Protocols at Network layer:

IP works at NL

↓

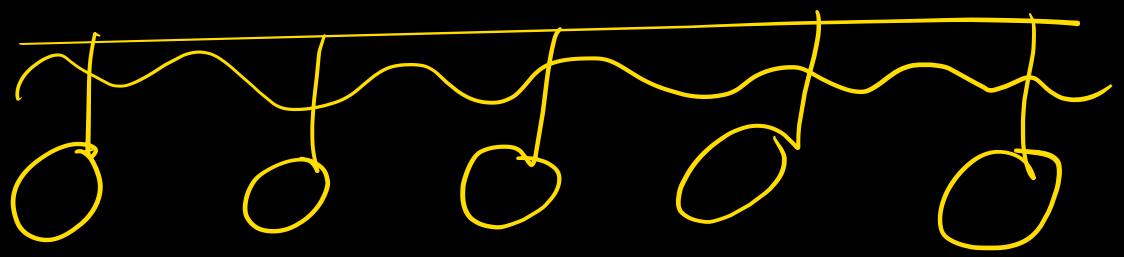
There are many other protocols at NL.

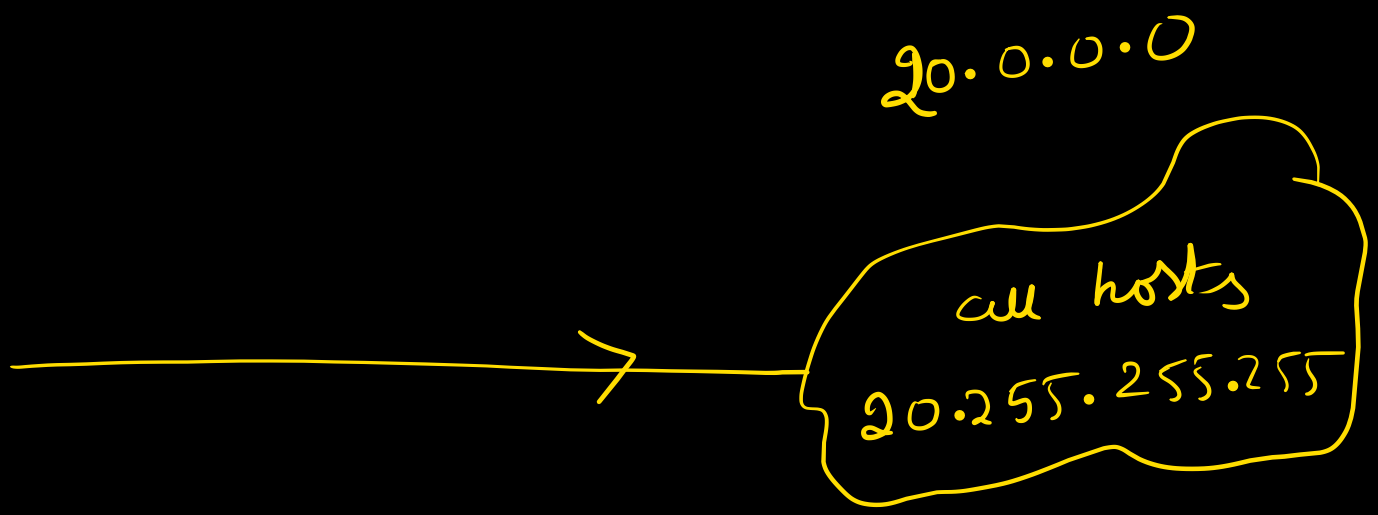
↓

First let us see how broadcasting works.

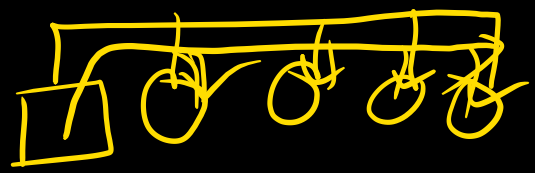
Earlier we have discussed DBA, LBA.

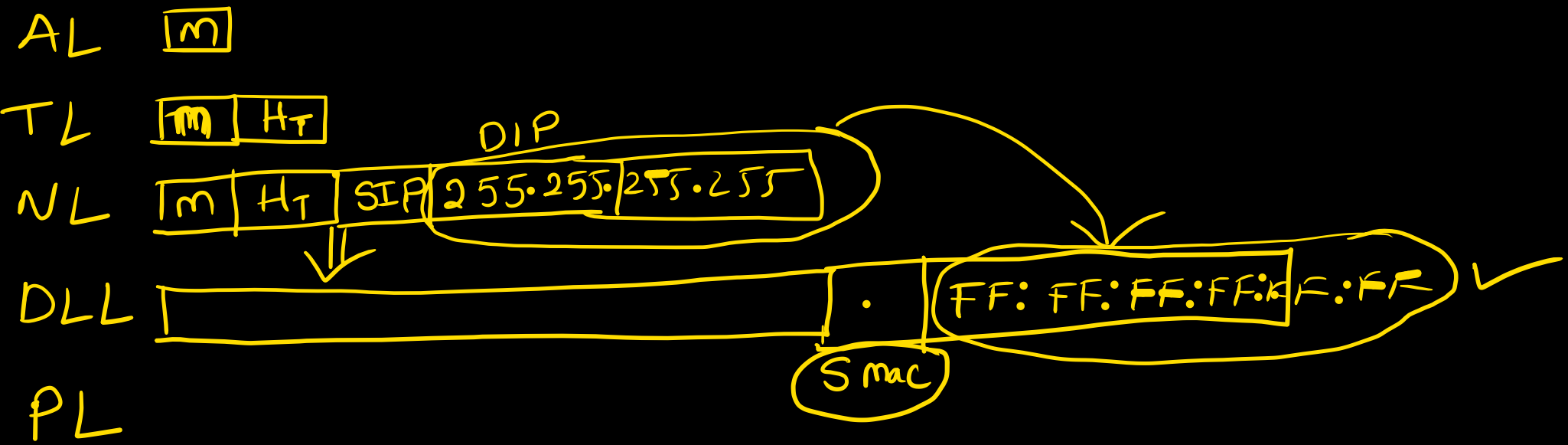
LBA: 255.255.255.255

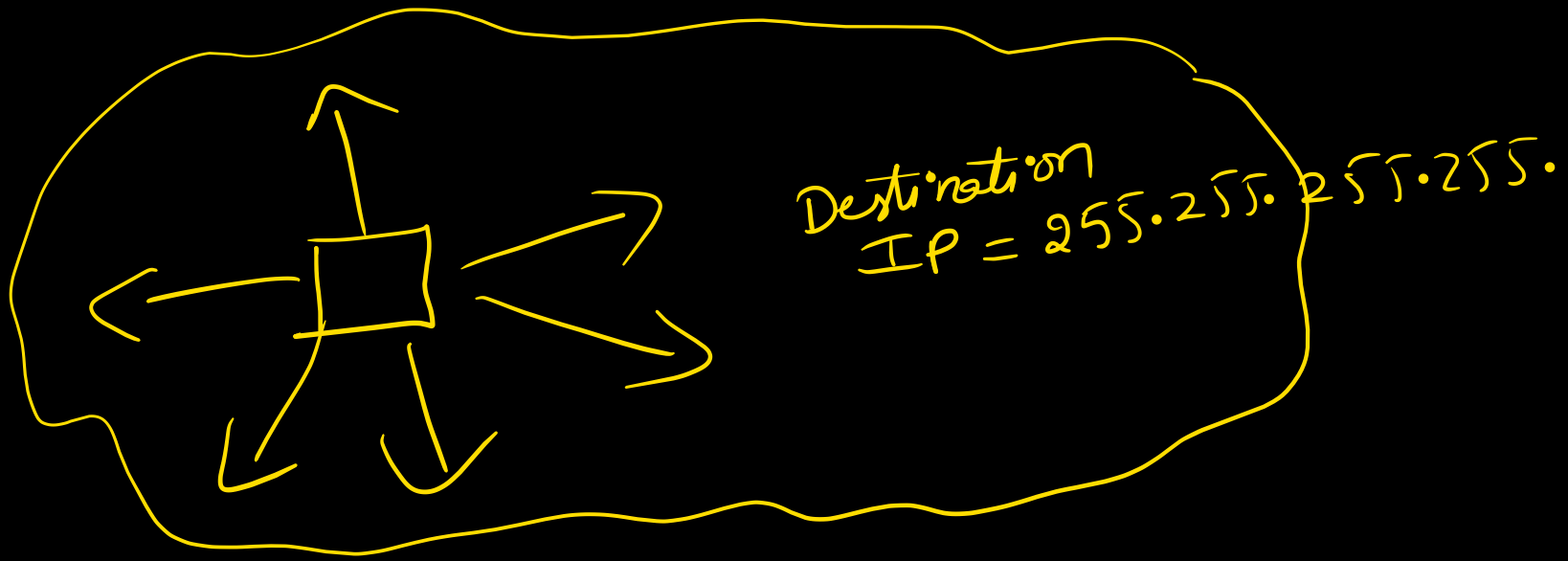


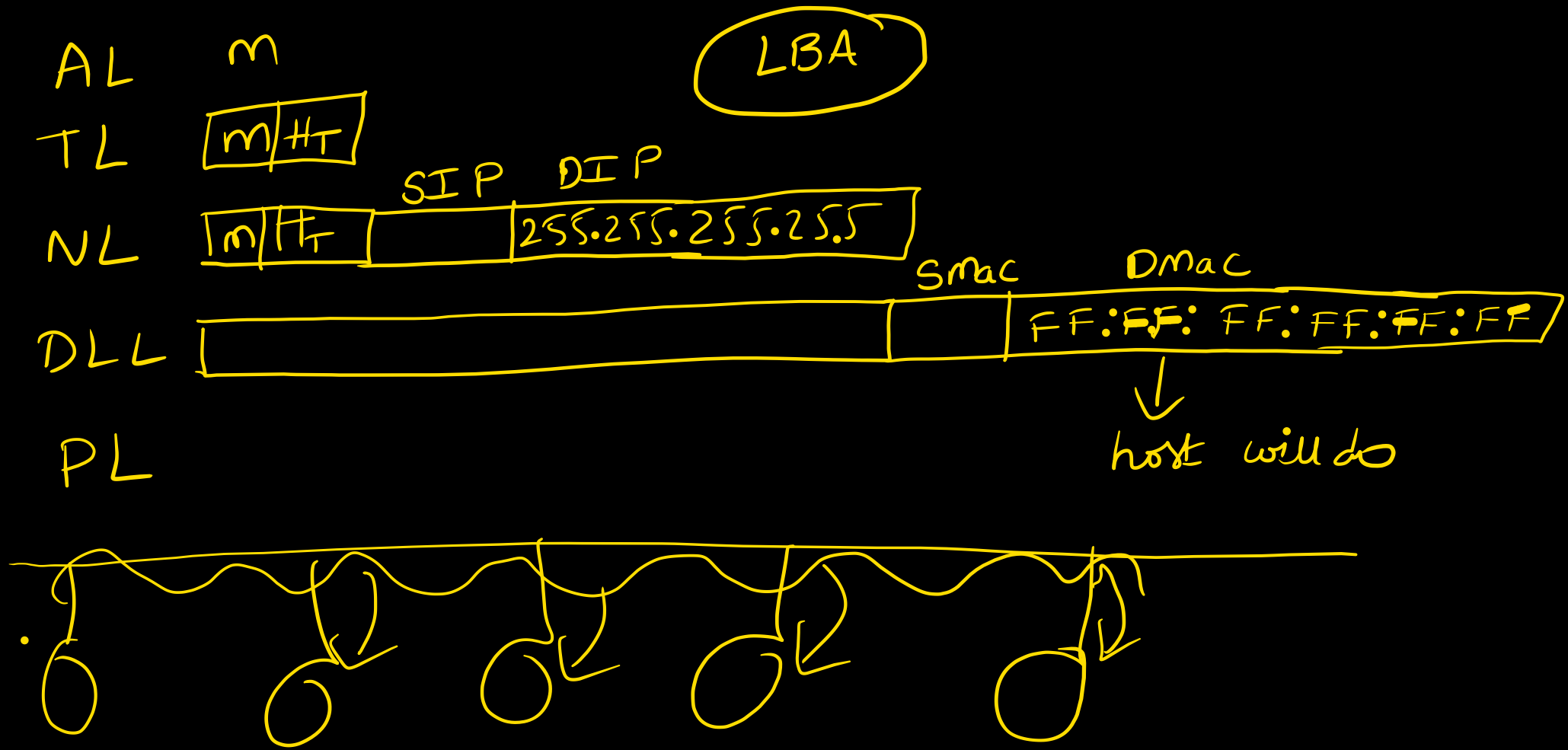

20.0.0.0
all hosts
20.255.255.255

Both LBA and DBA are converted to Broadcasting in the Data link layer.

