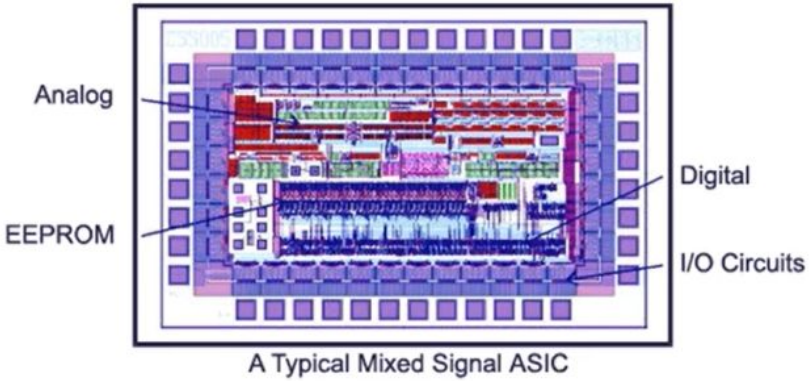
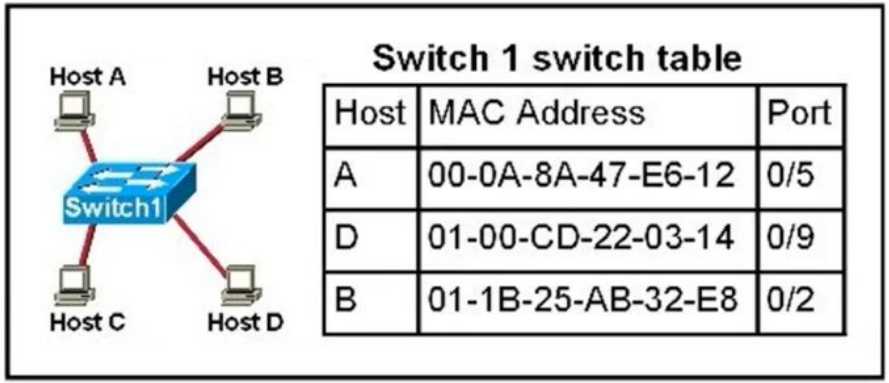
# Week7

# Switching Basic 交换基础

Switch use application-specific integrated circuits (ASICs) to build and maintain their MAC tables 交换机使用专用集成电路(ASIC)构建和维护其MAC表



A Typical Mixed Signal ASIC




Switch 1 switch table

| Host | MAC Address | Port |
|---|---|---|
| A | 00-0A-8A-47-E6-12 | 0/5 |
| D | 01-00-CD-22-03-14 | 0/9 |
| B | 01-1B-25-AB-32-E8 | 0/2 |

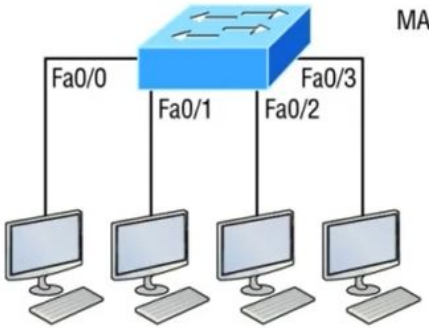
- Hardware-based bridging **基于硬件的桥接(ASICs)**
- Wire speed **线速**
- Low latency **低延迟**
- Low cost **低成本**

- How to learn MAC address **如何学习MAC地址**
- How to forward frame **如何转发帧**
- How to prevent loop **如何防止环路**

# Switch Address Learning 交换机地址学习

Layer 2 switches remember the source MAC address of each frame received on an interface and enter this information into a MAC table 第2层交换机会记住接口上接收到的每个 帧的源MAC地址，并将此信息 输入到MAC表中

- When a switch is first powered on, the MAC table is empty 首次打开交 换机电源时，MAC表为空白
- When a device transmits and an interface receives a frame, the switch places the frame's source address in the MAC table 当设备发送数据并且接口接收到 帧时，交换机会将帧的源地址放置在 MAC表中
- Switch will flood (broadcast) the network with this frame out of every port except the source port 交换机将从每个端口（源端口除外）在此网络中广播该帧
- If a device answers this flooded frame and sends a frame back, then the switch will take the source address from that frame and place that MAC address in its MAC table 如果一个设备应答此广播帧并发送回复的一帧，则交换机会从该帧获取源地址并将 该MAC地址放入他的MAC表中
- Switch now has both of the relevant MAC addresses 于是交换机现在就有了 这两个相关的MAC地址



