

Notes for Cisco Routing and Switching1 – Introduction to Networks

Chapter 9. Subnetting IP Networks

1. A router is used to route traffic between different networks. Broadcast traffic is not permitted to cross the router and therefore will be contained within the respective subnets where it originated.
2. The 192.168.1.32/27 sub-network has 32-2 valid host addresses from 192.168.1.33 - 192.168.1.62 which can be assigned to hosts. The last address 192.168.1.63 is a broadcast address for that given network and cannot be assigned to a host.
3. A mask of 255.255.252.0 is equal to a prefix of /22. A /22 prefix provides 6 bits for the network portion and leaves 10 bits for the host portion. The 10 bits in the host portion will provide $1024-2=1022$ usable IP addresses
4. Hosts that are accessible from the Internet require public IP addresses. End-user clients, mobile and laptop hosts, and workstation clients are internal network devices that would be assigned private IP addresses.
5. When monitoring servers, a network administrator needs to be able to quickly identify them. Using a predictable static addressing scheme for these devices makes them easier to identify. Server security, redundancy, and duplication of addresses are not features of an IP addressing scheme.
6. DHCP is generally the preferred method of assigning IP addresses to hosts on large networks because it reduces the burden on network support staff and virtually eliminates entry errors. However, DHCP itself does not discriminate between authorized and unauthorized devices and will assign configuration parameters to all requesting devices. DHCP servers are usually configured to assign addresses from a subnet range, so there is no guarantee that every device that needs an address will get one.
7. The 16 bits after the first 48 bits of an IPv6 address represent the subnet ID. If the gateway IPv6 address is in a different subnetwork, then the computer will not be able to communicate outside its own subnetwork.
8. A nibble is one hex digit, or four bits, so nibble boundaries occur at multiples of four bits (e.g. 64+4, 68+4).
9. A nibble is half of a byte or 4 bits. This is significant because subnetting in IPv6 is usually done on a nibble boundary $64+8=72$.
10. Subnetting an IPv6 network on the nibble boundary /72 enables the use of a complete hexadecimal value at the subnet boundaries. Subnetting within a nibble, such as at /66, /70, and /74, results in the first two bits of the hexadecimal value being part of the subnet ID and the second two bits being part of the interface ID.

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Network address: 192.168.10.0

Subnet mask: 255.255.255.224 (224 → 11100000)

1. How many subnets? $2^3=8$
2. How many valid hosts per subnets? 2^5-2
= $32-2=30$

IP Address: 192.168.10.0
 Subnet Mask: 255.255.255.224
 Mask Bits: 27 | Number of Subnets: 8
 Host Bits: 5 | Hosts per Subnet: 30
 Subnet Bit Mask: 110nnnnn.nnnnnnnn.nnnnnnnn.ssshhhhh

| Subnet | Mask | Subnet Size | Host Range | Broadcast |
|----------------|-----------------|-------------|----------------------------------|----------------|
| 192.168.10.0 | 255.255.255.224 | 30 | 192.168.10.1 to 192.168.10.30 | 192.168.10.31 |
| 192.168.10.32 | 255.255.255.224 | 30 | 192.168.10.33 to 192.168.10.62 | 192.168.10.63 |
| 192.168.10.64 | 255.255.255.224 | 30 | 192.168.10.65 to 192.168.10.94 | 192.168.10.95 |
| 192.168.10.96 | 255.255.255.224 | 30 | 192.168.10.97 to 192.168.10.126 | 192.168.10.127 |
| 192.168.10.128 | 255.255.255.224 | 30 | 192.168.10.129 to 192.168.10.158 | 192.168.10.159 |
| 192.168.10.160 | 255.255.255.224 | 30 | 192.168.10.161 to 192.168.10.190 | 192.168.10.191 |
| 192.168.10.192 | 255.255.255.224 | 30 | 192.168.10.193 to 192.168.10.222 | 192.168.10.223 |
| 192.168.10.224 | 255.255.255.224 | 30 | 192.168.10.225 to 192.168.10.254 | 192.168.10.255 |

Network address: 192.168.10.0

Subnet mask: 255.255.255.240 (240 → 11110000)

1. How many subnets? $2^4=16$
2. How many valid hosts per subnets? $2^4-2=16-2=14$

IP Address: 192.168.10.0
 Subnet Mask: 255.255.255.240
 Mask Bits: 28 | Number of Subnets: 16
 Host Bits: 4 | Hosts per Subnet: 14
 Subnet Bit Mask: 110nnnnn.nnnnnnnn.nnnnnnnn.sssshhhh

| Subnet | Mask | Subnet Size | Host Range | Broadcast |
|----------------|-----------------|-------------|----------------------------------|----------------|
| 192.168.10.0 | 255.255.255.240 | 14 | 192.168.10.1 to 192.168.10.14 | 192.168.10.15 |
| 192.168.10.16 | 255.255.255.240 | 14 | 192.168.10.17 to 192.168.10.30 | 192.168.10.31 |
| 192.168.10.32 | 255.255.255.240 | 14 | 192.168.10.33 to 192.168.10.46 | 192.168.10.47 |
| 192.168.10.48 | 255.255.255.240 | 14 | 192.168.10.49 to 192.168.10.62 | 192.168.10.63 |
| 192.168.10.64 | 255.255.255.240 | 14 | 192.168.10.65 to 192.168.10.78 | 192.168.10.79 |
| 192.168.10.80 | 255.255.255.240 | 14 | 192.168.10.81 to 192.168.10.94 | 192.168.10.95 |
| 192.168.10.96 | 255.255.255.240 | 14 | 192.168.10.97 to 192.168.10.110 | 192.168.10.111 |
| 192.168.10.112 | 255.255.255.240 | 14 | 192.168.10.113 to 192.168.10.126 | 192.168.10.127 |
| 192.168.10.128 | 255.255.255.240 | 14 | 192.168.10.129 to 192.168.10.142 | 192.168.10.143 |
| 192.168.10.144 | 255.255.255.240 | 14 | 192.168.10.145 to 192.168.10.158 | 192.168.10.159 |
| 192.168.10.160 | 255.255.255.240 | 14 | 192.168.10.161 to 192.168.10.174 | 192.168.10.175 |
| 192.168.10.176 | 255.255.255.240 | 14 | 192.168.10.177 to 192.168.10.190 | 192.168.10.191 |
| 192.168.10.192 | 255.255.255.240 | 14 | 192.168.10.193 to 192.168.10.206 | 192.168.10.207 |
| 192.168.10.208 | 255.255.255.240 | 14 | 192.168.10.209 to 192.168.10.222 | 192.168.10.223 |
| 192.168.10.224 | 255.255.255.240 | 14 | 192.168.10.225 to 192.168.10.238 | 192.168.10.239 |
| 192.168.10.240 | 255.255.255.240 | 14 | 192.168.10.241 to 192.168.10.254 | 192.168.10.255 |