

Document Title: Subnetting
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Quick Review (+):

IP Addressing

Addresses are made up of 4 Octets of 8 Bits each or a 32-bit binary number
 Each Octet is broken down into 8 bits as follows:

Example: 172 decimal = $\begin{matrix} 128 & | & 64 & | & 32 & | & 16 & | & 8 & | & 4 & | & 2 & | & 1 \\ & & 1 & & 0 & & 1 & & 0 & & 1 & & 1 & & 0 & & 0 \end{matrix}$ in binary

- Class A** addresses begin with **0xxx**, or **1 to 126** decimal.
- Class B** addresses begin with **10xx**, or **128 to 191** decimal.
- Class C** addresses begin with **110x**, or **192 to 223** decimal.
- Class D** addresses begin with **1110**, or **224 to 239** decimal.
- Class E** addresses begin with **1111**, or **240 to 254** decimal.

Default Subnet Masks

- Class A** = 255.0.0.0 / N.H.H.H
- Class B** = 255.255.0.0 / N.N.H.H
- Class C** = 255.255.255.0 / N.N.N.H

Subnetting is the borrowing of bits

- Network = Borrow Left to Right
- Hosts = Borrow Right to Left

Start with the Subnetting equation $2^n - 2 = 2$ with n being equal to 2
 $2^2 - 2 = 2$

Trick - Add answer to answer and add 2 to fill in a chart

- $(2+2) + 2 = 6$
- $(6+6) + 2 = 14$
- $(14+14) + 2 = 30$

$2^2 - 2 =$	2
$2^3 - 2 =$	6
$2^4 - 2 =$	14
$2^5 - 2 =$	30
$2^6 - 2 =$	62
$2^7 - 2 =$	126
$2^8 - 2 =$	254

$2^9 - 2 =$	510
$2^{10} - 2 =$	1022
$2^{11} - 2 =$	2046
$2^{12} - 2 =$	4094
$2^{13} - 2 =$	8190

128 | 64 | 32 | 16 | 32 | 8 | 4 | 2 | 1 | .
 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | .

<u>Network</u>	<u>Hosts</u>	<u>Broadcast</u>
192.168.1.32	192.168.1.33 - 192.168.1.62	192.168.1.63
192.168.1.64	192.168.1.65 - 192.168.1.94	192.168.1.95
...		
192.168.1.192	192.168.1.193 - 192.168.1.222	192.168.1.223
192.168.1.224		

With Classless Interdomain Domain Routing (CIDR), the zeros subnet and the all 1's subnet are useable and it is not uncommon to do so as it wastes IP addressing space.

For instance, 192.168.80.0/27

255.255.255.0 is Default Subnet Mask

$$8 + 8 + 8 + 3 \text{ borrowed} = 27 \quad /27 = 255.255.255.224$$

$$5 = 5 \text{ bits left for hosts}$$

$$2^3 - 2 = 6 \text{ Networks (Actually 8 useable Networks)}$$

$$2^5 - 2 = 30 \text{ Hosts}$$

- 192.168.80.0/27
- 192.168.80.32.0/27
- 192.168.80.64.0/27
- 192.168.80.96.0/27
- 192.168.80.128.0/27
- 192.168.80.160.0/27
- 192.168.80.192.0/27
- 192.168.80.224.0/27

The zeros subnet the three subnetwork bits are 000

The all 1's subnet the three subnet bits are 111