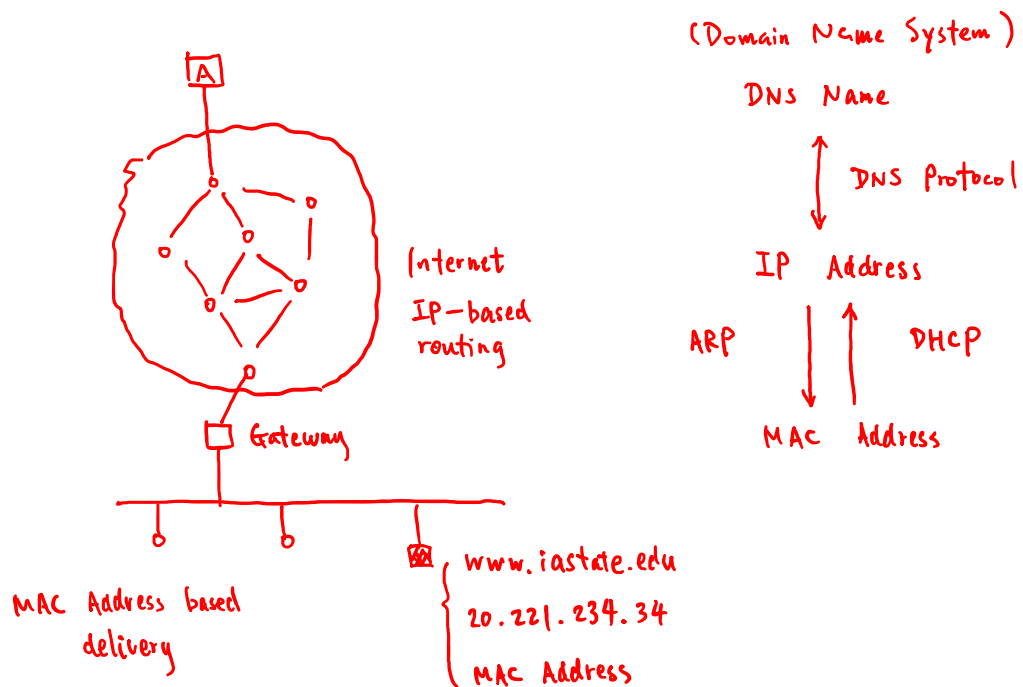


## Topic 5: Network Layer

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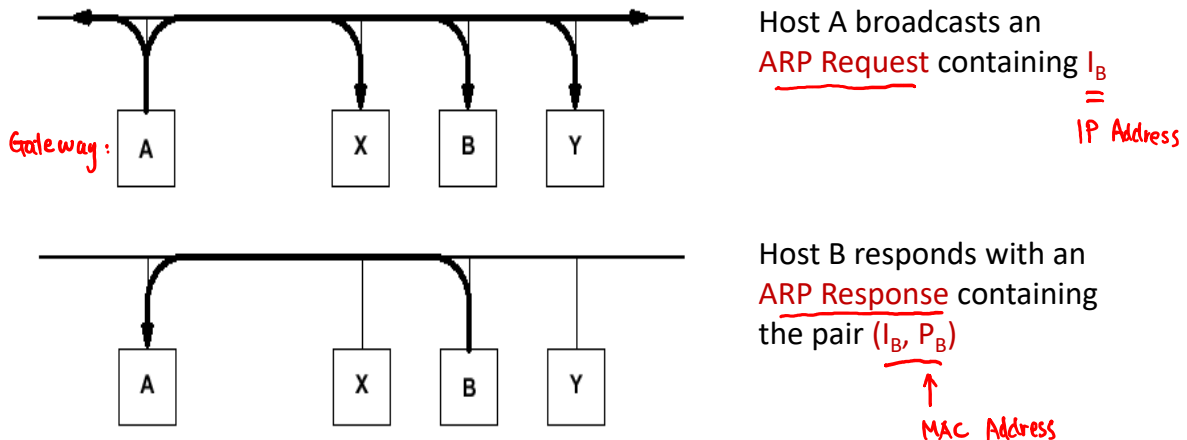
## Name and Address

