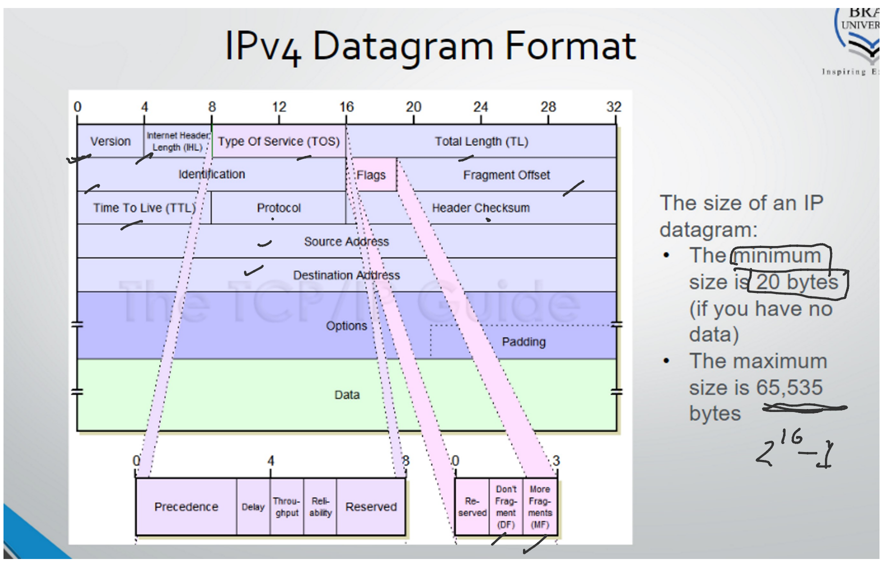
CSE421

Sunday, February 11, 2024 10:09 PM

* Chapter 7

Packet switching
- → Virtual Circuits (Connection oriented)
- → Datagram network (Connection less)



MTU → Max Transfer Unit (size)

20+3980

	length =4000	ID =x	fragflag MF =0	offset =0	

MTU = 1500

∴ Header = 20

∴ Data = 1500 − 20 = 1480

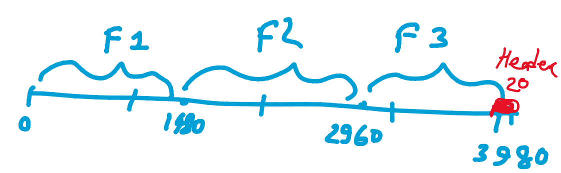
→ Frag 1

len=1500	ID=x	MF=1	Offset=0

→ Frag 2

1500	x	1	$\frac{1480}{8}=185$

→ Frag 3



Frag 3

1040	x	0	185+185=370

IP Fragmentation & Reassembly

MTU=20(H)+1480(D)
5140=20(H)+5120(D)
5120-1480=3640 (1st)
3640-1480=2160 (2nd)
2160-1480=680 (3rd)

680+20=700

20+ 5120

Original IP Datagram

Sequence	Identifier	Total Length	DF May / Don't	MF Last / More	Fragment Offset
0	345	5140	0	0	0

IP Fragments (Ethernet)

Sequence	Identifier	Total Length	DF May / Don't	MF Last / More	Fragment Offset	Data Bytes	Fragment Offset
0-0	345	1500	0	1	0	0 -1479	0/8=0
0-1	345	1500	0	1	185	1480-2959	1480/8=185
0-2	345	1500	0	1	370	2960-4439	2960/8=370
0-3	345	700	0	0	555	4440-5119	4440/8=555

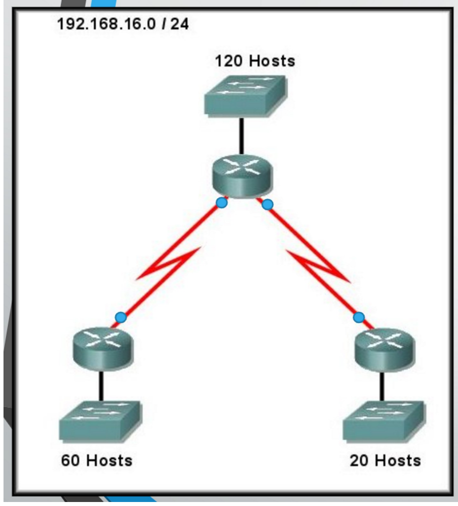
→ ICMP : Internet Control Message Protocol

