19

Management

19.1 Overview

This chapter explains how to configure TR-069 and remote management on the NVG2053.

19.1.1 What You Can Do in this Chapter

- Use the **TR-069** screen (Section 19.5 on page 204) to configure the NVG2053's TR-069 auto-configuration settings.
- Use the **WWW** screen (Section 19.5 on page 204) to configure the NVG2053's HTTP management settings.
- Use the **Telnet** screen (Section 19.5 on page 204) to specify which interfaces allow Telnet access and from which IP address the access can come.
- Use the **ICMP** screen (Section 19.6 on page 205) to specify which of the NVG2053's interfaces will respond to Ping requests.

19.2 What You Need To Know

Firewall Rules

When you configure remote management to allow management from any network except the LAN, you still need to configure a firewall rule to allow access. See Chapter 13 on page 251 for details on configuring firewall rules.

You can also disable a service on the NVG2053 by not allowing access for the service/protocol through any of the NVG2053 interfaces.

Remote Management Sessions

You may only have one remote management session running at a time. The NVG2053 automatically disconnects a remote management session of lower priority when another remote management session of higher priority starts. The priorities for the different types of remote management sessions are as follows.

1 Telnet

2 HTTP

Remote Management Limitations

Remote management does not work when:

1 You have not enabled that service on the interface in the corresponding remote management screen.

2 You have disabled that service in one of the remote management screens.

3 The IP address in the **Secured Client IP Address** field does not match the client IP address. If it does not match, the NVG2053 will disconnect the session immediately.

4 There is already another remote management session with an equal or higher priority running. You may only have one remote management session running at one time.

5 There is a firewall rule that blocks it.

System Timeout

There is a default system management idle timeout of five minutes (three hundred seconds). The NVG2053 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 **Maintenance** > **General** screen.

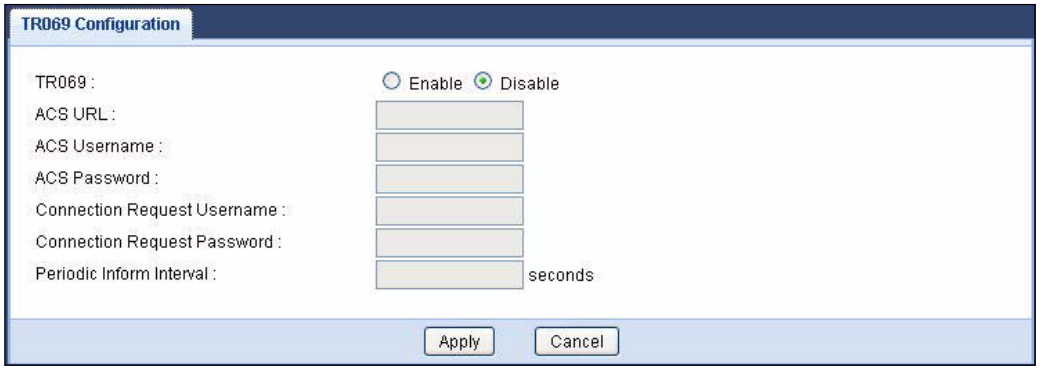
19.3 The TR-069 Screen

TR-069 defines how Customer Premise Equipment (CPE), for example your NVG2053, can be managed over the WAN by an Auto Configuration Server (ACS). TR-069 is based on sending Remote Procedure Calls (RPCs) between an ACS and a client device. RPCs are sent in Extensible Markup Language (XML) format over HTTP or HTTPS.

An administrator can use an ACS to remotely set up the NVG2053, modify settings, perform firmware upgrades as well as monitor and diagnose the NVG2053. You have to enable the device to be managed by the ACS and specify the ACS IP address or domain name and username and password.

Click **Configuration > Management > TR-069** to open the following screen. Use this screen to configure your NVG2053 to be managed by an ACS.

Figure 87 Management > TR-069



The following table describes the fields in this screen.

Table 69 Management > TR-069

LABEL	DESCRIPTION
TR069	Select **Enable** to activate remote management via TR-069 on the WAN. Otherwise, select **Disable**.
ACS URL	Enter the URL or IP address of the auto-configuration server.
ACS Username	Enter the TR-069 user name for authentication with the auto-configuration server.
ACS Password	Enter the TR-069 password for authentication with the auto-configuration server.
Connection Request Username	Enter the connection request user name. When the ACS makes a connection request to the NVG2053, this user name is used to authenticate the ACS.
Connection Request Password	Enter the connection request password. When the ACS makes a connection request to the NVG2053, this password is used to authenticate the ACS.
Periodic Inform Interval	The NVG2053 can initiate a connection to the ACS using the pre-configured address at any time. Enter the time interval (in seconds) at which the NVG2053 sends information to the auto-configuration server. "0" means the NVG2053 will not establish periodic communication with the ACS.
Apply	Click **Apply** to save your changes back to the NVG2053.
Cancel	Click **Cancel** to begin configuring this screen afresh.

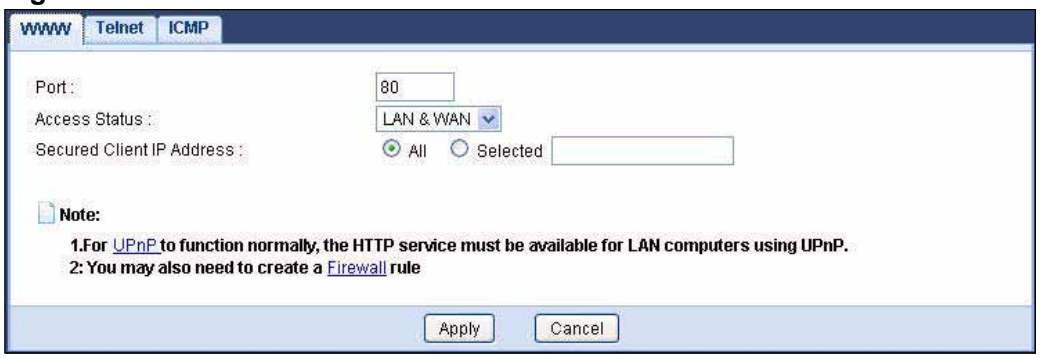
19.4 The WWW Screen

Use this screen to configure the NVG2053's HTTP management settings.

Note: If you disable the HTTP service in the **WWW** screen, then the NVG2053 blocks all HTTP connection attempts.

Click **Management > Remote MGMT** > **WWW** to open the following screen.

Figure 88 Remote MGMT > WWW



The following table describes the fields in this screen.

Table 70 Remote MGMT > WWW

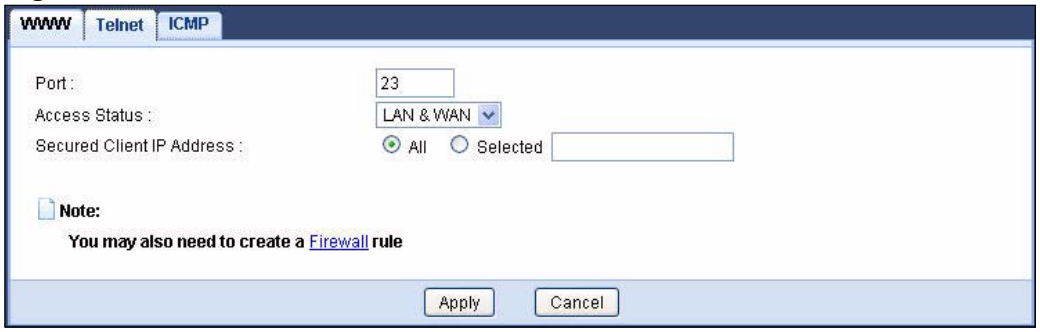
LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the NVG2053 using this service.
Secured Client IP Address	A secure client is a "trusted" computer that is allowed to communicate with the NVG2053 using this service. Select **All** to allow any computer to access the NVG2053 using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the NVG2053 using this service.
Apply	Click this to save your changes and to apply them to the NVG2053.
Cancel	Click this to set every field in this screen to its last-saved value.

19.5 The Telnet Screen

Use this screen to specify which interfaces allow Telnet access and from which IP address the access can come.

Click **Management > Remote MGMT** > **Telnet** to open the following screen.

Figure 89 Remote MGMT > Telnet



The following table describes the fields in this screen.

Table 71 Remote MGMT > Telnet

LABEL	DESCRIPTION
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.
Access Status	Select the interface(s) through which a computer may access the NVG2053 using this service.
Secured Client IP Address	A secure client is a "trusted" computer that is allowed to communicate with the NVG2053 using this service. Select **All** to allow any computer to access the NVG2053 using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the NVG2053 using this service.
Apply	Click this to save your changes and to apply them to the NVG2053.
Cancel	Click this to set every field in this screen to its last-saved value.

19.6 The ICMP Screen

Use this screen to help keep the NVG2053 hidden from probing attempts. You can specify which of the NVG2053's interfaces will respond to Ping requests.

Click **Management > Remote MGMT** > **ICMP** to open the following screen.

Figure 90 Remote MGMT > ICMP

The following table describes the fields in this screen.

Table 72 Remote MGMT > ICMP

LABEL	DESCRIPTION
Respond to Ping on	Select the interface(s) that you want to reply to incoming Ping requests. Select **Disable** to have the NVG2053 not respond to any Ping requests that come into an interface.
Apply	Click this to save your changes and to apply them to the NVG2053.
Cancel	Click this to set every field in this screen to its last-saved value.

20 Maintenance

20.1 Overview

This chapter provides information on the **Maintenance > General** screen.

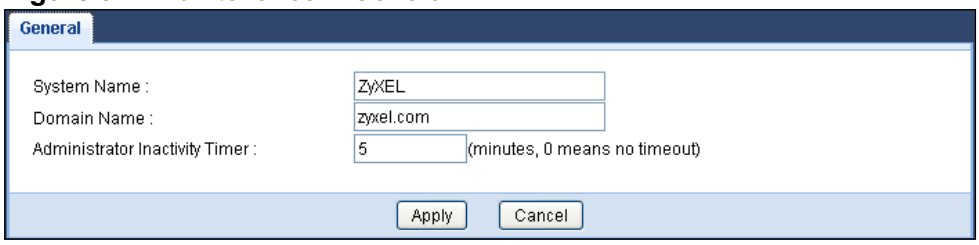
20.2 What You Can Do

Use the **General** screen (Section 20.3 on page 207) to enter a name to identify the NVG2053 in the network, and configure your device's domain name and management inactivity timeout.

20.3 General Screen

Use this screen to enter a name to identify the NVG2053 in the network and set the management inactivity timeout. Click **Maintenance** > **General**. The following screen displays.

Figure 91 Maintenance > General



The following table describes the labels in this screen.

Table 73 Maintenance > General

LABEL	DESCRIPTION
System Name	System Name is a unique name to identify the NVG2053 in an Ethernet network.
Domain Name	Enter the domain name you want to give to the NVG2053.

Table 73 Maintenance > General

LABEL	DESCRIPTION
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 NVG2053.
Cancel	Click **Cancel** to begin configuring this screen afresh.

21 Password

21.1 Overview

This chapter contains information about configuring the **Maintenance > Password** screen.

21.1.1 What You Can Do in this Chapter

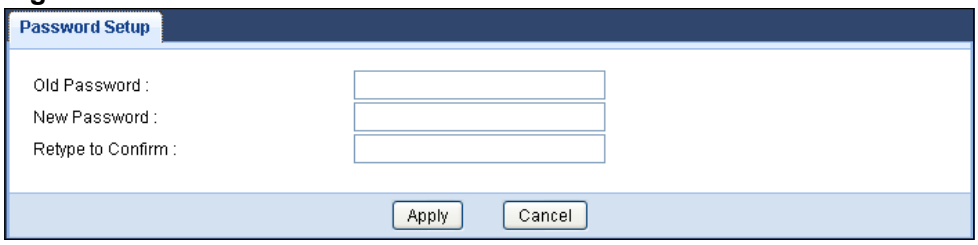
Use the **Password** screen (Section 21.2 on page 209) to configure the system password.

21.2 Password Screen

Use the **Password** screen to change your NVG2053's password (recommended).

Click **Maintenance** > **Password**.

Figure 92 Maintenance > Password



The following table describes the labels in this screen.

Table 74 Maintenance > Password

LABEL	DESCRIPTION
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.

Table 74 Maintenance > Password

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes back to the NVG2053.
Cancel	Click **Cancel** to begin configuring this screen afresh.

22 Time

22.1 Overview

This chapter provides information on the **Time** screen.

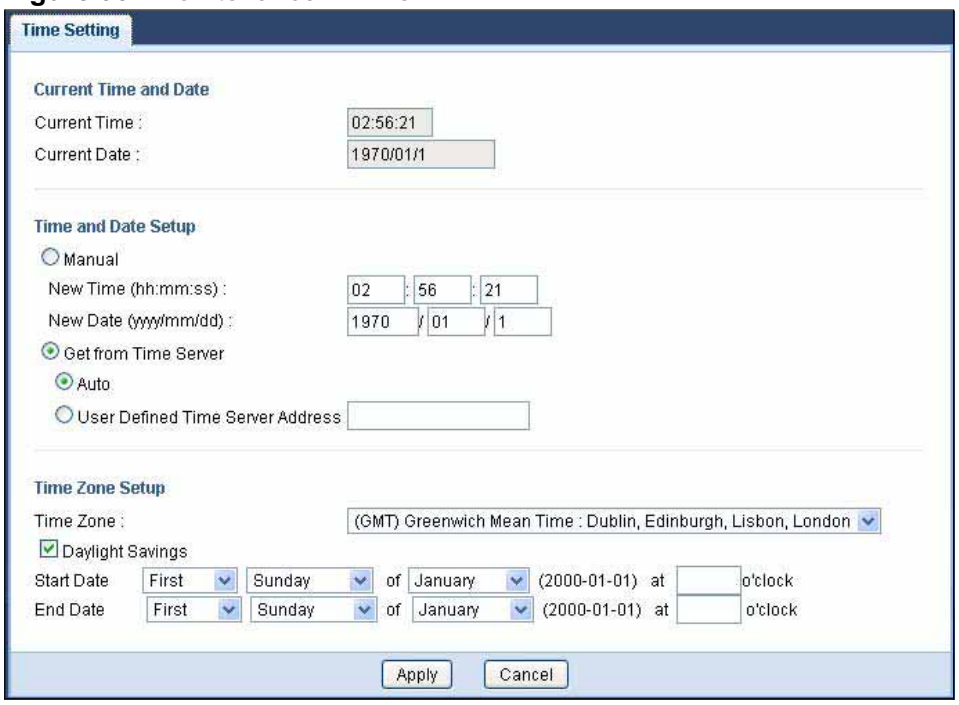
22.1.1 What You Can Do in this Chapter

Use the Time Setting screen (Section 22.2 on page 212) to change your NVG2053's time and date.

