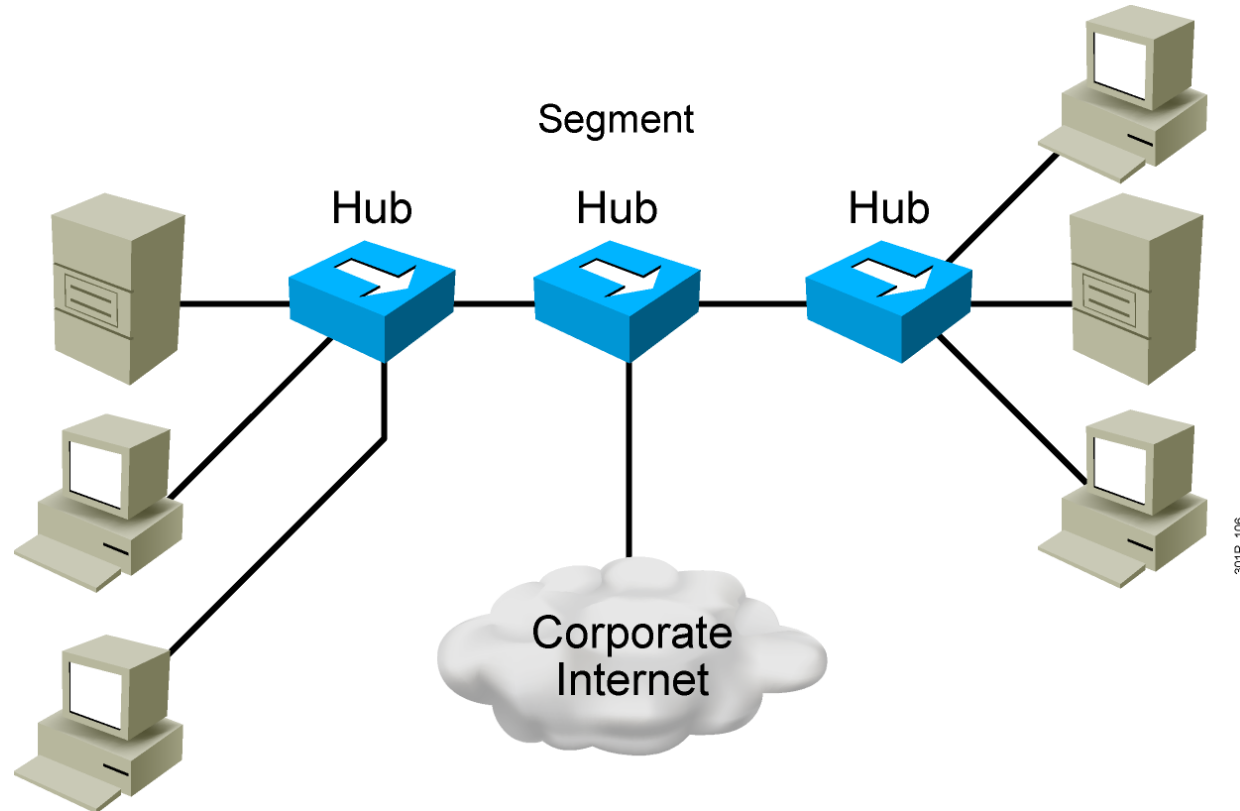




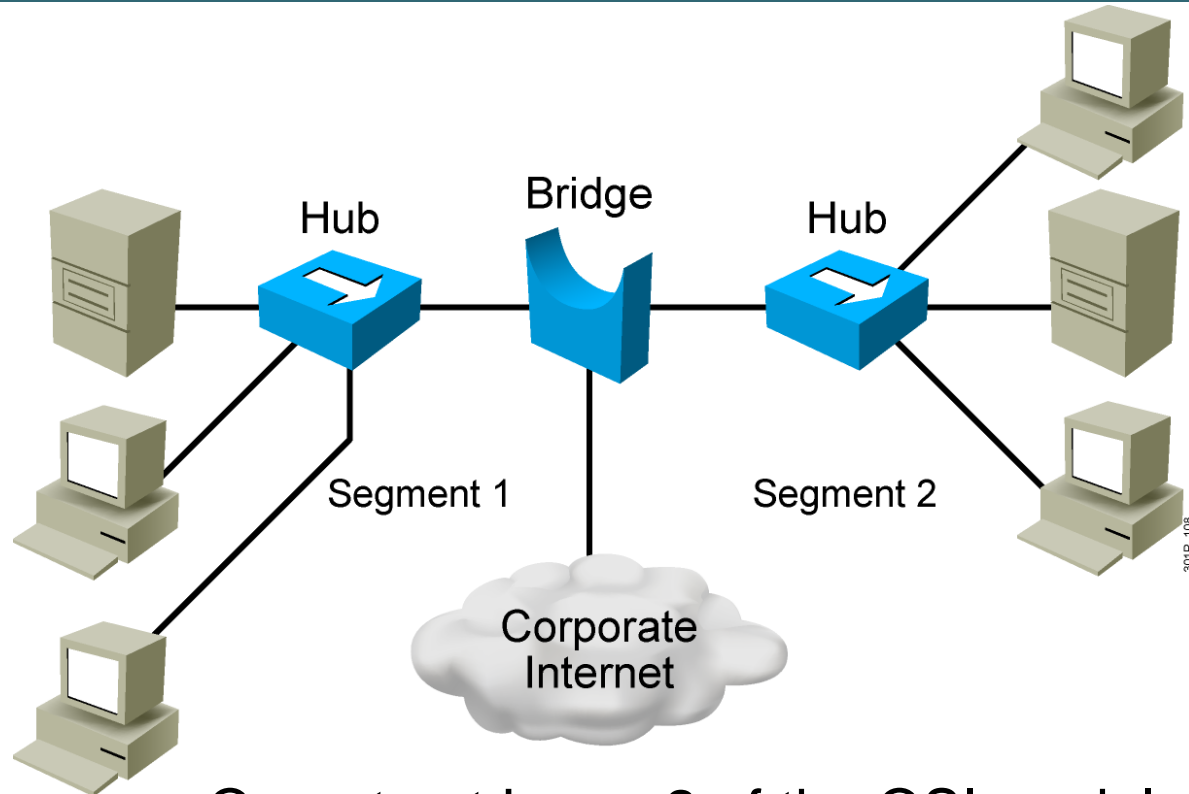
Ethernet Switch

Network Congestion



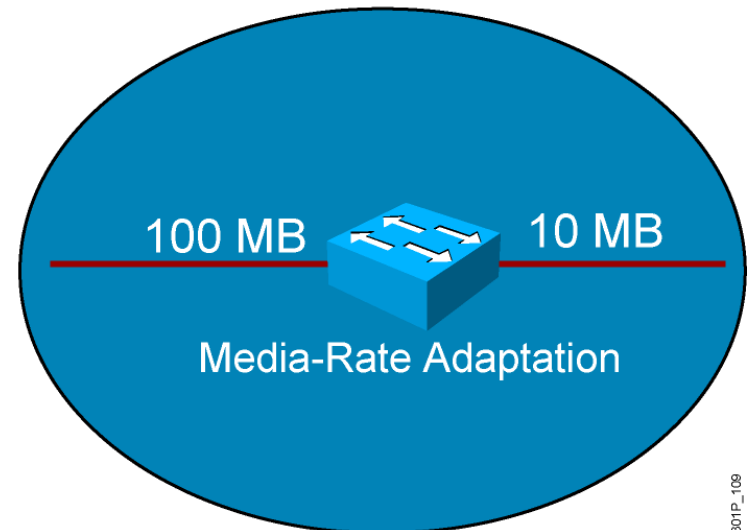
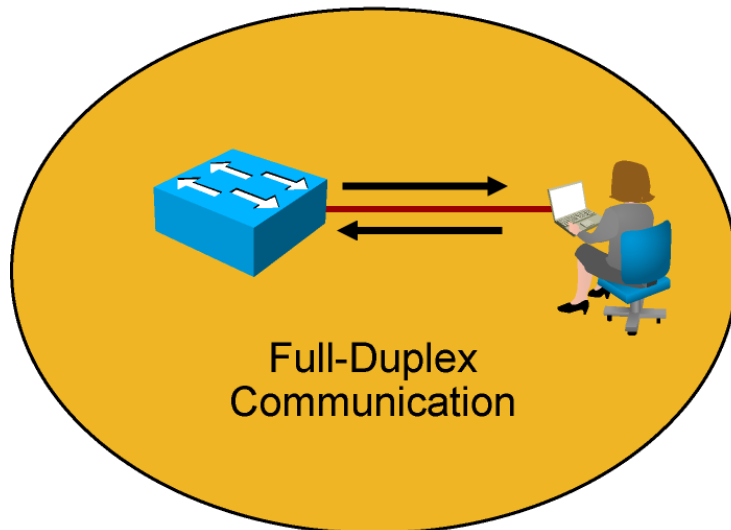
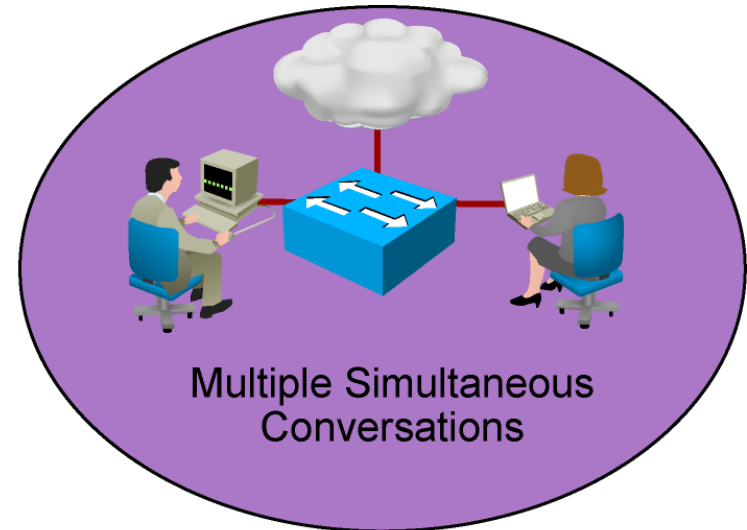
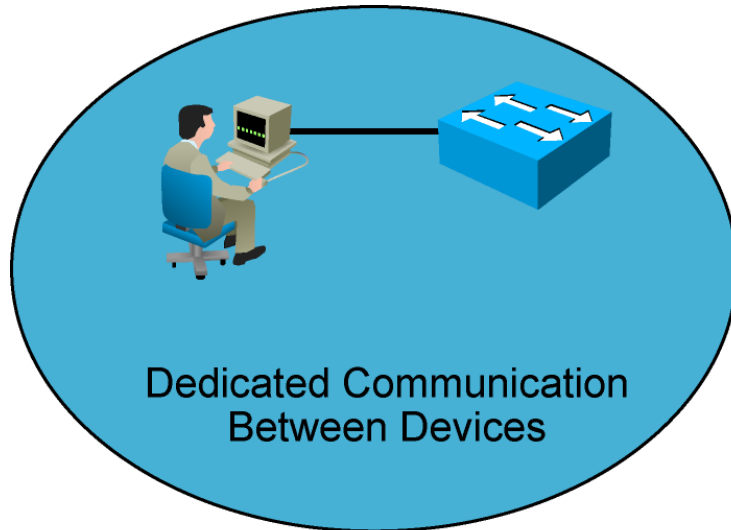
- High-performance PCs
- More networked data
- Bandwidth-intensive applications

