

**Wireless Network
Defense**

Module 10



Configuring Security on Wireless Router

A wireless router is a device that performs the functions of a router and also includes the functions of a wireless access point.

ICON KEY

Valuable information

Test your knowledge

Web exercise

Workbook review

Lab Scenario

Organizations are allowing wireless devices to connect to their network in today's environment (BYOD). However, security of the network infrastructure is a major challenge for organizations while adopting wireless devices. A wireless router/access point is the main entry for attackers. Attackers compromise the wireless access points to gain access to the organization's network. Organizations should ensure that their wireless access points are configured securely. As a network administrator, you should be able to configure the wireless router securely by applying all the possible hardening techniques.

Lab Objectives

The objective of this lab is to demonstrate the various hardening techniques on a wireless router.

Lab Environment

To carry out the lab, you need:

- A virtual machine running **Windows Server 2012**
- A web browser with an **Internet** connection
- Administrative privileges to run tools

Lab Duration

Time: 20 Minutes

Overview of Wireless Router Security

A wireless router is the first line of defense against attackers trying to access the organization's network. To keep the attackers away from compromising the security of wireless routers, we need to make appropriate configuration changes in order to make a router more secure

Lab Tasks

TASK 1

Configuring Linksys Router

Wireless Network routers should be secured in order to prevent access from outsiders.

1. Launch Windows Server 2012 machine
2. Browse **Linksys Wireless router** set up simulator available at <http://ui.linksys.com/WRT54G/v8/8.00.0/> in your browser

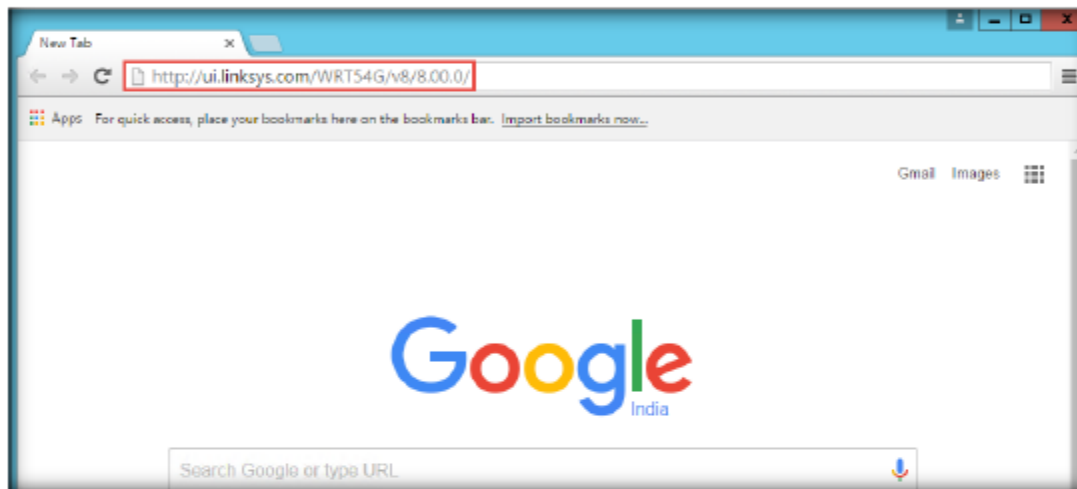


FIGURE 1.1: Browse Linksys Wireless Router

Note: Enter your router's local IP address then press [Enter] to actually open the Linksys wireless router interface

3. A Linksys router interface **window** will be displayed in the browser.

How a router functions depends on the way it is configured.

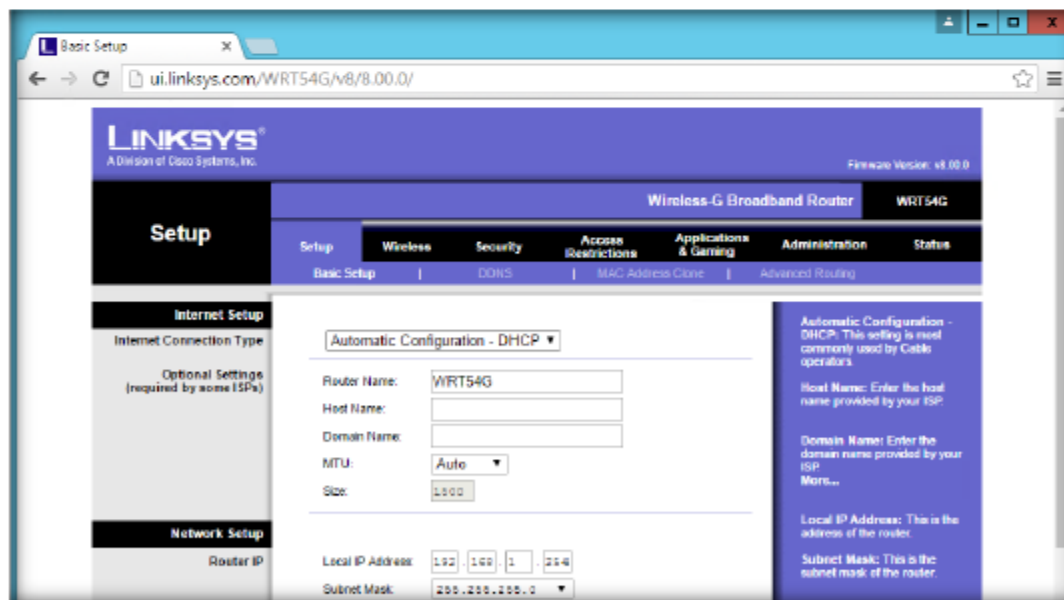



FIGURE 1.2 Linksys Wireless Router Main Window

4. Click on **Setup** tab → **Basic Setup**

 Basic Setup explains how a router connects to the service providers. Features differ according to the type of internet connection that you choose.

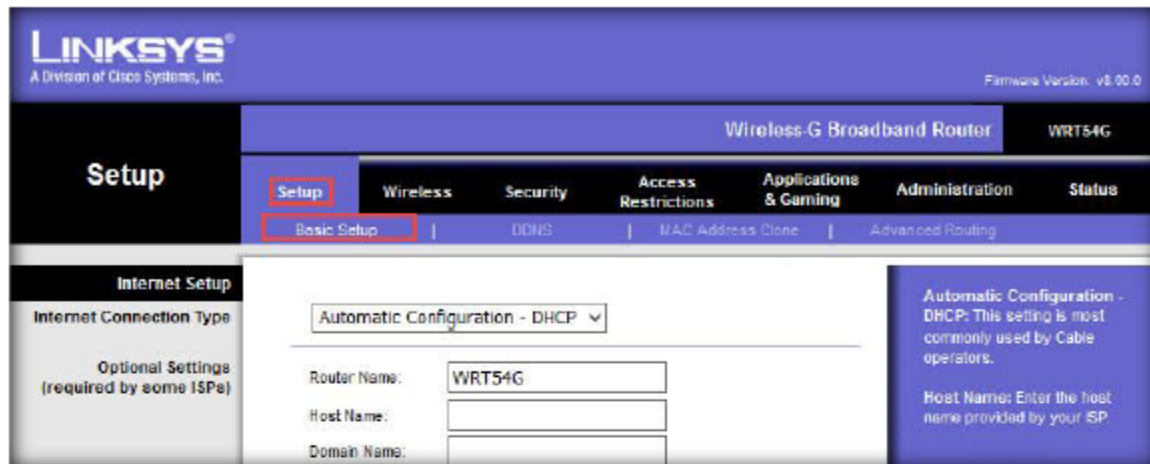




FIGURE 1.3 Linksys Wireless Router Basic Setup

5. Choose the required **Internet Connection Type** from the drop-down

 Specifying router, domain and host names are mandatory for some ISP's

 Specify a different name for the router as it will be easier to identify your router later.

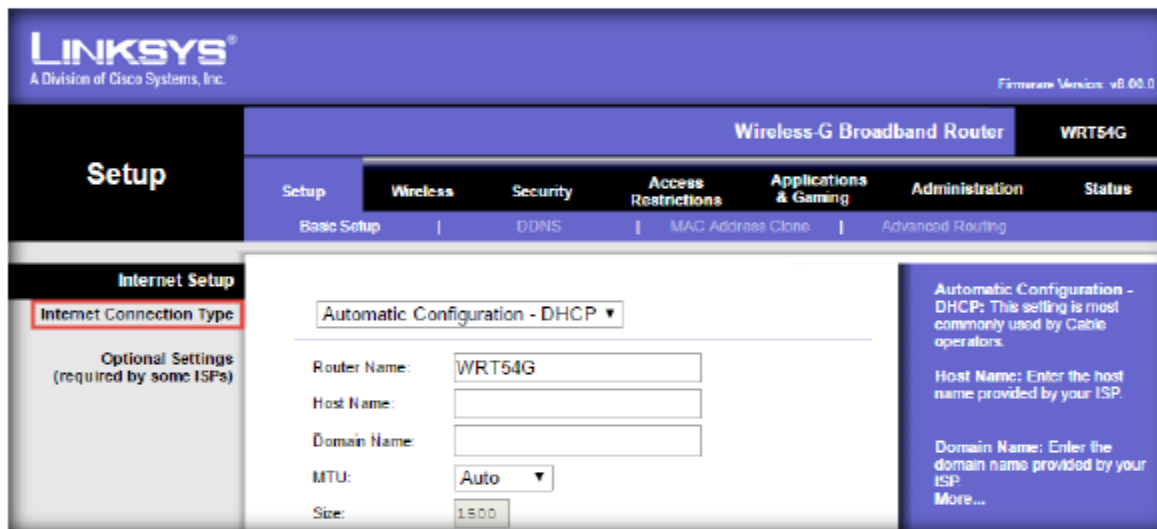



FIGURE 1.4 Linksys Wireless Router Internet Connection Type

6. Specify the **Router name**, **Host name** and **Domain name** in the optional settings

 MTU – Maximum Transmission Unit. This specifies the maximum permitted packet size for internet transmission.

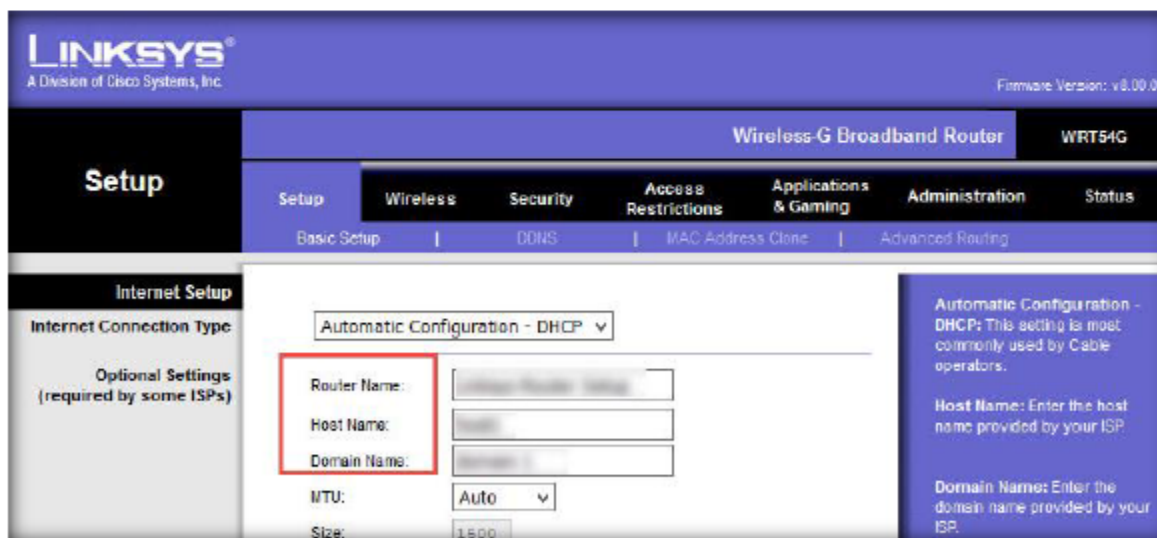


FIGURE 1.5 Optional Settings

7. Select **Auto** option from the drop-down for **MTU**

MTU may be specified manually. Default value is 1400. Any value within 1200 – 1500 may be specified.

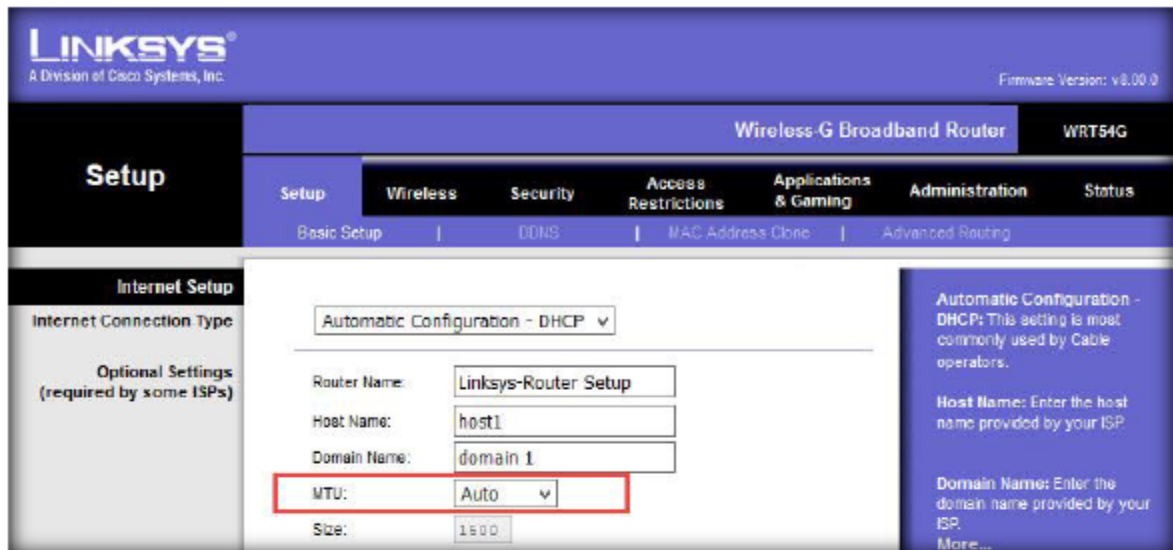


FIGURE 1.6 MTU

8. Provide the **Local IP Address** and **Subnet Mask** in the Router IP fields

IP Address refers to the router address. Default value for IP address is 192.168.1.1 and default value for subnet mask is 255.255.255.0