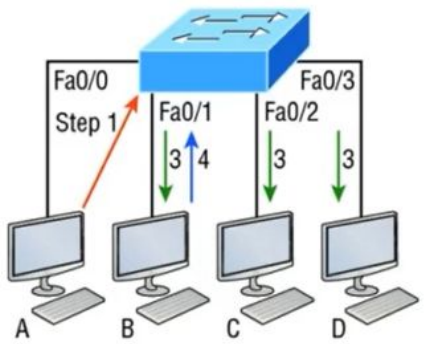

MAC forward/filter table

Fa0/0:

Fa0/1:

Fa0/2:

Fa0/3:



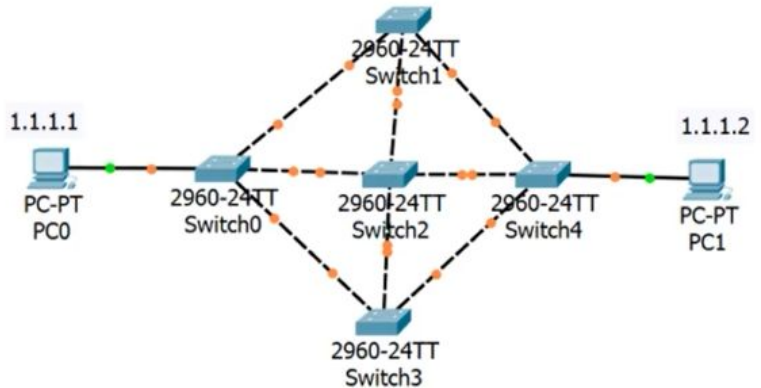

CAM/MAC forward/filter table

| | | |
|---|---|---|
| Fa0/0: | 0000.8c01.000A | Step 2 |
| Fa0/1: | 0000.8c01.000B | Step 4 |
| Fa0/2: | | |
| Fa0/3: | | |

# Switch Forwarding 交换机转发

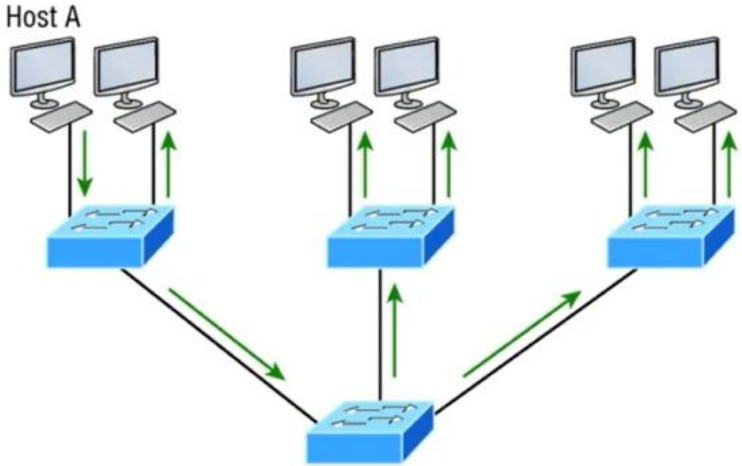
When a frame is received on an interface, the switch looks at the destination MAC address；then chooses the appropriate exit interface for it in the MAC table. 当在接口上接收到帧时，交换机将查看目标MAC地址；然后在MAC表中为其选择适当的出口接口。

- When a frame arrives at a switch interface, the destination MAC address is compared to the MAC table 当帧到达交换接口时，交换机将目标MAC地址与MAC表进行对照
- If the destination MAC address is known and listed in the table, the frame is only sent out of the appropriate exit interface 如果目标MAC地址是已知的并且在表中列出，则仅从适当的出口接口 发送帧
- If the destination MAC address isn't listed in the MAC table, then the frame will be flooded out all active interfaces except the interface it was received on 如果目标MAC地址未在MAC表中列出，则该帧将被广播到所有活 动接口上（接收 该帧的接口除外）
- If a host or server sends a broadcast on the LAN, by default, the switch will flood the frame out all active ports except the source port 如果主机或服务器在LAN上发送广播，则默认情况下，交 换机会将帧广播到除源端口之外的所有活 动端口上
- Switch creates **smaller collision domains**, but it's always still **one large broadcast domain** by default Switch会**创建较小的冲突域**，但默认情况下始终是一个**大的广播域**
- Source MAC is always checked first to make sure it's in the MAC table 始终先检查源MAC，以确保它在MAC表中



