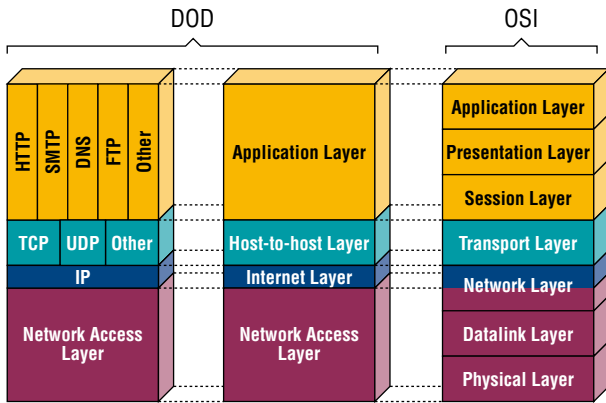
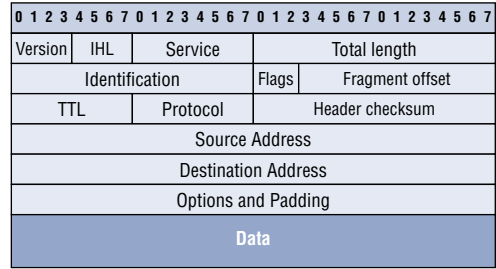


TCP/IP (IPv4) reference card

DoD Model - OSI Model

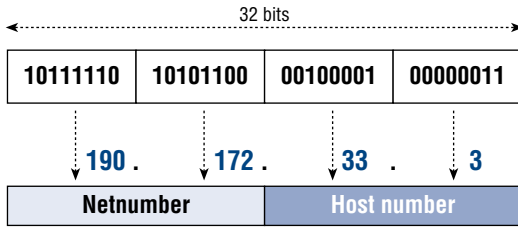


IP Datagram Format (IPv4)



- Version:** IP version number (4 bits)
- IHL:** Internet header length (4bits)
- Service:** Type of service flags (1 byte)
Precedence (=absolute priority) (3 bits)
Minimize delay (1 bit)
Maximize throughput (1 bit)
Maximize reliability (1 bit)
Minimize monetary cost (1 bit)
Reserved for future use (1 bit)
- Total length:** Total length of IP datagram (2 byte)
- Identification:** Unique packet identifier, used to identify the fragments of the datagram (2 bytes)
- Flags:** Fragmentation flags, indicates if datagram can be fragmented, and if a particular packet is the last in the series of the fragments (3 bits)
- Fragm. Offset:** Fragmentation offset field (13 bits)
- TTL:** Time to live field (1 byte)
- Protocol:** Protocol identifier field, identifies the next higher layer protocol (1 byte)
- Header Checksum:** Checksum field (2 bytes)
- Source Address:** IP address of the source host (4 bytes)
- Destination Address:** IP address of the destination host (4 bytes)
- Options and Padding:** (Variable length)
Options: Strict source route, Loose source route, Record route, Timestamp, Security

IP Addressing Format



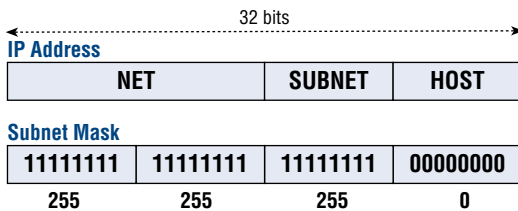
IP Address Classes

		Netnumber	Host number
0-126	A	0	
128-191	B	10	
192-223	C	110	
224-239	D	1110	
240-255	E	1111	

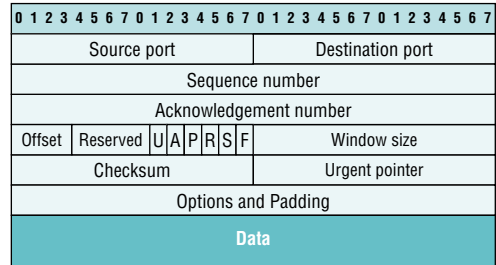
8-bit

Class	Number of networks	Number of hosts
Class A	126	16.777.214
Class B	16.384	65.534
Class C	2.097.152	254

Subnetmask



TCP Segment Format



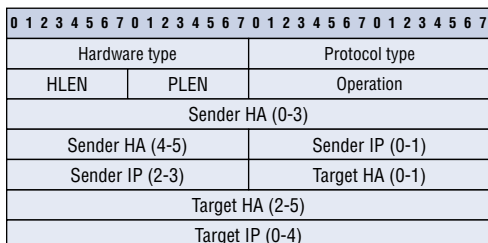
- Source port:** Number of the port that initiates the session (2 bytes)
- Destination port:** Number of the port for which the the transmission is destined (2 bytes)
- Sequence Number:** Used to reconstruct the fragmented data out of the segments (4 bytes)
- Acknowledgement number:** Used to acknowledge the receive of a segment (4 bytes)
- Offset:** Size of the TCP header (4 bits)
- Reserved:** Set to zero, reserved for future use (6 bits)
- Flags: (6 bits)**
 - URG: 1 bit (Urgent)
 - ACK: 1 bit (Acknowledgment)
 - PSH: 1 bit (Push)
 - RST: 1 bit (Reset connection)
 - SYN: 1 bit (Synchronisation of sequence numbers)
 - FIN: 1 bit (Finished sending data)
- Window Size:** Used to exchange TCP buffer sizes (2 bytes)
- Checksum:** Checksum field (2 bytes)
- Urgent pointer:** Points to urgent data in the data field (2 bytes)
- Options and Padding: (variable length)**
 - Options: Maximum segment size, TCP window scale, Selective acknowledgment, SACK-permitted, TCP timestamps

