12/1:

What is a network?

Collection of node and links that connect them.

TV, transportation, sewage. Think of the links and nodes for each of these.

How are computer networks different from other types of networks? Transportation in a city. Stations are the nodes, with train tracks being the links. Trains would be packets with the data in it.

Key computer network actors:

* Users. They interact with networks through application.
* App Developers create network applications. Worried about getting that shit working.
* Administrators. Operate and manage networks. Grow overlap between users and admins. Interested in the different characteristics of the network
* Designer. Design and build network devices and rules for communication.

Application of computer network:

* World Wide Web (WWW)
  + Email clients
  + Social networks
  + Just the links of all servers together. Does not exist as this magical cloud.
  + Internet “killer app”
    - More precisely – suite (platform) of applications
* Audio / streaming services
  + Instant messaging
  + File sharing
* Online gaming

Structure of URL example:

* 17 messgaes are involved to process single page (object) request:
  + 6 messages to translate the server name into IP address;
    - Cose.latech.edu -> 138.47.28.18
  + 3 messages to set up TCP connection;
  + 4 messages for HTTP request and acknowledgment;
  + 4 messages to tear down TCP connection.

Applications: Audio/video:

* Streaming audio/video
  + Video on demand, internet radio.
  + Delivery of streaming conent is different from fetching a webpage or an object.
* Real-time audio/video
  + Telecommunication, VolP.
  + Delivery of real-time content is different from precuessing of streaming data.
  + Zoom, skype, discord video
* Diversity of requirements drives how networks support different typers of appications.

General requirements

* Scalability
  + Adding more nodes to network
  + Node addressing and messages routing
* Efficienty
  + All nodes sharing the network.
  + Several nodes sharing a link
* Support of services
  + App-to-app communication through channels
  + Reliablilty issues
* Manageability
  + Automating network management
  + Stability vs. feature velocity

Foundations

Direct Links:

* What is a computer network
  + Group of computer ststems that are linked together through communication channels
* Computer systems – nodes
  + End poins
    - Hosts and servers
  + Redistribution points
    - Hubs, switches, routers
* Communicational channels – links
  + Wired links
  + Wireless links

Indirect links

* Switched network and networks of networks (internetwork) can be arranges with indirect links

Classification by scale

* Networks are frequently classified by their scale:
  + Wired
    - Local aera network (LAN) – around one specific router
    - Metropolitan area network (MAN) – covers sections of a city
    - Wide area network (WAN) – largest area covered. Fiber optic more common
  + Wireless
    - System networks – Bluetooth, RFID, infrared
    - Wireless LAN (WLAN) – Wifi tech
    - Wireless WAN (WWAN) – 4G, 5G
  + Internet

Concept of internet

* Internet is a network of networks
  + Billions of hosts (nodes) and communication links
    - Data is being transmitted by routers and switches
  + Protocols control sending and receiving of messages
    - TCP, UDP, IP, HTTP
  + Standards govern protocols operations
    - Request for comments (RFC)
  + Internet is an infrastructure for network applications
    - Provides services and rules of how to use them
      * Services – communication between applications
      * Rules – application programming interfaces (APIs)
* End nodes connect to interne via access internet service providers (ISPs)
* Access ISPs must be interconnected so hosts can exchange data
  + Connecting access ISPs to each other is not feasible
* Solution – regional, global and Tier-1 ISPs, internet exchange points (IXP), and content providers form complex “Internet Hierarchy”

Protocols

* Protocol (set of rules) defines:
  + Format of network messages
  + Order of messages sent and received among nodes
  + Actions taken on message transmission and receipt

Network edge: Components

* Components ar the network edge:
  + Hosts (end Points)
    - Client
    - Server
  + Access networks
    - Wired/wirless