Workstation ARP

Objective

- Introduce Address Resolution Protocol (ARP) and the **`arp -a`** workstation command.
- Explore the **`arp`** command help feature using the **`-?`** option.

Background / Preparation

ARP is used as a tool for confirming that a computer is successfully resolving network Layer 3 addresses to Media Access Control (MAC) Layer 2 addresses. The TCP/IP network protocol relies on IP addresses like 192.168.14.211 to identify individual devices and to assist in navigating data packets between networks. While the IP address is essential to move data from one LAN to another, it cannot deliver the data in the destination LAN by itself. Local network protocols, like Ethernet or Token Ring, use the MAC, or Layer 2, address to identify local devices and deliver all data. A computer MAC address has been seen in prior labs.

This is an example of a MAC address:

- **00-02-A5-9A-63-5C**

A MAC address is a 48-bit address displayed in Hexadecimal (HEX) format as six sets of two HEX characters separated by dashes. In this format each hex symbol represents 4 bits. With some devices, the 12 hex characters may be displayed as three sets of four characters separated by periods or colons (0002.A59A.635C).

ARP maintains a table in the computer of IP and MAC address combinations. In other words, it keeps track of which MAC address is associated with an IP address. If ARP does not know the MAC address of a local device, it issues a broadcast using the IP address. This broadcast searches for the MAC address that corresponds to the IP address. If the IP address is active on the LAN, it will send a reply from which ARP will extract the MAC address. ARP will then add the address combination to the local ARP table of the requesting computer.

MAC addresses and therefore ARP are only used within the LAN. When a computer prepares a packet for transmission, it checks the destination IP address to see if it is part of the local network. It does this by checking to see if the network portion of the IP address is the same as the local network. If it is, the ARP process is consulted to get the MAC address of the destination device using the IP address. The MAC address is then applied to the data packet and used for delivery.

If the destination IP address is not local, the computer will need the MAC address of the default gateway. The default gateway is the router interface that the local network is connected to in order to provide connectivity with other networks. The gateway MAC address is used because the packet will be delivered there and the router will then forward it to the network it is intended for.

If the computer does not receive any packets from an IP address after a few minutes, it will drop the MAC/IP entry from the ARP table assuming the device has logged off. Later attempts to access that IP address will cause ARP to do another broadcast and

update the table.

This lab assumes the use of any version of Windows. This is a non-destructive lab and can be performed with a home machine without concern of changing the system configuration. Ideally, this lab will be done in a classroom or other LAN connected to the Internet. It can be done from a single remote connection via a modem or DSL-type connection.

Step 1 Establish a network connection

If the connection to the Internet is dial-up, connect to the ISP to ensure that the computer has an IP address. In a TCP/IP LAN with a Dynamic Host Configuration Protocol (DHCP) server it should not be necessary to do this step.

Step 2 Access a command prompt

Windows NT / 2000 / XP users:

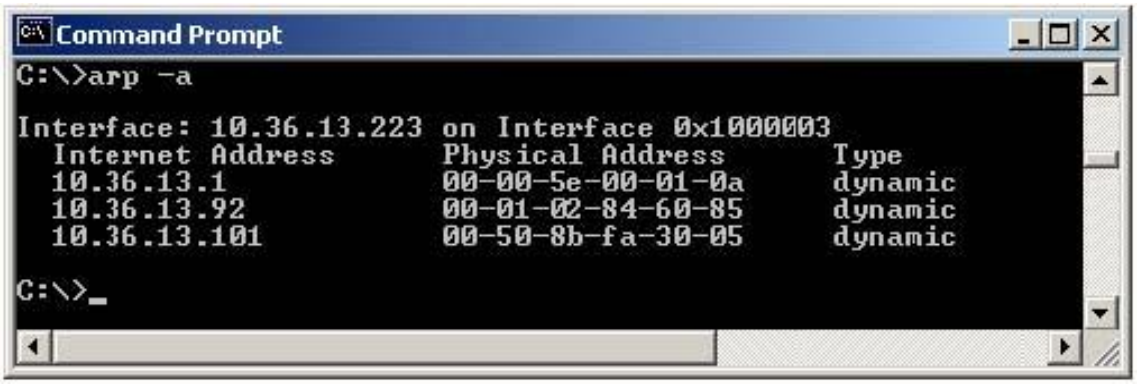
Use the Start menu to open the Command Prompt window. This window is similar to the MS-DOS window on older Windows versions: **Start** > **Programs** > **Accessories** > **Command Prompt or Start** > **Programs** > **Command Prompt Windows**

Step 3 Display the ARP table

a. In the window type **`arp -a`** and press **Enter**. Do not be surprised if there are no entries. The message displayed will probably be, 'No ARP Entries Found'. Windows computers remove any addresses that are unused after a couple minutes.

b. Try pinging a couple local addresses and a website URL. Then re-run the command. The figure below shows a possible result of the **`arp -a`** command. The MAC address for the website will be listed because it is not local, but that will cause the default gateway to be listed. In the example below 10.36.13.1 is the default gateway while the 10.36.13.92 and 10.36.13.101 are other network computers. Notice that for each IP address there is a physical address, or MAC, and type, indicating how the address was learned.

c.From the figure below, it might be logically concluded that the network is 10.36.13.0 and the host computers are represented by 22, 1, 92, and 101.



