Unit – 6 (Network Layer Function & Protocols)

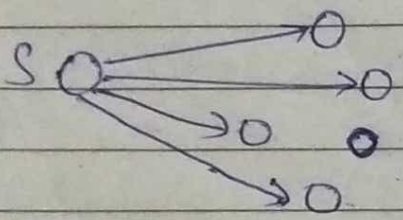
Routing :- It is an approach to decide the root which is to followed by a packet being transmitted from sindr and to receiver.

Types of Routing :-

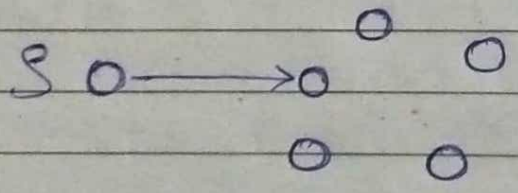
(i) Unicast Routing :- S ⟶ R

where there is one sindr and one receiver we call it Unicast Routing.

(ii) Multicast Routing :- one sindr multiple receiver.

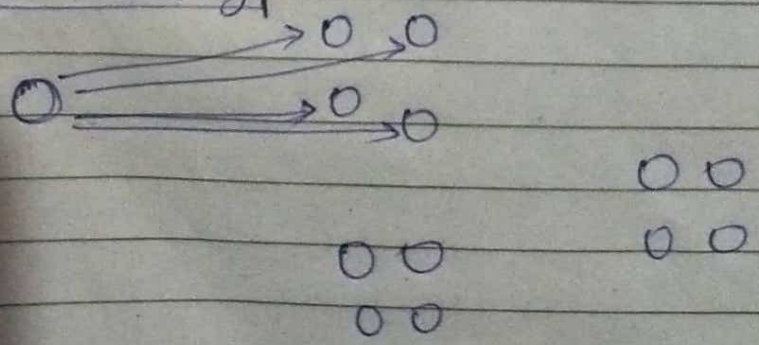


(iii) Anycast Routing :- Any of receiver from set of receiver is allow to receive a packet. receiver is not fixed.



Station which is sinsing the data first will receive the data.

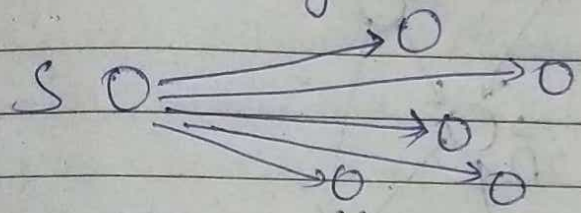
(iv) Geo Cast Routing :-



Here we have one sender and multiple receiver but it is different from multicast. Isme jab message transmit hota h, to jo receiver ek particular geographical location se belong kar rahe hai unko, uske according packet receive karaya jata hai.

Receivers which are belonging to a particular geographical location are allowed to receive the packet which are being transmitted from the sender. This type of routing is known as geocast routing.

(v) Broad Cast Routing :- It is also different from multicast.



All the receivers are equally allowed to receive the message.

28/01/22

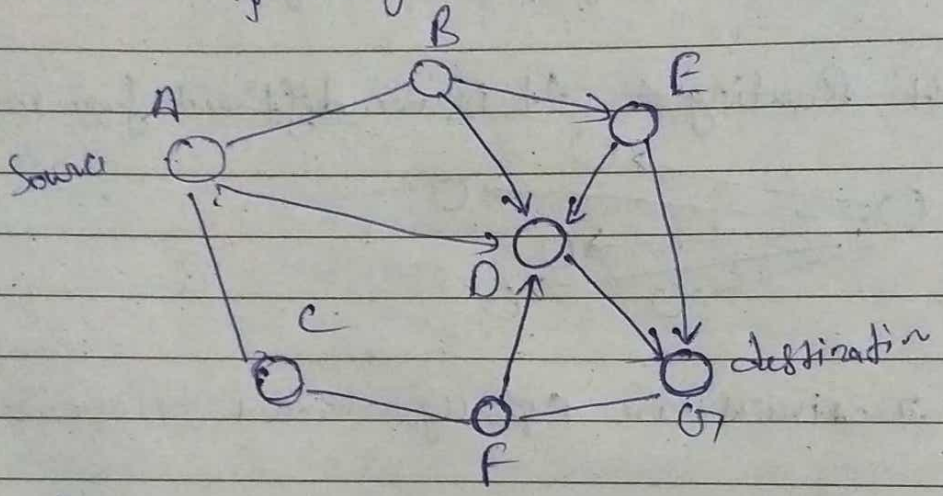
Flood based & flow based Routing:

Jab kisi bhi Entity ke flow ka path agar pre-decided hoga aur vo saari Entity usi path ko follow karegi source se destination tk jaane k. liye, we call it flow (when logical path is followed).