Bridges

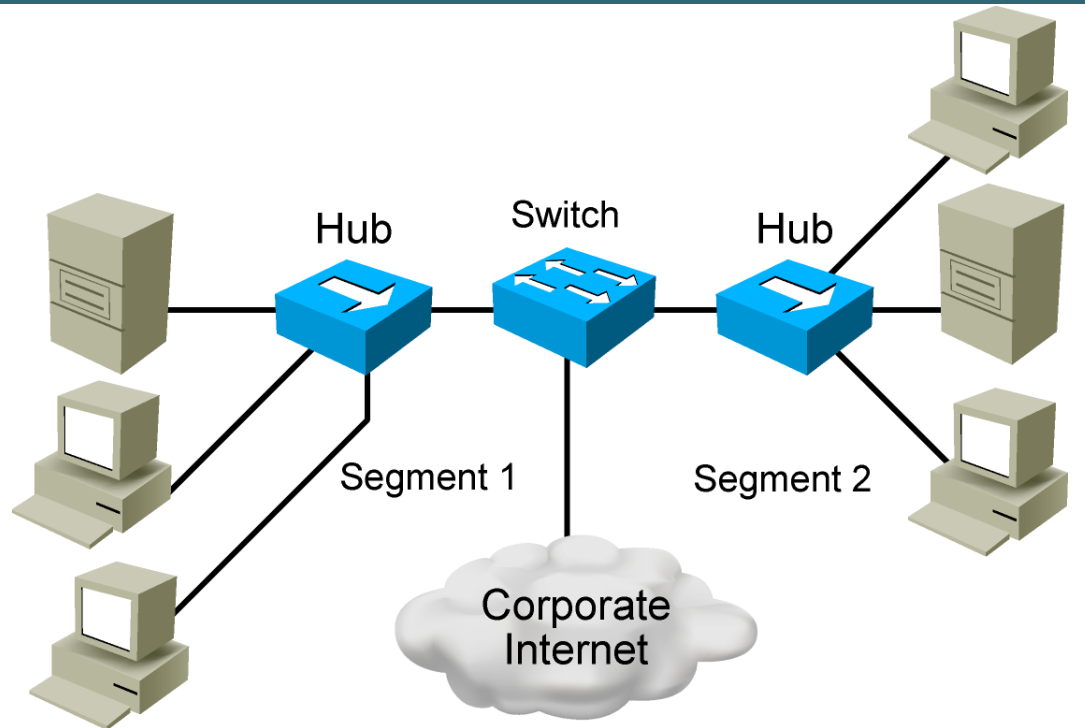


- Operate at Layer 2 of the OSI model
- Forward, filter, or flood frames
- Have few ports
- Are slow

LAN Switch Features



Switches Supersede Bridges

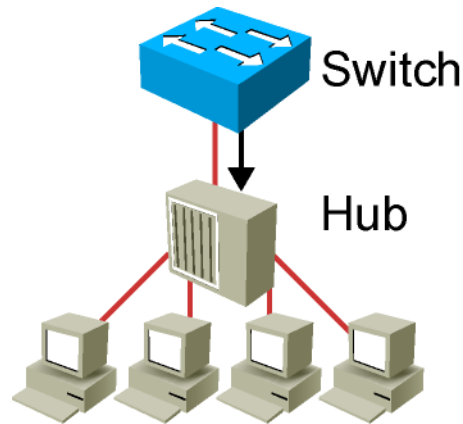


- Operate at Layer 2 of the OSI model
- Forward, filter, or flood frames
- Have many ports
- Are fast

Duplex Overview

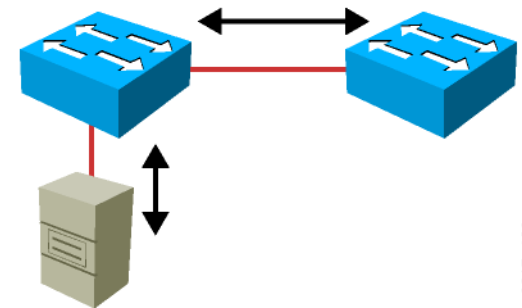
Half Duplex (CSMA/CD)

- Unidirectional data flow
- Higher potential for collision
- Hub connectivity



Full Duplex

- Point-to-point only
- Attached to dedicated switched port
- Requires full-duplex support on both ends
- Collision-free
- Collision detect circuit disabled



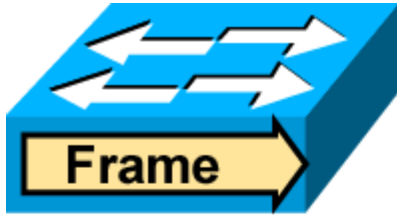
LAN Switch

- High port density
- Large frame buffers
- Mixture of port speeds
- Fast internal switching
- Switching modes:
 - Cut-through
 - Store-and-forward
 - Fragment-free

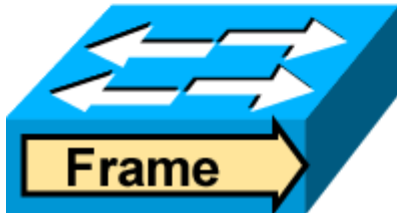


Transmitting Frames

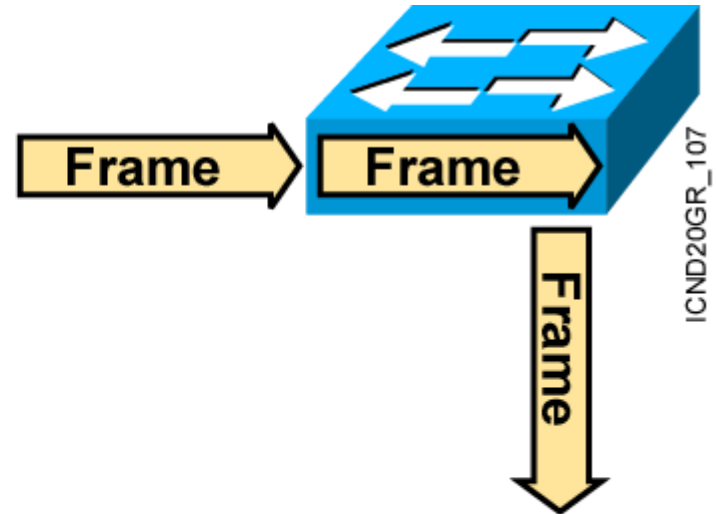
Cut-Through: Switch checks destination address and immediately begins forwarding frame.



