NBG4615

Wireless N Gigabit NetUSB Router

User's Guide

Default Login Details

IP Address	http://192.168.1.1
Password	1234

Firmware Version 1.0
Edition 3, 10/2011

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the NBG4615 using the Web Configurator.

Tips for Reading User's Guides On-Screen

When reading a ZyXEL User's Guide On-Screen, keep the following in mind:

- If you don't already have the latest version of Adobe Reader, you can download it from http://www.adobe.com.
- Use the PDF's bookmarks to quickly navigate to the areas that interest you. Adobe Reader's bookmarks pane opens by default in all ZyXEL User's Guide PDFs.
- If you know the page number or know vaguely which page-range you want to view, you can enter a number in the toolbar in Reader, then press [ENTER] to jump directly to that page.
- Type [CTRL]+[F] to open the Adobe Reader search utility and enter a word or phrase. This can help you quickly pinpoint the information you require. You can also enter text directly into the toolbar in Reader.
- To quickly move around within a page, press the [SPACE] bar. This turns your cursor into a "hand" with which you can grab the page and move it around freely on your screen.
- Embedded hyperlinks are actually cross-references to related text. Click them to jump to the corresponding section of the User's Guide PDF.

Related Documentation

- Quick Start Guide

  The Quick Start Guide is designed to help you get your NBG4615 up and running right away. It contains information on setting up your network and configuring for Internet access.
- Support Disc

  Refer to the included CD for support documents.

Document Conventions

Warnings and Notes

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

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

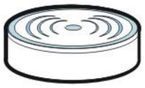
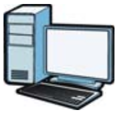
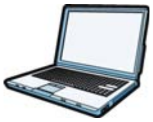
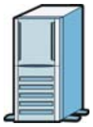
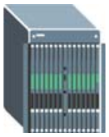
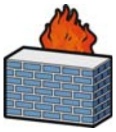
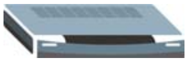
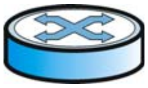
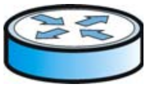
Note: Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The NBG4615 may be referred to as the "NBG4615", the "device", the "product" or the "system" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The NBG4615 icon is not an exact representation of your device.

NBG4615 	Computer 	Notebook computer 
Server 	DSLAM 	Firewall 
Modem 	Switch 	Router 

Safety Warnings

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device.
- Connect the power adaptor or cord to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the power outlet.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).
- If you wall mount your device, make sure that no electrical lines, gas or water pipes will be damaged.

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

Contents Overview

Table of Contents

PART I
User's Guide

1

Introduction

1.1 Overview

This chapter introduces the main features and applications of the NBG4615.

The NBG4615 extends the range of your existing wired network without additional wiring, providing easy network access to mobile users. You can set up a wireless network with other IEEE 802.11b/g/n compatible devices.

A range of services such as a firewall and content filtering are also available for secure Internet computing.

Note: Be sure to install the ZyXEL NetUSB^{TM} Share Center Utility (for NetUSB functionality) from the included disc, or download the latest version from the zyxel.com website.

1.2 Applications

Your can create the following networks using the NBG4615:

- **Wired**. You can connect network devices via the Ethernet ports of the NBG4615 so that they can communicate with each other and access the Internet.
- **Wireless**. Wireless clients can connect to the NBG4615 to access network resources.
- **WAN**. Connect to a broadband modem/router for Internet access.
- **WPS**. Create an instant network connection with another WPS-compatible device, sharing your network connection with it.
- **NetUSB**. The NBG4615 allows you to connect a USB device (such as printer, scanner, or portable hard disk) directly to the USB port and then share that device over the Internet. You can also connect a USB to the NBG4615, which can then share up to 3 additional USB devices with the rest of your personal home network.

1.3 Ways to Manage the NBG4615

Use any of the following methods to manage the NBG4615.

- WPS (Wi-Fi Protected Setup). You can use the WPS button or the WPS section of the Web Configurator to set up a wireless network with your ZyXEL Device.
- Web Configurator. This is recommended for everyday management of the NBG4615 using a (supported) web browser.

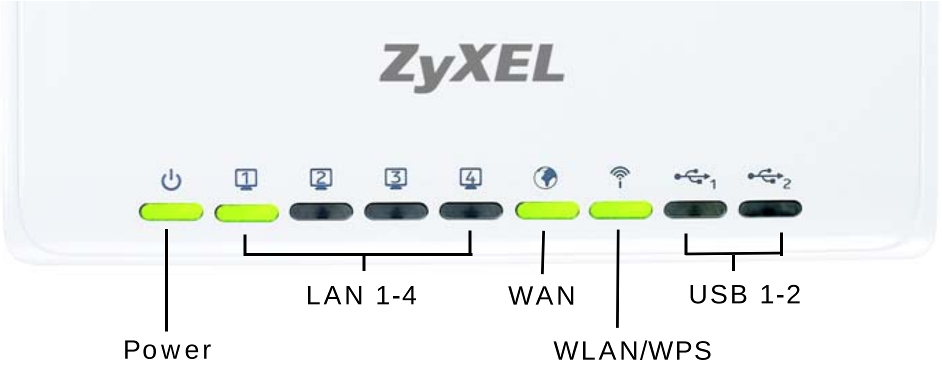
1.4 Good Habits for Managing the NBG4615

Do the following things regularly to make the NBG4615 more secure and to manage the NBG4615 more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the NBG4615 to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the NBG4615. You could simply restore your last configuration.

1.5 LEDs

Figure 1 Front Panel



The following table describes the LEDs and the WPS button.

Table 1 Front panel LEDs and WPS button

LED	COLOR	STATUS	DESCRIPTION
Power	Green	On	The NBG4615 is receiving power and functioning properly.
	Off		The NBG4615 is not receiving power.
LAN 1-4	Green	On	The NBG4615's LAN connection is ready.
		Blinking	The NBG4615 is sending/receiving data through the LAN with a 10/100Mbps transmission rate.
	Amber	Blinking	The NBG4615 is sending/receiving data through the LAN with a 1000Mbps transmission rate.
	Off		The LAN connection is not ready, or has failed.

Table 1 Front panel LEDs and WPS button (continued)

LED	COLOR	STATUS	DESCRIPTION
WAN	Green	On	The NBG4615’s WAN connection is ready.
		Blinking	The NBG4615 is sending/receiving data through the WAN with a 10/100Mbps transmission rate.
	Amber	Blinking	The NBG4615 is sending/receiving data through the WAN with a 1000Mbps transmission rate.
	Off		The WAN connection is not ready, or has failed.
WLAN/WPS	Green	On	The NBG4615 is ready, but is not sending/receiving data through the wireless LAN.
		Blinking	The NBG4615 is sending/receiving data through the wireless LAN. The NBG4615 is negotiating a WPS connection with a wireless client.
	Off		The wireless LAN is not ready or has failed.
USB 1-2	Green	On	The NBG4615 has a USB device installed.
		Blinking	The NBG4615 is transmitting and/or receiving data from routers through an installed USB device.
	Off		There is no USB device connected to the NBG4615.

The WPS Button

2.1 Overview

Your NBG4615 supports WiFi Protected Setup (WPS), which is an easy way to set up a secure wireless network. WPS is an industry standard specification, defined by the WiFi Alliance.

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

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

For more information on using WPS, see Section 14.2 on page 105.

3

ZyXEL NetUSB Share Center Utility

3.1 Overview

The ZyXEL NetUSB Share Center Utility allows you to work with the USB devices that are connected directly to the NBG4615 as if they are connected directly to your computer. This allows you to easily share USB-based devices such as printers, scanners, portable hard disks, MP3 players, faxes, and digital cameras (to name a few) with all the other people in your home or office as long as they are connected to the NBG4615 and have the ZyXEL NetUSB Share Center Utility installed.

Note: Be sure to install the ZyXEL NetUSB Share Center Utility (for NetUSB functionality) from the included disc, or download the latest version from the zyxel.com website.

3.1.1 Quick Setup

This section shows you how to get started using the ZyXEL NetUSB Share Center Utility.

1 Install the ZyXEL NetUSB Share Center Utility on each computer connected to the NBG4615.

2 Connect a USB device to the USB port on the NBG4615.

Note: If you are connecting multiple devices to the NBG4615, first connect a USB hub to the NBG4615 then connect your other USB devices to it.

3 Run the ZyXEL NetUSB Share Center Utility to display a list of all connected USB devices, then use it to connect your computer to them.

3.1.2 Installing ZyXEL NetUSB Share Center Utility

Before you can access USB devices connected to the NBG4615, you must first install the ZyXEL NetUSB Share Center Utility on any computer on your LAN to which you want to allow access to these devices.

Note: In order to properly use the utility with your NBG4615, ensure that the NBG4615 firmware is version v1.00(BWQ.0) or higher. See Chapter 29 on page 219 for information on updating your device’s firmware.

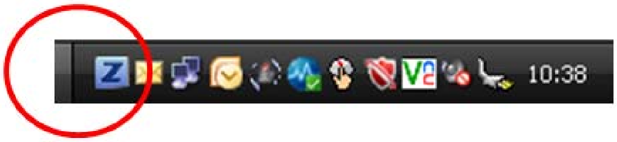
To install the ZyXEL NetUSB Share Center Utility:

1 Insert the disc that came with your NBG4615 into your computer’s disc drive.

2 Run the **Setup** program by double-clicking it and then follow the on-screen instructions for installing it on your computer.

Note: The following operating systems are supported: Windows XP/Vista/7 (32 and 64-bit versions), and Mac OS X 10.6.

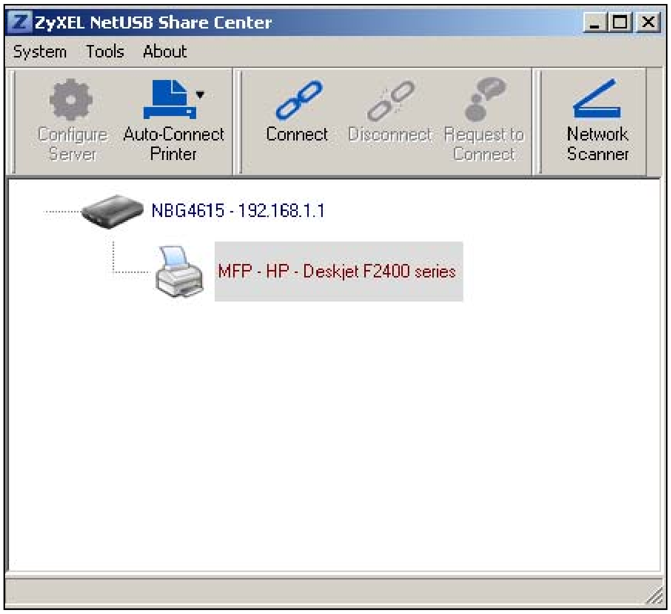
3 To open the ZyXEL NetUSB Share Center Utility, double-click its system tray icon.



3.2 The ZyXEL NetUSB Share Center Utility

This section describes the ZyXEL NetUSB Share Center Utility main window.

Figure 2 ZyXEL NetUSB Share Center Utility Main Window



The following table describes the icons in this window.

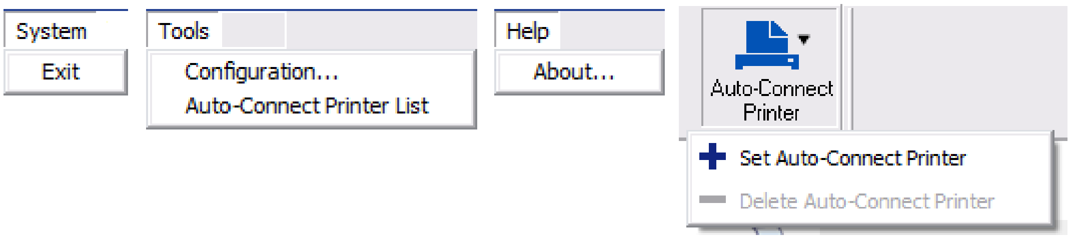
Table 2 ZyXEL NetUSB Share Center Utility Main Window Icons

ICON	DESCRIPTION
⚙	Configure Server Click to open the NBG4615's built-in Web Configurator, which you can use to set up the NBG4615 (see Chapter 5 on page 43 for details).
🖨	Auto-Connect Printer You can set the selected printer to 'auto-connect' after you have connected it to your computer during inital connection. If the printer is auto-connected to your computer, they will always be connected over the network. You do not need to configure it manually each time. Note: If the computer is connecting to the shared USB printer for the first time, you need to click **Connect** and setup the printer before you can use the **Auto-Connect Printer** function. See Chapter 14 on page 121 for more details. Note: You first must install the appropriate drivers for the printer that you intend to use.
🔗	Connect Select a USB device and then click this button to connect to it. Your computer can connect to as many USB devices as are connected to the NBG4615.
⛓️‍💥	Disconnect Select a device to which your computer is connected and then click this button to disconnect from it.
💬	Request to Connect Some USB devices may not allow automatic connections over the network. If so, select the device in question and click this button to issue a request to connect to it.
	Network Scanner Click this to open the scanner options on your computer for working with a scanner connected to the network.

3.2.1 The Menus

This section describes the utility's menus.

Figure 3 ZyXEL NetUSB Share Center Utility Menus



The following table describes the menus in this screen.

Table 3 ZyXEL NetUSB Share Center Utility Main Screen Menus

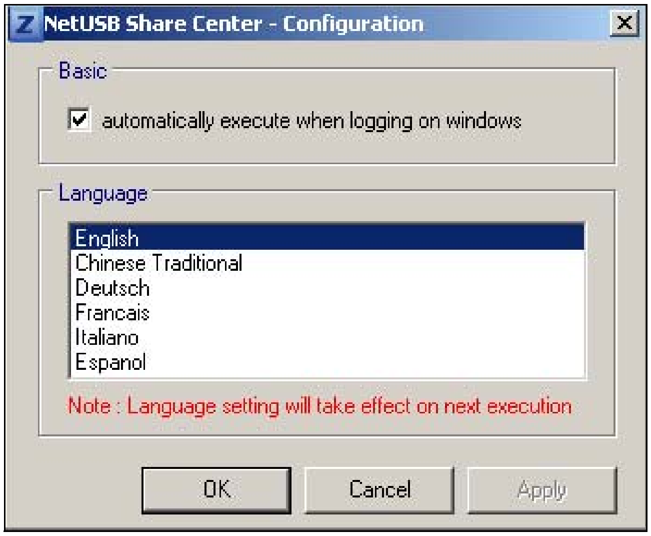
MENU	ITEM	DESCRIPTION
System	Exit	This closes the ZyXEL NetUSB Share Center Utility.
Tools	Configuration	This opens the ZyXEL NetUSB Share Center Utility configuration window.
	Auto-Connect Printer List	This opens the list window that displays all of the printing devices connected to the NBG4615.
Help	About	This opens the about window, which provides information of the utility software and driver versions.
Auto-Connect Printer	Set Auto-Connect Printer	You can set the selected printer to ‘auto-connect’ after you have connected it to your computer during inital connection. If the printer is auto-connected to your computer, they will always be connected over the network. You do not need to configure it manually each time. Click this to show your installed printer list and select the one you want to set as auto-connected. Note: If the computer is connecting to the shared USB printer for the first time, you need to click **Connect** and setup the printer before you can use the **Auto-Connect Printer** function. See Chapter 14 on page 121 for more details. Note: You first must install the appropriate drivers for the printer that you intend to use.
	Delete Auto-Connect Printer	This removes the auto-connect option from the selected printer.

3.2.2 The ZyXEL NetUSB Share Center Configuration Window

This section describes the utility’s configuration window, which allows you to set certain options for the utility. These options do not apply to the USB devices connected to the NBG4615.

You can open it by clicking the **Tools > Configuration** menu command.

Figure 4 ZyXEL NetUSB Share Center Utility Configuration Window



NetUSB Share Center - Configuration

Basic

☑ automatically execute when logging on windows

Language

English
Chinese Traditional
Deutsch
Francais
Italiano
Espanol

Note : Language setting will take effect on next execution

The following table describes the labels in this window.

Table 4 ZyXEL NetUSB Share Center Utility Configuration Window

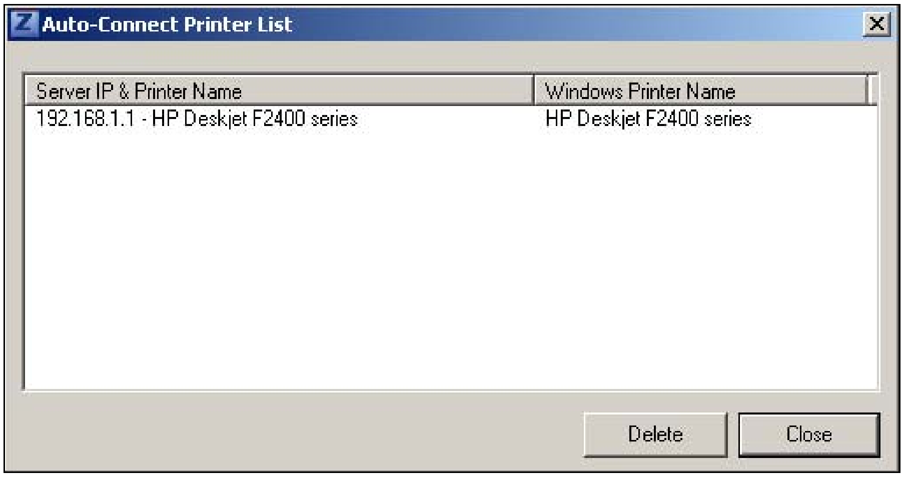
LABEL	DESCRIPTION
Basic	Select this to run the utility automatically when you log into or start up Windows.
Language	Select a language for the ZyXEL NetUSB Share Center Utility. You must restart the utility for the change to take effect.
OK	Click this to save your changes and close the window.
Cancel	Click this cancel to close the window without saving.
Apply	Click this to save your changes without closing the window.

3.2.3 The Auto-Connect Printer List Window

This section describes the utility’s auto-connect printer list window. You can open it by clicking the **Tools > Auto-Connect Printer List** menu command.

Note: If the computer is connecting to the shared USB printer for the first time, you need to click **Connect** and setup the printer before you can use the **Auto-Connect Printer** function. See Chapter 14 on page 121 for more details.

Figure 5 ZyXEL NetUSB Share Center Utility Auto-Connect Printer List Window



Server IP & Printer Name	Windows Printer Name
192.168.1.1 - HP Deskjet F2400 series	HP Deskjet F2400 series

The following table describes the labels in this screen.

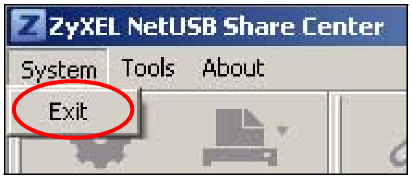
Table 5 ZyXEL NetUSB Share Center Utility Auto-Connect Printer List Window

LABEL	DESCRIPTION
Server IP & Printer Name	Displays a list of print server IPs and printer names connected to this NBG4615.
Windows Printer Name	Displays a corresponding list of Windows printer names connected to this devices listed in the other list.
Delete	Select an printer from the list and click this to remove it.
Close	Click this to close the window.

3.2.4 Exit the ZyXEL NetUSB Share Center Utility

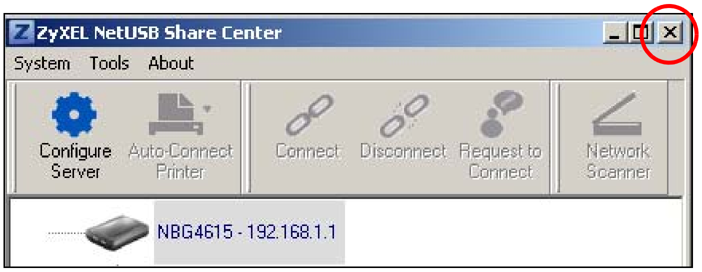
If you want to exit the ZyXEL NetUSB Share Center Utility when your computer is not connected to any USB device, follow the steps below:

1 Click **System > Exit** on the Utility screen. The Utility will automatically close.

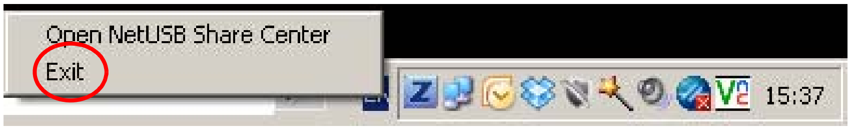


Or you can close the Utlity screen first, then exit:

1 Click the **X** on the upper-right corner of the Utility:



2 This will close the Utility screen to an icon at the system tray of your computer. Right-click on the Utility’s icon and click **Exit**.



4

Connection Wizard

4.1 Overview

This chapter provides information on the wizard setup screens in the Web Configurator.

The Web Configurator’s wizard setup helps you configure your device to access the Internet. Refer to your ISP for your Internet account information. Leave a field blank if you don’t have that information.

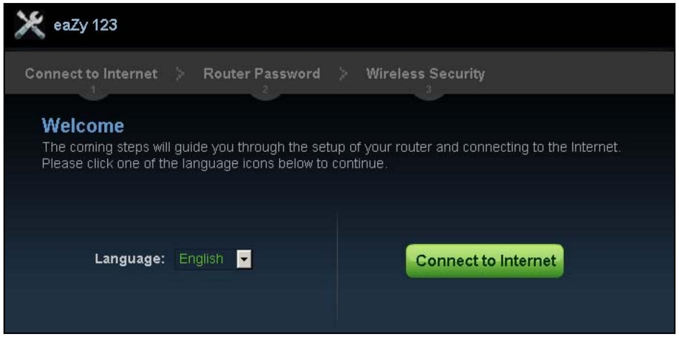
4.2 Accessing the Wizard

Launch your web browser and type "http://192.168.1.1" as the website address. Type "1234" (default) as the password and click **Login**.

Note: The Wizard appears when the NBG4615 is accessed for the first time or when you reset the NBG4615 to its default factory settings.

The Wizard screen opens. Choose your **Language** and click **Connect to Internet.**

Figure 6 Welcome



Welcome

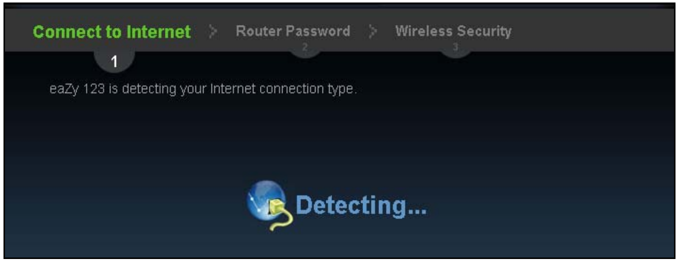
The coming steps will guide you through the setup of your router and connecting to the Internet. Please click one of the language icons below to continue.

Language: English

4.3 Connect to Internet

The NBG4615 offers five Internet connection types. They are **Static IP**, **DHCP**, **PPPoE**, **PPTP** or **L2TP**. The wizard attempts to detect which WAN connection type you are using.

Figure 7 Detecting your Internet Connection Type



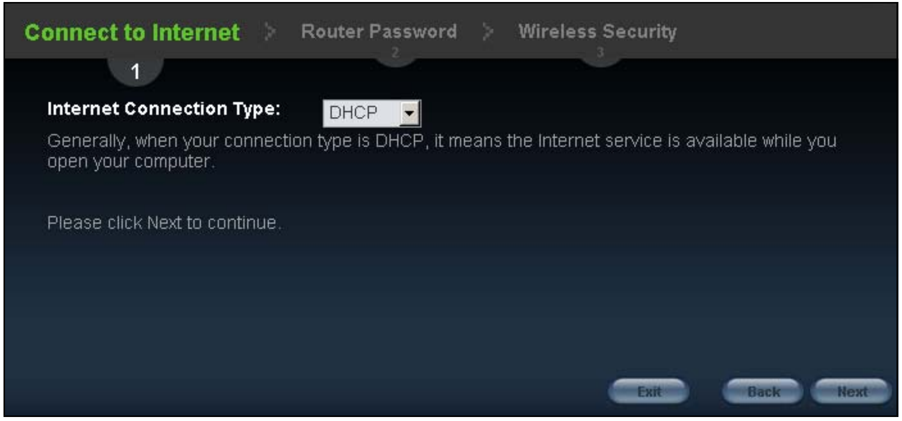
eaZy 123 is detecting your Internet connection type.

If the wizard does not detect a connection type, you must select one from the drop-down list box. Check with your ISP to make sure you use the correct type.

Note: If you get an error message, check your hardware connections. Make sure your Internet connection is up and running.

The following screen depends on your Internet connection type. Enter the details provided by your Internet Service Provider (ISP) in the fields (if any).

Figure 8 Internet Connection Type



Internet Connection Type: DHCP

Generally, when your connection type is DHCP, it means the Internet service is available while you open your computer.

Please click Next to continue.

Your NBG4615 detects the following Internet Connection type.

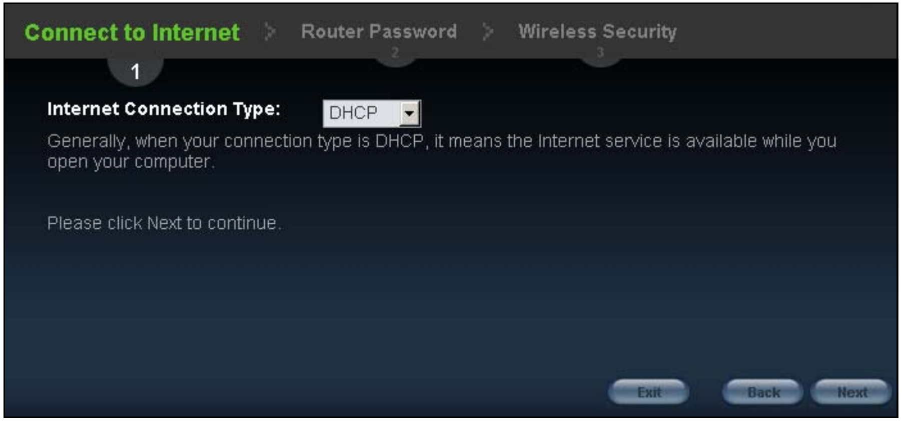
Table 6 Internet Connection Type

CONNECTION TYPE	DESCRIPTION
Static IP	Select the **Static IP** if an administrator assigns the IP address of your computer.
DHCP	Select the **DHCP** (Dynamic Host Configuration Protocol) option when the WAN port is used as a regular Ethernet.
PPPoE	Select the **PPPoE** (Point-to-Point Protocol over Ethernet) option for a dial-up connection.
PPTP	Select the **PPTP** (Point-to-Point Tunneling Protocol) option for a dial-up connection, and your ISP gave you an IP address and/or subnet mask.
L2TP	Select the **L2TP** (Layer 2 Tunnel Protocol) if you are connecting to another device over another network (like the Internet or VPN).

4.3.1 Connection Type: DHCP

Choose **DHCP** as the **Internet Connection Type** when the WAN port is used as a regular Ethernet. Click **Next**.

Figure 9 Internet Connection Type: DHCP



Internet Connection Type: DHCP

Generally, when your connection type is DHCP, it means the Internet service is available while you open your computer.

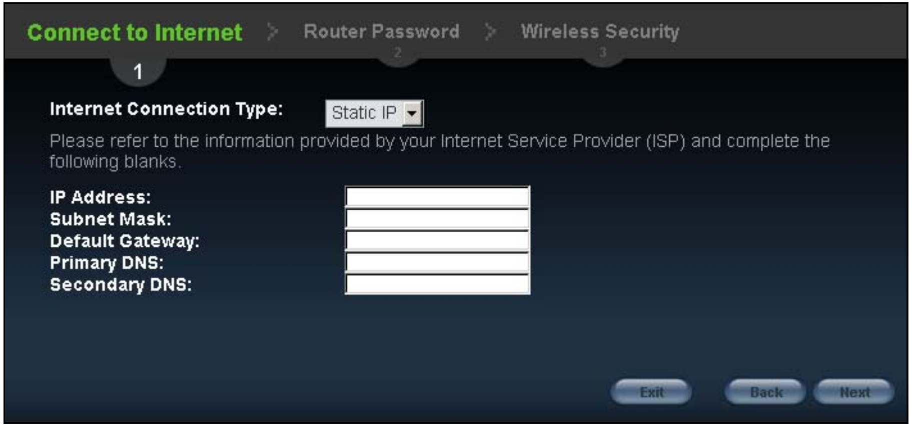
Please click Next to continue.

Note: If you get an error screen after clicking **Next**, you might have selected the wrong Internet Connection type. Click **Back**, make sure your Internet connection is working and select the right Connection Type. Contact your ISP if you are not sure of your Internet Connection type.

4.3.2 Connection Type: Static IP

Choose **Static IP** as the **Internet Connection Type** if your ISP assigned an IP address for your Internet connection. Click **Next**.

Figure 10 Internet Connection Type: Static IP



Internet Connection Type: Static IP

Please refer to the information provided by your Internet Service Provider (ISP) and complete the following blanks.

IP Address:
Subnet Mask:
Default Gateway:
Primary DNS:
Secondary DNS:

The following table describes the labels in this screen.

Table 7 Internet Connection Type: Static IP

LABEL	DESCRIPTION
Internet Connection Type	Select the **Static IP** option.
IP Address	Enter the IP address provided by your ISP.
Subnet Mask	Enter the IP subnet mask in this field.

Table 7 Internet Connection Type: Static IP (continued)

LABEL	DESCRIPTION
Default Gateway	Enter the gateway IP address in this field.
Primary DNS	DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it. The NBG4615 uses a system DNS server (in the order you specify here) to resolve domain names for DDNS and the time server. Enter the primary DNS server's IP address in the fields provided.
Secondary DNS	Enter the secondary DNS server's IP address in the fields provided.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

4.3.3 Connection Type: PPPoE

Point-to-Point Protocol over Ethernet (PPPoE) functions as a dial-up connection. PPPoE is an IETF (Internet Engineering Task Force) standard specifying how a host personal computer interacts with a broadband modem (for example DSL, cable, wireless, etc.) to achieve access to high-speed data networks.

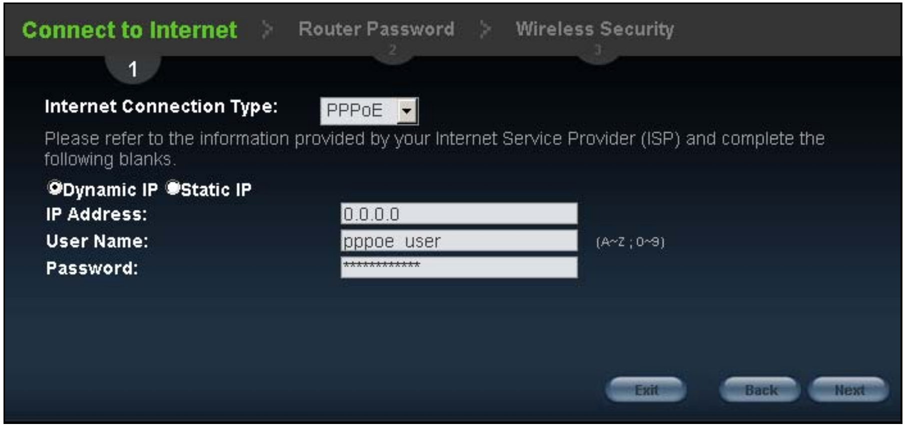
For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for instance, RADIUS).

One of the benefits of PPPoE is the ability to let end users 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 specific users.

Operationally, PPPoE saves significant effort for both the subscriber and the ISP/carrier, as it requires no specific configuration of the broadband modem at the subscriber's site.

By implementing PPPoE directly on the NBG4615 (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the NBG4615 does that part of the task. Furthermore, with NAT, all of the LAN's computers will have Internet access.

Figure 11 Internet Connection Type: PPPoE



Internet Connection Type: PPPoE

Please refer to the information provided by your Internet Service Provider (ISP) and complete the following blanks.

● Dynamic IP ○ Static IP

IP Address: 0.0.0.0

User Name: pppoe_user (A~Z ; 0~9)

Password: ************

The following table describes the labels in this screen.

Table 8 Internet Connection Type: PPPoE

LABEL	DESCRIPTION
Internet Connection Type	Select the **PPPoE** option for a dial-up connection.
Dynamic IP	Select this radio button if your ISP did not assign you a fixed IP address.
Static IP	Select this radio button, provided by your ISP to give the NBG4615 a fixed, unique IP address.
IP Address	Type the name of your service provider.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

4.3.4 Connection Type: PPTP

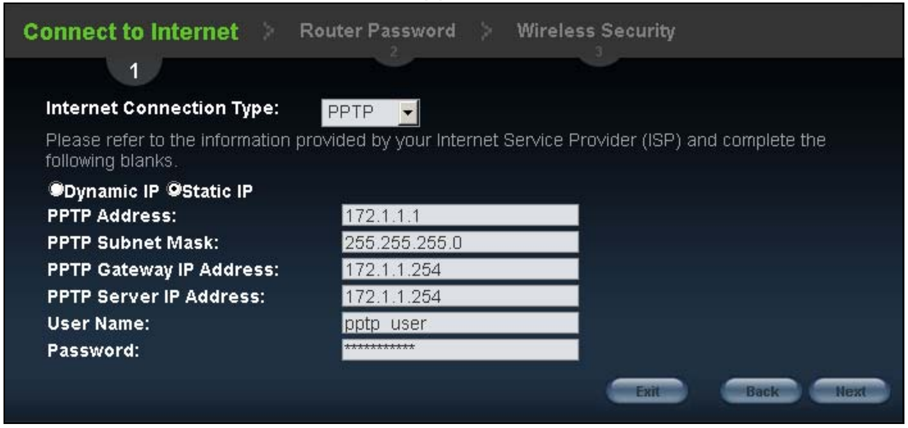
Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables transfers of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol, and virtual private networking over public networks, such as the Internet.

Refer to the appendix for more information on PPTP.

The NBG4615 supports one PPTP server connection at any given time.

Figure 12 Internet Connection Type: PPTP



Internet Connection Type: PPTP

Please refer to the information provided by your Internet Service Provider (ISP) and complete the following blanks.

○ Dynamic IP ● Static IP

PPTP Address:	172.1.1.1
PPTP Subnet Mask:	255.255.255.0
PPTP Gateway IP Address:	172.1.1.254
PPTP Server IP Address:	172.1.1.254
User Name:	pptp_user
Password:	***********

The following table describes the fields in this screen

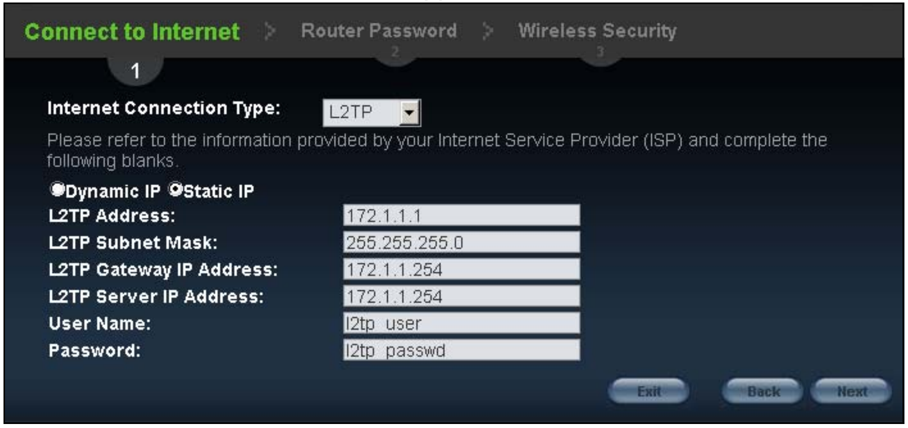
Table 9 Internet Connection Type: PPTP

LABEL	DESCRIPTION
Internet Connection Type	Select **PPTP** from the drop-down list box. To configure a PPTP client, you must configure the **User Name** and **Password** fields for a PPP connection and the PPTP parameters for a PPTP connection.
Dynamic IP	Select this radio button if your ISP did not assign you a fixed IP address.
Static IP	Select this radio button, provided by your ISP to give the NBG4615 a fixed, unique IP address.
PPTP Address	Type the (static) IP address assigned to you by your ISP.
PPTP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
PPTP Gateway IP Address	Type the gateway IP address of the PPTP server.
PPTP Server IP Address	Type the server IP address of the PPTP server.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the User Name above.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

4.3.5 Connection Type: L2TP

The Layer 2 Tunneling Protocol (L2TP) works at layer 2 (the data link layer) to tunnel network traffic between two peer devices over another network (like the Internet).

Figure 13 Internet Connection Type: L2TP



Internet Connection Type: L2TP

Please refer to the information provided by your Internet Service Provider (ISP) and complete the following blanks.

● Dynamic IP ○ Static IP

L2TP Address: 172.1.1.1

L2TP Subnet Mask: 255.255.255.0

L2TP Gateway IP Address: 172.1.1.254

L2TP Server IP Address: 172.1.1.254

User Name: l2tp user

Password: l2tp passwd

The following table describes the fields in this screen

Table 10 Internet Connection Type: L2TP

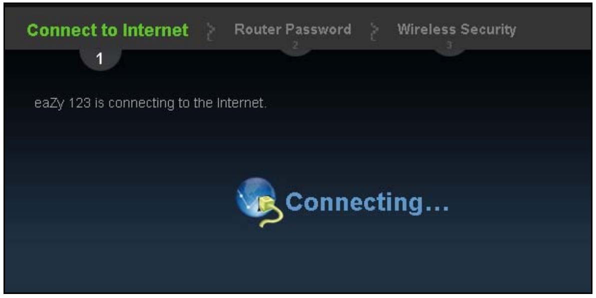
LABEL	DESCRIPTION
Internet Connection Type	Select **L2TP** from the drop-down list box.
Dynamic IP	Select this radio button if your ISP did not assign you a fixed IP address.

Table 10 Internet Connection Type: L2TP (continued)

LABEL	DESCRIPTION
Static IP	Select this radio button, provided by your ISP to give the NBG4615 a fixed, unique IP address.
L2TP Address	Type the (static) IP address assigned to you by your ISP.
L2TP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
L2TP Gateway IP Address	Type the gateway IP address of the L2TP server.
L2TP Server IP Address	Type the server IP address of the L2TP server.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the User Name above.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

The NBG4615 connects to the Internet.

Figure 14 Connecting to the Internet



eaZy 123 is connecting to the Internet.

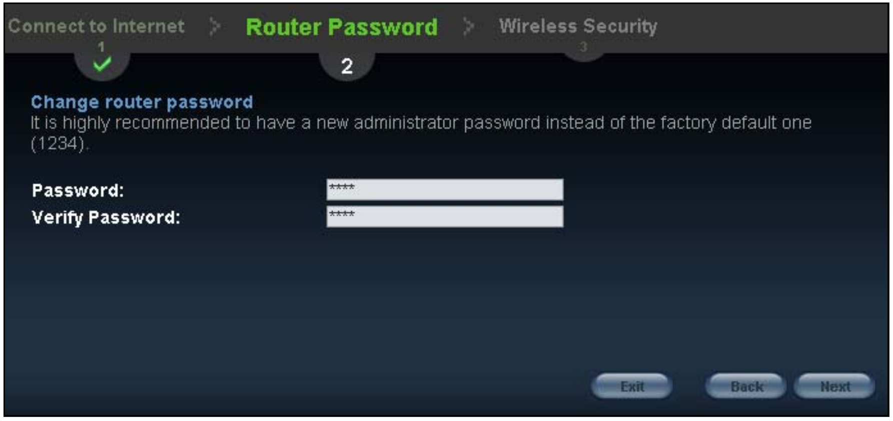
Connecting...

Note: If the Wizard successfully connects to the Internet, it proceeds to the next step. If you get an error message, go back to the previous screen and make sure you have entered the correct information provided by your ISP.

4.4 Router Password

Change the login password in the following screen. Enter the new password and retype it to confirm. Click **Next** to proceed with the **Wireless Security** screen**.**

Figure 15 Router Password



Change router password

It is highly recommended to have a new administrator password instead of the factory default one (1234).

Password: ****

Verify Password: ****

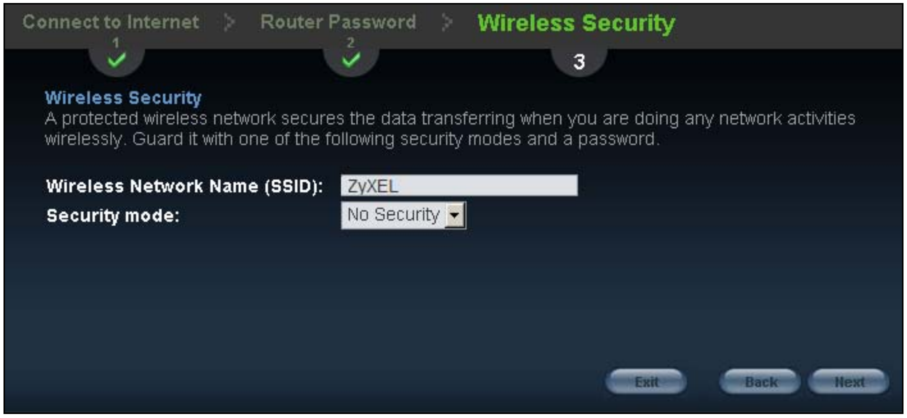
4.5 Wireless Security

Configure Wireless Settings. Configure the wireless network settings on your NBG4615 in the following screen. The fields that show up depend on the kind of security you select.

4.5.1 Wireless Security: No Security

Choose **No Security** in the Wireless Security screen to let wireless devices within range access your wireless network.

Figure 16 Wireless Security: No Security



Wireless Security

A protected wireless network secures the data transferring when you are doing any network activities wirelessly. Guard it with one of the following security modes and a password.

Wireless Network Name (SSID): ZyXEL

Security mode: No Security

The following table describes the labels in this screen.

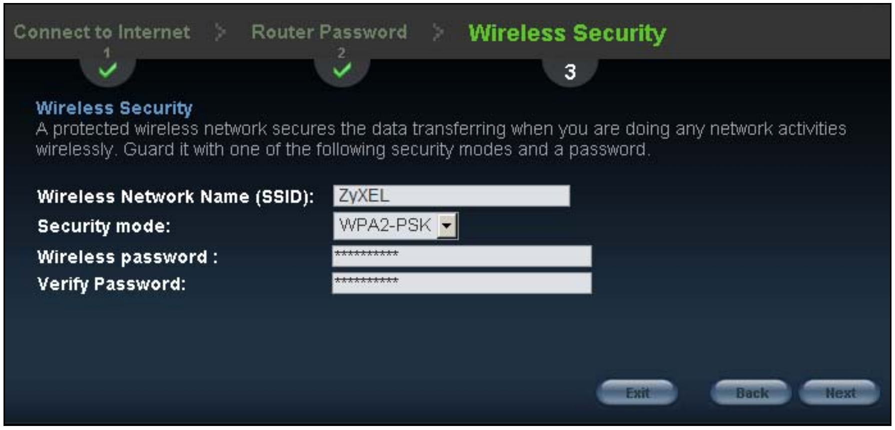
Table 11 Wireless Security: No Security

LABEL	DESCRIPTION
Wireless Network Name (SSID)	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the NBG4615, make sure all wireless stations use the same SSID in order to access the network.
Security mode	Select a **Security** level from the drop-down list box. Choose **No Security** to have no wireless LAN security configured. If you do not enable any wireless security on your NBG4615, your network is accessible to any wireless networking device that is within range.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

4.5.2 Wireless Security: WPA-PSK/WPA2-PSK

Choose **WPA-PSK** or **WPA2-PSK** security in the Wireless Security screen to set up a password for your wireless network.

Figure 17 Wireless Security: WPA-PSK/WPA2-PSK



Wireless Security

A protected wireless network secures the data transferring when you are doing any network activities wirelessly. Guard it with one of the following security modes and a password.

Wireless Network Name (SSID): ZyXEL

Security mode: WPA2-PSK

Wireless password : **********

Verify Password: **********

The following table describes the labels in this screen.

Table 12 Wireless Security: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Wireless Network Name (SSID)	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the NBG4615, make sure all wireless stations use the same SSID in order to access the network.
Security mode	Select a **Security** level from the drop-down list box. Choose **WPA-PSK** or **WPA2-PSK** security to configure a Pre-Shared Key. Choose this option only if your wireless clients support WPA-PSK or WPA2-PSK respectively.
Wireless password	Type from 8 to 63 case-sensitive ASCII characters. You can set up the most secure wireless connection by configuring WPA in the wireless LAN screens.

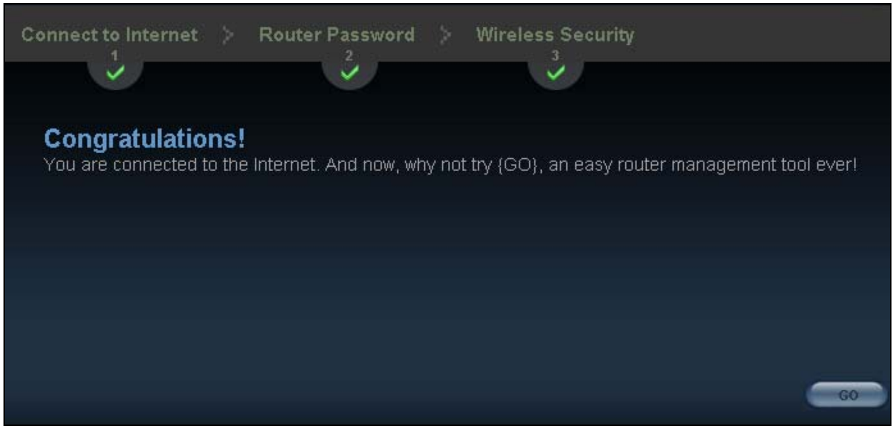
Table 12 Wireless Security: WPA-PSK/WPA2-PSK (continued)

LABEL	DESCRIPTION
Verify Password	Retype the password to confirm.
Exit	Click this to close the wizard screen without saving.
Back	Click this to return to the previous screen.
Next	Click this to continue.

Congratulations! Open a web browser, such as Internet Explorer, to visit your favorite website.

Note: If you cannot access the Internet when your computer is connected to one of the NBG4615's LAN ports, check your connections. Then turn the NBG4615 off, wait for a few seconds then turn it back on. If that does not work, log in to the web configurator again and check you have typed all information correctly. See the User's Guide for more suggestions.

Figure 18 Congratulations



Congratulations!

You are connected to the Internet. And now, why not try {GO}, an easy router management tool ever!

You can also click **GO** to open the **Easy Mode** Web Configurator of your NBG4615.

You have successfully set up your NBG4615 to operate on your network and access the Internet. You are now ready to connect wirelessly to your NBG4615 and access the Internet.

5

Introducing the Web Configurator

5.1 Overview

This chapter describes how to access the NBG4615 Web Configurator and provides an overview of its screens.

The Web Configurator is an HTML-based management interface that allows easy setup and management of the NBG4615 via Internet browser. Use Internet Explorer 6.0 and later versions, Mozilla Firefox 3 and later versions, or Safari 2.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

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

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

Refer to the Troubleshooting chapter (Chapter 30 on page 227) to see how to make sure these functions are allowed in Internet Explorer.

5.2 Accessing the Web Configurator

1. Make sure your NBG4615 hardware is properly connected and prepare your computer or computer network to connect to the NBG4615 (refer to the Quick Start Guide).
2. Launch your web browser.
3. Type "http://192.168.1.1" as the website address.

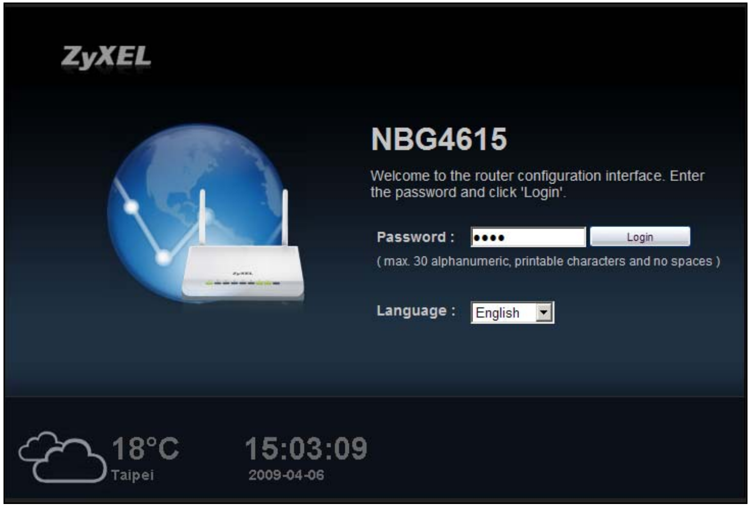
   Your computer must be in the same subnet in order to access this website address.

5.2.1 Login Screen

Note: If this is the first time you are accessing the Web Configurator, you may be redirected to the Wizard. Refer to Chapter 4 on page 33 for the Connection Wizard screens.

The Web Configurator initially displays the following login screen.

Figure 19 Login screen



NBG4615

Welcome to the router configuration interface. Enter the password and click 'Login'.

Password : ••••

(max. 30 alphanumeric, printable characters and no spaces)

Language : English

The following table describes the labels in this screen.

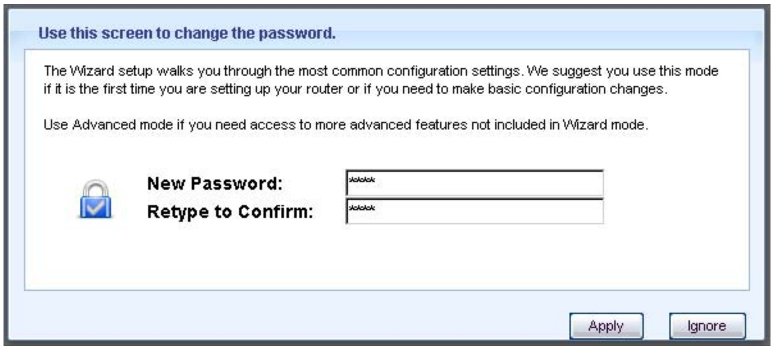
Table 13 Login screen

LABEL	DESCRIPTION
Password	Type "1234" (default) as the password.
Language	Select the language you want to use to configure the Web Configurator. Click **Login**.
	This shows the current weather, either in celsius or fahrenheit, of the city you specify in Section 5.2.3.1 on page 46.
	This shows the time (hh:mm:ss) and date (yyyy:mm:dd) of the timezone you select in Section 5.2.3.2 on page 46 or Section 29.5 on page 217. The time is in 24-hour format, for example 15:00 is 3:00 PM.

5.2.2 Password Screen

You should see a screen asking you to change your password (highly recommended) as shown next.

Figure 20 Change Password Screen



Use this screen to change the password.

The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.

Use Advanced mode if you need access to more advanced features not included in Wizard mode.

New Password: ****

Retype to Confirm: ****

The following table describes the labels in this screen.

Table 14 Change Password Screen

LABEL	DESCRIPTION
New Password	Type a new password.
Retype to Confirm	Retype the password for confirmation.
Apply	Click **Apply** to save your changes back to the NBG4615.
Ignore	Click **Ignore** if you do not want to change the password this time.

Note: The management session automatically times out when the time period set in the **Administrator Inactivity Timer** field expires (default five minutes; go to Chapter 29 on page 215 to change this). Simply log back into the NBG4615 if this happens.

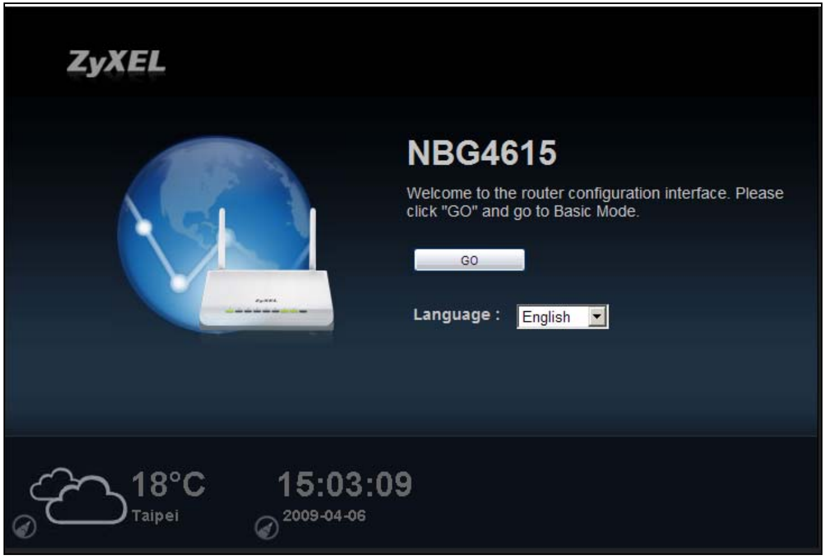
5.2.3 Home Screen

If you have previously logged into the Web Configurator but did not click **Logout**, you may be redirected to the Home screen.

You can also open this screen by clicking **Home** (Home or Home) in the Easy Mode or Expert mode screens.

The **Home** screen displays as follows.

Figure 21 Home Screen



NBG4615

Welcome to the router configuration interface. Please click "GO" and go to Basic Mode.

GO

Language : English

18°C Taipei

15:03:09 2009-04-06

The following table describes the labels in this screen.

Table 15 Home Screen

LABEL	DESCRIPTION
Go	Click this to open the **Easy Mode** Web Configurator.
Language	Select a language to go to the Easy mode Web Configurator in that language and click **Login**.

Table 15 Home Screen (continued)

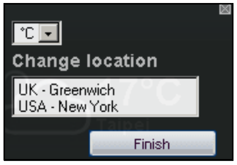
LABEL	DESCRIPTION
	(This is just an example). This shows the current weather, either in celsius or fahrenheit, of the city you specify in Section 5.2.3.1 on page 46.
	(This is just an example). This shows the time (hh:mm:ss) and date (yyyy:mm:dd) of the timezone you select in Section 5.2.3.2 on page 46 or Section 29.5 on page 217.

5.2.3.1 Weather Edit

You can change the temperature unit and select the location for which you want to know the weather.

Click the icon to change the Weather display.

Figure 22 Change Weather



The following table describes the labels in this screen.

Table 16 Change Weather

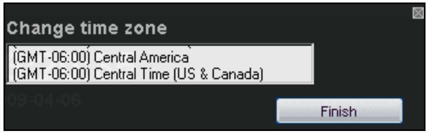
LABEL	DESCRIPTION
^{o}C or ^{o}F	Choose which temperature unit you want the NBG4615 to display.
Change Location	Select the location for which you want to know the weather. If the city you want is not listed, choose one that is closest to it.
Finish	Click this to apply the settings and refresh the date and time display.

5.2.3.2 Time/Date Edit

One timezone can cover more than one country. You can choose a particular country in which the NBG4615 is located and have the NBG4615 display and use the current time and date for its logs.

Click the icon to change the Weather display.

Figure 23 Change Password Screen


Change time zone
(GMT-06:00) Central America
(GMT-06:00) Central Time (US & Canada)
Finish

The following table describes the labels in this screen.

Table 17 Change Password Screen

LABEL	DESCRIPTION
Change time zone	Select the specific country whose current time and date you want the NBG4615 to display.
Finish	Click this to apply the settings and refresh the weather display.

Note: You can also edit the timezone in Section 29.5 on page 217.

5.3 Resetting the NBG4615

If you forget your password or IP address, or you cannot access the Web Configurator, you will need to use the **RESET** button at the back of the NBG4615 to reload the factory-default configuration file. This means that you will lose all configurations that you had previously saved, the password will be reset to "1234" and the IP address will be reset to "192.168.1.1".

5.3.1 How to Use the RESET Button

1 Make sure the power LED is on.

2 Press the **RESET** button for longer than 1 second to restart/reboot the NBG4615.

3 Press the **RESET** button for longer than 5 seconds to set the NBG4615 back to its factory-default configurations.

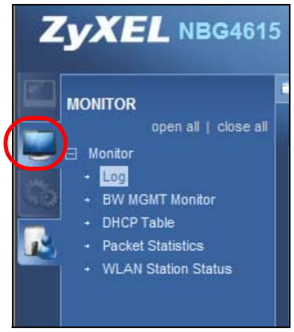
6

Monitor

6.1 Overview

This chapter discusses read-only information related to the device state of the NBG4615.

To access the Monitor screens, go to **Expert Mode** after login, then click . Click **open all** to show the complete menu.



You can also click the links in the **Summary** table of the **Status** screen to view the bandwidth consumed, packets sent/received as well as the status of clients connected to the NBG4615.

6.2 What You Can Do

- Use the **Log** screen to see the logs for the activity on the NBG4615 (Section 6.3 on page 49).
- Use the **BW MGMT Monitor** screen to view the amount of network bandwidth that applications running in the network are using (Section 6.4 on page 51).
- Use the **DHCP Table** screen to view information related to your DHCP status (Section 6.5 on page 51).
- use the **Packet Statistics** screen to view port status, packet specific statistics, the "system up time" and so on (Section 6.6 on page 53).
- Use the **WLAN Station Status** screen to view the wireless stations that are currently associated to the NBG4615 (Section 6.7 on page 54).

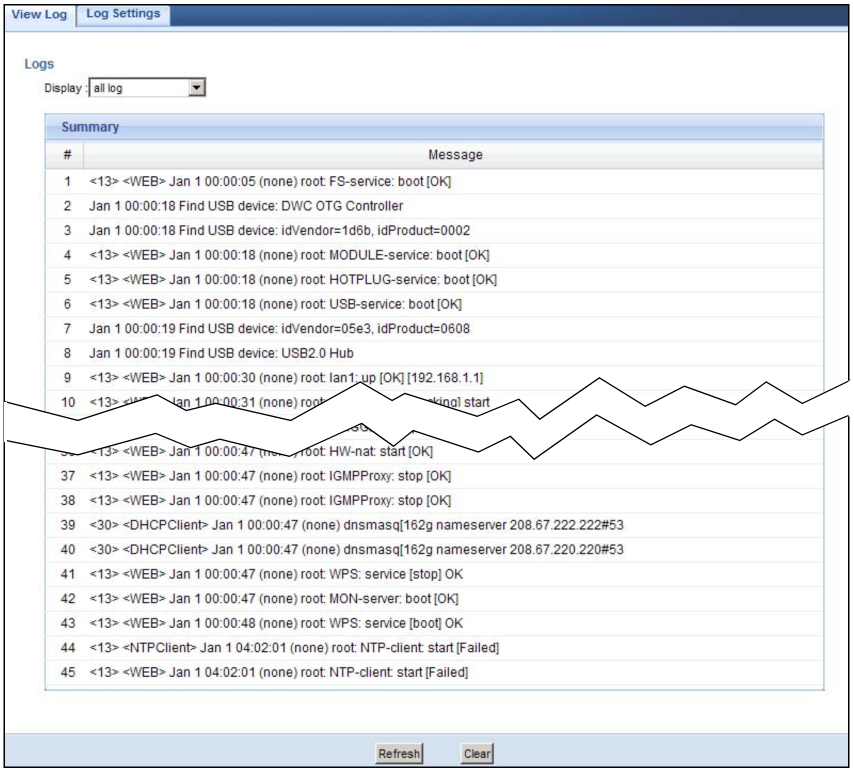
6.3 The Log Screen

The Web Configurator allows you to look at all of the NBG4615’s logs in one location.

6.3.1 View Log

Use the **View Log** screen to see the logged messages for the NBG4615. The log wraps around and deletes the old entries after it fills. Select what logs you want to see from the **Display** drop list. The log choices depend on your settings in the **Log Settings** screen. Click **Refresh** to renew the log screen. Click **Clear** to delete all the logs.

Figure 24 View Log



Logs

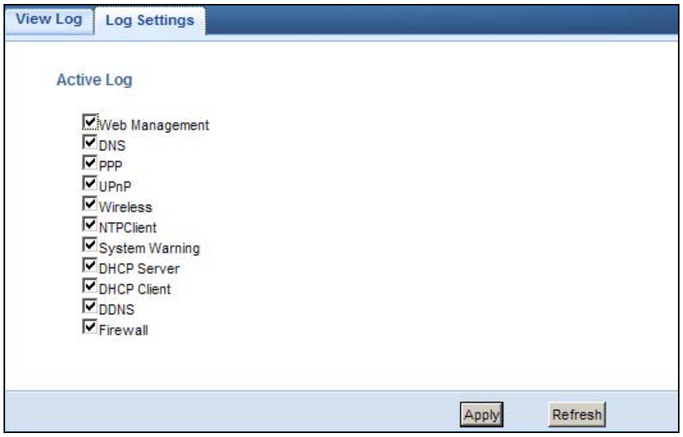
Display : all log

Summary

#	Message
1	<13> <WEB> Jan 1 00:00:05 (none) root: FS-service: boot [OK]
2	Jan 1 00:00:18 Find USB device: DWC OTG Controller
3	Jan 1 00:00:18 Find USB device: idVendor=1d6b, idProduct=0002
4	<13> <WEB> Jan 1 00:00:18 (none) root: MODULE-service: boot [OK]
5	<13> <WEB> Jan 1 00:00:18 (none) root: HOTPLUG-service: boot [OK]
6	<13> <WEB> Jan 1 00:00:18 (none) root: USB-service: boot [OK]
7	Jan 1 00:00:19 Find USB device: idVendor=05e3, idProduct=0608
8	Jan 1 00:00:19 Find USB device: USB2.0 Hub
9	<13> <WEB> Jan 1 00:00:30 (none) root: lan1: up [OK] [192.168.1.1]
10	<13> <W Jan 1 00:00:31 (none) root king] start
36	<13> <WEB> Jan 1 00:00:47 (no root: HW-nat: start [OK]
37	<13> <WEB> Jan 1 00:00:47 (none) root: IGMPProxy: stop [OK]
38	<13> <WEB> Jan 1 00:00:47 (none) root: IGMPProxy: stop [OK]
39	<30> <DHCPClient> Jan 1 00:00:47 (none) dnsmasq[162g nameserver 208.67.222.222#53
40	<30> <DHCPClient> Jan 1 00:00:47 (none) dnsmasq[162g nameserver 208.67.220.220#53
41	<13> <WEB> Jan 1 00:00:47 (none) root: WPS: service [stop] OK
42	<13> <WEB> Jan 1 00:00:47 (none) root: MON-server: boot [OK]
43	<13> <WEB> Jan 1 00:00:48 (none) root: WPS: service [boot] OK
44	<13> <NTPClient> Jan 1 04:02:01 (none) root: NTP-client: start [Failed]
45	<13> <WEB> Jan 1 04:02:01 (none) root: NTP-client: start [Failed]

You can configure which logs to display in the **View Log** screen. Go to the **Log Settings** screen and select the logs you wish to display. Click **Apply** to save your settings. Click **Refresh** to start the screen afresh.

Figure 25 Log Settings



Active Log

☑ Web Management
☑ DNS
☑ PPP
☑ UPnP
☑ Wireless
☑ NTPClient
☑ System Warning
☑ DHCP Server
☑ DHCP Client
☑ DDNS
☑ Firewall

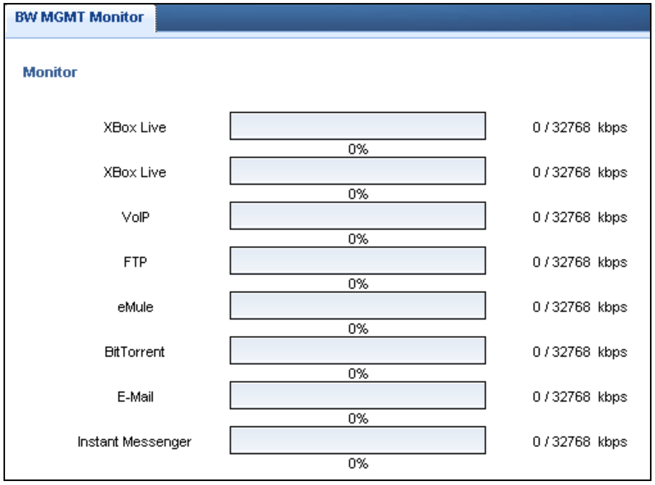
6.4 BW MGMT Monitor

The Bandwidth Management (BW MGMT) Monitor allows you to view the amount of network bandwidth that applications running in the network are using.

The bandwidth is measured in kilobytes per second (kbps).

The monitor shows what kinds of applications are running in the network, the maximum kbps that each application can use, as well as the percentage of bandwidth it is using.

Figure 26 Summary: BW MGMT Monitor



BW MGMT Monitor

Monitor

XBox Live	0%	0 / 32768 kbps
XBox Live	0%	0 / 32768 kbps
VoIP	0%	0 / 32768 kbps
FTP	0%	0 / 32768 kbps
eMule	0%	0 / 32768 kbps
BitTorrent	0%	0 / 32768 kbps
E-Mail	0%	0 / 32768 kbps
Instant Messenger	0%	0 / 32768 kbps

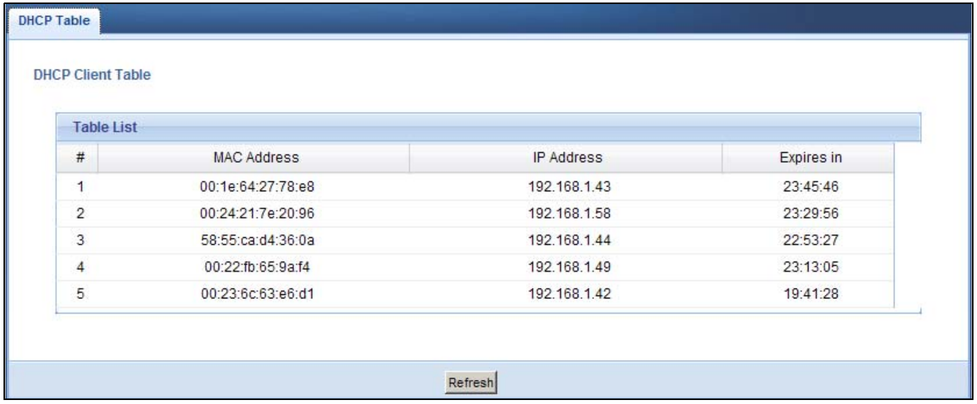
6.5 DHCP Table

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 NBG4615’s LAN as a DHCP server or disable it. When configured as a server, the NBG4615 provides the TCP/IP configuration for the clients. If DHCP service is disabled, you must have another DHCP server on that network, or else the computer must be manually configured.

Click the **DHCP Table (Details...)** hyperlink in the **Status** screen. Read-only information here relates to your DHCP status. The DHCP table shows current DHCP client information (including **MAC**

Address, IP Address, and **Expiration time**) of all network clients using the NBG4615's DHCP server.

Figure 27 Summary: DHCP Table



#	MAC Address	IP Address	Expires in
1	00:1e:64:27:78:e8	192.168.1.43	23:45:46
2	00:24:21:7e:20:96	192.168.1.58	23:29:56
3	58:55:ca:d4:36:0a	192.168.1.44	22:53:27
4	00:22:fb:65:9a:f4	192.168.1.49	23:13:05
5	00:23:6c:63:e6:d1	192.168.1.42	19:41:28

The following table describes the labels in this screen.

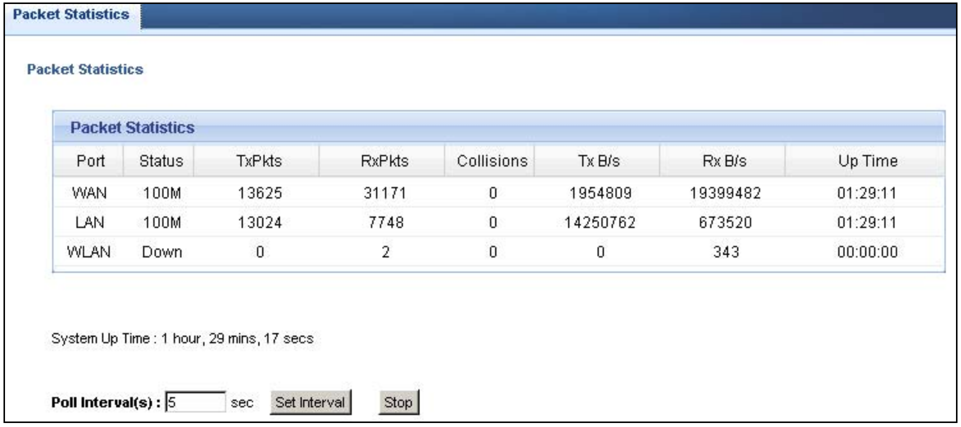
Table 18 Summary: DHCP Table

LABEL	DESCRIPTION
#	This is the index number of the host computer.
MAC Address	This field shows the MAC address of the computer with the name in the **Host Name** field. Every Ethernet device has a unique MAC (Media Access Control) address which uniquely identifies a device. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.
IP Address	This field displays the IP address relative to the # field listed above.
Expires in	This field displays the time when the IP address and MAC address association ends.
Refresh	Click **Refresh** to renew the screen.

6.6 Packet Statistics

Click the **Packet Statistics (Details...)** hyperlink in the **Status** screen. Read-only information here includes port status, packet specific statistics and the "system up time". The **Poll Interval(s)** field is configurable and is used for refreshing the screen.

Figure 28 Summary: Packet Statistics



Packet Statistics

Packet Statistics

Packet Statistics

Port	Status	TxPkts	RxPkts	Collisions	Tx B/s	Rx B/s	Up Time
WAN	100M	13625	31171	0	1954809	19399482	01:29:11
LAN	100M	13024	7748	0	14250762	673520	01:29:11
WLAN	Down	0	2	0	0	343	00:00:00

System Up Time : 1 hour, 29 mins, 17 secs

Poll Interval(s) : 5 sec

The following table describes the labels in this screen.

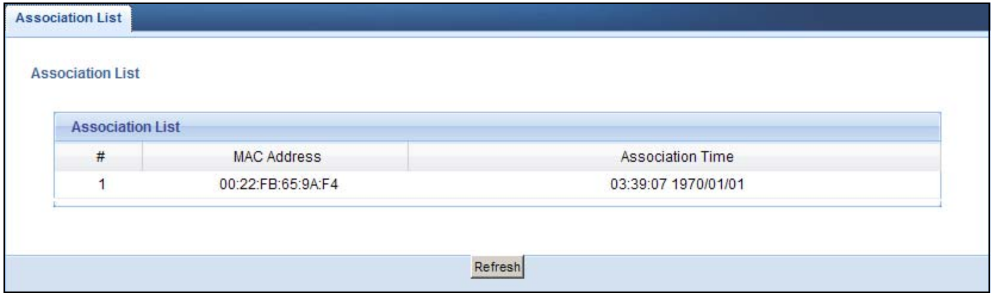
Table 19 Summary: Packet Statistics

LABEL	DESCRIPTION
Port	This is the NBG4615's port type.
Status	For the LAN ports, this displays the port speed and duplex setting or **Down** when the line is disconnected. For the WAN port, it displays the port speed and duplex setting if you're using Ethernet encapsulation and **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE or PPTP encapsulation. This field displays **Down** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **Down** when the WLAN is disabled.
TxPkts	This is the number of transmitted packets on this port.
RxPkts	This is the number of received packets on this port.
Collisions	This is the number of collisions on this port.
Tx B/s	This displays the transmission speed in bytes per second on this port.
Rx B/s	This displays the reception speed in bytes per second on this port.
Up Time	This is the total time the NBG4615 has been for each session.
System Up Time	This is the total time the NBG4615 has been on.
Poll Interval(s)	Enter the time interval in seconds for refreshing statistics in this field.
Set Interval	Click this button to apply the new poll interval you entered in the **Poll Interval(s)** field.
Stop	Click **Stop** to stop refreshing statistics.

6.7 WLAN Station Status

Click the **WLAN Station Status (Details...)** hyperlink in the **Status** screen. View the wireless stations that are currently associated to the NBG4615 in the **Association List**. Association means that a wireless client (for example, your network or computer with a wireless network card) has connected successfully to the AP (or wireless router) using the same SSID, channel and security settings.

Figure 29 Summary: Wireless Association List



#	MAC Address	Association Time
1	00:22:FB:65:9A:F4	03:39:07 1970/01/01

The following table describes the labels in this screen.

Table 20 Summary: Wireless Association List

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
MAC Address	This field displays the MAC address of an associated wireless station.
Association Time	This field displays the time a wireless station first associated with the NBG4615's WLAN network.
Refresh	Click **Refresh** to reload the list.

7

NBG4615 Modes

7.1 Overview

This chapter introduces the different modes available on your NBG4615. First, the term "mode" refers to two things in this User's Guide.

- **Web Configurator mode**. This refers to the Web Configurator interface you want to use for editing NBG4615 features.
- **Device mode**. This is the operating mode of your NBG4615, or simply how the NBG4615 is being used in the network.

7.1.1 Web Configurator Modes

This refers to the configuration interface of the Web Configurator, which has two modes:

- **Easy**: The Web Configurator shows this mode by default. Refer to Chapter 8 on page 57 for more information on the screens in this mode. This interface may be sufficient for users who just want to use the device.
- **Expert**: Advanced users can change to this mode to customize all the functions of the NBG4615. Click **Expert Mode** after logging into the Web Configurator. The User's Guide Chapter 5 on page 43 through Chapter 29 on page 224 discusses the screens in this mode.

7.1.2 Device Modes

This refers to the operating mode of the NBG4615, which can act as a:

- **Router**: This is the default device mode of the NBG4615. Use this mode to connect the local network to another network, like the Internet. Go to Section 9.2 on page 69 to view the **Status** screen in this mode.
- **Access Point**: Use this mode if you want to extend your network by allowing network devices to connect to the NBG4615 wirelessly. Go to Section 10.4 on page 78 to view the **Status** screen in this mode.
- **Universal Repeater**: In this mode, the NBG4615 can be an access point and a wireless client at the same time. Use this mode if there is an existing wireless router or access point in your network and you also want to allow clients to connect to the NBG4615. Go to Section 11.5 on page 84 to view the **Status** screen in this mode.
- **WISP**: Use this mode if there is an existing wireless router or access point in the network to which you want to connect your local network. Go to Section 11.5 on page 84 to view the **Status** screen in this mode.
- **WISP + UR**: In this mode, the NBG4615 has the same function as in WISP mode. In addition, it can provide WiFi function to the clients on the LAN side. Go to Section 13.4 on page 101 to view the **Status** screen in this mode.

For more information on these modes and to change the mode of your NBG4615, refer to Chapter 29 on page 224.

The menu for changing device modes is available in **Expert** mode only.

Note: Choose your Device Mode carefully to avoid having to change it later.

When changing to another mode, the IP address of the NBG4615 changes. The running applications and services of the network devices connected to the NBG4615 can be interrupted.

In **WISP** and **WISP + UR** mode, you should know the SSID and wireless security details of the access point to which you want to connect.

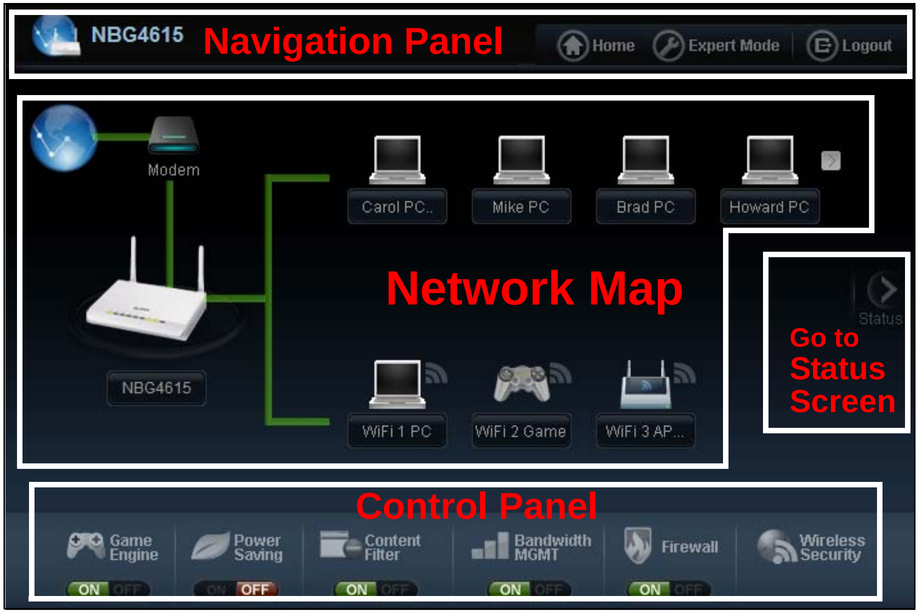
Easy Mode

8.1 Overview

The Web Configurator is set to **Easy Mode** by default. You can configure several key features of the NBG4615 in this mode. This mode is useful to users who are not fully familiar with some features that are usually intended for network administrators.

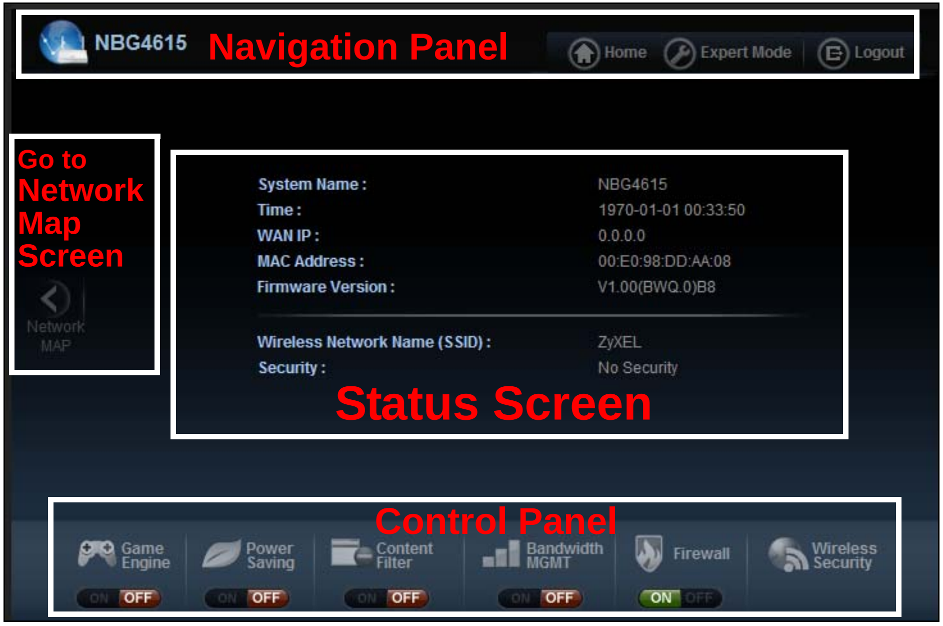
When you log in to the Web Configurator, the following screen opens.

Figure 30 Easy Mode: Network Map



Click **Status** to open the following screen.

Figure 31 Easy Mode: Status Screen


Navigation Panel

Go to Network Map Screen

Status Screen

Control Panel

System Name : NBG4615
Time : 1970-01-01 00:33:50
WAN IP : 0.0.0.0
MAC Address : 00:E0:98:DD:AA:08
Firmware Version : V1.00(BWQ.0)B8

Wireless Network Name (SSID) : ZyXEL
Security : No Security

Game Engine: OFF
Power Saving: OFF
Content Filter: OFF
Bandwidth MGMT: OFF
Firewall: ON

8.2 What You Can Do

You can do the following in this mode:

- Use this **Navigation Panel** to opt out of the **Easy** mode (Section 8.4 on page 59).
- Use the **Network Map** screen to check if your NBG4615 can ping the gateway and whether it is connected to the Internet (Section 8.5 on page 59).
- Use the **Control Panel** to configure and enable NBG4615 features, including wireless security, wireless scheduling and bandwidth management and so on (Section 8.6 on page 60).
- Use the **Status Screen** to view read-only information about the NBG4615, including the WAN IP, MAC Address of the NBG4615 and the firmware version (Section 8.7 on page 67).

8.3 What You Need to Know

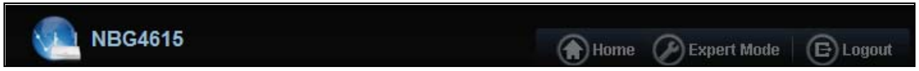
Between the different device modes, the **Control Panel** (Section 8.6 on page 60) changes depending on which features are applicable to the mode:

- **Router Mode**: All **Control Panel** features are available.
- **Access Point Mode**: Only **Power Saving** and **Wireless Security** are available.
- **Universal Repeater Mode**: Only **Power Saving** and **Wireless Security** are available.
- **WISP Mode**: The available features for this mode are **Game Console**, **Content Filter**, **Bandwidth MGMT**, and **Firewall**.
- **WISP + UR Mode**: All **Control Panel** features are available.

8.4 Navigation Panel

Use this navigation panel to opt out of the **Easy** mode.

Figure 32 Control Panel



The following table describes the labels in this screen.

Table 21 Control Panel

ITEM	DESCRIPTION
Home	Click this to go to the **Login** page.
Expert Mode	Click this to change to **Expert** mode and customize features of the NBG4615.
Logout	Click this to end the Web Configurator session.

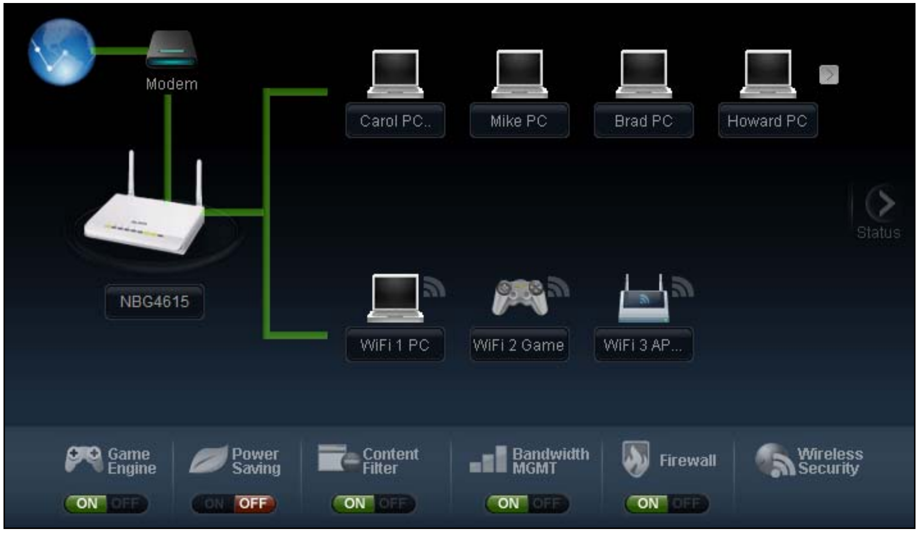
8.5 Network Map

Note: The Network MAP is viewable by Windows XP (need to install patch), Windows Vista and Windows 7 users only. For Windows XP (Service Pack 2) users, you can see the network devices connected to the NBG4615 by downloading the LLTD (Link Layer Topology Discovery) patch from the Microsoft Website.

Note: Don't worry if the Network Map does not display in your web browser. This feature may not be supported by your system. You can still configure the Control Panel (Section 8.6 on page 60) in the Easy Mode and the NBG4615 features that you want to use in the Expert Mode.

When you log into the Network Configurator, the Network Map is shown as follows.

Figure 33 Network Map



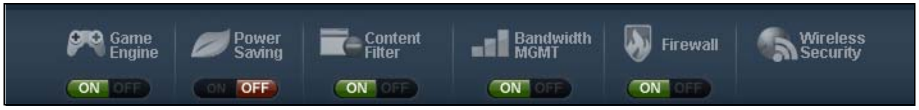
The line connecting the NBG4615 to the gateway becomes green when the NBG4615 is able to ping the gateway. It becomes red when the ping initiating from the NBG4615 does not get a response from the gateway. The same rule applies to the line connecting the gateway to the Internet.

You can also view the devices (represented by icons indicating the kind of network device) connected to the NBG4615, including those connecting wirelessly. Right-click on the NBG4615 icon to refresh the network map and go to the Wizard. Right click on the other icons to view information about the device.

8.6 Control Panel

The features configurable in **Easy Mode** are shown in the **Control Panel**.

Figure 34 Control Panel



Switch **ON** to enable the feature. Otherwise, switch **OFF**. If the feature is turned on, the green light flashes. If it is turned off, the red light flashes.

Additionally, click the feature to open a screen where you can edit its settings.

The following table describes the labels in this screen.

