Introduction to Computer Networks
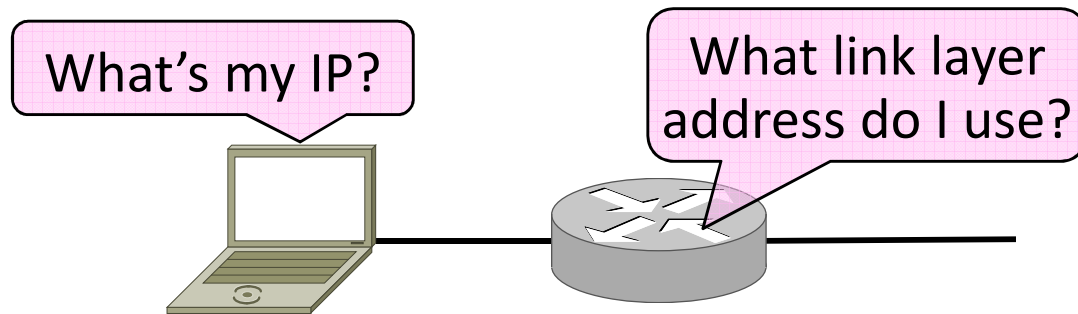
Helping IP with ARP, DHCP (§5.6.4)

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Topic

- Filling in the gaps we need to make for IP forwarding work in practice
  - Getting IP addresses (DHCP) **»**
  - Mapping IP to link addresses (ARP) **»**

What's my IP?

What link layer address do I use?

Getting IP Addresses

- Problem:
  - A node wakes up for the first time …
  - What is its IP address? What's the IP address of its router? Etc.
  - At least Ethernet address is on NIC

Hey, where am I?
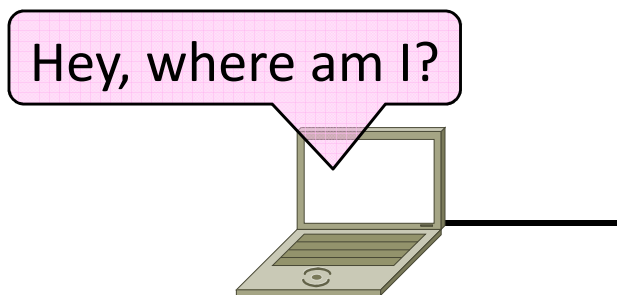
Getting IP Addresses (2)

1. Manual configuration (old days)
   - Can't be factory set, depends on use
2. A protocol for automatically configuring addresses (DHCP) »
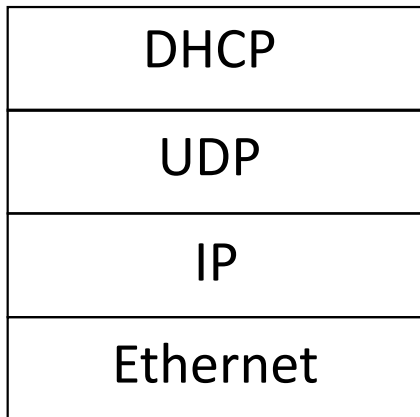   - Shifts burden from users to IT folk

What's my IP?

Use A.B.C.D
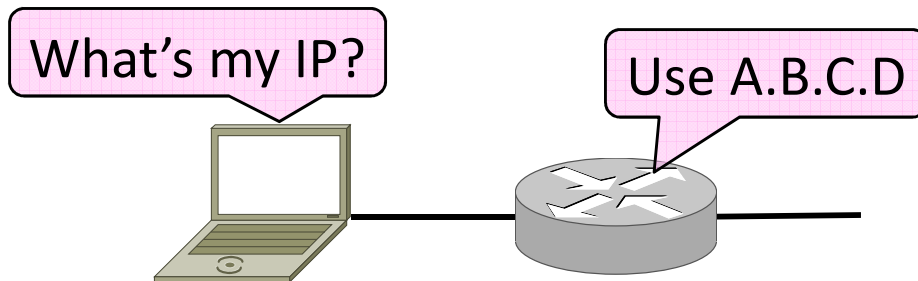
DHCP

- DHCP (Dynamic Host Configuration Protocol), from 1993, widely used

It leases IP address to nodes

Provides other parameters too

  Network prefix

  Address of local router

  DNS server, time server, etc.