- ⊕ DNS name in ASCII string: (dns)
  - ➡ [www.iastate.edu](http://www.iastate.edu)
- ⊕ IP address in dotted-decimal ASCII string (dd):
  - ➡ 20.221.234.34
  - IPv4 32 bits
  - IPv6 128 bits
- ⊕ IP address in 32-bit binary representation (b):
  - ➡ 00010100 11011101 11101010 00100010
- ⊕ Difference between a DNS name and an IP address
  - ➡ Names are meaningful, easy to remember
    - Variable-length, difficult for router to process
  - ➡ Addresses have fixed length, rigid hierarchical structure
    - Easy for router to process

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## ARP (Address Resolution Protocol)

- ⊕ ARP allows a host to find the MAC address of a target host on the same physical network, given the target host's IP address



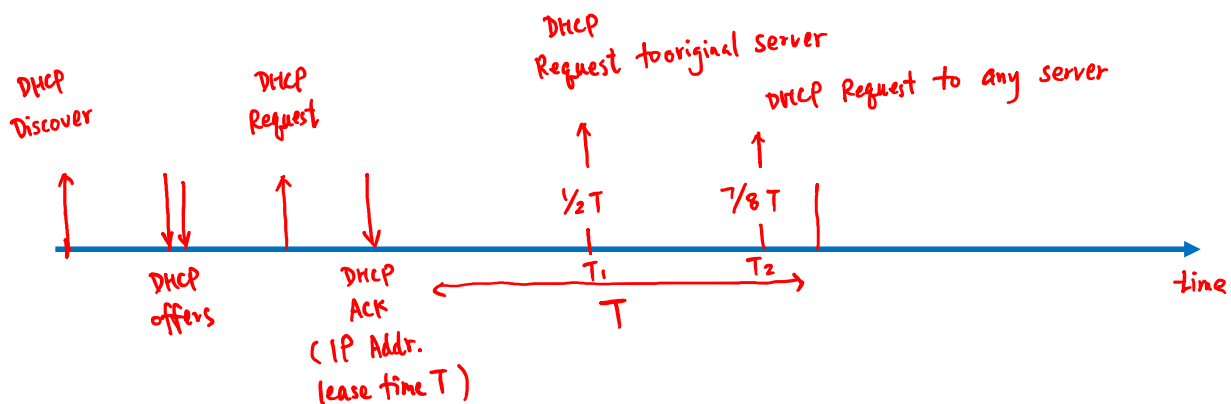
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## DHCP (Dynamic Host Configuration Protocol)

### Bootup Protocol

- + BOOTP allows a diskless workstation to be remotely booted up in a network
  - Well-known UDP ports 67 (server) & 68 (client) BOOTP/UDP/IP
- + DHCP builds on BOOTP to allow servers to deliver configuration information to a host
  - Used extensively to assign temporary IP addresses to hosts
  - Allows ISP to maximize usage of their limited IP addresses
- + DHCPv6 for IPv6
  - UDP ports 547 (server) & 546 (client)

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## DHCP Operation

- ✦ Host broadcasts **DHCP Discover** message on its physical network
- ✦ Servers reply with **DHCP Offer** messages:
  - (IP Address + Configuration Information)
- ✦ Host selects one offer and broadcasts **DHCP Request** message
- ✦ The selected server allocates IP address for lease time **T**
  - Sends **DHCP ACK** message with **T**, and two time thresholds **T1** ( $= 0.5T$ ) and **T2** ( $= 0.875T$ )
  - At **T1**, host attempts to renew lease by sending **DHCP Request** message to the original server
  - If no reply by **T2**, host broadcasts **DHCP Request** to any server
  - If no reply by **T**, host must relinquish the IP address and begin the DHCP process from scratch

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### Properties

Name:	Ethernet 3
Description:	Intel(R) Ethernet Connection I217-LM
Physical address (MAC):	98:90:96:d9:d0:b0
Status:	Operational
Maximum transmission unit:	1500
Link speed (Receive/Transmit):	1000/1000 (Mbps)
DHCP enabled:	Yes
DHCP servers:	10.10.67.166
DHCP lease obtained:	Tuesday, March 19, 2024 8:50:23 AM
DHCP lease expires:	Tuesday, March 19, 2024 9:50:23 AM
IPv4 address:	10.24.101.131/22
IPv6 address:	
Default gateway:	10.24.103.254
DNS servers:	129.186.78.200, 129.186.140.200, 129.186.142.200, 129.186.1.200
DNS domain name:	ece.iastate.edu
DNS connection suffix:	ece.iastate.edu
DNS search suffix list:	
Network name:	iastate.edu
Network category:	Domain
Connectivity (IPv4/IPv6):	Connected to Internet / Connected to unknown network

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