Table 22 Control Panel

ITEM	DESCRIPTION
Game Engine	Switch **ON** to maximize bandwidth for gaming traffic in your network. Otherwise, switch **OFF**. Refer to Section 8.6.1 on page 61 to see this screen.
Power Saving	Click this to schedule the wireless feature of the NBG4615. Disabling the wireless function helps lower the energy consumption of the NBG4615. Switch **ON** to apply wireless scheduling. Otherwise, switch **OFF**. Refer to Section 8.6.2 on page 61 to see this screen.
Content Filter	Click this to restrict access to certain websites, based on keywords contained in URLs, to which you do not want users in your network to open. Switch **ON** to apply website filtering. Otherwise, switch **OFF**. Refer to Section 8.6.3 on page 63 to see this screen.
Bandwidth MGMT	Click this to edit bandwidth management for predefined applications. Switch **ON** to have the NBG4615 management bandwidth for uplink and downlink traffic according to an application or service. Otherwise, switch **OFF**. Refer to Section 8.6.4 on page 63 to see this screen.

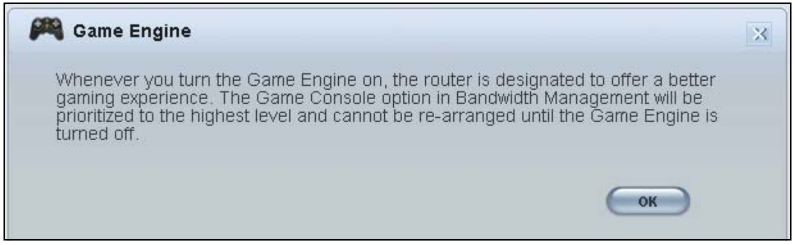
Table 22 Control Panel (continued)

ITEM	DESCRIPTION
Firewall	Switch **ON** to ensure that your network is protected from Denial of Service (DoS) attacks. Otherwise, switch **OFF**. Refer to Section 8.6.5 on page 64 to see this screen.
Wireless Security	Click this to configure the wireless security, such as SSID, security mode and WPS key on your NBG4615. Refer to Section 8.6.6 on page 64 to see this screen.

8.6.1 Game Engine

When this feature is enabled, the NBG4615 maximizes the bandwidth for gaming traffic that it forwards out through an interface.

Figure 35 Game Engine



Whenever you turn the Game Engine on, the router is designated to offer a better gaming experience. The Game Console option in Bandwidth Management will be prioritized to the highest level and cannot be re-arranged until the Game Engine is turned off.

Note: When this is switched on, the **Game Console** tab in the **Bandwidth Mgmt** screen is automatically positioned on top.

Turn this off if your network is not using gaming.

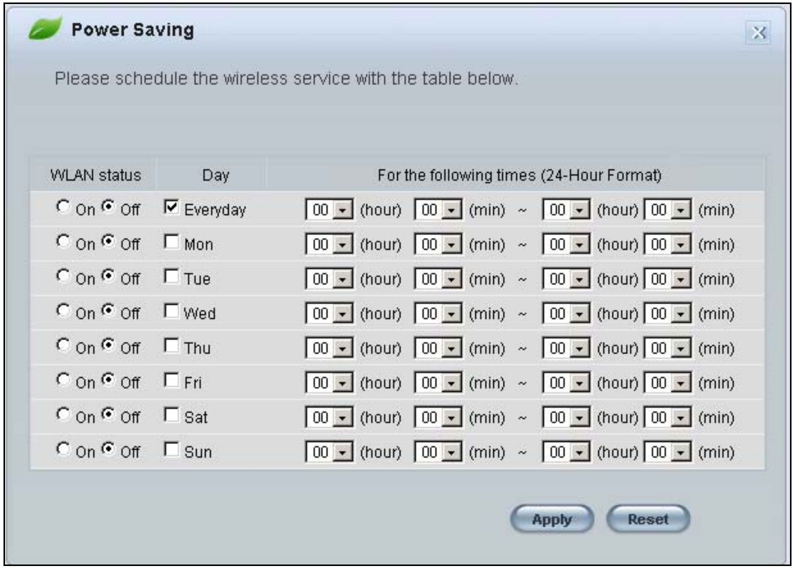
Click **OK** to close this screen.

8.6.2 Power Saving

Use this screen to set the day of the week and time of the day when your wireless LAN is turned on and off. Wireless LAN scheduling is disabled by default.

Disabling the wireless capability lowers the energy consumption of the of the NBG4615.

Figure 36 Power Saving



Power Saving

Please schedule the wireless service with the table below.

WLAN status	Day	For the following times (24-Hour Format)
○ On ● Off	☑ Everyday	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Mon	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Tue	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Wed	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Thu	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Fri	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Sat	00 (hour) 00 (min) ~ 00 (hour) 00 (min)
○ On ● Off	□ Sun	00 (hour) 00 (min) ~ 00 (hour) 00 (min)

The following table describes the labels in this screen.

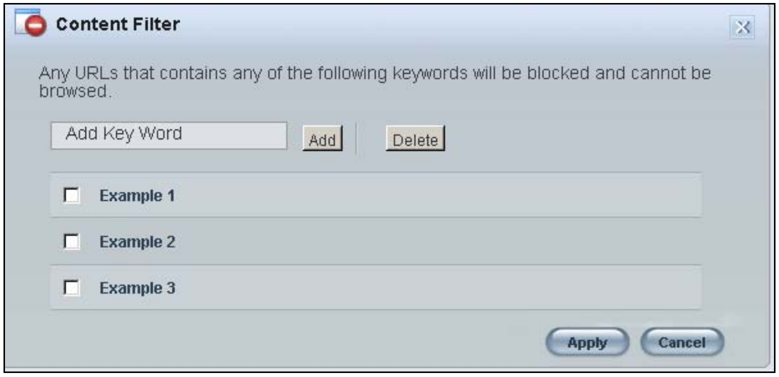
Table 23 Power Saving

LABEL	DESCRIPTION
WLAN Status	Select **On** or **Off** to specify whether the Wireless LAN is turned on or off (depending on what you selected in the **WLAN Status** field). This field works in conjunction with the **Day** and **For the following times** fields.
Day	Select **Everyday** or the specific days to turn the Wireless LAN on or off. If you select **Everyday** you can not select any specific days. This field works in conjunction with the **For the following times** field.
For the following times (24-Hour Format)	Select a begin time using the first set of **hour** and minute (**min**) drop down boxes and select an end time using the second set of **hour** and minute (**min**) drop down boxes. If you have chosen **On** earlier for the WLAN Status the Wireless LAN will turn on between the two times you enter in these fields. If you have chosen **Off** earlier for the WLAN Status the Wireless LAN will turn off between the two times you enter in these fields. In this time format, midnight is 00:00 and progresses up to 24:00. For example, 6:00 PM is 18:00.
Apply	Click **Apply** to save your changes back to the NBG4615.
Reset	Click **Reset** to begin configuring this screen afresh.

8.6.3 Content Filter

Use this screen to restrict access to certain websites, based on keywords contained in URLs, to which you do not want users in your network to open.

Figure 37 Content Filter



Content Filter

Any URLs that contains any of the following keywords will be blocked and cannot be browsed.

□ Example 1

□ Example 2

□ Example 3

The following table describes the labels in this screen.

Table 24 Content Filter

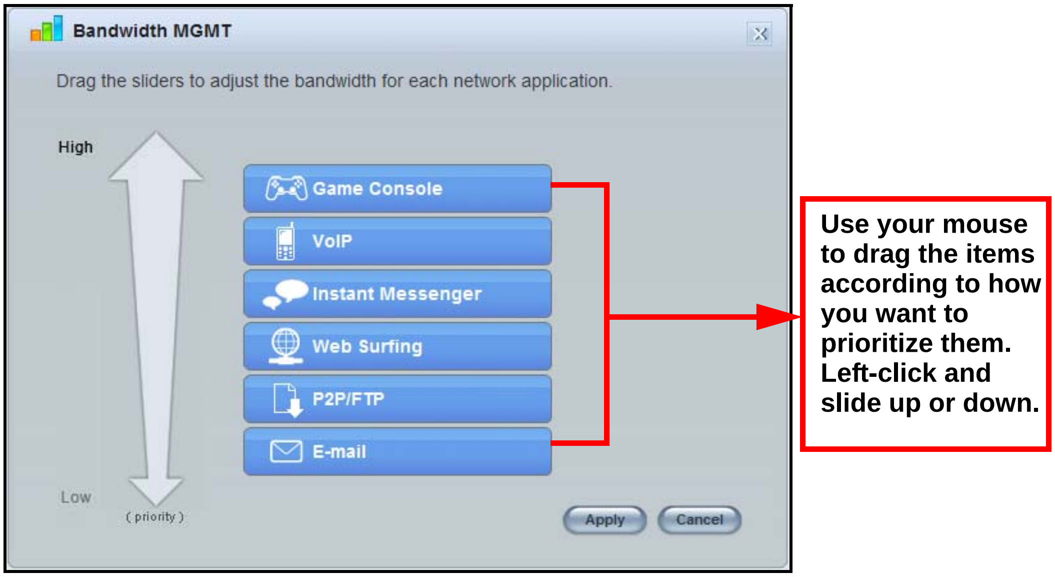
LABEL	DESCRIPTION
Add	Click **Add** after you have typed a keyword. Repeat this procedure to add other keywords. Up to 64 keywords are allowed. Note: The NBG4615 does not recognize wildcard characters as keywords. When you try to access a web page containing a keyword, you will get a message telling you that the content filter is blocking this request.
Delete	Highlight a keyword in the text box and click **Delete** to remove it. The keyword disappears from the text box after you click **Apply**.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to close this screen without saving any changes.

8.6.4 Bandwidth MGMT

Use this screen to set bandwidth allocation to pre-defined services and applications for bandwidth allocation.

The NBG4615 uses bandwidth management for incoming and outgoing traffic. Rank the services and applications by dragging them accordingly from **High** to **Low** and click **Apply**. Click **Cancel** to close the screen.

Figure 38 Bandwidth MGNT



Bandwidth MGMT

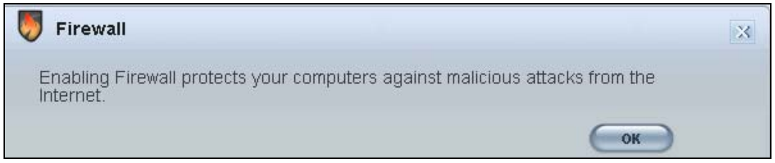
Drag the sliders to adjust the bandwidth for each network application.

Use your mouse to drag the items according to how you want to prioritize them. Left-click and slide up or down.

8.6.5 Firewall

Enable this feature to protect the network from Denial of Service (DoS) attacks. The NBG4615 blocks repetitive pings from the WAN that can otherwise cause systems to slow down or hang.

Figure 39 Firewall



Firewall

Enabling Firewall protects your computers against malicious attacks from the Internet.

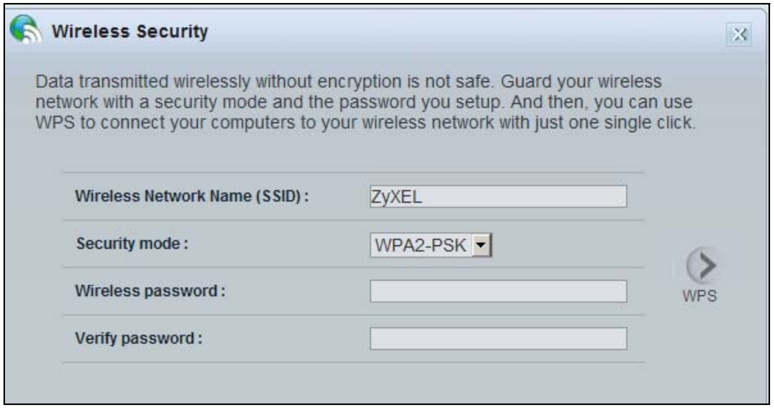
Click **OK** to close this screen.

8.6.6 Wireless Security

Use this screen to configure security for your the Wireless LAN. You can enter the SSID and select the wireless security mode in the following screen.

Note: You can enable the Wireless function of your NBG4615 by first turning on the switch in the back panel.

Figure 40 Wireless Security



Wireless Security

Data transmitted wirelessly without encryption is not safe. Guard your wireless network with a security mode and the password you setup. And then, you can use WPS to connect your computers to your wireless network with just one single click.

Wireless Network Name (SSID) :	ZyXEL
Security mode :	WPA2-PSK
Wireless password :	
Verify password :	

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

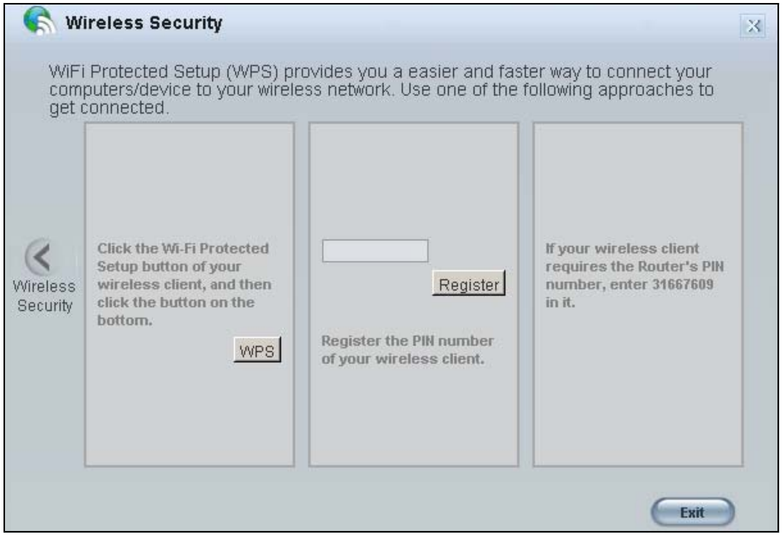
Table 25 Wireless Security

LABEL	DESCRIPTION
Wireless Network Name (SSID)	(Service Set IDentity) The SSID identifies the Service Set with which a wireless station is associated. Wireless stations associating to the access point (AP) must have the same SSID. Enter a descriptive name (up to 32 keyboard characters) for the wireless LAN.
Security mode	Select **WPA-PSK** or **WPA2-PSK** to add security on this wireless network. The wireless clients which want to associate to this network must have same wireless security settings as this device. After you select to use a security, additional options appears in this screen. Select **No Security** to allow any client to connect to this network without authentication.
Wireless password	This field appears when you choose wither **WPA-PSK** or **WPA2-PSK** as the security mode. Type a pre-shared key from 8 to 63 case-sensitive keyboard characters.
Verify password	Type the password again to confirm.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to close this screen.
WPS	Click this to configure the WPS screen. You can transfer the wireless settings configured here (**Wireless Security** screen) to another wireless device that supports WPS.

8.6.7 WPS

Use this screen to add a wireless station to the network using WPS. Click **WPS** in the **Wireless Security** to open the following screen.

Figure 41 Wireless Security: WPS



Wireless Security

WiFi Protected Setup (WPS) provides you a easier and faster way to connect your computers/device to your wireless network. Use one of the following approaches to get connected.

Click the Wi-Fi Protected Setup button of your wireless client, and then click the button on the bottom.

Register the PIN number of your wireless client.

If your wireless client requires the Router's PIN number, enter 31667609 in it.

The following table describes the labels in this screen.

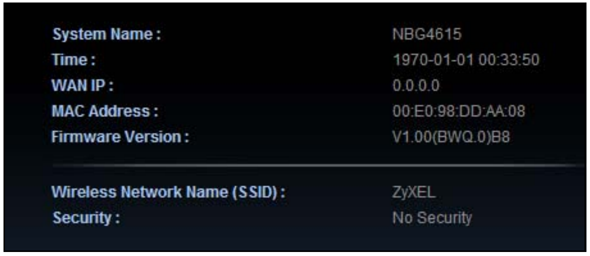
Table 26 Wireless Security: WPS

LABEL	DESCRIPTION
Wireless Security	Click this to go back to the **Wireless Security** screen.
WPS	Create a secure wireless network simply by pressing a button. The NBG4615 scans for a WPS-enabled device within the range and performs wireless security information synchronization. Note: After you click the **WPS** button on this screen, you have to press a similar button in the wireless station utility within 2 minutes. To add the second wireless station, you have to press these buttons on both device and the wireless station again after the first 2 minutes.
Register	Create a secure wireless network simply by entering a wireless client's PIN (Personal Identification Number) in the NBG4615's interface and pushing this button. Type the same PIN number generated in the wireless station's utility. Then click **Register** to associate to each other and perform the wireless security information synchronization.
Exit	Click **Exit** to close this screen.

8.7 Status Screen in Easy Mode

In the Network Map screen, click **Status** to view read-only information about the NBG4615.

Figure 42 Status Screen in Easy Mode



System Name : NBG4615
Time : 1970-01-01 00:33:50
WAN IP : 0.0.0.0
MAC Address : 00:E0:98:DD:AA:08
Firmware Version : V1.00(BWQ.0)B8

Wireless Network Name (SSID) : ZyXEL
Security : No Security

The following table describes the labels in this screen.

Table 27 Status Screen in Easy Mode

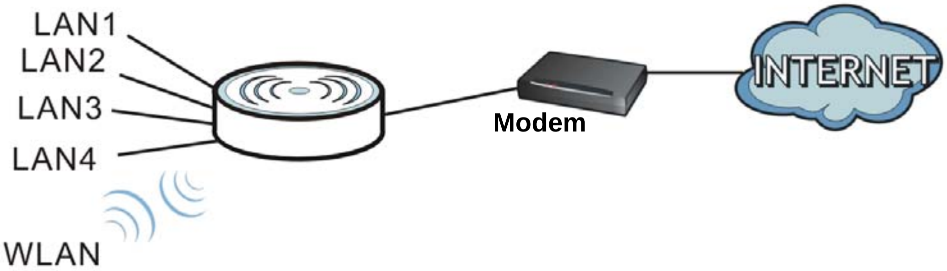
ITEM	DESCRIPTION
Name	This is the name of the NBG4615 in the network. You can change this in the **Maintenance > General** screen in Section 29.3 on page 215.
Time	This is the current system date and time. The date is in YYYY:MM:DD (Year-Month-Day) format. The time is in HH:MM:SS (Hour:Minutes:Seconds) format.
WAN IP	This is the IP address of the WAN port.
MAC Address	This is the MAC address of the NBG4615.
Firmware Version	This shows the firmware version of the NBG4615. The firmware version format shows the trunk version, model code and release number.
Wireless Network Name	This shows the SSID of the wireless network. You can configure this in the Wireless Security screen (Section 8.6.6 on page 64; Section 15.2 on page 128).
Security	This shows the wireless security used by the NBG4615.

Router Mode

9.1 Overview

The NBG4615 is set to router mode by default. Routers are used to connect the local network to another network (for example, the Internet). In the figure below, the NBG4615 connects the local network (**LAN1** ~ **LAN4**) to the Internet.

Figure 43 NBG4615 Network

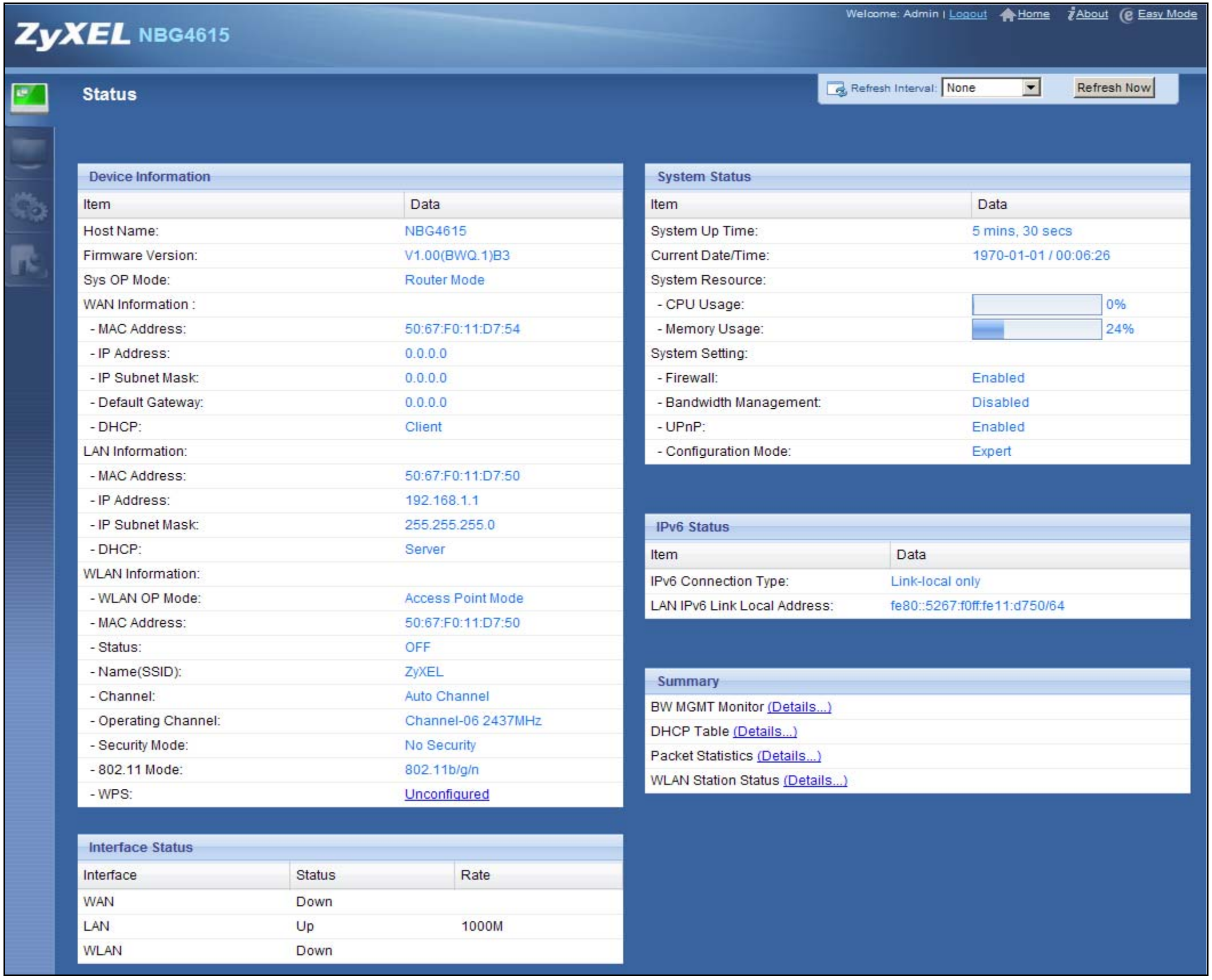


Note: The **Status** screen is shown after changing to the **Expert** mode of the Web Configurator. It varies depending on the device mode of your NBG4615.

9.2 Router Mode Status Screen

Click to open the status screen.

Figure 44 Status Screen: Router Mode



ZyXEL NBG4615

Welcome: Admin | Logout Home About Easy Mode

Status

Refresh Interval: None Refresh Now

Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.1)B3
Sys OP Mode:	Router Mode
WAN Information :	
- MAC Address:	50:67:F0:11:D7:54
- IP Address:	0.0.0.0
- IP Subnet Mask:	0.0.0.0
- Default Gateway:	0.0.0.0
- DHCP:	Client
LAN Information:	
- MAC Address:	50:67:F0:11:D7:50
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- WLAN OP Mode:	Access Point Mode
- MAC Address:	50:67:F0:11:D7:50
- Status:	OFF
- Name(SSID):	ZyXEL
- Channel:	Auto Channel
- Operating Channel:	Channel-06 2437MHz
- Security Mode:	No Security
- 802.11 Mode:	802.11b/g/n
- WPS:	Unconfigured

Interface Status

Interface	Status	Rate
WAN	Down	
LAN	Up	1000M
WLAN	Down	

System Status

Item	Data
System Up Time:	5 mins, 30 secs
Current Date/Time:	1970-01-01 / 00:06:26
System Resource:	
- CPU Usage:	0%
- Memory Usage:	24%
System Setting:	
- Firewall:	Enabled
- Bandwidth Management:	Disabled
- UPnP:	Enabled
- Configuration Mode:	Expert

IPv6 Status

Item	Data
IPv6 Connection Type:	Link-local only
LAN IPv6 Link Local Address:	fe80::5267:f0ff:fe11:d750/64

Summary

BW MGMT Monitor (Details...)

DHCP Table (Details...)

Packet Statistics (Details...)

WLAN Station Status (Details...)

The following table describes the icons shown in the **Status** screen.

Table 28 Status Screen Icon Key: Router Mode

ICON	DESCRIPTION
Logout	Click this at any time to exit the Web Configurator.
Home	Click this to go to the Home page. See Chapter 6 on page 49.
About	Click this icon to view copyright and a link for related product information.
Easy Mode	Click this icon to go to Easy Mode. See Chapter 8 on page 57.
Refresh Interval: None	Select a number of seconds or **None** from the drop-down list box to refresh all screen statistics automatically at the end of every time interval or to not refresh the screen statistics.
Refresh Now	Click this button to refresh the status screen statistics.

Table 28 Status Screen Icon Key: Router Mode (continued)

ICON	DESCRIPTION
	Click this icon to see the **Status** page. The information in this screen depends on the device mode you select.
	Click this icon to see the **Monitor** navigation menu.
	Click this icon to see the **Configuration** navigation menu.
	Click this icon to see the **Maintenance** navigation menu.

The following table describes the labels shown in the **Status** screen.

Table 29 Status Screen: Router Mode

LABEL	DESCRIPTION
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **General** screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.
Sys OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615 is set - **Router Mode**.
WAN Information	
- MAC Address	This shows the WAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the WAN port's IP address.
- IP Subnet Mask	This shows the WAN port's subnet mask.
- Default Gateway	This shows the WAN port's gateway IP address.
- DHCP	This shows the LAN port's DHCP role - **Client** or **None**.
LAN Information	
- MAC Address	This shows the LAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the LAN port's IP address.
- IP Subnet Mask	This shows the LAN port's subnet mask.
- DHCP	This shows the LAN port's DHCP role - **Server** or **Disable**.
WLAN Information	
- WLAN OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615's wireless LAN is set - **Access Point Mode**.
- MAC Address	This shows the wireless adapter MAC Address of your device.
- Status	This shows the current status of the Wireless LAN - **ON** or **OFF**.
- Name (SSID)	This shows a descriptive name used to identify the NBG4615 in the wireless LAN.
- Channel	This shows the channel number which you select manually.
- Operating Channel	This shows the channel number which the NBG4615 is currently using over the wireless LAN.
- Security Mode	This shows the level of wireless security the NBG4615 is using.
- 802.11 Mode	This shows the wireless standard.
- WPS	This displays **Configured** when the WPS has been set up. This displays **Unconfigured** if the WPS has not been set up. Click the status to display **Network > Wireless LAN > WPS** screen.
System Status	

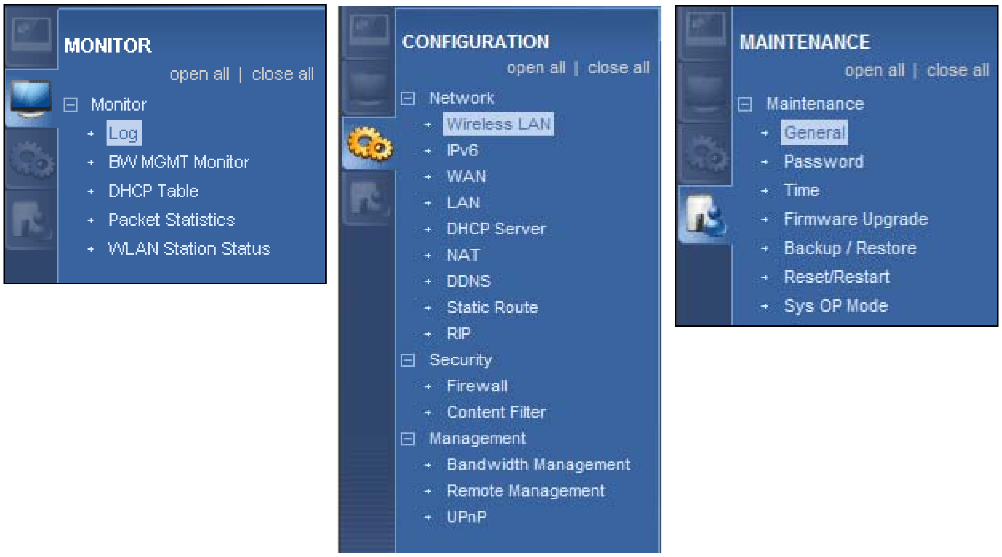
Table 29 Status Screen: Router Mode (continued)

LABEL	DESCRIPTION
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
System Up Time	This is the total time the NBG4615 has been on.
Current Date/Time	This field displays your NBG4615's present date and time.
System Resource	
- CPU Usage	This displays what percentage of the NBG4615's processing ability is currently used. When this percentage is close to 100%, the NBG4615 is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using bandwidth management.)
- Memory Usage	This shows what percentage of the heap memory the NBG4615 is using.
System Setting	
- Firewall	This shows whether the firewall is enabled or not.
- Bandwidth Management	This shows whether the bandwidth management is enabled or not.
- UPnP	This shows whether UPnP is enabled or not.
- Configuration Mode	This shows the web configurator mode you are viewing - **Expert**.
IPv6 Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
IPv6 Connection Type	This shows the type of IPv6 connection that is currently in use.
LAN IPv6 Link Local Address	This shows the NBG4615's LAN IPv6 link local address.
Summary	
BW MGMT Monitor	Click **Details...** to go to the **Monitor > BW MGMT Monitor** screen (Section 6.4 on page 51). Use this screen to view the amount of network bandwidth that applications running in the network are using.
DHCP Table	Click **Details...** to go to the **Monitor > DHCP Table** screen (Section 6.5 on page 51). Use this screen to view current DHCP client information.
Packet Statistics	Click **Details...** to go to the **Monitor > Packet Statistics** screen (Section 6.6 on page 53). Use this screen to view port status and packet specific statistics.
WLAN Station Status	Click **Details...** to go to the **Monitor > WLAN Station Status** screen (Section 6.7 on page 54). Use this screen to view the wireless stations that are currently associated to the NBG4615.
Interface Status	
Interface	This displays the NBG4615 port types. The port types are: **WAN**, **LAN** and **WLAN**.
Status	For the LAN and WAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN, it displays **Up** when the WLAN is enabled or **Down** when the WLAN is disabled.
Rate	For the LAN ports, this displays the port speed and duplex setting or **N/A** when the line is disconnected. For the WAN port, it displays the port speed and duplex setting if you're using Ethernet encapsulation. This field displays **N/A** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **N/A** when the WLAN is disabled.

9.2.1 Navigation Panel

Use the sub-menus on the navigation panel to configure NBG4615 features.

Figure 45 Navigation Panel: Router Mode



The following table describes the sub-menus.

Table 30 Navigation Panel: Router Mode

LINK	TAB	FUNCTION
Status		This screen shows the NBG4615's general device, system and interface status information. Use this screen to access the wizard, and summary statistics tables.
MONITOR		
Log		Use this screen to view the list of activities recorded by your NBG4615.
BW MGMT		Use this screen to view the amount of network bandwidth that applications running in the network are using.
DHCP Table		Use this screen to view current DHCP client information.
Packet Statistics		Use this screen to view port status and packet specific statistics.
WLAN Station Status		Use this screen to view the wireless stations that are currently associated to the NBG4615.
CONFIGURATION		
Network		

Table 30 Navigation Panel: Router Mode (continued)

LINK	TAB	FUNCTION
Wireless LAN	General	Use this screen to configure wireless LAN.
	Security	Use this screen to configure the level of wireless security for the NBG4615.
	MAC Filter	Use the MAC filter screen to configure the NBG4615 to block access to devices or block the devices from accessing the NBG4615.
	Advanced	This screen allows you to configure advanced wireless settings.
	QoS	Use this screen to configure Wi-Fi Multimedia Quality of Service (WMM QoS). WMM QoS allows you to prioritize wireless traffic according to the delivery requirements of individual services.
	WPS	Use this screen to configure WPS.
	WPS Station	Use this screen to add a wireless station using WPS.
	Scheduling	Use this screen to schedule the times the Wireless LAN is enabled.
	WDS	Use this screen to set up Wireless Distribution System (WDS) on your NBG4615.
IPv6	IPv6	Use this screen to set the IPv6 settings for your NBG4615.
WAN	Internet Connection	This screen allows you to configure ISP parameters, WAN IP address assignment, DNS servers and the WAN MAC address.
	Advanced	Use this screen to configure other advanced properties.
	IGMP Snooping	Use this screen to enable IGMP snooping if you have LAN users that subscribe to multicast services.
LAN	IP	Use this screen to configure LAN IP address and subnet mask.
	IP Alias	Use this screen to have the NBG4615 apply IP alias to create LAN subnets.
DHCP Server	General	Use this screen to enable the NBG4615's DHCP server.
	Advanced	Use this screen to assign IP addresses to specific individual computers based on their MAC addresses and to have DNS servers assigned by the DHCP server.
NAT	General	Use this screen to enable NAT.
	Application	Use this screen to configure servers behind the NBG4615.
	Advanced	Use this screen to change your NBG4615's port triggering settings.
DDNS	General	Use this screen to set up dynamic DNS.
Static Route	IP Static Route	Use this screen to configure IP static routes.
RIP	RIP	Use this screen to enable RIPv1 or RIPv2, which are LAN broadcast protocols.
Security		
Firewall	General	Use this screen to activate/deactivate the firewall.
	Services	This screen shows a summary of the firewall rules, and allows you to edit/add a firewall rule.
Content Filter	Content Filter	Use this screen to block certain web features and sites containing certain keywords in the URL.
Management		

Table 30 Navigation Panel: Router Mode (continued)

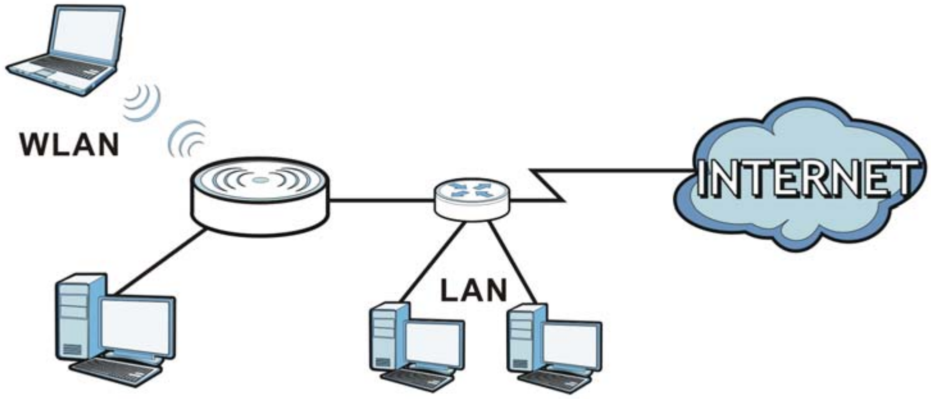
LINK	TAB	FUNCTION
Bandwidth Management	General	Use this screen to enable bandwidth management.
	Advanced	Use this screen to set the upstream bandwidth and edit a bandwidth management rule.
	Monitor	Use this screen to view the amount of network bandwidth that applications running in the network are using.
Remote Management	WWW	Use this screen to be able to access the NBG4615 from the LAN, WAN or both.
UPnP	General	Use this screen to enable UPnP on the NBG4615.
MAINTENANCE		
General	General	Use this screen to view and change administrative settings such as system and domain names.
Password	Password Setup	Use this screen to change the password of your NBG4615.
Time	Time Setting	Use this screen to change your NBG4615’s time and date.
Firmware Upgrade	Firmware Upgrade	Use this screen to upload firmware to your NBG4615.
Backup/ Restore	Backup/ Restore	Use this screen to backup and restore the configuration or reset the factory defaults to your NBG4615.
Reset/ Restart	Restart	This screen allows you to reboot the NBG4615 without turning the power off.
Sys OP Mode	Sys OP Mode	This screen allows you to select whether your device acts as a Router or a Access Point.

Access Point Mode

10.1 Overview

Use your NBG4615 as an access point (AP) if you already have a router or gateway on your network. In this mode your NBG4615 bridges a wired network (LAN) and wireless LAN (WLAN) in the same subnet. See the figure below for an example.

Figure 46 Wireless Internet Access in Access Point Mode



Many screens that are available in Router mode are not available in Access Point mode, such as bandwidth management and firewall.

Note: See Chapter 14 on page 105 for an example of setting up a wireless network in Access Point mode.

10.2 What You Can Do

- Use the **Status** screen to view read-only information about your NBG4615 (Section 10.4 on page 78).
- Use the **LAN** screen to set the IP address for your NBG4615 acting as an access point (Section 10.5 on page 80).

10.3 What You Need to Know

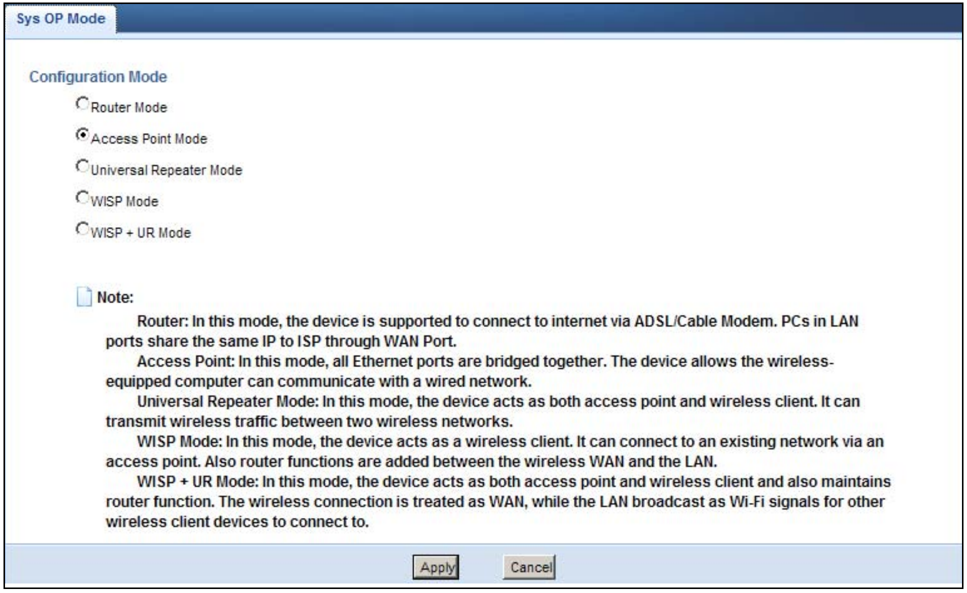
See Chapter 14 on page 105 for a tutorial on setting up a network with the NBG4615 as an access point.

10.3.1 Setting your NBG4615 to AP Mode

1 Log into the Web Configurator if you haven't already. See the Quick start Guide for instructions on how to do this.

2 To use your NBG4615 as an access point, go to **Maintenance > Sys OP Mode > General** and select **Access Point mode.**

Figure 47 Changing to Access Point mode



Configuration Mode

○ Router Mode
● Access Point Mode
○ Universal Repeater Mode
○ WISP Mode
○ WISP + UR Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

Universal Repeater Mode: In this mode, the device acts as both access point and wireless client. It can transmit wireless traffic between two wireless networks.

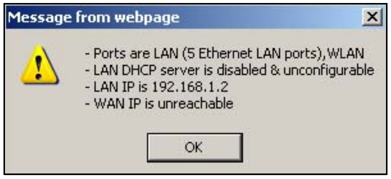
WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

WISP + UR Mode: In this mode, the device acts as both access point and wireless client and also maintains router function. The wireless connection is treated as WAN, while the LAN broadcast as Wi-Fi signals for other wireless client devices to connect to.

Note: You have to log in to the Web Configurator again when you change modes.As soon as you do, your NBG4615 is already in Access Point mode.

3 When you select **Access Point Mode**, the following pop-up message window appears.

Figure 48 Pop up for Access Point mode



- Ports are LAN (5 Ethernet LAN ports),WLAN
- LAN DHCP server is disabled & unconfigurable
- LAN IP is 192.168.1.2
- WAN IP is unreachable

Click **OK**. The Web Configurator refreshes once the change to Access Point mode is successful.

10.3.2 Accessing the Web Configurator in Access Point Mode

Log in to the Web Configurator in Access Point mode, do the following:

1 Connect your computer to the LAN port of the NBG4615.

2 The default IP address of the NBG4615 is "192.168.1.2". In this case, your computer must have an IP address in the range between "192.168.1.3" and "192.168.1.254".

3 Click **Start > Run** on your computer in Windows. Type "cmd" in the dialog box. Enter "ipconfig" to show your computer's IP address. If your computer's IP address is not in the correct range then see Appendix D on page 263 for information on changing your computer's IP address.

4 After you've set your computer's IP address, open a web browser such as Internet Explorer and type "192.168.1.2" as the web address in your web browser.

Note: After clicking Login, the Easy mode appears. Refer to Section on page 57 for the Easy mode screens. Change to Expert mode to see the screens described in the sections following this.

10.3.3 Configuring your WLAN, Bandwidth Management and Maintenance Settings

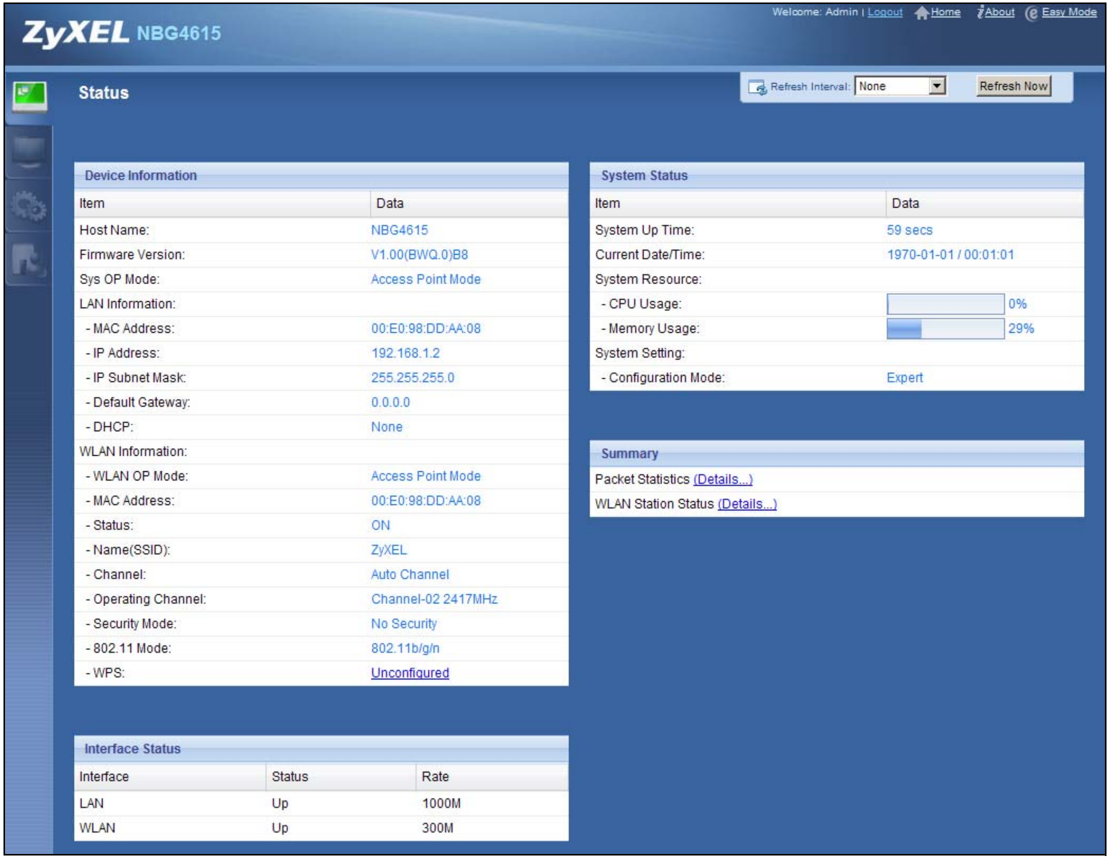
The configuration of wireless, bandwidth management and maintenance settings in **Access Point** mode is the same as for **Router Mode**.

- See Chapter 15 on page 125 for information on the configuring your wireless network.
- See Chapter 26 on page 197 for information on configuring your Bandwidth Management screen.
- See Chapter 29 on page 215 for information on configuring your Maintenance settings.

10.4 AP Mode Status Screen

Click to open the **Status** screen.

Figure 49 Status Screen: Access Point Mode



Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.0)B8
Sys OP Mode:	Access Point Mode
LAN Information:	
- MAC Address:	00:E0:98:DD:AA:08
- IP Address:	192.168.1.2
- IP Subnet Mask:	255.255.255.0
- Default Gateway:	0.0.0.0
- DHCP:	None
WLAN Information:	
- WLAN OP Mode:	Access Point Mode
- MAC Address:	00:E0:98:DD:AA:08
- Status:	ON
- Name(SSID):	ZyXEL
- Channel:	Auto Channel
- Operating Channel:	Channel-02 2417MHz
- Security Mode:	No Security
- 802.11 Mode:	802.11b/g/n
- WPS:	Unconfigured

System Status

Item	Data
System Up Time:	59 secs
Current Date/Time:	1970-01-01 / 00:01:01
System Resource:	
- CPU Usage:	0%
- Memory Usage:	29%
System Setting:	
- Configuration Mode:	Expert

Summary

Packet Statistics (Details...)
WLAN Station Status (Details...)

Interface Status

Interface	Status	Rate
LAN	Up	1000M
WLAN	Up	300M

The following table describes the labels shown in the **Status** screen.

Table 31 Status Screen: Access Point Mode

LABEL	DESCRIPTION
Logout	Click this at any time to exit the Web Configurator.
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **General** screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.
Sys OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615 is set - **Access Point Mode**.
LAN Information	
- MAC Address	This shows the LAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the LAN port’s IP address.
- IP Subnet Mask	This shows the LAN port’s subnet mask.
- DHCP	This shows the LAN port’s DHCP role - **Client** or **None**.
WLAN Information	

Table 31 Status Screen: Access Point Mode (continued)

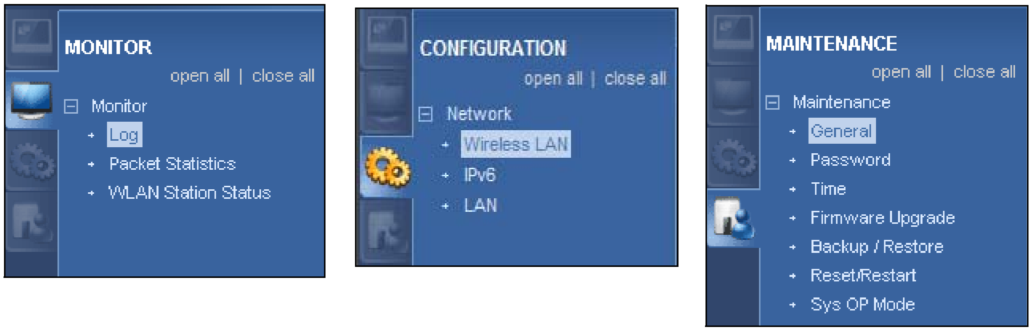
LABEL	DESCRIPTION
- WLAN OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615's wireless LAN is set - **Access Point Mode**.
- MAC Address	This shows the wireless adapter MAC Address of your device.
- Status	This shows the current status of the Wireless LAN - **ON** or **OFF**.
- Name (SSID)	This shows a descriptive name used to identify the NBG4615 in the wireless LAN.
- Channel	This shows the channel number which you select manually.
- Operating Channel	This shows the channel number which the NBG4615 is currently using over the wireless LAN.
- Security Mode	This shows the level of wireless security the NBG4615 is using.
- 802.11 Mode	This shows the wireless standard.
- WPS	This displays **Configured** when the WPS has been set up. This displays **Unconfigured** if the WPS has not been set up. Click the status to display **Network > Wireless LAN > WPS** screen.
System Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
System Up Time	This is the total time the NBG4615 has been on.
Current Date/Time	This field displays your NBG4615's present date and time.
System Resource	
- CPU Usage	This displays what percentage of the NBG4615's processing ability is currently used. When this percentage is close to 100%, the NBG4615 is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using bandwidth management.
- Memory Usage	This shows what percentage of the heap memory the NBG4615 is using.
System Setting	
- Configuration Mode	This shows the web configurator mode you are viewing - **Expert**.
Summary	
Packet Statistics	Click **Details...** to go to the **Monitor > Packet Statistics** screen (Section 6.6 on page 53). Use this screen to view port status and packet specific statistics.
WLAN Station Status	Click **Details...** to go to the **Monitor > WLAN Station Status** screen (Section 6.7 on page 54). Use this screen to view the wireless stations that are currently associated to the NBG4615.
Interface Status	
Interface	This displays the NBG4615 port types. The port types are: **LAN** and **WLAN**.
Status	For the LAN and WAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN, it displays **Up** when the WLAN is enabled or **Down** when the WLAN is disabled.
Rate	For the LAN ports, this displays the port speed and duplex setting or **N/A** when the line is disconnected. For the WAN port, it displays the port speed and duplex setting if you're using Ethernet encapsulation. This field displays **N/A** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **N/A** when the WLAN is disabled.

10.4.1 Navigation Panel

Use the menu in the navigation panel to configure NBG4615 features in Access Point mode.

The following screen and table show the features you can configure in Access Point mode.

Figure 50 Menu: Access Point Mode



Refer to Table 30 on page 72 for descriptions of the labels shown in the **Navigation** panel.

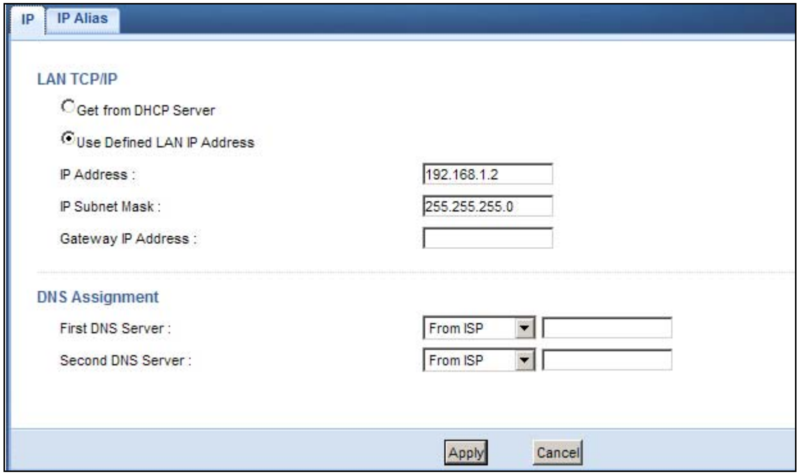
10.5 LAN Screen

Use this section to configure your LAN settings while in **Access Point** mode.

Click **Network > LAN** to see the screen below.

Note: If you change the IP address of the NBG4615 in the screen below, you will need to log into the NBG4615 again using the new IP address.

Figure 51 Network > LAN > IP



LAN TCP/IP

○ Get from DHCP Server

● Use Defined LAN IP Address

IP Address :	192.168.1.2
IP Subnet Mask :	255.255.255.0
Gateway IP Address :	

DNS Assignment

First DNS Server :	From ISP	
Second DNS Server :	From ISP	

The table below describes the labels in the screen.

Table 32 Network > LAN > IP

LABEL	DESCRIPTION
Get from DHCP Server	Click this to deploy the NBG4615 as an access point in the network. When you enable this, the NBG4615 gets its IP address from the network's DHCP server (for example, your ISP). Users connected to the NBG4615 can now access the network (i.e., the Internet if the IP address is given by the ISP). The Web Configurator may no longer be accessible unless you know the IP address assigned by the DHCP server to the NBG4615. You need to reset the NBG4615 to be able to access the Web Configurator again (see Section 29.7 on page 220 for details on how to reset the NBG4615). Also when you select this, you cannot enter an IP address for your NBG4615 in the field below.
Use Defined LAN IP Address	Click this if you want to specify the IP address of your NBG4615. Or if your ISP or network administrator gave you a static IP address to access the network or the Internet.
IP Address	Type the IP address in dotted decimal notation. The default setting is 192.168.1.2. If you change the IP address you will have to log in again with the new IP address.
IP Subnet Mask	The subnet mask specifies the network number portion of an IP address. Your NBG4615 will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the NBG4615.
Gateway IP Address	Enter a **Gateway IP Address** (if your ISP or network administrator gave you one) in this field.
DNS Assignment	
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
Apply	Click **Apply** to save your changes to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

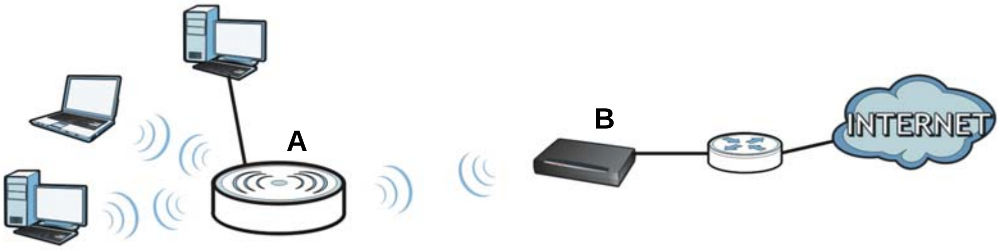
Universal Repeater Mode

11.1 Overview

In universal repeater mode, your NBG4615 can act as an access point and wireless client at the same time. The NBG4615 can connect to an existing network through another access point and also lets wireless clients connect to the network through it. This helps you expand wireless coverage when you have an access point or wireless router already in your network.

In the example below, the NBG4615 (**A**) is configured as a universal repeater. It has three clients that want to connect to the Internet. The NBG4615 wirelessly connects to the available access point (**B**).

Figure 52 Universal Repeater Mode



After the NBG4615 and the access point connect, the NBG4615 acquires its IP address from the access point. The clients of the NBG4615 can now surf the Internet.

11.2 What You Can Do

- Use the **Status** screen to view read-only information about your NBG4615 (Section 11.5 on page 84).
- Use the **LAN** screen to set the IP address for your NBG4615 acting as an access point (Section 10.5 on page 80).
- Use the **Universal Repeater** screen to configure the security between the NBG4615 and another access point (Section 11.6 on page 86).
- Use other **Wireless LAN** screens to configure the wireless settings and wireless security between the wireless clients and the NBG4615.

11.3 What You Need to Know

With the exception of the **Wireless LAN > AP Client** screen, other configuration screens in Universal Repeater mode are similar to the ones in Access Point Mode. See Chapter 15 on page 125 through Chapter 29 on page 224 of this User's Guide.

11.4 Setting your NBG4615 to Universal Repeater Mode

1 Connect your computer to the LAN port of the NBG4615.

2 The default IP address of the NBG4615 is "192.168.1.2". In this case, your computer must have an IP address in the range between "192.168.1.3" and "192.168.1.254".

3 Click **Start > Run** on your computer in Windows. Type "cmd" in the dialog box. Enter "ipconfig" to show your computer's IP address. If your computer's IP address is not in the correct range then see Appendix D on page 263 for information on changing your computer's IP address.

4 After you've set your computer's IP address, open a web browser such as Internet Explorer and type "http://192.168.1.2" as the web address in your web browser.

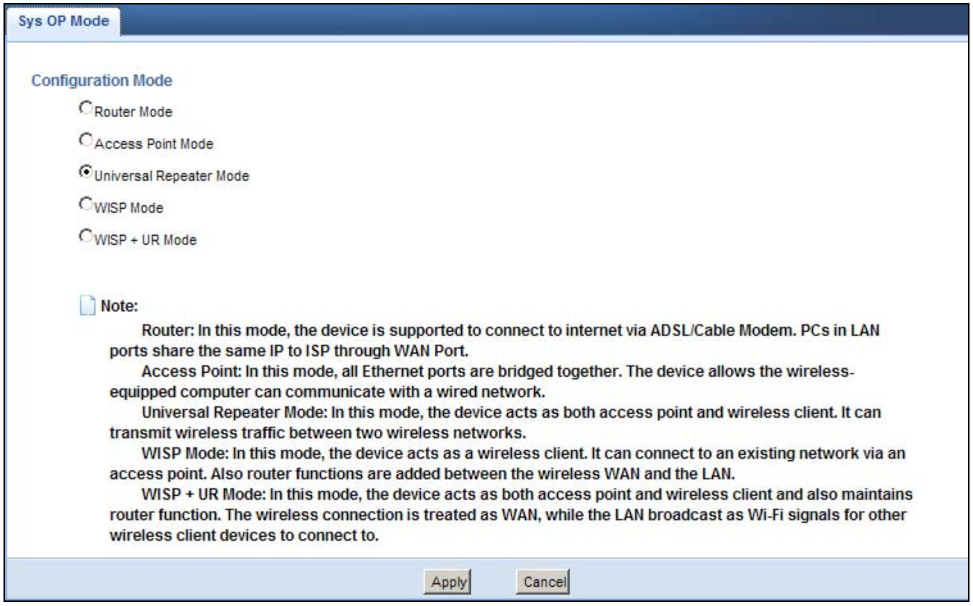
5 Enter "1234" (default) as the password and click **Login**.

6 Type a new password and retype it to confirm, then click **Apply**. Otherwise, click **Ignore**.

7 The Easy mode appears. Click **Expert Mode** in the navigation panel.

8 To set your NBG4615 to **Universal Repeater Mode**, on the left of the screen, click **Maintenance > Sys OP Mode** and select **Universal Repeater Mode**.

Figure 53 Changing to Universal Repeater mode


Sys OP Mode

Configuration Mode

○ Router Mode
○ Access Point Mode
● Universal Repeater Mode
○ WISP Mode
○ WISP + UR Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

Universal Repeater Mode: In this mode, the device acts as both access point and wireless client. It can transmit wireless traffic between two wireless networks.

WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

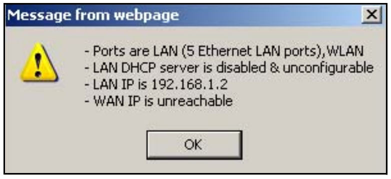
WISP + UR Mode: In this mode, the device acts as both access point and wireless client and also maintains router function. The wireless connection is treated as WAN, while the LAN broadcast as Wi-Fi signals for other wireless client devices to connect to.

Note: You have to log in to the Web Configurator again when you change modes. As soon as you do, your NBG4615 is already in Universal Repeater mode.

Note: The Universal Repeater mode IP address is always the same as the Access Point mode IP address. If you changed the IP address of your NBG4615 while in Access Point mode, use this IP address in Universal Repeater mode.

9 When you select **Universal Repeater Mode**, the following pop-up message window appears.

Figure 54 Pop up for Universal Repeater mode



Message from webpage

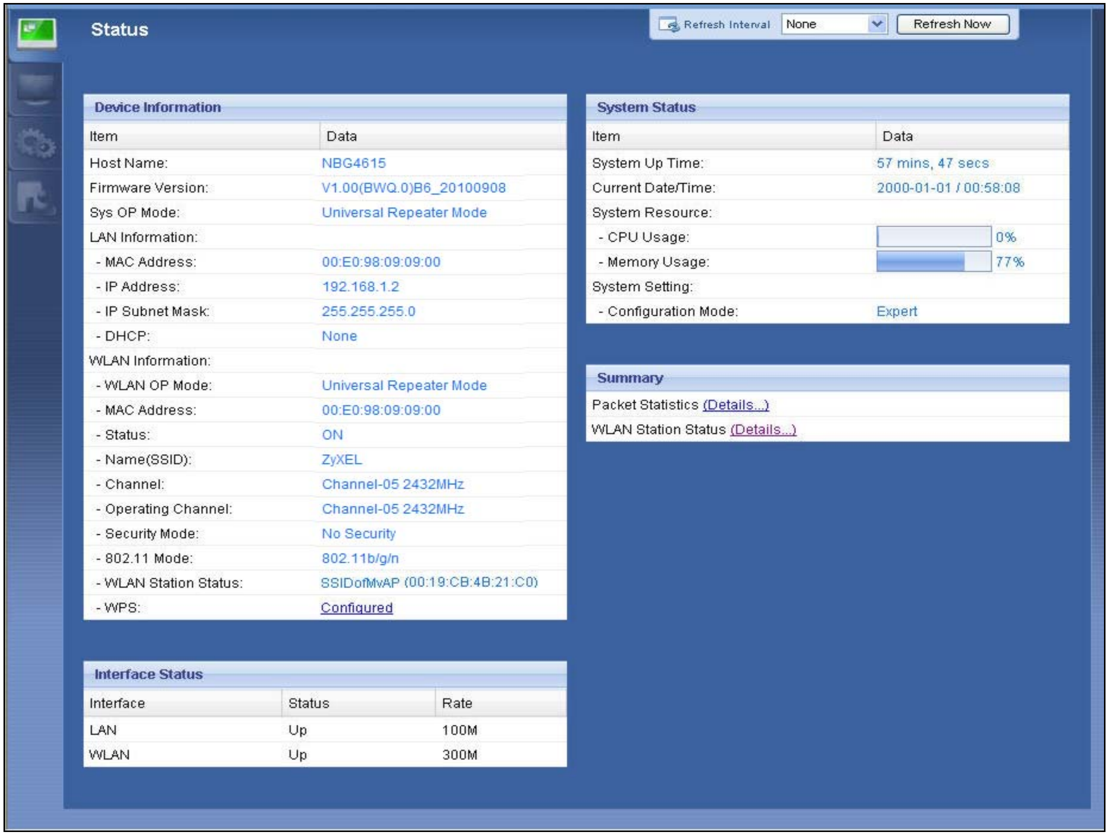
- Ports are LAN (5 Ethernet LAN ports),WLAN
- LAN DHCP server is disabled & unconfigurable
- LAN IP is 192.168.1.2
- WAN IP is unreachable

Click **OK**. The Web Configurator refreshes once the change to Universal Repeater mode is successful.

11.5 Universal Repeater Mode Status Screen

Click to open the status screen.

Figure 55 Status: Universal Repeater Mode



Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.0)B6_20100908
Sys OP Mode:	Universal Repeater Mode
LAN Information:	
- MAC Address:	00:E0:98:09:09:00
- IP Address:	192.168.1.2
- IP Subnet Mask:	255.255.255.0
- DHCP:	None
WLAN Information:	
- WLAN OP Mode:	Universal Repeater Mode
- MAC Address:	00:E0:98:09:09:00
- Status:	ON
- Name(SSID):	ZyXEL
- Channel:	Channel-05 2432MHz
- Operating Channel:	Channel-05 2432MHz
- Security Mode:	No Security
- 802.11 Mode:	802.11b/g/n
- WLAN Station Status:	SSIDofMyAP (00:19:CB:4B:21:C0)
- WPS:	Configured

System Status

Item	Data
System Up Time:	57 mins, 47 secs
Current Date/Time:	2000-01-01 / 00:58:08
System Resource:	
- CPU Usage:	0%
- Memory Usage:	77%
System Setting:	
- Configuration Mode:	Expert

Summary

Packet Statistics (Details...)
WLAN Station Status (Details...)

Interface Status

Interface	Status	Rate
LAN	Up	100M
WLAN	Up	300M

The following table describes the labels shown in the **Status** screen.

Table 33 Status Screen: Universal Repeater Mode

LABEL	DESCRIPTION
Logout	Click this at any time to exit the Web Configurator.
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **General** screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.
Sys OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615 is set - **Universal Repeater Mode**.
LAN Information	
MAC Address	This shows the LAN Ethernet adapter MAC Address of your device.
IP Address	This shows the LAN port's IP address.
IP Subnet Mask	This shows the LAN port's subnet mask.
DHCP	This shows the LAN port's DHCP role - **Client** or **None**.
WLAN Information	
WLAN OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615's wireless LAN is set - **Universal Repeater Mode**.
MAC Address	This shows the wireless adapter MAC Address of your device.
Status	This shows the current status of the Wireless LAN - **ON**.
Name (SSID)	This shows a descriptive name used to identify the NBG4615 in the wireless LAN.
Channel	This shows the channel number which you select manually or the NBG4615 automatically scans and selects.
Operating Channel	This shows the channel number which the NBG4615 is currently using over the wireless LAN.
Security Mode	This shows the level of wireless security the NBG4615 is using.
802.11 Mode	This shows the wireless standard.
WLAN Station Status	If the NBG4615 has successfully connected to an AP or wireless router, it displays the SSID and MAC address of the AP or wireless router in this field.
WPS	This displays **Configured** when the WPS has been set up. This displays **Unconfigured** if the WPS has not been set up. Click the status to display **Network > Wireless LAN > WPS** screen.
System Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
System Up Time	This is the total time the NBG4615 has been on.
Current Date/Time	This field displays your NBG4615's present date and time.
System Resource	
CPU Usage	This displays what percentage of the NBG4615's processing ability is currently used. When this percentage is close to 100%, the NBG4615 is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using bandwidth management.
Memory Usage	This shows what percentage of the heap memory the NBG4615 is using.
System Setting	
Configuration Mode	This shows the web configurator mode you are viewing - **Expert**.
Summary	

Table 33 Status Screen: Universal Repeater Mode (continued)

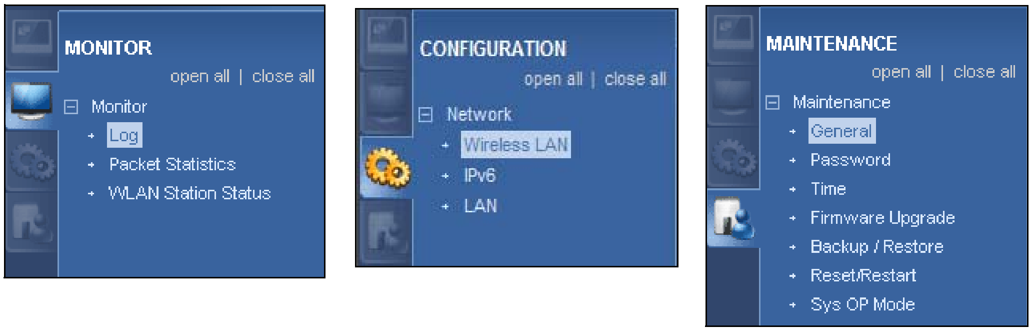
LABEL	DESCRIPTION
Packet Statistics	Click **Details...** to go to the **Monitor > Packet Statistics** screen (Section 6.6 on page 53). Use this screen to view port status and packet specific statistics.
WLAN Station Status	Click **Details...** to go to the **Monitor > WLAN Station Status** screen (Section 6.7 on page 54). Use this screen to view the wireless stations that are currently associated to the NBG4615.
Interface Status	
Interface	This displays the NBG4615 port types. The port types are: **LAN** and **WLAN**.
Status	For the LAN and WAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN, it displays **Up** when the WLAN is enabled or **Down** when the WLAN is disabled.
Rate	For the LAN ports, this displays the port speed or **N/A** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **N/A** when the WLAN is disabled.

11.5.0.1 Navigation Panel

Use the menu in the navigation panel to configure NBG4615 features in **Universal Repeater** mode.

The following screen and table show the features you can configure in **Universal Repeater** mode.

Figure 56 Menu: Universal Repeater Mode

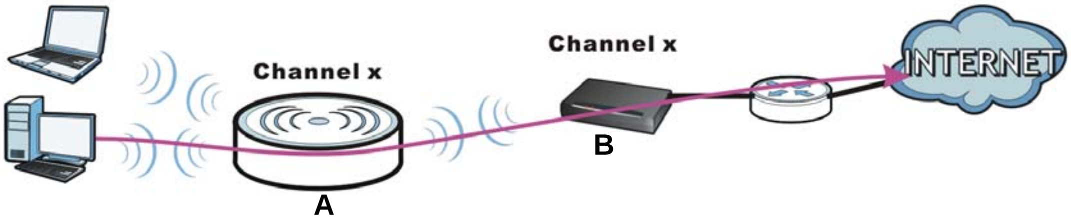


Refer to Table 30 on page 72 for descriptions of the labels shown in the **Navigation** panel.

11.6 Universal Repeater Screen

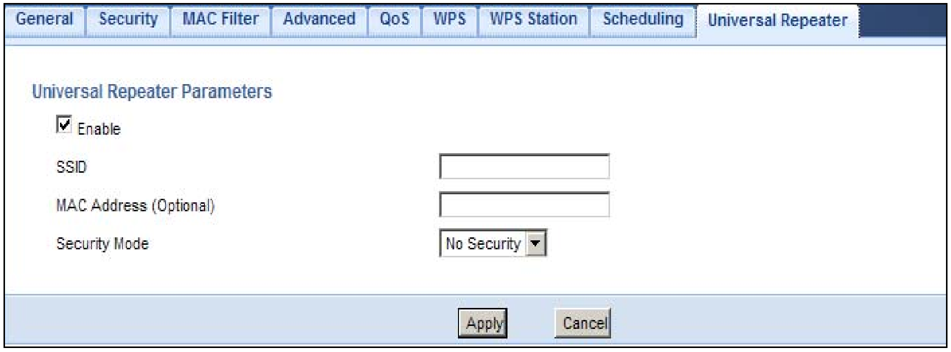
Use this screen to enter the SSID and select the wireless security mode used by the wireless device to which you want to connect. Go to **Configuration > Wireless LAN > Universal Repeater** to open the **Universal Repeater** screen. The screen varies depending on security mode.

Note: To have wireless clients access or acquire an IP address from another access point or wireless router (**B**) through the NBG4615 (**A**) in universal repeater mode, you must set the channel number in the **Wireless LAN > General** screen to be the same as the one on the wireless router or AP to which the NBG4615 wants to connect.



11.6.1 No Security

Figure 57 Universal Repeater Mode: Wireless LAN > Universal Repeater: No Security



Universal Repeater Parameters

☑ Enable

SSID

MAC Address (Optional)

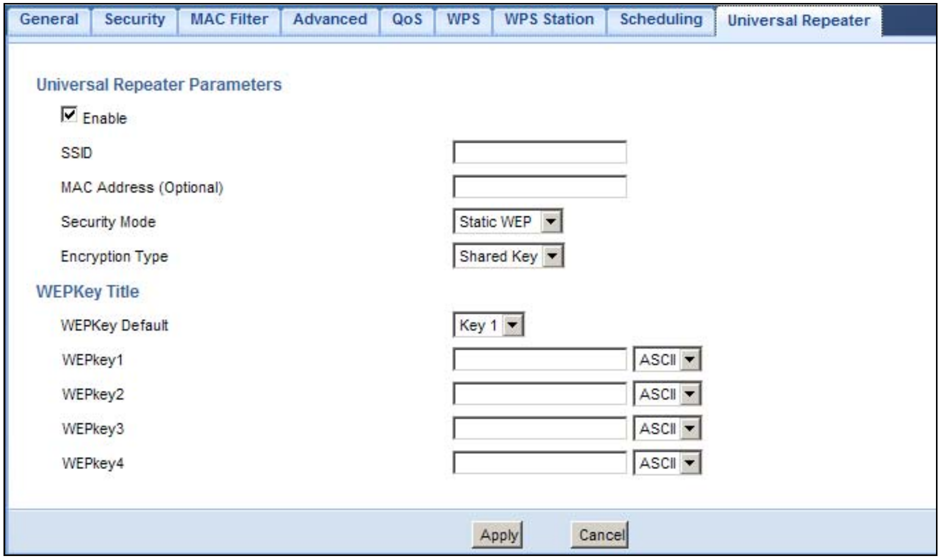
Security Mode: No Security

The following table describes the labels in this screen.

Table 34 Universal Repeater Mode: Wireless LAN > Universal Repeater: No Security

LABEL	DESCRIPTION
Universal Repeater Parameters	
Enable	Select this option to have the NBG4615 connect to the specified access point.
SSID	Enter the name of the access point to which you are connecting.
MAC Address (Optional)	Enter the MAC address of the access point to which you are connecting.
Security Mode	Select **No Security** if the access point to which you want to connect does not use encryption.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

11.6.2 Static WEP



Universal Repeater Parameters

☑ Enable

SSID

MAC Address (Optional)

Security Mode: Static WEP

Encryption Type: Shared Key

WEPKey Title

WEPKey Default: Key 1

WEPkey1: ASCII

WEPkey2: ASCII

WEPkey3: ASCII

WEPkey4: ASCII

Figure 58 Universal Repeater Mode: Wireless LAN > Universal Repeater: Static WEP

The following table describes the labels in this screen.

Table 35 Universal Repeater Mode: Wireless LAN > Universal Repeater: Static WEP

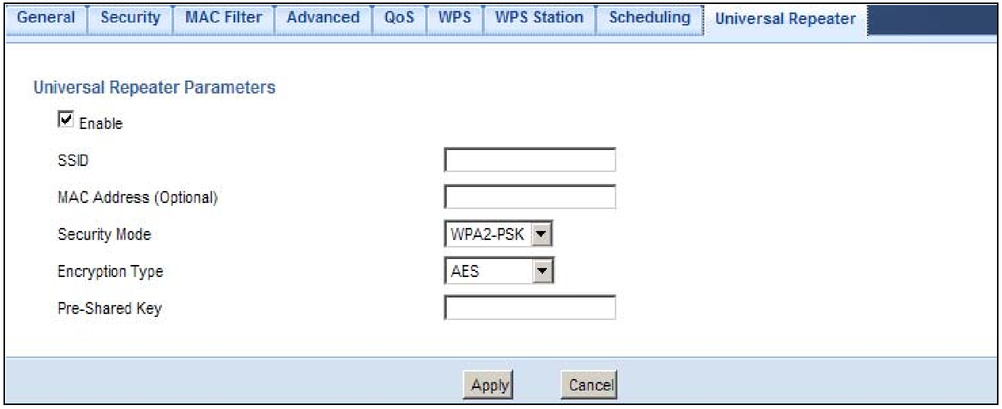
LABEL	DESCRIPTION
Universal Repeater Parameters	
Enable	Select this option to have the NBG4615 connect to the specified access point.
SSID	Enter the name of the access point to which you are connecting.
MAC Address (Optional)	Enter the MAC address of the access point to which you are connecting.
Security Mode	Select **Static WEP** if the access point to which you want to connect uses WEP data encryption.
Encryption Type	Select **Open** or **Shared Key** from the drop-down list box. This field specifies whether the wireless clients have to provide the WEP key to log into the wireless network. Keep this setting at **Open** unless you want to force a key verification before communication between the wireless client and the NBG4615 occurs. Select **Shared Key** to force the clients to provide the WEP key prior to communication.
WEP Key Title	
WEPKey Default	Select a default WEP key to use for data encryption.
WEP Key 1 ~ WEP Key 4	The WEP keys are used to encrypt data. Both the NBG4615 and the access point must use the same WEP key for data transmission. If you chose **HEX**, enter 10 or 26 hexadecimal characters in the range of "A-F", "a-f" and "0-9" (for example, 11AA22BB33) for a 64-bit or 128-bit WEP key respectively. If you chose **ASCII**, enter any 5 or 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for a 64-bit or 128-bit WEP key respectively. You must configure at least one key, only one key can be activated at any one time.

Table 35 Universal Repeater Mode: Wireless LAN > Universal Repeater: Static WEP (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

11.6.3 WPA(2)-PSK

Figure 59 Universal Repeater Mode: Wireless LAN > Universal Repeater: WPA(2)-PSK



Universal Repeater Parameters

☑ Enable

SSID

MAC Address (Optional)

Security Mode: WPA2-PSK

Encryption Type: AES

Pre-Shared Key

The following table describes the labels in this screen.

Table 36 Universal Repeater Mode: Wireless LAN > Universal Repeater: WPA(2)-PSK

LABEL	DESCRIPTION
Universal Repeater Parameters	
Enable	Select this option to have the NBG4615 connect to the specified access point.
SSID	Enter the name of the access point to which you are connecting.
MAC Address (Optional)	Enter the MAC address of the access point to which you are connecting.
Security Mode	Select **WPA-PSK** or **WPA2-PSK** if the access point to which you want to connect uses WPA-PSK or WPA2-PSK.
Encryption Type	Select the type of wireless encryption employed by the access point to which you want to connect.
Pre-Shared Key	**WPA-PSK** or **WPA2-PSK** uses a simple common password for authentication. Type the password employed by the access point to which you want to connect.
Apply	Click **Apply** to save your changes back to the NBG4615.
Reset	Click **Reset** to reload the previous configuration for this screen.

12

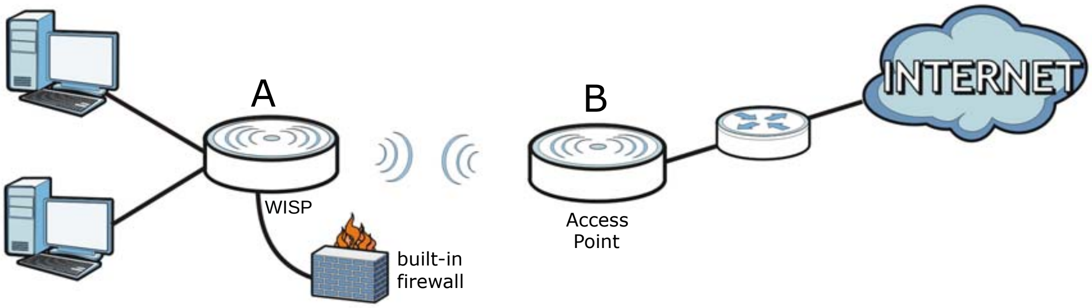
WISP Mode

12.1 Overview

Your NBG4615 can act as a wireless client. In wireless client mode, it can connect to an existing network via an access point. Use this mode if you already have an access point or router in your network.

In the example below, one NBG4615 (**A**) is configured as a wireless client and another is used as an access point (**B**). The wireless client has two clients that need to connect to the Internet. The NBG4615 wirelessly connects to the available access point (**B**).

Figure 60 Wireless Client Mode



After the NBG4615 and the access point connect, the NBG4615 acquires its WAN IP address from the access point. The clients of the NBG4615 can now surf the Internet.

12.2 What You Can Do

- Use the **Status** screen to view read-only information about your NBG4615 (Section 11.5 on page 84).
- Use the **LAN** screen to set the IP address for your NBG4615 acting as an access point (Section 10.5 on page 80).
- Use the **Wireless LAN** screen to associate your NBG4615 (acting as a wireless client) with an existing access point (Section 12.5 on page 95).

12.3 What You Need to Know

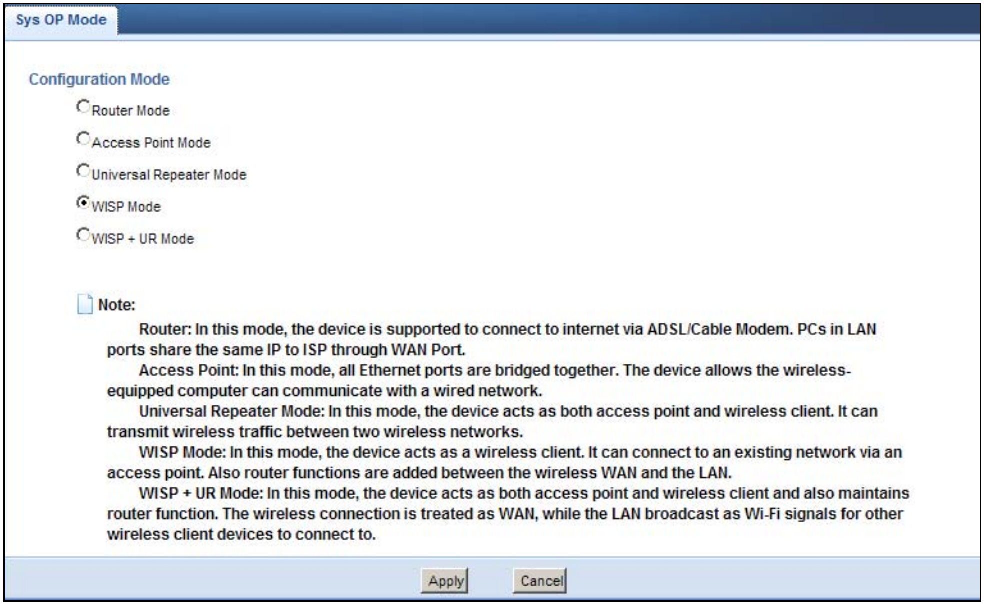
With the exception of the **Wireless LAN** screen, the **Monitor**, **Configuration** and **Maintenance** screens in **WISP** mode are similar to the ones in **Router** mode. See Chapter 15 on page 125 through Chapter 29 on page 224 of this User's Guide.

12.3.1 Setting your NBG4615 to WISP Mode

1 Log into the Web Configurator if you haven’t already. See the Quick start Guide for instructions on how to do this.

2 To set your NBG4615 to **WISP Mode**, go to **Maintenance > Sys OP Mode > General** and select **WISP Mode.**

Figure 61 Changing to WISP mode



Configuration Mode

○ Router Mode

○ Access Point Mode

○ Universal Repeater Mode

● WISP Mode

○ WISP + UR Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

Universal Repeater Mode: In this mode, the device acts as both access point and wireless client. It can transmit wireless traffic between two wireless networks.

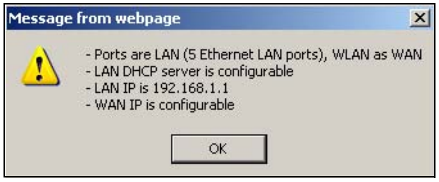
WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

WISP + UR Mode: In this mode, the device acts as both access point and wireless client and also maintains router function. The wireless connection is treated as WAN, while the LAN broadcast as Wi-Fi signals for other wireless client devices to connect to.

Note: You have to log in to the Web Configurator again when you change modes.As soon as you do, your NBG4615 is already in WISP mode.

3 When you select **WISP Mode**, the following pop-up message window appears.

Figure 62 Pop up window for WISP mode



Message from webpage

- Ports are LAN (5 Ethernet LAN ports), WLAN as WAN
- LAN DHCP server is configurable
- LAN IP is 192.168.1.1
- WAN IP is configurable

Click **OK**. The Web Configurator refreshes once the change to **WISP** mode is successful.

12.3.2 Accessing the Web Configurator in WISP Mode

To login to Web Configurator in **WISP Mode**, do the following:

1 Connect your computer to the LAN port of the NBG4615.

2 The default IP address of the NBG4615 is “192.168.1.1”. If you did not change this, you can use the same IP address in **WISP Mode**. Open a web browser such as Internet Explorer and type “192.168.1.1” as the web address in your web browser.

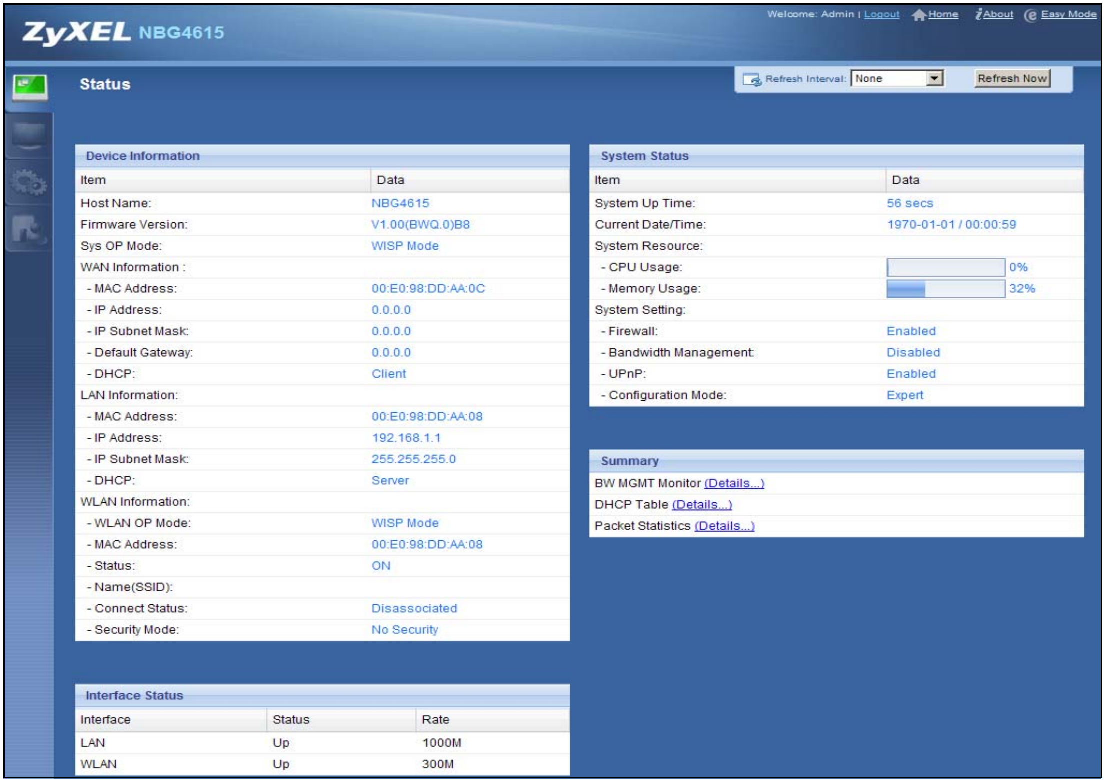
If you changed the IP address of your NBG4615 while in **Router** mode, use this IP address in **WISP Mode**. The **WISP Mode** IP address is always the same as the **Router** mode IP address.

