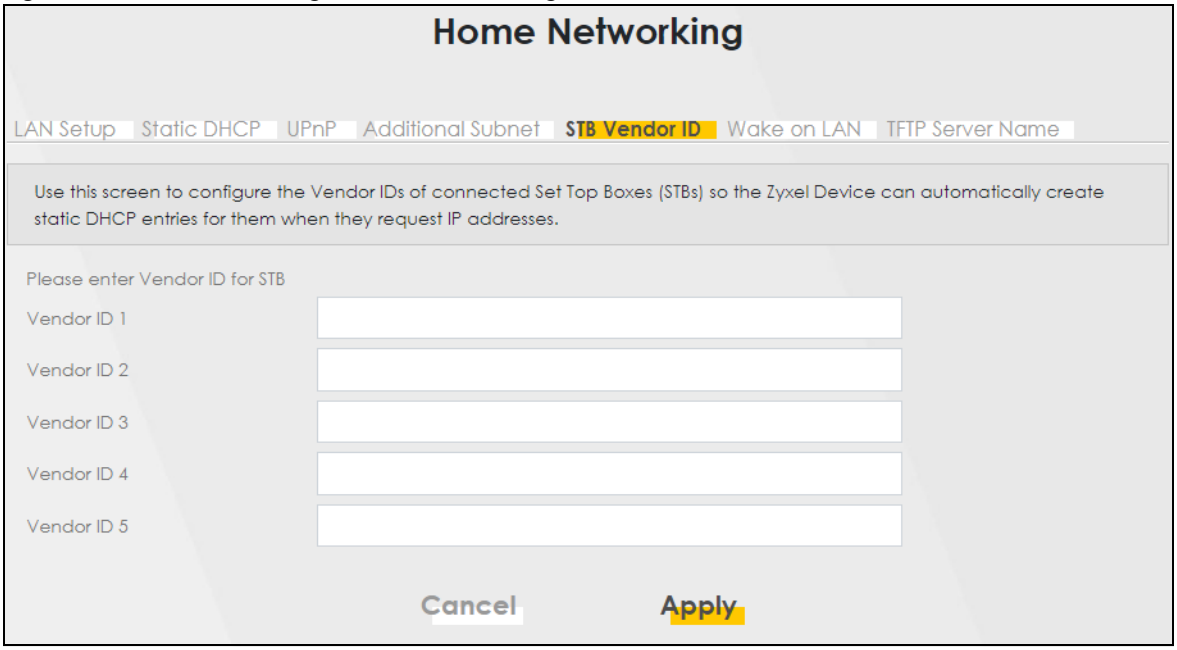
LABEL	DESCRIPTION
Subnet Mask	Your Zyxel Device will automatically calculate the subnet mask based on the IPv4 address that you assign. Unless you are implementing subnetting, use this value computed by the Zyxel Device.
Public LAN	
Active	Click this switch to enable or disable the Public LAN feature. 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 the Zyxel Device to provide public IP addresses by DHCP server. Otherwise, click to disable.
Enable ARP Proxy	Click this switch to enable the Address Resolution Protocol (ARP) proxy. Otherwise, click to disable.
Cancel	Click **Cancel** to restore your previously saved settings.
Apply	Click **Apply** to save your changes.

9.6 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 113 Network Setting > Home Networking > STB Vendor ID



The following table describes the labels in this screen.

Table 55 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.

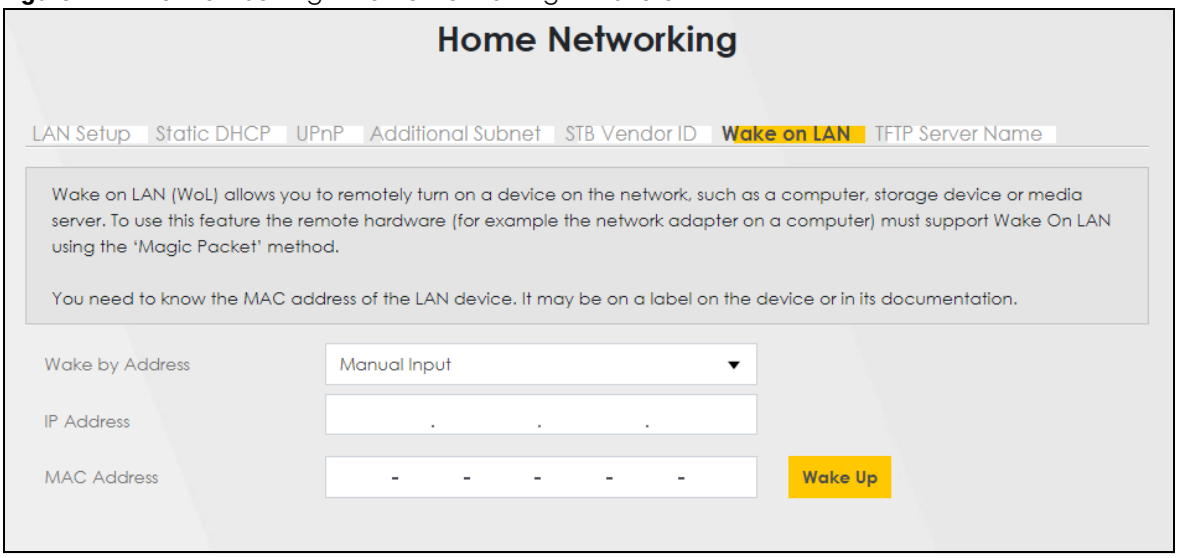
9.7 Wake on LAN

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 LAN device.

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

Figure 114 Network Setting > Home Networking > Wake on LAN



The following table describes the labels in this screen.

Table 56 Network Setting > Home Networking > Wake on LAN

LABEL	DESCRIPTION
Wake by Address	Select **Manual** and enter the IP address or MAC address of the LAN 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 LAN device with the selected IP address then displays in the **MAC Address** field.
IP Address	Enter the IPv4 IP address of the LAN device to turn it on. This field is not available if you select an IP address in the **Wake by Address** field.

Table 56 Network Setting > Home Networking > Wake on LAN (continued)

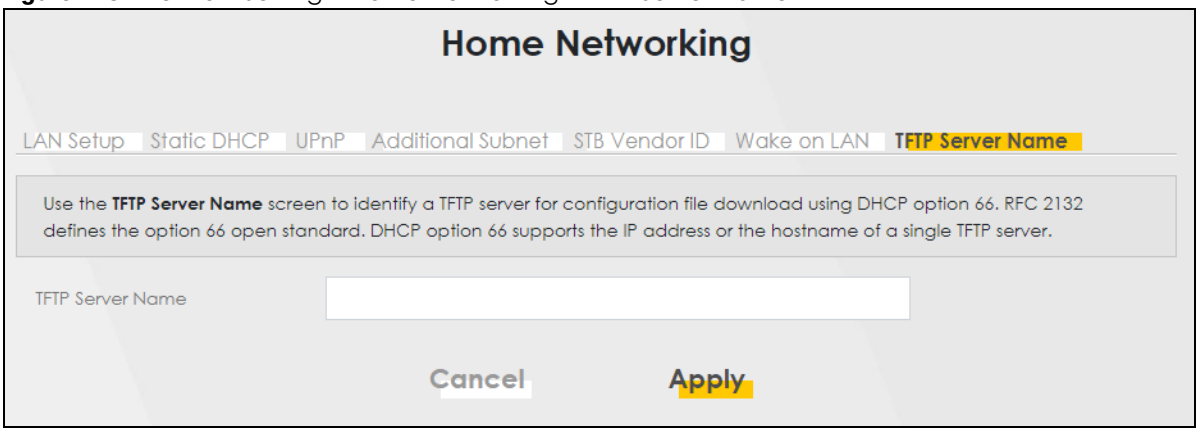
LABEL	DESCRIPTION
MAC Address	Enter the MAC address of the LAN device to turn it on. A MAC address consists of six hexadecimal character pairs.
Wake Up	Click this to send a WoL magic packet to wake up the specified LAN device.

9.8 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 115 Network Setting > Home Networking > TFTP Server Name



The following table describes the labels in this screen.

Table 57 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.

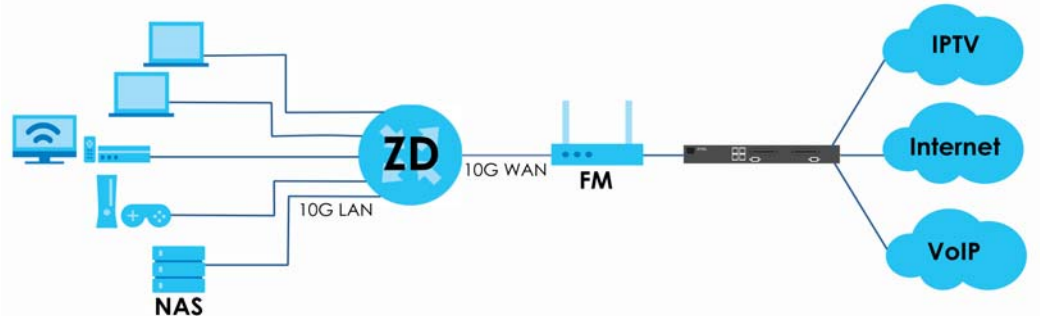
9.9 Any Port Any Service (APAS)

Any Port Any Service (APAS) allows a LAN device to use any available port to access any available service from a remote WAN device. Typically, a LAN device, such as a Set Top Box (STB), would have to use a specific port to access video streams from a video server. With APAS, the video streams only need to be received through the specified Bridge WAN interface for the LAN device specified in the APAS rule. You can connect the LAN device to any LAN port. Other LAN devices can access the Internet using the default gateway.

