COMPUTER COMMUNICATION NETWORK

Bivas Bhattacharya

Department of

Electronics and Communication Engineering

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Switched Local Area Networks

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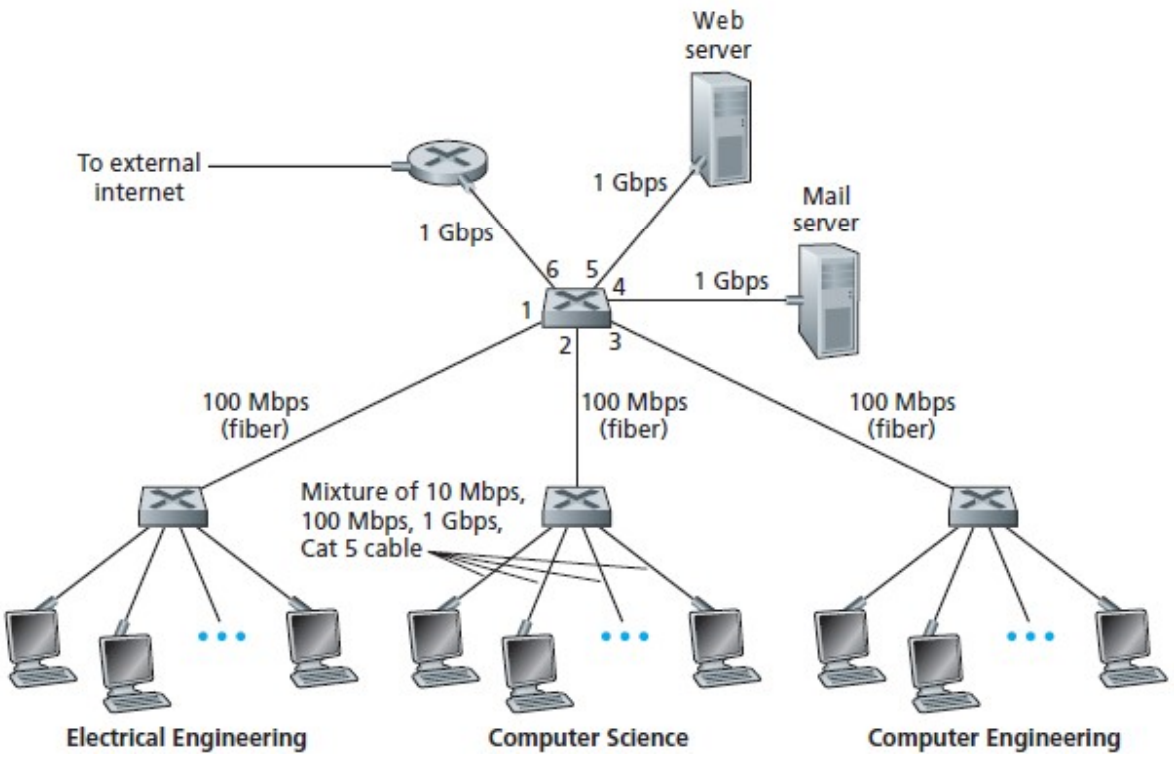
LAN architecture

