

## IPv6 Cheat Sheet

### IPv6 Header

<b>Version (4)</b>	<b>Traffic Class (8)</b>	<b>Flow Label (20)</b>	
<b>Payload Length (16)</b>		<b>Next Header (8)</b>	<b>Hop Limit (8)</b>
<b>Source Address (128 bits) [16 bytes]</b>			
<b>Destination Address (128 bits) [16 bytes]</b>			

**Version** : IP version number (6).

**Traffic class** : Used by originating nodes and/or forwarding routers to identify

and distinguish between different classes or priorities of IPv6 packets.

**Flow label** : Used by a source to label sequences of packets for which it requests special handling by the IPv6 routers.

**Payload Length** : Length of the IPv6 payload (also the extension headers).

**Next Header** : Identifies the type of header following the IPv6 header.

**Hop Limit** : Decrement by 1 by each node that forwards the packet.

**Source Address** : Address of the originator of the packet

**Destination Address** : Address of the intended recipient of the packet (possibly not the ultimate recipient, if a Routing header is present)

### General Format for IPv6 Global Unicast Addresses

Global routing prefix (n bits)	Subnet ID (m)	Interface ID (128-n-m)
--------------------------------	---------------	------------------------

### IPv6 Global Unicast Addresses (not starting with binary value 000)

! 000	Global routing prefix (n)	Subnet ID (64-1)	Interface ID (64)
-------	---------------------------	------------------	-------------------

### IPv6 Global Unicast Addresses (2000::/3 prefix, IANA delegated)

001	Global routing prefix (45)	Subnet ID (16)	Interface ID (64)
-----	----------------------------	----------------	-------------------

### IPv4-compatible IPv6 address

0 (80 bits)	0 (16 bits)	IPv4 address (32 bits)
-------------	-------------	------------------------

### IPv4-mapped IPv6 Address

0 (80 bits)	FFFF (16 bits)	IPv4 address (32 bits)
-------------	----------------	------------------------

### Link-Local IPv6 Unicast Address (FE80::/10)

1111111010 (10 bits)	0 (54 bits)	Interface ID (64 bits)
----------------------	-------------	------------------------

### Site-Local IPv6 Unicast Address (FEC0::/10)

1111111011 (10 bits)	Subnet ID (54)	Interface ID (64 bits)
----------------------	----------------	------------------------

### Subnet-Router Anycast Address

Subnet Prefix (n bits)	0 (128-n)
------------------------	-----------

### Ethernet Types

0800	IPv4
0806	ARP
8035	Reverse ARP
86DD	IPv6
8847	MPLS Unicast
8848	MPLS Multicast
8863	PPoE (Discovery stage)
8864	PPoE (PPP sess stage)

### IPv6 Option Types (8 bits, 3 fields)

#### act - 2 bits

00	skip over option
01	silently discard
10	discard and send ICMP
11	discard and send ICMP, if unicast

#### chg - 1 bit

0	= option data does not change en-route
1	= option data may change en-route

#### rest - 5 bits, the rest of the Option Type

### IPv6 Next Header Fields

041	IPv6
000	IPv6 Hop-by-Hop Option
060	Destination Options for IPv6
043	Routing Header for IPv6
044	Fragment Header for IPv6
051	Authentication Header (AH)
050	Encap Security Payload (ESP)
059	No Next Header for IPv6
002	Internet Group Management (IGMP)
006	Transmission Control (TCP)
017	User Datagram (UDP)
046	Reservation Protocol (RSVP)
047	General Routing Encapsulation (GRE)
055	IP Mobility (MOBILE)
058	ICMP for IPv6 (ICMPv6)
089	OSPFv6
094	IP-within-IP Encapsulation Protocol (IPIP)
103	Protocol Independent Multicast (PIM)
135	Mobility Header

### ICMPv6 Informational Messages

128	Echo Request
129	Echo Reply
130	Multicast Listener Query
131	Multicast Listener Report
132	Multicast Listener Done
133	Router Solicitation
134	Router Advertisement
135	Neighbor Solicitation
136	Neighbor Advertisement
137	Redirect Message
138	Router Renumbering
139	ICMP Node Information Query
140	ICMP Node Information Response
143	Version 2 Multicast Listener Report
144	Home Agent Address Discovery Request
145	Home Agent Address Discovery Reply
146	Mobile Prefix Solicitation
147	Mobile Prefix Advertisement
128 - 255	Informational Messages

### Flags (000T)

T = 0	Well-known
T = 1	Transient

### ICMPv6 Error Messages (Type/Code)

1	Destination Unreachable
0	no route to destination
1	communication with destination administratively prohibited
2	(not assigned)
3	address unreachable
4	port unreachable
2	Packet Too Big
3	Time Exceeded
0	hop limit exceeded in transit
1	fragment reassembly time exceeded
4	Parameter Problem
0	erroneous header field
1	unrecognized Next Header type
2	unrecognized IPv6 option
0-127	Error Messages

### IPv6 Extension Headers (NH = Next Header)

IPv6 Header NH = TCP	TCP Header + Data	
IPv6 Header NH = Routing	Routing Header NH = TCP	TCP Header + Data
IPv6 Header NH = Routing	Routing Header NH = Fragment	Fragment Header NH = TCP
		TCP Header + Data

### IPv6 Addressing

\* *Deprecated*

Address Type	Binary Prefix	IPv6 Notation
Unspecified	00...0 (128 bits)	::/128
Loopback	00...1 (128 bits)	::1/128
Multicast	11111111	FF00::/8
Link-local unicast	1111111010	FE80::/10
Site-local unicast*	1111111011	FEC0::/10
Unique local unicast	1111110000	FC00::/7
Global unicast	(everything else)	
Anycast	Unicast address assigned to multiple interfaces.	
IPv4-Compatible IPv6*	0:0:0:0:0:A.B.C.D	
IPv4-Mapped IPv6	0:0:0:0:0:FFFF:A.B.C.D	
6to4	2002::/16	

### Well Known Multicast Addresses

FF01:0:0:0:0:0:0:1	All Nodes Addresses	Interface-local
FF02:0:0:0:0:0:0:1	All Nodes Addresses	Link-local
FF01:0:0:0:0:0:0:2	All Routers Addresses	Interface-local
FF02:0:0:0:0:0:0:2	All Routers Addresses	Link-local
FF05:0:0:0:0:0:0:2	All Routers Addresses	Site-local
FF02:0:0:0:0:1:FFXX:XXXX	Solicited-Node Address	Link-local
FF02:0:0:0:0:0:0:4	DVMRP Routers	Link-local
FF02:0:0:0:0:0:0:5	OSPFv6	Link-local
FF02:0:0:0:0:0:0:6	OSPFv6 DRs	Link-local
FF02:0:0:0:0:0:0:9	RIP Routers	Link-local
FF02:0:0:0:0:0:0:D	All PIM Routers	Link-local
FF02:0:0:0:0:0:0:16	All MLDv2 Routers	Link-local
FF02:0:0:0:0:0:1:2	All DHCP Agents	Link-local
FF05:0:0:0:0:0:1:3	All DHCP Servers	Site-local
FF0X:0:0:0:0:0:0:101	Network Time Protocol	Variable Scope

### Multicast Address

FF (8 bits)	Flags (4)	Scope (4)	Group ID (112)	Scope
-------------	-----------	-----------	----------------	-------

1	Interface-local
2	Link-local
4	Admin-local
5	Site-local
8	Organization-local
E	Global