SCS 2105
Computer Networks I

Networking Devices

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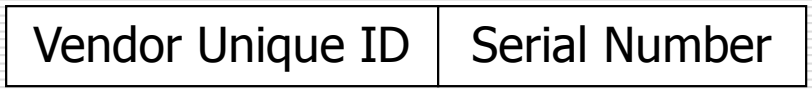
Medium Access Control (MAC) Addresses

- Every network interface device has this unique physical address
- These addresses are 48 bits long, and expressed as 12 hexadecimal digits
- First/left 6 hex digits represent the vendor, and the last/right 6 hex digits specify the serial number which vendor assigned



- A network node may have multiple NICs and each must have one unique MAC address per NIC.

Medium Access Control (MAC) Addresses

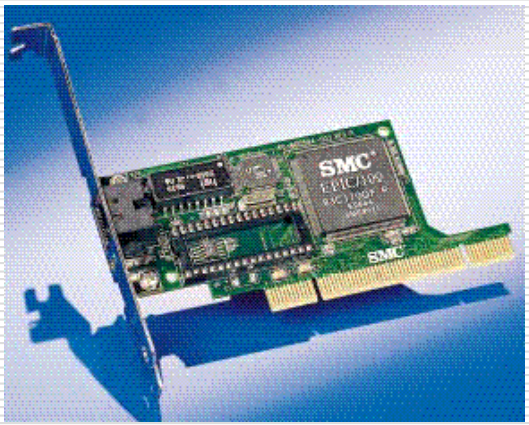
- The standard (IEEE 802) format for printing MAC-48 addresses in human-friendly form is six groups of two hexadecimal digits, separated by hyphens (-) or colons (:)

  e.g. 01-23-45-67-89-ab or 01:23:45:67:89:ab

- Every network interface device has this unique physical address
- The original IEEE 802 MAC address comes from the original Xerox Ethernet addressing scheme. This 48-bit address space contains potentially 2^{48} or 281,474,976,710,656 possible MAC addresses.
- When are we going to exhaust these addresses???

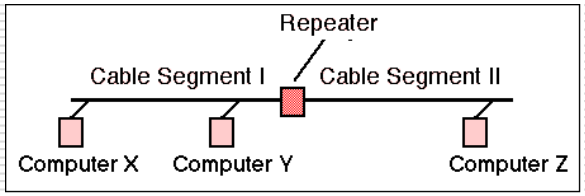
Network Adapter

- LAN cards, Network Interface (NIC) cards
- Different models
  - Type of the network (topology)
    - E.g. Ethernet cards, Localtalk connectors, Token Ring cards, Fibre cards
  - Type of cabling used
  - Speed of the network



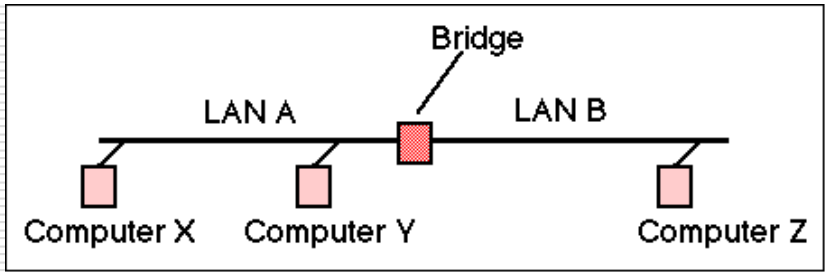
Repeater

- "…receive a signal, clean it up, strengthen it, and pass it along…"
- Allow smaller LANs to grow into larger ones by moving transmissions from one network segment to another
- Move transmission between different media types, such as coaxial and fiberoptic
- Represent a simple and relatively inexpensive means of enlarging a network
- Operates at the physical layer



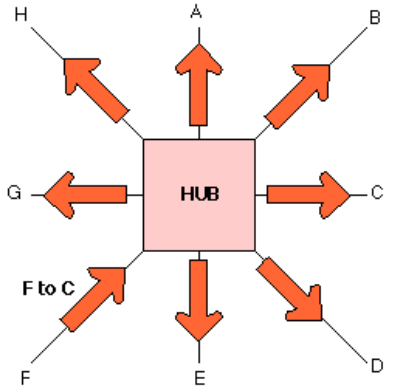
Bridge

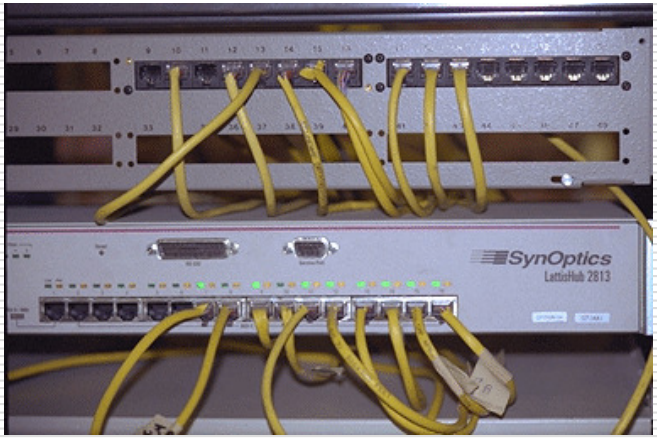
- Connects two LANs to construct a larger LAN
- Filter traffic passing between the two LANs
- Can join segments based on different architectures, for example, join an Ethernet segment to a Token Ring segment
- Operates at the data link layer