Unlike **Port Forwarding**, which forwards traffic based on port numbers, you do not need to know the port number for the video traffic from the IPTV server. You just select the LAN device host name or enter its MAC address and select a Bridge WAN interface.

Use the wildcard '*' for a range of MAC addresses for multiple LAN devices. For example, enter 00:13:49:*:*:* for all LAN devices from a vendor with the MAC OUI 00:13:49. (range). Any device with that MAC OUI aa:bb:cc connected to any LAN port on the Zyxel Device can access services or can be accessed for services through the specified Bridge WAN interface. For example, the LAN device could be an STB receiving video streams from a video server, or it could be a server, allowing access to it through the specified Bridge WAN interface.

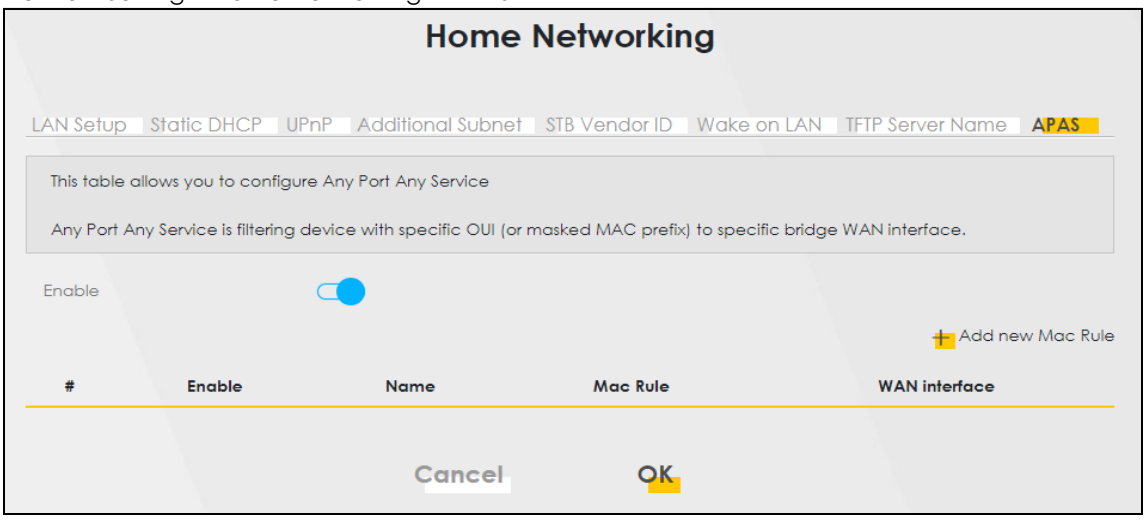
Note: You must configure a Bridge WAN interface in advance.



As APAS allows incoming traffic from any port to access any service on a configured LAN device, it may be difficult to distinguish between appropriate and malicious traffic going to the LAN device. Make sure to properly configure firewall rules to protect the LAN device, and monitor network traffic for suspicious activity.

Click **Network Setting** > **Home Networking** > **APAS** to open this screen.

Network Setting > Home Networking > APAS



The following table describes the labels in this screen.

Table 58 Network Setting > Home Networking > APAS

LABEL	DESCRIPTION
Enable	Click **Enable** to activate APAS.
Add new MAC Rule	Click this button to add a new MAC rule. You can create up to eight MAC rules.

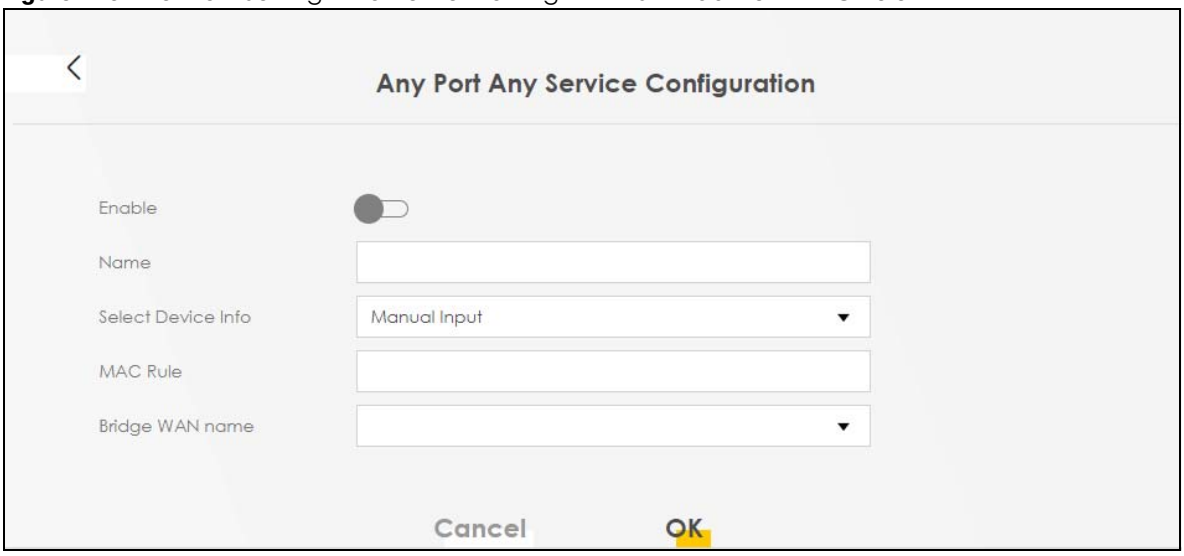
Table 58 Network Setting > Home Networking > APAS

LABEL	DESCRIPTION
#	This is the index number.
Name	This is the name of the rule.
MAC Rule	This is the LAN host MAC address that is applied to the rule.
WAN Interface	This is the bridge WAN interface for incoming traffic.
Cancel	Click **Cancel** to restore your previously saved changes.
OK	Click **OK** to save your changes.

9.9.1 Add APAS

Use this screen to create a new MAC rule. Click **Network Setting** > **Home Networking** > **APAS** > **Add New MAC Rule** to open the following screen.

Figure 116 Network Setting > Home Networking > APAS > Add New MAC Rule



The following table describes the labels in this screen.

Table 59 Network Setting > Home Networking > APAS > Add New MAC Rule

LABEL	DESCRIPTION
Enable	Click this to enable APAS on the Zyxel Device.
Name	Enter a name of up to 64 characters for the **APAS** rule to this host(s). Allowed characters for **Name** include the following within quotes: " !#%()*+,-./ 0123456789:=?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\\]_abcdefghijklmnopqrstuvwxyz{}~"
Select Device Info	Select a connected LAN host or select **Manual Input** to enter the MAC address of a client that is not yet connected and does not display in **Connection Status** > **Connectivity**.
MAC Rule	If you selected **Manual Input** for **Select Device Info**, then enter the LAN host MAC address here. You can use the wildcard '*' for a MAC address range. For example, enter 00:13:49:*:*:* for all LAN devices from a vendor with the MAC OUI 00:13:49.
Bridge WAN Name	Select a Bridge WAN interface for incoming traffic to apply the rule. You must have created at least one Bridge WAN interface in **Network Setting** > **Broadband** screen.

Table 59 Network Setting > Home Networking > APAS > Add New MAC Rule

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

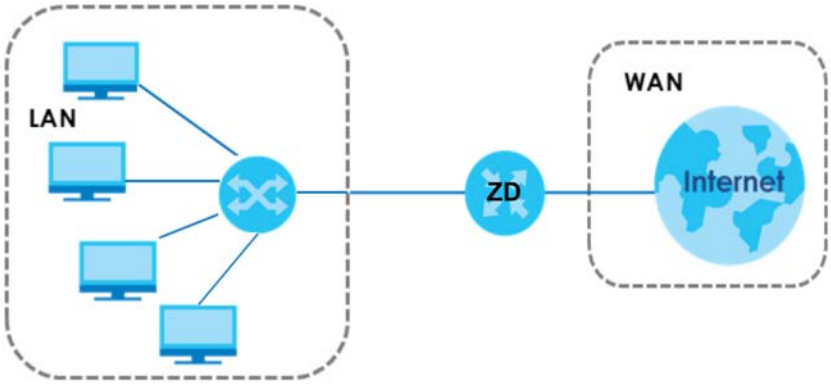
9.10 Technical Reference

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

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 117 LAN and WAN IP Addresses



9.10.1 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.

9.10.2 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.

9.10.3 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.

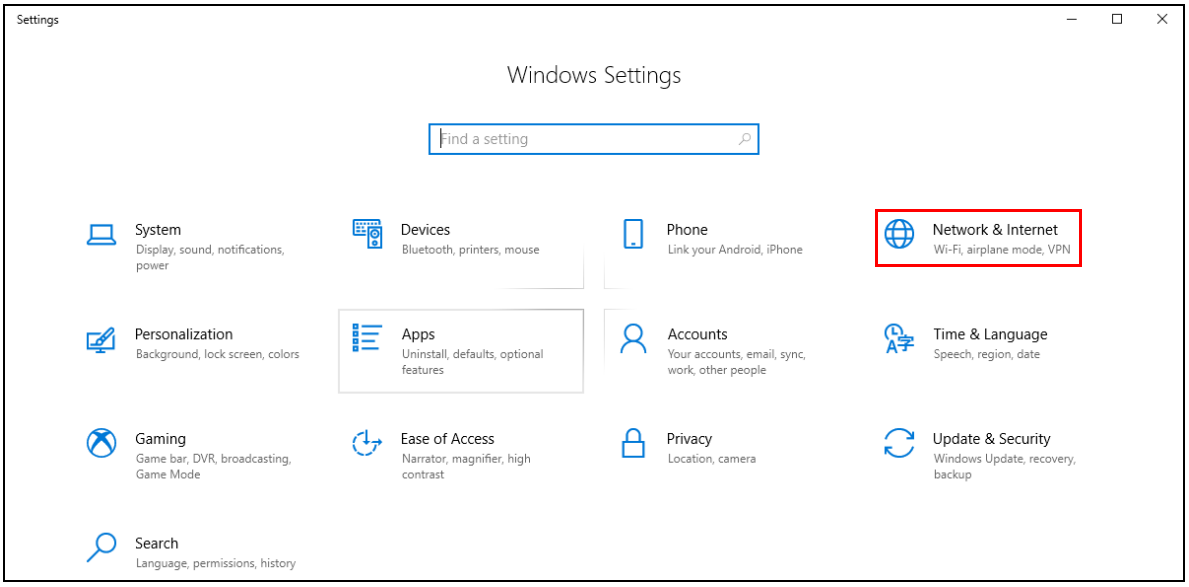
Note: Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, "Address Allocation for Private Internets" and RFC 1466, "Guidelines for Management of IP Address Space".