- Ping (Flood Attack, Zombie attack, Packet magnification)
- Traceroute (Uses TTL)

Chapter 8 :-

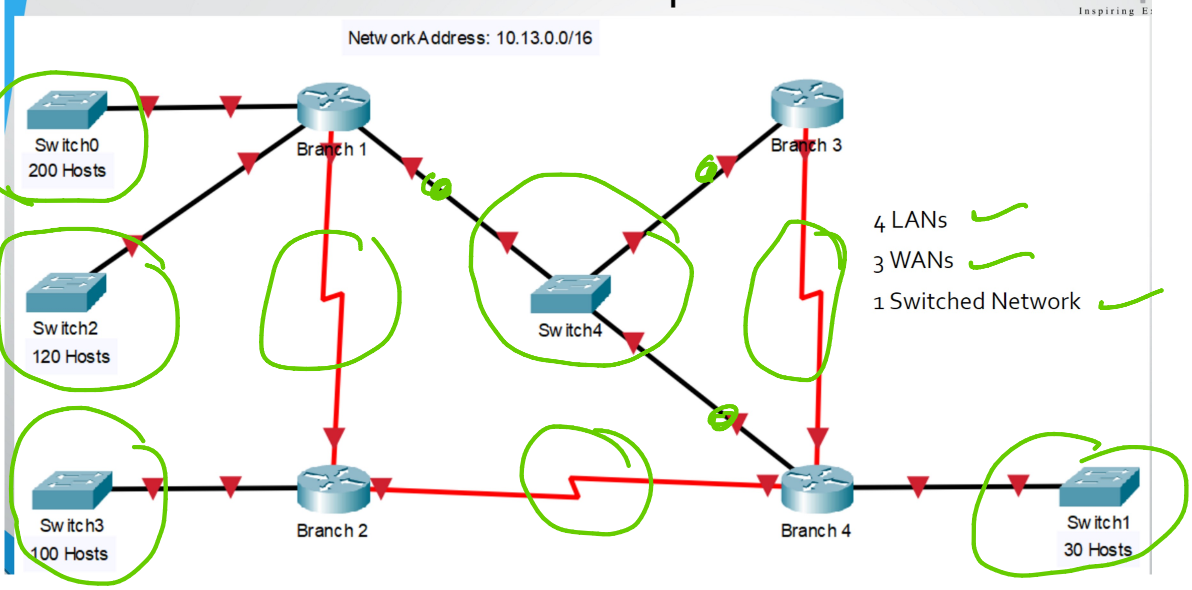
- ✓ FLSM
- ✓ VLSM

VLSM Example 1



- Network address given: 192.168.16.0/24
- Host requirements (sorted largest to smallest)
  - LAN 1: 120 Hosts → 128 → 7 → 16.0 $\underbrace{0\cdots0}_{7}$ /25
  - LAN 2: 60 Hosts → 64 → 6 → 16.10 $\underbrace{0\cdots0}_{6}$ /26
  - LAN 3: 20 Hosts → 32 → 5 → 16.110 $\underbrace{0\cdots0}_{5}$ /27
  - WAN 1: 2 Hosts → 4 → 2 → 16.111000 $\underbrace{00}$ /30
  - WAN 2: 2 Hosts → 4 → 2 → 16.111001 $\underbrace{00}$ /30

VLSM Example 2



4 LANs ✓
3 WANs ✓
1 Switched Network ✓

Chapter 9:-

✓ DHCP : Dynamic Host Configuration Protocol

DORA

New connection

Discover (Broadcast)
Offer (Unicast)
Request (Broadcast)
Acknowledgment (Unicast)

Lease Extension

- DHCP Relay (Helper address)
Forwarding Broadcast packets outside network.