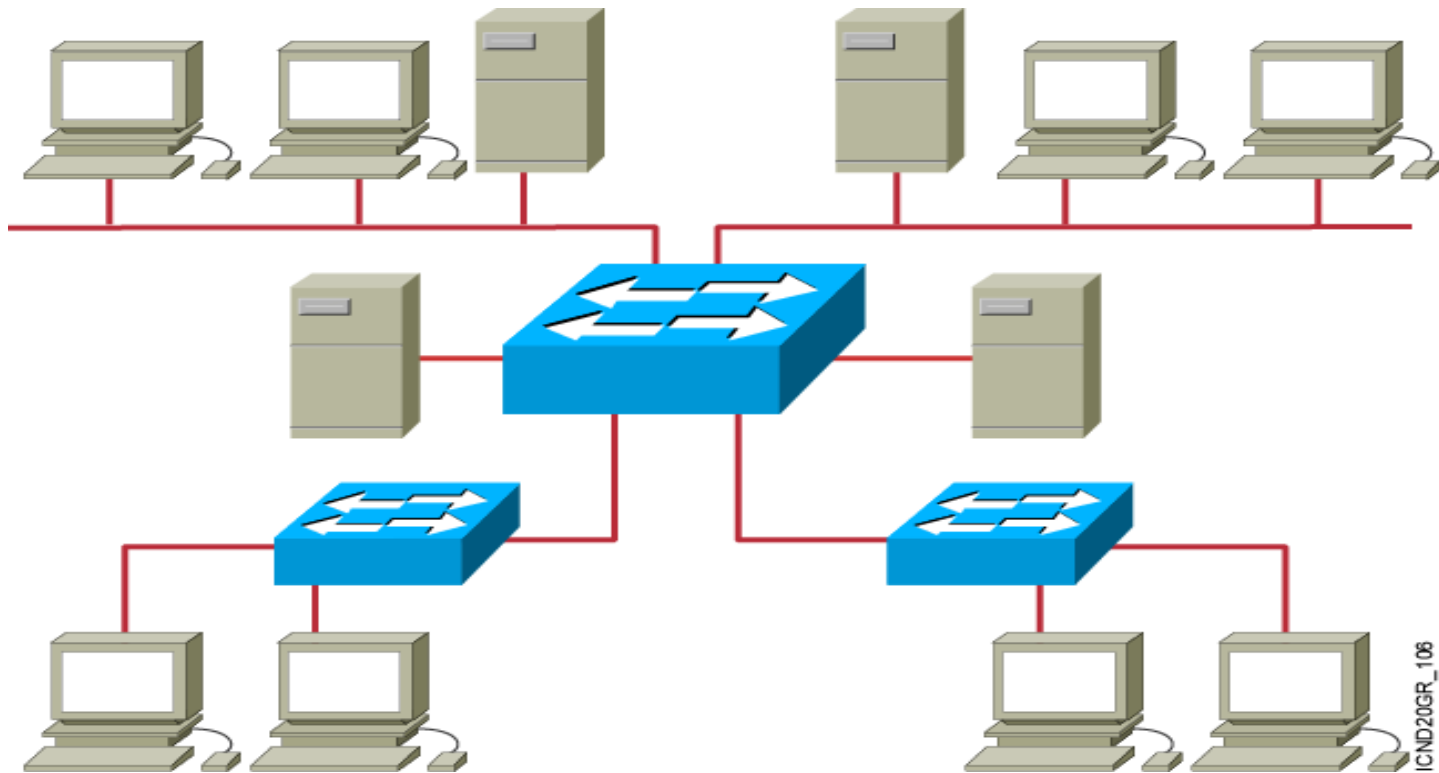
Fragment-Free: Switch checks the first 64 bytes, then immediately begins forwarding frame.



Store and Forward: Complete frame is received and checked before forwarding.

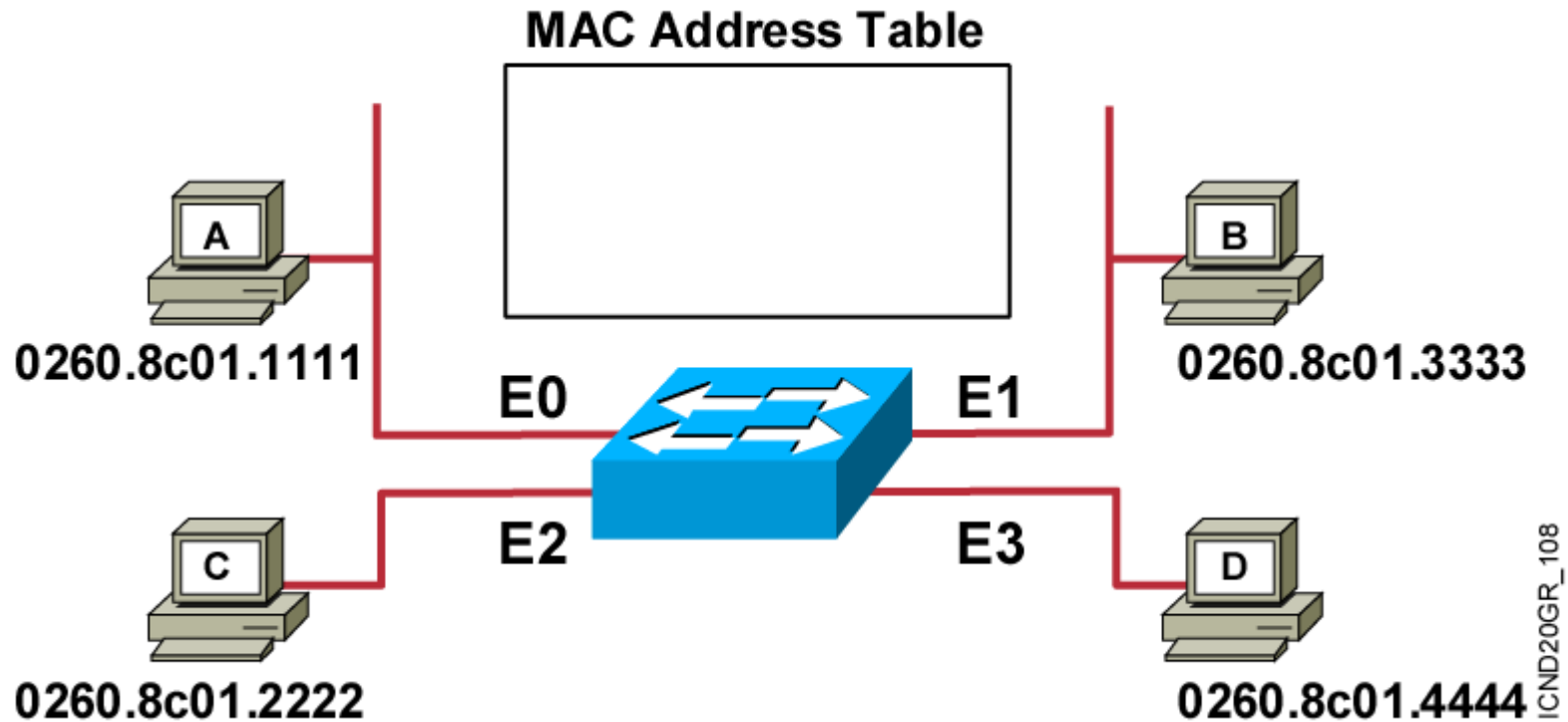


Ethernet Switches and Bridges



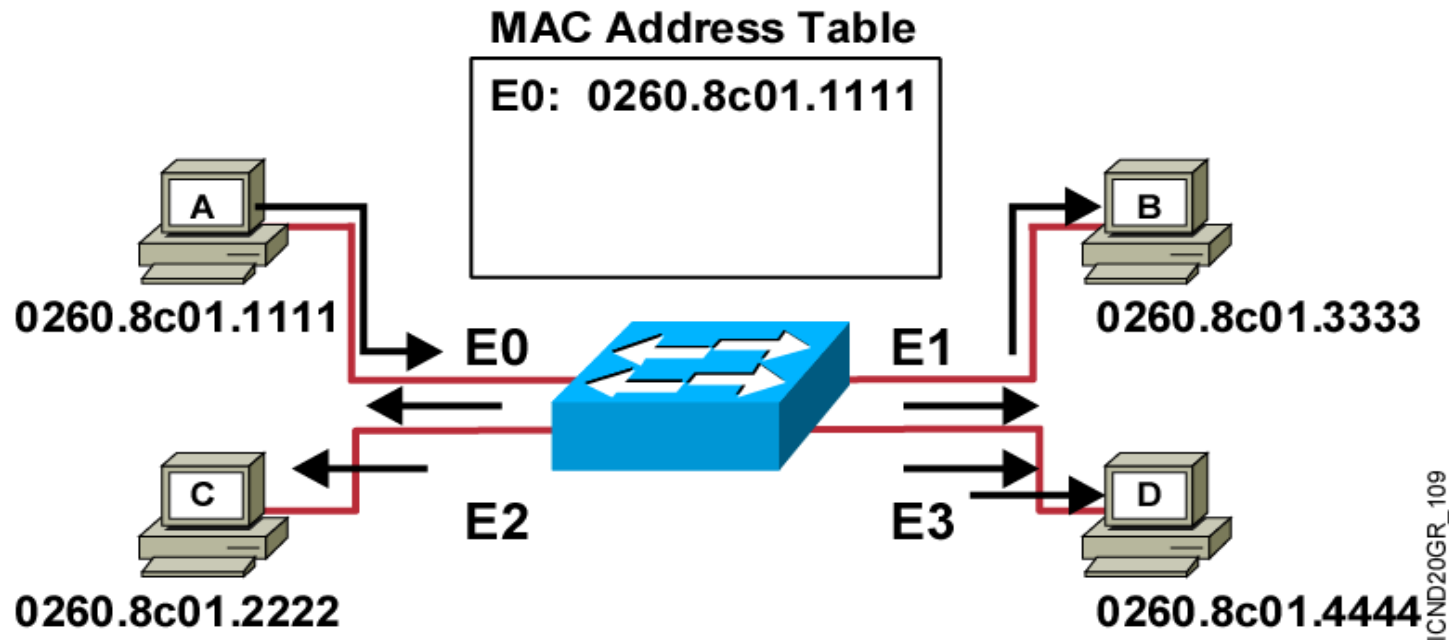
- Address learning
- Forward/filter decision
- Loop avoidance