9.11 Turn on UPnP in Windows 10 Example

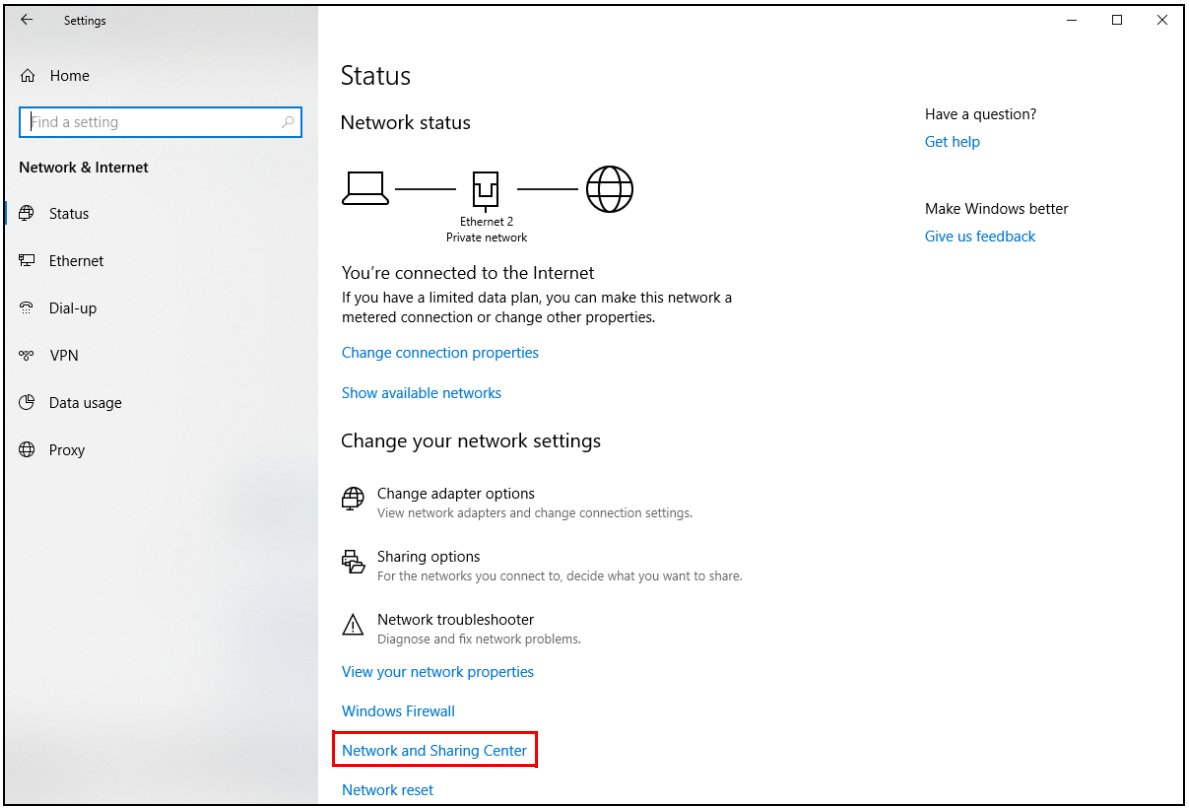
This section shows you how to use the UPnP feature in Windows 10. UPnP server is installed in Windows 10. Activate UPnP on the Zyxel Device by clicking **Network Setting** > **Home Networking** > **UPnP**.

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

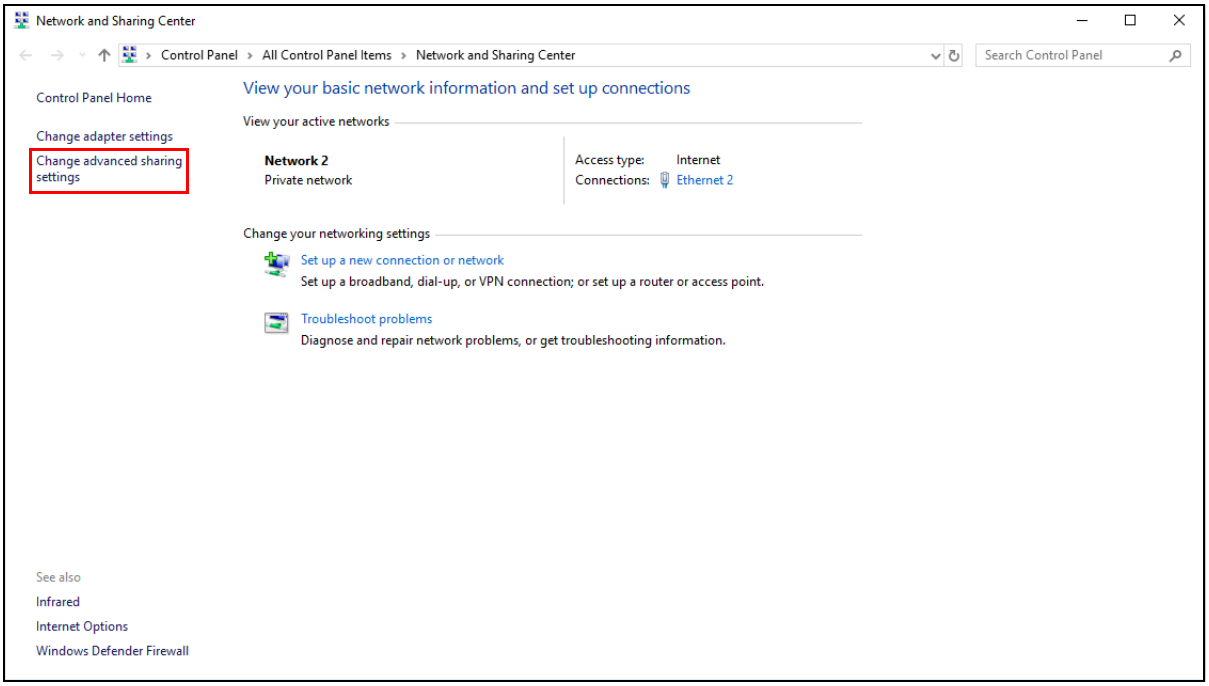
1 Click the start icon, **Settings** and then **Network & Internet**.



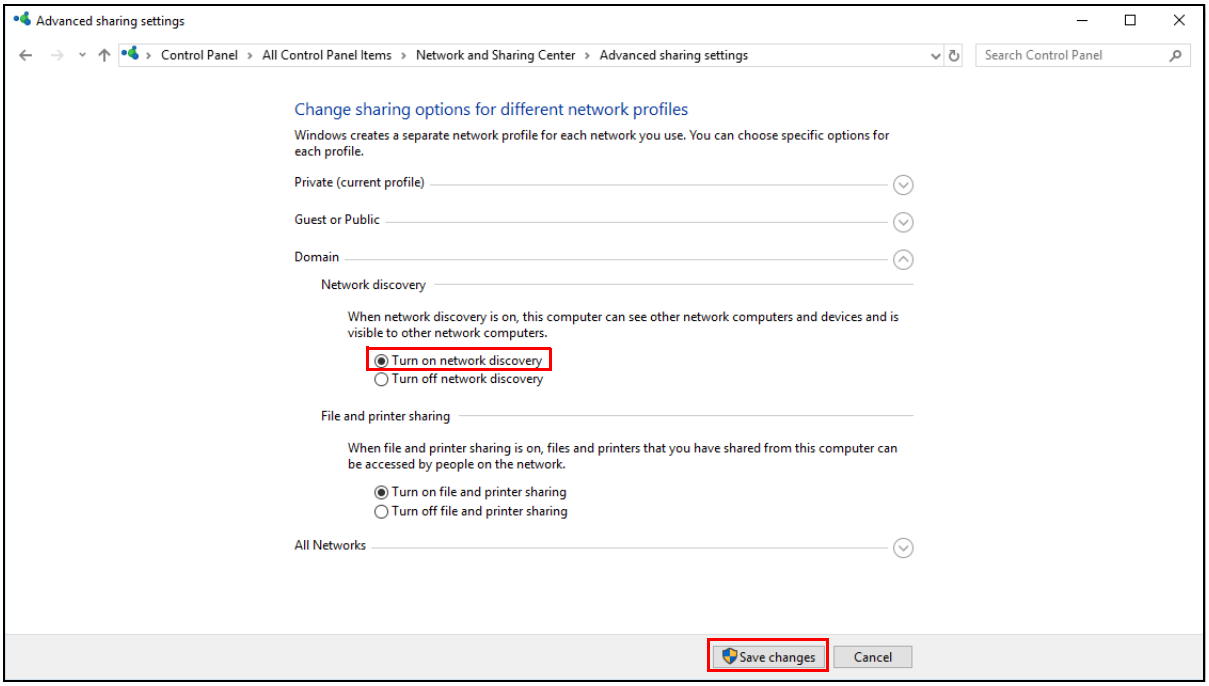
2 Click **Network and Sharing Center**.



