

## Wireless Networks Simulation with Assessment in PT Software

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**Abstract:** Teaching and learning more theoretical subjects, such as wireless networks, where higher level of student's imagination is necessary to understand advanced topics can be positively supported through a technique called practical learning. Students can more easily understand and adapt the information from the subject, when they can visually see how it really works. Teachers can present the subject using animations and practical examples, rather than just talking about theory facts. This paper presents the features of a practical learning tool called Packet Tracer - a computer networks simulator also used for wireless networks, which is freely available for all Cisco Networking Academy students. Packet Tracer includes features for assessment task authoring with automated scoring and reporting. We believe that this analysis helpful for wireless network students as well as faculties.

**Keywords—***Packet Tracer (PT), Wireless Access Point (AP), IBSS (Independent Basic Service Set), BSS (Basic Service Set), ESS (Extended Service Set).*

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### I. INTRODUCTION

Practical learning (with visual learning tool like packet tracer) is the use of graphics, images and animations to enable and enhance learning. It is a proven method in which ideas, concepts, data and other information are associated with images and animation, resulting in an easier and more effective method of transmitting skills. Students can understand theoretical concepts of wireless networks much easier if they can see them, or interact with them as in the real life. Teaching Learning with packet tracer tool helps students to open their minds and think graphically.

For this reason, the tools with the GUI (Graphical User Interface) support is one of the most important things. It can be seen, it can be felt and it can be touched.

As wireless networks are becoming more complex, new curricula and learning tools are needed to help students to acquire solid skills about wireless networks. In this paper, we discuss our teaching learning experience of wireless networks. To do so, we present one of the well-known tools (packet tracer) [1][3].

The rest of the paper is organized as follows. In section II we briefly introduced the different wireless devices available in the packet tracer simulator. Section III conducted sessions and observations. Conclusion and future work are discussed in Section IV.

### II. DIFFERENT WIRELESS DEVICES AVAILABLE IN THE PACKET TRACER SOFTWARE

Here, in this section different wireless network devices are presented in packet tracer with their explanation with all the parameters in packet tracer software.

#### A. Wireless Access Point (AP)

You will find a central component like a hub or switch in the vast majority of wired networks that's there to connect hosts together and allow them to communicate with each other. It's the same thing regarding wireless networks; they also have a component that connects all wireless devices together, only that device known as a wireless access point (AP). wireless APs have at least one antenna.

APs have the following characteristics:

- APs function as a central junction point for the wireless stations much like a switch or hubs.
- APs have at least one antenna-most likely two.
- APs function as a bridge to the wired network.
- APs come in two flavors- the stand-alone AP and the wireless router.[1][2]

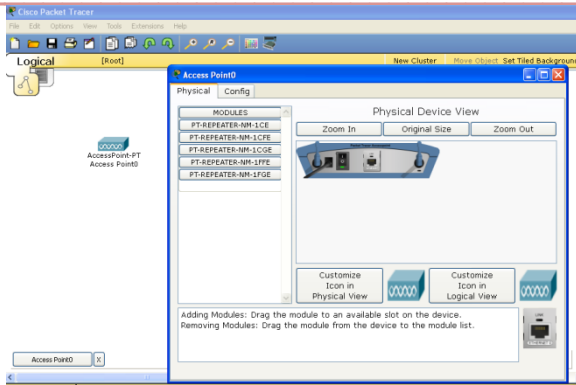


Fig 1: wireless Access point in packet tracer.

Wireless access point usually includes functions like network address translation (NAT) and dynamic host configuration protocol (DHCP). you can compare an AP TO Hub because it doesn't create collision domains for each port like a switch does, but APs are definitely smarter than hubs.

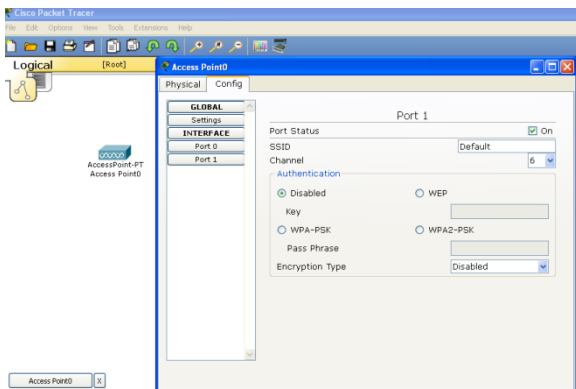


Fig 2: wireless Access Point settings in packet tracer.

