SLIIT UNI
THE KNOWLEDGE UNIVERSITY

Faculty of Computing

IE1030 – Data Communication Networks

Year 1 Semester 1 (2024)

Lab Sheet 3

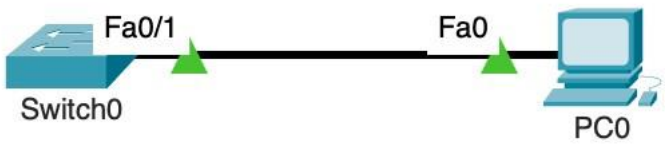
Introduction: This lab aims to provide hands-on experience with these critical networking concepts, enabling you to identify and analyze MAC addresses, understand the ARP process, and examine the structure and components of the Ethernet header. By the end of this lab, you will have a deeper insight into how devices on a local network communicate and how data is encapsulated for transmission.

Objectives:

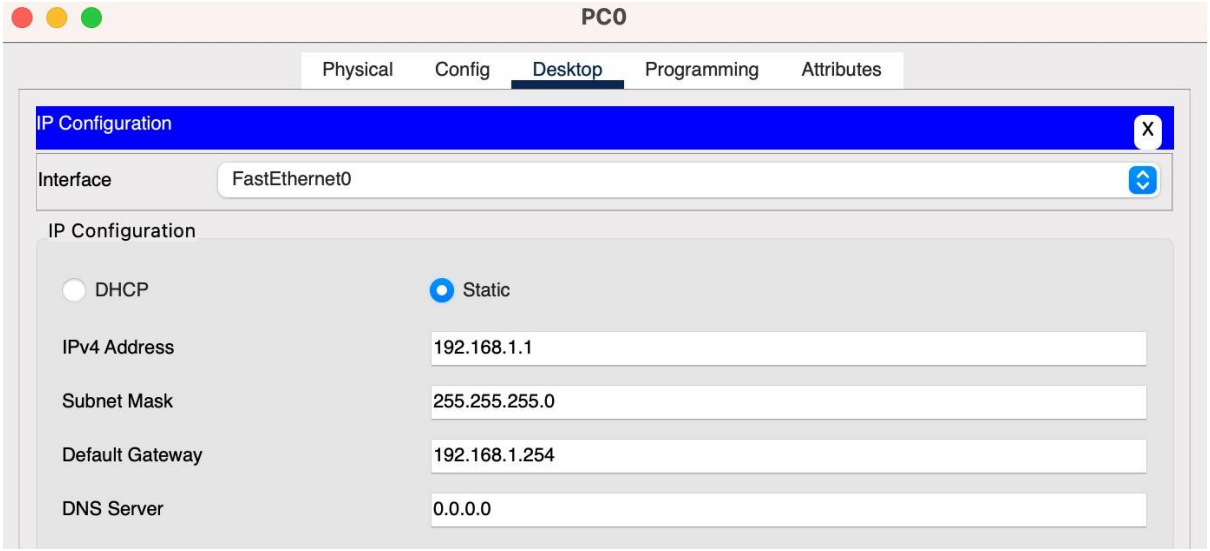
- Learn what MAC addresses are and their role in network communications.
- Identify the format and components of a MAC address.
- Understand the purpose of ARP in network communications.
- Observe how ARP resolves IP addresses to MAC addresses.
- Learn the structure and components of the Ethernet header.
- Understand how the Ethernet header encapsulates data for transmission.
- Analyze Ethernet frames to identify the source and destination MAC addresses, EtherType field, and payload data.

