

Communication Network Topologies

- Can be implemented physically or logically
 - Network switches
- Add redundancy
- Reduce costs



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Point to point versus bus

- RS-232: better direct connection
- RS-485: supports multidrop (broadcast)
 - Data packet header includes ID
 - Data bus is a more general form of multidrop
 - Common in digital networks



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Token Bus Topology



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Token Bus Topology

- Token (data frame)
 - Passed from device to device
 - Device holding token controls the channel flow (priority)
 - Packets stop at end of the bus if no takers
- Benefits
 - Inexpensive to implement
 - No interrupts
- Drawbacks
 - A bit slower → latency
 - Single point of failure



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Token Ring Topology



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Token Ring Topology

- Bidirectional data flow
- Can tolerate failures of devices
 - If device 6 fails can still communicate with 3 and 5
- Variation on topology: Synchronous Optical Network (SONET)
 - Cross-boundary communications
 - Limited number of devices
 - Used in critical infrastructure for
 - Reliable communications important
 - Time critical communications



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Token Ring Topology

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Media Access

- Communication Requirements and Considerations
- Media Access Control (MAC) address unique identifier associated with network interface card/device



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Network Connectivity Devices

- Hub (repeater hub): hardware device for connecting ethernet devices together
 - Layer 1 device
 - Data received in a port broadcast out all of the other ports
 - Devices depend on identifier in the data packets to choose what to read or respond to
 - Can be used as repeaters
 - For analyzing network traffic, protocol analyzers can be connected to a port on a hub as an alternative to a network tap, span port or port mirror



Network Connectivity Devices

- Network Switch (switching hub, bridging hub, IEEE MAC bridge)
 - Layer 2 (data link layer) device
 - Uses Media Access Control (MAC) addresses to forward data
 - Layer 2 bridging
 - Data is transmitted only out the port that is addressed
 - Trend for switches to include routing capabilities
 - Adds Layer 3 (network layer capabilities)
 - Might be referred to as layer 3 switches (multilayer switches)
 - Network segmentation to reduce collision domains
 - Can enable/disable ports
 - MAC filtering and other access control



Types of Switches

- Unmanaged switches
 - No configuration, essentially plug and play
- Managed switches
 - Configuration Interface
 - Serial console, telnet, secure shell
 - Simple network management protocol (SNMP) agent
 - Web interface, etc.
 - Features available with switches
 - Reconfiguration protocols
 - Port mirror
 - Port configuration
 - Packet filtering
 - Creating VLAN (virtual local area networks)



Types of Switches

- Enterprise managed switches
 - Additional features
- Software Defined Network (SDN) switches
 - Start out no paths defined
 - To configure the switch, one defines functional paths
 - This is opposite of a managed or unmanaged switch where path functions are largely on by default and then limited through configuration



Network Connectivity Devices

- Router: a networking device that forwards data packets between internetwork protocol-based networks
 - Network layer (layer 3)
 - Reads address in header
 - Routing table to direct packets to the right network
 - Modern routers may include firewall or VPN
 - Blurring with switches



Network Connectivity Devices

- Modem (modulator/demodulator)
- Used to convert between analog format (telephone, radio for example) and digital format
 - Transmits by modulating carrier wave signal to encode digital data in an analog transmission format
 - Receives by demodulating the analog carrier wave
- Early systems had audible sounds on phone lines
- Frequency raised to increase speed/performance