DHCP :-

Making DHCP server :-

ip dhcp excluded-address _._Start IP_._ _._End IP_._

ip dhcp pool POOL-NAME

network _._IP_._ _._Subnet_._

dns-server _._._._

default-router _._._._

Relay agent making :-

int g0/0

ip helper-address _._Next hop IP_._

Making DHCP client :-

int g0/0

ip address dhcp

no shut

✓NAT (Network Address Translation) :-

NAT (Network Address Translation) :-

ip access-list standard $\boxed{\text{NAME\_of\_NAT}}$

permit _._._._ (IP)   wild mask → opposite of subnet mask _._._._

= ''

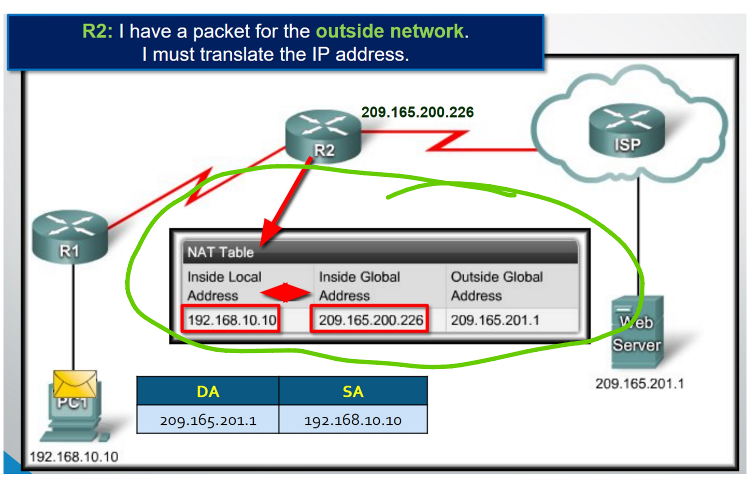
ip nat pool $\boxed{\text{POOL\_NAME}}$ _._._._ (IP start public)   _._._._ (IP End public)   netmask _._._._ (Subnet mask)

ip nat inside source list $\boxed{\text{NAME\_of\_NAT}}$ pool $\boxed{\text{Pool Name}}$ overload

int s0/0/0
 ip nat inside
int s0/0/1
 ip nat outside

ip nat inside source static _._._._ (Inside IP)   _._._._ (outside IP)

show ip nat translation



✓PAT (Port Address Translation)

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✓ Port Forwarding: Assigning static ip to NAT

✱ Chapter 10:-

Routing

- → Static
  - → Standard (AD=1) → Directly Connected, Next Hop IP, Fully Specified
  - → Summary
  - → Floating (AD>1)
  - → Default (0.0.0.0 0.0.0.0)

  ip route _IP_ _Subnet_ $\boxed{\text{Exit int}}$ $\boxed{\text{Next Hop IP}}$ $\boxed{\text{Administrative Distance}}$

- → Dynamic
  - → Intradomain
    - → Distance Vector (RIP)
    - → Link state (OSPF)
  - → Interdomain → Path vector (BGP)

Chapter 11 :-

Cold Start

Network	Interface	Hop
1	F 0/0	0
2	S 0/0/0	0
3	S 0/0/0	1
4	S 0/0/0	2

Network	Interface	Hop
2	S0/0/0	0
3	S0/0/1	0
1	S0/0/0	1
4	S0/0/1	1

Network	Interface	Hop
3	S0/0/1	0
4	F0/0	0
2	S0/0/1	1
1	S0/0/1	2

Chapter 12 :-

Link-State Routing Process
5 Step Process

BRAC UNIVERSITY Inspiring Excell

1. Each router learns about its own directly connected networks. → Directly Connected
2. Each router is responsible for contacting its neighbors (exchange Hello packet) on directly connected networks. → Hello → Neighbors
3. Each router builds a link-state packet (LSP) containing the state of each directly connected link. → LSP Flood
4. Each router floods the LSP to all routers, who then store all LSPs received in a database. → Database
5. Each router uses the LSPs to construct a database that is a complete map of the topology and computes the best path to each destination network. → Find best Path

Step 5: Constructing a Link-State Database

R1s Link-State Database

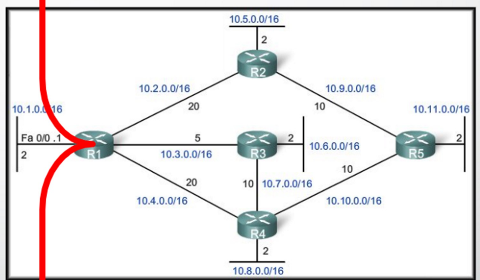
LSPs from R2:
- Connected to neighbor R1 on network 10.2.0.0/16, cost of 20
- Connected to neighbor R5 on network 10.9.0.0/16, cost of 10
- Has a network 10.5.0.0/16, cost of 2

LSPs from R3:
- Connected to neighbor R1 on network 10.3.0.0/16, cost of 5
- Connected to neighbor R4 on network 10.7.0.0/16, cost of 10
- Has a network 10.6.0.0/16, cost of 2