Part 1: Display, analyze and describe MAC addresses

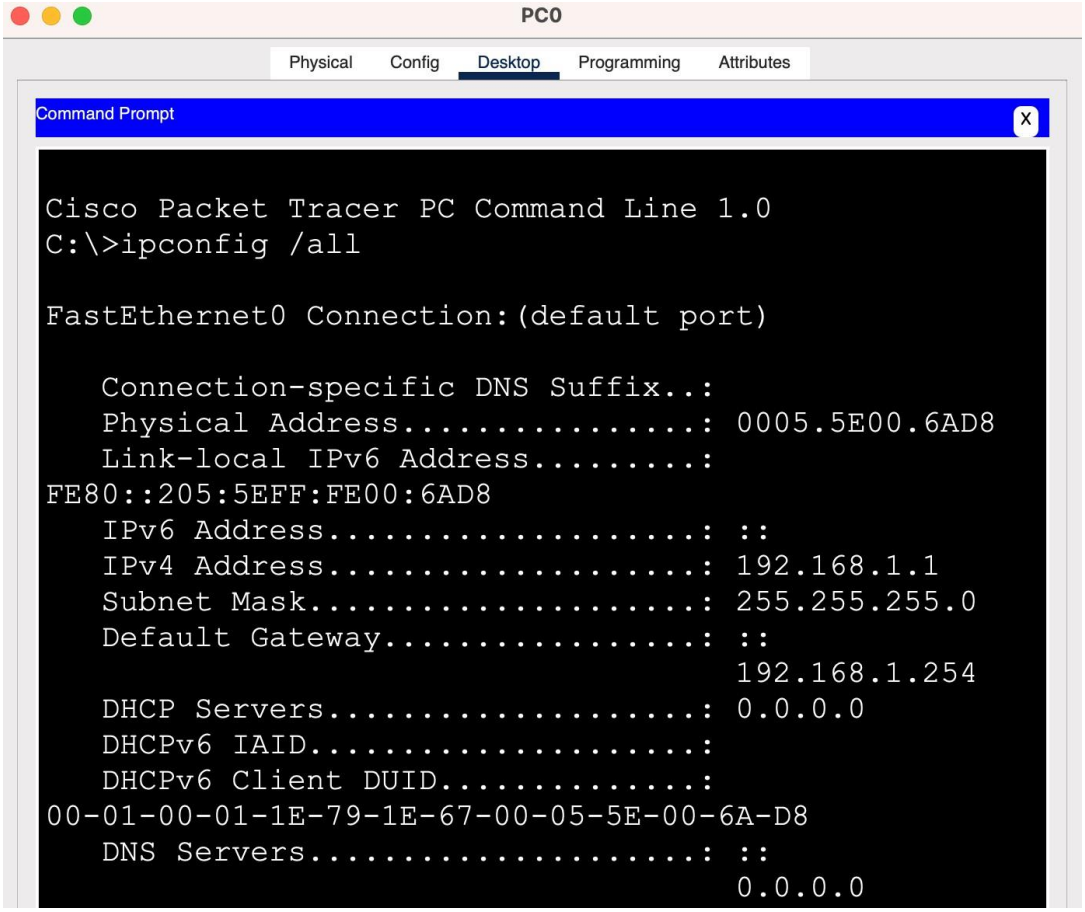
1. Connect a PC and a switch as shown in the diagram below.



2. Configure IP address 192.168.1.1, subnet mask 255.255.255.0 and default gateway 192.168.1.254 on PC0.



3. Enter ipconfig /all command at the command prompt of PC0. This command displays the configuration details of network interface(s) for PC0.



Questions:

What is the MAC address of PC0?
00:0C:85:21:4D:1D

What is the OUI portion of the MAC address for this device?
00:0C:85
What is the serial number portion of the MAC address for this device?
21:4D:1D