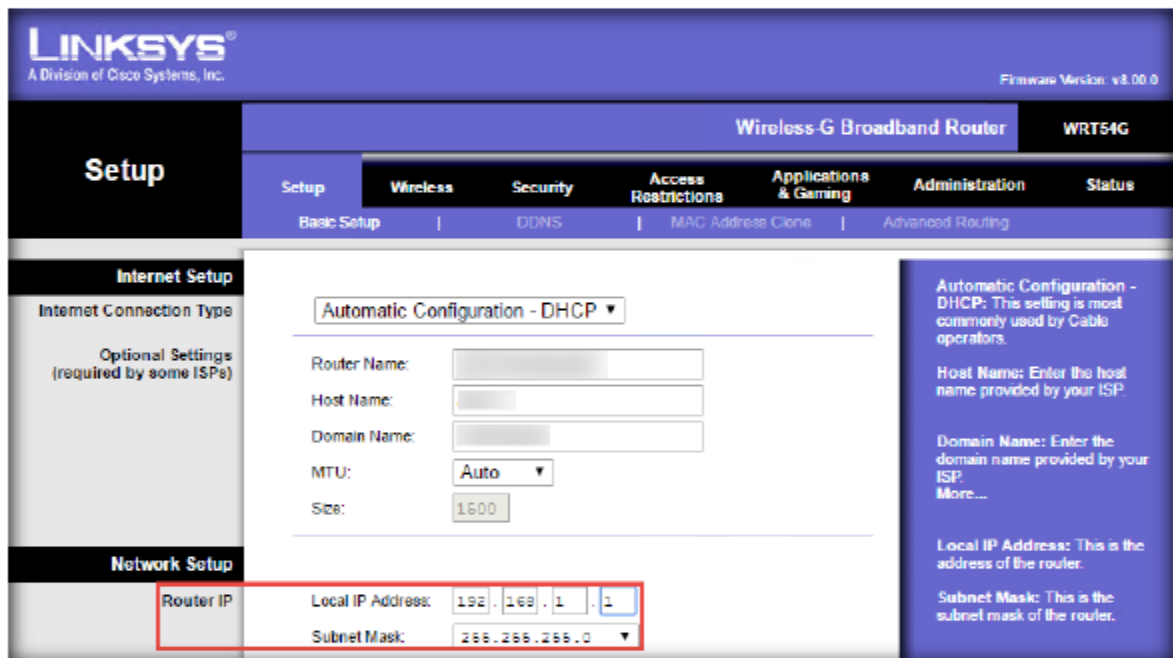


FIGURE 1.7 Network Setup

9. Choose **DHCP → Enable**

The enable option is selected in order to enable the router's DHCP server

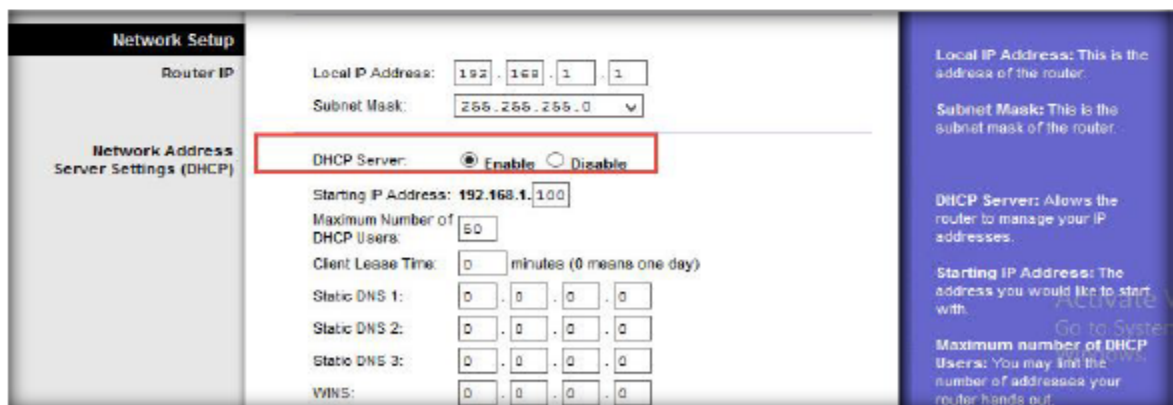


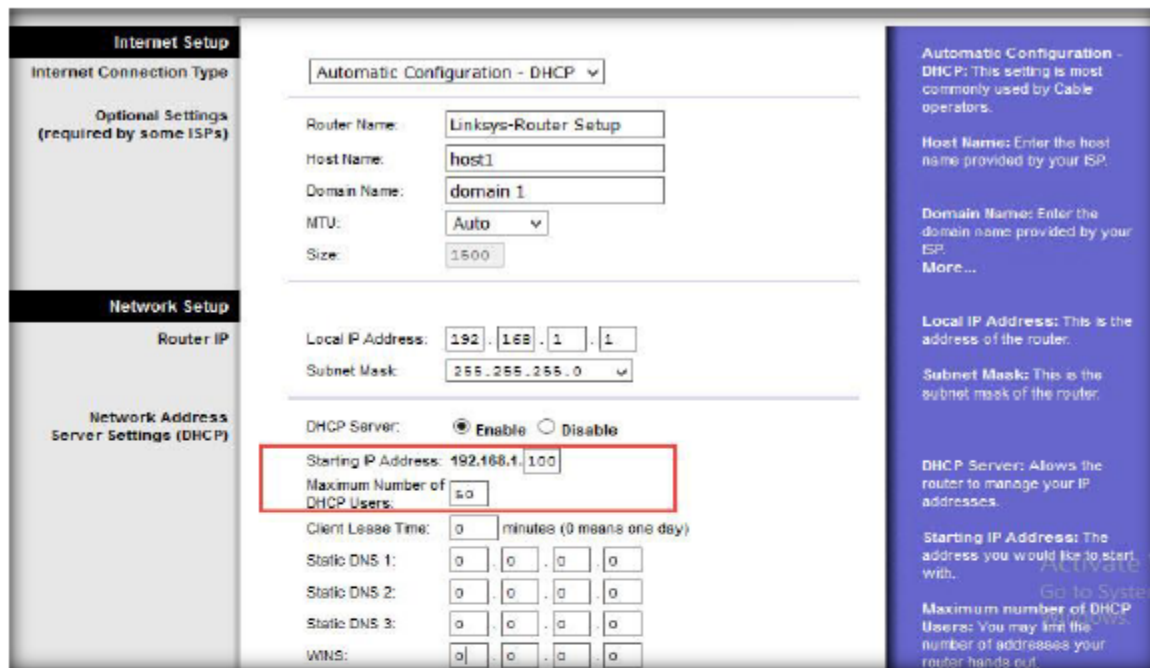


FIGURE 1.8 Network Address Servers

10. Specify the **Starting IP address** and specify the **Maximum Number of DHCP users**

 The number of DHCP users should be specified such that DHCP can assign that many IP addresses. Maximum number of DHCP users or PC's that can be connected to DHCP is 253.

 An IP address is specified in order for the DHCP to connect while issuing IP addresses. Please note that the IP address should not start with 192.168.1.1, the IP address of the router




The screenshot shows the DHCP configuration interface. On the left, there are tabs for 'Internet Setup' and 'Network Setup'. Under 'Network Setup', there is a sub-tab for 'Network Address Server Settings (DHCP)'. The main area contains various settings:

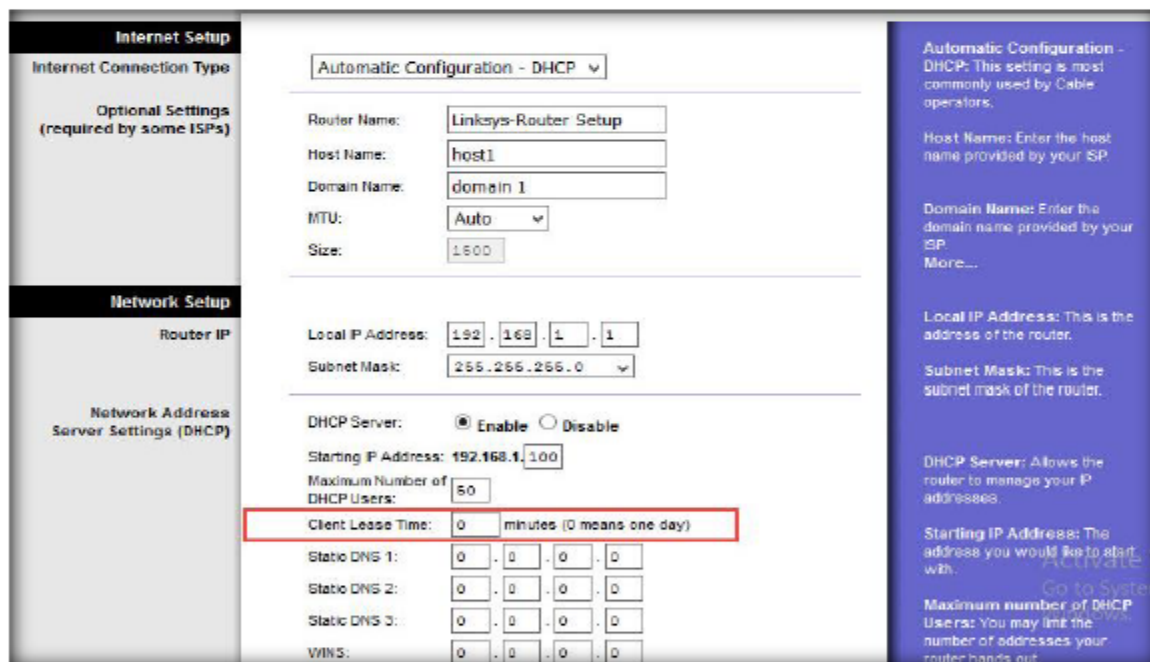
- Internet Connection Type: Automatic Configuration - DHCP
- Router Name: Linksys-Router Setup
- Host Name: host1
- Domain Name: domain1
- MTU: Auto
- Size: 1500
- Local IP Address: 192.168.1.1
- Subnet Mask: 255.255.255.0
- DHCP Server: Enable Disable
- Starting IP Address: 192.168.1.100 (highlighted in a red box)
- Maximum Number of DHCP Users: 50 (highlighted in a red box)
- Client Lease Time: 0 minutes (0 means one day)
- Static DNS 1, 2, 3: 0.0.0.0
- WINS: 0.0.0.0

 On the right side, there is a blue sidebar with explanatory text for each setting.

FIGURE 1.9 DHCP Settings

11. Provide the **Client Lease Time** in minutes.


 The Client Lease Time refers to the amount of time a network user is connected with the DHCP server using the dynamic IP address. The time is provided in minutes.

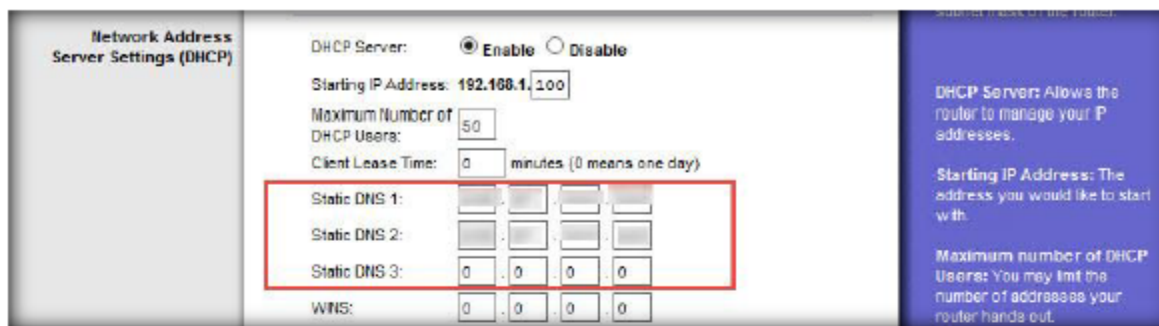


This screenshot is identical to Figure 1.9, showing the DHCP configuration page. In this instance, a red box highlights the 'Client Lease Time' field, which is set to 0 minutes (0 means one day). All other settings remain the same as in the previous figure.

FIGURE 1.10 Client Lease Time

12. Specify any **three DNS server IP addresses** in the **Static DNS (1-3)** fields

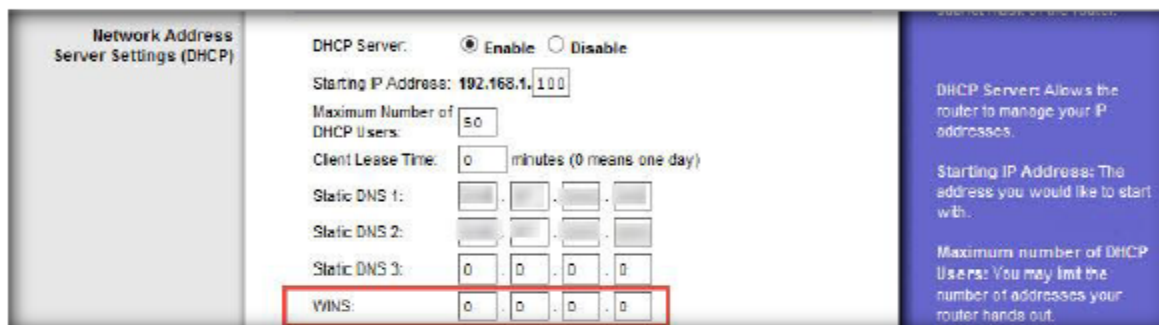
 The Domain Name System helps in translating the domain names to internet addresses or URL's. Routers will quickly access the DNS server using the provided IP addresses



The screenshot shows the 'Network Address Server Settings (DHCP)' configuration page. The 'DHCP Server' is set to 'Enable'. The 'Starting IP Address' is 192.168.1.100. The 'Maximum Number of DHCP Users' is 50. The 'Client Lease Time' is 0 minutes. The 'Static DNS 1', 'Static DNS 2', and 'Static DNS 3' fields are highlighted with a red box. The 'WINS' field is set to 0.0.0.0. A blue sidebar on the right contains explanatory text for each field.

FIGURE 1.11 DNS Server IP Addresses


13. Enter the **WINS** server IP address if you use a WINS server

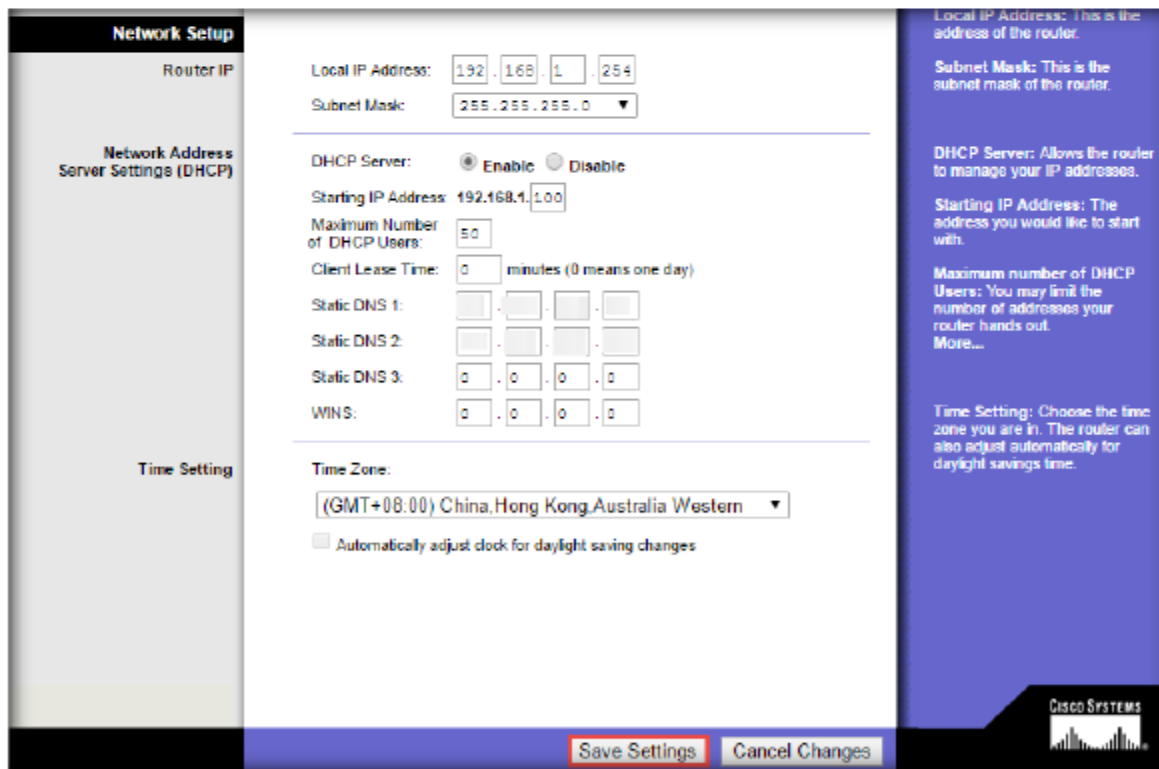


The screenshot shows the 'Network Address Server Settings (DHCP)' configuration page. The 'DHCP Server' is set to 'Enable'. The 'Starting IP Address' is 192.168.1.100. The 'Maximum Number of DHCP Users' is 50. The 'Client Lease Time' is 0 minutes. The 'Static DNS 1', 'Static DNS 2', and 'Static DNS 3' fields are empty. The 'WINS' field is highlighted with a red box and set to 0.0.0.0. A blue sidebar on the right contains explanatory text for each field.

FIGURE 1.12 WINS

14. Click the **Save Settings** button in order to save all the changes


 WINS – Windows Internet Naming Service. This manages the PC's interaction with the internet. Specify the IP address of the WINS server if using. Else, leave the field blank.



The screenshot shows the 'Network Setup' configuration page. The 'Router IP' section shows 'Local IP Address' as 192.168.1.254 and 'Subnet Mask' as 255.255.255.0. The 'Network Address Server Settings (DHCP)' section is expanded, showing 'DHCP Server' set to 'Enable', 'Starting IP Address' as 192.168.1.100, 'Maximum Number of DHCP Users' as 50, and 'Client Lease Time' as 0 minutes. The 'Static DNS 1', 'Static DNS 2', and 'Static DNS 3' fields are empty. The 'WINS' field is set to 0.0.0.0. The 'Time Setting' section shows 'Time Zone' set to '(GMT+08:00) China, Hong Kong, Australia Western' and 'Automatically adjust clock for daylight saving changes' checked. A blue sidebar on the right contains explanatory text for each field. At the bottom, the 'Save Settings' button is highlighted with a red box, and the 'Cancel Changes' button is also visible.

FIGURE 1.13 save Settings

15. A prompt saying **Settings are Successful** is displayed, click **Continue**

 DDNS helps in accessing domain names instead of IP addresses.

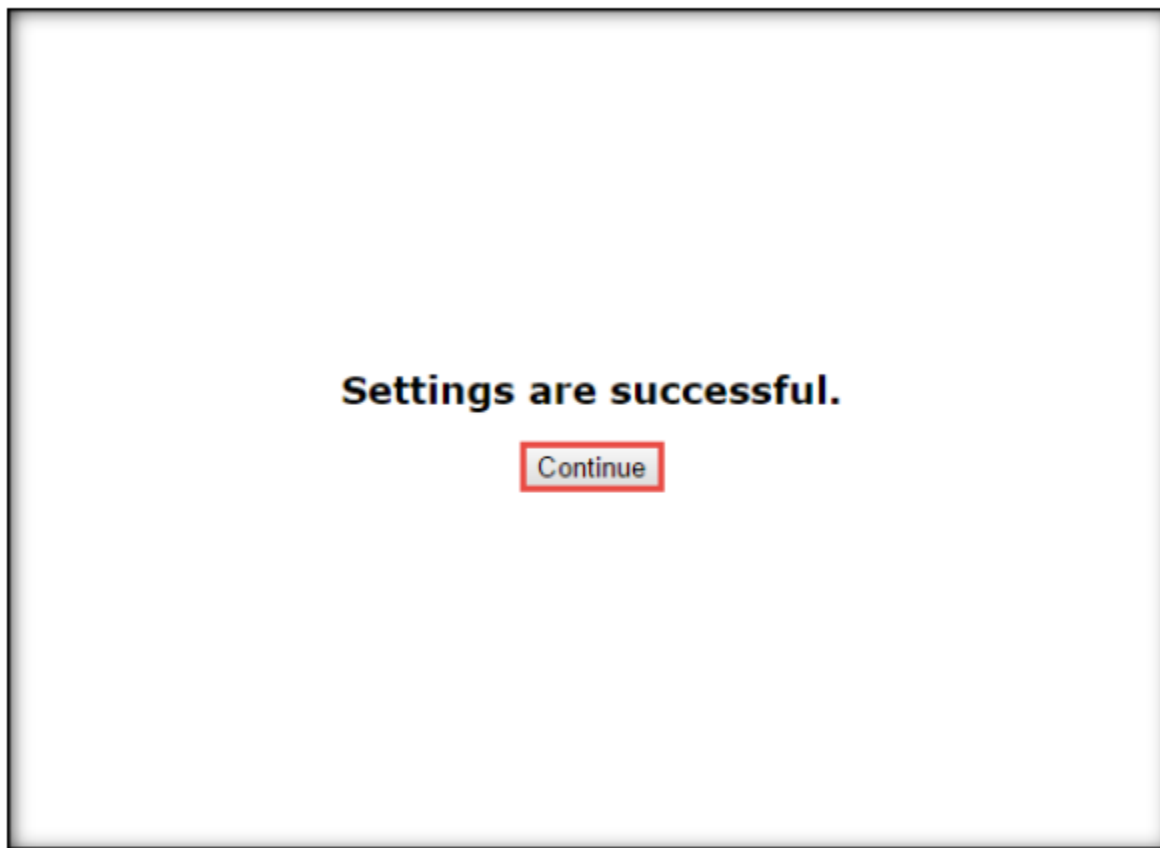



FIGURE 1.14 Settings are Successful

16. Next, click on the **DDNS** tab present near to **Basic Setup**

 Routers may be configured by updating the DNS settings using DynDNS.org or TZO.org

