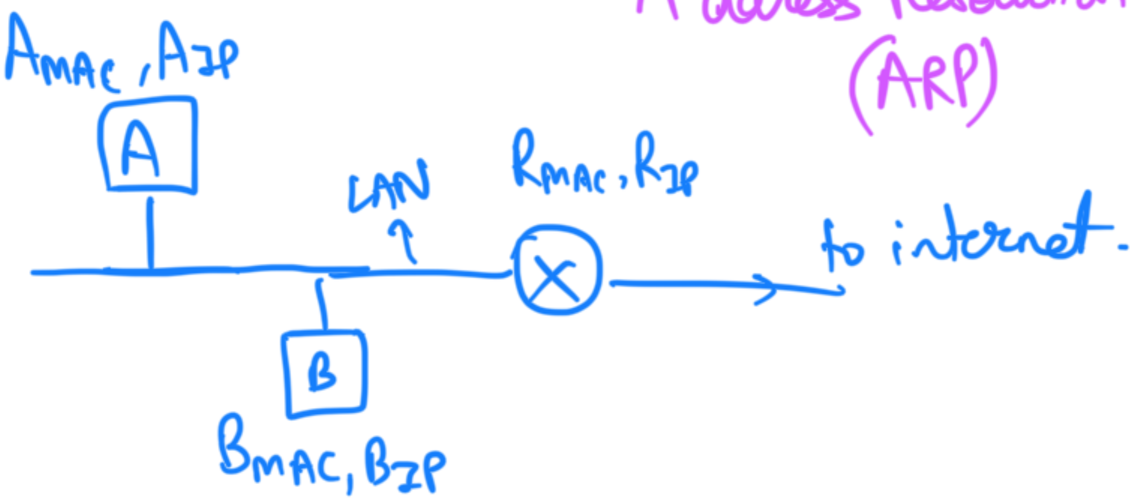
CS348 Notes
ARP+DHCP
Video Numbers: 19

OjMaha

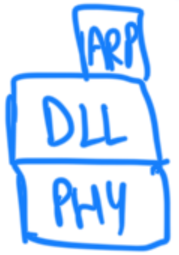
I have prepared these notes by watching the videos from Networks Playlist. The following notes may be asynchronous and irrelevant to what Prof. Vinay teaches in class (cuz I do not pay attention during lectures lol). Further, these notes might not cover *everything* as explained in the video lectures. Consider these to be a supplemental read :). If you find any errors, do notify me so they can be edited.

Address Resolution Protocol (ARP)



Suppose A wants to send an IP packet to B.
A knows B_{IP} but does not know B_{MAC}.

So when A sends an IP packet out, the MAC layer doesn't rlly know whom to send the packet out to. The ARP helps us extract IP address given its MAC address.



We talked only about 5 layers. Consider ARP to be a mini-layer.

if Val >1536; the field is used for type & not length of frame. (eg: 0x0806 ⇒ ARP packet)
If val < 1500 ; then it is used to specify length of msg

Consider the ethernet frame:

			2 bytes		
Preamble	Dst. MAC	Src. MAC	Type/ length	ARP Packet	CRC

Before A sends any message to B, it sends out the above frame to know where B is. But A doesn't know B_{MAC}, right? So to find out B_{MAC}, the sender broadcasts this packet. Dst. mac = all 1's. The IP layer already knows all 1's means broadcast.

ARP REQ: it corresponds to the ARP packet.
request (from A)

It has:

Sender MAC	Sender IP	Target MAC	Target IP
A_{MAC}	A_{IP}	All zeros.	B_{IP}

All devices but B ignore the msg after realising Dest IP != Self IP.

B replies ARP Reply:

Sender MAC	Sender IP	Target MAC	Target IP
B_{MAC}	B_{IP}	A_{MAC}	A_{IP}

⇓
a unicast! because B knows exactly who & where the intended receiver (A) is.

