



Computer Networks-Lab 08



Instructor: HURMAT HIDAYAT

CL30001 – Computer Networks-Lab

SEMESTER Fall 2023

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES, FAST- PESHAWAR CAMPUS
Department of Computer Science & Software Engineering

Computer Networks Lab 08

Objective

The objective of this lab is to introduce students to various network devices such as modems, routers, access points, and wireless routers. Students will learn about WLAN (Wireless Local Area Network) configuration and the configuration of wireless routers. Through practical exercises using Cisco Packet Tracer, students will gain hands-on experience in configuring WLAN settings and wireless routers.

Learning Outcomes

By the end of this lab, students will be able to:

- Understand the roles and functionalities of modems, routers, wireless access points, and wireless routers in a network.
- Establish a wireless connection between devices and the WLAN.
- Understand the basics of wireless router configuration, including setting up SSID, security settings, and DHCP (Dynamic Host Configuration Protocol).
- Configure a wireless router to provide internet connectivity to wireless devices.
- Analyze and troubleshoot WLAN and wireless router configurations to ensure proper functionality and connectivity.

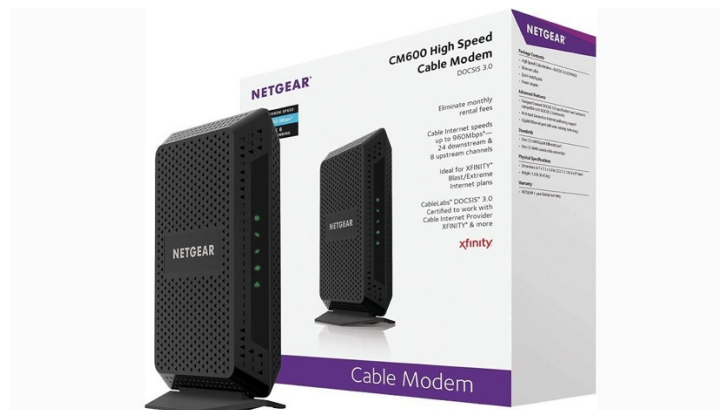
Table of Contents

Objectives	Error! Bookmark not defined.
Modem	3
Router	3
Access Point	4
Wireless Router	5
Task 1: WLAN Configuration on Packet Tracer	6
Task 2: Wireless Router configuration in Cisco Packet Tracer	10

Modem

A Modem Connects You to the Internet. A **modem** is your gateway to the internet—a cable, fiber optic, or telephone line comes through your neighborhood, to your house, and connects to your modem. The modem translates the digital 1s and 0s from your computer into analog information for the cable or telephone wire to carry out to the world, and translates incoming analog signals in the same way. This is called *modulation* and *demodulation*, respectively, and it's where the “mo-dem” gets its name.

Typically, your internet service provider (ISP) will offer you a modem for a small monthly fee.



Router

A Router Connects Your Devices to the Modem. If you only had one computer in your house, you could plug it straight into the modem with an Ethernet cable and call it a day—you'd be connected to the internet and watching videos instantly. But most people have more than one computer in their house, not to mention smartphones, tablets, e-readers, and a host of other devices.

Standalone modems aren't able to send data to multiple devices simultaneously. They usually only have one Ethernet port, and only produce one IP address, which identifies your location to the internet.



A **router** connects all your home's devices to each other—through Ethernet cables or Wi-Fi—and then connects to the modem.

That router gives each device its own internal IP address, which it uses to *route* traffic between them. If your modem's IP address is like the street address of a building, your router's internal IP addresses are like apartment numbers. Your modem receives information from the internet, sends it to the router, and the router sends it to the computer that asked for it.

The network created by your router is known as a local area network, or LAN, and it connects you to a larger wide area network, or WAN. In most home cases, your WAN is, for all intents and purposes, the internet.

Not all routers include Wi-Fi—some merely connect computers with Ethernet cables. That's where the next piece of equipment comes in.

Access Point

An Access Point Adds Wireless Connectivity. Once upon a time, all computers connected to the internet through a jumble of wires. Today, though, we have the ability to connect all those devices to your home network (and thus, the internet) over Wi-Fi. To do that, you need something to broadcast that wireless signal.

A **wireless access point** connects to your router, usually over Ethernet, and communicates with your Ethernet-less devices over wireless frequencies. Most home users have routers with wireless access points built in, but standalone access points are still common for businesses, since you can pair multiple access points together to extend your network over a large area.



A Switch Connects Extra Computers to the Router

All routers come with built-in Ethernet ports, but depending on the size and class of router you buy, you may not have enough to plug in all your devices—especially in the age of smart home tech, which often require numerous, hard-wired base stations.



Wireless Router

A wireless router refers to a network device that performs the functions of a router by connecting WiFi-enabled devices, like laptops, smartphones, tablets, and such wirelessly.

They also have firewalls and password protection functionality for defending against the potential threats outside of the LAN.

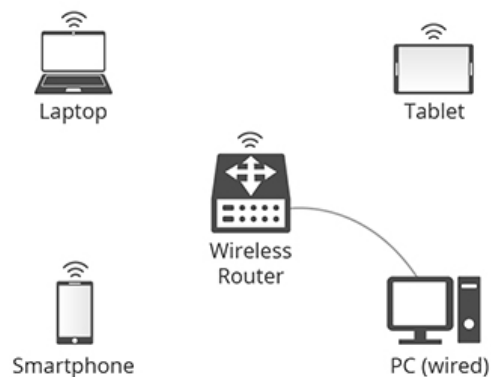
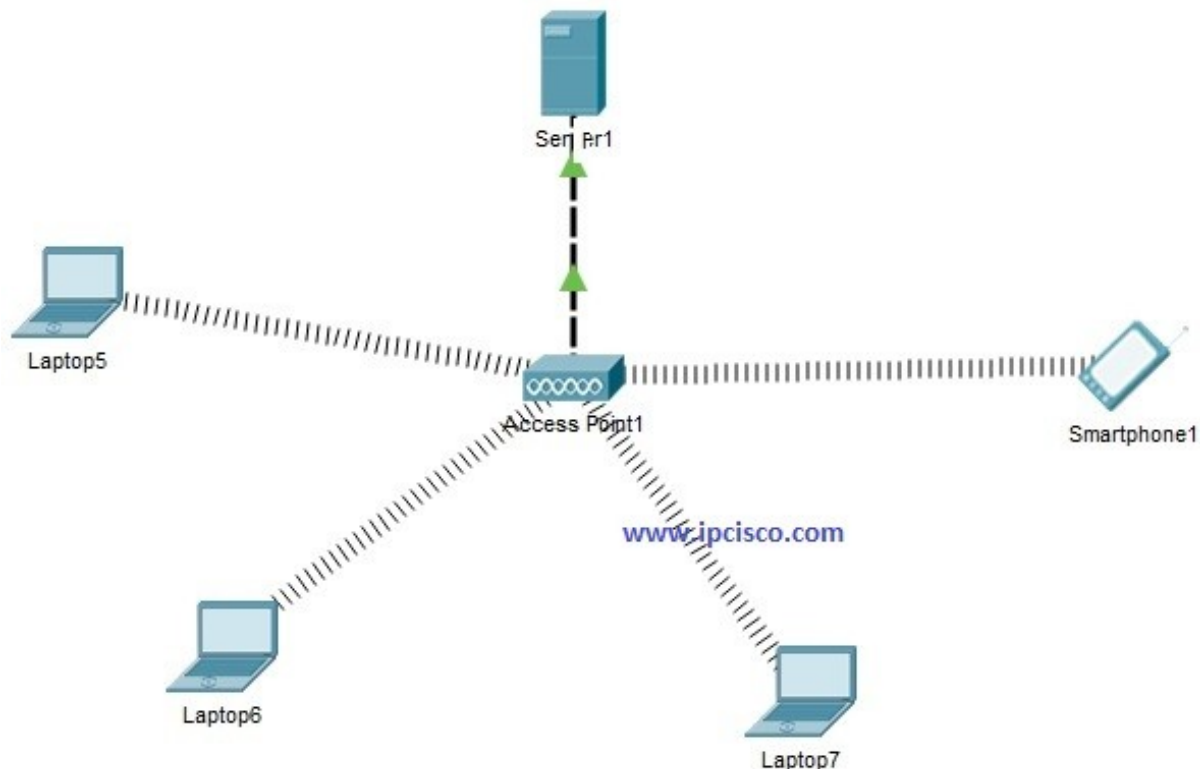


Figure 1 Wireless Router Network Connection Scenario

Task 1: WLAN Configuration on Packet Tracer



Cisco WLAN Configuration

WLANs (Wireless LANs) are very common in today's World. Everywhere there are a lot of wireless networks. Even now, you are in many of these wireless signals. In this task, we will focus **WLAN Packet Tracer Configuration** and we will learn **How to Configure a WLAN on Packet Tracer**.