MAC Address Table



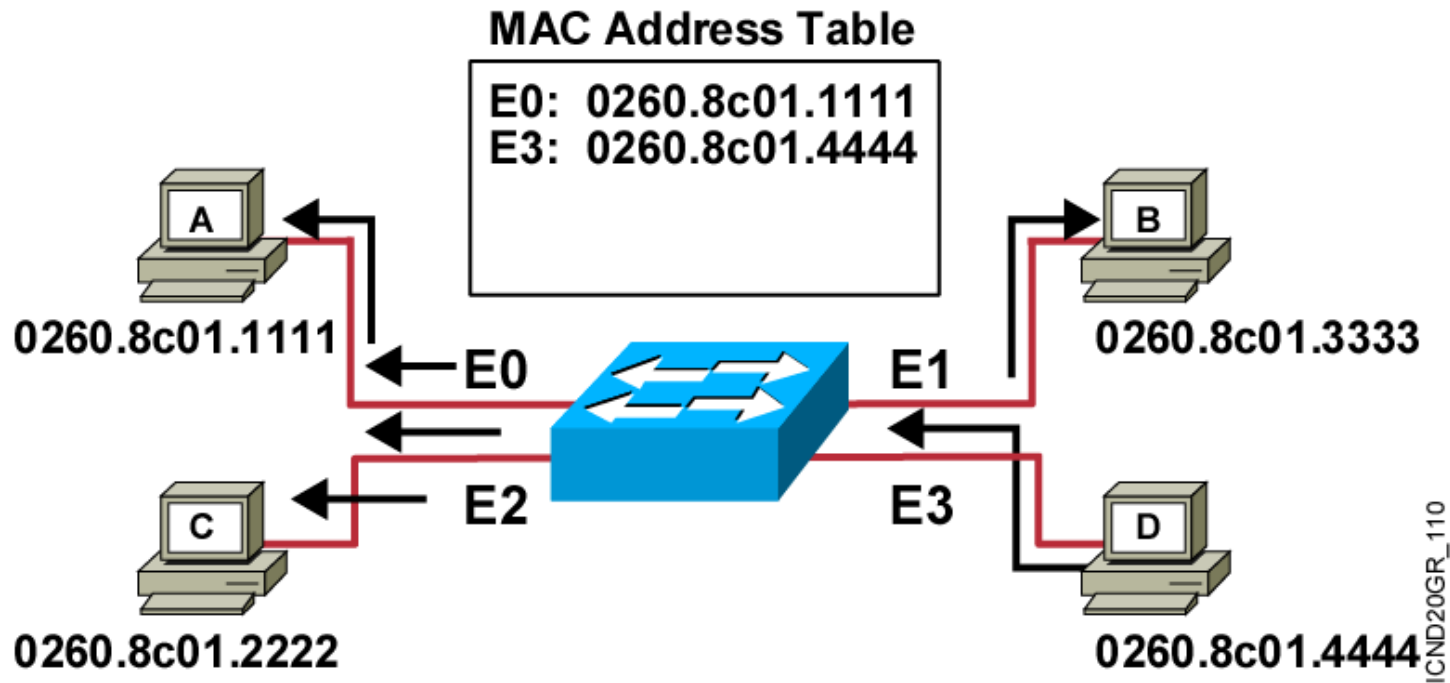
Initial MAC address table is empty

Learning Addresses



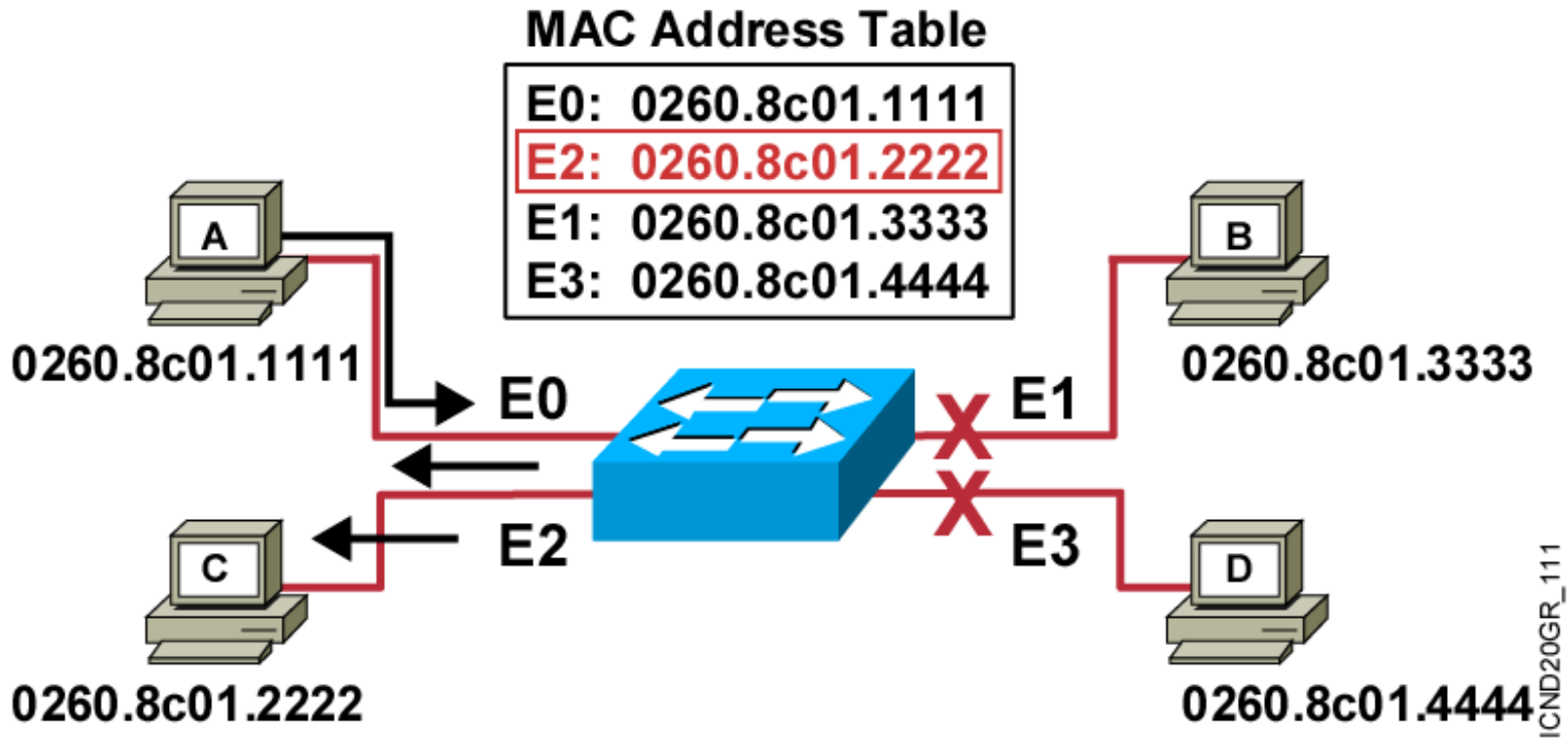
- Station A sends a frame to station C.
- Switch caches the MAC address of station A to port E0 by **learning the source address of data frames**.
- The frame from station A to station C is flooded out to all ports except port E0 (unknown unicasts are flooded).

Learning Addresses (Cont.)