Note: After clicking Login, the **Easy Mode** appears. Refer to Section on page 57 for the **Easy Mode** screens. Click **Expert** mode to see the screens described in the sections following this.

12.4 WISP Mode Status Screen

Click ▣ to open the status screen.

Figure 63 Status: WISP Mode



Device Information	
Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.0)B8
Sys OP Mode:	WISP Mode
WAN Information :	
- MAC Address:	00:E0:98:DD:AA:0C
- IP Address:	0.0.0.0
- IP Subnet Mask:	0.0.0.0
- Default Gateway:	0.0.0.0
- DHCP:	Client
LAN Information:	
- MAC Address:	00:E0:98:DD:AA:08
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- WLAN OP Mode:	WISP Mode
- MAC Address:	00:E0:98:DD:AA:08
- Status:	ON
- Name(SSID):	
- Connect Status:	Disassociated
- Security Mode:	No Security

System Status	
Item	Data
System Up Time:	56 secs
Current Date/Time:	1970-01-01 / 00:00:59
System Resource:	
- CPU Usage:	0%
- Memory Usage:	32%
System Setting:	
- Firewall:	Enabled
- Bandwidth Management:	Disabled
- UPnP:	Enabled
- Configuration Mode:	Expert

Summary

BW MGMT Monitor (Details...)
DHCP Table (Details...)
Packet Statistics (Details...)

Interface Status

Interface	Status	Rate
LAN	Up	1000M
WLAN	Up	300M

The following table describes the labels shown in the **Status** screen.

Table 37 Status Screen: WISP Mode

LABEL	DESCRIPTION
Logout	Click this at any time to exit the Web Configurator.
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **General** screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.

Table 37 Status Screen: WISP Mode (continued)

LABEL	DESCRIPTION
Sys OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615 is set - **WISP Mode**.
WAN Information	
- MAC Address	This shows the WAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the WAN port's IP address.
- IP Subnet Mask	This shows the WAN port's subnet mask.
- Default Gateway	This shows the WAN port's gateway IP address.
- DHCP	This shows the LAN port's DHCP role - **Client** or **None**.
LAN Information	
- MAC Address	This shows the LAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the LAN port's IP address.
- IP Subnet Mask	This shows the LAN port's subnet mask.
- DHCP	This shows the LAN port's DHCP role - **Server** or **Disable**.
WLAN Information	
- WLAN OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615's wireless LAN is set - **WISP Mode**.
- MAC Address	This shows the wireless adapter MAC Address of your device.
- Status	This shows the current status of the Wireless LAN - **ON** or **OFF**.
- Name (SSID)	This shows a descriptive name used to identify the NBG4615 in the wireless LAN.
- Connect Status	This shows whether or not the NBG4615 has successfully associated with an access point - **Associated** or **Disassociated**.
- Security Mode	This shows the level of wireless security the NBG4615 is using.
- 802.11 Mode	This shows the wireless standard.
System Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
System Up Time	This is the total time the NBG4615 has been on.
Current Date/Time	This field displays your NBG4615's present date and time.
System Resource	
- CPU Usage	This displays what percentage of the NBG4615's processing ability is currently used. When this percentage is close to 100%, the NBG4615 is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using bandwidth management.
- Memory Usage	This shows what percentage of the heap memory the NBG4615 is using.
System Setting	
- Firewall	This shows whether the firewall is enabled or not.
- Bandwidth Management	This shows whether the bandwidth management is enabled or not.
- UPnP	This shows whether UPnP is enabled or not.
- Configuration Mode	This shows the web configurator mode you are viewing - **Expert**.
Summary	
BW MGMT Monitor	Click **Details...** to go to the **Monitor > BW MGMT Monitor** screen (Section 6.4 on page 51). Use this screen to view the amount of network bandwidth that applications running in the network are using.

Table 37 Status Screen: WISP Mode (continued)

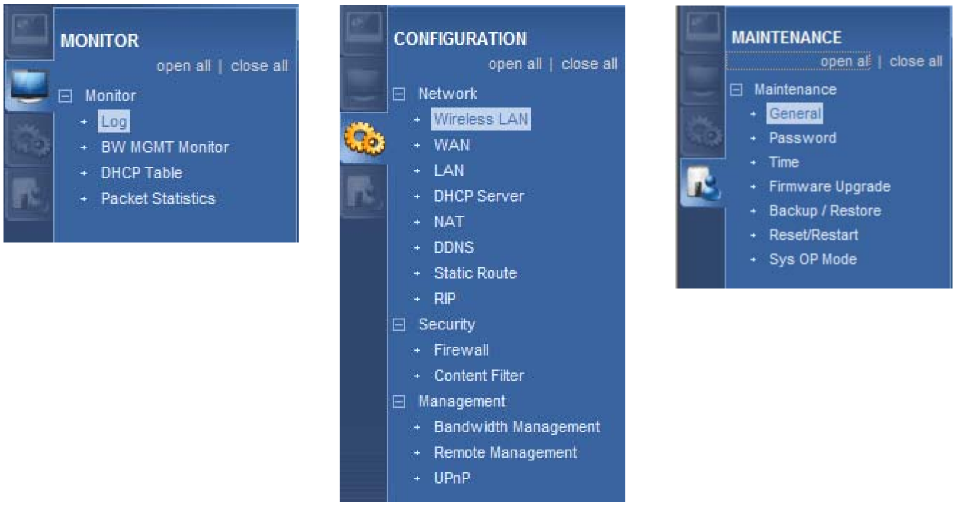
LABEL	DESCRIPTION
DHCP Table	Click **Details...** to go to the **Monitor > DHCP Table** screen (Section 6.5 on page 51). Use this screen to view current DHCP client information.
Packet Statistics	Click **Details...** to go to the **Monitor > Packet Statistics** screen (Section 6.6 on page 53). Use this screen to view port status and packet specific statistics.
Interface Status	
Interface	This displays the NBG4615 port types. The port types are: **LAN** and **WLAN**.
Status	For the LAN and WAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN, it displays **Up** when the WLAN is enabled or **Down** when the WLAN is disabled.
Rate	For the LAN ports, this displays the port speed and duplex setting or **N/A** when the line is disconnected. For the WAN port, it displays the port speed and duplex setting if you’re using Ethernet encapsulation and **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE or PPTP encapsulation. This field displays **N/A** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **N/A** when the WLAN is disabled.

12.4.0.1 Navigation Panel

Use the menu in the navigation panel to configure NBG4615 features in WISP mode.

The following screen and table show the features you can configure in **Access Point** mode.

Figure 64 Menu: WISP Mode

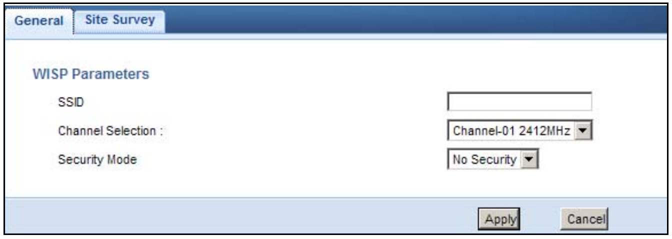


Refer to Table 30 on page 72 for descriptions of the labels shown in the **Navigation** panel.

12.5 Wireless LAN General Screen

Use this screen to configure the wireless LAN settings of your NBG4615. Go to **Configuration > Wireless LAN > General** to open the following screen.

Figure 65 WISP Mode: Wireless LAN > General



WISP Parameters

SSID

Channel Selection : Channel-01 2412MHz

Security Mode No Security

The following table describes the labels in this screen.

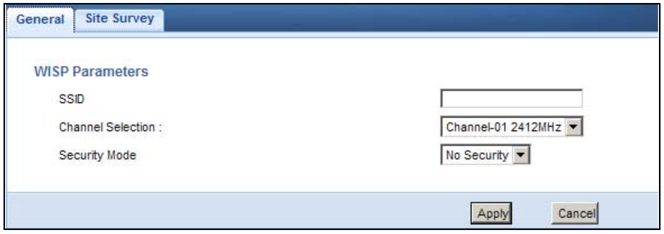
Table 38 WISP Mode: Wireless LAN > General

LABEL	DESCRIPTION
WISP Parameters	
SSID	Enter the name of the access point to which you are connecting.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g/n wireless devices is called a channel. The device will automatically select the channel with the least interference.
Security Mode	Select the security mode of the access point to which you want to connect.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

12.5.0.1 No Security

Use this screen if the access point to which you want to connect does not use encryption.

Figure 66 No Security (WISP)



WISP Parameters

SSID

Channel Selection : Channel-01 2412MHz

Security Mode No Security

The following table describes the labels in this screen.

Table 39 No Security (WISP)

LABEL	DESCRIPTION
WISP Parameters	
SSID	Enter the name of the access point to which you are connecting.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g/n wireless devices is called a channel. The device will automatically select the channel with the least interference.
Security Mode	Select **No Security** in this field.

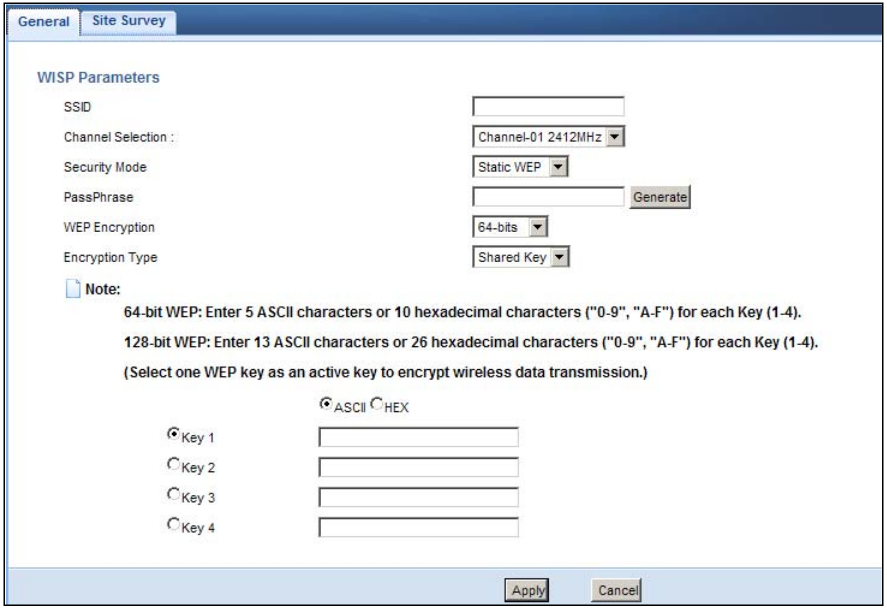
Table 39 No Security (WISP) (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

12.5.1 Static WEP

Use this screen if the access point to which you want to connect to uses WEP security mode.

Figure 67 WEP (WISP)



WISP Parameters

SSID

Channel Selection : Channel-01 2412MHz

Security Mode: Static WEP

PassPhrase: Generate

WEP Encryption: 64-bits

Encryption Type: Shared Key

Note:

64-bit WEP: Enter 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

128-bit WEP: Enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

(Select one WEP key as an active key to encrypt wireless data transmission.)

● ASCII ○ HEX

● Key 1

○ Key 2

○ Key 3

○ Key 4

The following table describes the labels in this screen.

Table 40 WEP (WISP)

LABEL	DESCRIPTION
WISP Parameters	
SSID	Enter the name of the access point to which you are connecting.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g/n wireless devices is called a channel. The device will automatically select the channel with the least interference.
Security Mode	Select **Static WEP** to enable data encryption.
PassPhrase	Enter a Passphrase (up to 26 printable characters) and click **Generate**. A passphrase functions like a password. In WEP security mode, it is further converted by the NBG4615 into a complicated string that is referred to as the “key”. This key is requested from all devices wishing to connect to a wireless network.
WEP Encryption	Select **64-bit WEP** or **128-bit WEP**. This dictates the length of the security key that the network is going to use.
ASCII	Select this option in order to enter ASCII characters as WEP key.
Hex	Select this option in order to enter hexadecimal characters as a WEP key. The preceding "0x", that identifies a hexadecimal key, is entered automatically.

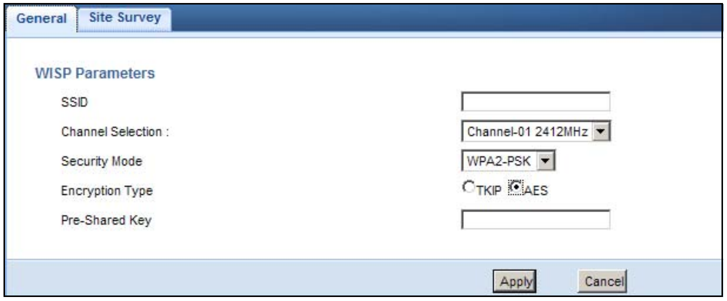
Table 40 WEP (WISP) (continued)

LABEL	DESCRIPTION
Key 1 to Key 4	The WEP keys are used to encrypt data. Both the NBG4615 and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP**, then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F"). If you chose **128-bit WEP**, then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F"). You must configure at least one key, only one key can be activated at any one time. The default key is key 1.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

12.5.2 WPA(2)-PSK

Use this screen if the access point to which you want to connect uses WPA(2)-PSK security mode.

Figure 68 WPA-PSK/WPA2-PSK (WISP)



WISP Parameters

SSID

Channel Selection : Channel-01 2412MHz

Security Mode: WPA2-PSK

Encryption Type: ○ TKIP ● AES

Pre-Shared Key

The following table describes the labels in this screen.

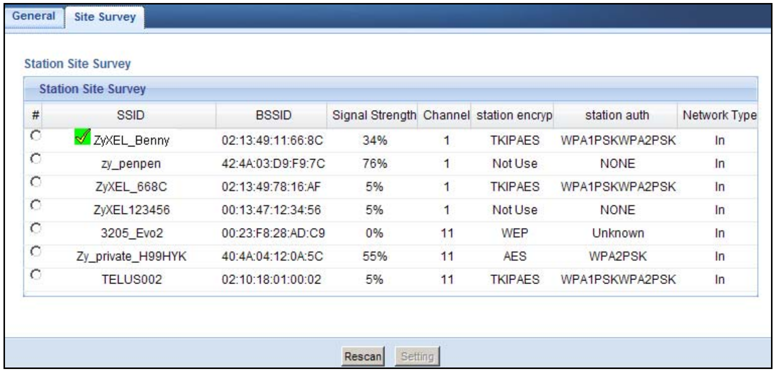
Table 41 WPA-PSK/WPA2-PSK (WISP)

LABEL	DESCRIPTION
WISP Parameters	
SSID	Enter the name of the access point to which you are connecting.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g/n wireless devices is called a channel. The device will automatically select the channel with the least interference.
Security Mode	Select **WPA-PSK** or **WPA2-PSK** to enable data encryption.
Encryption Type	Select the type of wireless encryption employed by the access point to which you want to connect.
Pre-Shared Key	**WPA-PSK / WPA2-PSK** uses a simple common password for authentication. Type the pre-shared key employed by the access point to which you want to connect.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

12.5.3 Site Survey Screen

Use this screen to scan for and connect to a wireless network automatically. Go to **Configuration > Site Survey** to open the following screen.

Figure 69 Configuration > Wireless LAN > Site Survey (WISP)



Station Site Survey

Station Site Survey

#	SSID	BSSID	Signal Strength	Channel	station encryp	station auth	Network Type
○	✓ ZyXEL_Benny	02:13:49:11:66:8C	34%	1	TKIPAES	WPA1PSKWPA2PSK	In
○	zy_penpen	42:4A:03:D9:F9:7C	76%	1	Not Use	NONE	In
○	ZyXEL_668C	02:13:49:78:16:AF	5%	1	TKIPAES	WPA1PSKWPA2PSK	In
○	ZyXEL123456	00:13:47:12:34:56	5%	1	Not Use	NONE	In
○	3205_Evo2	00:23:F8:28:AD:C9	0%	11	WEP	Unknown	In
○	Zy_private_H99HYK	40:4A:04:12:0A:5C	55%	11	AES	WPA2PSK	In
○	TELUS002	02:10:18:01:00:02	5%	11	TKIPAES	WPA1PSKWPA2PSK	In

The following table describes the labels in this screen.

Table 42 Configuration > Wireless LAN > Site Survey (WISP)

LABEL	DESCRIPTION
Station Site Survey	
#	Select a wireless device and click **Add Profile** to open a configuration screen where you can add the selected wireless device to a profile and then enable it.
SSID	This displays the SSID of the wireless device. ✓ indicates the wireless device is added to an activated profile and the NBG4615 is connecting to it.
BSSID	This displays the MAC address of the wireless device.
Signal Strength	This displays the strength of the wireless signal. The signal strength mainly depends on the antenna output power and the distance between your NBG4615 and this device.
Channel	This displays the channel number used by this wireless device.
station encryp	This displays the data encryption method used by this wireless device.
station auth	This displays the authentication method used by this wireless device.
Network Type	This displays the network type (**In** (Infrastructure) or **Ad** (Ad Hoc) of this wireless device.
Rescan	Click this button to search for available wireless devices within transmission range and update this table.
Setting	Select a wireless device and click this button to add it to a profile.

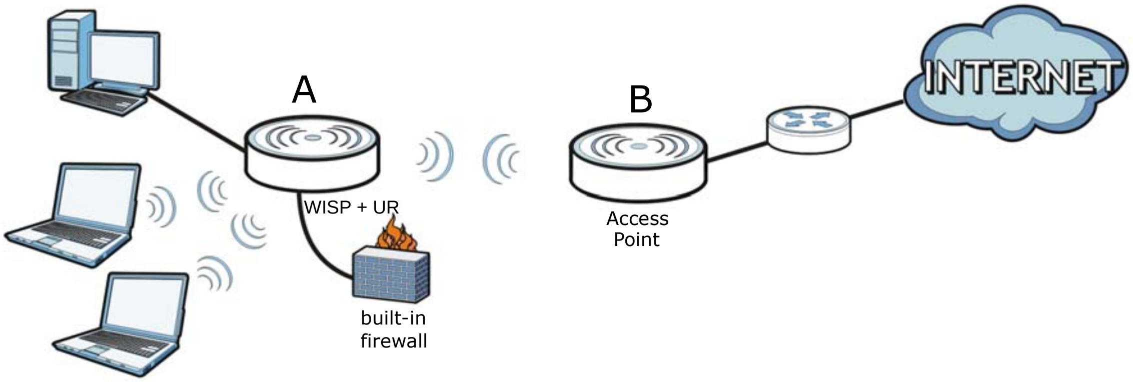
WISP + UR Mode

13.1 Overview

In WISP + UR mode, the NBG4615 has the same function as in WISP mode. In addition, it can provide WiFi function to the clients on the LAN side.

In the example below, one NBG4615 (**A**) is configured as WISP +UR mode and another is used as an access point (**B**). The NBG4615 (**A**) wirelessly connects to the available access point (**B**), and can provide WiFi wireless function to clients on its LAN side.

Figure 70 WISP + UR Mode



13.2 What You Can Do

- Use the **Status** screen to view read-only information about your NBG4615 (Section 11.5 on page 84).
- Use the **LAN** screen to set the IP address for your NBG4615 acting as an access point (Section 10.5 on page 80).
- Use the **Wireless LAN** screen to associate your NBG4615 (acting as a wireless client) with an existing access point (Section 12.5 on page 95).

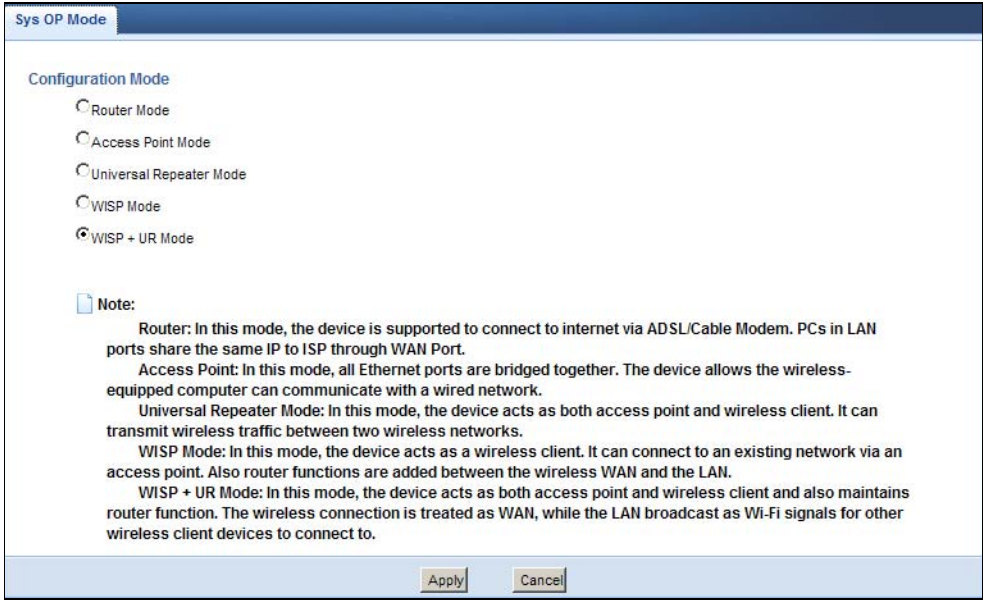
13.3 What You Need to Know

The **Monitor**, **Configuration** and **Maintenance** screens in **WISP + UR** mode are similar to the ones in **Router** mode. See Chapter 15 on page 125 through Chapter 29 on page 224 of this User's Guide.

13.3.1 Setting your NBG4615 to WISP + UR Mode

1 Log into the Web Configurator if you haven't already. See the Quick start Guide for instructions on how to do this.

2 To set your NBG4615 to **WISP + UR Mode Mode**, go to **Maintenance > Sys OP Mode > General** and select **WISP + UR Mode.**



Configuration Mode

○ Router Mode

○ Access Point Mode

○ Universal Repeater Mode

○ WISP Mode

● WISP + UR Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

Universal Repeater Mode: In this mode, the device acts as both access point and wireless client. It can transmit wireless traffic between two wireless networks.

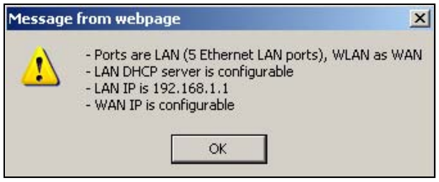
WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

WISP + UR Mode: In this mode, the device acts as both access point and wireless client and also maintains router function. The wireless connection is treated as WAN, while the LAN broadcast as Wi-Fi signals for other wireless client devices to connect to.

Figure 71 Changing to WISP + UR mode

Note: You have to log in to the Web Configurator again when you change modes. As soon as you do, your NBG4615 is already in WISP + UR mode.

3 When you select **WISP + UR Mode**, the following pop-up message window appears.



- Ports are LAN (5 Ethernet LAN ports), WLAN as WAN
- LAN DHCP server is configurable
- LAN IP is 192.168.1.1
- WAN IP is configurable

Figure 72 Pop up window for WISP mode

Click **OK**. The Web Configurator refreshes once the change to **WISP** mode is successful.

13.3.2 Accessing the Web Configurator in WISP Mode

To login to Web Configurator in **WISP + UR Mode**, do the following:

1 Connect your computer to the LAN port of the NBG4615.

2 The default IP address of the NBG4615 is “192.168.1.1”. If you did not change this, you can use the same IP address in **WISP + UR Mode**. Open a web browser such as Internet Explorer and type “192.168.1.1” as the web address in your web browser.

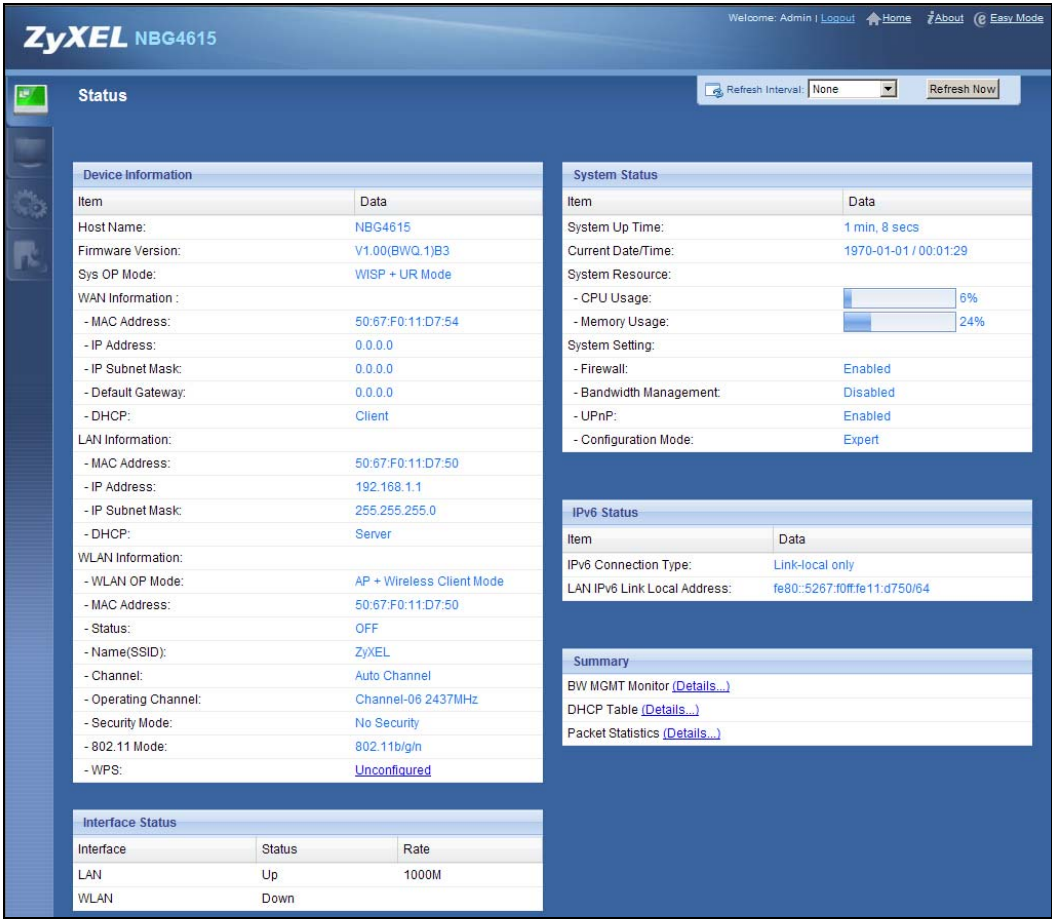
If you changed the IP address of your NBG4615 while in **Router** mode, use this IP address in **WISP + UR Mode Mode**. The **WISP + UR Mode Mode** IP address is always the same as the **Router** mode IP address.

Note: After clicking Login, the **Easy Mode** appears. Refer to Section on page 57 for the **Easy Mode** screens. Click **Expert** mode to see the screens described in the sections following this.

13.4 WISP + UR Mode Status Screen

Click ▣ to open the status screen.

Figure 73 Status: WISP + UR Mode



Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.1)B3
Sys OP Mode:	WISP + UR Mode
WAN Information :	
- MAC Address:	50:67:F0:11:D7:54
- IP Address:	0.0.0.0
- IP Subnet Mask:	0.0.0.0
- Default Gateway:	0.0.0.0
- DHCP:	Client
LAN Information:	
- MAC Address:	50:67:F0:11:D7:50
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- WLAN OP Mode:	AP + Wireless Client Mode
- MAC Address:	50:67:F0:11:D7:50
- Status:	OFF
- Name(SSID):	ZyXEL
- Channel:	Auto Channel
- Operating Channel:	Channel-06 2437MHz
- Security Mode:	No Security
- 802.11 Mode:	802.11b/g/n
- WPS:	Unconfigured

Interface Status

Interface	Status	Rate
LAN	Up	1000M
WLAN	Down	

System Status

Item	Data
System Up Time:	1 min, 8 secs
Current Date/Time:	1970-01-01 / 00:01:29
System Resource:	
- CPU Usage:	6%
- Memory Usage:	24%
System Setting:	
- Firewall:	Enabled
- Bandwidth Management:	Disabled
- UPnP:	Enabled
- Configuration Mode:	Expert

IPv6 Status

Item	Data
IPv6 Connection Type:	Link-local only
LAN IPv6 Link Local Address:	fe80::5267:f0ff:fe11:d750/64

Summary

BW MGMT Monitor (Details...)
DHCP Table (Details...)
Packet Statistics (Details...)

The following table describes the labels shown in the **Status** screen.

Table 43 Status Screen: WISP + UR Mode

LABEL	DESCRIPTION
Logout	Click this at any time to exit the Web Configurator.
Device Information	
Host Name	This is the **System Name** you enter in the **Maintenance** > **General** screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.
Sys OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615 is set - **WISP + UR Mode**.
WAN Information	
- MAC Address	This shows the WAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the WAN port’s IP address.
- IP Subnet Mask	This shows the WAN port’s subnet mask.
- Default Gateway	This shows the WAN port’s gateway IP address.
- DHCP	This shows the LAN port’s DHCP role - **Client** or **None**.
LAN Information	
- MAC Address	This shows the LAN Ethernet adapter MAC Address of your device.
- IP Address	This shows the LAN port’s IP address.
- IP Subnet Mask	This shows the LAN port’s subnet mask.
- DHCP	This shows the LAN port’s DHCP role - **Server** or **Disable**.
WLAN Information	
- WLAN OP Mode	This is the device mode (Section 7.1.2 on page 55) to which the NBG4615’s wireless LAN is set.
- MAC Address	This shows the wireless adapter MAC Address of your device.
- Status	This shows the current status of the Wireless LAN - **ON** or **OFF**.
- Name (SSID)	This shows a descriptive name used to identify the NBG4615 in the wireless LAN.
- Channel	This shows the channel number which you select manually.
- Operating Channel	This shows the channel number which the NBG4615 is currently using over the wireless LAN.
- Security Mode	This shows the level of wireless security the NBG4615 is using.
- 802.11 Mode	This shows the wireless standard.
- WPS	This displays **Configured** when the WPS has been set up. This displays **Unconfigured** if the WPS has not been set up. Click the status to display **Network > Wireless LAN > WPS** screen.
System Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
System Up Time	This is the total time the NBG4615 has been on.
Current Date/Time	This field displays your NBG4615’s present date and time.
System Resource	
- CPU Usage	This displays what percentage of the NBG4615’s processing ability is currently used. When this percentage is close to 100%, the NBG4615 is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using bandwidth management.

Table 43 Status Screen: WISP + UR Mode (continued)

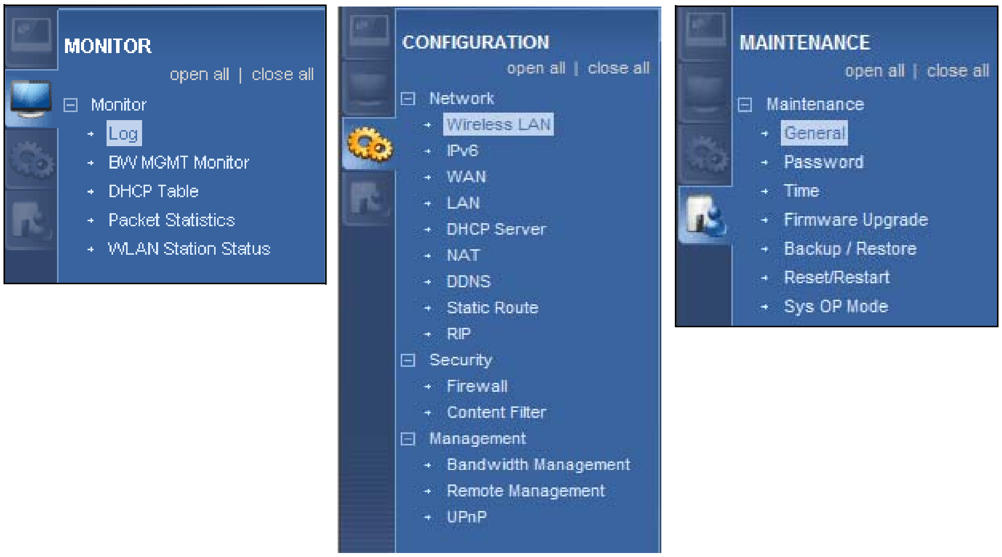
LABEL	DESCRIPTION
- Memory Usage	This shows what percentage of the heap memory the NBG4615 is using.
System Setting	
- Firewall	This shows whether the firewall is enabled or not.
- Bandwidth Management	This shows whether the bandwidth management is enabled or not.
- UPnP	This shows whether UPnP is enabled or not.
- Configuration Mode	This shows the web configurator mode you are viewing - **Expert**.
IPv6 Status	
Item	This column shows the type of data the NBG4615 is recording.
Data	This column shows the actual data recorded by the NBG4615.
IPv6 Connection Type	This shows the type of IPv6 connection that is currently in use.
LAN IPv6 Link Local Address	This shows the NBG4615's LAN IPv6 link local address.
Summary	
BW MGMT Monitor	Click **Details...** to go to the **Monitor > BW MGMT Monitor** screen (Section 6.4 on page 51). Use this screen to view the amount of network bandwidth that applications running in the network are using.
DHCP Table	Click **Details...** to go to the **Monitor > DHCP Table** screen (Section 6.5 on page 51). Use this screen to view current DHCP client information.
Packet Statistics	Click **Details...** to go to the **Monitor > Packet Statistics** screen (Section 6.6 on page 53). Use this screen to view port status and packet specific statistics.
Interface Status	
Interface	This displays the NBG4615 port types. The port types are: **LAN** and **WLAN**.
Status	For the LAN and WAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN, it displays **Up** when the WLAN is enabled or **Down** when the WLAN is disabled.
Rate	For the LAN ports, this displays the port speed and duplex setting or **N/A** when the line is disconnected. For the WAN port, it displays the port speed and duplex setting if you're using Ethernet encapsulation and **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE or PPTP encapsulation. This field displays **N/A** when the line is disconnected. For the WLAN, it displays the maximum transmission rate when the WLAN is enabled and **N/A** when the WLAN is disabled.

13.4.0.1 Navigation Panel

Use the menu in the navigation panel to configure NBG4615 features in WISP + UR mode.

The following screen and table show the features you can configure in **Access Point** mode.

Figure 74 Menu: WISP +UR Mode



Refer to Table 30 on page 72 for descriptions of the labels shown in the **Navigation** panel.

14

Tutorials

14.1 Overview

This chapter provides tutorials for setting up your NBG4615.

- Set Up a Wireless Network with WPS
- Configure Wireless Security without WPS
- Using Multiple SSIDs on the NBG4615
- Connecting the NBG4615 (in Universal Repeater Mode) to an AP or Wireless Router
- Connecting to USB Storage with the ZyXEL NetUSB Share Center Utility
- Automatically Connecting to a USB Printer

14.2 Set Up a Wireless Network with WPS

This section gives you an example of how to set up wireless network using WPS. This example uses the NBG4615 as the AP and NWD210N as the wireless client which connects to a notebook.

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

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

- **Push Button Configuration (PBC)** - create a secure wireless network simply by pressing a button. See Section 14.2.1 on page 105.This is the easier method.
- **PIN Configuration** - create a secure wireless network simply by entering a wireless client's PIN (Personal Identification Number) in the NBG4615's interface. See Section 14.2.2 on page 106. This is the more secure method, since one device can authenticate the other.

14.2.1 Push Button Configuration (PBC)

1 Make sure that your NBG4615 is turned on. Make sure the **WLAN** switch (at the back panel of the NBG4615) is set to **ON**, and that the device is placed within range of your computer.

2 Make sure that you have installed the wireless client (this example uses the NWD210N) driver and utility in your notebook.

3 In the wireless client utility, find the WPS settings. Enable WPS and press the WPS button (**Start** or **WPS** button)

4 Log into NBG4615’s Web Configurator and press the **Push Button** in the **Configuration > Network > Wireless Client > WPS Station** screen.

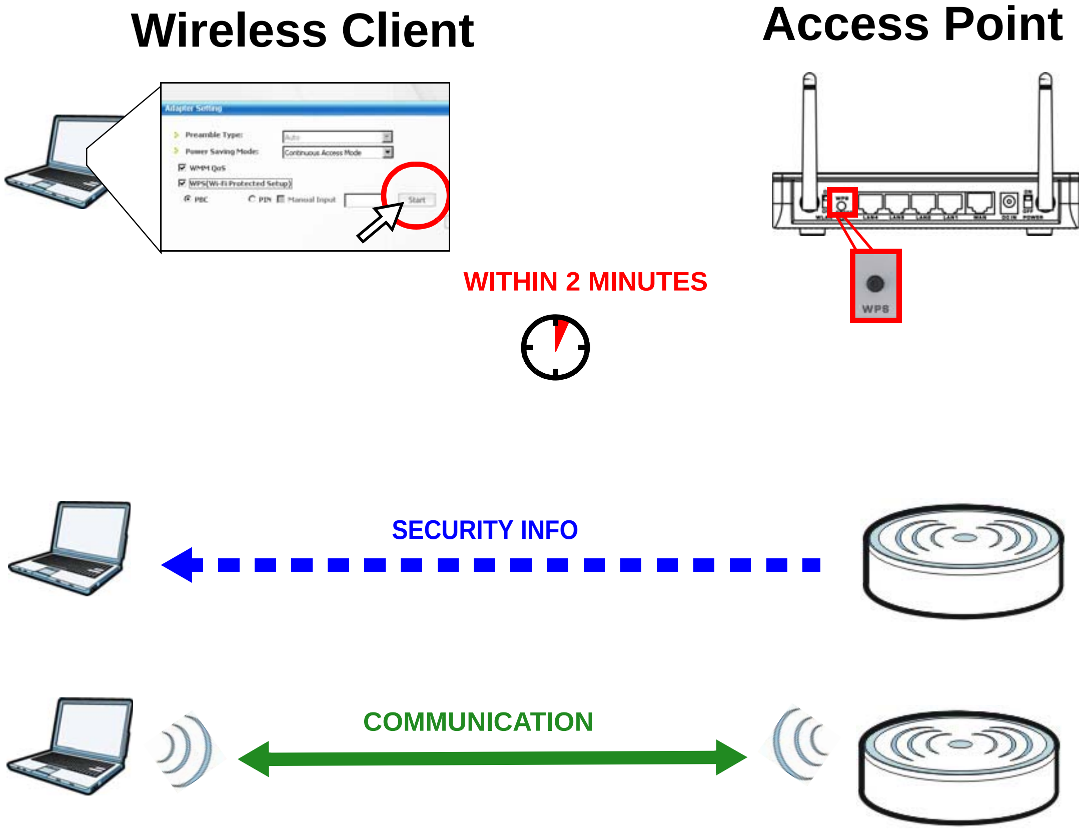
Note: Your NBG4615 has a WPS button located on its back panel, as well as a WPS button in its configuration utility. Both buttons have exactly the same function; you can use one or the other.

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

The NBG4615 sends the proper configuration settings to the wireless client. This may take up to two minutes. Then the wireless client is able to communicate with the NBG4615 securely.

The following figure shows you an example to set up wireless network and security by pressing a button on both NBG4615 and wireless client (the NWD210N in this example).

Figure 75 Example WPS Process: PBC Method



Preamble Type: Auto
Power Saving Mode: Continuous Access Mode
☑ WMM QoS
☑ WPS(Wi-Fi Protected Setup)
● PBC ○ PIN □ Manual Input

14.2.2 PIN Configuration

When you use the PIN configuration method, you need to use both NBG4615’s configuration interface and the client’s utilities.

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

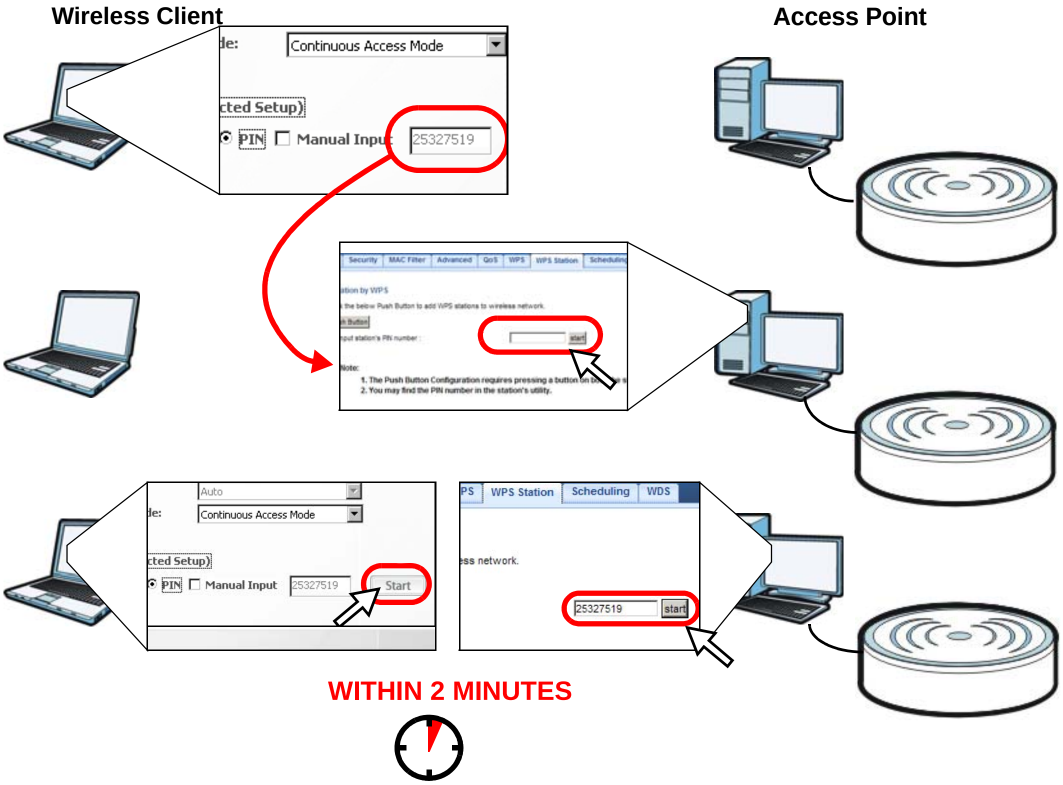
2 Enter the PIN number to the **PIN** field in the **Configuration > Network > Wireless LAN > WPS Station** screen on the NBG4615.

3 Click **Start** buttons (or button next to the PIN field) on both the wireless client utility screen and the NBG4615's **WPS Station** screen within two minutes.

The NBG4615 authenticates the wireless client and sends the proper configuration settings to the wireless client. This may take up to two minutes. Then the wireless client is able to communicate with the NBG4615 securely.

The following figure shows you the example to set up wireless network and security on NBG4615 and wireless client (ex. NWD210N in this example) by using PIN method.

Figure 76 Example WPS Process: PIN Method



14.3 Configure Wireless Security without WPS

This example shows you how to configure wireless security settings with the following parameters on your NBG4615.

SSID	SSID_Example3
Channel	6
Security	WPA-PSK (Pre-Shared Key: ThisismyWPA-PSKpre-sharedkey)

Follow the steps below to configure the wireless settings on your NBG4615.

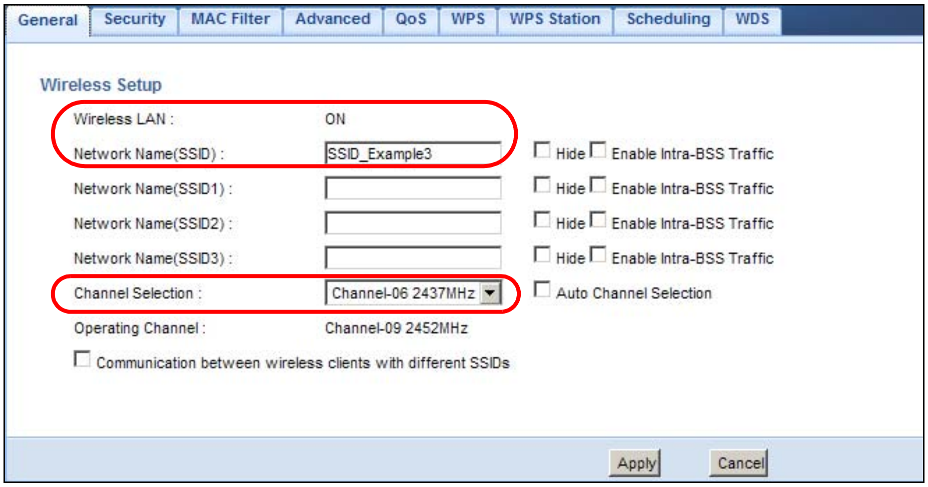
The instructions require that your hardware is connected (see the Quick Start Guide) and you are logged into the Web Configurator through your LAN connection (see Section 5.2 on page 43).

1 Make sure the **WLAN** switch (at the back panel of the NBG4615) is set to **ON**.

2 Open the **Configuration > Wireless LAN > General** screen in the AP's Web Configurator.

3 Confirm that the status of wireless LAN is **ON**.

4 Enter **SSID_Example3** as the SSID and select **Channel-06** as the channel. Click **Apply**.



Wireless Setup

Wireless LAN : ON

Network Name(SSID) : SSID_Example3 □ Hide □ Enable Intra-BSS Traffic

Network Name(SSID1) : □ Hide □ Enable Intra-BSS Traffic

Network Name(SSID2) : □ Hide □ Enable Intra-BSS Traffic

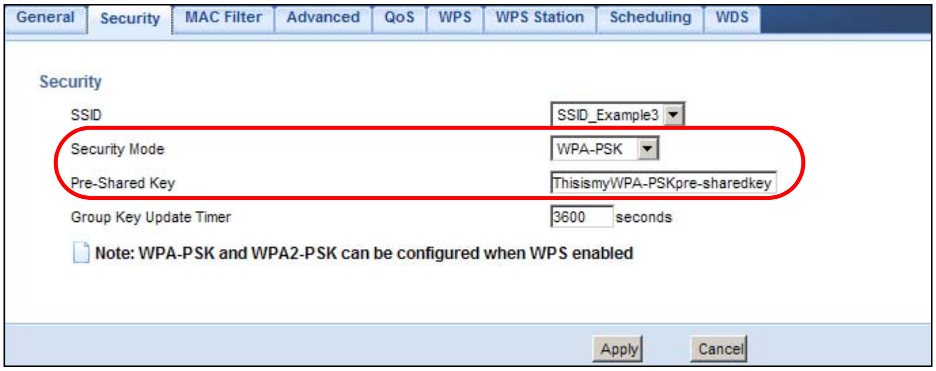
Network Name(SSID3) : □ Hide □ Enable Intra-BSS Traffic

Channel Selection : Channel-06 2437MHz □ Auto Channel Selection

Operating Channel : Channel-09 2452MHz

□ Communication between wireless clients with different SSIDs

5 Go to the **Configuration > Network > Wireless LAN > Security** screen. Set security mode to **WPA-PSK** and enter **ThisismyWPA-PSKpre-sharedkey** in the **Pre-Shared Key** field. Click **Apply**.l



Security

SSID: SSID_Example3

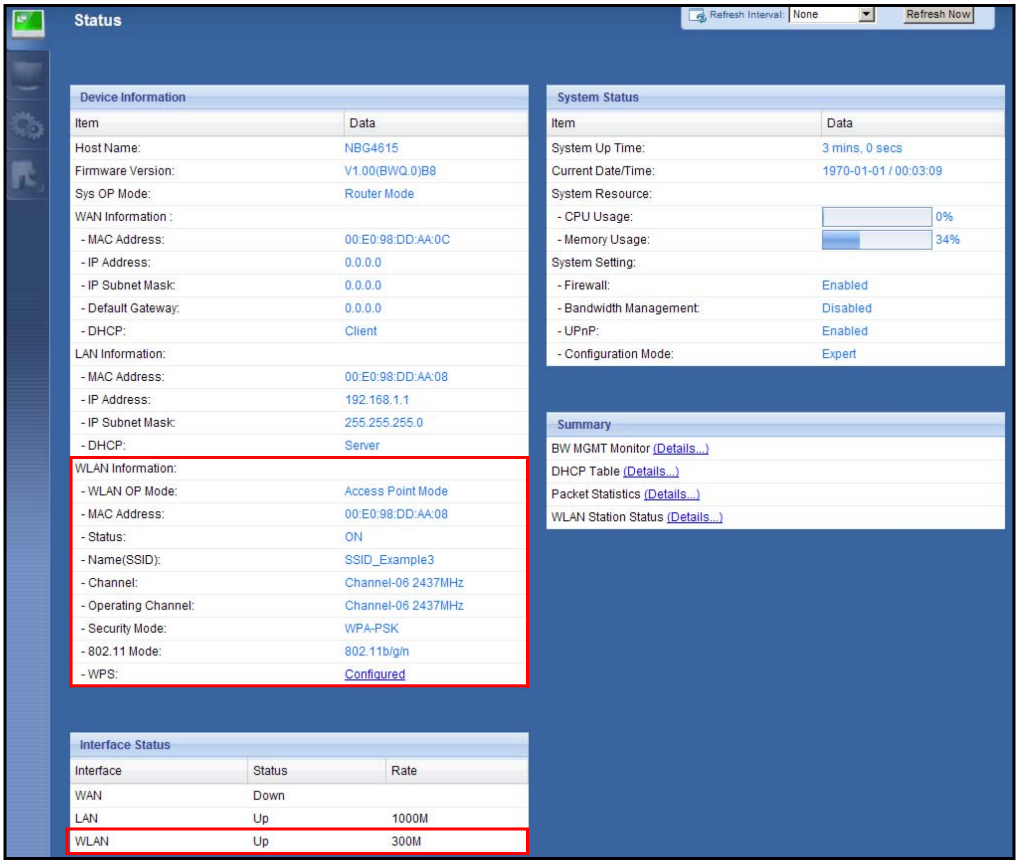
Security Mode: WPA-PSK

Pre-Shared Key: ThisismyWPA-PSKpre-sharedkey

Group Key Update Timer: 3600 seconds

Note: WPA-PSK and WPA2-PSK can be configured when WPS enabled

6 Open the **Status** screen. Verify your wireless and wireless security settings under **Device Information** and check if the WLAN connection is up under **Interface Status**.



Status

Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.0)B8
Sys OP Mode:	Router Mode
WAN Information :	
- MAC Address:	00:E0:98:DD:AA:0C
- IP Address:	0.0.0.0
- IP Subnet Mask:	0.0.0.0
- Default Gateway:	0.0.0.0
- DHCP:	Client
LAN Information:	
- MAC Address:	00:E0:98:DD:AA:08
- IP Address:	192.168.1.1
- IP Subnet Mask:	255.255.255.0
- DHCP:	Server
WLAN Information:	
- WLAN OP Mode:	Access Point Mode
- MAC Address:	00:E0:98:DD:AA:08
- Status:	ON
- Name(SSID):	SSID_Example3
- Channel:	Channel-06 2437MHz
- Operating Channel:	Channel-06 2437MHz
- Security Mode:	WPA-PSK
- 802.11 Mode:	802.11b/g/n
- WPS:	Configured

System Status

Item	Data
System Up Time:	3 mins, 0 secs
Current Date/Time:	1970-01-01 / 00:03:09
System Resource:	
- CPU Usage:	0%
- Memory Usage:	34%
System Setting:	
- Firewall:	Enabled
- Bandwidth Management:	Disabled
- UPnP:	Enabled
- Configuration Mode:	Expert

Summary

BW MGMT Monitor (Details...)
DHCP Table (Details...)
Packet Statistics (Details...)
WLAN Station Status (Details...)

Interface Status

Interface	Status	Rate
WAN	Down	
LAN	Up	1000M
WLAN	Up	300M

14.3.1 Configure Your Notebook

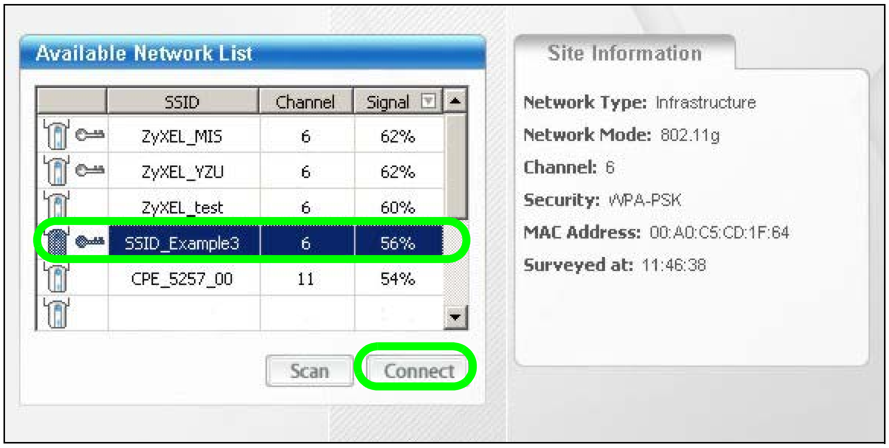
Note: We use the ZyXEL M-302 wireless adapter utility screens as an example for the wireless client. The screens may vary for different models.

1 The NBG4615 supports IEEE 802.11b, IEEE 802.11g and IEEE 802.11n wireless clients. Make sure that your notebook or computer’s wireless adapter supports one of these standards.

2 Wireless adapters come with software sometimes called a “utility” that you install on your computer. See your wireless adapter’s User’s Guide for information on how to do that.

3 After you’ve installed the utility, open it. If you cannot see your utility’s icon on your screen, go to **Start > Programs** and click on your utility in the list of programs that appears. The utility displays a list of APs within range, as shown in the example screen below.

4 Select SSID_Example3 and click **Connect**.



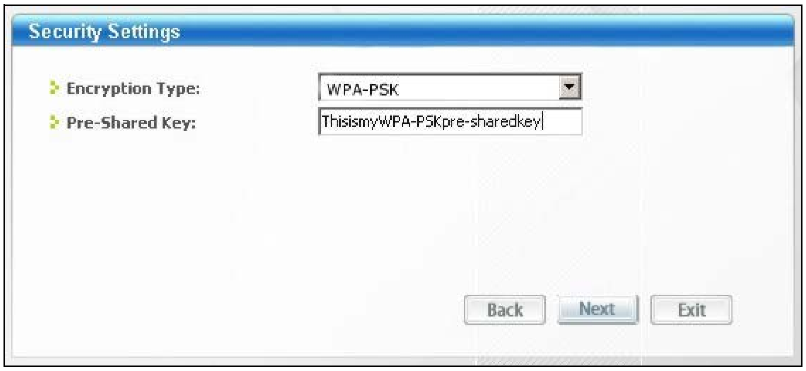
Available Network List

	SSID	Channel	Signal
	ZyXEL_MIS	6	62%
	ZyXEL_YZU	6	62%
	ZyXEL_test	6	60%
	SSID_Example3	6	56%
	CPE_5257_00	11	54%

Site Information

Network Type: Infrastructure
Network Mode: 802.11g
Channel: 6
Security: WPA-PSK
MAC Address: 00:A0:C5:CD:1F:64
Surveyed at: 11:46:38

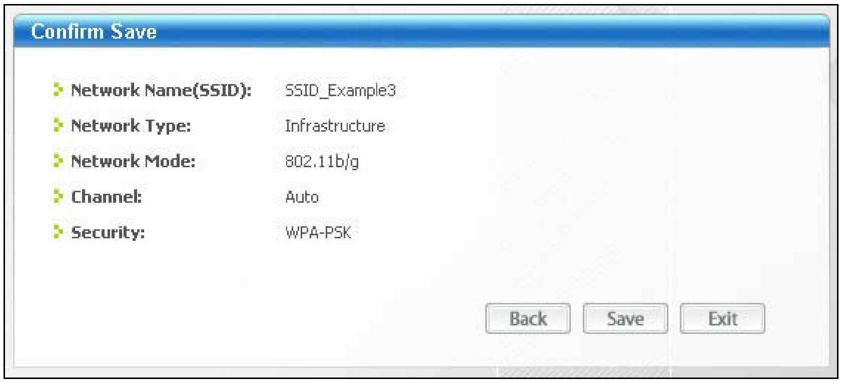
5 Select WPA-PSK and type the security key in the following screen. Click **Next**.



Security Settings

Encryption Type: WPA-PSK
Pre-Shared Key: ThisismyWPA-PSKpre-sharedkey

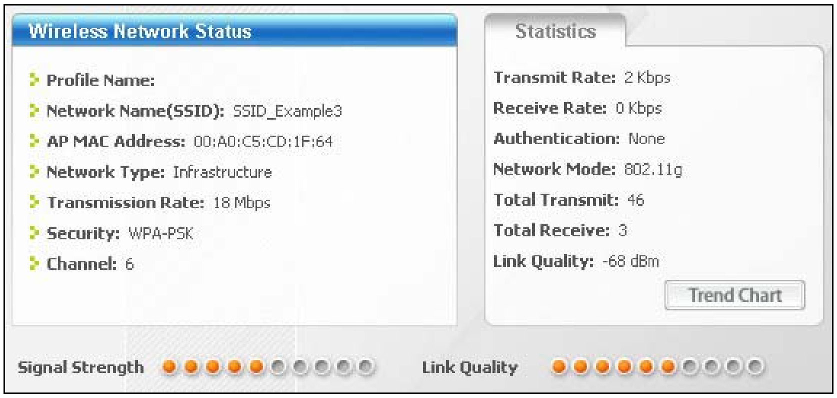
6 The **Confirm Save** window appears. Check your settings and click **Save** to continue.



Confirm Save

Network Name(SSID): SSID_Example3
Network Type: Infrastructure
Network Mode: 802.11b/g
Channel: Auto
Security: WPA-PSK

7 Check the status of your wireless connection in the screen below. If your wireless connection is weak or you have no connection, see the Troubleshooting section of this User’s Guide.



Wireless Network Status

- Profile Name:
- Network Name(SSID): SSID_Example3
- AP MAC Address: 00:A0:C5:CD:1F:64
- Network Type: Infrastructure
- Transmission Rate: 18 Mbps
- Security: WPA-PSK
- Channel: 6

Statistics

Transmit Rate: 2 Kbps
Receive Rate: 0 Kbps
Authentication: None
Network Mode: 802.11g
Total Transmit: 46
Total Receive: 3
Link Quality: -68 dBm

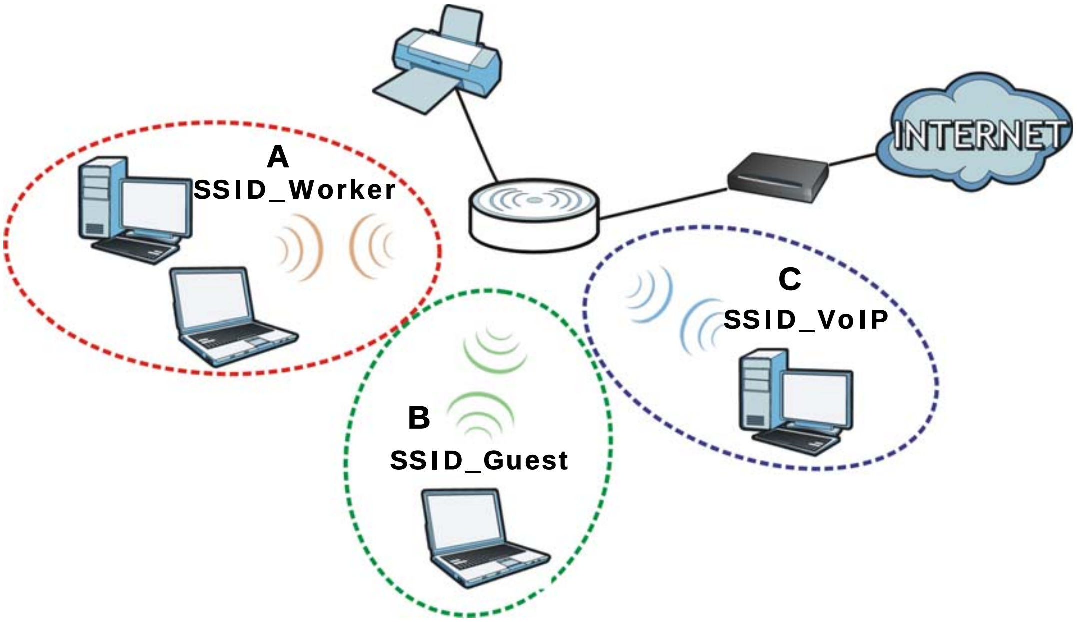
If your connection is successful, open your Internet browser and enter http://www.zyxel.com or the URL of any other web site in the address bar. If you are able to access the web site, your wireless connection is successfully configured.

14.4 Using Multiple SSIDs on the NBG4615

You can configure more than one SSID on a NBG4615 when it is operating in access point or universal repeater mode. This allows you to configure multiple independent wireless networks on the NBG4615 as if there were multiple APs (virtual APs). Each virtual AP has its own SSID, wireless security type and MAC filtering settings. That is, each SSID on the NBG4615 represents a different access point/wireless network to wireless clients in the network.

Clients can associate only with the SSIDs for which they have the correct security settings. Clients using different SSIDs can access the Internet and the wired network behind the NBG4615 (such as a printer). You can allow communication between wireless clients of different SSIDs in the **Network > Wireless LAN > General** screen. See Section 15.2 on page 128 for more information.

For example, you may set up three wireless networks (**A**, **B** and **C**) in your office. **A** is for workers, **B** is for guests and **C** is specific to a VoIP device in the meeting room.



14.4.1 Configuring Security Settings of Multiple SSIDs

The NBG4615 is in access point mode by default. If you want to use multiple SSIDs when the NBG4615 is in universal repeater mode, see Chapter 11 on page 82 for how to set the NBG4615 to universal repeater mode.

This example shows you how to configure the SSIDs with the following parameters on your NBG4615 (in access point mode).

SSID	SECURITY TYPE	KEY	MAC FILTERING
SSID_Worker	WPA2-PSK WPA Compatible	DoNotStealMyWirelessNetwork	Disable
SSID_Guest	Static WEP 128bit	keyexample123	Disable
SSID_VoIP	WPA-PSK	VoIPOnly12345678	Allow 00:A0:C5:01:23:45

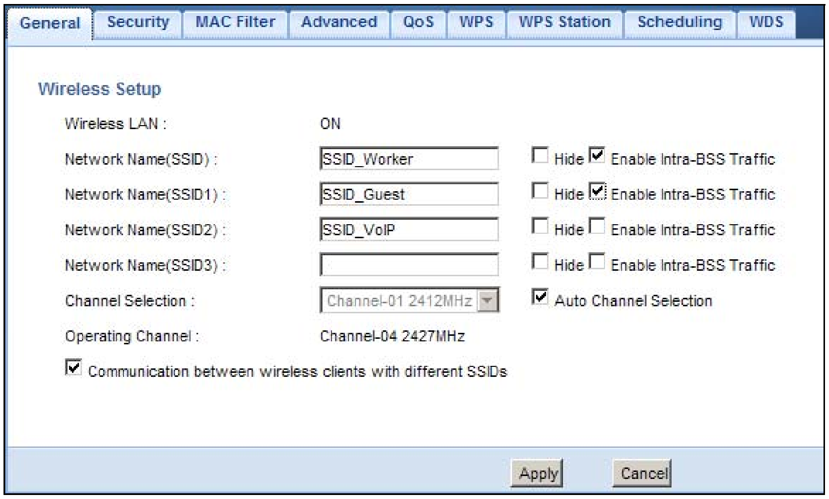
1. Connect your computer to the LAN port of the NBG4615 using an Ethernet cable.
2. The default IP address of the NBG4615 is "192.168.1.2". In this case, your computer must have an IP address in the range between "192.168.1.3" and "192.168.1.254".
3. Click **Start > Run** on your computer in Windows. Type "cmd" in the dialog box. Enter "ipconfig" to show your computer's IP address. If your computer's IP address is not in the correct range then see Appendix D on page 263 for information on changing your computer's IP address.
4. After you've set your computer's IP address, open a web browser such as Internet Explorer and type "http://192.168.1.2" as the web address in your web browser.

5 Enter “1234” (default) as the password and click **Login**.

6 Type a new password and retype it to confirm, then click **Apply**. Otherwise, click **Ignore**.

7 The Easy mode appears. Click **Expert Mode** in the navigation panel.

8 Go to **Configuration > Network > Wireless LAN > General**. Configure the screen as follows. In this example, you select **Enable Intra-BSS Traffic** for **SSID_Worker** and **SSID_Guest** to allow wireless clients in the same wireless network to communicate with each other. Click **Apply**.

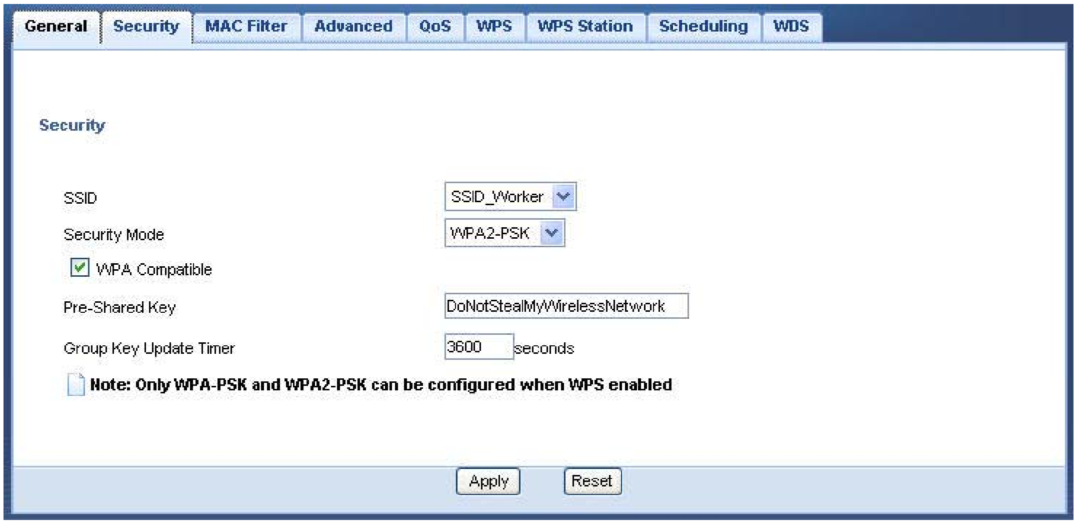


Wireless Setup

Wireless LAN :	ON	
Network Name(SSID) :	SSID_Worker	□ Hide ☑ Enable Intra-BSS Traffic
Network Name(SSID1) :	SSID_Guest	□ Hide ☑ Enable Intra-BSS Traffic
Network Name(SSID2) :	SSID_VoIP	□ Hide □ Enable Intra-BSS Traffic
Network Name(SSID3) :		□ Hide □ Enable Intra-BSS Traffic
Channel Selection :	Channel-01 2412MHz	☑ Auto Channel Selection
Operating Channel :	Channel-04 2427MHz	

☑ Communication between wireless clients with different SSIDs

9 Click the **Security** tab to configure security settings for each SSID. Select **SSID_Worker** from the **SSID** drop-down list. Configure the screen as follows. Click **Apply**.

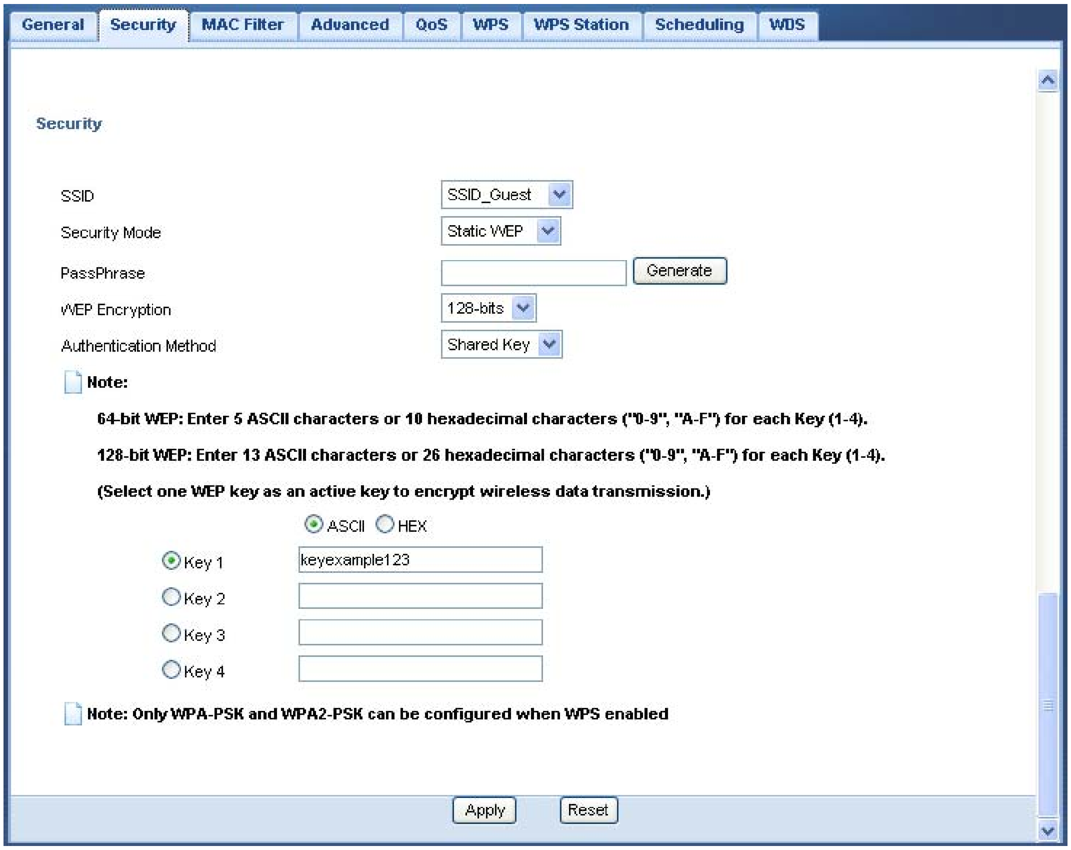


Security

SSID	SSID_Worker
Security Mode	WPA2-PSK
☑ WPA Compatible	
Pre-Shared Key	DoNotStealMyWirelessNetwork
Group Key Update Timer	3600 seconds

Note: Only WPA-PSK and WPA2-PSK can be configured when WPS enabled

10 Select **SSID_Guest** from the **SSID** drop-down list. Configure the screen as follows. Click **Apply**.



Security

SSID	SSID_Guest
Security Mode	Static WEP
PassPhrase	
WEP Encryption	128-bits
Authentication Method	Shared Key

Note:

64-bit WEP: Enter 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

128-bit WEP: Enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

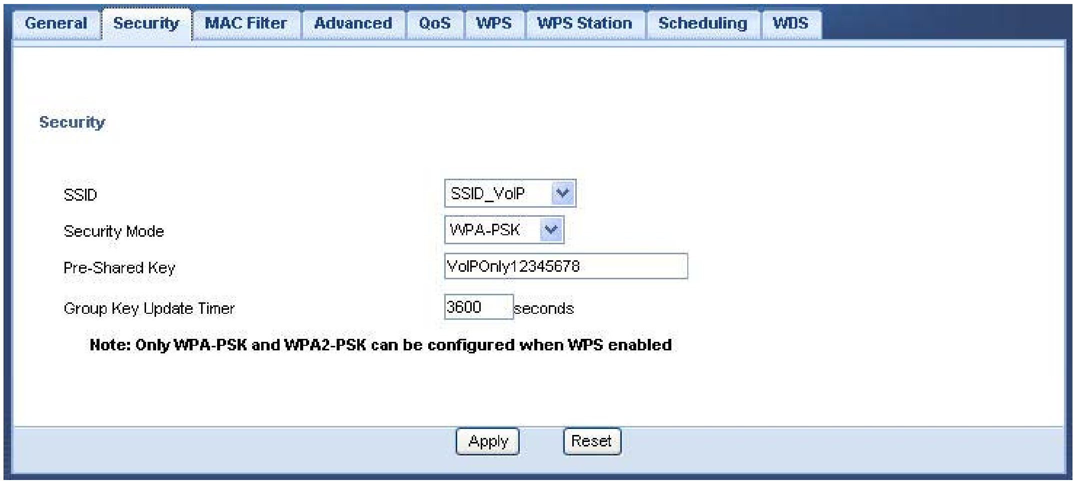
(Select one WEP key as an active key to encrypt wireless data transmission.)

● ASCII ○ HEX

● Key 1	keyexample123
○ Key 2	
○ Key 3	
○ Key 4	

Note: Only WPA-PSK and WPA2-PSK can be configured when WPS enabled

11 Select **SSID_VoIP** from the **SSID** drop-down list. Configure the screen as follows. Click **Apply**.

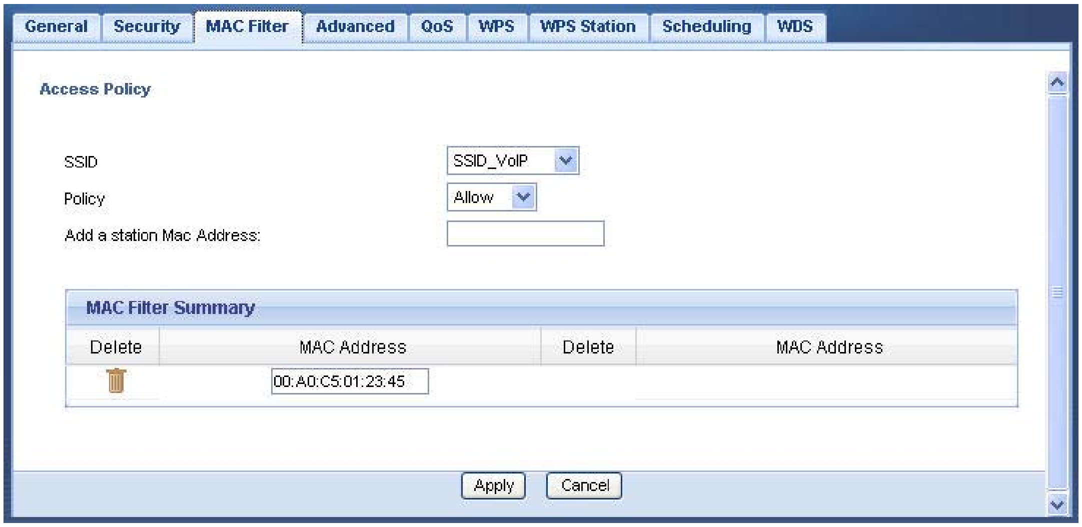


Security

SSID	SSID_VoIP
Security Mode	WPA-PSK
Pre-Shared Key	VoIPOnly12345678
Group Key Update Timer	3600 seconds

Note: Only WPA-PSK and WPA2-PSK can be configured when WPS enabled

12 Click the **MAC Filter** tab to configure MAC filtering for the **SSID_VoIP** wireless network. Select **SSID_VoIP** from the **SSID** drop-down list and select **Allow** in the **Policy** field. Enter the VoIP device's MAC address in the **Add a station Mac Address** field and click **Apply** to allow only the VoIP device to associate with the NBG4615 using this SSID.



Access Policy

SSID	SSID_VoIP
Policy	Allow
Add a station Mac Address:	

MAC Filter Summary

Delete	MAC Address	Delete	MAC Address
🗑	00:A0:C5:01:23:45		

14.5 Connecting the NBG4615 (in Universal Repeater Mode) to an AP or Wireless Router

If you have an access point or wireless router with Internet access deployed in your network already, and you want to have wireless clients connect to the existing AP or wireless router through the NBG4615, set the NBG4615 to **Universal Repeater** mode and then associate the NBG4615 with the AP or wireless router. The NBG4615 must be within the transmission range of the AP or wireless router.

1 Connect your computer to the LAN port of the NBG4615 using an Ethernet cable.

2 The default IP address of the NBG4615 is "192.168.1.2". In this case, your computer must have an IP address in the range between "192.168.1.3" and "192.168.1.254".

3 Click **Start > Run** on your computer in Windows. Type "cmd" in the dialog box. Enter "ipconfig" to show your computer's IP address. If your computer's IP address is not in the correct range then see Appendix D on page 263 for information on changing your computer's IP address.

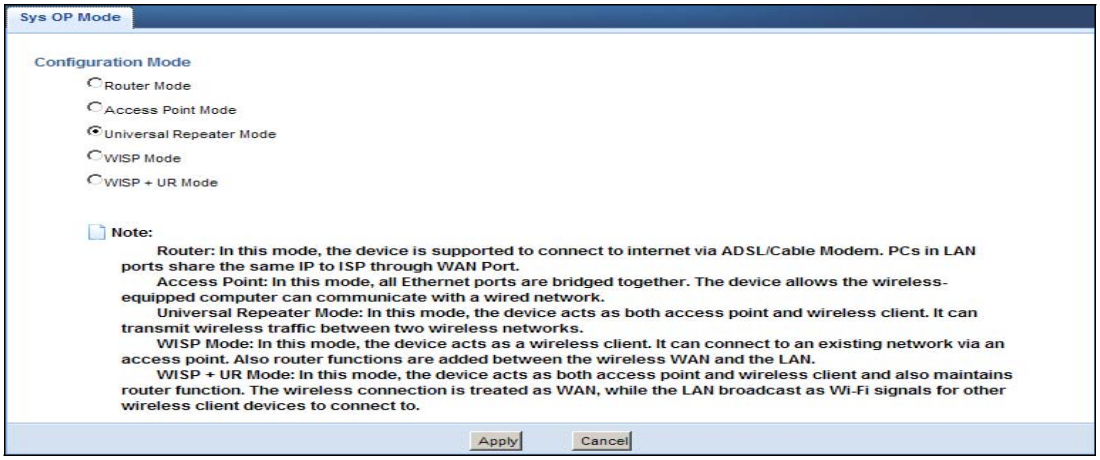
4 After you've set your computer's IP address, open a web browser such as Internet Explorer and type "http://192.168.1.2" as the web address in your web browser.

5 Enter "1234" (default) as the password and click **Login**.

6 Type a new password and retype it to confirm, then click **Apply**. Otherwise, click **Ignore**.

7 The **Easy** mode appears. Click **Expert Mode** in the navigation panel.

8 On the left of the screen, click **Maintenance > Sys OP Mode** and select **Universal Repeater Mode**. Click **Apply**. The NBG4615 restarts.



Configuration Mode

○ Router Mode
○ Access Point Mode
● Universal Repeater Mode
○ WISP Mode
○ WISP + UR Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

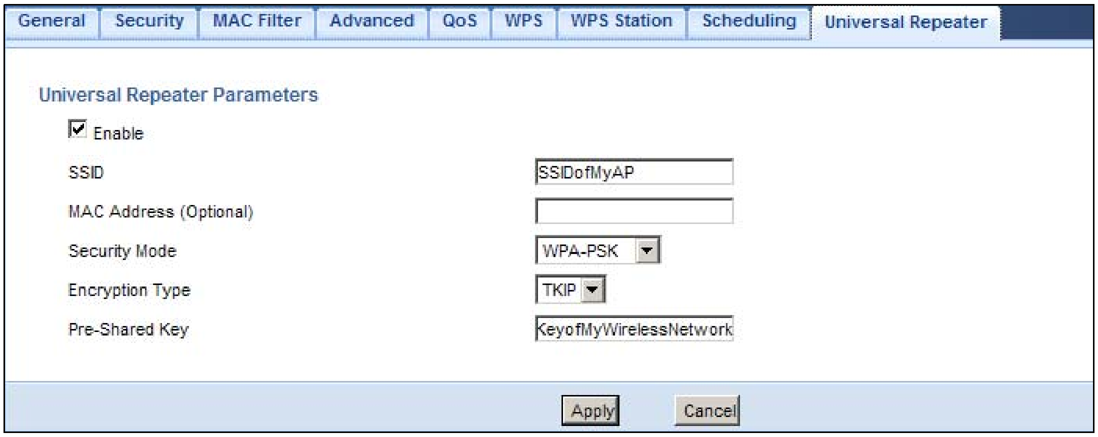
Universal Repeater Mode: In this mode, the device acts as both access point and wireless client. It can transmit wireless traffic between two wireless networks.

WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

WISP + UR Mode: In this mode, the device acts as both access point and wireless client and also maintains router function. The wireless connection is treated as WAN, while the LAN broadcast as Wi-Fi signals for other wireless client devices to connect to.

9 Enter the password and click **Login** to access the web configurator again. Click **Expert Mode**.

10 Go to **Configuration > Network > Wireless LAN > Universal Repeater** to connect the NBG4615 wirelessly to an AP. Select **Enable**. Enter the SSID of the existing AP or wireless router to which you want to connect (“SSIDofMyAP” in this example). Enter the wireless security settings which are the same as those on the existing AP or wireless router to access it (WPA-PSK and “KeyofMyWirelessNetwork” in this example). Click **Apply**.

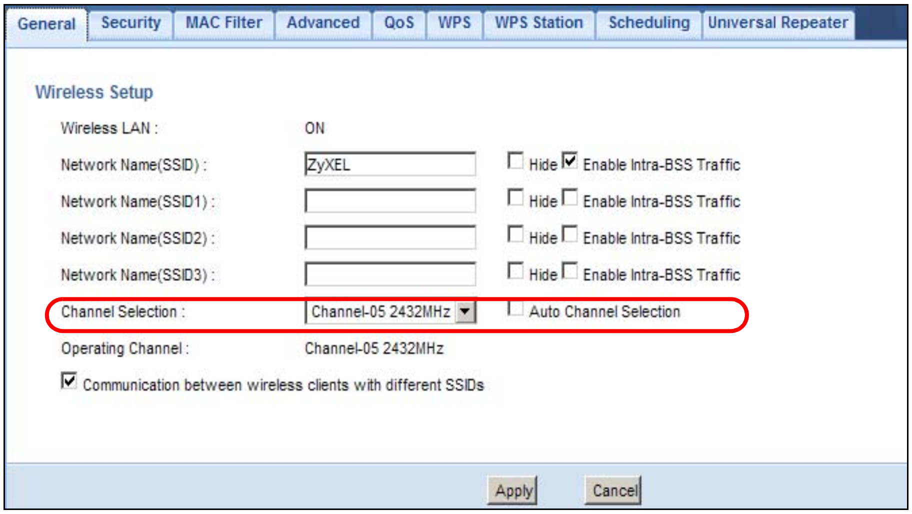


Universal Repeater Parameters

☑ Enable

SSID	SSIDofMyAP
MAC Address (Optional)	
Security Mode	WPA-PSK
Encryption Type	TKIP
Pre-Shared Key	KeyofMyWirelessNetwork

11 Set the channel number in the **Wireless LAN > General** screen to be the same as the one on the wireless router or AP to which the NBG4615 is connecting. This allows wireless clients access or acquire an IP address from another AP or wireless router through the NBG4615 in universal repeater mode.