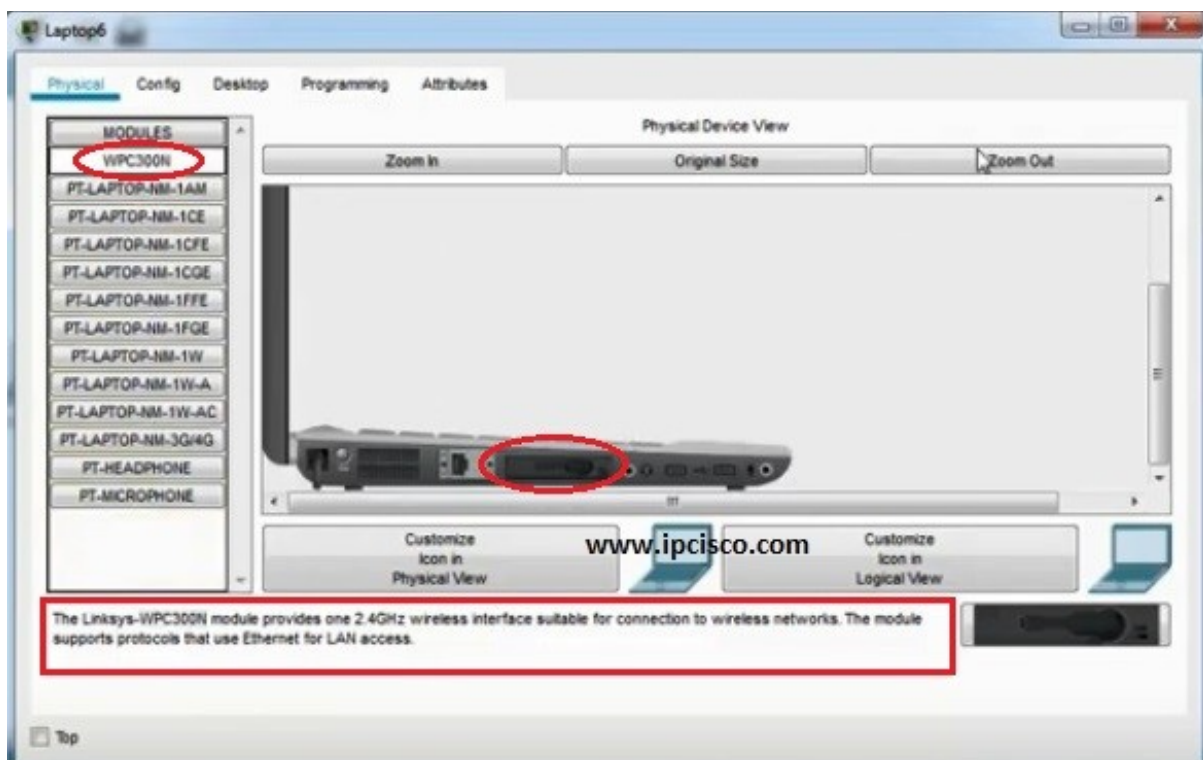
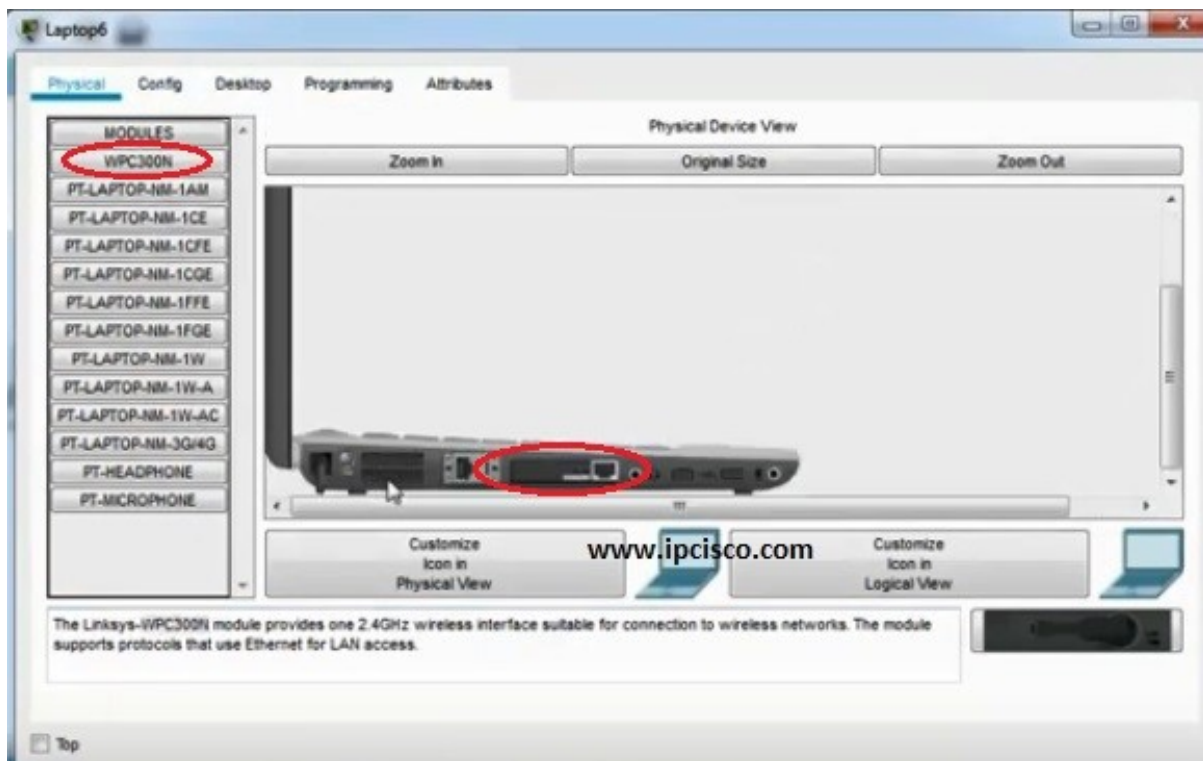
For Our **WLAN Configuration on Packet Tracer**, we will use the above topology that is consist of one Wireless Access Point, One Server , Three Laptops and One Smartphone. Smartphones are everywhere, even in **Cisco Packet Tracer** for many years.

Now, let's summarize what will we do for **Packet Tracer WLAN Configuration** :

- **Place Wireless Interface Card to Laptops**
- **IP Check on WLAN Devices**
- **DHCP Server Configuration**
- **IP Check on WLAN Devices again**