In above Fig.2 given configuration of AP in that port status is on. SSID which in our case it is default also we can set any numerical value for simple security purpose and also given different security protocols like WEP and WPA.

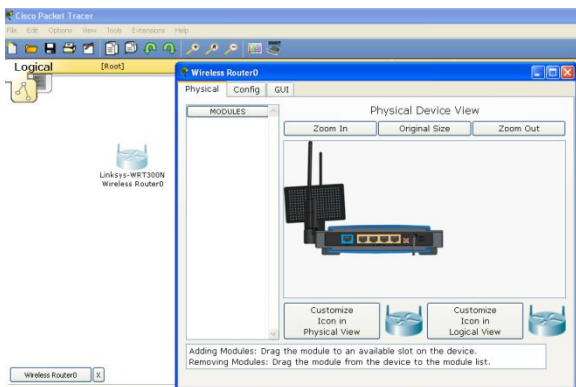


Fig 3: Linksys Wireless Router in packet tracer

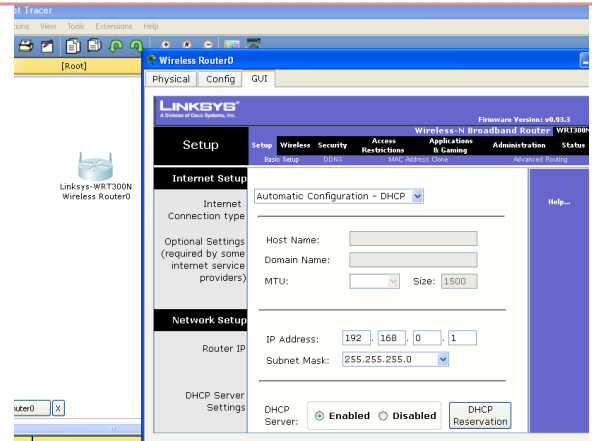


Fig 4: Wireless Router with GUI based configuration in packet tracer

As given in Fig 3 and Fig 4 wireless router like an original physical router same configuration is given in packet tracer so by practical, students will easily know how to configure original physical router.

### B. Wireless Network Interface Card (NIC)

Every host you want to connect to a wireless network needs a wireless network interface card (NIC) to do so. Basically, a wireless NIC does the same job as a traditional NIC, only instead of having a socket/port to plug a cable into; the wireless NIC has a radio antenna. [1]



Fig 5: Wireless NIC is attached with PC in packet tracer.

As given in Fig 4 facility provided in packet tracer by which we can remove Ethernet connector (wired NIC) and by drag and drop we can add wireless NIC card to PCs and Laptops.

### C. Wireless Antenna

Wireless antennas work with both transmitters and receivers. There are two broad classes of antennas on the market today: Omni-directional (or point-to-multipoint) and directional (or point-to-point).

Directional antennas usually provide greater range than Omni-directional antennas. Because directional antennas focus all their power in a single direction. Omnis must disperse the same amount of power in all directions at the same time.

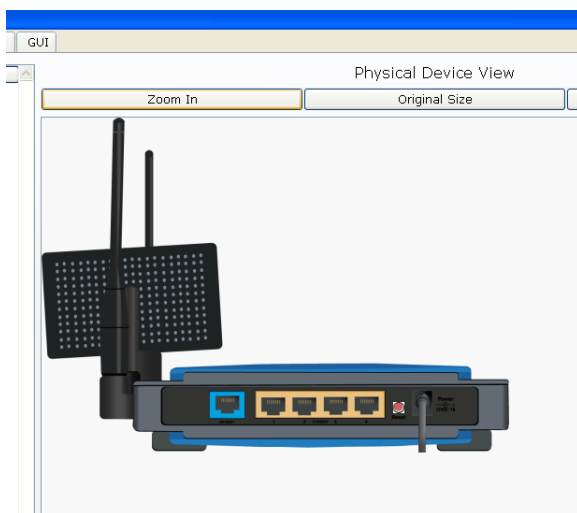


Fig 6: Wireless Router with antennas in packet tracer

### D. Wireless Topologies

There are many types of networks we can run across or design and implement.