Wireless Setup

Wireless LAN : ON

Network Name(SSID) : ZyXEL □ Hide ☑ Enable Intra-BSS Traffic

Network Name(SSID1) : □ Hide □ Enable Intra-BSS Traffic

Network Name(SSID2) : □ Hide □ Enable Intra-BSS Traffic

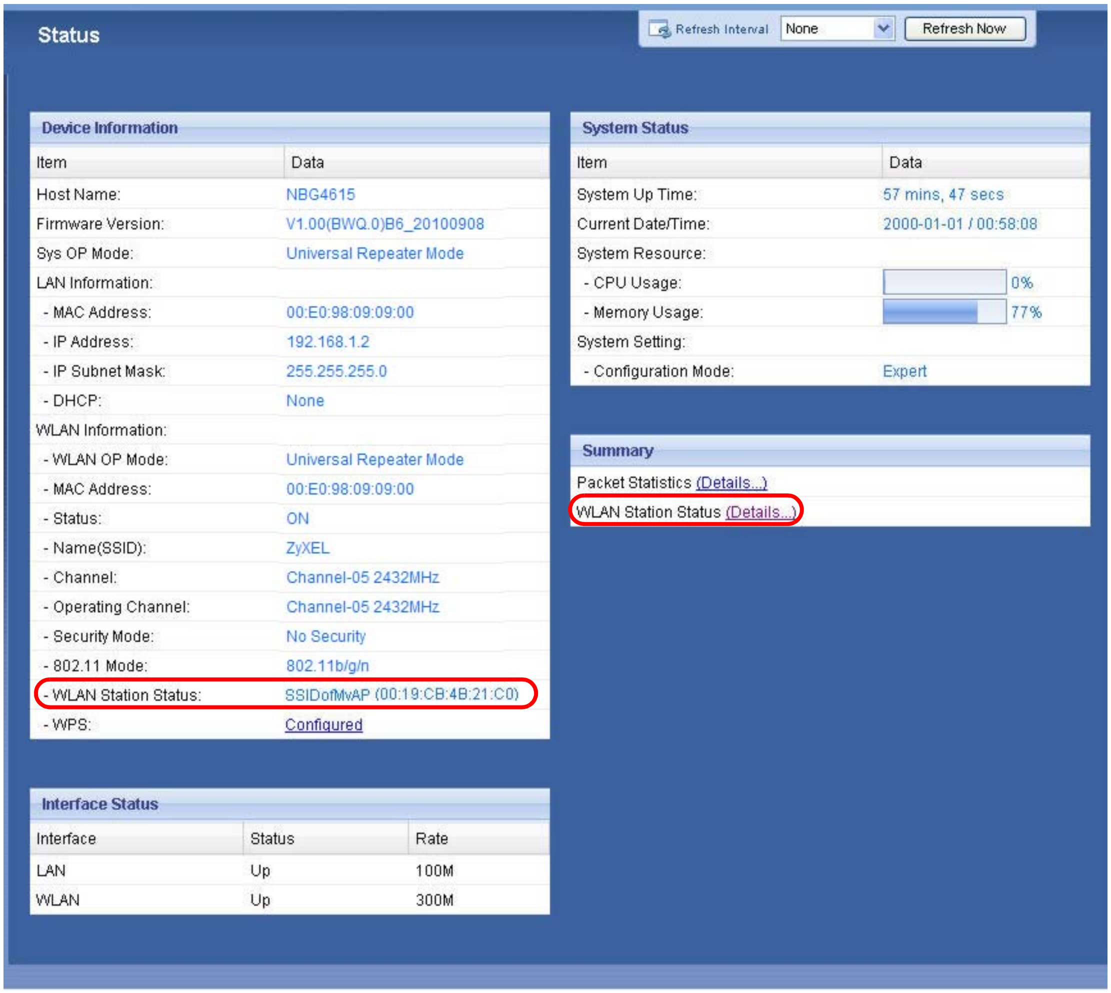
Network Name(SSID3) : □ Hide □ Enable Intra-BSS Traffic

Channel Selection : Channel-05 2432MHz □ Auto Channel Selection

Operating Channel : Channel-05 2432MHz

☑ Communication between wireless clients with different SSIDs

12 Go to the **Status** screen. If the NBG4615 has successfully connected to an AP or wireless router, it displays the SSID and MAC address of the AP or wireless router in the field next to **WLAN Station Status** under **Device Information**.



Device Information

Item	Data
Host Name:	NBG4615
Firmware Version:	V1.00(BWQ.0)B6_20100908
Sys OP Mode:	Universal Repeater Mode
LAN Information:	
- MAC Address:	00:E0:98:09:09:00
- IP Address:	192.168.1.2
- IP Subnet Mask:	255.255.255.0
- DHCP:	None
WLAN Information:	
- WLAN OP Mode:	Universal Repeater Mode
- MAC Address:	00:E0:98:09:09:00
- Status:	ON
- Name(SSID):	ZyXEL
- Channel:	Channel-05 2432MHz
- Operating Channel:	Channel-05 2432MHz
- Security Mode:	No Security
- 802.11 Mode:	802.11b/g/n
- WLAN Station Status:	SSIDofMyAP (00:19:CB:4B:21:C0)
- WPS:	Configured

System Status

Item	Data
System Up Time:	57 mins, 47 secs
Current Date/Time:	2000-01-01 / 00:58:08
System Resource:	
- CPU Usage:	0%
- Memory Usage:	77%
System Setting:	
- Configuration Mode:	Expert

Summary

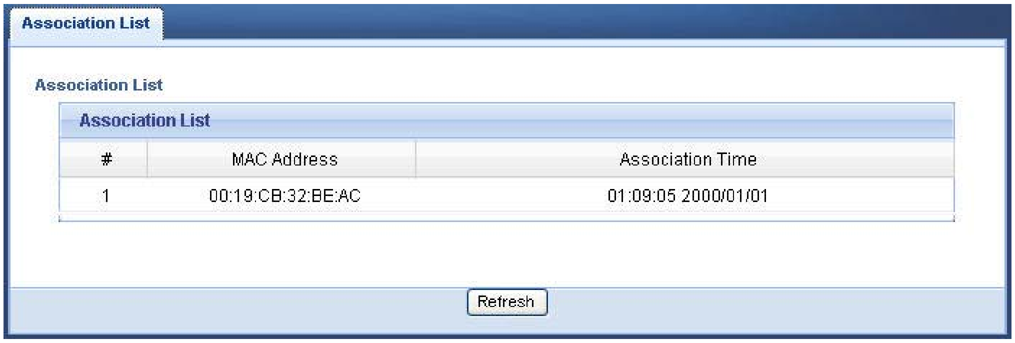
Packet Statistics (Details...)

WLAN Station Status (Details...)

Interface Status

Interface	Status	Rate
LAN	Up	100M
WLAN	Up	300M

To check whether a wireless client is currently connecting to the NBG4615, click the **WLAN Station Status (Details...)** hyperlink under **Summary** in the **Status** screen or **Monitor > WLAN Station Status**. See Chapter 6 on page 49 for more information.



Association List

#	MAC Address	Association Time
1	00:19:CB:32:BE:AC	01:09:05 2000/01/01

14.6 Connecting to USB Storage with the ZyXEL NetUSB Share Center Utility

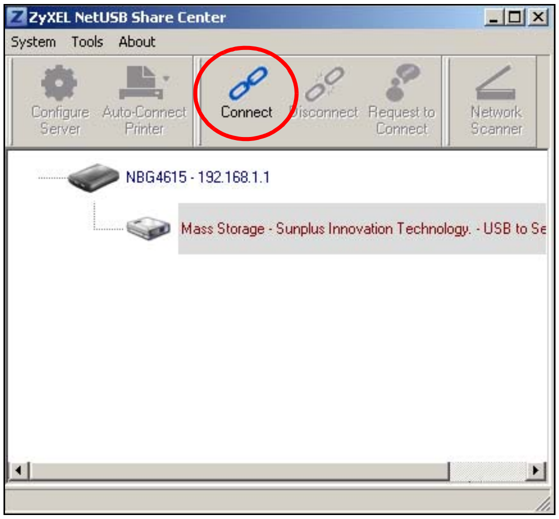
This tutorial shows you how to connect to a USB device over your NBG4615 network by using the ZyXEL NetUSB Share Center Utility.

1 Install the ZyXEL NetUSB Share Center Utility on the computer to which you want to connect the USB device. See Chapter 3 on page 26 for details on the installation.

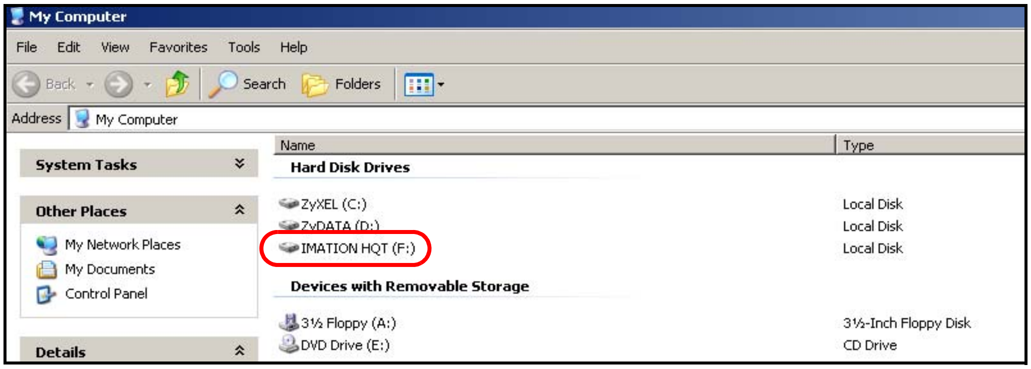
2 Connect a USB device to one of the USB ports of the NBG4615.

3 Open the **ZyXEL NetUSB Sharing Center Utility** on your computer. The name of the USB device automatically shows in the Utility screen.

4 Click on the USB device's name. Then click **Connect**.



5 The device mounts on your system.



Name	Type
Hard Disk Drives	
ZyXEL (C:)	Local Disk
ZyDATA (D:)	Local Disk
IMATION HQT (F:)	Local Disk
Devices with Removable Storage	
3½ Floppy (A:)	3½-Inch Floppy Disk
DVD Drive (E:)	CD Drive

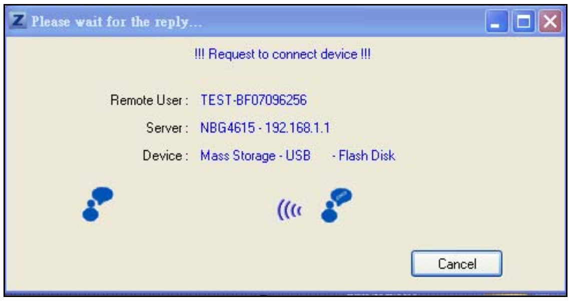
14.6.1 Multiple Connections to the USB Device

The Utility supports one connection to the NBG4615's USB device at a time. If more than one computer want to connect to the USB device, follow the steps below:

1 After the first computer (**A**) finishes using the USB device, click **Disconnect** on the Utilty to unmount it.

2 Click **Connect** on the Utility of the second computer (**B**) to mount the USB device on **B**.

3 If **A** does not disconnect from the USB device, **B** cannot use it. **B** can click the **Request to Connect** button to request **A** to disconnect. B will see the following message on its Utility:



Please wait for the reply...

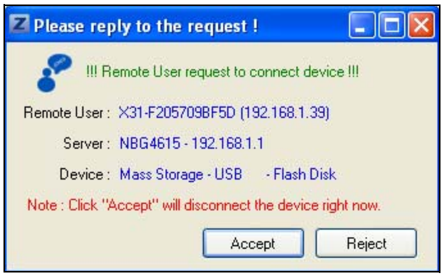
!!! Request to connect device !!!

Remote User : TEST-BF07096256

Server : NBG4615 - 192.168.1.1

Device : Mass Storage - USB - Flash Disk

4 **A** will receive the following message on its Utility screen.



Please reply to the request !

!!! Remote User request to connect device !!!

Remote User : X31-F205709BF5D (192.168.1.39)

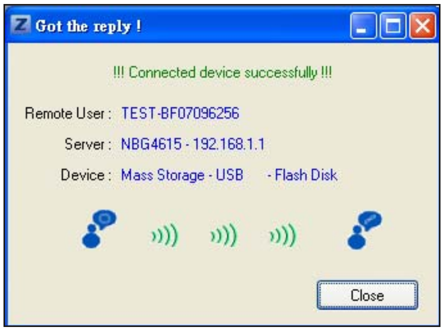
Server : NBG4615 - 192.168.1.1

Device : Mass Storage - USB - Flash Disk

Note : Click "Accept" will disconnect the device right now.

5 **A** should click **Accept** to disconnect to the USB device.

6 After **A** is disconnected from USB device, **B** will see the following message on its Utility. Now **B** can access the USB device.



Got the reply !

!!! Connected device successfully !!!

Remote User : TEST-BF07096256

Server : NBG4615 - 192.168.1.1

Device : Mass Storage - USB - Flash Disk

Note: If your computer is connected to a USB device, you must disconnect it and use **Exit** to close the Utility. If you use the X on the Utility screen, it only closes the Utility window. The Utility is still connected. Do not exit the Utility until the USB device is disconnected via the Utility or until you receive a request to disconnect. See Chapter 3 on page 30 for details on how to exit the Utility.

14.7 Automatically Connecting to a USB Printer

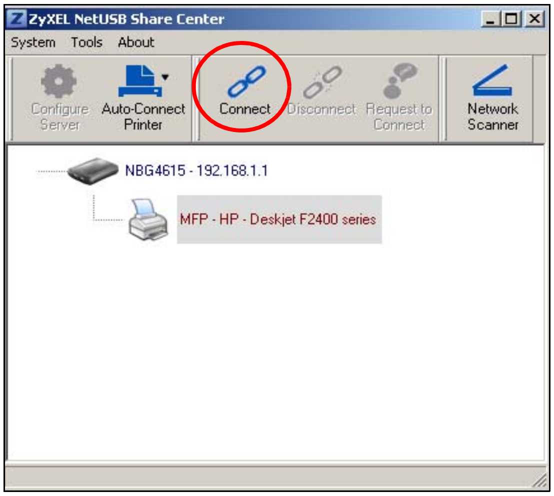
Your computer can connect to a shared USB printer by using the ZyXEL NetUSB Share Center Utility. This tutorial shows you how to set your computer to automatically connect to a shared USB printer over your NBG4615 network each time you log into your computer.

1 Install the ZyXEL NetUSB Share Center Utility to your computer. See Chapter 3 on page 26 for details on the installation.

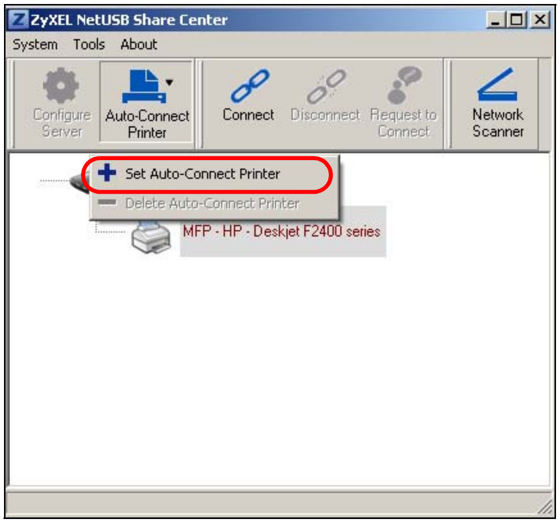
2 Connect a USB printer to one of the USB ports of the NBG4615.

3 Open the **ZyXEL NetUSB Sharing Center Utility** on your computer. The name of the USB printer automatically shows in the Utility screen.

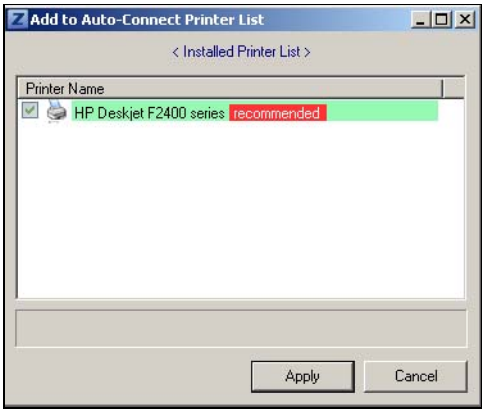
4 Click on the printer name. Then click **Connect**. Your computer will search for the printer driver. You may be prompted to install the driver. Follow the driver's installation steps to finish installing.



5 Click the **Auto-Connect Printer** menu and select **Set Auto-Connect Printer** from the menu.



6 Select the USB printer you want to connect to and click **Apply**.



Add to Auto-Connect Printer List

< Installed Printer List >

Printer Name
☑ HP Deskjet F2400 series recommended

7 Now your computer can automatically connect to this shared USB printer over your NBG4615 network each time you log into your computer. The printer will be automatically added to your printer list.

8 The Utility supports one connection to the NBG4615’s USB device at a time. If more than one computer is using the printer and are all auto-connected to the USB device, the second computer automatically starts printing after the first computer finishes its printing task.

PART II
Technical Reference

15

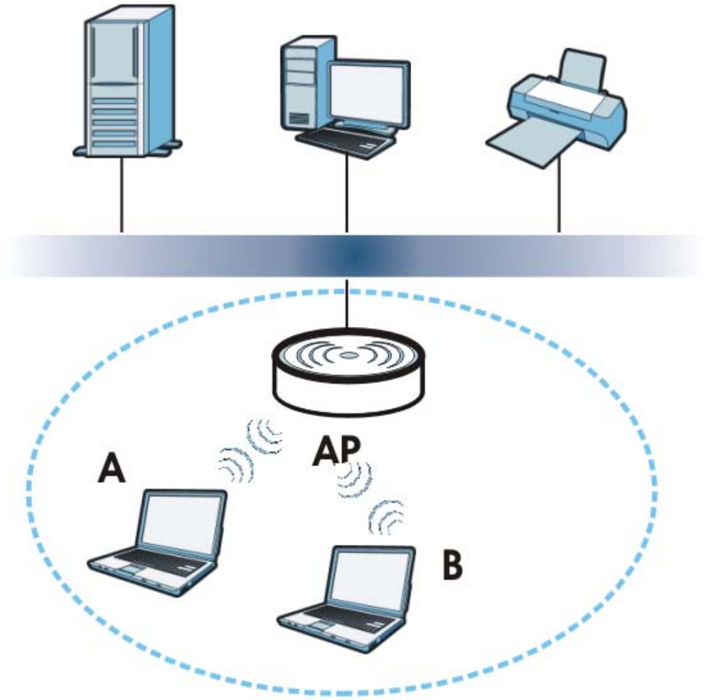
Wireless LAN

15.1 Overview

This chapter discusses how to configure the wireless network settings in your NBG4615. See the appendices for more detailed information about wireless networks.

The following figure provides an example of a wireless network.

Figure 77 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices **A** and **B** are called wireless clients. The wireless clients use the access point (AP) to interact with other devices (such as the printer) or with the Internet. Your NBG4615 is the AP.

15.1.1 What You Can Do

- Use the **General** screen to enter the SSID, enable intra-BSS traffic, enable guest WLAN, and select the channel. (Section 15.2 on page 128).
- Use the **Security** screen to configure wireless security between the NBG4615 and the wireless clients.
- Use the **MAC Filter** screen to allow or deny wireless stations based on their MAC addresses from connecting to the NBG4615 (Section 15.4 on page 135).

- Use the **Advanced** screen to allow intra-BSS networking and set the RTS/CTS Threshold (Section 15.5 on page 136).
- Use the **QoS** screen to ensure Quality of Service (QoS) in your wireless network (Section 15.6 on page 137).
- Use the **WPS** screen to quickly set up a wireless network with strong security, without having to configure security settings manually (Section 15.7 on page 137).
- Use the **WPS Station** screen to add a wireless station using WPS (Section 15.8 on page 139).
- Use the **Scheduling** screen to set the times your wireless LAN is turned on and off (Section 15.9 on page 140).
- Use the **WDS** screen to configure Wireless Distribution System on your NBG4615 (Section 15.10 on page 141).

15.1.2 What You Should Know

Every wireless network must follow these basic guidelines.

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

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

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

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

Wireless Security Overview

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

SSID

Normally, the AP acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the AP 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 devices to get the SSID. In addition, unauthorized devices can still see the information that is sent in the wireless network.

MAC Address Filter

Every wireless client 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

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

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

00:A0:C5:00:00:02. To get the MAC address for each wireless client, see the appropriate User’s Guide or other documentation.

You can use the MAC address filter to tell the AP which wireless clients are allowed or not allowed to use the wireless network. If a wireless client is allowed to use the wireless network, it still has to have the correct settings (SSID, channel, and security). If a wireless client is not allowed to use the wireless network, it does not matter if it has the correct settings.

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

User Authentication

You can make every user log in to the wireless network before they can use it. This is called user authentication. However, every wireless client in the wireless network has to support IEEE 802.1x to do this.

For wireless networks, there are two typical places to store the user names and passwords for each user.

- In the AP: this feature is called a local user database or a local database.
- In a RADIUS server: this is a server used in businesses more than in homes.

If your AP does not provide a local user database and if you do not have a RADIUS server, you cannot set up user names and passwords for your users.

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

Local user databases also have an additional limitation that is explained in the next section.

Encryption

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

The types of encryption you can choose depend on the type of user authentication. (See page 127 for information about this.)

Table 44 Types of Encryption for Each Type of Authentication

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

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

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

Note: It is recommended that wireless networks use **WPA-PSK**, **WPA**, or stronger encryption. IEEE 802.1x and WEP encryption are better than none at all, but it is still possible for unauthorized devices to figure out the original information pretty quickly.

Note: It is not possible to use **WPA-PSK**, **WPA** or stronger encryption with a local user database. In this case, it is better to set up stronger encryption with no authentication than to set up weaker encryption with the local user database.

When you select **WPA2** or **WPA2-PSK** in your NBG4615, you can also select an option (**WPA Compatible**) to support WPA as well. In this case, if some wireless clients support WPA and some support WPA2, you should set up **WPA2-PSK** or **WPA2** (depending on the type of wireless network login) and select the **WPA Compatible** option in the NBG4615.

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

WPS

WiFi Protected Setup (WPS) is an industry standard specification, defined by the WiFi Alliance. WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Depending on the devices in your network, you can either press a button (on the device itself, or in its configuration utility) or enter a PIN (Personal Identification Number) in the devices. Then, they connect and set up a secure network by themselves. See how to set up a secure wireless network using WPS in the Section 14.2 on page 105.

WDS

Wireless Distribution System or WDS security is used between bridged APs. It is independent of the security between the wired networks and their respective APs. If you do not enable WDS security, traffic between APs is not encrypted. When WDS security is enabled, both APs must use the same pre-shared key.

15.2 General Wireless LAN Screen

Use this screen to configure the SSIDs of the wireless LAN and configure guest wireless network settings.

Note: If you are configuring the NBG4615 from a computer connected to the wireless LAN and you change the NBG4615’s SSID, channel or security settings, you will lose your wireless connection when you press **Apply** to confirm. You must then change the wireless settings of your computer to match the NBG4615’s new settings.

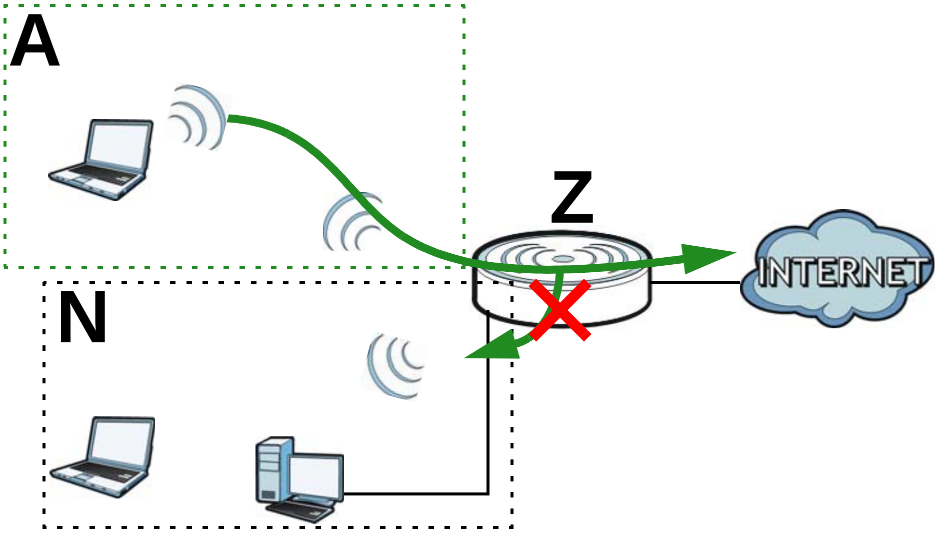
15.2.1 Guest WLAN

Guest WLAN allows you to set up a wireless network where users can access to Internet via the NBG4615 (**Z**), but not other networks connected to the **Z**. In the following figure, a guest user can access the Internet from the guest wireless network **A** via **Z** but not the home or company network **N**.

Note: The home or company network **N** and Guest WLAN network are independent networks.

Note: Only Router mode supports guest WLAN. AP mode, Universal Repeater mode, and WISP mode don’t support guest WLAN.

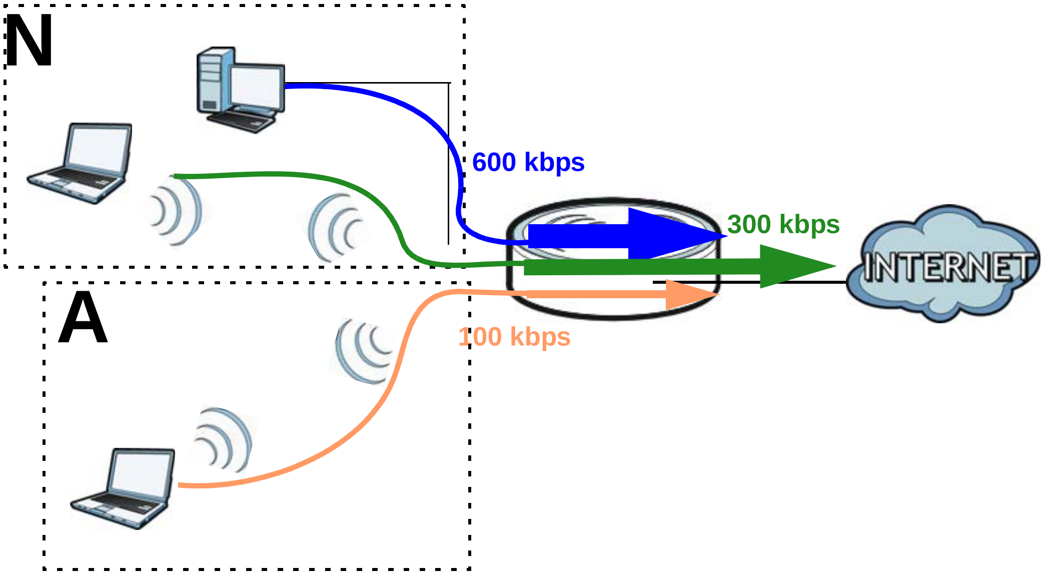
Figure 78 Guest Wireless LAN Network



Guest WLAN Bandwidth

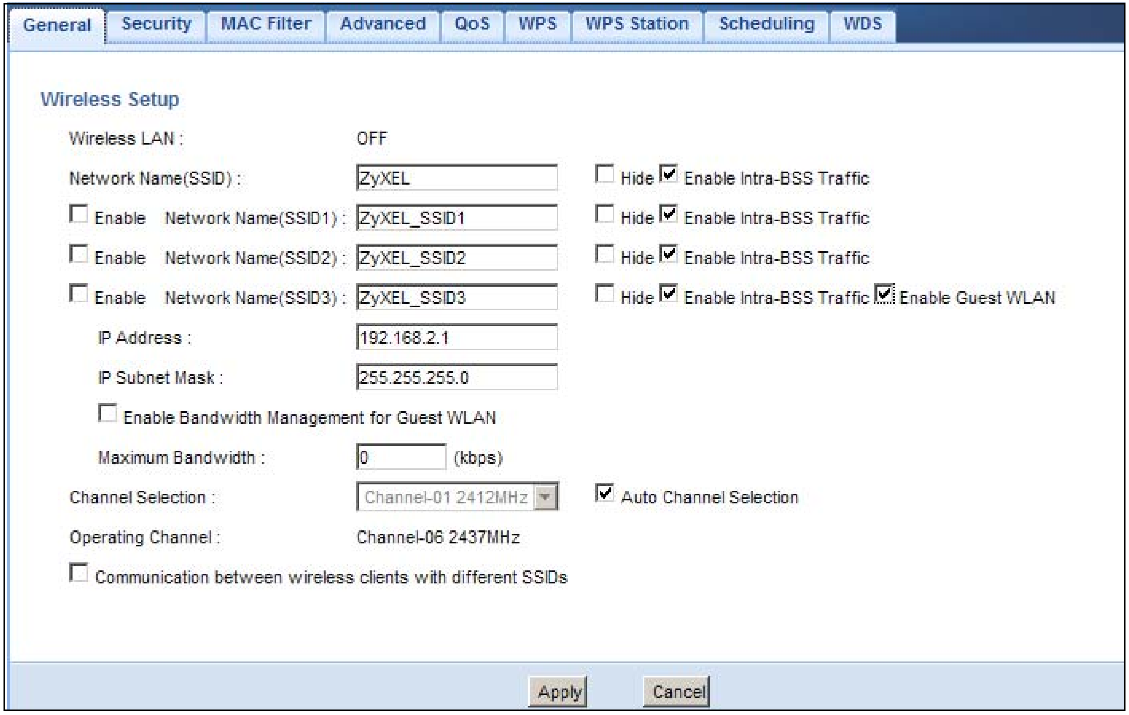
The Guest WLAN Bandwidth function allows you to specify a priority level and restrict the maximum bandwidth for the guest wireless network. Additionally, you can also define bandwidth for your home or office network. An example is shown next to define maximum bandwidth for your networks (**A** is Guest WLAN and **N** is home or company network.)

Figure 79 Example: Bandwidth for Different Networks



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

Figure 80 Network > Wireless LAN > General



Wireless Setup

Wireless LAN :	OFF	
Network Name(SSID) :	ZyXEL	□ Hide ☑ Enable Intra-BSS Traffic
□ Enable Network Name(SSID1) :	ZyXEL_SSID1	□ Hide ☑ Enable Intra-BSS Traffic
□ Enable Network Name(SSID2) :	ZyXEL_SSID2	□ Hide ☑ Enable Intra-BSS Traffic
□ Enable Network Name(SSID3) :	ZyXEL_SSID3	□ Hide ☑ Enable Intra-BSS Traffic ☑ Enable Guest WLAN
IP Address :	192.168.2.1	
IP Subnet Mask :	255.255.255.0	
□ Enable Bandwidth Management for Guest WLAN		
Maximum Bandwidth :	0 (kbps)	
Channel Selection :	Channel-01 2412MHz	☑ Auto Channel Selection
Operating Channel :	Channel-06 2437MHz	
□ Communication between wireless clients with different SSIDs		

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

Table 45 Network > Wireless LAN > General

LABEL	DESCRIPTION
Wireless LAN	This shows whether the wireless LAN is **ON** or **OFF**. You can enable or disable the wireless LAN by using the **WLAN** switch located on the back panel of the NBG4615.
Network Name(SSID)	The SSID (Service Set IDentity) identifies the Service Set with which a wireless client is associated. Enter a descriptive name (up to 32 printable characters found on a typical English language keyboard) for the wireless LAN. You can configure up to four SSIDs to enable multiple BSSs (Basic Service Sets) on the NBG4615. This allows you to use one access point to provide several BSSs simultaneously. You can then assign varying security types to different SSIDs. Wireless clients can use different SSIDs to associate with the same access point.
Hide	Select this check box to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool.
Enable Intra-BSS Traffic	A Basic Service Set (BSS) exists when all communications between wireless clients or between a wireless client and a wired network client go through one access point (AP). Intra-BSS traffic is traffic between wireless clients in the BSS. When Intra-BSS is enabled, wireless clients can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless clients can still access the wired network but cannot communicate with each other.
Enable Guest WLAN	Select the check box to activate guest wireless LAN. Note: Only Router mode supports guest WLAN. AP mode, Universal Repeater mode, and WISP mode don’t support guest WLAN.
IP Address	Type an IP address for the devices on the Guest WLAN using this as the gateway IP address.
IP Subnet Mask	Type the subnet mask for the guest wireless LAN.
Enable Bandwidth Management for Guest WLAN	Select this to turn on bandwidth management for the Guest WLAN network.
Maximum Bandwidth	Enter a number to specify maximum bandwidth the Guest WLAN network can use.
Channel Selection	Set the operating frequency/channel depending on your particular region. Select a channel from the drop-down list box. The options vary depending on the frequency band and the country you are in. Refer to the Connection Wizard chapter for more information on channels. This option is only available if **Auto Channel Selection** is disabled.
Auto Channel Selection	Select this check box for the NBG4615 to automatically choose the channel with the least interference. Deselect this check box if you wish to manually select the channel using the **Channel Section** field.
Operating Channel	This displays the channel the NBG4615 is currently using.
Communication between wireless clients with different SSIDs	Select the check box to allow communication between wireless clients of different SSIDs. Do not select the check box if you do not want to enable this function.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

See the rest of this chapter for information on the other labels in this screen.

15.3 Wireless Security Screen

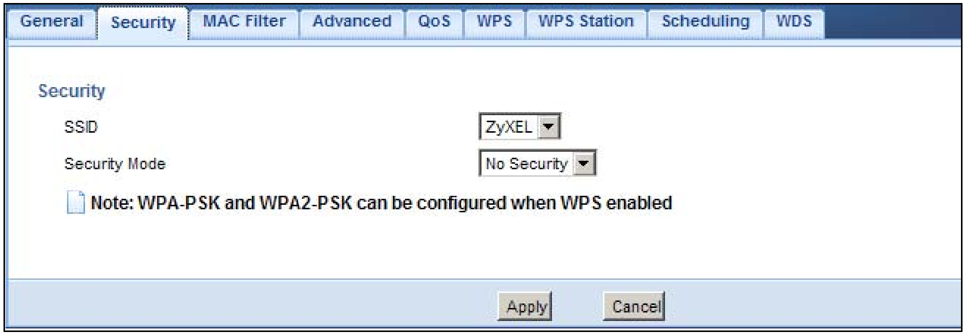
Use this screen to select the wireless security mode for each SSID. Click **Network** > **Wireless LAN** > **Security** to open the **Security** screen. The screen varies depending on what you select in the **Security Mode** field.

15.3.1 No Security

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

Note: If you do not enable any wireless security on your NBG4615, your network is accessible to any wireless networking device that is within range.

Figure 81 Network > Wireless LAN > Security: No Security



Security

SSID: ZyXEL

Security Mode: No Security

Note: WPA-PSK and WPA2-PSK can be configured when WPS enabled

The following table describes the labels in this screen.

Table 46 Network > Wireless LAN > Security: No Security

LABEL	DESCRIPTION
SSID	Select the SSID for which you want to configure the security.
Security Mode	Choose **No Security** from the drop-down list box.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

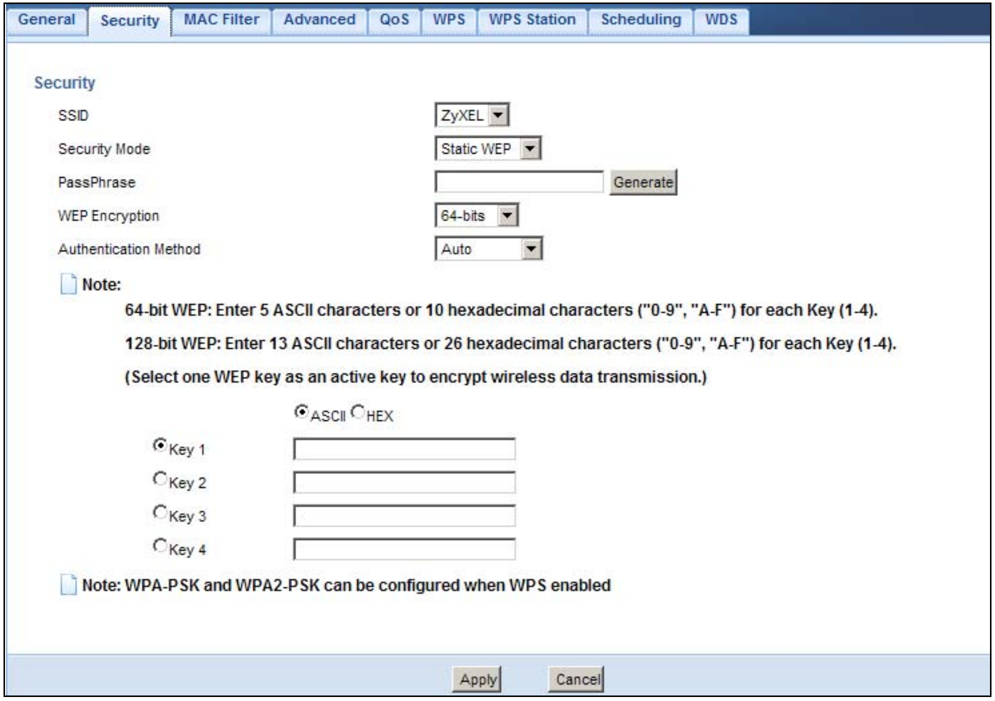
15.3.2 WEP Encryption

WEP encryption scrambles the data transmitted between the wireless stations and the access points to keep network communications private. It encrypts unicast and multicast communications in a network. Both the wireless stations and the access points must use the same WEP key.

Your NBG4615 allows you to configure up to four 64-bit or 128-bit WEP keys but only one key can be enabled at any one time.

Select **Static WEP** from the **Security Mode** list.

Figure 82 Network > Wireless LAN > Security: Static WEP



Security

SSID: ZyXEL

Security Mode: Static WEP

PassPhrase:

WEP Encryption: 64-bits

Authentication Method: Auto

Note:

64-bit WEP: Enter 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

128-bit WEP: Enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F") for each Key (1-4).

(Select one WEP key as an active key to encrypt wireless data transmission.)

● ASCII ○ HEX

● Key 1

○ Key 2

○ Key 3

○ Key 4

Note: WPA-PSK and WPA2-PSK can be configured when WPS enabled

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

Table 47 Network > Wireless LAN > Security: Static WEP

LABEL	DESCRIPTION
SSID	Select the SSID for which you want to configure the security.
Security Mode	Select **Static WEP** to enable data encryption.
PassPhrase	Enter a Passphrase (up to 26 printable characters) and click **Generate**. A passphrase functions like a password. In WEP security mode, it is further converted by the NBG4615 into a complicated string that is referred to as the “key”. This key is requested from all devices wishing to connect to a wireless network.
WEP Encryption	Select **64-bits** or **128-bits**. This dictates the length of the security key that the network is going to use.
Authentication Method	Select **Auto** or **Shared Key** from the drop-down list box. This field specifies whether the wireless clients have to provide the WEP key to login to the wireless client. Keep this setting at **Auto** unless you want to force a key verification before communication between the wireless client and the NBG4615 occurs. Select **Shared Key** to force the clients to provide the WEP key prior to communication.
ASCII	Select this option in order to enter ASCII characters as WEP key.
Hex	Select this option in order to enter hexadecimal characters as a WEP key. The preceding "0x", that identifies a hexadecimal key, is entered automatically.

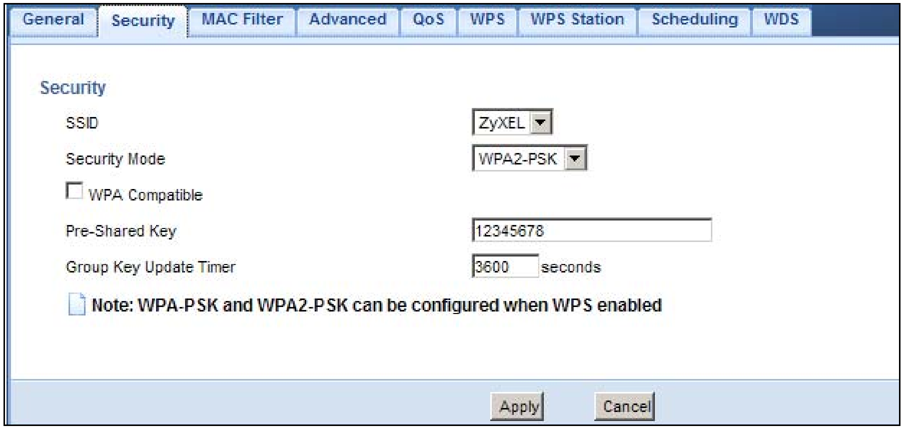
Table 47 Network > Wireless LAN > Security: Static WEP (continued)

LABEL	DESCRIPTION
Key 1 to Key 4	The WEP keys are used to encrypt data. Both the NBG4615 and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP**, then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F"). If you chose **128-bit WEP**, then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F"). You must configure at least one key, only one key can be activated at any one time. The default key is key 1.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.3.3 WPA-PSK/WPA2-PSK

Select **WPA-PSK** or **WPA2-PSK** from the **Security Mode** list.

Figure 83 Network > Wireless LAN > Security: WPA-PSK/WPA2-PSK



Security

SSID: ZyXEL

Security Mode: WPA2-PSK

□ WPA Compatible

Pre-Shared Key: 12345678

Group Key Update Timer: 3600 seconds

Note: WPA-PSK and WPA2-PSK can be configured when WPS enabled

The following table describes the labels in this screen.

Table 48 Network > Wireless LAN > Security: WPA-PSK/WPA2-PSK

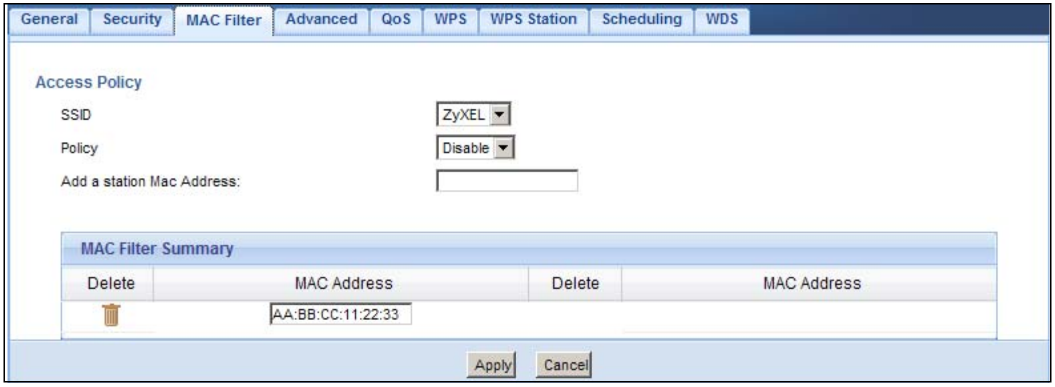
LABEL	DESCRIPTION
SSID	Select the SSID for which you want to configure the security.
Security Mode	Select **WPA-PSK** or **WPA2-PSK** to enable data encryption.
WPA Compatible	This field appears when you choose **WPA2-PSK** as the **Security Mode**. Check this field to allow wireless devices using **WPA-PSK** security mode to connect to your NBG4615.
Pre-Shared Key	**WPA-PSK/WPA2-PSK** uses a simple common password for authentication. Type a pre-shared key from 8 to 63 case-sensitive keyboard characters.
Group Key Update Timer	The **Group Key Update Timer** is the rate at which the AP sends a new group key out to all clients. The default is **3600** seconds (60 minutes).
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.4 MAC Filter

The MAC filter screen allows you to configure the NBG4615 to give exclusive access to devices (Allow) or exclude devices from accessing the NBG4615 (Deny). Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the devices to configure this screen.

To change your NBG4615's MAC filter settings, click **Network** > **Wireless LAN** > **MAC Filter**. The screen appears as shown.

Figure 84 Network > Wireless LAN > MAC Filter



Access Policy

SSID: ZyXEL

Policy: Disable

Add a station Mac Address:

MAC Filter Summary

Delete	MAC Address	Delete	MAC Address
🗑	AA:BB:CC:11:22:33		

The following table describes the labels in this menu.

Table 49 Network > Wireless LAN > MAC Filter

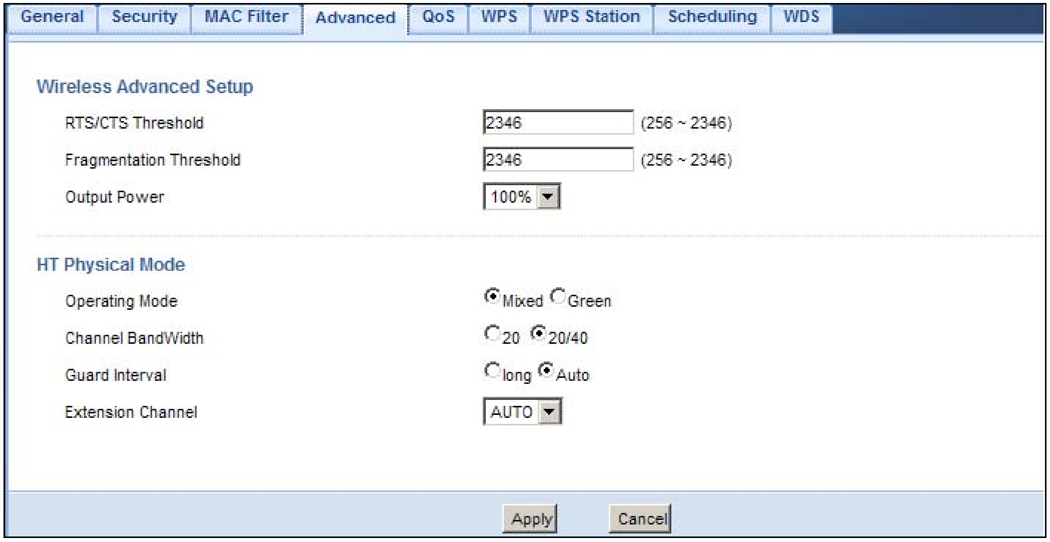
LABEL	DESCRIPTION
Access Policy	
SSID	Select the SSID for which you want to configure MAC filtering.
Policy	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Disable** to deactivate the MAC filtering rule you configure below. Select **Allow** to permit access to the NBG4615, MAC addresses not listed will be denied access to the NBG4615. Select **Reject** to block access to the NBG4615, MAC addresses not listed will be allowed to access the NBG4615
Add a station Mac Address	Enter the MAC addresses of the wireless station that are allowed or denied access to the NBG4615 in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc. Click **Add**.
MAC Filter Summary	
Delete	Click the delete icon to remove the MAC address from the list.
MAC Address	This is the MAC address of the wireless station that are allowed or denied access to the NBG4615.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.5 Wireless LAN Advanced Screen

Use this screen to allow wireless advanced features, such as the output power, RTS/CTS Threshold and high-throughput physical mode settings.

Click **Network** > **Wireless LAN** > **Advanced**. The screen appears as shown.

Figure 85 Network > Wireless LAN > Advanced



Wireless Advanced Setup

RTS/CTS Threshold 2346 (256 ~ 2346)

Fragmentation Threshold 2346 (256 ~ 2346)

Output Power 100%

HT Physical Mode

Operating Mode ● Mixed ○ Green

Channel BandWidth ○ 20 ● 20/40

Guard Interval ○ long ● Auto

Extension Channel AUTO

The following table describes the labels in this screen.

Table 50 Network > Wireless LAN > Advanced

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 256 and 2432.
Fragmentation Threshold	The threshold (number of bytes) for the fragmentation boundary for directed messages. It is the maximum data fragment size that can be sent. Enter an even number between **256** and **2346**.
Output Power	Set the output power of the NBG4615 in this field. If there is a high density of APs in an area, decrease the output power of the NBG4615 to reduce interference with other APs. Select one of the following **100%**, **90%**, **75%**, **50%**, **25%** or **10%**. See the product specifications for more information on your NBG4615's output power.
HT (High Throughput) Physical Mode - Use the fields below to configure the 802.11 wireless environment of your NBG4615.	
Operating Mode	Choose this according to the wireless mode(s) used in your network. **Mixed** - Select this if the wireless clients in your network use different wireless modes (for example, IEEE 802.11b/g and IEEE 802.1n modes) **Green** - Select this if the wireless clients in your network uses only one type of wireless mode (for example, IEEEE 802.11 n only)
Channel Bandwidth	Select the channel bandwidth you want to use for your wireless network. It is recommended that you select **20/40** (20/40 MHz). Select **20** MHz if you want to lessen radio interference with other wireless devices in your neighborhood.

Table 50 Network > Wireless LAN > Advanced (continued)

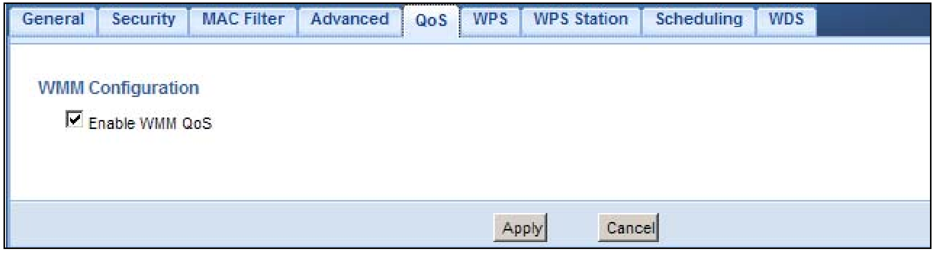
LABEL	DESCRIPTION
Guard Interval	Select **Auto** to increase data throughput. However, this may make data transfer more prone to errors. Select **Long** to prioritize data integrity. This may be because your wireless network is busy and congested or the NBG4615 is located in an environment prone to radio interference.
Extension Channel	This is set to **Auto** by default. If you select **20/40** as your **Channel Bandwidth**, the extension channel enables the NBG4615 to get higher data throughput. This also lowers radio interference and traffic.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.6 Quality of Service (QoS) Screen

The QoS screen allows you to automatically give a service (such as VoIP and video) a priority level.

Click **Network** > **Wireless LAN** > **QoS**. The following screen appears.

Figure 86 Network > Wireless LAN > QoS



The following table describes the labels in this screen.

Table 51 Network > Wireless LAN > QoS

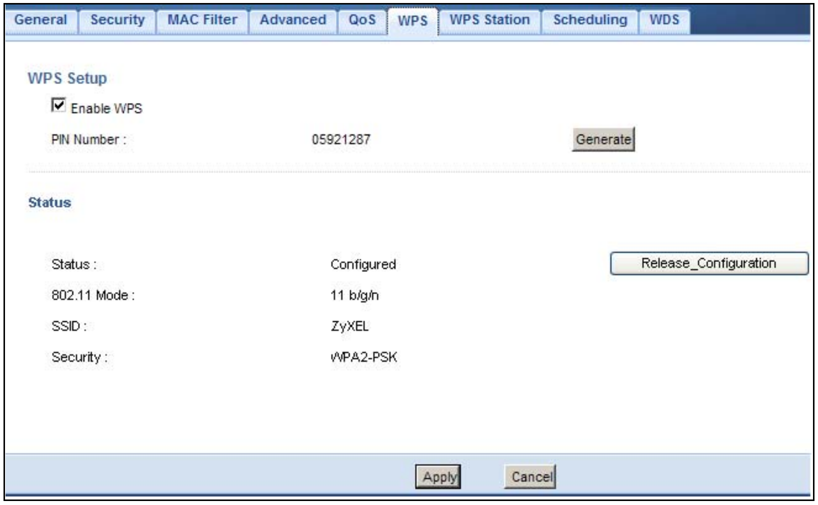
LABEL	DESCRIPTION
Enable WMM QoS	Check this to have the NBG4615 automatically give a service a priority level according to the ToS value in the IP header of packets it sends. WMM QoS (Wifi MultiMedia Quality of Service) gives high priority to voice and video, which makes them run more smoothly.
Apply	Click **Apply** to save your changes to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.7 WPS Screen

Use this screen to enable/disable WPS, view or generate a new PIN number and check current WPS status. To open this screen, click **Network** > **Wireless LAN** > **WPS** tab.

Note: With WPS, wireless clients can only connect to the wireless network using the first SSID on the NBG4615.

Figure 87 Network > Wireless LAN > WPS



WPS Setup

☑ Enable WPS

PIN Number : 05921287

Status

Status : Configured

802.11 Mode : 11 b/g/n

SSID : ZyXEL

Security : WPA2-PSK

The following table describes the labels in this screen.

Table 52 Network > Wireless LAN > WPS

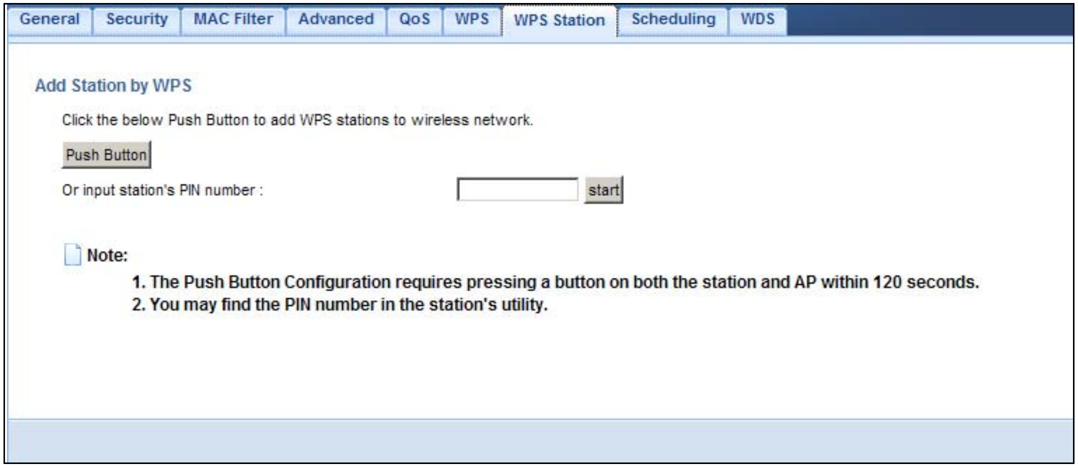
LABEL	DESCRIPTION
WPS Setup	
Enable WPS	Select this to enable the WPS feature.
PIN Number	This displays a PIN number last time system generated. Click **Generate** to generate a new PIN number.
Status	
Status	This displays **Configured** when the NBG4615 has connected to a wireless network using WPS or when **Enable WPS** is selected and wireless or wireless security settings have been changed. The current wireless and wireless security settings also appear in the screen. This displays **Unconfigured** if WPS is disabled and there are no wireless or wireless security changes on the NBG4615 or you click **Release_Configuration** to remove the configured wireless and wireless security settings.
Release Configuration	This button is only available when the WPS status displays **Configured**. Click this button to remove all configured wireless and wireless security settings for WPS connections on the NBG4615.
802.11 Mode	This is the 802.11 mode used. Only compliant WLAN devices can associate with the NBG4615.
SSID	This is the name of the wireless network (the NBG4615's first SSID).
Security	This is the type of wireless security employed by the network.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

15.8 WPS Station Screen

Use this screen when you want to add a wireless station using WPS. To open this screen, click **Network** > **Wireless LAN** > **WPS Station** tab.

Note: After you click **Push Button** on this screen, you have to press a similar button in the wireless station utility within 2 minutes. To add the second wireless station, you have to press these buttons on both device and the wireless station again after the first 2 minutes.

Figure 88 Network > Wireless LAN > WPS Station



Add Station by WPS

Click the below Push Button to add WPS stations to wireless network.

Or input station's PIN number :

Note:

1. The Push Button Configuration requires pressing a button on both the station and AP within 120 seconds.
2. You may find the PIN number in the station's utility.

The following table describes the labels in this screen.

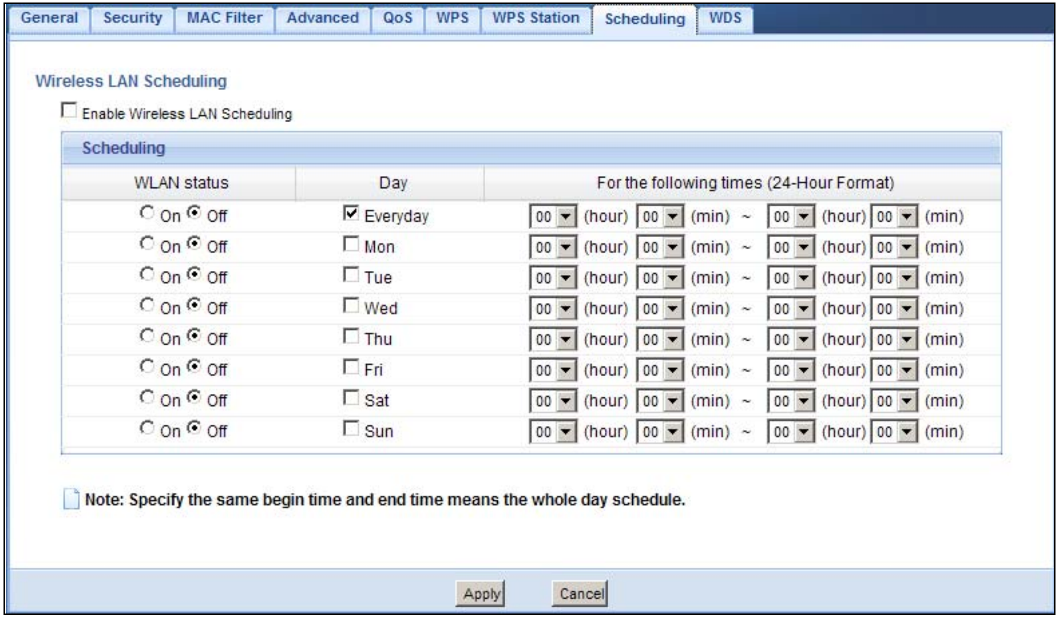
Table 53 Network > Wireless LAN > WPS Station

LABEL	DESCRIPTION
Push Button	Use this button when you use the PBC (Push Button Configuration) method to configure wireless stations's wireless settings. Click this to start WPS-aware wireless station scanning and the wireless security information synchronization.
Or input station's PIN number	Use this button when you use the PIN Configuration method to configure wireless station's wireless settings. Type the same PIN number generated in the wireless station's utility. Then click **Start** to associate to each other and perform the wireless security information synchronization.

15.9 Scheduling Screen

Use this screen to set the times your wireless LAN is turned on and off. Wireless LAN scheduling is disabled by default. The wireless LAN can be scheduled to turn on or off on certain days and at certain times. To open this screen, click **Network** > **Wireless LAN** > **Scheduling** tab.

Figure 89 Network > Wireless LAN > Scheduling



Wireless LAN Scheduling

□ Enable Wireless LAN Scheduling

Scheduling

WLAN status	Day	For the following times (24-Hour Format)
○ On ● Off	☑ Everyday	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Mon	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Tue	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Wed	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Thu	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Fri	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Sat	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)
○ On ● Off	□ Sun	00 ▾ (hour) 00 ▾ (min) ~ 00 ▾ (hour) 00 ▾ (min)

Note: Specify the same begin time and end time means the whole day schedule.

The following table describes the labels in this screen.

Table 54 Network > Wireless LAN > Scheduling

LABEL	DESCRIPTION
Wireless LAN Scheduling	
Enable Wireless LAN Scheduling	Select this to enable Wireless LAN scheduling.
Scheduling	
WLAN Status	Select **On** or **Off** to specify whether the Wireless LAN is turned on or off. This field works in conjunction with the **Day** and **For the following times** fields.
Day	Select **Everyday** or the specific days to turn the Wireless LAN on or off. If you select **Everyday** you can not select any specific days. This field works in conjunction with the **For the following times** field.
For the following times (24-Hour Format)	Select a begin time using the first set of **hour** and minute (**min**) drop down boxes and select an end time using the second set of **hour** and minute (**min**) drop down boxes. If you have chosen **On** earlier for the WLAN Status the Wireless LAN will turn on between the two times you enter in these fields. If you have chosen **Off** earlier for the WLAN Status the Wireless LAN will turn off between the two times you enter in these fields.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

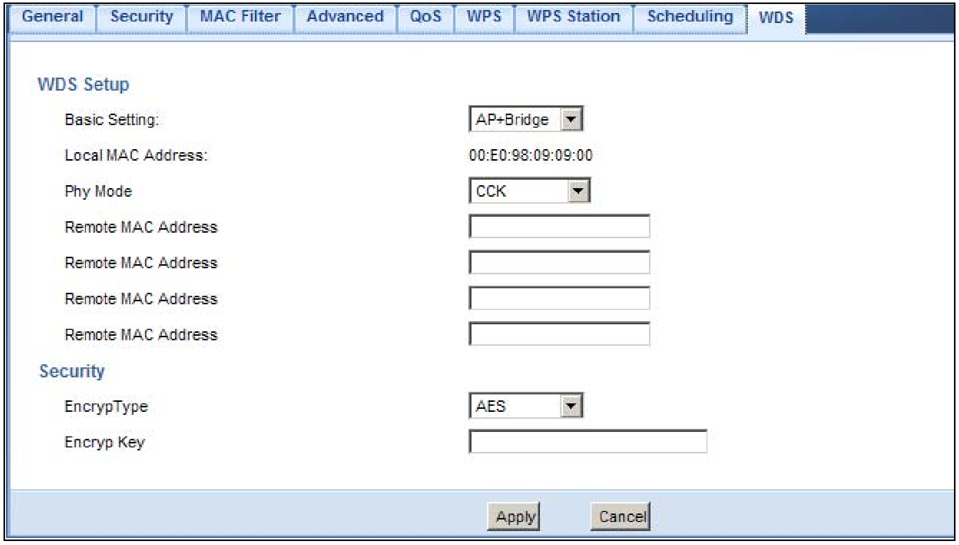
15.10 WDS Screen

A Wireless Distribution System (WDS) is a wireless connection between two or more APs. Use this screen to set the operating mode of your NBG4615 to **AP + Bridge** or **Bridge** and establish wireless links with other APs. You need to know the MAC address of the peer device, which also must be in bridge mode.

Note: You must enable the same wireless security settings on the NBG4615 and on all wireless clients that you want to associate with it.

Click **Network** > **Wireless LAN** > **WDS** tab. The following screen opens with the **Basic Setting** set to **Disabled**, and **Security Mode** set to **No Security**.

Figure 90 Network > Wireless LAN > WDS



WDS Setup

Basic Setting: AP+Bridge

Local MAC Address: 00:E0:98:09:09:00

Phy Mode: CCK

Remote MAC Address

Remote MAC Address

Remote MAC Address

Remote MAC Address

Security

EncrypType: AES

Encryp Key

The following table describes the labels in this screen.

Table 55 Network > Wireless LAN > WDS

LABEL	DESCRIPTION
WDS Setup	
Basic Settings	Select the operating mode for your NBG4615. • **Disable** - The NBG4615 works as an access point only and cannot establish wireless links with other APs. • **AP + Bridge -** The NBG4615 functions as a bridge and access point simultaneously. • **Bridge** - The NBG4615 acts as a wireless network bridge and establishes wireless links with other APs. You need to know the MAC address of the peer device, which also must be in bridge mode. The NBG4615 can establish up to five wireless links with other APs.
Local MAC Address	This is the MAC address of your NBG4615.
Phy Mode	Select the Phy mode you want the NBG4615 to use. This dictates the maximum size of packets during data transmission. This field is not available when you select **Disable** in the **Basic Setting** field.

Table 55 Network > Wireless LAN > WDS (continued)

LABEL	DESCRIPTION
Remote MAC Address	This is the MAC address of the peer device that your NBG4615 wants to make a bridge connection with. You can connect to up to 4 peer devices.
Security	
EncrypType	Select whether to use **WEP**, **TKIP** or **AES** encryption for your WDS connection in this field. Otherwise, select **No Security**.
EncrypKey	The **Encryp Key** is used to encrypt data. Peers must use the same key for data transmission.
Apply	Click **Apply** to save your changes to NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

16

IPv6

16.1 Overview

IPv6 (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in IPv6 address size to 128 bits (from the 32-bit IPv4 address) allows up to 3.4 x 1038 IP addresses.

- See Appendix G on page 309 for more information on IPv6.

16.1.1 What You Need to Know

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.

Stateless Autoconfiguration

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

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

When the interface is connected to a network with a router and the NBG4615 is set to automatically obtain an IPv6 network prefix from the router for the interface, it generates [3]another address which combines its interface ID and global and subnet information advertised from the router. This is a routable global IP address.

DHCPv6

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

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

16.2 The IPv6 Screen

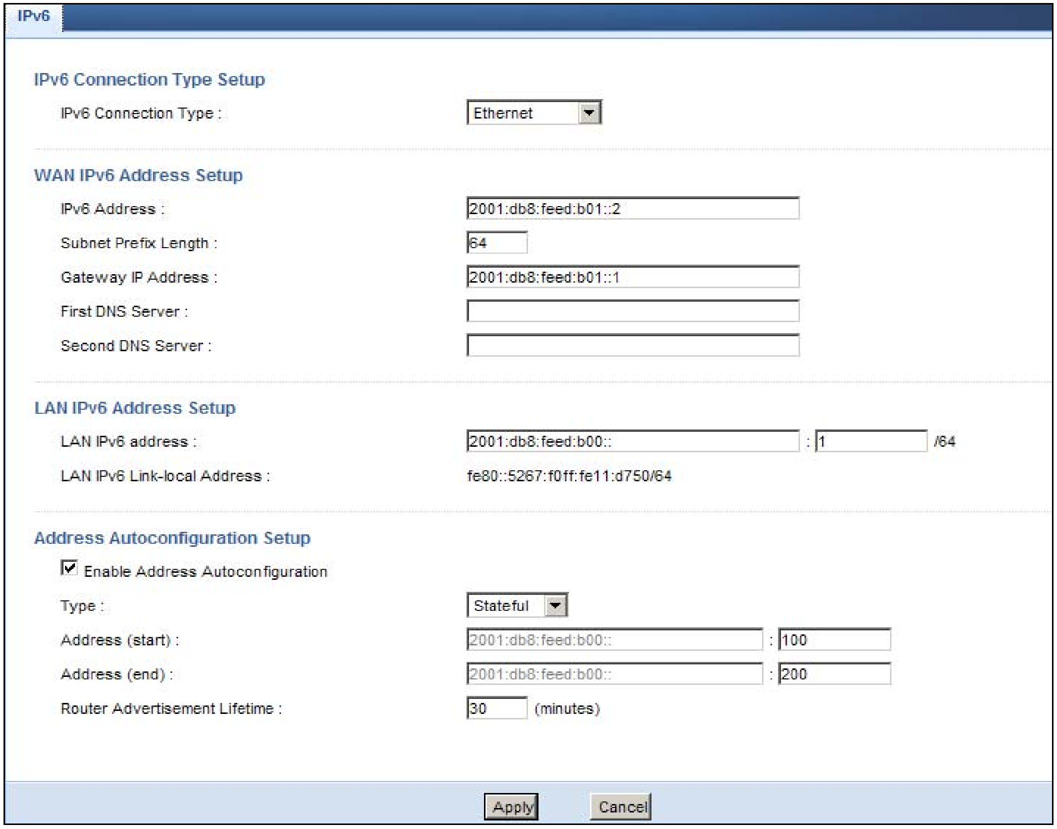
Click **Network > IPv6** to open the **IPv6** screen. Use this screen to configure the IPv6 settings for your NBG4615.

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

16.2.1 IPv6 Connection: Ethernet

If you select **Ethernet** as the IPv6 Connection Type, the following screen displays.

Figure 91 Network > IPv6: Ethernet



IPv6 Connection Type Setup

IPv6 Connection Type : Ethernet

WAN IPv6 Address Setup

IPv6 Address : 2001:db8:feed:b01::2
Subnet Prefix Length : 64
Gateway IP Address : 2001:db8:feed:b01::1
First DNS Server :
Second DNS Server :

LAN IPv6 Address Setup

LAN IPv6 address : 2001:db8:feed:b00:: : 1 /64
LAN IPv6 Link-local Address : fe80::5267:f0ff:fe11:d750/64

Address Autoconfiguration Setup

☑ Enable Address Autoconfiguration
Type : Stateful
Address (start) : 2001:db8:feed:b00:: : 100
Address (end) : 2001:db8:feed:b00:: : 200
Router Advertisement Lifetime : 30 (minutes)

The following table describes the fields in this screen.

Table 56 Network > IPv6: Ethernet

LABEL	DESCRIPTION
IPv6 Connection Type Setup	
IPv6 Connection Type	Select **Ethernet** as the IPv6 connection type if your ISP provides you a static IPv6 address. You need to enter the IPv6 information below according to what your ISP provided.
WAN IPv6 Address Setup	
IPv6 Address	Enter the static IPv6 address provided by your ISP using colon (:) hexadecimal notation.
Subnet Prefix Length	Enter the bit number of the IPv6 subnet mask provided by your ISP.
Gateway IP Address	Enter the IPv6 address of the default outgoing gateway using a colon (:) hexadecimal notation.
First DNS Server	Enter the primary DNS server's IP address in this field.
Second DNS Server	Enter the secondary DNS server's IP address in this field.
LAN IPv6 Address Setup	
LAN IPv6 address	Enter a valid IPv6 address for the LAN using colon (:) hexadecimal notation.
LAN IPv6 Link-local Address	This shows the IPv6 link-local address that the NBG4615 generates automatically.

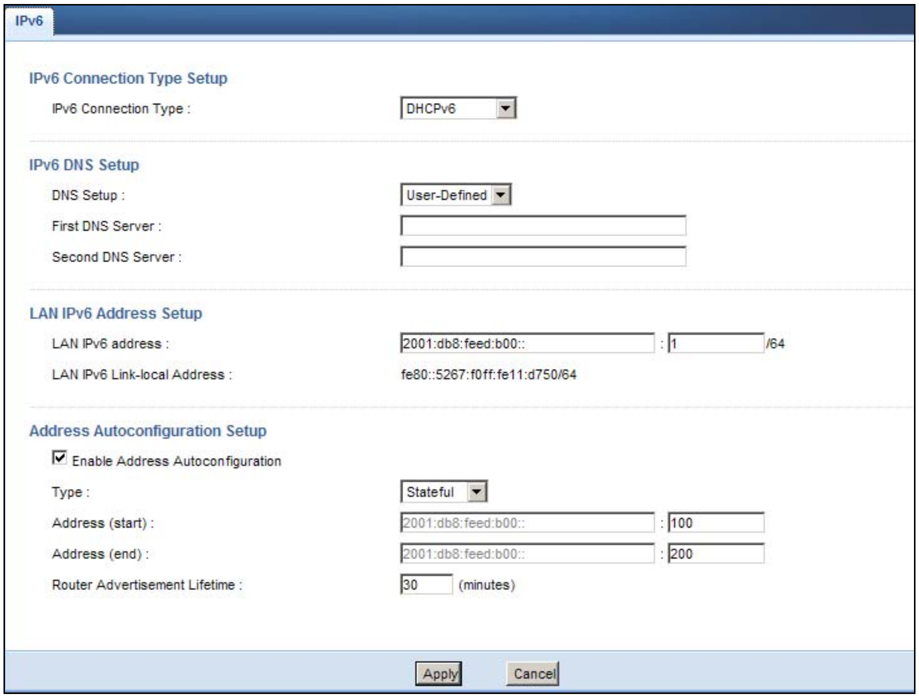
Table 56 Network > IPv6: Ethernet (continued)

LABEL	DESCRIPTION
Address Autoconfiguration Setup	
Enable Address Autoconfiguration	Select the checkbox to enable Address Autoconfiguration on the NBG4615.
Type	Select the IPv6 autoconfiguration type: **Stateless** or **Stateful**. If you choose **Stateful**, enter the beginning and end of the IPv6 address range in the fields below. If you choose **Stateless**, IP addresses are not generated by a DHCP server. They are formed by combining network prefixes with an interface identifier, which are derived from embedded IEEE Identifiers. See page 143 for more information.
Router Advertisement Lifetime	Specify the lifetime of the router advertisement. Router advertisement is a response to a router solicitation or a periodical multicast advertisement from a router to advertise its presence and other parameters, such as IPv6 prefix and DNS information.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

16.2.2 IPv6 Connection: DHCPv6

If you select **DHCPv6** as the **IPv6 Connection Type**, the following screen displays.

Figure 92 Network > IPv6: DHCPv6



IPv6

IPv6 Connection Type Setup

IPv6 Connection Type : DHCPv6

IPv6 DNS Setup

DNS Setup : User-Defined

First DNS Server :

Second DNS Server :

LAN IPv6 Address Setup

LAN IPv6 address : 2001:db8:feed:b00:: : 1 /64

LAN IPv6 Link-local Address : fe80::5267:f0ff:fe11:d750/64

Address Autoconfiguration Setup

☑ Enable Address Autoconfiguration

Type : Stateful

Address (start) : 2001:db8:feed:b00:: : 100

Address (end) : 2001:db8:feed:b00:: : 200

Router Advertisement Lifetime : 30 (minutes)

The following table describes the fields in this screen.

Table 57 Network > IPv6: DHCPv6

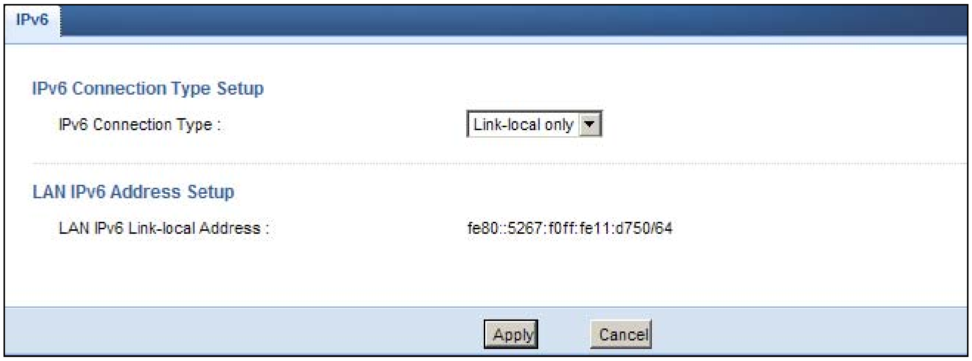
LABEL	DESCRIPTION
IPv6 Connection Type Setup	
IPv6 Connection Type	Select **DHCPv6** as the IPv6 connection type if you want to obtain an IPv6 address from a DHCPv6 server.
IPv6 DNS Setup	
DNS Setup	Select **From ISP** if your ISP dynamically assigns IPv6 DNS server information. Or select **User-Defined** to configure them manually.
First DNS Server	Enter the primary DNS server's IP address in this field.
Second DNS Server	Enter the secondary DNS server's IP address in this field.
LAN IPv6 Address Setup	
LAN IPv6 address	Enter a valid IPv6 address for the LAN using colon (:) hexadecimal notation.
LAN IPv6 Link-local Address	This shows the IPv6 link-local address that the NBG4615 generates automatically.
Address Autoconfiguration Setup	
Enable Address Autoconfiguration	Select the checkbox to enable Address Autoconfiguration on the NBG4615.
Type	Select the IPv6 autoconfiguration type: **Stateless** or **Stateful**. If you choose **Stateful**, enter the beginning and end of the IPv6 address range in the fields below. If you choose **Stateless**, IP addresses are not generated by a DHCP server. They are formed by combining network prefixes with an interface identifier, which are derived from embedded IEEE Identifiers. See page 143 for more information.
Router Advertisement Lifetime	Specify the lifetime of the router advertisement. Router advertisement is a response to a router solicitation or a periodical multicast advertisement from a router to advertise its presence and other parameters, such as IPv6 prefix and DNS information.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

16.2.3 IPv6 Connection: Link-local only

Use the **Link-local only** connection mode for the NBG4615 to communicate with other IPv6 devices on the LAN side. If you choose this mode, the **LAN IPv6 Link-local Address** will be shown in the screen.

If you select **Link-local only** as the **IPv6 Connection Type**, the following screen displays.

Figure 93 Network > IPv6: Link-local only



IPv6 Connection Type Setup

IPv6 Connection Type : Link-local only

LAN IPv6 Address Setup

LAN IPv6 Link-local Address : fe80::5267:f0ff:fe11:d750/64

17

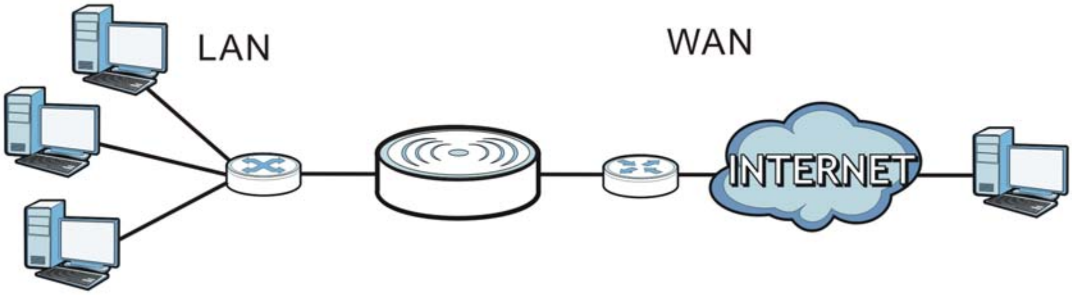
WAN

17.1 Overview

This chapter discusses the NBG4615's **WAN** screens. Use these screens to configure your NBG4615 for Internet access.

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

Figure 94 LAN and WAN



17.2 What You Can Do

- Use the **Internet Connection** screen to enter your ISP information and set how the computer acquires its IP, DNS and WAN MAC addresses (Section 17.4 on page 151).
- Use the **Advanced** screen to enable multicasting, configure Windows networking and bridge (Section 17.5 on page 159).
- Use **IGMP Snooping** screen to enable IGMP snooping in the LAN ports (Section 17.6 on page 160).

17.3 What You Need To Know

The information in this section can help you configure the screens for your WAN connection, as well as enable/disable some advanced features of your NBG4615.

17.3.1 Configuring Your Internet Connection

Encapsulation Method

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

WAN IP Address

The WAN IP address is an IP address for the NBG4615, which makes it accessible from an outside network. It is used by the NBG4615 to communicate with other devices in other networks. It can be static (fixed) or dynamically assigned by the ISP each time the NBG4615 tries to access the Internet.

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

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 NBG4615 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 NBG4615’s WAN IP address), set the DNS server fields to get the DNS server address from the ISP.

WAN MAC Address

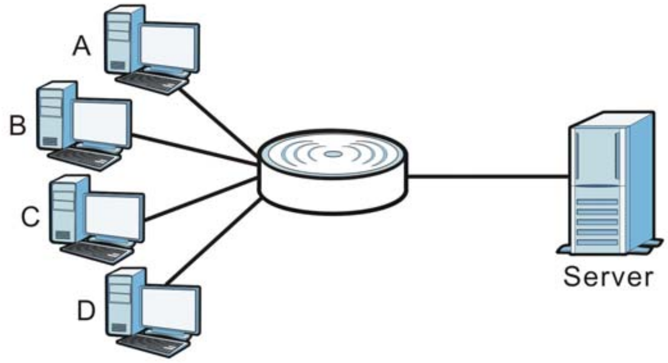
The MAC address screen allows users to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a computer on your LAN. Choose **Factory Default** to select the factory assigned default MAC Address.

Otherwise, click **Clone the computer's MAC address - IP Address** and enter the IP address of the computer on the LAN whose MAC you are cloning. Once it is successfully configured, the address will be copied to configuration file. It is recommended that you clone the MAC address prior to hooking up the WAN Port.

17.3.2 Multicast

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

Figure 95 Multicast Example



In the multicast example above, systems A and D comprise one multicast group. In multicasting, the server only needs to send one data stream and this is delivered to systems A and D.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data. The NBG4615 supports both IGMP version 1 (**IGMP-v1**) and IGMP version 2 (**IGMP-v2**).

At start up, the NBG4615 queries all directly connected networks to gather group membership. After that, the NBG4615 periodically updates this information. IP multicasting can be enabled/ disabled on the NBG4615 LAN and/or WAN interfaces in the Web Configurator (**LAN**; **WAN**). Select **None** to disable IP multicasting on these interfaces.

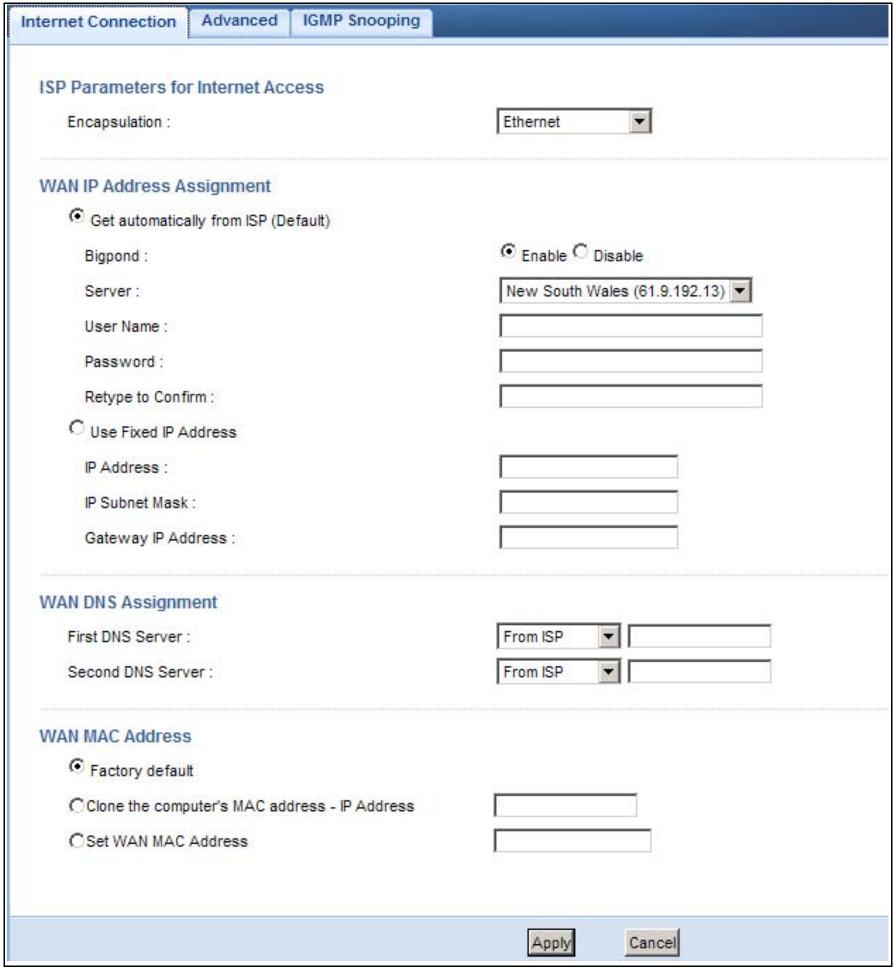
17.4 Internet Connection

Use this screen to change your NBG4615's Internet access settings. Click **WAN** from the **Configuration** menu. The screen differs according to the encapsulation you choose.

17.4.1 Ethernet Encapsulation

This screen displays when you select **Ethernet** encapsulation.

Figure 96 Network > WAN > Internet Connection: Ethernet Encapsulation



ISP Parameters for Internet Access

Encapsulation : Ethernet

WAN IP Address Assignment

● Get automatically from ISP (Default)

Bigpond : ● Enable ○ Disable

Server : New South Wales (61.9.192.13)

User Name :

Password :

Retype to Confirm :

○ Use Fixed IP Address

IP Address :

IP Subnet Mask :

Gateway IP Address :

WAN DNS Assignment

First DNS Server : From ISP

Second DNS Server : From ISP

WAN MAC Address

● Factory default

○ Clone the computer's MAC address - IP Address

○ Set WAN MAC Address

The following table describes the labels in this screen.

Table 58 Network > WAN > Internet Connection: Ethernet Encapsulation

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	You must choose the **Ethernet** option when the WAN port is used as a regular Ethernet.
WAN IP Address Assignment	
Get automatically from ISP (Default)	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Bigpond	Select **Enable** if you subscribe to Internet service from BigPond in Australia. Then configure the fields below with the information provided.
Server	Type the IP address of the BigPond server.
User Name	Type the user name given to you by your ISP. You can use alphanumeric and -_@$./ characters, and it can be up to 31 characters long.
Password	Type the password associated with the user name above. Use up to 64 ASCII characters except [,] and ?. This field can be blank.
Retype to Confirm	Type your password again for confirmation.

Table 58 Network > WAN > Internet Connection: Ethernet Encapsulation (continued)

LABEL	DESCRIPTION
Use Fixed 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 Fixed IP Address**.
IP Subnet Mask	Enter the **IP Subnet Mask** in this field.
Gateway IP Address	Enter a **Gateway IP Address** (if your ISP gave you one) in this field.
WAN DNS Assignment	
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
WAN MAC Address	The MAC address section allows users to configure the WAN port's MAC address by either using the NBG4615's MAC address, copying the MAC address from a computer on your LAN or manually entering a MAC address.
Factory default	Select **Factory default** to use the factory assigned default MAC Address.
Clone the computer's MAC address - IP Address	Select **Clone the computer's MAC address - IP Address** and enter the IP address of the computer on the LAN whose MAC you are cloning.
Set WAN MAC Address	Select this option and enter the MAC address you want to use.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.4.2 PPPoE Encapsulation

The NBG4615 supports PPPoE (Point-to-Point Protocol over Ethernet). PPPoE is an IETF standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection. The **PPP over Ethernet** option is for a dial-up connection using PPPoE.

