Data Link Layer

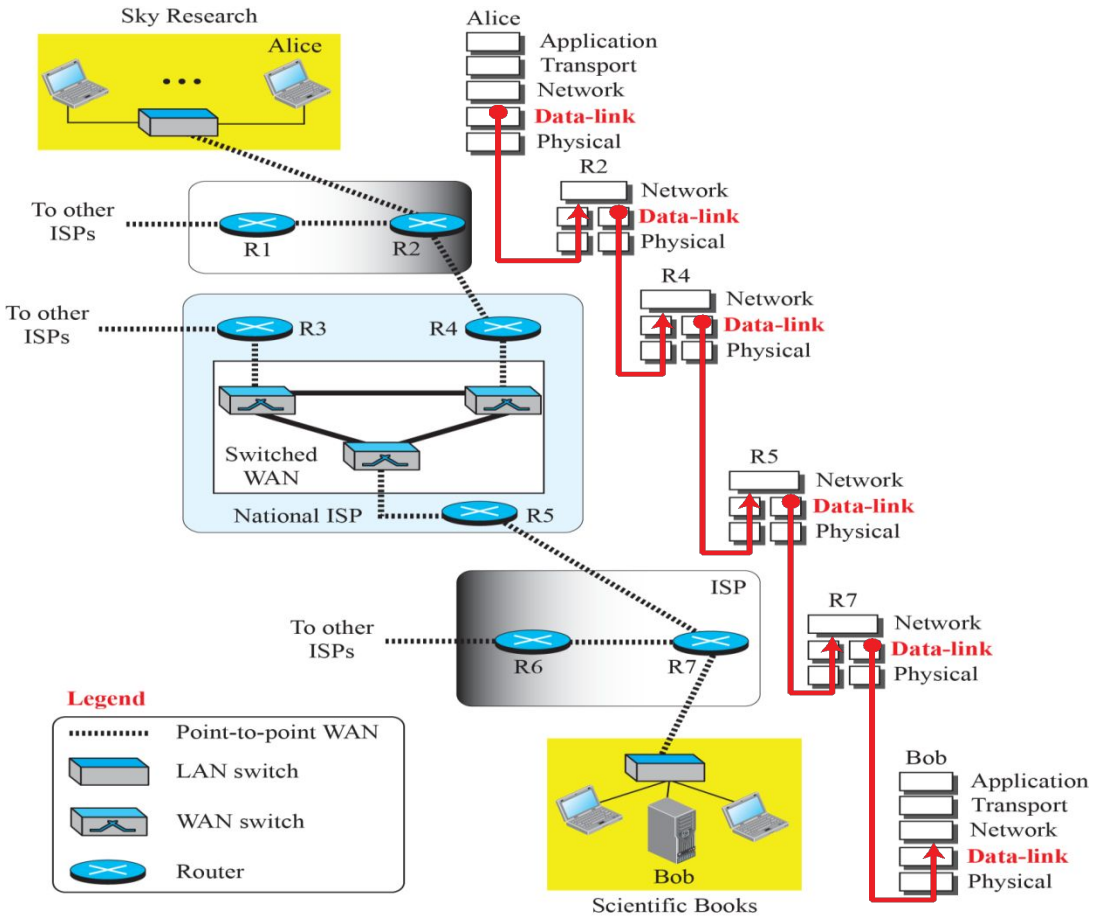
Session Objectives

After going through this session you will be able to understand:

- ✔ Node to node communication
- ✔ Nodes and Links
- ✔ Data link control layer
- ✔ Media access control layer

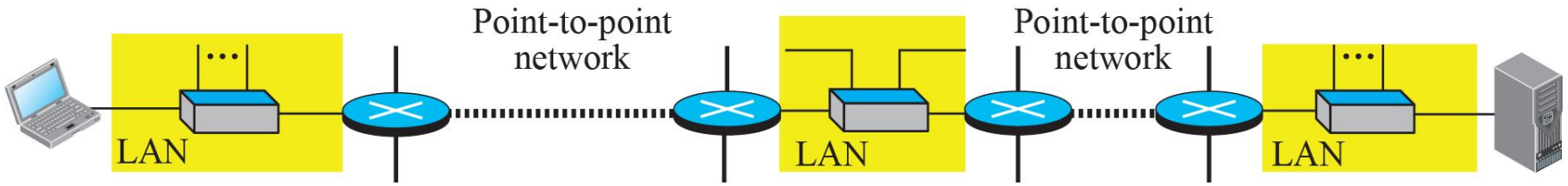
Node to Node Communication

- ✔ The Internet is a combination of networks glued together by connecting devices (routers or switches).
- ✔ If a packet is to travel from a host to another host, it needs to pass through these networks.

