Address Resolution Protocol (ARP)

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- To know the MAC address of the Router/Host
- Frame requires MAC address to move forward
- **ARP request** packet is sent that contains MAC and IP address of the sender and IP address of the destination
- Sender doesn't know the MAC address of the receiver, therefore broadcast address is used
- Every host/router receives and process the ARP request packet
- Intended receiver (present in the same network) recognizes and sends back **ARP response** packet
- Sender stores the MAC address in a table for future reference called **ARP Cache**
- Time till which MAC address remain in ARP cache is **ARP cache timeout**

Address Resolution Protocol (ARP)

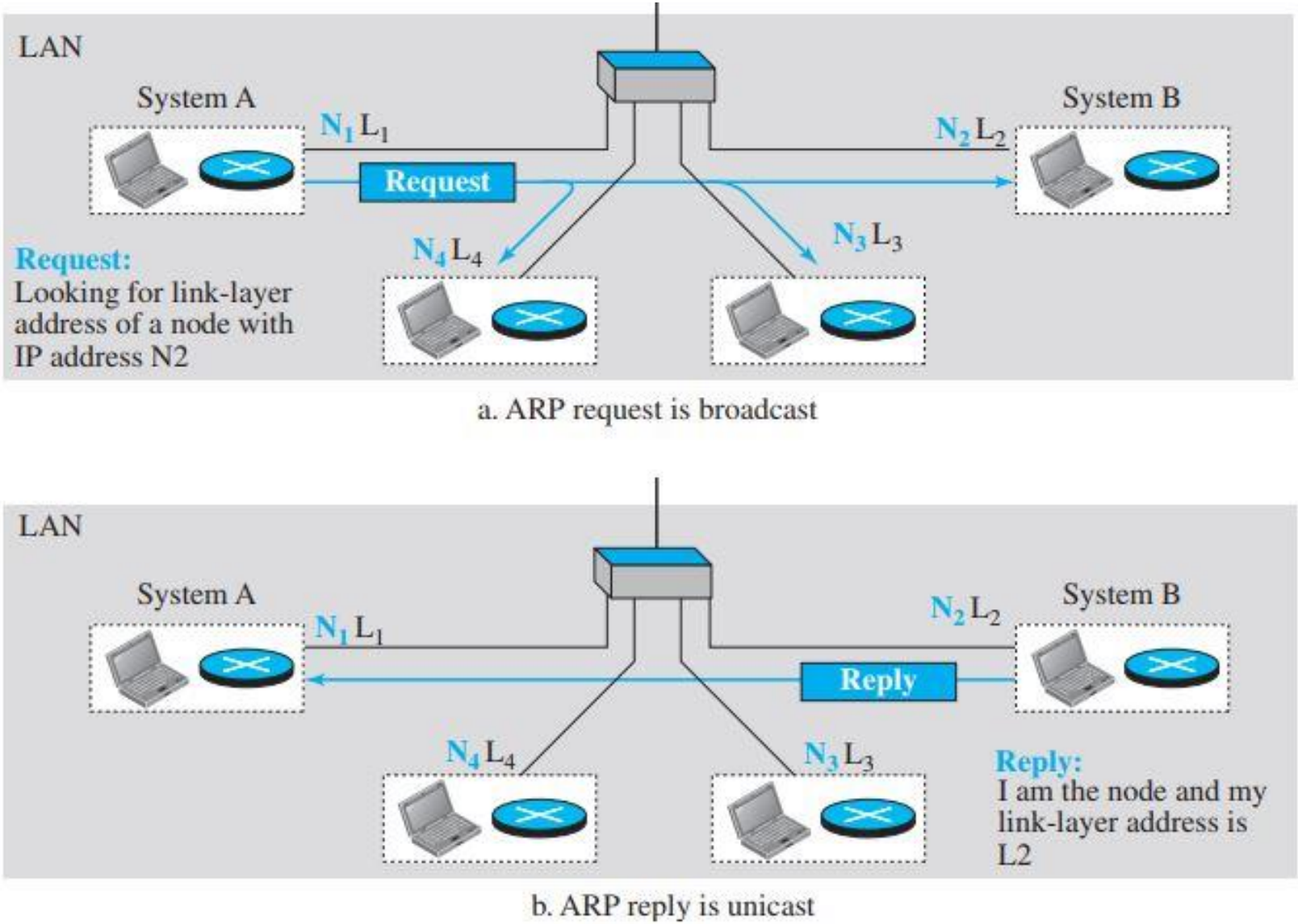
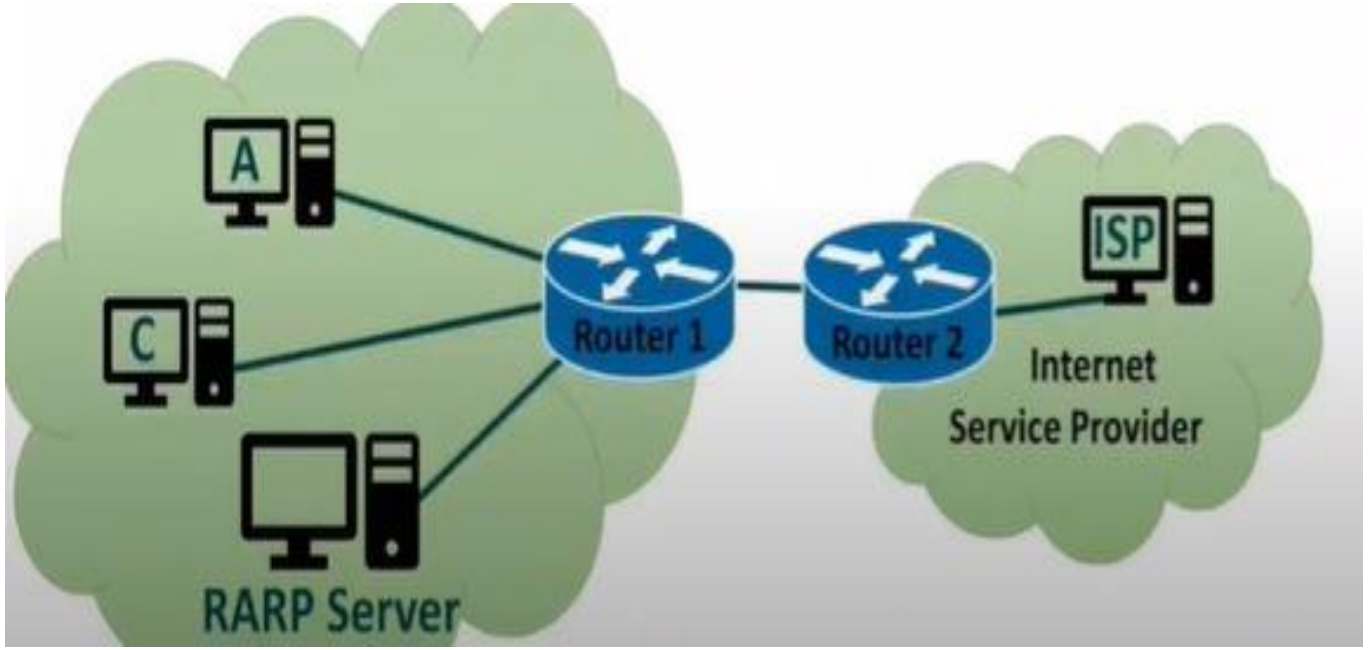


Fig 1. ARP Protocol

Reverse Address Resolution Protocol (RARP)

- To know the IP address of the newly arrived host
- Requesting IP address from the RARP server
- RARP server has MAC to its corresponding IP address mapping
- RARP request is received by all the hosts and only RARP server will response
- RARP server must be present within the same network
- RARP doesn’t provide authentication or security mechanism
- RARP is replaced by DHCP

Reverse Address Resolution Protocol (RARP)



