IPv6 Cheat Sheet *(www.estoile.com)*

IPv6 Header

Version (4)	Traffic Class (8)	Flow Label (20)	
Payload Length (16)		Next Header (8)	Hop Limit (8)
Source Address (128) (16 bytes)			
Destination Address (128) (16 bytes)			

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 : Decremented 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   OSPFIGP
094   IP-within-IP Encapsulation Protocol (IPIP)
103   Protocol Independent Multicast (PIM)
135   Mobility Header
```

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

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
Global unicast	(everything else)	
Anycast	Unicast address assigned to more than one interface.	
IPv4-Compatible IPv6	0:0:0:0:0:0: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
FF02:0:0:0:0:0:1: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	OSPFIGP	Link-local
FF02:0:0:0:0:0:0:6	OSPFIGP 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**

Flags (000T)
T = 0 **Well-known**
T = 1 **Transient**

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
```

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
```

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