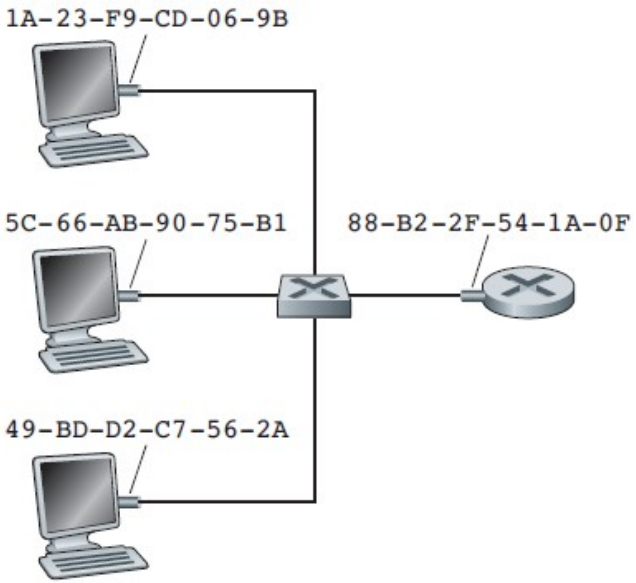


LAN architecture

- Local Area Network (LAN) is a popular access network consisting of hosts and switches connected by a common physical medium (aka channel)
- Switches and hubs can interconnect multiple such common channels to make a bigger LAN
- Switching operation is done by packet switching
- Switches are transparent to the hosts and routers
- Switches are self-configuring devices
- Switched LANs have mesh topology

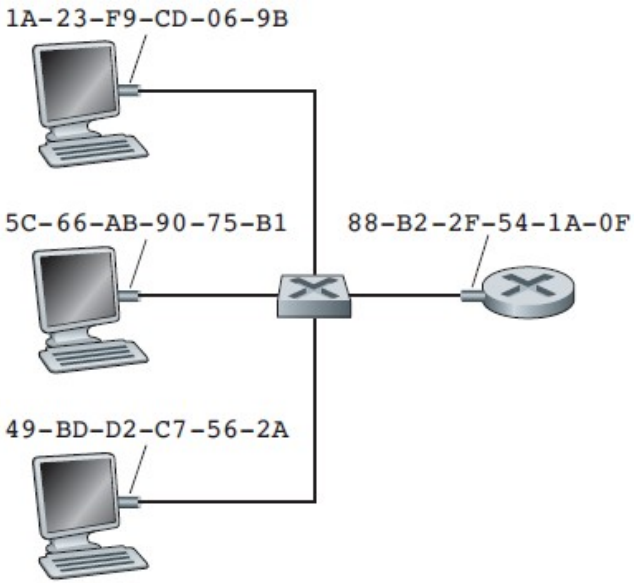
MAC Address

- Packet transmission across the internet required IP addresses (source and dest.).
- Devices like routers typically transmit over multiple links where each link (a pair of interfaces) must be uniquely identified
- Further, in a LAN, transmissions can happen via switches instead of routers
- Hence, we need some other way to uniquely identify the interfaces of sender and receiver
- MAC address aka LAN address or physical address serve this purpose. MAC addresses are 6-byte numbers



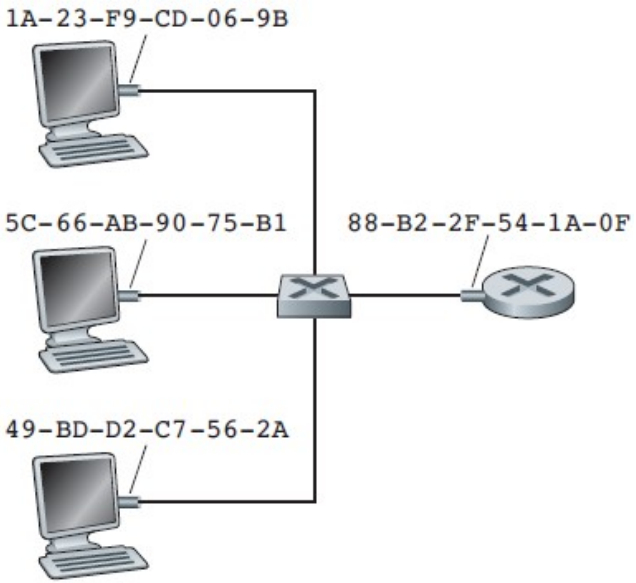
MAC address (contd.)

- A host or router with multiple network interfaces will have multiple MAC addresses associated with it
- Due to 6 byte long (48bits) addresses 2^{48} MAC addresses are possible
- No two adapters have the same address in the world
- IEEE manages the MAC address space. When a company wants to manufacture adapters, it purchases a chunk of the address space and uses unique one for each adapter
- If adapter is not changeable then MAC can work as identity of a device. But IP will change as it moves to different network.



