

PRACTICUM MODULE XI

Address Resolution Protocol (ARP)

COMPETENCE:

- Students **know** the ARP tool (C1)
- Students can **use** ARP Tool (C3)

TOOLS AND MATERIALS:

- Software Simulator GNS3
- Stable internet connection
- Connected to an IT Department VPN Server

Theory Review

1. TCP/IP

TCP/IP (Transmission Control Protocol / Internet Protocol) is a data communication standard used by the Internet community in the process of exchanging data from one computer to another in the Internet network. The TCP/IP protocol was developed in the late 1970s and early 1980s as a standard protocol for connecting computers and networks to form a wide network (WAN). TCP/IP is an open network standard that is independent of the physical network transport mechanism used, so it can be used anywhere.

Definition of Each Layer in the TCP/IP model

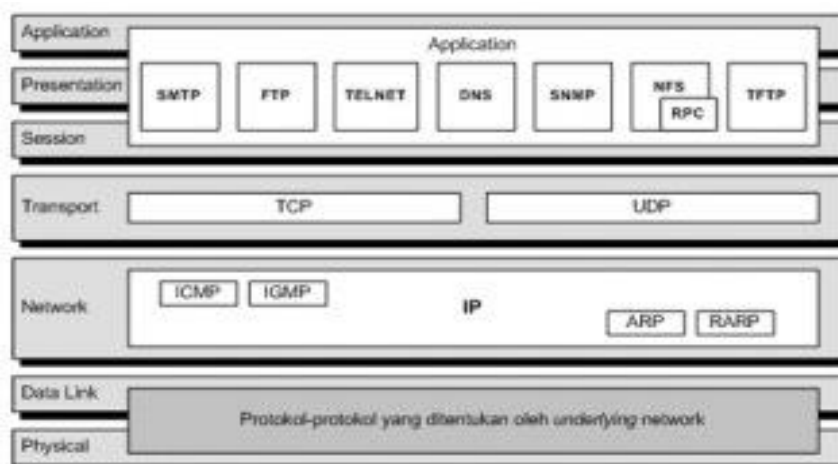


Figure 1. Seven-layer OSI and four-layer TCP/IP model arrangement

IP addresses are required by software to identify computers on a network, but the actual identity number is set by a *NIC (Network Interface Card)* or Network card that also has a unique number. Addressing in NICs is commonly referred to as MAC Address. This addressing is part of ethernet.

This physical / Mac address of network card consists of 48 bits, 24 bits ID from the manufacturer, while the remaining 24 bits are *sequence numbers*. Therefore, each TCP/IP network card implement this standard as a working mechanism of the network, so that software and hardware from various vendors can communicate with each other. In order to work, TCP / IP requires network hardwares, in this case is *Ethernet layer*, although ethernet is not part of TCP/IP, TCP/IP only interacts to use its facilities to move packets.

To send data to another computer, the software compiles an in-memory ethernet frame as follows:

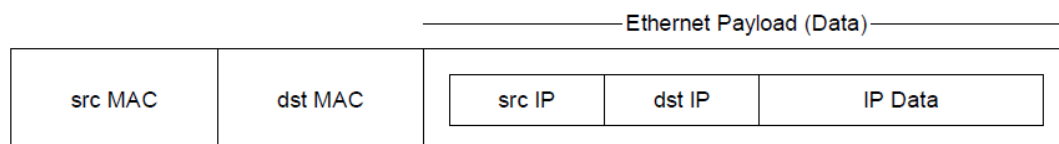


Figure 2. Ethernet Packets

In figure 2 is an IP reference to the MAC address so that the data is sent to the correct computer according to the physical address. When the computer knows the IP number but does not know the MAC, TCP/IP solves this problem by using ARP (Address Resolution Protocol)

2. ARP (Address Resolution Protocol)

ARP works on the **Network Layer** Internet Protocol (IP) which deals with routing data from source to destination. Elementary package delivery services.

