**PLATFORM**

**ENGINEERING**

**ASSIGNMENT-1**

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**IPv4 ADDRESSING:**

* The  **IPv4 address** or the Internet Protocol Address is the **fourth** version of the Internet Protocol.
* IPv4 addresses are **32-bit addresses** that are unique to every host or device on the internet.
* These 32 –bit addresses are divided into 4 octets separated by dot (.)

**[1 octet = 8 bits] .**

* The number that each octet contains should be in the range of **0-255**.
* IPv4 produces **4 billion** addresses.

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| **EXAMPLE : 192.0.2.126** |

**PARTS OF IPV4 ADDRESSING:**

* **NETWORK PART:**
  + The network part indicates the distinctive variety that’s appointed to the network.
  + The network part conjointly identifies the category of the network that’s assigned.
* **HOST PART:**
* The host part uniquely identifies the machine on your network.
* This part of the IPV4 address is assigned to every host**.**
* **SUBNET NUMBER:**
* This is the nonobligatory part of IPv4.
* Local networks that have massive numbers of hosts are divided into subnets and subnet numbers are appointed to that.

**TYPES OF CLASSES:**

* **CLASS – A:**
* Out of 32 bits, only 8 bits are assigned to the network part.
* Default subnet mask : 255.0.0.0.
* Valid IP range : 1.0.0.0 to 126.255.255.255.
* **CLASS-B:**
* Out of 32 bits, first 16 bits are assigned to the network part.
* Default subnet mask : 255.255.0.0.
* Valid IP range : 128.0.0.0 to 191.255.255.255.
* **CLASS – C:**
* Out of 32 bits, first 24 bits are assigned to the network part.
* Default subnet mask : 255.255.255.0.
* Valid IP range : 192.0.0.0 to 223.255.255.255
* **CLASS – D:**
* This class is used for multicasting communication.
* Valid IP range:224.0.0.0 to 239.255.255.255.
* **CLASS – E:**
* Valid IP range : 240.0.0.0 to 255.255.255.255.
* They are reserved for experimental or future use.

**IPv6 ADDRESSING:**

* IP**v**6 addressing is the successor of IPv4.
* It is designed to overcome the limitations of the IPv4 address space.
* IPv6 is a **128-bit addresses**, providing an enormous address space .

**COMPONENTS IN ADDRESS FORMAT:**

* There are 8 groups and each group represents 2 Bytes (16-Bits).
* Each Hex-Digit is of 4 bits (1nibble).
* Delimiter used – Colon(:).

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| **EXAMPLE :** **FE80:CD00:0:CDE:1257:0:211E:729C** |

**STRUCTURE OF IPv6 ADDRESS:**

**NETWORK (64 Bits) NODE (64 Bits)**

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| 48 Bits | 16 Bits | 64 Bits |

Global unicast address Subnet ID Interface ID

**TYPES OF IPv6 ADDRESSES:**

* **Unicast Address:**
* Identify a single network interface.
* Used for one-to-one communication.
* **Multicast Address:**
* Identify a group of devices and packets sent to a multicast address are delivered to all devices.
* **Anycast Address:**
* Identify a group of devices but packets sent to an anycast address are delivered to the nearest device within the group.

**ADVANTAGES:**

* Expanded address space.
* Enhanced Security.
* Scalability.
* Simplified address management.
* Faster Processing.
* Supports Authentication.

**DISADVANTAGES:**

* Compatability issues.
* Transition Complexity.
* Limited Adoption.
* Lack of universal support.
* Training and expertise requirements**.**
* Network management complexity.

**IP ADDRESSING SCHEMES:**

* **SUBNETTING:**
* Subnetting is a technique used to divide a single network into smaller subnetworks, known as **subnets**.
* It helps in efficient **address allocation** and **network management**.

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| Example: 192.168.0.0/24 |

where the first 24 bits represent the network portion and the remaining 8 bits represent the host portion.

* **PRIVATE IP ADDRESSES:**
* Used in private networks and are not routable on the public internet.
* Class A private range: 10.0.0.0 to 10.255.255.255.

