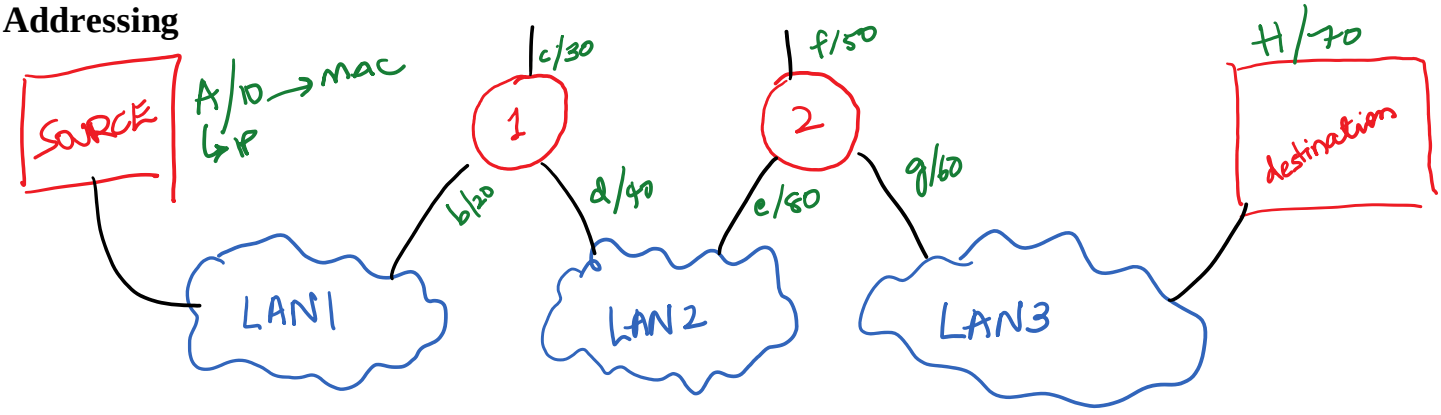
Addressing + Delays

Wednesday, February 10, 2021 1:01 PM

Addressing



Assigning simple IP & MAC addresses

Packet sent from application, presentation, session, transport to network layer.

www.google.com -> domain name server (from ISP)-> IP address

- We only give the IP address

Header with source and destination address in network layer packet.

Source IP	Destination IP	Data
A	H	3904

Data link layer:
Framing: add tailer about error correction/detection
At router 1:

Destination MAC	Source MAC	Packet	Tailer
20	10	AH3904	

- Scope of MAC address is to deliver to the next immediate node
- Routing table also contains where packets need to immediately delivered
- **ARP**

Receiver opens packet, verifies MAC address, decapsulates MAC addresses and sends to network layer. If packet IP address doesn't match, sends back to data link layer and updates new MAC addresses
At router 2:

Destination MAC	Source MAC	Packet	Tailer
80	40	AH3904	

At destination:

Destination MAC	Source MAC	Packet	Tailer
70	60	AH3904	

Since destination IP address matches, the packet is forwarded to the upper layers
IP address is global address
MAC address is local address

Prior to network layer, port number is added to header.

Port address:

16-bit port address number: range 0 to 2^16
- 0 to 1024 reserved

Network Criteria:
1. Throughput: actual number of bits transferred/second (usable capacity)
2. Bandwidth: maximum number of bits transferred/second (available capacity)

Delays:

Bandwidth: 10Mbps
12k frames/minute
1 frame = 10k bits
Throughput = $12000 * \frac{10000}{60} = 2Mbps$

RTT:
Round trip time when one bit starts journey from source and is sent back the moment it reaches the destination. Time to reach the source again is RTT.

1. **Transmission** delay Tt: time to place n bits into the channel
- If bandwidth is 100b/s and packet size is 1000b
- Involved either in end or intermediate node
  Depends on:
- Bandwidth (B)
- Length of packet/frame (L)
  Tt = $\frac{L}{B}$
2. **Propagation** delay Tp: the last bit leaves channel, the amount of traveling time from source to destination
  Depends on
- Distance between source and destination (d)
- Speed of propagation in the medium (s)
  $Tp = \frac{d}{s}$
  T(end-to-end) = Tt + Tp

When the complete packet is available at the destination
Tp is included in Tt for every bit except the last bit

3. **Processing** delay: whenever the packet arrives at an intermediate node (router), DL layer decapsulates and network layer checks IP address, refers routing table, data is encapsulated with new MAC address and packet arrives at new port.
   Mainly depends on size of routing table (which depends on the size of the network, algorithm, etc. Cannot be quantified)
4. **Buffer(queueing)** delay: happens only at intermediate nodes
   3 links connected to a router which handles 100b/s. 100 bits arrive at the router from all the links. Can handle only one packet at a time. The rest of the packets are stored in a temporary queue (buffer) where data is wait till ready to be processed. The time a packet waits in the queue is buffer delay.
   Depends on traffic intensity, number of nodes.
   Cannot be quantified

T(end-to-end) = Tt(S) + Tp(S-R) + Tq + Tprocc + Tt(R) + Tp(R-B)