Flood - Jab kisi chez ka logical path nahi hota hai i.e) uncontrolled flow of data.

* Flow based Routing :- where the path which is to be followed by packet is pre-decided and all the packets are required to follow that particular path only. Then based on some routing algorithm. This approach is flow based Routing.

* Flood based → path is not predecided instead packets are forwarded to the path which is available. Packets are forwarded Equally. Also called network flooding.

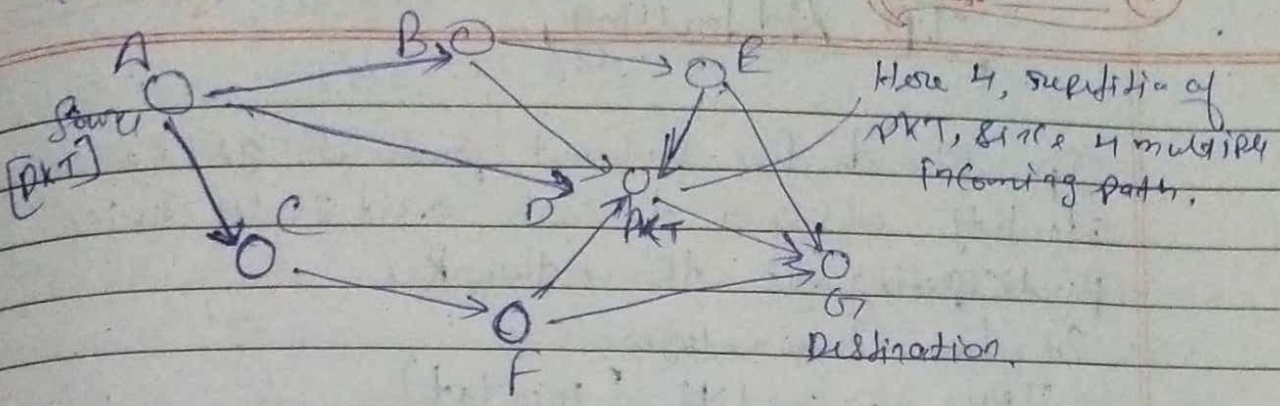


If we pre-decide the path using any algorithm (kisi bhi logical way me ye path ko determine karungi) i.e., A → B, B → D, D → G (A to B then B → D then D to G) this path will be followed always. It is flow based.

In flood based, PKT is Equally forwarded from an ongoing channel to a given node.

a) How packet repitition is identified in an intermediate node when flood based Routing approach is used?

(2) When flood based routing approach is used, how a receiver will know that how many replication should be retained and How may to be ignored



Here 4, replication of PKT, since 4 multiple incoming path.

A to B, A to C, A to D:
C to F, B to E, B to D
F to D
F to D

There is a replication of packets in node 'D'. If there are multiple incoming ~~channel~~ paths in an intermediate node then we say that packet replication will be there. There are 4 replication in D and 3 replication in G. Only 1 copy will be retained and rest are ignored In D, 3 PKTs are ignored, and in G 2 PKTs are ignored.

Merit of flood based ÷ No algorithmic steps to be followed. If Signal is received it is transmitted to the outgoing nodes. There is no Complexity of algorithm if we simply transmit to outgoing channel.

Demerit ÷ Packet replication are more. Multiple signals received acc. to multiple incoming path.

	A	B	C
A	0	3	1
B	2	0	2
C	2	2	0

No. of incoming path.

How many replication B will get = 5

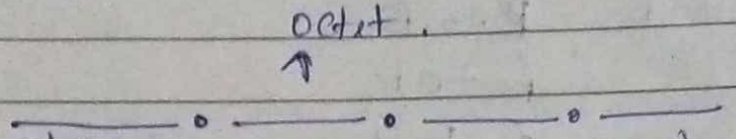
IP Addressing

Ip stands for Internet protocol. It is a unique identity assigned to each and every device participating in the network.

It has two categories.

IPV_4 – 32 bits (4 octet)

IPV_6 – 128 bits



1 group – 8 bits

max value = 256

cmd → administrator → ipconfig.

Ping google.co.in → 142.250.195.131

→ 192.168.42.77

Class A: 0

B: 10

C: 110

D: 1110

E: 11110

Class A → If 1st bit of 1st octet is zero.