TCP Port Numbers

7	Echo	25	SMTP
9	Discard	53	DNS
13	Daytime	80	HTTP
17	Qotd	110	POP3
19	Chargen	119	NNTP
20	FTP-data	179	BGP
21	FTP-control	143	IMAP
22	SSH	389	LDAP
23	Telnet	443	HTTPs (s=over SSL)
		646	MPLS

≤1023: Well known applications
 >1023: Proprietary applications and client applications

ARP Message Format



- Hardware type:** Identifies the type of hardware interface (2 bytes)
- Protocol Type:** Identifies the type of protocol the sending device is using (2 bytes)
- HLEN:** Hardware Address Length (1 byte)
- PLEN:** Protocol Address Length (1 byte)
- Operation:** Request or reply (2 bytes)
- Sender HA:** Sender hardware address (6 bytes)
- Sender IP:** Sender IP address (4 bytes)
- Target HA:** Target hardware address (6 bytes)
- Target IP:** Target IP address (4 bytes)

UDP Message Format

0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7	
Source port	Destination port
Length	Checksum
Data	

Source port: Number of the port that initiates the session (2 bytes)
Destination port: Number of the port for which the transmission is destined (2 bytes)
Length: Size of UDP message (2 bytes)
Checksum: Checksum field (2 bytes)

UDP Port Numbers

7	Echo	67	DHCP server	520	RIP
9	Discard	68	DHCP client	646	MPLS
13	Daytime	69	TFTP		
17	Qotd	123	NTP		
19	Chargen	161	SNMP		
53	DNS	162	SNMPtrap		

≤1023: Well known applications
 >1023: Proprietary applications

IP Encapsulation

DIX Ethernet v2

DA	SA	E-TYPE	DATA	FCS
----	----	--------	------	-----

IEEE 802.3

00 00 00	E-TYPE
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IEEE 802.2 SNAP	DSAP AA	SSAP AA	Control	SNAP	DATA
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IEEE 802.2	DSAP 06	SSAP 06	Control	DATA
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DA	SA	Length	DATA	FCS
----	----	--------	------	-----

E-Type (Hex.)

08 00: IP(v4) 08 06: ARP 86 DD: IP(v6)

Important RFC's

RFC 768: User Datagram Protocol	Standard
RFC 791: Internet Protocol v4	Standard
RFC 792: Internet Control Message Protocol	Standard
RFC 793: Transmission Control Protocol	Standard
RFC 821: Simple Mail Transfer Protocol	Standard
RFC 826: Ethernet Address Resolution Protocol	Standard
RFC 854: Telnet Protocol Specifications	Standard
RFC 959: File Transfer Protocol	Standard
RFC 1157: Simple Network Management Protocol	Standard
RFC 3232: Assigned Numbers	Informational
http://www.iana.org/numbers.html	
RFC 1771: Border Gateway Protocol v4	Draft Standard
RFC 2131: Dynamic Host Configuration Protocol	Draft Standard
RFC 2328: Open Shortest Path First v2	Standard
RFC 2453: Routing Information Protocol v2	Standard
RFC 2616: Hypertext Transfer Protocol 1.1	Draft Standard

Search for RFC's on <http://www.rfc-editor.org>

ICMP Message Format

0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7			
Version	IHL	T.O.S.	Total length
Identification		Flags	Fragment offset
TTL	Protocols=1	Header checksum	
Source Address			
Destination Address			
Options and Padding			
ICMP TYPE	ICMP CODE	Header checksum	
Unused or depending on TYPE (see notes)			
IP header + 8 octets of original datagram			

ICMP Types & Codes

Type	Code	
0	0	Echo Reply
3	0	Destination Unreachable
	0	Network unreachable
	1	Host unreachable
	2	Requested protocol unreachable
	3	Port unreachable
	4	Fragmentation needed, but "Don't Fragment flag set"
	5	Source route has failed
	6	Destination network unknown
	7	Destination host unknown
4	0	Source Quench
5	0	Redirect
	0	Redirect datagrams for network
	1	Redirect datagrams for host
8	0	Echo Request
9	0	Router advertisement
10	0	Router selection
11	0	Time Exceeded
	0	Time-to-live exceeded
	1	fragment reassembly time exceeded
12	0	Parameter Problem
	0	Pointer indicates the error
	1	Missing a required option
	2	Bad length

Interesting links

Internet Assigned Numbers Authority (IANA)	http://www.iana.org
Internet Corporation for Assigned Names and Numbers (ICANN)	http://www.icann.org
Réseaux IP Européens (RIPE)	http://www.ripe.net
American Registry for Internet Numbers (ARIN)	http://www.arin.net
Asia Pacific Network Information Center (APNIC)	http://www.apnic.net
Internet Engineering Task Force (IETF)	http://www.ietf.org
Institute of Electrical and Electronics Engineers (IEEE)	http://www.ieee.org
InterNIC	http://rs.internic.net
Internet Architecture Board (IAB)	http://www.iab.org
Internet Society (ISOC)	http://www.isoc.org
Internet Software Consortium	http://www.isc.org
World Wide Web Consortium	http://www.w3c.org
Internet Mail Consortium	http://www.imc.org
RFC Editor	http://www.rfc-editor.org
Telindus High-Tech Institute (THTI)	http://www.thti.telindus.be

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www.jccademy.com

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