

CECS 327 Notes

Week 1.1

- What is a Network?
 - A computer network is a collection of computers interconnected via a transmission medium.
- Types of Networks
 - LAN (Local Area Network): a network that covers a relatively small area. Usually characterized by high-speed transmission and usually connected with switches and hubs
 - Distance characterizes this network
 - MAN (Metropolitan area networks): network that covers medium sized areas (perhaps 1-10 square miles). Characterized by medium-to-high transmission speeds
 - WAN (Wide-Area Network): a network that typically covers large distances (100+ miles). Lower speeds than LANs or MANs.
 - Ex. The Internet, A Provider Network like Verizon
- Why use Networks?
 - Availability of resources:
 - Ex. sharing resources like multiple people connecting to a printer, letting multiple people access a folder, etc.
 - Load sharing
 - Ex. split processes between multiple servers
 - High reliability
 - Ex. if one server goes down can use another
 - Human to human communication
 - Ex. WhatsApp, etc.
- Connectivity
 - Point-to-Point can only have one connection at a time
 - Multiple Access
 - There are Network collisions, performance drops, but obviously more efficient when needing to access multiple people
- Switched Networks
 - Circuit Switched
 - Packet switched:
- Cost-Effective Resource Sharing
 - Frequency Divided Multiplexing
 - Got small portion of network for the whole time
 - Time Divided Multiplexing
 - Split up depending on time, get whole signal for a certain time slot
- Protocols
 - Think of following a set of rules when an emergency happens, or how to deal with certain events
 - Networks go through protocols to exchange data

- Different router companies like Cisco and others follow the same protocols to make sure that networks work together
 - There are a set of protocols that work together to facilitate communication
 - Https is a protocol
- OSI 7 Layer Model
 - 1st: Physical - wifi card, ethernet card, enters in 0s and 1s.
 - 2nd: Data Link - frames (streams of bits) are delivered based on amc address
- TCP/IP 5 Layers
 - 1: Physical - similar to OSI
 - 2: Network Interface similar to OSI
 - 3: Internet (IP) - called datagram vs packet
 - 4: Transport (TCP/UDP)
 - Data is called segments
 - 5: application: similar to 6 and 7 in OSI
 - Data is called message
- Performance
 - Bandwidth
 - Latency

Week 4: (P (Internet Protocol addressing))

- An IP address does not identify a specific computer. Instead, each IP address identifies a connection between a computer and a network
- A computer with multiple network connections (e.g., a router) must be assigned one IP address for each connectin
- IPv4 address are:
 - Virtual (they are only understood by software)
 - Used for all communication in TCP/IP
 - 32-bit integers*
 - Unique for each host
- Note
 - IPv4 uses 32-bit IP addresses
 - IPv6 uses 128-bit IP addresses.
- IP addresses are divided into two parts
 - Prefix - which identifies the network
 - Suffix - which identifies the host
- The Internet Assigned Number Authority is the global authority that has control over the assignment a unique prefix to each network
- A local administrator assigns a unique suffix to each host.
- The IP hierarchy guarantees that:
- Each computer is assigned a unique address
- Suffixes can be assigned locally without global coordination
- IP address: 32-bit identifier for host, router interface
- **Will be tested on Network diagrams**
- The initial bits The initial bits determine the class of the address
- The class determines the boundary between prefix and suffix

- **Test Question: How do we know which class an IP address belongs to? Look at the first 4 bits**
- Class A – Large
- Class B - Medium
- Class C - Small
- Dotted Decimal notation is how to read IP addresses
- Special IP addresses
 - Prefix - Suffix - Type of Address - Purpose
 - All-0s - all-0s - this computer - used during bootstrap
 - Network - all-0s - network - identifies a network
 - Network - all-1s - directed broadcast - broadcast on specified net
 - Network - all-1s - limited broadcast - broadcast on local net
 - 127 - any - loopback - testing
- 10.X.X.X and 172.16.X.X - 172.31.X.X and 192.168.X.X are IP addresses from private network
- NAT (Network Address Translation) Maps Private IPs to Public IPS
- ICANN: Internet Corporation for Assigned names and Numbers (ICANN) authority was established to handle:
 - Address assignment and
 - Adjudicate disputes
- Subnets and Classless addressing:
 - Original goal: network part would uniquely identify a single physical network but
 - Being exhausted IP address
 - Inefficient address space usage
 - Class A and B networks too big
 - Also, very few LANs have close to 64K hosts
 - Easy for networks to outgrow class-C
 - Routing table size is too high
 - Two mechanism invented to overcome the limitation:
 - Subnet addressing
 - Classless addressing
- Subnetting
 - Main Concept: instead of having three distinct address classes (A B and C), allow the division between prefix/suffix to concur on an arbitrary bit boundary.
 - Security
 - Organization
 - Performance
 - To get Subnet Address you use the given subnet mask and ip address
 - Number of slices is maximum subnets
 - The original address falls inside a slice”subnet”
 - Look at CIDR notation, just another notation used for subnet masks.
 - End to End = Software connection
 - Link to Link = Network Connection
- Midterm Review:

- There is point to point vs multiple access
 - multiple access has circuit switched and packet switched.
 - There is frequency division multiplexing vs time division multiplexing
- Cloud Computing
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