Place Wireless Interface Card to Laptops

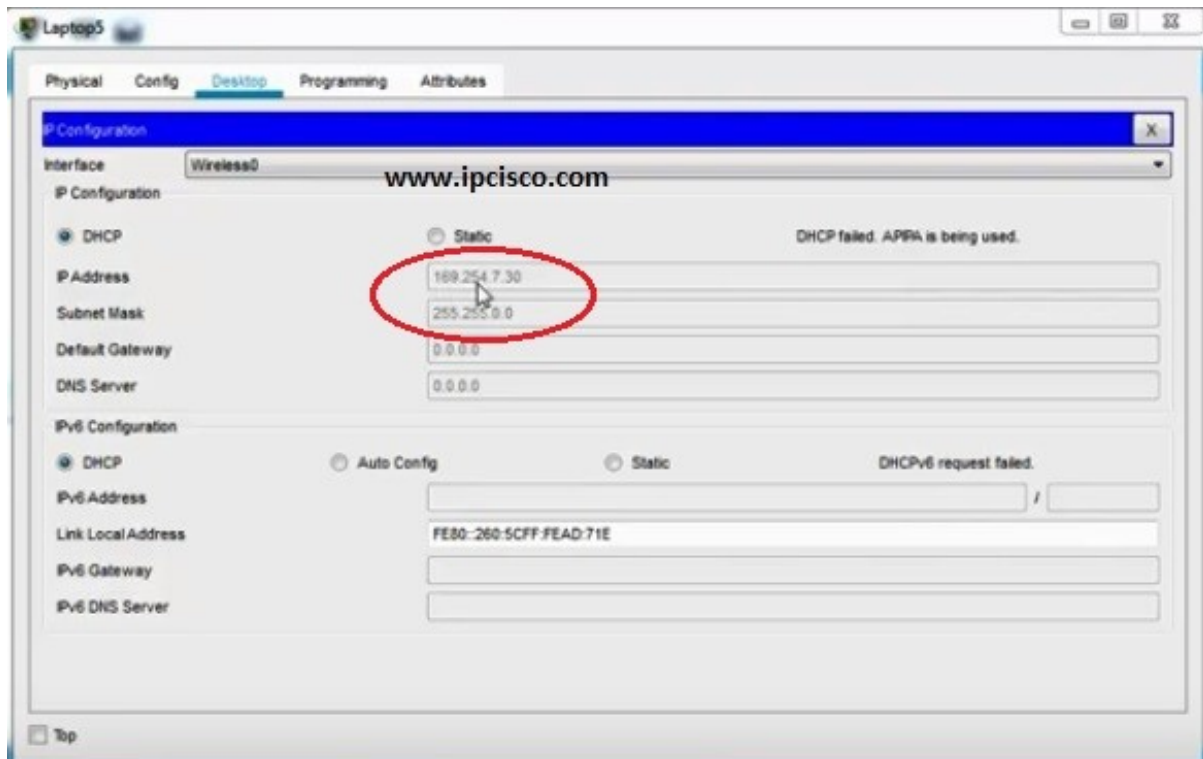
By **default** laptops has classic **Ethernet card**. To involve in a wireless network, we should have wireless interface card. So, in each laptop, we should turn off the laptop, remove the classical Ethernet, instead of it we place **Wireless Interface Card (WPC300N)**. Then, we power on the laptop again.



After this process each laptop connects to the wireless Access Point in Packet Tracer. Smartphone devices in Packet Tracer connects to **Access Points (AP)** by default. So, there is nothing to do on them.

IP Check on WLAN Devices

We will check the IP addresses of the laptops. For now, checking only one of them is enough. Because, at the beginning if there is no Static IP Configuration and no DHCP, an IP from a special block is assigned to the devices. This is **APIPA (Automatic Private IP Addressing)** addresses. These addresses are from the block “169.254.x.x/25”. Simple, when we say this type of IP address in a device, we can say that it has no IP address.

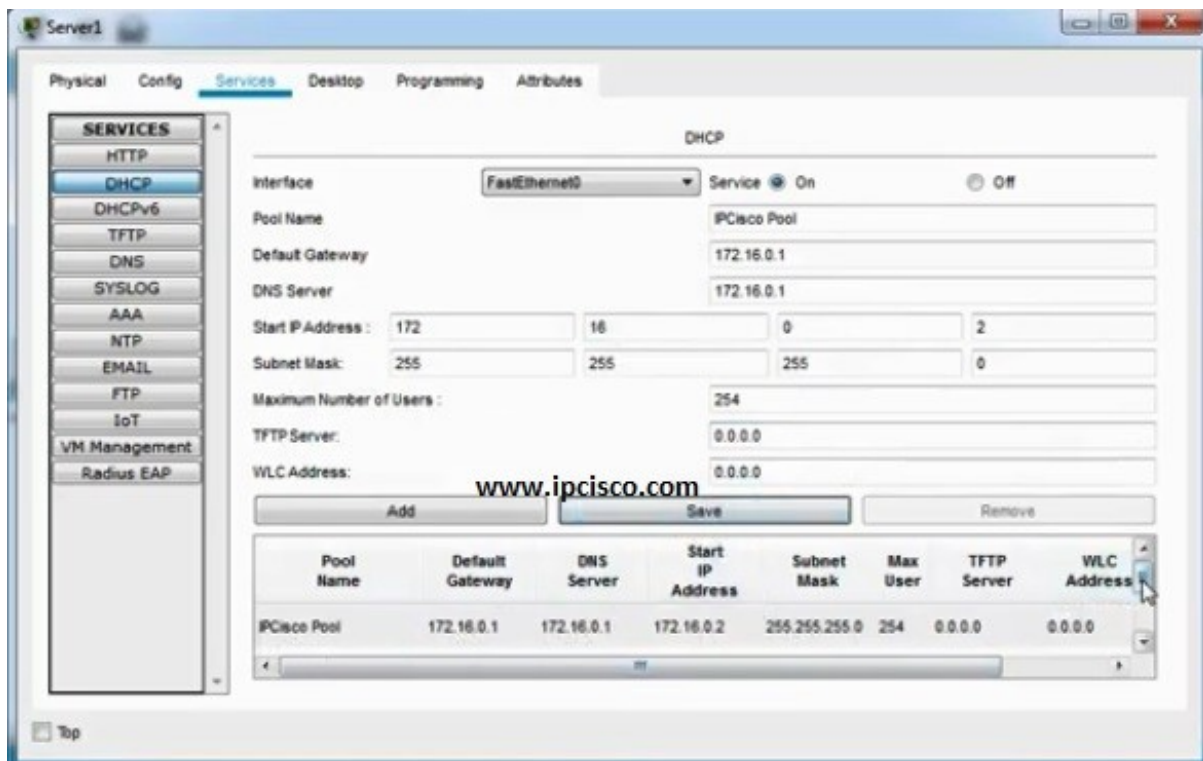


DHCP Server Configuration

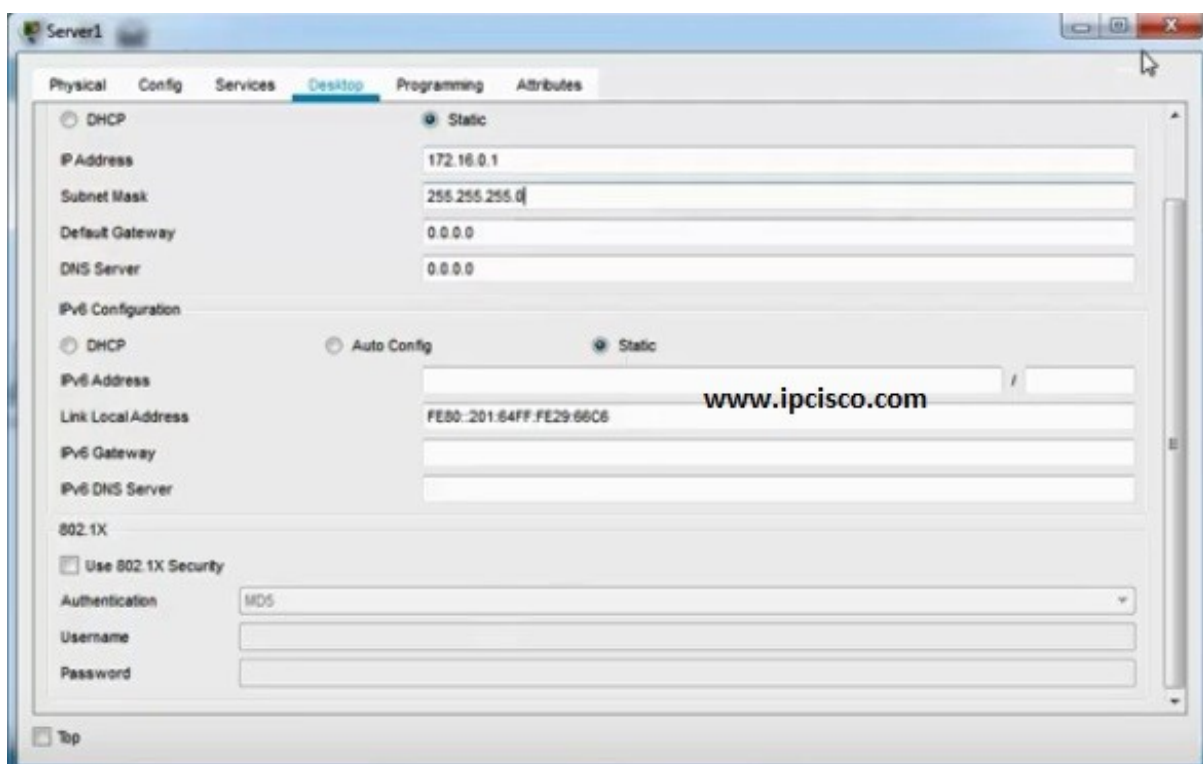
In this step, we will configure our **DHCP Server** in the WLAN. This server will give IP addresses to our devices who are connected to the **Access Point**.