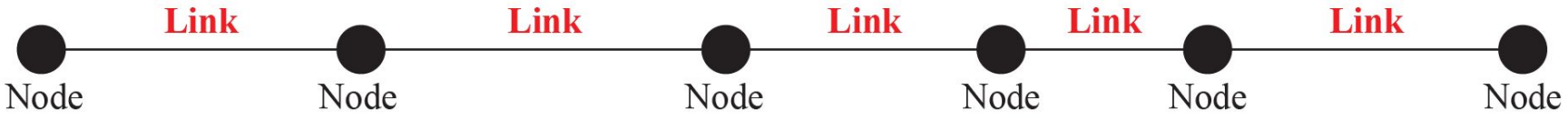


Nodes and Links

- Communication at the data-link layer is node-to-node.
- A data unit from one point in the Internet needs to pass through many networks (LANs and WANs) to reach another point.
- Theses LANs and WANs are connected by routers.
- The routers are taken as nodes and the networks in between as links.



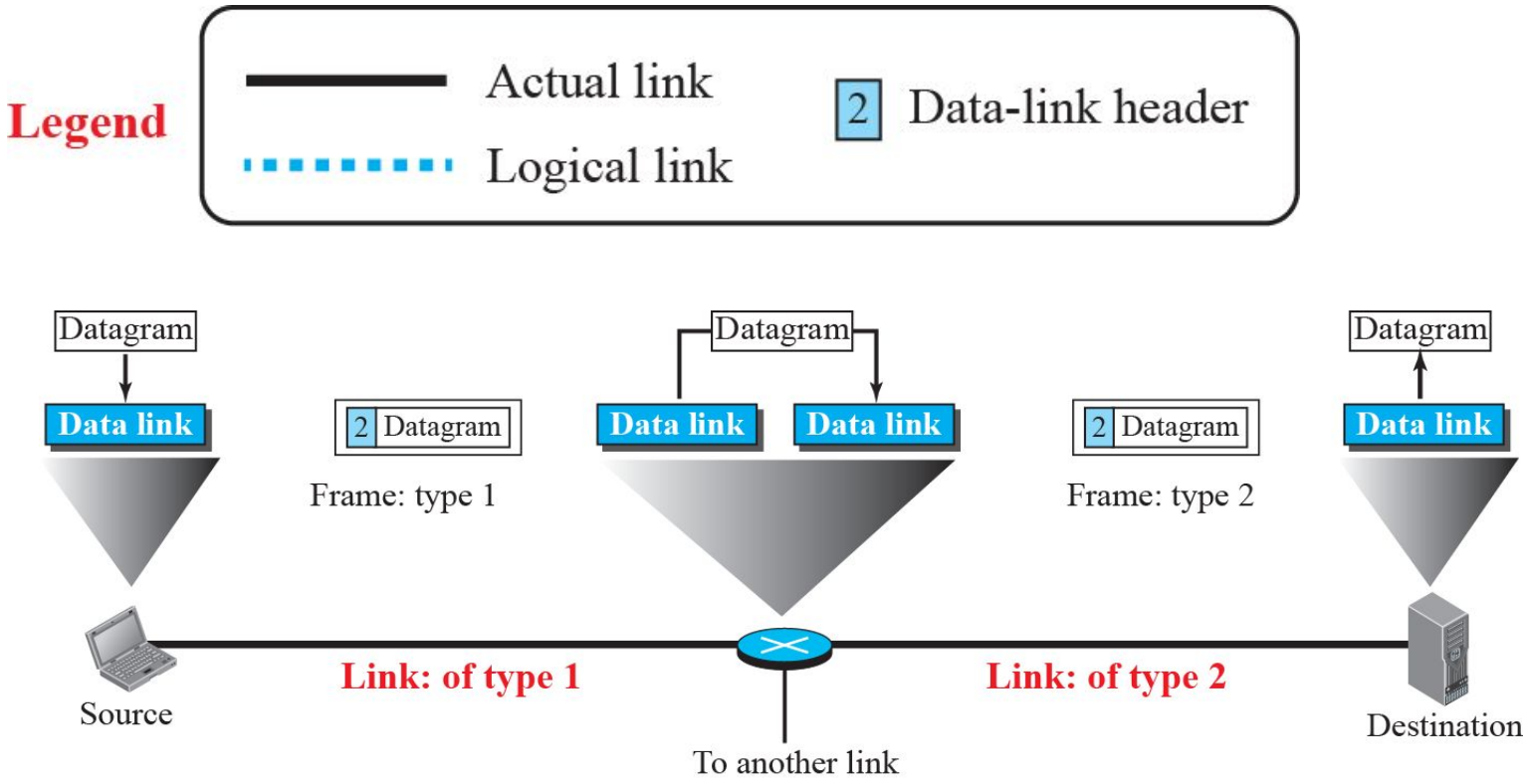