# Virtual LAN (VLAN) Basic 虚拟局域网(VLAN)基础

A group of devices within a VLAN communicate as if they were attached to the same wire. VLANs are based on logical connections, instead of physical connections. VLAN中的一组设备进行通信，就像它们连接到同一条线上一样。VLAN基于逻辑上的连接，而不是物理上的连接。

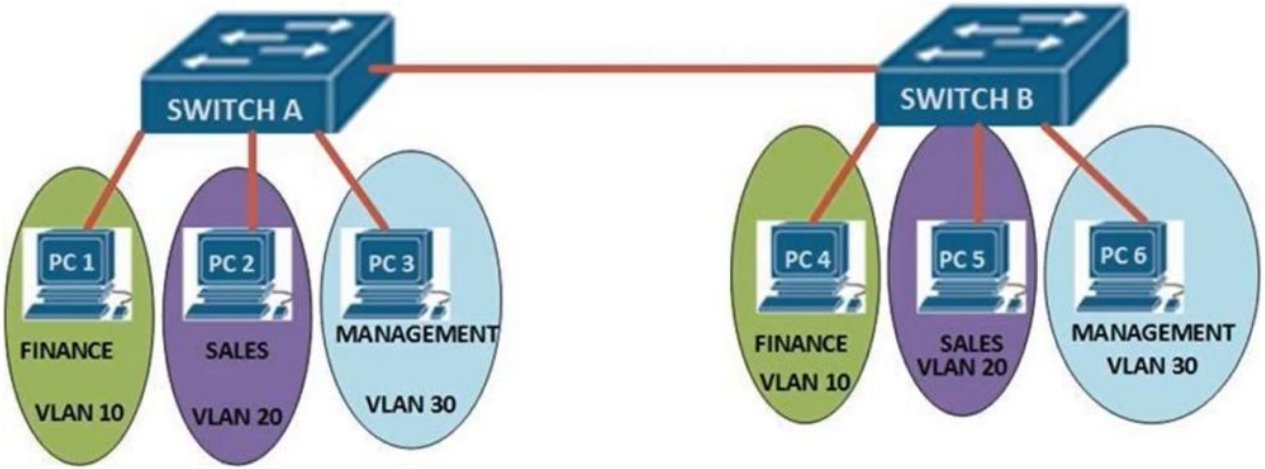



Flat network - one broadcast domain 扁平网络 - 一个广播域


- Logical segregation 逻辑上的隔离
- Enhance network security 增强网络安全性
- Increase the number of broadcast domains while decreasing their size 增加广播域的数量，同时减小其大小

Ethernet VLANs 1 and 1006 through 4094 use only default values. 以太网VLAN 1和1006至4094仅使用默认值。

