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Network Devices

Networking Basics

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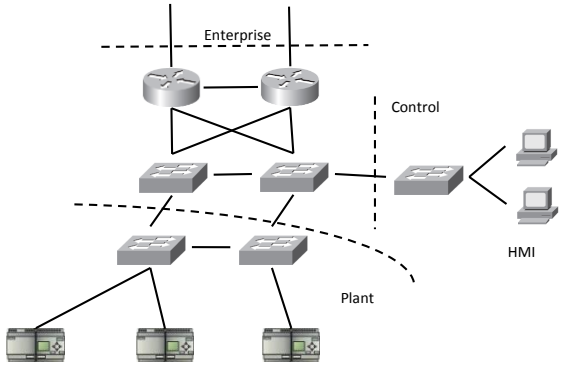
Network Devices

- You will eventually be handed a network diagram from a customer at some point and it will be filled with symbols. We will cover the more common ones and explain in detail
- Hubs
- Switches
- Routers



Domain Concepts

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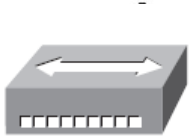
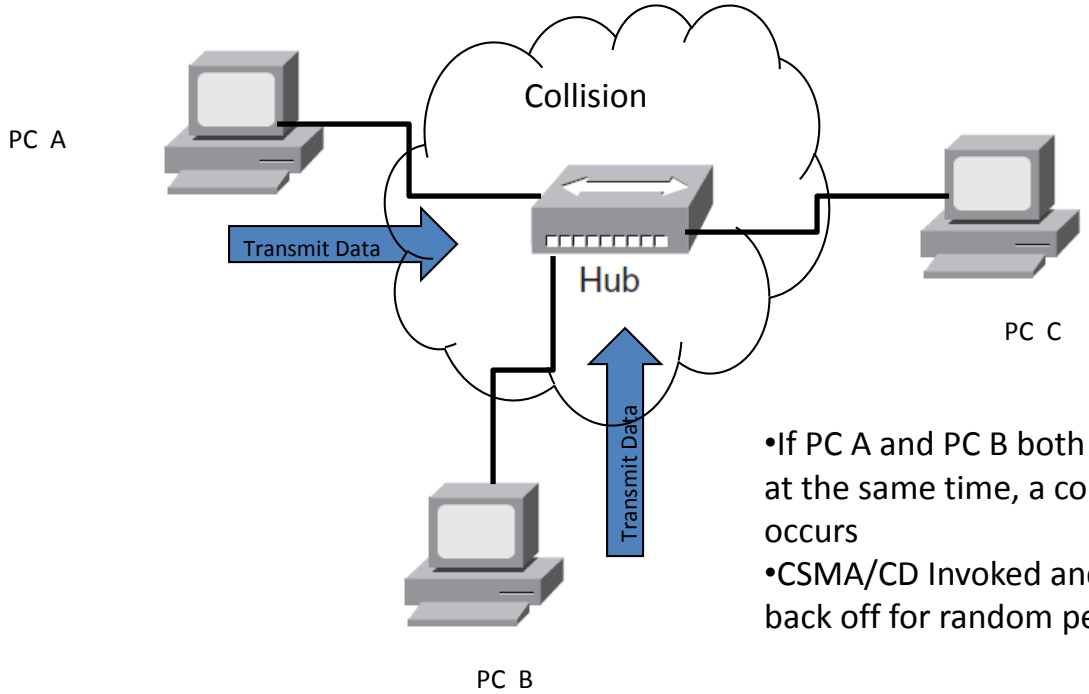
- Collision domain
  - All bandwidth is shared in a collision domain
  - Only one client can ‘talk’ at a time.
  - Collision can occur when two try to talk simultaneously resulting in retransmission and wasted bandwidth
  - Each client forces all other clients to pay attention to it
- Broadcast domain
  - What it is: A group of devices on a network segment that hear all broadcasts sent on that network segment
  - Devices use broadcasts when they want to share information with all other devices or are looking for a particular device to respond.

Hubs



- Symbol
- Hubs create a single collision domain
- Hubs don’t have anything to do with the Data Link layer of the OSI model, nor do they perform any switching at all. Hubs are strictly Physical layer devices. (OSI Layer 1)
- Hubs electrically repeat signals on each interface.