In the Services tab of Server, we will go through the DHCP at the left hand. In here, we will define our IP Pool. For this configuration example our DHCP Pool's name is “**IPCisco Pool**”. Beside, we will configure the **Default Gateway**, **DNS Server IP** addresses. After that we will configure the **starting IP** and **Subnet Mask**. DHCP server will start IP assignation with this IP. And for this example, we have created **254** IP for our IP Pool. We also assign this value on this screen.

After this configuration, we should not forget to “**on**” our DHCP Service at the top and then, we add our DHCP Pool to the configuration with “**add**” button.



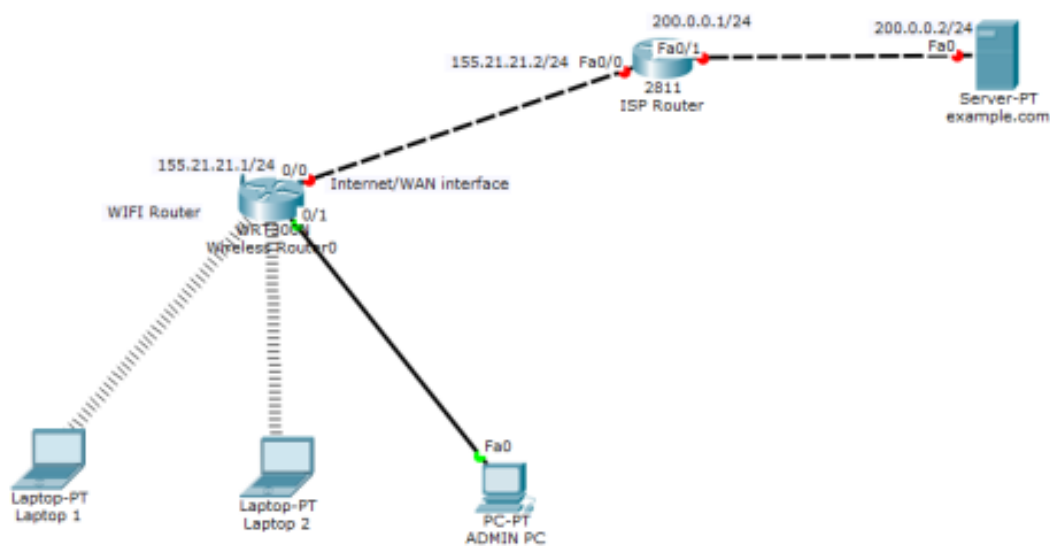
After DHCP Services configuration on **DHCP Server**, we will configure one more thing on this DHCP Server. This is the IP address and subnet mask of the Server. Here, our Servr IP address will be 172.16.0.1 and the mask will be 255.255.255.0.



Task 2: Wireless Router configuration in Cisco Packet Tracer

We'll go through wireless LAN configuration, wireless security and configuring the wireless router for internet connectivity. Briefly, here are the configurations we'll perform on the wireless router:

- Wireless LAN administration.
- Wireless LAN network setup.
- Securing a wireless network with WPA and WEP security features.
- Setting up internet connectivity on the wireless router.



In our network set up, we have two laptops and a PC which should connect to a LAN provided by one wireless router. The PC is used by the network Admin and connects to the LAN via an Ethernet port of wireless router. The laptops should connect to the same LAN by wireless means, and for this reason we'll install wireless adapters on them. Still, we'll need to connect the LAN to the internet via an ISP router.

Wireless LAN configuration

First get into Cisco Packet Tracer, pick a wireless router and two laptops, a PC, a generic server and a 2800-series router(or just any other router other than wireless).

Now connect the PC to the **Ethernet 1** of the wireless router.

For the laptops, replace the already-installed wired LAN module with a wireless adapter module (**WMP 300N**) .

Make sure that you first power off each laptop before you make any replacement then restore the power back after replacement. That's easy to do!

Once you have the wireless modules in place, you'll see the wireless connections come up between the laptops and the wireless router as shown below.

Next, we're going to do some settings on the wireless router to create a LAN then connect it to the internet.

To do any configuration on the wireless router, we'll use its GUI(Graphical User Interface) which we can access either by:

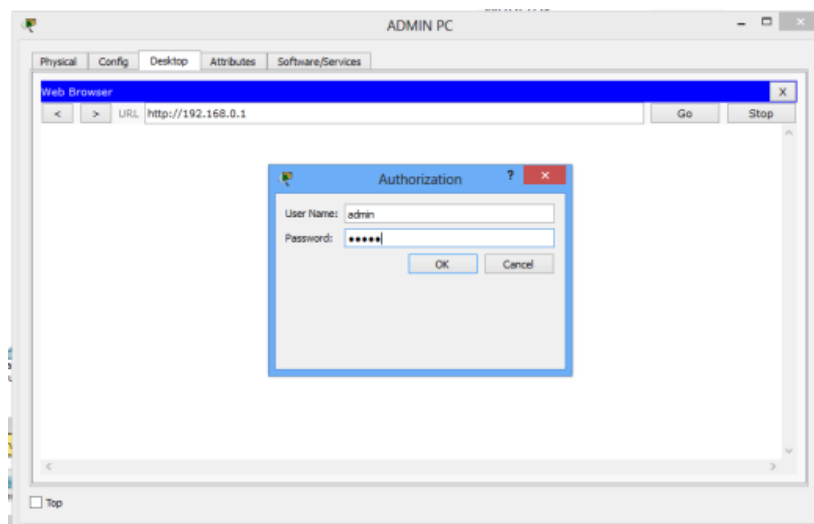
- Clicking the Wireless Router icon then **GUI tab**, or
- Using a browser in a PC or laptop in the LAN.

Let's use the PC to access the router GUI.

We'll access the router from the PC or the laptops using the router's LAN interface. The LAN interface is simply the default gateway of the LAN.

So now, on the ADMIN PC browser, type the IP address of the LAN interface of the wireless router.(192.168.0.1 by default), then hit **Go**.

A login prompt appears. Provide the username (**admin**) and password (**admin**) to be allowed into the GUI of the router.You can always change these settings later.



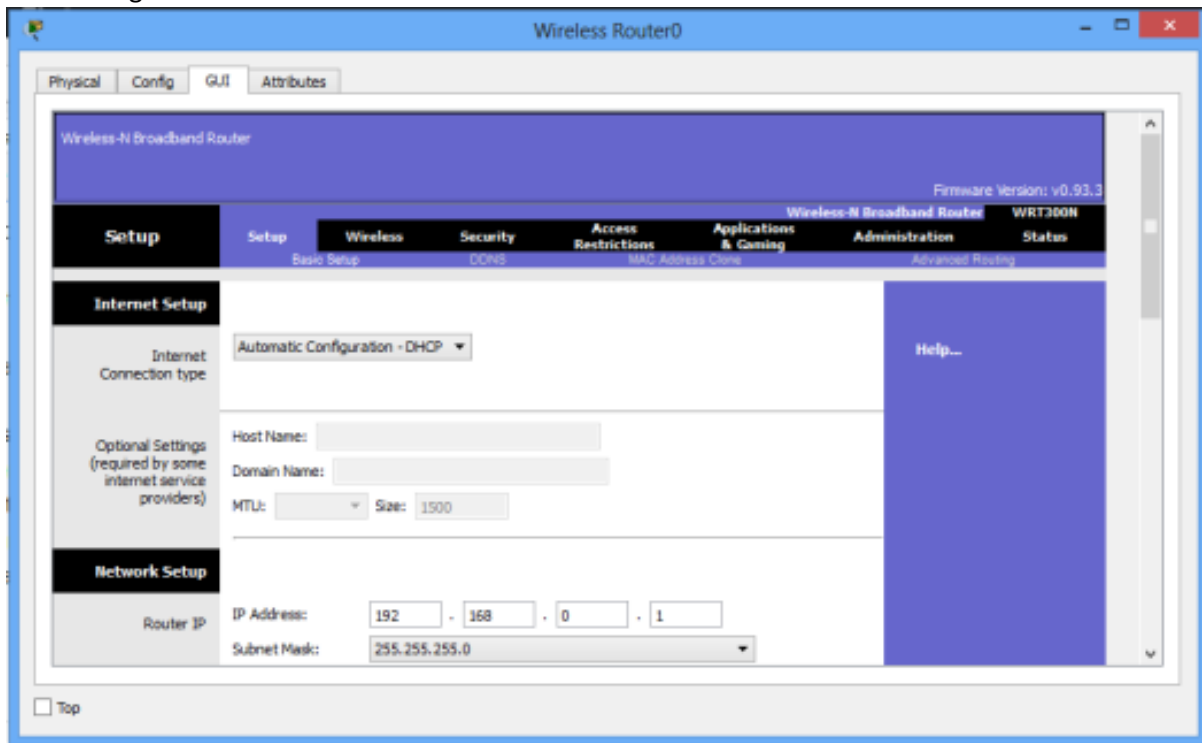
You should now be in the GUI of the router, whichever approach you chose to access it. Just examine it closely for a moment. On it, you can see several tabs like Setup, Wireless, Security, Access Restrictions, Application & Gaming, Administration and WRT 300N status.

