



SNS COLLEGE OF ENGINEERING



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Department of Information Technology

Course Name – 19IT401 Computer Networks

II Year / IV Semester

Unit 2 – Link Layer

Topic 1- Services, ARP





Link Layer - Services



Services

- Framing
- Flow Control
- Error Control
- Congestion Control

Framing

- A packet at the data-link layer is normally called a frame.
- Framing enables the message to reach the destination by adding physical address of sender and destination.
- The data-link layer at each node needs to encapsulate the datagram in a frame before sending it to the next node.
- The node also needs to decapsulate the datagram from the frame received on the logical channel.
- Frames can be of fixed or variable size.



Link Layer - Services

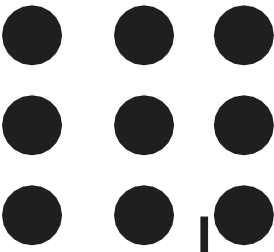


Flow Control

- If the receiving rate is less than the transmission rate, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.
- Flow control is a set of procedures that tells the sender how much data it can transmit before it must wait for an acknowledgment from the receiver.
- An acknowledgment (ACK for short) is a small control frame that a protocol sends back to its peer saying that it has received an earlier frame
- If the sender does not receive an acknowledgment after a reasonable amount of time, then it retransmits the original frame. This is known as timeout.
- The strategy of using acknowledgments and timeouts to implement reliable delivery is called automatic repeat request (ARQ).
- The ARQ mechanism available:
 - o Stop and Wait ARQ
 - o Sliding Window
 - Go Back N ARQ
 - Selective Repeat ARQ



Link Layer - Services



Error Control

- The data link layer adds reliability to the physical layer by adding a trailer to detect and retransmit damaged/lost frames and to recognize duplicate frames.
- Since electromagnetic signals are susceptible to error, a frame is susceptible to error. The error needs first to be detected. Types of Error Detection – Two Dimensional Parity, Internet Checksum, Cyclic Redundancy Check (CRC)
- After detection, it needs to be either corrected at the receiver node or discarded and retransmitted by the sending node. Types of Error Correction – Hamming Code
- Bit errors are introduced into frames because of electrical interference or thermal noise. This interference can change the shape of the signal
- The two types of error are single-bit error and burst error. Single-bit error means that only 1 bit of a given data unit is changed. The term burst error means that 2 or more bits in the data unit have changed.



Link Layer - Services

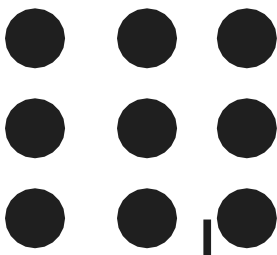


Congestion Control

- Congestion is a situation in Communication Networks in which too many packets are present in a part of the subnet, performance degrades.
- Congestion in a network may occur when the load on the network (i.e. the number of packets sent to the network) is greater than the capacity of the network (i.e. the number of packets a network can handle.).
- Network congestion occurs in case of traffic overloading.
- Congestion Control refers to techniques and mechanisms that can either prevent congestion, before it happens, or remove congestion, after it has happened.



Address Resolution Protocol (ARP)



