

# CS 305 Lab Tutorial

## Lab12 MAC, ARP and Switch

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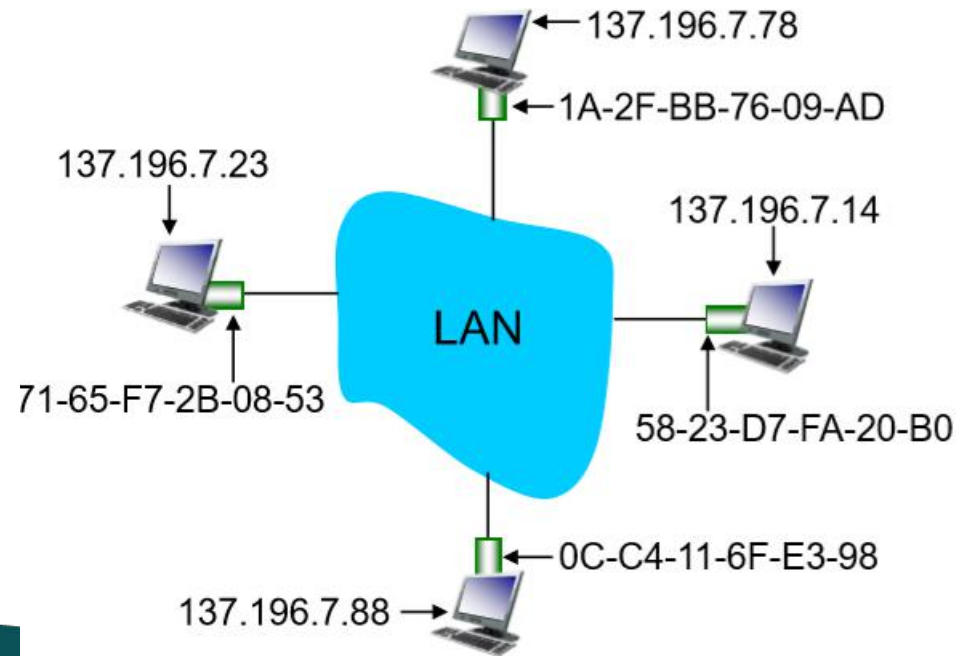
# Topic

- MAC address & ARP
  - Device
    - Bridge (Lay2) vs Hub (Lay1)
    - Switch (Lay2)
  - Practise
    - ARP
    - STP
- address resolution Protocol
- Arp -a
  - arp -d 删除缓存

# MAC address

- MAC (or LAN or physical or Ethernet) address:
  - function: *used 'locally' to get frame from one interface to another physically-connected interface (same network, in IP-addressing sense)*
  - 48 bit MAC address (for most LANs) burned in NIC ROM, also sometimes software settable
  - e.g.: 1A-2F-BB-76-09-AD

hexadecimal (base 16) notation  
(each "numeral" represents 4 bits)



# ARP(Address Resolution Protocol)

A→B

23	3.409057	Micro-St_b3:5c:39	Broadcast	ARP	Who has 172.18.130.25? Tell 172.18.130.27
24	3.409348	Micro-St_b0:d9:cd	Micro-St_b3:5c:39	ARP	172.18.130.25 is at 44:8a:5b:b0:d9:cd

> Frame 23: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
> Ethernet II, Src: Micro-St_b3:5c:39 (44:8a:5b:b3:5c:39), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
✓ Address Resolution Protocol (request)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: request (1)
Sender MAC address: Micro-St_b3:5c:39 (44:8a:5b:b3:5c:39)
Sender IP address: 172.18.130.27 (172.18.130.27)
Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
Target IP address: 172.18.130.25 (172.18.130.25)

B可以学到A的mac地址

1. using “arp -d” to clear the mac-address table on PC
2. “ping” an reachable IP

24	3.409348	Micro-St_b0:d9:cd	Micro-St_b3:5c:39	ARP	172.18.130.25 is at 44:8a:5b:b0:d9:cd
----	----------	-------------------	-------------------	-----	---------------------------------------

> Frame 24: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
> Ethernet II, Src: Micro-St_b0:d9:cd (44:8a:5b:b0:d9:cd), Dst: Micro-St_b3:5c:39 (44:8a:5b:b3:5c:39)
✓ Address Resolution Protocol (reply)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: reply (2)
Sender MAC address: Micro-St_b0:d9:cd (44:8a:5b:b0:d9:cd)
Sender IP address: 172.18.130.25 (172.18.130.25)
Target MAC address: Micro-St_b3:5c:39 (44:8a:5b:b3:5c:39)
Target IP address: 172.18.130.27 (172.18.130.27)

交换机

[H3C]display mac-address				
MAC Address	VLAN ID	State	Port/Nickname	Aging
448a-5bb3-5c39	1	Learned	GE1/0/23	Y
448a-5bb3-5f55	1	Learned	GE1/0/1	Y
[H3C]				

# Practice1

Build the network as below topology, do the following test on simulation mode of packet-tracer

- invoke "ping" on PC0 to reach PC1
  - Is there any arp message?
  - Does the arp message reache to the route? what does route do after received the arp message?

