Kardan University
BCS Faculty
Network Strategy

Outline

- What is IP?
- IPv4 notation
- IPv4 classes
- APIPA
- Loopback IP addresses
- Private IP addresses
- Public IP Addresses
- IP configuration

What is IP?

- IP (Internet Protocol) is used to identify a device on the network or internet.
- There are two version of IP
  - IPv4: 32bits=>Decimal=>4.3 Billion IPs or 2^{32}
  - IPv6: 128bits=>Hexadecimal=>$3.4*10^{38}$ or 2^{128}
- IPv6 has $7.9*10^{27}$ times of the addresses of IPv4.

IPv4

- IPv4 is a 32bits address
- These 32bits are divided into 4 portions called octet, each octet has 8 bits.
- Format of IPv4: n.n.n.n
- Each octet take a decimal value between 0-255
  - Min value of 8 bits: 00000000=0
  - Max value of 8 bits: 11111111=255

Network & host part

- Each IPv4 contains two parts:
- Network Part:
  - Network part identifies a network not a single device.
  - Network part must be the same for the entire network
  - It show the number of bits which are ON (1s)
- Host Part:
  - Host part identifies a single device.
  - Host part must be different for all devices
  - It show the number of bits which are OFF (0s)

Subnet mask

- We can not identify the network part and host part of an IP address until we see the subnet mask.
- Example:
  - 192.168.20.12
  - 255.255.255.0

Subnet mask notations

- We can write a subnet mask in three ways:
- Binary notation:
  - Class A: 11111111.00000000.00000000.00000000
- Decimal notation:
  - Class A: 255.0.0.0
- Slash Notation:
  - /8

IPv4 Classes: Class A

- The first octet of class A range from (1-127)
- Subnet mask: 255.0.0.0 or /8
- It means that only one octet belongs to network the rest three octets are host parts.
- Number of networks: 126
- Number of hosts/network: 2^{24}-2=16777214
- Here 24 is the host bits and (-2) is the broadcast IP and network ID (NID).

IPv4 Classes: Class A

- The NID represents an entire network and can not be assigned to a device.
- Example: 120.0.0.0
- The broadcast IP of a network is used for broadcast messages and can not be assigned to a device.
- Example: 120.255.255.255

IPv4 Classes: Class B

- The first octet must range (128-191)
- Subnet mask: 255.255.0.0
- Number of networks: 2^{16-2}=16384
  - In (16-2), 16 is the number of network bits and 2 is the number of network octets.
- Number of hosts/network: 2^{16}-2= 65534
  - 16 is the number of host bits, 2 is Broadcast IP & Network ID.

IPv4 Classes: Class C

- The first octet must range (192-223)
- Subnet mask: 255.255.255.0
- Number of networks: 2^{24-3}=2097152
  - In (24-3), 24 is the number of network bits and 3 is the number of network octets.
- Number of hosts/network: 2^{8}-2= 254
  - 8 is the number of host bits, 2 is Broadcast IP & Network ID.

IPv4 Classes: Class D

- Range (224-239)
- Class D IP addresses (it is 32-bit network addresses and they don’t have host-ID.) are used for multicasting.
- Multicast means sending some information to some predefined group of users/networks (Intended ones, as they want to receive).

IPv4 Classes: Class E

- Range (240-255)
- Class E IP addresses are not used on the internet due to restrictions of The IETF (Internet Engineering Task Force).
- They have reserved this for their own research purpose.
- No Class E Address has been released for public use till now.
- Some says It is defined as experimental and reserved for future testing purposes.

Loopback IP (127.0.0.0)

- 127.0.0.0 is called loopback IP
- ::1 is the loopback IPv6
- Also referred to as the localhost, the address is used to establish an IP connection to the same machine or computer being used by the end-user.
- Is reserved by InterNIC for use in testing network cards.
- This IP address corresponds to the software loopback interface of the network card, which does not have hardware associated with it.

IP configuration

- We can assign an IP to a device in two ways:
- Static or Manual IP configuration:
  - Is assigned manually by us.
  - Run=>ncpa.cpl=>Ethernet NIC=>properties=>
  - IPv4=>properties=uncheck the obtain an IP automatically.
  - Run=>cmd: ipconfig or ipconfig/all

IP configuration

- Default Gateway: is the IP of address of a Router, Server or Access Point through which we connect to another network or internet.
- DNS Server IP: DNS is the domain name system. The DNS Server translate domain name into IP and IP address into domain name
- The DNS server IP is IP address of a server where the DNS services are configured to translate name to IP and IP to domain name.

IP configuration

- Dynamic or Automatic IP Configuration:
- A DHCP (Dynamic Host Configuration Protocol) server assigns IP, subnet mask, default gateway and DNS server IP to clients automatically.
  - Run=>ncpa.cpl=>Ethernet NIC=>properties=>
  - IPv4=>properties=check the obtain an IP automatically.

APIPA

- Stands for Automatic Private IP Addresses
- When a client machine fails to receive an IP address from a DHCP server automatically then the client itself assigns an APIPA address to itself.
- Range 169.254.0.0 to 169.254.255.255
- The data can be transferred using APIPA addresses but no one ever use them for data transfer purpose.
- Indicates a DHCP server issue.
- They are temporary.

Private IP addresses

- A private IP address is an IP address that's reserved for internal use behind a router or other Network Address Translation (NAT) device.
- Can be used freely in LAN networks.
- IANA (Internet Assigned Numbers Authority) reserved the following IP addresses for private networks:
- A=> 10.0.0.0 to 10.255.255.255
- B=>172.16.0.0 to 172.31.255.255
- C=>192.168.0.0 to 192.168.255.255

Public IP addresses

- Public IP addresses can not be used within a home or business network.
- Apart from the private range of IP addresses, the rest of IP addresses in each class are public IP addresses.
- Are used in WAN networks or Internet.
- We must purchase public IP addresses (Internet Connection)

Why IPv4?

- They are easy to understand and work with.
- Users like to stay with IPv4 but as the number of users increases around the globe, we may not have enough IPv4 addresses for all internet users.
- NAT and subnetting allows us to use IPv4 efficiently.
- Private IP <=>public IP
- Subnetting is dividing a large network into many small ones.

THANK YOU