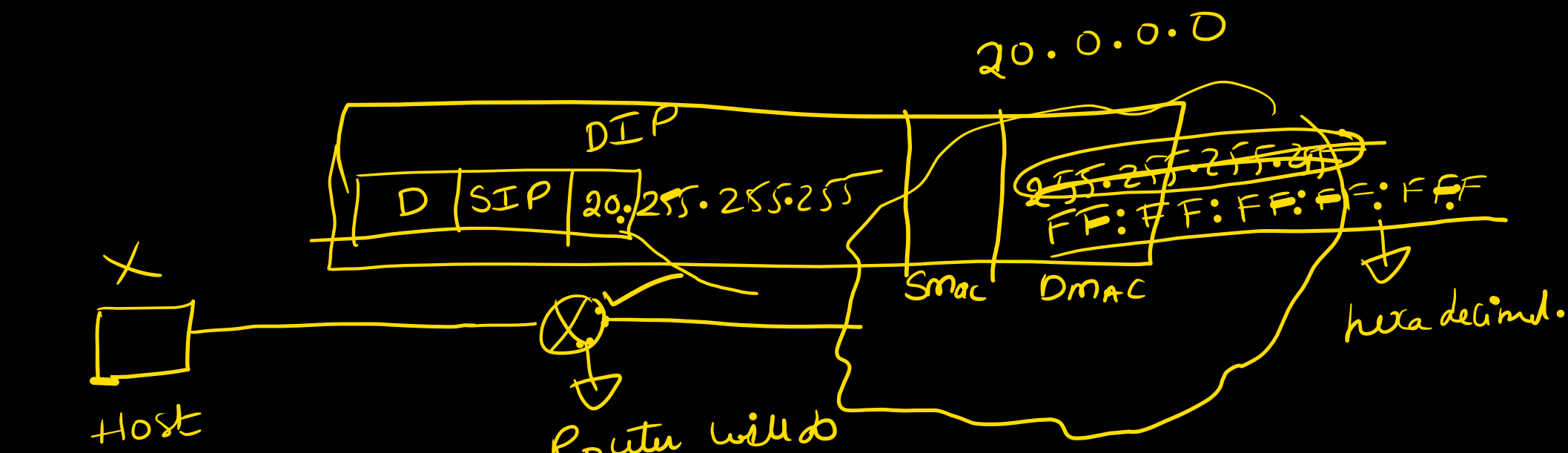




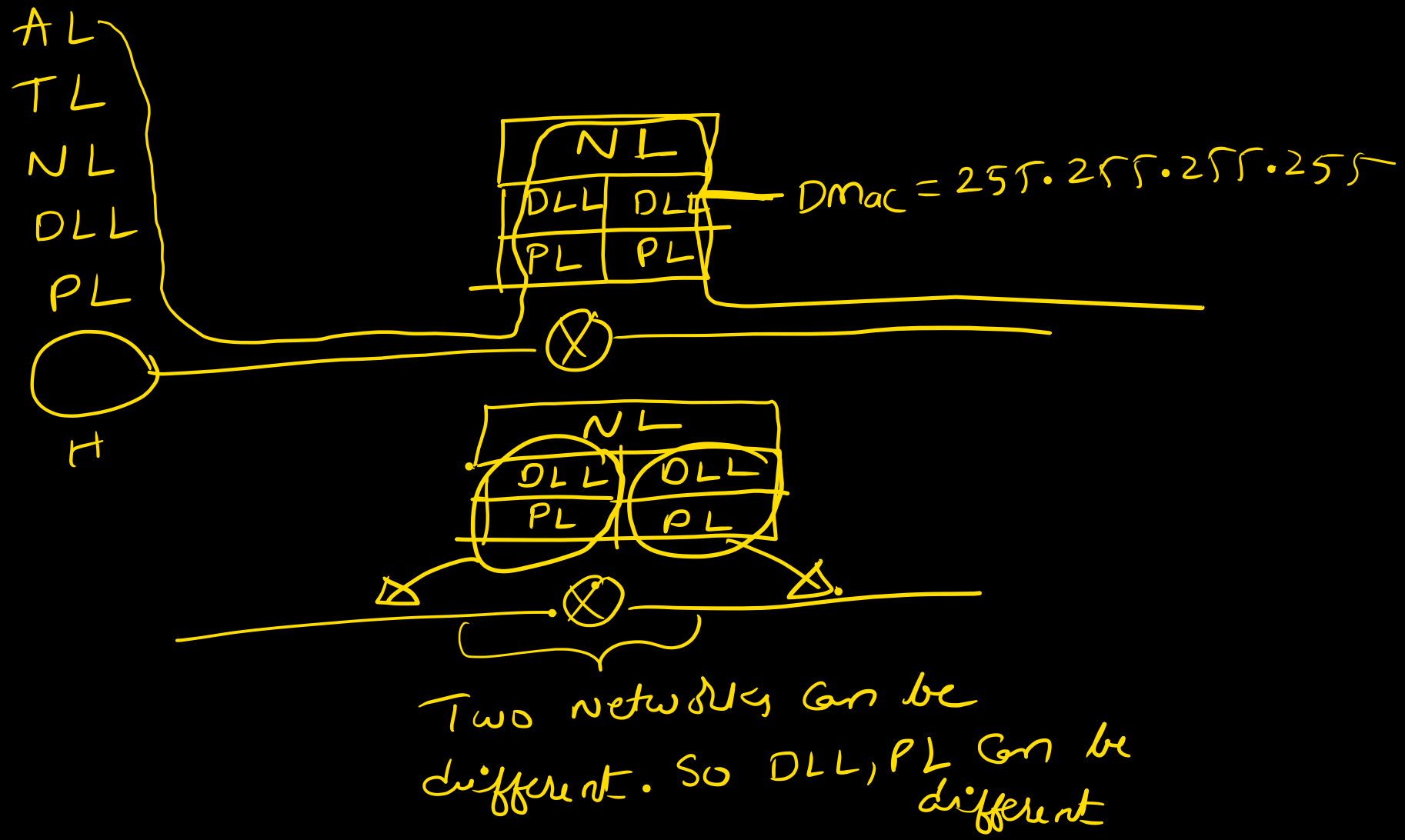

Destination
IP = 255.255.255.255.

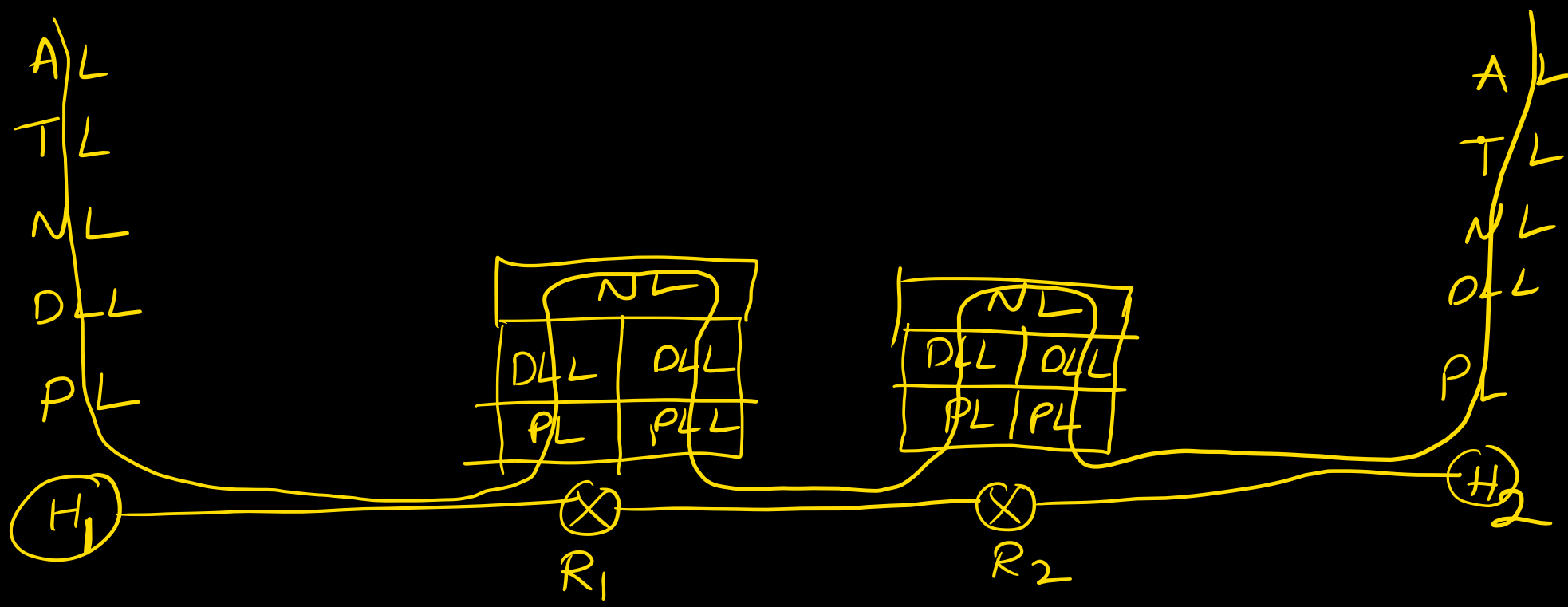

AL
m
LBA
TL
m
HT
SIP
DIP
NL
m
FT
255.255.255.255
SMac
DMac
DLL
FF:FF:FF:FF:FF:FF
host will do
PL

