2023

COMPUTER NETWORKING

PACKET TRANSMISSION MODEL

INTRODUCTION

Aim:

To demonstrate the process of packet transmission from sender to receiver in a Full Duplex Network.

What is Packet Transmission?

Packet Transmission transmits data across digital networks by breaking it down into blocks or packets for more efficient transfer using various network devices.

What is Full Duplex Network?

A full-duplex network is a type of communication network where data can be transmitted in both directions simultaneously.

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3.COMPONENTS

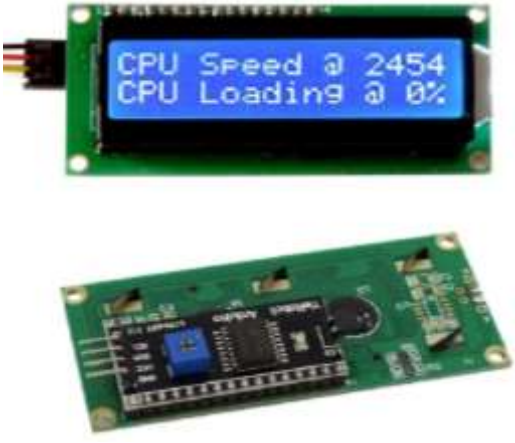
Arduino Uno R3 (1)

Arduino Uno R3 Data Cable (1)

9V2A Adapter

USB Male to Female

Type-C OTG



LCD I2C 16x2 (1)

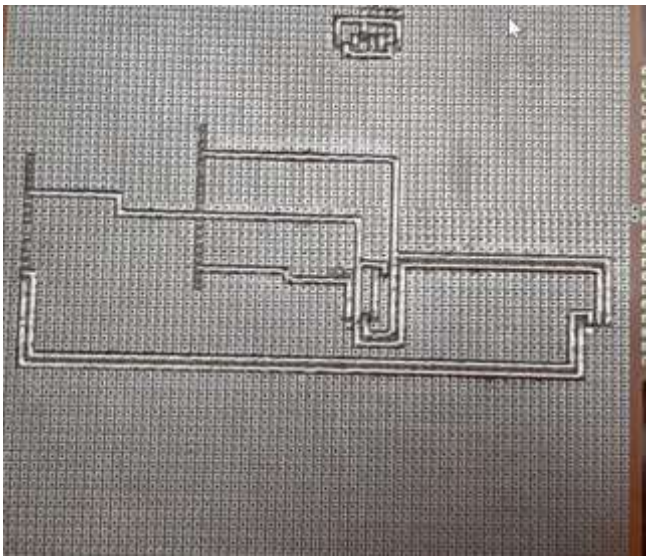
GPB – General Purpose Board

Neo pixel 16 LED Rings (WS2812B) Compatible

Neo pixel 8 LED Strips (WS2812B) Compatible (2)

3.1Components Usage:

- **Arduino Uno R3**: Code Processing.
- **Data Cable:** Connectivity with computing device.
- **USB Male to Female**: For data cable extension.
- **Type C OTG:** For phone connectivity.
- **LCD I2C 16x2:** For displaying the current activity taking place in the network.
- **Neopixel LED Strips:** For denoting transmission path.
- **Neopixel LED Rings:** For denoting hosts.
- **GPB:** For mounting and soldering components.
- **9V2A Adapter:** For Power supply.



4. Protocols Explanations

Our model demonstrates 3 Protocols:

1) Sliding Window Protocol
2) Go-Back-N Protocol
3) Selective Repeat Protocol

1) Sliding Window Protocol: -

The sliding window is a technique for sending multiple frames at a time. It controls the data packets between the two devices where reliable and gradual delivery of data frames is needed. It is also used in TCP.

We can see the detailed explain of the protocols in the explanation of model.

2) Go-Back-N Protocol: -

The Go-Back-N protocol is a specific type of sliding window protocol that uses a "window" of consecutive sequence numbers to ensure reliable transmission and reception of data. If an error is detected, the sender "goes back" and retransmits all the packets starting from the one that experienced an error, hence the name "Go-Back-N."