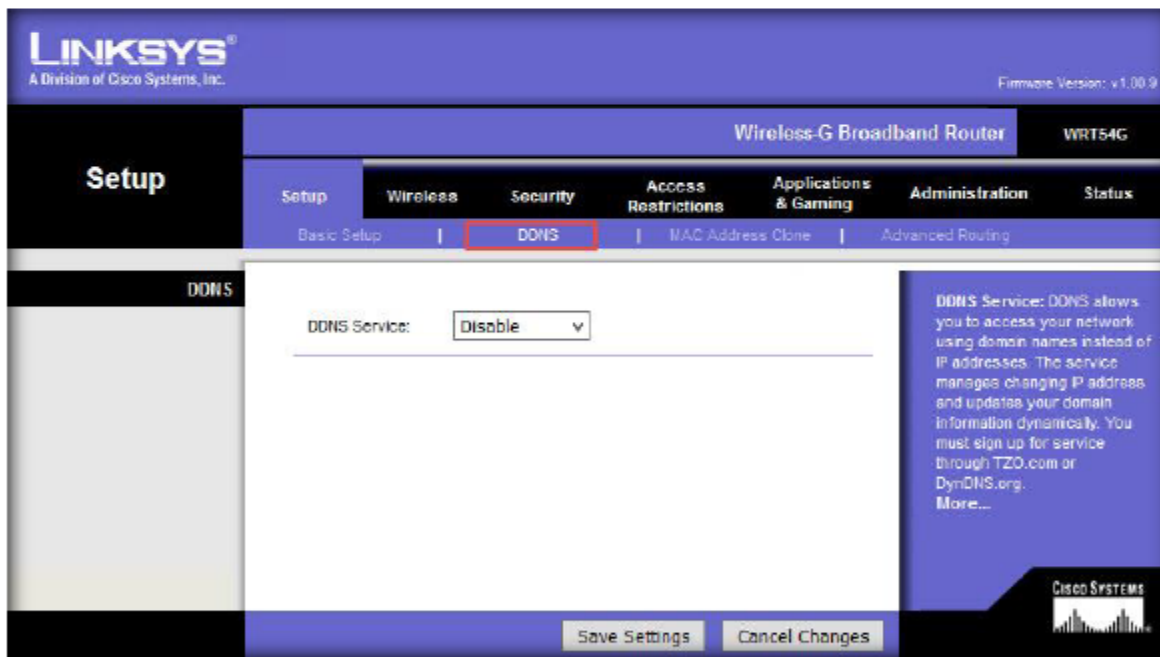


FIGURE 1.15 DDNS

17. Select the **DDNS Service** → **Disable** from the drop-down

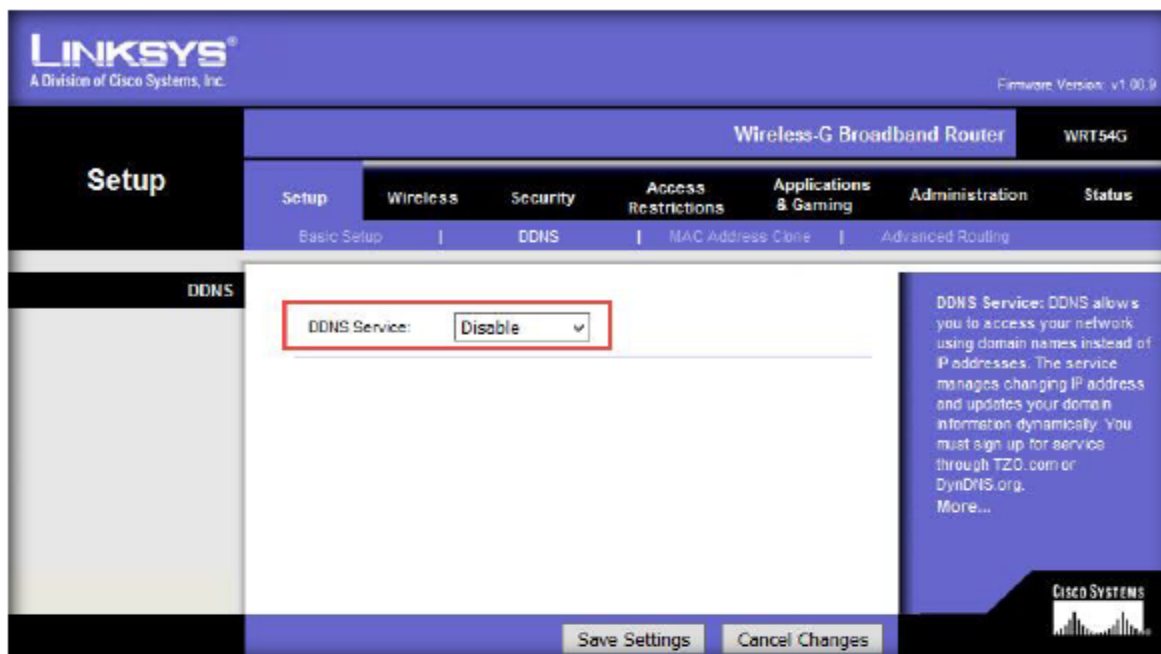


FIGURE 1.16 Disable DDNS

18. Click on the **Save Settings** button.

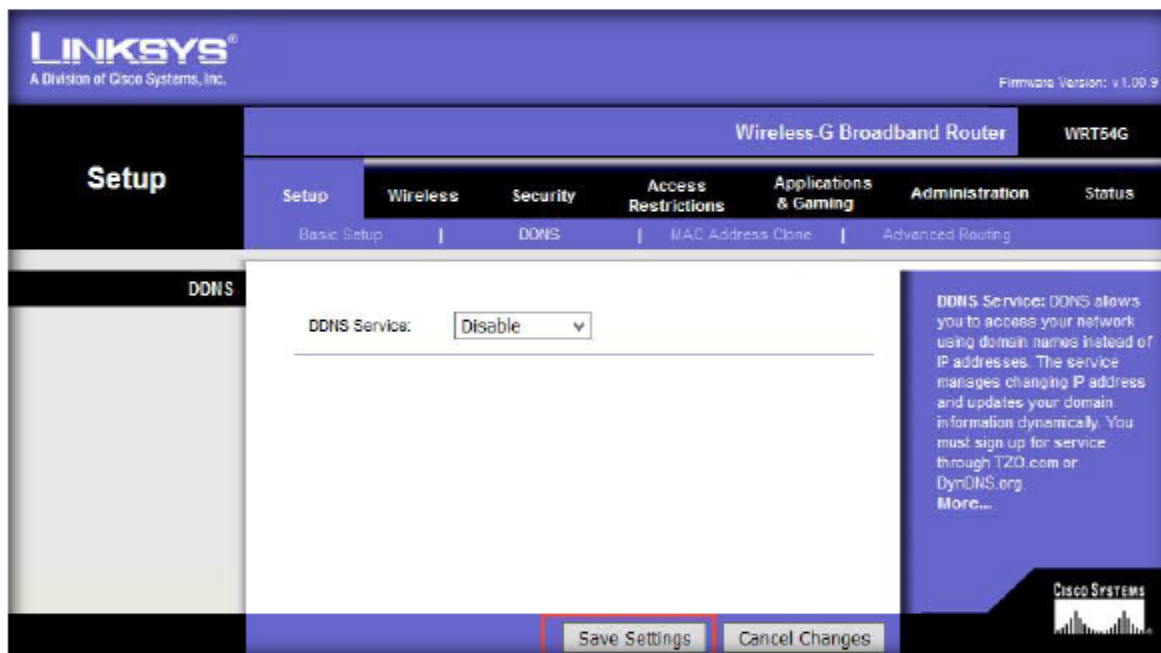


FIGURE 1.17 save Settings

19. A prompt **Settings are Successful** is displayed

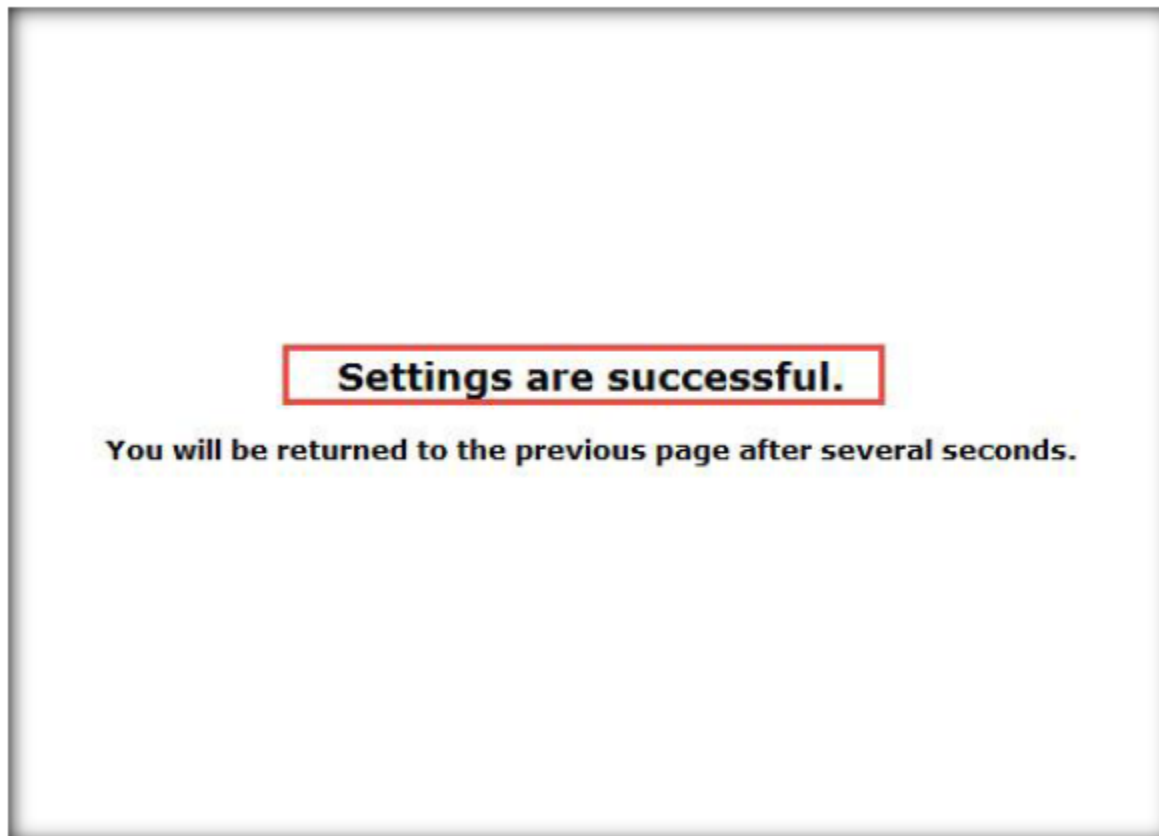



FIGURE 1.18 Settings are Successful

20. Now, click **MAC Address Clone**

 MAC Address clone helps you in adding any specific IP address.

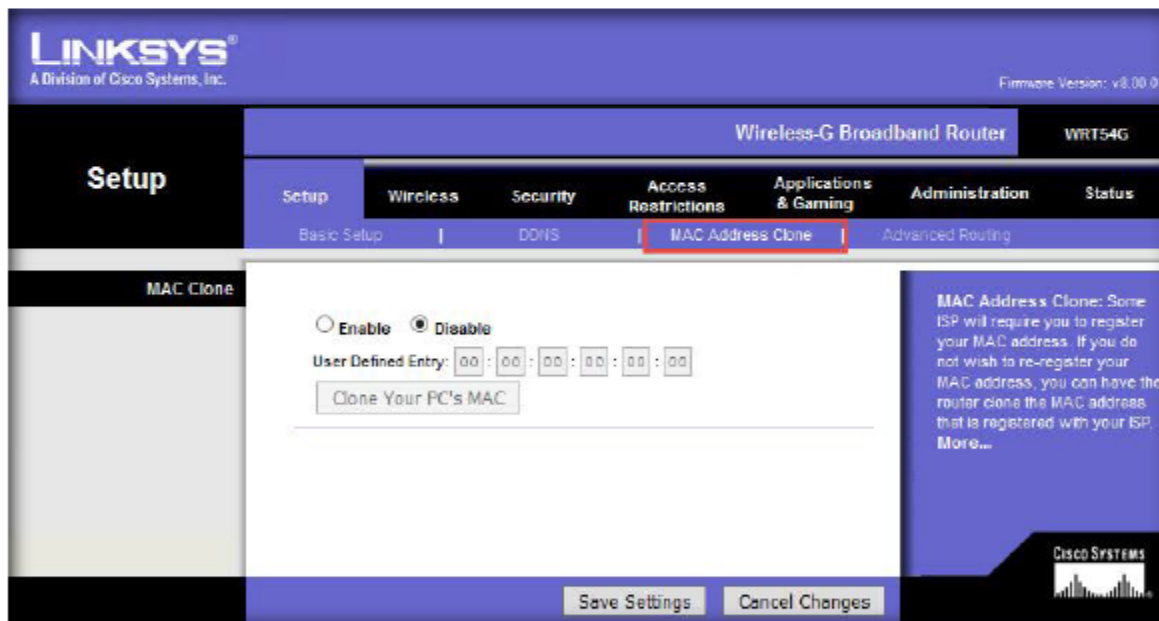



FIGURE 1.19 MAC Address Clone

21. Choose **Disable** → **Mac Clone**

 Operational Mode has two options: Gateway and Router.


Gateway is selected when the router hosts the network connection to the internet.

Router is selected if the router exists with other routers in the network



FIGURE 1.20 Disable MAC Clone

22. Now, click **Advanced Routing**

 Router operational mode provides another option Dynamic Routing.

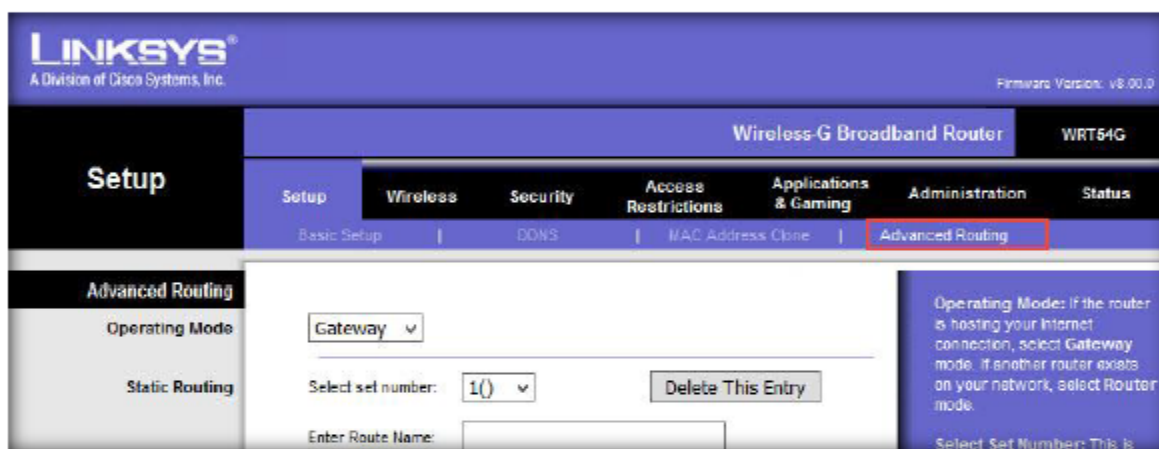



FIGURE 1.21 Advanced Routing

23. Select the **Operating Mode** from the drop-down

 Dynamic Routing uses RIP protocol. RIP: Router Information Protocol, which provides the maximum number of efficient paths available between the source and the destination.

RIP has four options: Disable

- WAN
- LAN and Wireless
- Both

WAN is selected in order to enable dynamic routing.

LAN is enabled for LAN and Wireless side

If dynamic routing is required for LAN and WAN, select both.

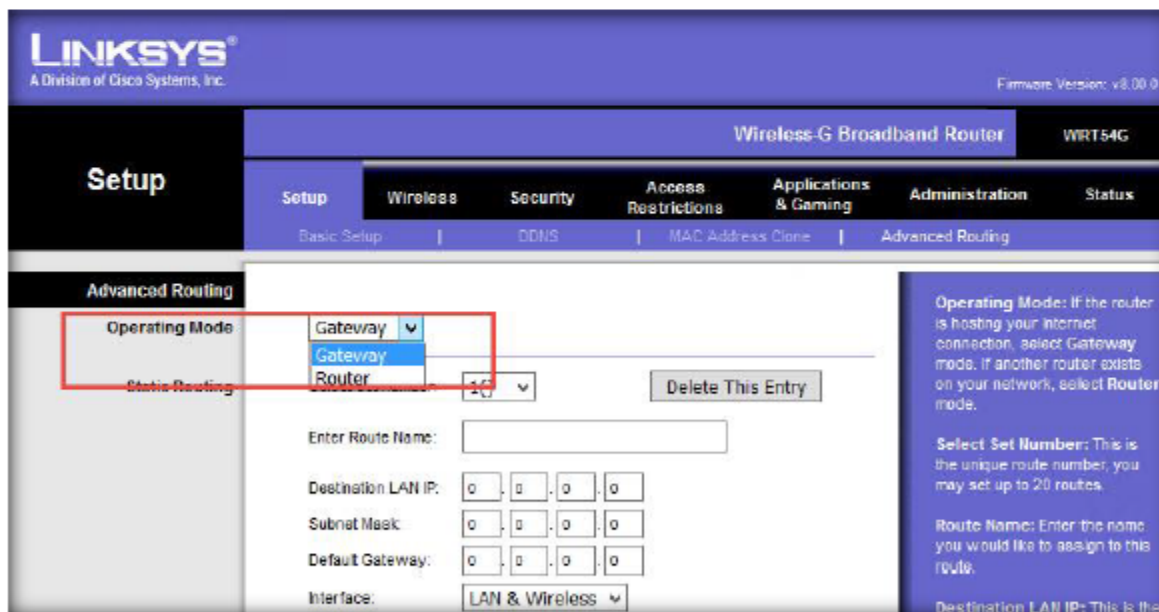



FIGURE 1.22 Operating Mode

24. Select a number from the **static routing** drop-down list

 The Static number denotes the number of pathways taken in order to reach the network information to a particular host.

