

Panel 1

Last time:

- IP header format
- IP addressing details
- Special servers on a LAN:
 - DHCP
 - Gateway
 - DNS
 - Firewall

the network-level protocols

DHCP, DNS, ARP, RARP, ICMP, BOOTP

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Panel 2

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<u>Group 2:</u>	DNS	Anthony Ambrose Chris Dubra
<u>Group 3:</u>	DHCP	Frank Gounello Jeff Johnson
<u>Group 4:</u>	ICMP	Michael Malenkov Steven Marinelli
<u>Group 5:</u>	ARP + RARP	Ed Mikusewski Thomas Odenhouse Stefano Polo

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Panel 3

New Protocol needed

IP v4 has several limitations

Address space : $2^{32} \approx 4$ Billion

compare with Ethernet ≈ 48 bits $\Rightarrow 2^{48} = 218\,000\,000\,000\,000$

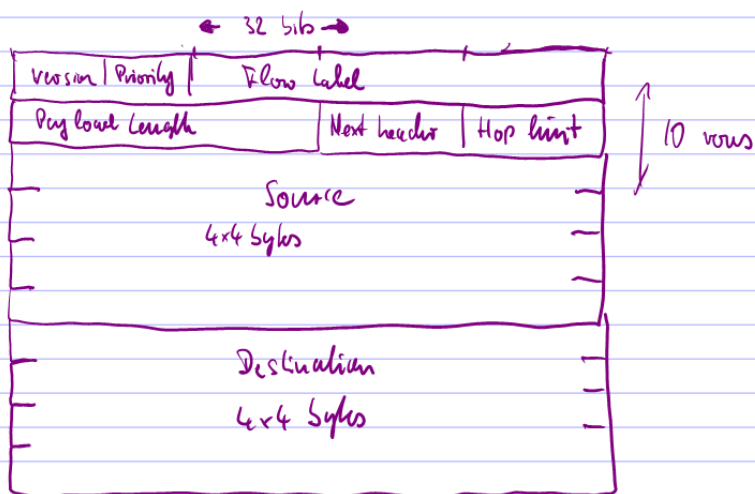
- New goals:
- support more hosts
 - reduce size of routing tables
 - simplify protocol for faster processing
 - better security
 - attention to type of service
 - multicasting + roaming support
 - compatible with old IPv4

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Panel 4

IP v6

After much discussion \rightarrow IP v6



No header checksum \rightarrow faster processing

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Panel 5

20 = 4 * 5 byte IPv4 header

version	HL	Type of service	Total length
Identification			Fragment offset
Time to live	Protocol	Header checksum	
Source address			
Destination address			
Options			

40 = 4 * 10 byte IPv6 header

Ver	Priority	Flow Label
Payload length		Next header
Hop Limit		
Source address		
Dest. address		

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Panel 6

Ver	Priority	Flow Label
Payload length		Next header
Hop Limit		
Source address		
Dest. address		

Priority: 0-7 for transmission with flow control, 8-15 for constant rate, real-time traffic (with potential loss) QoS

Flow label: experimental to try to setup virtual circuits

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Panel 7

Ver	Priority	Flow Label
Payload length		Next header
Hop Limit		
Source address (4x4 bytes = 128 bits)		
Dest. address (128 bits)		

Payload length: how many bytes follow header
 $2^{16} - 1$ as before

Next header: signifies "extension" ~~headers~~ or which protocol in transport layer to use

Hop Limit: same as TTL (Time to Live)

~~Source Dest~~: 2^{64} ~~is~~ instead of 2^{32} , fixed length
 Source + Dest: $2^{128} = 18 \text{ } 000 \text{ } 000 \text{ } 000 \text{ } 000 \text{ } 000$

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Panel 8

IP v6 addresses

8 groups of 4 hex-decimal digits with commas:
 8000:0000:0000:0000:0123:4567:89AB:CDEF

32 hex values $\rightarrow 32 \times 4 \text{ bits} = 128 \text{ bits}$

- a) leading zeros in a group can be omitted
- b) one or more groups of 4 zeros can be replaced by pair of colons

$8000 :: 123...$

- c) IP v4 addresses were ~~was~~ pre-filled with 0's:
 $149.150.53.101 = :: 149...$

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Panel 9

Extension Headers

Options can immediately follow header

Controversies

Many discussions preceded IPv6
 / 70 byte header
 \ 12 byte header

Hop count : 255 is unworkable?

Max packet size - jumbo-grams via extensions

CRC checksum - remove breaks from core
 but still in data-link layer

Security: in network layer would be convenient, but
 nobody would rely on it for real!
 what type MD5? DES?

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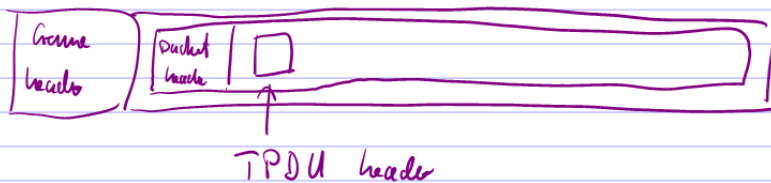
Panel 10

The Transport Layer

Provide reliable, cost-effective data transport
 from source to destination.

Network: routing + addressing

Transport: reliable



TPDU = Transport Protocol Data Unit

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Panel 11

Transport Service Primitives

reliable - connection oriented

Berkeley UNIX for TCP socket primitives

SOCKET	create new comm. endpoint
BIND	attach local address to socket
LISTEN	willingness to accept connections
ACCEPT	block until connect. attempt arrives
CONNECT	attempt to establish connection
SEND	send data
RECEIVE	receive data
CLOSE	release connection

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