TCP/IP

An overview of TCP/IP and
related protocols

Reuven Aviv

Reuven Aviv: IT302 TCP/IP   5/13/99   1

Overview

➤ Brief history
➤ Ethernet
➤ Internet Addressing
➤ Mapping from IP address to
  Physical addresses
➤ The Internet Protocol
➤ IP Routing
➤ ICMP

Reuven Aviv: IT302 TCP/IP   5/13/99   2

Overview Continued...

➤ Layering Communication
  Software
➤ UDP
➤ TCP

Reuven Aviv: IT302 TCP/IP   5/13/99   3

Brief History

➤ APRANET
➤ UNIX
➤ Internet Activities Board (IAB)
➤ Network Information Centre (NIC)
➤ Documentation
  ➤ Request for comments (RFC)
  ➤ Internet Engineering Notes (IEN)

Reuven Aviv: IT302 TCP/IP   5/13/99   4

Ethernet

➤ Carrier Sense Multiple Access Protocol
➤ Send and forget
➤ Error checking: Drop frames with errors

Destination address	Source address	type	data	crc

Reuven Aviv: IT302 TCP/IP   5/13/99   5

Internet Addresses

➤ Contain Host and Network Id's
➤ Each Id is universal and unique
➤ Assigned to connections to internet
➤ Different classes
  ➤ Class A
  ➤ Class B
  ➤ Class C
  ➤ See diagram
➤ Take format like 128.10.2.30

Reuven Aviv: IT302 TCP/IP   5/13/99   6

Internet Addresses (cont'd)

```
1 2 3 4    8                    31
0 Net Id    Host Id
1 0    Net    Id    Host  Id
1 1 0        Net    Id    Host Id
```

Reuven Aviv: IT302 TCP/IP   5/13/99   7

Mapping IP and Physical addresses

➤ Direct Mapping
➤ ARP
➤ RARP

```
0         8        16        24        31
   Hardware Type        Protocol Type
 HLEN    PLEN           Operation
 Sender HA (Octets 0-3)    Sender IP (0-1)
 Sender IP (2-3)           Target HA (0-1)
        Target HA (2-5)
        Target IP (0-3)
```

Reuven Aviv: IT302 TCP/IP   5/13/99   8

Internet Protocol

➤ Provides virtual network
➤ Unreliable, Connectionless, Best-effort Packet Transmission Protocol

```
0     4     8        16     19     24        31
Vers  HLEN  Service Type       Total Length
    Identification      Flags    Fragment Offset
Time To Live  Protocol       Header Checksum
        Source IP address
        Destination IP address
        IP Options              Padding
              Data
               ....
```

Reuven Aviv: IT302 TCP/IP   5/13/99   9

IP Routing

➤ Direct & Indirect
➤ Direct delivery
    ➤ Can IP be reached directly
      (without going through a router)
    ➤ Efficient
➤ Indirect delivery
    ➤ Use routers
    ➤ Next-hop routing

Reuven Aviv: IT302 TCP/IP   5/13/99   10

ICMP - Internet Control Message Protocol

➤ Error reporting mechanism
➤ Used by Routers and Hosts
➤ At IP level
➤ Travels in IP datagram

Reuven Aviv: IT302 TCP/IP   5/13/99   11

Layering Communication Software

Application	Software outside OS
<-- Messages or streams	Software inside OS
Transport	
<-- Transport protocol packets (UDP)	
Internet	
<-- IP datagrams	Only IP addresses used
Network Interface	Physical addresses used
<-- Network specific frames e.g. Ethernet	
Hardware	

Reuven Aviv: IT302 TCP/IP   5/13/99   12

UDP - User Datagram Protocol

➤ Provides ports and allows applications to communicate
➤ Unreliable, connectionless service
➤ Uses IP
➤ Header:

0	16	31
UDP Source Port	UDP Destination Port	
UDP Message Length	UDP Checksum	
Data		
...		

Reuven Aviv: IT302 TCP/IP   5/13/99   13

TCP - Transmission Control Protocol

➤ Connection Oriented, Reliable Stream Service
➤ Uses IP

source port	Destination port
Sequence number	
Acknowledgment number	
length	flags	window
checksum	Urgent pointer
Optional parameters	
Data (payload)	

Reuven Aviv: IT302 TCP/IP   5/13/99   14