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

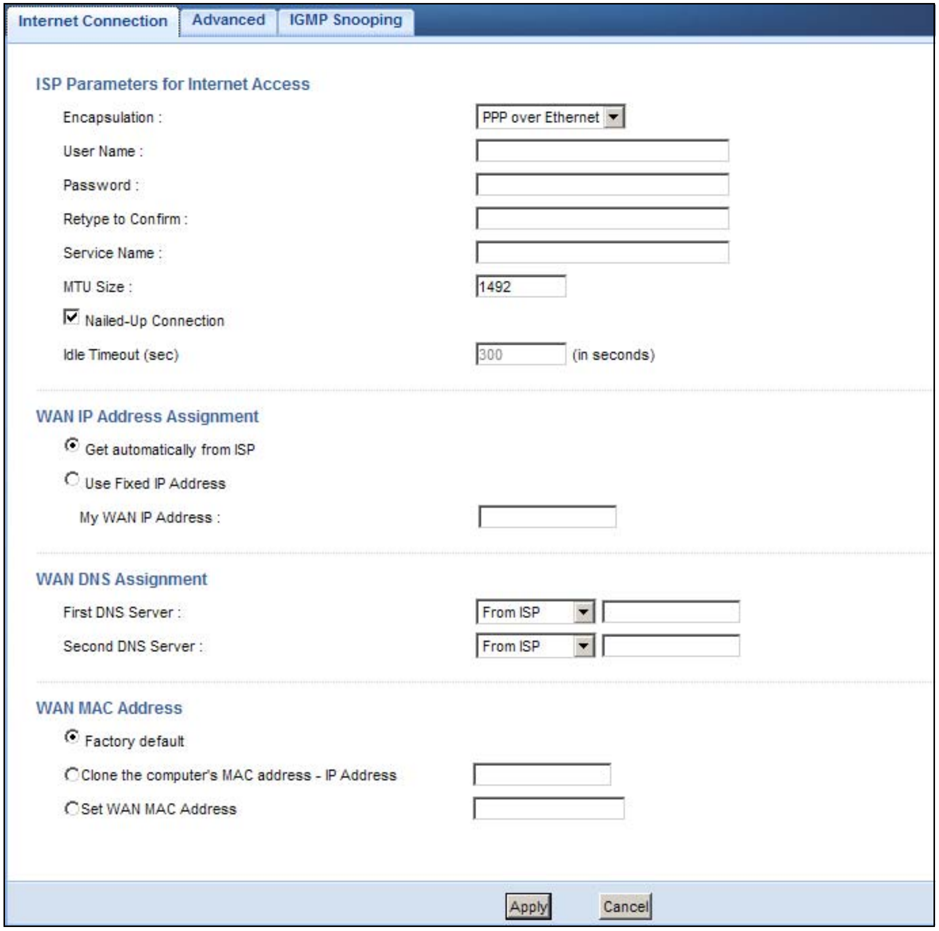
One of the benefits of PPPoE is the ability to let you access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for individuals.

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

By implementing PPPoE directly on the NBG4615 (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the NBG4615 does that part of the task. Furthermore, with NAT, all of the LANs' computers will have access.

This screen displays when you select **PPPoE** encapsulation.

Figure 97 Network > WAN > Internet Connection: PPPoE Encapsulation



ISP Parameters for Internet Access

Encapsulation : PPP over Ethernet

User Name :

Password :

Retype to Confirm :

Service Name :

MTU Size : 1492

☑ Nailed-Up Connection

Idle Timeout (sec) 300 (in seconds)

WAN IP Address Assignment

● Get automatically from ISP

○ Use Fixed IP Address

My WAN IP Address :

WAN DNS Assignment

First DNS Server : From ISP

Second DNS Server : From ISP

WAN MAC Address

● Factory default

○ Clone the computer's MAC address - IP Address

○ Set WAN MAC Address

The following table describes the labels in this screen.

Table 59 Network > WAN > Internet Connection: PPPoE Encapsulation

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	Select **PPP over Ethernet** if you connect to your Internet via dial-up.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Retype to Confirm	Type your password again to make sure that you have entered is correctly.
MTU Size	Enter the Maximum Transmission Unit (MTU) or the largest packet size per frame that your NBG4615 can receive and process.
Nailed-Up Connection	Select **Nailed-Up Connection** if you do not want the connection to time out.
Idle Timeout (sec)	This value specifies the time in minutes that elapses before the router automatically disconnects from the PPPoE server.

Table 59 Network > WAN > Internet Connection: PPPoE Encapsulation (continued)

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Use Fixed IP Address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address**.
WAN DNS Assignment	
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
WAN MAC Address	The MAC address section allows users to configure the WAN port's MAC address by using the NBG4615’s MAC address, copying the MAC address from a computer on your LAN or manually entering a MAC address.
Factory default	Select **Factory default** to use the factory assigned default MAC Address.
Clone the computer’s MAC address - IP Address	Select **Clone the computer's MAC address - IP Address** and enter the IP address of the computer on the LAN whose MAC you are cloning.
Set WAN MAC Address	Select this option and enter the MAC address you want to use.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

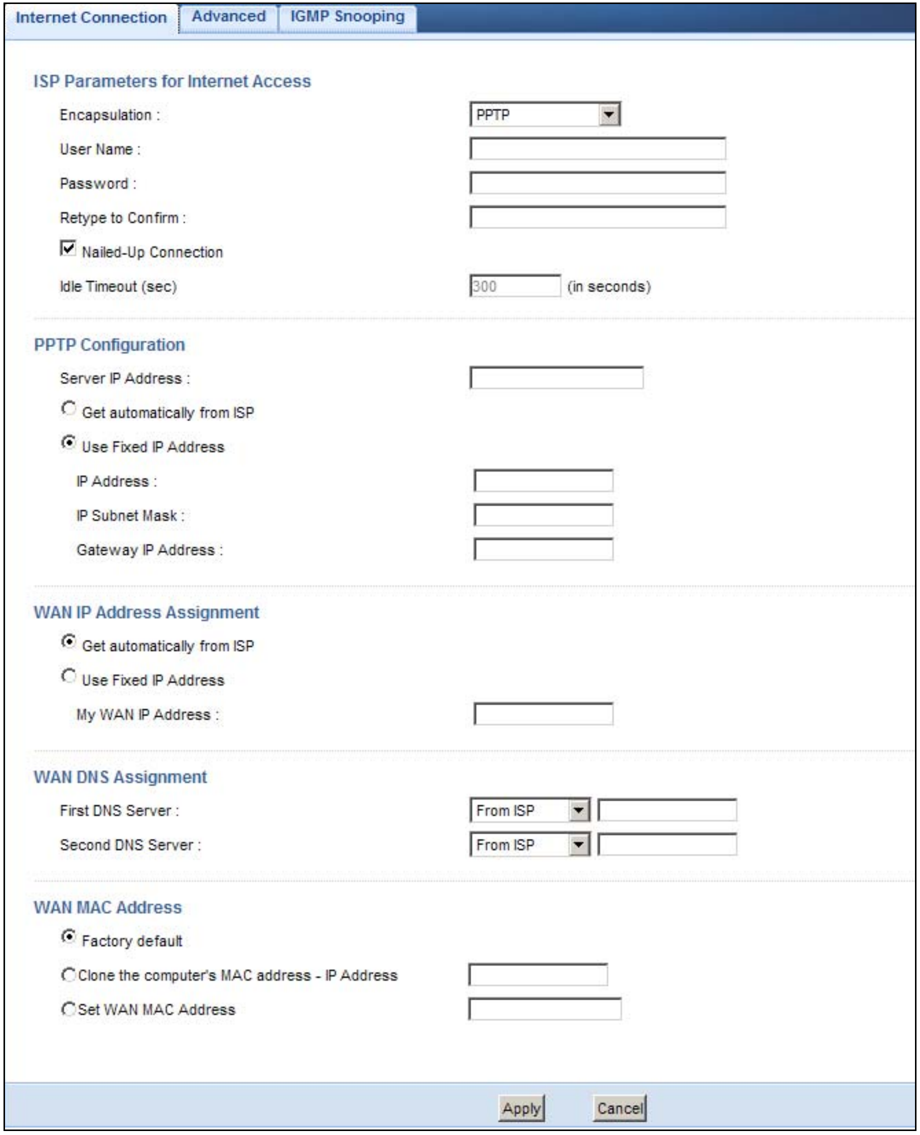
17.4.3 PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables secure transfer of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol and virtual private networking over public networks, such as the Internet.

This screen displays when you select **PPTP** encapsulation.

Figure 98 Network > WAN > Internet Connection: PPTP Encapsulation



ISP Parameters for Internet Access

Encapsulation : PPTP

User Name :

Password :

Retype to Confirm :

☑ Nailed-Up Connection

Idle Timeout (sec) 300 (in seconds)

PPTP Configuration

Server IP Address :

○ Get automatically from ISP

● Use Fixed IP Address

IP Address :

IP Subnet Mask :

Gateway IP Address :

WAN IP Address Assignment

● Get automatically from ISP

○ Use Fixed IP Address

My WAN IP Address :

WAN DNS Assignment

First DNS Server : From ISP

Second DNS Server : From ISP

WAN MAC Address

● Factory default

○ Clone the computer's MAC address - IP Address

○ Set WAN MAC Address

The following table describes the labels in this screen.

Table 60 Network > WAN > Internet Connection: PPTP Encapsulation

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Connection Type	To configure a PPTP client, you must configure the **User Name** and **Password** fields for a PPP connection and the PPTP parameters for a PPTP connection.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the User Name above.
Retype to Confirm	Type your password again to make sure that you have entered is correctly.
Nailed-up Connection	Select **Nailed-Up Connection** if you do not want the connection to time out.

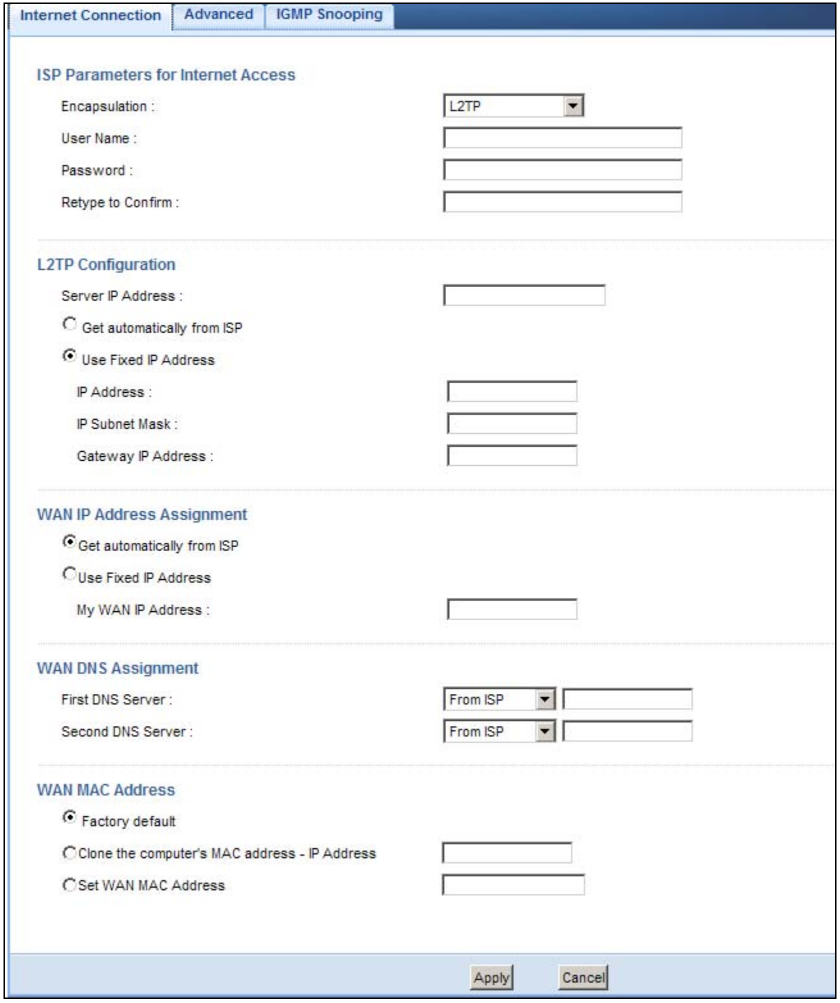
Table 60 Network > WAN > Internet Connection: PPTP Encapsulation (continued)

LABEL	DESCRIPTION
Idle Timeout	This value specifies the time in minutes that elapses before the NBG4615 automatically disconnects from the PPTP server.
PPTP Configuration	
Server IP Address	Type the IP address of the PPTP server.
Get automatically from ISP	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Use Fixed 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 Fixed IP Address**.
IP Subnet Mask	Your NBG4615 will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the NBG4615.
Gateway IP Address	Enter a **Gateway IP Address** (if your ISP gave you one) in this field.
WAN IP Address Assignment	
Get automatically from ISP	Select this to get your WAN IP address from your ISP.
Use Fixed IP Address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address**.
WAN DNS Assignment	
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
WAN MAC Address	The MAC address section allows users to configure the WAN port's MAC address by either using the NBG4615’s MAC address, copying the MAC address from a computer on your LAN or manually entering a MAC address.
Factory default	Select **Factory default** to use the factory assigned default MAC Address.
Clone the computer’s MAC address - IP Address	Select **Clone the computer's MAC address - IP Address** and enter the IP address of the computer on the LAN whose MAC you are cloning.
Set WAN MAC Address	Select this option and enter the MAC address you want to use.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.4.4 L2TP Encapsulation

The Layer 2 Tunneling Protocol (L2TP) works at layer 2 (the data link layer) to tunnel network traffic between two peer devices over another network (like the Internet).

This screen displays when you select **L2TP** encapsulation.



ISP Parameters for Internet Access

Encapsulation : L2TP

User Name :

Password :

Retype to Confirm :

L2TP Configuration

Server IP Address :

○ Get automatically from ISP

● Use Fixed IP Address

IP Address :

IP Subnet Mask :

Gateway IP Address :

WAN IP Address Assignment

● Get automatically from ISP

○ Use Fixed IP Address

My WAN IP Address :

WAN DNS Assignment

First DNS Server : From ISP

Second DNS Server : From ISP

WAN MAC Address

● Factory default

○ Clone the computer's MAC address - IP Address

○ Set WAN MAC Address

Figure 99 Network > WAN > Internet Connection: L2TP Encapsulation

The following table describes the labels in this screen.

Table 61 Network > WAN > Internet Connection: L2TP Encapsulation

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Connection Type	To configure a L2TP client, you must configure the **User Name** and **Password** fields for a layer-2 connection and the L2TP parameters for an L2TP connection.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the **User Name** above.
Retype to Confirm	Type your password again to make sure that you have entered is correctly.
L2TP Configuration	
Server IP Address	Type the IP address of the L2TP server.
Get automatically from ISP	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Use Fixed IP Address	Select this option If the ISP assigned a fixed IP address.

Table 61 Network > WAN > Internet Connection: L2TP Encapsulation (continued)

LABEL	DESCRIPTION
IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address**.
IP Subnet Mask	Your NBG4615 will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the NBG4615.
Gateway IP Address	Enter a **Gateway IP Address** (if your ISP gave you one) in this field.
WAN IP Address Assignment	
Get automatically from ISP	Select this to get your WAN IP address from your ISP.
Use Fixed IP Address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address**.
WAN DNS Assignment	
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
WAN MAC Address	The MAC address section allows users to configure the WAN port's MAC address by either using the NBG4615's MAC address, copying the MAC address from a computer on your LAN or manually entering a MAC address.
Factory default	Select **Factory default** to use the factory assigned default MAC Address.
Clone the computer's MAC address - IP Address	Select **Clone the computer's MAC address - IP Address** and enter the IP address of the computer on the LAN whose MAC you are cloning.
Set WAN MAC Address	Select this option and enter the MAC address you want to use.
Apply	Click **Apply** to save your changes back to the NBG4615.
Reset	Click **Reset** to begin configuring this screen afresh.

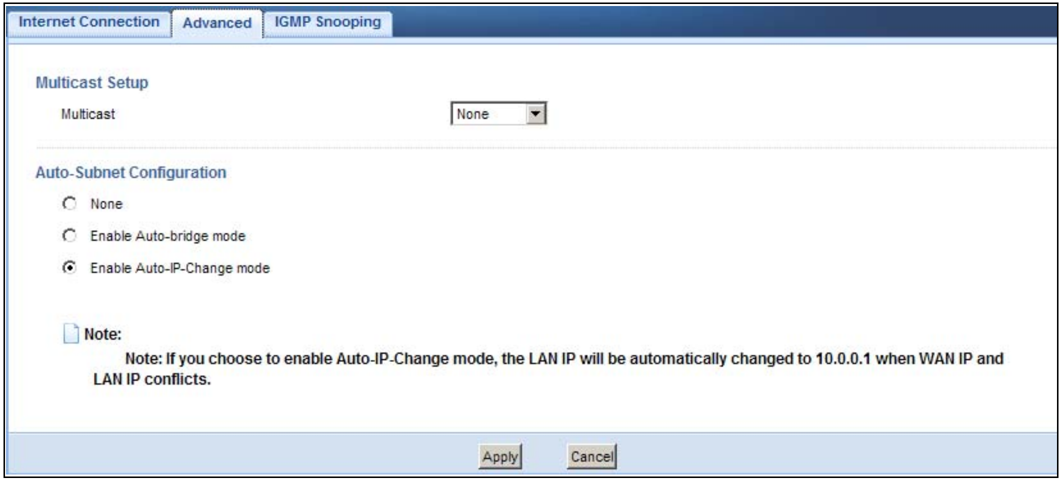
17.5 Advanced WAN Screen

Use this screen to enable **Multicast** and enable **Auto-bridge**.

Note: The categories shown in this screen are independent of each other.

To change your NBG4615’s advanced WAN settings, click **Network** > **WAN** > **Advanced**. The screen appears as shown.

Figure 100 Network > WAN > Advanced



Multicast Setup

Multicast: None

Auto-Subnet Configuration

○ None

○ Enable Auto-bridge mode

● Enable Auto-IP-Change mode

Note:

Note: If you choose to enable Auto-IP-Change mode, the LAN IP will be automatically changed to 10.0.0.1 when WAN IP and LAN IP conflicts.

The following table describes the labels in this screen.

Table 62 Network > WAN > Advanced

LABEL	DESCRIPTION
Multicast Setup	
Multicast	Select **IGMPv1/v2** to enable multicasting. This applies to traffic routed from the WAN to the LAN. Select **None** to disable this feature. This may cause incoming traffic to be dropped or sent to all connected network devices.
Auto-Subnet Configuration	
None	Select this option to have the NBG4615 do nothing when it gets a WAN IP address in the range of 192.168.x.y (where x and y are from zero to nine) or in the same subnet as the LAN IP address.
Enable Auto-bridge mode	Select this option to have the NBG4615 switch to bridge mode automatically when the NBG4615 gets a WAN IP address in the range of 192.168.x.y (where x and y are from zero to nine) no matter what the LAN IP address is.
Enable Auto-IP-Change mode	Select this option to have the NBG4615 change its LAN IP address to 10.0.0.1 or 192.168.1.1 accordingly when the NBG4615 gets a dynamic WAN IP address in the same subnet as the LAN IP address 192.168.1.1 or 10.0.0.1. The NAT, DHCP server and firewall functions on the NBG4615 are still available in this mode.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

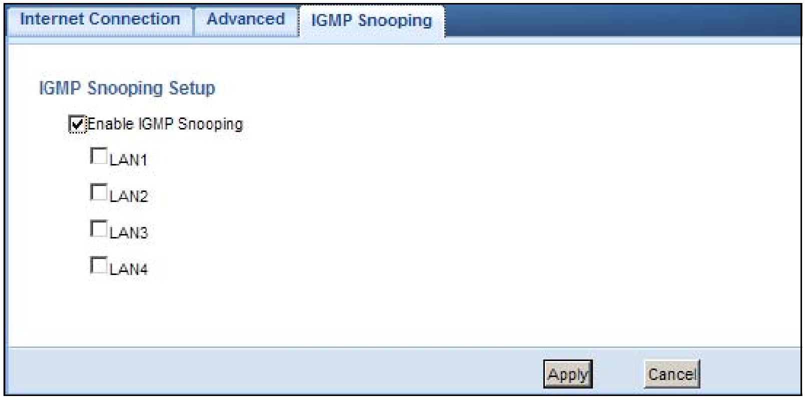
17.6 IGMP Snooping Screen

Use this screen to enable IGMP snooping if you have LAN users that subscribe to multicast services.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data.

Click **Network > WAN > IGMP Snooping**. The screen appears as shown.

Figure 101 Network > WAN > IGMP Snooping



The following table describes the labels in this screen.

Table 63 Network > WAN > IGMP Snooping

LABEL	DESCRIPTION
Enable IGMP Snooping	Select this option to have the NBG4615 use IGMP snooping. Check the LAN port/s to which IGMP snooping applies.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

18

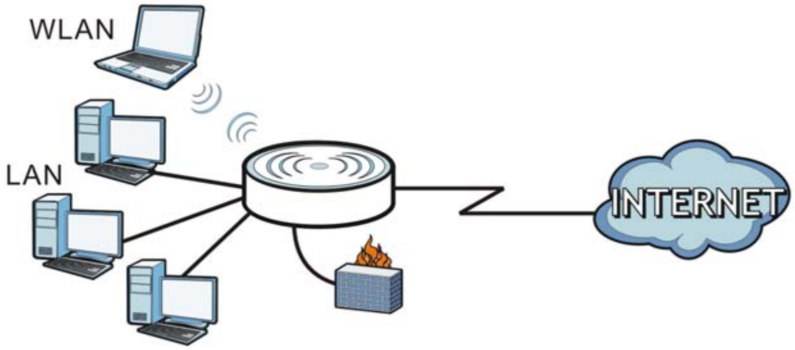
LAN

18.1 Overview

This chapter describes how to configure LAN settings.

A Local Area Network (LAN) is a shared communication system to which many computers are attached. A LAN is a computer network limited to the immediate area, usually the same building or floor of a building. The LAN screens can help you configure a LAN DHCP server, manage IP addresses, and partition your physical network into logical networks.

Figure 102 LAN Example



The LAN screens can help you manage IP addresses.

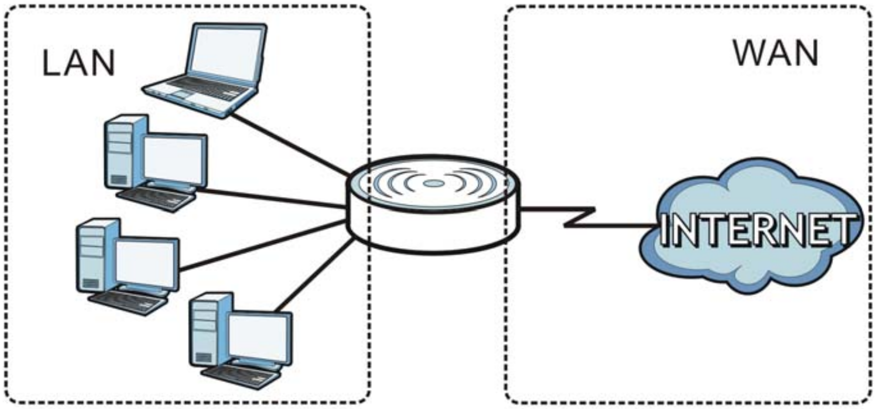
18.2 What You Can Do

- Use the **IP** screen to change the IP address for your (Section 18.4 on page 165).
- Use the **IP Alias** screen to have the NBG4615 apply IP alias to create LAN subnets (Section 18.5 on page 165).

18.3 What You Need To Know

The actual physical connection determines whether the NBG4615 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 103 LAN and WAN IP Addresses



The LAN parameters of the NBG4615 are preset in the factory with the following values:

- IP address of 192.168.1.1 with subnet mask of 255.255.255.0 (24 bits)
- DHCP server enabled with 32 client IP addresses starting from 192.168.1.33.

These parameters should work for the majority of installations. If your ISP gives you explicit DNS server address(es), read the embedded Web Configurator help regarding what fields need to be configured.

18.3.1 IP Pool Setup

The NBG4615 is pre-configured with a pool of 32 IP addresses starting from 192.168.1.33 to 192.168.1.64. This configuration leaves 31 IP addresses (excluding the NBG4615 itself) in the lower range (192.168.1.2 to 192.168.1.32) for other server computers, for instance, servers for mail, FTP, TFTP, web, etc., that you may have.

18.3.2 LAN TCP/IP

The NBG4615 has built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

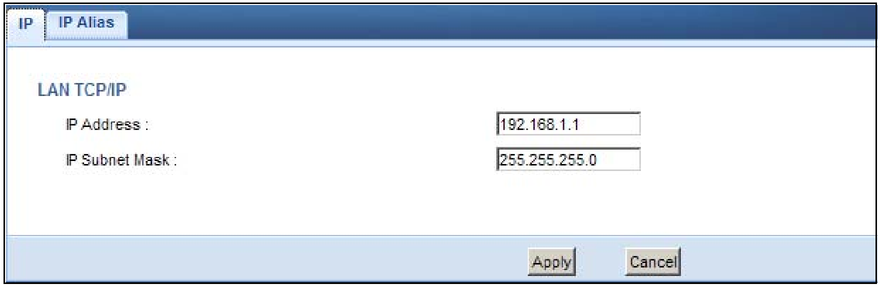
18.3.3 IP Alias

IP alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The NBG4615 supports three logical LAN interfaces via its single physical Ethernet interface with the NBG4615 itself as the gateway for each LAN network.

18.4 LAN IP Screen

Use this screen to change the IP address for your NBG4615. Click **Network > LAN > IP**.

Figure 104 Network > LAN > IP



IP Address : 192.168.1.1

IP Subnet Mask : 255.255.255.0

The following table describes the labels in this screen.

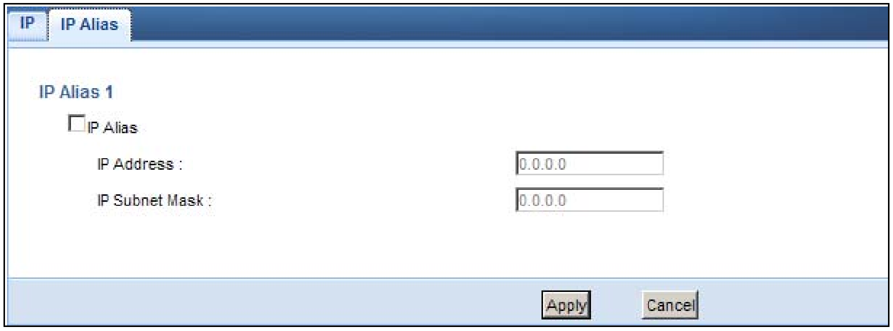
Table 64 Network > LAN > IP

LABEL	DESCRIPTION
IP Address	Type the IP address of your NBG4615 in dotted decimal notation.
IP Subnet Mask	The subnet mask specifies the network number portion of an IP address. Your NBG4615 will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the NBG4615.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

18.5 IP Alias Screen

Use this screen to have the NBG4615 apply IP alias to create LAN subnets. Click **LAN** > **IP Alias**.

Figure 105 Network > LAN > IP Alias



□ IP Alias

IP Address : 0.0.0.0

IP Subnet Mask : 0.0.0.0

The following table describes the labels in this screen.

Table 65 Network > LAN > IP Alias

LABEL	DESCRIPTION
IP Alias	Check this to enable IP alias.
IP Address	Type the IP alias address of your NBG4615 in dotted decimal notation.

Table 65 Network > LAN > IP Alias (continued)

LABEL	DESCRIPTION
IP Subnet Mask	The subnet mask specifies the network number portion of an IP address. Your NBG4615 will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the NBG4615.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19

DHCP Server

19.1 Overview

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 NBG4615’s LAN as a DHCP server or disable it. When configured as a server, the NBG4615 provides the TCP/IP configuration for the clients. If DHCP service is disabled, you must have another DHCP server on your LAN, or else the computer must be manually configured.

19.1.1 What You Can Do

- Use the **General** screen to enable the DHCP server (Section 19.2 on page 168).
- Use the **Advanced** screen to assign IP addresses on the LAN to specific individual computers based on their MAC Addresses (Section 19.3 on page 169).

19.1.2 What You Need To Know

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

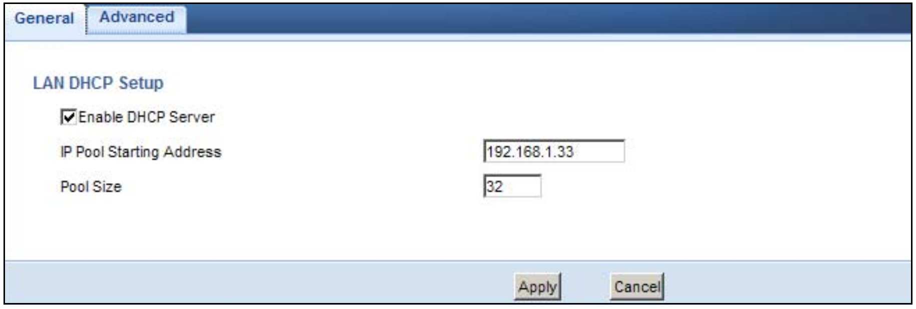
MAC Addresses

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

19.2 General

Use this screen to enable the DHCP server. Click **Network** > **DHCP Server**. The following screen displays.

Figure 106 Network > DHCP Server > General



LAN DHCP Setup

☑ Enable DHCP Server

IP Pool Starting Address: 192.168.1.33

Pool Size: 32

The following table describes the labels in this screen.

Table 66 Network > DHCP Server > General

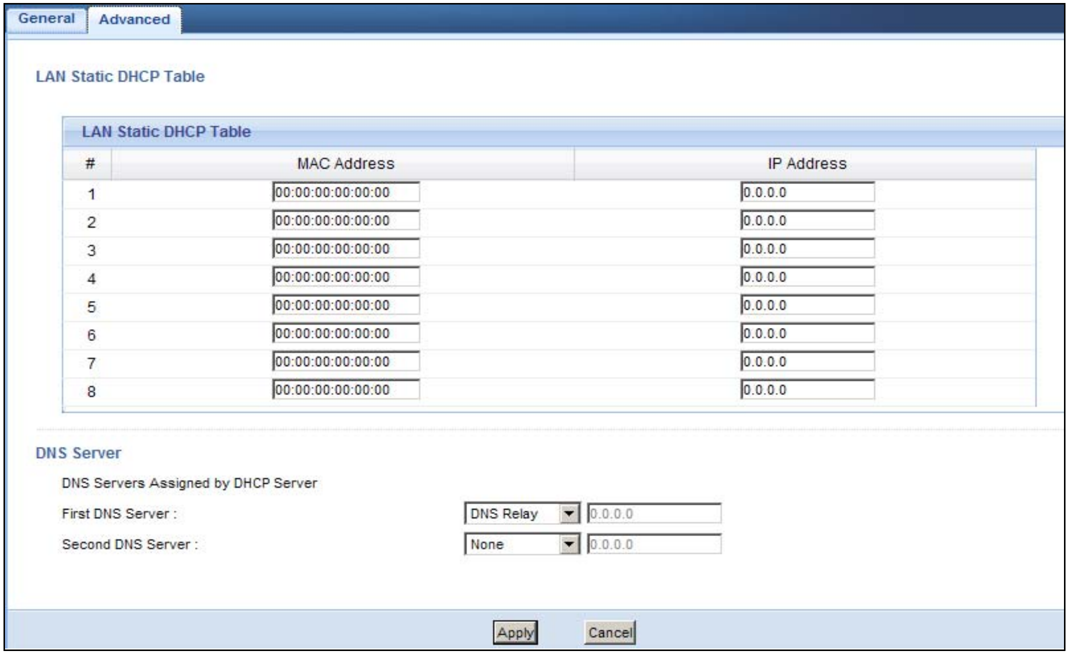
LABEL	DESCRIPTION
Enable DHCP Server	Select the checkbox to enable DHCP for LAN. DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients (computers) to obtain TCP/IP configuration at startup from a server. Leave the **Enable DHCP Server** check box selected unless your ISP instructs you to do otherwise. Clear it to disable the NBG4615 acting as a DHCP server. When configured as a server, the NBG4615 provides TCP/IP configuration for the clients. If not, DHCP service is disabled and you must have another DHCP server on your LAN, or else the computers must be manually configured. When set as a server, fill in the following four fields.
IP Pool Starting Address	This field specifies the first of the contiguous addresses in the IP address pool for LAN.
Pool Size	This field specifies the size, or count of the IP address pool for LAN.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.3 Advanced

This screen allows you to assign IP addresses on the LAN to specific individual computers based on their MAC addresses. You can also use this screen to configure the DNS server information that the NBG4615 sends to the DHCP clients.

To change your NBG4615's static DHCP settings, click **Network** > **DHCP Server** > **Advanced**. The following screen displays.

Figure 107 Network > DHCP Server > Advanced



LAN Static DHCP Table

LAN Static DHCP Table

#	MAC Address	IP Address
1	00:00:00:00:00:00	0.0.0.0
2	00:00:00:00:00:00	0.0.0.0
3	00:00:00:00:00:00	0.0.0.0
4	00:00:00:00:00:00	0.0.0.0
5	00:00:00:00:00:00	0.0.0.0
6	00:00:00:00:00:00	0.0.0.0
7	00:00:00:00:00:00	0.0.0.0
8	00:00:00:00:00:00	0.0.0.0

DNS Server

DNS Servers Assigned by DHCP Server

First DNS Server : DNS Relay 0.0.0.0

Second DNS Server : None 0.0.0.0

The following table describes the labels in this screen.

Table 67 Network > DHCP Server > Advanced

LABEL	DESCRIPTION
LAN Static DHCP Table	
#	This is the index number of the static IP table entry (row).
MAC Address	Type the MAC address (with colons) of a computer on your LAN.
IP Address	Type the LAN IP address of a computer on your LAN.
DNS Server	
DNS Servers Assigned by DHCP Server	The NBG4615 passes a DNS (Domain Name System) server IP address (in the order you specify here) to the DHCP clients. The NBG4615 only passes this information to the LAN DHCP clients when you select the **Enable DHCP Server** check box. When you clear the **Enable DHCP Server** check box, DHCP service is disabled and you must have another DHCP sever on your LAN, or else the computers must have their DNS server addresses manually configured.

Table 67 Network > DHCP Server > Advanced (continued)

LABEL	DESCRIPTION
First DNS Server Second DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the NBG4615's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined**, but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply**. If you set a second choice to **User-Defined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **DNS Relay** to have the NBG4615 act as a DNS proxy. The NBG4615's LAN IP address displays in the field to the right (read-only). The NBG4615 tells the DHCP clients on the LAN that the NBG4615 itself is the DNS server. When a computer on the LAN sends a DNS query to the NBG4615, the NBG4615 forwards the query to the NBG4615's system DNS server (configured in the **WAN > Internet Connection** screen) and relays the response back to the computer. You can only select **DNS Relay** for one of the three servers; if you select **DNS Relay** for a second or third DNS server, that choice changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20

NAT

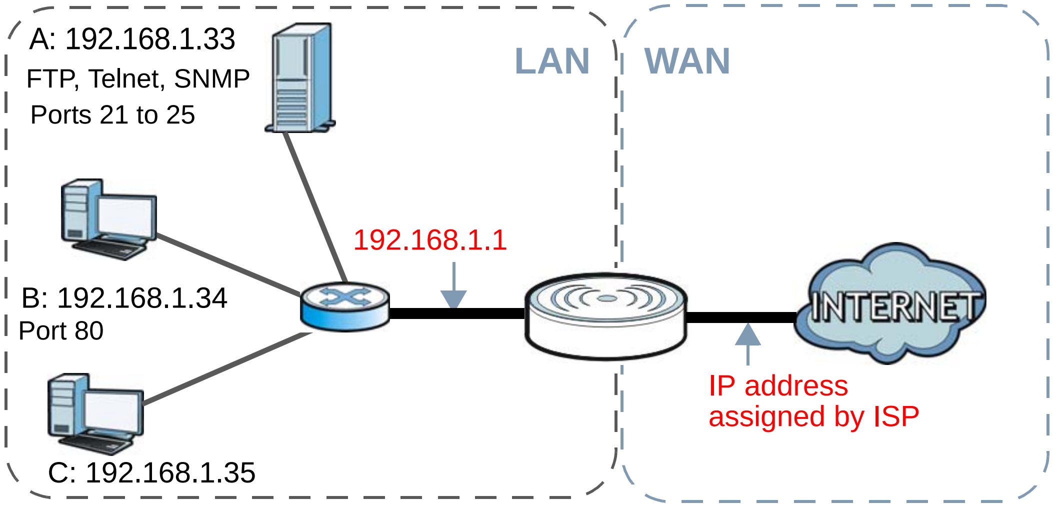
20.1 Overview

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

The figure below is a simple illustration of a NAT network. You want to assign ports 21-25 to one FTP, Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example) and assign a default server IP address of 192.168.1.35 to a third (**C** in the example).

You assign the LAN IP addresses to the devices (**A** to **D**) connected to your NBG4615. The ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet. All traffic coming from **A** to **D** going out to the Internet use the IP address of the NBG4615, which is 192.168.1.1.

Figure 108 NAT Example



This chapter discusses how to configure NAT on the NBG4615.

Note: You must create a firewall rule in addition to setting up NAT, to allow traffic from the WAN to be forwarded through the NBG4615.

20.1.1 What You Can Do

- Use the **General** screen to enable NAT and set a default server (Section 20.2 on page 173).
- Use the **Application** screen to change your NBG4615's port forwarding settings (Section 20.3 on page 174).

- Use the **Advanced** screen to change your NBG4615's trigger port settings (Section 20.5.3 on page 178).

20.1.2 What You Need To Know

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

Inside/Outside

This denotes where a host is located relative to the NBG4615, for example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/Local

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

Note: Inside/outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet.

An inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side. The following table summarizes this information.

Table 68 NAT Definitions

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

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

What NAT Does

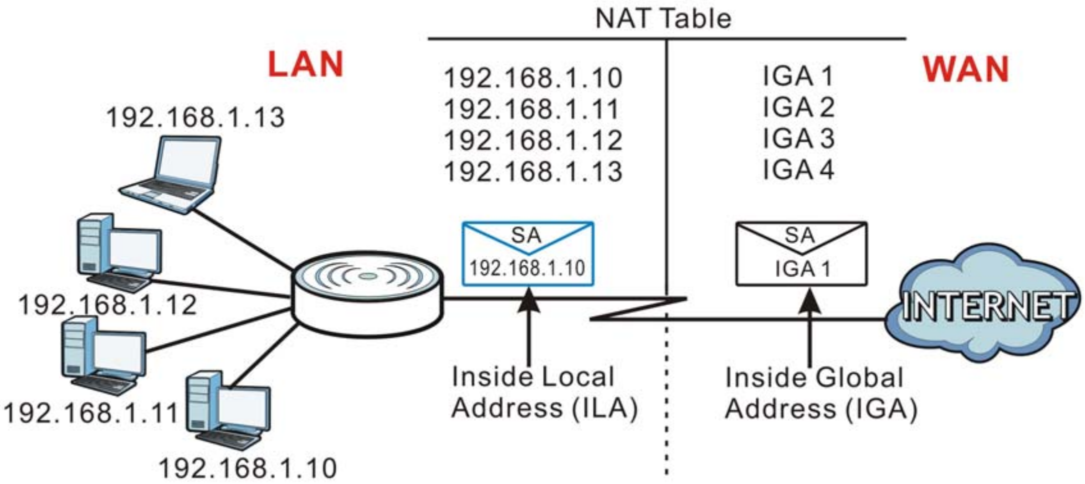
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address)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

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers, for example, a web server and a telnet server, on your local network and make them accessible to the outside world. If you do not define any servers , NAT offers the additional benefit of firewall protection. With no servers defined, your NBG4615 filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to *RFC 1631*, *The IP Network Address Translator (NAT)*.

How NAT Works

Each packet has two addresses – a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address in each packet and then forwards it to the Internet. The NBG4615 keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored. The following figure illustrates this.

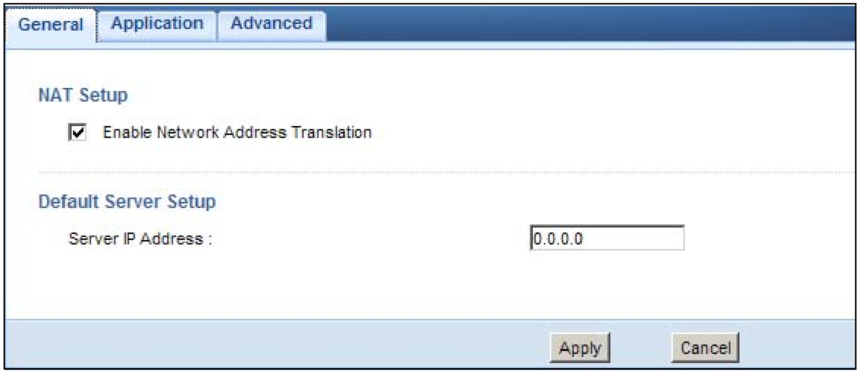
Figure 109 How NAT Works



20.2 General

Use this screen to enable NAT and set a default server. Click **Network > NAT** to open the **General** screen.

Figure 110 Network > NAT > General



NAT Setup

☑ Enable Network Address Translation

Default Server Setup

Server IP Address : 0.0.0.0

The following table describes the labels in this screen.

Table 69 Network > NAT > General

LABEL	DESCRIPTION
NAT Setup	
Enable Network Address Translation	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network (for example a private IP address used in a local network) to a different IP address known within another network (for example a public IP address used on the Internet). Select the check box to enable NAT.
Default Server Setup	
Server IP Address	In addition to the servers for specified services, NAT supports a default server. A default server receives packets from ports that are not specified in the **Application** screen. If you do not assign a **Default Server IP address**, the NBG4615 discards all packets received for ports that are not specified in the **Application** screen or remote management.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

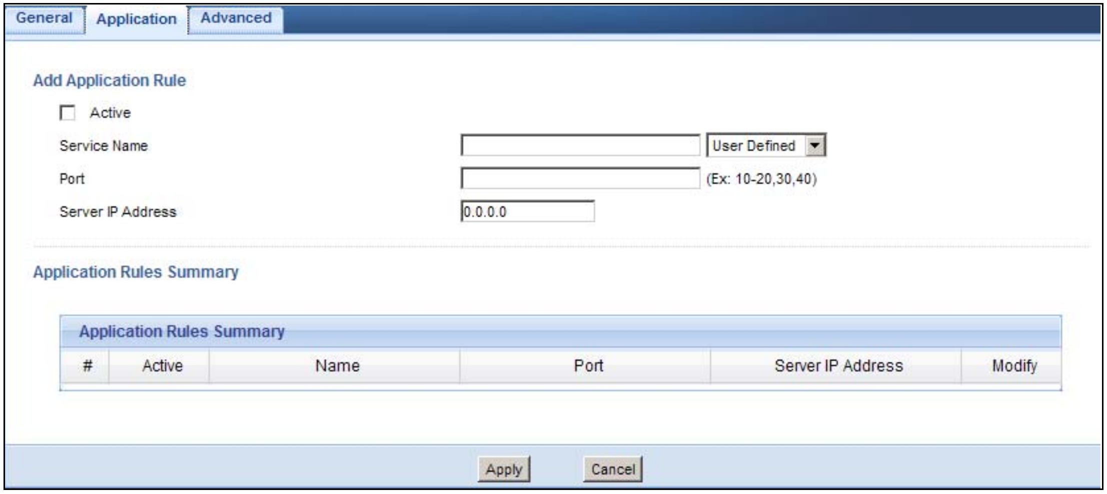
20.3 Application

Port forwarding allows you to define the local servers to which the incoming services will be forwarded. To change your NBG4615's port forwarding settings, click **Network > NAT** > **Application**. The screen appears as shown.

Note: If you do not assign a **Default Server IP address** in the **NAT > General** screen, the NBG4615 discards all packets received for ports that are not specified in this screen or remote management.

Refer to Appendix F on page 305 for port numbers commonly used for particular services.

Figure 111 Network > NAT > Application



Add Application Rule

□ Active

Service Name [ ] User Defined ▾

Port [ ] (Ex: 10-20,30,40)

Server IP Address 0.0.0.0

Application Rules Summary

Application Rules Summary					
#	Active	Name	Port	Server IP Address	Modify

The following table describes the labels in this screen.

Table 70 Network > NAT > Application

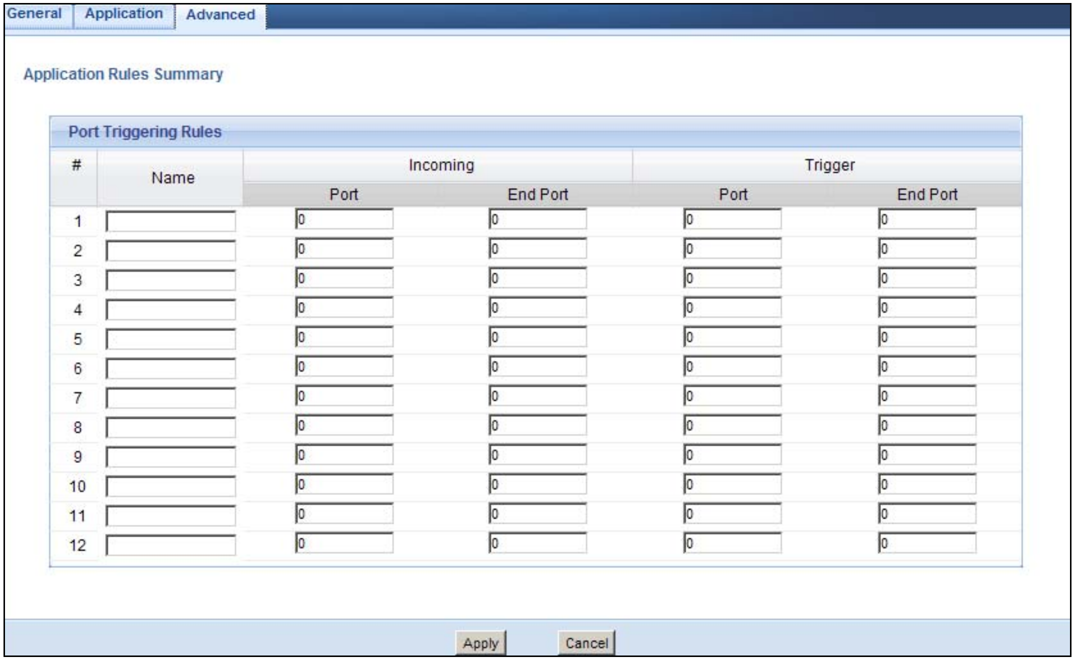
LABEL	DESCRIPTION
Add Application Rule	
Active	Select the check box to enable this rule and the requested service can be forwarded to the host with a specified internal IP address. Clear the checkbox to disallow forwarding of these ports to an inside server without having to delete the entry.
Service Name	Type a name (of up to 31 printable characters) to identify this rule in the first field next to **Service Name**. Otherwise, select a predefined service in the second field next to **Service Name**. The predefined service name and port number(s) will display in the **Service Name** and **Port** fields.
Port	Enter the start and end port(s) to be forwarded.
Server IP Address	Type the inside IP address of the server that receives packets from the port(s) specified in the **Port** field.
Application Rules Summary	
#	This is the number of an individual port forwarding server entry.
Active	This icon is turned on when the rule is enabled.
Name	This field displays a name to identify this rule.
Port	This field displays the port number(s).
Server IP Address	This field displays the inside IP address of the server.
Modify	Click the **Edit** icon to display and modify an existing rule setting in the fields under **Add Application Rule**. Click the **Remove** icon to delete a rule.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20.4 Advanced

To change your NBG4615's trigger port settings, click **Network > NAT > Advanced**. The screen appears as shown.

Note: Only one LAN computer can use a trigger port (range) at a time.

Figure 112 Network > NAT > Advanced



Application Rules Summary

Port Triggering Rules

#	Name	Incoming		Trigger	
		Port	End Port	Port	End Port
1		0	0	0	0
2		0	0	0	0
3		0	0	0	0
4		0	0	0	0
5		0	0	0	0
6		0	0	0	0
7		0	0	0	0
8		0	0	0	0
9		0	0	0	0
10		0	0	0	0
11		0	0	0	0
12		0	0	0	0

The following table describes the labels in this screen.

Table 71 Network > NAT > Advanced

LABEL	DESCRIPTION
#	This is the rule index number (read-only).
Name	Type a unique name (up to 15 characters) for identification purposes. All characters are permitted - including spaces.
Incoming	Incoming is a port (or a range of ports) that a server on the WAN uses when it sends out a particular service. The NBG4615 forwards the traffic with this port (or range of ports) to the client computer on the LAN that requested the service.
Port	Type a port number or the starting port number in a range of port numbers.
End Port	Type a port number or the ending port number in a range of port numbers.
Trigger	The trigger port is a port (or a range of ports) that causes (or triggers) the NBG4615 to record the IP address of the LAN computer that sent the traffic to a server on the WAN.
Port	Type a port number or the starting port number in a range of port numbers.
End Port	Type a port number or the ending port number in a range of port numbers.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20.5 Technical Reference

The following section contains additional technical information about the NBG4615 features described in this chapter.

20.5.1 NATPort Forwarding: Services and Port Numbers

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

Use the **Application** screen to forward incoming service requests to the server(s) on your local network. You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers.

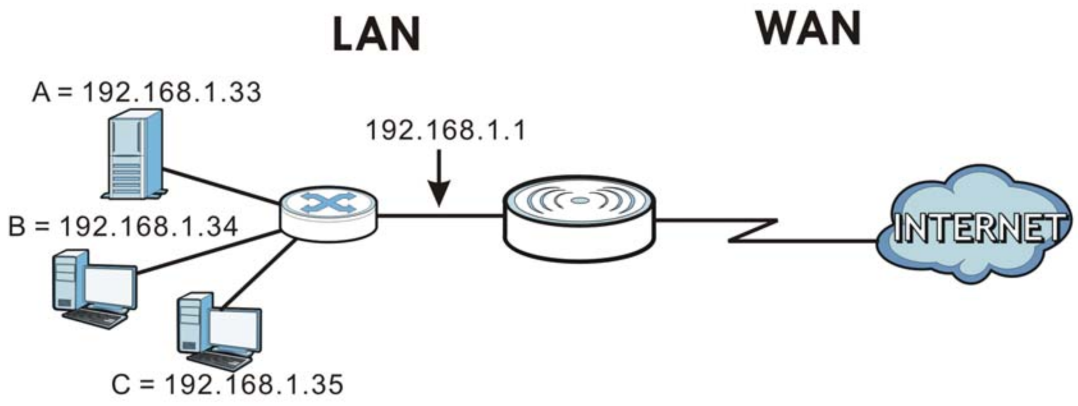
In addition to the servers for specified services, NAT supports a default server. A service request that does not have a server explicitly designated for it is forwarded to the default server. If the default is not defined, the service request is simply discarded.

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

20.5.2 NAT Port Forwarding Example

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

Figure 113 Multiple Servers Behind NAT Example



20.5.3 Trigger Port Forwarding

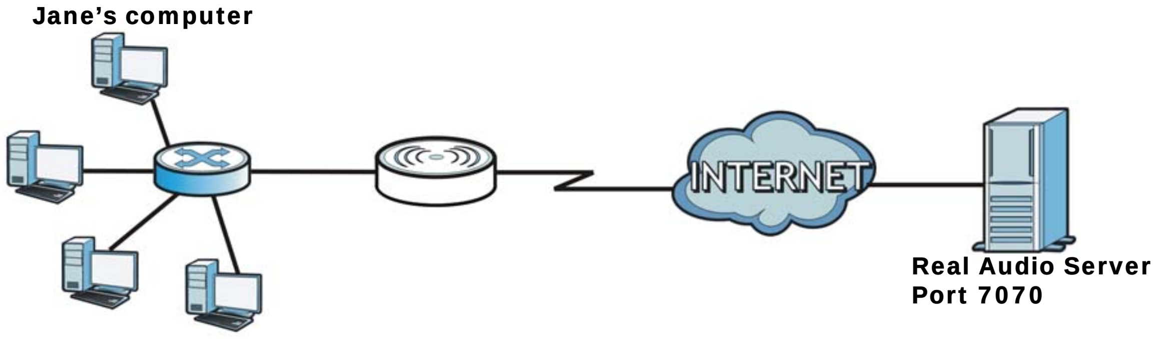
Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem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

Trigger port forwarding solves this problem by allowing computers on the LAN to dynamically take turns using the service. The NBG4615 records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the NBG4615's WAN port receives a response with a specific port number and protocol ("incoming" port), the NBG4615 forwards the traffic to the LAN IP address of the computer that sent the request. After that computer’s connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

20.5.4 Trigger Port Forwarding Example

The following is an example of trigger port forwarding.

Figure 114 Trigger Port Forwarding Process: Example



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

2 Port 7070 is a “trigger” port and causes the NBG4615 to record Jane’s computer IP address. The NBG4615 associates Jane's computer IP address with the "incoming" port range of 6970-7170.

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

4 The NBG4615 forwards the traffic to Jane’s computer IP address.

5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The NBG4615 times out in three minutes with UDP (User Datagram Protocol), or two hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

20.5.5 Two Points To Remember About Trigger Ports

1 Trigger events only happen on data that is going coming from inside the NBG4615 and going to the outside.

2 If an application needs a continuous data stream, that port (range) will be tied up so that another computer on the LAN can’t trigger it.

21

DDNS

21.1 Overview

DDNS services let you use a domain name with a dynamic IP address.

21.1.1 What You Need To Know

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

What is DDNS?

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

DynDNS Wildcard

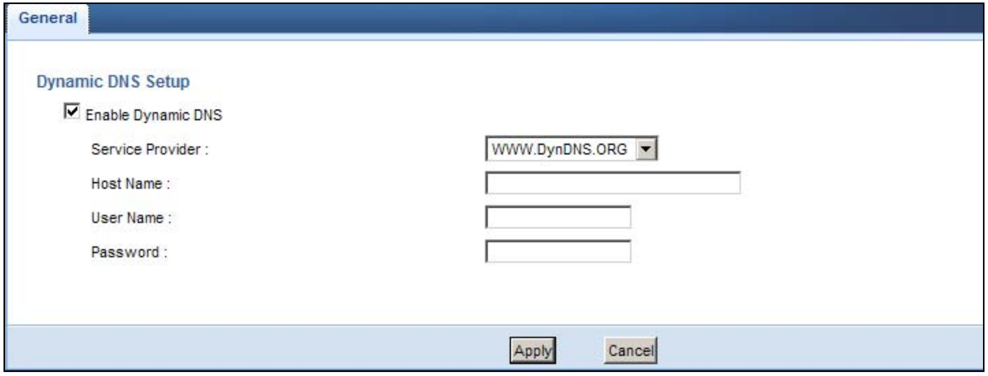
Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

Note: If you have a private WAN IP address, then you cannot use Dynamic DNS. You must have a public WAN IP address.

21.2 General

To change your NBG4615’s DDNS, click **Network > DDNS**. The screen appears as shown.

Figure 115 Dynamic DNS



Dynamic DNS Setup

☑ Enable Dynamic DNS

Service Provider : WWW.DynDNS.ORG

Host Name :

User Name :

Password :

The following table describes the labels in this screen.

Table 72 Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Enable Dynamic DNS	Select this check box to use dynamic DNS.
Service Provider	Select the name of your Dynamic DNS service provider.
Host Name	Enter a host names in the field provided. You can specify up to two host names in the field separated by a comma (",").
User Name	Enter your user name.
Password	Enter the password assigned to you.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

22

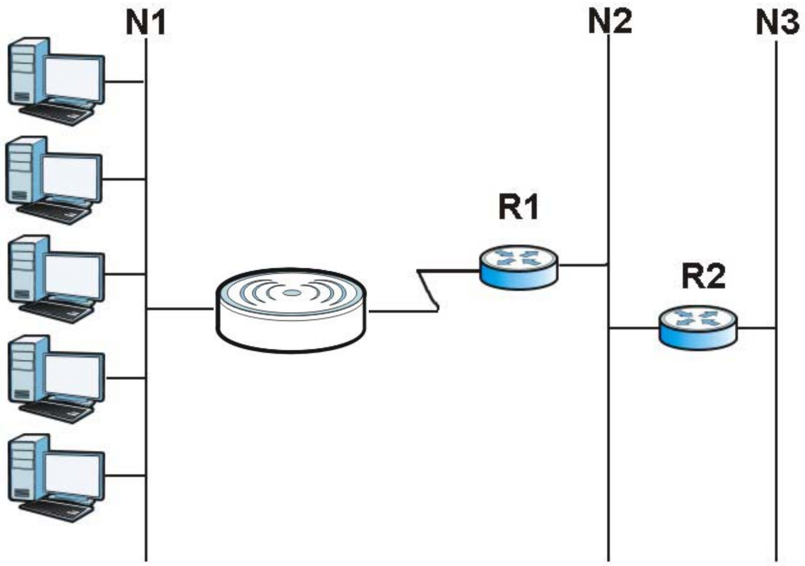
Static Route

22.1 Overview

This chapter shows you how to configure static routes for your NBG4615.

Each remote node specifies only the network to which the gateway is directly connected, and the NBG4615 has no knowledge of the networks beyond. For instance, the NBG4615 knows about network N2 in the following figure through remote node Router 1. However, the NBG4615 is unable to route a packet to network N3 because it doesn't know that there is a route through the same remote node Router 1 (via gateway Router 2). The static routes are for you to tell the NBG4615 about the networks beyond the remote nodes.

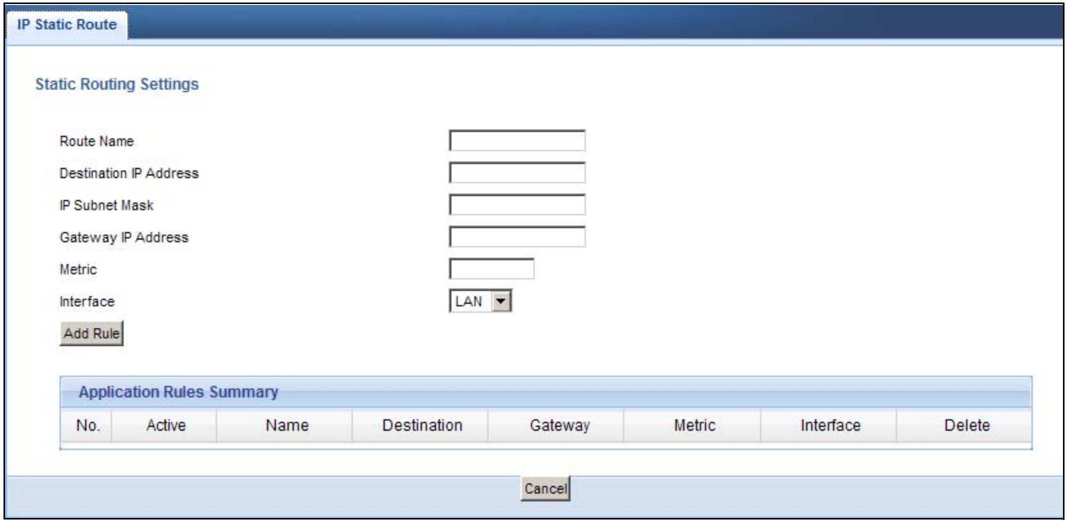
Figure 116 Example of Static Routing Topology



22.2 IP Static Route Screen

Click **Network > Static Route** to open the **IP Static Route** screen.

Figure 117 Network > Static Route



The following table describes the labels in this screen.

Table 73 Network > Static Route

LABEL	DESCRIPTION
Static Routing Settings	
Route Name	Enter a the name that describes or identifies this route.
Destination IP Address	Enter the IP network address of the final destination.
IP Subnet Netmask	This is the subnet to which the route’s final destination belongs.
Gateway IP Address	Enter the IP address of the gateway.
Metric	Assign a number to identify the route.
Interface	Select the interface through which the traffic is routed.
Add Rule	Click this to add the IP static route.
Application Rules Summary	
No.	This is the number of an individual static route.
Active	The rules are always on and this is indicated by the icon.
Name	This is the name that describes or identifies this route.
Destination	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
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.
Metric	This is the number assigned to the route.
Delete	Click the **Delete** icon to remove a static route from the NBG4615. A window displays asking you to confirm that you want to delete the route.
Cancel	Click **Cancel** to begin configuring this screen afresh.

23

RIP

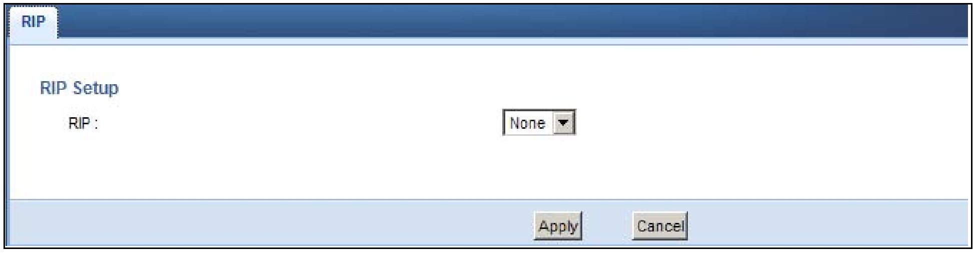
23.1 Overview

Routing Information Protocol (RIP) is an interior or intra-domain routing protocol that uses distance-vector routing algorithms. RIP is used on the Internet and is common in the NetWare environment as a method for exchanging routing information between routers.

23.2 RIP Screen

Use this screen to enable RIPv1 or RIPv2, which are LAN broadcast protocols. Click **Network > RIP**. The screen appears as shown.

Figure 118 Network > RIP



RIP Setup

RIP : None

The following table describes the labels in this screen.

Table 74 Network > RIP

LABEL	DESCRIPTION
RIP	Select the **RIPv1** or **RIPv2** you want the NBG4615 to use. Otherwise select **None**.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

Firewall

24.1 Overview

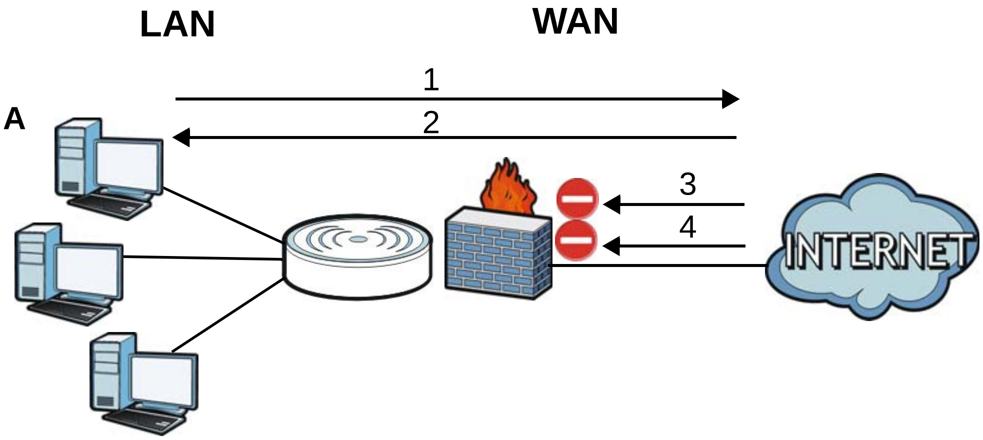
Use these screens to enable and configure the firewall that protects your NBG4615 and your LAN from unwanted or malicious traffic.

Enable the firewall to protect your LAN computers from attacks by hackers on the Internet and control access between the LAN and WAN. By default the firewall:

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

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

Figure 119 Default Firewall Action



24.1.1 What You Can Do

- Use the **General** screen to enable or disable the NBG4615’s firewall (Section 24.2 on page 189).
- Use the **Services** screen enable service blocking, enter/delete/modify the services you want to block and the date/time you want to block them (Section 24.3 on page 189).

24.1.2 What You Need To Know

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

What is a Firewall?

Originally, the term “firewall” referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term "firewall" is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from a network that is not trusted. Of course, firewalls cannot solve every security problem. A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

Stateful Inspection Firewall

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also "inspect" the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency; however, they may lack the granular application level access control or caching that some proxies support. Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

About the NBG4615 Firewall

The NBG4615’s firewall feature physically separates the LAN and the WAN and acts as a secure gateway for all data passing between the networks.

It is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated (click the **General** tab under **Firewall** and then click the **Enable Firewall** check box). The NBG4615's purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The NBG4615 can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network.

The NBG4615 is installed between the LAN and a broadband modem connecting to the Internet. This allows it to act as a secure gateway for all data passing between the Internet and the LAN.

The NBG4615 has one Ethernet WAN port and four Ethernet LAN ports, which are used to physically separate the network into two areas.The WAN (Wide Area Network) port attaches to the broadband (cable or DSL) modem to the Internet.

The LAN (Local Area Network) port attaches to a network of computers, which needs security from the outside world. These computers will have access to Internet services such as e-mail, FTP and the World Wide Web. However, "inbound access" is not allowed (by default) unless the remote host is authorized to use a specific service.

Guidelines For Enhancing Security With Your Firewall

1. Change the default password via Web Configurator.
2. Think about access control before you connect to the network in any way, including attaching a modem to the port.
3. Limit who can access your router.

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

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

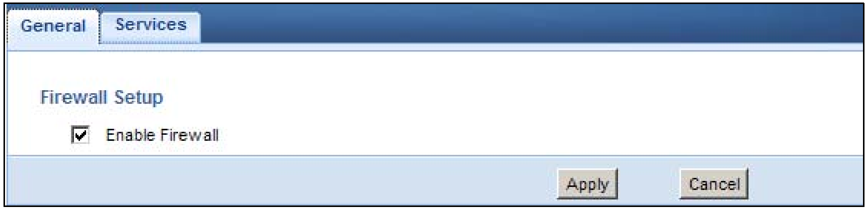
6 Protect against IP spoofing by making sure the firewall is active.

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

24.2 General

Use this screen to enable or disable the NBG4615’s firewall, and set up firewall logs. Click **Security** > **Firewall** to open the **General** screen.

Figure 120 Security > Firewall > General l



☑ Enable Firewall

The following table describes the labels in this screen.

Table 75 Security > Firewall > General

LABEL	DESCRIPTION
Enable Firewall	Select this check box to activate the firewall. The NBG4615 performs access control and protects against Denial of Service (DoS) attacks when the firewall is activated.
Apply	Click **Apply** to save the settings.
Cancel	Click **Cancel** to start configuring this screen again.

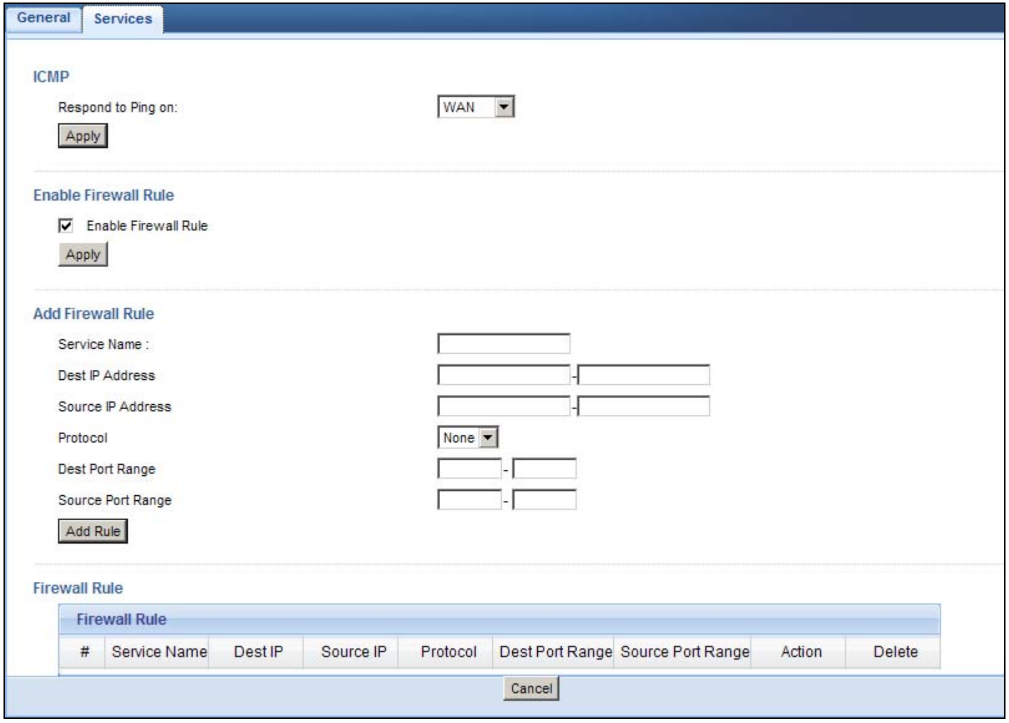
24.3 Services

If an outside user attempts to probe an unsupported port on your NBG4615, an ICMP response packet is automatically returned. This allows the outside user to know the NBG4615 exists. Use this screen to prevent the ICMP response packet from being sent. This keeps outsiders from discovering your NBG4615 when unsupported ports are probed.

You can also use this screen to enable service blocking, enter/delete/modify the services you want to block and the date/time you want to block them.

Click **Security** > **Firewall** > **Services**. The screen appears as shown next.

Figure 121 Security > Firewall > Services I



General | Services

ICMP

Respond to Ping on: WAN ▾

Apply

Enable Firewall Rule

☑ Enable Firewall Rule

Apply

Add Firewall Rule

Service Name :

Dest IP Address -

Source IP Address -

Protocol None ▾

Dest Port Range -

Source Port Range -

Add Rule

Firewall Rule

#	Service Name	Dest IP	Source IP	Protocol	Dest Port Range	Source Port Range	Action	Delete

Cancel

The following table describes the labels in this screen.

Table 76 Security > Firewall > Services

LABEL	DESCRIPTION
LABEL	**DESCRIPTION**
ICMP	Internet Control Message Protocol is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.
Respond to Ping on	The NBG4615 will not respond to any incoming Ping requests when **Disable** is selected. Select **WAN** to reply to incoming WAN Ping requests.
Apply	Click **Apply** to save the settings.
Enable Firewall Rule	
Enable Firewall Rule	Select this check box to activate the firewall rules that you define (see **Add Firewall Rule** below).
Apply	Click **Apply** to save the settings.
Add Firewall Rule	
Service Name	Enter a name that identifies or describes the firewall rule.
Dest IP Address	Enter the IP address of the computer to which traffic for the application or service is entering. The NBG4615 applies the firewall rule to traffic initiating from this computer.
Source IP Address	Enter the IP address of the computer that initializes traffic for the application or service. The NBG4615 applies the firewall rule to traffic initiating from this computer.

Table 76 Security > Firewall > Services (continued)

LABEL	DESCRIPTION
Protocol	Select the protocol (**ALL**,**TCP**, **UDP** or **BOTH**) used to transport the packets for which you want to apply the firewall rule.
Dest Port Range	Enter the port number/range of the destination that define the traffic type, for example TCP port 80 defines web traffic.
Source Port Range	Enter the port number/range of the source that define the traffic type, for example TCP port 80 defines web traffic.
Add Rule	Click **Add** to save the firewall rule.
Firewall Rule	
#	This is your firewall rule number. The ordering of your rules is important as rules are applied in turn.
Service Name	This is a name that identifies or describes the firewall rule.
Dest IP	This is the IP address of the computer to which traffic for the application or service is entering.
Source IP	This is the IP address of the computer from which traffic for the application or service is initialized.
Protocol	This is the protocol (**ALL**,**TCP**, **UDP** or **BOTH**) used to transport the packets for which you want to apply the firewall rule.
Dest Port Range	This is the port number/range of the destination that define the traffic type, for example TCP port 80 defines web traffic.
Source Port Range	This is the port number/range of the source that define the traffic type, for example TCP port 80 defines web traffic.
Action	**Drop** - Traffic matching the conditions of the firewall rule are stopped.
Delete	Click **Delete** to remove the firewall rule.
Cancel	Click **Cancel** to start configuring this screen again.

See Appendix F on page 305 for commonly used services and port numbers.

25

Content Filtering

25.1 Overview

This chapter provides a brief overview of content filtering using the embedded web GUI.

Internet content filtering allows you to create and enforce Internet access policies tailored to your needs. Content filtering is the ability to block certain web features or specific URL keywords.

25.1.1 What You Need To Know

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

Content Filtering Profiles

Content filtering allows you to block certain web features, such as cookies, and/or block access to specific web sites. For example, you can configure one policy that blocks John Doe's access to arts and entertainment web pages.

A content filtering profile conveniently stores your custom settings for the following features.

Keyword Blocking URL Checking

The NBG4615 checks the URL's domain name (or IP address) and file path separately when performing keyword blocking.

The URL's domain name or IP address is the characters that come before the first slash in the URL. For example, with the URL www.zyxel.com.tw/news/pressroom.php, the domain name is www.zyxel.com.tw.

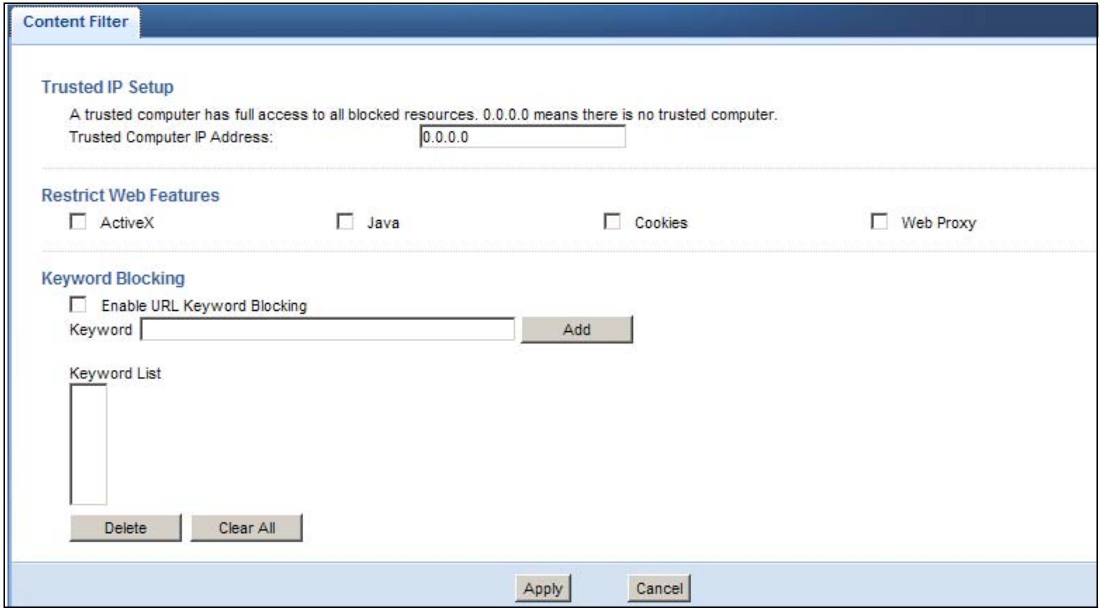
The file path is the characters that come after the first slash in the URL. For example, with the URL www.zyxel.com.tw/news/pressroom.php, the file path is news/pressroom.php.

Since the NBG4615 checks the URL's domain name (or IP address) and file path separately, it will not find items that go across the two. For example, with the URL www.zyxel.com.tw/news/pressroom.php, the NBG4615 would find "tw" in the domain name (www.zyxel.com.tw). It would also find "news" in the file path (news/pressroom.php) but it would not find "tw/news".

25.2 Content Filter

Use this screen to restrict web features, add keywords for blocking and designate a trusted computer. Click **Security** > **Content Filter** to open the **Content Filter** screen.

Figure 122 Security > Content Filter



A trusted computer has full access to all blocked resources. 0.0.0.0 means there is no trusted computer.

Trusted Computer IP Address: 0.0.0.0

The following table describes the labels in this screen.

Table 77 Security > Content Filter

LABEL	DESCRIPTION
Trusted IP Setup	To enable this feature, type an IP address of any one of the computers in your network that you want to have as a trusted computer. This allows the trusted computer to have full access to all features that are configured to be blocked by content filtering. Leave this field blank to have no trusted computers.
Restrict Web Features	Select the box(es) to restrict a feature. When you download a page containing a restricted feature, that part of the web page will appear blank or grayed out.
ActiveX	A tool for building dynamic and active Web pages and distributed object applications. When you visit an ActiveX Web site, ActiveX controls are downloaded to your browser, where they remain in case you visit the site again.
Java	A programming language and development environment for building downloadable Web components or Internet and intranet business applications of all kinds.
Cookies	Used by Web servers to track usage and provide service based on ID.
Web Proxy	A server that acts as an intermediary between a user and the Internet to provide security, administrative control, and caching service. When a proxy server is located on the WAN it is possible for LAN users to circumvent content filtering by pointing to this proxy server.
Enable URL Keyword Blocking	The NBG4615 can block Web sites with URLs that contain certain keywords in the domain name or IP address. For example, if the keyword "bad" was enabled, all sites containing this keyword in the domain name or IP address will be blocked, e.g., URL http://www.website.com/bad.html would be blocked. Select this check box to enable this feature.

Table 77 Security > Content Filter (continued)

LABEL	DESCRIPTION
Keyword	Type a keyword in this field. You may use any character (up to 64 characters). Wildcards are not allowed. You can also enter a numerical IP address.
Keyword List	This list displays the keywords already added.
Add	Click **Add** after you have typed a keyword. Repeat this procedure to add other keywords. Up to 64 keywords are allowed. When you try to access a web page containing a keyword, you will get a message telling you that the content filter is blocking this request.
Delete	Highlight a keyword in the lower box and click **Delete** to remove it. The keyword disappears from the text box after you click **Apply**.
Clear All	Click this button to remove all of the listed keywords.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to begin configuring this screen afresh

25.3 Technical Reference

The following section contains additional technical information about the NBG4615 features described in this chapter.

25.3.1 Customizing Keyword Blocking URL Checking

You can use commands to set how much of a website’s URL the content filter is to check for keyword blocking. See the appendices for information on how to access and use the command interpreter.

Domain Name or IP Address URL Checking

By default, the NBG4615 checks the URL’s domain name or IP address when performing keyword blocking.

This means that the NBG4615 checks the characters that come before the first slash in the URL.

For example, with the URL www.zyxel.com.tw/news/pressroom.php, content filtering only searches for keywords within www.zyxel.com.tw.

Full Path URL Checking

Full path URL checking has the NBG4615 check the characters that come before the last slash in the URL.

For example, with the URL www.zyxel.com.tw/news/pressroom.php, full path URL checking searches for keywords within www.zyxel.com.tw/news/.

Use the `ip urlfilter customize actionFlags 6 [disable | enable]` command to extend (or not extend) the keyword blocking search to include the URL's full path.

File Name URL Checking

Filename URL checking has the NBG4615 check all of the characters in the URL.

For example, filename URL checking searches for keywords within the URL www.zyxel.com.tw/news/pressroom.php.

Use the `ip urlfilter customize actionFlags 8 [disable | enable]` command to extend (or not extend) the keyword blocking search to include the URL's complete filename.

Bandwidth Management

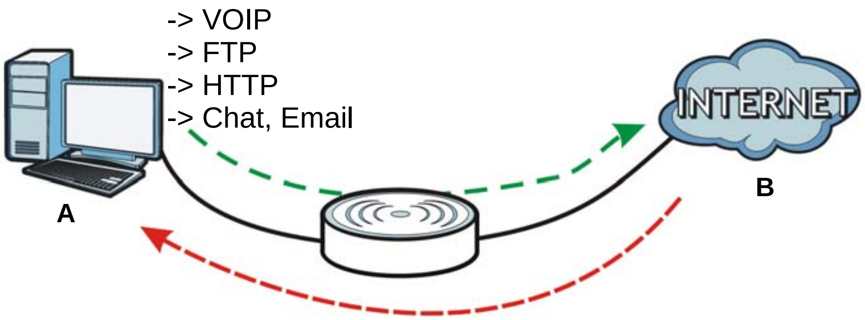
26.1 Overview

This chapter contains information about configuring bandwidth management and editing rules.

ZyXEL's Bandwidth Management allows you to specify bandwidth management rules based on an application.

In the figure below, uplink traffic goes from the LAN device (**A**) to the WAN device (**B**). Bandwidth management is applied before sending the packets out to the WAN. Downlink traffic comes back from the WAN device (**B**) to the LAN device (**A**). Bandwidth management is applied before sending the traffic out to LAN.

Figure 123 Bandwidth Management Example



You can allocate specific amounts of bandwidth capacity (bandwidth budgets) to individual applications (like VoIP, Web, FTP, and E-mail for example).

26.2 What You Can Do

- Use the **General** screen to enable bandwidth management and assign bandwidth values (Section 26.4 on page 198).
- Use the **Advanced** screen to configure bandwidth managements rule for the pre-defined services and applications (Section 26.5 on page 198).
- Use the **Monitor** screen to view the amount of network bandwidth that applications running in the network are using (Section 26.6 on page 203).

26.3 What You Need To Know

The sum of the bandwidth allotments that apply to the WAN interface (LAN to WAN, WLAN to WAN) must be less than or equal to the **Upstream Bandwidth** that you configure in the **Bandwidth Management Advanced** screen (Section 26.5 on page 198).

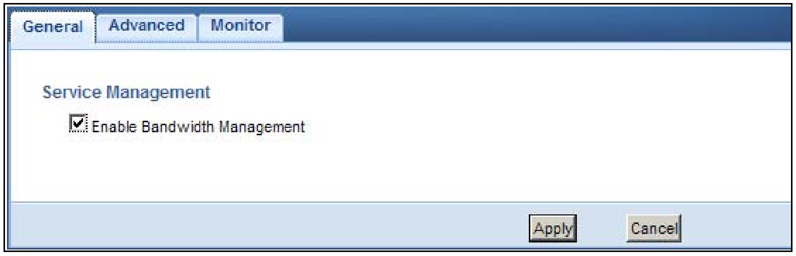
The sum of the bandwidth allotments that apply to the LAN interface (WAN to LAN, WAN to WLAN) must be less than or equal to the **Downstream Bandwidth** that you configure in the **Bandwidth Management Advanced** screen Section 26.5 on page 198.

26.4 General Screen

Use this screen to have the NBG4615 apply bandwidth management.

Click **Management > Bandwidth MGMT** to open the bandwidth management **General** screen.

Figure 124 Management > Bandwidth Management > General



The following table describes the labels in this screen.

Table 78 Management > Bandwidth Management > General

LABEL	DESCRIPTION
Enable Bandwidth Management	This field allows you to have NBG4615 apply bandwidth management. Enable bandwidth management to give traffic that matches a bandwidth rule priority over traffic that does not match a bandwidth rule. Enabling bandwidth management also allows you to control the maximum or minimum amounts of bandwidth that can be used by traffic that matches a bandwidth rule.
Apply	Click **Apply** to save your customized settings.
Cancel	Click **Cancel** to begin configuring this screen afresh.

26.5 Advanced Screen

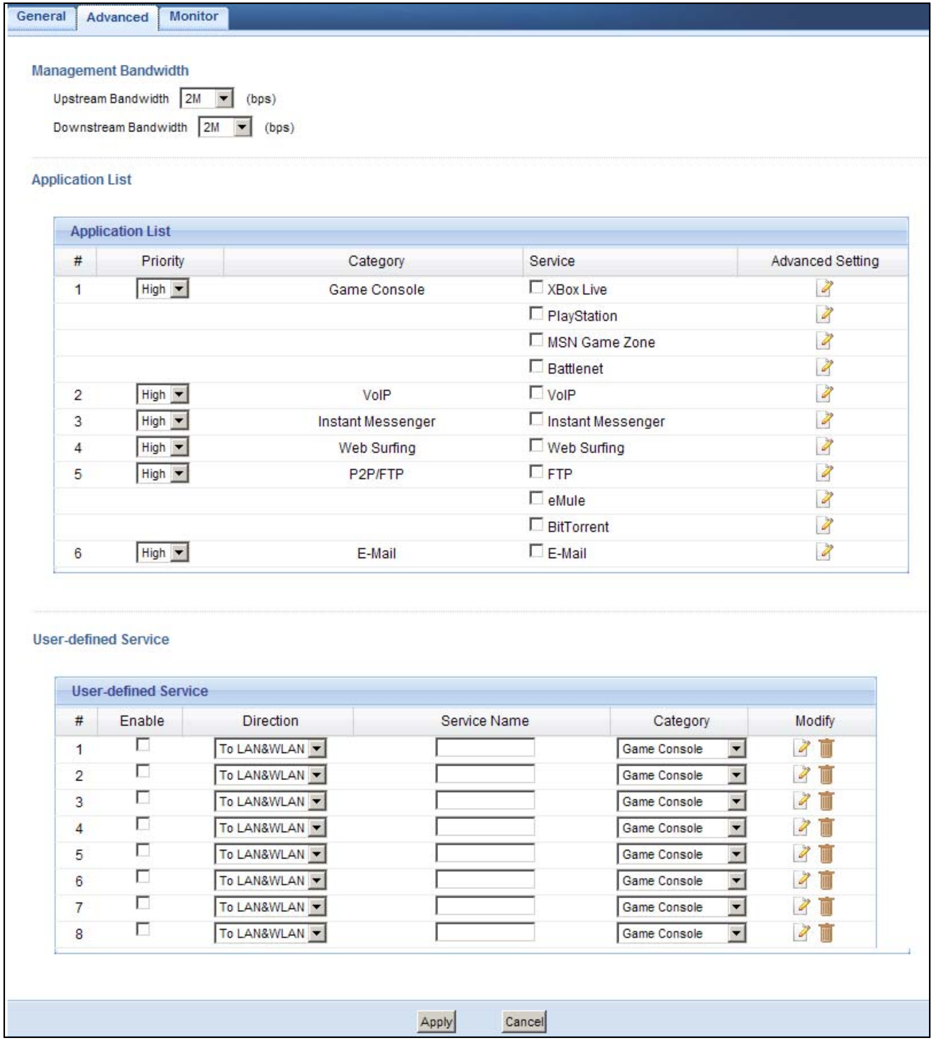
Use this screen to configure bandwidth management rules for the pre-defined services or applications.