MAC address (contd.)

- Each byte is expressed using two hexadecimal numbers
- A sender must know the destination MAC address in order to send a unicast packet to connected adapter.
- Upon knowing the destination MAC address, the sender broadcasts the packet
- A host can send packet to multiple destinations using the special MAC address FF-FF-FF-FF-FF-FF
- For point to point channel, communication can take place without any MAC address



MAC address (contd.)

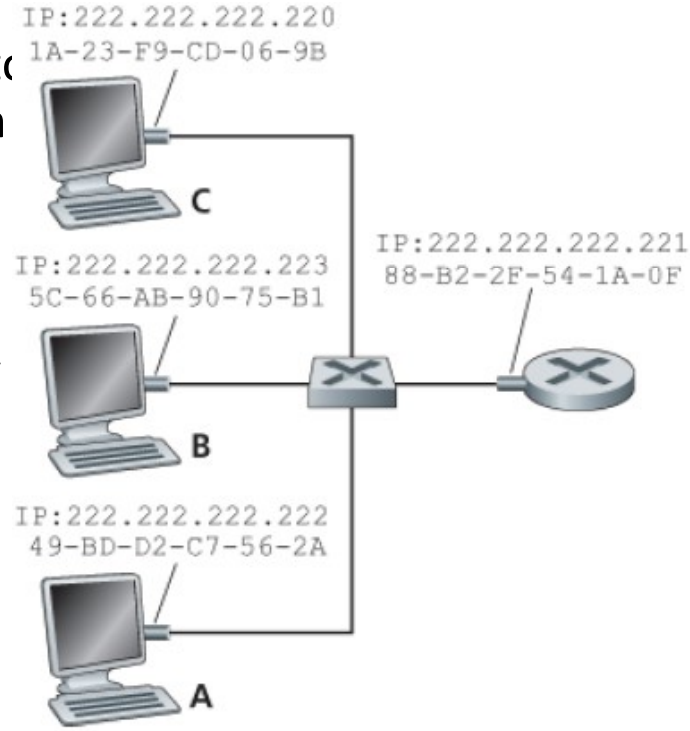
- When an adapter receives a frame, it will check to see whether the destination MAC address in the frame matches its own MAC address.
- If there is a match, the adapter extracts the enclosed datagram and passes the datagram up the protocol stack.
- If there isn't a match, the adapter discards the frame, without passing the network-layer datagram up.
- Thus destination device only will be interrupted when right frame is received. It saves lots of processing power
- In promiscus mode adapter does not use the feature to receive all the packet transactions in the network.

Address Resolution Protocol (ARP)

- MAC address is identity of physical device where as IP address is identity of the device for IP protocol.
- With MAC addresses, adapters would be able to support other network-layer protocols like IPX or DECnet.
- As there are both network-layer addresses (IP addresses) and link-layer addresses (MAC addresses) for the same interface, there is a need to translate between them which is done by Address Resolution Protocol (ARP)