We'll focus on setup, wireless and administration tabs.

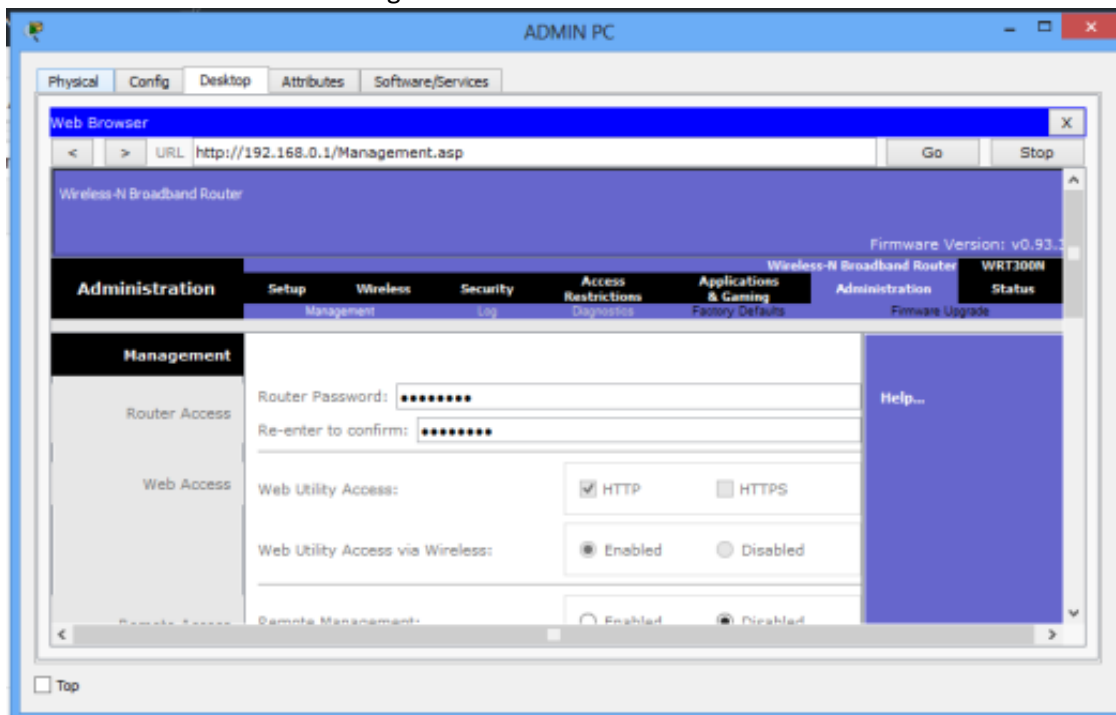
Wireless Router Administration

We'll begin with **Administration** in the GUI. Here we'll simply change the router's username and password.

On the browser of Admin PC, type the IP address of the LAN interface of the wireless router(192.168.0.1, by default). Hit **Go** to access the GUI of the router. Provide the default **username(admin)** and **password(admin)**. Click **OK**. You're now on the GUI of the router. See it on the figure below.



Click on the Administration tab and set a new password for administrative access. Scroll down and Save settings. You will be prompted for a username and the new password you just set. Type them and click OK. Wait a bit. A new screen appears confirming settings are successful. You can click on continue to continue with configurations.



To test for the new password entered, close the browser of Admin PC and try to access the GUI again using the browser. You'll now provide the new password you've just set.

The admin username and password are important, as only a network admin(or a user with admin rights) is able to log into the router and manage its settings.

Let's now move on to another setup.

LAN Setup and Internet Setup

To configure addresses for the LAN and internet connectivity, we'll use **Setup** tab.

Network Setup

Network setup means LAN setup. Already, we have a PC and three laptops in the LAN. We'll assign them IP addresses either statically or dynamically (using a DHCP pool set up in the wireless router).

The default LAN network address given here is 192.168.0.0 with a subnet mask of 255.255.255.0. The first address in this network (192.168.0.1 by default) has been assigned to the LAN interface of the router. It has just been named **IP address**. Obviously, all the PCs in the LAN will use the LAN interface as their default interface(to communicate to hosts in outside networks).

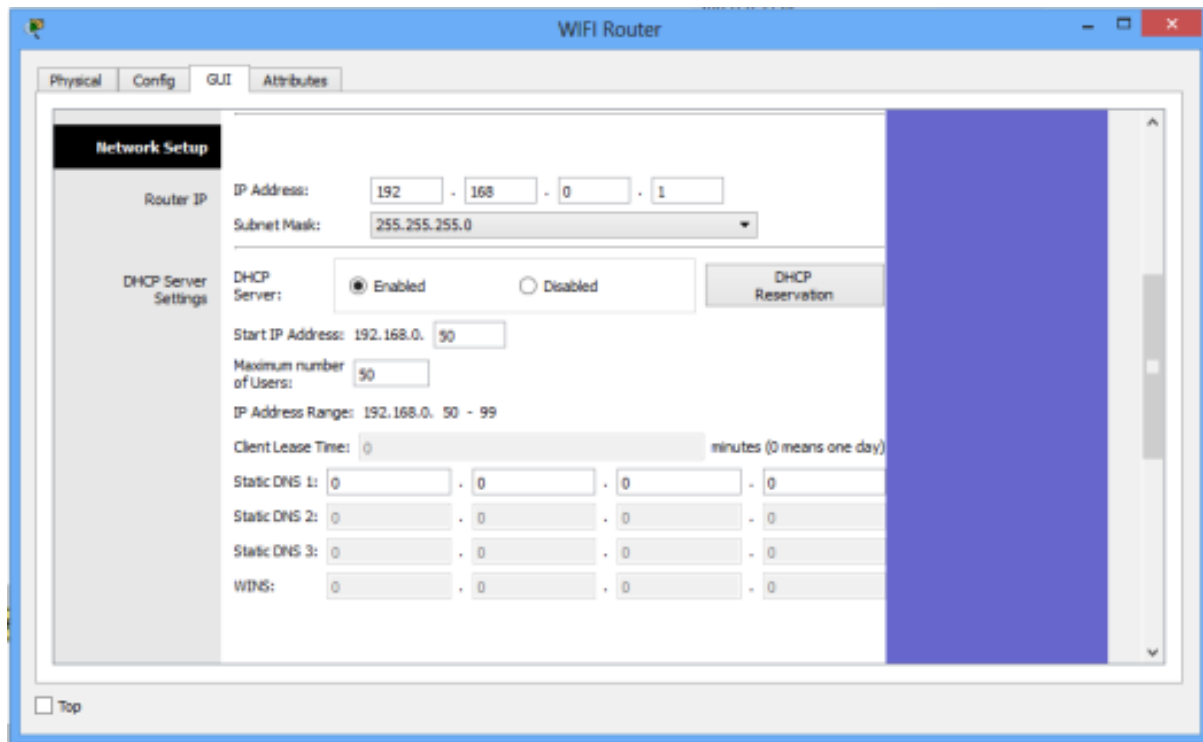
Now, in the router's network settings, you may choose to enable DHCP to dynamically assign IP addresses to the PCs. On the other hand, if you choose to disable DHCP, then obviously, you'll have to configure static IP addresses on the PCs.

When you choose to enable DHCP, set the **start address** for the LAN pool, **maximum hosts** to be allowed in your LAN and the **DNS server** for the LAN. The PCs will receive addresses automatically from the pool.

