



**Lab 4: Wireless Topology**

**EE-450 (Lec : 30454)**

**Session #4 (Dis : 30503)**

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**■ Abstract**

The ns3 is a discrete event network simulator, widely used in academia and industry. In this lab, you will be simulating a combined network topology that includes a point to point link, an Ethernet link as well as Wireless links using NS3.

**■ Answers to Questions**

**• Total how many times ARP requests are issued (add up for all the segments of the Network)? Why?**

Total ARP requests are 4 for all the segments of the network.

UDP Echo Client application is installed at 10.1.3.3, and WiFi AP is at 10.1.3.4. In order to send udp packet from udp client to csma network, UDP Echo Client must know WiFi AP's mac address. Also, in order to send received udp packet from WiFi AP to udp client, AP needs to know udp client's mac address.

In CSMA network, UDP Echo Server is at 10.1.2.4, and router is located at 10.1.2.1. When udp packet is sent from WiFi network, router needs to know the mac address of udp server whose ip address is 10.1.2.4. Also, when udp server response to the udp echo message, server needs to know the router's mac address since destination is located at the other network.

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| **[third-0-1.pcap]** |
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**• What are the steps of a connection establishment to a Wireless Access Point? (Hint. Check the trace third01.pcap)**

Since this wireless network is using passive scanning, beacon frames are sent from AP.

When clients get the beacon frame, they send Association Request frame to AP.

When AP gets the request frame, it sends back Association Response frame to the clients.

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**♣ Now By default, the program assigns some standard IP address to the network.**

**Change the Base network addresses. (Hint: Look at the lines “address.SetBase ("10.1.1.0", "255.255.255.0");” ) Be careful in assigning the IP addresses. They must be nonoverlapping.**

**Furthermore, the original code creates 3 WIFI devices , by default.**

**Change the number of devices to 10 by using the following command:**

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| ./waf run "scratch/mythird tracing=true nWifi=10" |

As seen below, I changed base network addresses into 10.1.101.0, 10.1.102.0 and 10.1.103.0.

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**• From the trace files, how would you calculate the number of wifi devices connected to the AP? (Hint. Check the trace third01.pcap )**

When you count Association Request and Response pairs, there are 10 wifi devices connected to the AP.

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**• What is the maximum number of Wifi devices that can be created with this program?**

According to the code, maximum number of Wifi devices are 250.

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| if (nWifi > 250 || nCsma > 250)  {  std::cout << "Too many wifi or csma nodes, no more than 250 each." << std::endl;  return 1;  } |

**♣ Next, Change the Probing mechanism in WIFI devices to Active probing by changing the following line in the code**

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| mac.SetType ("ns3::StaWifiMac",  "Ssid", SsidValue (ssid),  "ActiveProbing", BooleanValue (true)); |

**• Run the program again (With 10 WIFI nodes) and then, based on the trace third01.pcap point out the differences between the active probing and nonactive (passive) probing.**

In active probing, clients first send Probe Request frames to broadcast, and then AP sends back Probe Response to clients. When clients get the Probe Response, they send Association Request to the destination which is AP's ip address. AP now sends back the Association Response to the clients.

In conclusion, active probing have more steps for Probe Request and Probe Response.

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**■ Conclusion**

**• Write a summary of what did you learn by doing this lab exercise**

From this lab, I learned a program, NS3, which can simulate network interfaces close to the real network. I learned its functions and mechanism to run the simulation.

I also could learn that Wireless network and CSMA network can be connected together with the help of interface. I could see the concrete process of ARP mechanism and the communication steps of Active Probing and Passive Probing.