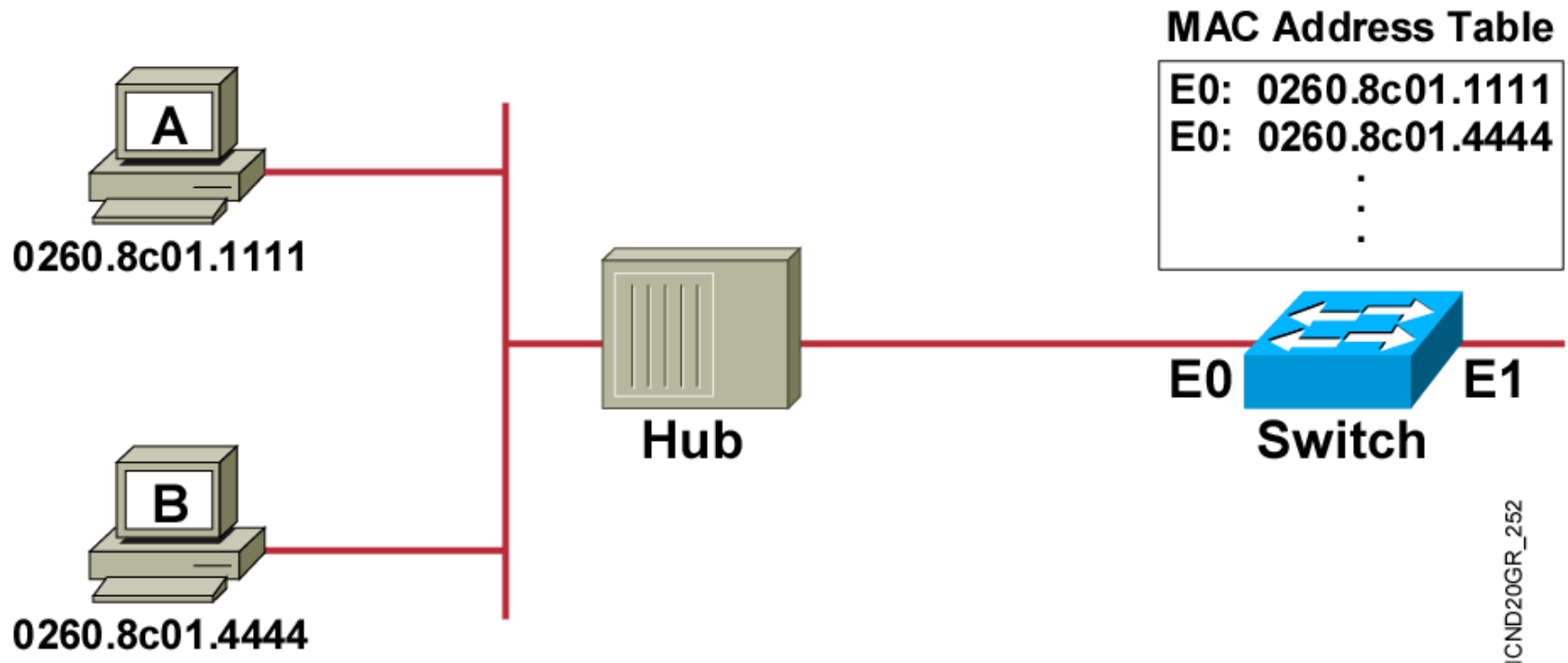
- Station D sends a frame to station C.
- Switch caches the MAC address of station D to port E3 by learning the source address of data frames.
- The frame from station D to station C is flooded out to all ports except port E3 (unknown unicasts are flooded).

Forward Frames



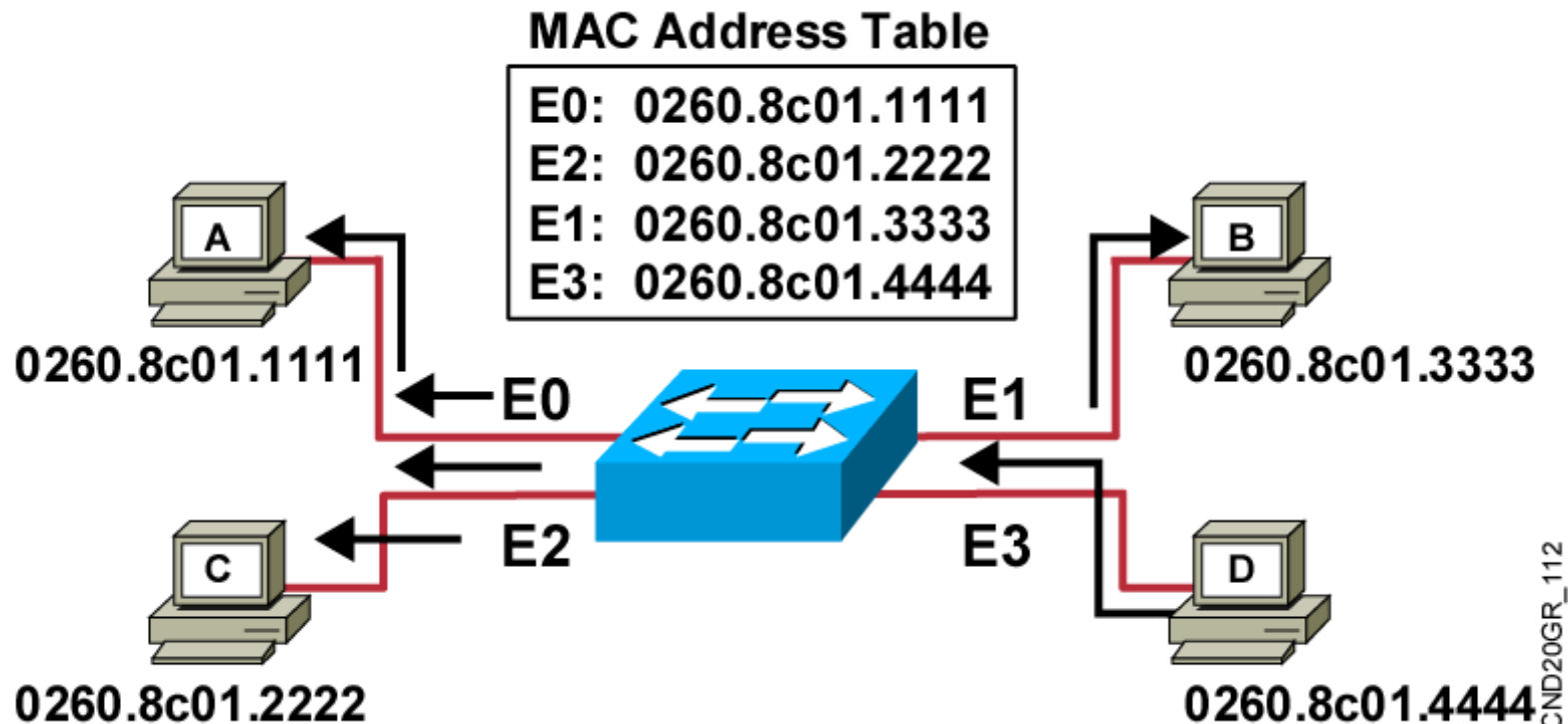
- Station A sends a frame to station C.
- Destination is known; frame is not flooded.

Filtering Frames



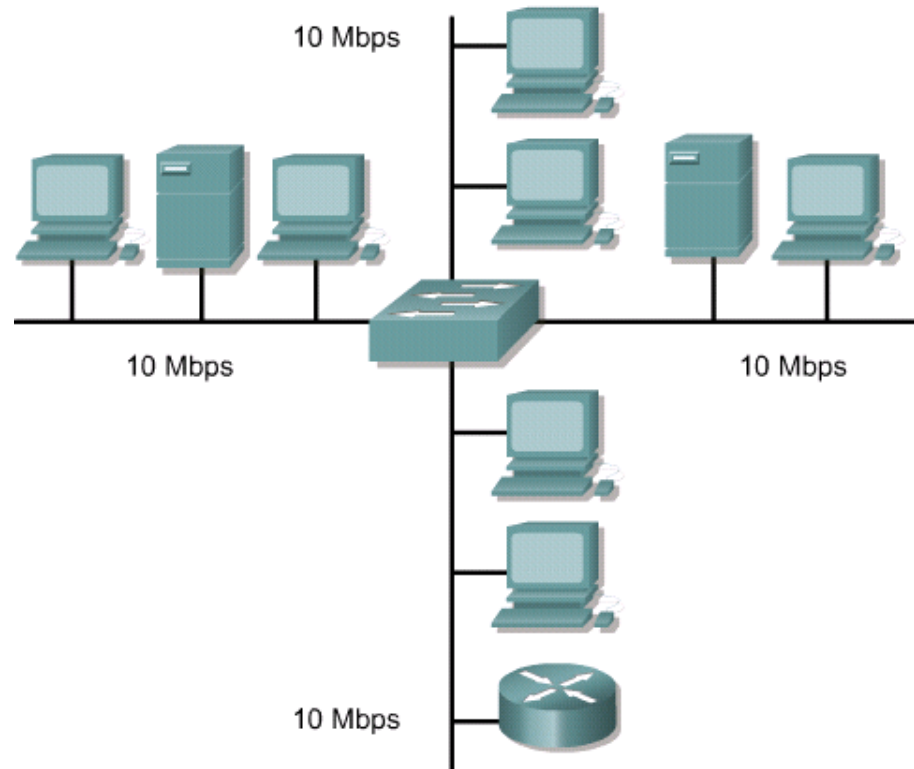
- Station A sends a frame to station B.
- The switch has the address for station B in the MAC address table.