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| **Example: 10.0.0.1** |

* Class B private range: 172.16.0.0 to 172.31.255.255.

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| **Example: 172.16.0.1** |

* Class C private range: 192.168.0.0 to 192.168.255.255.

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| **Example: 192.168.0.1** |

* **CLASSLESS INTER DOMAIN ROUTING:**
* It allows for more flexible allocation of IP addresses .
* Eliminates the rigid class-based addressing of classful addressing.

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| **Example: 192.168.0.0/16** |

* First 16 bits represent the network portion
* Last 16 bits represent the host portion.
* **DYNAMIC HOST CONFIGURATION PROTOCOL (DHCP):**
* It is a network protocol that dynamically assigns IP addresses to devices on a network.

**Example:** When a device connects to a network, it can receive an IP address such as 192.168.1.100 from the DHCP server.

* **PORT NUMBERS:**
* They are used in conjunction with IP addresses to identify specific processes or services running on a device.
* They are used at the transport layer of the network stack .
* Enable multiple applications to run simultaneously on the same device.

**PORT NUMBERS :** 80 for HTTP, 443 for HTTPS, 25 for SMTP, etc.

* **MEDIA ACCESS CONTROL (MAC) ADDRESS:**
* A Media Access Control (MAC) address is a unique identifier assigned to a network interface controller (NIC) by the manufacturer.
* MAC addresses are used at the data link layer of the network protocol stack.
* They are typically assigned by the manufacturer and consist of six octets (48 bits).

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| **EXAMPLE : 00:1A:8C:45:98:FA** |

* The first three pairs (00:1A:8C) - Organizationally Unique Identifier (OUI).
* The last three pairs (45:98:FA) - The unique identifier assigned by the manufacturer.
* **IP ADDRESS:**
* Internet Protocol (IP) addresses are used to identify devices on a network.
* They are assigned at the network layer.
* They are essential for routing and delivering data across different networks.
* IP addresses comes in two versions:
* IPv4(32 - bits) - **EG : 187.0.2.135**
* IPv6(128 – bits)  **- EG: FE80:CD00:0:CDE:1257:0:211E:729C**
* **DOMAIN NAME SYSTEM (DNS):**
* DNS is a hierarchical naming system .
* It maps domain names to IP addresses.
* Instead of remembering IP addresses, users can access websites and services using domain names.

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| **EG :www.example.com** |

* DNS translates these domain names into IP addresses.

**RESERVED PORTS:**

Reserved ports refer to specific port numbers that are set aside for well-known protocols and services. These port numbers are reserved by the Internet Assigned Numbers Authority (IANA) to ensure standardized communication across networks and to prevent conflicts between different applications or services.

* It is a part of the TCP/IP protocol suite, which is used for communication over the internet.
* It is also known as Well-Known Ports.
* The reserved port range extends from 0 to 1023.
* These ports are commonly recognized and associated with specific protocols or services.

**For example:** port 80 is reserved for HTTP (Hypertext Transfer Protocol), port 25 is reserved for SMTP (Simple Mail Transfer Protocol), and port 443 is reserved for HTTPS (HTTP Secure).

* Operating systems and widely adopted network applications commonly use reserved ports for their intended purposes.
* It makes easier for computers to find and connect with the right services.
* These ports are reserved to prevent conflicts when multiple applications or services need to use the same port.
* It makes easier to identify and connect to the services.
* Reserved ports are used by the client application to communicate with that services.
* Applications and services use reserved ports to establish communication channels and send/receive data.
* By using reserved ports, applications and services can rely on consistent port numbers across different systems.
* It enable the efficient routing of network traffic.

**EG :** Port SSH are used to avoid block traffic

* It play a crucial role in firewall configurations and network security by allowing or blocking access to specific port numbers.
* Well-known services like web browsing (port 80) and email (port 25) have assigned reserved ports.
* It is an essential component in the functioning of internet infrastructure.
* They enabling the exchange of data between systems.
* They are a fundamental part of the client-server model in networking.
* These reserved ports help computers understand which application or service should handle incoming data.
* They can also be used by other networking protocols.
* Ports beyond 1023 are available for general use and are not reserved for specific applications.