Directed Broadcast address:



wants to send to all hosts in 20.0.0.0

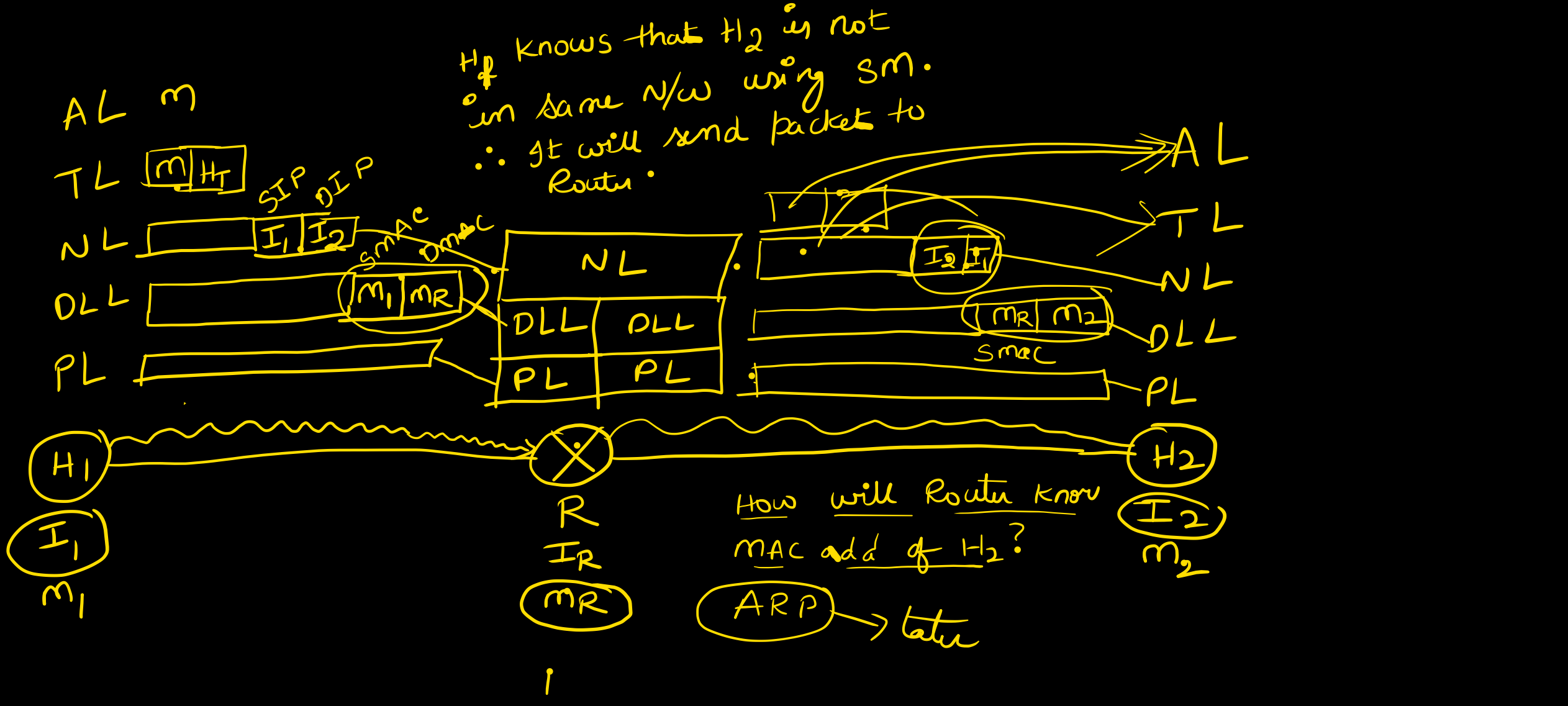

AL
TL
NL
DLL
PL
H
NL
DLL
DLL
PL
PL
DMac = 255.255.255.255
NL
DLL
DLL
PL
PL
Two networks can be different. So DLL, PL can be different



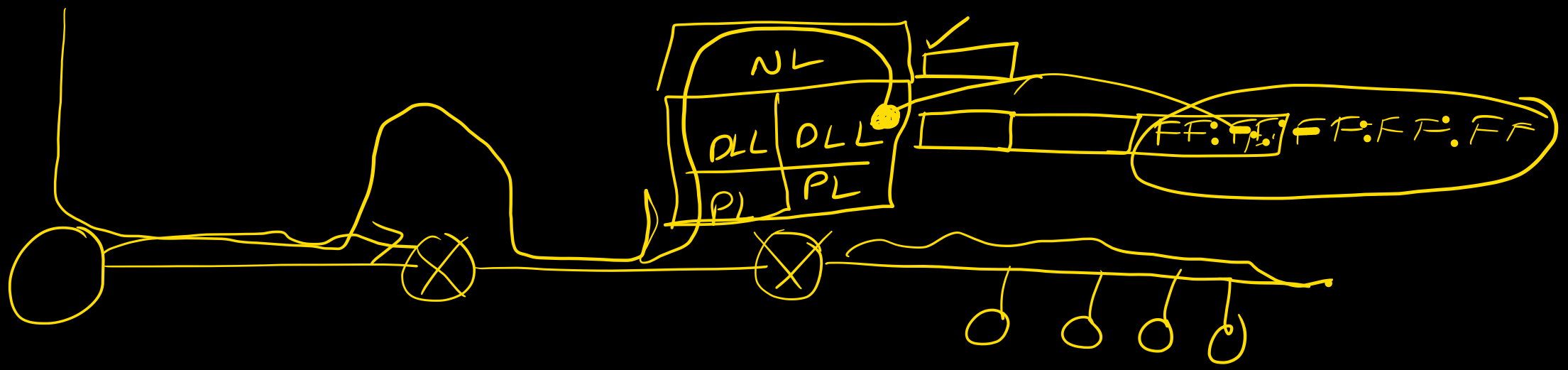
How many times NL is touched? 4 time

DLL is touched? 6 times

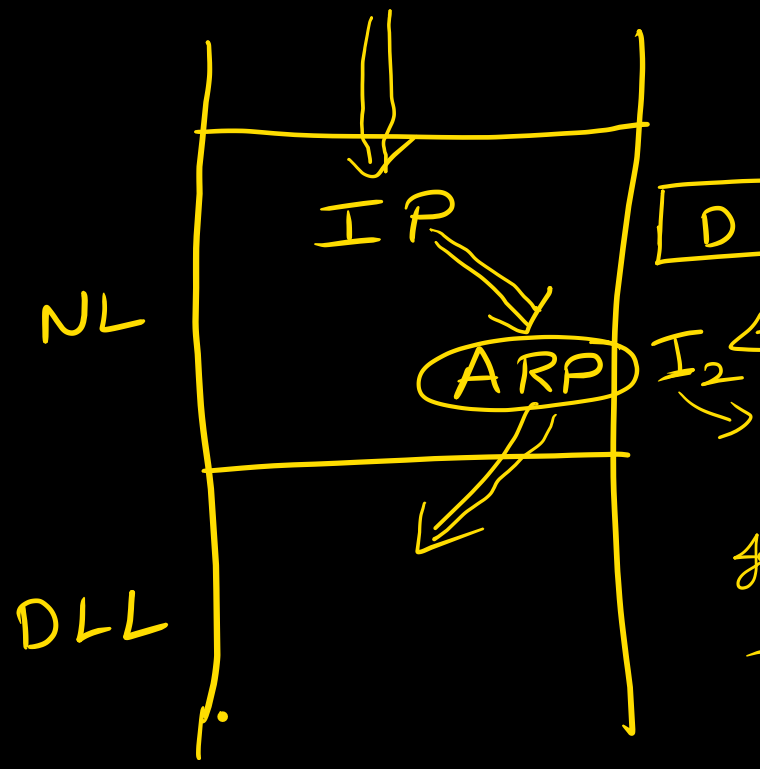
TL is touched? 2 times.


H1 knows that H2 is not in same N/w using SM.
∴ it will send packet to Router.
AL
TL
NL
DLL
PL
m
H1
SIP
DIP
I1
I2
SMAC
DMAC
m1
mR
H1
I1
m1
R
IR
mR
How will Router know MAC add of H2?
ARP
later
H2
I2
m2

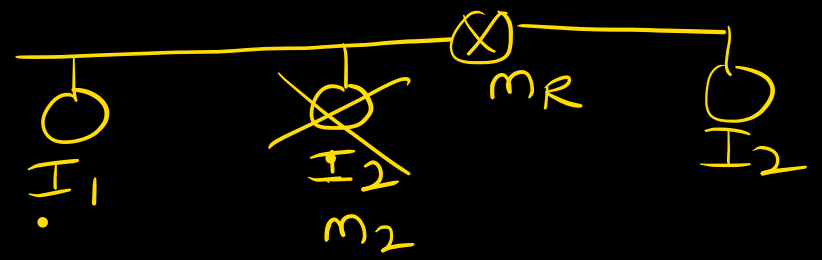
How is DBA implemented



ARP (address resolution protocol)

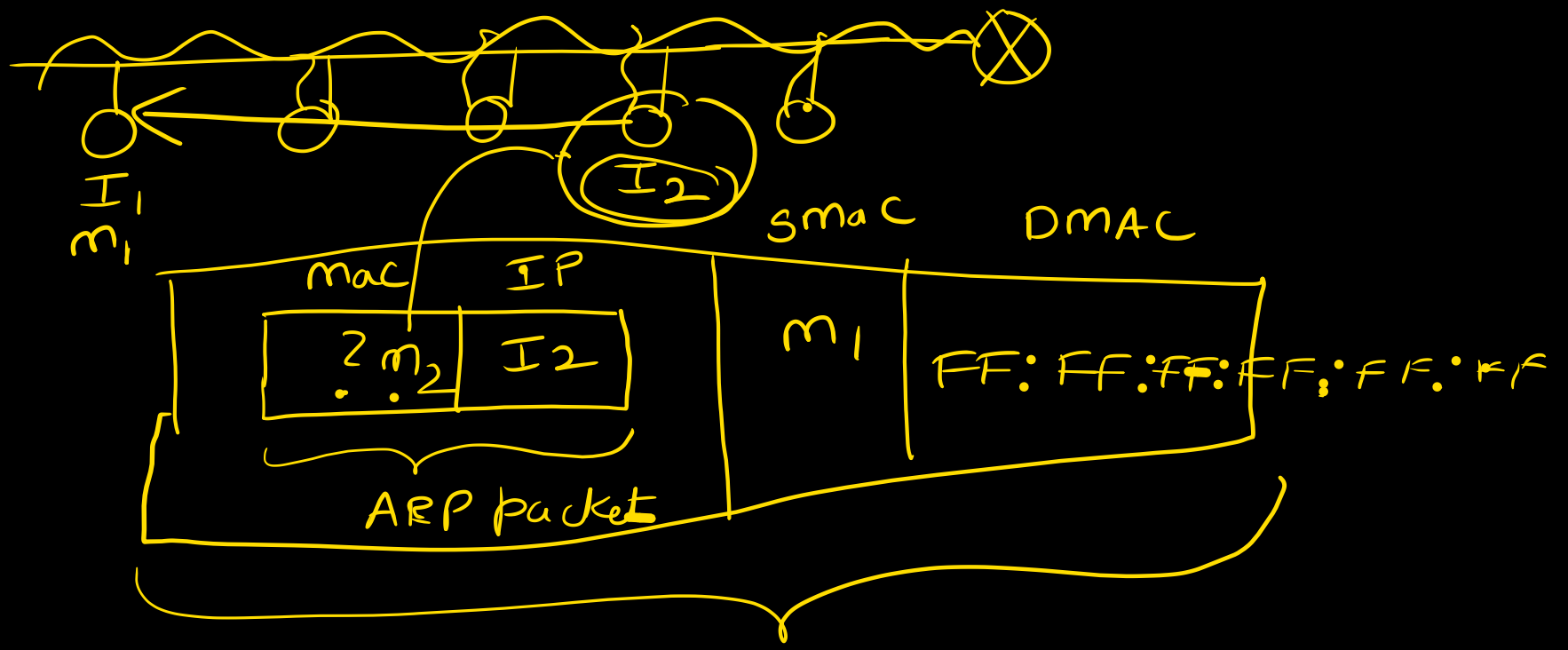


check if I_2 is in same N/w → SM.
If I_2 is in same N/w, then it will get mac add of I_2
Otherwise it will get mac add of Router and gives to DLL.