22.2 Time Setting Screen

Use this screen to configure the NVG2053's time based on your local time zone. To change your NVG2053's time and date, click **Maintenance** > **Time**. The screen appears as shown.

Figure 93 Maintenance > Time



he following table describes the labels in this screen.

Table 75 Maintenance > Time

LABEL	DESCRIPTION
Current Time and Date	
Current Time	This field displays the time of your NVG2053.
Current Date	This field displays the date of your NVG2053.
Time and Date Setup	
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 set **Time and Date Setup** to **Manual**, enter the new time in this field and then click **Apply**.

Table 75 Maintenance > Time

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 set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**.
Get from Time Server	Select this radio button to have the NVG2053 get the time and date from the time server you specified below.
Auto	Select **Auto** to have the NVG2053 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 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).

Table 75 Maintenance > Time

LABEL	DESCRIPTION
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 NVG2053.
Cancel	Click **Cancel** to begin configuring this screen afresh.

23

Firmware Upgrade

23.1 Overview

This chapter shows you how to upload a new firmware.

23.1.1 What You Can Do in this Chapter

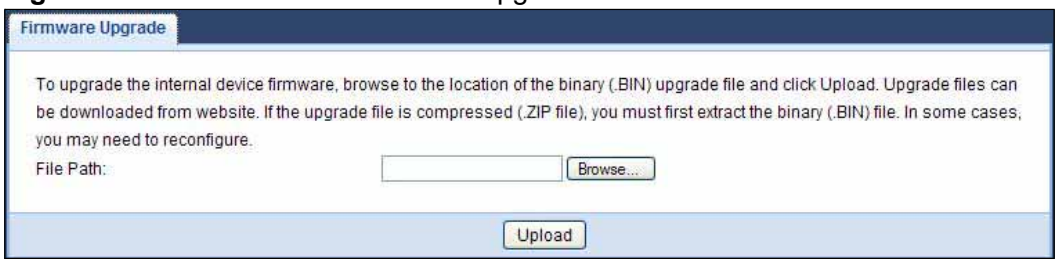
Use the **Firmware Upgrade** screen (Section 23.2 on page 215) to upload firmware to your NVG2053.

23.2 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., "NVG2053.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 NVG2053.

Figure 94 Maintenance > Firmware Upgrade



The following table describes the labels in this screen.

Table 76 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.

Note: Do not turn off the NVG2053 while firmware upload is in progress!

After you see the **Firmware Upgrade is proceeding** screen, wait six minutes before logging into the NVG2053 again.

The NVG2053 automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 95 Network Temporarily Disconnected

After six 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 **OK** to go back to the **Firmware** screen.

24

Backup/Restore

24.1 Overview

This chapter shows you how to backup, restore and reset your NVG2053.

Backup configuration allows you to back up (save) the NVG2053's current configuration to a file on your computer. Once your NVG2053 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 NVG2053.

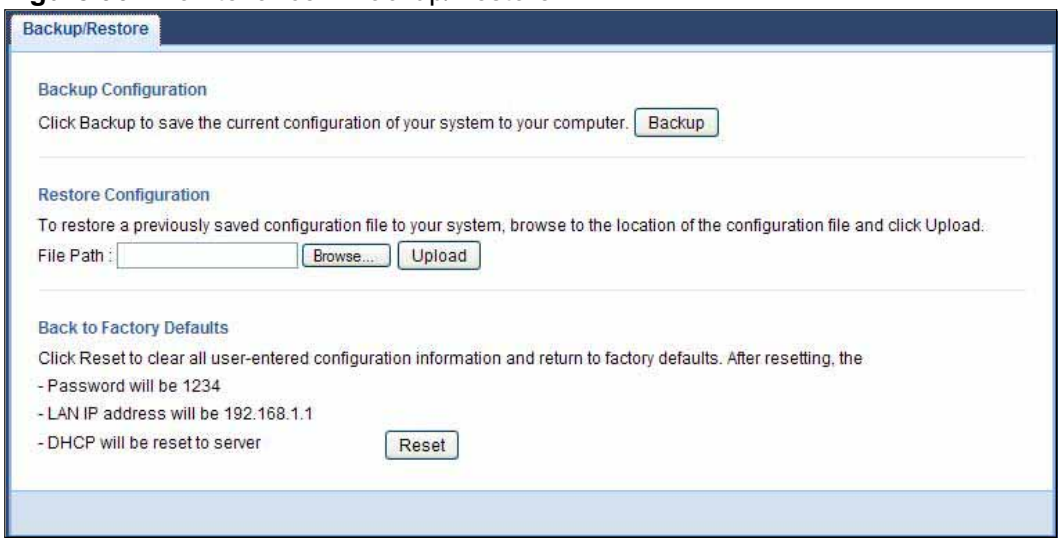
24.1.1 What You Can Do in this Chapter

Use the **Backup/Restore** screen (Section 24.2 on page 218) to view information related to factory defaults, backup configuration, and restoring configuration.

24.2 Backup/Restore Screen

Click **Maintenance > Backup/Restore**. Information related to factory defaults, backup configuration, and restoring configuration appears as shown next.

Figure 96 Maintenance > Backup/Restore



The following table describes the labels in this screen.

Table 77 Maintenance > Backup/Restore

LABEL	DESCRIPTION
Backup	Click **Backup** to save the NVG2053'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 77 Maintenance > Backup/Restore

LABEL	DESCRIPTION
Upload	Click **Upload** to begin the upload process. Note: Do not turn off the NVG2053 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 NVG2053 again. The NVG2053 automatically restarts in this time causing a temporary network disconnect. If you see an error screen, click **OK** to return to the **Backup/Restore** screen.
Reset	Pressing the **Reset** button in this section clears all user-entered configuration information and returns the NVG2053 to its factory defaults. You can also press the **RESET** button on the side panel to reset the factory defaults of your NVG2053. 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 NVG2053 IP address (192.168.1.1). See Appendix B on page 247 for details on how to set up your computer's IP address.

25 Language

25.1 Overview

This chapter shows you how to change the Web Configurator's display language.

25.2 What You Can Do

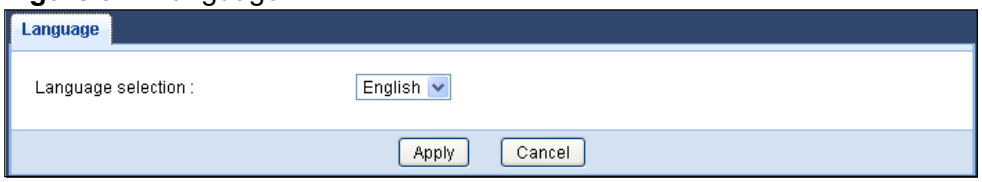
Use the **Language** screen (Section 25.3 on page 221) to change the language for the Web Configurator display.

25.3 The Language Screen

Select the language you prefer and click **Apply**. The Web Configurator language changes after a while without restarting the NVG2053. Click **Maintenance > Language**.

At the time of writing, the NVG2053 supports English only.

Figure 97 Language



26 Restart

26.1 Overview

This chapter shows you how to restart your NVG2053.

26.2 What You Can Do

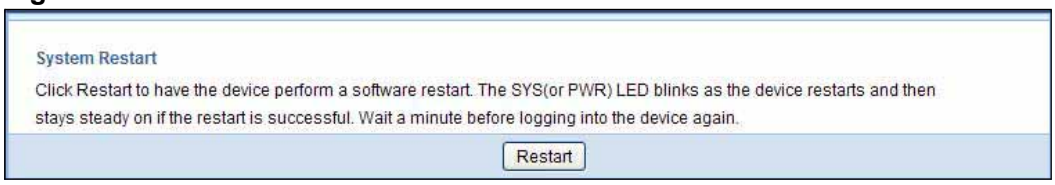
Use the **Restart** screen (Section 26.3 on page 223) to reboot the NVG2053 without turning the power off.

26.3 The Restart Screen

System restart allows you to reboot the NVG2053 without turning the power off.

Click **Maintenance > Restart** to open the following screen.

Figure 98 Maintenance > Restart



Click **Restart** to have the NVG2053 reboot. This does not affect the NVG2053's configuration.

27

Troubleshooting

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

- Power, Hardware Connections, and LEDs
- NVG2053 Access and Login
- Internet Access
- Resetting the NVG2053 to Its Factory Defaults
- Wireless Router/AP Troubleshooting

27.1 Power, Hardware Connections, and LEDs

The NVG2053 does not turn on. None of the LEDs turn on.

1. Make sure you are using the power adaptor or cord included with the NVG2053.
2. Make sure the power adaptor or cord is connected to the NVG2053 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 NVG2053.
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 24.
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 NVG2053.

5 If the problem continues, contact the vendor.

27.2 NVG2053 Access and Login

I don't know the IP address of my NVG2053.

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 NVG2053 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 NVG2053 (it depends on the network), so enter this IP address in your Internet browser.

3 Reset your NVG2053 to change all settings back to their default. This means your current settings are lost. See Section 27.4 on page 229 in the **Troubleshooting** for information on resetting your NVG2053.

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 27.4 on page 229.

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 9.4 on page 123), 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 NVG2053.

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 JavaScripts and Java enabled. See Appendix A on page 235.

4 Make sure your computer is in the same subnet as the NVG2053. (If you know that there are routers between your computer and the NVG2053, skip this step.)

- If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. See Section 10.3 on page 126.
- If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the NVG2053. See Appendix C on page 263.

5 Reset the device to its factory defaults, and try to access the NVG2053 with the default IP address. See Section 24.2 on page 218.

6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestion

- 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 NVG2053.

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 This can happen when you fail to log out properly from your last session. Try logging in again after 5 minutes (default).

3 Disconnect and re-connect the power adaptor or cord to the NVG2053.

4 If this does not work, you have to reset the device to its factory defaults. See Section 27.4 on page 229.

27.3 Internet Access

I cannot access the Internet.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide.
2. Make sure you entered your ISP account information correctly in the wizard or **Broadband** screen. These fields are case-sensitive, so make sure [Caps Lock] is not on.
3. If you are trying to access the Internet wirelessly, make sure the wireless settings in the wireless client are the same as the settings in the NVG2053.
4. Disconnect all the cables from your device, and follow the directions in the Quick Start Guide again.
5. If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the NVG2053), 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 24.
2. Reboot the NVG2053.
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 24. If the NVG2053 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 NVG2053 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 NVG2053.

4 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Check the settings for QoS. If it is disabled, you might consider activating it. If it is enabled, you might consider raising or lowering the priority for some applications.

27.4 Resetting the NVG2053 to Its Factory Defaults

If you reset the NVG2053, you lose all of the changes you have made. The NVG2053 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 NVG2053,

1 Make sure the power LED is on.

2 Press the **RESET** button for longer than 10 seconds to set the NVG2053 back to its factory-default configurations.

If the NVG2053 restarts automatically, wait for the NVG2053 to finish restarting, and log in to the Web Configurator. The password is "1234".

If the NVG2053 does not restart automatically, disconnect and reconnect the NVG2053's power. Then, follow the directions above again.

27.5 Wireless Router/AP Troubleshooting

I cannot access the NVG2053 or ping any computer from the WLAN.

1. Make sure the wireless LAN is enabled on the NVG2053
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 NVG2053.
4. Make sure your computer (with a wireless adapter installed) is within the transmission range of the NVG2053.
5. Check that both the NVG2053 and your wireless station are using the same wireless and wireless security settings.
6. Make sure you allow the NVG2053 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.

28

Product Specifications

The following tables summarize the NVG2053's hardware and firmware features.

Table 78 Hardware Features

Device Dimensions (W x D x H)	220 mm x 145 mm x 40 mm
Device Weight	395 g
Power Specification	Input: 100~240 V AC, 50~60 Hz Output: 12 V DC 1.5A
Ethernet ports	Auto-negotiating: 10 Mbps, 100 Mbps, 1000 Mbps in either half-duplex or full-duplex mode. Auto-crossover: Use either crossover or straight-through Ethernet cables.
4-Port Switch	A combination of switch and router makes your NVG2053 a cost-effective and viable network solution. You can add up to four computers to the NVG2053 without the cost of a hub when connecting to the Internet through the WAN port. You can add up to five computers to the NVG2053 when you connect to the Internet in AP mode. Add more than four computers to your LAN by using a hub.
Reset Button	The reset button is built into the side panel. Use this button to restore the NVG2053 to its factory default settings. Press for 10 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.
Wireless Switch	Turn on or turn off the wireless function of the NVG2053 using this switch. There is no need to go into the Web Configurator.
Antenna	The NVG2053 is equipped with two 2dBi (2.4GHz) detachable antennas to provide clear radio transmission and reception on the wireless network.
Operation Environment	Temperature: 0º C ~ 40º C / 32ºF ~ 104ºF Humidity: 20% ~ 90%
Storage Environment	Temperature: -30º C ~ 70º C / -22ºF ~ 158ºF Humidity: 20% ~ 95%

Table 79 Firmware Features

FEATURE	DESCRIPTION
Default IP Address	192.168.1.1
Default Subnet Mask	255.255.255.0 (24 bits)
Default Password	1234
DHCP Pool	192.168.1.33 to 192.168.1.64
Wireless Interface	Wireless LAN
Default Wireless SSID	ZyXEL
Default Wireless DHCP Pool Size	Wireless LAN: Same as LAN (32 from 192.168.1.33 to 192.168.1.64)
Device Management	Use the Web Configurator to easily configure the rich range of features on the NVG2053.
Wireless Functionality	Allows IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n wireless clients to connect to the NVG2053 wirelessly. Enable wireless security (WPA(2)-PSK) and/or MAC filtering to protect your wireless network. Note: The NVG2053 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 NVG2053. Note: Only upload firmware for your specific model!
Configuration Backup & Restoration	Make a copy of the NVG2053's configuration and put it back on the NVG2053 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 NVG2053 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.
Remote Management	This allows you to decide whether a service (HTTP or Telnet traffic for example) from a computer on a network (LAN or WAN for example) can access the NVG2053.
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 NVG2053. You can also set the time manually. These dates and times are then used in logs.

