Network Basics
Network Definition

- Set of technologies that connects computers
- Allows communication and collaboration between users
Figure: The definition of a computer network: a set of transmission paths, interconnected at nodes.
Components of a computer network

A computer network is composed of:

- Hosts (PCs, laptops, handhelds)
- Routers & switches (IP router, Ethernet switch)
- Links (wired, wireless)
- Protocols (IP, TCP, CSMA/CD, CSMA/CA)
- Applications (network services)
- Humans and service agents
The Uses of a Network

• Simultaneous access to data
  – Data files are shared
    • Access can be limited
  – Shared files stored on a server
  – Software can be shared
    • Site licenses
    • Network versions
    • Application servers
The Uses of a Network

- Shared peripheral device
  - Printers and faxes are common shares
  - Reduces the cost per user
  - Devices can be connected to the network
  - Print servers control network printing
    - Manage the print queue
Sharing Data

File server contains documents used by other computers.
The Uses of a Network

• Personal communication
  – Email
    • Instantaneous communication
  – Conferencing
    • Tele conferencing
    • Videoconferencing
    • Audio-conferencing
    • Data-conferencing
  – Voice over IP
    • Phone communication over network wires
Voice Over IP
The Uses of a Network

• Easier data backup
  – Backup copies data to removable media
  – Server data backed up in one step
Local Area Network (LAN)

- Contains printers, servers and computers
- Systems are close to each other
- Contained in one office or building
- Organizations often have several LANS
Common Network Types

Wide Area Networks (WAN)
- Two or more LANs connected
- Over a large geographic area
- Typically use public or leased lines
  - Phone lines
  - Satellite
- The Internet is a WAN
Campus Area Networks (CAN)
- A LAN in one large geographic area
- Resources related to the same organization
- Each department shares the LAN
Hybrid Network Types

**Metropolitan Area Network (MAN)**
- Large network that connects different organizations
- Shares regional resources
- A network provider sells time
Hybrid Network Types

Home Area Network (HAN)

- Small scale network
- Connects computers and entertainment appliances
- Found mainly in the home
Hybrid Network Types

Personal Area Network (PAN)
- Very small scale network
- Range is less than 2 meters
- Cell phones, PDAs, MP3 players
The design of computers, devices, and media on a network is sometimes called the network architecture.

Can be categorized as:

- Client/server network
- Peer-to-peer network
- Internet Peer-to-peer network
How Networks Are Structured

- **Server based network**
  - Node is any network device
  - Servers control what the node accesses
  - Users gain access by logging in
  - Server is the most important computer
How Networks Are Structured

- **Client/Server network**
  - Nodes and servers share data roles
  - Nodes are called clients
  - Servers are used to control access
  - Database software
    - Access to data controlled by server
  - Server is the most important computer
How Networks Are Structured

• Peer–to–peer network
  ➢ Simple network that connects fewer than 10 computers
  ➢ Each computer, or peer, has equal capabilities
How Networks Are Structured

- **Internet Peer – to - peer networks (P2PN)**
  - All nodes are equal
  - Nodes access resources on other nodes
  - Each node controls its own resources
  - Most modern OS allow P2PN
  - Distributing computing is a form
A Network topology refers to the layout of the computers and devices in a communication network.

- Star Network
- Bus Network
- Ring Network
- Mesh Network
- Tree Network
Network Topologies

• Topology
  – Choice affects
    • Network performance
    • Network size
    • Network collision detection
  – Several different types
Network Topologies

- **Packets**
  - Pieces of data transmitted over a network
    - Packets are created by sending node
    - Data is reassembled by receiving node
  - Packet header
    - Sending and receiving address
  - Packet payload
    - Number and size of data
    - Actual data
  - Packet error control
Network Topologies

- **Bus topology**
  - Also called linear bus
  - One wire connects all nodes
  - Terminator ends the wires
  - Advantages
    - Easy to setup
    - Small amount of wire
  - Disadvantages
    - Slow
    - Easy to crash
Network Topologies

• Star topology
  – All nodes connect to a hub
    • Packets sent to hub
    • Hub sends packet to destination
  – Advantages
    • Easy to setup
    • One cable can not crash network
  – Disadvantages
    • One hub crashing downs entire network
    • Uses lots of cable
  – Most common topology
Star Topology
Network Topologies