- Independent Basic service set (Ad Hoc): in this mode, the wireless NICs (or other devices) can communicate directly without the need for an AP. A good example of this is two laptops with wireless NICs installed. If both cards were set up to operate in ad hoc mode, they could connect and transfer files as long as the other network settings. We will also call this an independent basic service set (IBSS), which is created as soon as two wireless devices communicate. To create an ad hoc network, all we need is two or more wireless-capable devices. Once you've placed them within a range of 20-40 meters of each other, they'll see each other and be able to connect- this can also practically be done in packet tracer software. So students can easily understand the idea of an ad-hoc network.

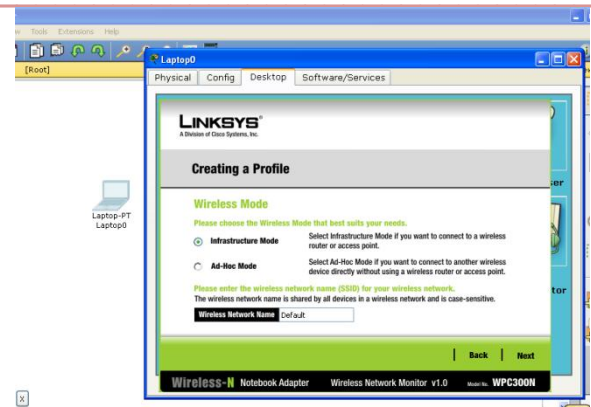


Fig 7: Ad-hoc mode setting in packet tracer

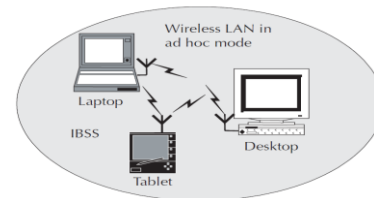


Fig 8: mobile ad-hoc network an example. [10]

An ad hoc network also referred to as peer to peer, doesn't scale well and I wouldn't recommend it due to collision and organization issues in today's corporate networks. Additionally, ad hoc networks are a fairly insecure method, and care should be taken to have the Ad hoc setting turned off prior to connecting to your wired network. [12]

- Basic Service Set (BSS): A basic service set (BSS) is the area, or cell, defined by the wireless signal served by the AP. It can also be called a basic service area (BSA) and the two terms, BSS and BSA, can be interchangeable. [2] As shown in Fig.9 the AP is not connected to a wired network in this example, but the AP provides management of wireless frames so the hosts can communicate. Unlike the ad hoc network, this network will scale better and more hosts can communicate in this network because the AP manages all network connections.
- Extended Service Set (ESS): A good thing to know is that if you set all your access points to the same SSID, mobile wireless clients can roam around freely within the same network. This is the most common wireless network design you'll find in today's corporate settings. Doing this creates something called an extended service set (ESS). [2]

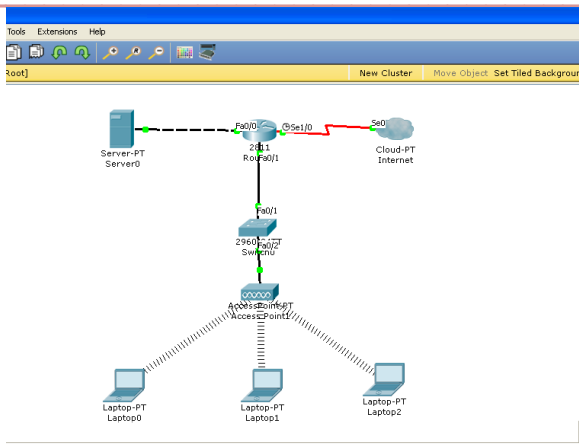


Fig 9: Basic Service set/basic service area in packet tracer. Which provide more converge than a single access point and allows users to roam from one AP to another without having their host disconnected from the network. This design creates the ability to move or less seamlessly from one AP to another. [4]

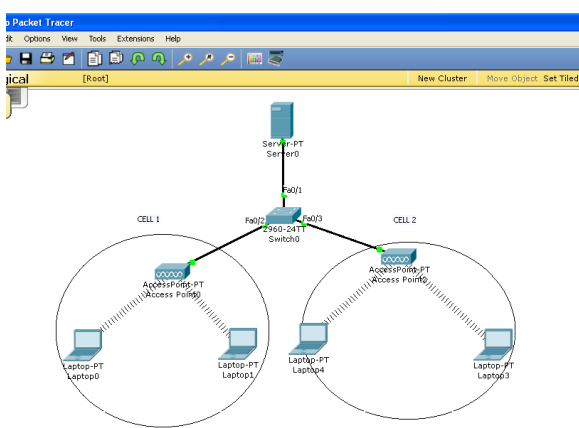


Fig 10: Extended service set (ESS)