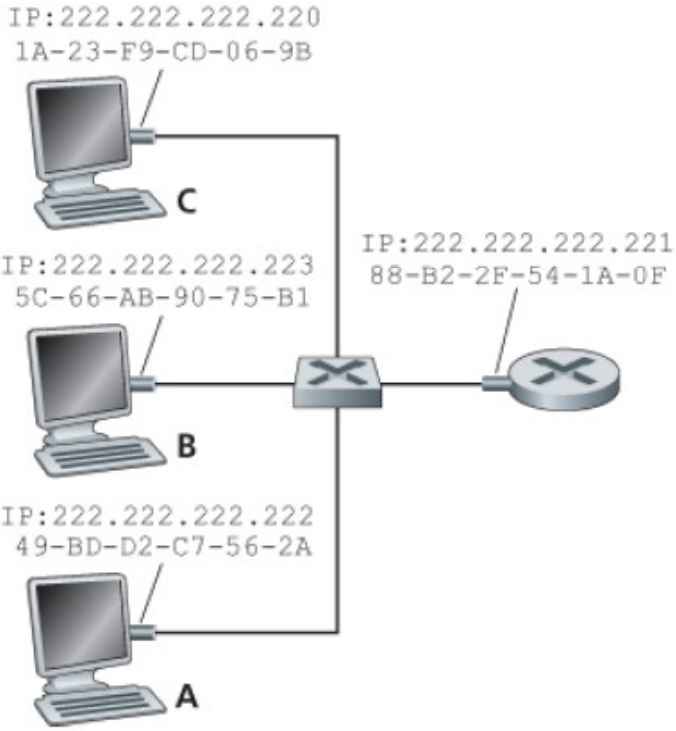
ARP

- Suppose a host with IP address 222.222.222.220 (C) wants to send an IP datagram to host 222.222.222.222 (A) which is in the same subnet
- For data link layer communication from C MAC address of A is required. So C needs to ask “who has the IP address 222.222.222.222?” and A should respond back to the query with its MAC address 49-BD-D2-C7-56-2A. This is the ARP protocol in gist.
- An ARP packet has several fields, including the sending and receiving IP and MAC addresses. Both ARP query and response packets have the same format.



ARP

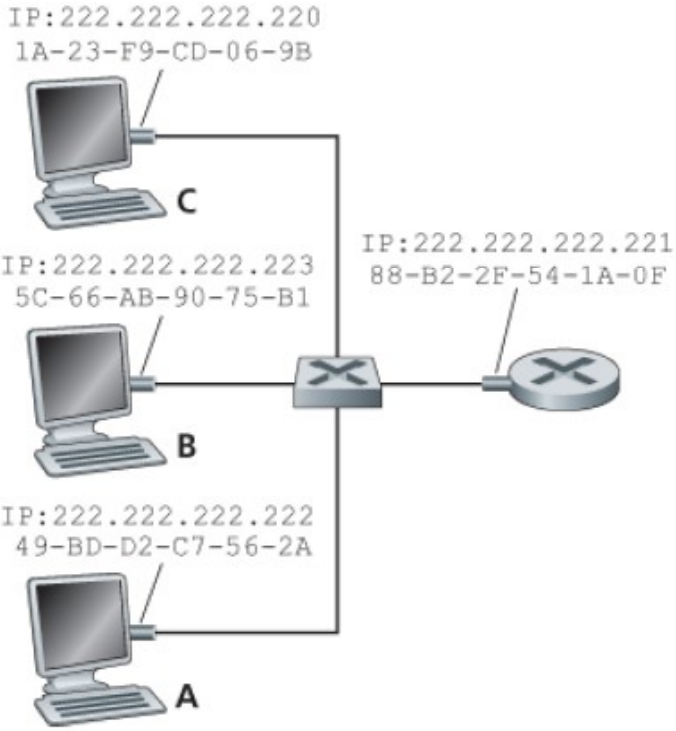
- As C do not know MAC of A it broadcast the query using MAC address FF-FF-FF-FF-FF-FF.
- The ARP query frame is received by all adapters and each adapter passes the ARP packet within the frame up to its ARP module.
- Each ARP modules checks to see if its IP address matches the destination IP address in the ARP packet. The one with a match sends back to the querying host a response ARP packet with its MAC.
- The response packet need not be broadcasted because A came to know the MAC address of C from source MAC address in query frame.



ARP

- ARP protocol is not executed before every IP packet transactions. It is done for the first time when MAC is not known and then the node save the mapping in its ARP table.
- After ARP query response interaction it is not only C update its table with entry of A but A also update about C.
- A device may leave a network or change its IP address. So entry of ARP table is kept valid for certain duration know as time-to-live (TTL) and flushed after that duration. A typical expiration time for an entry is 20 minutes from when an entry is placed in an ARP table.

IP Address	MAC Address	TTL
222.222.222.221	88-B2-2F-54-1A-0F	13:45:00
222.222.222.223	5C-66-AB-90-75-B1	13:52:00



THANK YOU

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bivas@pes.edu