LSPs from R4:
- Connected to neighbor R1 on network 10.4.0.0/16, cost of 20
- Connected to neighbor R3 on network 10.7.0.0/16, cost of 10
- Connected to neighbor R5 on network 10.10.0.0/16, cost of 10
- Has a network 10.8.0.0/16, cost of 2

LSPs from R5:
- Connected to neighbor R2 on network 10.9.0.0/16, cost of 10
- Connected to neighbor R4 on network 10.10.0.0/16, cost of 10
- Has a network 10.11.0.0/16, cost of 2

R1 Link-states:
- Connected to neighbor R2 on network 10.2.0.0/16, cost of 20
- Connected to neighbor R3 on network 10.3.0.0/16, cost of 5
- Connected to neighbor R4 on network 10.4.0.0/16, cost of 20
- Has a network 10.1.0.0/16, cost of 2



- As a result of the flooding process, router R1 has learned the link-state information for each router in its routing area.

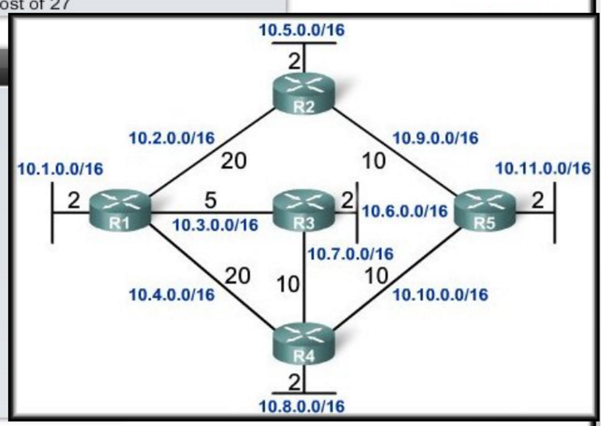
Generating a Routing Table

SPF Information
- Network 10.5.0.0/16 via R2 serial 0/0/0 at a cost of 22
- Network 10.6.0.0/16 via R3 serial 0/0/1 at a cost of 7
- Network 10.7.0.0/16 via R3 serial 0/0/1 at a cost of 15
- Network 10.8.0.0/16 via R3 serial 0/0/1 at a cost of 17
- Network 10.9.0.0/16 via R2 serial 0/0/0 at a cost of 30
- Network 10.10.0.0/16 via R3 serial 0/0/1 at a cost of 25
- Network 10.11.0.0/16 via R3 serial 0/0/1 at a cost of 27

R1 Routing Table

Directly Connected Networks
- 10.1.0.0/16 Directly Connected Network
- 10.2.0.0/16 Directly Connected Network
- 10.3.0.0/16 Directly Connected Network
- 10.4.0.0/16 Directly Connected Network

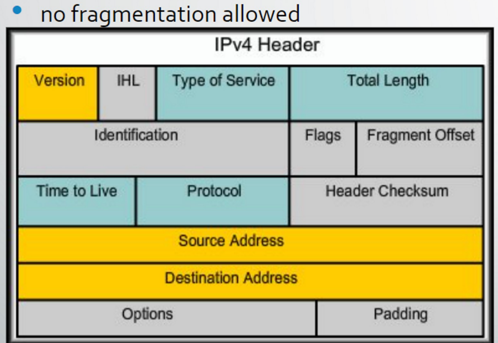
Remote Networks
- 10.5.0.0/16 via R2 serial 0/0/0, cost = 22
- 10.6.0.0/16 via R3 serial 0/0/1, cost = 7
- 10.7.0.0/16 via R3 serial 0/0/1, cost = 15
- 10.8.0.0/16 via R3 serial 0/0/1, cost = 17
- 10.9.0.0/16 via R2 serial 0/0/0, cost = 30
- 10.10.0.0/16 via R3 serial 0/0/1, cost = 25
- 10.11.0.0/16 via R3 serial 0/0/1, cost = 27