Hub Example



- If PC A and PC B both transmit at the same time, a collision occurs
- CSMA/CD Invoked and all must back off for random period

Switches

Switch

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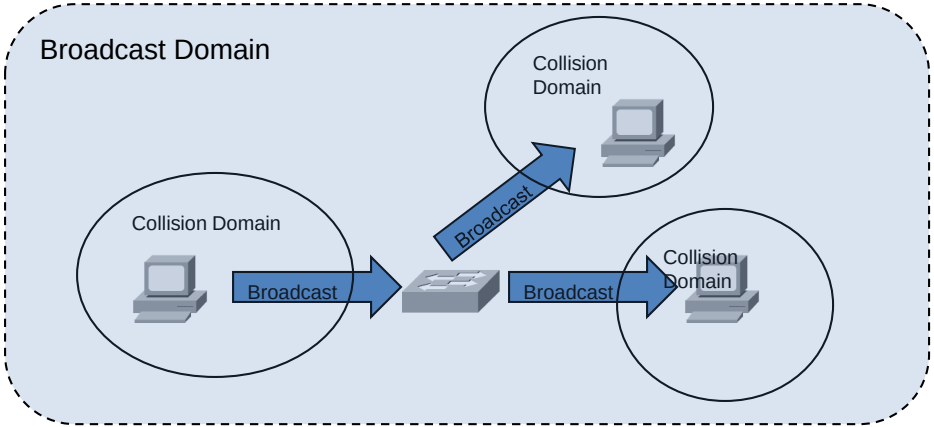
- Symbol for a switch
- Purpose: Create multiple collision domains. One for each port.
- Increases available bandwidth
- Decisions: flood, forward, filter
- Can be used to break up broadcast domains
  - Virtual LANs (VLANs)
- Switches operate at layer 2 of the OSI model
  - Sometimes layer 3.

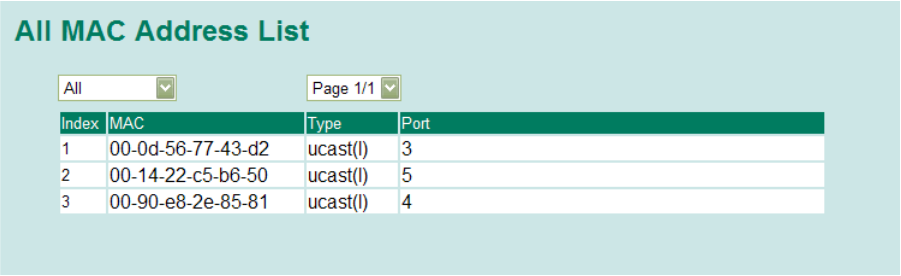
Switching and Domains

- One broadcast domain by default
  - This can be changed through the use of VLANs
  - Most managed switches use a single VLAN.
- Multiple collision domains however
  - Each port is its own collision domain



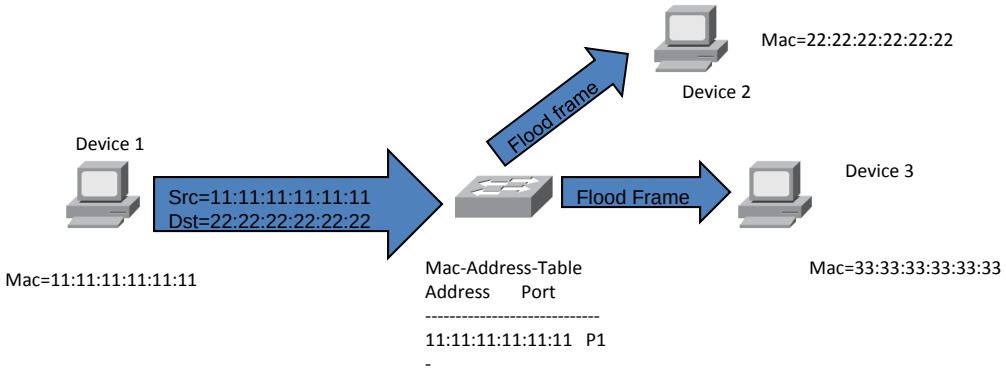
Switching Decisions

- A switch will do one of three things with an incoming frame.
  - Forward it
  - Filter it
  - Flood it
- These decisions are made based on the contents of the mac address table in the switch