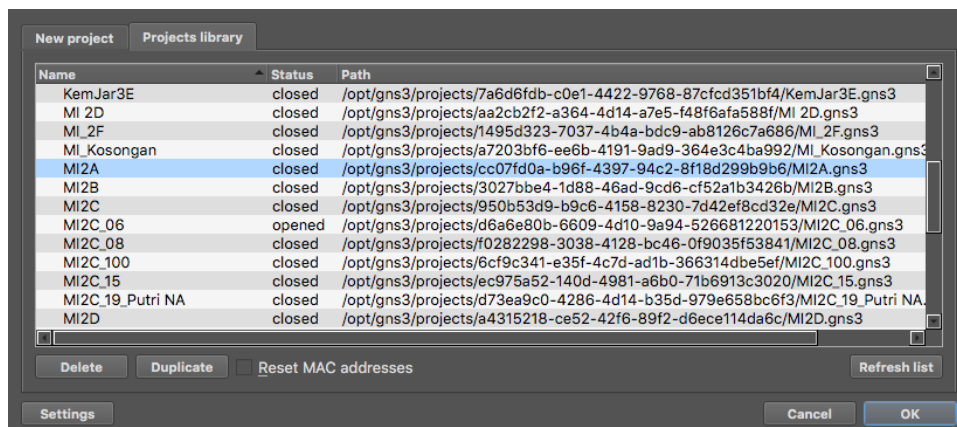
Internally, ARP performs address resolution and ARP is directly related to the Data Link Layer. ARP processes a table containing IP-addresses and Ethernet cards. And this table is filled after ARP requests (broadcasts) to the entire network.

For example, the user runs the ssh command (ssh is a command in Linux that is used to run certain machines from other machines) with a host for example: 192.168.1.1 (#ssh 192.168.1.1). After the user runs the ssh command, the system will check the ARP cache to find a physical address number related to the IP address. If this information is not found, then the host will issue a special ARP request. The ARP Request is encapsulated with all the information needed except the destination physical address, because the host does not know where the physical destination is. Usually the destination address for this

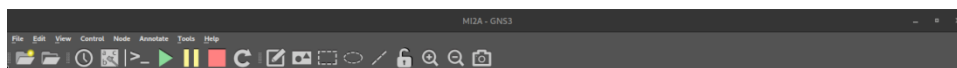
request is using FF:FF:FF:FF (broadcast physical address) to send the packet to the network. Because it is a broadcast packet, all systems/hosts/workstations on the local network will process the request. The ARP request/Reply package has the same format.

PRACTICUM PREPARATION

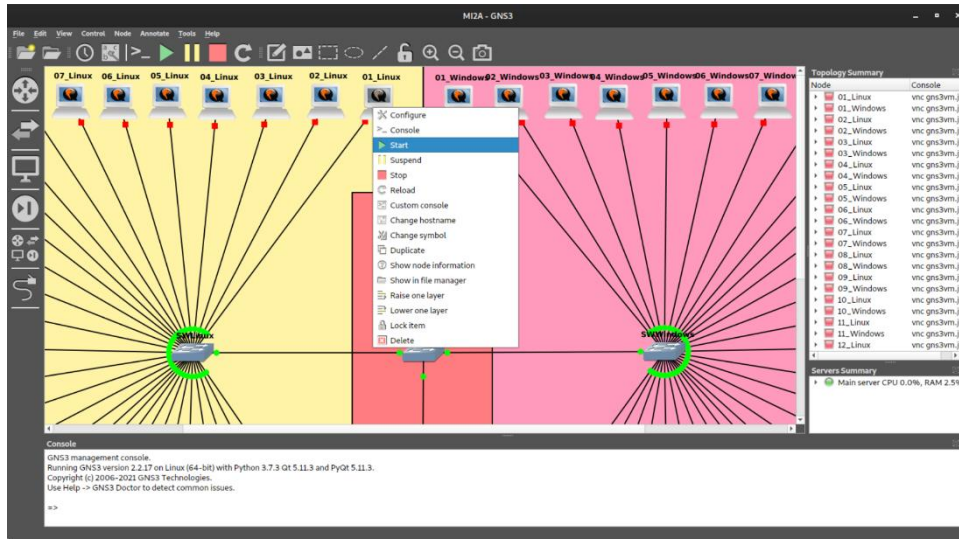
1. Connect your computer to the internet network.
2. Connect your computer to the Information Technology Department's VPN server using the OpenVPN Connect app. Use the profile, username and password that you have obtained in the previous meeting.
3. Once connected to the OpenVPN server, open the GNS3 application on your computer.
4. On the initial screen of the GNS3 application window, select the Project library tab. Then select the project you've set up for your class (e.g. MI2A). Then uncheck the Reset MAC Address option. Then press the OK button.



