DHCP: Dynamic Host Configuration Protocol

- Dynamic Host Configuration Protocol (DHCP) is a network management protocol that automates the configuration of devices on IP networks by dynamically assigning IP addresses and other necessary network configurations.

Its functions are:

1. Automatic IP Assignment: DHCP automatically assigns a unique IP address to each device, preventing conflicts and ensuring efficient IP address management. DHCP usually assigns IP addresses for a limited duration, known as a lease. The IP address can be reassigned to another device or renewed for the same device afterwards.

2. Other Configuration Parameters: Along with IP addresses, DHCP provides essential configuration details such as subnet mask, default gateway, and DNS servers.

Private IP Address

A private IP address is an IP address that is reserved for use within a private network and not routable on the public internet. The three reserved private IP address ranges in IPv4 are:

10.0.0.0 to 10.255.255.255 (10.0.0.0/8)

172.16.0.0 to 172.31.255.255 (172.16.0.0/12)

192.168.0.0 to 192.168.255.255 (192.168.0.0/16)

Devices within these ranges communicate internally within a local network and use **NAT** to access external networks.

Public IP Addresses

Public IP addresses are IP addresses that are routable on the global internet. They are assigned by Internet Service Providers (ISPs) and can be used to uniquely identify devices on the internet, allowing them to communicate with other devices across different networks.

Each public IP address is unique across the entire internet and can be accessed from anywhere on the internet.

Q. How Private and Public IP Addresses Work Together to Address IP Address Shortages

A: Private and public IP addresses work together through the mechanism of Network Address Translation (NAT) to efficiently use the available IP address space and address the problem of IP address shortages.

NAT: Network Address Translation

Network Address Translation (NAT) is a mechanism in networking used to modify network address information in IP packet headers while in transit, enabling multiple devices on a local network to share a single public IP address for accessing external networks, such as the Internet.

Need:

The limitation of 32-bit IP addresses in IPv4 allows for a theoretical maximum of about 4.3 billion unique addresses. To address the need for a larger address space, IPv6 was developed. This isn't necessarily needed as of now in IPv6 as it uses 128-bit addresses, vastly increasing the number of possible unique IP addresses.

Types of NAT:

1. Static NAT: This maps a single private IP address to a single public IP address. It's used for devices that need to be accessible from the outside, such as web servers. Example: Private IP 192.168.1.1 mapped to Public IP 255.0.190.10.
2. Dynamic NAT: This maps a private IP address to a public IP address from a pool of public addresses. It's used when there are fewer public IP addresses than private devices needing Internet access. Example: Private IP 192.168.1.1 might be mapped to any available Public IP from a pool of 255.0.190.10 to 255.0.190.30.
3. Port Address Translation (PAT): Also known as Overloading or NAT overload. This maps multiple private IP addresses to a single public IP address using different port numbers. It's the most common form of NAT, used in home routers. Example: Private IP 192.168.1.2:1212 might be mapped to Public IP 255.0.190.10:3434.