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.



9.11.1 Auto-discover Your UPnP-enabled Network Device

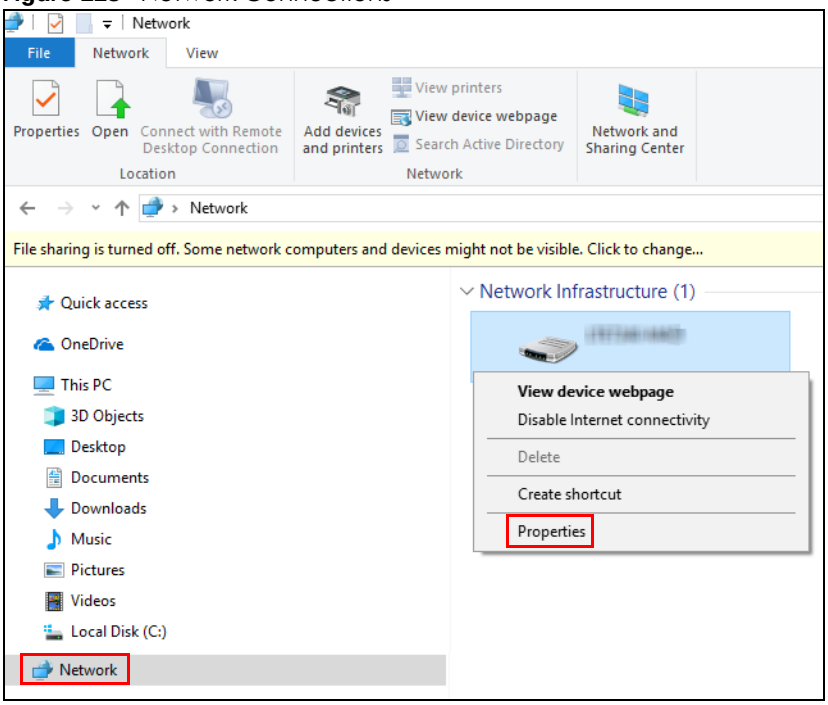
Before you follow these steps, make sure you already have UPnP activated on the Zyxel Device and in your computer.

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

1 Open **File Explorer** and click **Network**.

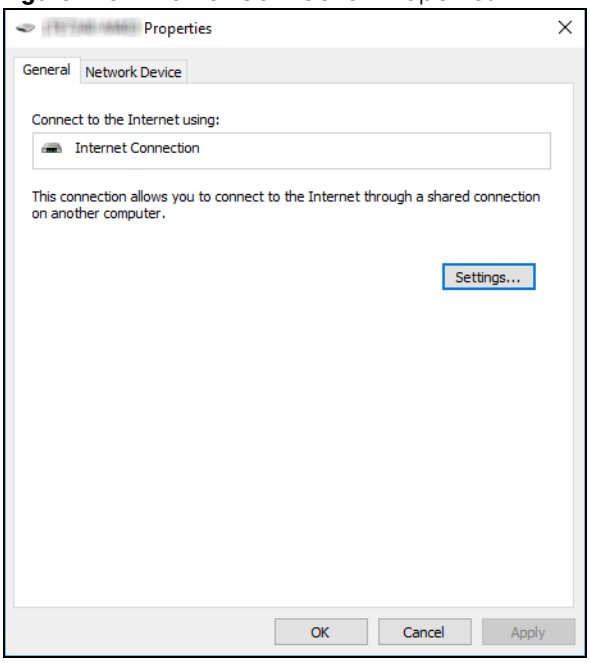
2 Right-click the Zyxel Device icon and select **Properties**.

Figure 118 Network Connections



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

Figure 119 Internet Connection Properties



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

Figure 120 Internet Connection Properties: Advanced Settings

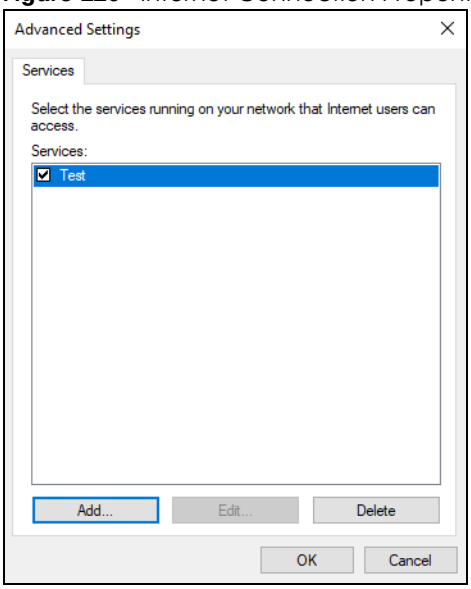
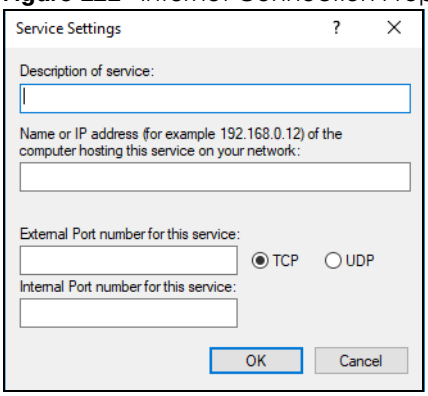


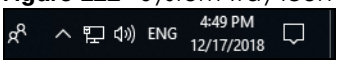
Figure 121 Internet Connection Properties: Advanced Settings: Add



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

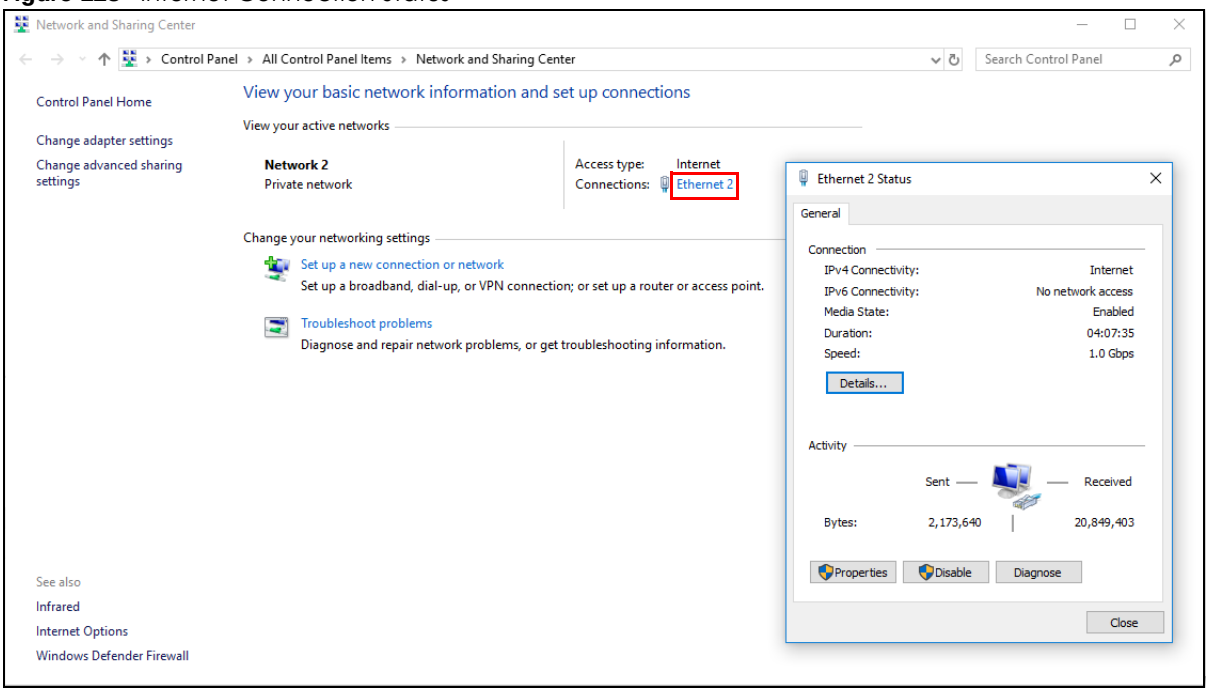
5 Click **OK**. Check the network icon on the system tray to see your Internet connection status.

Figure 122 System Tray Icon



6 To see more details about your current Internet connection status, right click the network icon in the system tray and click **Open Network & Internet settings**. Click **Network and Sharing Center** and click the **Connections**.

