SAPIENZA
UNIVERSITÀ DI ROMA

Network Infrastructures

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Introduction

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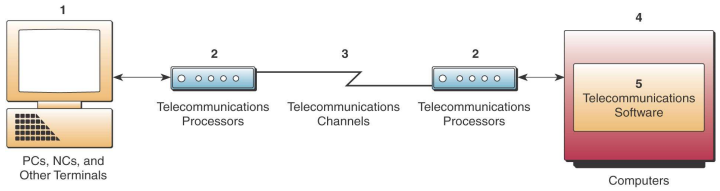
A Telecommunications Network Model

- Consists of five basic components
  - Terminals
    - » Any input/output device that uses telecommunication networks to transmit or receive data
  - Telecommunication processors
    - » Support data transmission and reception between terminals and computers



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A Telecommunications Network Model

- Telecommunications channels
  - » The medium over which data are transmitted and received
- Computers/Phones
  - » Interconnected by telecommunications networks
- Telecommunications control software
  - » Control telecommunications activities & manage the functions of telecommunications networks

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Types of Telecommunications Networks

- Wide Area Networks (WAN)
  - Cover a large geographic area.
- Metropolitan Area Networks (MAN)
  - Cover a metropolitan area.
  - Typically connect multiple geographically nearby LANs to one another (over an area of up to a few dozen kilometres) at high speeds
- Local Area Networks (LAN)
  - Connect computers & other information processing devices within a limited physical area.
  - Connected via ordinary telephone wiring, coaxial cable, or wireless radio & infrared systems

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Types of Telecommunications Networks

- Virtual Private Networks
  - A secure network that uses the Internet as its main backbone network, but relies on firewalls and other security features
  - A VPN Enabling Technology is IPSec (SVPN)
    - » It is an open architecture for IP-packet encryption and authentication, thus it is located in the network layer.
    - » IPSec adds additional headers/trailers to an IP packet and can encapsulate (tunnel) IP packets in new ones.

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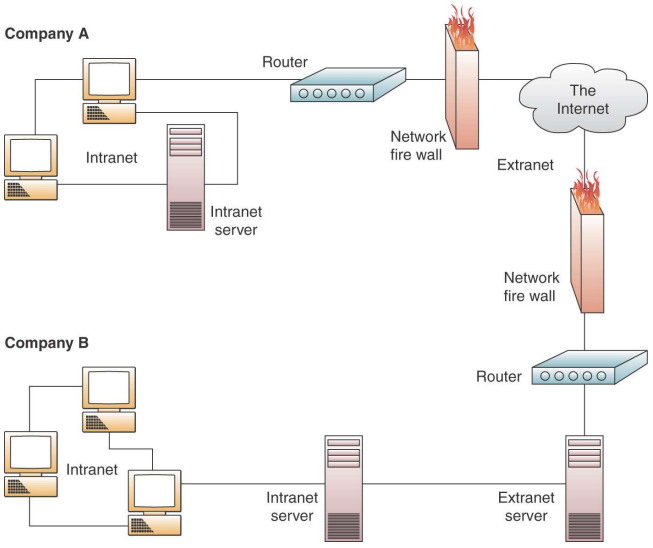
Types of Telecommunications Networks



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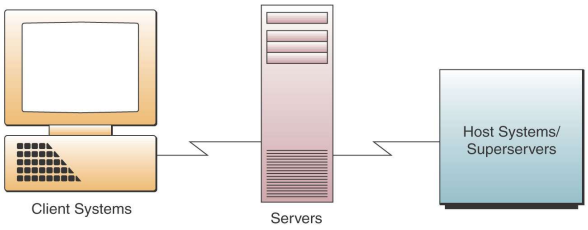
Types of Telecommunications Networks

- Client/Server Networks
  - Clients – end user PCs
  - Server – helps with application processing and also manages the network



- Types: PCs, Network Computers, Workstations, Macintoshes.
- Functions: Provide user interface, perform some/most processing on an application.

- Types: Servers, Workstations, or Midrange Systems.
- Functions: Shared computation, application control, distributed databases.

- Types: Mainframes and Midrange Systems.
- Functions: Central database control, security, directory management, heavy-duty processing.

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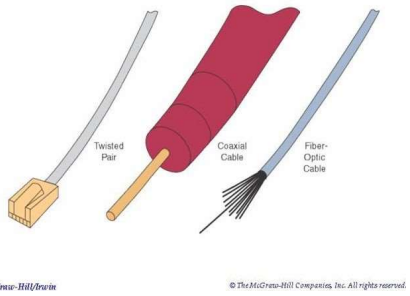
Telecommunications Media

- Twisted-pair wire
- Coaxial cable
  - Minimizes interference and distortion
  - Allows high-speed data transmission
- Fiber optics
  - Glass fiber that conducts pulses of light generated by lasers
  - Size and weight reduction
  - Increased speed and carrying capacity



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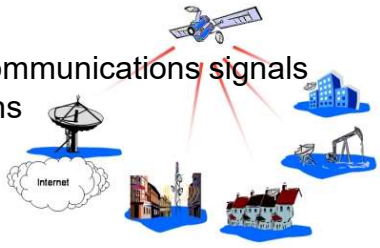
Wireless Technologies

- Terrestrial Microwave
  - Line-of-sight path between relay stations spaced approximately 40 km apart
- Communications Satellites
  - Geosynchronous orbits
  - Serve as relay stations for communications signals transmitted from earth stations



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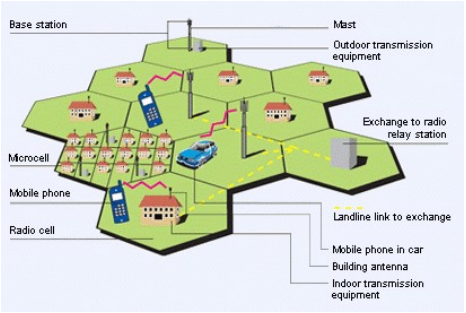
Wireless Technologies