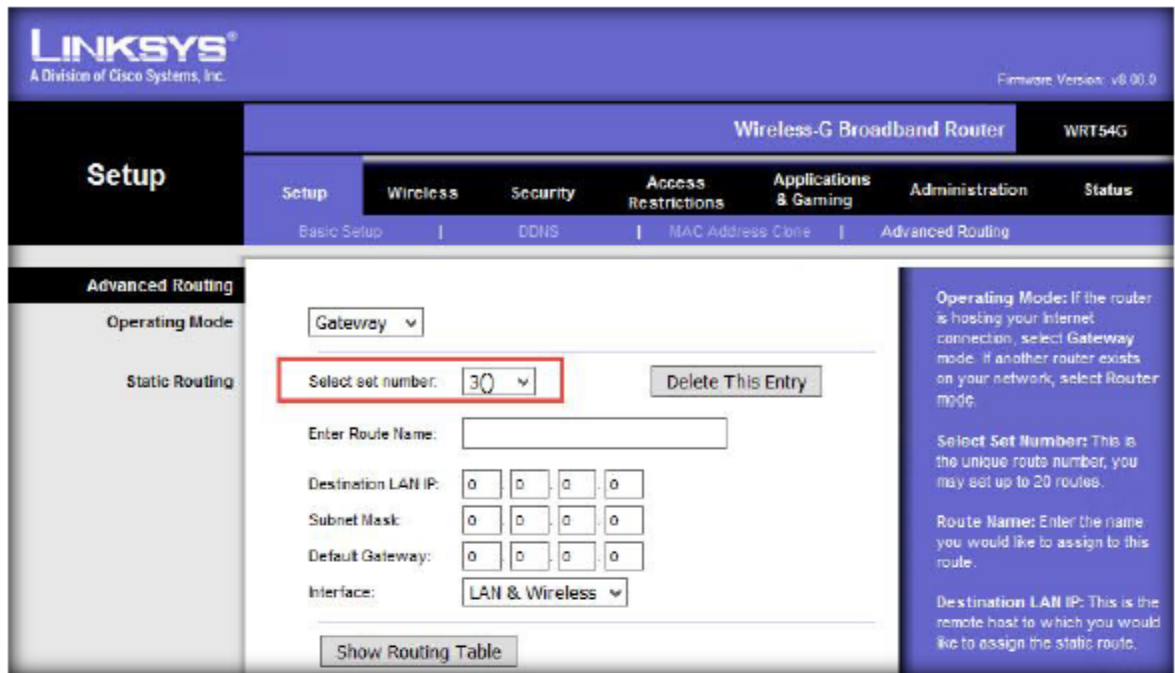





FIGURE 1.23 Static Routing

25. Next, enter the following details:

- **Router Name**
- **Destination LAN IP**
- **Subnet Mask**
- **Gateway**

 The Destination IP Address: IP address of the host or the network to which the static route is connected

 The Subnet Mask: Determines the network portion and host portion of the IP Address

 The Gateway: Allows the connection between the router and the host

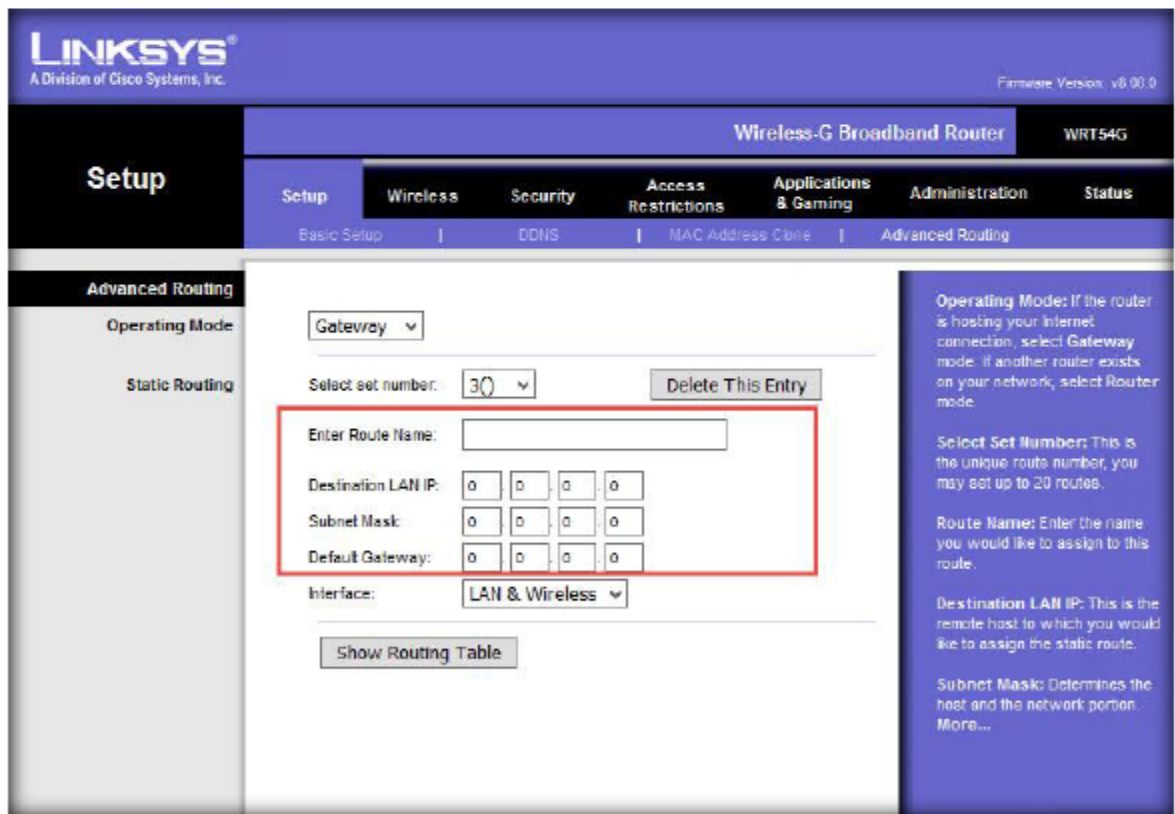




FIGURE 1.24 Static Routing

26. Now, Select an **Interface** from the drop-down

 The Interface defines whether the network is on the LAN or the internet

 Selection of LAN & Wireless and Internet for interface drop-down depends on the location of the IP address. If it is connected to a LAN, select LAN or else internet.

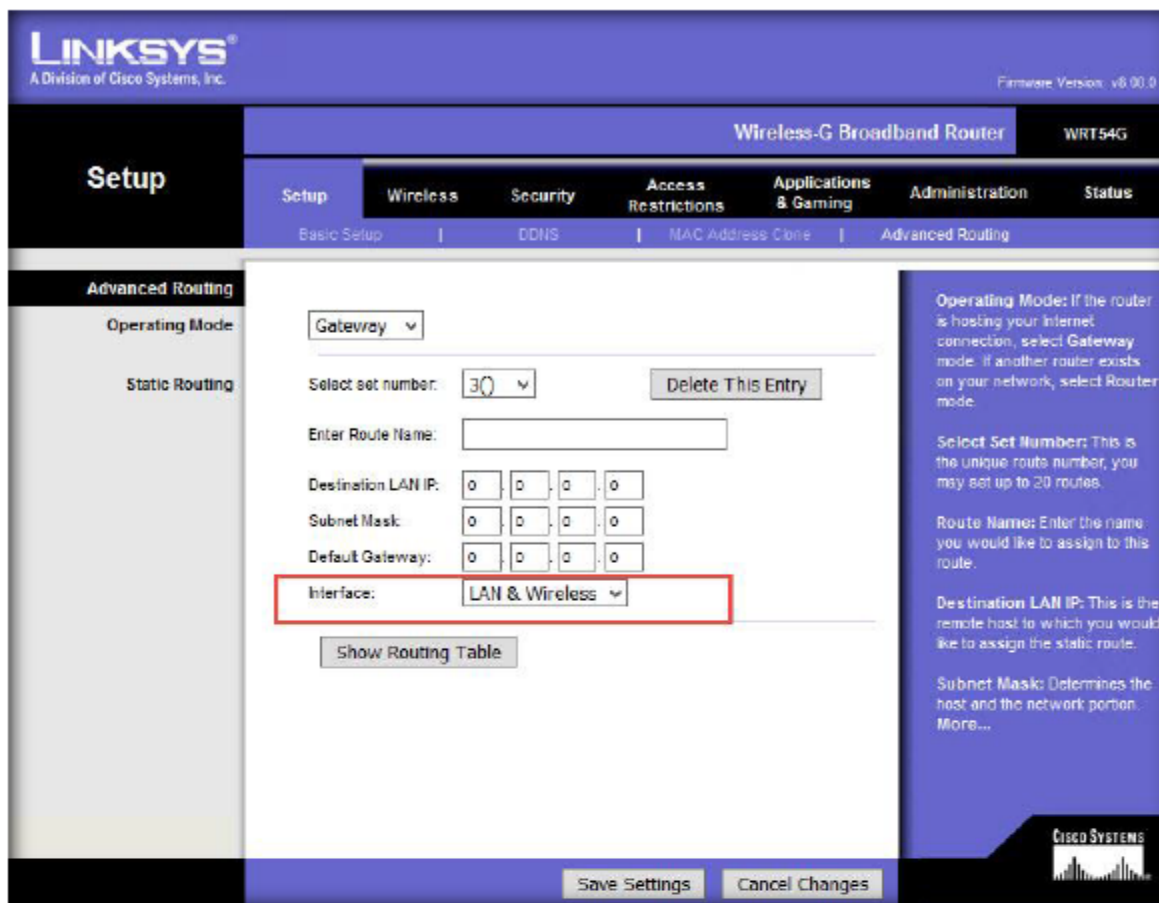




FIGURE 1.25 Interface

27. Click **Save Settings**

 Delete This Entry deletes the entered IP address

 Show Routing Table provides the current routing table

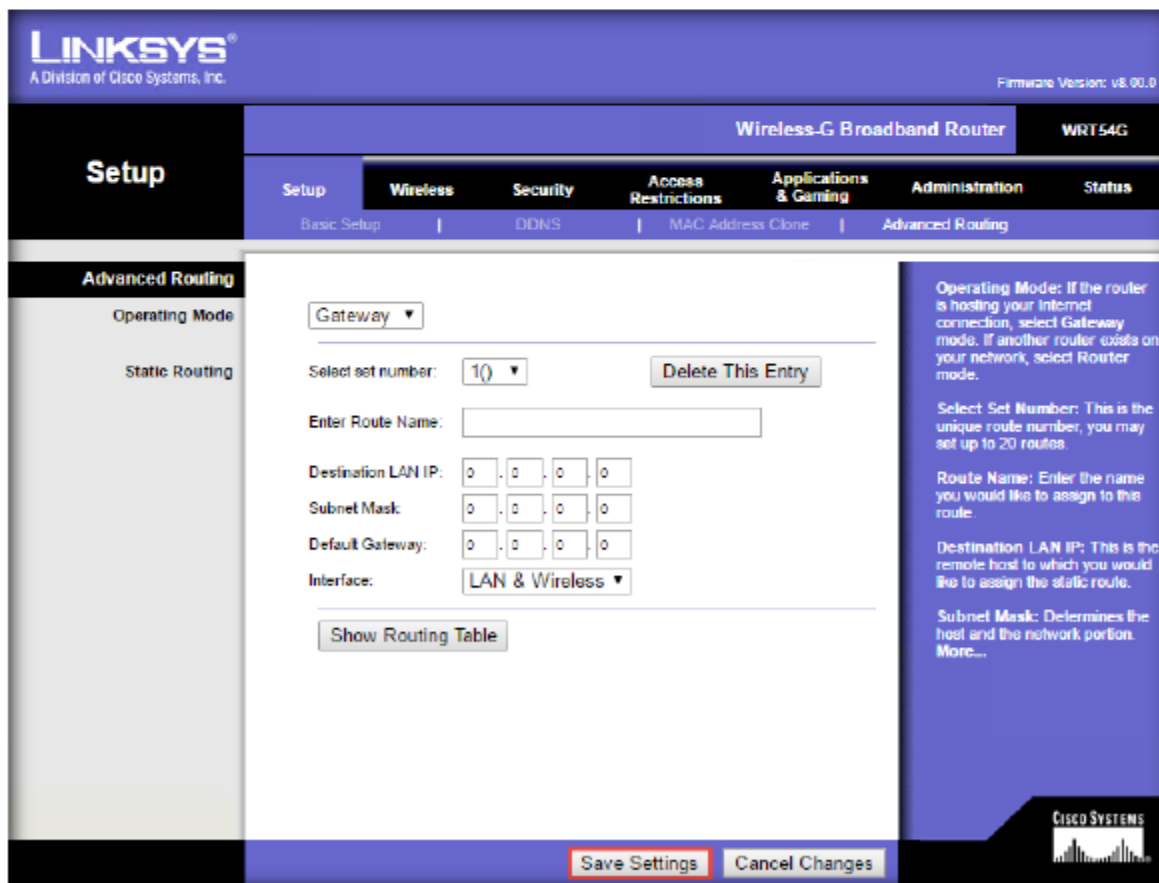


FIGURE 1.26 save Settings

28. A prompt saying **Settings are Successful** pops up. Click **Continue**

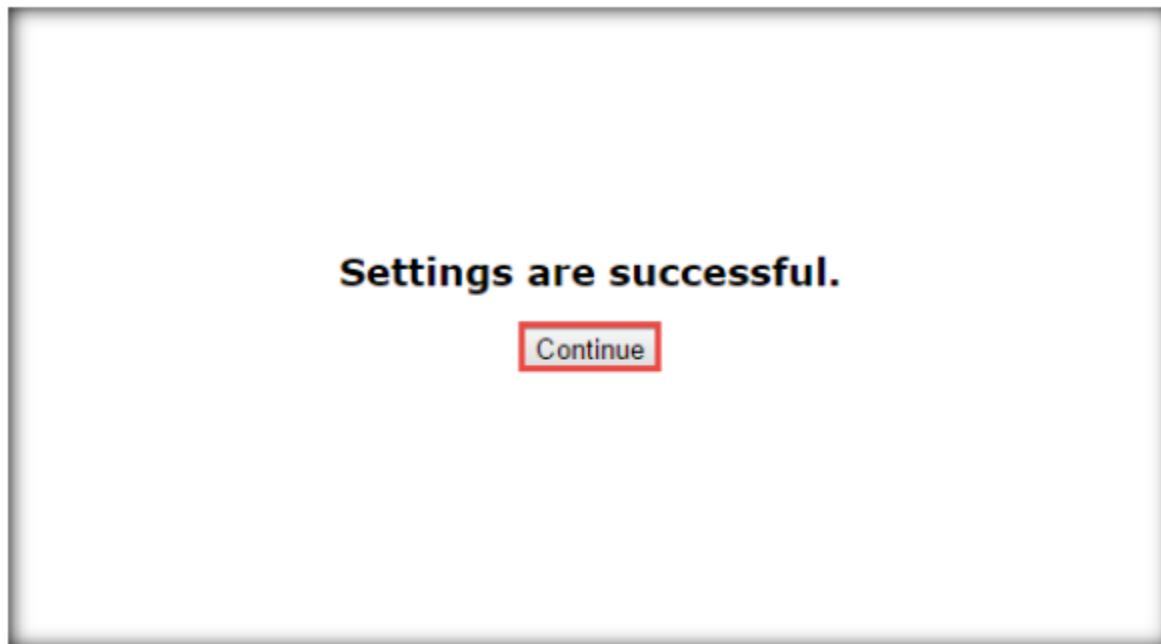


FIGURE 1.27 Settings are Successful

29. Click on the **Wireless** tab in the menu bar

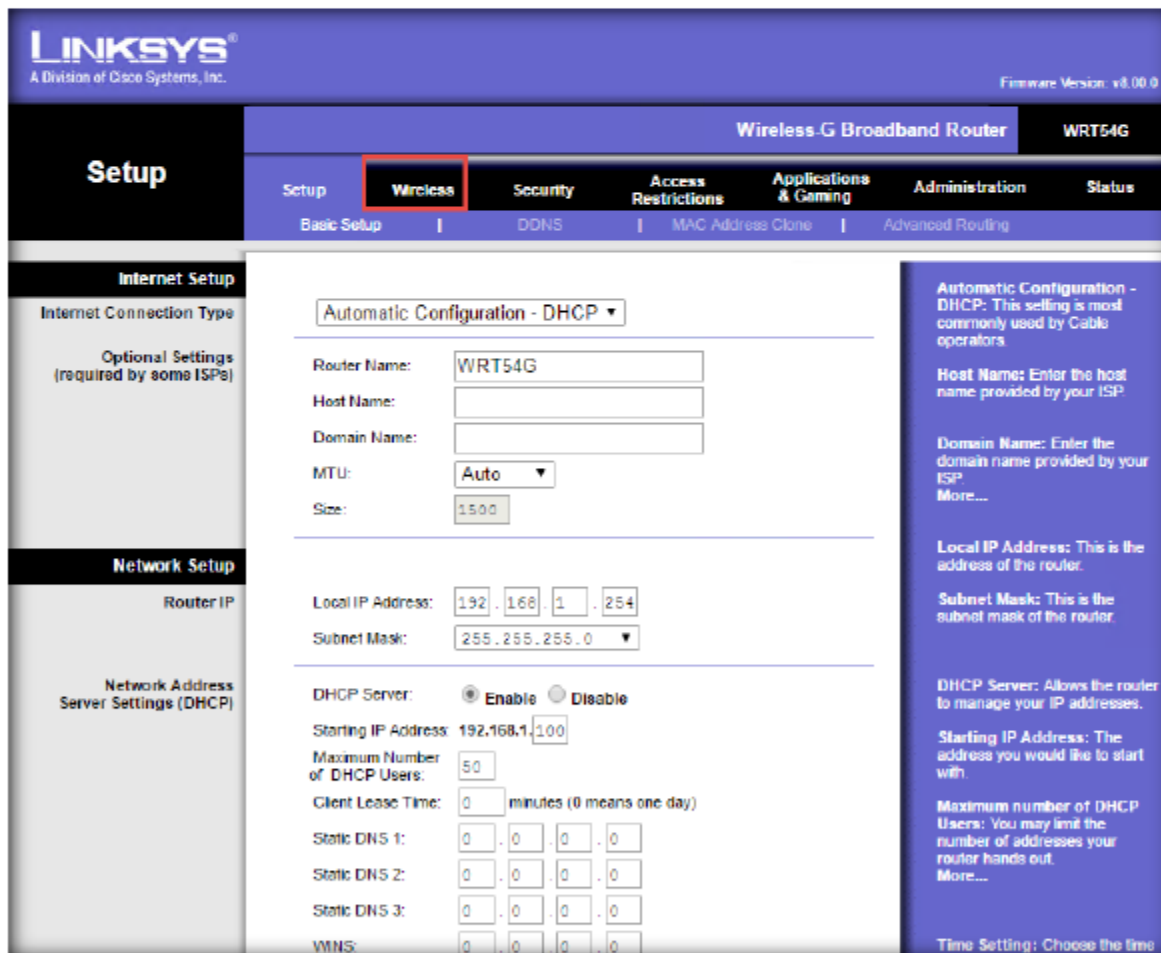


FIGURE 1.28 Wireless tab

30. Click the “Basic Wireless Settings” tab

There are four modes for Wireless Network Mode:

- Disabled: No wireless operation possible
- Mixed: Allows 802.11B and 802.11G wireless equipment
- B - Only: Allow only 802.11B wireless equipment
- G - Only: Allow only 802.11G wireless equipment

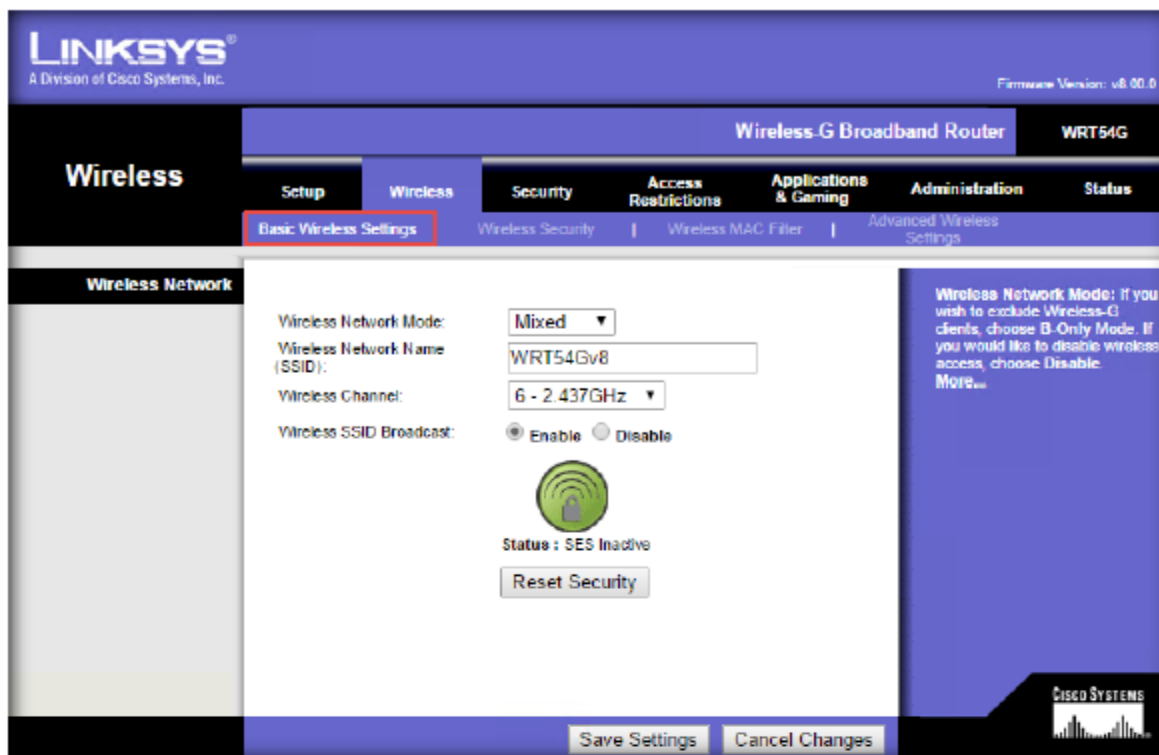


FIGURE 1.29 Basic Wireless Settings

31. Choose the radio button for the option **Wireless SSID Broadcast** → **Disable**

Wireless Network Name (SSID) represents the name of the wireless router

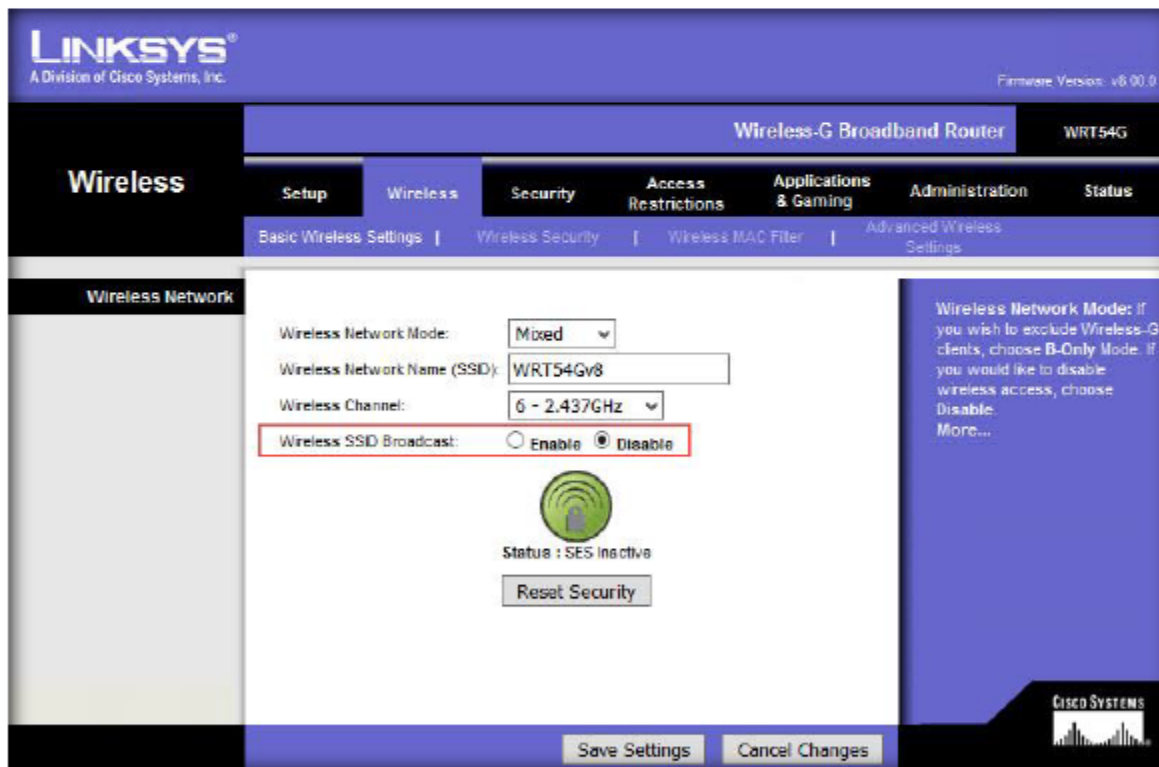


FIGURE 1.30 Disabling Wireless SSID Broadcast

32. Click on the **Wireless Security** tab next to the **Basic Wireless Settings** tab

Disabling the SSID broadcast makes it impossible for other people to recognize your network while searching for a wireless network



FIGURE 1.31 Wireless Security

33. Select appropriate strongest **encryption mode**

Note: Here, use of WPA2 is considered the strongest encryption mode for wireless security from the Security Mode drop-down

WPA Personal: Commonly used in personal or home networks

WPA Enterprise: Used for wireless networks in business environments. More complicated and provides personal and centralized control over the Wi-Fi connection

WPA2 Personal: Commonly used for home and small business units

WPA2 is more secure than WEP.

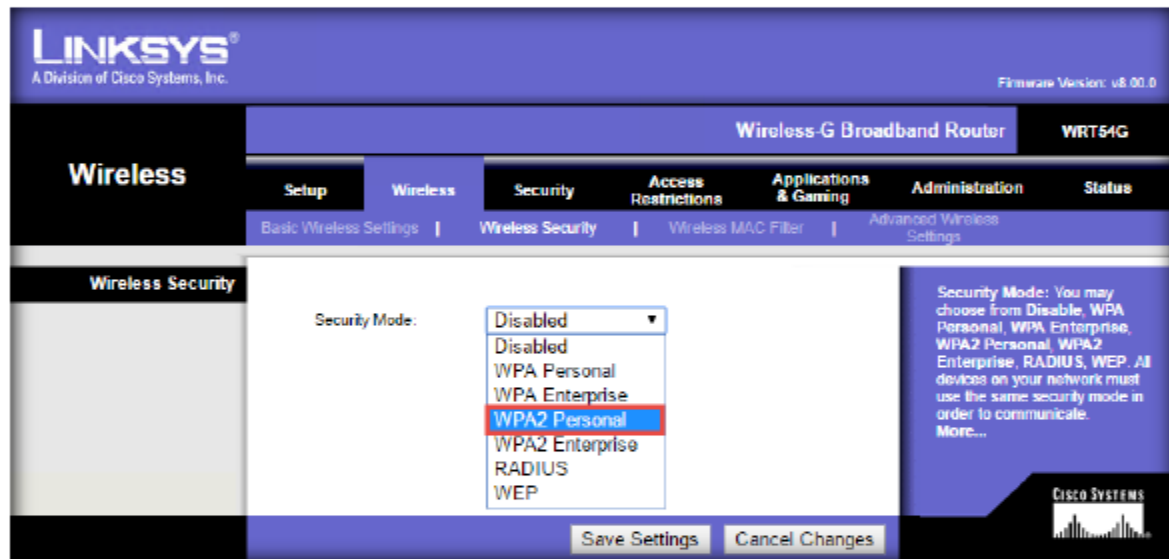


FIGURE 1.32 Select security mode

34. Select **AES** for the **WPA algorithm** and enter a valid key value for the **WPA shared key** field

WPA2 Enterprise: They require RADIUS authentication server. Requires a username and a password for authentication

AES: Stands for Advanced Encryption Standard. More secure encryption method used by WPA2 standard. Provides optimal security

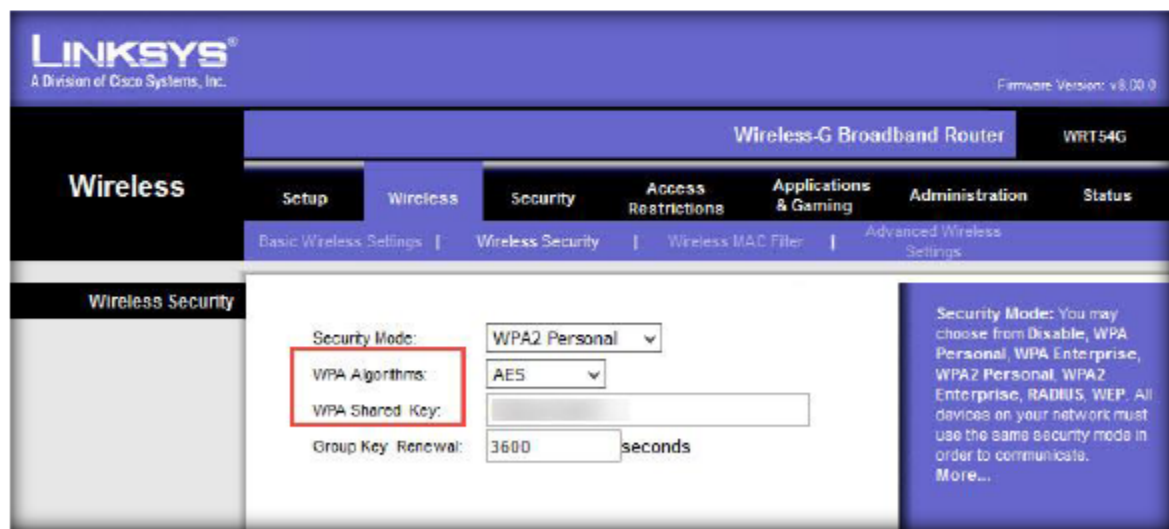



FIGURE 1.33 Configuring shared key and WPA algorithm

35. Click **Save Settings**

 The Passphrase creates the keys required. Hence, any wireless network accessing the secured router should have the key.

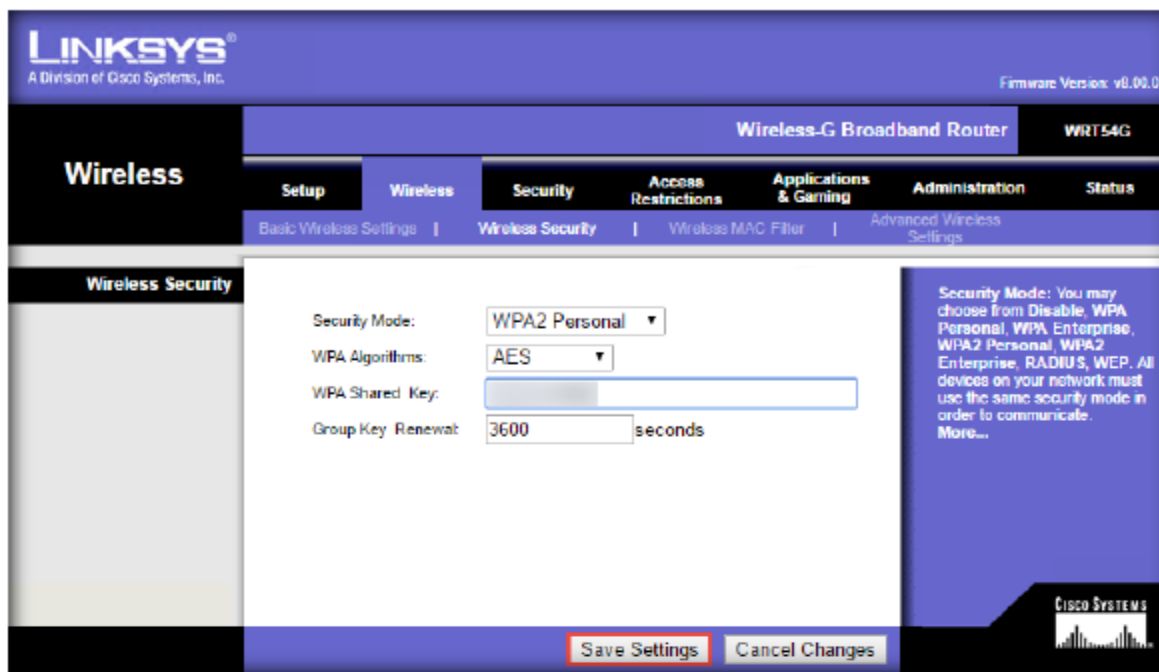


FIGURE 1.34 Saving settings

36. A prompt saying **Settings are Successful** shows on the screen. Click **Continue**




 Advanced Wireless Settings are always kept in their default values. Changes in these values may result in the poor performance of the router and hence may be manipulated by experienced users



FIGURE 1.35 Prompt for successful settings

37. Click on the **Wireless MAC Filter**

 The Wireless MAC filter allows connecting a MAC address to the network

 The Enabling Wireless Mac Filter blocks the addition of any other Mac addresses to the network

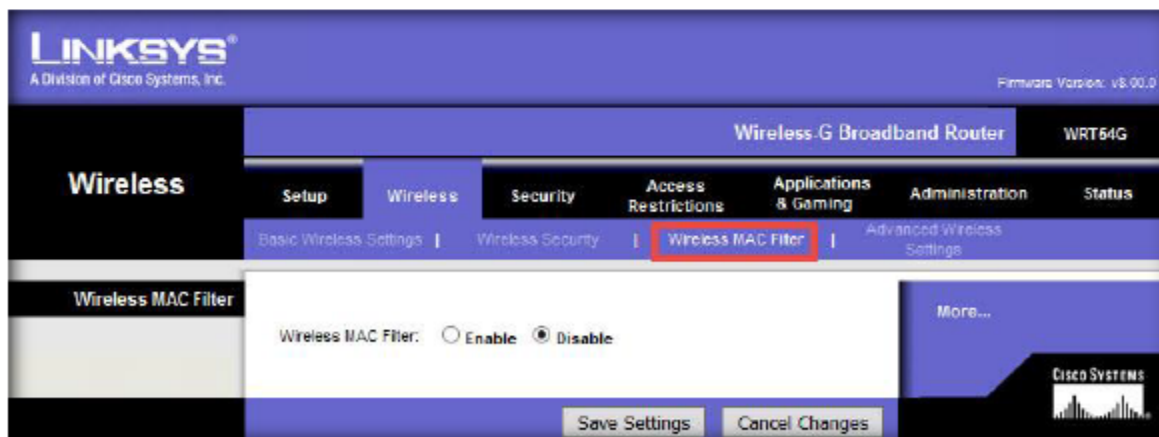





FIGURE 1.36 Wireless MAC filter


38. Click on the **Enable** radio button under the **Wireless MAC Filter** option


 Prevent helps in preventing a device being connected to the wireless network.


Permit only allows the selected devices to access the wireless network

 Editing the MAC Filter list allows the addition of another set of MAC addresses

 TKIP: Stands for Temporal Key Integral Protocol. Less secure and used commonly with WPA standards

 IDENT is an internet protocol that distinguishes users for particular TCP connections

 Normally responds to TCP port 113

 A Firewall provides an extra level of security to the network

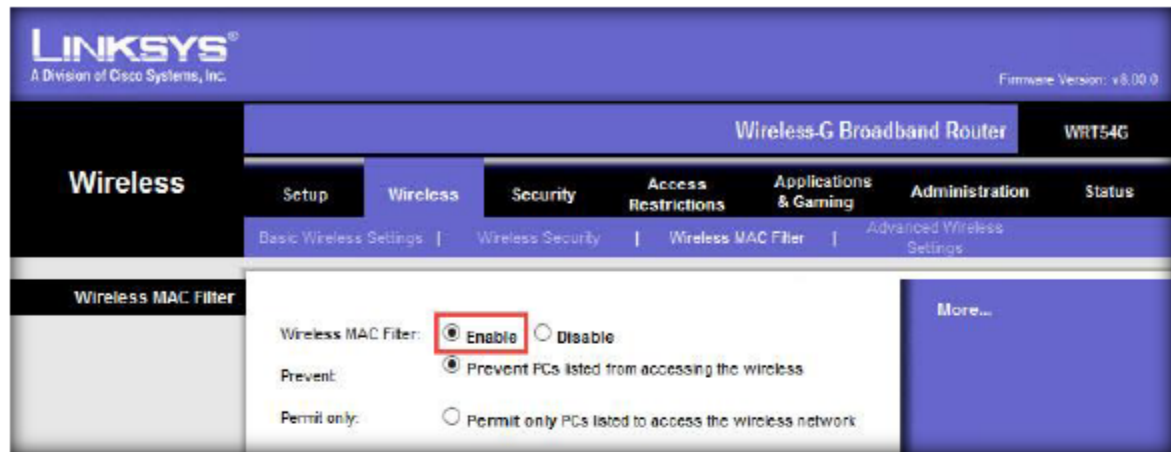


FIGURE 1.37 Enabling wireless MAC filter

39. Now, go to the **Security** tab, in order to enable firewall restrictions in the router

Note: Select the options **Block Anonymous Internet Requests** and **Filter IDENT (Port 113)**



FIGURE 1.38 Configuring firewall restriction

40. Click on **Access restrictions**



 Access restrictions control the access of the internet access in the network.