Figure 123 Internet Connection Status



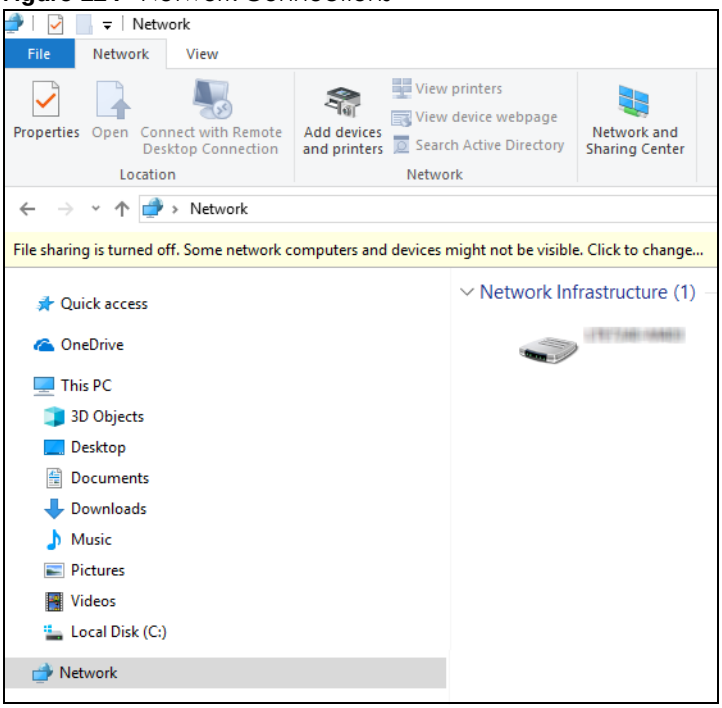
9.12 Web Configurator Access with UPnP in Windows 10

Follow the steps below to access the Web Configurator.

1 Open **File Explorer**.

2 Click **Network**.

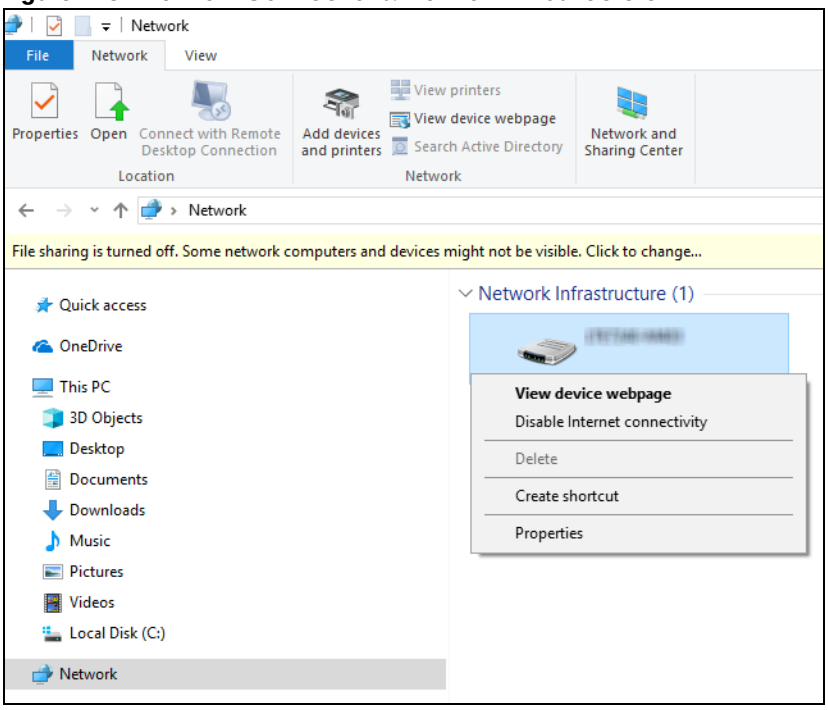
Figure 124 Network Connections



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

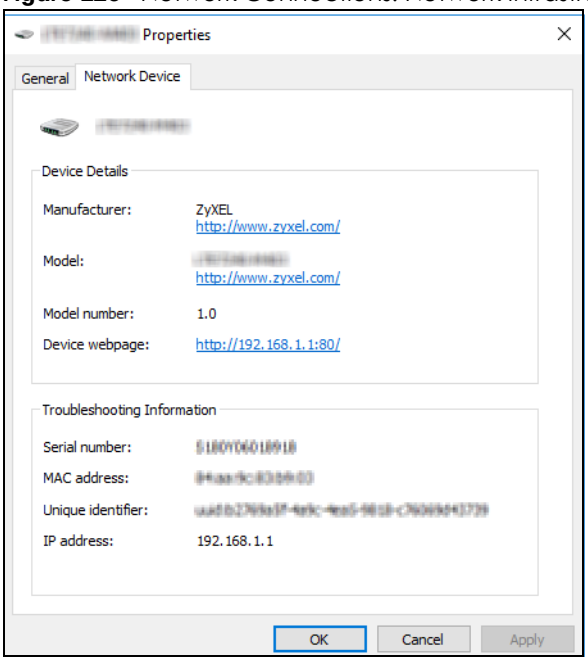
4 Right-click the icon for your Zyxel Device and select **View device webpage**. The Web Configurator login screen displays.

Figure 125 Network Connections: Network Infrastructure



5 Right-click the icon for your Zyxel Device and select **Properties**. Click the **Network Device** tab. A window displays information about the Zyxel Device.

Figure 126 Network Connections: Network Infrastructure: Properties: Example



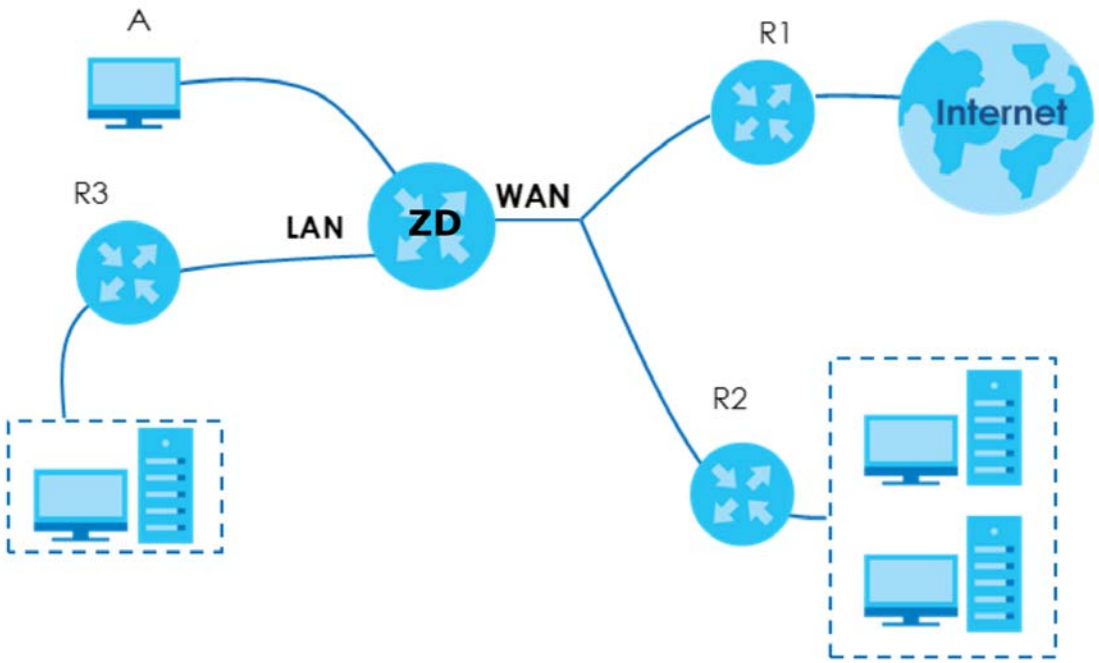
CHAPTER 10
Routing

10.1 Routing Overview

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

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

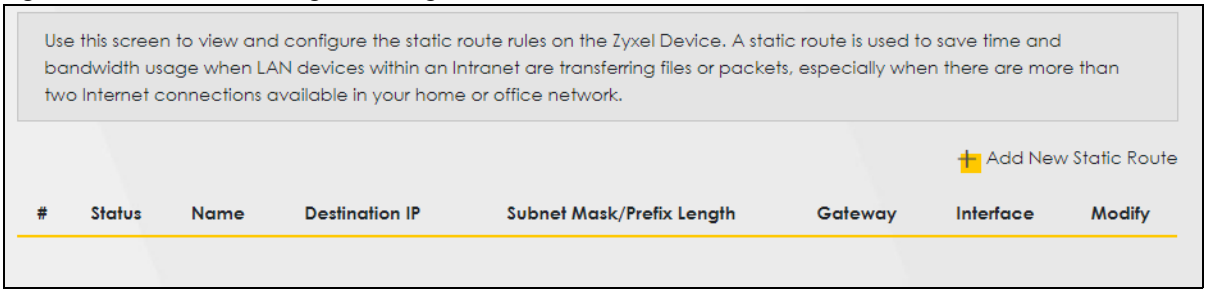
Figure 127 Example of Static Routing Topology



10.2 Configure Static Route

Use this screen to view and configure static route rules on the Zyxel Device. A static route is used to save time and bandwidth usage when LAN devices within an Intranet are transferring files or packets, especially when there are more than two Internet connections in your home or office network. Click **Network Setting** > **Routing** to open the **Static Route** screen.

Figure 128 Network Setting > Routing > Static Route



The following table describes the labels in this screen.