ARP → (Packet, m_2) → DLL
ARP → (Packet, m_R) → DLL

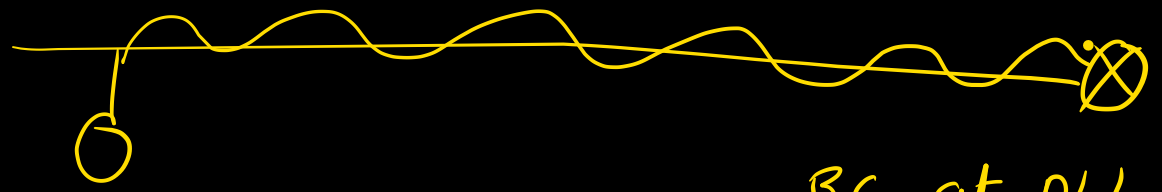
How ARP knows MAC add?
we will see.



∴ ARP request → broadcast ✓

ARP reply → unicast ✓

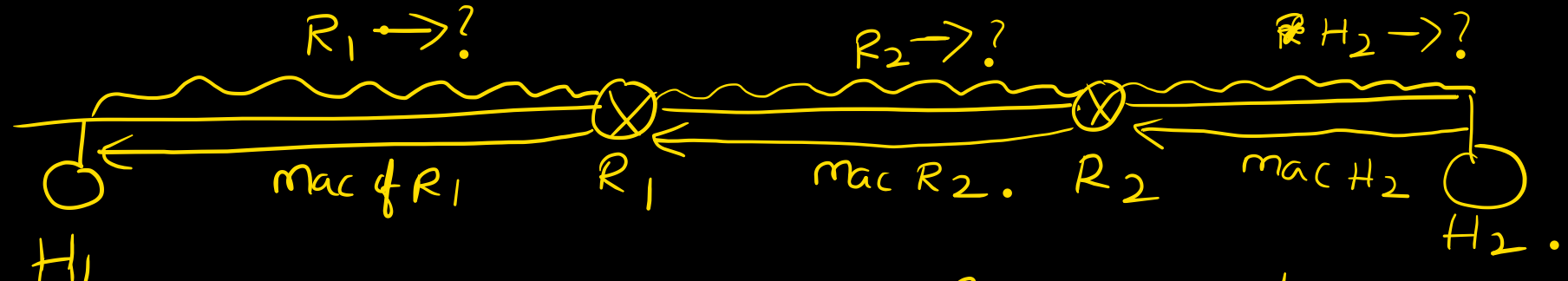
Broadcasting done at DLL is always limited to N/w.



BC at DLL will never cross Routers.

Routers are boundaries to N/w's.

ARP: (IP → MAC)



4 Cases: H → H in same n/w

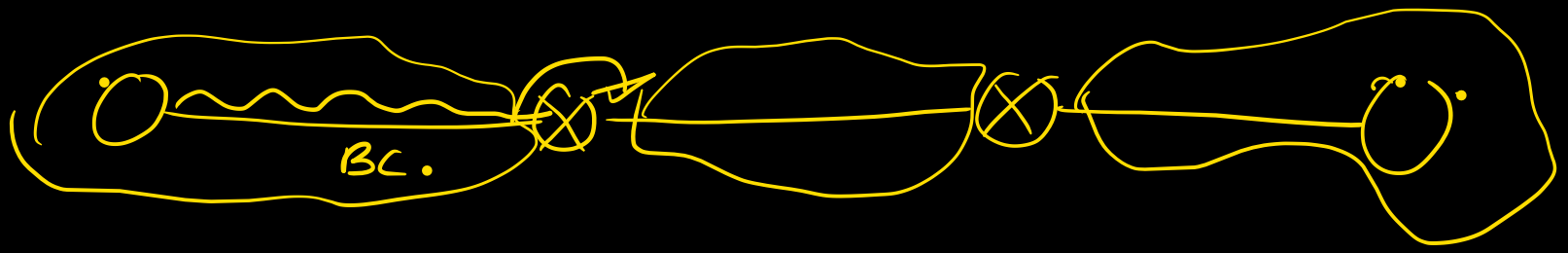
H → R1 ''

R1 → R2 ''

R2 → H ''

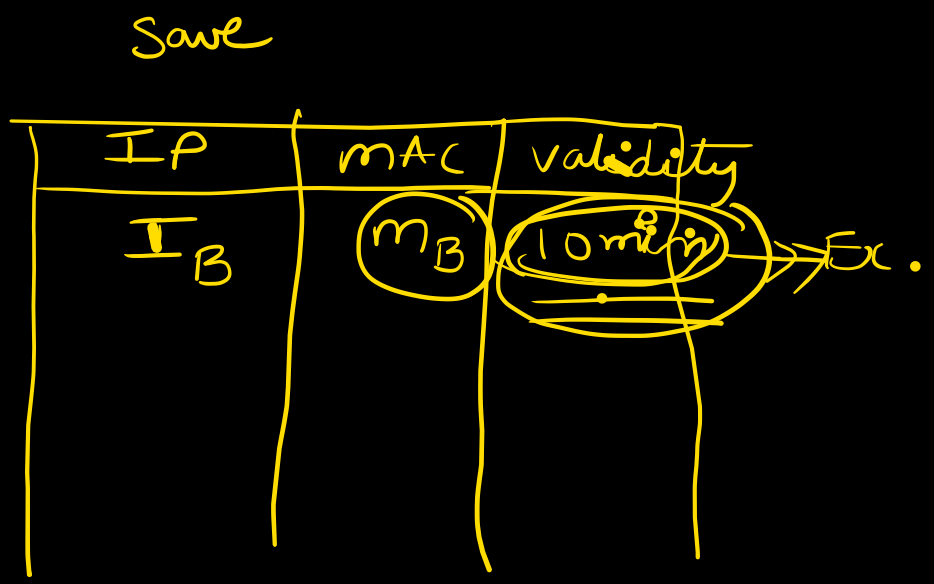
Always ARP works in the same n/w

Why ARP works in same N/W.



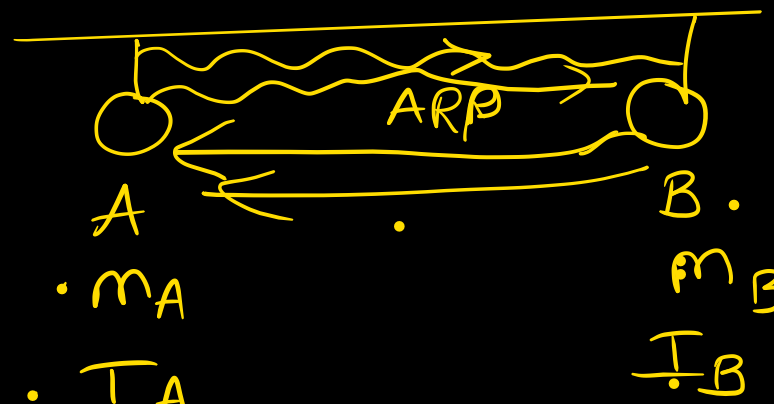
BC packets at DLL
will never cross boundaries

ARP table:



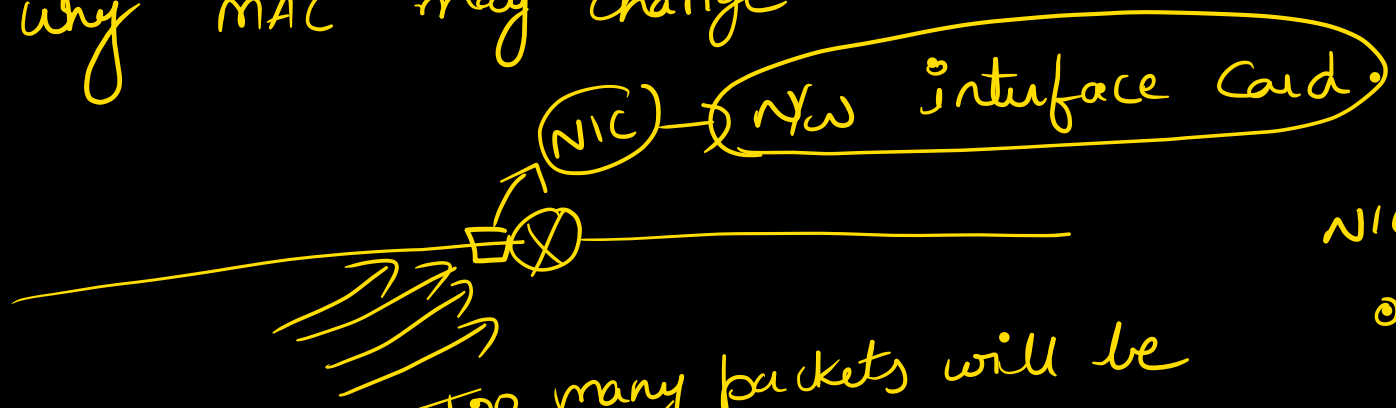
Why only sometime?

Because mac may change.



For sometime, A host will save mac add of another host to reuse.

Why MAC may change.



Too many packets will be coming because of which there will be wear and tear.

∴ NIC has to be changed.

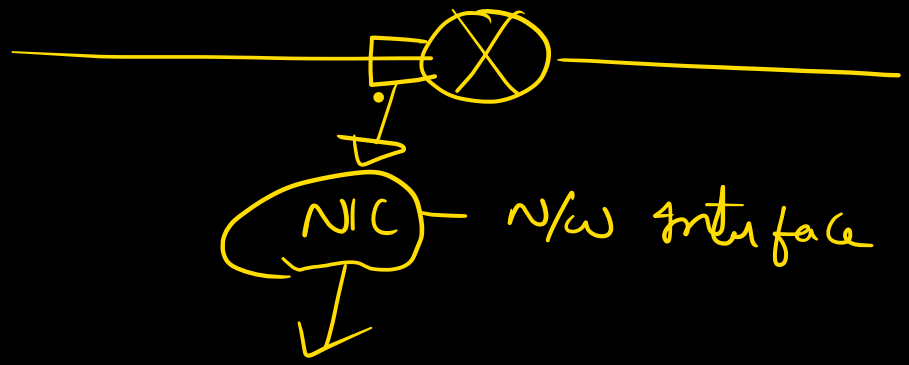
↓

Contains MAC.

NIC may change because of overheat.

So mac may change.