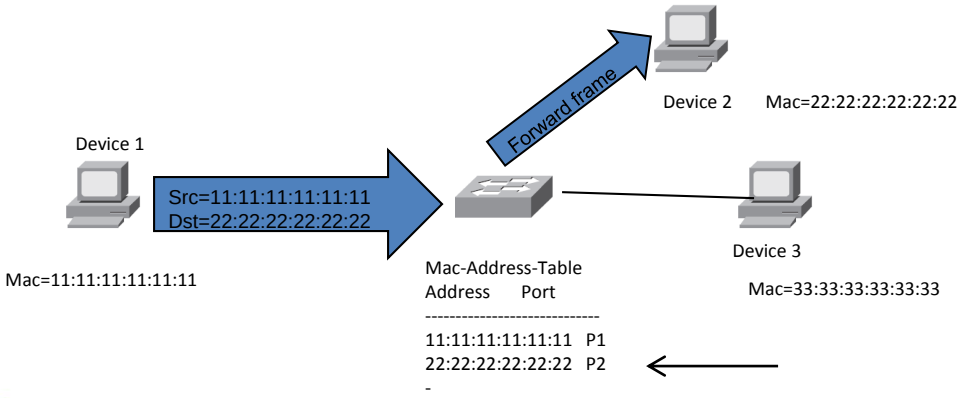
Flooding

- Flooding is done when a switch does not have an entry for the destination in its mac address table
- When a frame is flooded it is sent out every port on the switch except the one it came in on.



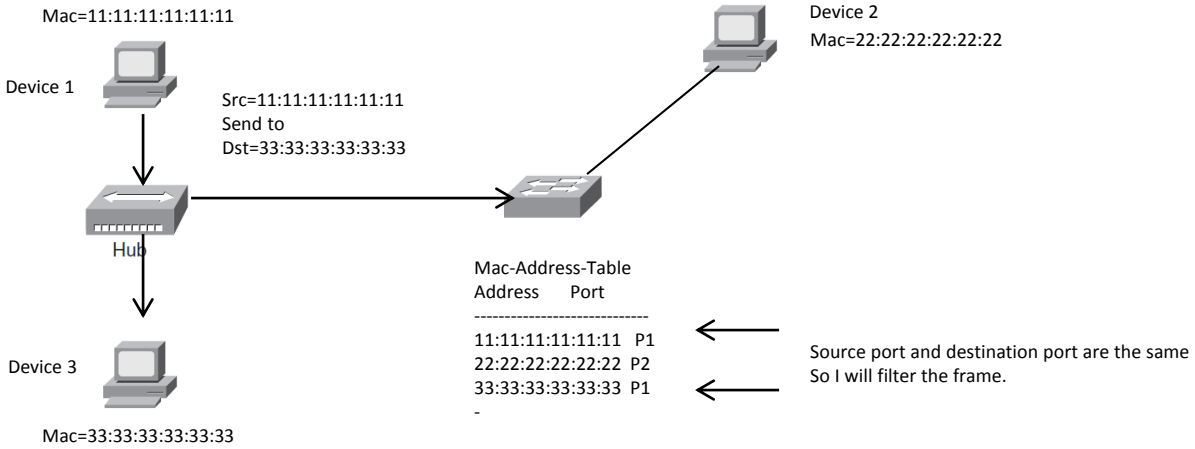
Forwarding

- Forwarding is done when a switch already HAS an entry for the destination in its mac address table
- When a frame is forwarded, it is sent out only on the port that has the mac associated with it