5. Then after the project opens in the main window of the GNS3 application, you can adjust the zoom on the project display to your liking by pressing the positive magnifying glass button (to zoom in) or the negative magnifying glass button (to zoom out) on the top toolbar of the window.



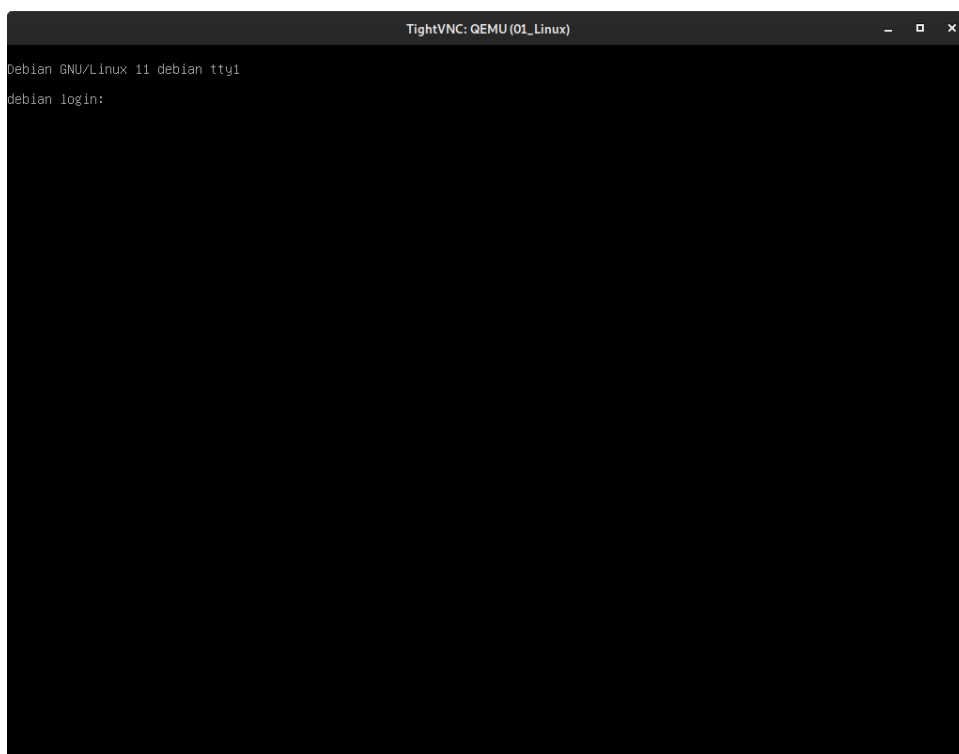
6. Then you can turn on the computer you are going to use. To do this, right-click on the logo of the computer you want to use, then select the Start option.



- Wait a few moments and you can check the status of turning on or not your computer on the Topology Summary sidebar on the right side of the window.

Node	Console
01_Linux	vnc gns3vm.jf
01_Windows	vnc gns3vm.jf
02_Linux	vnc gns3vm.jf
02_Windows	vnc gns3vm.jf
03_Linux	vnc gns3vm.jf
03_Windows	vnc gns3vm.jf
04_Linux	vnc gns3vm.jf

- Once your computer is on, access your computer by double-clicking (2x) on your computer's logo. Then a new window will appear, which is the display of your computer as shown below.



You can use the computer for lab work according to the next steps.

Practicum Steps

1. Make sure your computer gets a dhcp ip from the DHCP server.
2. Open a terminal and run the command `sudo arp -a` on your respective host, observe the results and do a screenshot. What does the output produced by the `arp -a` command mean?
3. Do the `ping ip_number` command (eg: ping 192.168.130.150, ip address that is still available on your network)
4. Run the command `sudo arp -a` once again. Observe the difference in the output compared to experiment no. 2.
5. Answer the following question: Why is the command result have differences compared to previous experimental results even though the same command is used? Explain briefly.
6. We can reduce ARP Cache or disable ARP Cache, do the experiment below:
 - a. Run commad `sudo arp -d hostname` (**hostname** can be an ip address, use one of the hostnames listed on the ARP Cache). Observe the result by running the command `sudo arp -a`. Record the results of your experiment as your report.
 - b. Run the following command: `sudo ifconfig ens3 -arp down`, observe the results by running the command `arp -a`. Record the results of your experiment as your report.
7. Write the results of your experiment and answers in a report and collect them using the usual file naming format.