Table 79 Firmware Features

FEATURE	DESCRIPTION
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 NVG2053 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.
QoS (Quality of Service)	You can efficiently manage traffic on your network by reserving bandwidth and giving priority to certain types of traffic and/or to particular computers.
IP Multicast	IP Multicast is used to send traffic to a specific group of computers. The NVG2053 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.
Universal Plug and Play (UPnP)	The NVG2053 can communicate with other UPnP enabled devices in a network.
Voice over IP (VoIP)	You can configure the NVG2053 to use your SIP account(s) to make or receive phone calls over the Internet and your regular phone line. You can also configure speed-dial entries for frequently-used (VoIP) phone numbers.
3G	You can attach a 3G wireless adapter to the NVG2053's USB port and set the NVG2053 to use this 3G connection as your WAN or a backup when the wired WAN connection fails.

A

Pop-up Windows, JavaScripts and Java Permissions

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

- Web browser pop-up windows from your device.
- JavaScripts (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

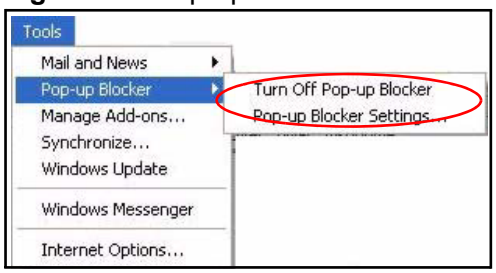
You may have to disable pop-up blocking to log into your device.

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 99 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 100 Internet Options: Privacy

3 Click **Apply** to save this setting.

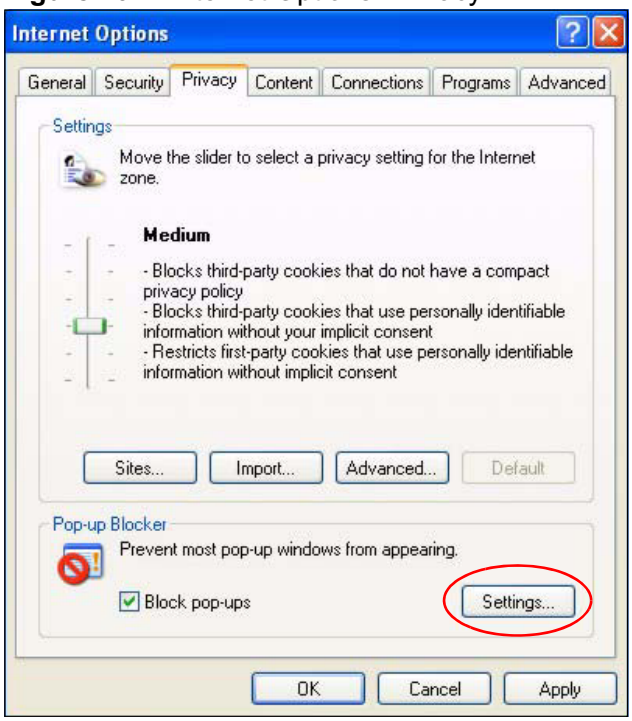
Enable Pop-up Blockers with Exceptions

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.

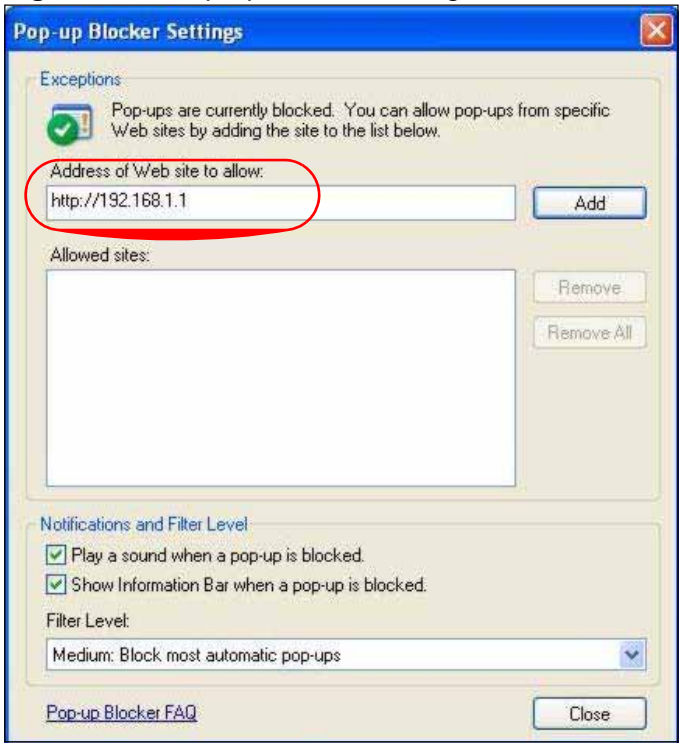
Figure 101 Internet Options: Privacy



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 102 Pop-up Blocker Settings



5 Click **Close** to return to the **Privacy** screen.

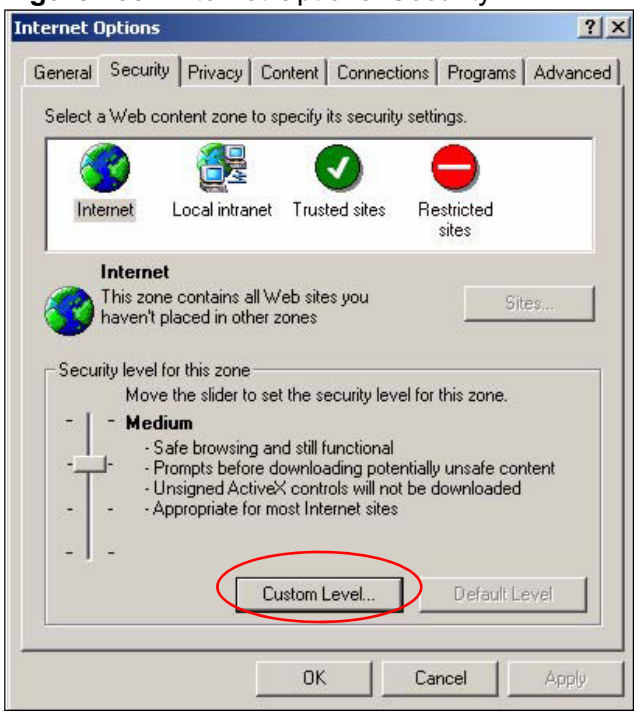
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 103 Internet Options: Security



2 Click the **Custom Level...** button.

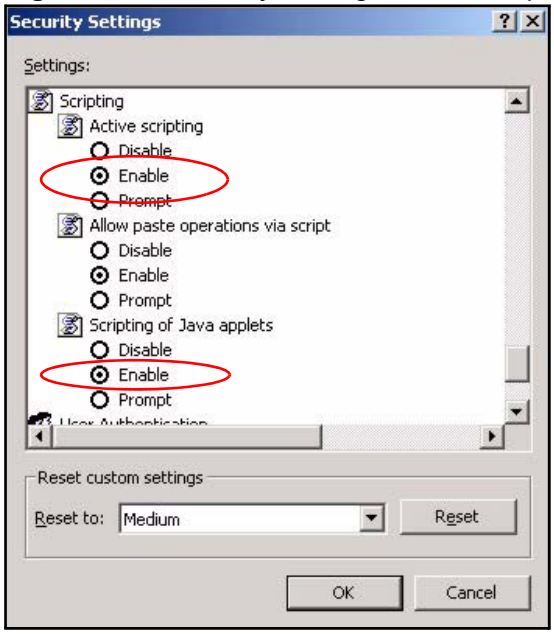
3 Scroll down to **Scripting**.

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 104 Security Settings - Java Scripting



Java Permissions

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

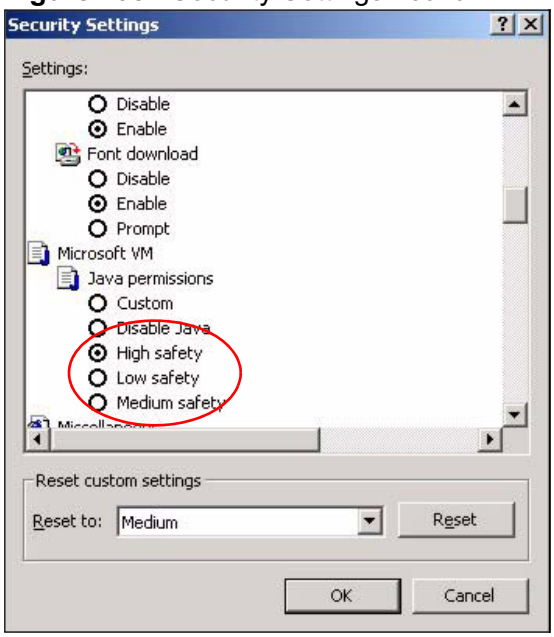
2 Click the **Custom Level...** button.

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 105 Security Settings - Java



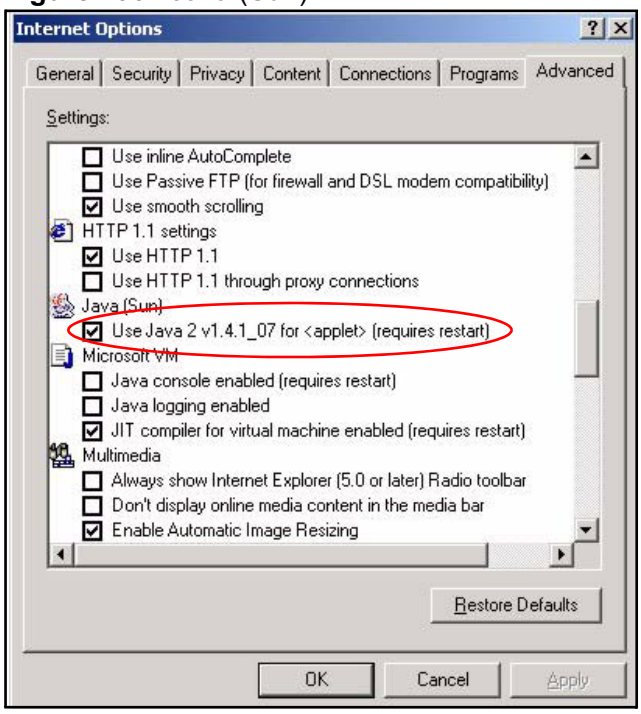
JAVA (Sun)

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 106 Java (Sun)



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, Javascripts and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 107 Mozilla Firefox: TOOLS > Options

Click **Content** to show the screen below. Select the check boxes as shown in the following screen.

Figure 108 Mozilla Firefox Content Security

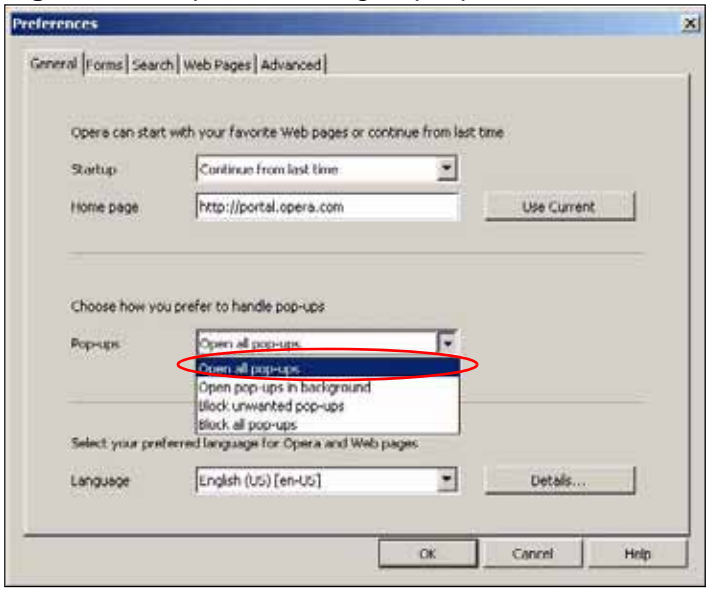
Opera

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**.