Broadcast and Multicast Frames



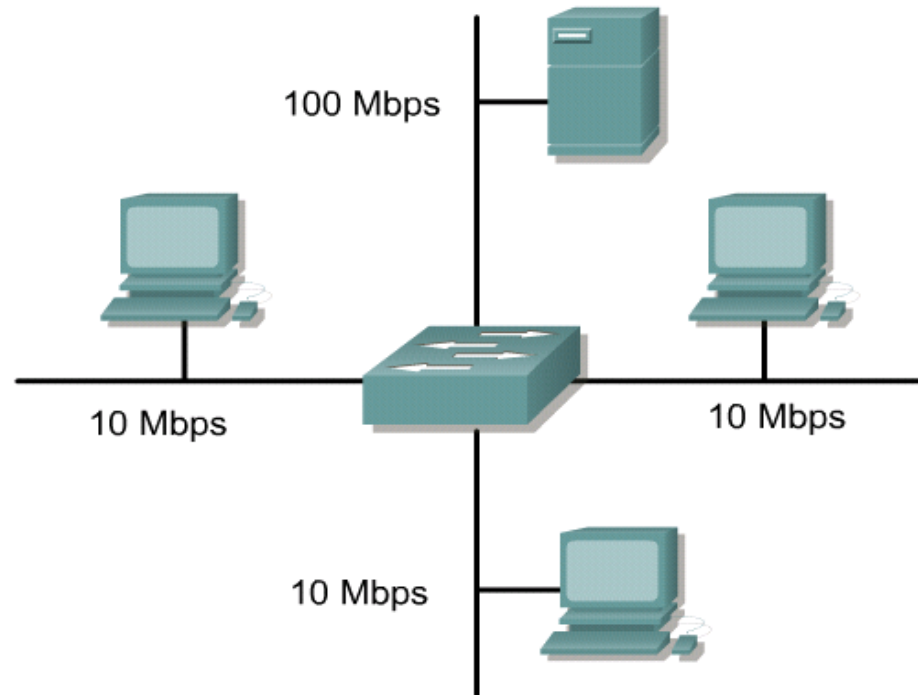
- Station D sends a broadcast or multicast frame.
- Broadcast and multicast frames are flooded to all ports other than the originating port.

Symmetric switching



- A symmetric switch provides switched connections between ports with the same bandwidth.

Asymmetric switching



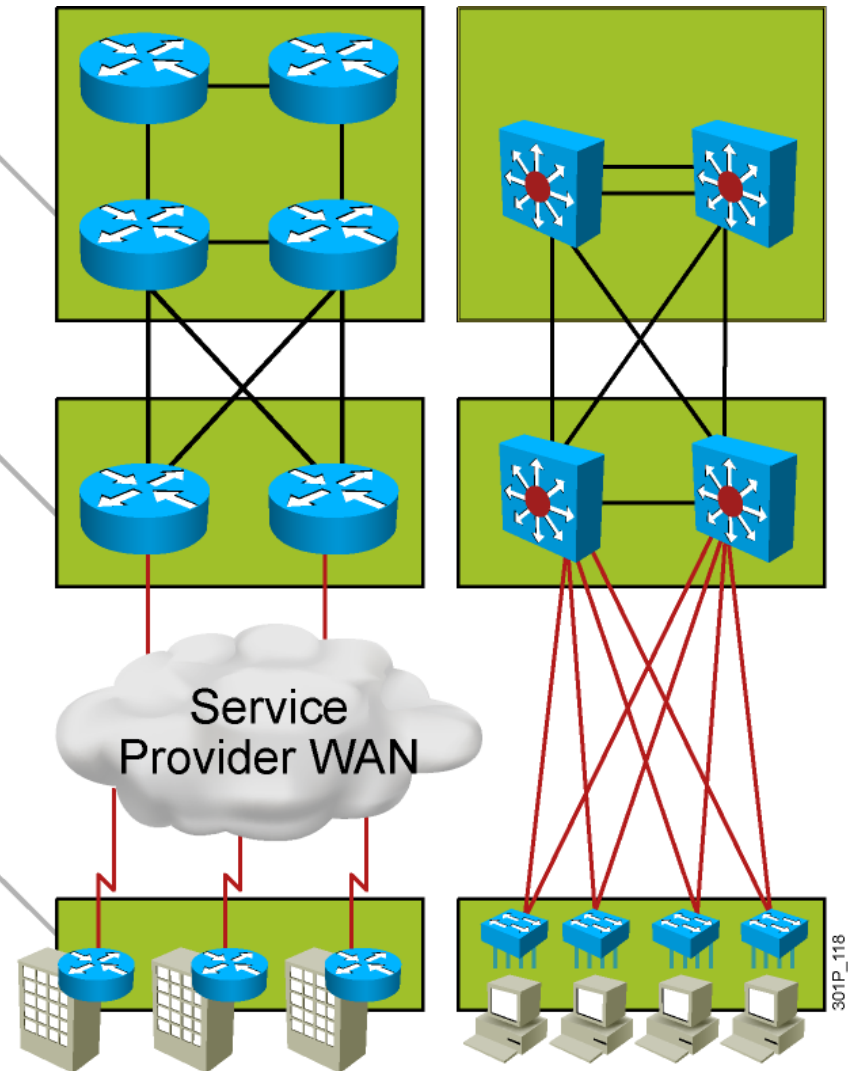
- An asymmetric LAN switch provides switched connections between ports of unlike bandwidth, such as a combination of 10 Mbps and 100 Mbps ports.
- Asymmetric switching enables more bandwidth to be dedicated to the server switch port in order to prevent a bottleneck.

The Hierarchy of Connectivity

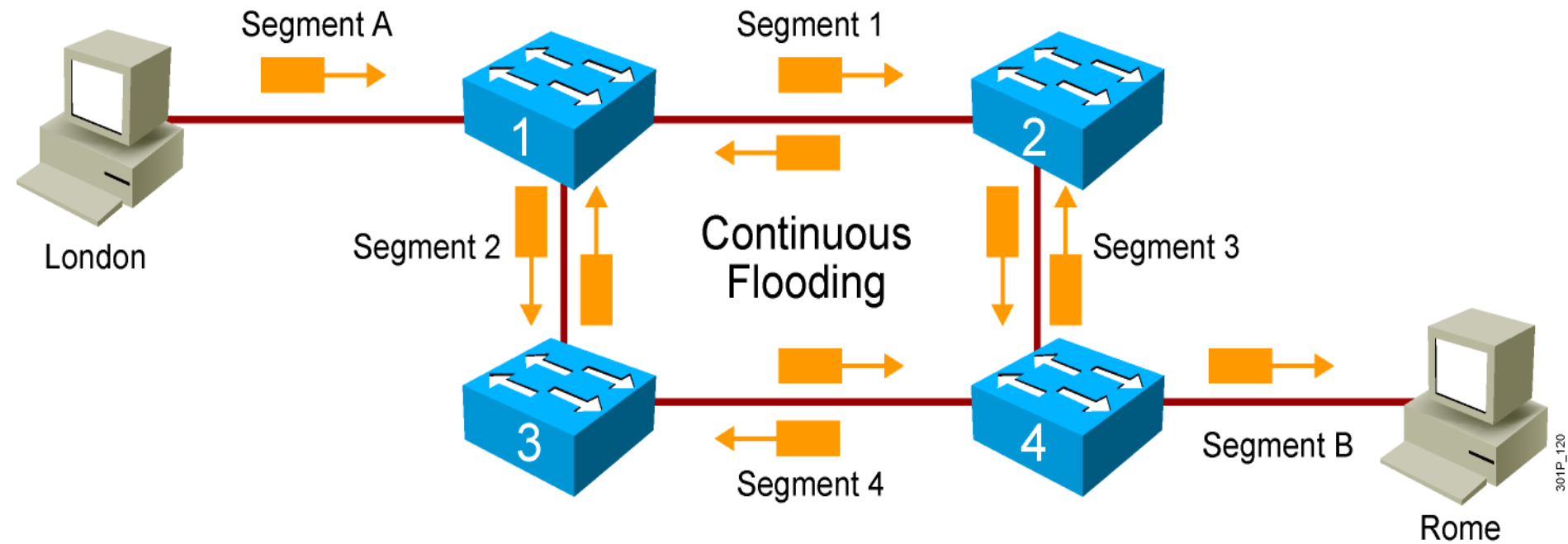
Core layer: Provides optimal transport between core routers and distribution sites

Distribution layer: Provides policy-based connectivity, ? peer reduction, and aggregation

