CALIFORNIA STATE UNIVERSITY
LONG BEACH
College of Engineering

CECS 303: Networks and Network Security

Course Introduction

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Week 2 – 2nd Lecture
1/27/2022

Course Information

CALIFORNIA STATE UNIVERSITY
LONG BEACH
College of Engineering

- CECS 303
  - Networks and Network Security – 3.0 units
- Class meeting schedule
  - TuTH 5:00PM to 7:15PM
  - Lecture Room: VEC 402
  - Lab Room: ECS 413
- Class communication
  - chris.samayoa@csulb.edu
  - Cell: 562-706-2196
- Office hours
  - Thursdays 4pm-5pm
  - Other times by appointment only

Objectives

- Review OSI Model
- Advantages of network computing
- Client/server versus peer-to-peer networks
- Common client/server network elements
- Network use examples
- TCP/IP Model overview
- TCP/IP protocol suite characteristics

OSI Model - Summary

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OSI model layer	Function
Application (Layer 7)	Provides interface between software applications and a network for interpreting applications' requests and requirements
Presentation (Layer 6)	Allows hosts and applications to use a common language; performs data formatting, encryption, and compression
Session (Layer 5)	Establishes, maintains, and terminates user connections
Transport (Layer 4)	Ensures accurate delivery of data through flow control, segmentation and reassembly, error correction, and acknowledgment
Network (Layer 3)	Establishes network connections; translates network addresses into their physical counterparts and determines routing
Data Link (Layer 2)	Packages data in frames appropriate to network transmission method
Physical (Layer 1)	Manages signaling to and from physical network connections

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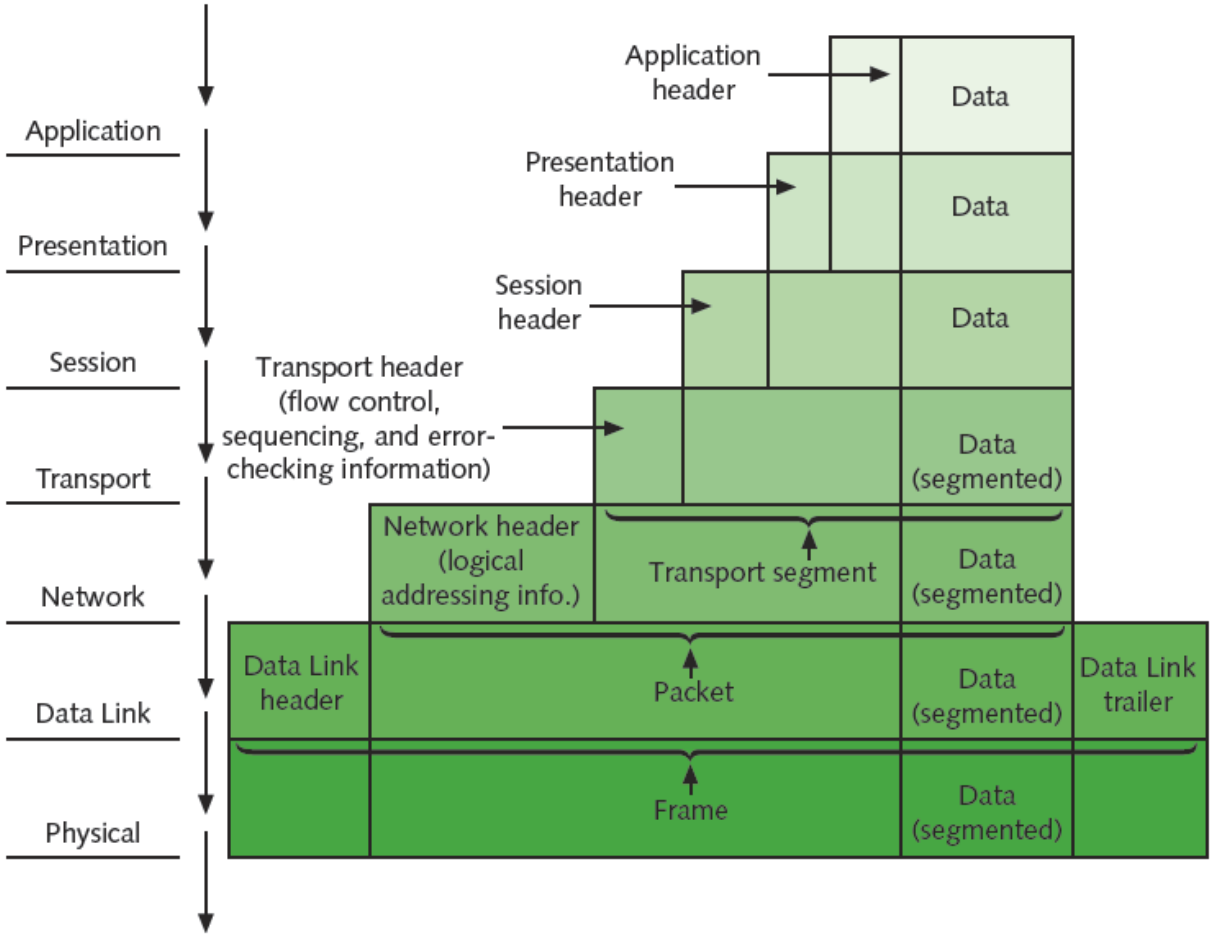
OSI Model - Communication