Thus the frame:

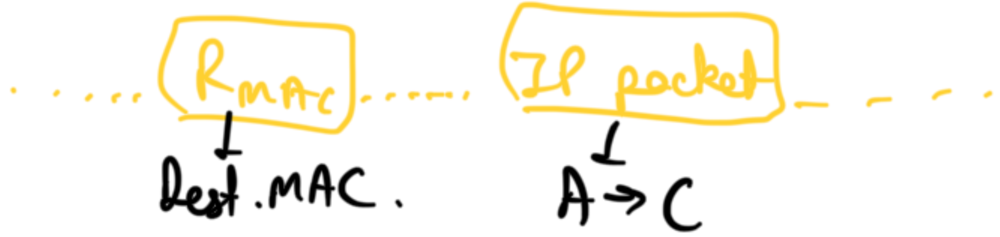
preamble	A_{MAC}	B_{MAC}	ARP Reply	CRC

When A receives the ARP reply, it stores B_{MAC} into the ARP Cache. cuz A doesn't want to send ARP every time it needs to send smth. to B.

Every entry in the cache has a time-out. → MAC-IP binding isn't permanent.

What if A wants to send packet to C which is not a part of its LAN?

A sends a frame:



Once R receives this frame, it forwards it to the next router & so on till packet reaches dest.

A needs to be a bit intelligent and know if the destin^n is in its own LAN or not. How does A know this??

☆ A_{IP} : $a_1 . a_2 . a_3 . a_4$; Subnet Mask.

if Dest.IP AND MASK == A_{IP} AND MASK. ⇒ dest. is in my network.

But now, if device is outside own network; how to know R_{IP} & R_{MAC}??

Suppose for now we somehow know R_{IP}; how to find R_{MAC}? (RIP).

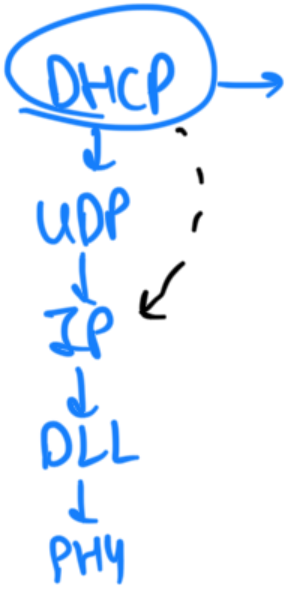
We use the og ARP REQ → ARP Reply for this.

Say A is a device newly connected to the LAN. It doesn't know who the default router is, what A IP is. We use DHCP to automate the process of finding this info out.

Dynamic Host Configuration Protocol (DHCP)

Here, given self.mac; you wanna configure self.ip, router.ip.

There is a DHCP Server that keeps track of IP addresses used.