So, ip addrss comes in class A.

Eg: Class A: 01111111

min value: 00000000

max: 11111111 } 128

16. — . — . — → Class 'A'

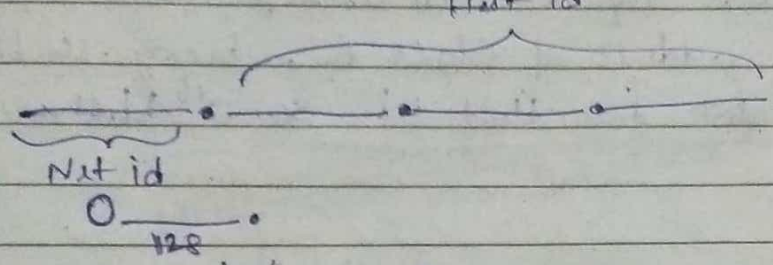
16 → 8 bit representation — 00010000

193 → Class 'C'

172.217.14.196
142.250.193.195
142.250.192.110
} google.co.in

Ip address has domain name ke liye rehta hai. Domain name is google.com. uska ek unique identity hai Ip address. Ip address ko yaad rakh pana possible nahi hai. So given the domain name. When we enter domain name it further transformed to its Ip address.

Class: A



agar class 'A' me first octet net id ko denote karta h. Sath hi ye v fixed h, class A ka first octet ka first bit 0 hota hai. Baki 7 bits bache unka maximum value 128 h. Means throughout the world class A ke 128 address exist krte hai.

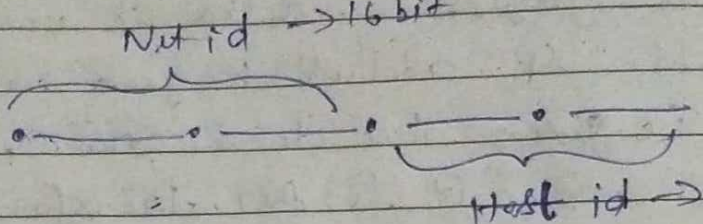
Host id has 24 bits. It means, throughout the world Class A ke 128 network hai usme har network ke paas 2^{24} host honge.

If any organisation resume the address of class 'A' say 64. ___.___.___. then it has 2^{24} host required to utilize the whole address. If it has cant have 2^{24} host then most addresses will be lost.
Organisation should take Ip address acc. to the Ip address requirement.

31.13.79.25

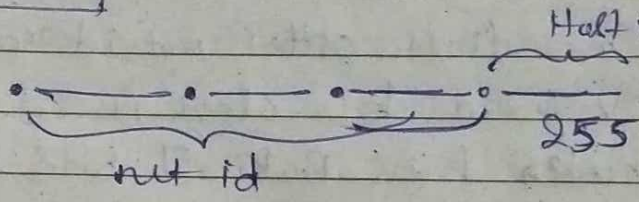
A → 103.2158.27
B → 157.240.218.35

* Class B :



2^{16} Host are required to utilize whole address if we assign address of Class B. bucoz 16 bits are reserved for Host id. So 2^{16} Host are needed.

* Class C :



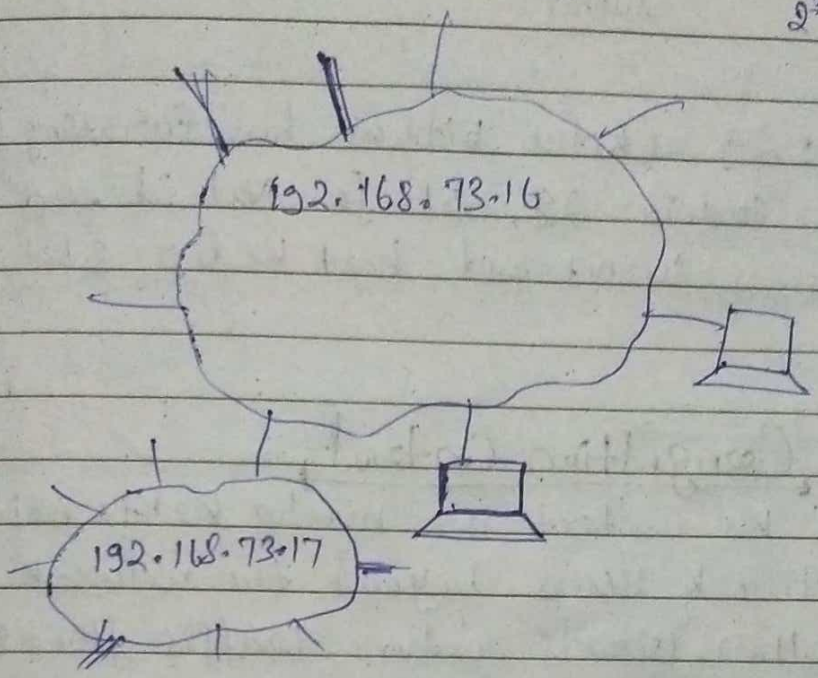
Class 'C' suffers from address shortage. there are total 8 bits present over Host id. Means 256 host can be addressed uniquly and one among them is reserved for broadcasting. So, there are remaining 255 host which can be addressed uniquly in class C Ip address. 255 is not more, So we say it suffers from address shortage.

