

CSET 2200 Lecture 14 - Summary Day!

Physical Layer

- ▶ PDU: Bit
- ▶ Electrical or Optical implementation that carries data
- ▶ Ethernet, Token Ring, Wifi, Bluetooth, etc

Data Link Layer

- ▶ PDU: Frame
- ▶ Handles local communication

Ethernet

- ▶ Has pieces of Layer 1 and Layer 2
- ▶ 802.3 is the IEEE working group
- ▶ Primary LAN technology

Ethernet PHY

- ▶ Layer 1 piece of Ethernet
- ▶ Defines Electrical Format
 - ▶ 10Base2 - Thin Coax
 - ▶ 10Base5 - Thick Coax
 - ▶ 10BaseT - Twisted Pair
 - ▶ 100BaseT - 100mbps
 - ▶ 1000BaseT, 10GBaseT, etc - all Twisted Pair
 - ▶ XBaseFX/LX/SX/ZX - Ethernet over Fiber

Ethernet Layer 1

- ▶ Broadcast Medium
- ▶ Every frame is seen by everyone
- ▶ Various devices such as switches limit this

CSMA/CD

- ▶ Carrier Sense Multi Access with Collision Detect
- ▶ Listen before you transmit
- ▶ When gap transmit and listen
- ▶ If garbage, back off random time and try again

Collision Domain

- ▶ Hosts that all receive broadcasts electrically
- ▶ Switches limit broadcast domain

Full vs Half Duplex

- ▶ With half one transmitter at a time
- ▶ With full both can - only 2 stations possible

Layer 2 - Ethernet

- ▶ PDU: Frame
- ▶ Address - 6 byte MAC address
- ▶ Format:
 - ▶ 6 Byte Dest Mac
 - ▶ 6 Byte Src Mac
 - ▶ Optional 4 byte tag
 - ▶ 2 Byte type (Or size then type)
 - ▶ Pay load

Devices

- ▶ Repeater extends reach
- ▶ Hub just connects multiple twisted pair - dumb and half duplex
- ▶ Bridge joins two collision domains
- ▶ Switch is a multi port bridge
 - ▶ Each port collision domain
 - ▶ Usually full duplex

Layer 3

- ▶ PDU is packet
- ▶ Address - 4 byte IP address
- ▶ Dotted quad
- ▶ Each network has a network and a mask
- ▶ Mask decides if address is local

ARP

- ▶ Used to Map layer 3 to Layer 2
- ▶ Sent to broadcast asking who has an IP
- ▶ Response is Unicast with answer

IPv4

- ▶ Connectionless
- ▶ Best effort
- ▶ Addresses allocated by IANA

Classes

- ▶ A = 0-127 (128 networks, 2^{24} hosts)
- ▶ B = 128-191 (16384 networks, 2^{16} hosts)
- ▶ C = 193-223 (2^{21} networks, 256 hosts)
- ▶ D = 224-239 (Multicast)
- ▶ E = 240-255 (Experimental)
- ▶ Can be combined or split if classless

RFC1918 Space

- ▶ Private use
- ▶ 10.0.0.0/8
- ▶ 172.16.0.0/12
- ▶ 192.168.0.0/16

IPV4 Header

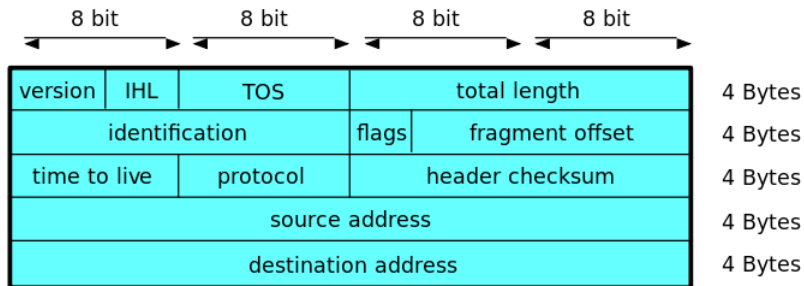


Figure 1: IPV4 Header

Subnets

- ▶ Written as dotted quad or CIDR mask
- ▶ 1 is care bit or network address
- ▶ 0 is host addresses
- ▶ Binary AND to determine if local

CIDR

- ▶ Classless Inter-Domain Routing
- ▶ Uses VLSM
 - ▶ Variable Length Subnet Mask

VLSM

- ▶ Split network and host at any boundary
- ▶ We can combine adjacent networks or split big ones
- ▶ Use Tree method to split networks if needed