Table 60 Network Setting > Routing > Static Route

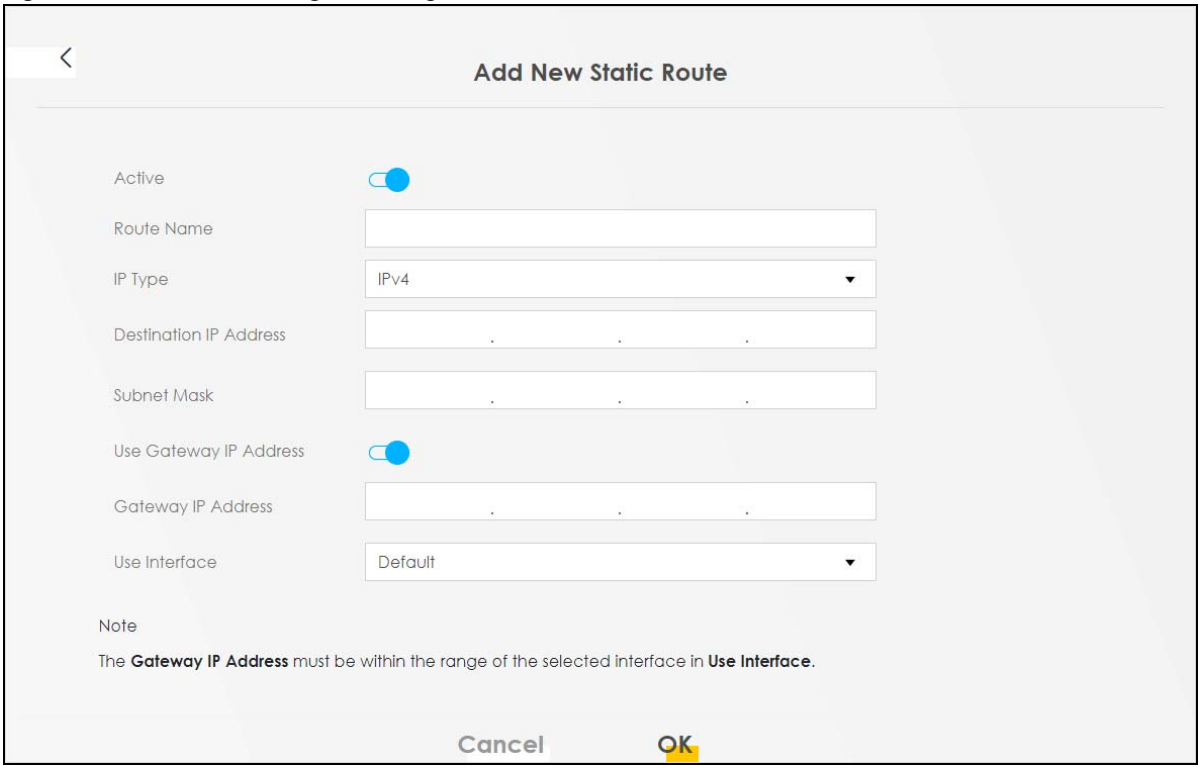
LABEL	DESCRIPTION
Add New Static Route	Click this to set up a new static route on the Zyxel Device.
#	This is the number of an individual static route.
Status	This field indicates whether the rule is active (yellow bulb) or not (gray bulb).
Name	This is the name of the static route.
Destination IP	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Subnet Mask/ Prefix Length	This parameter specifies the IP network subnet mask of the final destination.
Gateway	This is the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Interface	This is the WAN interface through which the traffic is routed.
Modify	Click the **Edit** icon to go to the screen where you can set up a static route on the Zyxel Device. Click the **Delete** icon to remove a static route from the Zyxel Device.

10.2.1 Add or Edit Static Route

Use this screen to add or edit a static route. Click **Add New Static Route** in the **Static Route** screen, the following screen appears. Configure the required information for a static route.

Note: The **Gateway IP Address** must be within the range of the selected interface in **Use Interface**.

Figure 129 Network Setting > Routing > Static Route > Add New Static Route



The following table describes the labels in this screen.

Table 61 Network Setting > Routing > Static Route > Add New Static Route

LABEL	DESCRIPTION
Active	Click this switch to activate static route. Otherwise, click to disable.
Route Name	Enter a name for your static route. You can use up to 15 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
IP Type	Select between **IPv4** or **IPv6**. Compared to **IPv4**, **IPv6** (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in **IPv6** address size to 128 bits (from the 32-bit **IPv4** address) allows up to 3.4 x 1038 IP addresses. The Zyxel Device can use **IPv4**/**IPv6** dual stack to connect to **IPv4** and **IPv6** networks, and supports **IPv6** rapid deployment (6RD).
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
Subnet Mask	If you are using IPv4 and need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID. Enter the IP subnet mask here. Note: This field appears only when you select **IPv4** in the **IP Type** field.
Prefix Length	If you are using IPv6, enter the address prefix length to specify how many most significant bits in an IPv6 address compose the network address. Note: This field appears only when you select **IPv6** in the **IP Type** field.
Use Gateway IP Address	The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations. Click this switch to enable or disable the gateway IP address. When the switch goes to the right, the function is enabled. Otherwise, it is not.

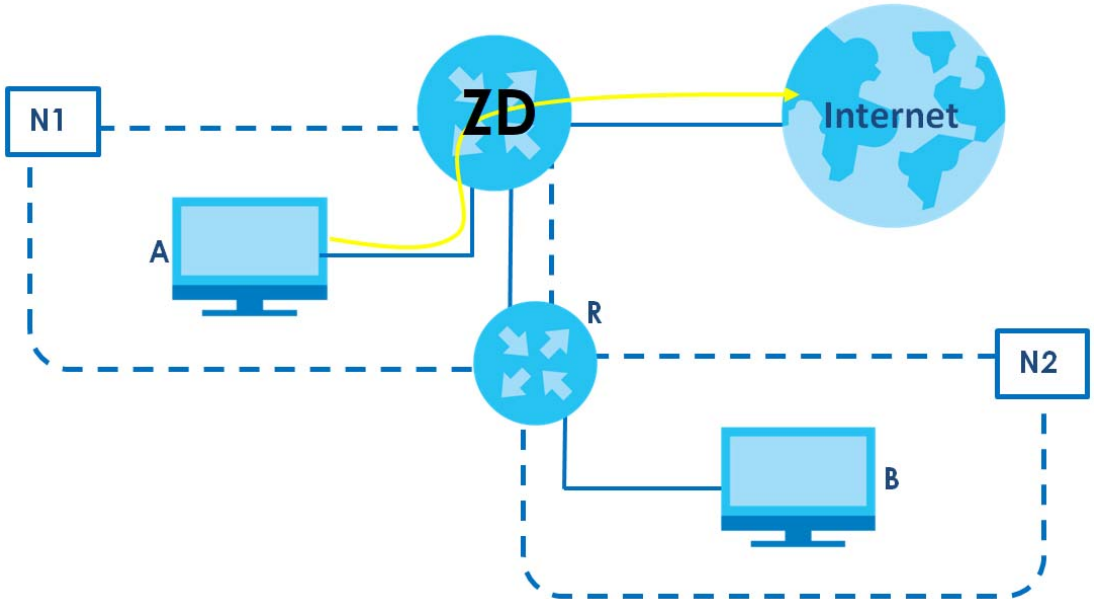
Table 61 (continued)Network Setting > Routing > Static Route > Add New Static Route

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

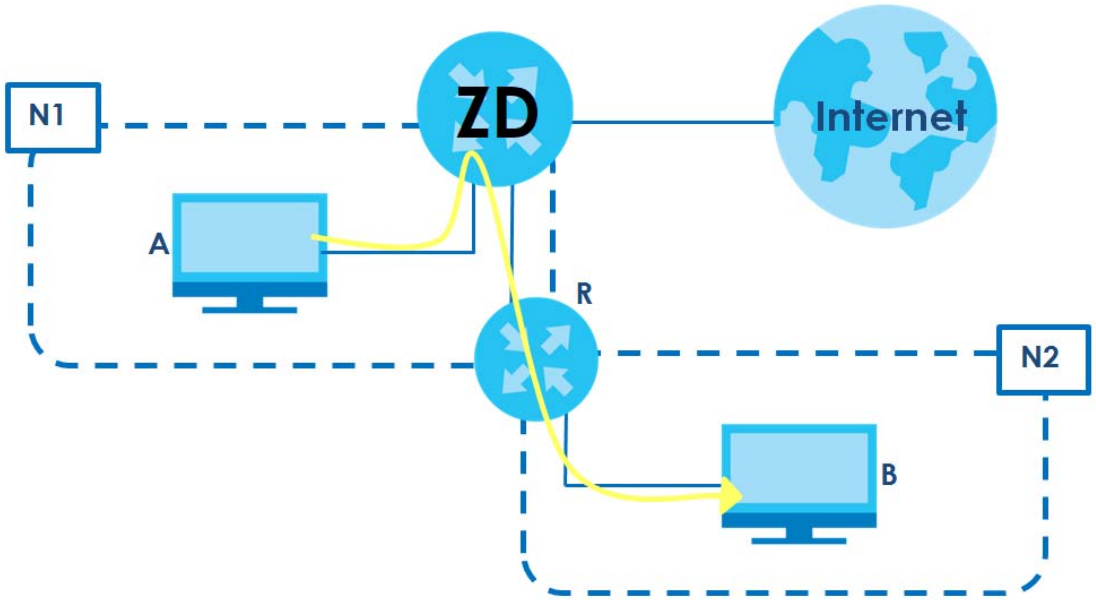
10.2.1.1 An Example of Adding a Static Route

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

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



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



This tutorial uses the following example IP settings:

Table 62 IP Settings in this Tutorial

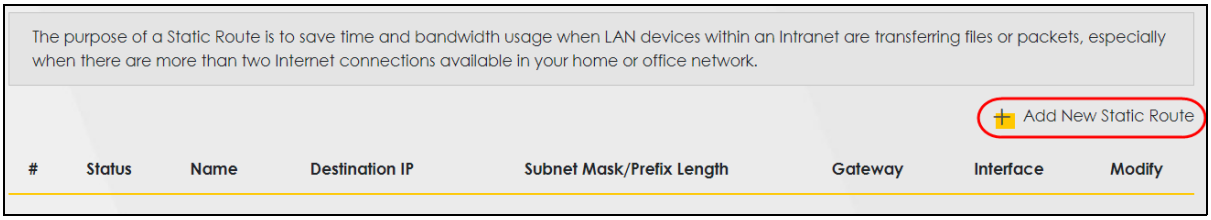
DEVICE / COMPUTER	IP ADDRESS
The Zyxel Device's WAN	172.16.1.1
The Zyxel Device's LAN	
IP Type	IPv4
Use Interface	Default
A	192.168.1.34
R's N1	192.168.1.253
R's N2	192.168.10.2
B	192.168.10.33