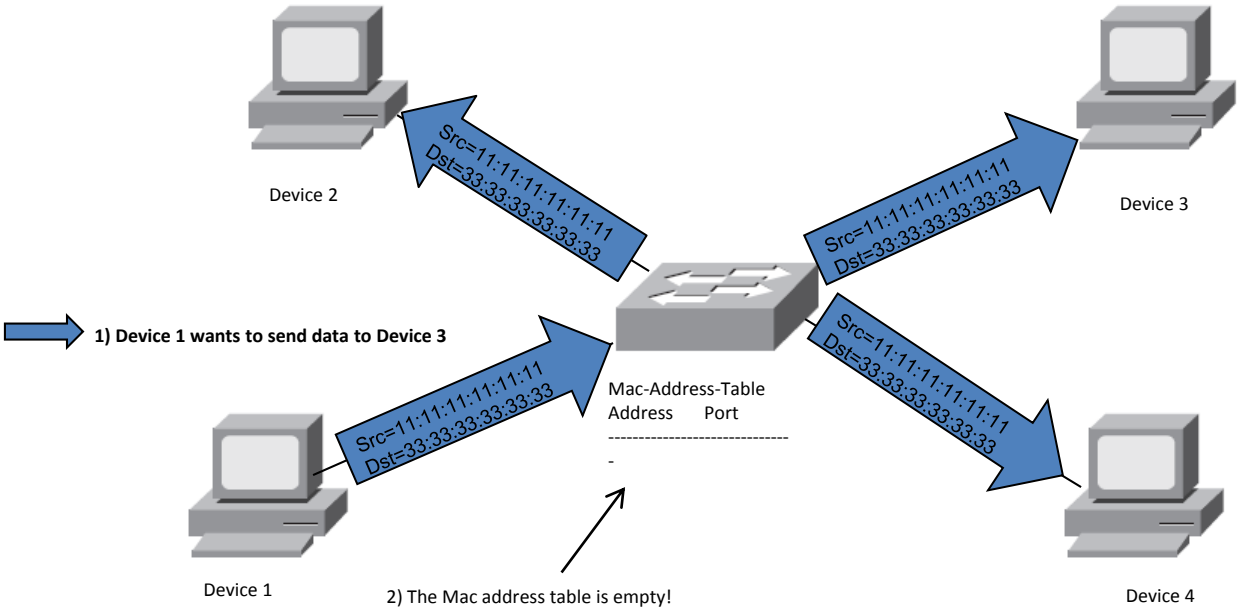


Filtering

- A switch port will filter a frame if it finds a match for both the source and destination mac addresses AND they are on the same port.

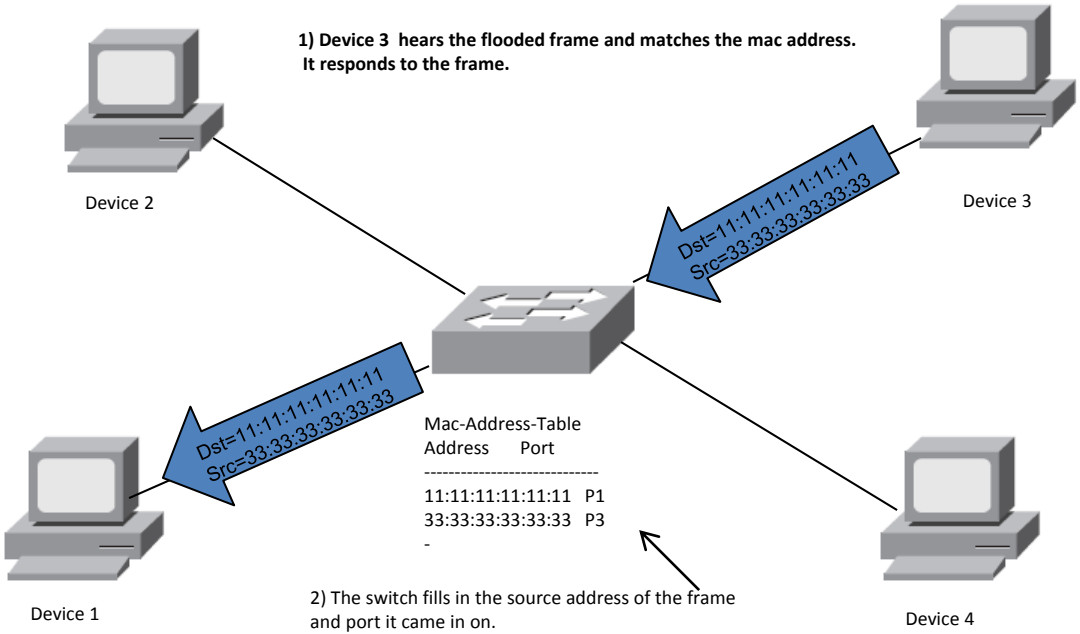


Switching Example 1



3) The switch puts an entry in the table with the source address of the frame and the port it came in on and Floods the frame out all ports

Switching Example cont..



Address Resolution Protocol

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- Typically the process of learning the mac addresses happens during the ARP process
- Arp is Address Resolution Protocol (layer3)
- It is used to find the layer 2 hardware address from a layer 3 IP address.
- It asks the question: Who has IP address x.x.x.x, please tell y.y.y.y
- A host will ask this question to populate its local ARP cache. In this way it will be able to populate the Layer 2 frame with the proper hardware addresses for the LAN.

