



SAPIENZA
UNIVERSITÀ DI ROMA

Network Infrastructures

A.A. 2019-2020
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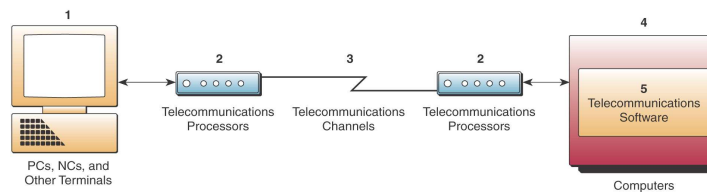
Introduction

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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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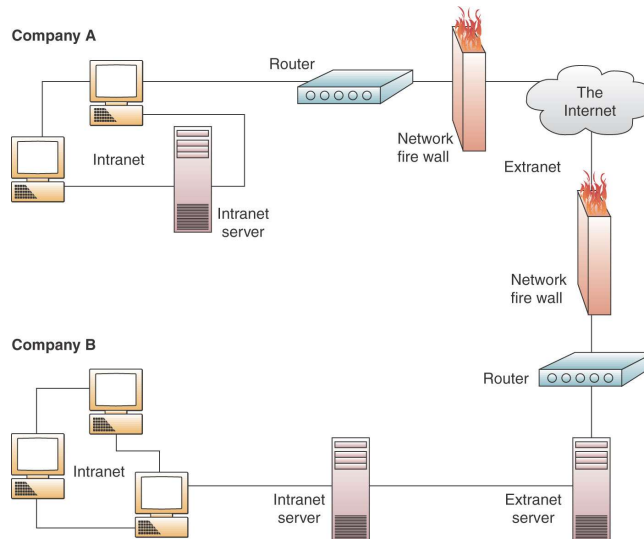
Types of Telecommunications Networks

- 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

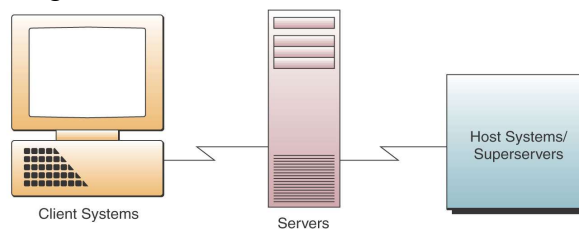


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Types of Telecommunications Networks

- 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.

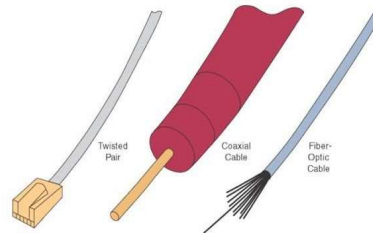
- Types: Mainframes and Midrange Systems.
- Functions: Central database control, security, directory management, heavy-duty processing.

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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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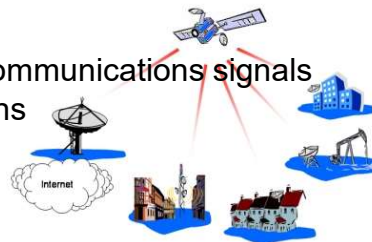
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Wireless Technologies

- 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



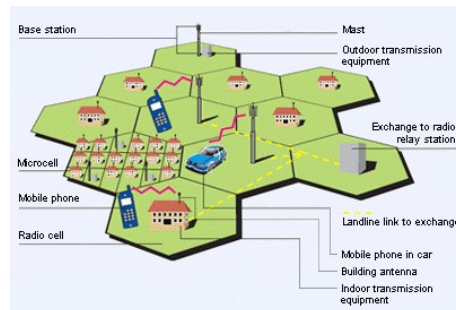
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Wireless Technologies

- 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

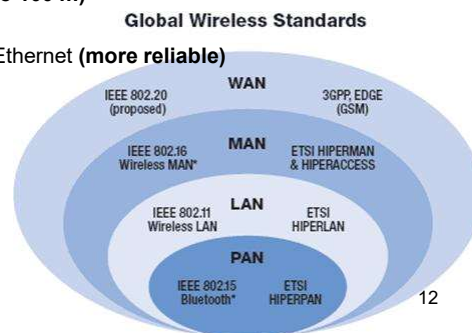


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Personal Area Networks

- 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)



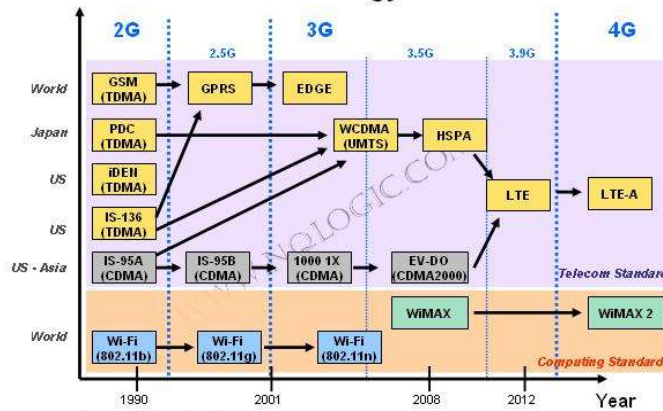
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New Generations of Wireless Networks

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

Mobile Technology Evolution



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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



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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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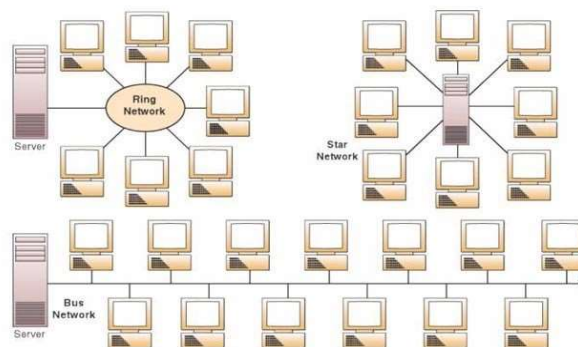
Network Topologies

- 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



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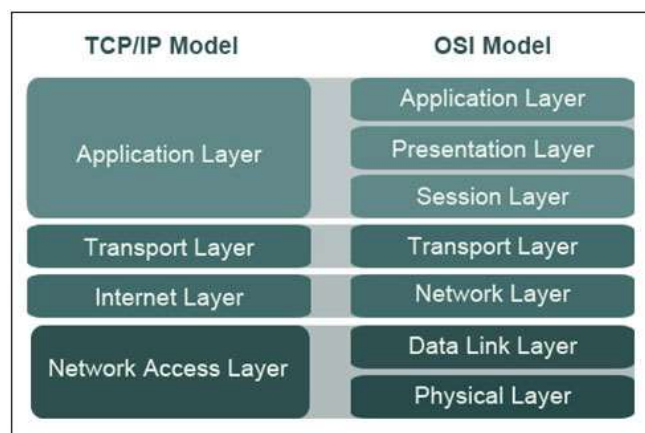
Network Architectures & Protocols

- 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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