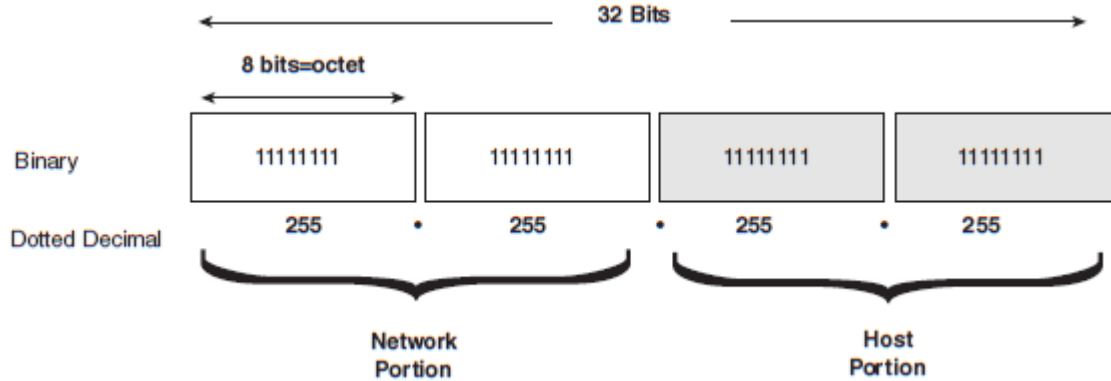


IP Addressing
IPv4 Classful & Classless (VLSM)

IPv4 - 32 bit = $2^{32} = 4,294,967,296$ Counted in Bits



IPv4 Classes:

Class A - 1 to 126	00000001 to 01111110	126 Networks 16,777,214 Hosts
Loopback - 127	01111111	Local Host - 16,777,214 Wasted Addresses
Class B - 128 to 191	10000000 to 10111111	16,384 Networks 65,534 Hosts
Class C - 192 to 223	11000000 to 11011111	2,097,152 Networks 254 Hosts
Class D - 224 to 239	11100000 to 11101111	Multicast
Class E - 240 to 255	11110000 to 11111111	Reserved

IPv4 Private IP Addresses:

- Class A range - 10.0.0.0 through 10.255.255.255
- Class B range - 172.16.0.0 through 172.31.255.255
- Class C range - 192.168.0.0 through 192.168.255.255
- Automatic Private IP Addressing (APIPA) - 169.254.0.1 through 169.254.255.254

IPv4 Subnet Masks:

- Default Subnet Masks:**
- Class A - 255.0.0.0
 - Class B - 255.255.0.0
 - Class C - 255.255.255.0

Classless Interdomain Routing (CIDR):

- Class A - /8
- Class B - /16
- Class C - /24

IPv4 Counting Bits:

7	6	5	4	3	2	1	0	Bits#
128	64	32	16	8	4	2	1	Exponent (2^N)
128	192	224	240	248	252	254	255	Mask
127	63	31	15	7	3	1	0	Wild Card Mask
Line will always be even number							N/A	Subnet (Line Address)
Broadcast will always be odd number							N/A	Broadcast
254	126	62	30	14	6	2	0	Usable Hosts ($2^H - 2$)

IPv4 Exponents (2^x) 32 bit:

- $2^0=1$ $2^1=2$ $2^2=4$ $2^3=8$ $2^4=16$ $2^5=32$ $2^6=64$ $2^7=128$ $2^8=256$ $2^9=512$ $2^{10}=1,024$ $2^{11}=2,048$
- $2^{12}=4,096$ $2^{13}=8,192$ $2^{14}=16,384$ $2^{15}=32,768$ $2^{16}=65,536$ $2^{17}=131,072$ $2^{18}=262,144$
- $2^{19}=524,288$ $2^{20}=1,048,576$ $2^{21}=2,097,152$ $2^{22}=4,194,304$ $2^{23}=8,388,608$ $2^{24}=16,777,216$
- $2^{25}=33,554,432$ $2^{26}=67,108,864$ $2^{27}=134,217,728$ $2^{28}=268,435,456$ $2^{29}=536,870,912$
- $2^{30}=1,073,741,824$ $2^{31}=2,147,483,648$ $2^{32}=4,294,967,296$

IP Addressing

IPv6

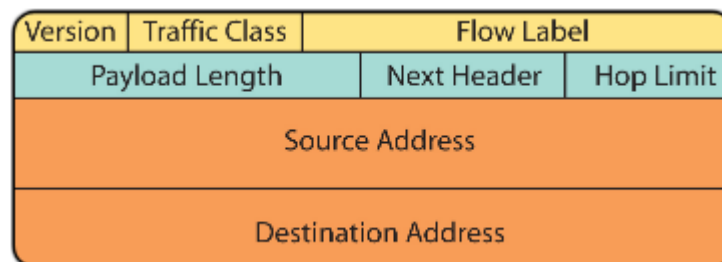
IPv6 - 128 bit = $2^{128} = 340,282,366,920,938,463,374,607,431,768,211,456$ Counted in HEX
Roughly 2^{95} addresses for each of the roughly 6.5 billion people alive in 2006

IPv6 Counting HEX

1 2 3 4 5 6 7 8 9 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F 20 →

IPv6 Summary:

- Larger address space than IPv4, simpler configuration, IP level security, quality of service
- 64 Bit Network Prefix - 64 Bit Local (Host) Identifier
- 32 Hexadecimal digits broken into eight groups of four
- Utilizes CIDR notation - also no broadcast in IPv6, only multicast
- IPv6 packet is composed of three main parts:
 - fixed header
 - optional extension headers
 - payload
- First 40 bytes/octets ($40 \times 8 = 320$ bits) of an IPv6 packet comprise of the header
 - Source address (128 bits)
 - Destination address (128 bits)
 - Version/IP version (4-bits)
 - Packet priority/Traffic class (8 bits)
 - Flow Label/QoS management (20 bits)
 - Payload length in bytes(16 bits)
 - Next Header (8 bits)
 - Time To Live (TTL)/Hop Limit (8 bits)



IPv6 Addressing:

Any four-digit group of zeroes within an IPv6 address may be reduced to a single zero or altogether omitted

2001:0db8:0000:0000:0000:0000:1428:57ab

2001:0db8:0000:0000:0000::1428:57ab

2001:0db8:0:0:0:0:1428:57ab

2001:0db8:0:0::1428:57ab

2001:0db8::1428:57ab

2001:db8::1428:57ab