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Network Basics

- What is a computer network?
  - Group of interconnected computers and devices
    - Connected by transmission media
- Stand-alone computer
  - Not connected to other computers
  - Can only use local software and data
- Advantages of networks
  - Device and resource sharing by multiple users
    - Saves money and time
  - Central network management

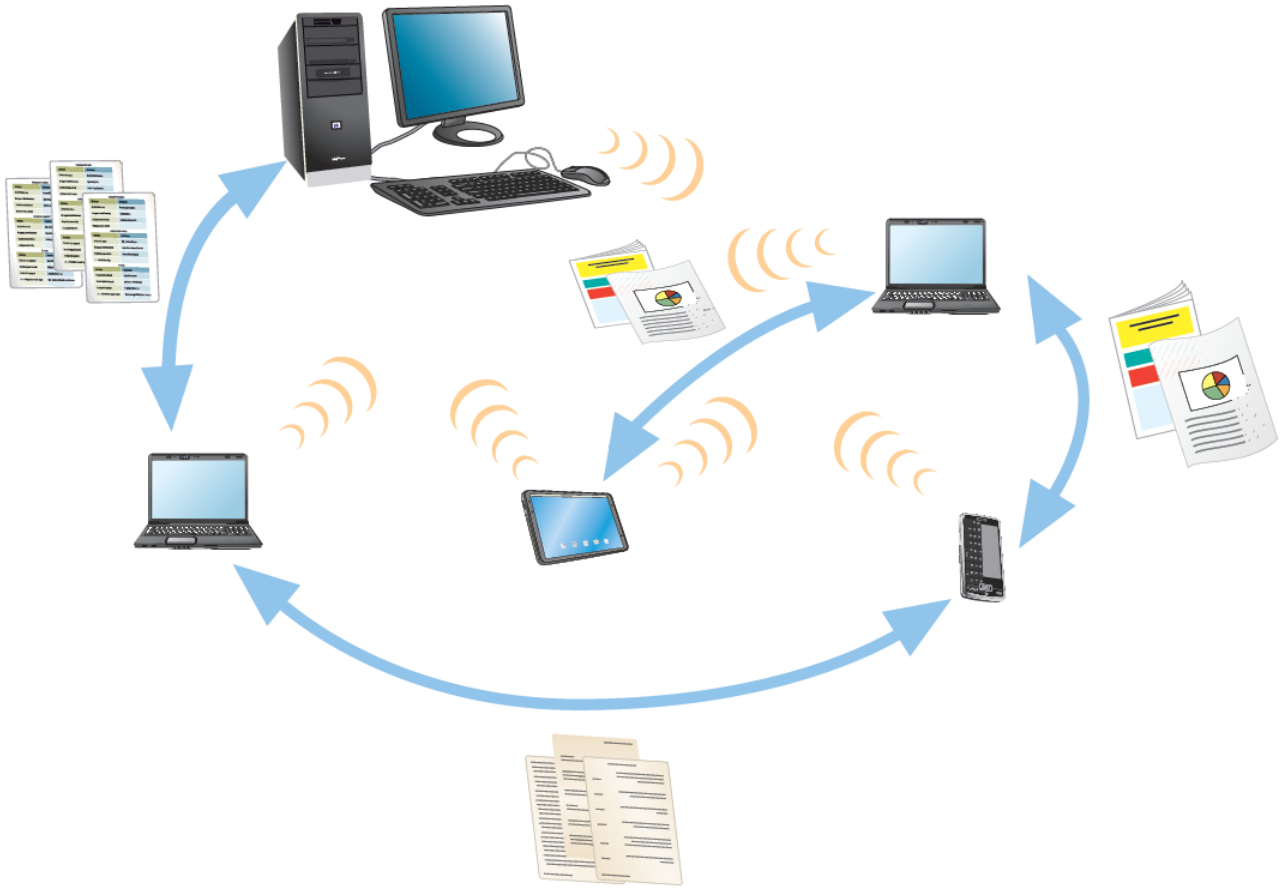
Types of Networks

- Models vary according to:
  - Computer positioning
  - Control levels over shared resources
  - Communication and resource sharing schemes
- Network Models
  - Peer-to-peer
  - Client/server