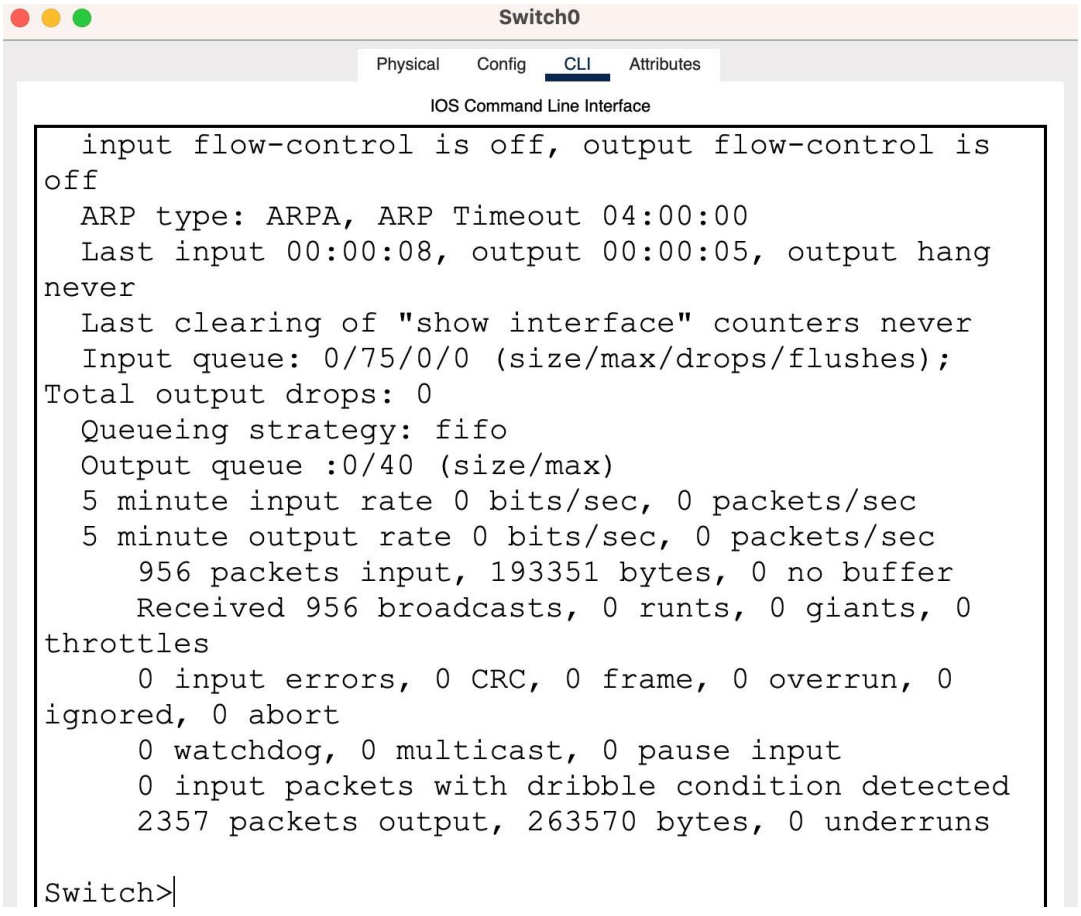
Find the name of the vendor that manufactured this NIC.
Cisco Systems, Inc

Find the name of the vendor that manufactures the NIC of your PC.
Dell Inc

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address.................: 000C.8521.4D1D
   Link-local IPv6 Address.........: FE80::20C:85FF:FE21:4D1D
   IPv6 Address....................: ::
   IPv4 Address....................: 192.168.1.1
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: ::
                                     192.168.1.254
   DHCP Servers....................: 0.0.0.0
   DHCPv6 IAID.....................:
   DHCPv6 Client DUID..............: 00-01-00-01-94-DA-6C-03-00-0C-85-21-4D-1D
   DNS Servers.....................: ::
                                     0.0.0.0

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Physical Address.................: 0007.EC0A.1549
   Link-local IPv6 Address.........: ::
```

4. Login to Switch1 CLI and then enter the following command.

Switch>show interfaces fastEthernet 0/1



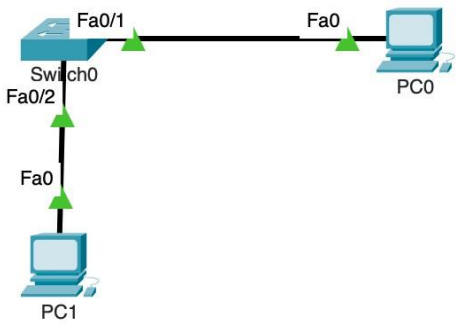
Questions:

What is the MAC address of FastEthernet 0/1 interface of Switch1?
00:60:70:88:CE:01

Based on the OUI of the above MAC address, what is the name of the vendor?
Cisco Systems, Inc

```
Switch>show interfaces fastEthernet 0/1
FastEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0060.7088.ce01 (bia 0060.7088.ce01)
 BW 100000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s
  input flow-control is off, output flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     956 packets input, 193351 bytes, 0 no buffer
     Received 956 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 watchdog, 0 multicast, 0 pause input
     0 input packets with dribble condition detected
     2357 packets output, 263570 bytes, 0 underruns
     0 output errors, 0 collisions, 10 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out

