Network Layer

For Distance Communication We Can use IP Address which is a logical address this is the addressing of layer 3

This layer allows different Networks to Communicate Through Routers .

IP is like the Heart of the Internet
the IP Address belongs to the Network not to the device Unlike The MAC Address Which is Globally Unique

IP ADDRESS

is 32 bits 4 Octets each octet id 0 to 255

There is Dynamic And Static IP
The Dynamic IP is Given To device Automatically And change every specific period and commonly used with hosts
The Static IP is Given to Device Manually and doesn't change unless the admin change it manually it is commonly used with servers, network devices and ip camera

Data in the Network Layer Called Packets or IP Datagram it has two primary sections HEADER and PAY Load

PACKET

4 bits for IP Version

4 bits For Header Length

8 bits for Service Type: it specifies Quality of Service so can decide which datagram is more important

16 bits Total Length : The total length of IP Datagram

16 bits Identification: used to group messages together as if the data length exceed the max length the ip layer will split data into individual packets so ID will be used in receiver so we can know that these packets are in the same group

16 Bits Flags and fragment offset: this indicate that if datagram allowed to be fragmented or it is already fragmented
Fragmenting : means taking IP datagram and splitting it up into several smaller when moving from network that has larger datagram size to network has smaller datagram size

8 bits TTL Time to Live : How Many Routers (Hops) Datagram Travels Before it thrown Away

8 bits Protocol: What Transport Layer Protocol Being Used

Header Check Sum : check sum of the entire content of the datagram header

Source & destination IP Address

Option: set of special characteristics for datagram primarily used for testing purposes

Padding: series of zeros to ensure header is correct total size

IP Datagram is Encapsulated as Data link Frame

IP ADDRESS
it consist of Network ID and Host ID

Class A	*Class B*	*Class C*
First octet is the Network ID Subnet Mask is 255.0.0.0 NO. Host = 2^{24}	First Two octets are the Network ID Subnet Mask is 255.255.0.0 NO. Host = 2^{16}	First Three octets are the Network ID Subnet Mask is 255.255.255.0 NO. Host = 2^{8}

Class D : is for Multicast purposes

Class E : is for tested Purposes

In Practical class System is replaced by CIDR Classless Inter-Domain Routing IP/Prefix(No. of ones in Subnet Mask)

There are some Ips That Called Private Ips or non-Routable Ips :
these are used by anyone but they can't be routed it can communicate with any devices but the gateway can't make it access the Internet

10.0.0.0/8

172.16.0.0/12

192.168.0.0/16

Routing : The Way Communication Happens Across networks allows you access data from other side of planet through router

Router : Network Device forward data depend on destination address of the traffic

Routing Process : (1) Router receives packet

(2) Exam the destination IP address

(3) look up Destination IP Network in the Routing Table

(4) Forward Data

Routing Table

It includes

(1) Destination Network : for each network routers know network ID & Mask it Examine Destination IP & Choose Network that IP belongs to

(2) Next Hop: it contain IP address of next router that should Receive the data

(3) Total Hops: total hops of shortest path (this column change over time that a router maybe shut down or a new router is on)

(4) Interface : which interface match the network ID

Layer 3 Devices :

Router , Access Points & Layer3 switch

Layer 2 Switch		Layer 3 Switch
Only use MAC Address and can't Understand IP address		Can Understand both Ip & MAC Address
Doesn't have VLAN Tag		Has VLAN Tag
Faster		Slower
Switching only		Switching and Routing

ICMP Internet Control Message Protocol:

Is used to communicate with the source of packet about transmitting issues like if the data not delivered