You can also use this screen to configure bandwidth management rule for other services or applications that are not on the pre-defined list of NBG4615. Additionally, you can define the source and destination IP addresses and port for a service or application.

Note: The two tables shown in this screen can be configured and applied at the same time.

Click **Management** > **Bandwidth Management** > **Advanced** to open the bandwidth management **Advanced** screen.

Figure 125 Management > Bandwidth Management > Advanced



Management Bandwidth

Upstream Bandwidth 2M (bps)

Downstream Bandwidth 2M (bps)

Application List

Application List

#	Priority	Category	Service	Advanced Setting
1	High	Game Console	□ XBox Live	✎
			□ PlayStation	✎
			□ MSN Game Zone	✎
			□ Battlenet	✎
2	High	VoIP	□ VoIP	✎
3	High	Instant Messenger	□ Instant Messenger	✎
4	High	Web Surfing	□ Web Surfing	✎
5	High	P2P/FTP	□ FTP	✎
			□ eMule	✎
			□ BitTorrent	✎
6	High	E-Mail	□ E-Mail	✎

User-defined Service

User-defined Service

#	Enable	Direction	Service Name	Category	Modify
1	□	To LAN&WLAN		Game Console	✎ 🗑
2	□	To LAN&WLAN		Game Console	✎ 🗑
3	□	To LAN&WLAN		Game Console	✎ 🗑
4	□	To LAN&WLAN		Game Console	✎ 🗑
5	□	To LAN&WLAN		Game Console	✎ 🗑
6	□	To LAN&WLAN		Game Console	✎ 🗑
7	□	To LAN&WLAN		Game Console	✎ 🗑
8	□	To LAN&WLAN		Game Console	✎ 🗑

The following table describes the labels in this screen.

Table 79 Management > Bandwidth Management > Advanced

LABEL	DESCRIPTION
Management Bandwidth	
Upstream Bandwidth	Select the total amount of bandwidth (from 64 Kilobits to 32 Megabits) that you want to dedicate to uplink traffic. This is traffic from LAN/WLAN to WAN.
Downstream Bandwidth	Select the total amount of bandwidth (from 64 Kilobits to 32 Megabits) that you want to dedicate to uplink traffic. This is traffic from WAN to LAN/WLAN.

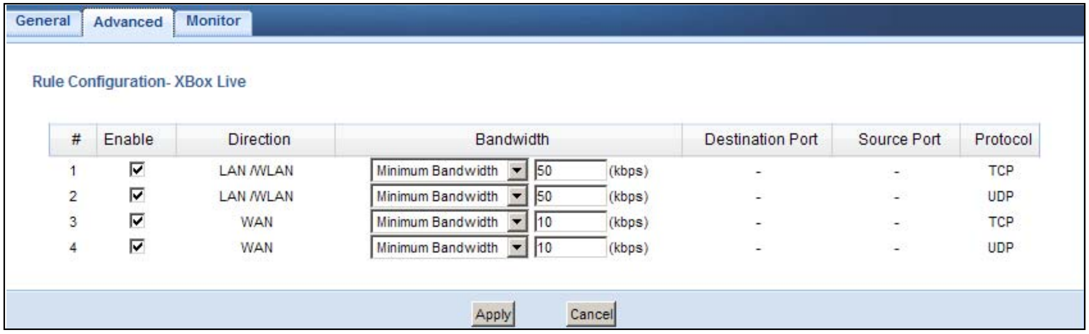
Table 79 Management > Bandwidth Management > Advanced (continued)

LABEL	DESCRIPTION
Application List	Use this table to allocate specific amounts of bandwidth based on a pre-defined service.
#	This is the number of an individual bandwidth management rule.
Priority	Select a priority from the drop down list box. Choose **High**, **Mid** or **Low**. • **High** - Select this for voice traffic or video that is especially sensitive to jitter (jitter is the variations in delay). • **Mid** - Select this for "excellent effort" or better than best effort and would include important business traffic that can tolerate some delay. • **Low** - Select this for non-critical "background" traffic such as bulk transfers that are allowed but that should not affect other applications and users.
Category	This is the category where a service belongs.
Service	This is the name of the service. Select the check box to have the NBG4615 apply this bandwidth management rule.
Advanced Setting	Click the **Edit** icon to open the **Rule Configuration** screen where you can modify the rule.
User-defined Service	Use this table to allocate specific amounts of bandwidth to specific applications or services you specify.
#	This is the number of an individual bandwidth management rule.
Enable	Select this check box to have the NBG4615 apply this bandwidth management rule.
Direction	Select To **LAN&WLAN** to apply bandwidth management to traffic from WAN to LAN and WLAN. Select **To WAN** to apply bandwidth management to traffic from LAN/WLAN to WAN.
Service Name	Enter a descriptive name for the bandwidth management rule.
Category	This is the category where a service belongs.
Modify	Click the **Edit** icon to open the **Rule Configuration** screen. Modify an existing rule or create a new rule in the **Rule Configuration** screen. See Section 26.5.2 on page 202 for more information. Click the **Remove** icon to delete a rule.
Apply	Click **Apply** to save your customized settings.
Cancel	Click **Cancel** to begin configuring this screen afresh.

26.5.1 Rule Configuration: Application Rule Configuration

If you want to edit a bandwidth management rule for a pre-defined service or application, click the **Edit** icon in the **Application List** table of the **Advanced** screen. The following screen displays.

Figure 126 Bandwidth Management Rule Configuration: Application List



Rule Configuration- XBox Live

#	Enable	Direction	Bandwidth	Destination Port	Source Port	Protocol
1	☑	LAN /WLAN	Minimum Bandwidth ▾ 50 (kbps)	-	-	TCP
2	☑	LAN /WLAN	Minimum Bandwidth ▾ 50 (kbps)	-	-	UDP
3	☑	WAN	Minimum Bandwidth ▾ 10 (kbps)	-	-	TCP
4	☑	WAN	Minimum Bandwidth ▾ 10 (kbps)	-	-	UDP

The following table describes the labels in this screen.

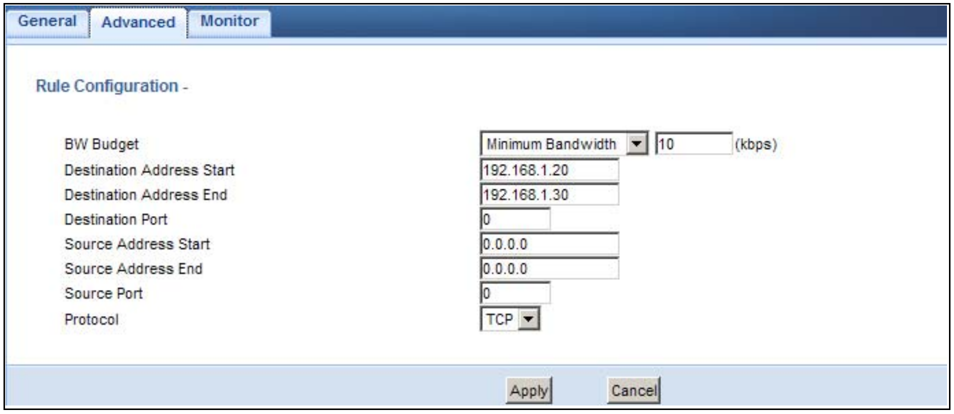
Table 80 Bandwidth Management Rule Configuration: Application List

LABEL	DESCRIPTION
#	This is the number of an individual bandwidth management rule.
Enable	Select an interface’s check box to enable bandwidth management on that interface.
Direction	These read-only labels represent the physical interfaces. Bandwidth management applies to all traffic flowing out of the router through the interface, regardless of the traffic’s source. Traffic redirect or IP alias may cause LAN-to-LAN traffic to pass through the NBG4615 and be managed by bandwidth management.
Bandwidth	Select **Maximum Bandwidth** or **Minimum Bandwidth** and specify the maximum or minimum bandwidth allowed for the rule in kilobits per second.
Destination Port	This is the port number of the destination that define the traffic type, for example TCP port 80 defines web traffic. See Appendix F on page 305 for some common services and port numbers.
Source Port	This is the port number of the source that define the traffic type, for example TCP port 80 defines web traffic. See Appendix F on page 305 for some common services and port numbers.
Protocol	This is the protocol (**TCP**, **UDP** or **user-defined**) used for the service.
Apply	Click **Apply** to save your customized settings.
Cancel	Click **Cancel** to exit this screen without saving.

26.5.2 Rule Configuration: User Defined Service Rule Configuration

If you want to edit a bandwidth management rule for other applications or services, click the **Edit** icon in the **User-defined Service** table of the **Advanced** screen. The following screen displays.

Figure 127 Bandwidth Management Rule Configuration: User-defined Service



Rule Configuration -

BW Budget: Minimum Bandwidth 10 (kbps)
Destination Address Start: 192.168.1.20
Destination Address End: 192.168.1.30
Destination Port: 0
Source Address Start: 0.0.0.0
Source Address End: 0.0.0.0
Source Port: 0
Protocol: TCP

The following table describes the labels in this screen.

Table 81 Bandwidth Management Rule Configuration: User-defined Service

LABEL	DESCRIPTION
BW Budget	Select **Maximum Bandwidth** or **Minimum Bandwidth** and specify the maximum or minimum bandwidth allowed for the rule in kilobits per second.
Destination Address Start	Enter the starting IP address of the destination computer. The NBG4615 applies bandwidth management to the service or application that is entering this computer.
Destination Address End	Enter the ending IP address of the destination computer. The NBG4615 applies bandwidth management to the service or application that is entering this computer.
Destination Port	This is the port number of the destination that define the traffic type, for example TCP port 80 defines web traffic.
Source Address Start	Enter the starting IP address of the computer that initializes traffic for the application or service. The NBG4615 applies bandwidth management to traffic initiating from this computer.
Source Address End	Enter the ending IP address of the computer that initializes traffic for the application or service. The NBG4615 applies bandwidth management to traffic initiating from this computer.
Source Port	This is the port number of the source that define the traffic type, for example TCP port 80 defines web traffic.
Protocol	Select the protocol (**TCP**, **UDP**, **BOTH**) for which the bandwidth management rule applies. If you select **BOTH**, enter the protocol for which the bandwidth management rule applies. For example, ICMP for ping traffic.
Apply	Click **Apply** to save your customized settings.
Cancel	Click **Cancel** to exit this screen without saving.

See Appendix F on page 305 for commonly used services and port numbers.

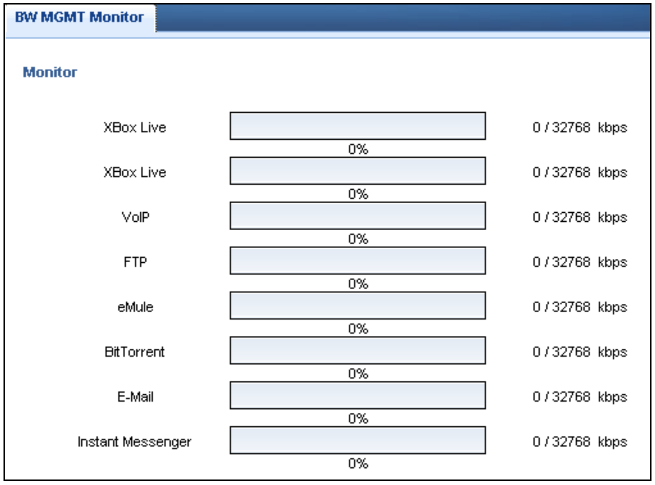
26.6 Monitor Screen

Use this screen to view the amount of network bandwidth that applications running in the network are using.

The bandwidth is measured in kilobits per second (kbps).

The monitor shows what kinds of applications are running in the network, the maximum kbps that each application can use, as well as the percentage of bandwidth it is using.

Figure 128 Management > Bandwidth Management > Monitor



Monitor

XBox Live	0%	0 / 32768 kbps
XBox Live	0%	0 / 32768 kbps
VoIP	0%	0 / 32768 kbps
FTP	0%	0 / 32768 kbps
eMule	0%	0 / 32768 kbps
BitTorrent	0%	0 / 32768 kbps
E-Mail	0%	0 / 32768 kbps
Instant Messenger	0%	0 / 32768 kbps

26.6.1 Predefined Bandwidth Management Services

The following is a description of some services that you can select and to which you can apply media bandwidth management in the **Management** > **Bandwidth Management** > **Advanced** screen.

Table 82 Media Bandwidth Management Setup: Services

SERVICE	DESCRIPTION
FTP	File Transfer Program enables fast transfer of files, including large files that may not be possible by e-mail.
WWW	The World Wide Web (WWW) is an Internet system to distribute graphical, hyper-linked information, based on Hyper Text Transfer Protocol (HTTP) - a client/server protocol for the World Wide Web. The Web is not synonymous with the Internet; rather, it is just one service on the Internet. Other services on the Internet include Internet Relay Chat and Newsgroups. The Web is accessed through use of a browser.
E-Mail	Electronic mail consists of messages sent through a computer network to specific groups or individuals. Here are some default ports for e-mail:

Table 82 Media Bandwidth Management Setup: Services (continued)

SERVICE	DESCRIPTION
VoIP (SIP)	Sending voice signals over the Internet is called Voice over IP or VoIP. Session Initiated Protocol (SIP) is an internationally recognized standard for implementing VoIP. SIP is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet. SIP is transported primarily over UDP but can also be transported over TCP.
BitTorrent	BitTorrent is a free P2P (peer-to-peer) sharing tool allowing you to distribute large software and media files. BitTorrent requires you to search for a file with a searching engine yourself. It distributes files by corporation and trading, that is, the client downloads the file in small pieces and share the pieces with other peers to get other half of the file.
Gaming	Online gaming services lets you play multiplayer games on the Internet via broadband technology. As of this writing, your NBG4615 supports Xbox, Playstation, Battlenet and MSN Game Zone.

27

Remote Management

27.1 Overview

This chapter provides information on the Remote Management screens.

Remote Management allows you to manage your NBG4615 from a remote location through the following interfaces:

- LAN and WAN
- LAN only
- WAN only

Note: The NBG4615 is managed using the Web Configurator.

27.2 What You Need to Know

Remote management over LAN or WAN will not work when:

1 The IP address in the **Secured Client IP Address** field (Section 27.3 on page 206) does not match the client IP address. If it does not match, the NBG4615 will disconnect the session immediately.

2 There is already another remote management session. You may only have one remote management session running at one time.

3 There is a firewall rule that blocks it.

27.2.1 Remote Management and NAT

When NAT is enabled:

- Use the NBG4615's WAN IP address when configuring from the WAN.
- Use the NBG4615's LAN IP address when configuring from the LAN.

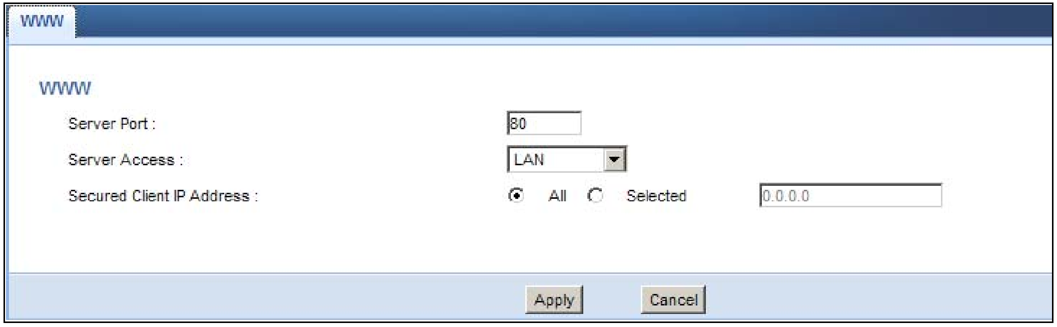
27.2.2 System Timeout

There is a default system management idle timeout of five minutes (three hundred seconds). The NBG4615 automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling. You can change the timeout period in the **System** screen

27.3 WWW Screen

To change your NBG4615’s remote management settings, click **Management > Remote Management > WWW**.

Figure 129 Management > Remote Management > WWW



WWW

Server Port : 80

Server Access : LAN

Secured Client IP Address : ● All ○ Selected 0.0.0.0

The following table describes the labels in this screen.

Table 83 Management > Remote Management > WWW

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the NBG4615 using this service.
Secured Client IP Address	Select **All** to allow all computes to access the NBG4615. Otherwise, check **Selected** and specify the IP address of the computer that can access the NBG4615.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28

Universal Plug-and-Play (UPnP)

28.1 Overview

This chapter introduces the UPnP feature in the web configurator.

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

28.2 What You Need to Know

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

28.2.1 NAT Traversal

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

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

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

See the NAT chapter for more information on NAT.

28.2.2 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 NBG4615 allows multicast messages on the LAN only.

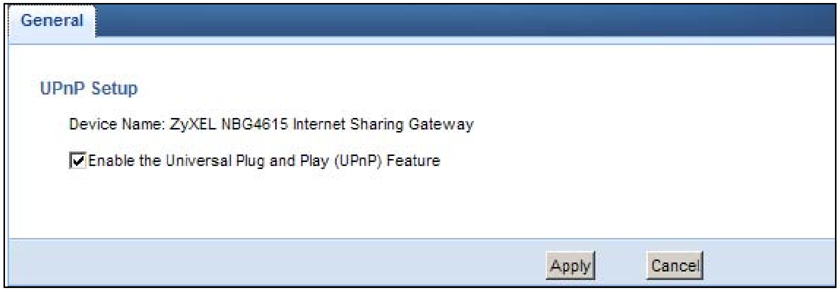
All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

28.3 UPnP Screen

Use this screen to enable UPnP on your NBG4615.

Click **Management > UPnP** to display the screen shown next.

Figure 130 Management > UPnP



Device Name: ZyXEL NBG4615 Internet Sharing Gateway

☑ Enable the Universal Plug and Play (UPnP) Feature

The following table describes the fields in this screen.

Table 84 Management > UPnP

LABEL	DESCRIPTION
Enable the Universal Plug and Play (UPnP) Feature	Select this check box to activate UPnP. Be aware that anyone could use a UPnP application to open the web configurator's login screen without entering the NBG4615's IP address (although you must still enter the password to access the web configurator).
Apply	Click **Apply** to save the setting to the NBG4615.
Cancel	Click **Cancel** to return to the previously saved settings.

28.4 Technical Reference

The sections show examples of using UPnP.

28.4.1 Using UPnP in Windows XP Example

This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the NBG4615.

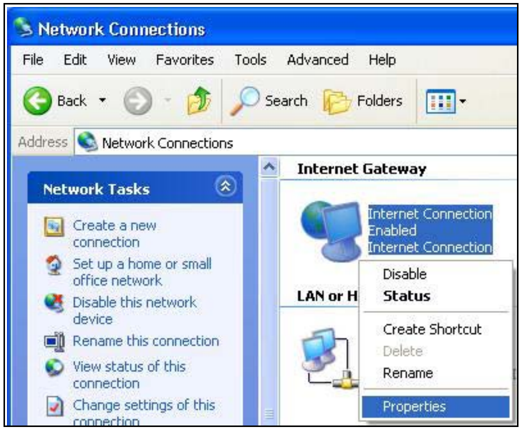
Make sure the computer is connected to a LAN port of the NBG4615. Turn on your computer and the NBG4615.

28.4.1.1 Auto-discover Your UPnP-enabled Network Device

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

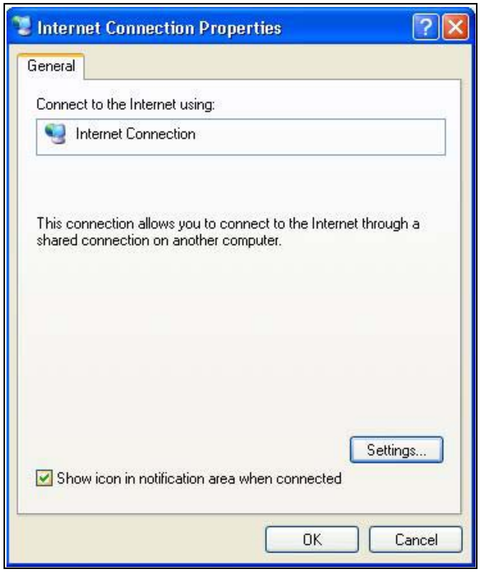
2 Right-click the icon and select **Properties**.

Figure 131 Network Connections



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

Figure 132 Internet Connection Properties



Connect to the Internet using:

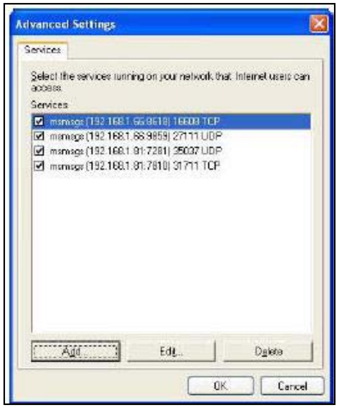
Internet Connection

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

☑ Show icon in notification area when connected

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

Figure 133 Internet Connection Properties: Advanced Settings

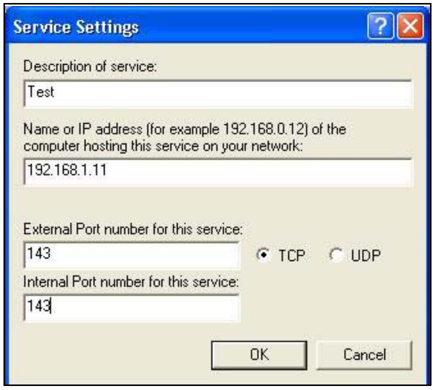


Select the services running on your network that Internet users can access.

Services

☑ msmsgs (192.168.1.66:9618) 16609 TCP
☑ msmsgs (192.168.1.66:9859) 27111 UDP
☑ msmsgs (192.168.1.81:7281) 35037 UDP
☑ msmsgs (192.168.1.81:7810) 31711 TCP

Figure 134 Internet Connection Properties: Advanced Settings: Add



Description of service:
Test

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

External Port number for this service:
143

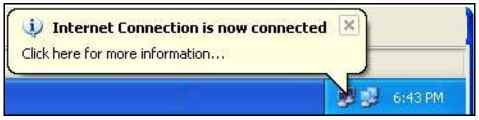
● TCP ○ UDP

Internal Port number for this service:
143

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

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

Figure 135 System Tray Icon

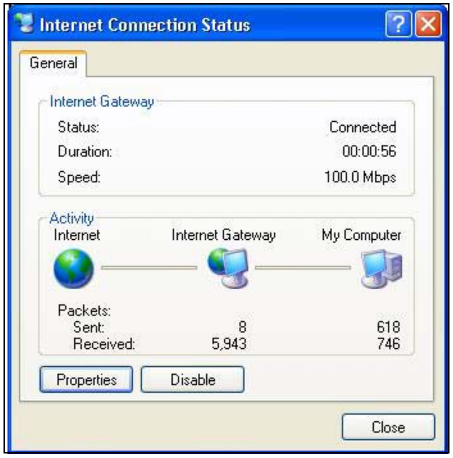


Internet Connection is now connected

Click here for more information...

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

Figure 136 Internet Connection Status



Internet Gateway

Status: Connected

Duration: 00:00:56

Speed: 100.0 Mbps

Activity

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

28.4.2 Web Configurator Easy Access

With UPnP, you can access the web-based configurator on the NBG4615 without finding out the IP address of the NBG4615 first. This comes helpful if you do not know the IP address of the NBG4615.

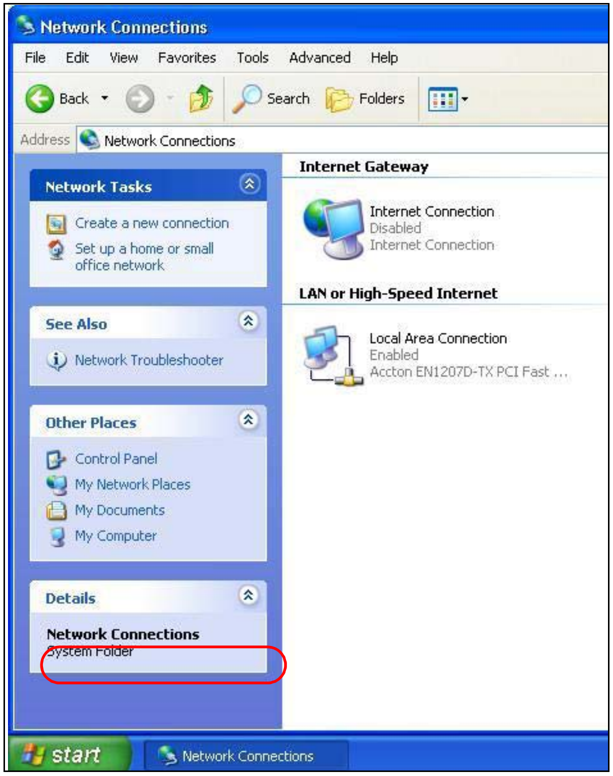
Follow the steps below to access the web configurator.

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

2 Double-click **Network Connections**.

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

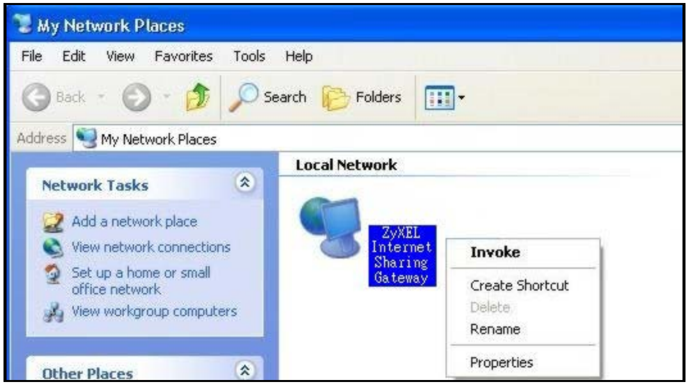
Figure 137 Network Connections



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

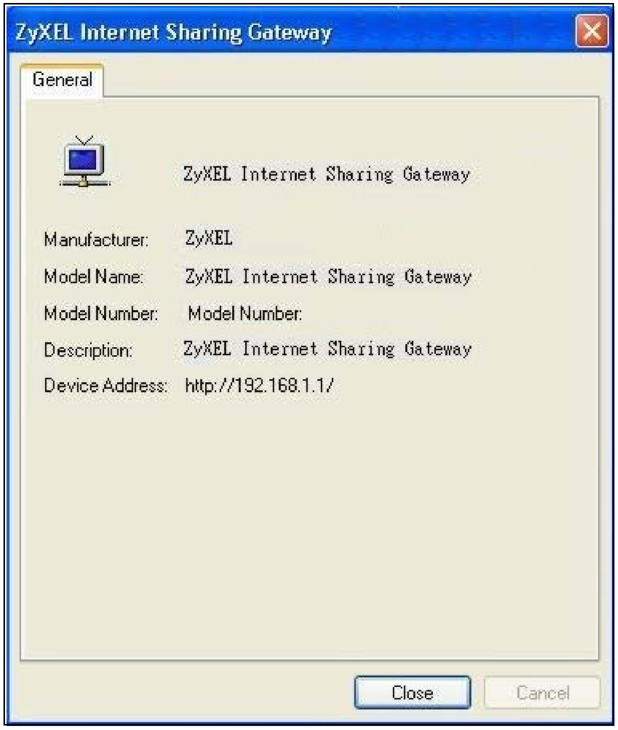
5 Right-click on the icon for your NBG4615 and select **Invoke**. The web configurator login screen displays.

Figure 138 Network Connections: My Network Places



6 Right-click on the icon for your NBG4615 and select **Properties**. A properties window displays with basic information about the NBG4615.

Figure 139 Network Connections: My Network Places: Properties: Example



ZyXEL Internet Sharing Gateway

General

ZyXEL Internet Sharing Gateway

Manufacturer: ZyXEL

Model Name: ZyXEL Internet Sharing Gateway

Model Number: Model Number:

Description: ZyXEL Internet Sharing Gateway

Device Address: http://192.168.1.1/

Maintenance

29.1 Overview

This chapter provides information on the **Maintenance** screens.

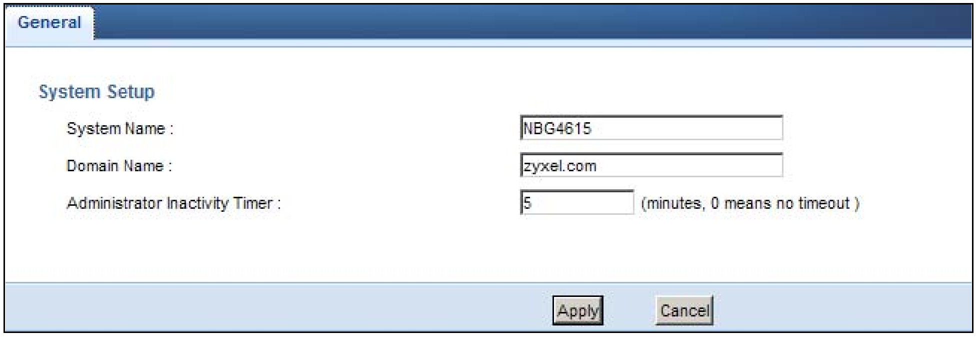
29.2 What You Can Do

- Use the **General** screen to set the timeout period of the management session (Section 29.3 on page 215).
- Use the **Password** screen to change your NBG4615's system password (Section 29.4 on page 216).
- Use the **Time** screen to change your NBG4615's time and date (Section 29.5 on page 217).
- Use the **Firmware Upgrade** screen to upload firmware to your NBG4615 (Section 29.6 on page 219).
- Use the **Backup/Restore** screen to view information related to factory defaults, backup configuration, and restoring configuration (Section 29.8 on page 221).
- Use the **Reset/Restart** screen to reboot the NBG4615 without turning the power off (Section 29.8 on page 221).
- Use the **Sys OP Mode** screen to select how you want to use your NBG4615 (Section 29.10 on page 224).

29.3 General Screen

Use this screen to set the management session timeout period. Click **Maintenance** > **General**. The following screen displays.

Figure 140 Maintenance > General



System Setup

System Name :	NBG4615
Domain Name :	zyxel.com
Administrator Inactivity Timer :	5 (minutes, 0 means no timeout)

The following table describes the labels in this screen.

Table 85 Maintenance > General

LABEL	DESCRIPTION
System Setup	
System Name	System Name is a unique name to identify the NBG4615 in an Ethernet network.
Domain Name	Enter the domain name you want to give to the NBG4615.
Administrator Inactivity Timer	Type how many minutes a management session can be left idle before the session times out. The default is 5 minutes. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

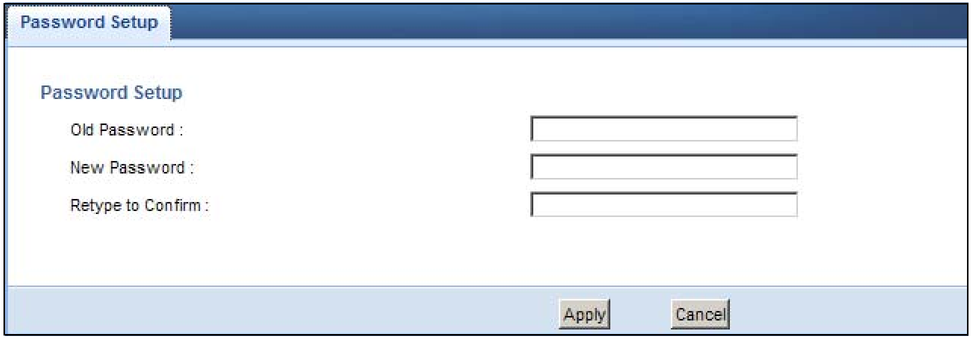
29.4 Password Screen

It is strongly recommended that you change your NBG4615's password.

If you forget your NBG4615's password (or IP address), you will need to reset the device. See Section 29.8 on page 221 for details.

Click **Maintenance** > **Password**. The screen appears as shown.

Figure 141 Maintenance > Password



The following table describes the labels in this screen.

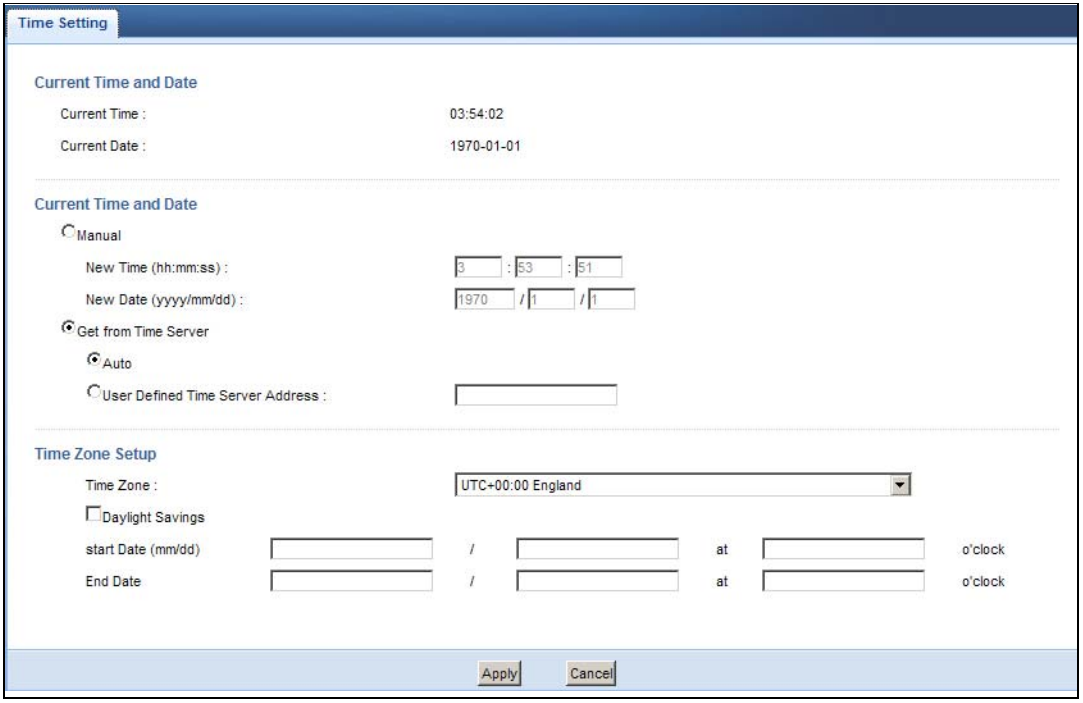
Table 86 Maintenance > Password

LABEL	DESCRIPTION
Password Setup	Change your NBG4615’s password (recommended) using the fields as shown.
Old Password	Type the default password or the existing password you use to access the system in this field.
New Password	Type your new system password (up to 30 characters). Note that as you type a password, the screen displays an asterisk (*) for each character you type.
Retype to Confirm	Type the new password again in this field.
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

29.5 Time Setting Screen

Use this screen to configure the NBG4615’s time based on your local time zone. To change your NBG4615’s time and date, click **Maintenance** > **Time**. The screen appears as shown.

Figure 142 Maintenance > Time



Time Setting

Current Time and Date

Current Time : 03:54:02

Current Date : 1970-01-01

Current Time and Date

○ Manual

New Time (hh:mm:ss) : 3 : 53 : 51

New Date (yyyy/mm/dd) : 1970 / 1 / 1

● Get from Time Server

● Auto

○ User Defined Time Server Address :

Time Zone Setup

Time Zone : UTC+00:00 England

□ Daylight Savings

start Date (mm/dd) / at o'clock

End Date / at o'clock

The following table describes the labels in this screen.

Table 87 Maintenance > Time

LABEL	DESCRIPTION
Current Time and Date	
Current Time	This field displays the time of your NBG4615. Each time you reload this page, the NBG4615 synchronizes the time with the time server.
Current Date	This field displays the date of your NBG4615. Each time you reload this page, the NBG4615 synchronizes the date with the time server.
Current Time and Date	
Manual	Select this radio button to enter the time and date manually. If you configure a new time and date, Time Zone and Daylight Saving at the same time, the new time and date you entered has priority and the Time Zone and Daylight Saving settings do not affect it.
New Time (hh:mm:ss)	This field displays the last updated time from the time server or the last time configured manually. When you select **Manual**, enter the new time in this field and then click **Apply**.

Table 87 Maintenance > Time (continued)

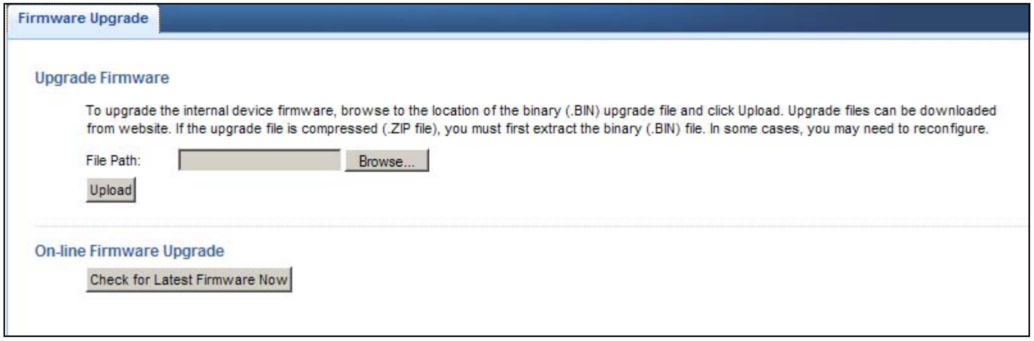
LABEL	DESCRIPTION
New Date (yyyy/mm/dd)	This field displays the last updated date from the time server or the last date configured manually. When you select **Manual**, enter the new date in this field and then click **Apply**.
Get from Time Server	Select this radio button to have the NBG4615 get the time and date from the time server you specified below.
Auto	Select **Auto** to have the NBG4615 automatically search for an available time server and synchronize the date and time with the time server after you click **Apply**.
User Defined Time Server Address	Select **User Defined Time Server Address** and enter the IP address or URL (up to 20 extended ASCII characters in length) of your time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone Setup	
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Savings	Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Daylight Savings**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the first Sunday of April. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, **April** and type 2 in the **o'clock** field. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **March**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Daylight Savings**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the last Sunday of October. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Last**, **Sunday**, **October** and type 2 in the **o'clock** field. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **October**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes back to the NBG4615.
Cancel	Click **Cancel** to begin configuring this screen afresh.

29.6 Firmware Upgrade Screen

Find firmware at www.zyxel.com in a file that (usually) uses the system model name with a "*.bin" extension, e.g., "NBG4615.bin". The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot.

Click **Maintenance > Firmware Upgrade**. Follow the instructions in this screen to upload firmware to your NBG4615.

Figure 143 Maintenance > Firmware Upgrade



Upgrade Firmware

To upgrade the internal device firmware, browse to the location of the binary (.BIN) upgrade file and click Upload. Upgrade files can be downloaded from website. If the upgrade file is compressed (.ZIP file), you must first extract the binary (.BIN) file. In some cases, you may need to reconfigure.

File Path: Browse...

Upload

On-line Firmware Upgrade

Check for Latest Firmware Now

The following table describes the labels in this screen.

Table 88 Maintenance > Firmware Upgrade

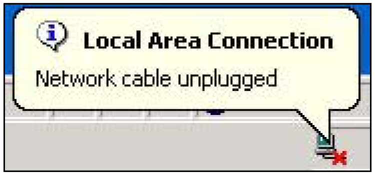
LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse...** to find it.
Browse...	Click **Browse...** to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.
Check for Latest Firmware Now	Click this to check for the latest updated firmware.

Note: Do not turn off the NBG4615 while firmware upload is in progress!

After you see the **Firmware Upload In Process** screen, wait two minutes before logging into the NBG4615 again.

The NBG4615 automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 144 Network Temporarily Disconnected



Local Area Connection

Network cable unplugged

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

If the upload was not successful, an error message appears. Click **Return** to go back to the **Firmware Upgrade** screen.

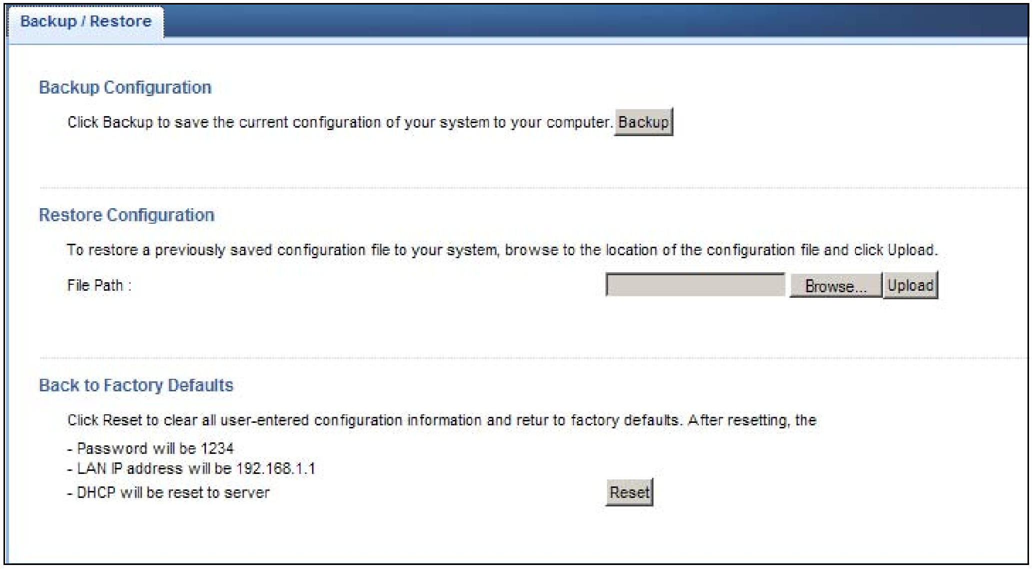
29.7 Configuration Backup/Restore Screen

Backup configuration allows you to back up (save) the NBG4615's current configuration to a file on your computer. Once your NBG4615 is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Restore configuration allows you to upload a new or previously saved configuration file from your computer to your NBG4615.

Click **Maintenance > Backup/Restore**. Information related to factory defaults, backup configuration, and restoring configuration appears as shown next.

Figure 145 Maintenance > Backup/Restore



Backup / Restore

Backup Configuration

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

Restore Configuration

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

File Path : Browse... Upload

Back to Factory Defaults

Click Reset to clear all user-entered configuration information and retur to factory defaults. After resetting, the

- Password will be 1234
- LAN IP address will be 192.168.1.1
- DHCP will be reset to server

Reset

The following table describes the labels in this screen.

Table 89 Maintenance > Backup/Restore

LABEL	DESCRIPTION
Backup	Click **Backup** to save the NBG4615's current configuration to your computer.
File Path	Type in the location of the file you want to upload in this field or click **Browse...** to find it.
Browse...	Click **Browse...** to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.

Table 89 Maintenance > Backup/Restore (continued)

LABEL	DESCRIPTION
Upload	Click **Upload** to begin the upload process. Note: Do not turn off the NBG4615 while configuration file upload is in progress. After you see a "configuration upload successful" screen, you must then wait one minute before logging into the NBG4615 again. The NBG4615 automatically restarts in this time causing a temporary network disconnect. If you see an error screen, click Back to return to the Backup/Restore screen.
Reset	Pressing the **Reset** button in this section clears all user-entered configuration information and returns the NBG4615 to its factory defaults. You can also press the **RESET** button on the rear panel to reset the factory defaults of your NBG4615. Refer to the chapter about introducing the Web Configurator for more information on the **RESET** button.

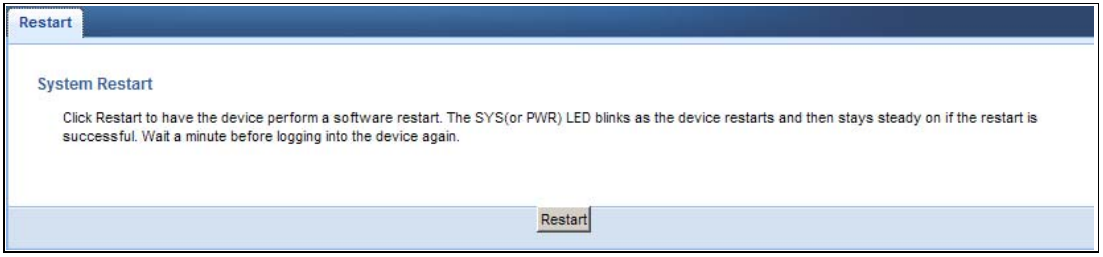
Note: If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default NBG4615 IP address (192.168.1.2). See Appendix D on page 263 for details on how to set up your computer's IP address.

29.8 Reset/Restart Screen

System restart allows you to reboot the NBG4615 without turning the power off.

Click **Maintenance > Reset/Restart** to open the following screen.

Figure 146 Maintenance > Reset/Restart



System Restart

Click Restart to have the device perform a software restart. The SYS(or PWR) LED blinks as the device restarts and then stays steady on if the restart is successful. Wait a minute before logging into the device again.

Click **Restart** to have the NBG4615 reboot. This does not affect the NBG4615's configuration.

29.9 System Operation Mode Overview

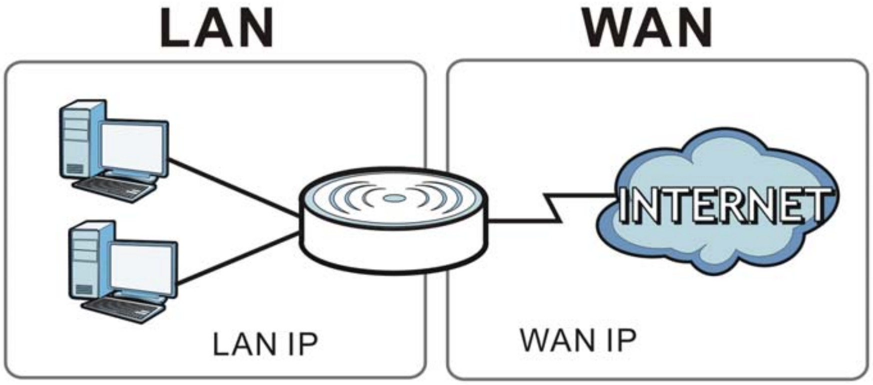
The **Sys OP Mode** (System Operation Mode) function lets you configure your NBG4615 as an access point, wireless client or both at the same time. You can choose between **Router, Access Point Mode**, **Universal Repeater Mode**, and **WISP Mode** depending on your network topology and the features you require from your device.

The following describes the device modes available in your NBG4615.

Router

A router connects your local network with another network, such as the Internet. The router has two IP addresses, the LAN IP address and the WAN IP address.

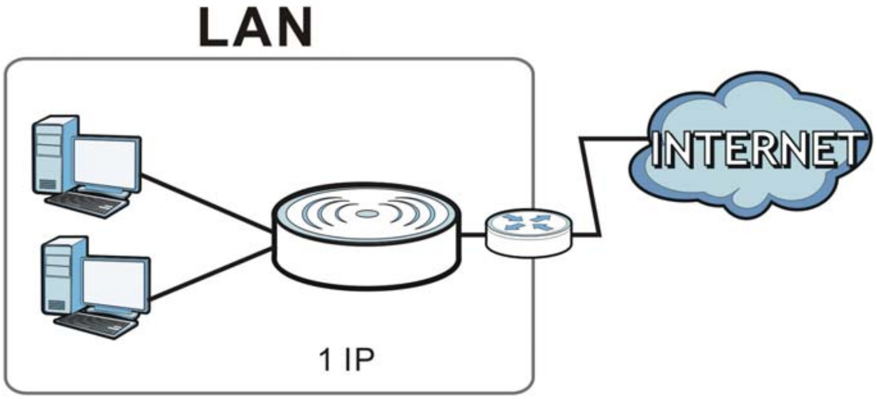
Figure 147 LAN and WAN IP Addresses in Router Mode



Access Point

An access point enabled all ethernet ports to be bridged together and be in the same subnet. To connect to the Internet, another device, such as a router, is required.

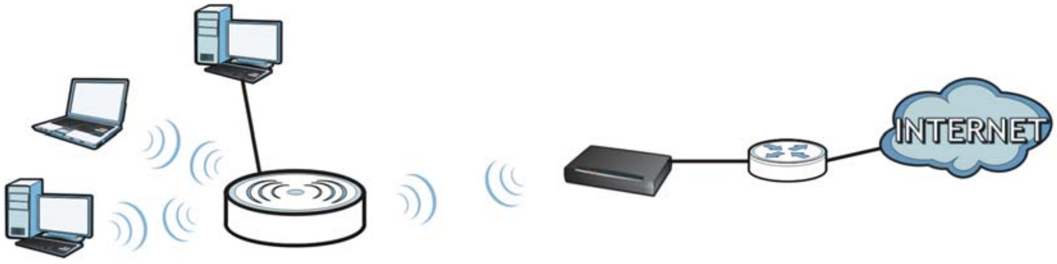
Figure 148 Access Point Mode



Universal Repeater

NBG4615 in Universal Repeater mode work as an access point and wireless client simultaneously.

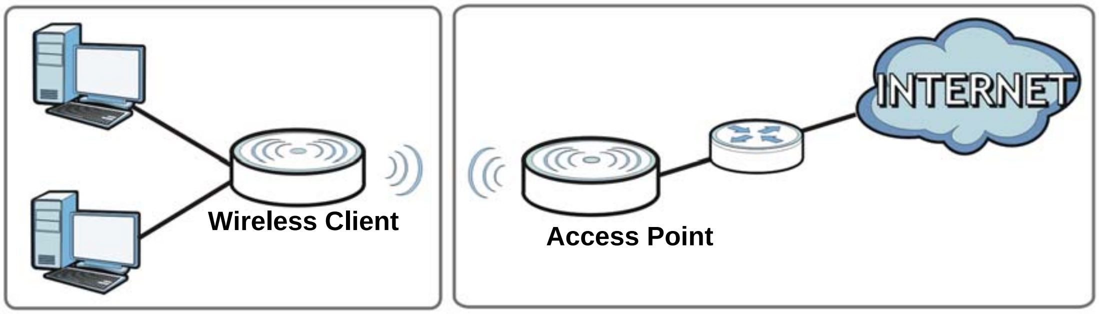
Figure 149 Universal Repeater Mode



WISP

A WISP client connects to an existing access point wirelessly. It acts just like a wireless client in notebooks/computers.

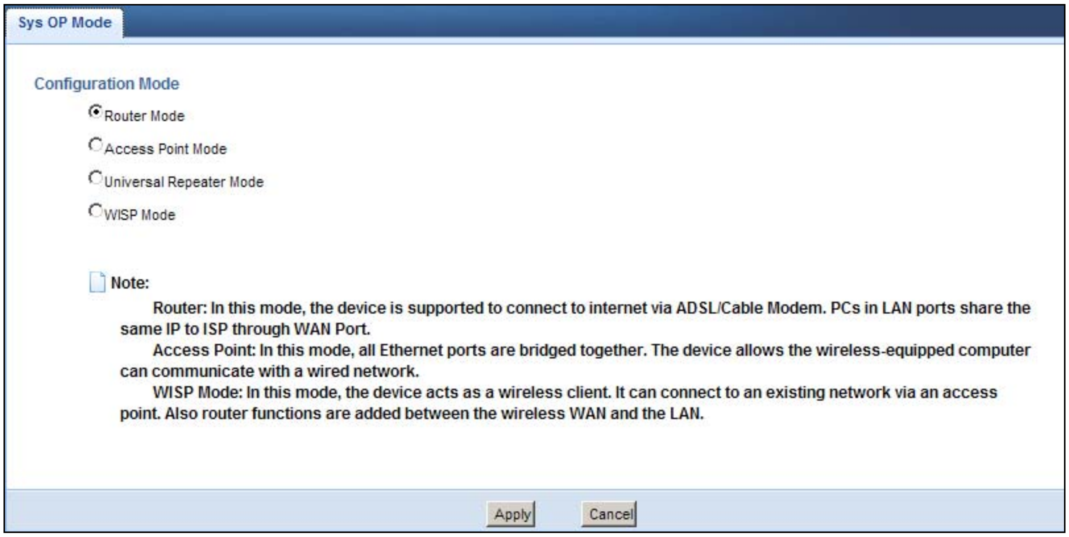
Figure 150 IP Address in WISP Mode



29.10 Sys OP Mode Screen

Use this screen to select how you want to use your NBG4615.

Figure 151 Maintenance > Sys OP Mode



Configuration Mode

● Router Mode

○ Access Point Mode

○ Universal Repeater Mode

○ WISP Mode

Note:

Router: In this mode, the device is supported to connect to internet via ADSL/Cable Modem. PCs in LAN ports share the same IP to ISP through WAN Port.

Access Point: In this mode, all Ethernet ports are bridged together. The device allows the wireless-equipped computer can communicate with a wired network.

WISP Mode: In this mode, the device acts as a wireless client. It can connect to an existing network via an access point. Also router functions are added between the wireless WAN and the LAN.

The following table describes the labels in the **General** screen.

Table 90 Maintenance > Sys OP Mode

LABEL	DESCRIPTION
System Operation Mode	
Router	Select **Router Mode** if your device routes traffic between a local network and another network such as the Internet. This mode offers services such as a firewall or bandwidth management. You can configure the IP address settings on your WAN port. Contact your ISP or system administrator for more information on appropriate settings.
Access Point	Select **Access Point Mode** if your device bridges traffic between clients on the same network. • In **Access Point Mode**, all Ethernet ports have the same IP address. • All ports on the rear panel of the device are LAN ports, including the port labeled WAN. There is no WAN port. • The DHCP server on your device is disabled. • The IP address of the device on the local network is set to 192.168.1.2.
Universal Repeater Mode	Select **Universal Repeater Mode** if you want to have wireless clients associate with the NBG4615 and also want to connect the NBG4615 to an existing access point. • In addition to wireless LAN settings between the NBG4615 and wireless clients, you also need to configure security and wireless settings between the NBG4615 and another access point. • WDS is not available when the NBG4615 is in **Universal Repeater Mode**. • The IP address of the device on the local network is the same as the IP address given to the NBG4615 while in **Access Point Mode** (default is 192.168.1.2).

Table 90 Maintenance > Sys OP Mode (continued)

LABEL	DESCRIPTION
WISP Mode	Select **WISP Mode** if your device needs a wireless client to connect to an existing access point. • You cannot configure Wireless LAN settings (including WPS) and scheduling in the **WISP Mode**. • The IP address of the device on the local network is the same as the IP address given to the NBG4615 while in router mode (default is 192.168.1.1).
Apply	Click **Apply** to save your settings.
Cancel	Click **Cancel** to return your settings to the default (**Router**).

Note: If you select the incorrect System Operation Mode you may not be able to connect to the Internet.

30

Troubleshooting

30.1 Overview

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

- Power, Hardware Connections, and LEDs
- NBG4615 Access and Login
- Internet Access
- Resetting the NBG4615 to Its Factory Defaults
- Wireless Router/AP Troubleshooting
- USB Device Problems
- ZyXEL Share Center Utility Problems

30.2 Power, Hardware Connections, and LEDs

The NBG4615 does not turn on. None of the LEDs turn on.

1. Make sure you are using the power adaptor or cord included with the NBG4615.
2. Make sure the power adaptor or cord is connected to the NBG4615 and plugged in to an appropriate power source. Make sure the power source is turned on.
3. Disconnect and re-connect the power adaptor or cord to the NBG4615.
4. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 1.5 on page 22.
2. Check the hardware connections. See the Quick Start Guide.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.

4 Disconnect and re-connect the power adaptor to the NBG4615.

5 If the problem continues, contact the vendor.

30.3 NBG4615 Access and Login

I don’t know the IP address of my NBG4615.

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

2 If you changed the IP address and have forgotten it, you might get the IP address of the NBG4615 by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the NBG4615 (it depends on the network), so enter this IP address in your Internet browser.Set your device to **Router Mode**, login (see the Quick Start Guide for instructions) and go to the **Device Information** table in the **Status** screen. Your NBG4615’s IP address is available in the **Device Information** table.

- If the **DHCP** setting under **LAN information** is **None**, your device has a fixed IP address.
- If the **DHCP** setting under **LAN information** is **Client**, then your device receives an IP address from a DHCP server on the network.

3 If your NBG4615 is a DHCP client, you can find your IP address from the DHCP server. This information is only available from the DHCP server which allocates IP addresses on your network. Find this information directly from the DHCP server or contact your system administrator for more information.

4 Reset your NBG4615 to change all settings back to their default. This means your current settings are lost. See Section 30.5 on page 231 in the **Troubleshooting** for information on resetting your NBG4615.

I forgot the password.

1 The default password is **1234**.

2 If this does not work, you have to reset the device to its factory defaults. See Section 30.5 on page 231.

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

1 Make sure you are using the correct IP address.

- The default IP address is 192.168.1.1.

- If you changed the IP address (Section 18.4 on page 165), use the new IP address.
- If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I don't know the IP address of my NBG4615.

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

3 Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled. See Appendix B on page 241.

4 Make sure your computer is in the same subnet as the NBG4615. (If you know that there are routers between your computer and the NBG4615, skip this step.)

- If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. See Section 18.4 on page 165.
- If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the NBG4615. See Section 18.4 on page 165.

5 Reset the device to its factory defaults, and try to access the NBG4615 with the default IP address. See Section 5.3.1 on page 47.

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

Advanced Suggestions

- Try to access the NBG4615 using another service, such as Telnet. If you can access the NBG4615, check the remote management settings and firewall rules to find out why the NBG4615 does not respond to HTTP.
- If your computer is connected to the **WAN** port or is connected wirelessly, use a computer that is connected to a **LAN**/**ETHERNET** port.

I can see the **Login** screen, but I cannot log in to the NBG4615.

1 Make sure you have entered the password correctly. The default password is **1234**. This field is case-sensitive, so make sure [Caps Lock] is not on.

2 You cannot log in to the Web Configurator while someone is using Telnet to access the NBG4615. Log out of the NBG4615 in the other session, or ask the person who is logged in to log out.

3 This can happen when you fail to log out properly from your last session. Try logging in again after 5 minutes.

4 Disconnect and re-connect the power adaptor or cord to the NBG4615.

5 If this does not work, you have to reset the device to its factory defaults. See Section 30.5 on page 231.

30.4 Internet Access

I cannot access the Internet.

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

2 Make sure you entered your ISP account information correctly in the wizard. These fields are case-sensitive, so make sure [Caps Lock] is not on.

3 If you are trying to access the Internet wirelessly, make sure the wireless settings in the wireless client are the same as the settings in the AP.

- Go to Network > Wireless LAN > General > WDS and check if the NBG4615 is set to bridge mode. Select **Disable** and try to connect to the Internet again.

4 Disconnect all the cables from your device, and follow the directions in the Quick Start Guide again.

5 Go to Maintenance > Sys OP Mode > General. Check your System Operation Mode setting.

- Select **Router** if your device routes traffic between a local network and another network such as the Internet.
- Select **Access Point** if your device bridges traffic between clients on the same network.

6 If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the NBG4615), but my Internet connection is not available anymore.

1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.5 on page 22.

2 Reboot the NBG4615.

3 If the problem continues, contact your ISP.

The Internet connection is slow or intermittent.

1 There might be a lot of traffic on the network. Look at the LEDs, and check Section 1.5 on page 22. If the NBG4615 is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.

2 Check the signal strength. If the signal strength is low, try moving the NBG4615 closer to the AP if possible, and look around to see if there are any devices that might be interfering with the wireless network (for example, microwaves, other wireless networks, and so on).

3 Reboot the NBG4615.

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

Advanced Suggestion

- Check the settings for QoS. If it is disabled, you might consider activating it.

30.5 Resetting the NBG4615 to Its Factory Defaults

If you reset the NBG4615, you lose all of the changes you have made. The NBG4615 re-loads its default settings, and the password resets to **1234**. You have to make all of your changes again.

You will lose all of your changes when you push the **RESET** button.

To reset the NBG4615:

1 Make sure the power LED is on.

2 Press the **RESET** button for longer than 1 second to restart/reboot the NBG4615.

3 Press the **RESET** button for longer than five seconds to set the NBG4615 back to its factory-default configurations.

If the NBG4615 restarts automatically, wait for the NBG4615 to finish restarting, and log in to the Web Configurator. The password is "1234".

If the NBG4615 does not restart automatically, disconnect and reconnect the NBG4615's power. Then, follow the directions above again.

30.6 Wireless Router/AP Troubleshooting

I cannot access the NBG4615 or ping any computer from the WLAN (wireless AP or router).

1 Make sure the wireless LAN is enabled on the NBG4615.

2 Make sure the wireless adapter on the wireless station is working properly.

3 Make sure the wireless adapter installed on your computer is IEEE 802.11 compatible and supports the same wireless standard as the NBG4615.

4 Make sure your computer (with a wireless adapter installed) is within the transmission range of the NBG4615.

5 Check that both the NBG4615 and your wireless station are using the same wireless and wireless security settings.

6 Make sure traffic between the WLAN and the LAN is not blocked by the firewall on the NBG4615.

7 Make sure you allow the NBG4615 to be remotely accessed through the WLAN interface. Check your remote management settings.

- See the chapter on Wireless LAN in the User's Guide for more information.

I set up URL keyword blocking, but I can still access a website that should be blocked.

Make sure that you select the **Enable URL Keyword Blocking** check box in the Content Filtering screen. Make sure that the keywords that you type are listed in the **Keyword List**.

If a keyword that is listed in the **Keyword List** is not blocked when it is found in a URL, customize the keyword blocking using commands. See the Customizing Keyword Blocking URL Checking section in the Content Filtering chapter.

I can access the Internet, but I cannot open my network folders.

In the **Network > LAN > Advanced** screen, make sure **Allow between LAN and WAN** is checked. This is not checked by default to keep the LAN secure.

If you still cannot access a network folder, make sure your account has access rights to the folder you are trying to open.

I cannot access the Web Configurator after I switched to AP mode.

When you change from router mode to AP mode, your computer must have an IP address in the range between "192.168.1.3" and "192.168.1.254".

Refer to Appendix D on page 263 for instructions on how to change your computer's IP address.

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

The following factors may cause interference:

- Obstacles: walls, ceilings, furniture, and so on.

- Building Materials: metal doors, aluminum studs.
- Electrical devices: microwaves, monitors, electric motors, cordless phones, and other wireless devices.

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

- Move your wireless device closer to the AP if the signal strength is low.
- Reduce wireless interference that may be caused by other wireless networks or surrounding wireless electronics such as cordless phones.
- Place the AP where there are minimum obstacles (such as walls and ceilings) between the AP and the wireless client.
- Reduce the number of wireless clients connecting to the same AP simultaneously, or add additional APs if necessary.
- Try closing some programs that use the Internet, especially peer-to-peer applications. If the wireless client is sending or receiving a lot of information, it may have too many programs open that use the Internet.
- Position the antennas for best reception. If the AP is placed on a table or floor, point the antennas upwards. If the AP is placed at a high position, point the antennas downwards. Try pointing the antennas in different directions and check which provides the strongest signal to the wireless clients.

30.7 USB Device Problems

I cannot access or see a USB device that is connected to the NBG4615.

1. Be sure to install the ZyXEL NetUSB Share Center Utility (for NetUSB functionality) first from the included disc, or download the latest version from the zyxel.com website.
2. Disconnect the problematic USB device, then reconnect it to the NBG4615.
3. Ensure that the USB device has power.
4. Check your cable connections.
5. Restart the NBG4615 by disconnecting the power and then reconnecting it.
6. If the USB device requires a special driver, install the driver from the installation disc that came with the device. After driver installation, reconnect the USB device to the NBG4615 and try to connect to it again with your computer.
7. If the problem persists, contact your vendor.

What kind of USB devices do the NBG4615 support?

1 It is strongly recommended to use version 2.0 or lower USB storage devices (such as memory sticks, USB hard drives) and/or USB devices (such as USB printers). Other USB products are not guaranteed to function properly with the NBG4615.

30.8 ZyXEL Share Center Utility Problems

I cannot access or see a USB device that is connected to the NBG4615.

1 Disconnect the problematic USB device, then reconnect it to the NBG4615.

2 Ensure that the USB device in question has power.

3 Check your cable connections.

4 Restart the NBG4615 by disconnecting the power and then reconnecting it.

5 If the USB device requires a special driver, install the driver from the installation disc that came with the device. After driver installation, reconnect the USB device to the NBG4615 and try to connect to it again with your computer.

6 If the problem persists, contact your vendor.

I cannot install the ZyXEL Share Center Utility.

1 Make sure that the set up program is one required for your operating system.

2 Install the latest patches and updates for your operating system.

3 Check the zyxel.com download site for a newer version of the utility.

Two computers cannot connect the USB storage at the same time using the ZyXEL Share Center Utility.

Only one computer can connect to the USB storage through the ZyXEL Share Center Utlity at a time. If two computers (**A** and **B**) want to connect to the USB storage by using the Utility, do the following:

1 After **A** finishes connection to the USB storage, disconnect it by clicking **Disconnect** in **A**'s Utlity.

2 Connect **B** to the USB storage (through the Utility) by clicking **Connect** in **B**'s Utility.

3 If **A** does not disconnect the USB storage, **B** should click **Request to Connect** in the Utility to request **A** to disconnect. **B** cannot access the USB storage until **A** disconnects.

- See Chapter 14 on page 119 for more details on connecting to USB storage by the Utility.

A

Product Specifications

The following tables summarize the NBG4615's hardware and firmware features.

Table 91 Hardware Features

Dimensions	162 mm (W) x 106 mm (D) x 28 mm (H)
Weight	285g
SDRAM	32 MB
Flash Memory	8 MB
Power Specification	Input: 100~240 AC, 50~60 Hz Output: 12 V DC 1.5A
Ethernet ports	Auto-negotiating: 100 Mbps, 1000 Mbps in either half-duplex or full-duplex mode. Auto-crossover: Use either crossover or straight-through Ethernet cables.
Built-in Switch	You can use either straight-through or crossover Ethernet cables (MDI/ MDI-X support) to connect multiple computers or servers (for example, game servers) in your network to the NBG4615.
LEDs	Power, LAN1-4, WAN, Internet/WPS, USB1-2
Reset button	The reset button is built into the rear panel. Use this button to restore the NBG4615 to its factory default settings. Press for 1 second to restart the device. Press for 5 seconds to restore to factory default settings.
WPS button	Press the WPS on two WPS enabled devices within 120 seconds for a security-enabled wireless connection.
Power switch	Turn on or turn off the power of the NBG4615 using this switch.
WLAN switch	Turn on or turn off the wireless function of the NBG4615 using this switch. There is no need to go into the Web Configurator.
Antenna	The NBG4615 is equipped with two 2dBi (2.4GHz) detachable antenna to provide clear radio transmission and reception on the wireless network.
USB Port	The NBG4615 has two built-in USB 2.0 type A for USB device connectivity and supports 3G USB dongle.
Operation Environment	Temperature: 0º C ~ 40º C / 32ºF ~ 104ºF Humidity: 10% ~ 90%
Storage Environment	Temperature: -30º C ~ 70º C / -22ºF ~ 158ºF Humidity: 10% ~ 95%

Table 92 Firmware Features

FEATURE	DESCRIPTION
Default LAN IP Address	192.168.1.1 (router) 192.168.1.2. (AP)
Default LAN Subnet Mask	255.255.255.0 (24 bits)

Table 92 Firmware Features (continued)

FEATURE	DESCRIPTION
Default Password	1234
DHCP Pool	192.168.1.33 to 192.168.1.64
Wireless Interface	Wireless LAN
Default Wireless SSID	ZyXEL
Device Management	Use the Web Configurator to easily configure the rich range of features on the NBG4615.
Wireless Functionality	Allows IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n wireless clients to connect to the NBG4615 wirelessly. Enable wireless security (WPA(2)-PSK) and/or MAC filtering to protect your wireless network. Note: The NBG4615 may be prone to RF (Radio Frequency) interference from other 2.4 GHz devices such as microwave ovens, wireless phones, Bluetooth enabled devices, and other wireless LANs.
Firmware Upgrade	Download new firmware (when available) from the ZyXEL web site and use the Web Configurator to put it on the NBG4615. Note: Only upload firmware for your specific model!
Configuration Backup & Restoration	Make a copy of the NBG4615's configuration and put it back on the NBG4615 later if you decide you want to revert back to an earlier configuration.
Network Address Translation (NAT)	Each computer on your network must have its own unique IP address. Use NAT to convert a single public IP address to multiple private IP addresses for the computers on your network.
Firewall	You can configure firewall on the NBG4615 for secure Internet access. When the firewall is on, by default, all incoming traffic from the Internet to your network is blocked unless it is initiated from your network. This means that probes from the outside to your network are not allowed, but you can safely browse the Internet and download files for example.
Content Filter	The NBG4615 blocks or allows access to web sites that you specify and blocks access to web sites with URLs that contain keywords that you specify.
Bandwidth Management	You can efficiently manage traffic on your network by reserving bandwidth and giving priority to certain types of traffic and/or to particular computers.
Remote Management	This allows you to decide whether a service (HTTP traffic for example) from a computer on a network (LAN or WAN for example) can access the NBG4615.
Wireless LAN Scheduler	You can schedule the times the Wireless LAN is enabled/disabled.
Time and Date	Get the current time and date from an external server when you turn on your NBG4615. You can also set the time manually. These dates and times are then used in logs.
Port Forwarding	If you have a server (mail or web server for example) on your network, then use this feature to let people access it from the Internet.
DHCP (Dynamic Host Configuration Protocol)	Use this feature to have the NBG4615 assign IP addresses, an IP default gateway and DNS servers to computers on your network.
Dynamic DNS Support	With Dynamic DNS (Domain Name System) support, you can use a fixed URL, www.zyxel.com for example, with a dynamic IP address. You must register for this service with a Dynamic DNS service provider.

Table 92 Firmware Features (continued)

FEATURE	DESCRIPTION
IP Multicast	IP Multicast is used to send traffic to a specific group of computers. The NBG4615 supports versions 1 and 2 of IGMP (Internet Group Management Protocol) used to join multicast groups (see RFC 2236).
Logging	Use logs for troubleshooting. You can view logs in the Web Configurator.
PPPoE	PPPoE mimics a dial-up Internet access connection.
PPTP Encapsulation	Point-to-Point Tunneling Protocol (PPTP) enables secure transfer of data through a Virtual Private Network (VPN). The NBG4615 supports one PPTP connection at a time.
Universal Plug and Play (UPnP)	The NBG4615 can communicate with other UPnP enabled devices in a network.

Wall-mounting Instructions

Complete the following steps to hang your NBG4615 on a wall.

1. Select a position free of obstructions on a sturdy wall.

2. Drill two holes for the screws.

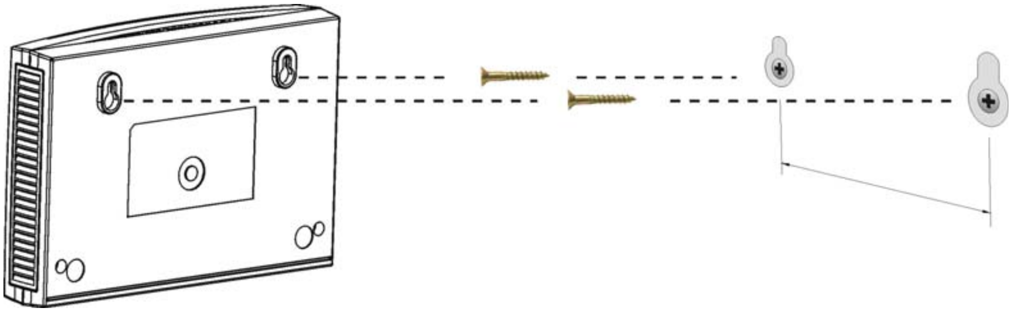
Be careful to avoid damaging pipes or cables located inside the wall when drilling holes for the screws.

3. Do not insert the screws all the way into the wall. Leave a small gap of about 0.5 cm between the heads of the screws and the wall.

4. Make sure the screws are snugly fastened to the wall. They need to hold the weight of the NBG4615 with the connection cables.

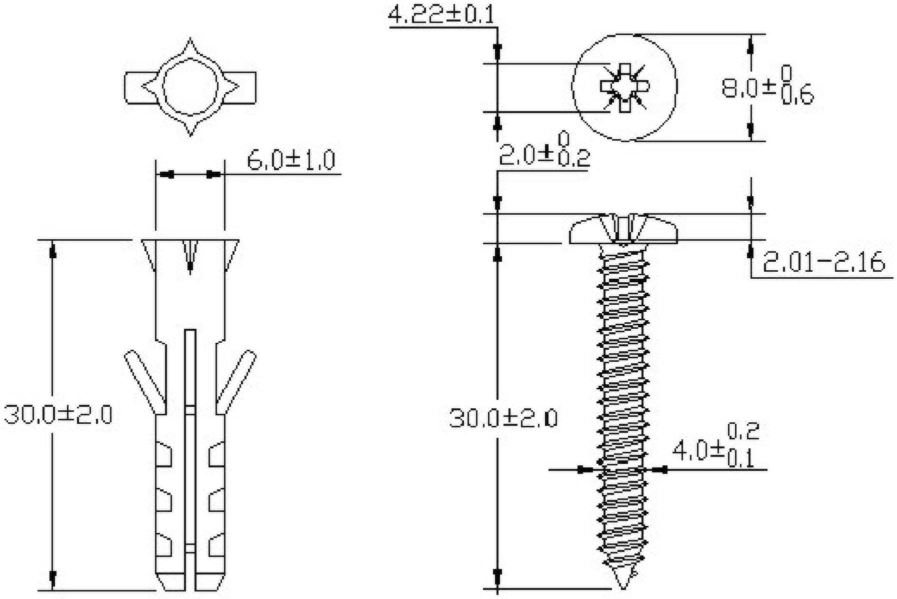
5. Align the holes on the back of the NBG4615 with the screws on the wall. Hang the NBG4615 on the screws.

Figure 152 Wall-mounting Example



The following are dimensions of an M4 tap screw and masonry plug used for wall mounting. All measurements are in millimeters (mm).

Figure 153 Masonry Plug and M4 Tap Screw



Pop-up Windows, JavaScript and Java Permissions

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

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

Note: The screens used below belong to Internet Explorer version 6, 7 and 8. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

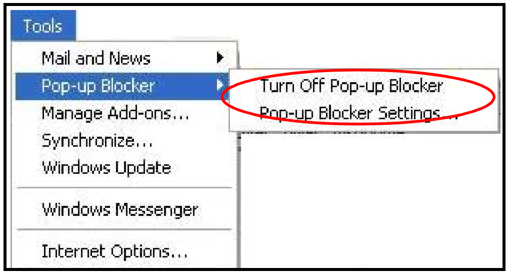
You may have to disable pop-up blocking to log into your device.

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

Disable Pop-up Blockers

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

Figure 154 Pop-up Blocker

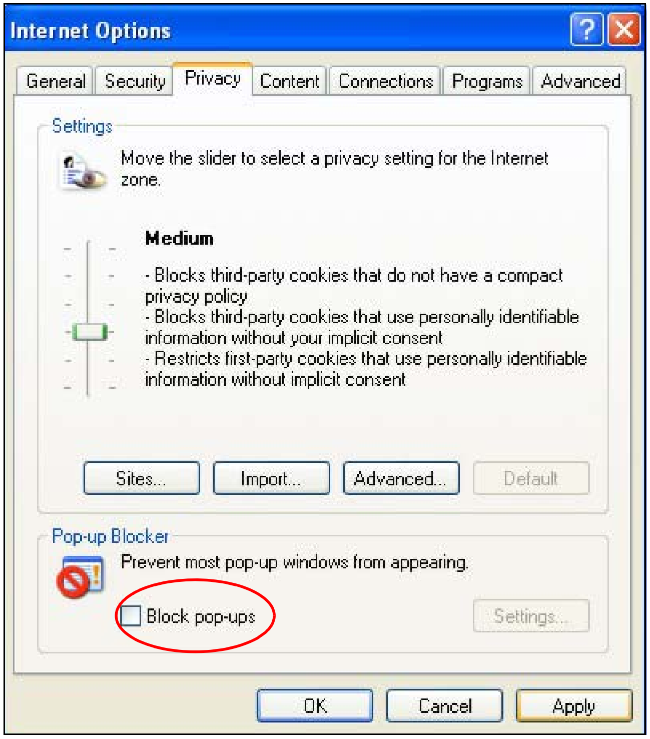


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

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

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

Figure 155 Internet Options: Privacy



Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Prevent most pop-up windows from appearing.

□ Block pop-ups

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

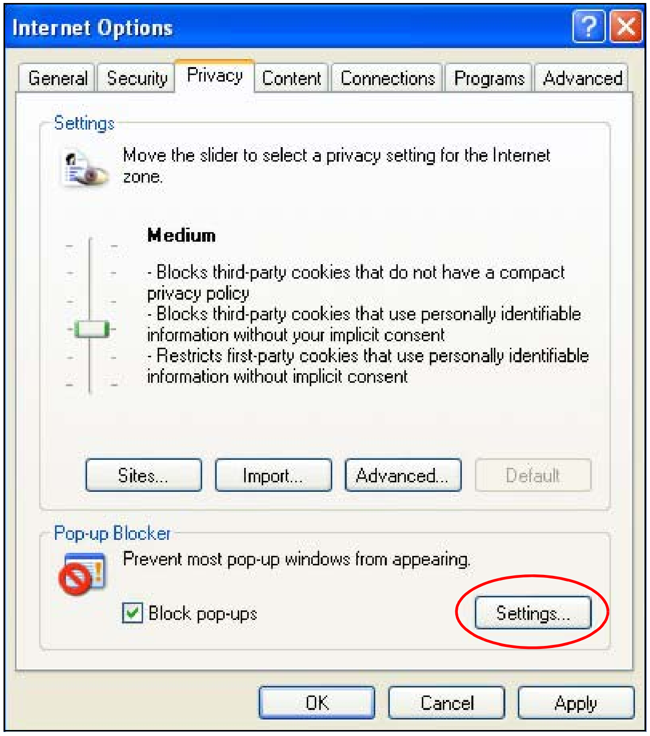
Enable Pop-up Blockers with Exceptions

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

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

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

Figure 156 Internet Options: Privacy



Internet Options

General | Security | Privacy | Content | Connections | Programs | Advanced

Settings

Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Pop-up Blocker

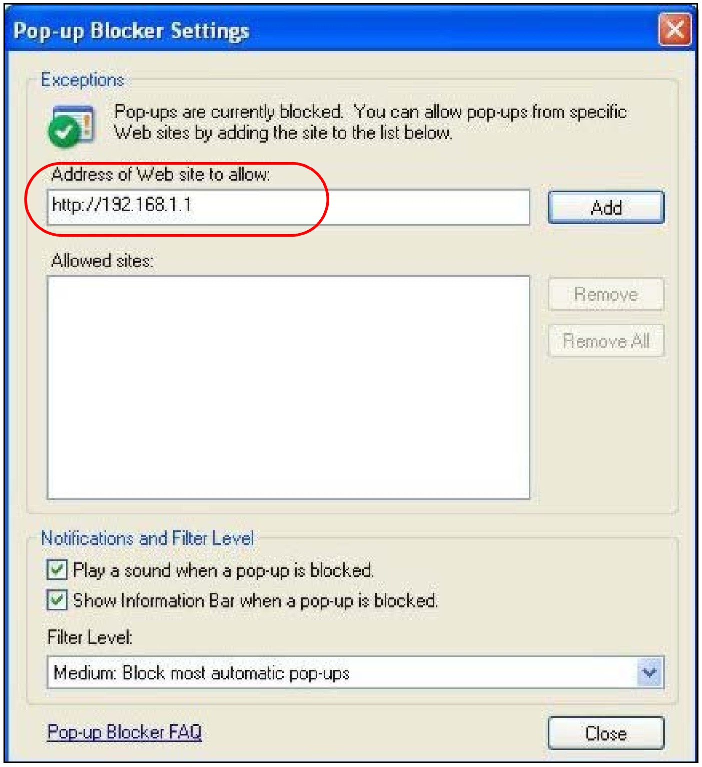
Prevent most pop-up windows from appearing.

☑ Block pop-ups

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

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

Figure 157 Pop-up Blocker Settings



Pop-up Blocker Settings

Exceptions

Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.

Address of Web site to allow: http://192.168.1.1

Notifications and Filter Level

☑ Play a sound when a pop-up is blocked.

☑ Show Information Bar when a pop-up is blocked.

Filter Level: Medium: Block most automatic pop-ups

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

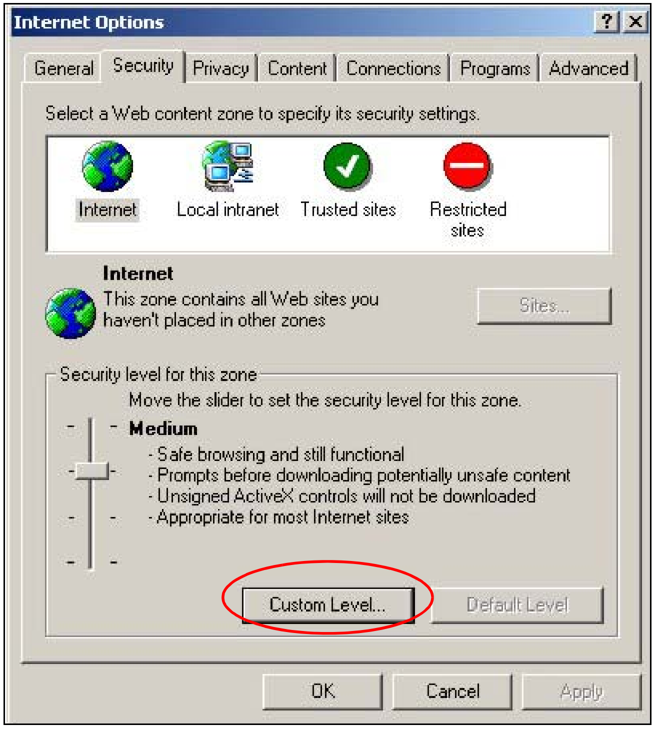
6 Click **Apply** to save this setting.

JavaScript

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

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

Figure 158 Internet Options: Security



Select a Web content zone to specify its security settings.

Internet

This zone contains all Web sites you haven't placed in other zones

Security level for this zone

Move the slider to set the security level for this zone.

Medium

- Safe browsing and still functional
- Prompts before downloading potentially unsafe content
- Unsigned ActiveX controls will not be downloaded
- Appropriate for most Internet sites

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

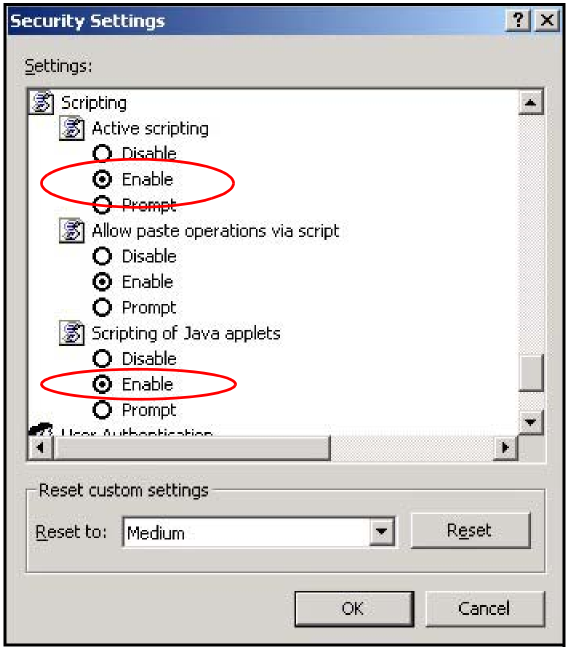
3 Scroll down to **Scripting**.