192.168.208.78
192.168.29.102
192.168.144.250
192.168.121.72
Same

192.168.73.16 → 16th part from 255

10000 (5 bits) — 3 bit bacha remaining

So, we can make $2^3 = 8$ connections



16 ke liye 5 bits rakhna tha aur 3 remaining bits se $2^3 = 8$ host ko connect kar sakte hai

We can make subnet.

When ek badi network me more no. of host direct connected honge to uski wajah se network pe traffic ka load bahut jyada ho jayega. If we subnet it dono ka benefit :- (i) address space improved (no. of accomodation increases)

(ii) traffic movement becomes smooth.

Agar subnetting kiya hua hai to kaha tak kiya hua hai.

192.168.73.21

CIDR Constant

↳ Classless Inter Domain Routing Concept.

Net id.
192.168.73.21

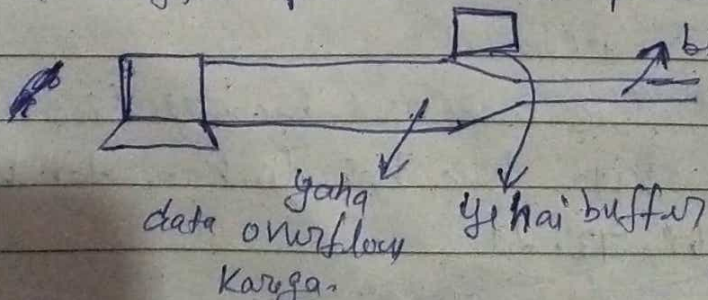
Subnet mask : 255.255.255.0
Net id
192.168.73. .
Subnet

CIDR : 29 (Kitne bits use hue Subnetting ke liye)
that is 29, 24 for Net id and 5 for
Subnet and host ke liye 3 bit bacha.

Congestion Control

Network ke Context me humlog kehte hai, if traffic on the network runs beyond the network capability or in other words when traffic flow exceeds the available bandwidth, this phenomena is called Congestion. Also, when network is overload.

Reason : Source & destination tak bandwidth ka specification ek jaisa nahi hota. Kahin wider to kahin narrow bandwidth ho jata hai, To waha buffer place karna padta hai.

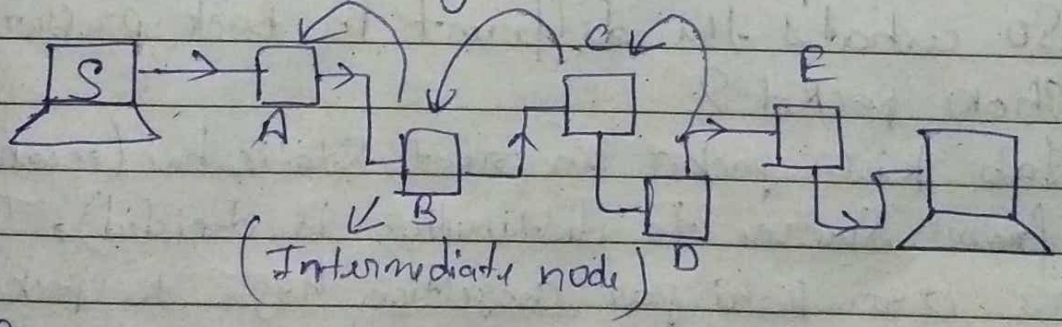


If we are finding Congestion, this happen before Congestion & after Congestion Estimation possible because bandwidth ka Specification agar known hai har jagah to iss particular place me Congestion hone ki probability hai.