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

1 Log into the Zyxel Device's Web Configurator.

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

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

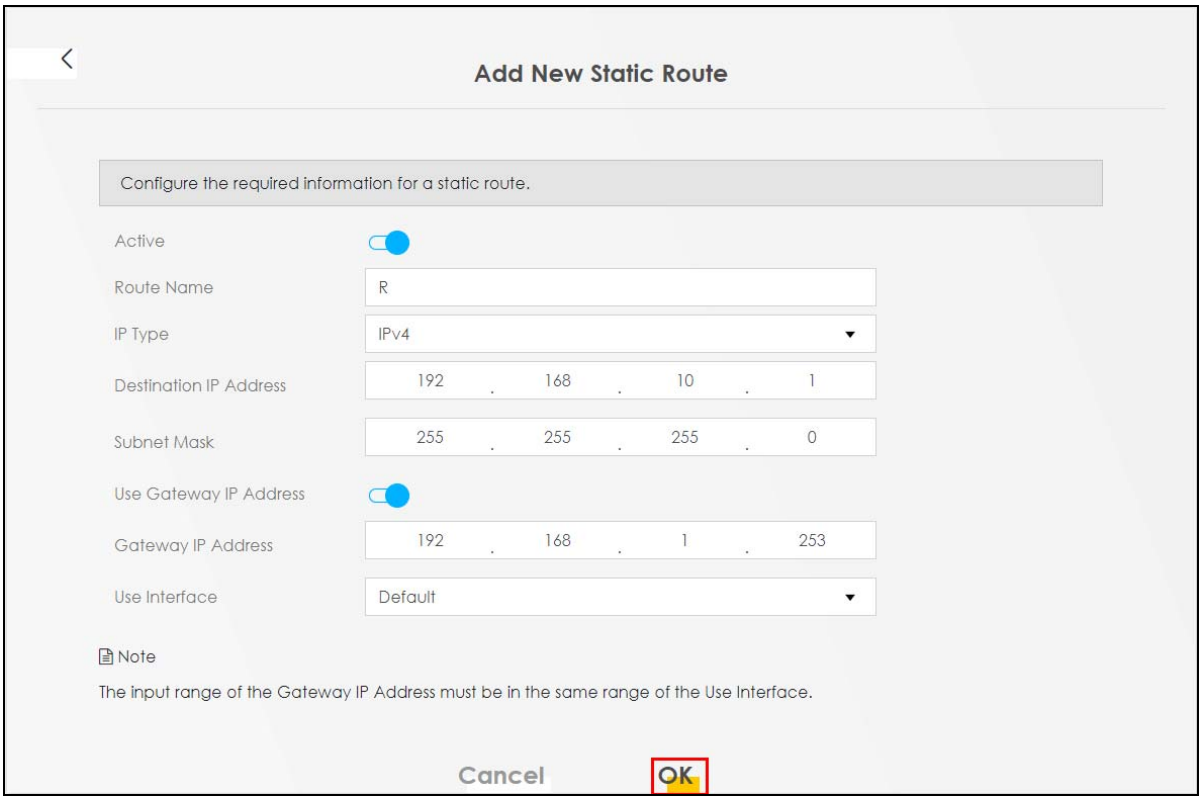


4 Configure the **Static Route Setup** screen using the following settings:

- Click the **Active** button to enable this static route. When the switch goes to the right, the function is enabled. Enter the **Route Name** as **R**.

- Set **IP Type** to **IPv4**.
- Enter the **Destination IP Address 192.168.10.1** and **IP Subnet Mask 255.255.255.0** for the destination, **N2**.
- Click the **Use Gateway IP Address** button to enable this function. When the switch goes to the right, the function is enabled. Enter **192.168.1.253** (**R**'s N1 address) in the **Gateway IP Address** field.
- Select **Default** as the **Use Interface**.
- Click **OK**.

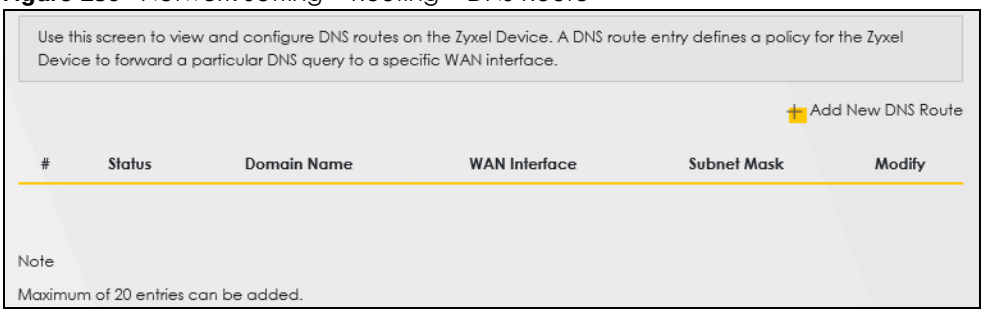
Now **B** should be able to receive traffic from **A**. You may need to additionally configure **B**'s firewall settings to allow specific traffic to pass through.



10.3 DNS Route

Use this screen to view and configure DNS routes on the Zyxel Device. A DNS route entry defines a policy for the Zyxel Device to forward a particular DNS query to a specific WAN interface. Click **Network Setting** > **Routing** > **DNS Route** to open the **DNS Route** screen.

Figure 130 Network Setting > Routing > DNS Route



The following table describes the labels in this screen.

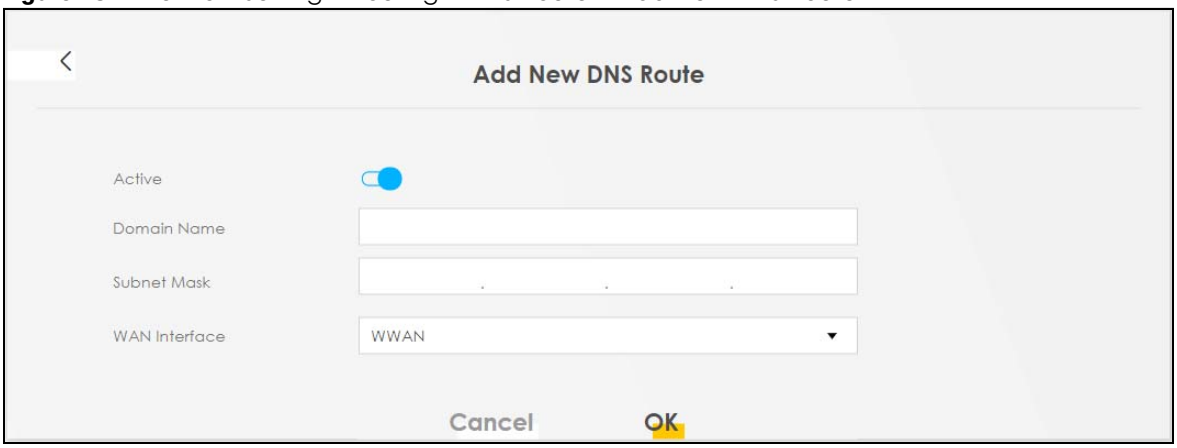
Table 63 Network Setting > Routing > DNS Route

LABEL	DESCRIPTION
Add New DNS Route	Click this to create a new entry.
#	This is the number of an individual DNS route.
Status	This field indicates whether the rule is active (yellow bulb) or not (gray bulb).
Domain Name	This is the domain name to which the DNS route applies.
WAN Interface	This is the WAN interface through which the matched DNS request is routed.
Subnet Mask	This parameter specifies the IP network subnet mask.
Modify	Click the **Edit** icon to configure a DNS route on the Zyxel Device. Click the **Delete** icon to remove a DNS route from the Zyxel Device.

10.3.1 Add or Edit DNS Route

You can manually add the Zyxel Device's DNS route entry. Click **Add New DNS Route** in the **DNS Route** screen, use this screen to configure the required information for a DNS route.

Figure 131 Network Setting > Routing > DNS Route > Add New DNS Route



The following table describes the labels in this screen.

Table 64 Network Setting > Routing > DNS Route > Add New DNS Route

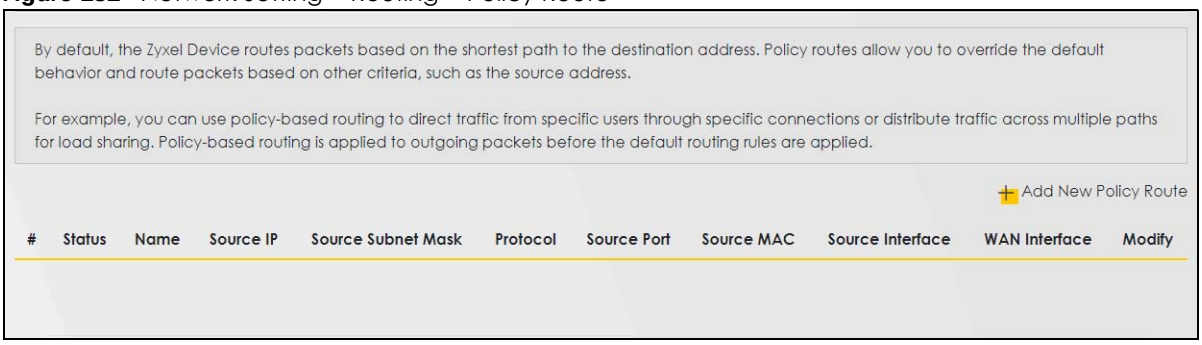
LABEL	DESCRIPTION
Active	Enable DNS route in your Zyxel Device.
Domain Name	Enter the domain name you want to resolve. You can use up to 64 alphanumeric (0-9, a-z, A-Z) characters with hyphens [-] and periods [.]. You can use the wildcard character, an "*" (asterisk) as the left most part of a domain name, such as *.example.com. The Zyxel Device forwards DNS queries for any domain name ending in example.com to the WAN interface specified in this route.
Subnet Mask	Enter the subnet mask of the network for which to use the DNS route in dotted decimal notation, for example 255.255.255.255.
WAN Interface	Select a WAN interface through which the matched DNS query is sent. You must have the WAN interfaces already configured in the **Broadband** screen.
OK	Click this to save your changes.
Cancel	Click this to exit this screen without saving.