Types of Switches

- Unmanaged
  - No management interface
  - No setup or configuration
  - Example EDS-205A

- Managed
  - Management interface
  - Rich feature set
  - Configuration required
  - Example EDR-510A

- Managed Layer 3
  - All the features of a managed L2 switch
  - Unlike Layer-2 switching, which uses the MAC address for exchanging data, a Layer-3 switch uses the IP address to represent the destination of a data packet.

Example Managed Switches

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	Managed DIN-Rail Switches						
							
	EDS-518A	EDS-510A	EDS-516A	EDS-508A	EDS-505A	EDS-408A	EDS-405A
Supported Modules							
Gigabit Ethernet Modules	–	–	–	–	–	–	–
Fast Ethernet Modules	–						
SFP Gigabit Ethernet Modules	✓						
SFP Fast Ethernet Modules	–						
Number of Ports							
Max. Number of Ports	18						
Gigabit Ethernet, 10/100/1000 Mbps	2						
Fast Ethernet, 10/100 Mbps	16						
Redundancy and Backup Options							
Turbo Ring (Recovery Time < 20 ms)	✓	✓	✓	✓	✓	✓	✓
Turbo Chain (Recovery Time < 20 ms)	✓	✓	✓	✓	✓	✓	✓
STP/RSTP	✓	✓	✓	✓	✓	✓	✓
Automatic Backup Configurator (ABC-01)	✓	✓	✓	✓	✓	✓	✓
Network Management and Control							
Layer 3 Switching	–	–	–	–	–	–	–
Port Trunking	✓	✓	✓	✓	✓	–	–
Modbus/TCP	✓	✓	✓	✓	✓	✓	✓
IEEE 1588 PTP	✓	✓	✓	✓	✓	–	–
SNMP/RMON	✓	✓	✓	✓	✓	✓	✓
LLDP	✓	✓	✓	✓	✓	✓	✓
DHCP Option 66/67/82	✓	✓	✓	✓	✓	✓	✓
IGMP Snooping/GMRP	✓	✓	✓	✓	✓	✓	✓
QoS	✓	✓	✓	✓	✓	✓	✓
IEEE 802.1Q VLAN	✓	✓	✓	✓	✓	✓	✓
Port-based VLAN	✓	✓	✓	✓	✓	✓	✓
IEEE 802.1X	✓	✓	✓	✓	✓	–	–
Port Lock	✓	✓	✓	✓	✓	–	–
IPv6	✓	✓	✓	✓	✓	✓	✓
Relay Warning	✓	✓	✓	✓	✓	✓	✓

Additional Features, and configurations for a more intelligent network.

Example Unmanaged Switches

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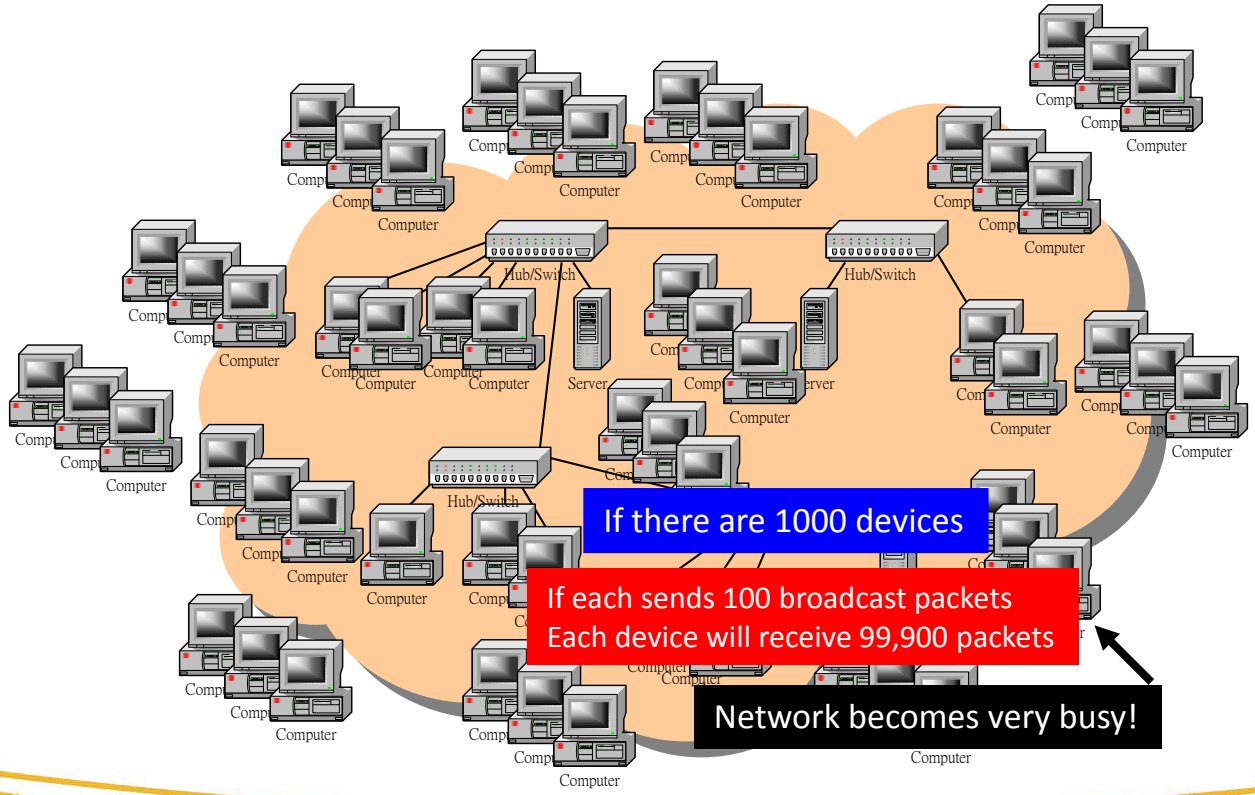
DIN-Rail Ethernet Switches