Step 4 Ping several URLs

a. Ping the following URLs and note the IP address of each. Also select one additional URL to ping and record it below: www.hh.se _____

www.msn.com: _____

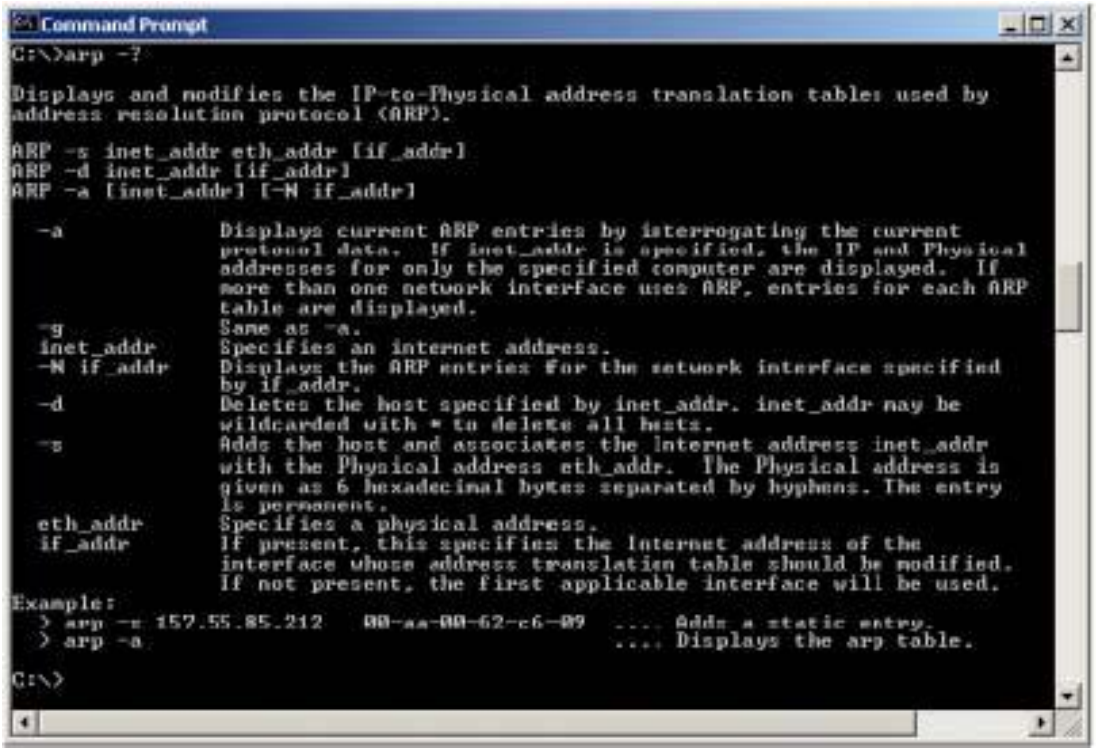
b. Now run the **`arp -a`** command again and record the MAC addresses for each of the above next to their IP addresses. Can it be done? _____

c. Why or why not? _____

d. What MAC address was used in delivering each of the pings to the URLs? _____
Why? _____

Step 4 Use the ARP help feature

Try the command **`arp -?`** to see the help feature and look over the options.



The purpose of this step is not so much the ARP command options but to demonstrate using the **`?`** to access help, if available. Help is not always implemented uniformly. Some commands use `/?` instead of `-?`.

Step 5 Use help with tracert and ping

Try **`tracert -?`** and then **`ping -?`** to see the options available for the commands used previously.

In looking at the help for ping, notice the –t option, which will send continuous pings, not just four. More importantly, notice the two commands to stop it:

- **Control-Break**
- **Control-C**

These two-key commands are common for stopping runaway activities. Try pinging a neighboring computer with the -t option and then try the Control-Break and Control-C features. An example in the above network would be **`ping 10.36.13.101 -t`** and then press **Enter**.

Be sure to use the **`Control-C`** command to stop the pings.

Reflection

Based on observations made today, what could be deduced about the following results?

Computer 1
IP Address: 192.168.12.113
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.12.1
Pings and tracert to 207.46.28.116 were both successful.

What will be the ARP table entry associated with this address and why