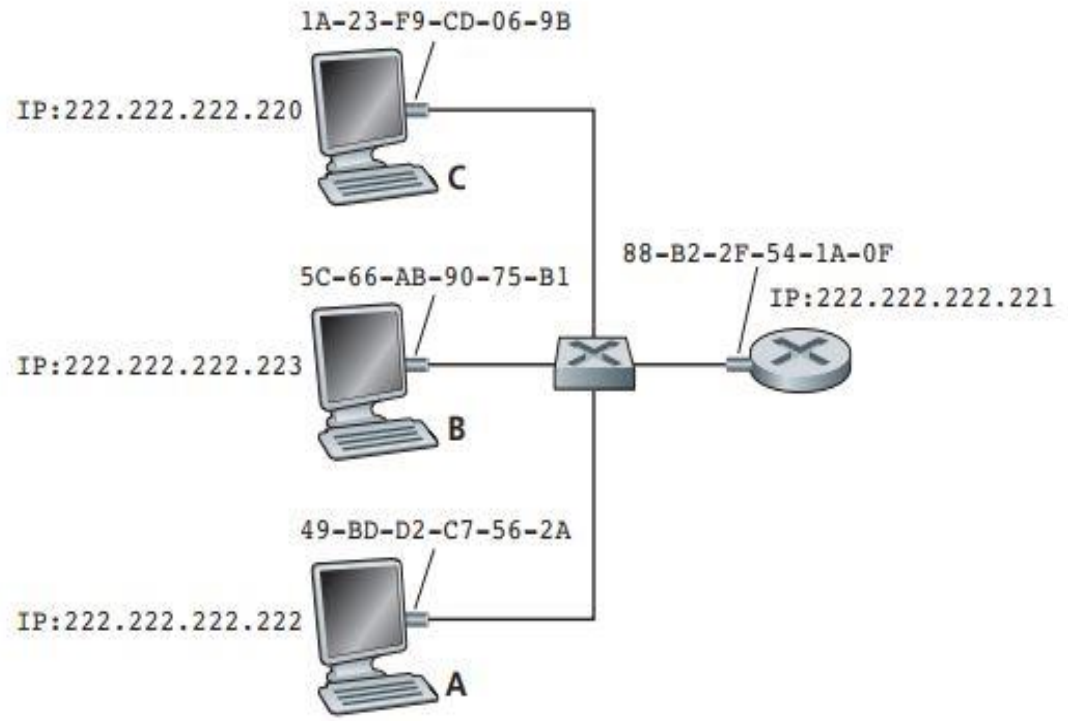


Fig 2. RARP Protocol

Bootstrap Protocol (BOOTP)

- BOOTP use UDP (User Datagram Protocol) messages which router can forward
- Transport layer protocol which provides IP address
- BOOTP is assisted by relaying