Peer-to-Peer Networks

- Direct computer communication
  - Equal authority
- Individual resource sharing
  - Up to individuals if resources are shared (and which ones)
- Traditional model
  - Two or more general purpose computers
    - Able to send/receive information to and from every other connected computer

Peer-to-Peer Networks (cont'd)



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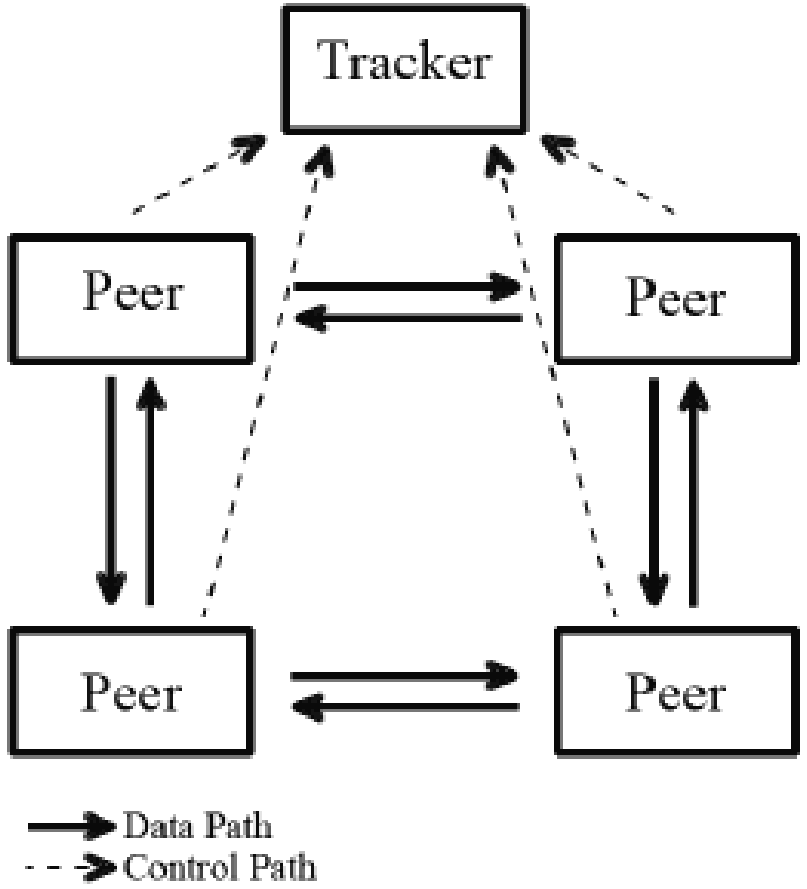
Peer-to-Peer Networks (cont'd)

- What are the advantages?
  - Simple configuration
  - Less expensive
    - Compared to other network models
- Disadvantages
  - Not flexible
  - Potentially less secure
  - Not practical for large installations