Layer 4

- ▶ TCP
- ▶ UDP
- ▶ ICMP

TCP

- ▶ Transport Control Protocol
- ▶ PDU: Segment
- ▶ Connection Oriented
- ▶ Stream Oriented
- ▶ Reliable
 - ▶ In Order Delivery
 - ▶ Error Handling

TCP Header

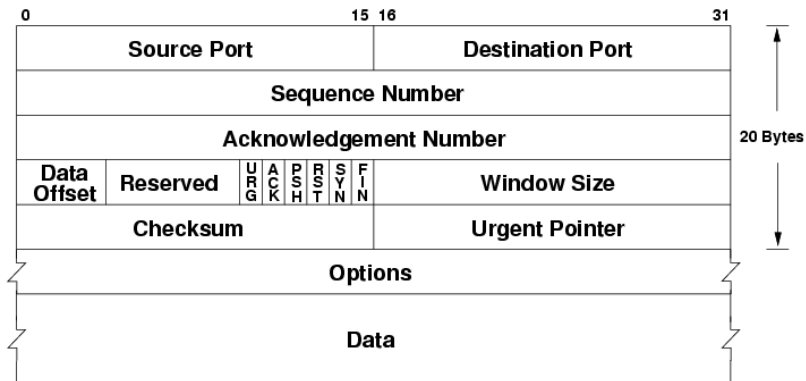


Figure 2: TCP Header

TCP connections

- ▶ 3 way handshake to connect
- ▶ 4 way handshake to disconnect
- ▶ Each packet gets ACK
- ▶ Scaling controls ACK with no reply

UDP

- ▶ PDU: Datagram
- ▶ User Datagram Protocol
- ▶ Connectionless
- ▶ Unreliable
- ▶ Used by services that need low latency

UDP Header

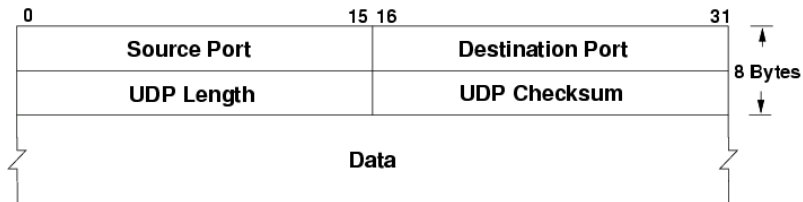


Figure 3: UDP Header

ICMP

- ▶ Internet Control Message Protocol
- ▶ Error handling
- ▶ Also used for Ping/Traceroute

ICMP Header

ICMP Header Format																																	
Offsets	Octet	0							1								2								3								
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Type							Code								Checksum																
4	32	Rest of Header																															

Figure 4: ICMP Header

Layer 5 - Session

- ▶ Not much to talk about
- ▶ Handles Persistence
- ▶ Not present in TCP/IP Model

Layer 6 - Presentation

- ▶ Again boring
- ▶ Handles data conversion
- ▶ Also not in TCP/IP Model

Layer 7 - Application

- ▶ What we care about if not network people
- ▶ Carries user data
- ▶ Many Protocols

BOOTP

- ▶ Used to get IP address from ARP
- ▶ Opposite of ARP kinda
- ▶ Static mappings
- ▶ Simple request/reply

DHCP

- ▶ Extends BOOTP to add dynamic pools
- ▶ Supports passing other options
 - ▶ Discover
 - ▶ Offer
 - ▶ Request
 - ▶ Acknowledge

DNS

- ▶ Domain name system
- ▶ Maps hosts to IP and vice versa
- ▶ Many hosts to one IP
- ▶ One IP to one hostname
- ▶ Hierachal - also a tree

DNS (contd)

- ▶ A record = Answer - Hostname
- ▶ NS Record = Name Server - Delegation
- ▶ CNAME Record = Alias
- ▶ PTR record = Pointer - Reverse

Internetworks

- ▶ Link many local networks
- ▶ Internet large example
- ▶ Changing as time goes on

Router

- ▶ Links multiple layer 2 networks
- ▶ Moves packets at layer 3

Route table

- ▶ Contains destination network
- ▶ Mask
- ▶ Next Hop IP
- ▶ Metric

Routing

- ▶ Most specific match wins
- ▶ On tie metric breaks it
- ▶ Metric varies by protocol
- ▶ Default Gateway (0.0.0.0/0) = Where packets go if not known

Questions

Next Session

- ▶ Review game/session
 - ▶ Lucas will have exam so will likely give good review
- ▶ Exam 2 weeks from today