Switch>
```

5. Change the network by adding another PC. Configure IP address 192.168.1.2, subnet mask 255.255.255.0 and default gateway 192.168.1.254 on PC1.



6. Enter the following command to display the MAC address table of the switch.

Switch>show mac-address-table

```
Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
```

6. From PC0 cmd generate a message for PC1

```
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

7. Enter the same command from switch 1to display the MAC address table of the switch.

```
Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0005.5e00.6ad8    DYNAMIC     Fa0/1
   1    0030.f26b.02a8    DYNAMIC     Fa0/2
```

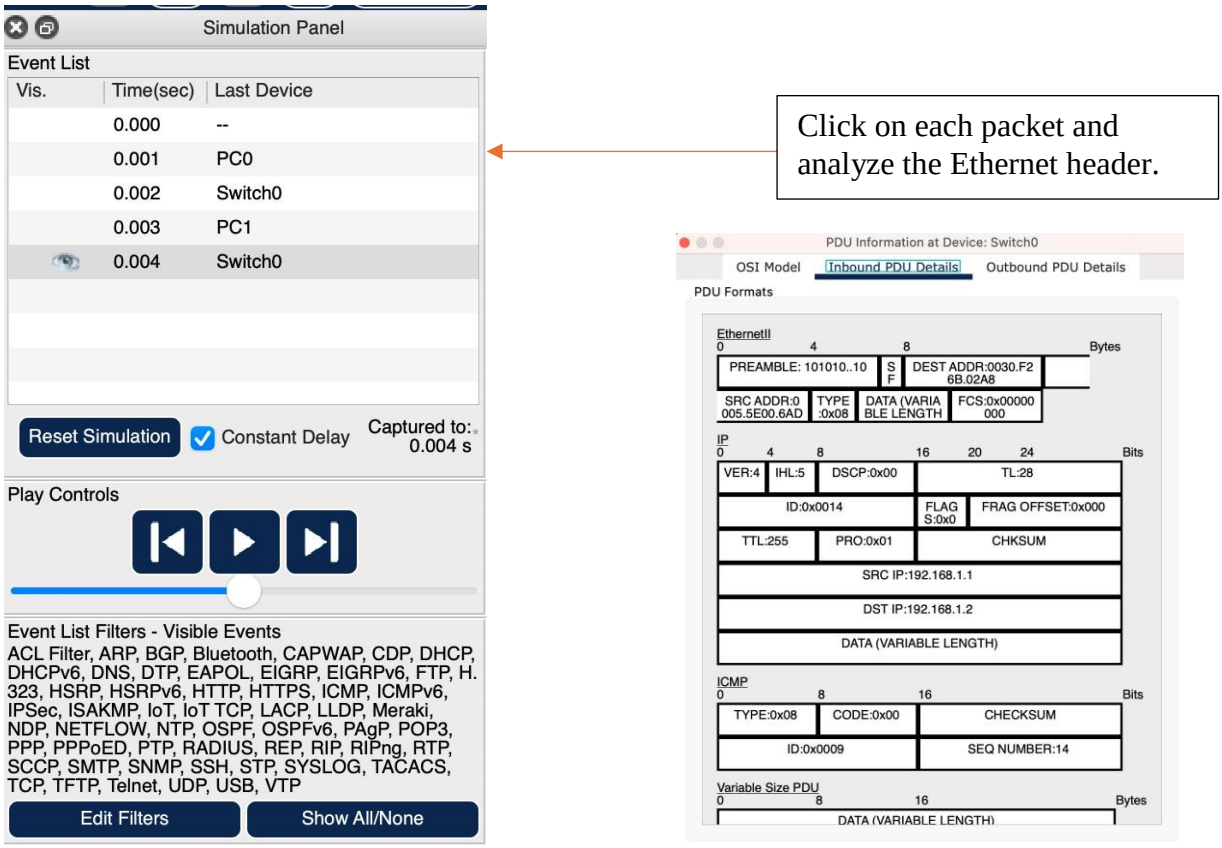
```
Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0002.17ab.413b    DYNAMIC     Fa0/2
   1    000c.8521.4d1d    DYNAMIC     Fa0/1
Switch>
```

Part 2: Examine fields in an Ethernet frame

1. Move to simulation mode in the Cisco Packet Tracer

2. Generate a traffic in between PC0 and PC1

3. Once PC0 receives the response from PC1 stop the simulation. Now you should be able to see the following packets created under the Event List.



