Mac Address

Introduction ;

To communicate or transfer data from one computer to another, we need an address. In computer networks, various types of addresses are introduced; each works at a different layer. A MAC address, which stands for Media Access Control Address, is a physical address that works at the Data Link Layer.

**MAC Addresses** are unique **48-bit** hardware numbers of a computer that are embedded into a network card (known as a [**Network Interface Card**](https://www.geeksforgeeks.org/nic-full-form/)) during manufacturing. The MAC Address is also known as the [**Physical Address**](https://www.geeksforgeeks.org/logical-and-physical-address-in-operating-system/) of a network device.

There are two sublayers ;

1. Logical Link Control (LLC) Sublayer
2. Media Access Control (MAC) Sublayer

Format of MacAddress ;

A MAC Address is a 12-digit hexadecimal number (6-bit binary number), which is mostly represented by Colon-Hexadecimal notation.

The First 6 digits (say 00:40:96) of the MAC Address identify the manufacturer, called the OUI (**Organizational Unique Identifier**).

The rightmost six digits represent **Network Interface Controller**, which is assigned by the manufacturer.The MAC address is represented by Colon-Hexadecimal notation.

Example ;

Mac Adresss ; 00-B0-D0-63-C2-26

Types Of Mac Address ;

There are three types of Mac Addree;

* Unicast
* Multicast
* Broadcast

Unicast ;

A Unicast-addressed frame is only sent out to the interface leading to a specific NIC. If the LSB (least significant bit) of the first octet of an address is set to zero, the frame is meant to reach only one receiving NIC. The MAC Address of the source machine is always Unicast

Muticast ;

The multicast address allows the source to send a frame to a group of devices. In Layer-2 (Ethernet) Multicast address, the LSB (least significant bit) of the first octet of an address is set to one. IEEE has allocated the address block 01-80-C2-xx-xx-xx (01-80-C2-00-00-00 to 01-80-C2-FF-FF-FF) for group addresses for use by standard protocols.

Broadcast ;

Similar to Network Layer, Broadcast is also possible on the underlying layer( Data Link Layer). Ethernet frames with ones in all bits of the destination address (FF-FF-FF-FF-FF-FF) are referred to as the broadcast addresses. Frames that are destined with MAC address FF-FF-FF-FF-FF-FF will reach every computer belonging to that LAN segment.

**Advantages of MAC Address ;**

1. **Uniqueness:**Each MAC address is unique, which means that devices on the network can be easily identified and managed.
2. **Simplicity:** MAC addresses are easy to configure and manage, and do not require any additional network infrastructure.
3. **Compatibility:** MAC addresses are widely used and supported by a variety of networking technologies and protocols, making them compatible with many different systems.
4. **Security:**MAC addresses can be used to restrict access to a network by only allowing devices with authorized MAC addresses to connect.
5. **Fault-tolerance:**In case of hardware or software failure, a device can be easily replaced without affecting the network, as long as the new device has the same MAC address as the old one.
6. **Multicasting:**MAC addresses can be used for multicasting, allowing a single packet to be sent to multiple devices at once.
7. **Efficiency:**MAC addresses allow for efficient communication on the network, as they enable devices to quickly and easily identify and communicate with each other.
8. **Lower network overhead:**MAC addresses reduce network overhead by allowing devices to communicate directly with each other without the need for additional routing or addressing.
9. **Ease of troubleshooting:**MAC addresses can be used to troubleshoot network issues by identifying the source of problems and tracking network activity.
10. **Flexibility:**  MAC addresses can be used to support a variety of network configurations and topologies, including peer-to-peer, client-server, and hybrid models.