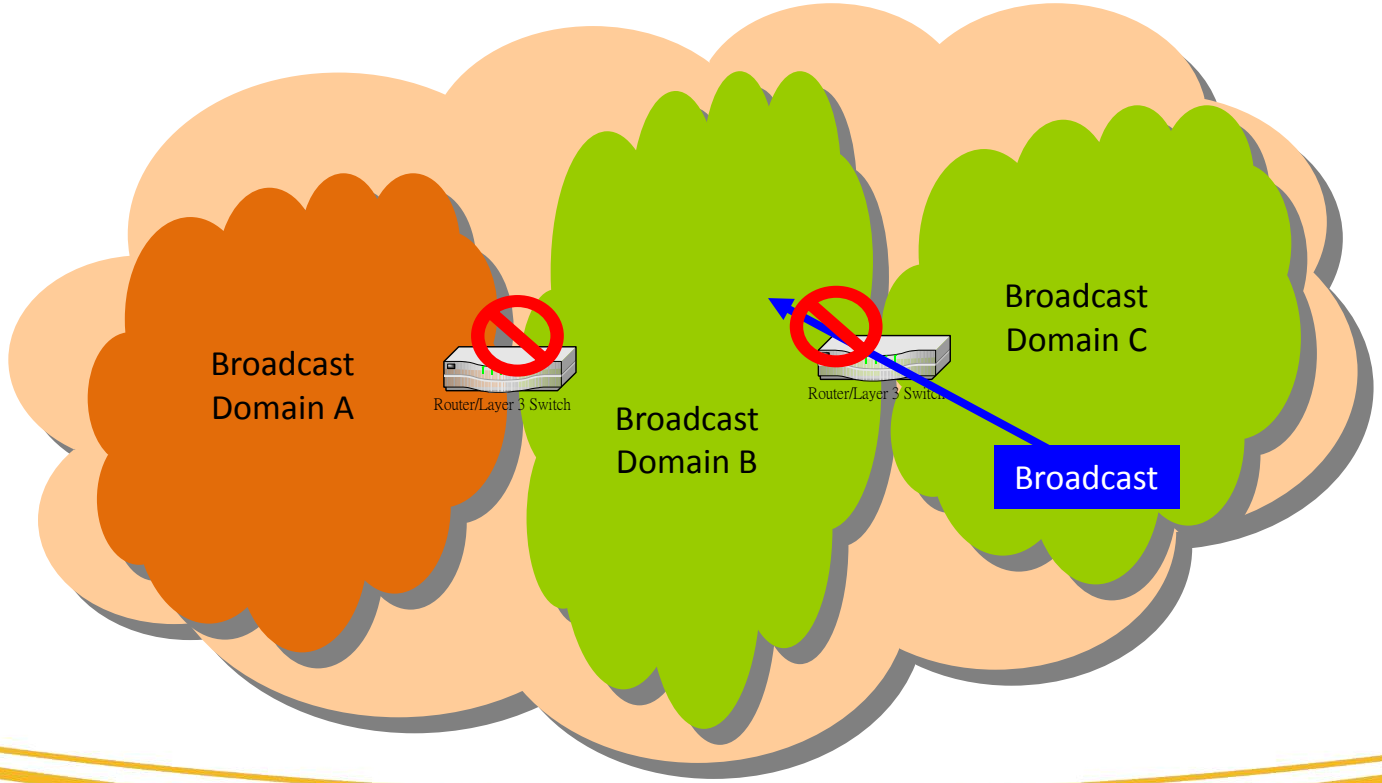
	Unmanaged DIN-Rail Switches									
										
	EDS-G308	EDS-G205	EDS-316	EDS-309	EDS-308	EDS-305	EDS-208A	EDS-205A	EDS-208	EDS-205
Supported Modules										
SFP Gigabit Ethernet Modules	✓	–	–	–	–	–	–	–	–	–
SFP Fast Ethernet Modules	✓	–	–	–	–	–	–	–	–	–
Number of Ports										
Max. Number of Ports	8	5	16	9	8	5	8	5	8	5
Gigabit Ethernet, 10/100/1000 Mbps	8	5	–	–	–	–	–	–	–	–
Fast Ethernet, 10/100 Mbps	–	–	16	9	8	5	8	5	8	5
Available Power Supplies										
24 VDC	–	–	✓	✓	✓	✓	–	–	✓	✓
24 VAC	–	–	–	–	–	–	✓	✓	✓	✓
12/24/48 VDC	✓	✓	–	–	–	–	✓	✓	–	–

Basic functionality, Low Cost

Broadcast In the Layer 2 Network



Divide Broadcast Domain



Routers

Router

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- Symbol
