

IP Addressing & Subnetting Made Easy

Developed by **Peter Smith**

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Octets

- The 32-bit IP address is broken up into 4 octets, which are arranged into a dotted-decimal notation scheme.
- An octet is a set of 8 bits & not a musical instrument.
- Example of an IP version 4:

172.64.126.52

Thinking in Binary

- The binary system uses only 2 values “0 & 1” to represent numbers in positions representing increasing powers of 2.
- To most humans, the number 124 represents $100 + 20 + 4$.
- To the computer, this number is 1111100, which is $64 (2^6) + 32 (2^5) + 16 (2^4) + 8 (2^3) + 4 (2^2) + 0 + 0$

3

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Converting to Decimal (Cont.)

- What then do you suppose is the largest decimal number that can be expressed in an octet?

Eight 1's (1111 1111)

- What is its equivalent decimal value?

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	1	1	1	1	1	1	1
128	64	32	16	8	4	2	1

The binary number 1111 1111 converts into the decimal number:
 $128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255$

4

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- Therefore, the largest decimal number that can be stored in an IP address octet is 255.
- The significance of this should become evident later in this presentation.

IP Address Classes

- IP addresses are divided into 5 classes, each of which is designated with the alphabetic letters A to E.
- Class D addresses are used for multicasting.
- Class E addresses are reserved for testing & some mysterious future use.

5

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IP Address Classes (Cont.)

- The 5 IP classes are split up based on the value in the 1st octet:

IP Address Class Assignments	
<i>Class</i>	<i>First Octet Value</i>
Class A	0 ~ 127
Class B	128 ~ 191
Class C	192 ~ 223
Class D	224 ~ 239
Class E	240 ~ 255

6

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IP Address Classes (Cont.)

- Using the ranges, you can determine the class of an address from its 1st octet value.
- An address beginning with 120 is a Class A address, 155 is a Class B address & 220 is a Class C address.
- There are only 2 specific rules that govern the value of the address.
- A host address cannot be designated by all zeros or all ones.
- These are special addresses that are reserved for special purposes.

7

7

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Are You the Host or the Network?

- The 32 bits of the IP address are divided into Network & Host portions, with the octets assigned as a part of one or the other.

Network & Host Representation By IP Address Class				
Class	Octet1	Octet2	Octet3	Octet4
Class A	Network	Host	Host	Host
Class B	Network	Network	Host	Host
Class C	Network	Network	Network	Host

- Each Network is assigned a network address & every device or interface (such as a router port) on the network is assigned a host address.

8

8

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Subnet mask in dotted decimal format	Subnet mask in CIDR notation
255.0.0.0	/8 <- Class A Default
255.128.0.0	/9
255.192.0.0	/10
255.224.0.0	/11
255.240.0.0	/12
255.248.0.0	/13
255.252.0.0	/14
255.254.0.0	/15
255.255.0.0	/16 <- Class B Default
255.255.128.0	/17
255.255.192.0	/18
255.255.224.0	/19
255.255.240.0	/20
255.255.248.0	/21
255.255.252.0	/22
255.255.254.0	/23
255.255.255.0	/24 <- Class C Default
255.255.255.128	/25
255.255.255.192	/26
255.255.255.224	/27
255.255.255.240	/28
255.255.255.248	/29
255.255.255.252	/30