• Ring topology
  – Nodes connected in a circle
  – Tokens used to transmit data
    • Nodes must wait for token to send
  – Advantages
    • Time to send data is known
    • No data collisions
  – Disadvantages
    • Slow
    • Lots of cable
Network Topologies

• Mesh topology
  – All computers connected together
  – Internet is a mesh network
  – Advantage
    • Data will always be delivered
  – Disadvantages
    • Lots of cable
    • Hard to setup
Mesh Topology
Network Media

- Links that connect nodes
- Choice impacts
  - Speed
  - Security
  - Size
Wire Based Media

- Twisted-pair cabling
  - Most common LAN cable
  - Called Cat5 or 100BaseT
  - Four pairs of copper cable twisted
  - May be shielded from interference
  - Speeds range from 1 Mbps to 1,000 Mbps
Wire Based Media

• Coaxial cable
  – Similar to cable TV wire
  – One wire runs through cable
  – Shielded from interference
  – Speeds up to 10 Mbps
  – Nearly obsolete
Wire Based Media

• Fiber-optic cable
  – Data is transmitted with light pulses
  – Glass strand instead of cable
  – Immune to interference
  – Very secure
  – Hard to work with
  – Speeds up to 100 Gbps
Wireless Media

- Data transmitted through the air
- LANs use radio waves
- WANs use microwave signals
- Easy to setup
- Difficult to secure
Network Hardware

• Network interface cards
  – Network adapter
  – Connects node to the media
  – Unique Machine Access Code (MAC)
Network Hardware

• Network linking devices
  – Connect nodes in the network
  – Cable runs from node to device
  – Crossover cable connects two computers
Network Hardware

• Hubs
  – Center of a star network
  – All nodes receive transmitted packets
  – Slow and insecure
Network Hardware

• Switches
  – Replacement for hubs
  – Only intended node receives transmission
  – Fast and secure
Network Hardware

• Bridge
  – Connects two or more LANs together
  – Packets sent to remote LAN cross
    • Other packets do not cross
  – Segments the network on MAC addresses
• **Router**
  – Connects two or more LANs together
  – Packets sent to remote LAN cross
  – Network is segmented by IP address
  – Connect internal networks to the Internet
  – Need configured before installation
Network Hardware

• Gateway
  – Connects two dissimilar networks
  – Connects coax to twisted pair
  – Most gateways contained in other devices
Network Cabling

• Cabling specifications
  – Bandwidth measures cable speed
    • Typically measured in Mbps
  – Maximum cable length
  – Connector describes the type of plug
Network Cabling

• Ethernet
  – Very popular cabling technology
  – 10 Base T, 10Base2, 10Base5
  – Maximum bandwidth 10 Mbps
  – Maximum distances 100 to 500 meters
Network Cabling

• Fast Ethernet
  – Newer version of Ethernet
  – Bandwidth is 100 Mbps
  – Uses Cat5 or greater cable
    • Sometimes called 100Base T
  – Requires a switch
Network Cabling

• Gigabit Ethernet
  – High bandwidth version of Ethernet
  – 1 to 10 Gbps
  – Cat 5 or fiber optic cable
  – Video applications
Network Cabling

• Token ring
  – Uses shielded twisted pair cabling
  – Bandwidth between 10 and 25 Mbps
  – Uses a multiple access unit (MAU)
  – Popular in manufacturing and finance
Network Protocols

• Language of the network
  – Rules of communication
  – Error resolution
  – Defines collision and collision recovery
  – Size of packet
  – Naming rules for computers
Network Protocols

• TCP/IP
  – Transmission Control Protocol/Internet Protocol
  – Most popular protocol
  – Machines assigned a name of 4 numbers
    • IP address
      • 209.8.166.179 is the White House’s web site
  – Dynamic Host Configuration Protocol
    • Simplifies assignment of IP addresses
  – Required for Internet access
Network Protocols

• IPX/SPX
  – Internet Packet Exchange/Sequenced Packet Exchange
  – Older protocol
  – Associated with Novell Netware
  – Replaced by TCP/IP
Network Protocols

• NetBEUI
  – Network BIOS Extended User Interface
  – Used by Windows to name computers
  – Transmission details handled by TCP/IP
Network Protocols

• Token ring
  – Popular in manufacturing and finance
  – Nodes communicate when they have the token
End of Presentation