DHCP Protocol Stack

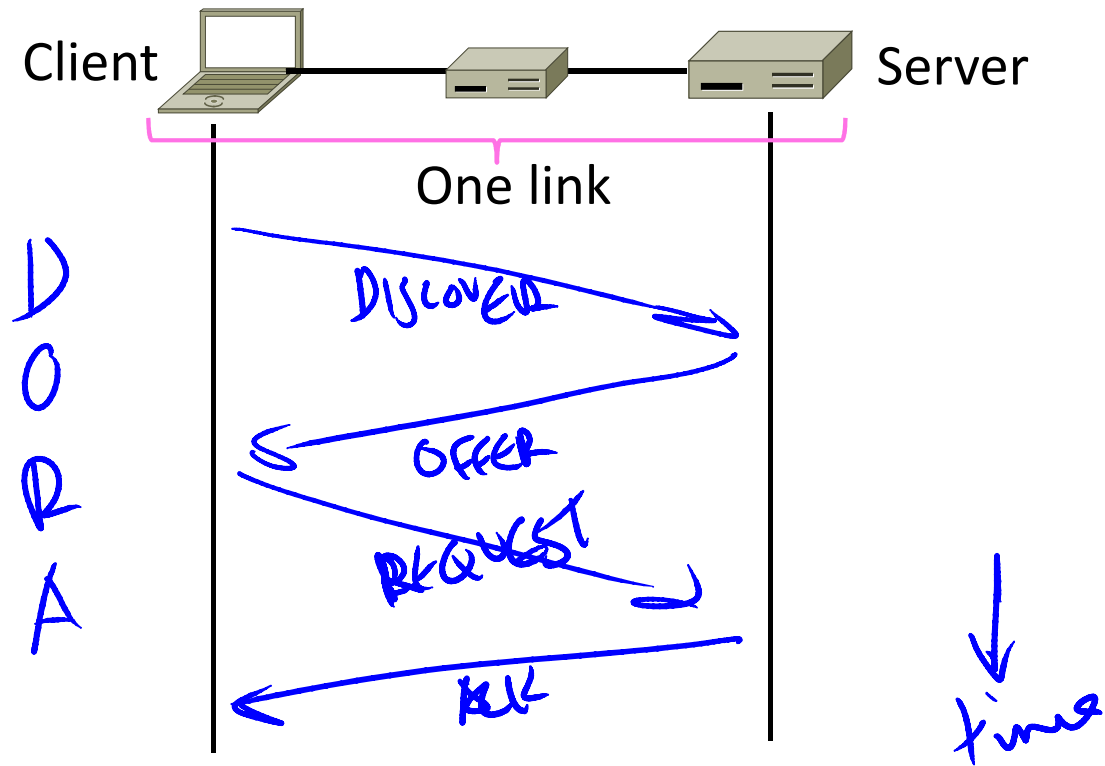- DHCP is a client-server application
  - Uses UDP ports 67, 68