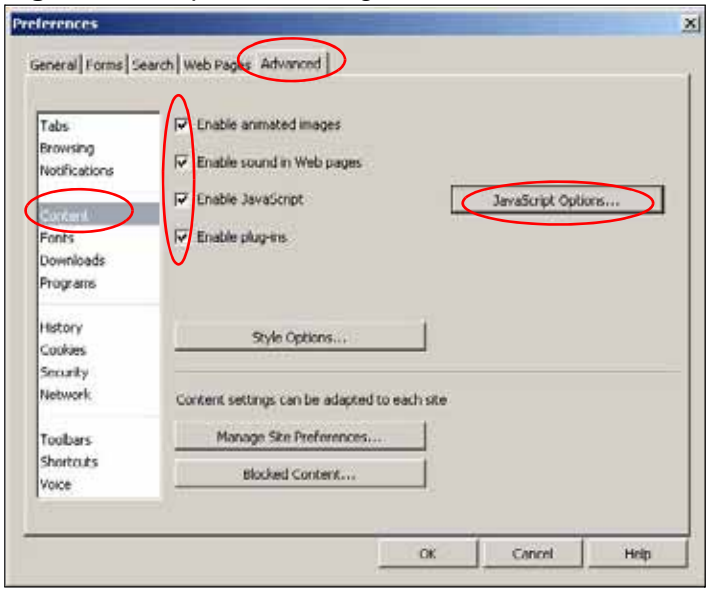
Figure 109 Opera: Allowing Pop-Ups



Enabling Java

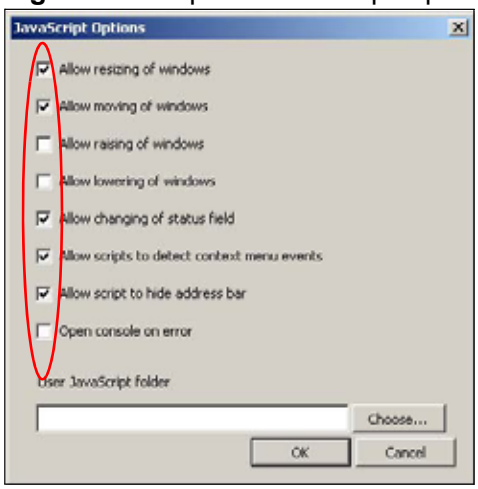
From Opera, click **Tools**, then **Preferences**. In the **Advanced** tab, select **Content** from the left-side menu. Select the check boxes as shown in the following screen.

Figure 110 Opera: Enabling Java



To customize JavaScript behavior in the Opera browser, click **JavaScript Options**.

Figure 111 Opera: JavaScript Options



Select the items you want Opera's JavaScript to apply.

B

Setting Up Your Computer's IP Address

Note: Your specific NVG2053 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.

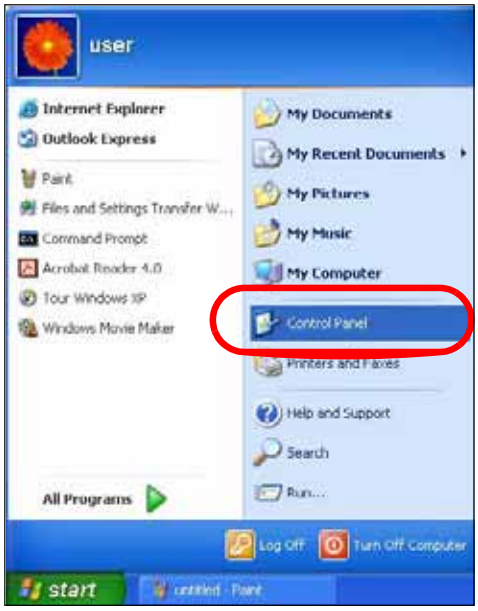
If you manually assign IP information instead of using a dynamic IP, make sure that your network's computers have IP addresses that place them in the same subnet.

In this appendix, you can set up an IP address for:

Windows XP/NT/2000

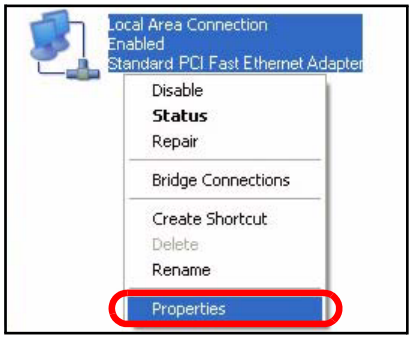
The following example uses the default Windows XP display theme but can also apply to Windows 2000 and Windows NT.

1 Click **Start** > **Control Panel**.

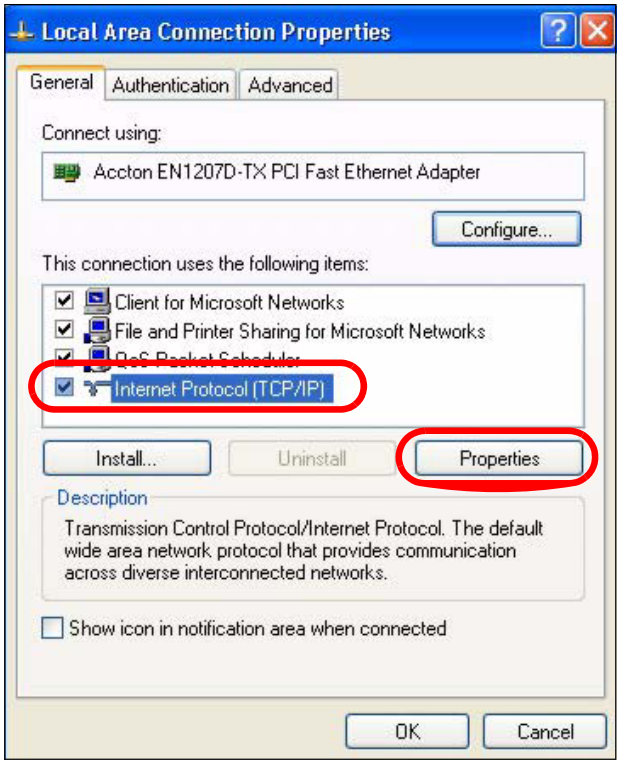


2 In the **Control Panel**, click the **Network Connections** icon.

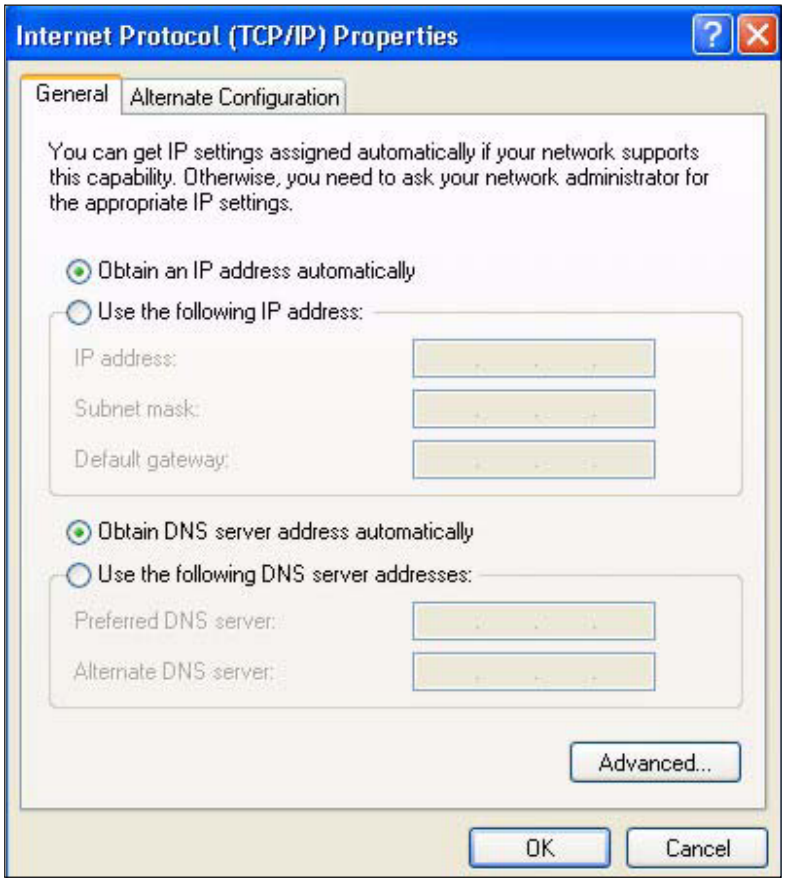
3 Right-click **Local Area Connection** and then select **Properties**.



4 On the **General** tab, select **Internet Protocol (TCP/IP)** and then click **Properties**.



5 The **Internet Protocol TCP/IP Properties** window opens.



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**.

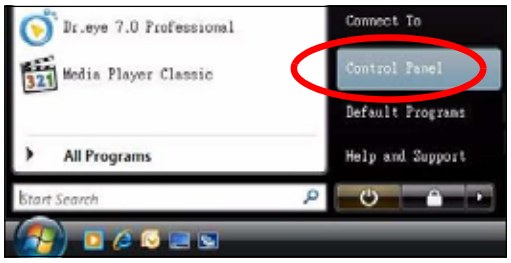
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

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.

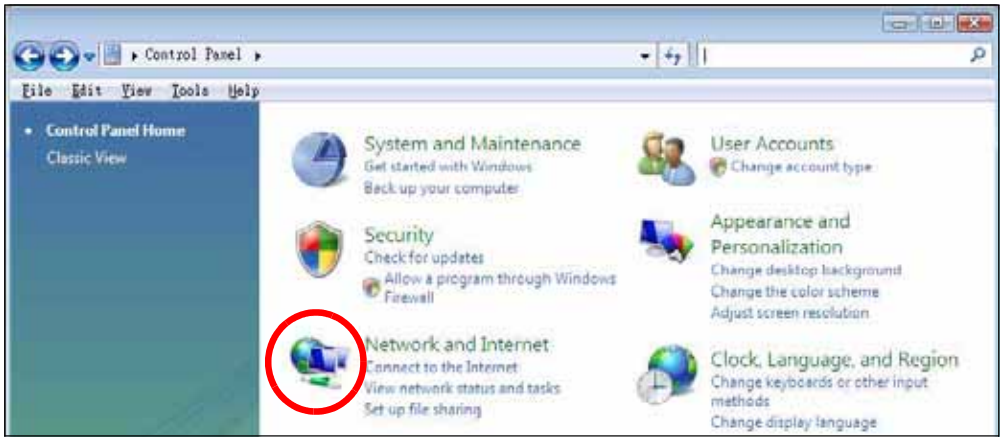
Windows Vista

This section shows screens from Windows Vista Professional.

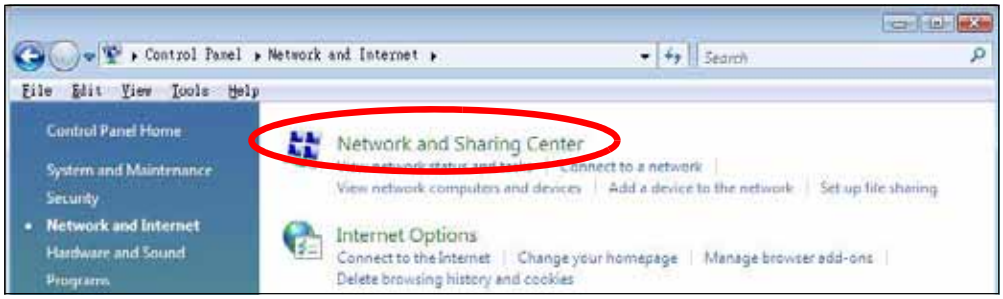
1 Click **Start** > **Control Panel**.



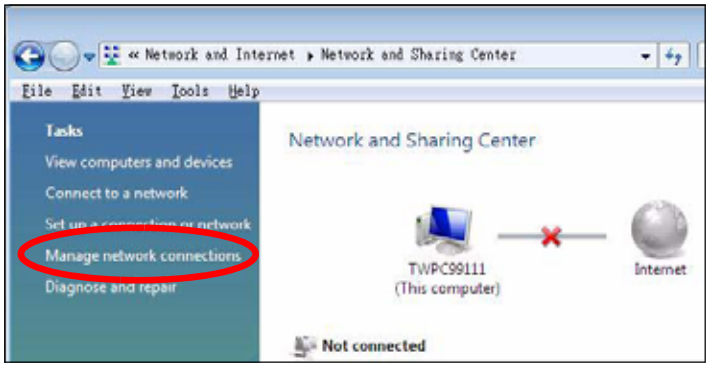
2 In the **Control Panel**, click the **Network and Internet** icon.



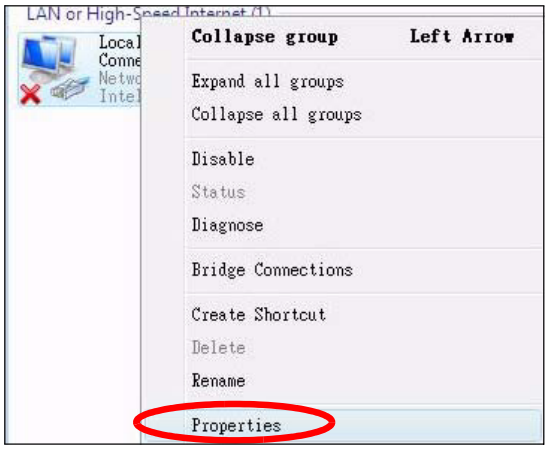
3 Click the **Network and Sharing Center** icon.