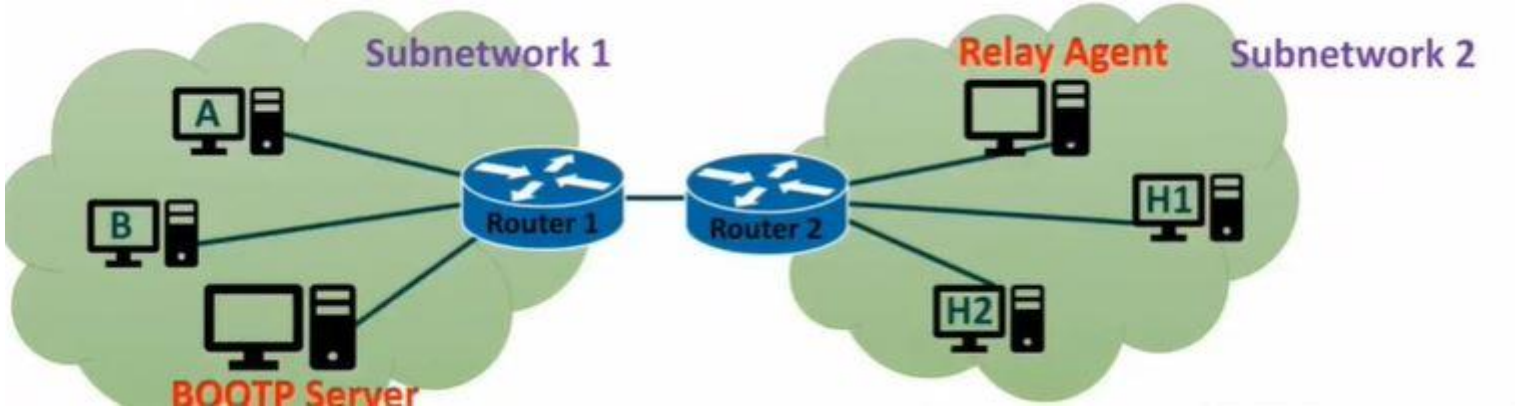


Fig 3. BOOTP Protocol

Bootstrap Protocol (BOOTP)

- BOOTP uses a static table for IP assignments
- IP address is occupied even if the user is not using it
- Results in shortage of IP address

Dynamic Host Configuration Protocol (DHCP)

- DHCP is an application layer protocol
- It can assign permanent IP address (routers/servers) or temporary IP address based on demand (hosts)
- It also provides subnet mask, IP address of the router (default gateway), IP address of DNS server
- ***DHCPDISCOVER*** message is broadcasts by client
- ***DHCPOFFER*** message is broadcasts by server so that another server (if any) can give better offer
- Client selects the best offer among all
- ***DHCPREQUEST*** is broadcasts by client to know other servers that their offer is rejected
- Selected server broadcasts ***DHCPACK*** message to let another server knows that offer is accepted
- If address given to another host in between the process ***DHCPNACK*** message is broadcast to let another server knows that offer is rejected

Dynamic Host Configuration Protocol (DHCP)