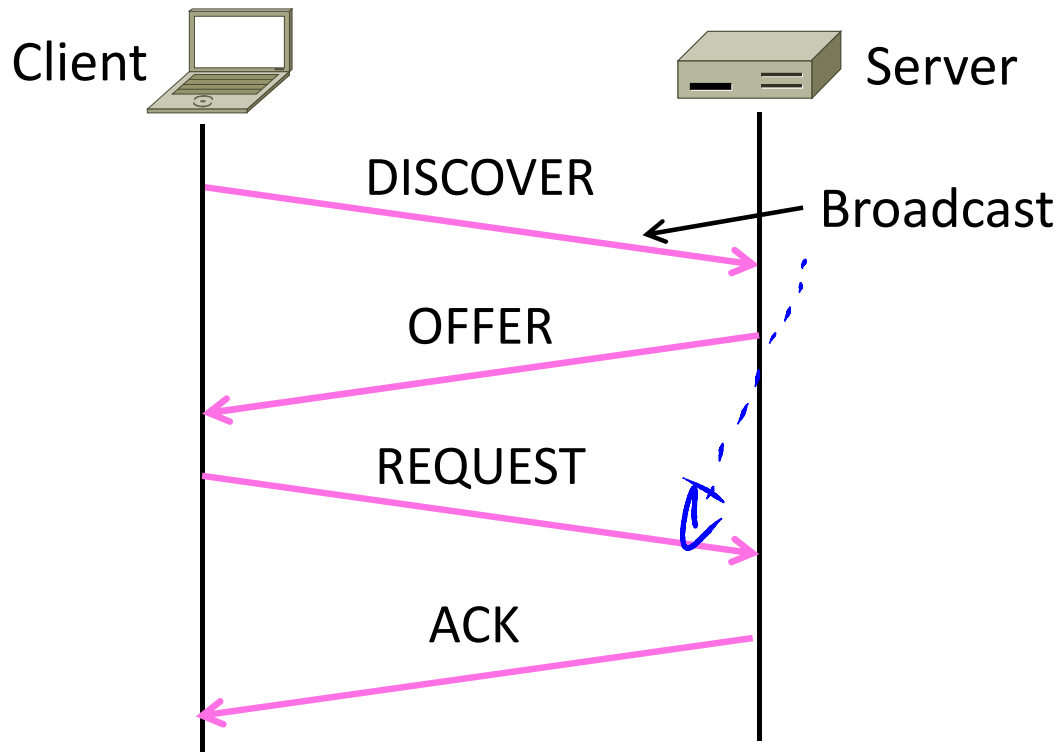| DHCP |
| --- |
| UDP |
| IP |
| Ethernet |

DHCP Addressing

- Bootstrap issue:
  - How does node send a message to DHCP server before it is configured?

- Answer:
  - Node sends broadcast messages that delivered to all nodes on the network
  - Broadcast address is all 1s
  - IP (32 bit): 255.255.255.255
  - Ethernet (48 bit): ff:ff:ff:ff:ff:ff

DHCP Messages

Client   Server

One link

D
O
R
A

DISCOVER

OFFER

REQUEST

ACK

time

DHCP Messages (2)

Client

Server

DISCOVER → Broadcast

OFFER

REQUEST

ACK

DHCP Messages (3)

- To renew an existing lease, an abbreviated sequence is used:
  - REQUEST, followed by ACK

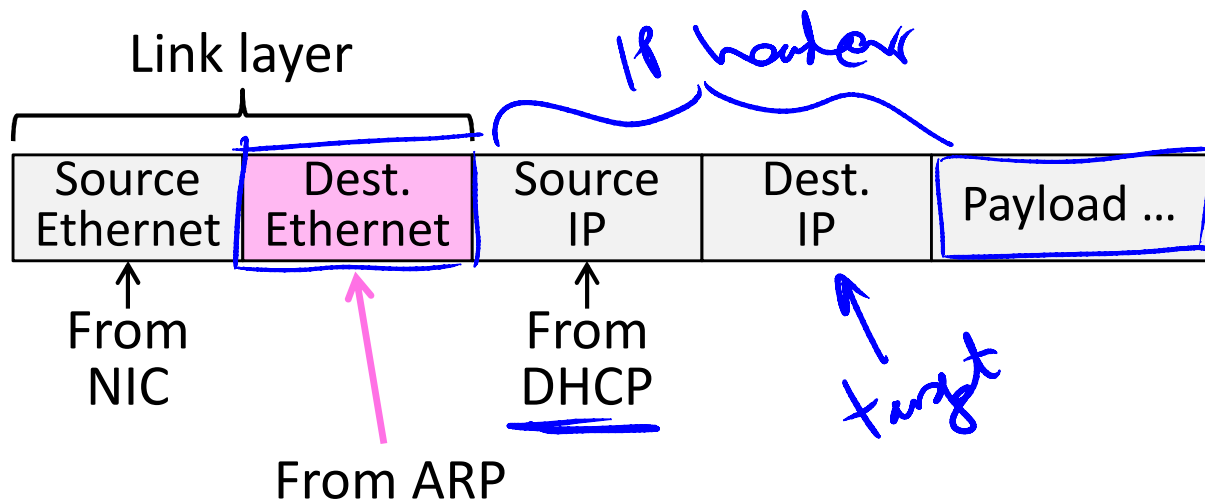- Protocol also supports replicated servers for reliability