# Access and Trunk Port 接入和中继端口




**Access Port 接入端口**

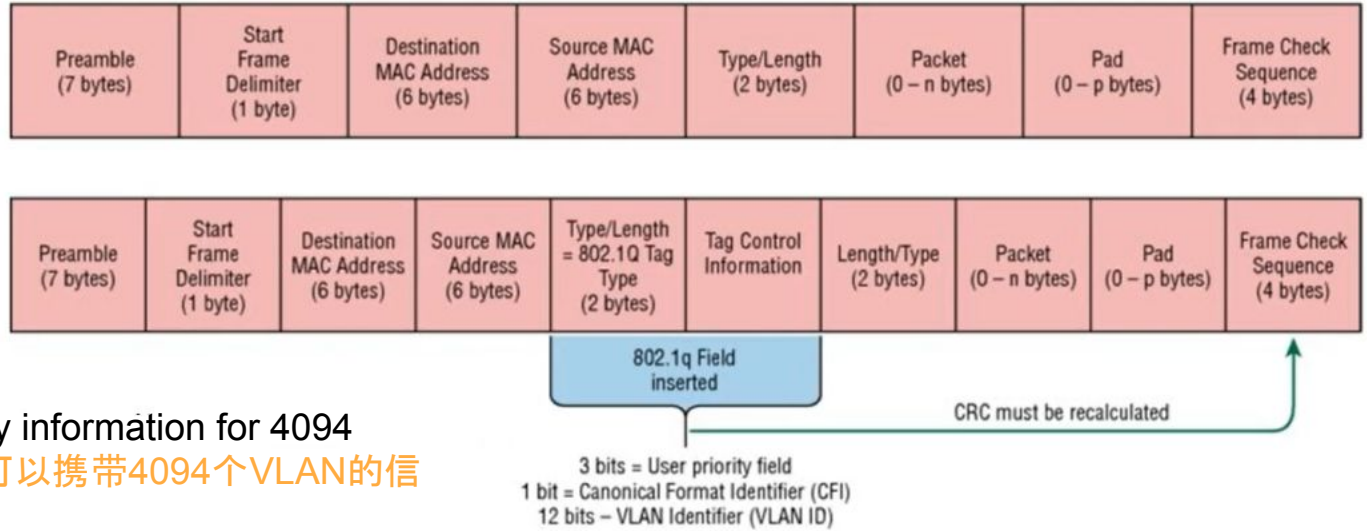
- Belongs to and carries the traffic of only one VLAN 属于并且仅携带一个VLAN的流量
- Traffic is both received and sent in native formats with **no VLAN information (tagging)** whatsoever 流量以本地格式接收和发送，**没有任何VLAN信息（标记）**

**Trunk Port 中继端口**

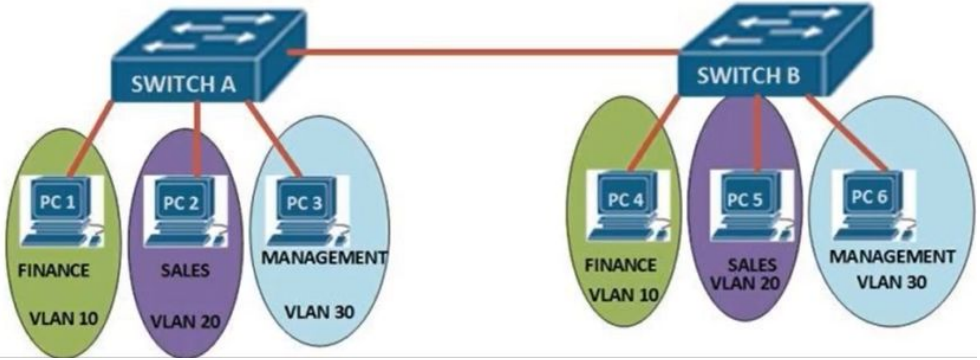
- Carries the traffic of multiple VLANs 携带多个VLAN的流量

# Frame Tagging 帧标签

- Inter-Switch Link(ISL)
- IEEE 802.1q




802.1q tagged frame can carry information for 4094 VLANs ($2^{12}$) 802.1q标记的帧可以携带4094个VLAN的信息（$2^{12}$）



# Configure VLAN and Access Port

```
S1(config)#vlan ?
        WORD            ISL VLAN IDs 1-4094
        access-map      Create vlan access-map or enter
vlan access-map command mode
        dot1q           dot1q parameters
        filter          Apply a VLAN Map
        group           Create a vlan group
        internal        internal VLAN
```

```
Switch#show vlan
Switch#show vlan brief
```

```
S1(config)#vlan 2
S1(config-vlan)#name Sales
S1(config-vlan)#vlan 3
S1(config-vlan)#name Marketing
S1(config-vlan)#vlan 4
S1(config-vlan)#name Accounting

S1(config)#interface gi0/1
S1(config-if)#switchport mode access
S1(config-if)#switchport access vlan 3
```

# Configure Trunk Port

Switch(config)#int f0/15

Switch(config(config-if))#switchport trunk encapsulation dot1q

Switch(config(config-if))#switchport mode trunk

# Dynamic Trunk Protocol (DTP)

| | Dynamic Auto | Dynamic Desirable | Trunk | Access |
|---|---|---|---|---|
| **Dynamic Auto** | Access | Trunk | Trunk | Access |
| **Dynamic Desirable** | Trunk | Trunk | Trunk | Access |
| **Trunk** | Trunk | Trunk | Trunk | Limited Connectivity |
| **Access** | Access | Access | Limited Connectivity | Access |