FIGURE 1.39 Configuring Access Restrictions


41. **Configure** the appropriate Internet access restrictions

42. Select **Application and Gaming** from the main menu

 Access restriction allows you to block applications like HTTP, HTTPS, DNS, Ping, etc. and certain other services.

 It also allows you to restrict or block certain websites using a keyword or by URL.

 Allows the router to block access to local resources from other local devices

 Filter Multicast allows multiple hosts to reach their destination

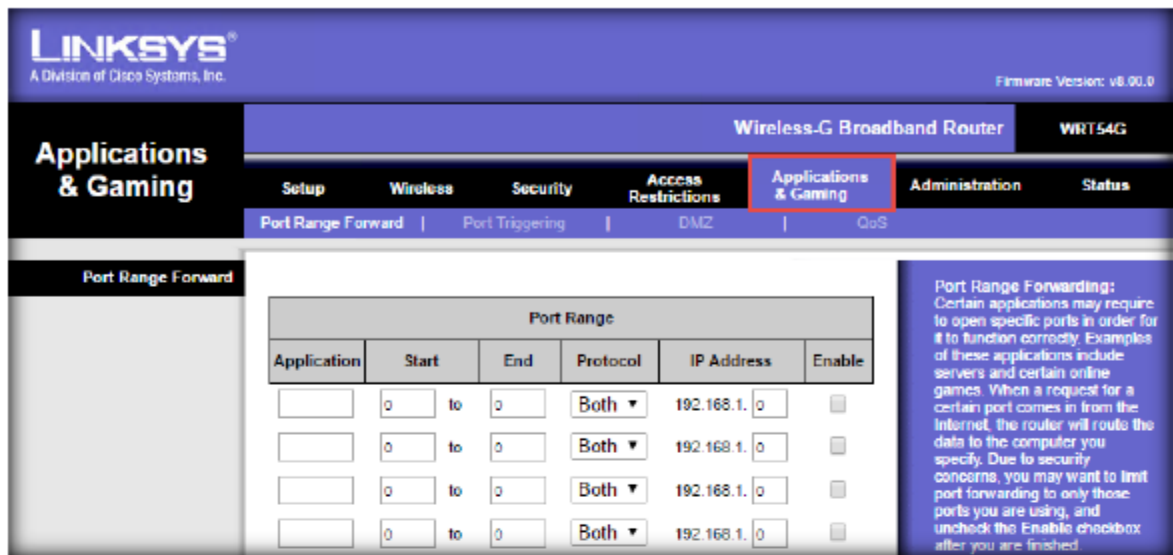


FIGURE 1.40 Applications and Gaming

43. Enter the following details:

- **Application** – Enter the name of the program
- **Start / End**– Enter the range of ports
- **Protocol** – Select any one of the protocols or both
- **IP Address** – Enter the IP address of that port receiving the port traffic
- **Enable** – Enable or disables the port forwarding rule

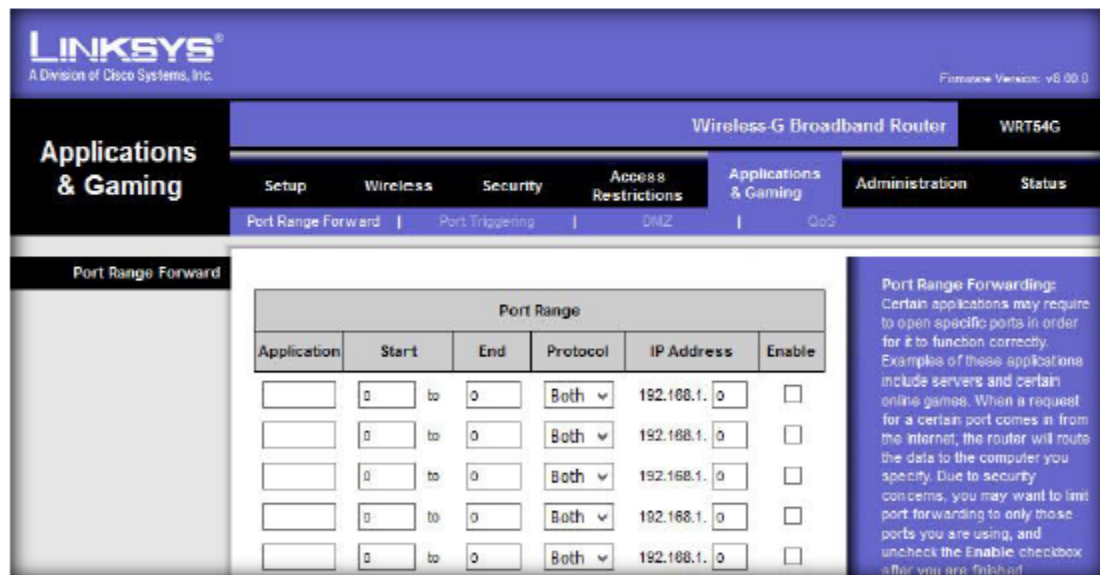

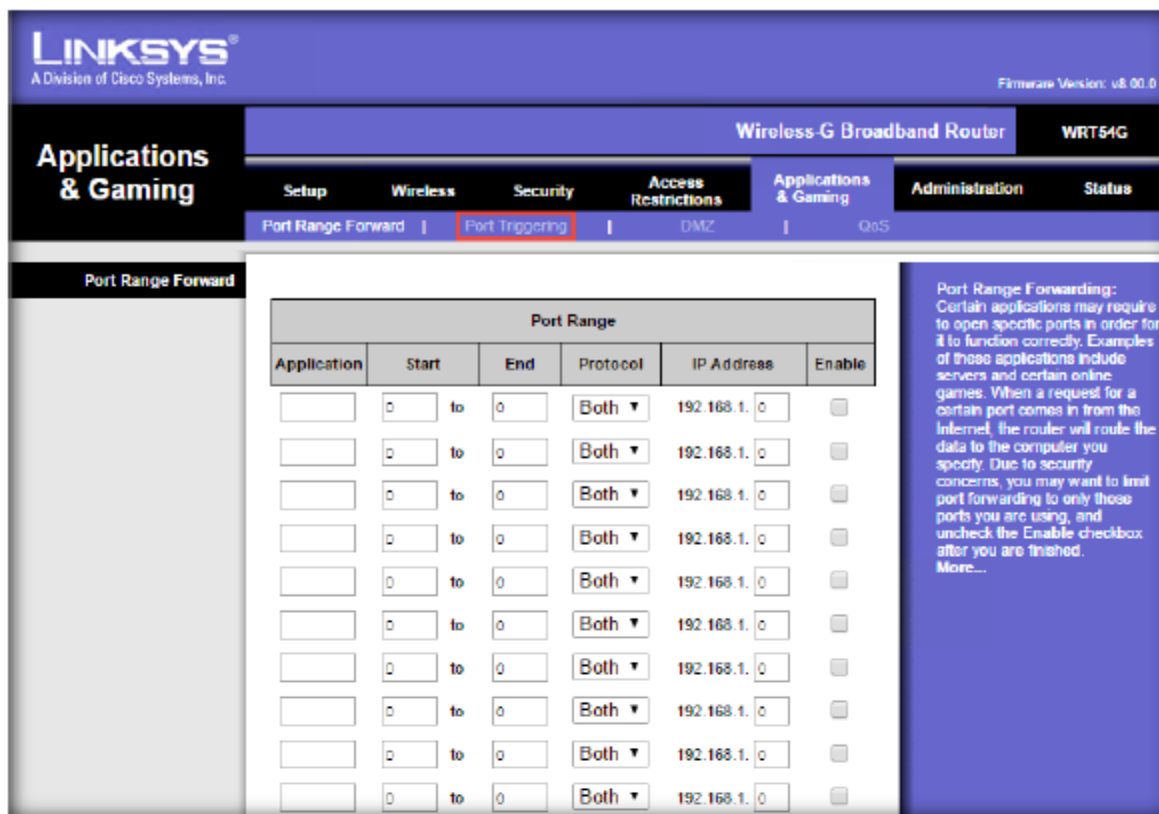


FIGURE 1.41 Port Range Forward

44. Click on the **Port Triggering** tab

 **Port Triggering** provides special internet applications in a local network

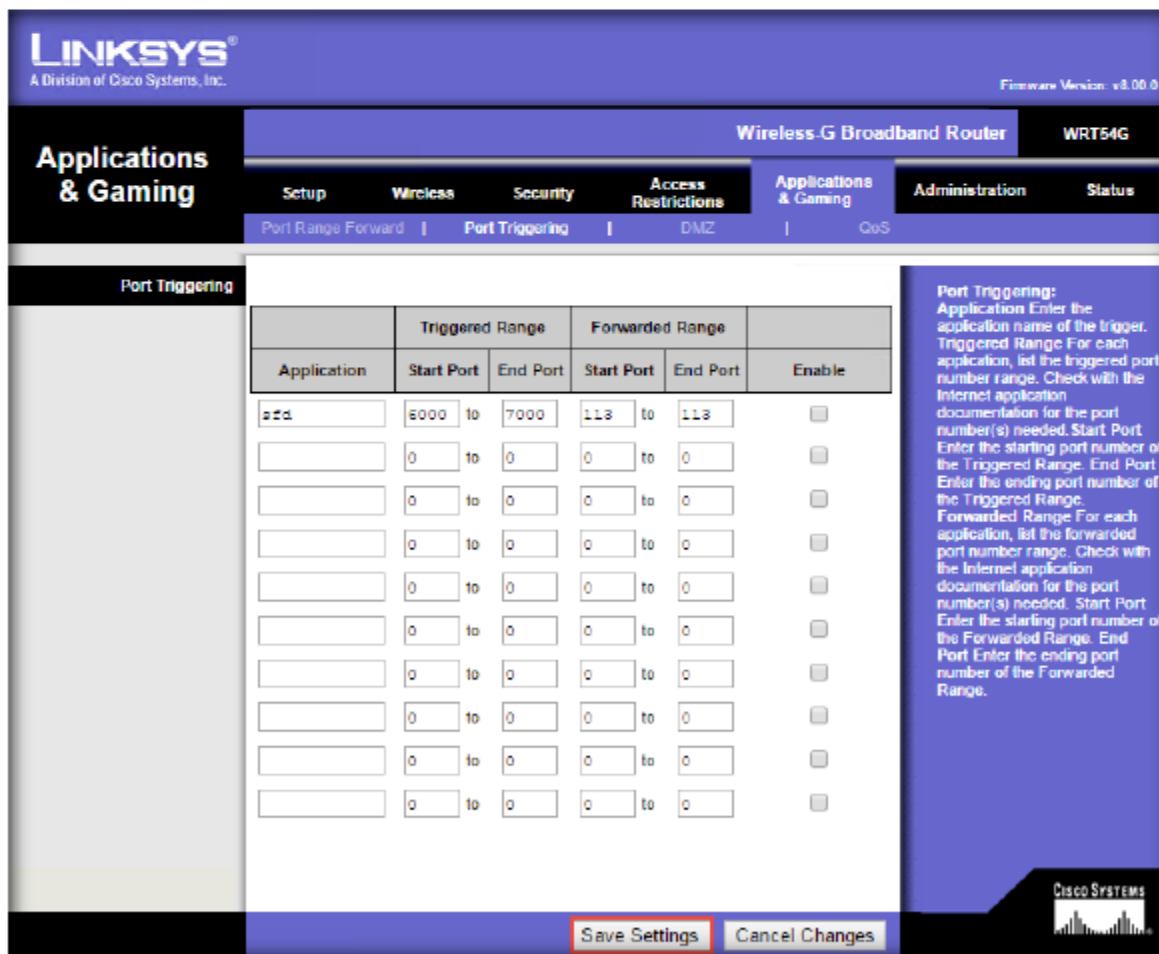


Port Range Forwarding: Certain applications may require to open specific ports in order for it to function correctly. Examples of those applications include servers and certain online games. When a request for a certain port comes in from the Internet, the router will route the data to the computer you specify. Due to security concerns, you may want to limit port forwarding to only those ports you are using, and uncheck the Enable checkbox after you are finished. More...

Port Range					
Application	Start	End	Protocol	IP Address	Enable
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>
	0	to 0	Both ▼	192.168.1.0	<input type="checkbox"/>

FIGURE 1.42 Port Triggering

45. Enter the fields in the Port Triggering page and Click **Save Settings**



Port Triggering: Application Enter the application name of the trigger. Triggered Range For each application, list the triggered port number range. Check with the Internet application documentation for the port number(s) needed. Start Port Enter the starting port number of the Triggered Range. End Port Enter the ending port number of the Triggered Range. Forwarded Range For each application, list the forwarded port number range. Check with the Internet application documentation for the port number(s) needed. Start Port Enter the starting port number of the Forwarded Range. End Port Enter the ending port number of the Forwarded Range.

Application	Triggered Range		Forwarded Range		Enable
	Start Port	End Port	Start Port	End Port	
p2p	8000	to 7000	113	to 113	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>
	0	to 0	0	to 0	<input type="checkbox"/>

Save Settings Cancel Changes

FIGURE 1.43 save Settings

46. A prompt saying the **Settings are Successful** will appear. Click **Continue**



FIGURE 1.44 Settings are Successful

47. Next, Click on the **DMZ** tab

Enabling the DMZ opens all the ports thereby exposing the computer to the internet.