Peer-to-Peer Networks (cont'd)

- How are resources shared?
  - Modify file sharing controls
    - User controlled
  - Not centrally controlled
    - Access likely not uniform or secure
- Environments
  - Small home or office
  - Large networks using the internet
    - Original Limewire and Napster
    - BitTorrent software

Peer-to-Peer Networks (BitTorrent Example)



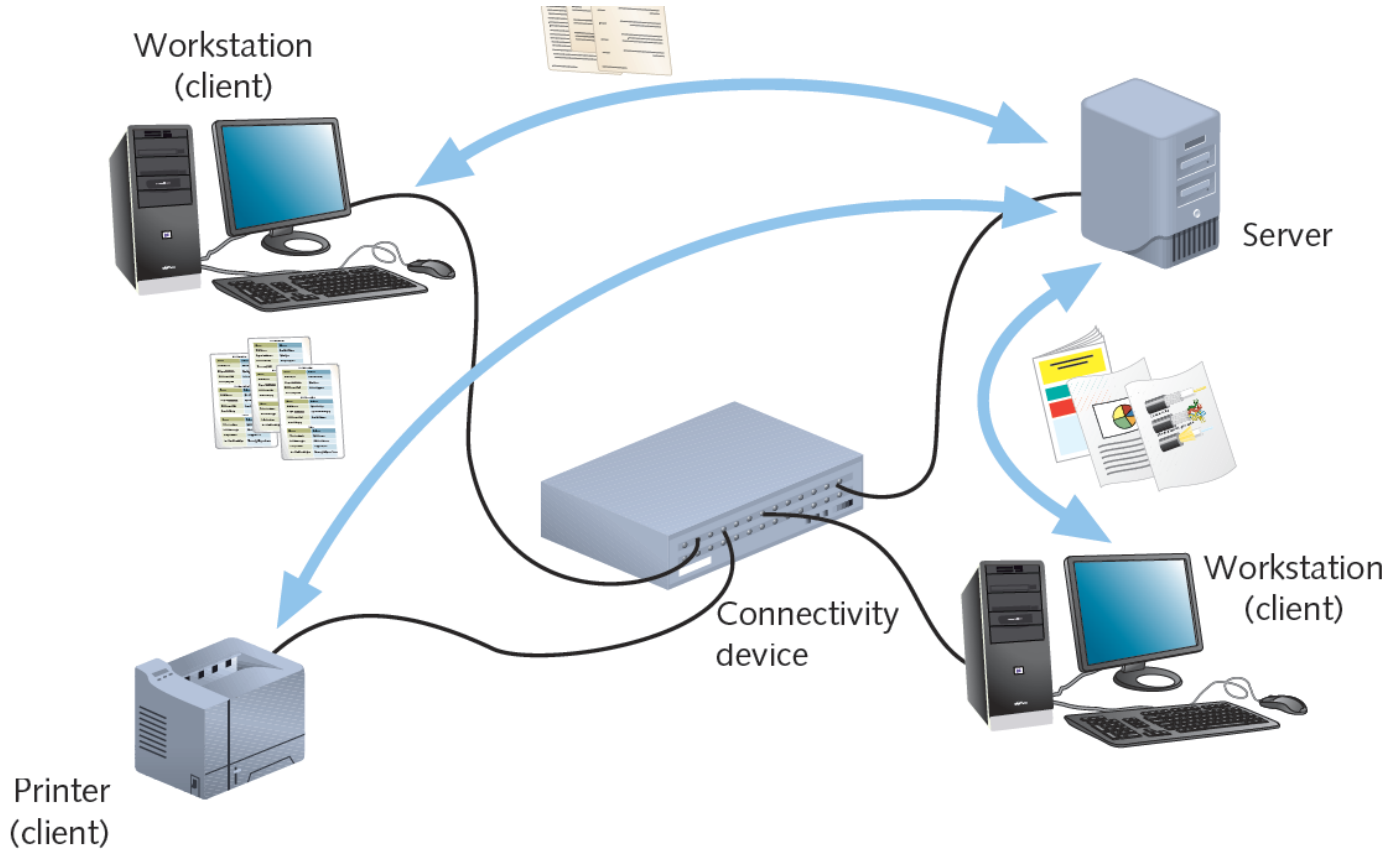
Client/Server Networks

- Server
  - Central computer
  - Facilitates communication and resource sharing
- Clients
  - Personal computers (e.g. laptops/workstations)
  - Mobile devices, IoT devices, etc.
- Central resource sharing controlled by server(s)
  - Sharing data, storage space, and devices
  - No direct sharing of client resources