**E. Students Assessment in Packet tracer**

Activity Wizard facility is provided in packet tracer as given Fig 11. The activity wizard is an assessment tool that allows you to create detailed networking scenarios for students or other users. grouping of networks users and resources connected to administrative defined ports on a switch. When you create VLANs, you’re given the ability to create

In our session we have given students to complete scenario given as.

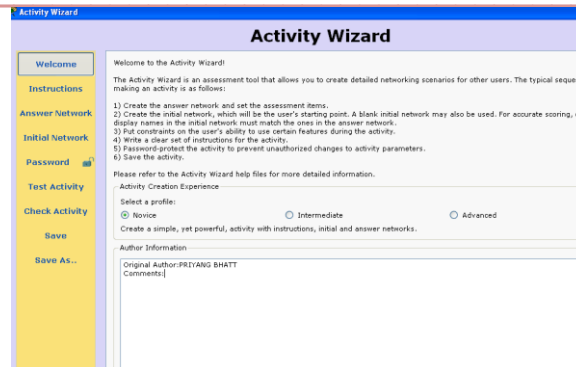


Fig 11: Activity Wizard in Packet Tracer

As Shown in Fig 11: Activity Wizard, Teacher can create their activity given as below if activity is completed or not message will be display on the screen after clicking on check activity button. How many activities completed out of total activities.

Here I have given one example of such activity. That we have given during out session.

Activity 1: Adding and configuring network devices  
Open the “Wireless.pka” file and follow the Instructions, which are repeated here:

Step 1: Add a server, a printer, a wireless access point, and two generic PCs.

Step 2: Remove the Ethernet modules and add wireless modules for the 2 PCs and the printer. Make sure to power off the devices before removing the modules and power on the devices once the wireless modules have been added.

Step 3: Connect the server to the wireless access point using a cross-over cable.

Step 4: Change the name of PC0 to Workstation, PC1 to Laptop, Server0 to Server, and Printer 0 to Printer.

Step 5: Configure the devices with the following addresses:

Workstation – IP Address 192.168.1.1/24

Laptop – IP Address 192.168.1.2/24

Server – IP Address 192.168.1.3/24

Printer – IP Address 192.168.1.4/24

Step 6: Verify connectivity. From Workstation use the PING command to test connectivity to Laptop.

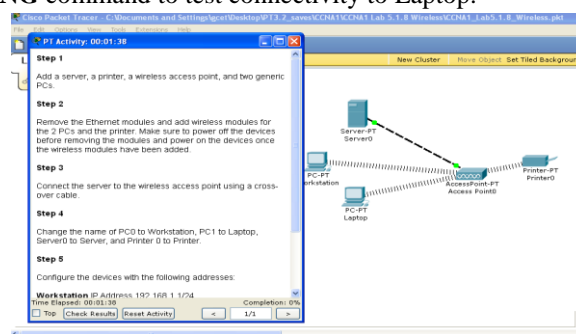


Fig 12: Activity Wizard in packet tracer

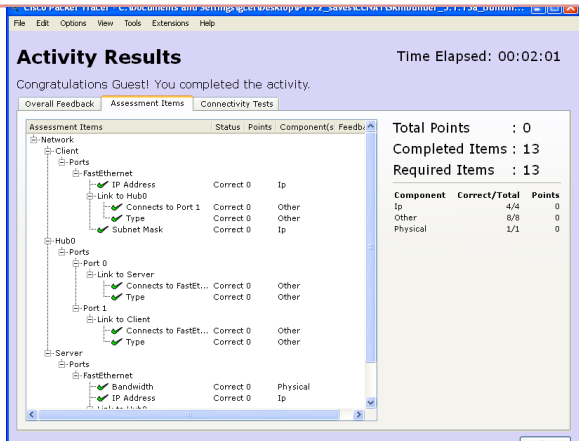


Fig 13. Activity Result in packet tracer

Activity Results given in above Fig 13. in our session several such activity have been given to the students and after completion, assessment result will be generated which include time Elapsed, completed items, required items etc.

