IPv4 Addressing

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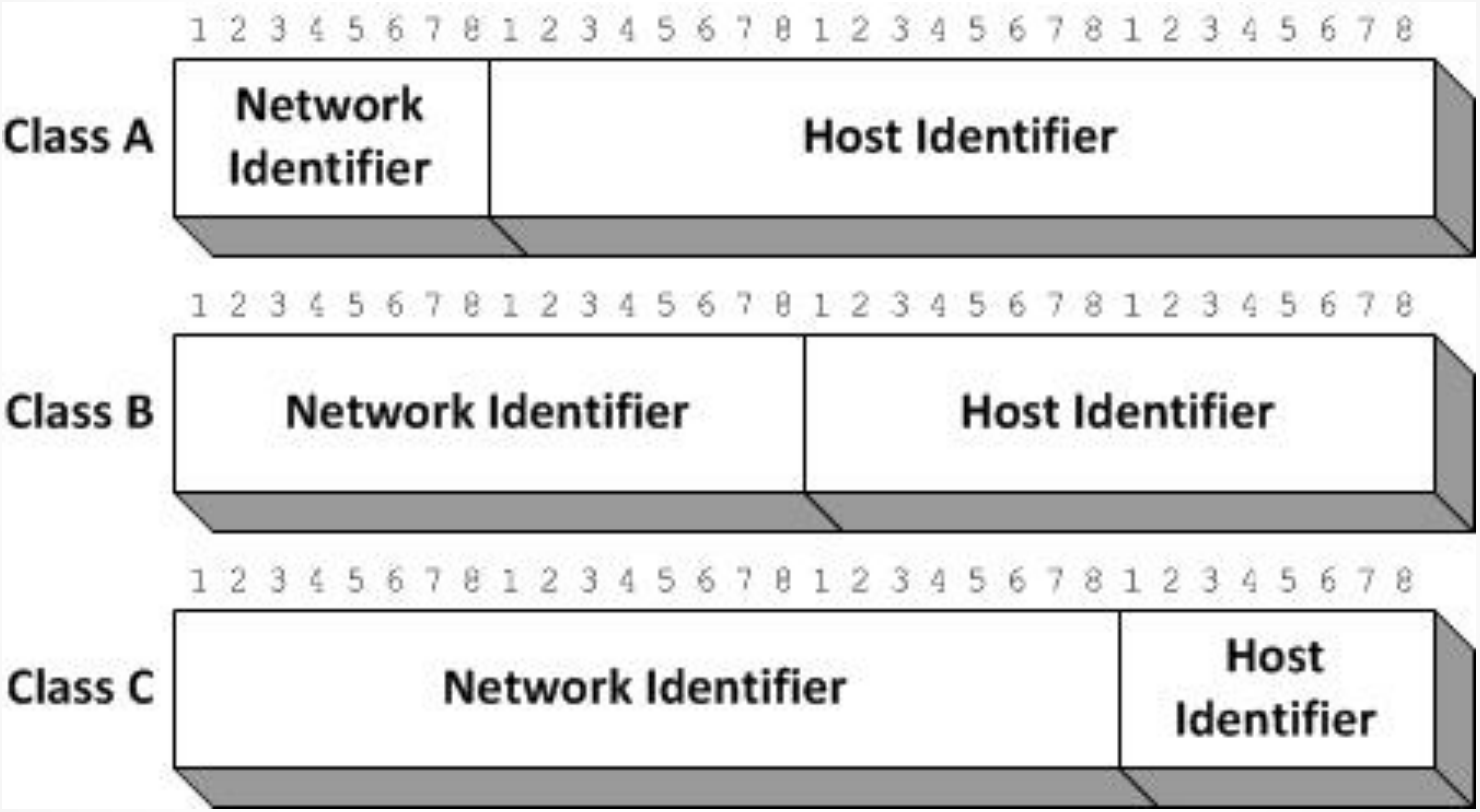
- **IP Address**
  - 32-bit address
  - Four 8-bit decimal values between 0 and 255 separated by periods (octets)
- **Subnet Mask**
  - 32-bit value of 0's and 1's
  - 1's designate network bits, 0's are host bits

Network Host

Examples: IP Address **192.168.43.100**

Subnet Mask **255.255.255.0**

IPv4 Classful Addressing



The three IPv4 address classes

IPv4 Address Classes

IP Address Class	***Class A***	***Class B***	***Class C***
First bit values (binary)	0	10	110
First byte value (decimal)	0–127	128–191	192–223
Number of network identifier bits	8	16	24
Number of host identifier bits	24	16	8
Number of possible networks	126	16,384	2,097,152
Number of possible hosts	16,777,214	65,534	254

Classless Inter-Domain Routing

- Classful addressing was gradually phased out by a series of subnetting methods, including variable length subnet masking (VLSM) and, eventually, **Classless Inter-Domain Routing (CIDR)**.
- **CIDR** is a subnetting method that enables administrators to place the division between the network bits and the host bits anywhere in the address, not just between octets.