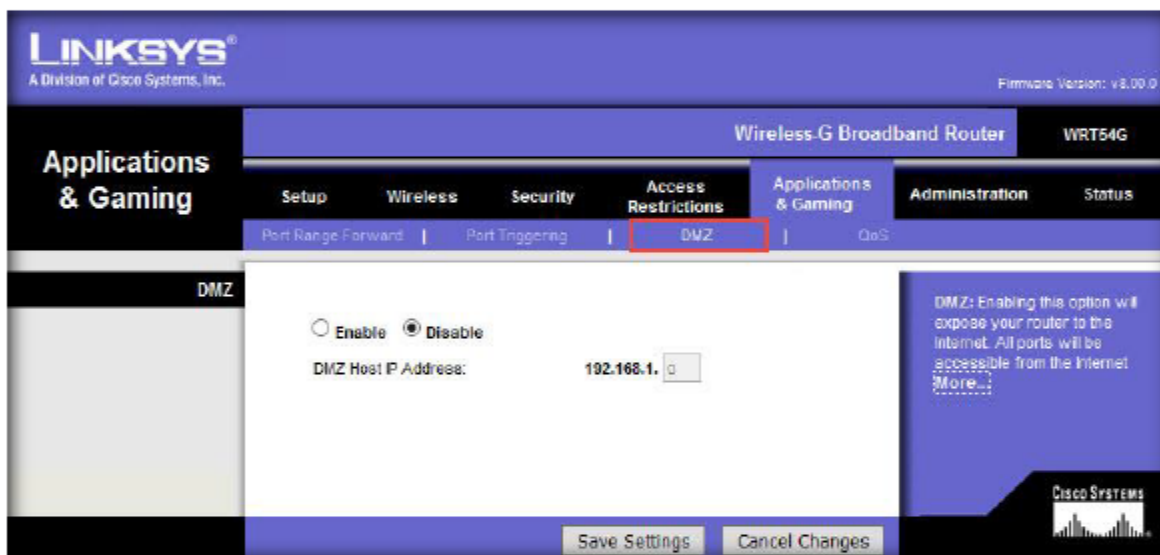


FIGURE 1.45 DMZ

48. Choose **DMZ** → **Disable**

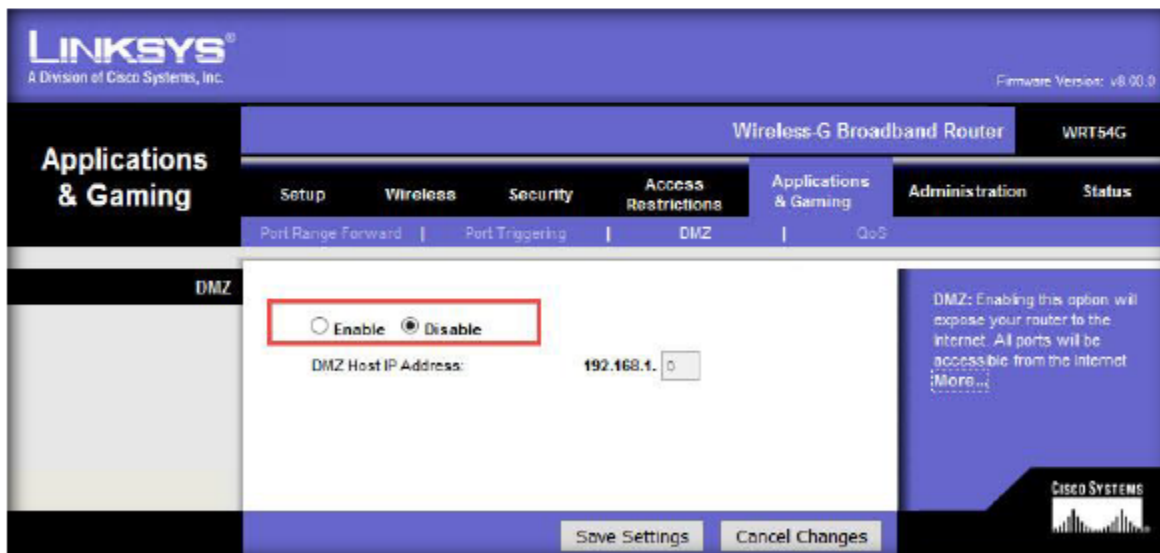


FIGURE 1.46 Disable DMZ

49. Now, click on **QoS** tab



FIGURE 1.47 QoS

50. Choose **QoS** → **Disable**

QoS is enabled only when you require any prioritization for any of the services

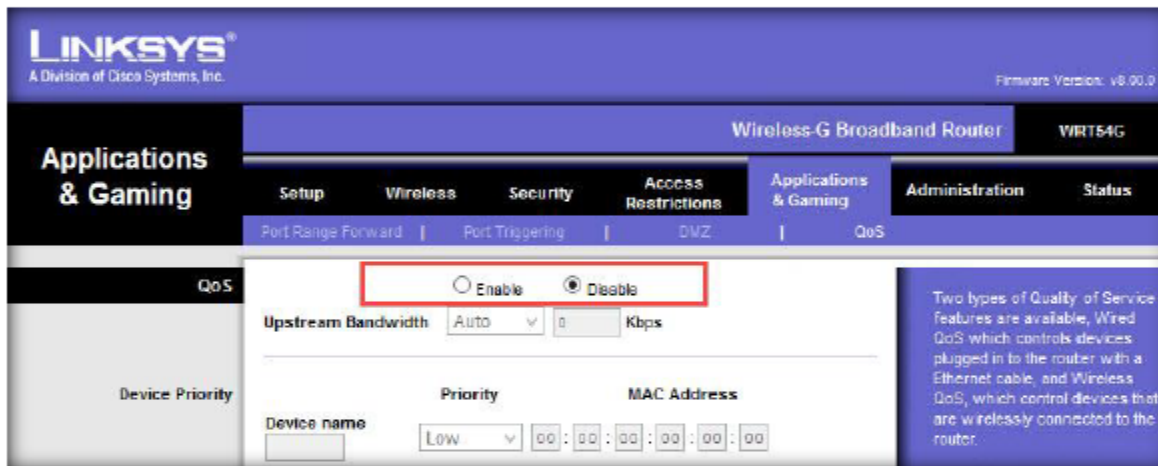


FIGURE 1.48 Disable QoS

51. Click **Save Settings**

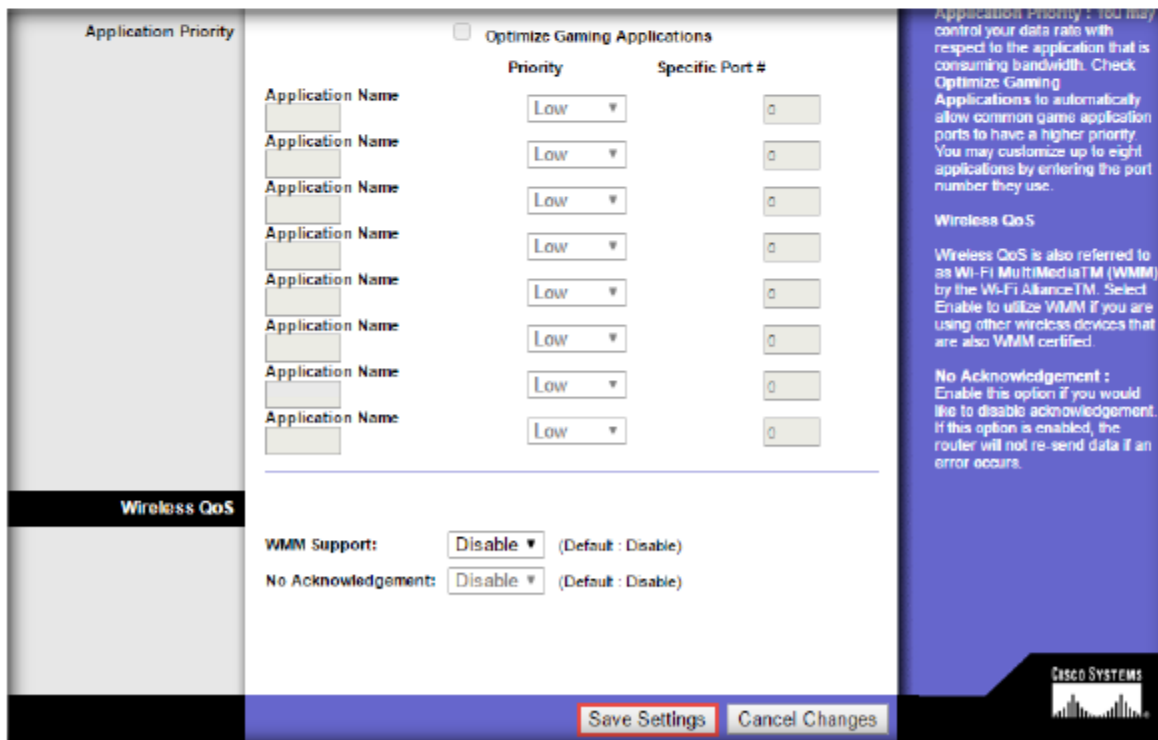


FIGURE 1.49 Save Settings

52. A prompt saying the **Settings are Successful** is displayed. Click **Continue**

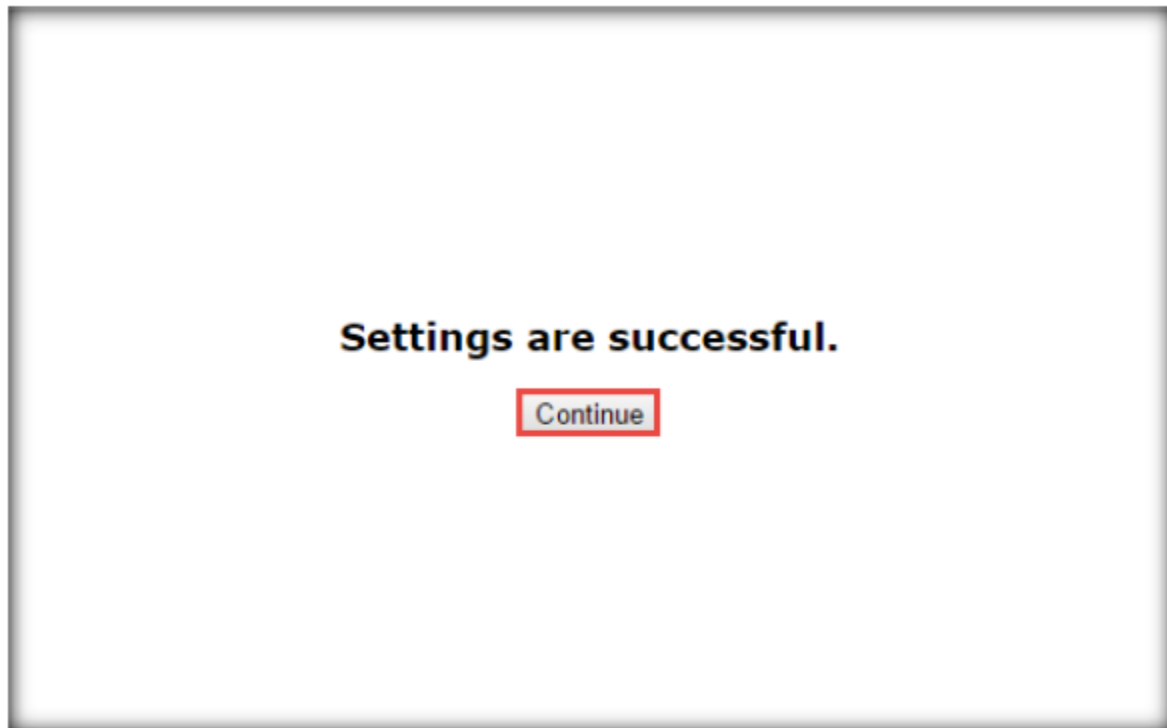



FIGURE 1.50 Savings are Successful

53. Click on the **Administration** tab

 The Administration tab helps in managing the router and log configurations. All the software upgrades may be performed here.

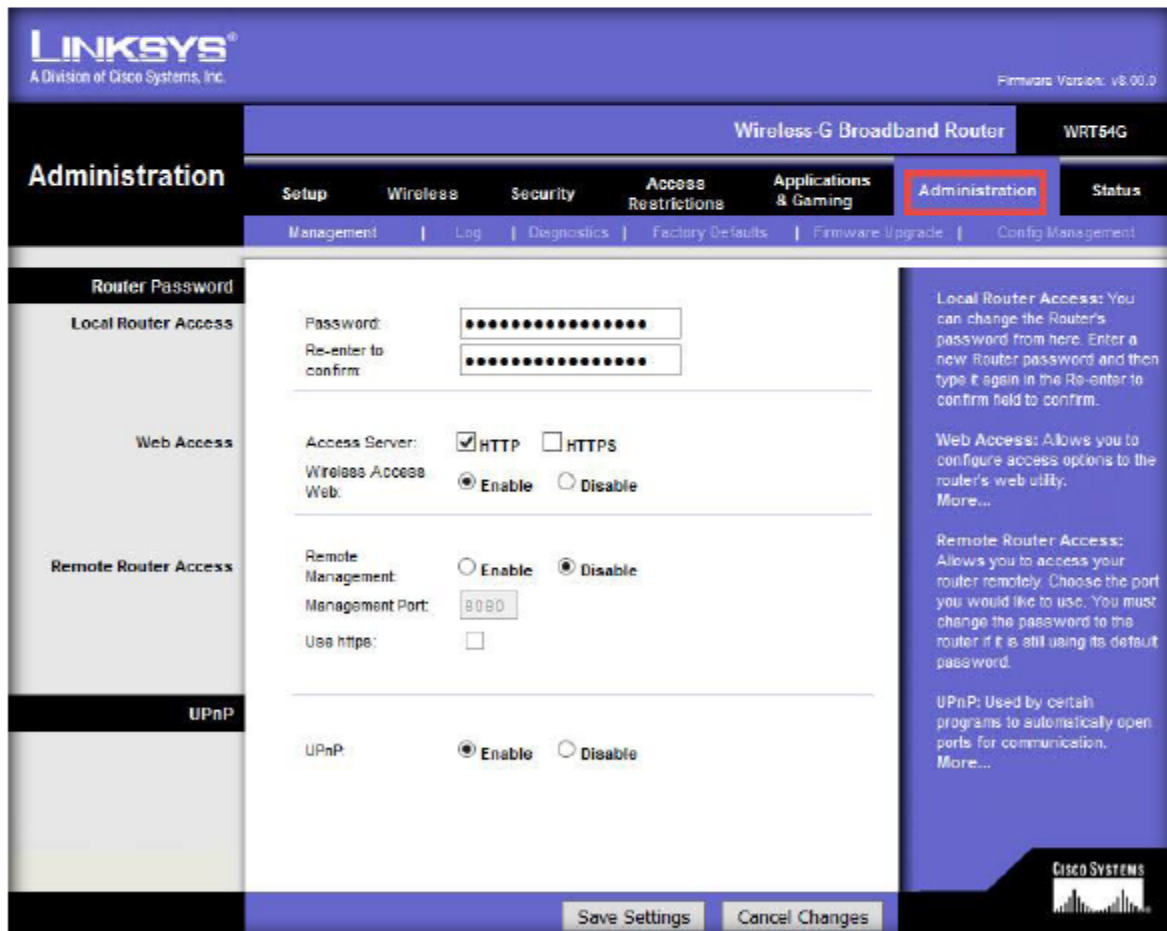



FIGURE 1.51 Administration tab

54. Click on the **Management** tab under Administration

 The Management tab specifies the router password.

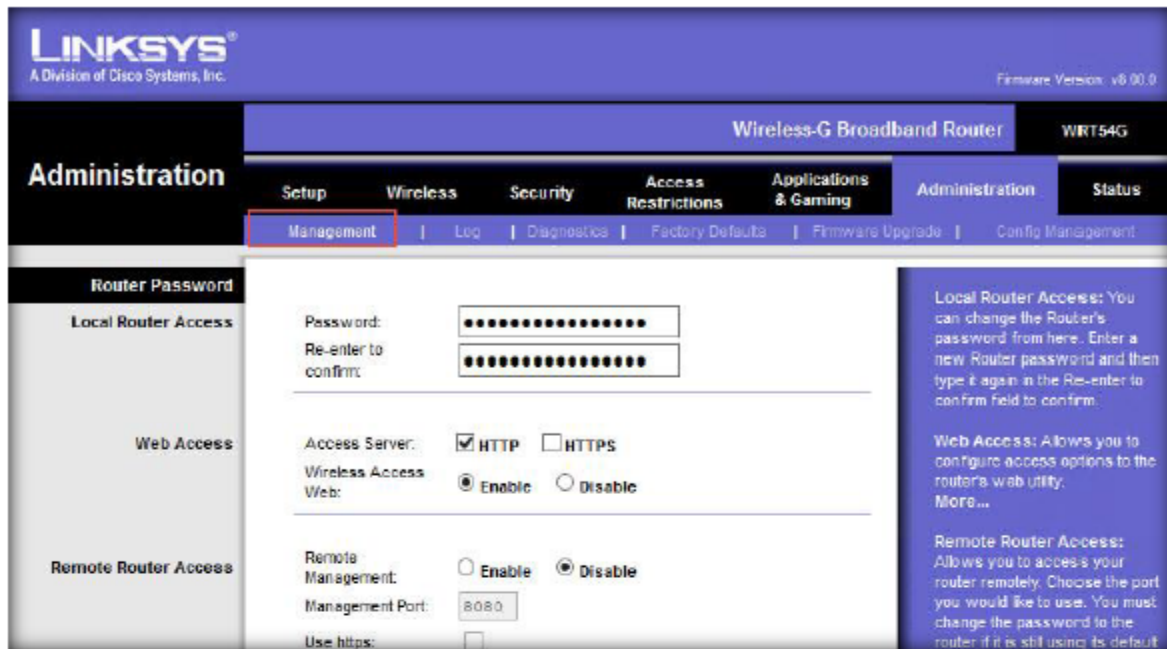



FIGURE 1.52 Management tab

55. In the **Password** field, choose the strongest password for a wireless router.

56. Type a new password. Re-type the new password in the **Re-enter to Confirm** field

Note: Passwords should be changed periodically in order to restrict any unauthorized access to the wireless network

 The Administrator router password differs from the Wireless network name (SSID) and passphrase of the wireless network.

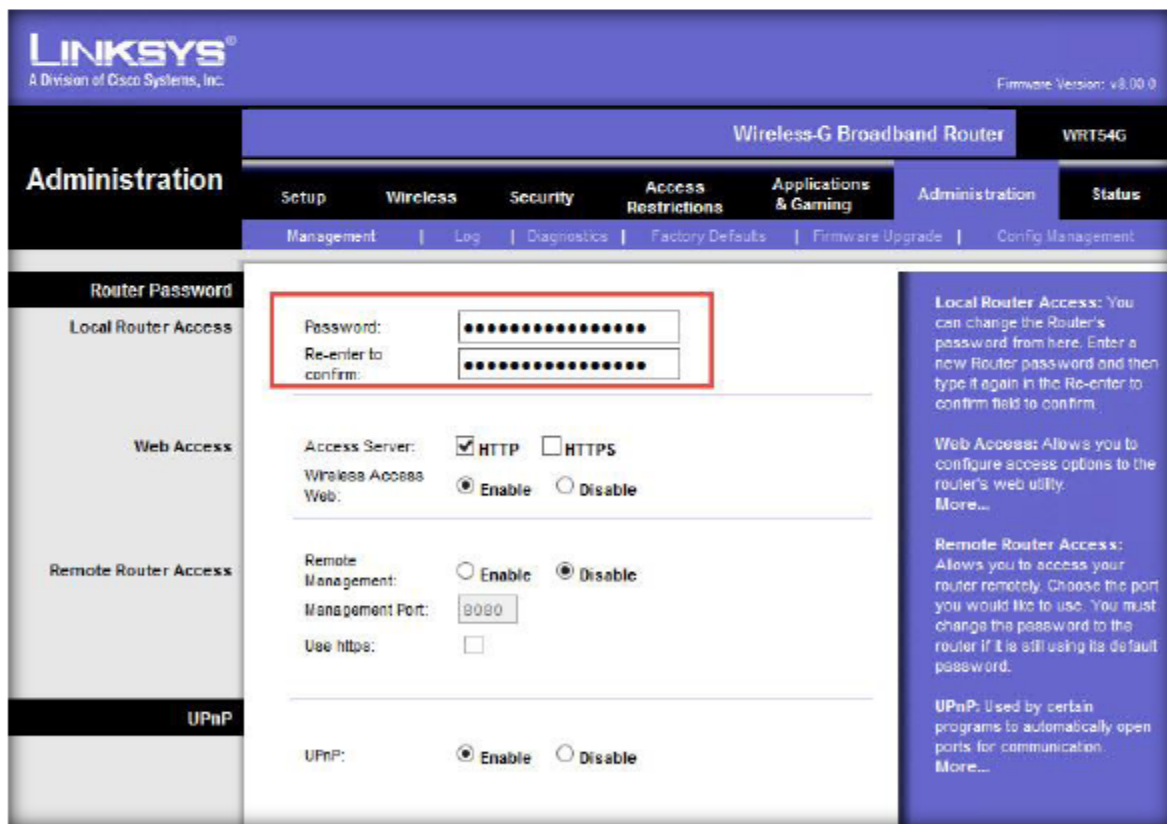


FIGURE 1.53 Configuring router passwords

57. Now, Select **HTTPS** from **Web Access** → **Access Server**

Enabling Remote router access for the first time prompts you to change the default router password. This can enable secure admin access and change the admin port from 8080.