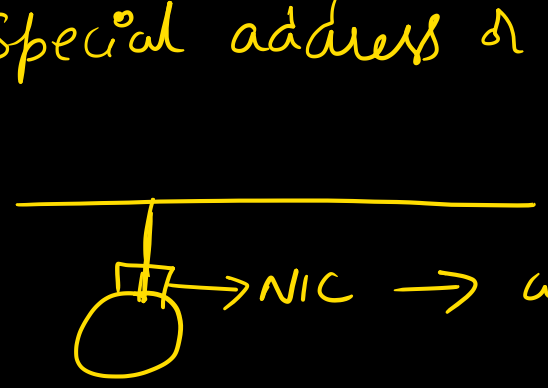
So even though MAC is permanent, NIC may change.

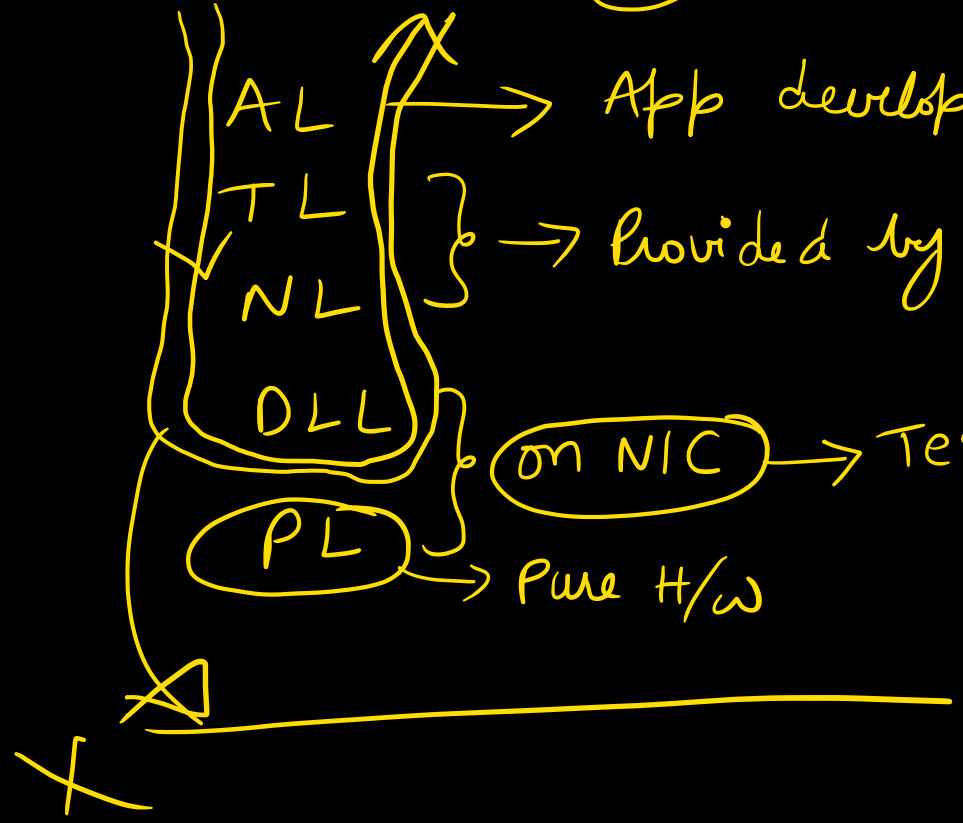


get spoiled → over use

∴ MAC may change.

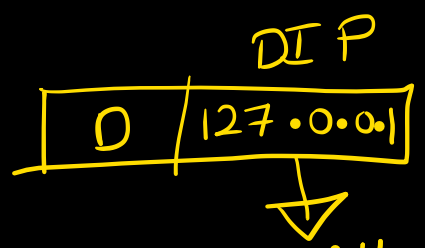
127 → Special address & loop back address.



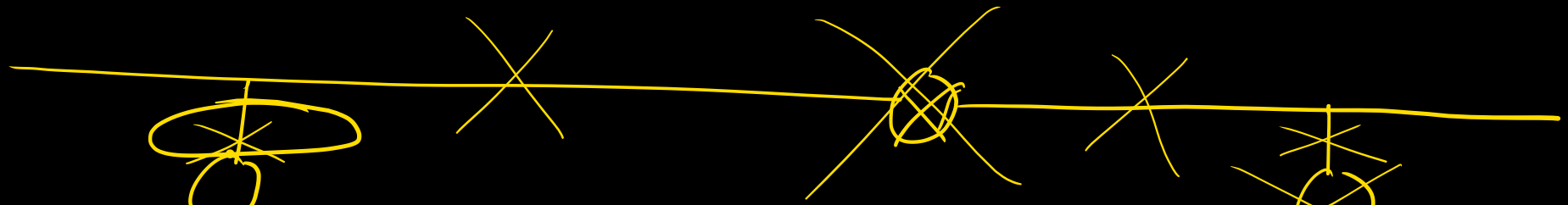


127.—.—.— any number.

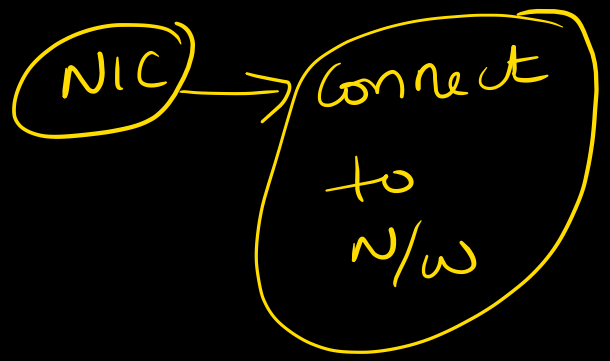
except
127.0.0.0 ✗
127.255.255.255 ✗



will go to DLL and comes back. which means NIC is working.



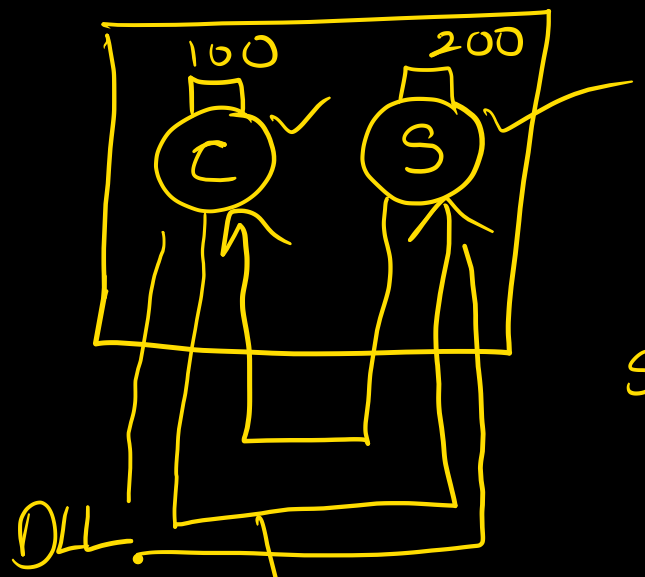
If I dont get a reply from server.



Where to start testing?

Better to start at the NIC of the client.

Another application of 127.: → client server in the same host.



C->S DP DIP

m	200	127.0.0.1

S-C

m	100	127.0.0.1

127.1.2.3
.1.2.5
.2.4.10

X 0.0.0.0
X 255.255.255.255

Generally 127.0.0.1 → local host

X n/w.

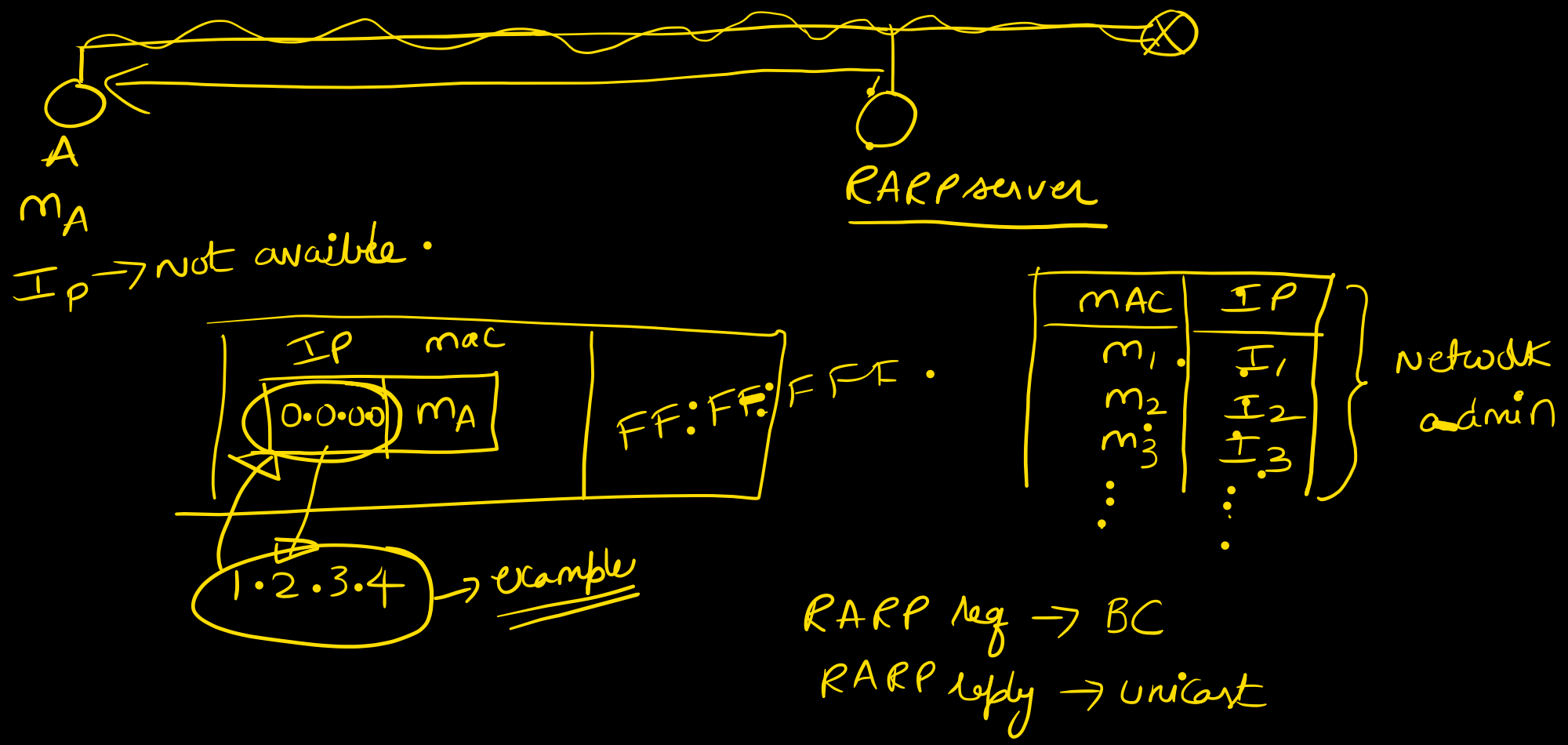
RARP: Reverse ARP

ARP: IP → MAC

RARP: MAC → IP

Given a MAC → ?IP.

If you shutdown your Computer, → You will lose IP add and You have to ask for IP again.