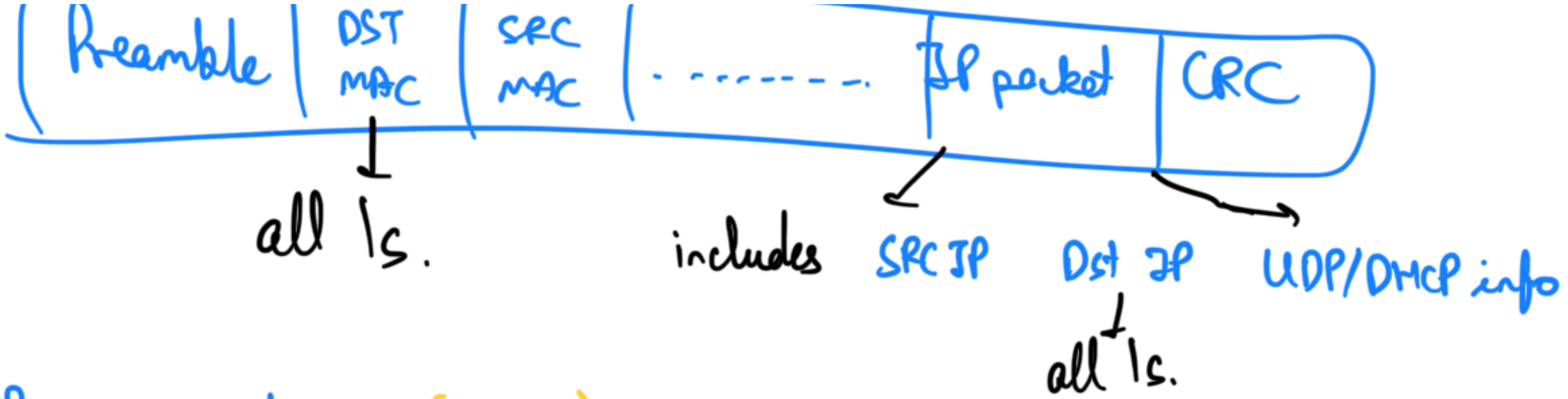


→ it sits on top of UDP in the protocol stack (somewhat appl. layer). And populates the IP address. It sends info to the lower layer (cross-layer interaction).

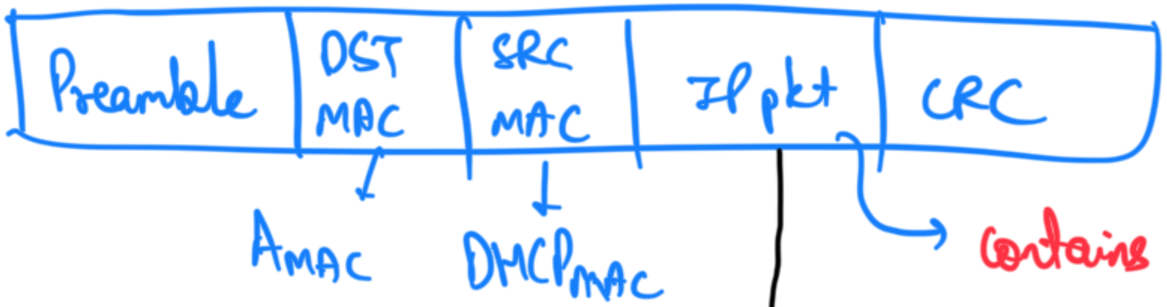
We broadcast the message @ IP & DLL layer both to make sure the server receives DHCP packet.

The IP packet has a protocol field indicating it is for DHCP. UDP also has specific port nos. for the same purpose. (# 68: DHCP server, # 67: DHCP client

Thus A sends out DHCP "Discover" Packet :



DHCP Server replies : (OFFER) → contains a potential offer for A.



contains potential A_{IP}. (offer A_{IP})

SRC IP : $DHCP_{IP}$

Dest IP : ??? → put all 1s. (broadcast)

we dk wut to put here since A hasn't configured its IP.

When A receives the offer, it sends a request to the DHCP server for obtaining that IP. Then the server sends ACK to confirm the request.

We do this → (request, ack protocol) cuz A might receive multiple requests (there may be multiple DHCP servers who recd the packet).

Further, before A sends a request, it

→ before it sends a request, it double-checks if the offered IP is being used by anyone else by sending an ARP packet.

<u>Note</u>: When A sends DHCP discov. broadcast; it doesn't reach all devices on the internet lmao. The gateway router does the job of not forwarding it as a broadcast & restricting it to its own network. (else whole internet floods) But then when router is restricting the broadcast, the DHCP discover might not reach the server na. Thus, we keep a relay agent (RA). It knows the IP address of the DHCP server. So when RA receives a DHCP discover, it unicasts the msg to the server. The server replies unicasts the OFFER to RA. Then the RA sends the OFFER to A.

(I'm not sure how RA knows DHCP IP. My guess is that it follows the og non-relay protocol and then helps other new devices configure themselves)