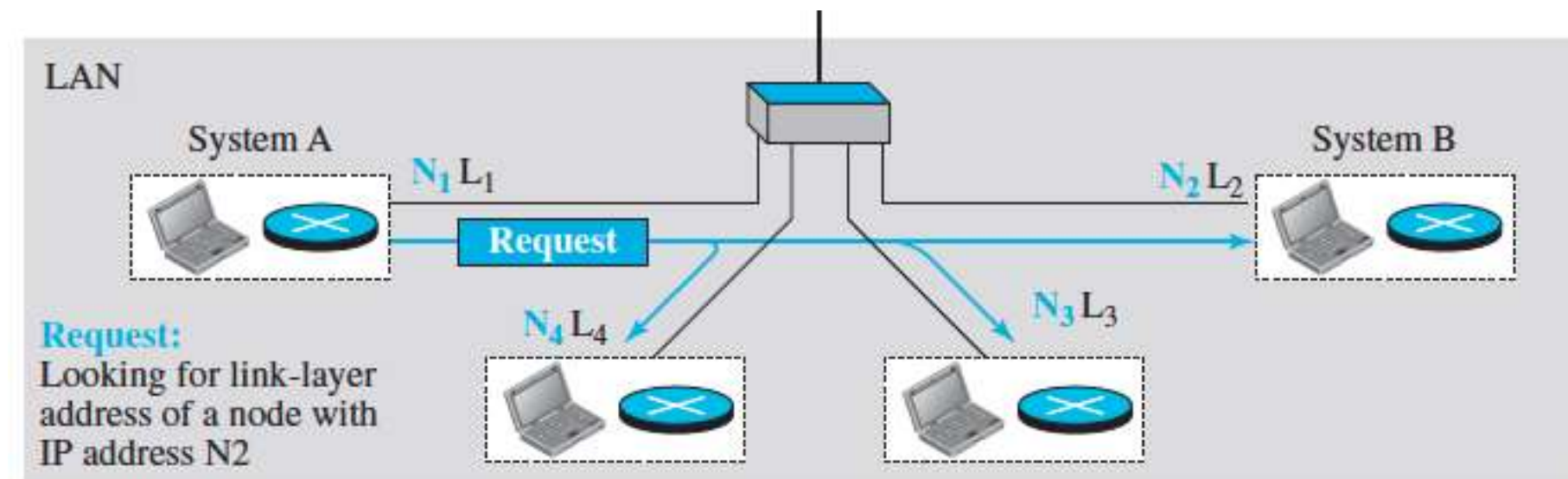
ARP

- A host or a router to send a IP datagram, needs to know both the logical and physical address of the receiver.
- The IP address is obtained from DNS (host) or from its routing table (router). The physical address of the receiver is needed to pass through the physical network.
- The address resolution protocol (ARP) enables to know the physical address of a node when the logical address is known.
- ARP accepts an IP address from the IP protocol, maps the address to the corresponding link-layer address, and passes it to the data-link layer.
- ARP enable each host on a network to build up a table of mappings between IP addresses and link-level addresses

Address Resolution Protocol (ARP)

ARP Working Mechanism

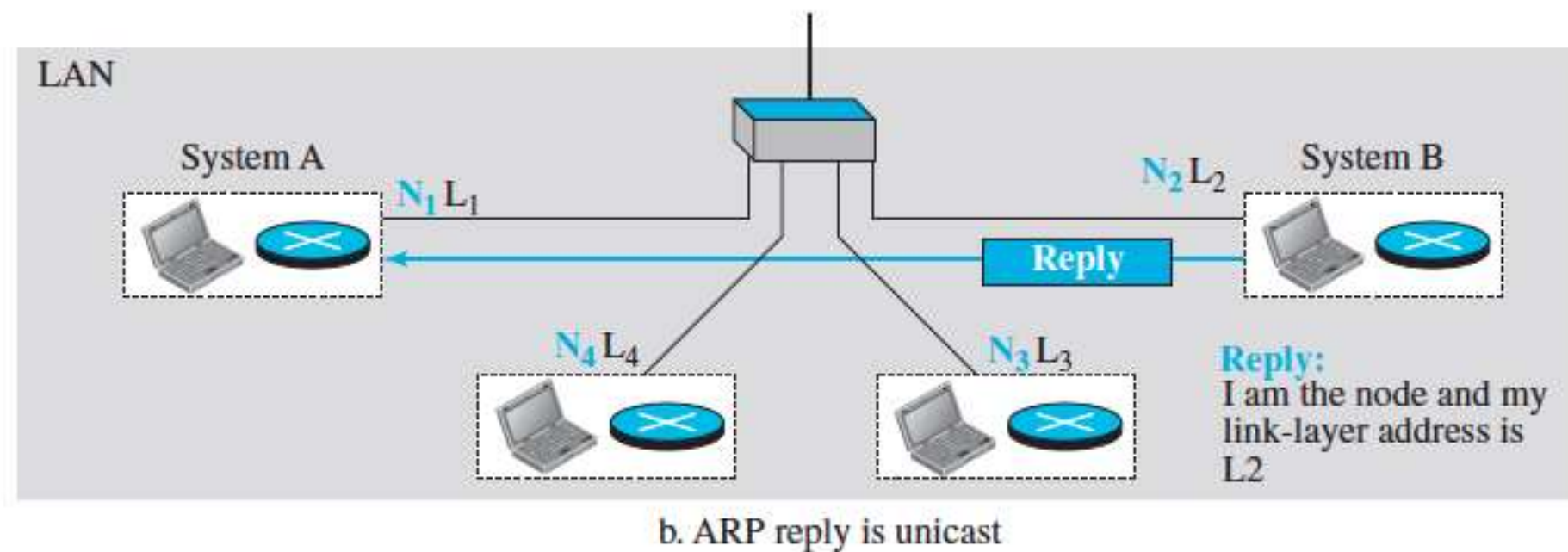
- Anytime a host or a router needs to find the link-layer address of another host or router in its network, it sends an ARP request packet.
- An ARP request packet is created with value for operation field as 1.
- The packet includes the link-layer and IP addresses of the sender and the IP address of the receiver.
- Because the sender does not know the link-layer address of the receiver, the query is broadcast over the link using the link-layer broadcast address.
- The target physical address field is unknown and is filled with 0s (broadcast).



Address Resolution Protocol (ARP)

ARP Working Mechanism

- Every host or router on the network receives and processes the ARP request packet, but only the intended recipient recognizes its IP address and sends back an ARP response packet.
- The target node constructs an ARP reply packet with value of 2 for operation.
- The response packet contains the recipient's IP and link-layer addresses. The packet is unicast directly to the node that sent the request packet.