CIDR

CIDR notation: **192.168.43.0/26**

- Where the **/26** means 26 bits of the address are used as the network identifier
- In binary, the subnet mask translates to: **11111111.11111111.1111111.11000000** or **255.255.255.192** in decimal
- This would allow us to divide this address into **4 networks**, each with up to **62 hosts**

CIDR 192.168.43.0/26 Networks

Network Address	*Starting IP Address*	*Ending IP Address*	*Subnet Mask*
192.168.43.0	192.168.43.1	192.168.43.62	255.255.255.192
192.168.43.64	192.168.43.65	192.168.43.126	255.255.255.192
192.168.43.128	192.168.43.129	192.168.43.190	255.255.255.192
192.168.43.192	192.168.43.193	192.168.43.254	255.255.255.192

Public and Private IPv4 Addressing

- Registered IP addresses are not necessary for workstations that merely access resources on the Internet
- The three blocks of addresses allocated for private use are as follows:
  - 10.0.0.0/8
  - 172.16.0.0/12
  - 192.168.0.0/16

IPv4 Subnetting

- Allows you to split one IP address range into multiple networks (e.g., you can take the 10.0.0.0/8 private IP address range and use the entire second octet as a subnet ID).
- This creates up to 256 subnets with up to 65,536 hosts.
- The subnet masks will be 255.255.0.0 and the network addresses will proceed as follows:
  - 10.0.0.0/16
  - 10.1.0.0/16
  - 10.2.0.0/16
  - …
  - 10.255.0.0/16
- When you are working on an existing network, the subnetting process is more difficult.

Calculate IPv4 Subnets

1. Determine how many subnet identifier bits you need to create the required number of subnets.
2. Subtract the subnet bits you need from the host bits and add them to the network bits.
3. Calculate the subnet mask by adding the network and subnet bits in binary form and converting the binary value to decimal.
4. Take the least significant subnet bit and the host bits, in binary form, and convert them to a decimal value.
5. Increment the network identifier (including the subnet bits) by the decimal value you calculated to determine the network addresses of your new subnets.

Supernetting

- Allows contiguous networks to be added to a routing table with one entry to reduce the size of Internet routing tables.
- For example:
  - 172.16.43.0/24
  - 172.16.44.0/24
  - 172.16.45.0/24
  - 172.16.46.0/24
  - 172.16.47.0/24
- Can all be expressed in one supernet address:
  - 172.16.40.0/21

Assigning IPv4 Addresses

To assign IPv4 addresses, there are three basic methods:

- Manual configuration
- Dynamic Host Configuration Protocol (DHCP)
- Automatic Private IP Addressing (APIPA)

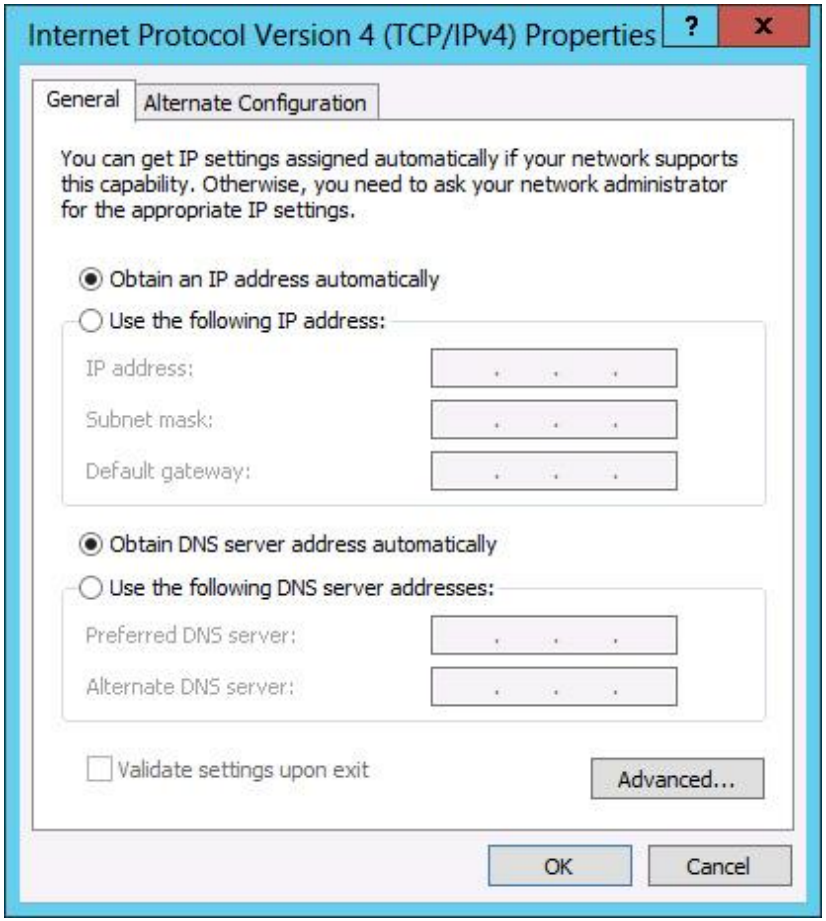
Manual IPv4 Address Configuration

- Manually enter IP address, subnet mask, default gateway and DNS servers.
- Use a GUI or command line.
- Not difficult, but it can be time consuming on a large network.
- Difficult to troubleshoot if information is entered incorrectly.

Dynamic Host Configuration Protocol (DHCP)

- Client computers are configured to Obtain an IP address automatically.
- DHCP Servers on the network contain a pool of addresses and other IPv4 configuration.
- Clients request configuration at boot up.
- DHCP Servers respond to the requests.
- IPv4 configurations are leased for a period of time and renewed as necessary.
- No addresses are duplicated.

Assigning IPv4 Addresses



The Internet Protocol Version 4 (TCP/IPv4) Properties sheet

Automatic Private IP Addressing (APIPA)

- A DHCP failover mechanism used by all current Microsoft Windows operating systems.
- If a system fails to locate a DHCP server on the network, APIPA takes over and automatically assigns an address on the 169.254.0.0/16 network to the computer.
- For a small network that consists of only a single LAN, APIPA is a simple and effective alternative to installing a DHCP server.