a. A small part of the Internet

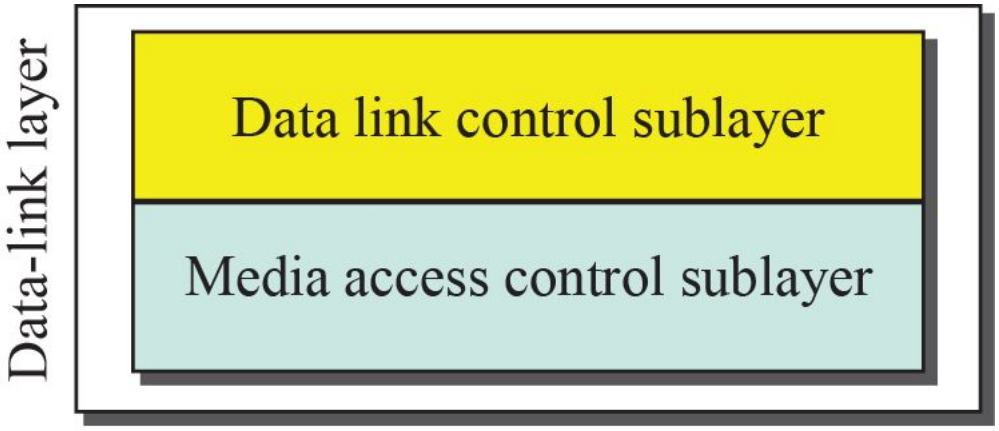


b. Nodes and links

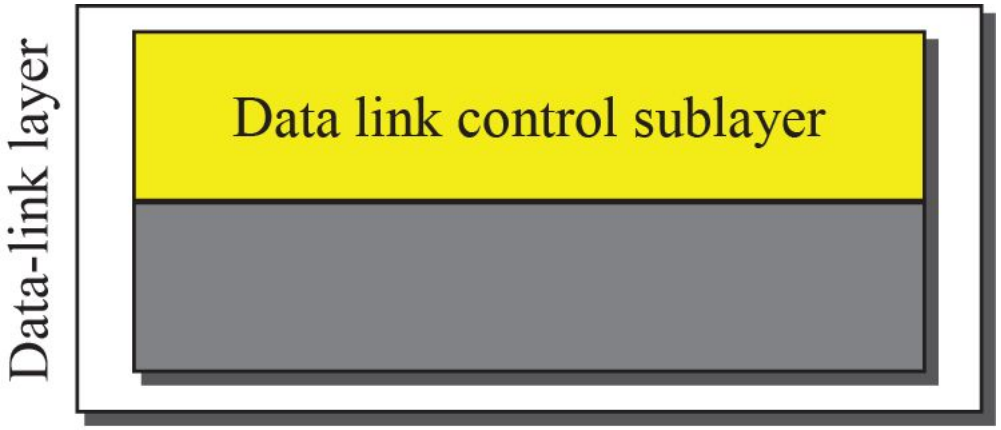
Data Link Layer Services

- The data-link layer provides services to the network layer; it receives services from the physical layer.
- Services at Data Link layer can be divided into two sub layers: data link control (DLC) and media access control (MAC).