Multiple Port Bridge - Hub

- Forwards a received frame out of all the interfaces

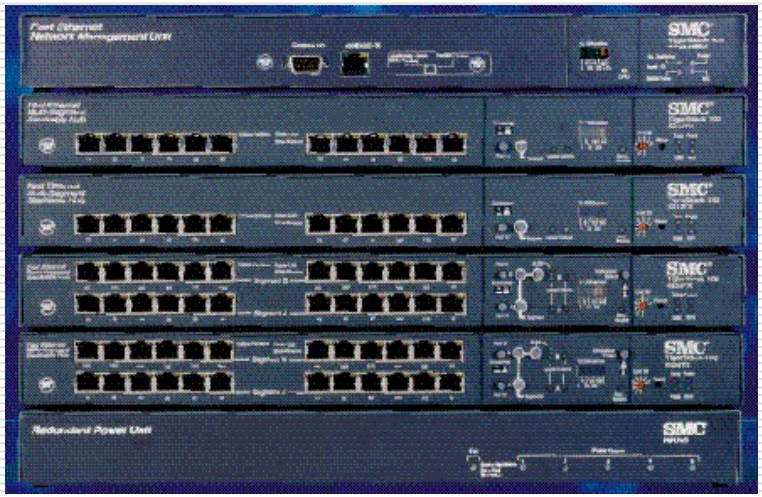




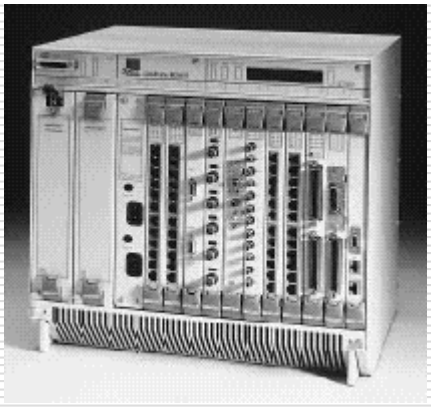
Hubs *(Contd.)*

- Varieties
  - Intelligent, or manageable hubs
    - Allow each port to be individually controlled (enable, disable, manage) by the network administrator
  - Active hubs (multi-port repeaters)
    - Clean up the signal by boosting and adjusting the timing
  - Passive hubs
    - Does not affect the message in any way
  - Modular hubs
    - Manageable hubs
    - Equipped with card slots
    - Some hubs support more than one network type
  - Standalone (typical) hubs
    - Connecting box in star-shaped topologies
    - Not manageable
  - Stacked on hubs

Hubs *(Contd.)*



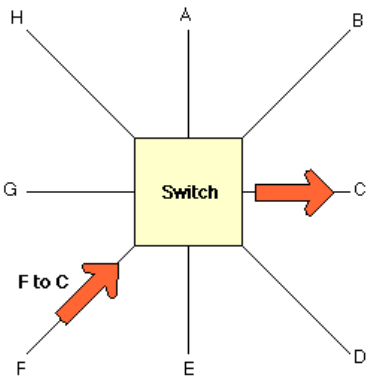
Stacked on hub



Modular hub

Multiple Port Bridge - Switch

- Forwards the frame to only the required interface
- Relies on internal address tables to determine where to route packets

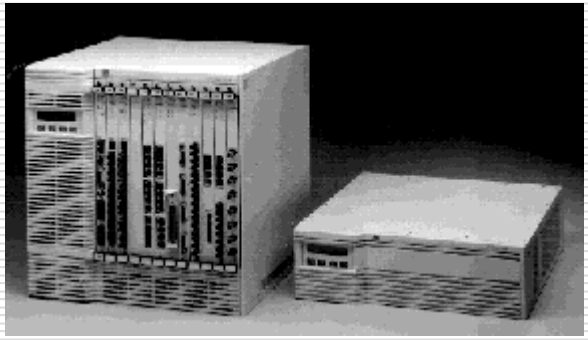


Switches *(Contd.)*

- Varieties
  - Cut-through switch
    - Simply reads the address of a received frame and then immediately routes the frame to the destination port associated with the recipient
  - Store-and-forward switch
    - Waits until the entire frame is received and then checks for errors before sending the frame on to its destination port

Switches *(Contd.)*

Fully configured Catalyst 5000 (CISCO) switch displaying a wealth of communications processors, interface cards and with dual redundant power supplies



The Lanplex range of high performance modular switch from 3COM

Router

- Forward packets from one network to another
- Figure out the best route to use in making the delivery
- Talks to other routers on the other networks, but not to computers
- Relies on a routing table
- Operates at the network layer

Choosing the Best Route

- The number of hops (bounces from router to router)
- The line speed
- How busy the route
- Cost of transmission
- …

High Capacity Router

- Cisco CRS-1
  - up to 46 Tb/s thruput
- two rack types
- line card rack
  - 640 Gb/s thruput
  - up to 16 line cards
    - up to 40 Gb/s each
  - up to 72 racks
- switch rack
  - central switch stage
  - up to 8 racks
- in-service scaling

Questions?