4 Click **Manage network connections**.

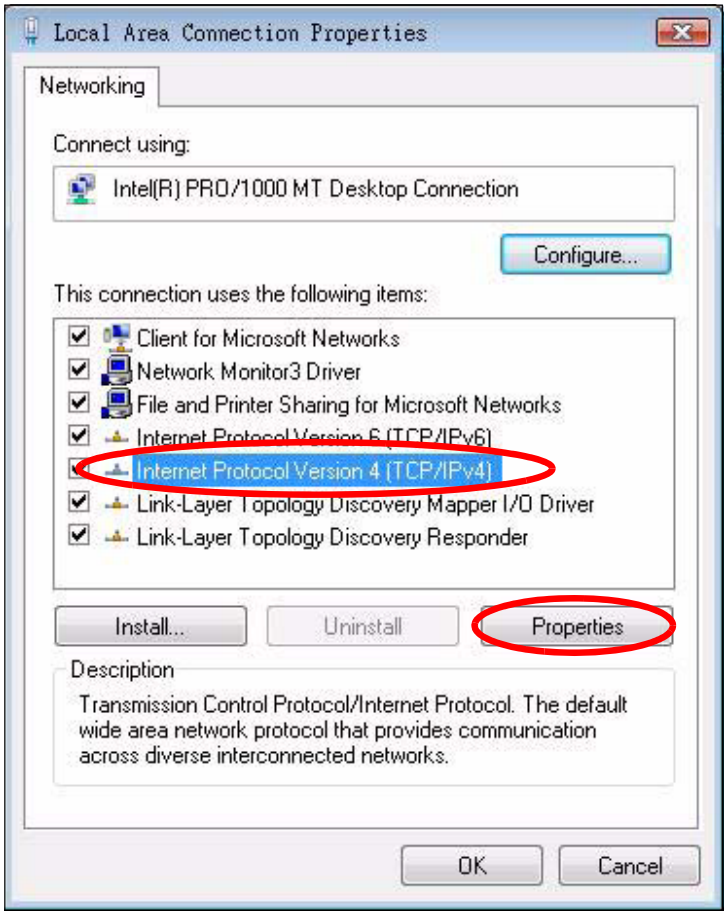


5 Right-click **Local Area Connection** and then select **Properties**.

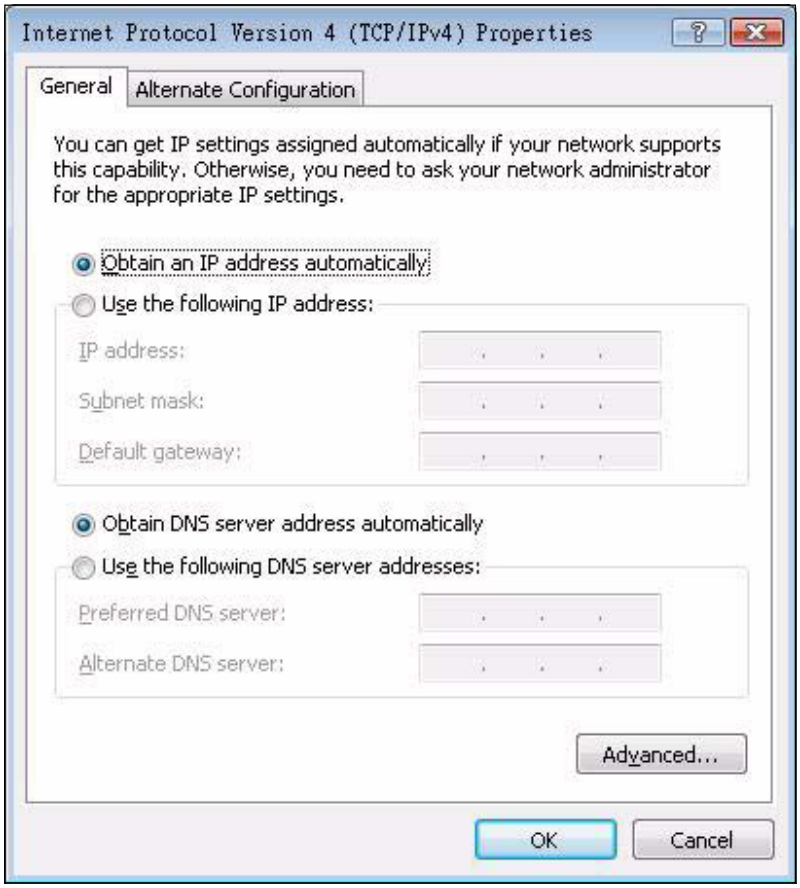


Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

6 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.



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**.

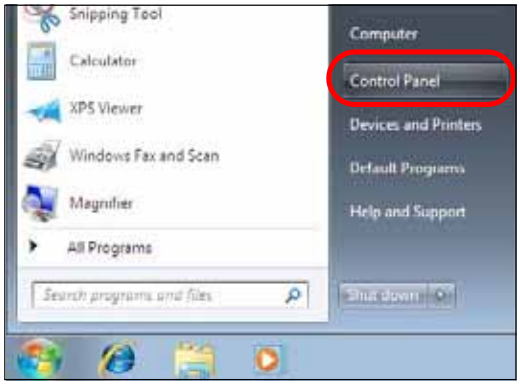
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

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

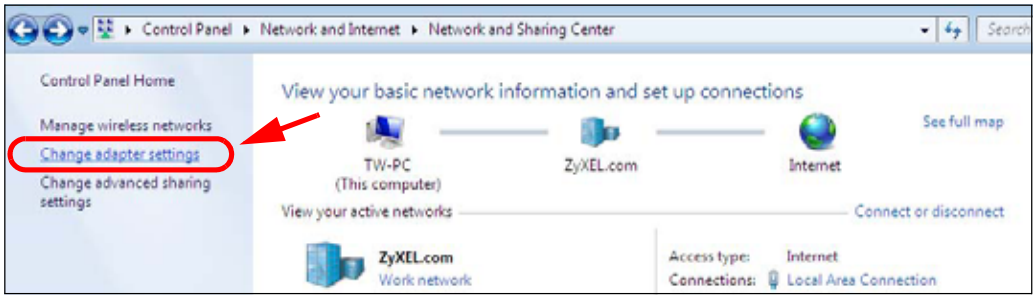
This section shows screens from Windows 7 Enterprise.

1 Click **Start** > **Control Panel**.

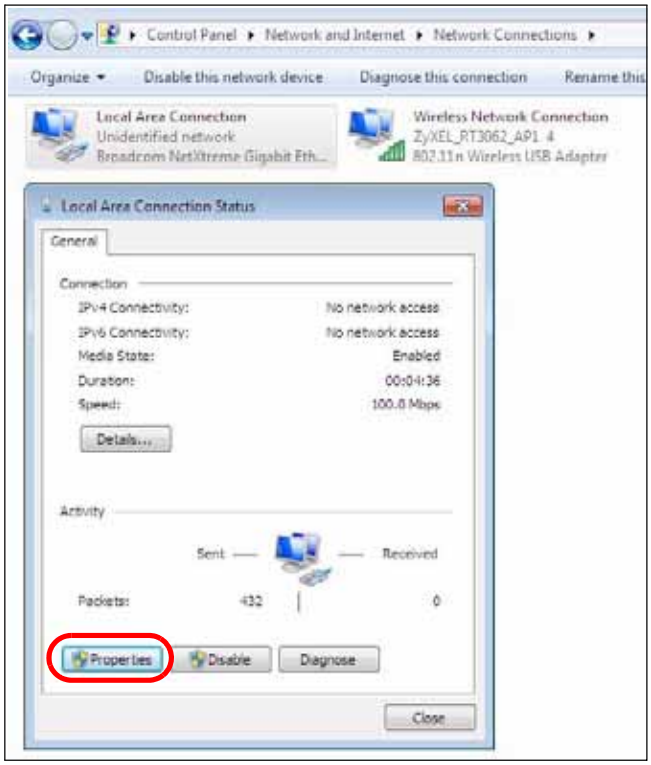


2 In the **Control Panel**, click **View network status and tasks** under the **Network and Internet** category.

3 Click **Change adapter settings**.

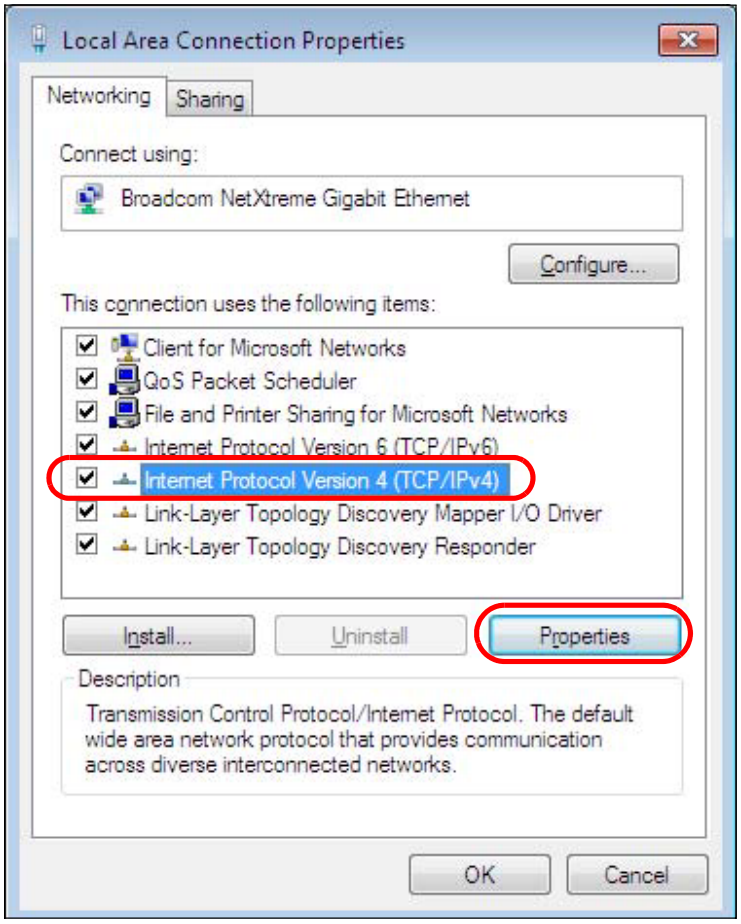


4 Double click **Local Area Connection** and then select **Properties**.

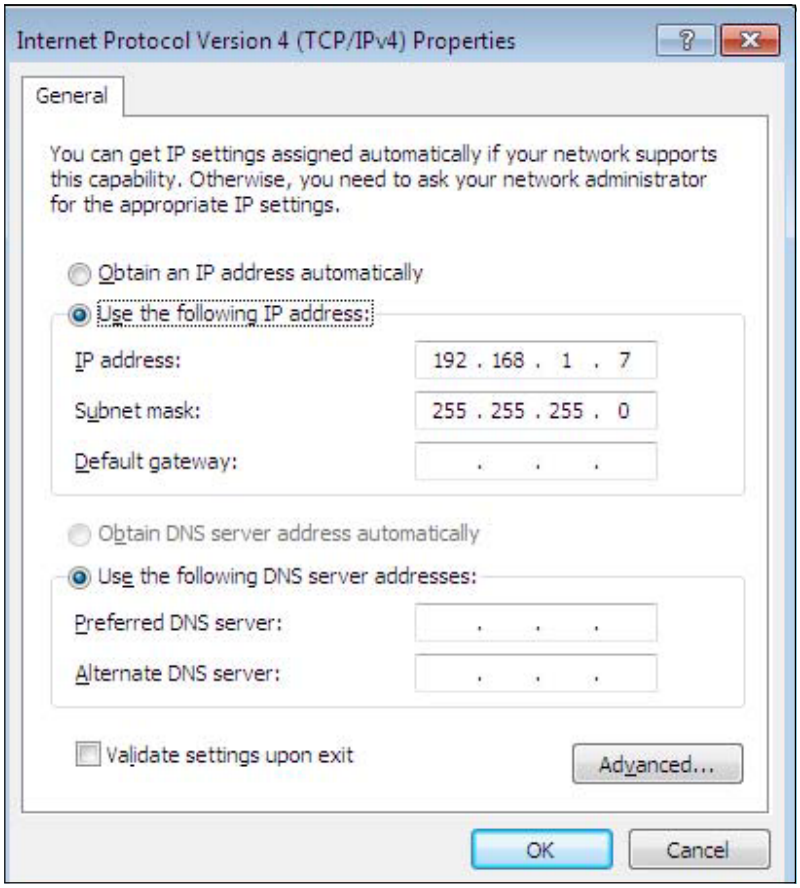


Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

5 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.



6 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.



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.

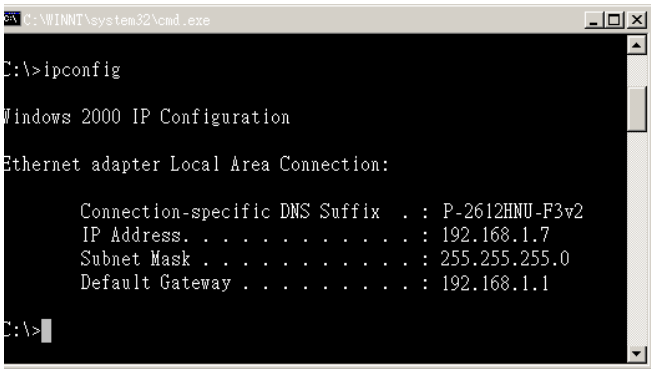
9 Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

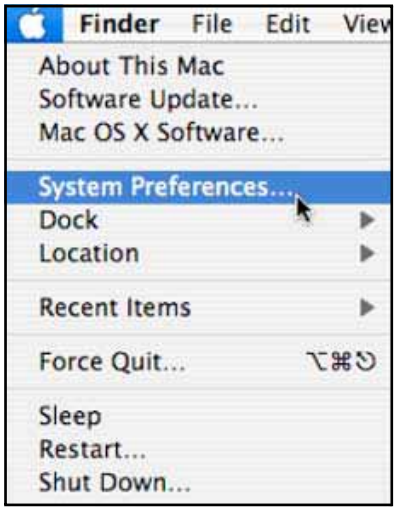
3 The IP settings are displayed as follows.