Now, going the DHCP way:

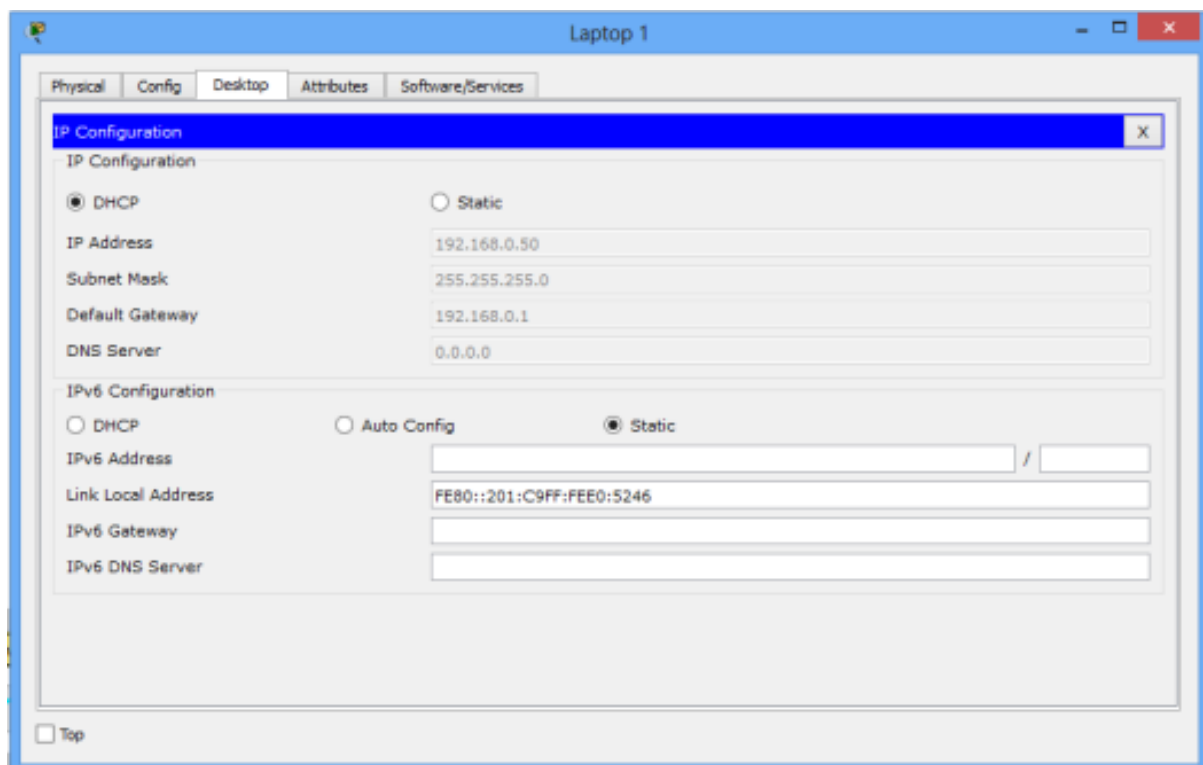
- Ensure DHCP is checked.
- Leave the **IP address** as 192.168.0.1 (This is the default LAN gateway address).
- Set a start address of 192.168.0.50 and set **maximum users** to 100 (or any number of users you want)
- You can leave the DNS server entry as it is (0.0.0.0) or specify the address of a DNS server of your choice.
- Scroll down and **Save settings**.

See the set up window below.



Moving on, let's enable DHCP on each PC for dynamic configuration. Go to the **IP configuration** tab for each PC and enable DHCP. Each PC should automatically obtain an IP address from the router.

As an example, here is the IP configuration for **Laptop1**:



Now let's test our wireless LAN.

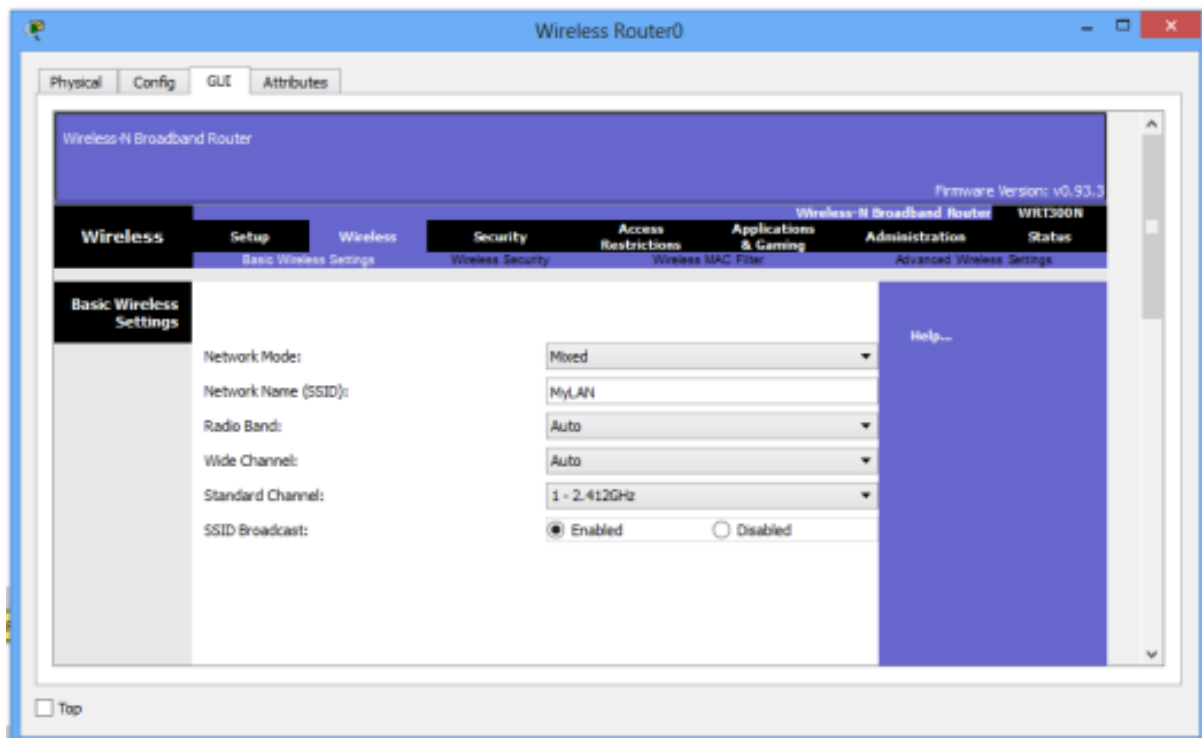
Ping PC2 from PC1. Ping should succeed.

Try also to ping the LAN interface of the router from one of the PCs ,say, PC1 . It should be successful.

Adding security for wireless LAN access

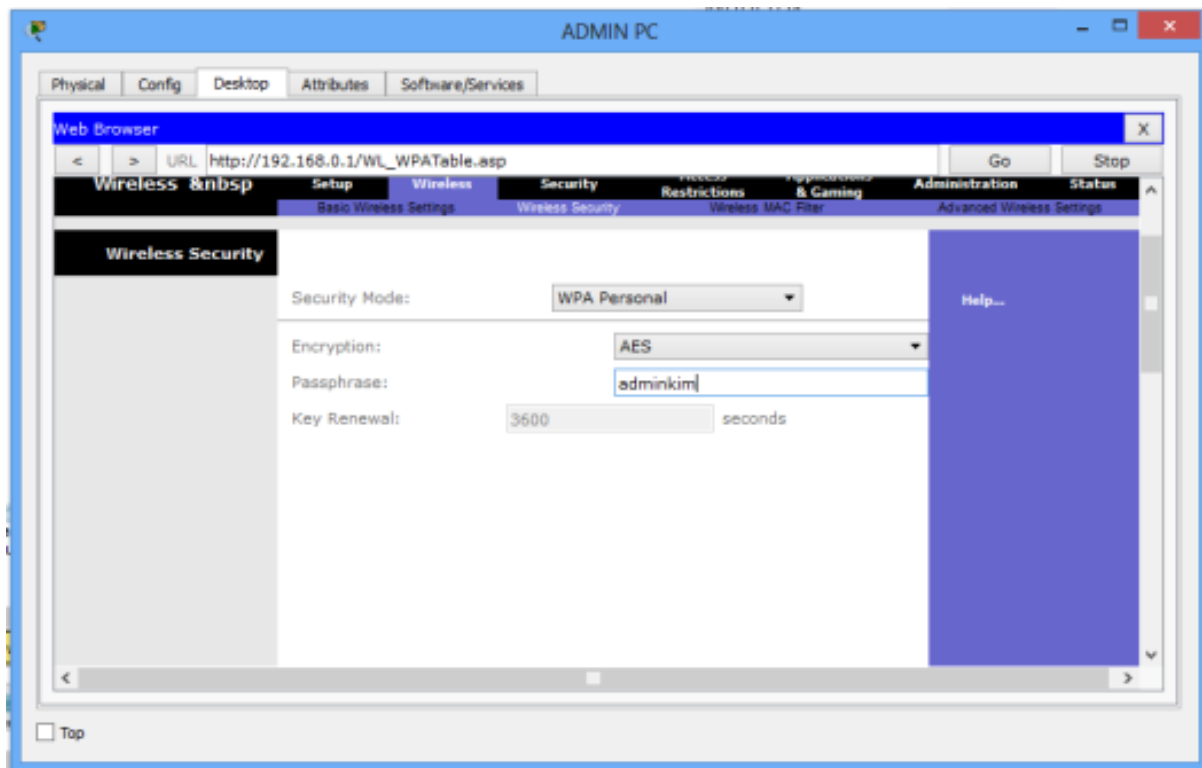
The LAN network we have just setup has no wireless security features enabled. If this was a production network, this would mean an obvious security threat since this makes the network accessible to unauthorized users. So let's implement some level of wireless security to our LAN.

