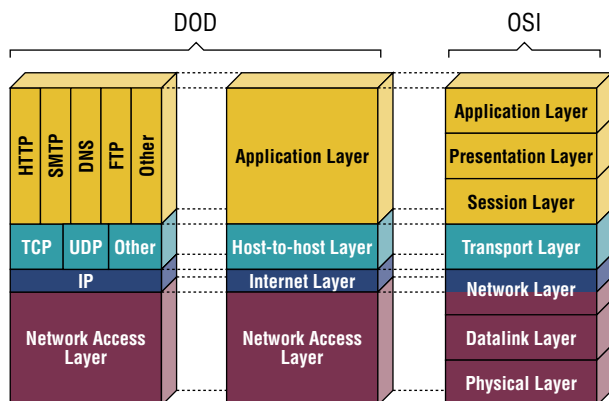


TCP/IP (IPv4) reference card

DoD Model - OSI Model



IP Datagram Format (IPv4)

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				Service								Total length							
Identification												Flags				Fragment offset							
TTL				Protocol				Header checksum															
Source Address																							
Destination Address																							
Options and Padding																							
Data																							

Protocol:

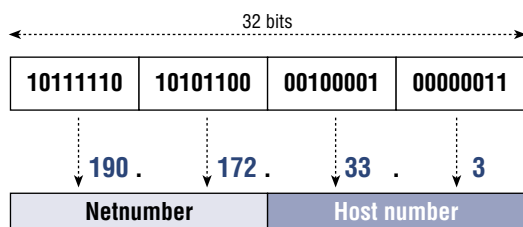
1	ICMP
2	IGMP
6	TCP
8	EGP
9	IGRP
17	UDP
46	RSVP
88	EIGRP
89	OSPF

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 of IP datagram (2 byte)

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



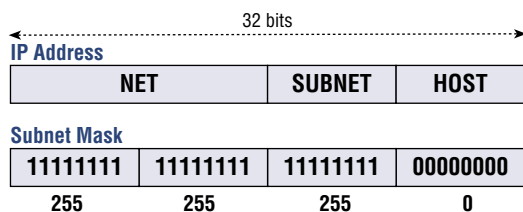
IP Address Classes

		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

	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

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																							
Sequence number																															
Acknowledgement number																															
Offset		Reserved		U		A		P		R		S		F		Window size															
Checksum														Urgent pointer																	
Options and Padding																															
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)
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)	Enables the control functions of urgent fields	(URG, 1 bit)
	Acknowledgment	(ACK, 1 bit)
	Push	(PSH, 1 bit)
	Reset connection	(RST, 1 bit)
	Synchronisation of sequence numbers	(SYN, 1 bit)
	Finished sending data	(FIN, 1 bit)
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)	Only valid if the urgent flag is set	(2 bytes)
	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

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Hardware type								Protocol type															
HLEN				PLEN				Operation															
Sender HA (0-3)																							
Sender HA (4-5)								Sender IP (0-1)															
Sender IP (2-3)								Target HA (0-1)															
Target HA (2-5)																							
Target IP (0-4)																							

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
----------	--------

IEEE 802.2 SNAP	DSAP AA	SSAP AA	Control	SNAP	DATA
-----------------	---------	---------	---------	------	------

IEEE 802.2	DSAP 06	SSAP 06	Control	DATA
------------	---------	---------	---------	------

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