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

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

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

Figure 159 Security Settings - Java Scripting



Settings:

Scripting
Active scripting
○ Disable
● Enable
○ Prompt
Allow paste operations via script
○ Disable
● Enable
○ Prompt
Scripting of Java applets
○ Disable
● Enable
○ Prompt
User Authentication

Reset custom settings

Reset to: Medium

Java Permissions

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

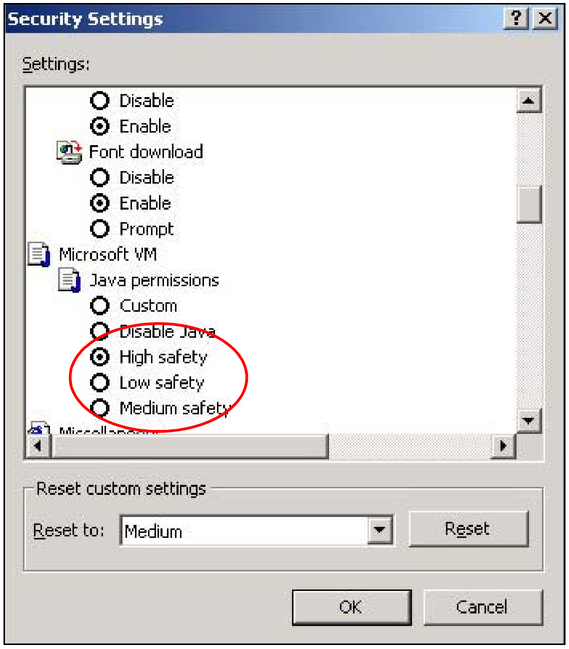
2 Click the **Custom Level...** button.

3 Scroll down to **Microsoft VM**.

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

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

Figure 160 Security Settings - Java



Security Settings

Settings:

- ○ Disable
- ● Enable
- Font download
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Microsoft VM
  - Java permissions
    - ○ Custom
    - ○ Disable Java
    - ● High safety
    - ○ Low safety
    - ○ Medium safety

Reset custom settings

Reset to: Medium

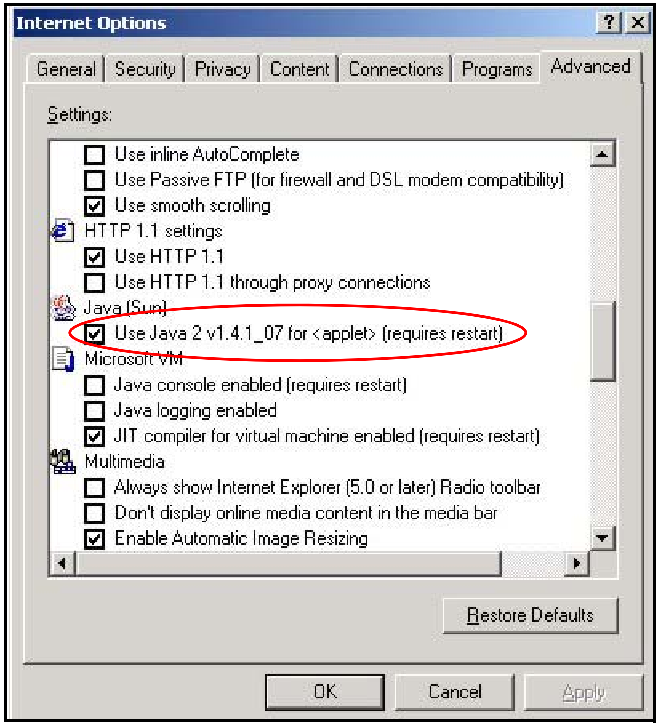
JAVA (Sun)

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

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

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

Figure 161 Java (Sun)



Internet Options

General | Security | Privacy | Content | Connections | Programs | Advanced

Settings:

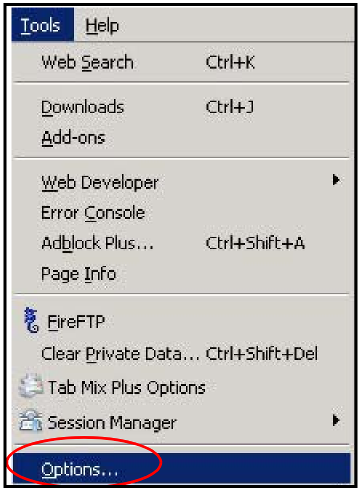
- □ Use inline AutoComplete
- □ Use Passive FTP (for firewall and DSL modem compatibility)
- ☑ Use smooth scrolling
- HTTP 1.1 settings
  - ☑ Use HTTP 1.1
  - □ Use HTTP 1.1 through proxy connections
- Java (Sun)
  - ☑ Use Java 2 v1.4.1_07 for <applet> (requires restart)
- Microsoft VM
  - □ Java console enabled (requires restart)
  - □ Java logging enabled
  - ☑ JIT compiler for virtual machine enabled (requires restart)
- Multimedia
  - □ Always show Internet Explorer (5.0 or later) Radio toolbar
  - □ Don't display online media content in the media bar
  - ☑ Enable Automatic Image Resizing

Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary slightly. The steps below apply to Mozilla Firefox 3.0 as well.

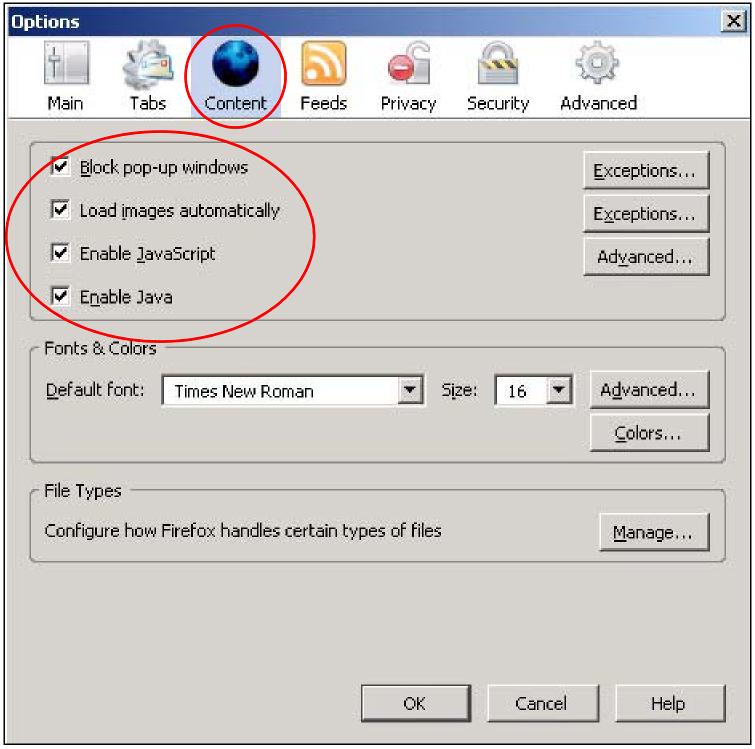
You can enable Java, Javascript and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 162 Mozilla Firefox: TOOLS > Options



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

Figure 163 Mozilla Firefox Content Security



☑ Block pop-up windows

☑ Load images automatically

☑ Enable JavaScript

☑ Enable Java

Fonts & Colors

Default font: Times New Roman Size: 16

File Types

Configure how Firefox handles certain types of files

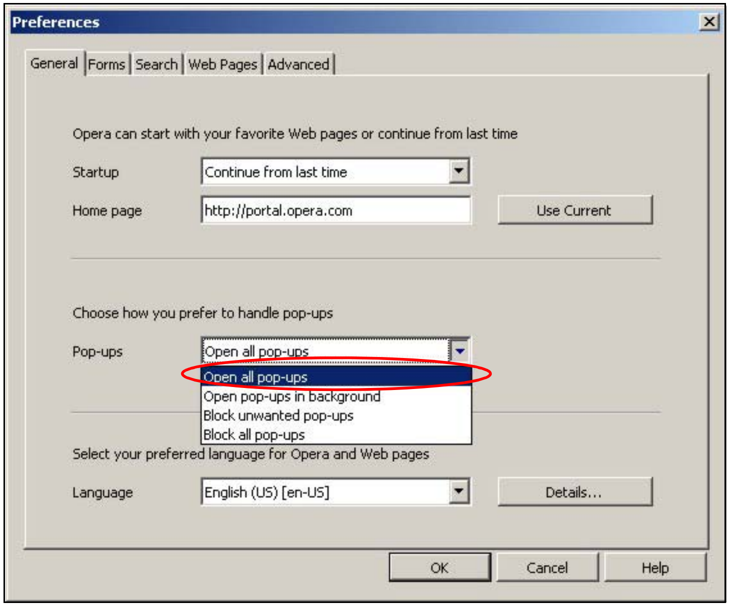
Opera

Opera 10 screens are used here. Screens for other versions may vary slightly.

Allowing Pop-Ups

From Opera, click **Tools**, then **Preferences**. In the **General** tab, go to **Choose how you prefer to handle pop-ups** and select **Open all pop-ups**.

Figure 164 Opera: Allowing Pop-Ups



Preferences

Opera can start with your favorite Web pages or continue from last time

Startup: Continue from last time

Home page: http://portal.opera.com

Choose how you prefer to handle pop-ups

Pop-ups: Open all pop-ups

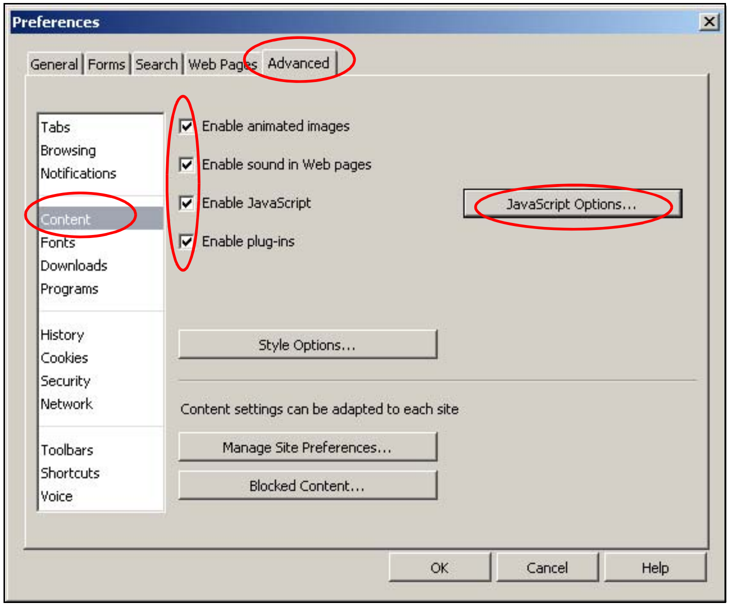
Select your preferred language for Opera and Web pages

Language: English (US) [en-US]

Enabling Java

From Opera, click **Tools**, then **Preferences**. In the **Advanced** tab, select **Content** from the left-side menu. Select the check boxes as shown in the following screen.

Figure 165 Opera: Enabling Java



Preferences

☑ Enable animated images

☑ Enable sound in Web pages

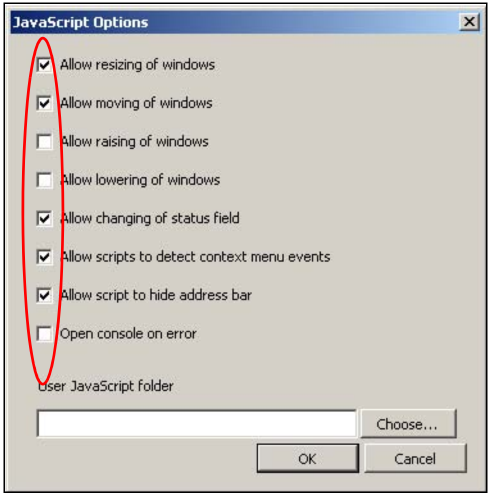
☑ Enable JavaScript

☑ Enable plug-ins

Content settings can be adapted to each site

To customize JavaScript behavior in the Opera browser, click **JavaScript Options**.

Figure 166 Opera: JavaScript Options



☑ Allow resizing of windows

☑ Allow moving of windows

□ Allow raising of windows

□ Allow lowering of windows

☑ Allow changing of status field

☑ Allow scripts to detect context menu events

☑ Allow script to hide address bar

□ Open console on error

User JavaScript folder

Select the items you want Opera's JavaScript to apply.

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

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

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

Introduction to IP Addresses

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

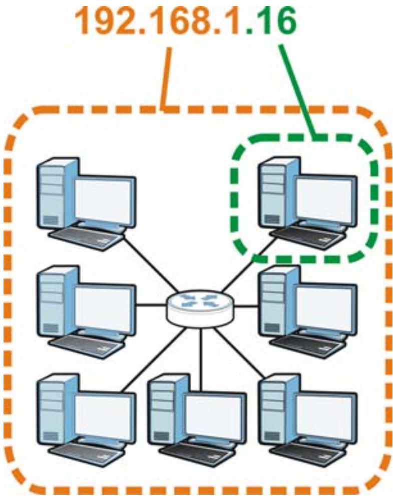
Structure

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

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

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

Figure 167 Network Number and Host ID



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

Subnet Masks

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

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

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

Table 93 IP Address Network Number and Host ID Example

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

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

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

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

Table 94 Subnet Masks

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

Network Size

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

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

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

Table 95 Maximum Host Numbers

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

Notation

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

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

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

Table 96 Alternative Subnet Mask Notation

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

Table 96 Alternative Subnet Mask Notation (continued)

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

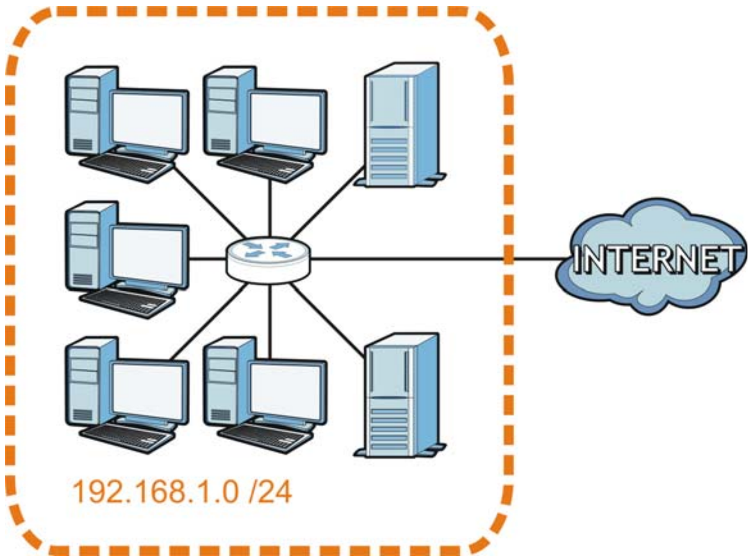
Subnetting

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

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

The following figure shows the company network before subnetting.

Figure 168 Subnetting Example: Before Subnetting

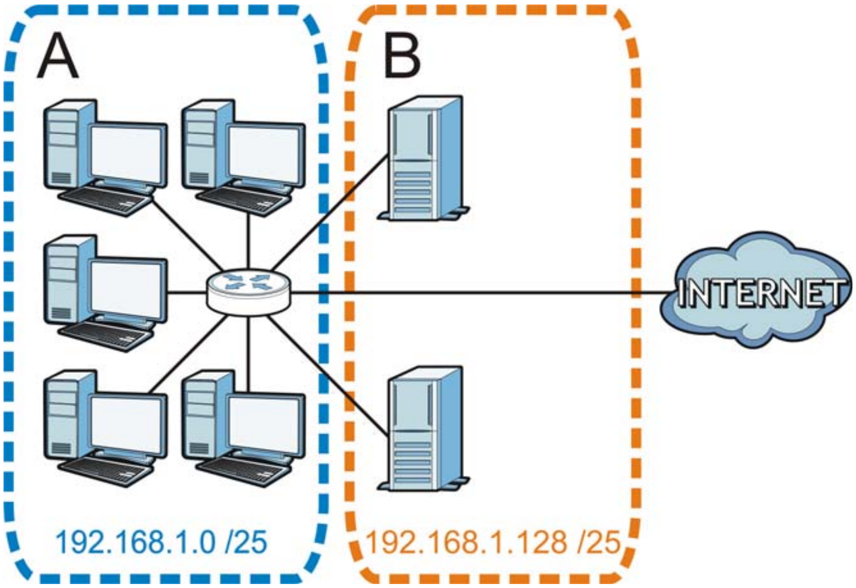


You can “borrow” one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

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

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

Figure 169 Subnetting Example: After Subnetting



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

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

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

Example: Four Subnets

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

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

Table 97 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000

Table 97 Subnet 1 (continued)

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 98 Subnet 2

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

Table 99 Subnet 3

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

Table 100 Subnet 4

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

Example: Eight Subnets

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

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

Table 101 Eight Subnets

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

Subnet Planning

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

Table 102 24-bit Network Number Subnet Planning

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

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

Table 103 16-bit Network Number Subnet Planning

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

Table 103 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
13	255.255.255.248 (/29)	8192	6
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

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

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the NBG4615.

Once you have decided on the network number, pick an IP address for your NBG4615 that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your NBG4615 will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the NBG4615 unless you are instructed to do otherwise.

Private IP Addresses

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

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

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

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

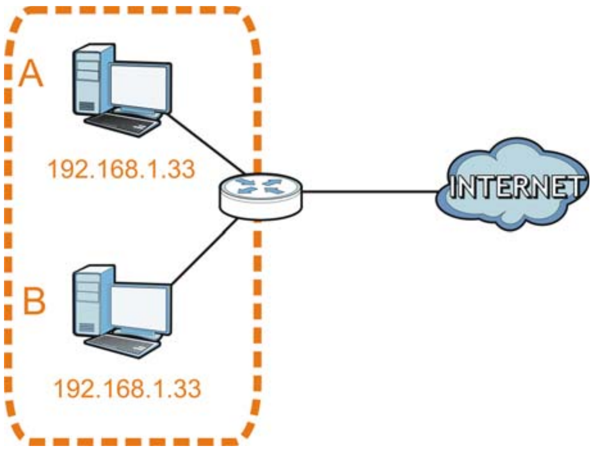
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

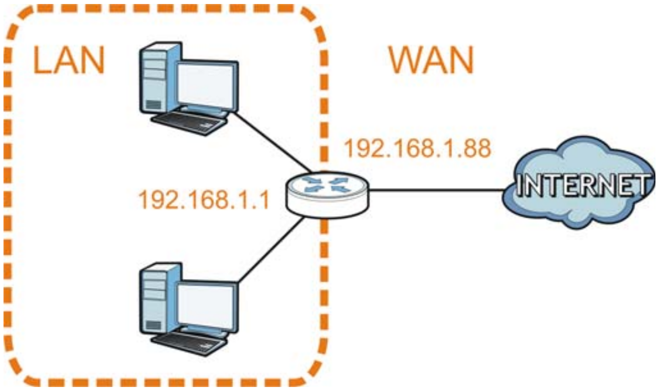
Figure 170 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router’s LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

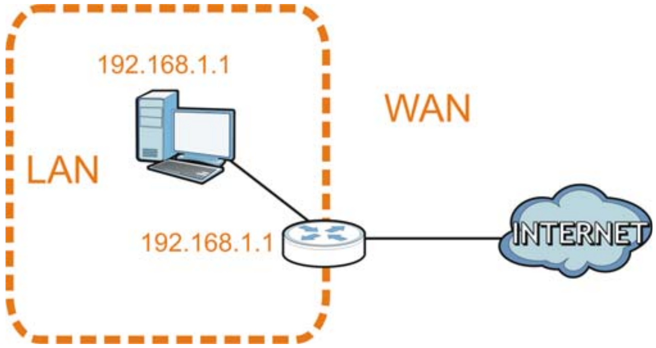
Figure 171 Conflicting Router IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 172 Conflicting Computer and Router IP Addresses Example



Setting Up Your Computer’s IP Address

Note: Your specific NBG4615 may not support all of the operating systems described in this appendix. See the product specifications for more information about which operating systems are supported.

This appendix shows you how to configure the IP settings on your computer in order for it to be able to communicate with the other devices on your network. Windows Vista/XP/2000, Mac OS 9/ OS X, and all versions of UNIX/LINUX include the software components you need to use TCP/IP on your computer.

If you manually assign IP information instead of using a dynamic IP, make sure that your network’s computers have IP addresses that place them in the same subnet.

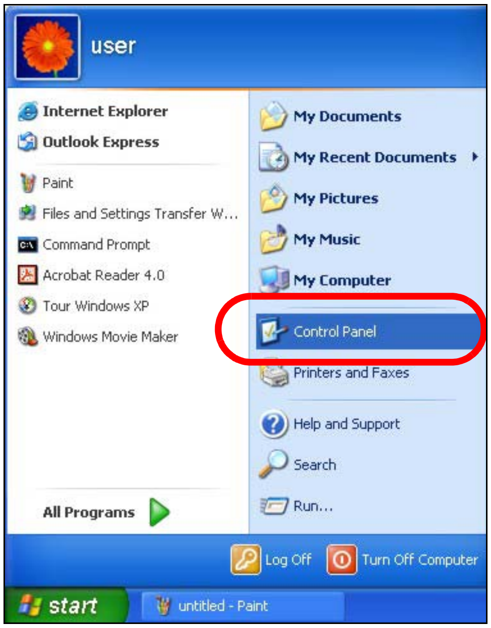
In this appendix, you can set up an IP address for:

- Windows XP/NT/2000 on page 264
- Windows Vista on page 267
- Windows 7 on page 271
- Mac OS X: 10.3 and 10.4 on page 275
- Mac OS X: 10.5 and 10.6 on page 278
- Linux: Ubuntu 8 (GNOME) on page 281
- Linux: openSUSE 10.3 (KDE) on page 285

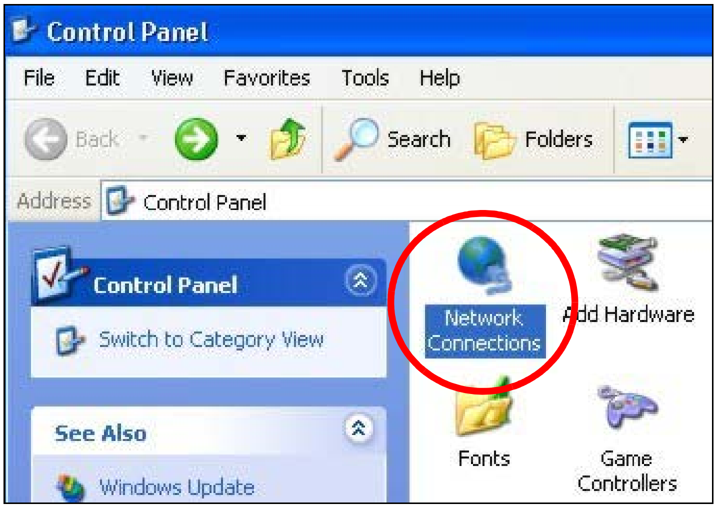
Windows XP/NT/2000

The following example uses the default Windows XP display theme but can also apply to Windows 2000 and Windows NT.

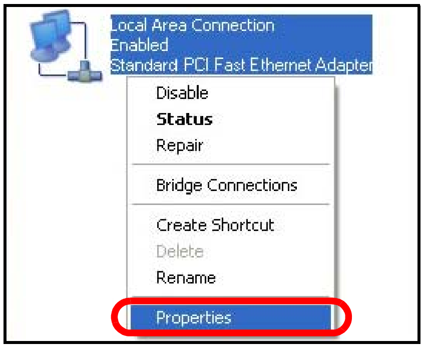
1 Click **Start** > **Control Panel**.



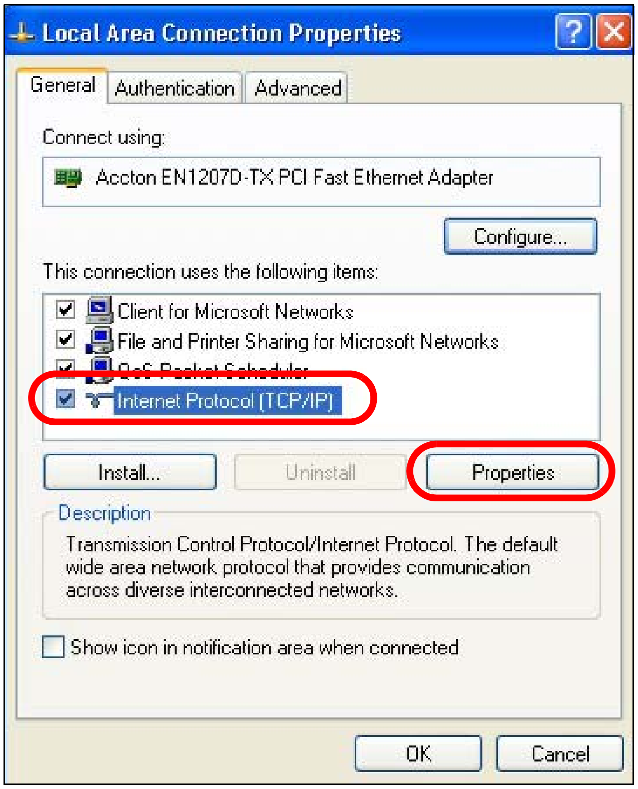
2 In the **Control Panel**, click the **Network Connections** icon.



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



4 On the **General** tab, select **Internet Protocol (TCP/IP)** and then click **Properties**.



Connect using:

Accton EN1207D-TX PCI Fast Ethernet Adapter

This connection uses the following items:

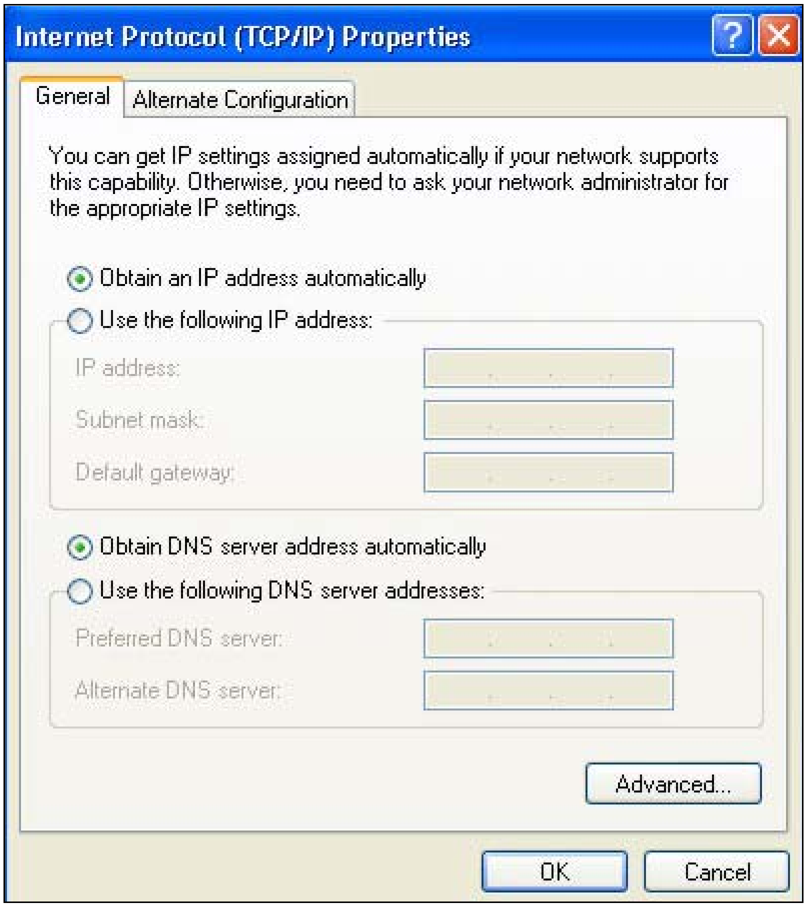
☑ Client for Microsoft Networks
☑ File and Printer Sharing for Microsoft Networks
☑ QoS Packet Scheduler
☑ Internet Protocol (TCP/IP)

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

□ Show icon in notification area when connected

5 The **Internet Protocol TCP/IP Properties** window opens.



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

6 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.

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

8 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

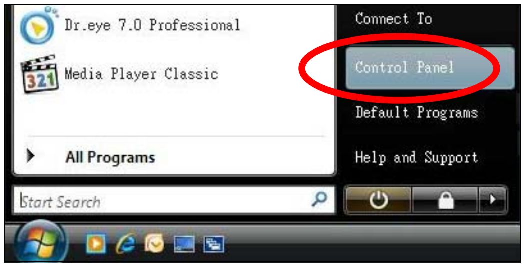
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

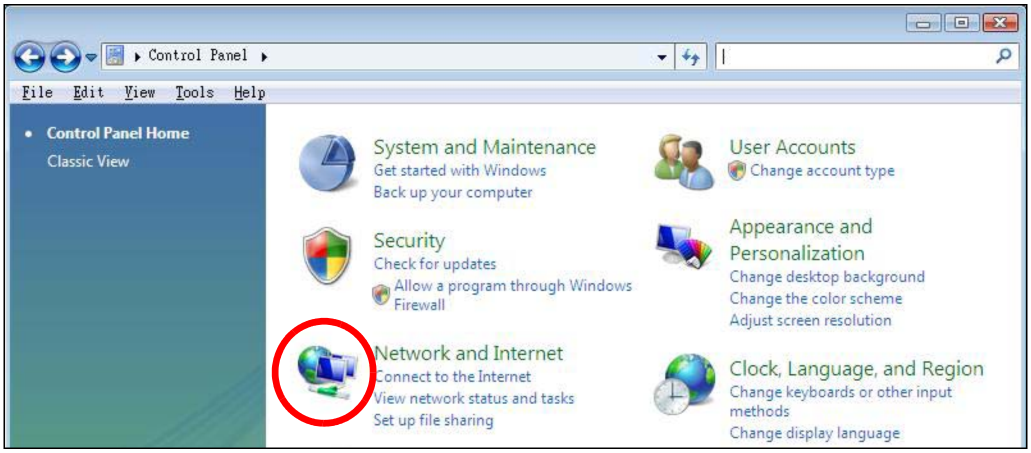
Windows Vista

This section shows screens from Windows Vista Professional.

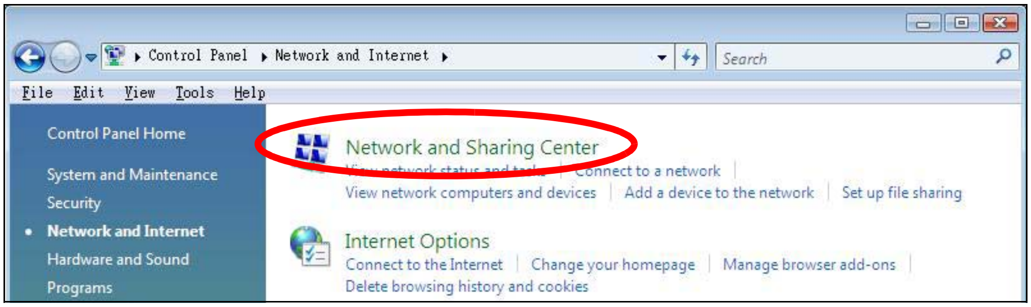
1 Click **Start** > **Control Panel**.



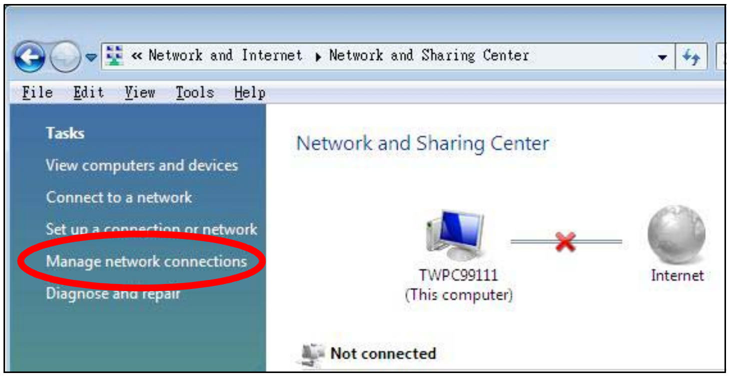
2 In the **Control Panel**, click the **Network and Internet** icon.



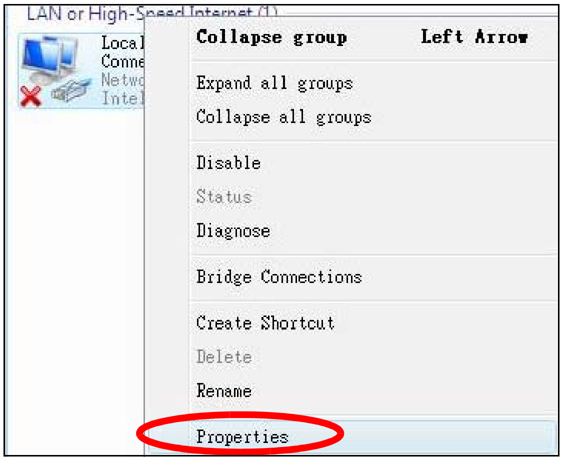
3 Click the **Network and Sharing Center** icon.



4 Click **Manage network connections**.

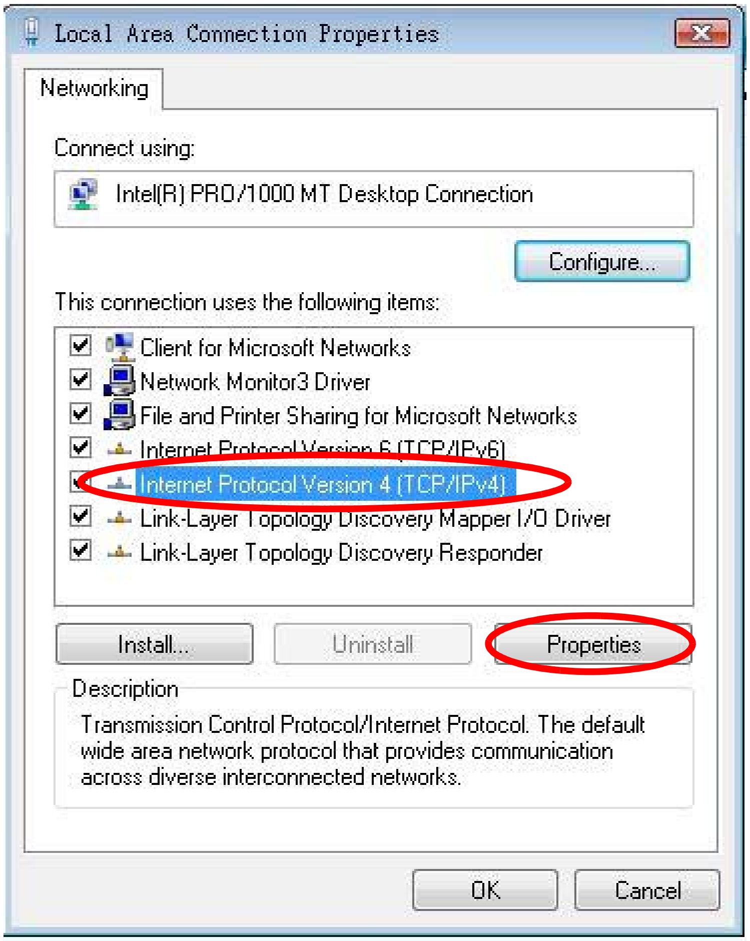

« Network and Internet ▸ Network and Sharing Center
File Edit View Tools Help
Tasks
View computers and devices
Connect to a network
Set up a connection or network
Manage network connections
Diagnose and repair
Network and Sharing Center
TWPC99111
(This computer)
Internet
Not connected

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



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

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



Local Area Connection Properties

Networking

Connect using:

Intel(R) PRO/1000 MT Desktop Connection

Configure...

This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ Network Monitor3 Driver
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

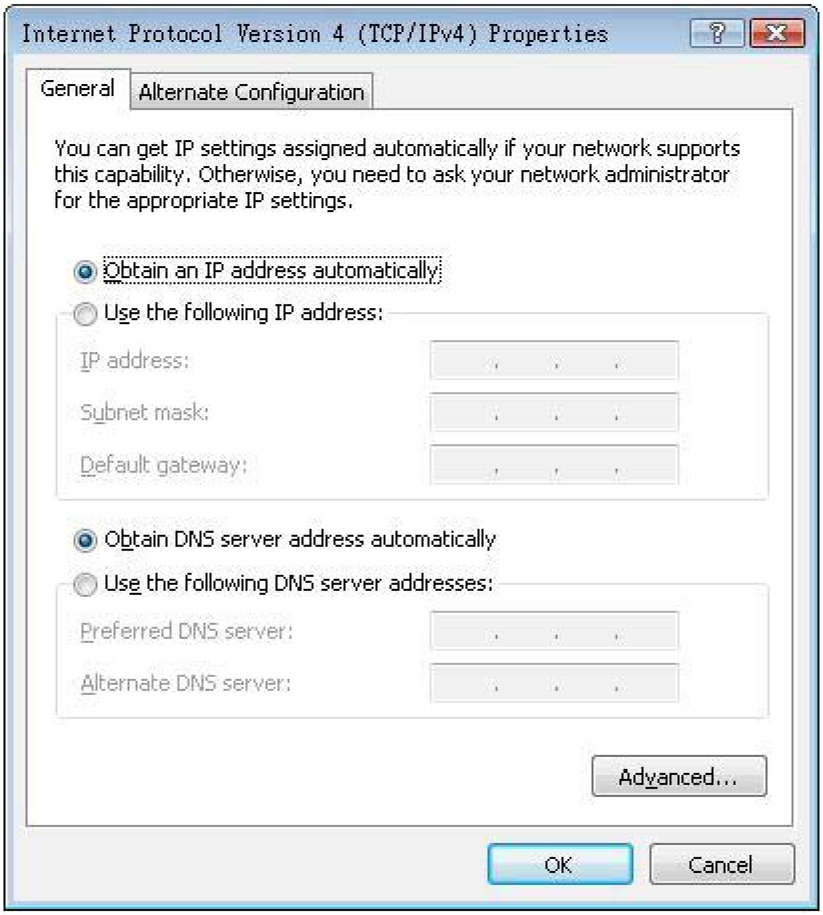
Install... Uninstall Properties

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

OK Cancel

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



Internet Protocol Version 4 (TCP/IPv4) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

8 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.Click **Advanced**.

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

10 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

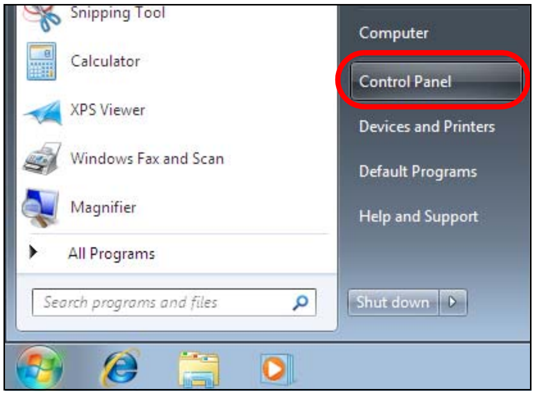
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

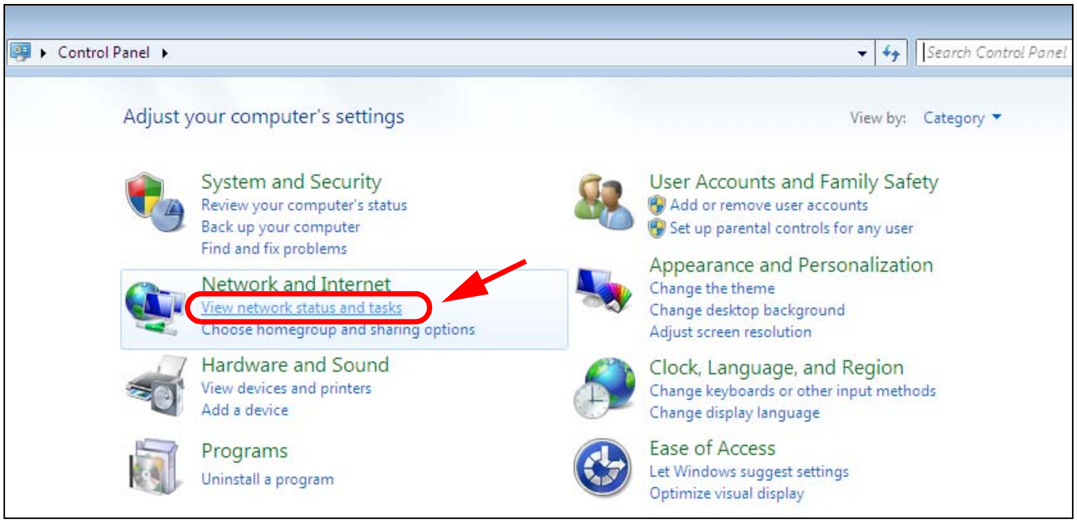
Windows 7

This section shows screens from Windows 7 Enterprise.

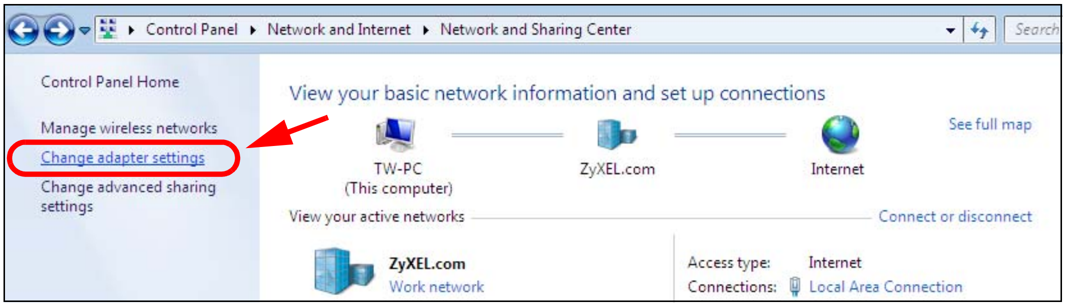
1 Click **Start** > **Control Panel**.



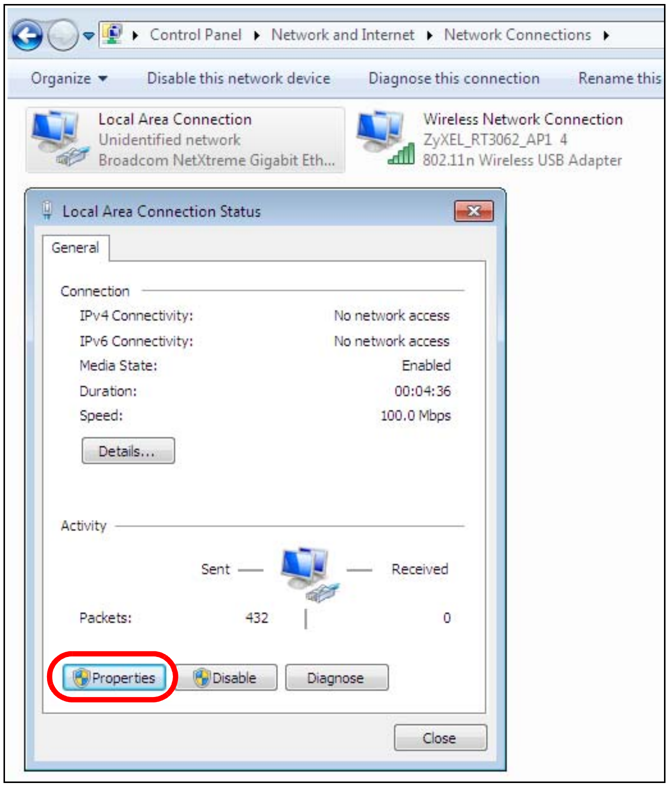
2 In the **Control Panel**, click **View network status and tasks** under the **Network and Internet** category.


Control Panel
Search Control Panel
Adjust your computer's settings
View by: Category
System and Security
Review your computer's status
Back up your computer
Find and fix problems
Network and Internet
View network status and tasks
Choose homegroup and sharing options
Hardware and Sound
View devices and printers
Add a device
Programs
Uninstall a program
User Accounts and Family Safety
Add or remove user accounts
Set up parental controls for any user
Appearance and Personalization
Change the theme
Change desktop background
Adjust screen resolution
Clock, Language, and Region
Change keyboards or other input methods
Change display language
Ease of Access
Let Windows suggest settings
Optimize visual display

3 Click **Change adapter settings**.



4 Double click **Local Area Connection** and then select **Properties**.



Local Area Connection
Unidentified network
Broadcom NetXtreme Gigabit Eth...

Wireless Network Connection
ZyXEL_RT3062_AP1 4
802.11n Wireless USB Adapter

Local Area Connection Status

Connection

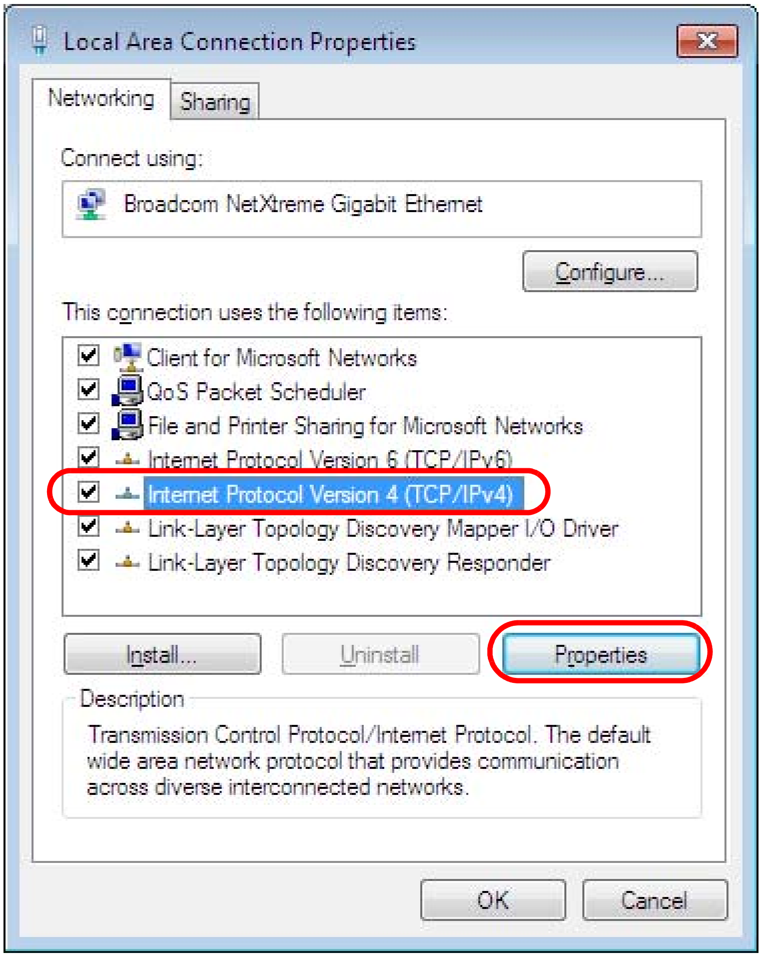
IPv4 Connectivity:	No network access
IPv6 Connectivity:	No network access
Media State:	Enabled
Duration:	00:04:36
Speed:	100.0 Mbps

Activity

	Sent	Received
Packets:	432	0

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

5 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.



Local Area Connection Properties

Connect using:

Broadcom NetXtreme Gigabit Ethernet

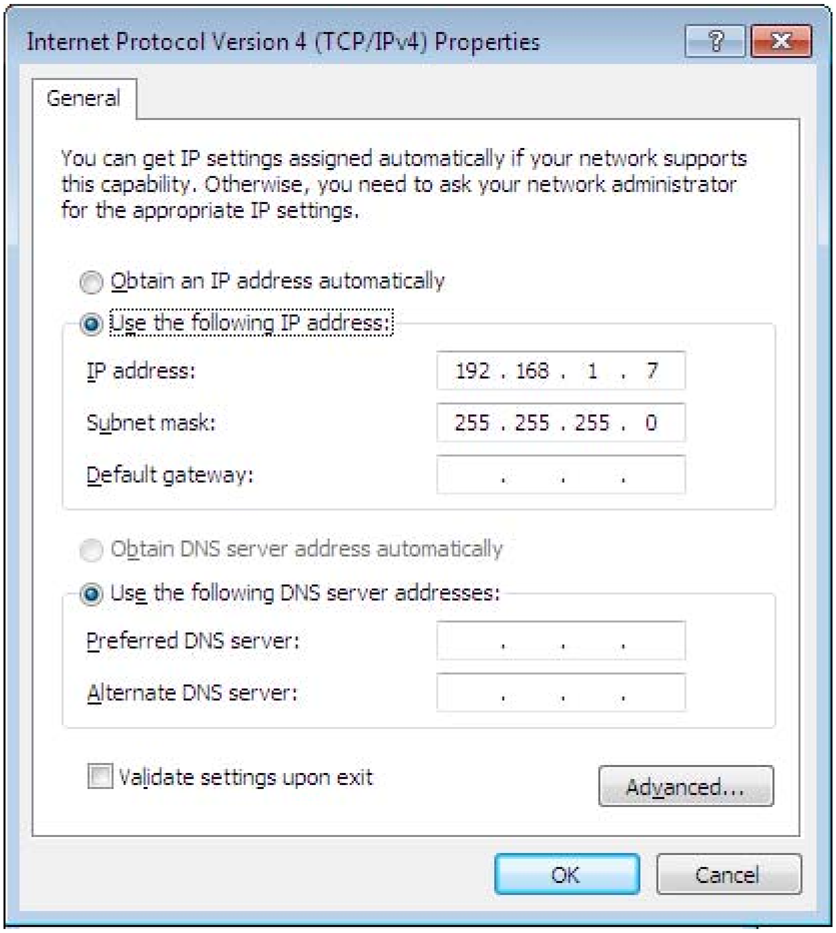
This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

6 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.



Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 192 . 168 . 1 . 7

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

□ Validate settings upon exit

7 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided. Click **Advanced** if you want to configure advanced settings for IP, DNS and WINS.

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

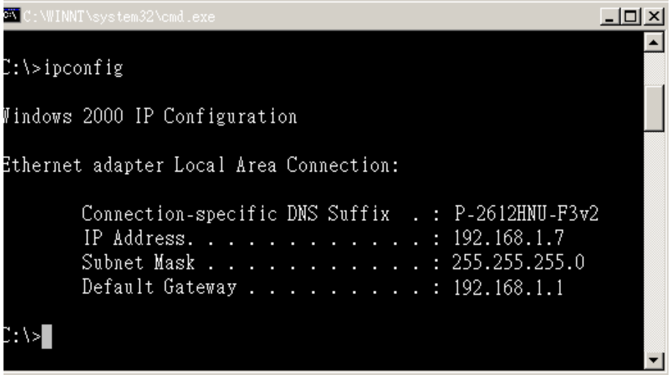
9 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

3 The IP settings are displayed as follows.

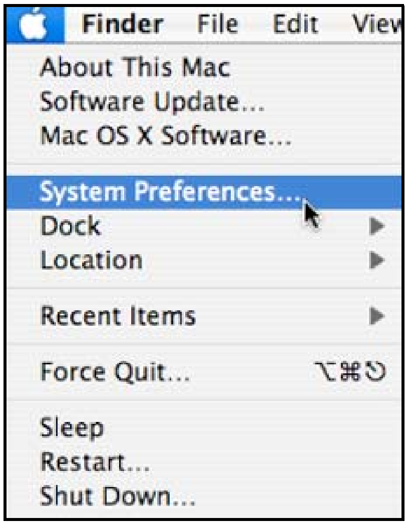


```
C:\>ipconfig

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . : P-2612HNU-F3v2
        IP Address. . . . . . . . . . . . : 192.168.1.7
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.1.1

C:\>
```

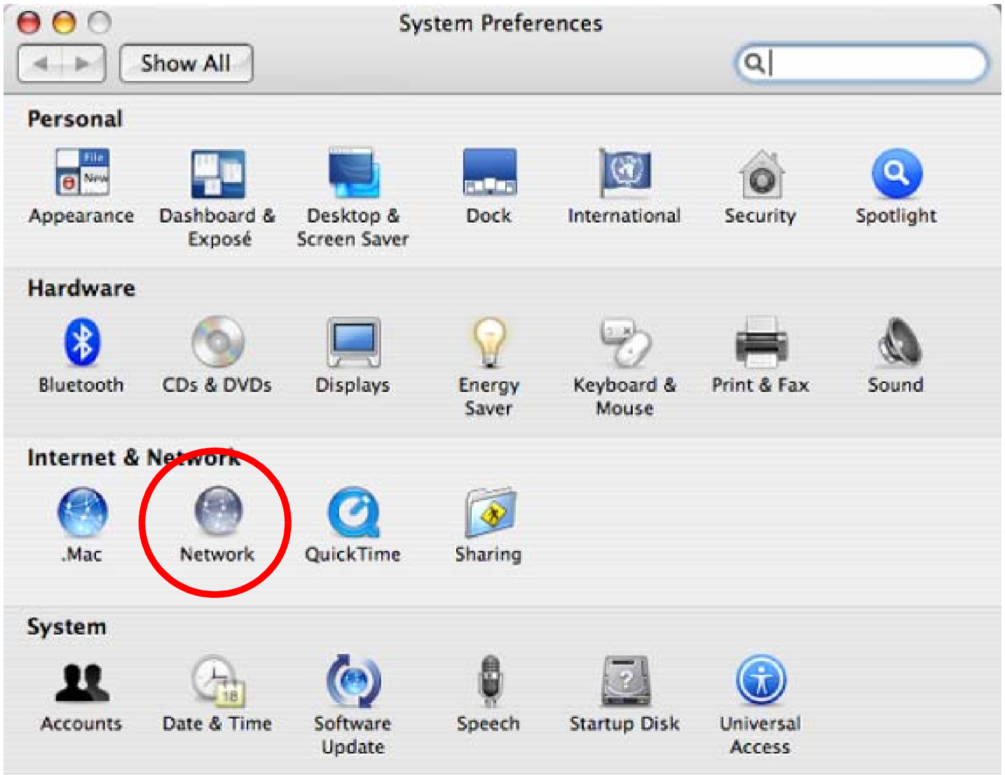
Mac OS X: 10.3 and 10.4

The screens in this section are from Mac OS X 10.4 but can also apply to 10.3.

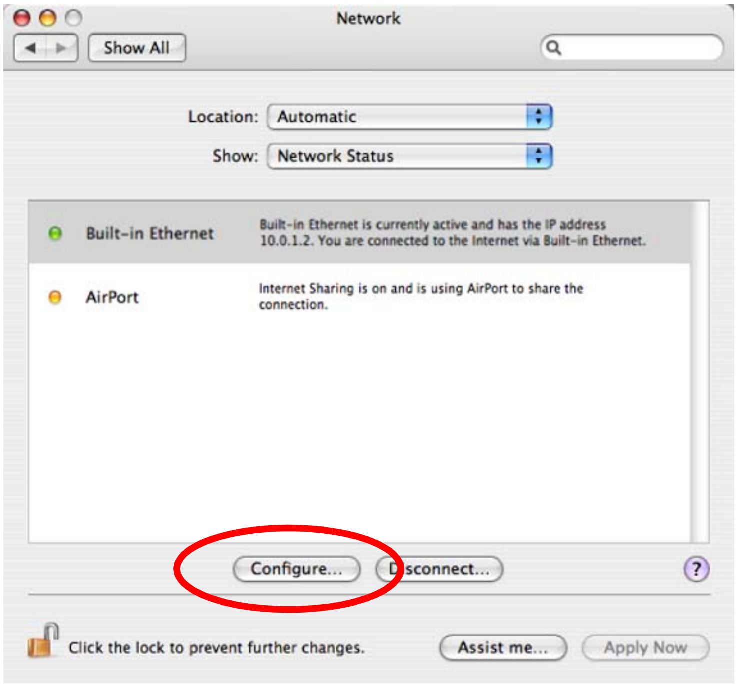
1 Click **Apple** > **System Preferences**.



2 In the **System Preferences** window, click the **Network** icon.



3 When the **Network** preferences pane opens, select **Built-in Ethernet** from the network connection type list, and then click **Configure.**



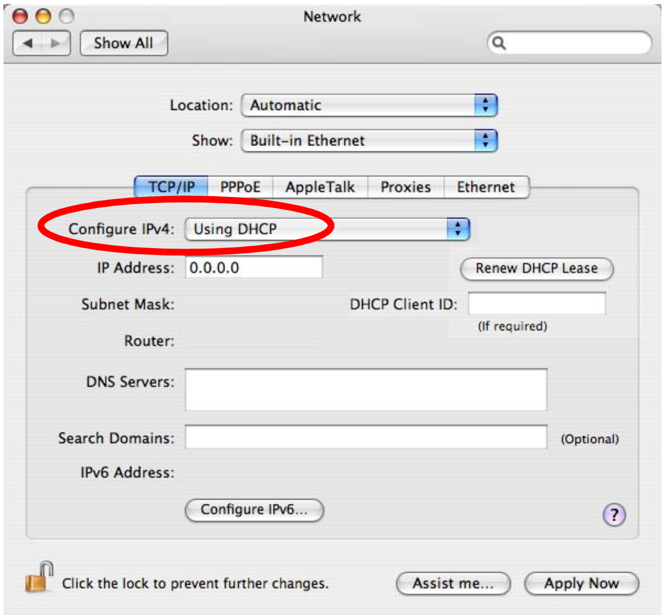
Location: Automatic

Show: Network Status

Built-in Ethernet	Built-in Ethernet is currently active and has the IP address 10.0.1.2. You are connected to the Internet via Built-in Ethernet.
AirPort	Internet Sharing is on and is using AirPort to share the connection.

Click the lock to prevent further changes.

4 For dynamically assigned settings, select **Using DHCP** from the **Configure IPv4** list in the **TCP/IP** tab.



Location: Automatic

Show: Built-in Ethernet

Configure IPv4: Using DHCP

IP Address: 0.0.0.0

Subnet Mask:

Router:

DNS Servers:

Search Domains: (Optional)

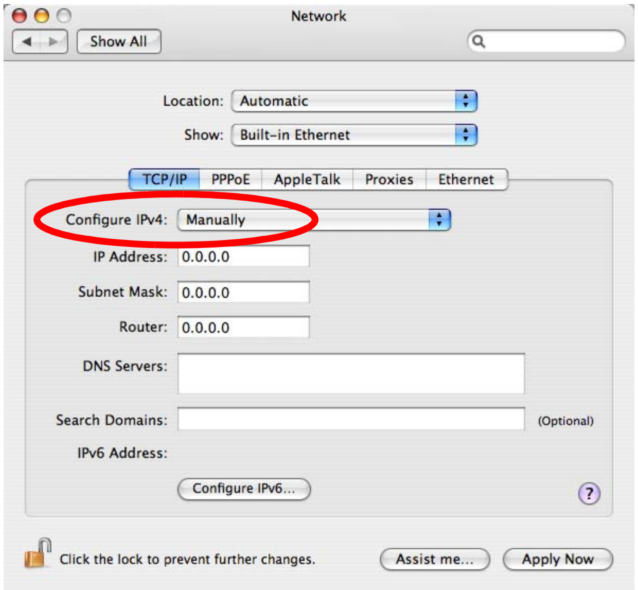
IPv6 Address:

DHCP Client ID: (If required)

Click the lock to prevent further changes.

5 For statically assigned settings, do the following:

- From the **Configure IPv4** list, select **Manually**.
- In the **IP Address** field, type your IP address.
- In the **Subnet Mask** field, type your subnet mask.
- In the **Router** field, type the IP address of your device.



Location: Automatic

Show: Built-in Ethernet

Configure IPv4: Manually

IP Address: 0.0.0.0

Subnet Mask: 0.0.0.0

Router: 0.0.0.0

DNS Servers:

Search Domains: (Optional)

IPv6 Address:

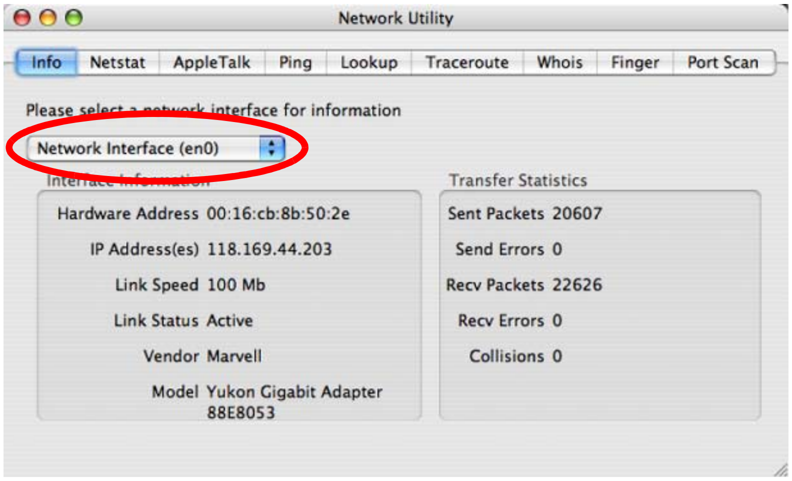
Click the lock to prevent further changes.

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

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network Interface** from the **Info** tab.

Figure 173 Mac OS X 10.4: Network Utility



Please select a network interface for information

Network Interface (en0)

Interface Information

Hardware Address 00:16:cb:8b:50:2e
IP Address(es) 118.169.44.203
Link Speed 100 Mb
Link Status Active
Vendor Marvell
Model Yukon Gigabit Adapter 88E8053

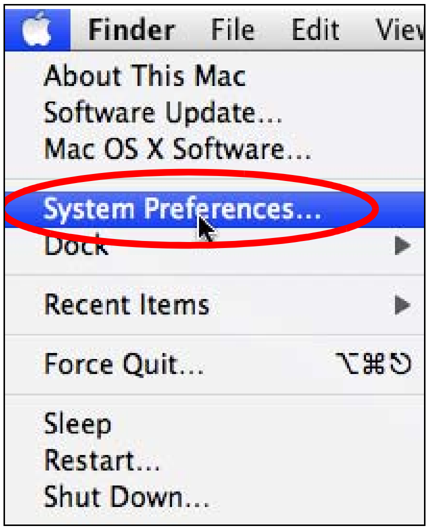
Transfer Statistics

Sent Packets 20607
Send Errors 0
Recv Packets 22626
Recv Errors 0
Collisions 0

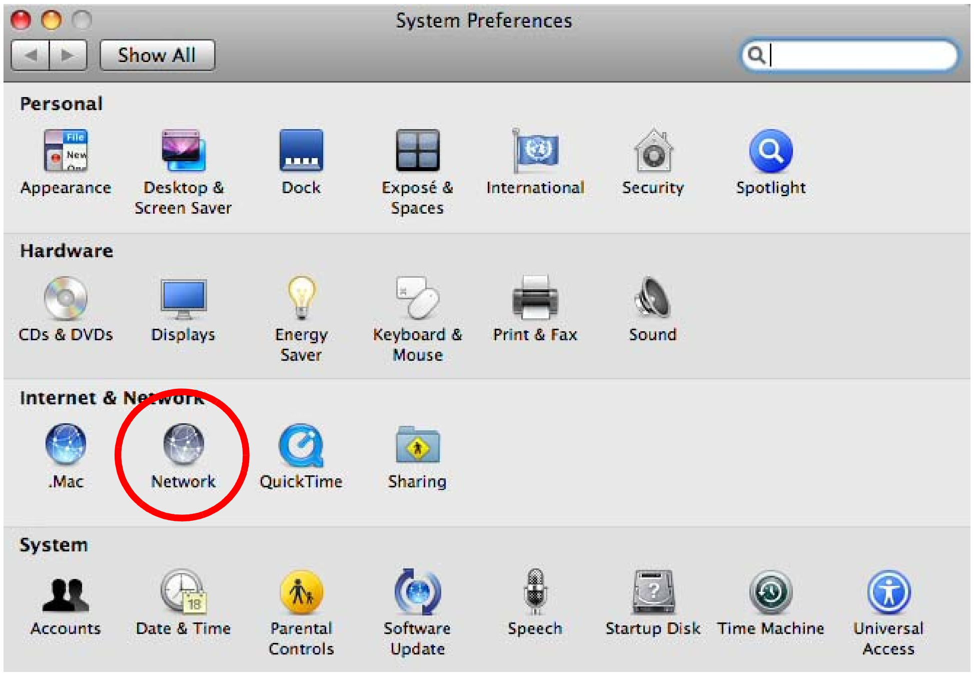
Mac OS X: 10.5 and 10.6

The screens in this section are from Mac OS X 10.5 but can also apply to 10.6.

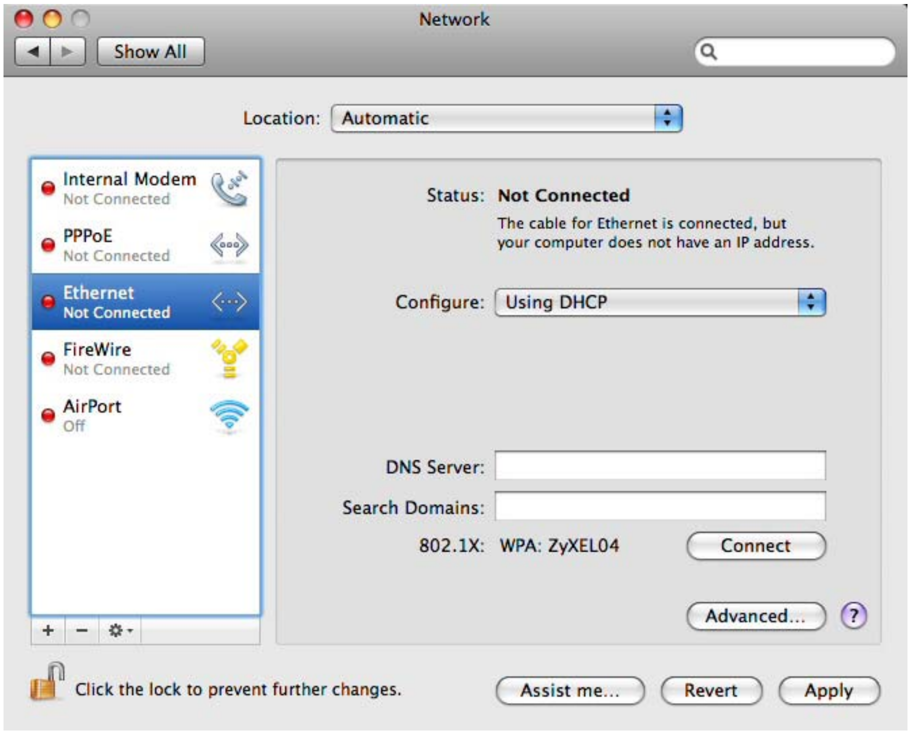
1 Click **Apple** > **System Preferences**.



2 In **System Preferences**, click the **Network** icon.



3 When the **Network** preferences pane opens, select **Ethernet** from the list of available connection types.



Location: Automatic

Status: Not Connected

The cable for Ethernet is connected, but your computer does not have an IP address.

Configure: Using DHCP

DNS Server:

Search Domains:

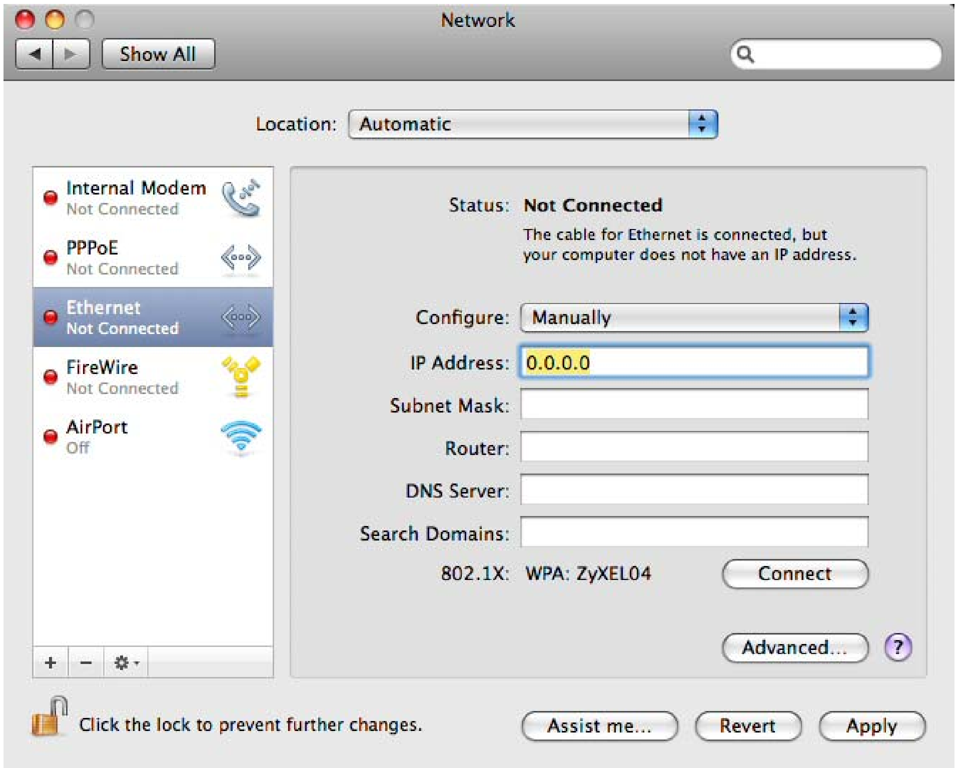
802.1X: WPA: ZyXEL04

Click the lock to prevent further changes.

4 From the **Configure** list, select **Using DHCP** for dynamically assigned settings.

5 For statically assigned settings, do the following:

- From the **Configure** list, select **Manually**.
- In the **IP Address** field, enter your IP address.
- In the **Subnet Mask** field, enter your subnet mask.
- In the **Router** field, enter the IP address of your NBG4615.



Location: Automatic

Internal Modem
Not Connected

PPPoE
Not Connected

Ethernet
Not Connected

FireWire
Not Connected

AirPort
Off

Status: **Not Connected**

The cable for Ethernet is connected, but your computer does not have an IP address.

Configure: Manually

IP Address: 0.0.0.0

Subnet Mask:

Router:

DNS Server:

Search Domains:

802.1X: WPA: ZyXEL04

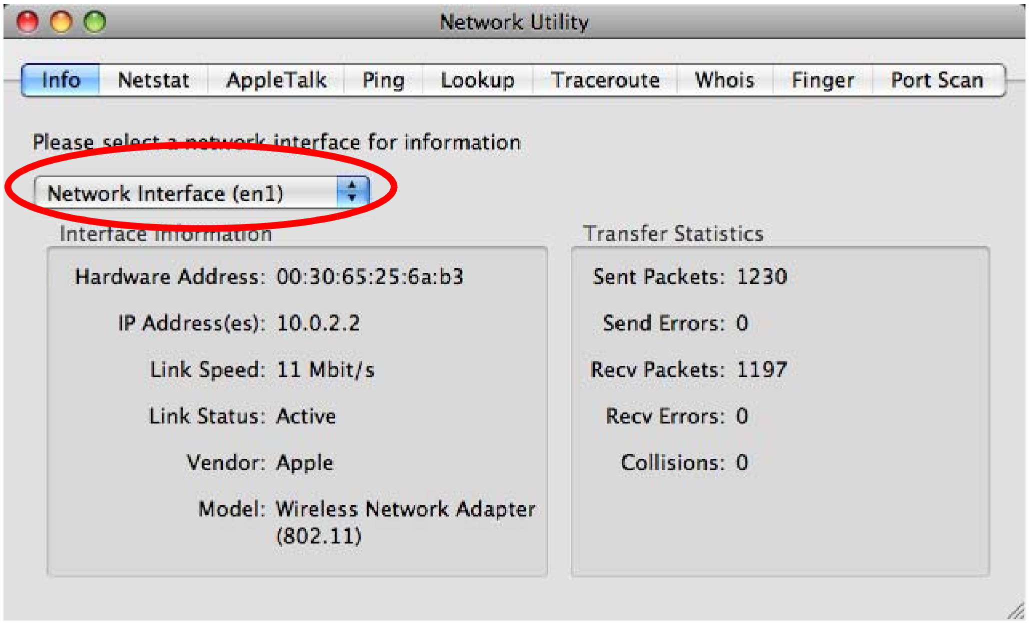
Click the lock to prevent further changes.

6 Click **Apply** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network interface** from the **Info** tab.

Figure 174 Mac OS X 10.5: Network Utility



Please select a network interface for information

Network Interface (en1)

Interface Information

Hardware Address: 00:30:65:25:6a:b3
IP Address(es): 10.0.2.2
Link Speed: 11 Mbit/s
Link Status: Active
Vendor: Apple
Model: Wireless Network Adapter (802.11)

Transfer Statistics

Sent Packets: 1230
Send Errors: 0
Recv Packets: 1197
Recv Errors: 0
Collisions: 0

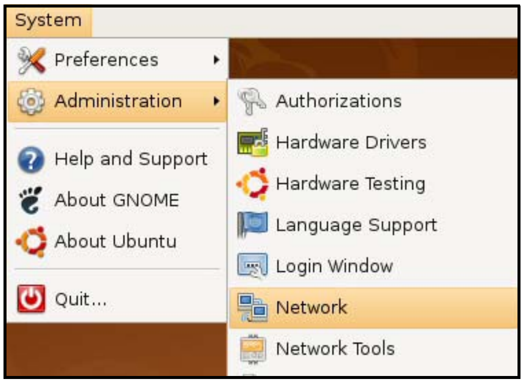
Linux: Ubuntu 8 (GNOME)

This section shows you how to configure your computer's TCP/IP settings in the GNU Object Model Environment (GNOME) using the Ubuntu 8 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default Ubuntu 8 installation.

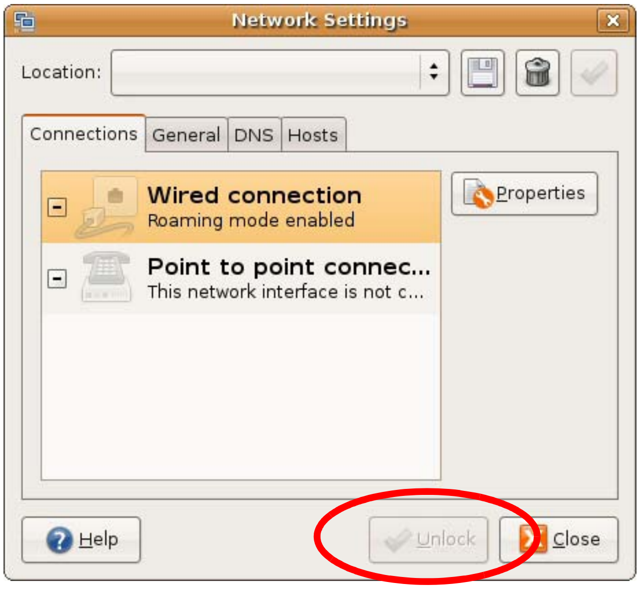
Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in GNOME:

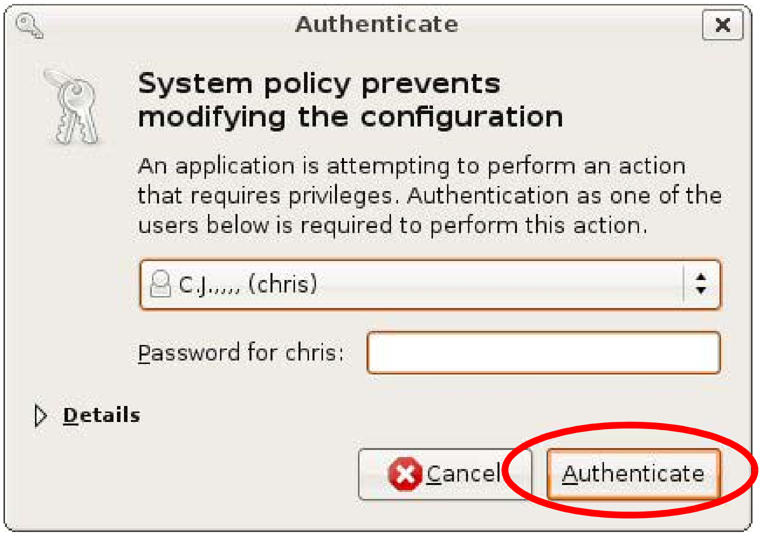
1 Click **System > Administration > Network**.



2 When the **Network Settings** window opens, click **Unlock** to open the **Authenticate** window. (By default, the **Unlock** button is greyed out until clicked.) You cannot make changes to your configuration unless you first enter your admin password.



3 In the **Authenticate** window, enter your admin account name and password then click the **Authenticate** button.



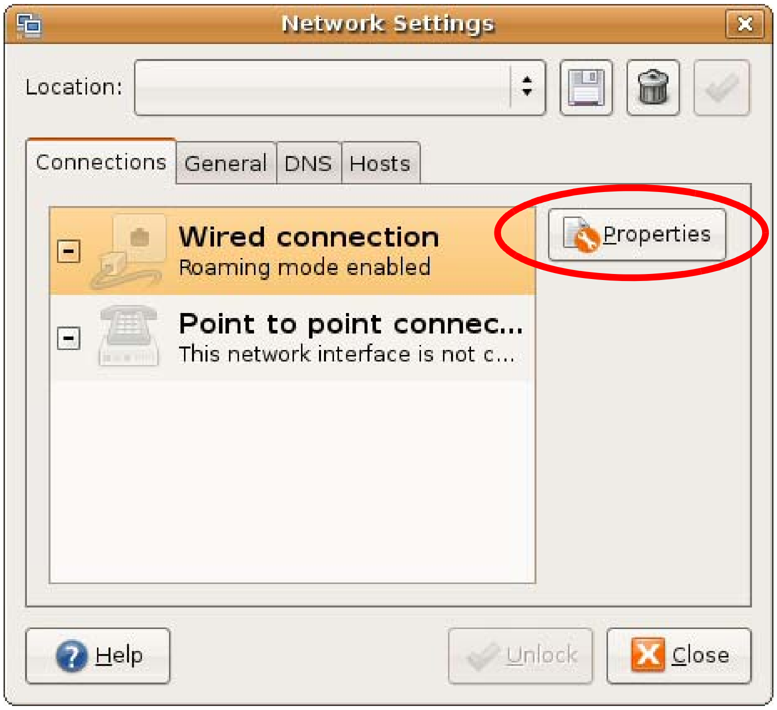
System policy prevents modifying the configuration

An application is attempting to perform an action that requires privileges. Authentication as one of the users below is required to perform this action.

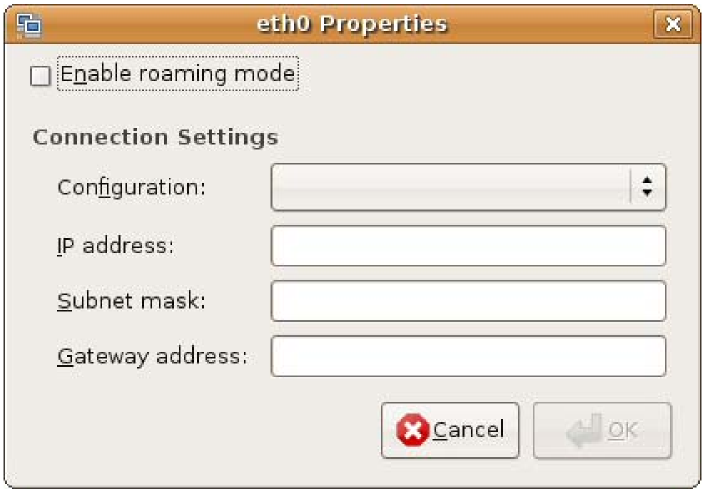
C.J.,,,, (chris)

Password for chris:

4 In the **Network Settings** window, select the connection that you want to configure, then click **Properties**.



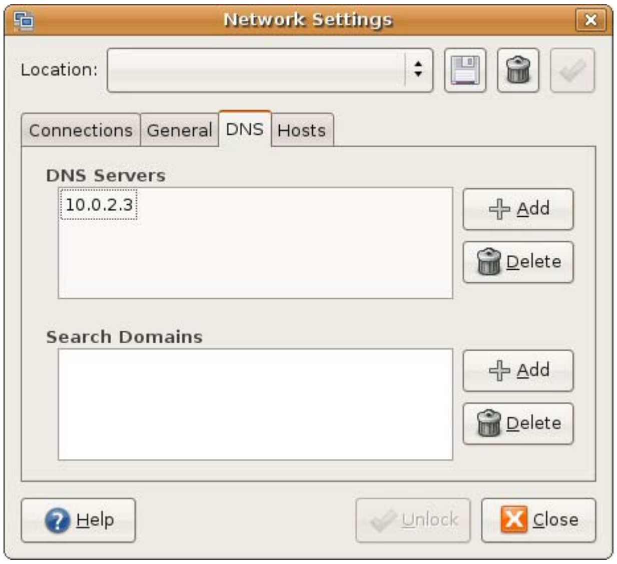
5 The **Properties** dialog box opens.



- In the **Configuration** list, select **Automatic Configuration (DHCP)** if you have a dynamic IP address.
- In the **Configuration** list, select **Static IP address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Gateway address** fields.

6 Click **OK** to save the changes and close the **Properties** dialog box and return to the **Network Settings** screen.

7 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Settings** window and then enter the DNS server information in the fields provided.



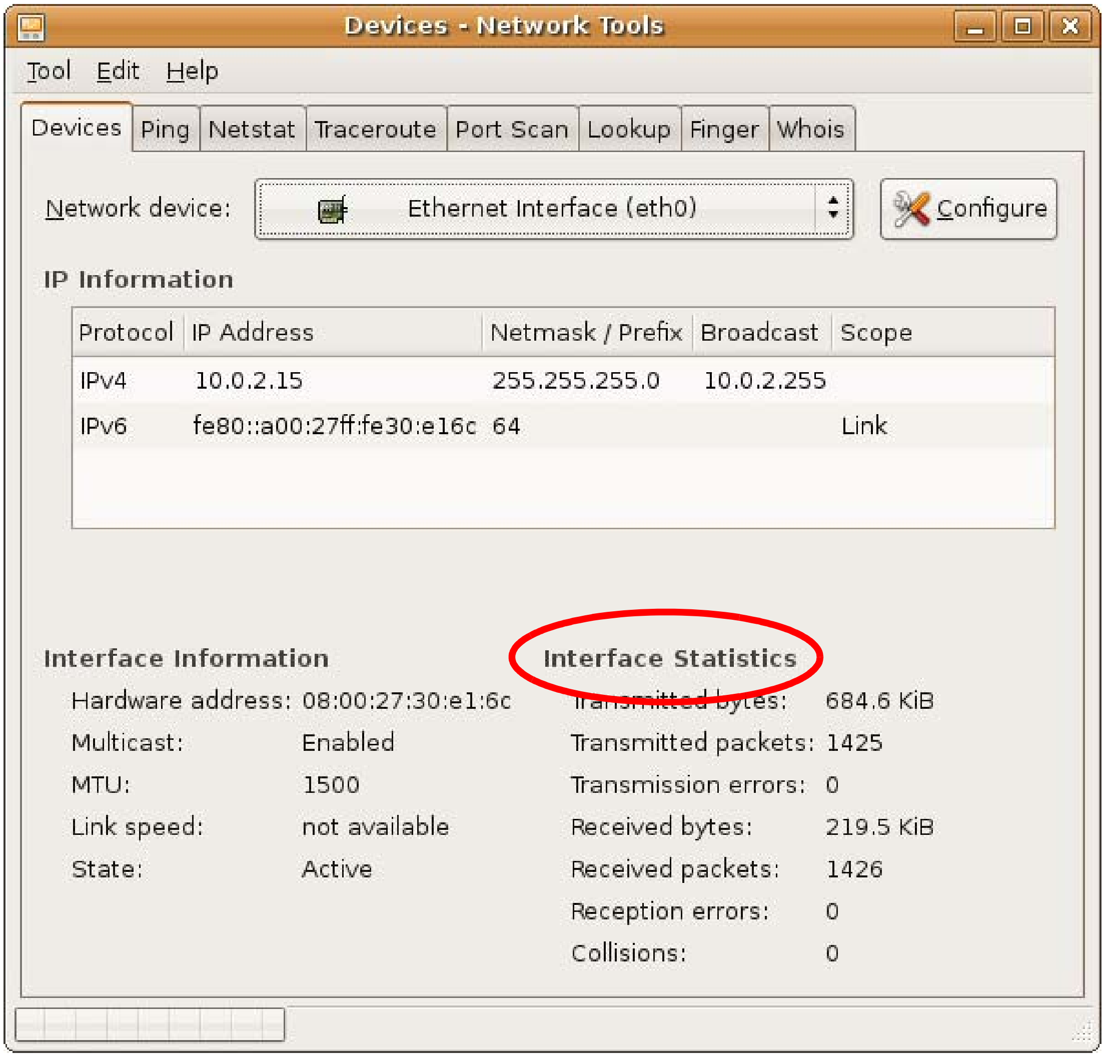
DNS Servers: 10.0.2.3

8 Click the **Close** button to apply the changes.

Verifying Settings

Check your TCP/IP properties by clicking **System > Administration > Network Tools**, and then selecting the appropriate **Network device** from the **Devices** tab. The **Interface Statistics** column shows data if your connection is working properly.