So we have two types of Congestion Control

- Open loop Congestion Control (before Congestion)
  - Preventive measure
    1. → Retransmission Policy
    2. → Window Policy
    3. → Discarding Policy
    4. → Acknowledgement Policy
- Closed loop Congestion Control (after Congestion)
  - (Corrective Policy)
    1. → Back Pressure
    2. → Choke Packet
    3. → Implicit Signal
    4. → Explicit Signal
       - → forward Signal
       - → Backward Signal

* Closed Loop Policy :



(1) Back pressure policy :- It is implemented after Congestion. Its working mechanism is :-
When a station finds the occurrence of Congestion it informs its immediate sender at its place (i.e) the previous sender).
Jab wo previous sender ko Congestion ki baare me inform karega, suppose node D me Congestion

occur hua to yi previous Sender 'C' ko inform karega aur 'C' phir apne previous Sender ko inform karega. Aisa krte krte, 'D' me jo network ka pressure tha. wo backward reach karte krte finally jo Sender 'A' tak pahunch jata hai. Network ka jo pressure hai, uski baare me information backward travel karti hai aur lastly original Sender ko milti hai, that's why it is called back pressure.

(2) Choke Packet: Choke ka mtlb hi hai Rokna. It means wo Sender ko ~~transit ka~~ transmit karne ko rokta hai. So, its logic is, Jab koi Station Congestion ki occurrence ko sense karega, to wo ek Choke Packet (iska format Pre-decided hai) bhejta hai Sender ko. Yaha original Sender ko Choke packet bhejega. So, Original Sender slow down its speed.

So what's the different in Back pressure & Choke Packet?
Jab kisi packet ka route Static hai (means Path from Source to destination is decided). To us case me agar kahi par Congestion hoga to packet ko dekhte hi original Sender ki baare me sab kuch known ho jata hai. To waha Choke packet bhejna possible hai.
But, Jab node-by-node route update hoke chal raha (dynamic route) i.e, Cost par, ~~Path par~~ least Path par. Yaha routing para meter hai us me original Sender ke baare me information nahi hota kyki

data node by-node update hota hai. So, here back pressure will be applied to control Congestion.

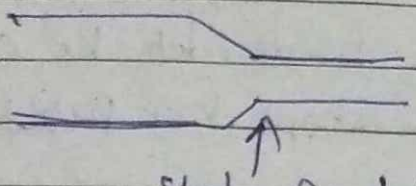
(2) Implicit Signal ÷ Implicit jab use in built hoti hai. In implicit Signal, when receiver senses the occurrence of Congestion it remains silent means it will not acknowledge the data, if data is coming let it be and will discard it.
Now Sender is expecting data agar properly receive hua to acknowledgement aayega. Receiver ke taraf Congestion hua h iss liye use silent ho gaya h aur acknowledge nhi kar raha. Sender ir not getting acknowledgement aur Sender samjh raha ki packet receive nhi hua hai. So Sender is retransmitting the packet. Receiver ke side Congestion hai to use retransmitted packet ko discard karte ja rha hai aur jo already arrived packets hai unko process kar raha hai. To already arrived packet ko process karega aur buffer khali hoga to phir acknowledge karega. So, in this way Congestion is dealt.

(3) Explicit Signal ÷ Receiver explicitly informs the Sender about Congestion. Sender will stop acc. to limit. Same thing happens in choke packet also. So, what's the difference?

Choke packet me alag se ek packet jata hai aur explicit me acknowledgment ke sath ek signal accomodate hoke jata hai. This is the difference.

Traffic Shaping :- It is the process of managing and controlling the flow of data in order to accomodate it smoothly inside the bandwidth.

Why it is needed to be shaped ?



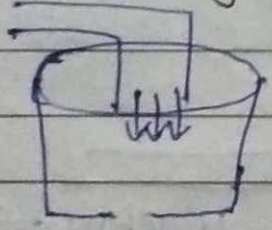
Yaha pe data
jis speed se flow ho
raha, aage uss speed se flow nhi ho payega.

Speed mismatch uss jagah pe, Congestion cause kar dega.

Sender jis speed se data send kar raha h, receiver uss speed se process nahi kar pa raha to bhi Congestion hoga. Ye sab Congestion ko manage krne ke liye aur bandwidth ke bich ka jo difference hai usko overcome karne ke liye, traffic Shaping ko implement karte hai.