Client/Server Networks (cont'd)

- Client roles
  - Run local applications
  - Store data locally
  - Use server shared applications, data, devices
  - Use server as intermediary
- Communication
  - Switches and/or routers

Client/Server Networks (cont'd)



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Client/Server Networks (cont'd)

- Server Responsibilities
  - Manage client data / resources
  - Ensure authenticated /authorized user access
  - Control user file access
  - Restrict user network access
  - Dictate computer communication rules
  - Supply application(s) to clients
- Server operating system (OS) examples
  - Unix, Linux, Microsoft Server, macOS Server

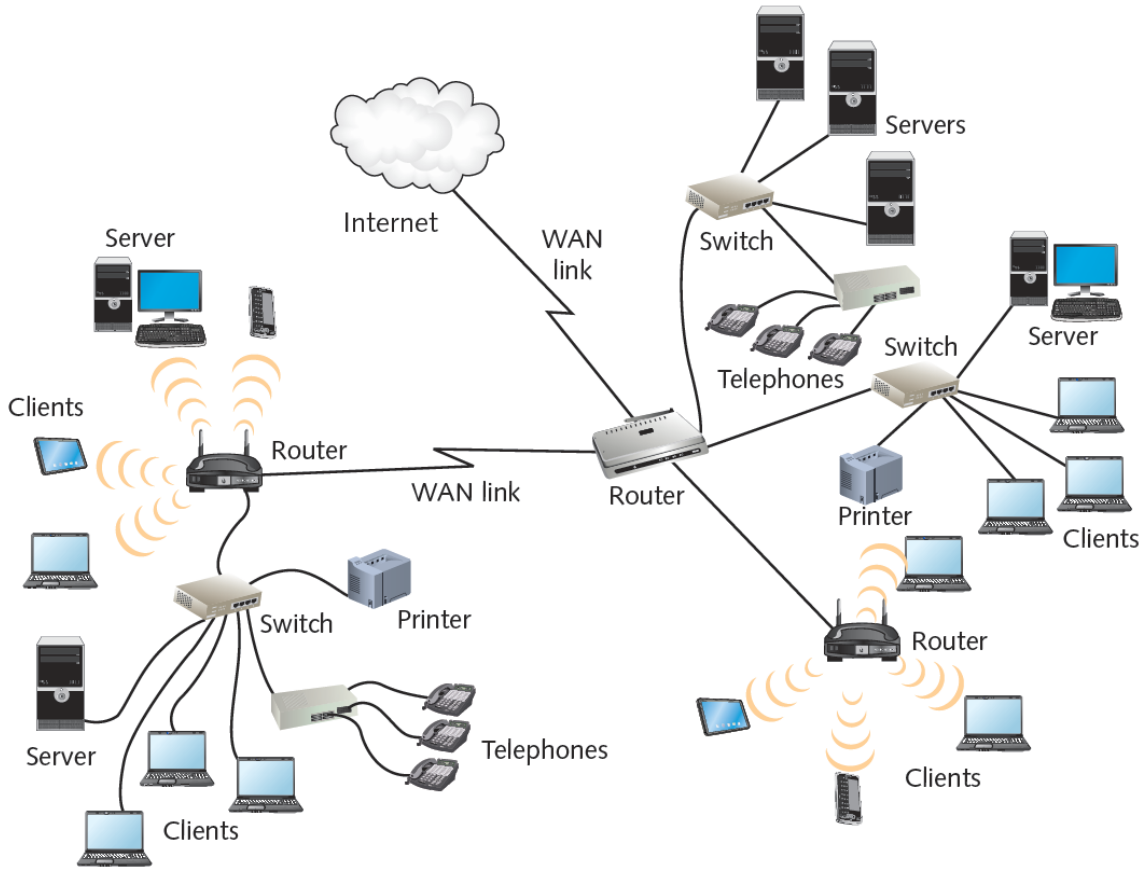
Client/Server Networks (cont'd)