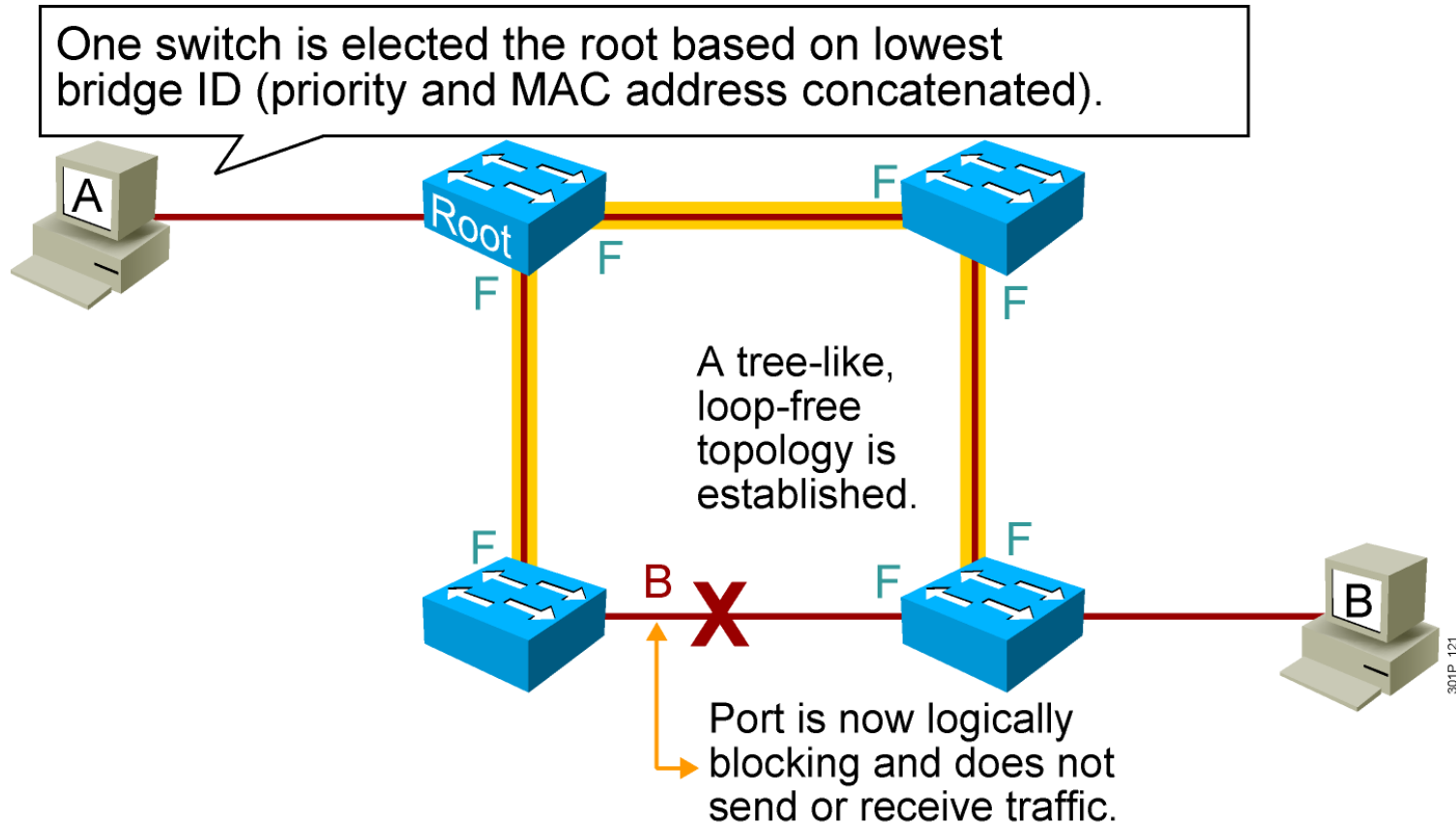
Access layer: Provides common group access to the internetworking environment



Loops



Spanning Tree Protocol





Ethernet LANs

Starting a Switch

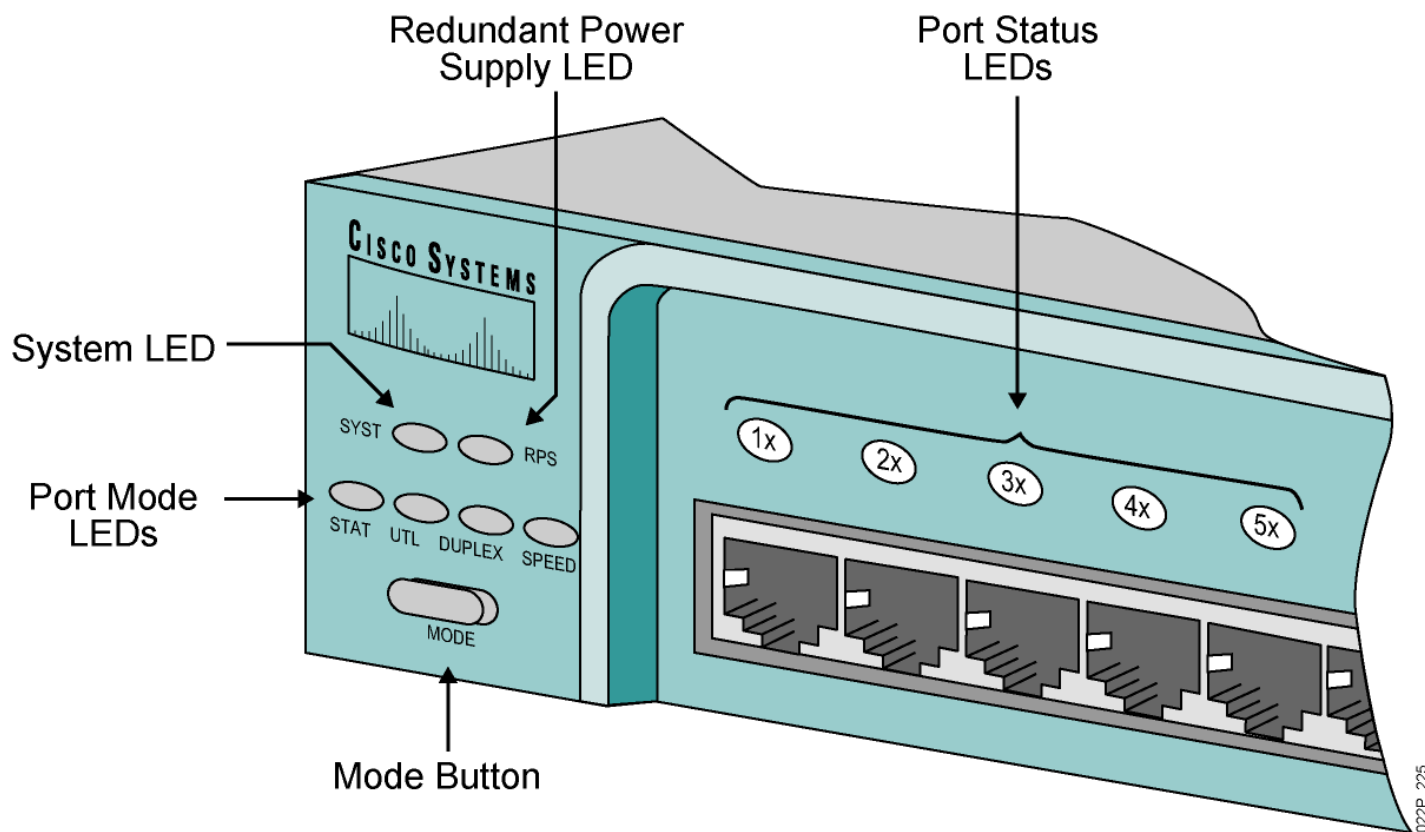
Initial Startup of the Catalyst Switch

- **System startup routines initiate switch software.**
- **Initial startup uses default configuration parameters.**

1. Before you start the switch, verify the cabling and console connection.
2. Attach the power cable plug to the switch power supply socket.
3. Observe the boot sequence:
 - LEDs on the switch chassis
 - Cisco IOS software output text



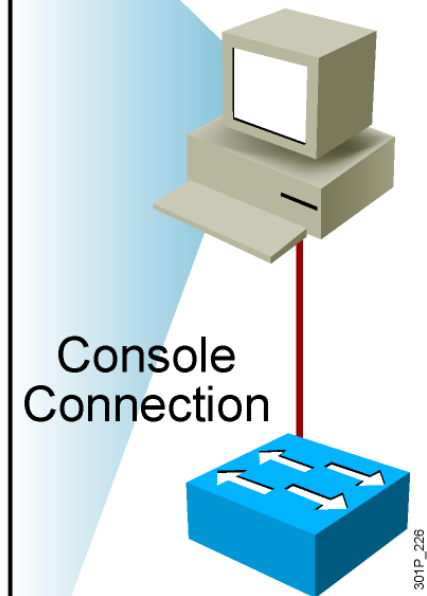
Catalyst 2960 Switch LED Indicators



Initial Bootup Output from the Catalyst 2960 Switch

```
Base ethernet MAC Address: 00:19:30:38:bd:00
Xmodem file system is available.
The password-recovery mechanism is enabled.
Initializing Flash...
flashfs[0]: 598 files, 19 directories
flashfs[0]: 0 orphaned files, 0 orphaned directories
flashfs[0]: Total bytes: 32514048
flashfs[0]: Bytes used: 8210432
flashfs[0]: Bytes available: 24303616
flashfs[0]: flashfs fsck took 9 seconds.
...done Initializing Flash.
Boot Sector Filesystem (bs) installed, fsid: 3
done.
Loading "flash:c2960-lanbasek9-mz.122-25.SEE2/c2960-lanbasek9
-mz.122-25.SEE2.bin"...
File "flash:c2960-lanbasek9-mz.122-25.SEE2/c2960-lanbasek9-mz.
122-25.SEE2.bin" uncompressed and installed, entry point: 0x3000
executing...

!Rest of startup text omitted
```



Initial Configuration of the Catalyst 2960 Switch Using Setup

```
--- System Configuration Dialog ---
```

```
Would you like to enter the initial configuration dialog? [yes/no]:  
Y
```

```
At any point you may enter a question mark '?' for help.  
Use ctrl-c to abort configuration dialog at any prompt.  
Default settings are in square brackets '[]'.
```

```
Basic management setup configures only enough connectivity  
for management of the system, extended setup will ask you  
to configure each interface on the system
```

```
Would you like to enter basic management setup? [yes/no]: no  
First, would you like to see the current interface summary? [yes]:  
no
```

```
Configuring global parameters:
```

```
..  
..text omitted ..
```

```
..  
[0] Go to the IOS command prompt without saving this config.  
[1] Return back to the setup without saving this config.  
[2] Save this configuration to nvram and exit.
```