Figure 175 Ubuntu 8: Network Tools



Network device: Ethernet Interface (eth0)

IP Information

Protocol	IP Address	Netmask / Prefix	Broadcast	Scope
IPv4	10.0.2.15	255.255.255.0	10.0.2.255	
IPv6	fe80::a00:27ff:fe30:e16c	64		Link

Interface Information

Hardware address:	08:00:27:30:e1:6c
Multicast:	Enabled
MTU:	1500
Link speed:	not available
State:	Active

Interface Statistics

Transmitted bytes:	684.6 KiB
Transmitted packets:	1425
Transmission errors:	0
Received bytes:	219.5 KiB
Received packets:	1426
Reception errors:	0
Collisions:	0

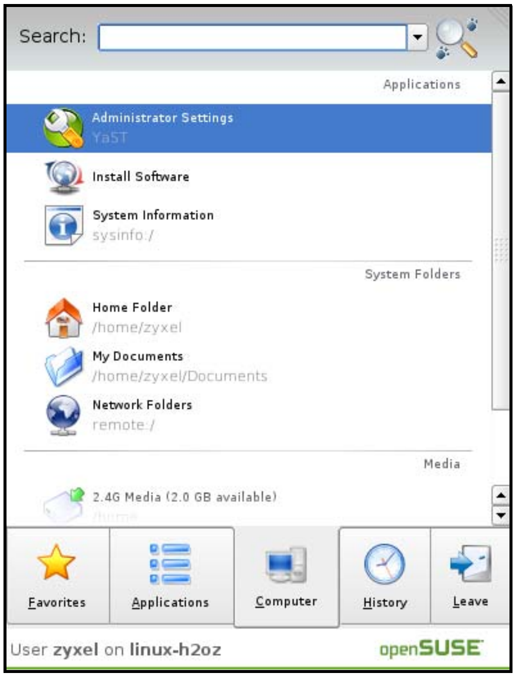
Linux: openSUSE 10.3 (KDE)

This section shows you how to configure your computer’s TCP/IP settings in the K Desktop Environment (KDE) using the openSUSE 10.3 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default openSUSE 10.3 installation.

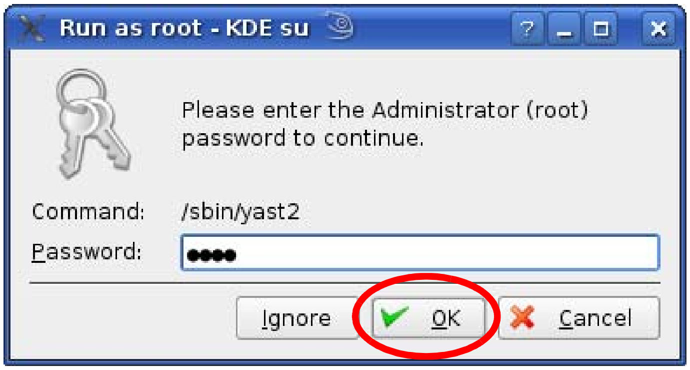
Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in the KDE:

1 Click **K Menu > Computer > Administrator Settings (YaST)**.



2 When the **Run as Root - KDE su** dialog opens, enter the admin password and click **OK**.

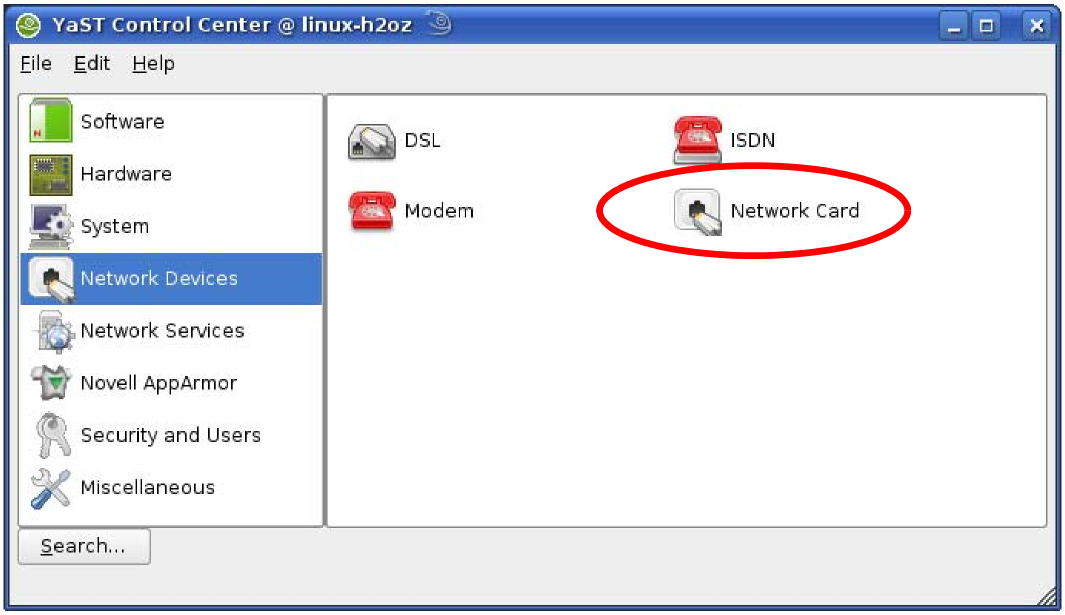


Please enter the Administrator (root) password to continue.

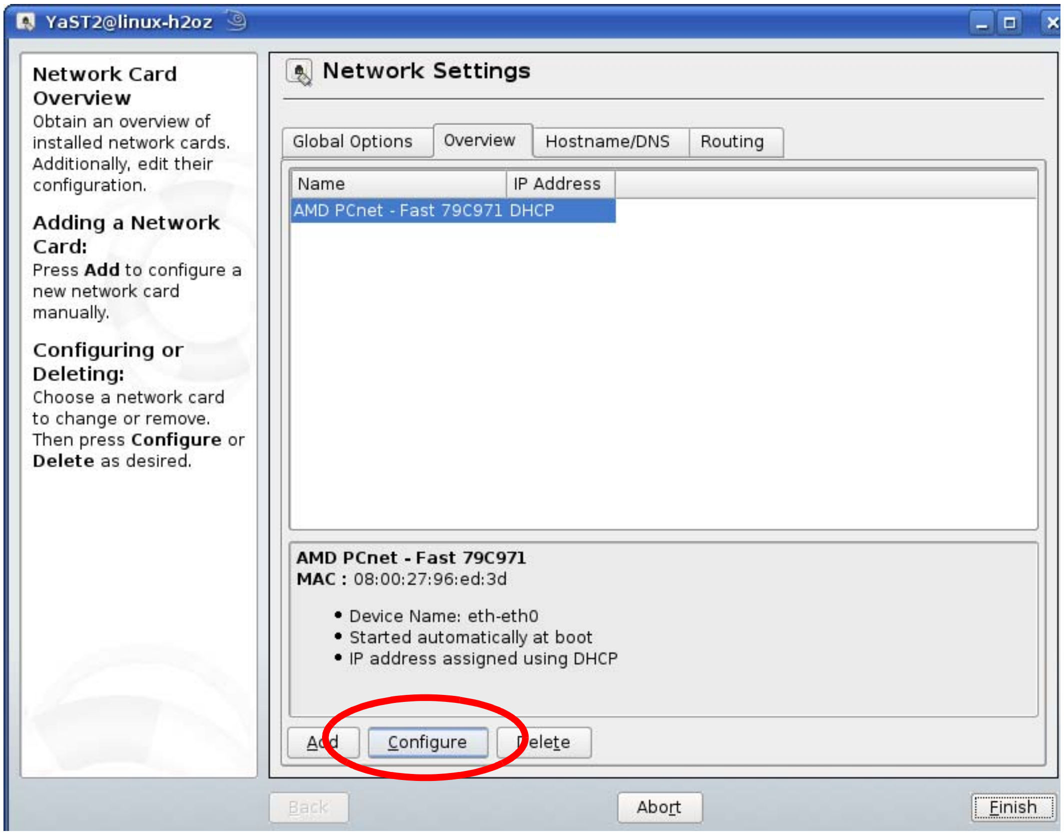
Command: /sbin/yast2

Password: ●●●●

3 When the **YaST Control Center** window opens, select **Network Devices** and then click the **Network Card** icon.



4 When the **Network Settings** window opens, click the **Overview** tab, select the appropriate connection **Name** from the list, and then click the **Configure** button.



Network Card Overview
Obtain an overview of installed network cards. Additionally, edit their configuration.

Adding a Network Card:
Press **Add** to configure a new network card manually.

Configuring or Deleting:
Choose a network card to change or remove. Then press **Configure** or **Delete** as desired.

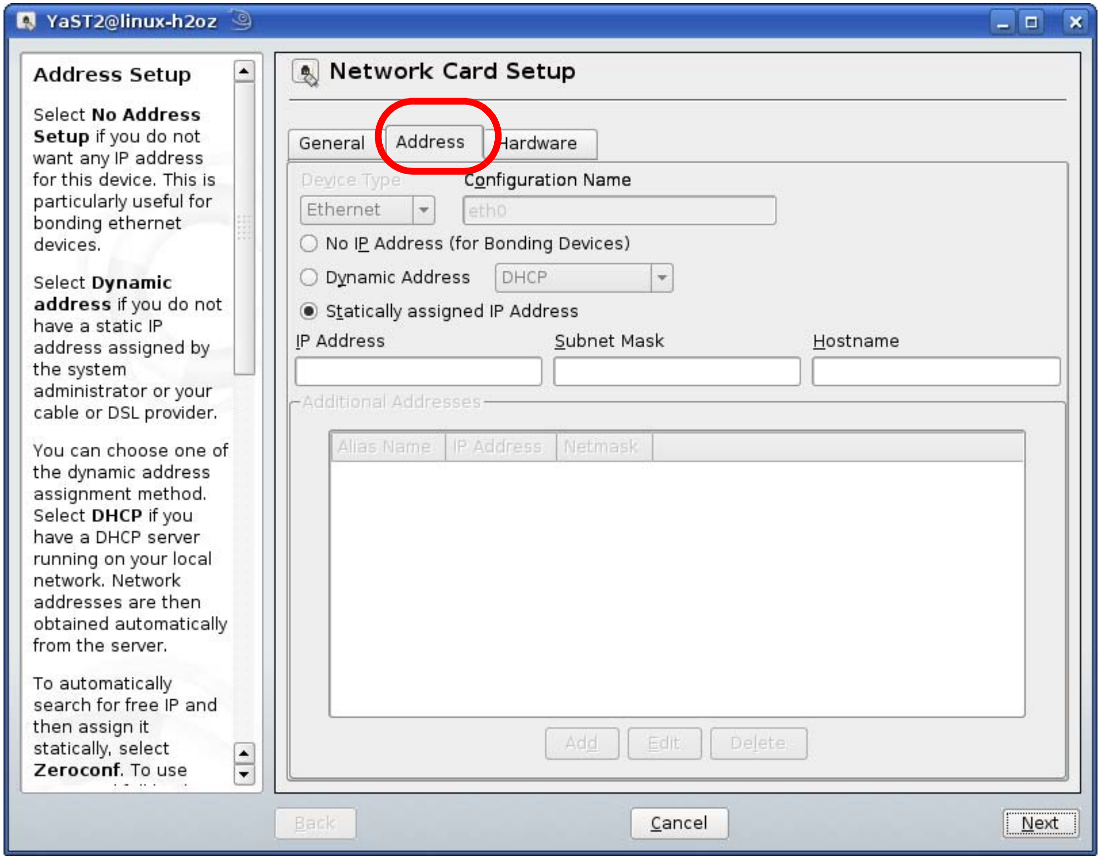
Name	IP Address
AMD PCnet - Fast 79C971	DHCP

AMD PCnet - Fast 79C971
MAC : 08:00:27:96:ed:3d

- Device Name: eth-eth0
- Started automatically at boot
- IP address assigned using DHCP

5 When the **Network Card Setup** window opens, click the **Address** tab

Figure 176 openSUSE 10.3: Network Card Setup



Address Setup

Select **No Address Setup** if you do not want any IP address for this device. This is particularly useful for bonding ethernet devices.

Select **Dynamic address** if you do not have a static IP address assigned by the system administrator or your cable or DSL provider.

You can choose one of the dynamic address assignment method. Select **DHCP** if you have a DHCP server running on your local network. Network addresses are then obtained automatically from the server.

To automatically search for free IP and then assign it statically, select **Zeroconf.** To use

Device Type: Ethernet
Configuration Name: eth0

○ No IP Address (for Bonding Devices)
○ Dynamic Address DHCP
● Statically assigned IP Address

IP Address	Subnet Mask	Hostname

Additional Addresses

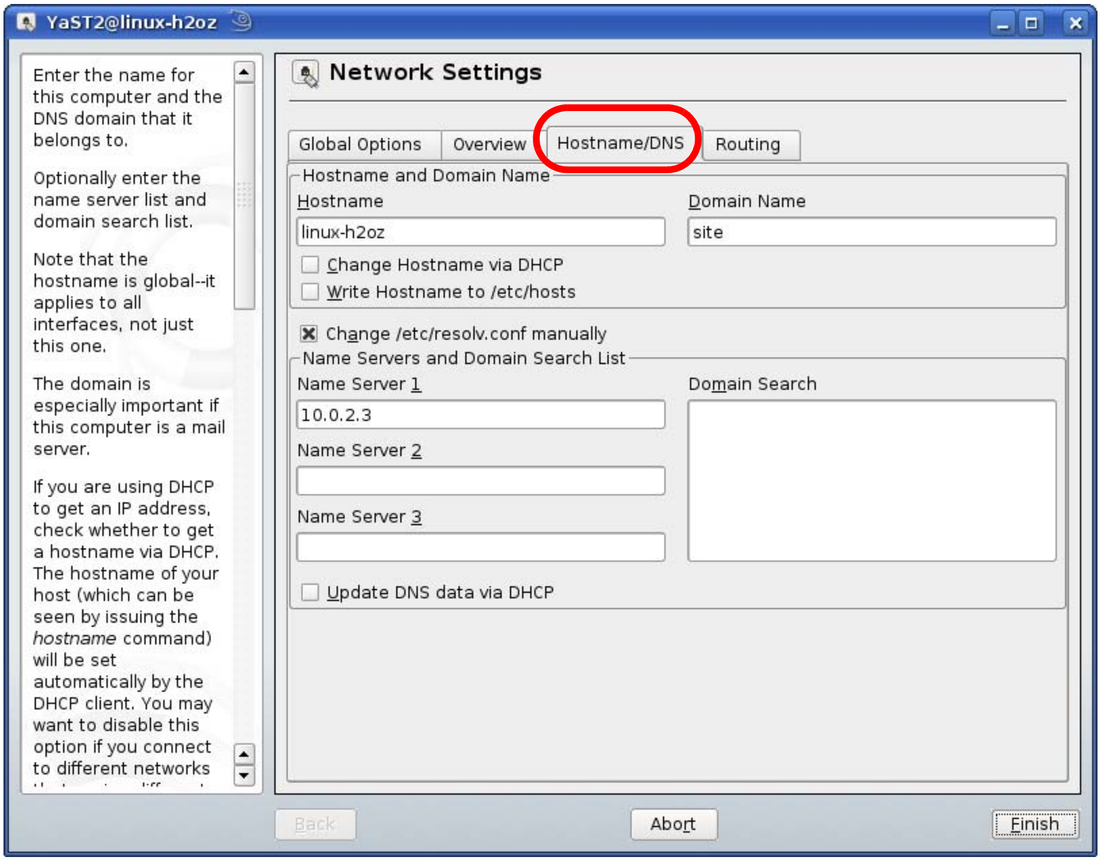
Alias Name	IP Address	Netmask

6 Select **Dynamic Address (DHCP)** if you have a dynamic IP address.

Select **Statically assigned IP Address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Hostname** fields.

7 Click **Next** to save the changes and close the **Network Card Setup** window.

8 If you know your DNS server IP address(es), click the **Hostname/DNS** tab in **Network Settings** and then enter the DNS server information in the fields provided.



Enter the name for this computer and the DNS domain that it belongs to.

Optionally enter the name server list and domain search list.

Note that the hostname is global--it applies to all interfaces, not just this one.

The domain is especially important if this computer is a mail server.

If you are using DHCP to get an IP address, check whether to get a hostname via DHCP. The hostname of your host (which can be seen by issuing the *hostname* command) will be set automatically by the DHCP client. You may want to disable this option if you connect to different networks

Hostname and Domain Name

Hostname: linux-h2oz

Domain Name: site

☐ Change Hostname via DHCP

☐ Write Hostname to /etc/hosts

☒ Change /etc/resolv.conf manually

Name Servers and Domain Search List

Name Server 1: 10.0.2.3

Name Server 2:

Name Server 3:

Domain Search:

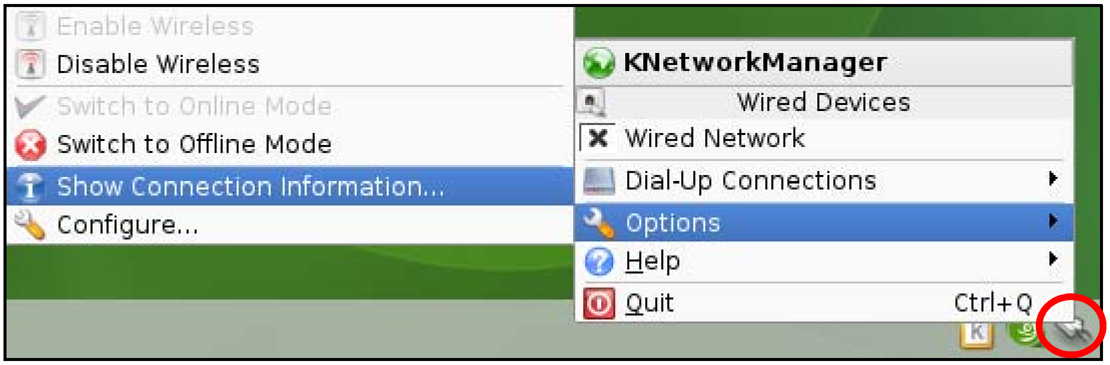
☐ Update DNS data via DHCP

9 Click **Finish** to save your settings and close the window.

Verifying Settings

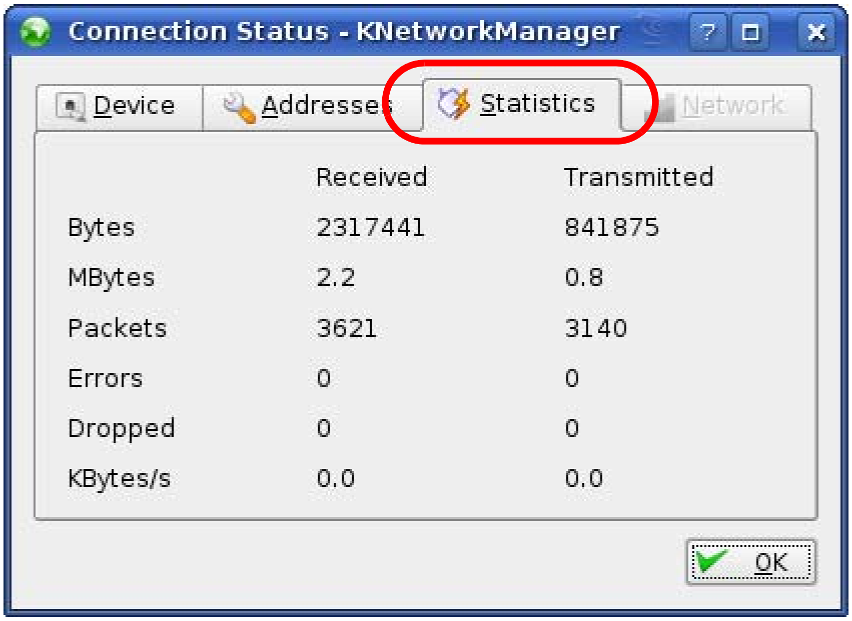
Click the **KNetwork Manager** icon on the **Task bar** to check your TCP/IP properties. From the **Options** sub-menu, select **Show Connection Information**.

Figure 177 openSUSE 10.3: KNetwork Manager



When the **Connection Status - KNetwork Manager** window opens, click the **Statistics tab** to see if your connection is working properly.

Figure 178 openSUSE: Connection Status - KNetwork Manager



	Received	Transmitted
Bytes	2317441	841875
MBytes	2.2	0.8
Packets	3621	3140
Errors	0	0
Dropped	0	0
KBytes/s	0.0	0.0

E

Wireless LANs

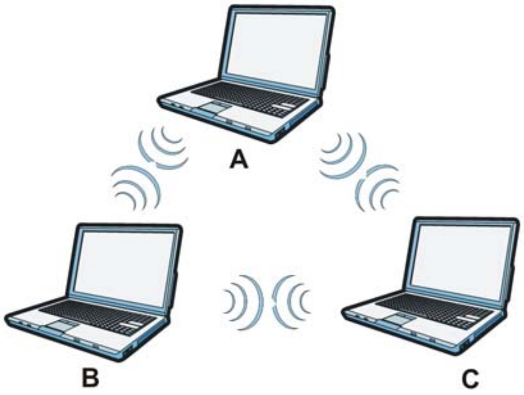
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

Figure 179 Peer-to-Peer Communication in an Ad-hoc Network

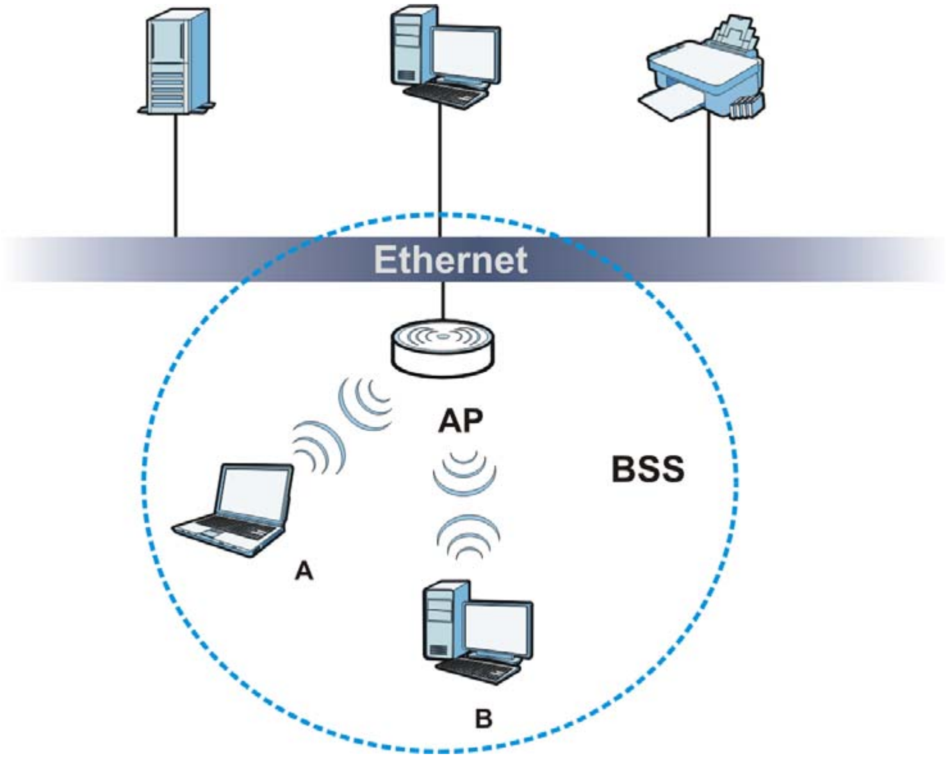


BSS

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

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

Figure 180 Basic Service Set



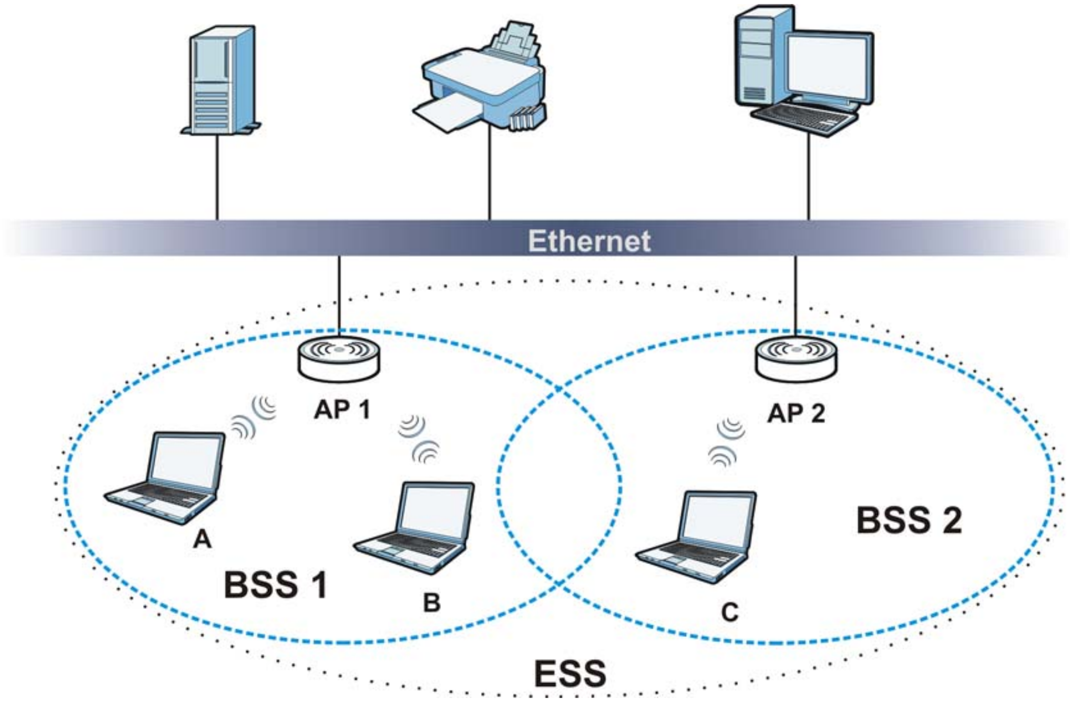
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless clients within the same ESS must have the same ESSID in order to communicate.

Figure 181 Infrastructure WLAN



Channel

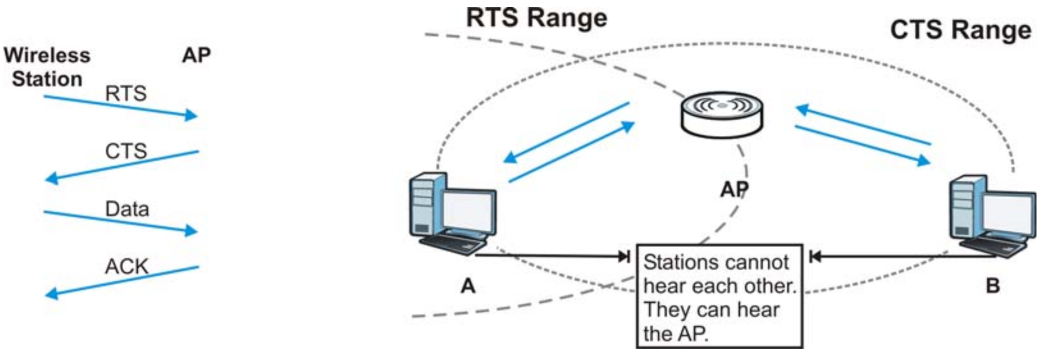
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference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

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 182 RTS/CTS



When station **A** sends data to the AP, it might not know that the station **B** is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Note: Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Preamble Type

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

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

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

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

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the NBG4615 uses long preamble.

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

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 104 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless clients, access points and the wired network.

Wireless security methods available on the NBG4615 are data encryption, wireless client authentication, restricting access by device MAC address and hiding the NBG4615 identity.

The following figure shows the relative effectiveness of these wireless security methods available on your NBG4615.

Table 105 Wireless Security Levels

SECURITY LEVEL	SECURITY TYPE
Least Secure	Unique SSID (Default)
	Unique SSID with Hide SSID Enabled
	MAC Address Filtering
	WEP Encryption
	IEEE802.1x EAP with RADIUS Server Authentication
	Wi-Fi Protected Access (WPA)
Most Secure	WPA2

Note: You must enable the same wireless security settings on the NBG4615 and on all wireless clients that you want to associate with it.

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.
- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless clients.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication

  Determines the identity of the users.
- Authorization

  Determines the network services available to authenticated users once they are connected to the network.
- Accounting

  Keeps track of the client’s network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless client and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request

  Sent by an access point requesting authentication.
- Access-Reject

  Sent by a RADIUS server rejecting access.
- Access-Accept

  Sent by a RADIUS server allowing access.
- Access-Challenge

  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request

  Sent by the access point requesting accounting.
- Accounting-Response

  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. .

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless client. The wireless client ‘proves’ that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless clients for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender’s identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the wireless security configuration screen. You may still configure and store keys, but they will not be used while dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 106 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA or WPA2 and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

WPA improves data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA2 also uses TKIP when required for compatibility reasons, but offers stronger encryption than TKIP with Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP).

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it’s still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless clients using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

Wireless Client WPA Supplicants

A wireless client supplicant is the software that runs on an operating system instructing the wireless client how to use WPA. At the time of writing, the most widely available supplicant is the WPA patch for Windows XP, Funk Software's Odyssey client.

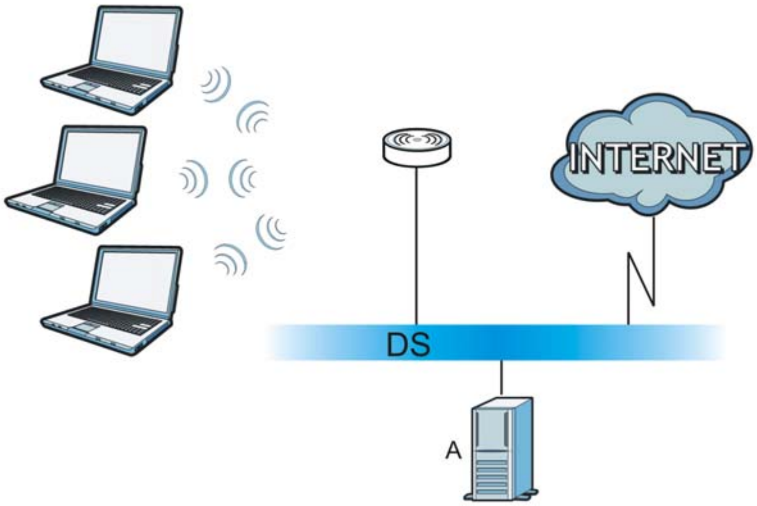
The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

WPA(2) with RADIUS Application Example

To set up WPA(2), you need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

1. The AP passes the wireless client's authentication request to the RADIUS server.
2. The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
3. A 256-bit Pairwise Master Key (PMK) is derived from the authentication process by the RADIUS server and the client.
4. The RADIUS server distributes the PMK to the AP. The AP then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys. The keys are used to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 183 WPA(2) with RADIUS Application Example



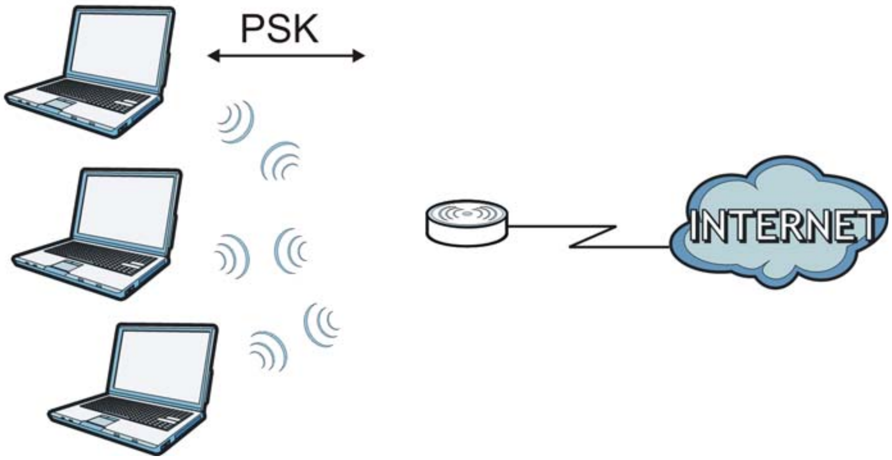
WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

1. First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
2. The AP checks each wireless client's password and allows it to join the network only if the password matches.
3. The AP and wireless clients generate a common PMK (Pairwise Master Key). The key itself is not sent over the network, but is derived from the PSK and the SSID.

4 The AP and wireless clients use the TKIP or AES encryption process, the PMK and information exchanged in a handshake to create temporal encryption keys. They use these keys to encrypt data exchanged between them.

Figure 184 WPA(2)-PSK Authentication



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each authentication method or key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 107 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

Antenna Overview

An antenna couples RF signals onto air. A transmitter within a wireless device sends an RF signal to the antenna, which propagates the signal through the air. The antenna also operates in reverse by capturing RF signals from the air.

Positioning the antennas properly increases the range and coverage area of a wireless LAN.

Antenna Characteristics

Frequency

An antenna in the frequency of 2.4GHz (IEEE 802.11b and IEEE 802.11g) or 5GHz (IEEE 802.11a) is needed to communicate efficiently in a wireless LAN

Radiation Pattern

A radiation pattern is a diagram that allows you to visualize the shape of the antenna's coverage area.

Antenna Gain

Antenna gain, measured in dB (decibel), is the increase in coverage within the RF beam width. Higher antenna gain improves the range of the signal for better communications.

For an indoor site, each 1 dB increase in antenna gain results in a range increase of approximately 2.5%. For an unobstructed outdoor site, each 1dB increase in gain results in a range increase of approximately 5%. Actual results may vary depending on the network environment.

Antenna gain is sometimes specified in dBi, which is how much the antenna increases the signal power compared to using an isotropic antenna. An isotropic antenna is a theoretical perfect antenna that sends out radio signals equally well in all directions. dBi represents the true gain that the antenna provides.

Types of Antennas for WLAN

There are two types of antennas used for wireless LAN applications.

- Omni-directional antennas send the RF signal out in all directions on a horizontal plane. The coverage area is torus-shaped (like a donut) which makes these antennas ideal for a room environment. With a wide coverage area, it is possible to make circular overlapping coverage areas with multiple access points.
- Directional antennas concentrate the RF signal in a beam, like a flashlight does with the light from its bulb. The angle of the beam determines the width of the coverage pattern. Angles typically range from 20 degrees (very directional) to 120 degrees (less directional). Directional antennas are ideal for hallways and outdoor point-to-point applications.

Positioning Antennas

In general, antennas should be mounted as high as practically possible and free of obstructions. In point-to–point application, position both antennas at the same height and in a direct line of sight to each other to attain the best performance.

For omni-directional antennas mounted on a table, desk, and so on, point the antenna up. For omni-directional antennas mounted on a wall or ceiling, point the antenna down. For a single AP application, place omni-directional antennas as close to the center of the coverage area as possible.

For directional antennas, point the antenna in the direction of the desired coverage area.

Common Services

The following table lists some commonly-used services and their associated protocols and port numbers. For a comprehensive list of port numbers, ICMP type/code numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**. Please refer to RFC 1700 for further information about port numbers.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 108 Commonly Used Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM/New-ICQ	TCP	5190	AOL's Internet Messenger service. It is also used as a listening port by ICQ.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for example www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.

Table 108 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/ server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic or routing purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/ server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	Simple File Transfer Protocol.

Table 108 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP	7000	Another videoconferencing solution.

G

IPv6

Overview

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

IPv6 Addressing

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

IPv6 addresses can be abbreviated in two ways:

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

Prefix and Prefix Length

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

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

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

Link-local Address

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

Table 109 Link-local Unicast Address Format

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

Global Address

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

Unspecified Address

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

Loopback Address

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

Multicast Address

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

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

Table 110 Predefined Multicast Address

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

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

Table 111 Reserved Multicast Address

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

Table 111 Reserved Multicast Address (continued)

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

Subnet Masking

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

Interface ID

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

EUI-64

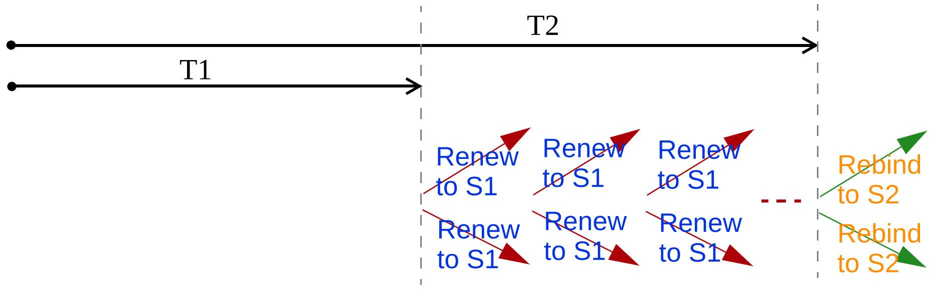
The EUI-64 (Extended Unique Identifier) defined by the IEEE (Institute of Electrical and Electronics Engineers) is an interface ID format designed to adapt with IPv6. It is derived from the 48-bit (6-byte) Ethernet MAC address as shown next. EUI-64 inserts the hex digits fffe between the third and fourth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

MAC	00 : 13 : 49 : 12 : 34 : 56
EUI-64	02 : 13 : 49 : FF : FE : 12 : 34 : 56

Identity Association

An Identity Association (IA) is a collection of addresses assigned to a DHCP client, through which the server and client can manage a set of related IP addresses. Each IA must be associated with exactly one interface. The DHCP client uses the IA assigned to an interface to obtain configuration from a DHCP server for that interface. Each IA consists of a unique IAID and associated IP information.

The IA type is the type of address in the IA. Each IA holds one type of address. IA_NA means an identity association for non-temporary addresses and IA_TA is an identity association for temporary addresses. An IA_NA option contains the T1 and T2 fields, but an IA_TA option does not. The DHCPv6 server uses T1 and T2 to control the time at which the client contacts with the server to extend the lifetimes on any addresses in the IA_NA before the lifetimes expire. After T1, the client sends the server (**S1**) (from which the addresses in the IA_NA were obtained) a Renew message. If the time T2 is reached and the server does not respond, the client sends a Rebind message to any available server (**S2**). For an IA_TA, the client may send a Renew or Rebind message at the client's discretion.



DHCP Relay Agent

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

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

Prefix Delegation

Prefix delegation enables an IPv6 router to use the IPv6 prefix (network address) received from the ISP (or a connected uplink router) for its LAN. The NBG4615 uses the received IPv6 prefix (for example, 2001:db2::/48) to generate its LAN IP address. Through sending Router Advertisements (RAs) regularly by multicast, the NBG4615 passes the IPv6 prefix information to its LAN hosts. The hosts then can use the prefix to generate their IPv6 addresses.

ICMPv6

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

Neighbor Discovery Protocol (NDP)

The Neighbor Discovery Protocol (NDP) is a protocol used to discover other IPv6 devices and track neighbor’s reachability in a network. An IPv6 device uses the following ICMPv6 messages types:

- Neighbor solicitation: A request from a host to determine a neighbor’s link-layer address (MAC address) and detect if the neighbor is still reachable. A neighbor being “reachable” means it responds to a neighbor solicitation message (from the host) with a neighbor advertisement message.

- Neighbor advertisement: A response from a node to announce its link-layer address.
- Router solicitation: A request from a host to locate a router that can act as the default router and forward packets.
- Router advertisement: A response to a router solicitation or a periodical multicast advertisement from a router to advertise its presence and other parameters.

IPv6 Cache

An IPv6 host is required to have a neighbor cache, destination cache, prefix list and default router list. The NBG4615 maintains and updates its IPv6 caches constantly using the information from response messages. In IPv6, the NBG4615 configures a link-local address automatically, and then sends a neighbor solicitation message to check if the address is unique. If there is an address to be resolved or verified, the NBG4615 also sends out a neighbor solicitation message. When the NBG4615 receives a neighbor advertisement in response, it stores the neighbor’s link-layer address in the neighbor cache. When the NBG4615 uses a router solicitation message to query for a router and receives a router advertisement message, it adds the router’s information to the neighbor cache, prefix list and destination cache. The NBG4615 creates an entry in the default router list cache if the router can be used as a default router.

When the NBG4615 needs to send a packet, it first consults the destination cache to determine the next hop. If there is no matching entry in the destination cache, the NBG4615 uses the prefix list to determine whether the destination address is on-link and can be reached directly without passing through a router. If the address is unlink, the address is considered as the next hop. Otherwise, the NBG4615 determines the next-hop from the default router list or routing table. Once the next hop IP address is known, the NBG4615 looks into the neighbor cache to get the link-layer address and sends the packet when the neighbor is reachable. If the NBG4615 cannot find an entry in the neighbor cache or the state for the neighbor is not reachable, it starts the address resolution process. This helps reduce the number of IPv6 solicitation and advertisement messages.

Multicast Listener Discovery

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

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

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

MLD filtering controls which multicast groups a port can join.

MLD Messages

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

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

Example - Enabling IPv6 on Windows XP/2003/Vista

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

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

C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

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

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

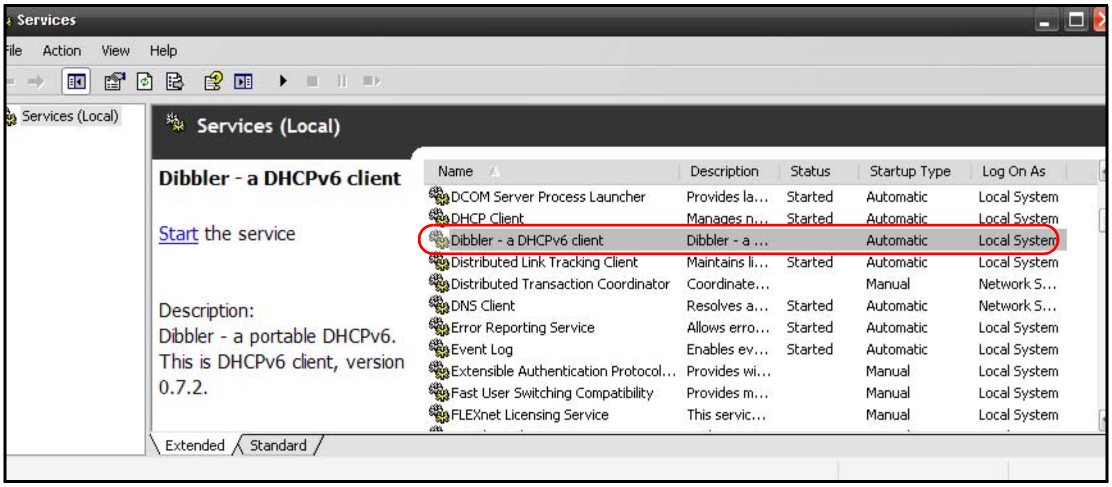
Example - Enabling DHCPv6 on Windows XP

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

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

1. Install Dibbler and select the DHCPv6 client option on your computer.
2. After the installation is complete, select **Start** > **All Programs** > **Dibbler-DHCPv6** > **Client Install as service**.
3. Select **Start** > **Control Panel** > **Administrative Tools** > **Services**.

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



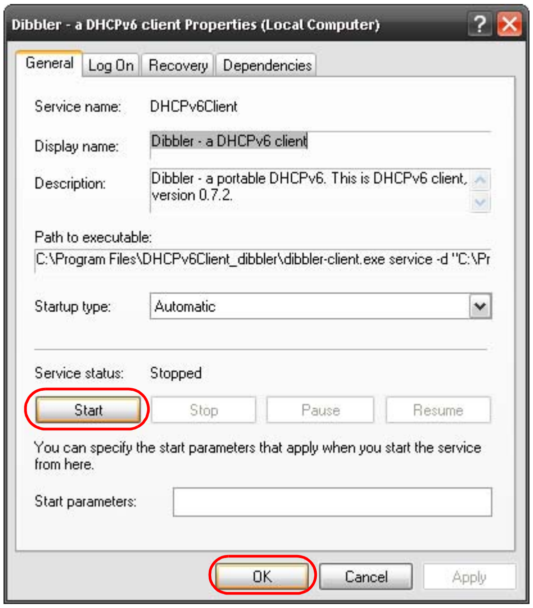
Dibbler - a DHCPv6 client

Start the service

Description:
Dibbler - a portable DHCPv6. This is DHCPv6 client, version 0.7.2.

Name	Description	Status	Startup Type	Log On As
DCOM Server Process Launcher	Provides la...	Started	Automatic	Local System
DHCP Client	Manages n...	Started	Automatic	Local System
Dibbler - a DHCPv6 client	Dibbler - a ...		Automatic	Local System
Distributed Link Tracking Client	Maintains li...	Started	Automatic	Local System
Distributed Transaction Coordinator	Coordinate...		Manual	Network S...
DNS Client	Resolves a...	Started	Automatic	Network S...
Error Reporting Service	Allows erro...	Started	Automatic	Local System
Event Log	Enables ev...	Started	Automatic	Local System
Extensible Authentication Protocol...	Provides wi...		Manual	Local System
Fast User Switching Compatibility	Provides m...		Manual	Local System
FLEXnet Licensing Service	This servic...		Manual	Local System

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



Service name: DHCPv6Client

Display name: Dibbler - a DHCPv6 client

Description: Dibbler - a portable DHCPv6. This is DHCPv6 client, version 0.7.2.

Path to executable:
C:\Program Files\DHCPv6Client_dibbler\dibbler-client.exe service -d "C:\Pr

Startup type: Automatic

Service status: Stopped

You can specify the start parameters that apply when you start the service from here.

Start parameters:

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

Example - Enabling IPv6 on Windows 7

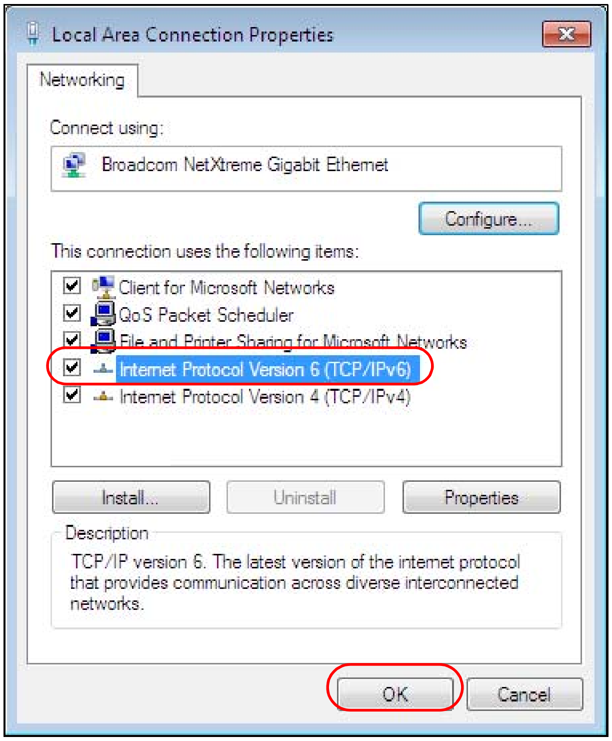
Windows 7 supports IPv6 by default. DHCPv6 is also enabled when you enable IPv6 on a Windows 7 computer.

To enable IPv6 in Windows 7:

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

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

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



Connect using:

Broadcom NetXtreme Gigabit Ethernet

This connection uses the following items:

☑ Client for Microsoft Networks
☑ QoS Packet Scheduler
☑ File and Printer Sharing for Microsoft Networks
☑ Internet Protocol Version 6 (TCP/IPv6)
☑ Internet Protocol Version 4 (TCP/IPv4)

Description

TCP/IP version 6. The latest version of the internet protocol that provides communication across diverse interconnected networks.

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

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

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

```
C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

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

Open Software Announcements

End-User License Agreement for "NBG4615"

WARNING: ZyXEL Communications Corp. IS WILLING TO LICENSE THE SOFTWARE TO YOU ONLY UPON THE CONDITION THAT YOU ACCEPT ALL OF THE TERMS CONTAINED IN THIS LICENSE AGREEMENT. PLEASE READ THE TERMS CAREFULLY BEFORE COMPLETING THE INSTALLATION PROCESS AS INSTALLING THE SOFTWARE WILL INDICATE YOUR ASSENT TO THEM. IF YOU DO NOT AGREE TO THESE TERMS, THEN ZyXEL IS UNWILLING TO LICENSE THE SOFTWARE TO YOU, IN WHICH EVENT YOU SHOULD RETURN THE UNINSTALLED SOFTWARE AND PACKAGING TO THE PLACE FROM WHICH IT WAS ACQUIRED OR ZyXEL, AND YOUR MONEY WILL BE REFUNDED. HOWEVER, CERTAIN ZYXEL'S PRODUCTS MAY CONTAIN-IN PART-SOME THIRD PARTY'S FREE AND OPEN SOFTWARE PROGRAMS WHICH ALLOW YOU TO FREELY COPY, RUN, DISTRIBUTE, MODIFY AND IMPROVE THE SOFTWARE UNDER THE APPLICABLE TERMS OF SUCH THRID PARTY'S LICENSES ("OPEN-SOURCED COMPONENTS"). THE OPEN-SOURCED COMPONENTS ARE LISTED IN THE NOTICE OR APPENDIX BELOW. ZYXEL MAY HAVE DISTRIBUTED TO YOU HARDWARE AND/OR SOFTWARE, OR MADE AVAILABLE FOR ELECTRONIC DOWNLOADS THESE FREE SOFTWARE PROGRAMS OF THRID PARTIES AND YOU ARE LICENSED TO FREELY COPY, MODIFY AND REDISTIBUTE THAT SOFTWARE UNDER THE APPLICABLE LICENSE TERMS OF SUCH THIRD PARTY. NONE OF THE STATEMENTS OR DOCUMENTATION FROM ZYXEL INCLUDING ANY RESTRICTIONS OR CONDITIONS STATED IN THIS END USER LICENSE AGREEMENT SHALL RESTRICT ANY RIGHTS AND LICENSES YOU MAY HAVE WITH RESPECT TO THE OPEN-SOURCED COMPONENTS UNDER THE APPLICABLE LICENSE TERMS OF SUCH THIRD PARTY.

1.Grant of License for Personal Use

ZyXEL Communications Corp. ("ZyXEL") grants you a non-exclusive, non-sublicense, non-transferable license to use the program with which this license is distributed (the "Software"), including any documentation files accompanying the Software ("Documentation"), for internal business use only, for up to the number of users specified in sales order and invoice. You have the right to make one backup copy of the Software and Documentation solely for archival, back-up or disaster recovery purposes. You shall not exceed the scope of the license granted hereunder. Any rights not expressly granted by ZyXEL to you are reserved by ZyXEL, and all implied licenses are disclaimed.

2.Ownership

You have no ownership rights in the Software. Rather, you have a license to use the Software as long as this License Agreement remains in full force and effect. Ownership of the Software, Documentation and all intellectual property rights therein shall remain at all times with ZyXEL. Any other use of the Software by any other entity is strictly forbidden and is a violation of this License Agreement.

3.Copyright

The Software and Documentation contain material that is protected by international copyright law, trade secret law, international treaty provisions, and the applicable national laws of each respective country. All rights not granted to you herein are expressly reserved by ZyXEL. You may not remove any proprietary notice of ZyXEL or any of its licensors from any copy of the Software or Documentation.

4.Restrictions

You may not publish, display, disclose, sell, rent, lease, modify, store, loan, distribute, or create derivative works of the Software, or any part thereof. You may not assign, sublicense, convey or otherwise transfer, pledge as security or otherwise encumber the rights and licenses granted hereunder with respect to the Software. ZyXEL is not obligated to provide any maintenance, technical or other support for the resultant modified Software. You may not copy, reverse engineer, decompile, reverse compile, translate, adapt, or disassemble the Software, or any part thereof, nor shall you attempt to create the source code from the object code for the Software. Except as and only to the extent expressly permitted in this License, you may not market, co-brand, and private label or otherwise permit third parties to link to the Software, or any part thereof. You may not use the Software, or any part thereof, in the operation of a service bureau or for the benefit of any other person or entity. You may not cause, assist or permit any third party to do any of the foregoing. Portions of the Software utilize or include third party software and other copyright material. Acknowledgements, licensing terms and disclaimers for such material are contained in the License Notice as below for the third party software, and your use of such material is exclusively governed by their respective terms. ZyXEL has provided, as part of the Software package, access to certain third party software as a convenience. To the extent that the Software contains third party software, ZyXEL has no express or implied obligation to provide any technical or other support for such software other than compliance with the applicable license terms of such third party, and makes no warranty (express, implied or statutory) whatsoever with respect thereto. Please contact the appropriate software vendor or manufacturer directly for technical support and customer service related to its software and products.

5.Confidentiality

You acknowledge that the Software contains proprietary trade secrets of ZyXEL and you hereby agree to maintain the confidentiality of the Software using at least as great a degree of care as you use to maintain the confidentiality of your own most confidential information. You agree to reasonably communicate the terms and conditions of this License Agreement to those persons employed by you who come into contact with the Software, and to use reasonable best efforts to ensure their compliance with such terms and conditions, including, without limitation, not knowingly permitting such persons to use any portion of the Software for the purpose of deriving the source code of the Software.

6.No Warranty

THE SOFTWARE IS PROVIDED "AS IS." TO THE MAXIMUM EXTENT PERMITTED BY LAW, ZyXEL DISCLAIMS ALL WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. ZyXEL DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE WILL MEET ANY REQUIREMENTS OR NEEDS YOU MAY HAVE, OR THAT THE SOFTWARE WILL OPERATE ERROR FREE, OR IN AN UNINTERUPTED FASHION, OR THAT ANY DEFECTS OR ERRORS IN THE SOFTWARE WILL BE CORRECTED, OR THAT THE SOFTWARE IS COMPATIBLE WITH ANY PARTICULAR PLATFORM. SOME JURISDICTIONS DO NOT ALLOW THE WAIVER OR EXCLUSION OF IMPLIED WARRANTIES SO THEY MAY NOT APPLY TO YOU. IF THIS EXCLUSION IS HELD TO BE UNENFORCEABLE BY A COURT OF COMPETENT JURISDICTION, THEN ALL EXPRESS AND IMPLIED WARRANTIES SHALL BE LIMITED IN DURATION TO A PERIOD OF

THIRTY (30) DAYS FROM THE DATE OF PURCHASE OF THE SOFTWARE, AND NO WARRANTIES SHALL APPLY AFTER THAT PERIOD.

7.Limitation of Liability

IN NO EVENT WILL ZyXEL BE LIABLE TO YOU OR ANY THIRD PARTY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, INDIRECT, SPECIAL, PUNITIVE, OR EXEMPLARY DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF BUSINESS INFORMATION) ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE OR PROGRAM, OR FOR ANY CLAIM BY ANY OTHER PARTY, EVEN IF ZyXEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. ZyXEL's TOTAL AGGREGATE LIABILITY WITH RESPECT TO ITS OBLIGATIONS UNDER THIS AGREEMENT OR OTHERWISE WITH RESPECT TO THE SOFTWARE AND DOCUMENTATION OR OTHERWISE SHALL BE EQUAL TO THE PURCHASE PRICE, BUT SHALL IN NO EVENT EXCEED THE PRODUCT'S PRICE. BECAUSE SOME STATES/COUNTRIES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

8.Export Restrictions

THIS LICENSE AGREEMENT IS EXPRESSLY MADE SUBJECT TO ANY APPLICABLE LAWS, REGULATIONS, ORDERS, OR OTHER RESTRICTIONS ON THE EXPORT OF THE SOFTWARE OR INFORMATION ABOUT SUCH SOFTWARE WHICH MAY BE IMPOSED FROM TIME TO TIME. YOU SHALL NOT EXPORT THE SOFTWARE, DOCUMENTATION OR INFORMATION ABOUT THE SOFTWARE AND DOCUMENTATION WITHOUT COMPLYING WITH SUCH LAWS, REGULATIONS, ORDERS, OR OTHER RESTRICTIONS. YOU AGREE TO INDEMNIFY ZyXEL AGAINST ALL CLAIMS, LOSSES, DAMAGES, LIABILITIES, COSTS AND EXPENSES, INCLUDING REASONABLE ATTORNEYS' FEES, TO THE EXTENT SUCH CLAIMS ARISE OUT OF ANY BREACH OF THIS SECTION 8.

9.Audit Rights

ZyXEL SHALL HAVE THE RIGHT, AT ITS OWN EXPENSE, UPON REASONABLE PRIOR NOTICE, TO PERIODICALLY INSPECT AND AUDIT YOUR RECORDS TO ENSURE YOUR COMPLIANCE WITH THE TERMS AND CONDITIONS OF THIS LICENSE AGREEMENT.

10.Termination

This License Agreement is effective until it is terminated. You may terminate this License Agreement at any time by destroying or returning to ZyXEL all copies of the Software and Documentation in your possession or under your control. ZyXEL may terminate this License Agreement for any reason, including, but not limited to, if ZyXEL finds that you have violated any of the terms of this License Agreement. Upon notification of termination, you agree to destroy or return to ZyXEL all copies of the Software and Documentation and to certify in writing that all known copies, including backup copies, have been destroyed. All provisions relating to confidentiality, proprietary rights, and non-disclosure shall survive the termination of this Software License Agreement.

11.General

This License Agreement shall be construed, interpreted and governed by the laws of Republic of China without regard to conflicts of laws provisions thereof. The exclusive forum for any disputes arising out of or relating to this License Agreement shall be an appropriate court or Commercial Arbitration Association sitting in ROC, Taiwan if the parties agree to a binding arbitration. This License Agreement shall constitute the entire Agreement between the parties hereto. This License Agreement, the rights granted hereunder, the Software and Documentation shall not be assigned by you without the prior written consent of ZyXEL. Any waiver or modification of this License

Agreement shall only be effective if it is in writing and signed by both parties hereto. If any part of this License Agreement is found invalid or unenforceable by a court of competent jurisdiction, the remainder of this License Agreement shall be interpreted so as to reasonably effect the intention of the parties.

NOTE: Some components of this product incorporate free software programs covered under the open source code licenses which allows you to freely copy, modify and redistribute the software. For at least three (3) years from the date of distribution of the applicable product or software, we will give to anyone who contacts us at the ZyXEL Technical Support (support@zyxel.com.tw), for a charge of no more than our cost of physically performing source code distribution, a complete machine-readable copy of the complete corresponding source code for the version of the Programs that we distributed to you if we are in possession of such.

Notice

Information herein is subject to change without notice. Companies, names, and data used in examples herein are fictitious unless otherwise noted. No part may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, except the express written permission of ZyXEL Communications Corporation.

This Product includes Linux Kernel , Uboot, Busybox, bpalogin, bridge-utils, dnsmasq, hotplug2, igmpproxy, iproute2, iptables, linux-igd, mtd-utils, ntpclient, ppp(pppd plugins), pptp, rp-l2pt, quagga, syslog-ng, updated, wireless_tools and gcc software under GPL 2.0 license.

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc.

59 Temple Place - Suite 330, Boston, MA 02111-1307, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you". Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program. In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or, c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.) The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the

scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable. If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances. It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify

a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

All other trademarks or trade names mentioned herein, if any, are the property of their respective owners.

This Product includes curl software under below license

COPYRIGHT AND PERMISSION NOTICE

Copyright (c) 1996 - 2007, Daniel Stenberg, <daniel@haxx.se>.

All rights reserved.

Permission to use, copy, modify, and distribute this software for any purpose

with or without fee is hereby granted, provided that the above copyright

notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR

IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, NOTICE

Curl contains pieces of source code that is Copyright (c) 1998, 1999 Kungliga Tekniska H÷g skolan. This notice is included here to comply with the distribution terms.

This Product includes goahead software under below license

License Agreement

THIS LICENSE ALLOWS ONLY THE LIMITED USE OF GO AHEAD SOFTWARE, INC. PROPRIETARY CODE. PLEASE CAREFULLY READ THIS AGREEMENT AS IT PERTAINS TO THIS LICENSE, YOU CERTIFY THAT YOU WILL USE THE SOFTWARE ONLY IN THE MANNER PERMITTED HEREIN.

1. Definitions.

1.1 "Documentation" means any documentation GoAhead includes with the Original Code.

1.2 "GoAhead" means Go Ahead Software, Inc.

1.3 "Intellectual Property Rights" means all rights, whether now existing or hereinafter acquired, in and to trade secrets, patents, copyrights, trademarks, know-how, as well as moral rights and similar rights of any type under the laws of any governmental authority, domestic or foreign, including rights in and to all applications and registrations relating to any of the foregoing.

1.4 "License" or "Agreement" means this document.

1.5 "Modifications" means any addition to or deletion from the substance or structure of either the Original Code or any previous Modifications.

1.6 "Original Code" means the Source Code to GoAhead? proprietary computer software entitled GoAhead WebServer.

1.7 "Response Header" means the first portion of the response message output by the GoAhead WebServer, containing but not limited to, header fields for date, content-type, server identification and cache control.

1.8 "Server Identification Field" means the field in the Response Header which contains the text "Server: GoAhead-Webs".

1.9 "You" means an individual or a legal entity exercising rights under, and complying with all of the terms of, this license or a future version of this license. For legal entities, "You" includes any entity which controls, is controlled by, or is under common control with You. For purposes of this definition, "control" means (a) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (b) ownership of fifty percent (50%) or more of the outstanding shares or beneficial ownership of such entity.

2. Source Code License.

2.1 Limited Source Code Grant.

GoAhead hereby grants You a world-wide, royalty-free, non-exclusive license, subject to third party intellectual property claims, to use, reproduce, modify, copy and distribute the Original Code.

2.2 Binary Code.

GoAhead hereby grants You a world-wide, royalty-free, non-exclusive license to copy and distribute the binary code versions of the Original Code together with Your Modifications.

2.3 License Back to GoAhead.

You hereby grant in both source code and binary code to GoAhead a world-wide, royalty-free, non-exclusive license to copy, modify, display, use and sublicense any Modifications You make that are distributed or planned for distribution. Within 30 days of either such event, You agree to ship to GoAhead a file containing the Modifications (in a media to be determined by the parties), including any programmer's notes and other programmers' materials. Additionally, You will provide to GoAhead a complete description of the product, the product code or model number, the date on which the product is initially shipped, and a contact name, phone number and e-mail address for future correspondence. GoAhead will keep confidential all data specifically marked as such.

2.4 Restrictions on Use.

You may sublicense Modifications to third parties such as subcontractors or OEM's provided that You enter into license agreements with such third parties that bind such third parties to all the obligations under this Agreement applicable to you and that are otherwise substantially similar in scope and application to this Agreement.

3. Term.

This Agreement and license are effective from the time You accept the terms of this Agreement until this Agreement is terminated. You may terminate this Agreement at any time by uninstalling or destroying all copies of the Original Code including any and all binary versions and removing any Modifications to the Original Code existing in any products. This Agreement will terminate immediately and without further notice if You fail to comply with any provision of this Agreement. All restrictions on use, and all other provisions that may reasonably be interpreted to survive termination of this Agreement, will survive termination of this Agreement for any reason. Upon termination, You agree to uninstall or destroy all copies of the Original Code, Modifications, and Documentation.

4. Trademarks and Brand.

4.1 License and Use.

GoAhead hereby grants to You a limited world-wide, royalty-free, non-exclusive license to use the GoAhead trade names, trademarks, logos, service marks and product designations posted in Exhibit A (collectively, the "GoAhead Marks") in connection with the activities by You under this Agreement. Additionally, GoAhead grants You a license under the terms above to such GoAhead trademarks as shall be identified at a URL (the "URL") provided by GoAhead. The use by You of GoAhead Marks shall be in accordance with GoAhead? trademark policies regarding trademark usage as established at the web site designated by the URL, or as otherwise communicated to You by GoAhead at its sole discretion. You understand and agree that any use of GoAhead Marks in connection with this Agreement shall not create any right, title or interest in or to such GoAhead Marks and that all such use and goodwill associated with GoAhead Marks will inure to the benefit of GoAhead.

4.2 Promotion by You of GoAhead WebServer Mark.

In consideration for the licenses granted by GoAhead to You herein, You agree to notify GoAhead when You incorporate the GoAhead WebServer in Your product and to inform GoAhead when such product begins to ship. You agree to promote the Original Code by prominently and visibly displaying a graphic of the GoAhead WebServer mark on the initial web page of Your product that is displayed each time a user connects to it. You also agree that GoAhead may identify your company as a user of the GoAhead WebServer in conjunction with its own marketing efforts. You may further promote the Original Code by displaying the GoAhead WebServer mark in marketing and promotional materials such as the home page of your web site or web pages promoting the product.

4.3 Placement of Copyright Notice by You.

You agree to include copies of the following notice (the "Notice") regarding proprietary rights in all copies of the products that You distribute, as follows: (i) embedded in the object code; and (ii) on the title pages of all documentation. Furthermore, You agree to use commercially reasonable efforts to cause any licensees of your products to embed the Notice in object code and on the title pages or relevant documentation. The Notice is as follows: Copyright (c) 20xx GoAhead Software, Inc. All Rights Reserved. Unless GoAhead otherwise instructs, the year 20xx is to be replaced with the year during which the release of the Original Code containing the notice is issued by GoAhead. If this year is not supplied with Documentation, GoAhead will supply it upon request.

4.4 No Modifications to Server Identification Field.

You agree not to remove or modify the Server identification Field contained in the Response Header as defined in Section 1.6 and 1.7.

5. Warranty Disclaimers.

THE ORIGINAL CODE, THE DOCUMENTATION AND THE MEDIA UPON WHICH THE ORIGINAL CODE IS RECORDED (IF ANY) ARE PROVIDED "AS IS" AND WITHOUT WARRANTIES OF ANY KIND, EXPRESS, STATUTORY OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The entire risk as to the quality and performance of the Original Code

(including any Modifications You make) and the Documentation is with
You. Should the Original Code or the Documentation prove defective,
You (and not GoAhead or its distributors, licensors or dealers) assume
the entire cost of all necessary servicing or repair. GoAhead does not
warrant that the functions contained in the Original Code will meet your
requirements or operate in the combination that You may select for use,
that the operation of the Original Code will be uninterrupted or error
free, or that defects in the Original Code will be corrected. No oral
or written statement by GoAhead or by a representative of GoAhead shall
create a warranty or increase the scope of this warranty.

GOAHEAD DOES NOT WARRANT THE ORIGINAL CODE AGAINST INFRINGEMENT OR THE
LIKE WITH RESPECT TO ANY COPYRIGHT, PATENT, TRADE SECRET, TRADEMARK
OR OTHER PROPRIETARY RIGHT OF ANY THIRD PARTY AND DOES NOT WARRANT
THAT THE ORIGINAL CODE DOES NOT INCLUDE ANY VIRUS, SOFTWARE ROUTINE
OR OTHER SOFTWARE DESIGNED TO PERMIT UNAUTHORIZED ACCESS, TO DISABLE,
ERASE OR OTHERWISE HARM SOFTWARE, HARDWARE OR DATA, OR TO PERFORM ANY
OTHER SUCH ACTIONS.

Any warranties that by law survive the foregoing disclaimers shall
terminate ninety (90) days from the date You received the Original Code.

6. Limitation of Liability.

YOUR SOLE REMEDIES AND GOAHEAD'S ENTIRE LIABILITY ARE SET FORTH ABOVE. IN
NO EVENT WILL GOAHEAD OR ITS DISTRIBUTORS OR DEALERS BE LIABLE FOR
DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM
THE USE OF THE ORIGINAL CODE, THE INABILITY TO USE THE ORIGINAL CODE,

OR ANY DEFECT IN THE ORIGINAL CODE, INCLUDING ANY LOST PROFITS, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

You agree that GoAhead and its distributors and dealers will not be LIABLE for defense or indemnity with respect to any claim against You by any third party arising from your possession or use of the Original Code or the Documentation.

In no event will GoAhead? total liability to You for all damages, losses, and causes of action (whether in contract, tort, including negligence, or otherwise) exceed the amount You paid for this product.

SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, AND SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

7. Indemnification by You.

You agree to indemnify and hold GoAhead harmless against any and all claims, losses, damages and costs (including legal expenses and reasonable counsel fees) arising out of any claim of a third party with respect to the contents of the Your products, and any intellectual property rights or other rights or interests related thereto.

8. High Risk Activities.

The Original Code is not fault-tolerant and is not designed , manufactured
or intended for use or resale as online control equipment in hazardous
environments requiring fail-safe performance, such as in the operation
of nuclear facilities, aircraft navigation or communication systems,
air traffic control, direct life support machines or weapons systems,
in which the failure of the Original Code could lead directly to death,
personal injury, or severe physical or environmental damage. GoAhead and
its suppliers specifically disclaim any express or implied warranty of
fitness for any high risk uses listed above.

9. Government Restricted Rights.

For units of the Department of Defense, use, duplication, or disclosure
by the Government is subject to restrictions as set forth in subparagraph
(c)(1)(ii) of the Rights in Technical Data and Computer Software clause
at DFARS 252.227-7013. Contractor/manufacturer is GoAhead Software,
Inc., 10900 N.E. 8th Street, Suite 750, Bellevue, Washington 98004.

If the Commercial Computer Software Restricted rights clause at FAR
52.227-19 or its successors apply, the Software and Documentation
constitute restricted computer software as defined in that clause and
the Government shall not have the license for published software set
forth in subparagraph (c)(3) of that clause.

The Original Code (i) was developed at private expense, and no part of it
was developed with governmental funds; (ii) is a trade secret of GoAhead
(or its licensor(s)) for all purposes of the Freedom of Information Act;
(iii) is "restricted computer software" subject to limited utilization as

provided in the contract between the vendor and the governmental entity;
and (iv) in all respects is proprietary data belonging solely to GoAhead
(or its licensor(s)).

10. Governing Law and Interpretation.

This Agreement shall be interpreted under and governed by the laws of the State of Washington, without regard to its rules governing the conflict of laws. If any provision of this Agreement is held illegal or unenforceable by a court or tribunal of competent jurisdiction, the remaining provisions of this Agreement shall remain in effect and the invalid provision deemed modified to the least degree necessary to remedy such invalidity.

11. Entire Agreement.

This Agreement is the complete agreement between GoAhead and You and supersedes all prior agreements, oral or written, with respect to the subject matter hereof.

If You have any questions concerning this Agreement, You may write to GoAhead Software, Inc., 10900 N.E. 8th Street, Suite 750, Bellevue, Washington 98004 or send e-mail to info@goahead.com.

BY CLICKING ON THE "Register" BUTTON ON THE REGISTRATION FORM, YOU ACCEPT AND AGREE TO BE BOUND BY ALL OF THE TERMS AND CONDITIONS SET FORTH IN THIS AGREEMENT. IF YOU DO NOT WISH TO ACCEPT THIS LICENSE OR YOU DO NOT QUALIFY FOR A LICENSE BASED ON THE TERMS SET FORTH ABOVE, YOU MUST NOT CLICK THE "Register" BUTTON.

Exhibit A

GoAhead Trademarks, Logos, and Product Designation Information

01/28/00

This Product includes LLTD software under below license

LICENSE NOTICE. Use of the Microsoft Windows Rally Development Kit is covered under the Microsoft Windows Rally Development Kit License Agreement, which is provided within the Microsoft Windows Rally Development Kit or at http://www.microsoft.com/whdc/rally/rallykit.mspx. If you want a license from Microsoft to use the software in the Microsoft Windows Rally Development Kit, you must (1) complete the designated "licensee" information in the Windows Rally Development Kit License Agreement, and (2) sign and return the Agreement AS IS to Microsoft at the address provided in the Agreement.

This Product includes ntpclient software under below license

ntpclient is Copyright 1997, 1999, 2000, 2003, 2006, 2007 Larry Doolittle,

and may be freely copied and modified according to the terms of the GNU

General Public License, version 2. If you want to distribute ntpclient

under other terms, contact me. I might agree to some other arrangement,

if you talk to me _before_ you start violating GPL terms.

This Product includes igmpproxy software under below license

igmpproxy - IGMP proxy based multicast router

Copyright (C) 2005 Johnny Egeland <johnny@rlo.org>

This program is free software; you can redistribute it and/or modify

it under the terms of the GNU General Public License as published by

This software is derived work from the following software. The original

source code has been modified from it's original state by the author

of igmpproxy.

smcroute 0.92 - Copyright (C) 2001 Carsten Schill <carsten@cschill.de>

- Licensed under the GNU General Public License, version 2

mrouted 3.9-beta3 - COPYRIGHT 1989 by The Board of Trustees of

Leland Stanford Junior University.

-Original license can be found in the Stanford.txt file.

This Product includes openssl software under below license

LICENSE ISSUES

  ==============

The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL please contact openssl-core@openssl.org.

OpenSSL License

* Copyright (c) 1998-2008 The OpenSSL Project. All rights reserved.
*
* Redistribution and use in source and binary forms, with or without
* modification, are permitted provided that the following conditions
* are met:
*
* 1. Redistributions of source code must retain the above copyright
*   notice, this list of conditions and the following disclaimer.
*
* 2. Redistributions in binary form must reproduce the above copyright
*   notice, this list of conditions and the following disclaimer in
*   the documentation and/or other materials provided with the
*   distribution.
*
* 3. All advertising materials mentioning features or use of this
*   software must display the following acknowledgment:
*   "This product includes software developed by the OpenSSL Project
*   for use in the OpenSSL Toolkit. (http://www.openssl.org/)"
*
* 4. The names "OpenSSL Toolkit" and "OpenSSL Project" must not be used to

```
*    endorse or promote products derived from this software without
*    prior written permission. For written permission, please contact
*    openssl-core@openssl.org.
*
* 5. Products derived from this software may not be called "OpenSSL"
*    nor may "OpenSSL" appear in their names without prior written
*    permission of the OpenSSL Project.
*
* 6. Redistributions of any form whatsoever must retain the following
*    acknowledgment:
*    "This product includes software developed by the OpenSSL Project
*    for use in the OpenSSL Toolkit (http://www.openssl.org/)"
*
* THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT ``AS IS'' AND ANY
* EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR
* PURPOSE ARE DISCLAIMED.  IN NO EVENT SHALL THE OpenSSL PROJECT OR
* ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL,
* SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT
* NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES;
* LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
* HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT,
* STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED
* OF THE POSSIBILITY OF SUCH DAMAGE.
* This product includes cryptographic software written by Eric Young
* (eay@cryptsoft.com).  This product includes software written by Tim
* Hudson (tjh@cryptsoft.com).
```

Original SSLeay License

```
* 2. Redistributions in binary form must reproduce the above copyright
*    notice, this list of conditions and the following disclaimer in the
*    documentation and/or other materials provided with the distribution.
* 3. All advertising materials mentioning features or use of this software
*    must display the following acknowledgement:
*    "This product includes cryptographic software written by
*     Eric Young (eay@cryptsoft.com)"
*    The word 'cryptographic' can be left out if the rouines from the library
*    being used are not cryptographic related :-).
* 4. If you include any Windows specific code (or a derivative thereof) from
*    the apps directory (application code) you must include an acknowledgement:
*    "This product includes software written by Tim Hudson (tjh@cryptsoft.com)"
*
* THIS SOFTWARE IS PROVIDED BY ERIC YOUNG ``AS IS'' AND
* ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
* ARE DISCLAIMED.  IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE
* FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL
* DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS
* OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
* HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
* LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
* SUCH DAMAGE.
*
* The licence and distribution terms for any publically available version or
* derivative of this code cannot be changed.  i.e. this code cannot simply be
* copied and put under another distribution licence
```

* [including the GNU Public Licence.]

This Product includes ppp software under below license

Copyrights:

****

All of the code can be freely used and redistributed. The individual source files each have their own copyright and permission notice. Pppd, pppstats and pppdump are under BSD-style notices. Some of the pppd plugins are GPL'd. Chat is public domain.

The BSD license

Copyright (c) <YEAR>, <OWNER>

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

"Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

"Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

"Neither the name of the <ORGANIZATION> nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This Product includes radvd software under below license

The author(s) grant permission for redistribution and use in source and

This Product includes rp-l2pt software under below license

Copying

This Product includes zlib software under below license

Copyright notice:

If you use the zlib library in a product, we would appreciate *not* receiving lengthy legal documents to sign. The sources are provided for free but without warranty of any kind. The library has been entirely written by Jean-loup Gailly and Mark Adler; it does not include third-party code.

If you redistribute modified sources, we would appreciate that you include in the file ChangeLog history information documenting your changes. Please read the FAQ for more information on the distribution of modified source versions.

This Product includes libupnp software under below license

This Product includes uClibc software under LGPL 2.1 license

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

[This is the first released version of the Lesser GPL. It also counts

as the successor of the GNU Library Public License, version 2, hence

the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

"a) The modified work must itself be a software library.

"b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

"c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

"d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

"a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

"b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

"c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

"d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

"e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

"a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

"b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.

10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.

11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

Legal Information

Copyright

Disclaimer

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

TradeMarks

NetUSB is a trademark of ZyXEL Communications, Inc. Other trademarks mentioned in this publication are used for identification purposes only and may be properties of their respective owners.

Certifications

Federal Communications Commission (FCC) Interference Statement

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

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

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

If this device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

FCC Radiation Exposure Statement

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

Industry Canada Statement

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions:

1. this device may not cause interference and
2. this device must accept any interference, including interference that may cause undesired operation of the device

This device has been designed to operate with an antenna having a maximum gain of 2dBi and 5dBi.

Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the EIRP is not more than required for successful communication.

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

注意 ！

依據　低功率電波輻射性電機管理辦法

第十二條　經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用
者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條　低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現
有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。
前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍
受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

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

Notices

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

This device has been designed for the WLAN 2.4 GHz network throughout the EC region and Switzerland, with restrictions in France.

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

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

Viewing Certifications

1 Go to http://www.zyxel.com.

2 Select your product on the ZyXEL home page to go to that product's page.

3 Select the certification you wish to view from this page.

ZyXEL Limited Warranty

ZyXEL warrants to the original end user (purchaser) that this product is free from any defects in material or workmanship for a specific period (the Warranty Period) from the date of purchase. The Warranty Period varies by region. Check with your vendor and/or the authorized ZyXEL local distributor for details about the Warranty Period of this product. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, ZyXEL will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal or higher value, and will be solely at the discretion of ZyXEL. This warranty shall not apply if the product has been modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

Note

Repair or replacement, as provided under this warranty, is the exclusive remedy of the purchaser. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular use or purpose. ZyXEL shall in no event be held liable for indirect or consequential damages of any kind to the purchaser.

To obtain the services of this warranty, contact your vendor. You may also refer to the warranty policy for the region in which you bought the device at http://www.zyxel.com/web/support_warranty_info.php.

Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com.

Regulatory Information

European Union

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

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

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

[Czech]	ZyXEL tímto prohlašuje, že tento zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/EC.
[Danish]	Undertegnede ZyXEL erklærer herved, at følgende udstyr udstyr overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
[German]	Hiermit erklärt ZyXEL, dass sich das Gerät Ausstattung in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EU befindet.
[Estonian]	Käesolevaga kinnitab ZyXEL seadme seadmed vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
English	Hereby, ZyXEL declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
[Spanish]	Por medio de la presente ZyXEL declara que el equipo cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
[Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ ZyXEL ΔΗΛΩΝΕΙ ΟΤΙ εξοπλισμός ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/EC.
[French]	Par la présente ZyXEL déclare que l'appareil équipements est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/EC.
[Italian]	Con la presente ZyXEL dichiara che questo attrezzatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
[Latvian]	Ar šo ZyXEL deklarē, ka iekārtas atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.

[Lithuanian]	Šiuo ZyXEL deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
[Dutch]	Hierbij verklaart ZyXEL dat het toestel uitrusting in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EC.
[Maltese]	Hawnhekk, ZyXEL, jiddikjara li dan tagħmir jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
[Hungarian]	Alulírott, ZyXEL nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EK irányelv egyéb elõírásainak.
[Polish]	Niniejszym ZyXEL oświadcza, że sprzęt jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
[Portuguese]	ZyXEL declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/EC.
[Slovenian]	ZyXEL izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/EC.
[Slovak]	ZyXEL týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/EC.
[Finnish]	ZyXEL vakuuttaa täten että laitteet tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
[Swedish]	Härmed intygar ZyXEL att denna utrustning står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EC.
[Bulgarian]	С настоящото ZyXEL декларира, че това оборудване е в съответствие със съществените изисквания и другите приложими разпоредбите на Директива 1999/5/ЕС.
[Icelandic]	Hér með lýsir, ZyXEL því yfir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði tilskipunar 1999/5/EC.
[Norwegian]	Erklærer herved ZyXEL at dette utstyret er I samsvar med de grunnleggende kravene og andre relevante bestemmelser I direktiv 1999/5/EF.
[Romanian]	Prin prezenta, ZyXEL declară că acest echipament este în conformitate cu cerinţele esenţiale şi alte prevederi relevante ale Directivei 1999/5/EC.

National Restrictions

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

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

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

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

In the majority of the EU and other European countries, the 2, 4- and 5-GHz bands have been made available for the use of wireless local area networks (LANs). Later in this document you will find an overview of countries inwhich additional restrictions or requirements or both are applicable.

The requirements for any country may evolve. ZyXEL recommends that you check with the local authorities for the latest status of their national regulations for both the 2,4- and 5-GHz wireless LANs.

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

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

Belgium

The Belgian Institute for Postal Services and Telecommunications (BIPT) must be notified of any outdoor wireless link having a range exceeding 300 meters. Please check http://www.bipt.be for more details.

Draadloze verbindingen voor buitengebruik en met een reikwijdte van meer dan 300 meter dienen aangemeld te worden bij het Belgisch Instituut voor postdiensten en telecommunicatie (BIPT). Zie http://www.bipt.be voor meer gegevens.

Les liaisons sans fil pour une utilisation en extérieur d'une distance supérieure à 300 mètres doivent être notifiées à l'Institut Belge des services Postaux et des Télécommunications (IBPT). Visitez http://www.ibpt.be pour de plus amples détails.

Denmark

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

I Danmark må frekvensbåndet 5150 - 5350 også anvendes udendørs.

France

For 2.4 GHz, the output power is restricted to 10 mW EIRP when the product is used outdoors in the band 2454 - 2483.5 MHz. There are no restrictions when used indoors or in other parts of the 2.4 GHz band. Check http://www.arcep.fr/ for more details.

Pour la bande 2.4 GHz, la puissance est limitée à 10 mW en p.i.r.e. pour les équipements utilisés en extérieur dans la bande 2454 - 2483.5 MHz. Il n'y a pas de restrictions pour des utilisations en intérieur ou dans d'autres parties de la bande 2.4 GHz. Consultez http://www.arcep.fr/ pour de plus amples détails.

R&TTE 1999/5/EC		
WLAN 2.4 – 2.4835 GHz		
IEEE 802.11 b/g/n		
Location	Frequency Range(GHz)	Power (EIRP)
Indoor (No restrictions)	2.4 – 2.4835	100mW (20dBm)
Outdoor	2.4 – 2.454	100mW (20dBm)
	2.454 – 2.4835	10mW (10dBm)

Italy

This product meets the National Radio Interface and the requirements specified in the National Frequency Allocation Table for Italy. Unless this wireless LAN product is operating within the boundaries of the owner's property, its use requires a “general authorization.” Please check http://www.sviluppoeconomico.gov.it/ for more details.

Questo prodotto è conforme alla specifiche di Interfaccia Radio Nazionali e rispetta il Piano Nazionale di ripartizione delle frequenze in Italia. Se non viene installato all 'interno del proprio fondo, l'utilizzo di prodotti Wireless LAN richiede una “Autorizzazione Generale”. Consultare http://www.sviluppoeconomico.gov.it/ per maggiori dettagli.

Latvia

The outdoor usage of the 2.4 GHz band requires an authorization from the Electronic Communications Office. Please check http://www.esd.lv for more details.

2.4 GHz frekvenèu joslas izmantoðanai ârpus telpâm nepiecieðama atïauja no Elektronisko sakaru direkcijas. Vairâk informâcijas: http://www.esd.lv.

Notes:

1. Although Norway, Switzerland and Liechtenstein are not EU member states, the EU Directive 1999/5/EC has also been implemented in those countries.

2. The regulatory limits for maximum output power are specified in EIRP. The EIRP level (in dBm) of a device can be calculated by adding the gain of the antenna used(specified in dBi) to the output power available at the connector (specified in dBm).

Index