Sending an IP Packet

- Problem:
  - A node needs <u>Link layer addresses</u> to send a frame over the local link
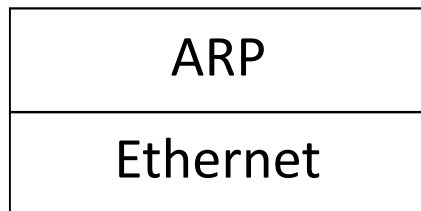 - How does it get the destination link address from a destination IP address?

Uh oh …

My IP is 1.2.3.4
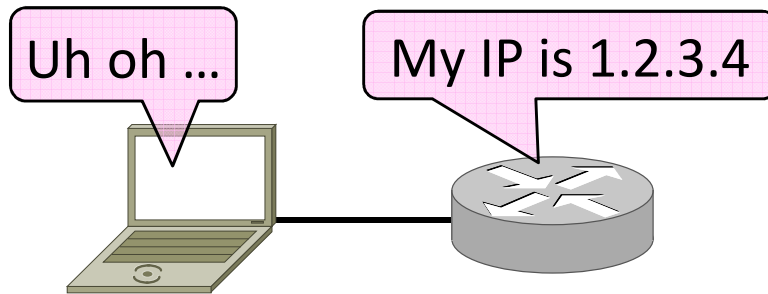
ARP (Address Resolution Protocol)

- Node uses to map a local IP address
  to its Link layer addresses

Link layer

IP header

Source Ethernet	Dest. Ethernet	Source IP	Dest. IP	Payload ...

