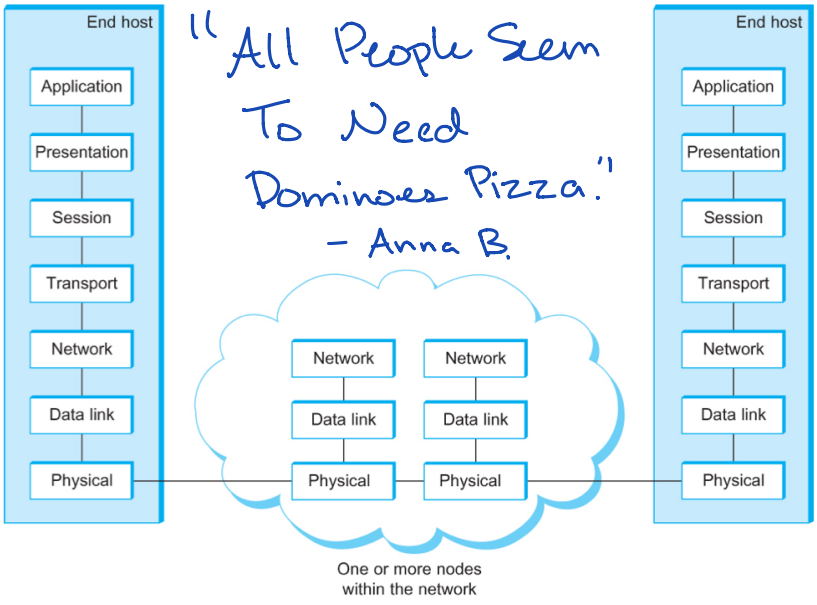
Chapter 1: Foundation Problem: Building a Network

OSI 7-layer Model

* 348 is OSI going bottom-up



→ lower layer serves the one above it.
→ encompasses rules, algorithms, & protocols.

→ Rules: format, naming, addressing, etc.
→ Algorithms: functions
→ Protocols: a collection of agreements (incl. rules & algos) for a conversation.

↳ Specified in the header of each layer

Know Network Applications

→ WWW / internet
→ email
→ online social networks
→ streaming videos
→ file sharing
→ instant messaging

* kB vs. kb

kB = 1024 bytes
kb = 1000 bits

Application Protocols

→ URL - uniform resource locator
→ HTTP - Hyper text transfer protocol
→ TCP - Transmission Control protocol

Links - physical connection

→ has a bit-rate or capacity
→ has a propagation delay
→ transfer time on link:
→ can be shared by multiplexing, de-multiplexing, and Synchronous time-division multiplexing

bit/bit-rate + prop. delay

* know difference b/t bandwidth, throughput, and (perceived) data rate
↳ perceived data rate = how much data the app. is actually reading/transmitting

Delay

→ Latency = propagation + transmit + queue

→ Propagation = distance / speed of light

→ Transmit = size / bandwidth

} know how to use to find total delay

★ for 1 bit transmissions — prop. time is important
↳ for large byte transmissions — bandwidth is important

★ think of latency (delay) as the length of the pipe and of bandwidth (transmission rate) as the width of the pipe.

→ $RTT = \left(\frac{\text{distance}}{c} \times 2\right)$ + any processing that happens along the way

→ see delay x bandwidth product.

→ Throughput = TransferSize / TransferTime

→ TransferTime = RTT + 1/Bandwidth × TransferSize

Chapter 1 Terminology

→ OSI Model - Open Systems Interconnection Model p. 32

→ Protocol - a collection of agreements (including rules + algorithms) for a conversation.

→ Host - comp. attached to one or more networks that supports users and runs application programs.

→ Switch - a network node that forwards packets from inputs to outputs based on header info. in each packet.
↳ differs from a router mainly b/c it usually does not interconnect networks of different types

→ Internetwork (internet) - a collection of (poss. heterogenous) (h-to-h) packet-switching networks interconnected by routers.
↳ different from def. for Internet which uses TCP/IP architecture

→ Router (gateway) - network node connected to 2 or more networks that forwards packets from one network to another.
↳ different from a bridge, repeater, and switch.

→ Routing - process by which nodes exchange topological info. to build correct forwarding tables.
↳ see forwarding, link state, and distance vector.

→ Broadcast - a method of deliv. a packet to every host on a network or internet. Can be imp. in hardware (Ethernet) or software (IP broadcast).

→ Unicast - sending a packet to a single dest. host.

→ Multicast - a special form of broadcast where packets are deliv. to a specified subgroup of network hosts.

→ Bandwidth (data rate) - measure of capacity of a link or connection, usually given in bits/second.

→ Throughput - observed rate of data sent through a channel

→ Delay x Bandwidth Product - product of a network's RTT and Bandwidth. Gives a measure of how much data can be in transit on the network. Aka. how many bits the sender must transmit before the first bit arrives at the receiver if the sender keeps the pipe full.

1 pipe full = Delay x Bandwidth = RTT x Bandwidth