Access the GUI of wireless router (either by clicking on Router icon or from Admin PC browser), then click on **Wireless** tab. Under the Basic Wireless Settings sub tab, change the default wireless **SSID** to any name of your choice. I have named mine '**myLAN**'. After this, don't forget to **Save settings**.



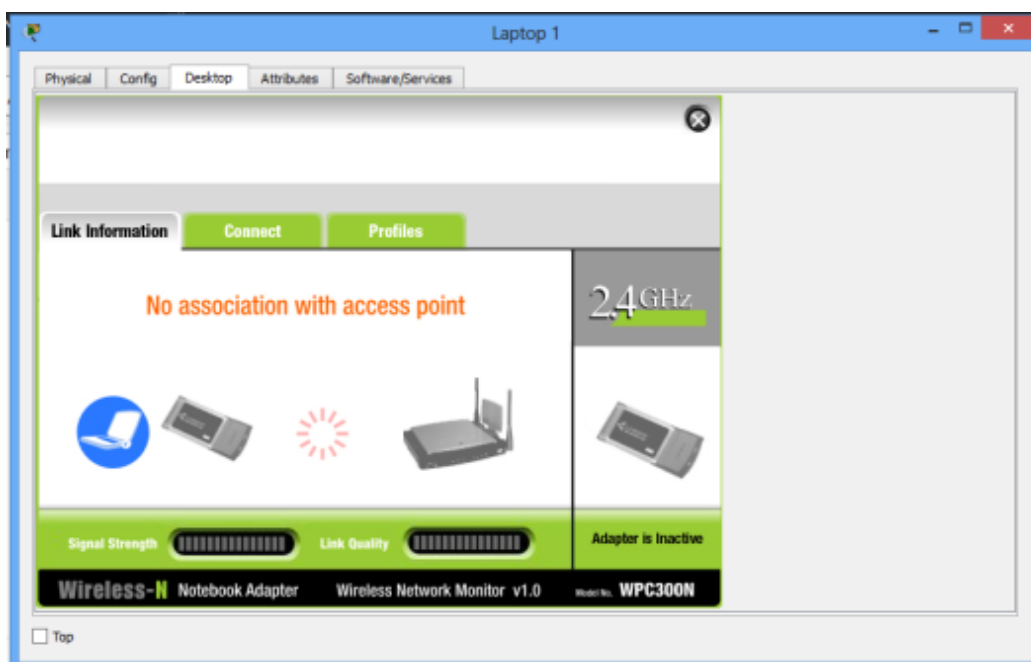
The acronym SSID stands for Service Set Identifier, and it's the name of your wireless network(wireless LAN).

Still, in the **Wireless** tab, under the **Wireless security** sub tab, change security mode to **WPA personal** , then set **passphrase** field to a password of your choice. Scroll down and **Save settings**

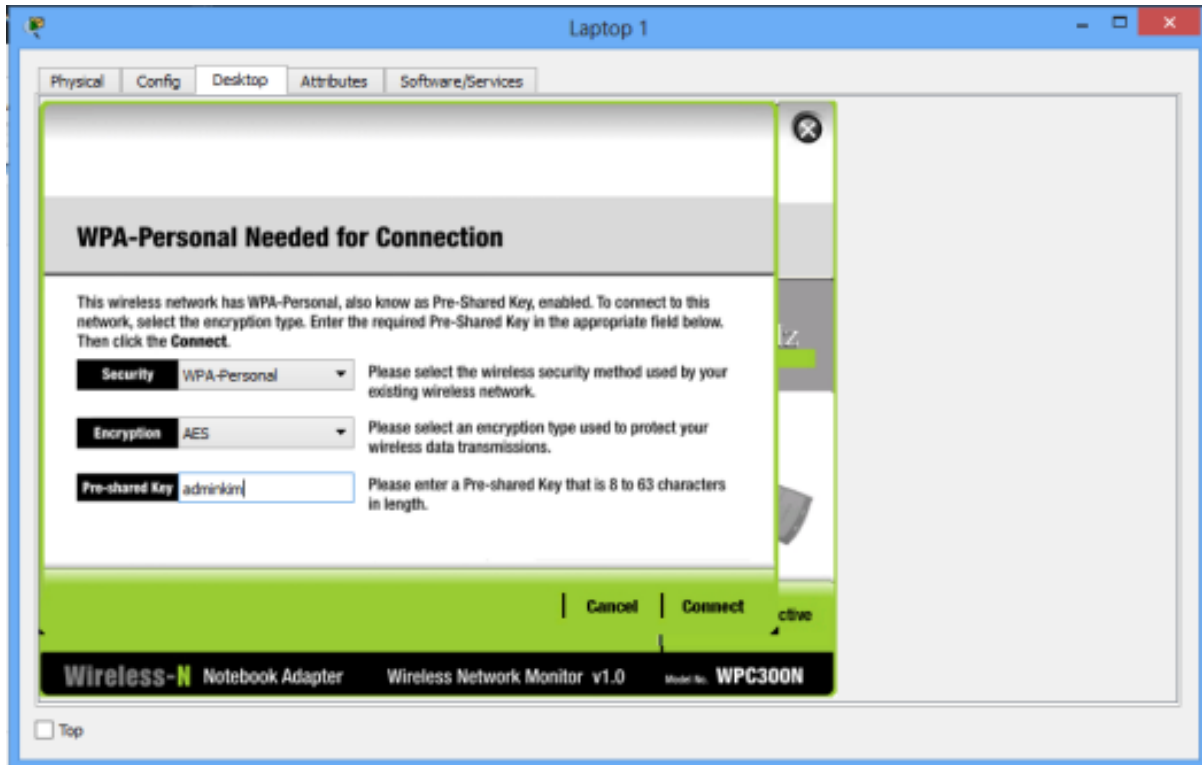


The LAN network is now secured for wireless access. To test whether its really protected, click **Laptop1->Desktop->Wireless**.

A new window appears that shows the now secured wireless network. Click **connect**. You can now see the name of the wireless network(**myWIFI** , in my case) and its signal strength. Site features listed include **WPA1 PSK** security feature.



Again, click **connect**, then provide the security **pre-shared key** for the WiFi that you set, then **connect**. **Laptop 1** is now connected to the WiFi network. You can see at the bottom right of the screen that the wireless network adapter on the laptop is active. Repeat this process for the Laptop2.



