CprE 489
Lecture 20

Fall Semester 1997

Internetworking

- At some level there must be a uniform address space over all parties in an internet. This enables potential communciation between parties.
- Individual subnets may have their own address and routing schemes. Address translation might be needed.
- Individual subnets may use different size or forms of packets. There may fragmentation or "tunneling".
- Individual subnets may be under different authorities. There may be a need for security, or so-called "firewalls".
- One subnet might provide a connectionless datagram service while another provides a connection oriented virtual circuit service.

Repeaters, Bridges, Routers

- Repeater - physical layer

  - can connect several LANs of the same type
  - no buffering or at most a bit for regeneration

- Bridge - data link layer or mac layer

  - can connect several LANs of different or the same types
  - buffers frames
  - there can be loss if LANs are incompatible in some way: different frame sizes or different speeds

- Multiprotocol router (gateway) - network layer

  - may divide packets up into smaller packets
  - typically used to connect WANs with LANs and other WANs
  - routers provide good "firewall" between networks.

IP

- Designed orignally in 1980 to handle internetworking. It now dominates and is a defacto international standard.
- IP packets are of variable length but usually about 1500 bytes.
- An IP packet may be fragmented and reassembled multiple times during its time in the Internet.
- IP addresses are essentially universal but only 32 bits long.

Fields of an IP Packet

- Version (4)
- Header Length (4)
- Type of Service (8)
- Total Length (16)
- Identification - all fragement of a datagram have the same id (16)
- Don't fragment field (1)
- More fragments field (1)
- Time to live (8)
- Protocol - what is the transport protocol (8)
- Header Checksum (16)
- Source Address (32)
- Destination Address (32)

IP Addresses

- 0.0.0.0 to 255.255.255.255 = 2^{32} = 4 billion addresses
- Classes A, B, C have addresses partitioned into (network,host)

  A - 126 networks with 16 million hosts each
  B - 16,382 networks with 65,536 hosts each
  C - 2 million networks with 254 hosts each

  Example: 128.95.1.4 = June is a Class B IP address
- Class D address is a multicast address used for broadcast
- Class E reserved for future use

Address Resolution Protocol for LANs

- ARP is a simple way to locate a local host using an IP address.
- Recall that an ethernet has its own addressing scheme. Given an IP address the sending host first determines if the IP address is local or remote.

  - if remote then send to the external router on the LAN

  - if local then broadcast the IP address on the LAN. Each station on the LAN looks up it own IP address to see if it matches the broadcasted IP address. If it is then it sends its LAN address to the sending host. The sending host can now send the IP packet enclosed in a LAN packet to the correct receiver.
- Typically, each host caches oftenly used LAN addresses so that the broadcast does not have to be used all the time.

The Future - IPv6

- Address space is 128 bits = 3.4 x 10^{38} addresses.
- Much simplified protocol so that the routers can work faster

  - no checksum
  - no encouragement for longer packets which could be fragemented
- More attention to quality of service

  - packets have information embedded to indicate quality of service requirements.