10.4 Policy Route

By default, the Zyxel Device routes packets based on the shortest path to the destination address. Policy routes allow you to override the default behavior and route packets based on other criteria, such as the source address. For example, you can use policy-based routing to direct traffic from specific users through specific connections or distribute traffic across multiple paths for load sharing. Policy-based routing is applied to outgoing packets before the default routing rules are applied.

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

Figure 132 Network Setting > Routing > Policy Route



The following table describes the labels in this screen.

Table 65 Network Setting > Routing > Policy Route

LABEL	DESCRIPTION
Add New Policy Route	Click this to create a new policy forwarding rule.
#	This is the index number of the entry.
Status	This field displays whether the DNS route is active or not. A yellow bulb signifies that this DNS route is active. A gray bulb signifies that this DNS route is not active.

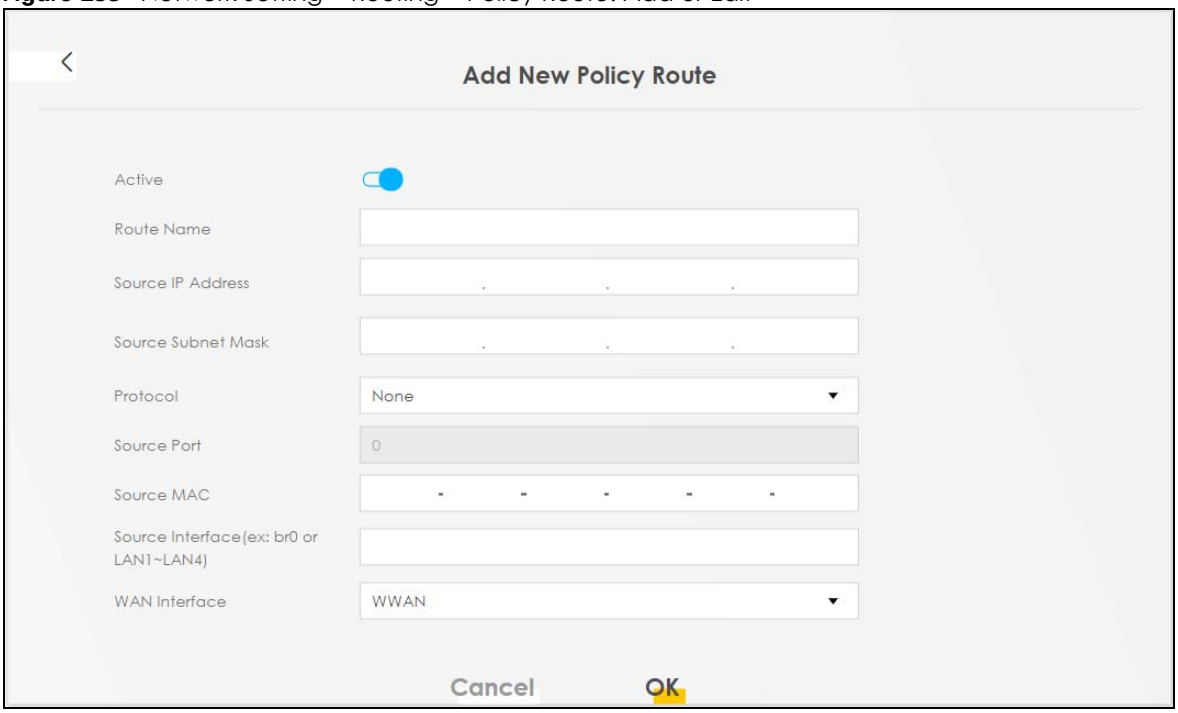
Table 65 Network Setting > Routing > Policy Route (continued)

LABEL	DESCRIPTION
Name	This is the name of the rule.
Source IP	This is the source IP address.
Source Subnet Mask	This is the source subnet mask address.
Protocol	This is the transport layer protocol.
Source Port	This is the source port number.
Source MAC	This is the source MAC address.
Source Interface	This is the interface from which the matched traffic is sent.
WAN Interface	This is the WAN interface through which the traffic is routed.
Modify	Click the **Edit** icon to edit this policy. Click the **Delete** icon to remove a policy from the Zyxel Device. A window displays asking you to confirm that you want to delete the policy.

10.4.1 Add or Edit Policy Route

Click **Add New Policy Route** in the **Policy Route** screen or click the **Edit** icon next to a policy. Use this screen to configure the required information for a policy route.

Figure 133 Network Setting > Routing > Policy Route: Add or Edit



The following table describes the labels in this screen.

Table 66 Network Setting > Routing > Policy Route: Add or Edit

LABEL	DESCRIPTION
Active	Click this switch to activate this policy route. Otherwise, click to disable.
Route Name	Enter a descriptive name of this policy route. You can use up to 15 printable characters except ["], [`], ['], [<], [>], [^], [$], [|], [&], or [;]. Spaces are allowed.
Source IP Address	Enter the source IP address.
Source Subnet Mask	Enter the source subnet mask address.
Protocol	Select the transport layer protocol (**TCP**, **UDP, or None**).
Source Port	Enter the source port number.
Source MAC	Enter the source MAC address.
Source Interface (example: br0 or LAN1 – LAN4)	Enter the name of the interface from which the matched traffic is sent.
WAN Interface	Select a WAN interface through which the traffic is sent. You must have the WAN interfaces already configured in the **Broadband** screens.
Cancel	Click **Cancel** to exit this screen without saving.
OK	Click **OK** to save your changes.

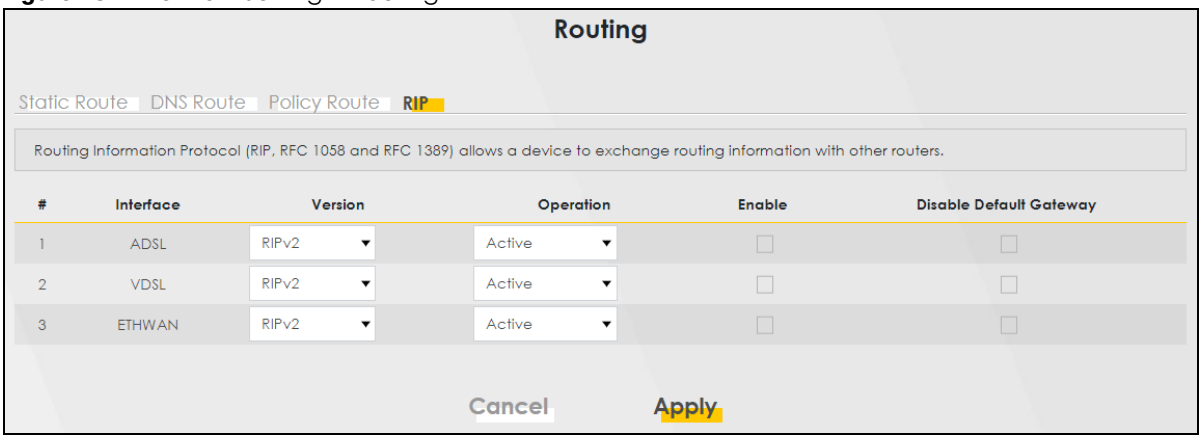
10.5 RIP Overview

Routing Information Protocol (RIP, RFC 1058 and RFC 1389) allows the Zyxel Device to exchange routing information with other routers. To activate RIP for the WAN interface, select the supported RIP version and operation.

10.5.1 RIP

Click **Network Setting** > **Routing** > **RIP** to open the **RIP** screen. Select the desired RIP version and operation by clicking the checkbox. To stop RIP on the WAN interface, clear the checkbox. Click the **Apply** button to start or stop RIP and save the configuration.

Figure 134 Network Setting > Routing > RIP



The following table describes the labels in this screen.

Table 67 Network Setting > Routing > RIP

LABEL	DESCRIPTION
#	This is the index of the interface in which the RIP setting is used.
Interface	This is the name of the interface in which the RIP setting is used.
Version	The RIP version controls the format and the broadcasting method of the RIP packets that the Zyxel Device sends (it recognizes both formats when receiving). **RIPv1** is universally supported but **RIPv2** carries more information. **RIPv1** is probably adequate for most networks, unless you have an unusual network topology. When set to **Both**, the Zyxel Device will broadcast its routing table periodically and incorporate the RIP information that it receives
Operation	Select **Passive** to have the Zyxel Device update the routing table based on the RIP packets received from neighbors but not advertise its route information to other routers in this interface. Select **Active** to have the Zyxel Device advertise its route information and also listen for routing updates from neighboring routers.
Enable	Select the checkbox to activate the settings.
Disable Default Gateway	Select the checkbox to set the Zyxel Device to not send the route information to the default gateway.
Cancel	Click **Cancel** to exit this screen without saving.
Apply	Click **Apply** to save your changes back to the Zyxel Device.