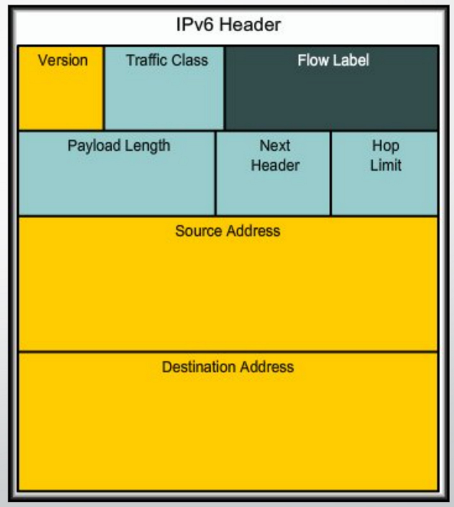


Chapter 13 :-

Reasons for Using IPv6

- IPv6 Features:
  - fixed-length 40 byte header
  - no fragmentation allowed





IPv6

Unicast

Anycast

Multicast

Broadcast = All nodes multicast

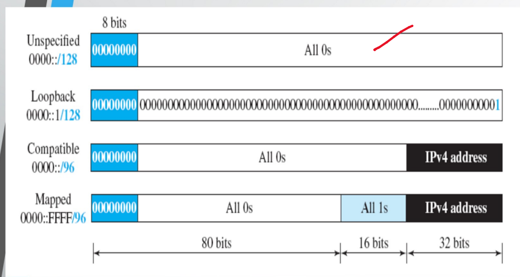
Unicast addresses

- A unicast address is an address that identifies a single device.

- Types of Unicast Addresses:

Block prefix	*CIDR*	*Block assignment*	*Fraction*
0000 0000	0000::/8	Special addresses	1/256
001	**2000::/3**	**Global unicast**	**1/8**
1111 110	FC00::/7	Unique local unicast	1/128
1111 1110 10	FE80::/10	Link local addresses	1/1024
1111 1111	FF00::/8	Multicast addresses	1/256

Special Addresses



- **Unspecified Address:**
  - ::/128
  - In a host, it refers to the host itself, and is used when a device does not know its own address
  - For addressing purposes within a software. .
- **Loopback Address**
  - ::1/128
  - loopback (same as 127.0.0.1 in many IPv4 implementations)
  - In IPv6 there is just one address, not a whole block, for this function.

Network Interface ID

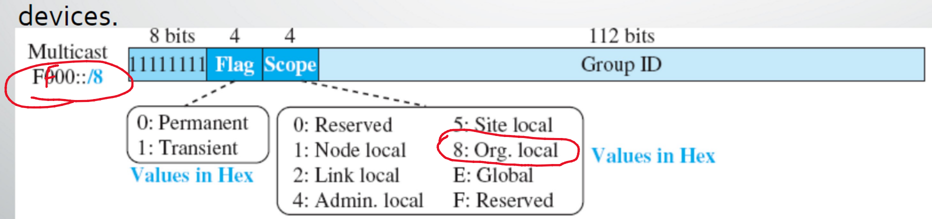
64 | 64 → 2000::/3

→ FC00::/7

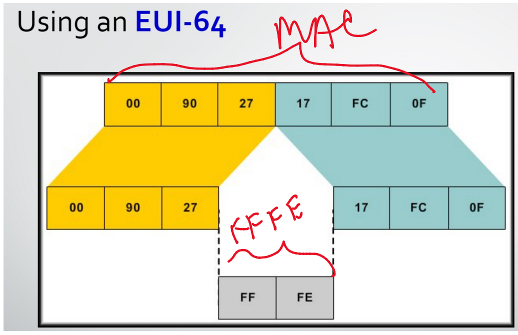
→ FE80::/10

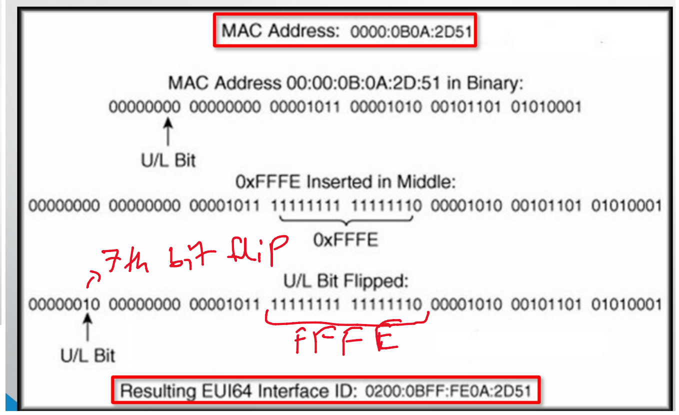
Multicast Addresses

- Multicast addresses are used to send data to a number of devices on an internetwork simultaneously.
- Each multicast address can be specified for a variety of *different scopes*
  - allowing a transmission to be targeted to either a wide or narrow audience of recipient devices.