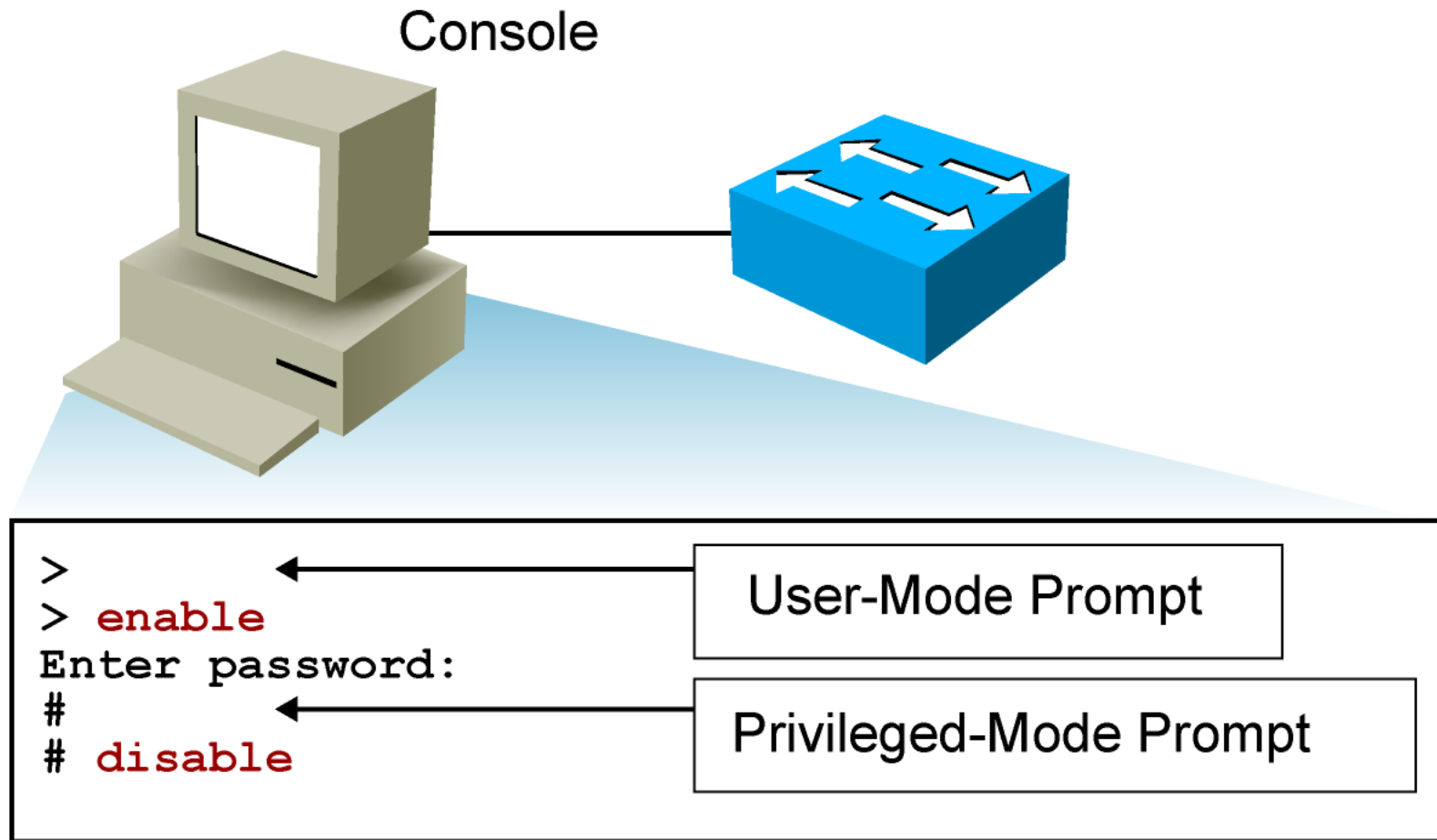
```
Enter your selection [2]:
```

```
Building configuration...
```

```
[OK]
```

```
Use the enabled mode 'configure' command to modify this  
configuration.
```

Logging In to the Switch and Entering the Privileged EXEC Mode



Configuring the Switch



Configuration modes:

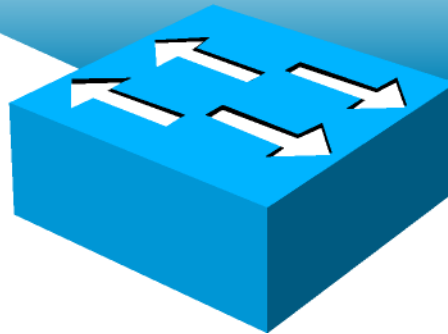
- Global configuration mode
 - `SwitchX#configure terminal`
 - `SwitchX(config)#`
- Interface configuration mode
 - `SwitchX(config)#interface fa0/1`
 - `SwitchX(config-if)#`

Configuring Switch Identification

Switch Name

```
(config) #hostname SwitchX  
SwitchX(config) #
```

301P_231



Sets the local identity for the switch

Configuring the Switch IP Address

```
SwitchX(config)#interface vlan 1  
SwitchX(config-if)#ip address {ip address} {mask}
```

Example:

```
SwitchX(config)#interface vlan 1  
SwitchX(config-if)#ip address 10.5.5.11 255.255.255.0  
SwitchX(config-if)#no shutdown
```

Note: It is necessary to use the **no shutdown** command to make the interface operational.

Configuring the Switch Default Gateway



```
SwitchX(config)#ip default-gateway {ip address}
```

Example:

```
SwitchX(config)#ip default-gateway 172.20.137.1
```

Saving Configurations

```
SwitchX#  
SwitchX#copy running-config startup-config  
Destination filename [startup-config]?  
Building configuration..  
[OK]  
SwitchX#
```

- Copies the current configuration to NVRAM

Showing Switch Initial Startup Status

```
SwitchX#show version
```

- Displays the configuration of the system hardware, software version, names and sources of configuration files, and boot images

```
SwitchX#show running-config
```

- Displays the current active configuration file of the switch

```
SwitchX#show interfaces
```

- Displays statistics for all interfaces configured on the switch

Switch *show version* Command

```
Switch#show version
```

```
Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 12.2(25)SEE2, RELEASE
```

```
SOFTWARE (fc1)
```

```
Copyright (c) 1986-2006 by Cisco Systems, Inc.
```

```
Compiled Fri 28-Jul-06 11:57 by yenanh
```

```
Image text-base: 0x00003000, data-base: 0x00BB7944
```

```
ROM: Bootstrap program is C2960 boot loader
```

```
BOOTLDR: C2960 Boot Loader (C2960-HBOOT-M) Version 12.2(25r)SEE1, RELEASE SOFTWARE (fc1)
```

```
Switch uptime is 24 minutes
```

```
System returned to ROM by power-on
```

```
System image file is "flash:c2960-lanbasek9-mz.122-25.SEE2/c2960-lanbasek9-mz.122-25.SEE2.bin"
```

```
cisco WS-C2960-24TT-L (PowerPC405)processor(revision B0) with 61440K/4088K bytes of memory.
```

```
Processor board ID FOC1052W3XC
```

```
Last reset from power-on
```

```
1 Virtual Ethernet interface
```

```
24 FastEthernet interfaces
```

```
2 Gigabit Ethernet interfaces
```

```
The password-recovery mechanism is enabled.
```

```
! Text omitted
```

```
Switch#
```

Switch *show interfaces* Command

```
SwitchX#show interfaces FastEthernet0/2
```

```
FastEthernet0/2 is up, line protocol is up (connected)
```

```
Hardware is Fast Ethernet, address is 0008.a445.ce82 (bia 0008.a445.ce82)
```

```
MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,  
    reliability 255/255, txload 1/255, rxload 1/255
```

```
Encapsulation ARPA, loopback not set
```

```
Keepalive set (10 sec)
```

```
Half-duplex, 10Mb/s
```

```
input flow-control is unsupported output flow-control is unsupported
```

```
ARP type: ARPA, ARP Timeout 04:00:00
```

```
Last input 4w6d, output 00:00:01, 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
```

```
182979 packets input, 16802150 bytes, 0 no buffer
```

```
Received 49954 broadcasts (0 multicast)
```

```
0 runs, 0 giants, 0 throttles
```

```
0 input errors 0 CRC, 0 frame, 0 overrun, 8 ignored
```

```
0 watchdog, 20115 multicast, 0 pause input
```

```
0 input packets with dribble condition detected
```

```
3747473 packets output, 353656347 bytes, 0 underruns
```

```
--More--
```

Cisco Catalyst 2960 Series

```
SwitchX(config)#interface fa0/1  
SwitchX(config-if)#duplex {auto|full|half}  
SwitchX(config-if)#speed {10|100|1000|auto}
```

Managing the MAC Address Table

Catalyst 2960 Series

```
SwitchX#show mac address-table
```

Mac Address Table

Vlan	Mac Address	Type	Ports
----	-----	-----	-----
A11	0008.a445.9b40	STATIC	CPU
A11	0100.0ccc.cccc	STATIC	CPU
A11	0100.0ccc.cccd	STATIC	CPU
A11	0100.0cdd.dddd	STATIC	CPU
1	0008.e3e8.0440	DYNAMIC	Fa0/2

```
Total Mac Addresses for this criterion: 5
```

```
SwitchX#
```