- invoke "ping" on PC0 to reach PC2 **清除缓存**

- how many arp messages are used before the 1st icmp reply packet is received by PC0? **1/2**

- which device send these arp messages?

- is there any info about gateway in these arp messages?

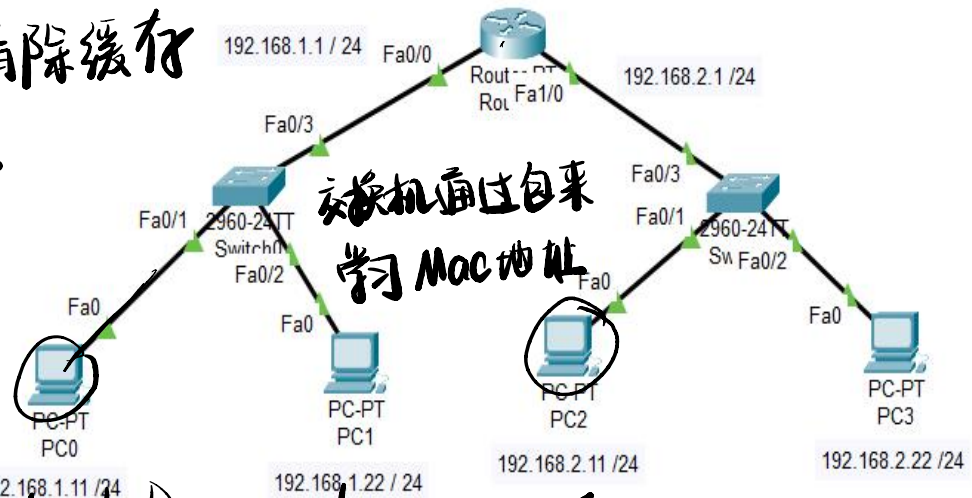
→ since PC2 is not in the same network with PC0, so first PC0 send arp message to ask for the

tips:

"arp -d" could be used to clear the arp-table on PC;

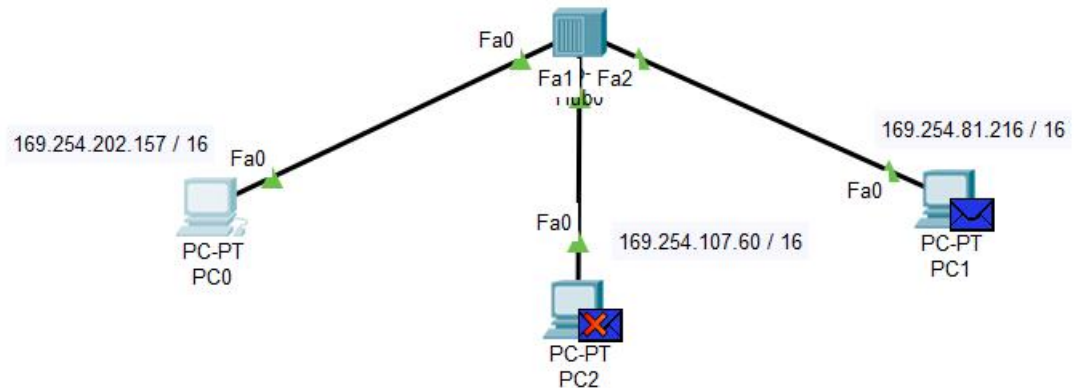
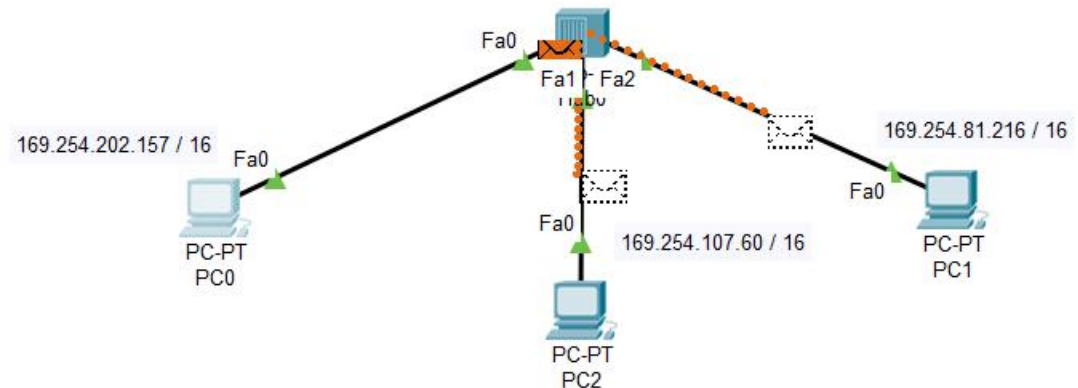
turn off the interface on Switch / Route could clear its arp-table/ mac-address table