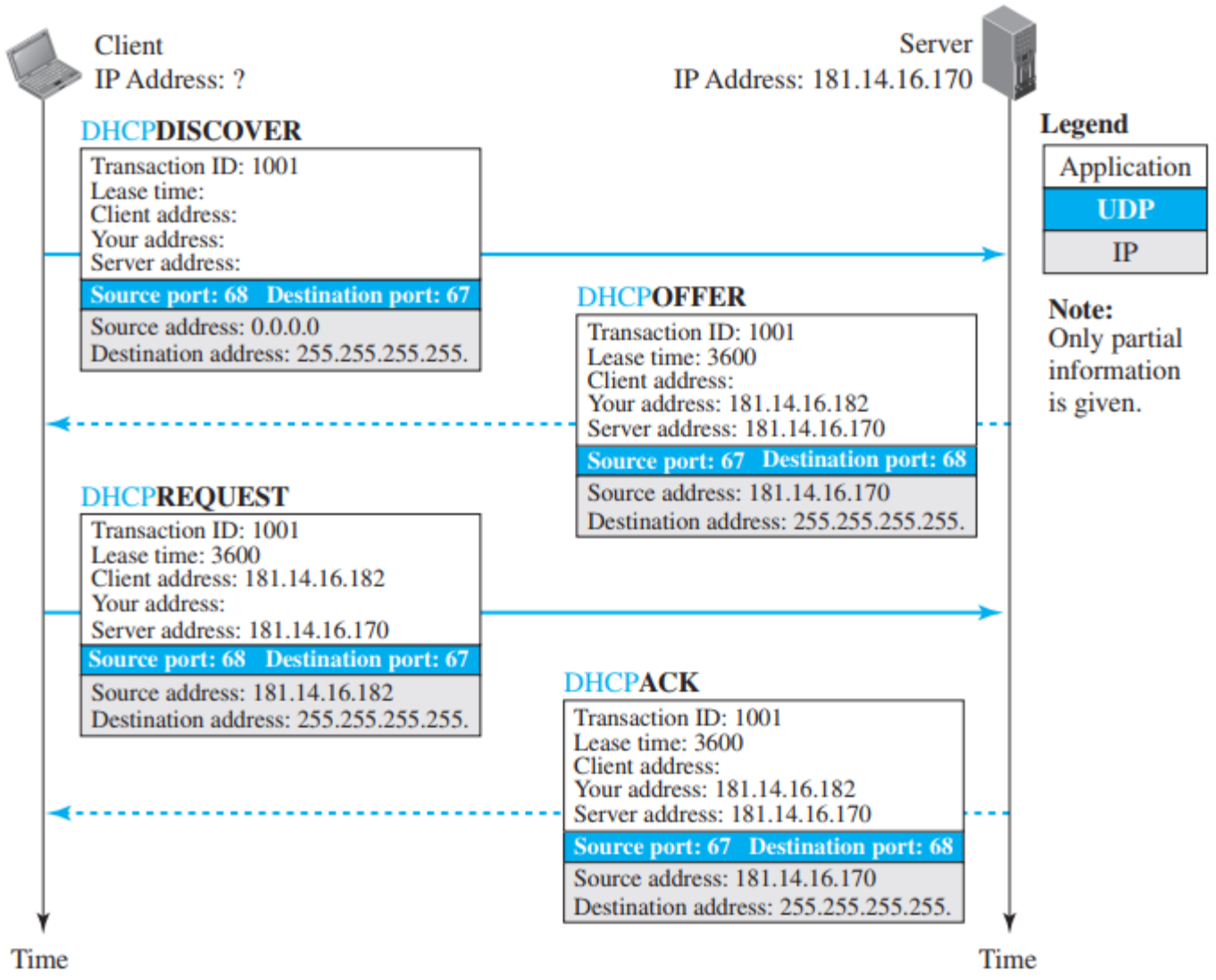


Fig 4. DHCP Protocol

Internet Control Message Protocol (ICMP)

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- **IP layer is unreliable, no error-reporting mechanism**
- **ICMP is network layer protocol**
- **Destination Unreachable**
  - Server is down
  - “Destination host is not reachable”
- **Source Quench**
  - Network encountered congestion and datagram is dropped
  - Source needs to slow down sending more datagrams
- **Redirection Message**
  - Source sends datagram to the wrong router
- **Parameter Problem**
  - Issue in the header of the datagram

Internet Control Message Protocol (ICMP)

- **Query Messages**
  - To test the liveliness of host and routers
  - To find one-way or round-trip time of a datagram between two devices
  - To test whether a clock in two devices are synchronized

- **Debugging**
  - Ping
  - Traceroute

Internet Group Management Protocol (IGMP)

- **Multicasting communication**
  - Used by hosts and router
  - IP layer protocol

- **Messages**
  - Query message is periodically sent by a router
  - Asking hosts about their interest in membership
  - Report message is sent by the hosts as a response

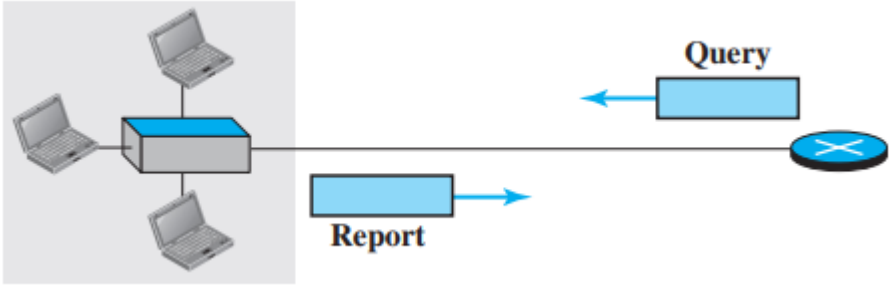

Fig 4. IGMP Messages

Internet Group Management Protocol (IGMP)

- **General Query Message**
  - Asking about membership in any group
  - Encapsulated in datagram with destination address 224.0.0.1 (all hosts and routers)
  - Informing other routers to refrain sending this same message

- **Group-Specific Query Message**
  - Asking about membership in a specific group
  - Sent by router when it doesn't receive information about a member from a specific group

- **Source-And-Group-Specific Query Message**
  - Asking about a particular member from a specific group
  - It happens when a specific source/sources is communicating with router

- **Multicast Tree**