For this we have an algorithm :-

Leaky Bucket Algorithm :-

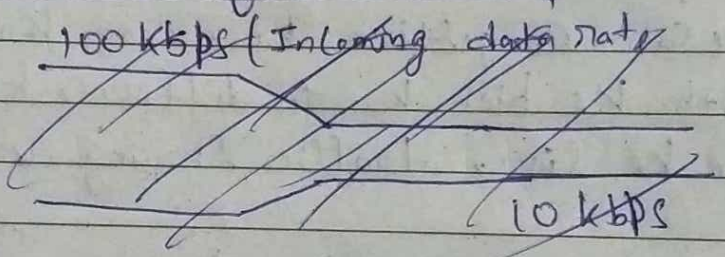


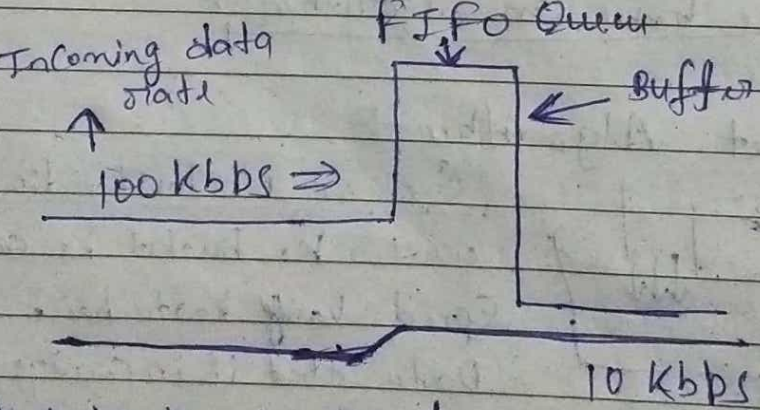
General understanding,
water ke bucket ki andar aane ka speed vary karta hai.
Data that is incoming is of variable speed, and jo leakage hai wahan se flow ho raha wo constant hai. So, Data ke in hone ka rate is variable and output rate is constant. Data is coming with high speed and coming out with low speed.
Ek time aayega jab bucket full ho jayega aur water overflow kar jayega. Lekin wo jo time

hai uska, ye agar bucket nahi hota aur pipe direct connect hota to usi time Congestion ho jata. ye bucket water ko hold karega kuch der ke liye, that depends upon capacity of the bucket that when bucket will be full & overflow causes. Lekin ye traffic ko bandwidth ke according kuch der ke liye to shape kar payega na.

Traffic handling depends on 3 parameters
(i) rate of input
(ii) Rate of output
(iii) Capacity of bucket.

* In terms of Network,





Bucket is the buffer (temporary storage location).
Inside Buffer FIFO Queue is implemented.
now,
1 Second me 100 kb data aaya
1 Sec. me 10 Kb data nikla.
Ek processing cycle agar 10 sec. ka hai, then

what's the Capacity of buffer?

Sol^n

In 10 seconds maximum data = 100x10
= 1000kb

per second data coming out at rate
= 10kbps.

In 10 second, 10x10 = 100 kb

So, data collected in buffer = 1000 - 100
= 900kb.

So, 900 kb of buffer required for traffic Shaping.

* Overview of DNS (Domain Name Server),

Server :- Technically, it is a Computer of high Capability and ~~big~~ larger Storage Capacity.
Domain Name Server is a Server of Domain names.

Domain Name :- Koi bhi web based entity ka domain name hota hai. Also, any webbased entity contains IP address and it is not possible to remember these IP addresses. In in web that entity is identified in the form of IP address. So, there needs a translator that would map domain name into its associative IP address. So, DNS is supposed to do that.

Ex:

Domain Name (google.com) → from right to left.

- Com DNS Server
- Org DNS Server
- edu DNS Server

When we open something using browser, first we interact with Domain Server. Website ka jo content hai directly waha nahi jaate, we enter name and if any IP address associated with that name exist, then we direct to website.
Before receiving the requested content, we are actually interacting with Domain Name Server. And this interaction is in Connectionless form. Means DNS ka user ke sath jo interaction hota hai wo Connectionless hota hai.
If it is Connection oriented then Sender will send request to DNS, it will respond and both parties are ready and after that Communication will start So, it becomes very tidious. So, it takes long time to open website

DNS works on UDP (User Datagram Protocol)?

Q) If we are already having a reliable protocol like TCP/IP. What is the need behind Connection less protocol like UDP?

→ UDP is a Connectionless unreliable protocol and mainly it is used in DNS, for Communication between user and DNS Server. This Connection is of Connectionless nature and works upon UDP. Connection less Communication between user and DNS will be time saving. We don't need reliability here instead we need Speed and fast response. That's why it is based on UDP.