mac address for gateway. Secondly, the gateway asks the mac address for PC2



# Hub(Layer 1) broadcast

Hub is a Layer 1 device which only broadcast the package while not check the address of it.



```
Physical  Config  Desktop  Programming  Attributes
Command Prompt

Packet Tracer PC Command Line 1.0
C:\>ping 169.254.81.216

Pinging 169.254.81.216 with 32 bytes of data:

Reply from 169.254.81.216: bytes=32 time=8ms TTL=128
Reply from 169.254.81.216: bytes=32 time=4ms TTL=128
Reply from 169.254.81.216: bytes=32 time=4ms TTL=128
Reply from 169.254.81.216: bytes=32 time=4ms TTL=128

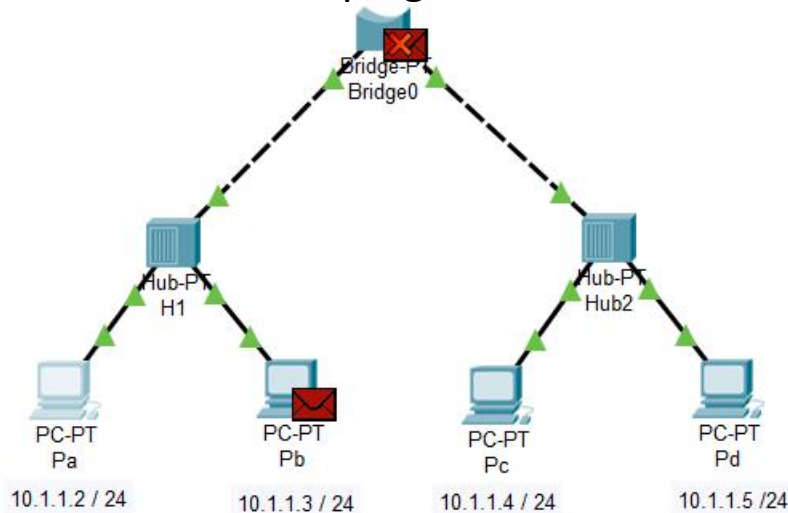
Ping statistics for 169.254.81.216:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 8ms, Average = 5ms
```



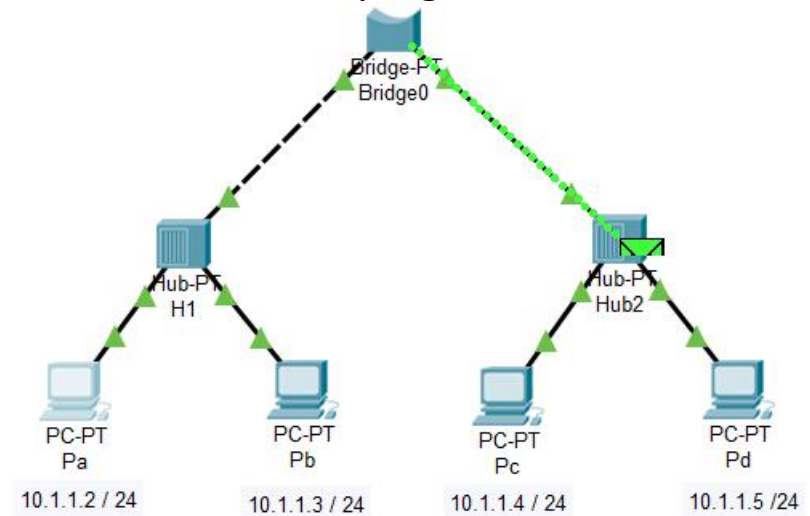
Q: Bridge与switch区别在哪?