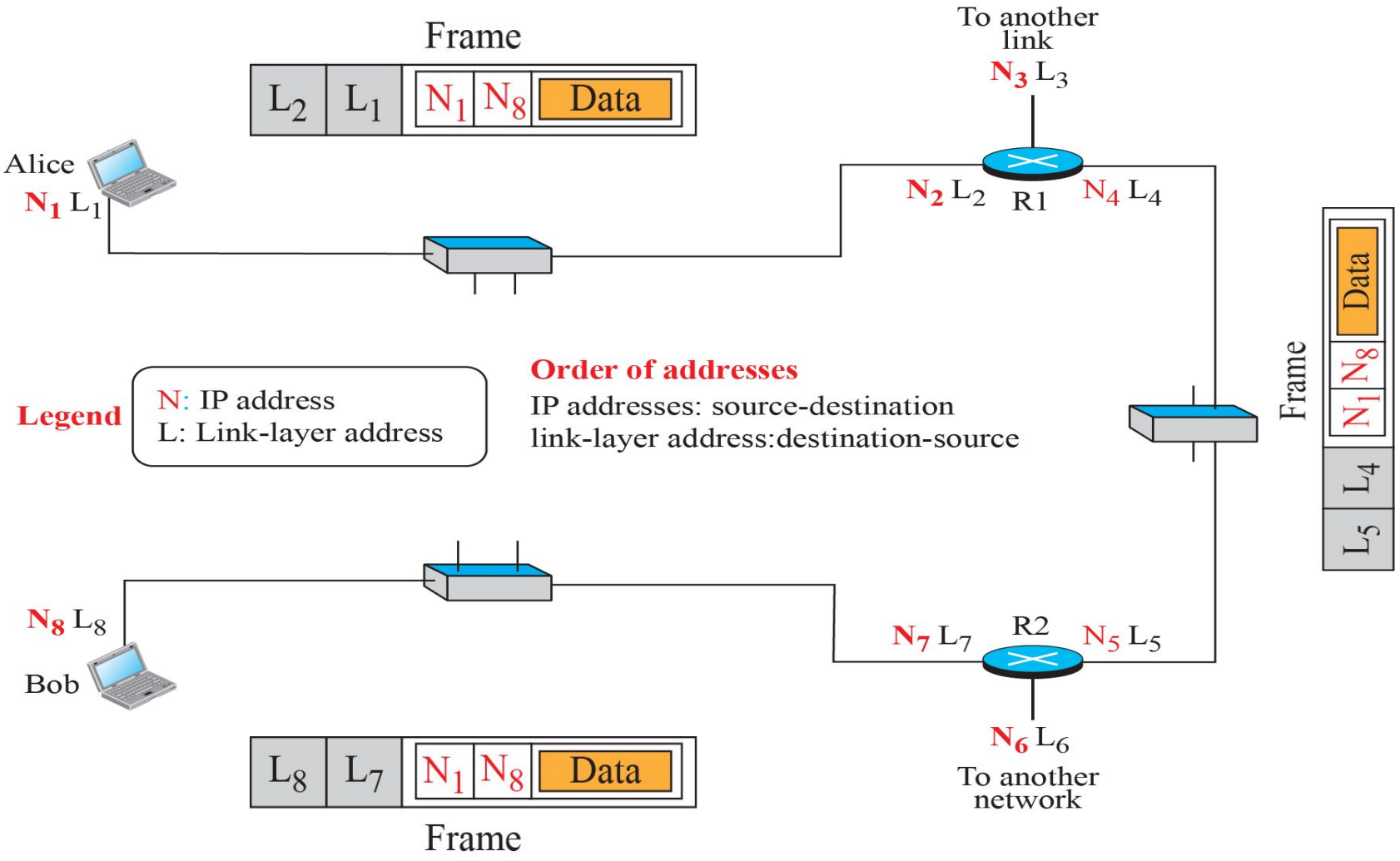


a. Data-link layer of a broadcast link



b. Data-link layer of a point-to-point link

IP and Link Layer Addressing



Three Level of Addressing

- Link-layer protocols define three types of addresses: unicast, multicast, and broadcast.
- The **MULTICAST** link-layer addresses are 48 bits (six bytes) that are presented as 12 hexadecimal digits separated by colons. The **second digit needs to be an odd number**.