- Server features relative to clients (typical)
  - Increased memory, processing, storage capacity, and other resources
  - Additional special hardware dependent on application
- Advantages relative to peer-to-peer networks
  - User credential(s) assigned centrally
  - Shared resource access centrally controlled
  - Central problem monitoring, diagnostics, correction capabilities
  - Optimized to handle heavy processing loads
  - Can connect many computers on a network
  - More scalable
- Disadvantages relative to peer-to-peer networks
  - Complex design and maintenance

LANs, MANs, and WANs

- LAN (local area network)
  - Network confined to relatively small location
  - Original simple peer-to-peer based networks
  - Currently used for large and complex client/server networks and peer-to-peer networks
- Original simple peer-to-peer based networks
  - Up to individuals if resources are shared (and which ones)
- MAN (metropolitan area network)
  - Connects clients and servers from multiple buildings

LANs, MANs, and WANs (cont'd)

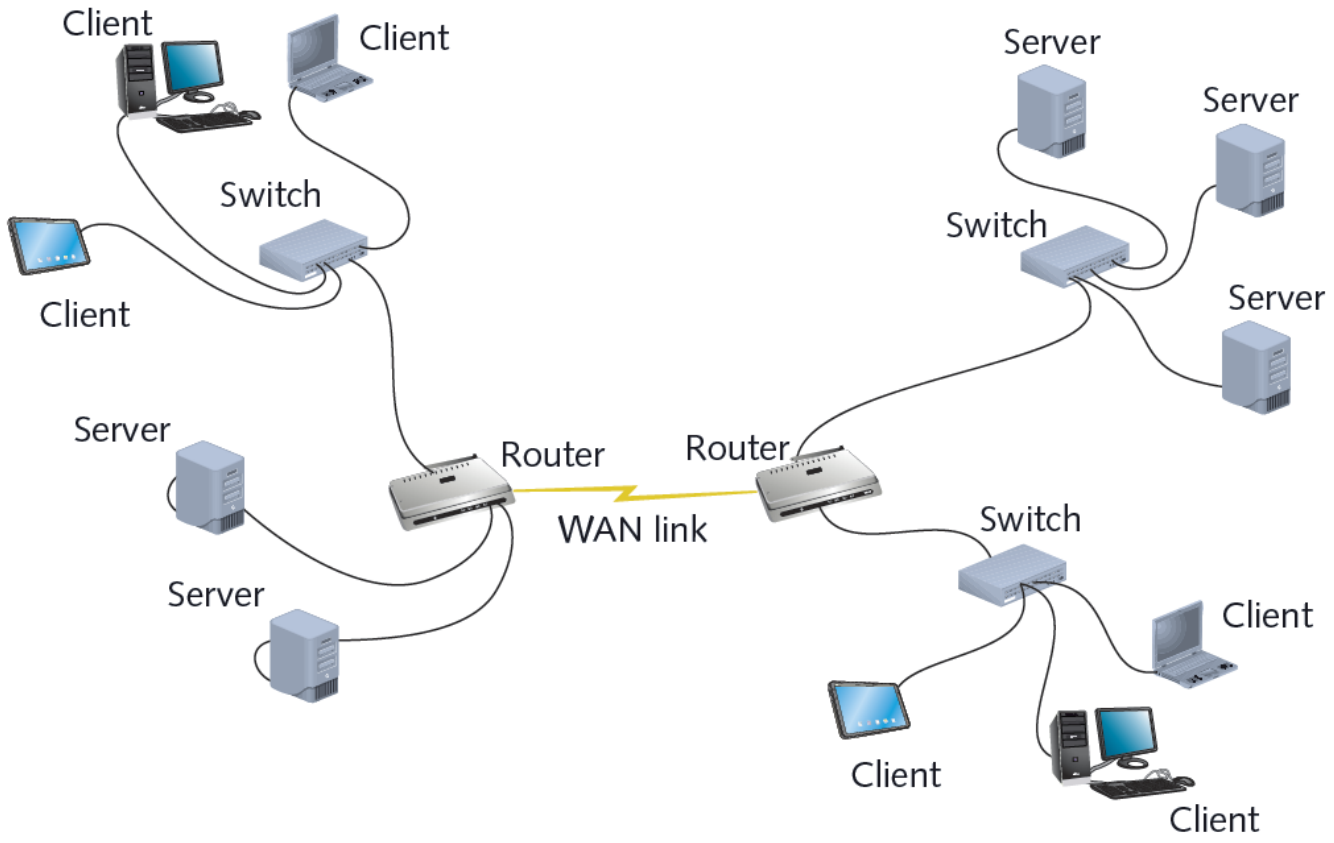


Interconnected LANs

LANs, MANs, and WANs (cont'd)

- WAN (wide area network)
  - Connects two or more geographically separate LANs or MANs
  - Often interconnected via the internet and different internet service providers
  - Uses
    - Interconnect separate offices for same organization
    - Interconnect separate offices/networks for different organizations and client users

LANs, MANs, and WANs (cont'd)



Simple WAN

Elements Common to Client/ Server Networks

- Protocols
  - Standard method or format for communication between networked devices
- Packet
  - Distinct data units exchanged between nodes
- Addressing
  - Scheme for assigning unique identifying number to ever node
- Transmission Media
  - Means through which data is transmitted and received