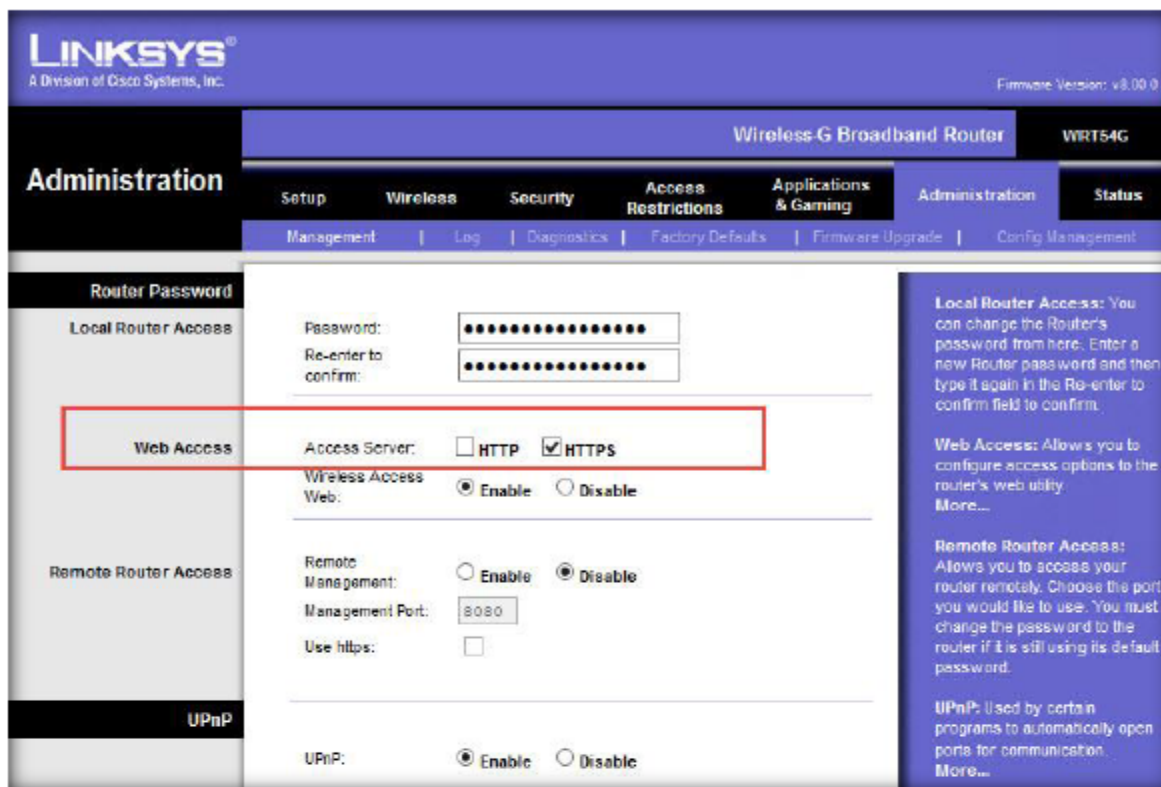


FIGURE 1.54 Configuring Web access

58. Choose **Remote Router Access** → **Remote Management** → **Disable**

Status provides the details regarding the current status of the router

Config Management allows backup management and Restore Management

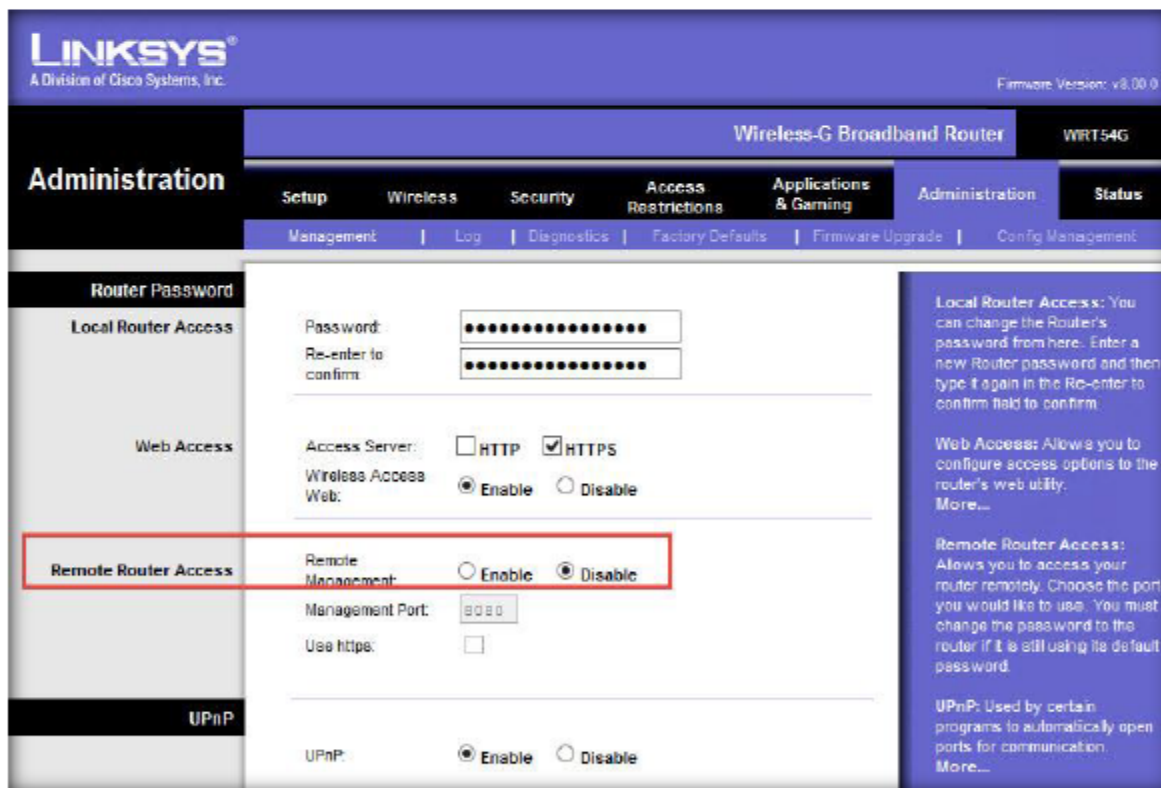



FIGURE 1.55 Configuring Remote Router Access

59. Click on the **Log** tab under **Administration**

 The Firmware Upgrade allows you to upgrade the firmware. Upgrading may lead to loss of configuration details and hence you need to save all configuration details before

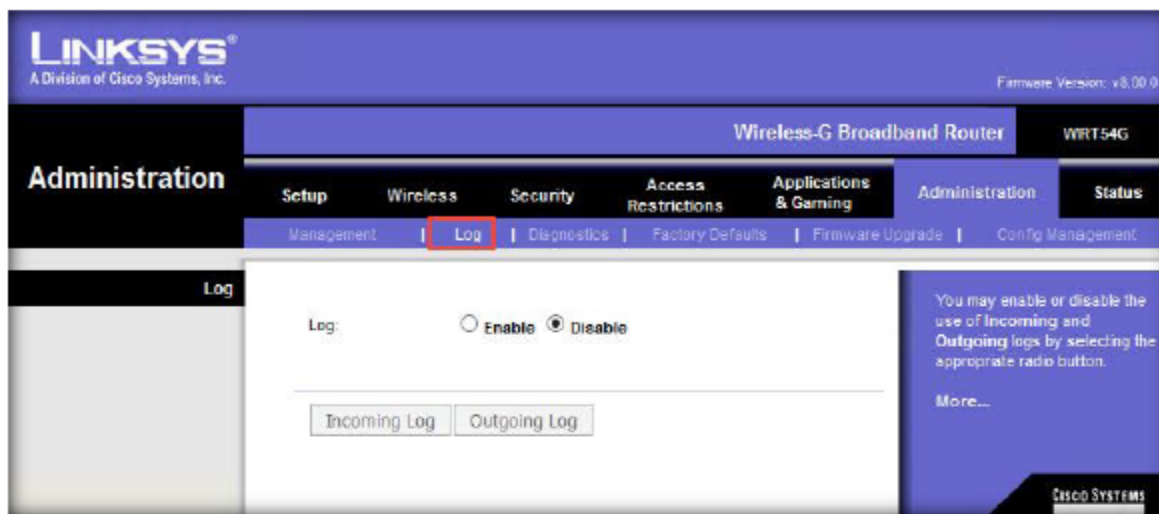



FIGURE 1.56 Log tab

60. Choose **Log** → **Enable**

 Log helps in sending logs to any particular computer

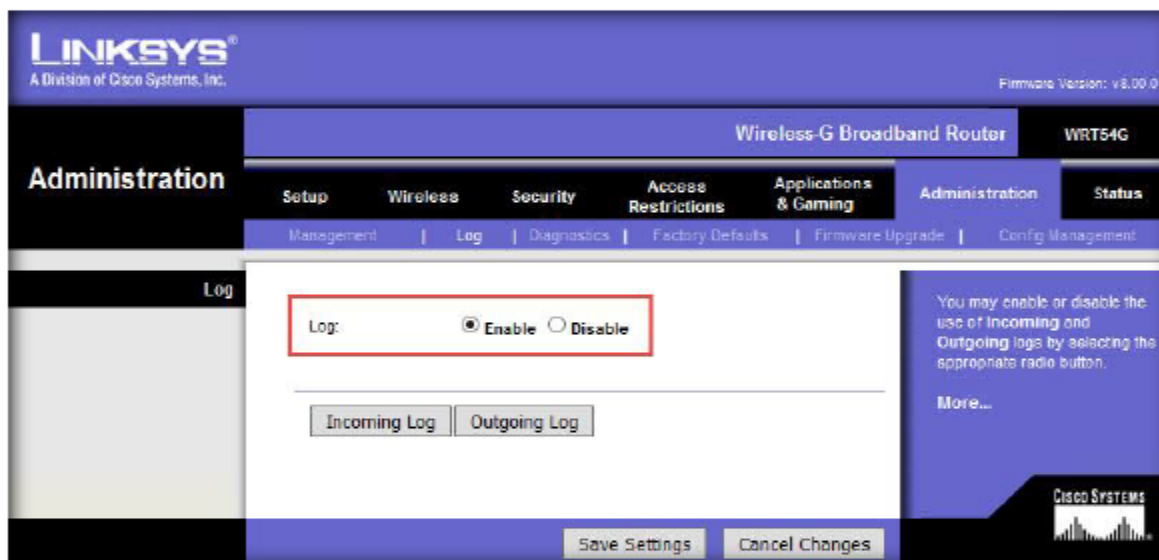



FIGURE 1.57 Enabling log

61. Click **Save Settings**

 Diagnostics consists of two steps: Ping and Traceroute

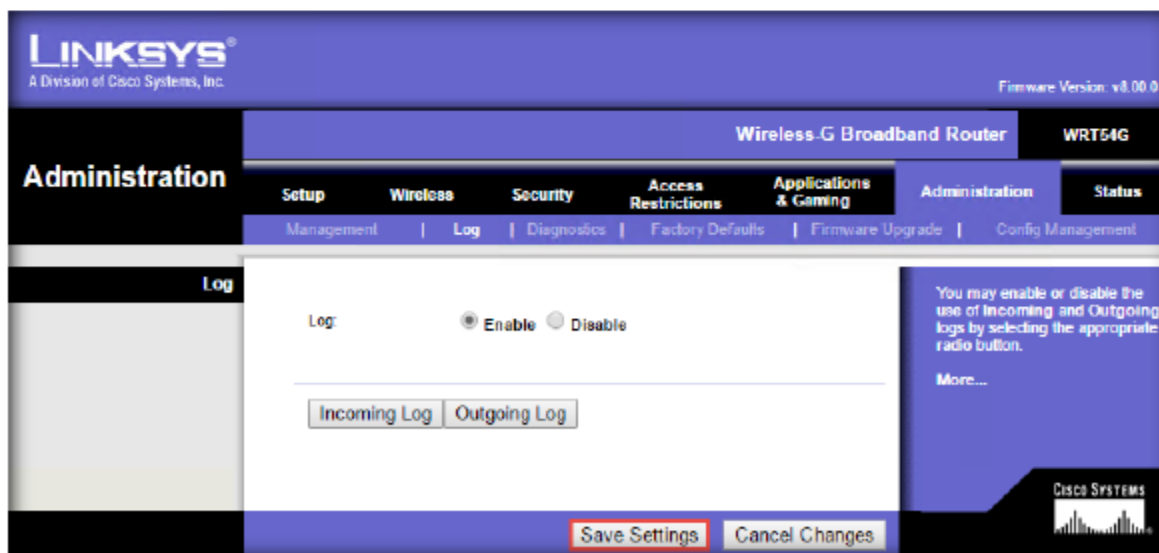

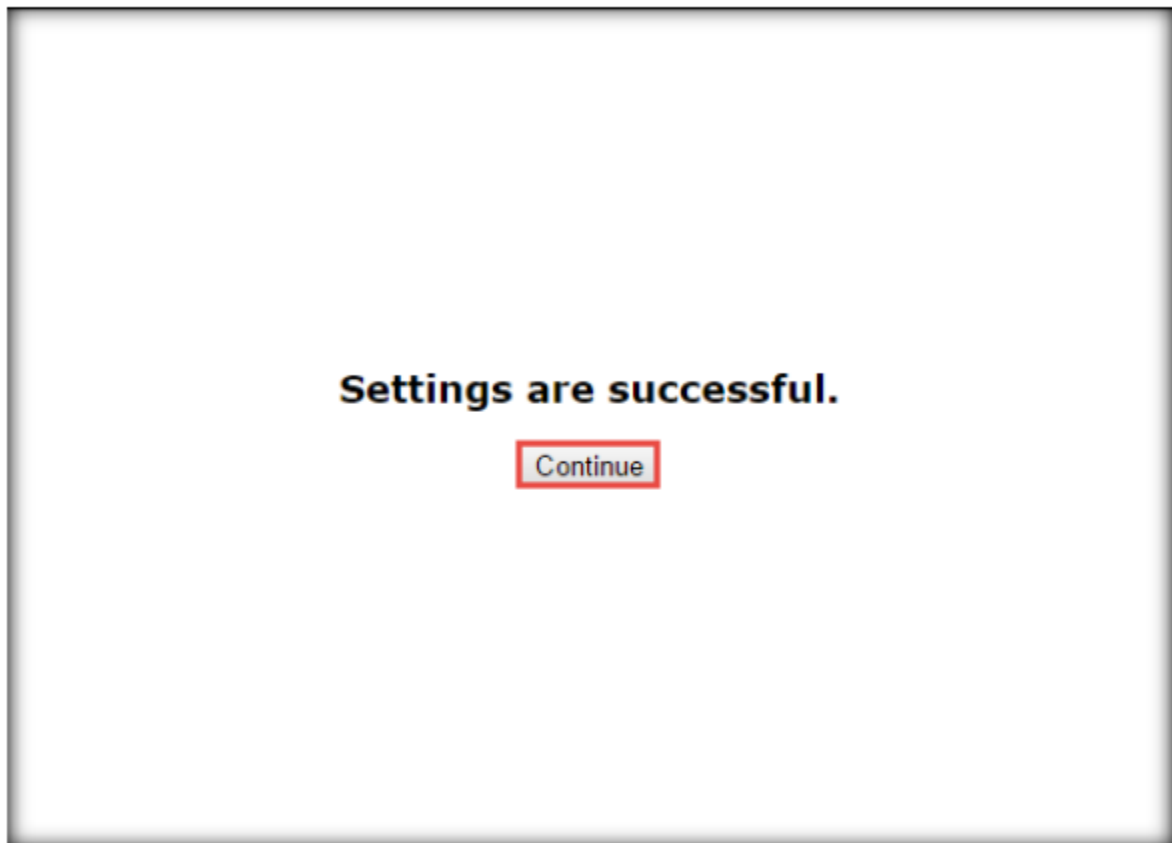


FIGURE 1.58 Saving Settings

62. A prompt “Settings are Successful” pops-up

 Factory Defaults allow changing the default values in the router. Changing these values may lead to the loss of saved values





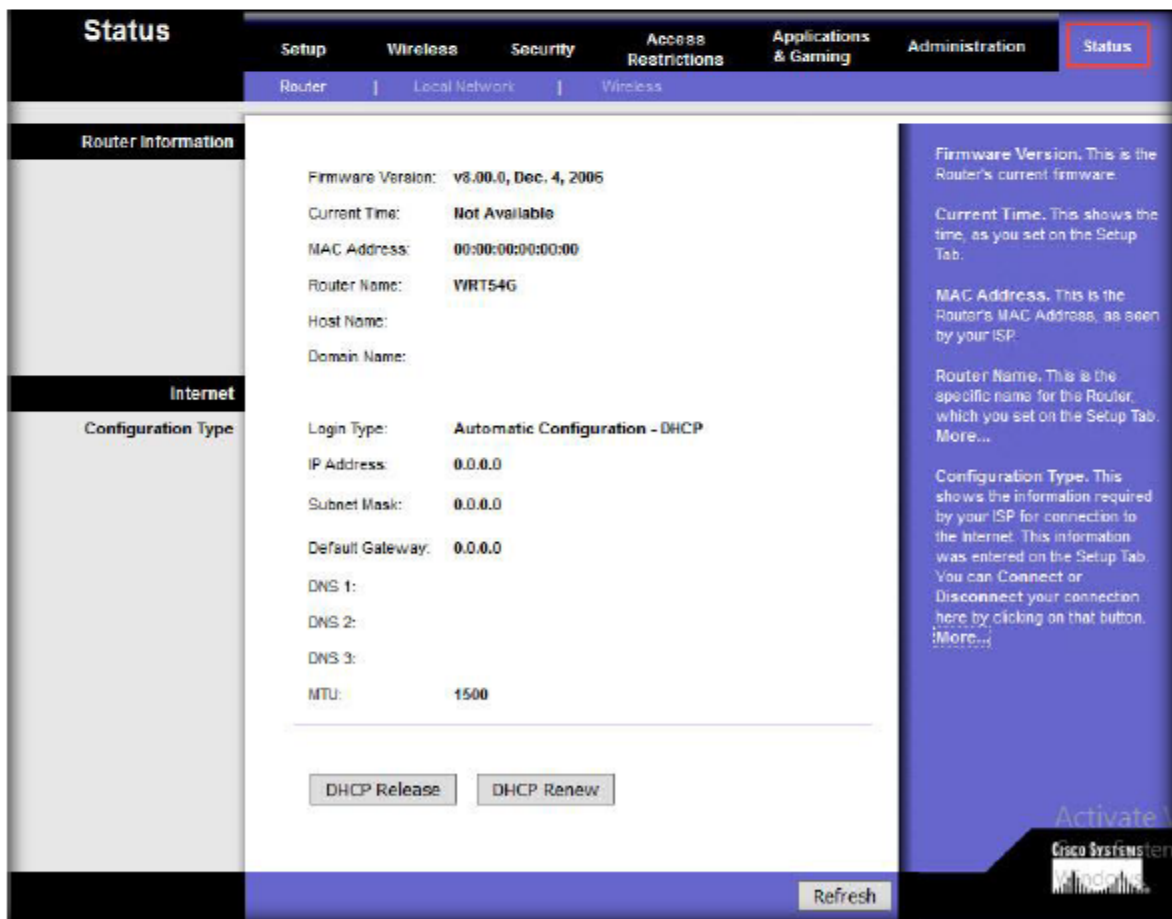
 Status displays the router information and the configuration type of the internet

FIGURE 1.59 Settings Successful prompt

63. Next, Click on **Status** from menu bar

 DHCP Release deletes the current IP address




 DHCP Renew adds a new IP address to the router.

FIGURE 1.60 Status tab

64. In this way, you can make configuration changes in wireless router interface to secure your wireless router.

Lab Analysis

Analyze and document the results related to the lab exercise. Give your opinion on securing the wireless network using Linksys router

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Internet Connection Required	
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Platform Supported	
<input checked="" type="checkbox"/> Classroom	<input type="checkbox"/> iLabs