Mac OS X: 10.3 and 10.4

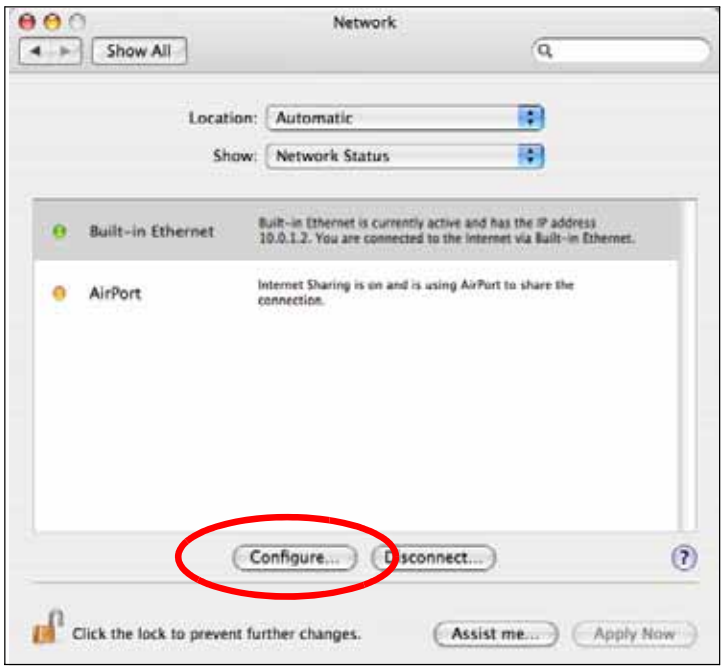
The screens in this section are from Mac OS X 10.4 but can also apply to 10.3.

1 Click **Apple** > **System Preferences**.

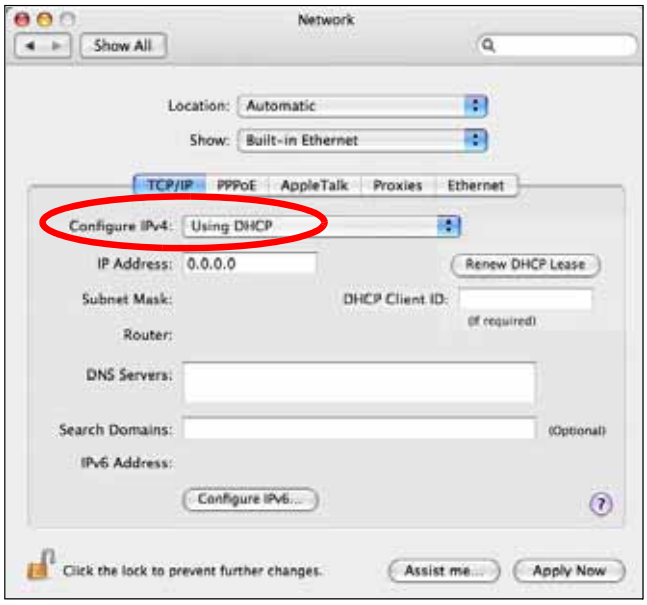


2 In the **System Preferences** window, click the **Network** icon.

3 When the **Network** preferences pane opens, select **Built-in Ethernet** from the network connection type list, and then click **Configure.**

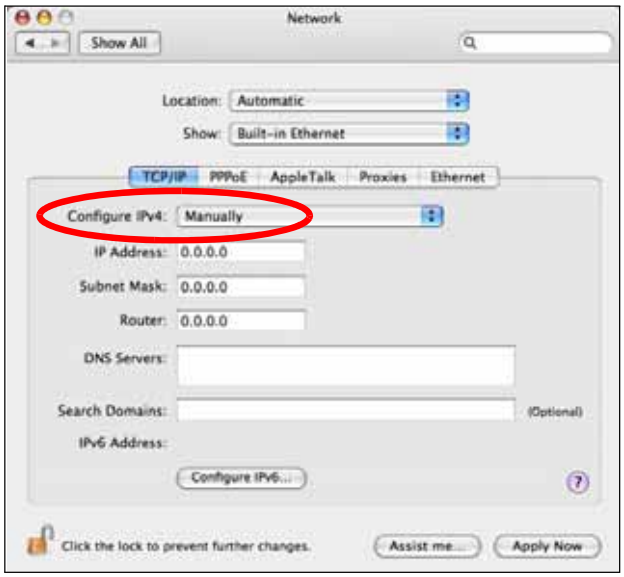


4 For dynamically assigned settings, select **Using DHCP** from the **Configure IPv4** list in the **TCP/IP** tab.



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.

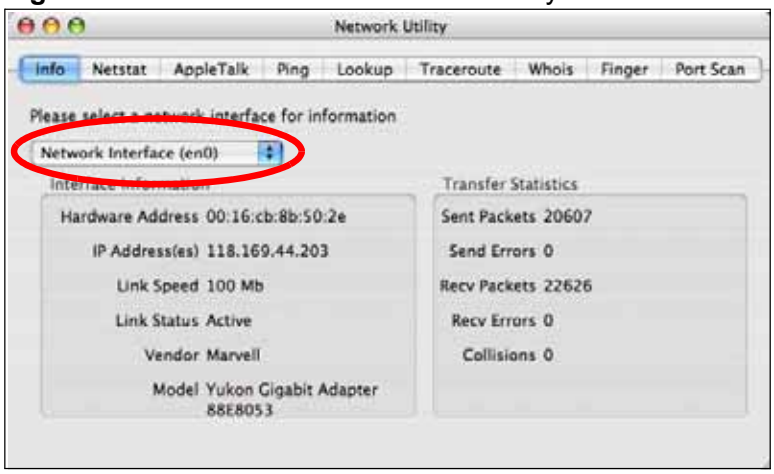


6 Click **Apply Now** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network Interface** from the **Info** tab.

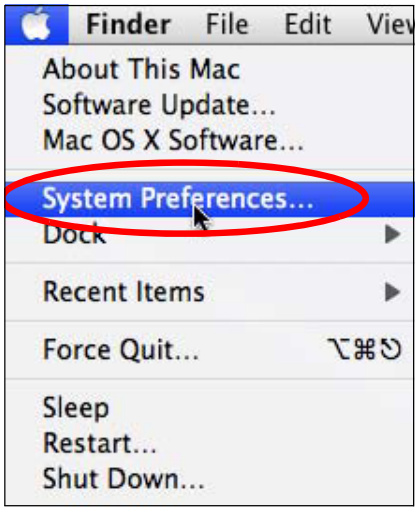
Figure 112 Mac OS X 10.4: Network Utility



Mac OS X: 10.5 and 10.6

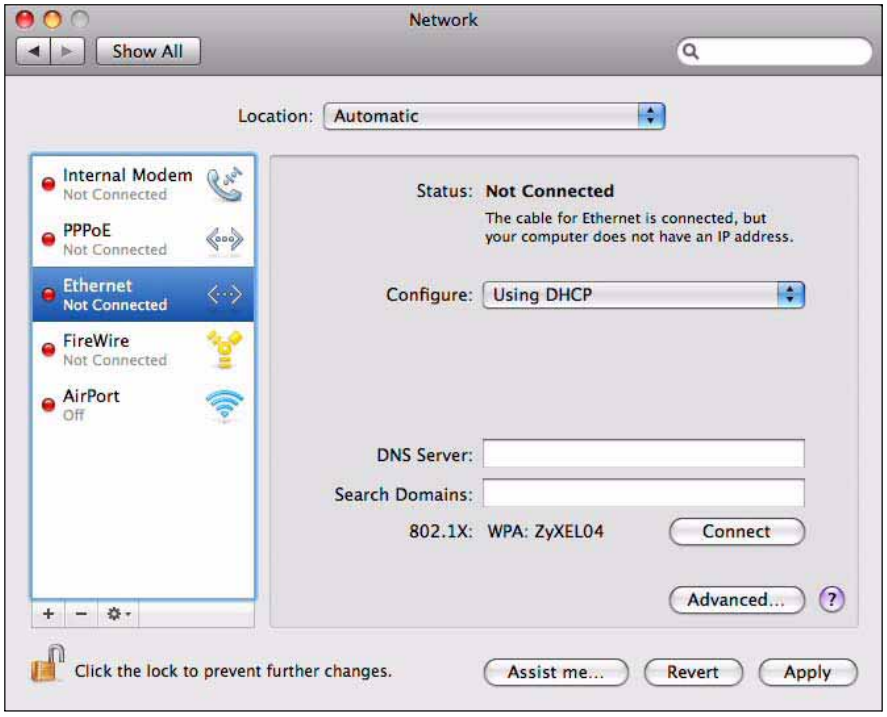
The screens in this section are from Mac OS X 10.5 but can also apply to 10.6.

1 Click **Apple** > **System Preferences**.



2 In **System Preferences**, click the **Network** icon.

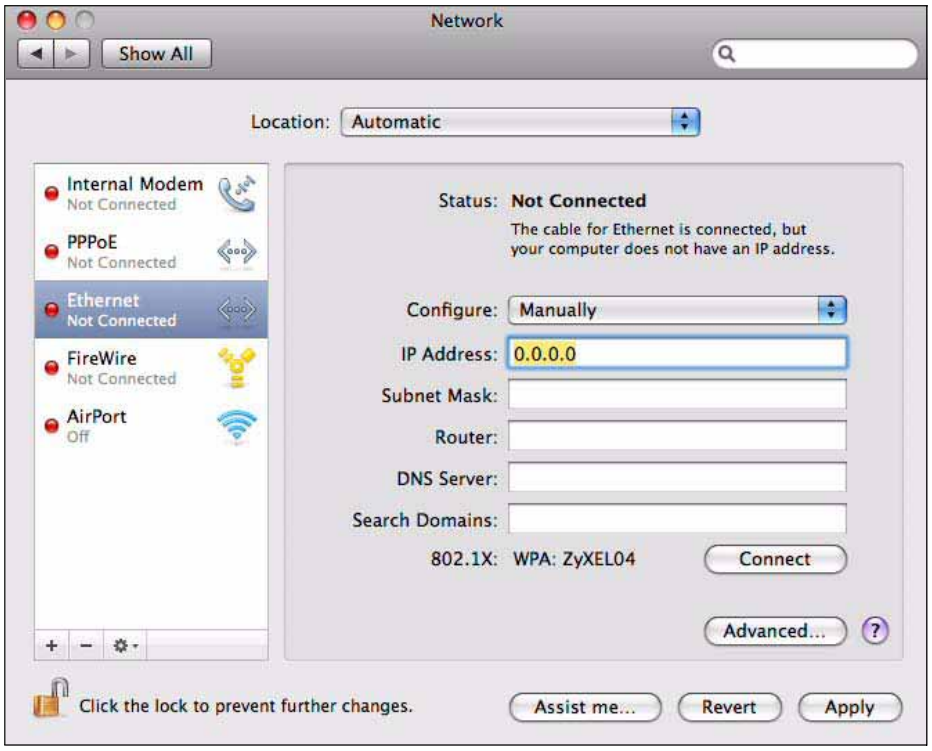
3 When the **Network** preferences pane opens, select **Ethernet** from the list of available connection types.



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 NVG2053.

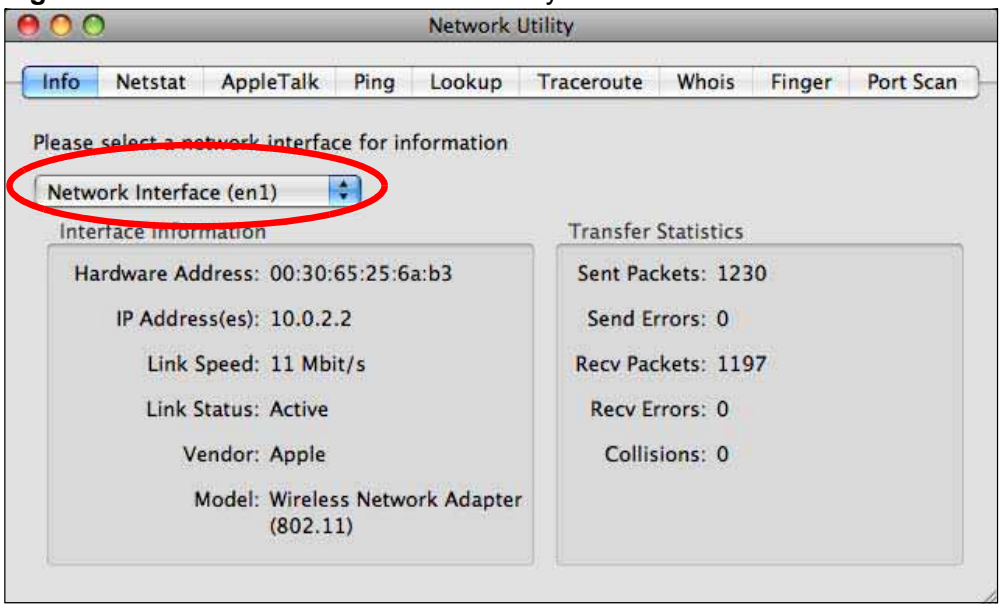


6 Click **Apply** and close the window.

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 113 Mac OS X 10.5: Network Utility



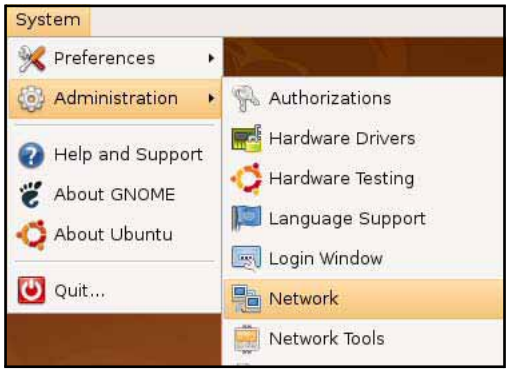
Linux: Ubuntu 8 (GNOME)

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.