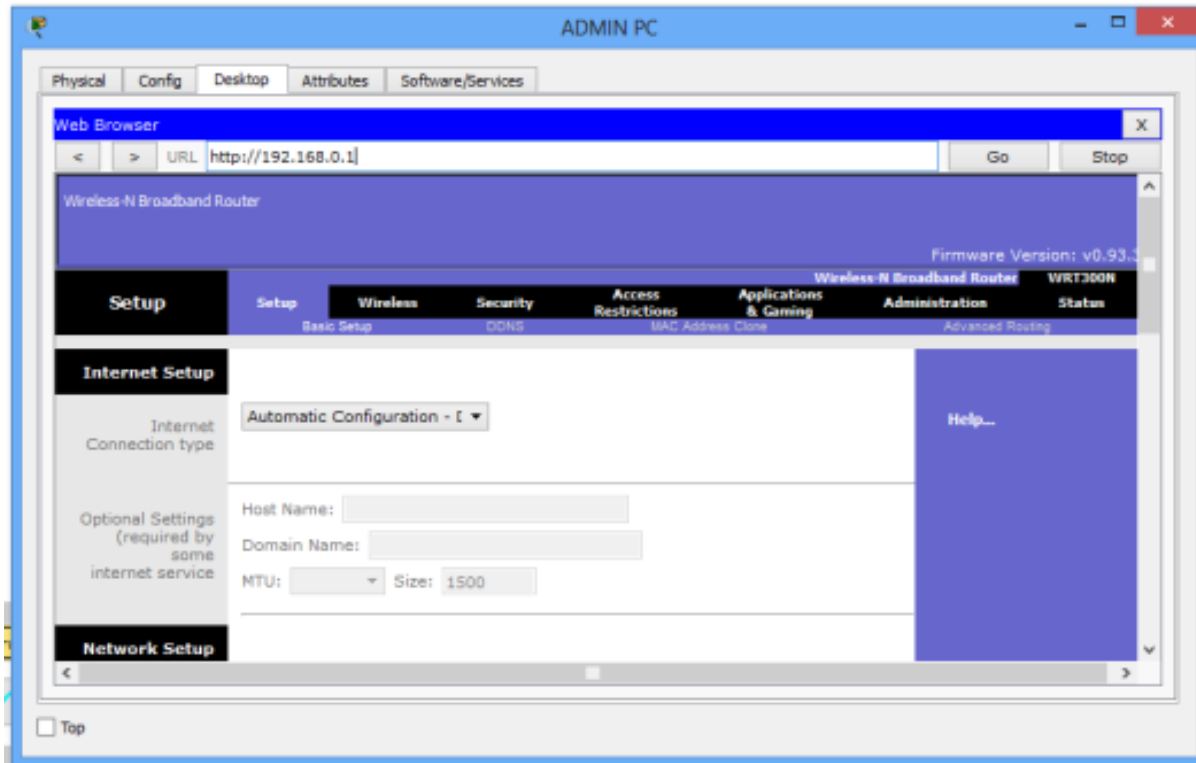
Now, you can change the wireless **security mode** to any other from the available options. You may choose **WEP** security feature for our wireless network, for example. For **WEP**, provide a 40-bit (10 hexadecimal digits e.g. **A123B456C789**) or 64 -bit key(16 hex characters). WEP and WPA configurations look almost alike.

Internet Setup

For this part, we'll configure the **internet interface** on the router so as to connect our LAN to the internet. Note that for different routers (from different vendors), the internet interface may be named differently; in some routers, for example, the interface may have the name '**WAN interface**', suitably because it's the interface that allows devices in our LAN to access the internet.

Here, we'll connect the internet interface to an ISP router which then connects to an internet server (**example.com**, as an example).

So now, access the **Internet Setup** tab on the GUI of the wireless router (either by clicking on its icon or from admin PC browser). Actually, in a real life router configuration, you'll use a PC browser. In this case you should remember the **username** name and the new **password** you set.



To Set internet connectivity , we'll need to set a static IP address on the interface or set interface as a DHCP client so that it will be assigned an address dynamically by the ISP router. Alternatively, you may use **PPPoE** to provide WAN connectivity to the internet.

Now, if you choose to configure a static IP address for the internet interface, you can specify also the **default gateway** and a **DNS server** of your choice.

And, if you'd rather like to have the internet interface address configured by DHCP, you'll then set the internet interface as a **DHCP client**. A DHCP server will be configured on another device, such as the ISP router (in our topology here!).

Otherwise, if you choose PPPoE for internet connectivity, then set up the **username** and **password** for PPPoE authentication. The internet interface will then become a **PPPoE client** and will negotiate for connection with a PPPoE server running on an ISP device so as to achieve internet connectivity. Usually the username and password will be provided by your ISP.

For now, we'll set the internet interface to act as a DHCP client (with the DHCP server configured on the ISP router)

So then :

First configure IP addresses and a DHCP server on ISP router.

```
ISP_ROUTER(config)#int fa0/0
```

```
ISP_ROUTER(config-if)#ip add 155.21.21.1 255.255.0.0

ISP_ROUTER(config-if)#no shut

ISP_ROUTER(config-if)#

ISP_ROUTER(config-if)#int fa0/1

ISP_ROUTER(config-if)#ip add 1

ISP_ROUTER(config-if)#no shut

ISP_ROUTER(config-if)#exit

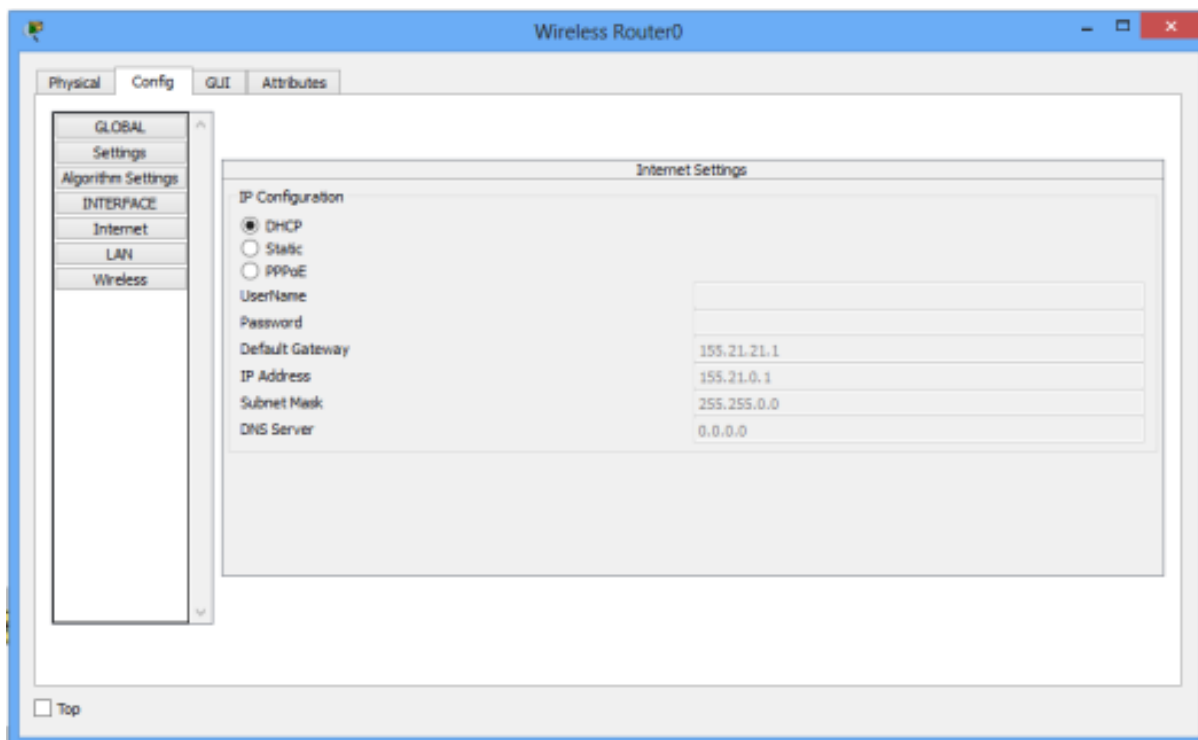
ISP_ROUTER(config)#ip dhcp pool mypool

ISP_ROUTER(dhcp-config)#net 155.21.0.0 255.255.0.0

ISP_ROUTER(dhcp-config)#default-router 155.21.21.1

ISP_ROUTER(dhcp-config)#dns-server 0.0.0.0
```

Now make the internet interface a DHCP client by enabling DHCP on it.



To verify DHCP configuration, click on the wireless router icon, then go to **Config tab**. Pick **DHCP**. The interface is now configured with an IP address from the pool set in the ISP router.

Next, we have to configure static or dynamic routes in the ISP router for the devices in the wireless LAN to gain access the internet server:

Here is a static route:

```
ISP_ROUTER(config)#ip route 192.168.0.0 255.255.255.0 fa0/0
```

Lastly, assign an IP address to the internet server (if you hadn't done so), then try to reach the server from a host in the LAN.

For example, you can ping the server from Laptop1. Ping should succeed.

Lab Tasks

- **Experiment 1:** WLAN Configuration on Packet Tracer
- **Experiment 2:** Wireless Router Configuration in Cisco Packet Tracer