III. CONDUCTED SESSIONS AND OBSERVATIONS

A. Conducted Sessions Schedule

A scheduled of conducted sessions are given in Table 2.

TABLE 2. CONDUCTED SESSIONS SCHEDULE

SESSIONS	TIME	DAY	NO.OF.STU DENTS
1	10:00 AM TO 6:00 PM	22 <sup>ND</sup> MAR 2013	18
2	10:00 AM TO 6:00 PM	26 <sup>TH</sup> MAR 2013	30

Each session were conducted with packet tracer simulator, started with the introduction to packet tracer simulator with simple topology for wireless network.

After completion of each session we were given some practical task as an assignment to every student with the time period of 30 minutes.

B. Observation Details

Qualitative feedback was collected from each student; the intension was to understand their personal viewpoint of their experience in the sessions as well as participating in the activities.

At the end of the session, before departure, the students were asked to complete a short anonymous questionnaires with questions listed in Table 1.

TABLE 1. QUESTIONNAIRE FOR STUDENT FEEDBACK

NO	QUESTION	Y	N
1	Has this session enhanced your practical understanding and concepts of wireless networks?		
2	Have you ever tried packet tracer for implementing the wireless networks?		
3	Have you properly understood the wireless networks concepts presented in this session?		
4	Is this tool (packet tracer) is useful to you in coming future?		
5	Are you ready with the some emerging concepts of wireless network security like WEP and WPA configuration using packet tracer tool?		

The questionnaire results are summarized in graph. As the groups are small, and the questionnaire short, there are no missing responses. The students were able to drop the forms into a box on departure. There was no additional personal information requested.

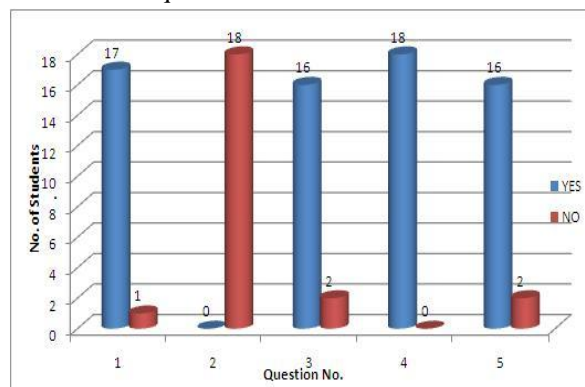


Fig 13: session 1 questionnaire results (18 students)

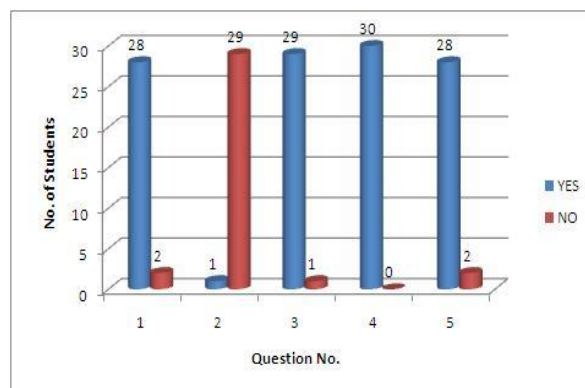


Fig 14: session 2 questionnaire results (30 students)



## IV. CONCLUSIONS AND FUTURE WORK

Wireless Networks is becoming more and more important in today's era. Then, it is an essential area in the training of computer science students. Wireless network is complex concepts that are not easy to understand at first glance. To facilitate the teaching and learning process of Wireless networks, visual tools can be used. In this paper, we presented a well-known tool (Packet Tracer) that can significantly help students to become familiar with wireless networks. This tool allows users to do labs with several simulated access points with number of PCs or Laptops with wireless NICs, that is, without the need of a real and expensive devices and software like AP wireless routers etc. They have advanced GUIs to ease settings, and animations to facilitate the understanding of ideas. This tool enables a direct look inside of a different configuration of wireless devices. So students can visually see and therefore more easily understand that what is really going on in the Wireless networks.

For future work, we plan to next session in coming future for other security concepts like WEP, WPA-2, AAA server for authentication in wireless network and other security concepts using packet tracer for wireless networks.

## ACKNOWLEDGMENT

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