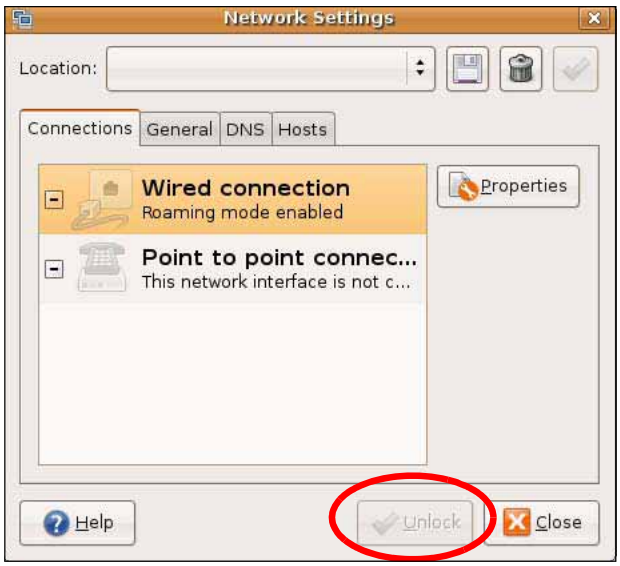
Note: Make sure you are logged in as the root administrator.

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.

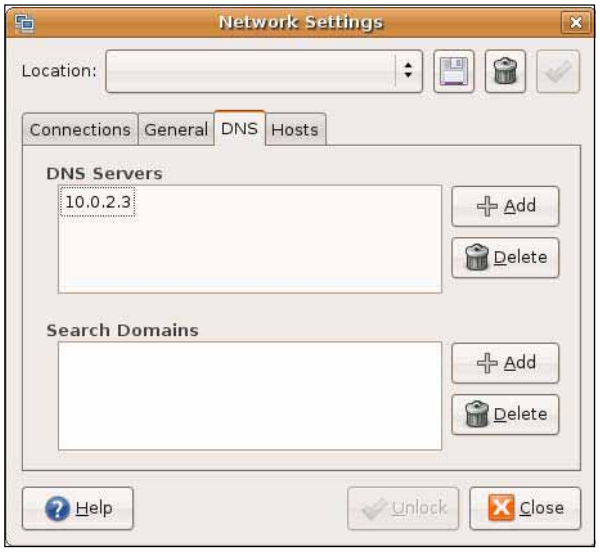
4 In the **Network Settings** window, select the connection that you want to configure, then click **Properties**.

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.

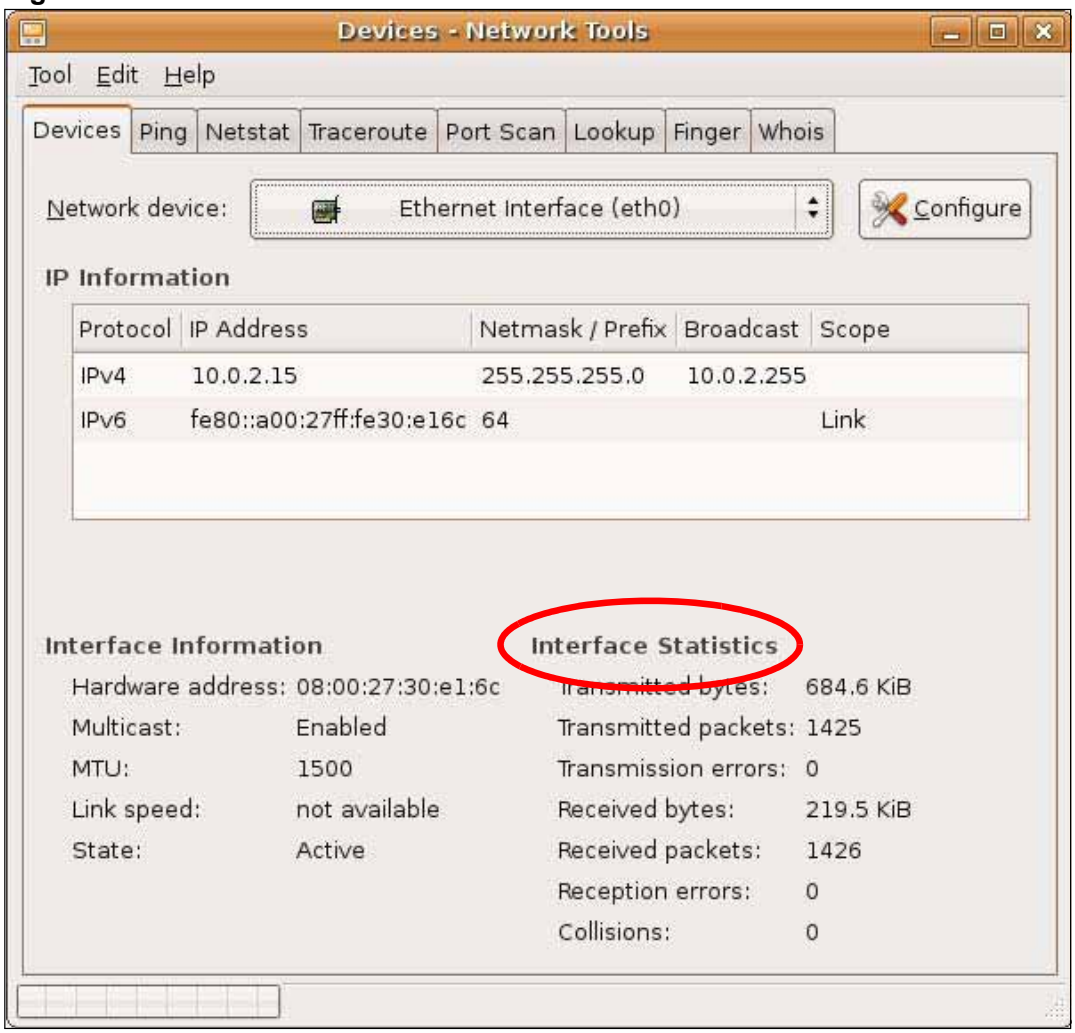


8 Click the **Close** button to apply the changes.

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 114 Ubuntu 8: Network Tools



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.

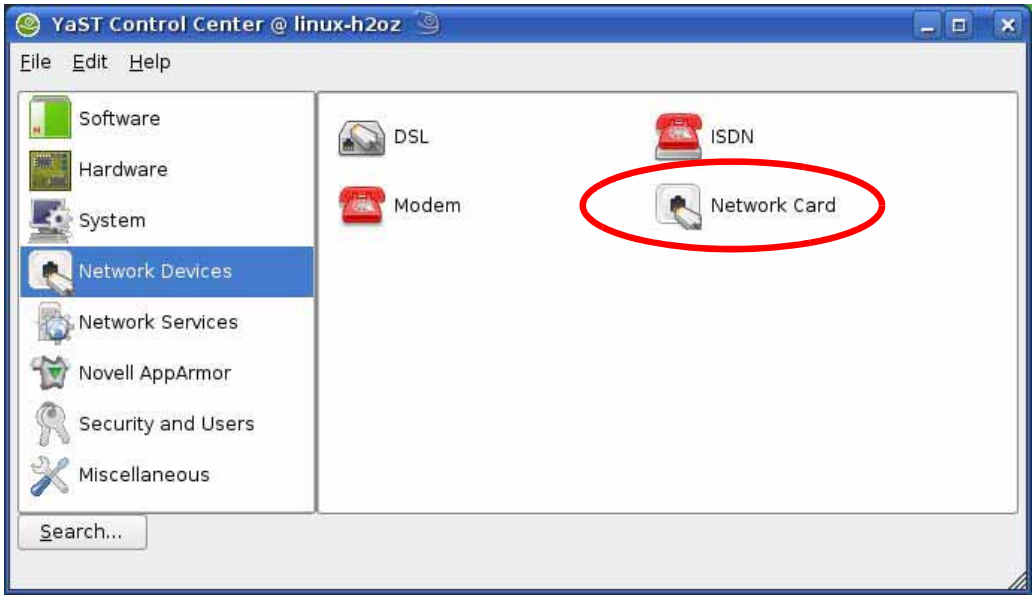
Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in the KDE:

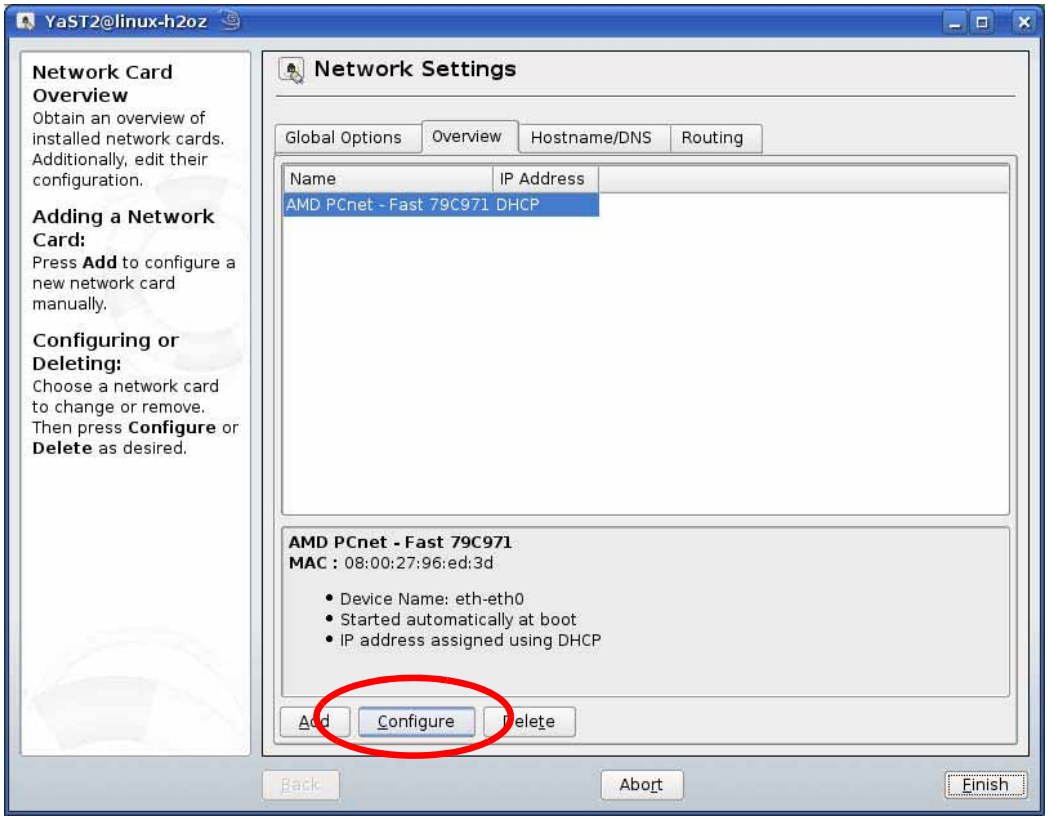
1 Click **K Menu > Computer > Administrator Settings (YaST)**.

2 When the **Run as Root - KDE su** dialog opens, enter the admin password and click **OK**.

3 When the **YaST Control Center** window opens, select **Network Devices** and then click the **Network Card** icon.

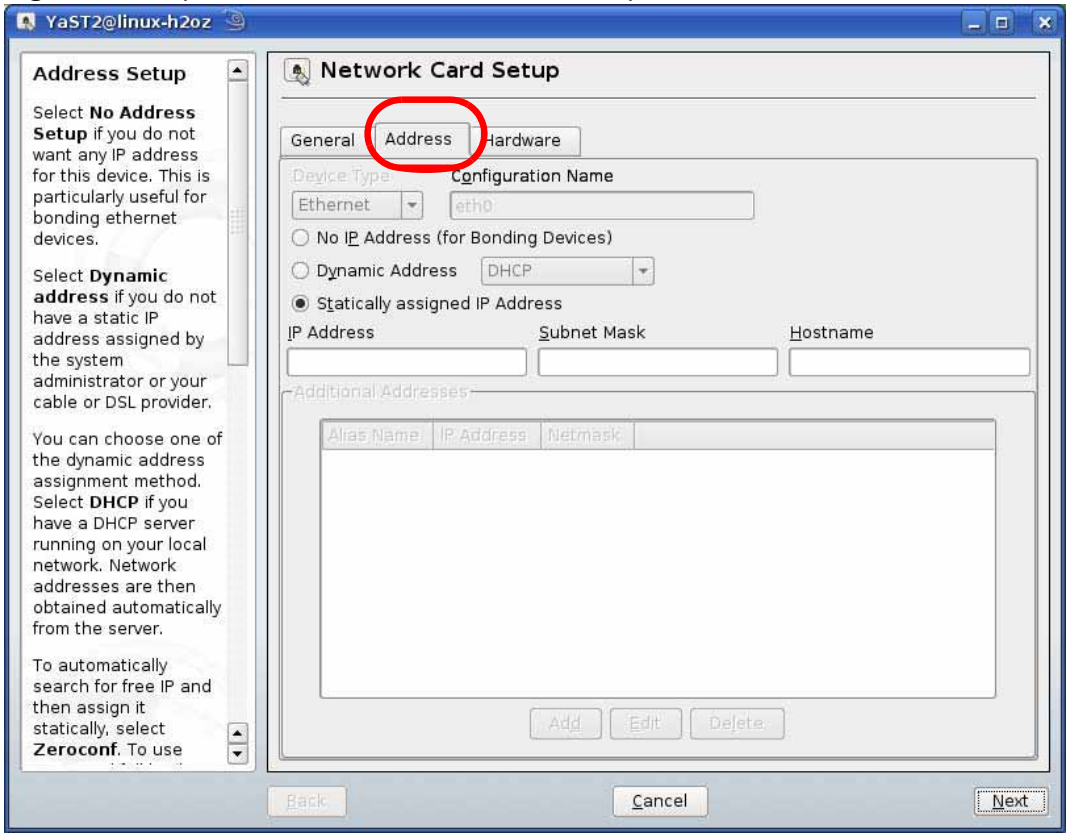


4 When the **Network Settings** window opens, click the **Overview** tab, select the appropriate connection **Name** from the list, and then click the **Configure** button.