Common Network Uses

- E-mail
- Printer sharing
- File sharing
- Internet access and website delivery
- Remote access capabilities
- Voice (telephone) and video services
- Network management
- Network and host monitoring

File and Print Services

- File services
  - Capability of server to share data file, applications, and disk storage space
- A file server provides file services
- File services provided the foundational need for networking
- Print services
  - Share printers across network
  - Saves time and money – particularly for an organization

Access Services

- Allow a remote user access to internal network resources
- Remote user
  - Computer user on a different network and/or in a different geographical location from LAN's servers
- Allow network users to connect to machines outside of their LAN
- Operating systems include many built-in access services
- Allows external administrators to diagnose and troubleshoot network issues
- Can provide "local" desktop access to remote users

Mail Servers

- Host responsible for e-mail storage and transfer of messages
- Additional tasks of mail servers
  - Intercept spam
  - Handle objectionable content
  - Route messages according to rules
  - Provide Web-based client for checking e-mail
  - Notify administrators or users if certain events occur
  - Schedule e-mail transmission, retrieval, storage, maintenance
  - Communicate with mail servers on other networks
- Specialized software is needed in order to function as a mail server

Internet Services

- Web server
  - Host running specialized software that allows it to serve web pages to various clients
- Other network services
  - File transfer capabilities
  - Internet addressing schemes
  - Security filters
  - Means for directly logging on to other networked computers

