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## IP Classes, Addresses and Binary

### Values for Bits

32 bit address = 32 1s or 0s

Host = Addressable devices like a computer on a network

High Order Bit = the first bit in the first octet

Network portion = unique world wide

Host portion of address = unique to network

### Values of Bit Position

| <b>128</b> | <b>64</b> | <b>32</b> | <b>16</b> | <b>8</b> | <b>4</b> | <b>2</b> | <b>1</b> |         |
|------------|-----------|-----------|-----------|----------|----------|----------|----------|---------|
| 0          | 0         | 0         | 0         | 0        | 0        | 1        | 1        | 1 = 3   |
| 0          | 0         | 0         | 0         | 0        | 1        | 1        | 1        | 1 = 7   |
| 0          | 1         | 0         | 1         | 1        | 0        | 0        | 0        | 0 = 88  |
| 1          | 1         | 1         | 1         | 1        | 1        | 1        | 1        | 1 = 255 |

The IP address of 216.62.86.131 would be 110110000011111001010110100000011 in Binary.

### IP Classes

There are 5 IP classes ABCDE.

The IP addresses D and E are reserved addresses not for public use.

**Class A** = Network.Host.Host.Host - 8 bits for network 24 bits for host. High Order bit must be turned off. No network portion can equal all zeros and 127.xxx.xxx.xxx is not usable. 127.xxx.xxx.xxx is reserved as the loop back IP address. So the usable range for a Class A IP address is 1-126.xxx.xxx.xxx There are 126 possible Class A networks with  $2^{24}$  or 16,777,216 host on each network. **The IP address 10.xxx.xxx.xxx is reserved for internal networks and is not a publicly routable IP address.**

**Class B** = Network.Network.Host.Host 16 bits for network 16 bits for host. High Order bit must be turned on. Second bit must be turned off. From 128-191 is the possible range in first Octet and 1-255 range for second Octet. There is a total of 16,384 total possible Class B Networks, with 65,534 possible hosts on that network.

**Class C** = Network.Network.Network.Host First 2 bits must be turned on and the 3<sup>rd</sup> bit being turned off. **192.xxx.xxx.xxx is reserved for internal use** and is not publicly routable. A possible 2,097,152 networks are available with 254 possible hosts.

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## IP Classes Tables

| IP Address Class Network and Host Capacities |                                          |                           |                                             |                             |                                |                              |
|----------------------------------------------|------------------------------------------|---------------------------|---------------------------------------------|-----------------------------|--------------------------------|------------------------------|
| IP Address Class                             | Total # Of Bits For Network ID / Host ID | First Octet of IP Address | # Of Network ID Bits Used To Identify Class | Usable # Of Network ID Bits | Number of Possible Network IDs | # Of Host IDs Per Network ID |
| <b>Class A</b>                               | 8 / 24                                   | <b>0</b> xxx<br>xxxx      | 1                                           | 8-1 = 7                     | $2^7-2 = 126$                  | $2^{24}-2 = 16,277,214$      |
| <b>Class B</b>                               | 16 / 16                                  | <b>10</b> xx<br>xxxx      | 2                                           | 16-2 = 14                   | $2^{14} = 16,384$              | $2^{16}-2 = 65,534$          |
| <b>Class C</b>                               | 24 / 8                                   | <b>110</b> x<br>xxxx      | 3                                           | 24-3 = 21                   | $2^{21} = 2,097,152$           | $2^8-2 = 254$                |

| IP Address Classes and Class Characteristics and Uses |                                    |                           |                        |                                                                                                                             |
|-------------------------------------------------------|------------------------------------|---------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| IP Address Class                                      | Fraction of Total IP Address Space | Number Of Network ID Bits | Number Of Host ID Bits | Intended Use                                                                                                                |
| <b>Class A</b>                                        | 1/2                                | 8                         | 24                     | Unicast addressing for very large organizations with hundreds of thousands or millions of hosts to connect to the Internet. |
| <b>Class B</b>                                        | 1/4                                | 16                        | 16                     | Unicast addressing for medium-to-large organizations with many hundreds to thousands of hosts to connect to the Internet.   |
| <b>Class C</b>                                        | 1/8                                | 24                        | 8                      | Unicast addressing for smaller organizations with no more than about 250 hosts to connect to the Internet.                  |
| <b>Class D</b>                                        | 1/16                               | n/a                       | n/a                    | IP multicasting.                                                                                                            |
| <b>Class E</b>                                        | 1/16                               | n/a                       | n/a                    | Reserved for "experimental use".                                                                                            |