5 When the **Network Card Setup** window opens, click the **Address** tab

Figure 115 openSUSE 10.3: Network Card Setup

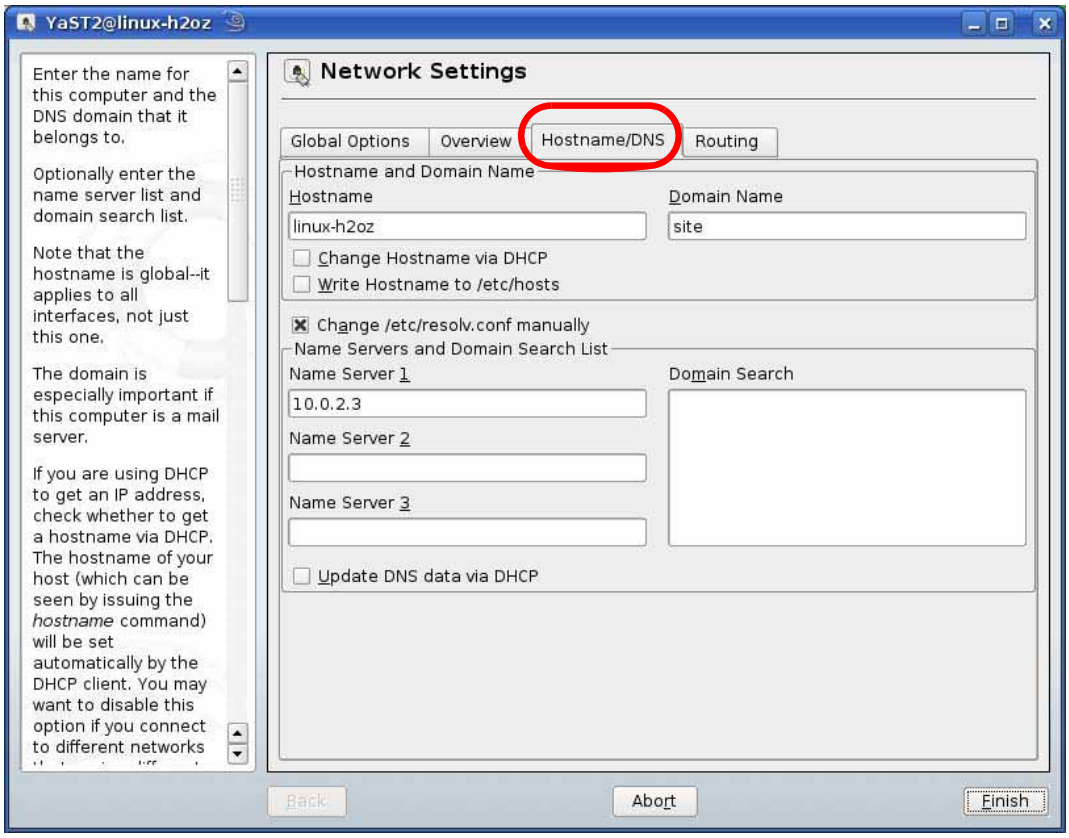


6 Select **Dynamic Address (DHCP)** if you have a dynamic IP address.

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.



9 Click **Finish** to save your settings and close the window.

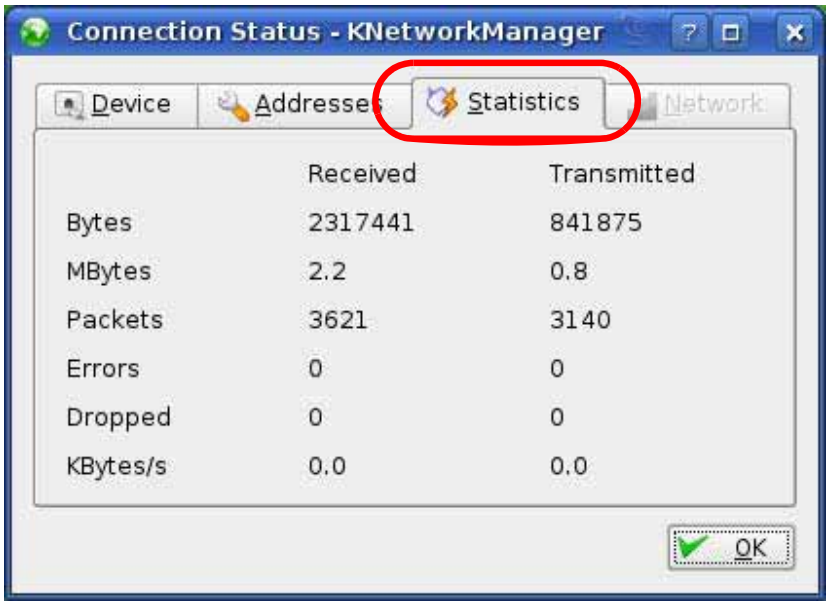
Verifying Settings

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 116 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 117 openSUSE: Connection Status - KNetwork Manager



C

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 118 Peer-to-Peer Communication in an Ad-hoc Network

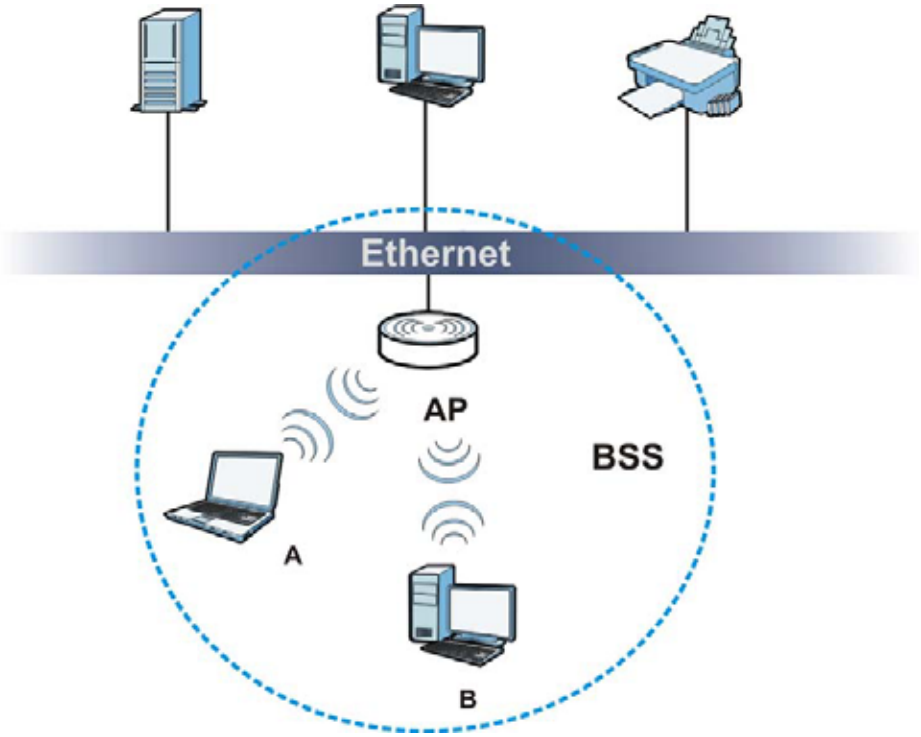
BSS

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 119 Basic Service Set



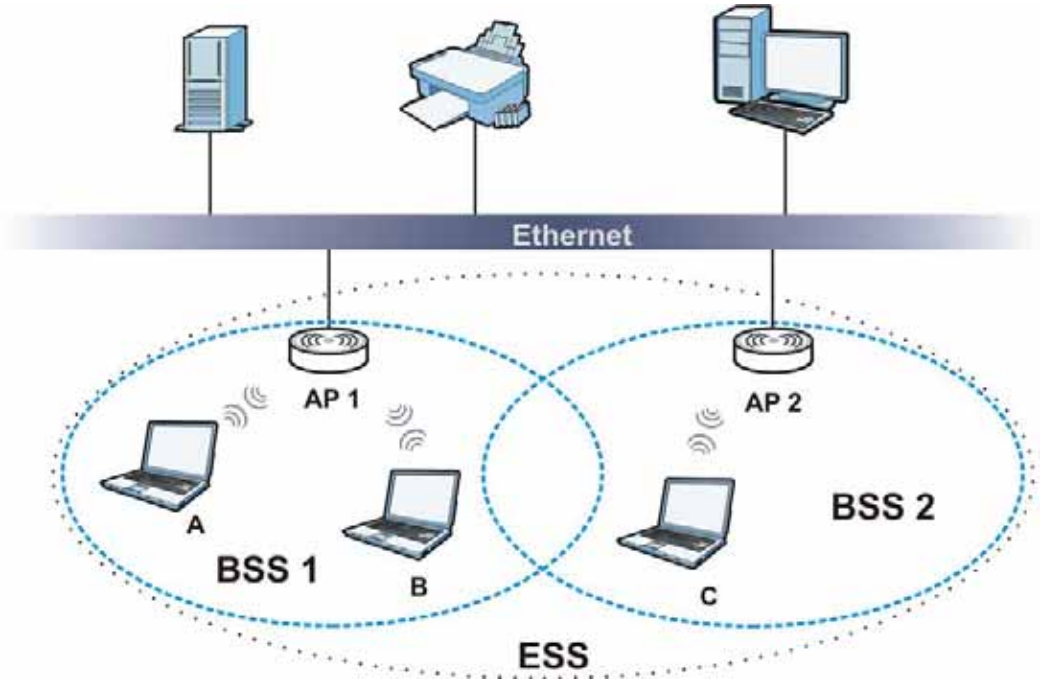
ESS

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 120 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.

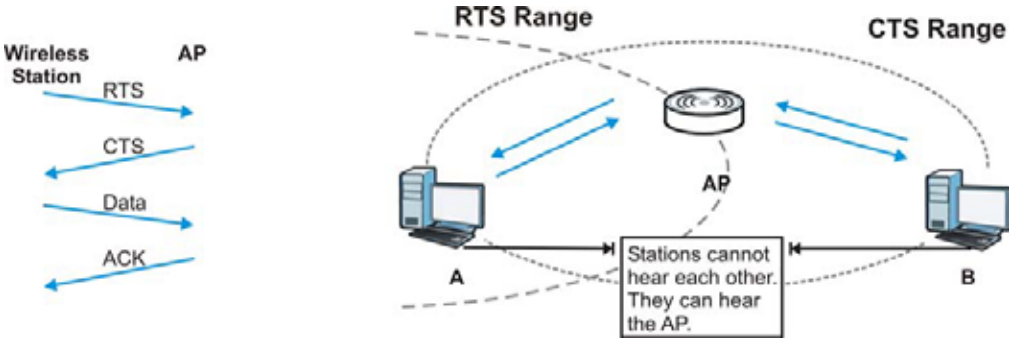
Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel 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 121 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 NVG2053 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 80 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 NVG2053 are data encryption, wireless client authentication, restricting access by device MAC address and hiding the NVG2053 identity.

The following figure shows the relative effectiveness of these wireless security methods available on your NVG2053.

Table 81 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 NVG2053 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 82 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.

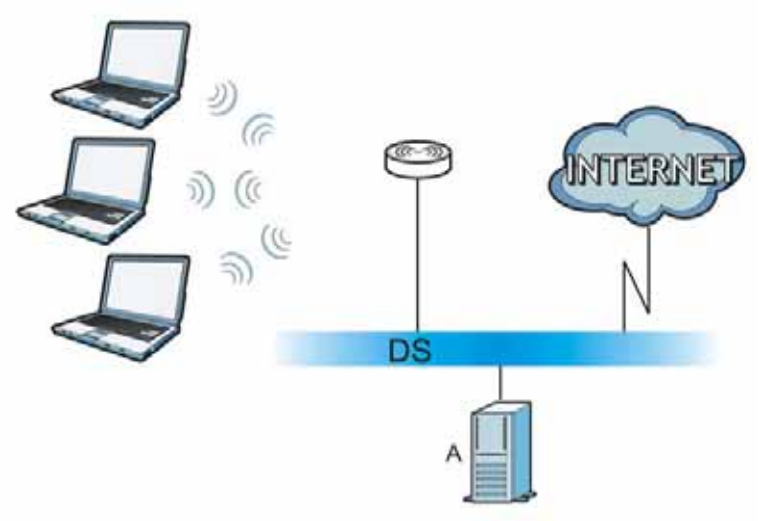
WPA(2) with RADIUS Application Example

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 122 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

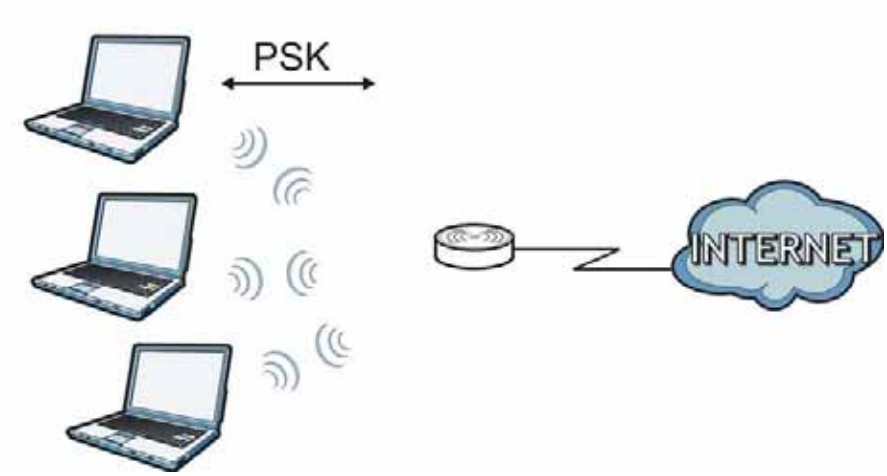
1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).

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 123 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 83 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.

D

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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.

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

Device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems; users should also be cautioned to take note that high-power radars are allocated as primary users (meaning they have priority) of the bands 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage to LE-LAN devices.

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！

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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.

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