A
m_A
I_P → not availble.
RARP server
IP
mac
0.0.0.0
m_A
FF:FF:FF:FF:FF:FF.
1.2.3.4 → example
MAC
IP
m_1
m_2
m_3
I_1
I_2
I_3
network admin
RARP req → BC
RARP reply → unicast

RARP → IP add of own host

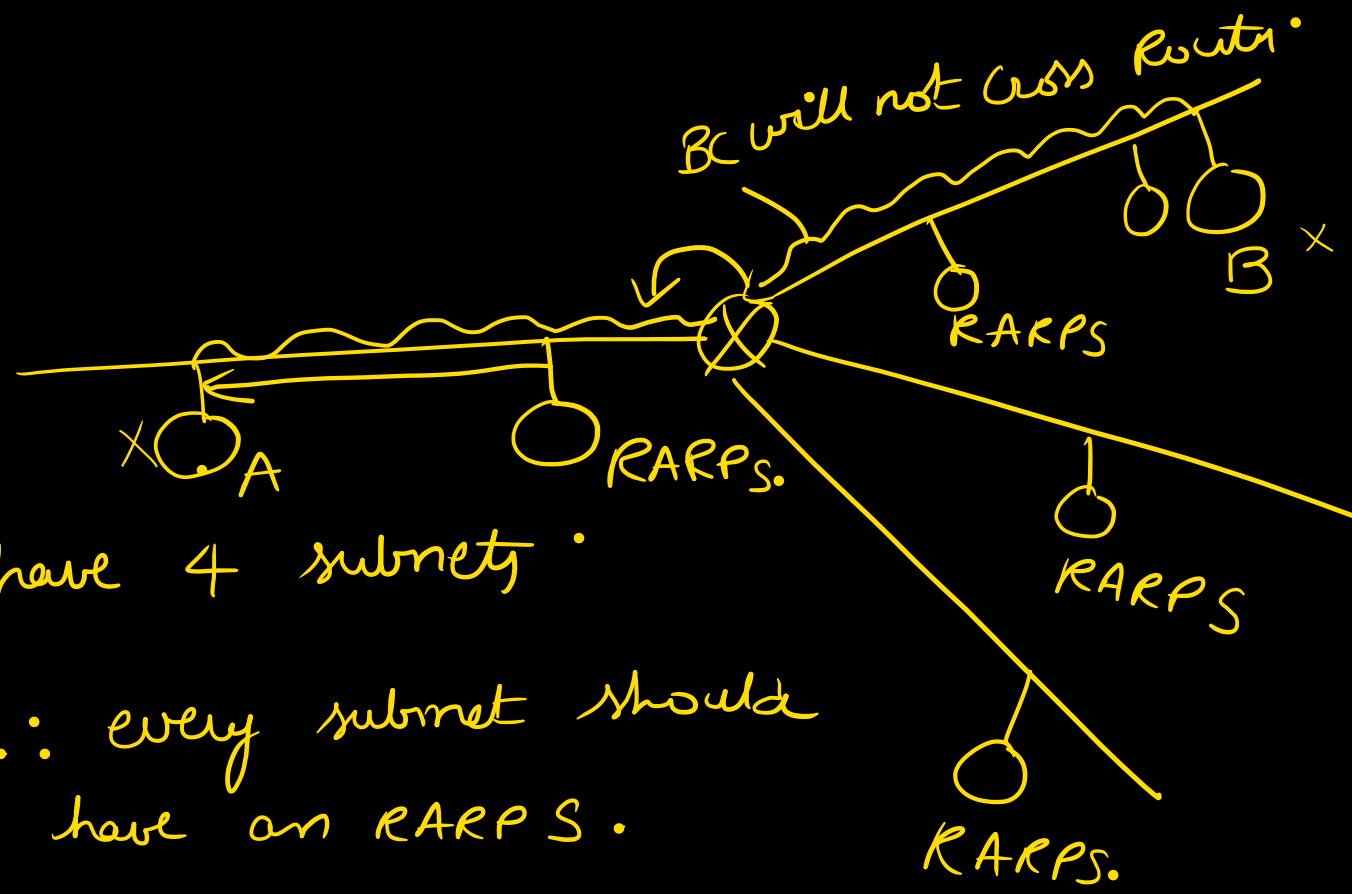
ARP → MAC add of other host

RARP table: if we have 100 hosts then we need 100 IP add.

MAC	IP
M_1	I_1
M_2	I_2
⋮	⋮
M_{100}	I_{100}

∴ Table is static, not dynamic

↑ disadvantage.



we have 4 subnets.

∴ every subnet should have an RARPS.

Dis: many RARPS are required.

RARP is very old and not used.

BOOTP and DHCP are used.

To be clear, RARP works at NL and only Protocols at AL are called servers.

∴ RARP is not a sever technically.


AL
TL
RARP
NL
DLL
PL
AL
TL
NL
RARP
DLL
PL

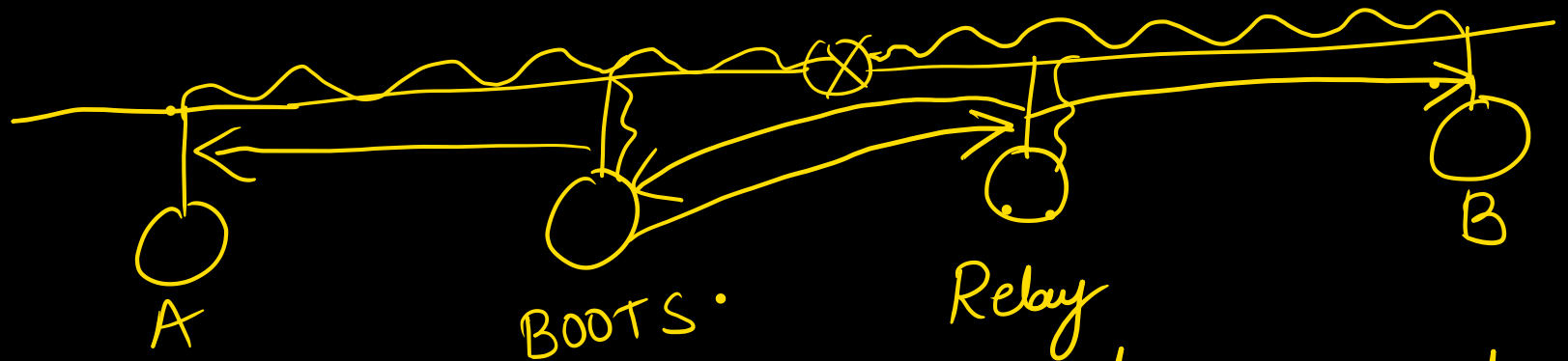
Disad of RARP:

1) Every N/w should have an RARPS.
2) mapping table is static (IP ≥ Hosts)

ex: 100 → 100 90 (≤ 100)

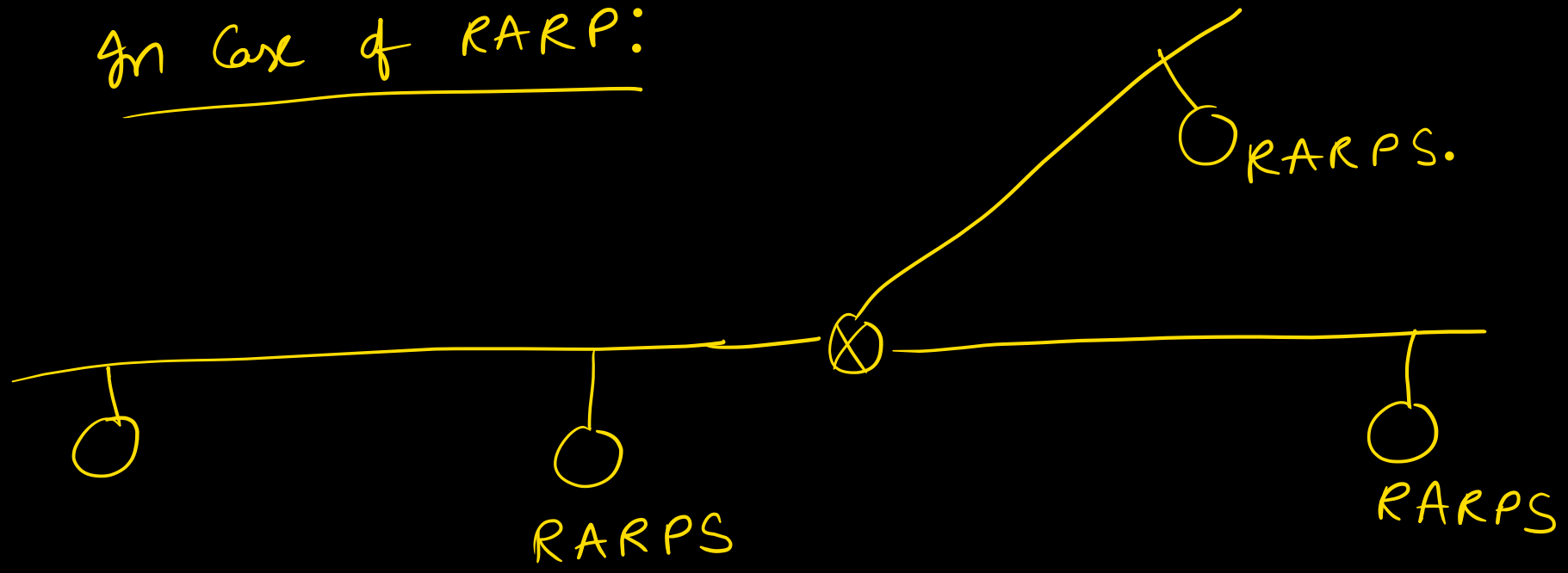
200 → 200 → max (≤ 200)

BOOTP: Let us say we have two ~~Nos~~ Subnets.

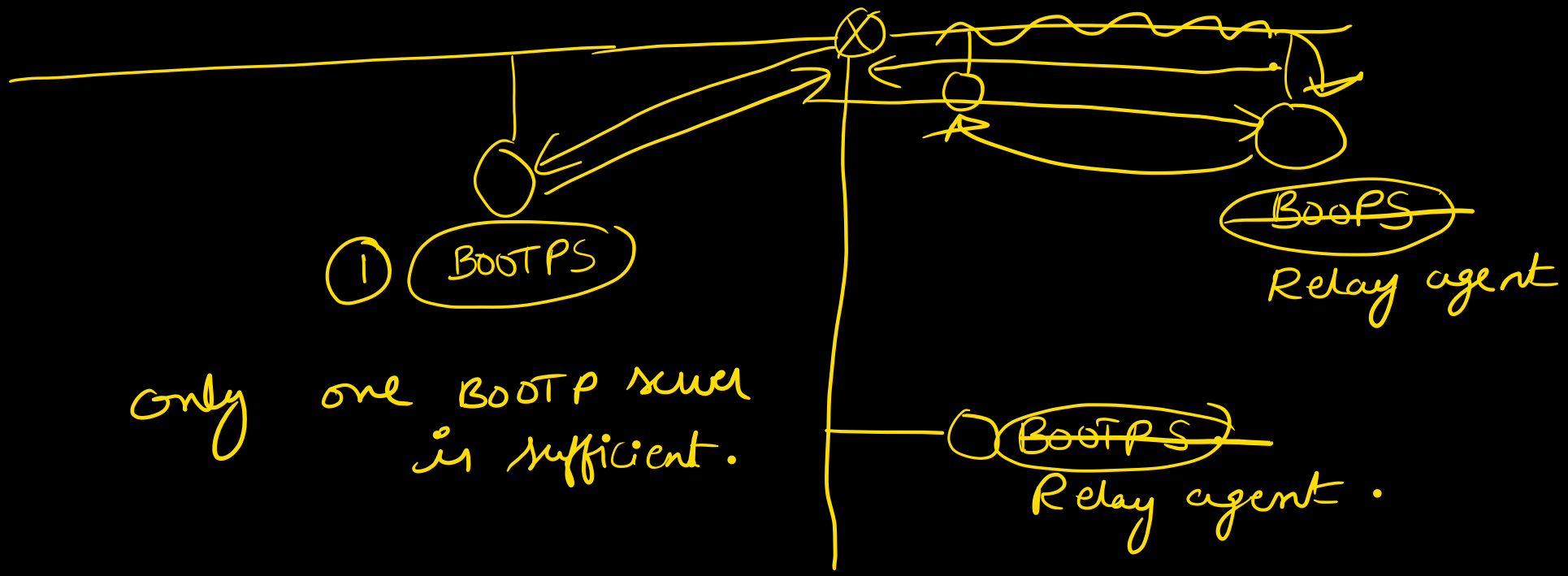


∴ only ~~only~~ one BOOTPS is required

In Case of RARP:

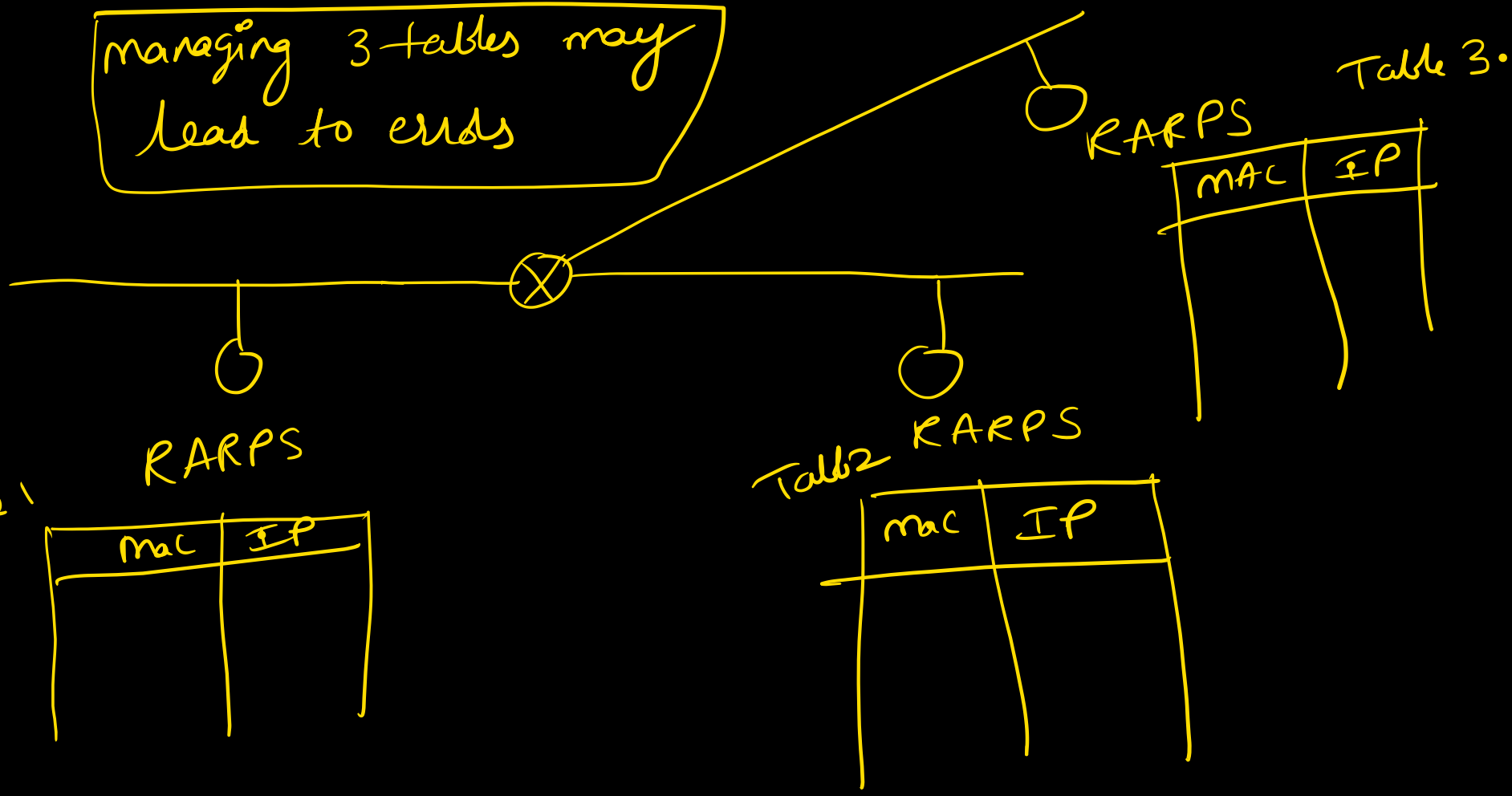


∴ no RARP servers
= no of subnets

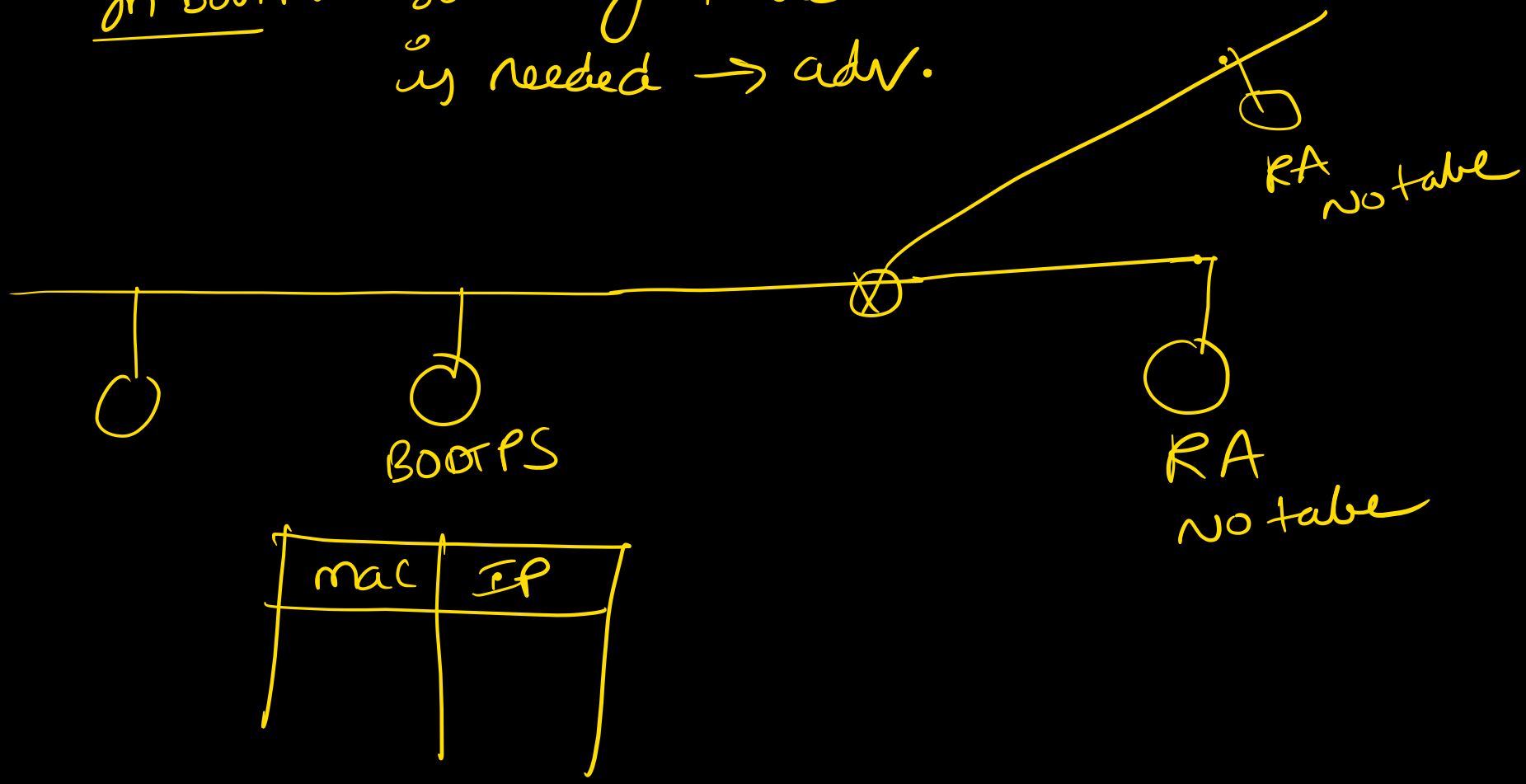


Only one BOOTP server is sufficient.

managing 3 tables may lead to errors



In BOOTP: so only table is needed → adv.



Disadv of BOOTP:

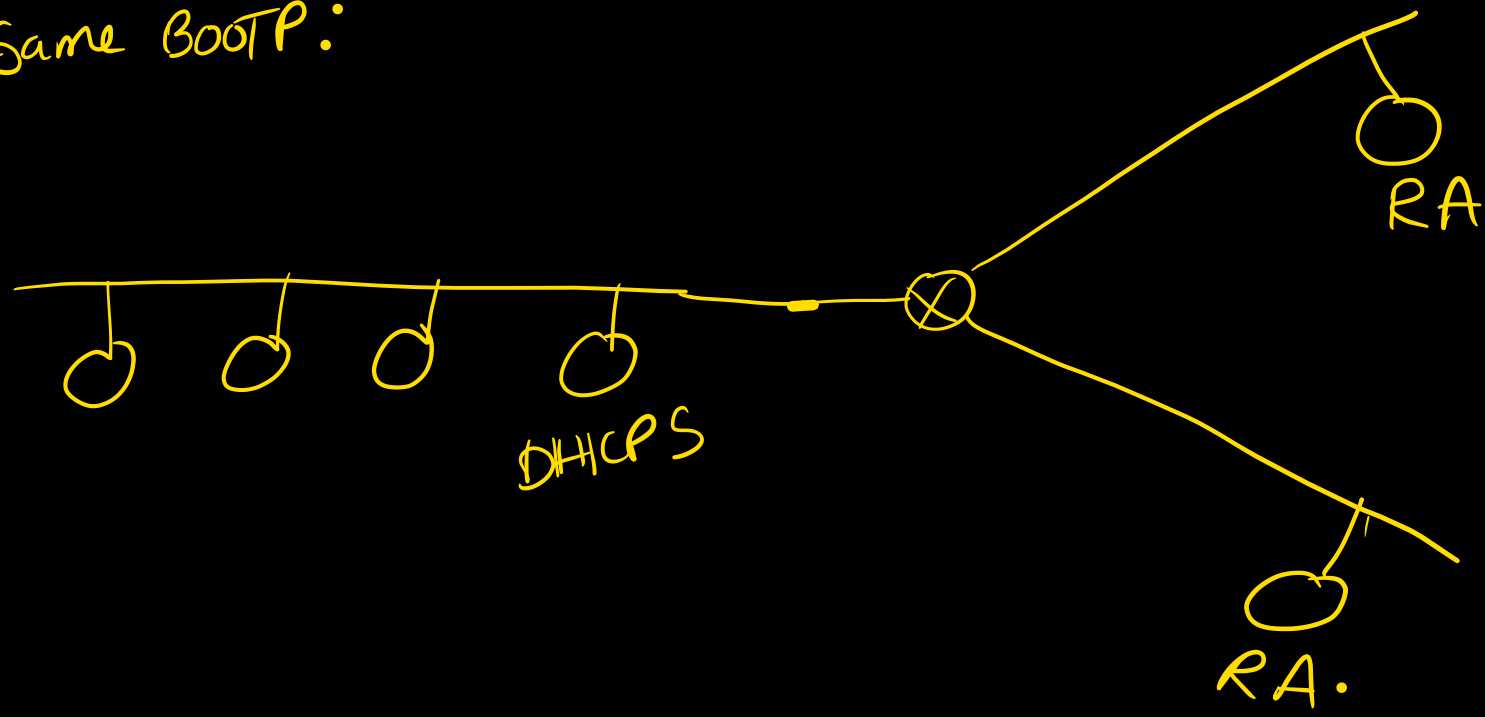
mapping table is static.