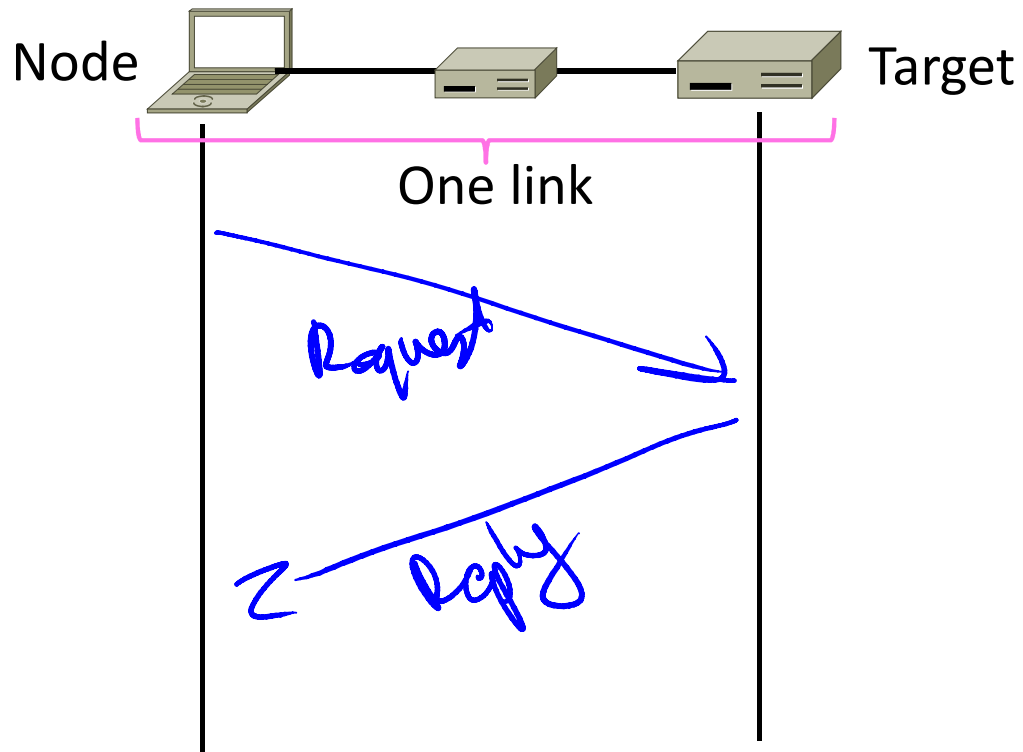From NIC

From ARP

From DHCP

target

ARP Protocol Stack

Address Resolution Protocol

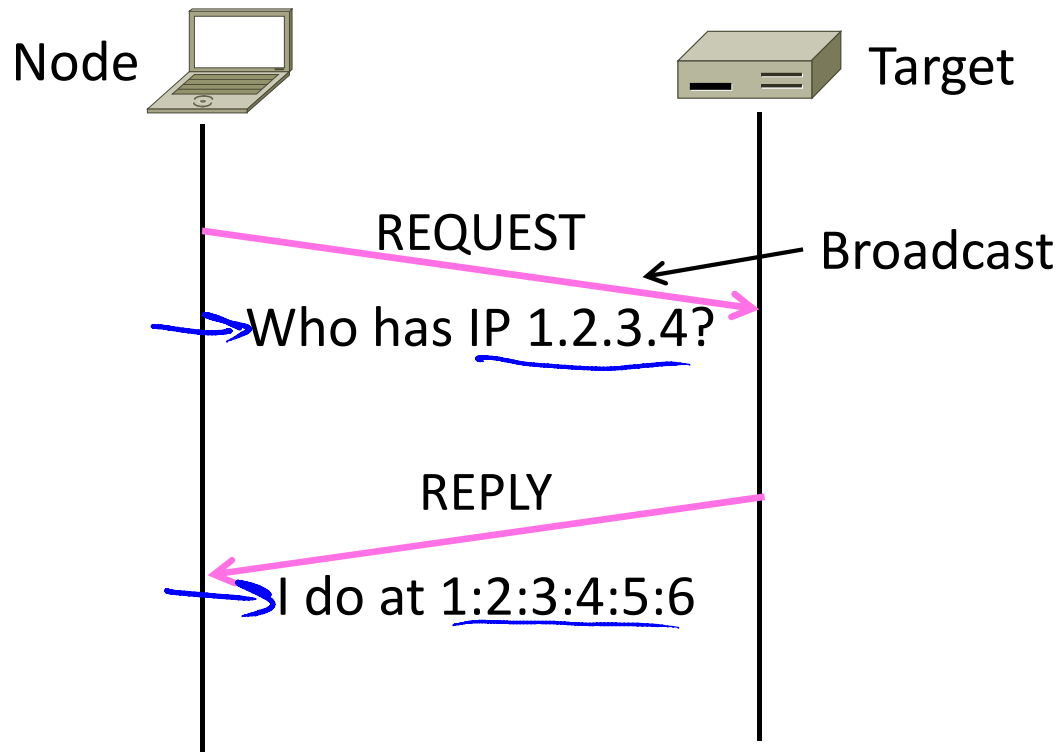- ARP sits right on top of link layer
  - No servers, just asks node with target IP to identify itself
  - Uses broadcast to reach all nodes

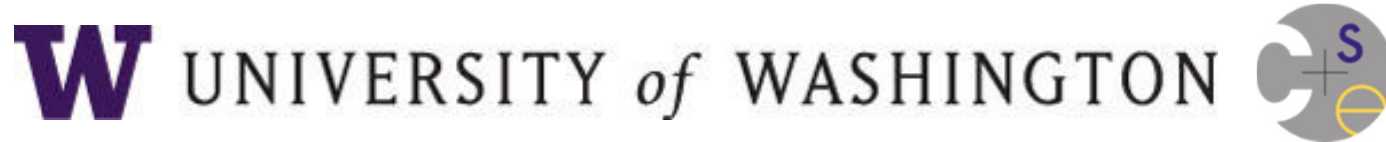| ARP |
|-----|
| Ethernet |

ARP Messages

Node Target

One link

Request

Reply

ARP Messages (2)

Node

Target

REQUEST
Broadcast

Who has IP 1.2.3.4?

REPLY

I do at 1:2:3:4:5:6

Discovery Protocols

- Help nodes find each other
  - There are more of them!
    - E.g., zeroconf, Bonjour

- Often involve broadcast
  - Since nodes aren't introduced
  - Very handy glue

END

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