A3:34:45:11:92:F1

- The **UNICAST** link-layer addresses are 48 bits (six bytes) that are presented as 12 hexadecimal digits separated by colons. The **second digit, however, needs to be an even number in hexadecimal.**

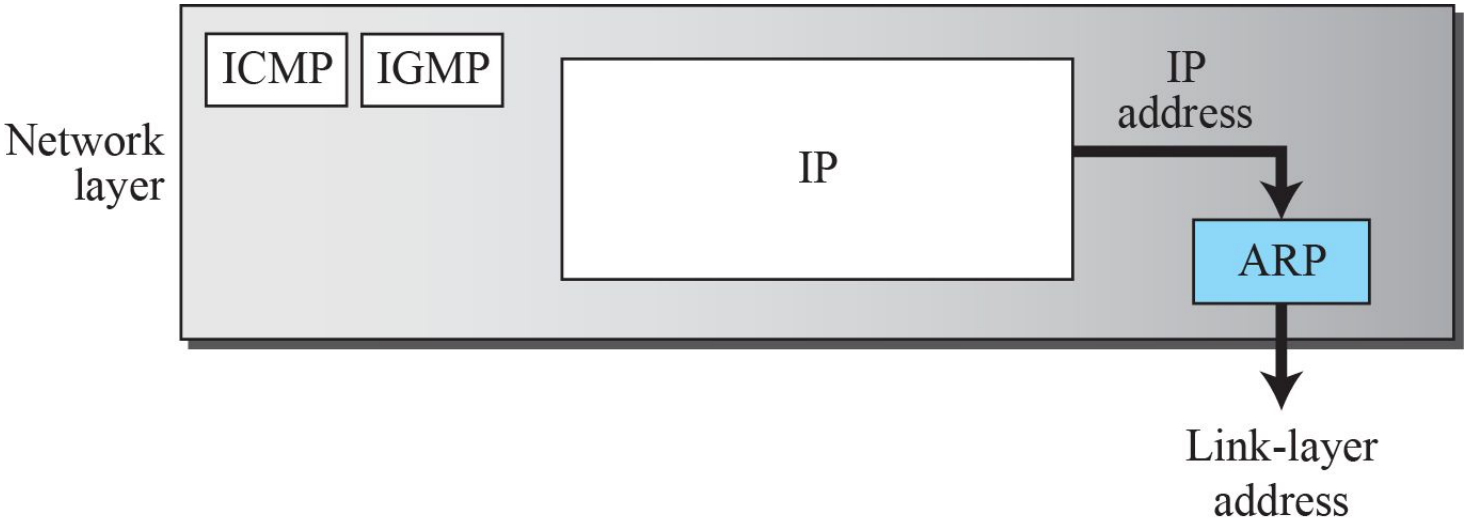
A2:34:45:11:92:F1

- The **BROADCAST** link-layer addresses are 48 bits, all 1s, that are presented as 12 hexadecimal digits separated by colons.