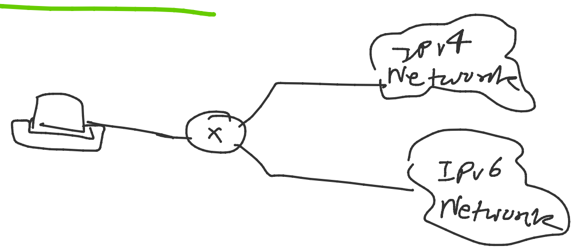
Extended Unique Identifier



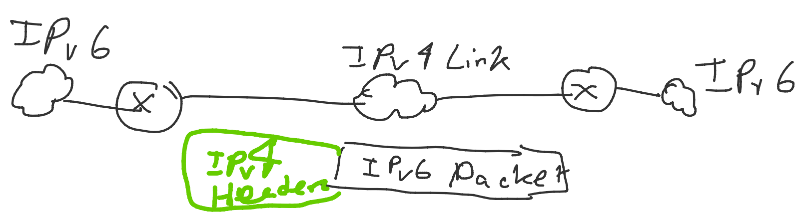


IPv4 → IPv6 Transition:-

1. Dual stack



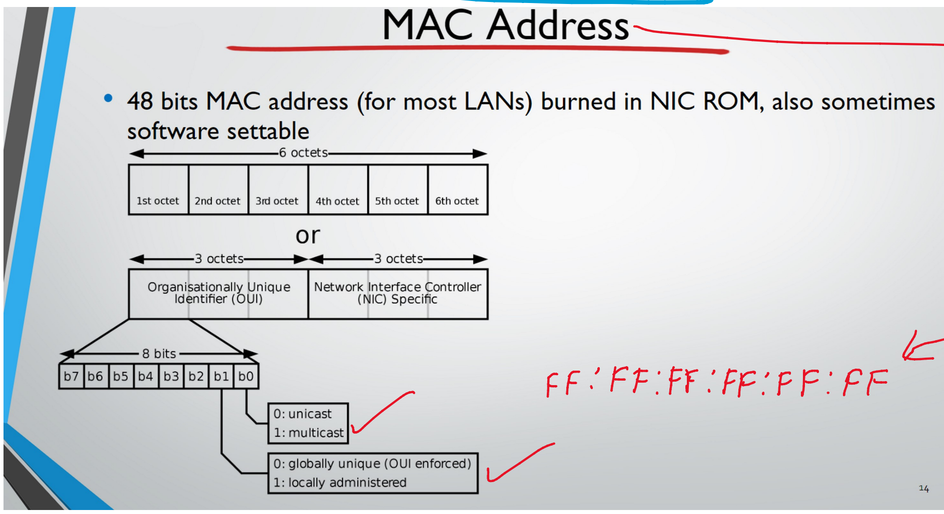
2. Tunneling



3. NAT Translation

Chapter 14:-

Chapter 14 :-

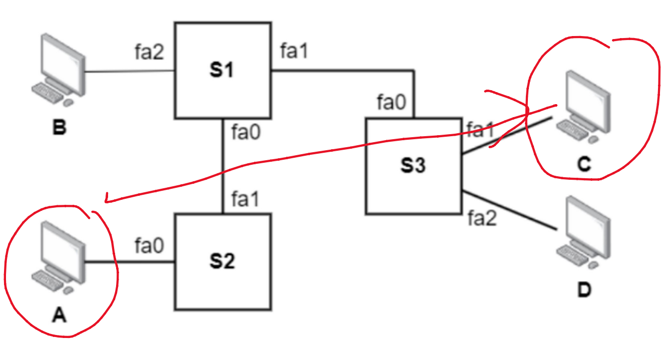


Unicast Multicast Broadcast

FF:FF:FF:FF:FF:FF

ARP: Address Resolution Protocol

* Switches



Consider the following topology, where **S1**, **S2**, and **S3** are three switches and **A**, **B**, **C**, and **D** are host devices. All the switches are just turned on. Then, **Host A** sends a frame to **Host C** and gets a reply. **State** the current condition of all switches' MAC Address tables. *Drawing the tables is enough.*

S1	S2	S3
A, f0	A, f0, ...	A, f0
C, f1	C, f1	C, f1

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