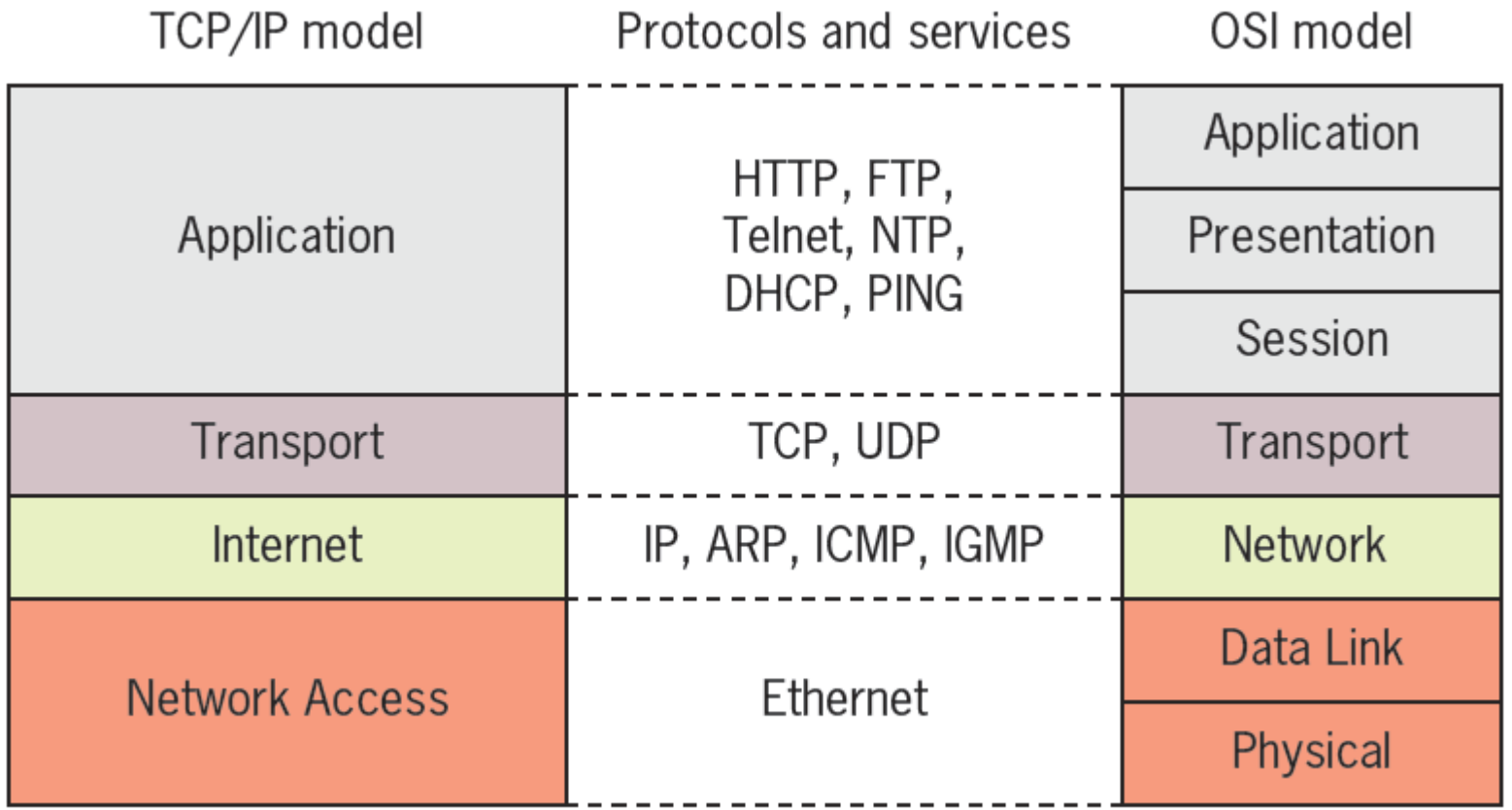
Management Services

- Traffic monitoring and control
- Load balancing
- Hardware diagnosis and failure alert
- Asset management
- License tracking
- Security auditing
- Address management
- Backup and restoration of data

TCP/IP Model

- Four Layers
  - Application layer
  - Transport layer
  - Internet layer
  - Network access layer (or Link layer)

TCP/IP Model (cont'd)



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Characteristics of TCP/IP

- TCP/IP = Transmission Control Protocol / Internet Protocol
- Protocol Suite
  - Commonly referred to as “IP” or “TCP/IP”
  - Subprotocols include TCP, IP, UDP, and ARP
  - Internet layer
  - Network access layer (or Link layer)
- Developed by US Department of Defense
  - Specifically DARPA (Defense Advanced Research Projects Agency)
  - ARPANET (developed in late 1960s) was precursor to TCP/IP protocol suite and internet as a whole

Advantages of TCP/IP

- Open Standard
  - Available on IETF website as RFCs
- Flexible
  - Runs on virtually any platform
  - Connects dissimilar operating systems and devices
- Routable
  - Transmissions carry Network layer addressing information
  - Suitable for small AND large networks

Summary

- A network is a group of interconnected computers and other devices
- Types of networks include peer-to-peer and client-server networks
- LANs, MANs, and WANs describe the different sizes and scopes of computer networks
- Networks provide a wide range of services
  - e.g. file sharing, printing, and voice
- Network management services centrally administer management tasks on a network
  - e.g. hardware/software diagnosis, troubleshooting, and backups
- TCP/IP Model
- TCP/IP Protocol suite characteristics