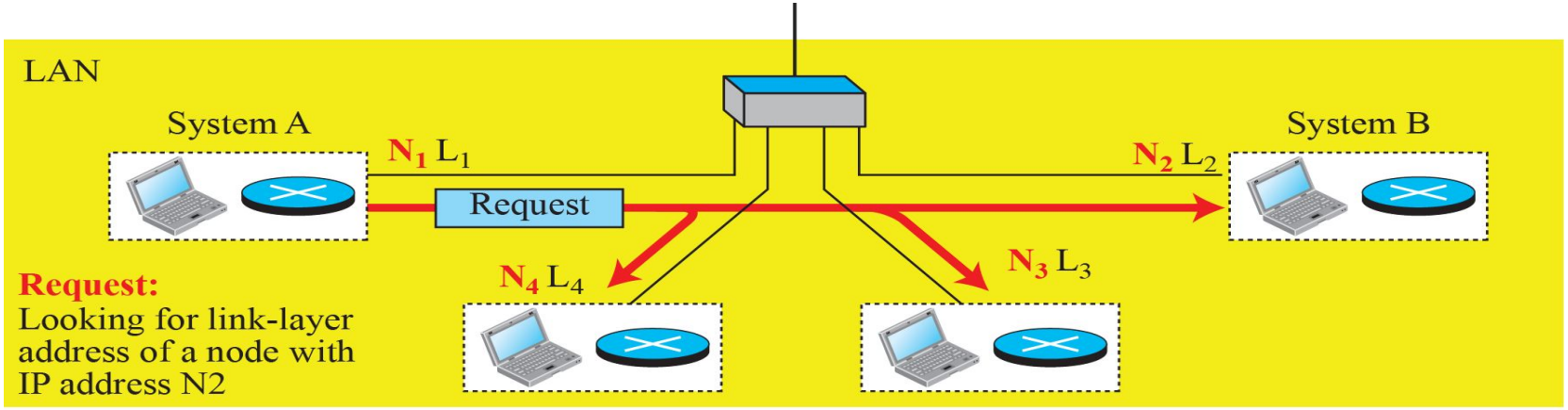
FF:FF:FF:FF:FF:FF

Address Resolution Protocol (ARP)

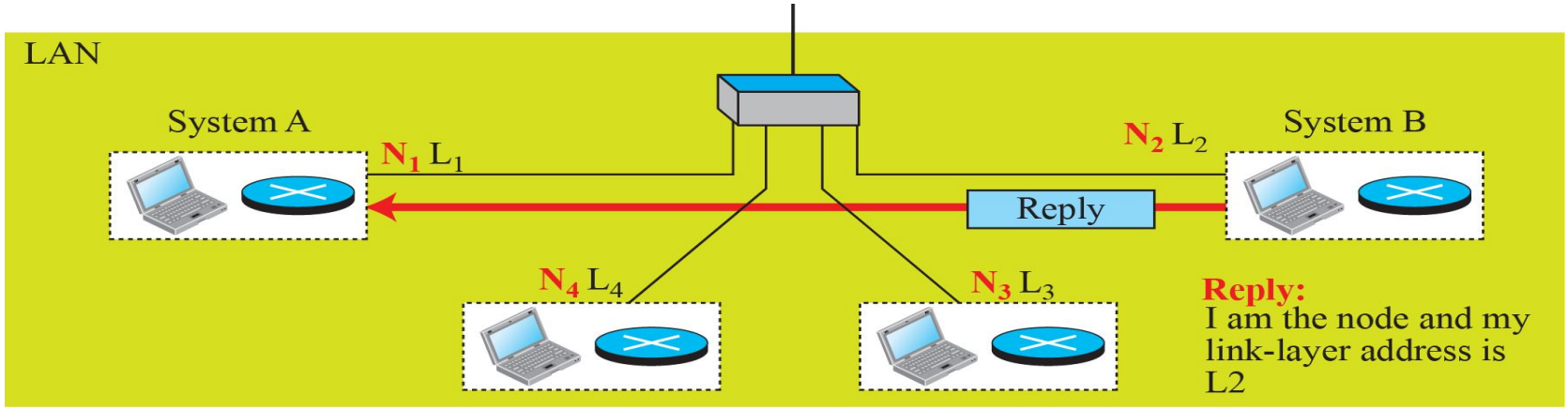
- Anytime a node has an IP datagram to send to another node in a link, it has the IP address of the receiving node.
- However, the IP address of the next node is not helpful in moving a frame through a link; we need the link-layer address of the next node.
- This is the time when the Address Resolution Protocol (ARP) becomes helpful.
- Position of ARP in TCP/IP protocol suite is shown below.