# Bridge(Layer 2) forwarding

Test1: Pa ping Pb



Test2: Pa ping Pd



Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	1.012	--	Pa	ICMP
	1.013	Pa	H1	ICMP
	1.014	H1	Pb	ICMP
	1.014	H1	Bridge0	ICMP
	1.015	Pb	H1	ICMP
	1.016	H1	Pa	ICMP
	1.016	H1	Bridge0	ICMP

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	Pa	ICMP
	0.001	Pa	H1	ICMP
	0.002	H1	Pb	ICMP
	0.002	H1	Bridge0	ICMP
	0.003	Bridge0	Hub2	ICMP
	0.004	Hub2	Pc	ICMP
	0.004	Hub2	Pd	ICMP
	0.005	Pd	Hub2	ICMP
	0.006	Hub2	Pc	ICMP
	0.006	Hub2	Bridge0	ICMP
	0.007	Bridge0	H1	ICMP
	0.008	H1	Pa	ICMP
	0.008	H1	Pb	ICMP

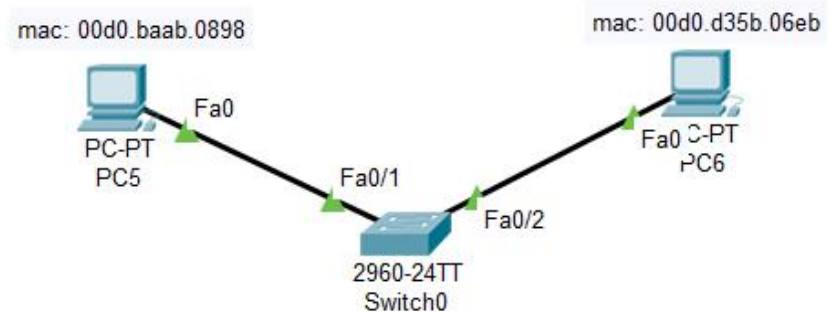
# Switch(Layer 2)

Switch can **learn** from the received package: to gain its source mac address and the interface id to make a **Mac-address Table**.

Switch use the Mac-address Table to forward the package on Layer2.

Tips: Both PC5 and PC6 has an local ipv6 address which are in the same network.

Make **PC5** “ping” **PC6** to invoke **Switch0** switch packets and learn mac-address-table



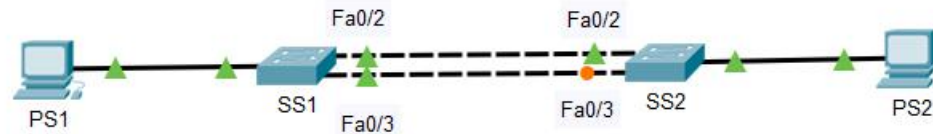
```
Switch# show mac address-table
Mac Address Table
```

Vlan	Mac Address	Type	Ports
1	00d0.baab.0898	DYNAMIC	Fa0/1
1	00d0.d35b.06eb	DYNAMIC	Fa0/2



# STP

Spanning Tree algorithm is always used in the Ethernet network to create a spanning tree with a interface of a switch as the root, automatically block one or more redundant ports in logic to avoid loops.



```
SS1#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0090.0C79.A27E
             This bridge is the root
             Hello Time 2 sec Max Age 20 sec Forward Delay 15
sec
  Bridge ID   Priority    32769 (priority 32768 sys-id-ext 1)
             Address     0090.0C79.A27E
             Hello Time 2 sec Max Age 20 sec Forward Delay 15
sec
             Aging Time 20

Interface    Role Sts Cost      Prio.Nbr Type
-----
Fa0/3        Desg FWD 19        128.3    P2p
Fa0/2        Desg FWD 19        128.2    P2p
Fa0/1        Desg FWD 19        128.1    P2p
```

```
SS2#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0090.0C79.A27E
             Cost         19
             Port         1(FastEthernet0/1)
             Hello Time 2 sec Max Age 20 sec Forward Delay 15
sec
  Bridge ID   Priority    32769 (priority 32768 sys-id-ext 1)
             Address     00D0.5837.D0AC
             Hello Time 2 sec Max Age 20 sec Forward Delay 15
sec
             Aging Time 20

Interface    Role Sts Cost      Prio.Nbr Type
-----
Fa0/1        Root FWD 19        128.1    P2p
Fa0/2        Desg FWD 19        128.2    P2p
Fa0/3        Altn BLK 19        128.3    P2p
```

# Practice(2)

Build a LAN as the topology:

- What's the state of link marked with **yellow spot** in the following network, will it block the communication between PC10 and PC11?
- Find the **root of the spanning-tree**
- **Shutdown the Fa0/3 of switch5**, will the root and yellow spot changes? Will the communication between PC10 and PC11 be blocked?
- Is there any way to set a new root of the **spanning-tree**(option)