- Purpose is to forward packets between networks
  - Forward traffic by IP Address instead of MAC Address
  - Connects Subnets at the IP Layer
- Routers break up broadcast domains
- Routers are located at gateways, the places where two or more networks connect.
- Provide security with firewall rules
- Network Address Translation

LANs and Routers

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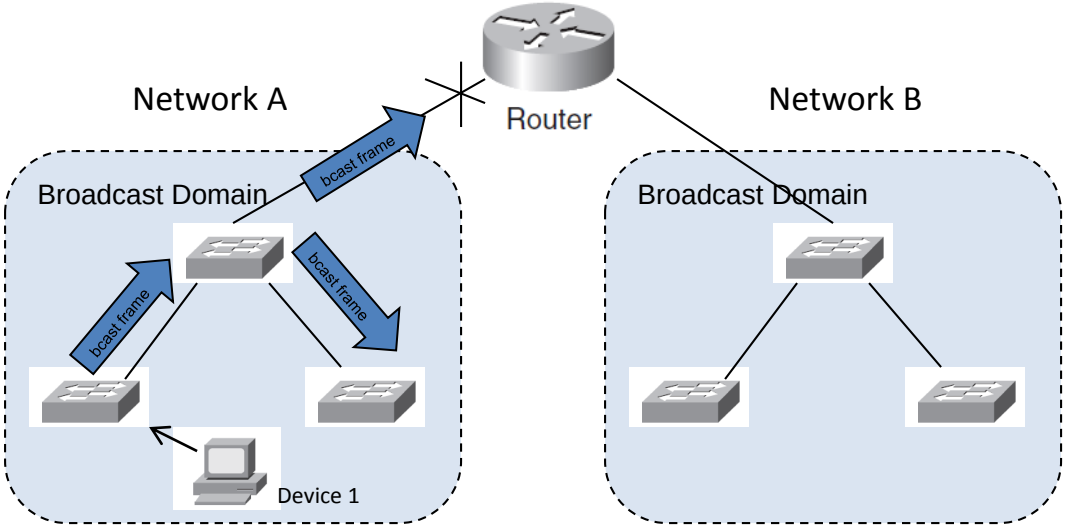
- Routers breakup broadcast domains
- Routers are layer 3 devices (IP)



•All broadcast frames will remain local to the broadcast domain
•All layer 2 MAC addressing is isolated to the broadcast domain
•Benefit is in greater security and better utilization of bandwidth

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