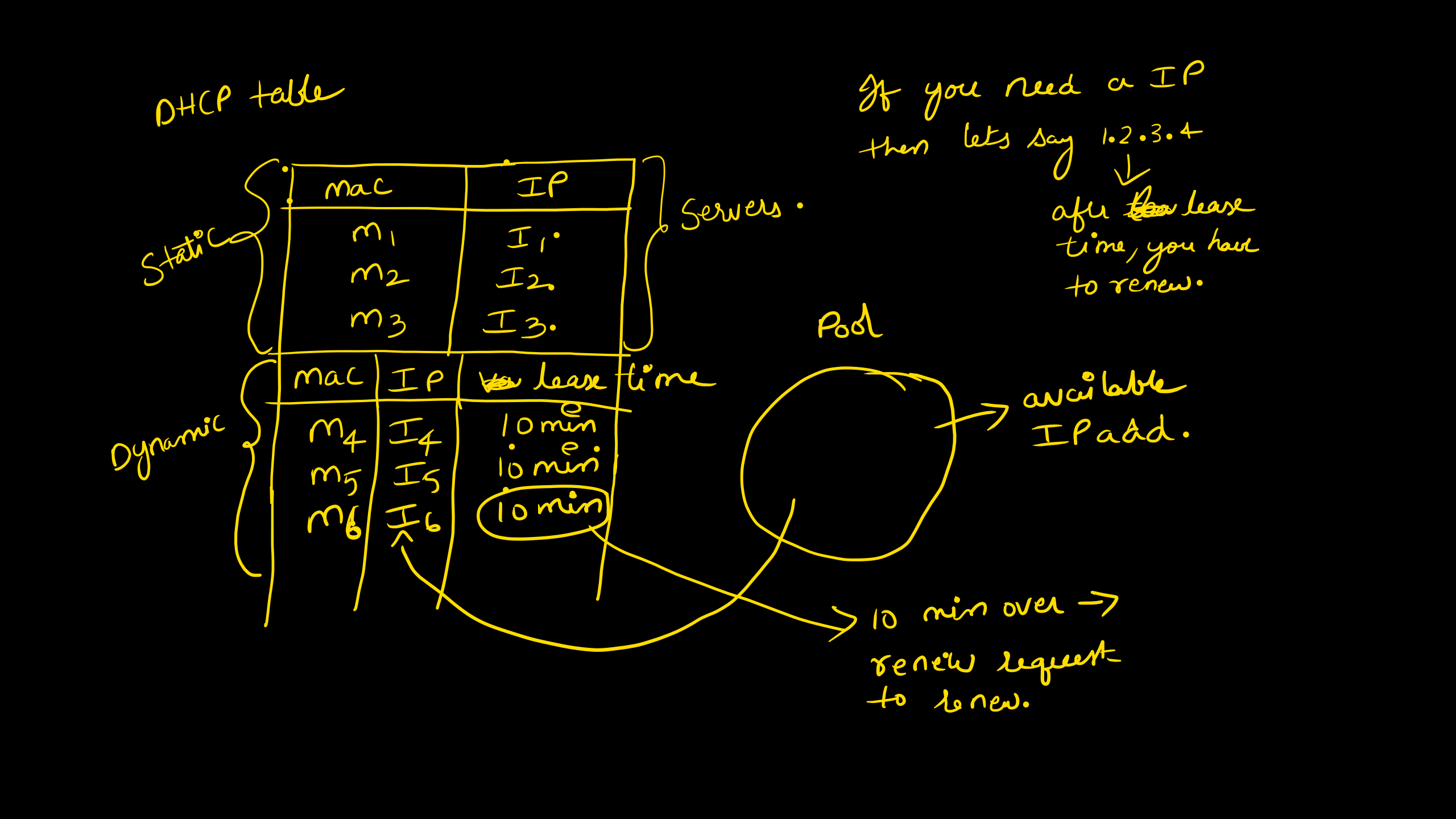
MAC	IP
m_1	I_1
m_2	I_2

$\therefore |Hosts| \leq |IP|$.

DHCP: (Dynamic Host Configuration protocol).

Same BOOTP:




DHCP table
If you need a IP then lets say 1.2.3.4
after lease time, you have to renew.
Static
mac
IP
m_1 I_1.
m_2 I_2.
m_3 I_3.
Servers.
Dynamic
mac
IP
lease time
m_4 I_4 10 min
m_5 I_5 10 min
m_6 I_6 10 min
Pool
available IP add.
10 min over → renew request to renew.

adv: 1) only one DHCP Server is needed

2) mapping table is dynamic.

∴ 100 users → but only 50 are online at any time.?

How many IPs are required in

RARP → 100

BOOTP → 100

DHCP → 50.

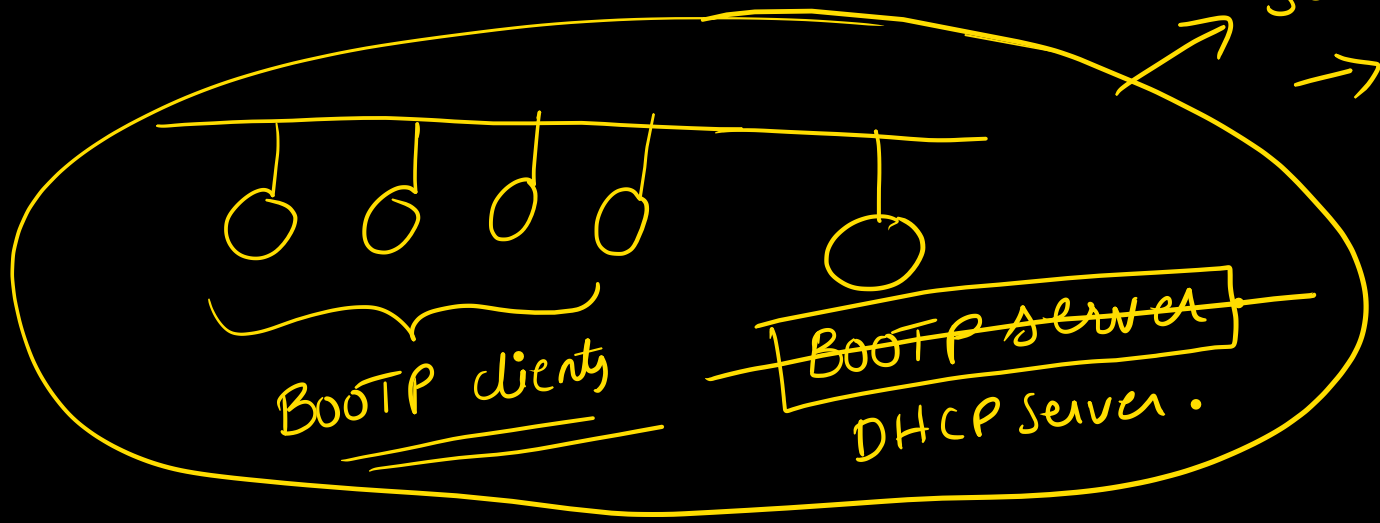
Backward Compatible:

RARP → BOOTP → DHCP.

RARP → NL

BOOTP → DHCP → works at AL

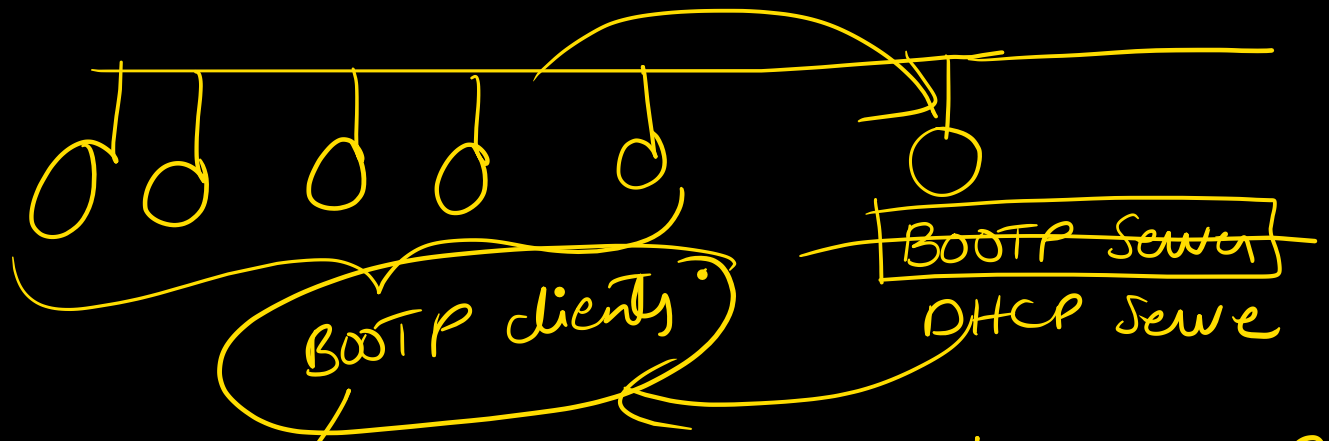
You dont have to upgrade the software.



→ still works

→ BOOTP clients can contact DHCP servers

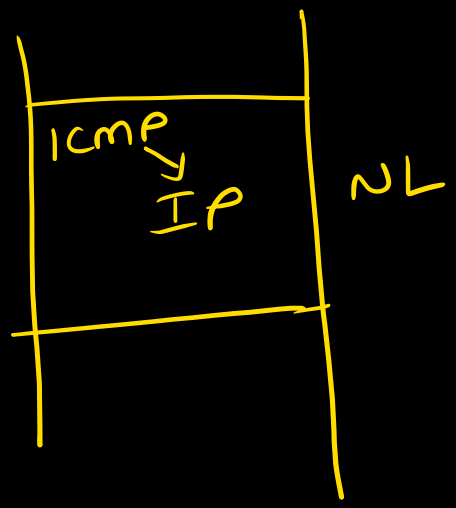
let us say we are using BOOTP :



I want to use DHCP.

Don't have to upgrade BOOTP clients to DHCP clients.

ICMP (Internet Control message protocol)



ICMP packet travels in IP packet.