ARP Operation



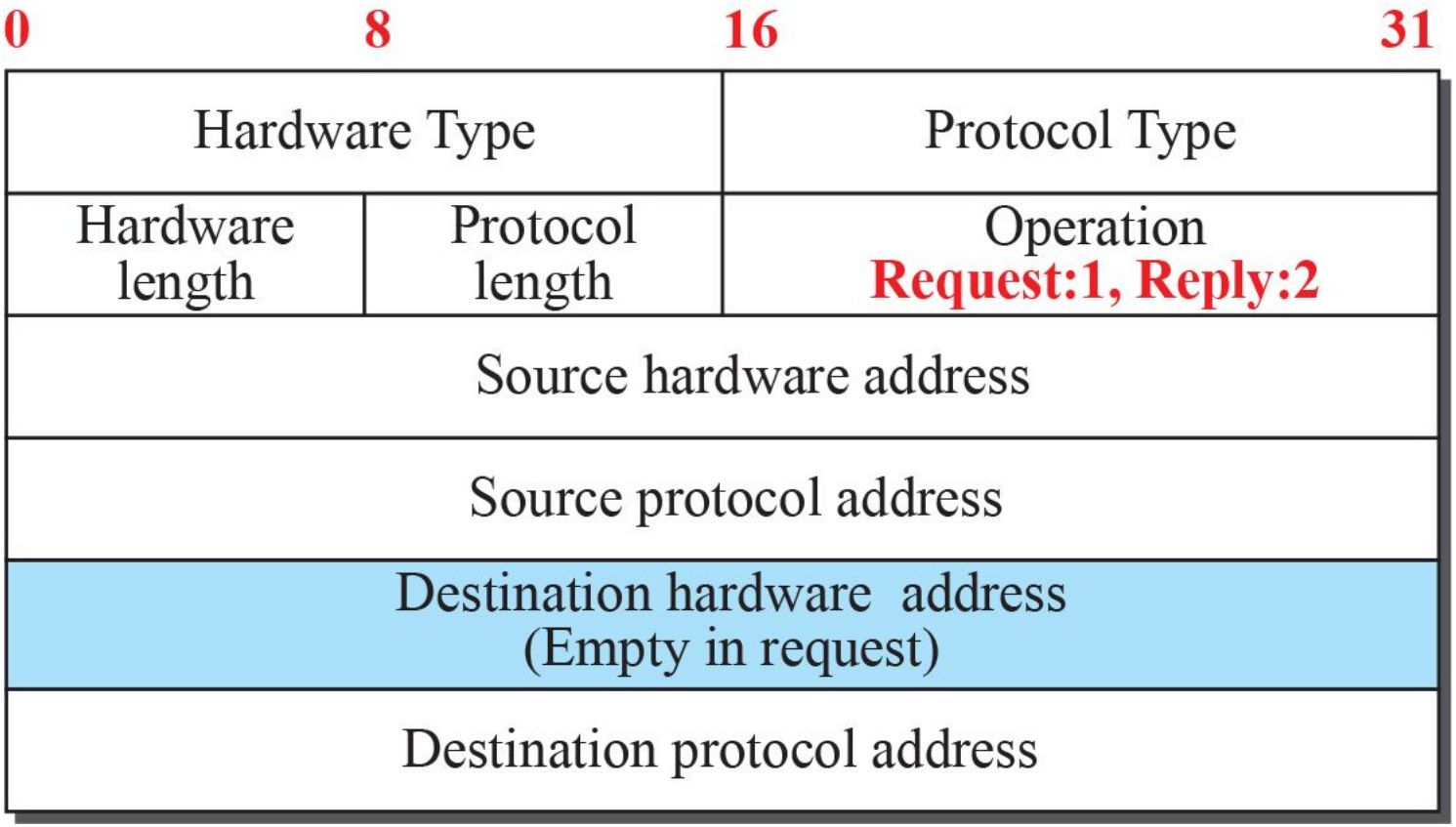
a. ARP request is broadcast



b. ARP reply is unicast

ARP Packet Format

Hardware: LAN or WAN protocol
Protocol: Network-layer protocol



Summary

In this section we have discussed the following:

- ✔ Link and Nodes
- ✔ Communication at Data Link Layer
- ✔ ARP protocol


Thank
you!