- Cellular Systems
  - Each cell is typically from one to several square miles in area.
  - Each cell has its own low-power transmitter or radio relay antenna.
  - Computers & other communications processors coordinate & control the transmissions to/from mobile users as they move from one cell to another



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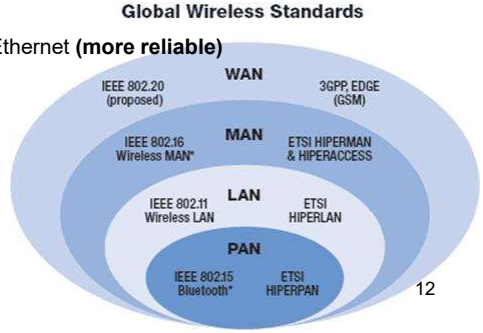
Personal Area Networks

- Connection of computer to peripherals or other computers
- Connect PDA and desktop computer
- Several connection methods:
  - Bluetooth **(radio frequency – up to 100 m)**
  - IrDA (Infrared) **(cheap)**
  - Wireless LAN 802.11b – wireless Ethernet **(more reliable)**



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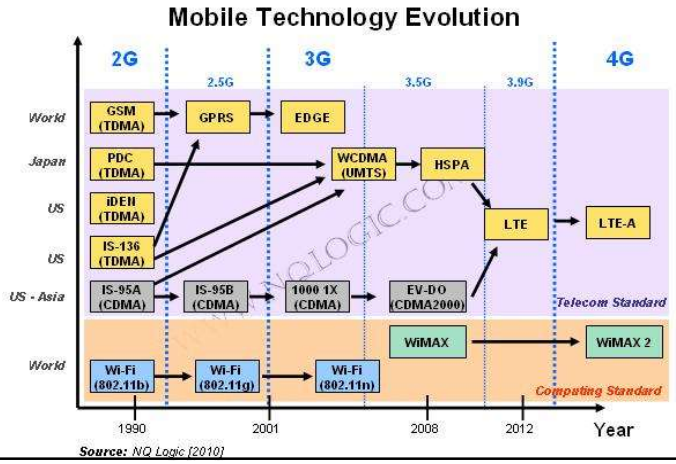
New Generations of Wireless Networks

- 3G network
  - Broadband up to 2 Mbps
  - Packet switched



Telecommunications Processors

- Modems (modulation/demodulation)
  - Changes signals from analog to digital and back to analog

- Multiplexers
  - Allows a single communication channel to carry simultaneous data transmissions from many terminals

Telecommunications Processors

- Internetwork Processors
  - Switches
    - » Makes connections between telecomm circuits so a message can reach its intended destination
  - Router
    - » Interconnects networks based on different rules or protocols
  - Hub
    - » Port switching communications processor
  - Gateway
    - » A processor that interconnects networks that use different communications architecture

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Telecommunications Software

- Provides a variety of communications support services including connecting & disconnecting communications links & establishing communications parameters such as transmission speed, mode, and direction
- Network Management
  - Traffic management
  - Security
  - Network monitoring
  - Capacity planning

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Network Topologies

- Star
  - Ties end user computers to a central computer
  - Considered the least reliable
- Ring (sometimes called Token Ring)
  - Ties local computer processors together in a ring on a more equal basis.
  - Considered more reliable & less costly
- Bus
  - Local processors share the same bus, or communications channel
  - Tree is a variation which ties several bus networks together

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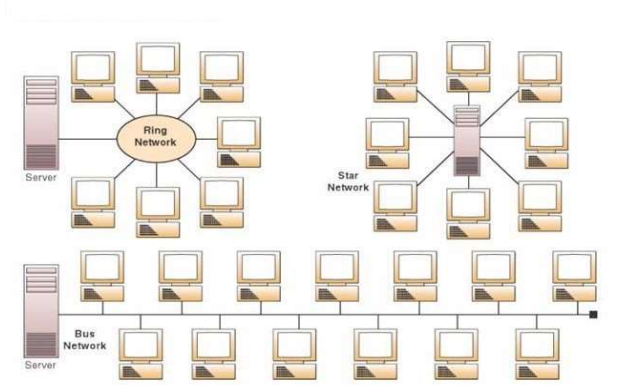
Network Topologies



McGraw-Hill/Irwin

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Network Architectures & Protocols

- Protocols
  - A standard set of rules & procedures for the control of communications in a network
  - Standards for the physical characteristics of cables and connectors
- Network Architecture
  - Goal is to promote an open, simple, flexible, efficient telecommunications environment

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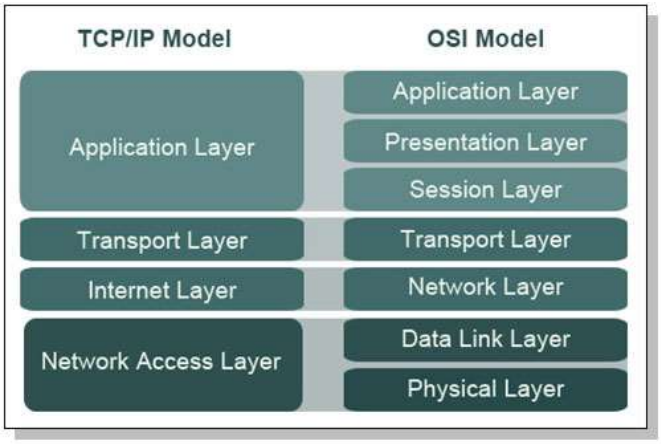
Network Architectures and Protocols



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