Address Resolution Protocol (ARP)

Packet Format

0		8		16		31	
Hardware Type				Protocol Type			
Hardware length		Protocol length		Operation Request:1, Reply:2			
Source hardware address							
Source protocol address							
Destination hardware address (Empty in request)							
Destination protocol address							

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

Hardware type - defines the type of the network on which ARP is running. Each LAN has been assigned an integer based on its type. Ethernet has value 1.

Protocol type - specifies the protocol value. ARP can be used with any higher-level protocol. For IPv4 the value is 0x0800.



Address Resolution Protocol (ARP)

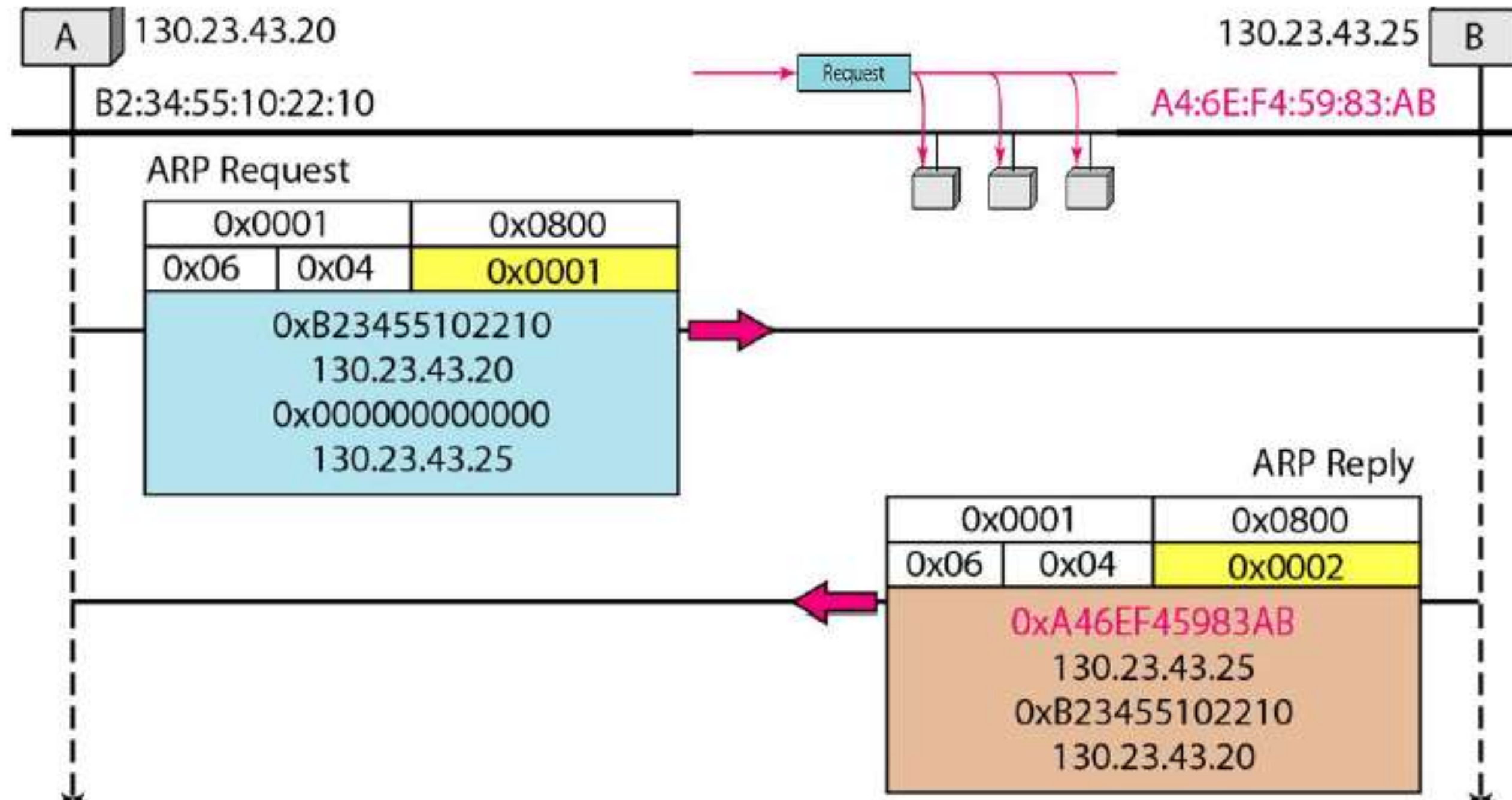


Packet Format

- Hardware length - specifies length of the physical address in bytes. For Ethernet, the value is 6
- Protocol length - specifies length of the logical address in bytes. For IPv4 protocol, the value is 4
- Operation - defines the type of packet. It is either ARP request (1) or ARP reply (2).
- Sender hardware address - a variable-length field contains physical address of the sender.
- Sender protocol address - a variable-length field contains logical address of the sender.
- Target hardware address - a variable-length field contains physical address of the target.
- Target protocol address - a variable-length field contains logical address of the target.

Address Resolution Protocol (ARP)

ARP Working Mechanism





THANK YOU