Questions:

Write your findings on the Ethernet header within the lab report.

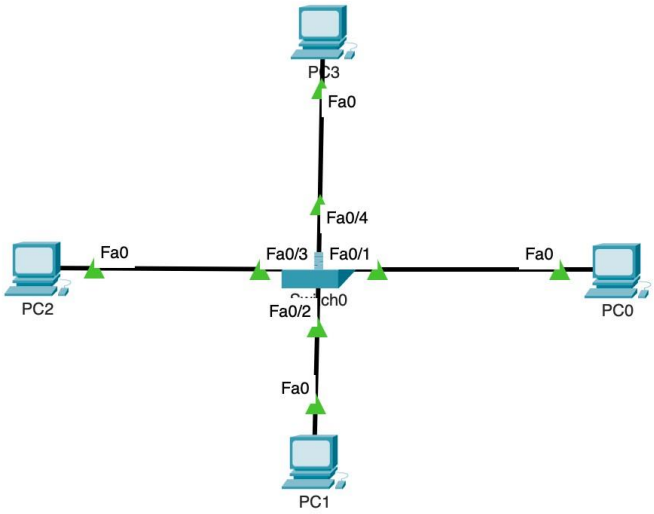
When the process of sending the message is initialized, it is first sent from the PC0 to the switch. After it is received at the switch, the message is forwarded to the relevant destination, and in this case PC1. Once PC1 receives the message, a reply is sent. It is first received at the switch, which forwards it to the PC0. The communication is successful.

Part 3: ARP within the local network

1. Add two more PCs to the network design.

Configure IP address 192.168.1.3, subnet mask 255.255.255.0 and default gateway 192.168.1.254 on PC2

Configure IP address 192.168.1.4, subnet mask 255.255.255.0 and default gateway 192.168.1.254 on PC3



2. Open a command prompt in PC0 and enter arp –a (arp cache).

```
C:\>arp -a
  Internet Address      Physical Address      Type
  192.168.1.2           0030.f26b.02a8        dynamic
```

3. Ping from PC0 to PC2, and PC3as well. Then observe the arp cache of PC0 again.

```
C:\>arp -a
  Internet Address      Physical Address      Type
  192.168.1.2           0030.f26b.02a8        dynamic
  192.168.1.3           00e0.f97e.c385        dynamic
  192.168.1.4           0010.1194.1115        dynamic
```

Questions:

What is the reason for the above difference?

When sending a message the sender needs to know the MAC address of the receiver. Since it is inefficient to send a ping to the switch every single time to ask for a MAC address, the computer stores the MAC address of the corresponding IP address when the first time a message is sent to the said device.

The difference has occurred, because PC0 has only communicated with PC1. Hence, only one MAC address is stored. However, in the second scenario, PC0 has additionally communicated with PC2 and PC3. Hence, it has three MAC addresses stored.

```
C:\>arp -a
  Internet Address      Physical Address      Type
  192.168.1.2           0002.17ab.413b        dynamic

C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=3ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 0ms

C:\>ping 192.168.1.4

Pinging 192.168.1.4 with 32 bytes of data:

Reply from 192.168.1.4: bytes=32 time<1ms TTL=128
Reply from 192.168.1.4: bytes=32 time=1ms TTL=128
Reply from 192.168.1.4: bytes=32 time=8ms TTL=128
Reply from 192.168.1.4: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 8ms, Average = 2ms

C:\>arp -a
  Internet Address      Physical Address      Type
  192.168.1.2           0002.17ab.413b        dynamic
  192.168.1.3           0030.f2a9.c0c5        dynamic
  192.168.1.4           0030.a3e2.24d8        dynamic

C:\>
```