3) Selective Repeat Protocol: -

Suppose there are a sender and a receiver, and let's assume that there are 12 frames to be sent. These frames are represented as 0,1,2,3,4,5,6,7,8,9,10,11.

And while sending the frame one by one and if there is error in 8^{th} frame and the receiver receives the defective frame then the receiver sends the error Acknowledgement to the sender and the sender will sends ONLY 8^{th} frame to receiver.

5.Working of Model: -

24 LED ring: SENDER
12 LED ring: RECEIVER
8 LED light strip 1: Transmission channel for sending packets.
8 LED light strip 2: Transmission channel for sending acknowledgements.

Our model demonstrates 3 Protocols:
1) Sliding Window Protocol
2) Go-Back-N Protocol
3) Selective Repeat Protocol

5.1 Sliding Window Protocol: -

•In the terminal, if u Enter (1), the **sliding window protocol** will be executed in following manner:

Step 1: Sender generates 4 packets, each consisting of 6 bits, and assigns a different colour to each packet (Pink, Blue, White, Yellow).

Step 2: The sender starts sending the packets through the transmission channel. Meanwhile, the receiver starts receiving the packets. The transmission channel has a capacity of 8 bits, meaning it can transmit up to 8 bits at a time.

As soon as the receiver receives a packet, it generates an acknowledgment (ACK) for that particular packet. The ACK is assigned the colour Green. The receiver then sends the ACK to

the sender through another transmission channel, which is also 8 bits in capacity.

While the receiver is sending the ACK, it continues to receive the remaining packets from the sender. This allows for parallel processing of received packets and ACK generation. The sender continues sending all the packets to the receiver, one after the other, until all packets have been transmitted.

If the receiver successfully receives all the packets, it generates an acknowledgment for all the packets received. The receiver sends this acknowledgment to the sender, indicating that all the packets have been received successfully.

This protocol ensures reliable data transmission by using acknowledgments to confirm the receipt of packets. The sliding window technique allows for efficient transmission and acknowledgment handling by enabling parallel processing of packets and acknowledgments.

5.2 Go-Back-N Protocol: -

•In the terminal, if u Enter (2), the **Go-Back-N protocol** will be executed in following manner:

Step 1: The sender generates 4 packets, each consisting of 6 bits, and assigns a different colour to each packet: Packet 1 (Pink), Packet 2 (Blue), Packet 3 (White), and Packet 4 (Yellow).

Step 2: The sender starts sending the packets through the transmission channel, which has a capacity of 8 bits. The receiver begins receiving the packets. As soon as the receiver successfully receives a packet, it generates an acknowledgement (ACK) for that packet, indicated by the colour Green. The receiver simultaneously sends the ACK to the sender through another transmission channel while continuing to receive other packets.

Step 3: However, when the receiver receives the 3rd packet, it detects errors in the packet. Instead of generating a Green ACK, it generates an acknowledgement for the 3rd packet in the colour Red. This indicates that there was an error in the received packet.

Step 4: After receiving all the acknowledgements from the receiver, the sender becomes aware of the error in the 3rd packet due to the Red ACK.

Step 5: The sender regenerates both the 3rd and 4th packets (White and Yellow) for retransmission. It sends these retransmitted packets to the receiver through the transmission channel.

Step 6: The receiver receives the retransmitted packets and successfully detects and receives them without errors. It generates green acknowledgements for these packets, indicating successful receipt.

Step 7: The receiver sends the green acknowledgements to the sender through another transmission channel.

Step 8: The sender receives all the acknowledgements, confirming the successful receipt of the retransmitted packets.

This process continues until all packets are successfully transmitted and acknowledged.

The Go-Back-N protocol is a specific type of sliding window protocol that uses a "window" of consecutive sequence numbers to ensure reliable transmission and reception of data. If an error is detected, the sender "goes back" and retransmits all the packets starting from the one that experienced an error, hence the name "Go-Back-N."

5.3 Selective Repeat Protocol: -

•In the terminal, if u Enter (3), the **Selective Repeat protocol** will be executed in following manner:

Step 1: The sender generates 4 packets, each consisting of 6 bits, and assigns a different colour to each packet: Packet 1 (Pink), Packet 2 (Blue), Packet 3 (White), and Packet 4 (Yellow).

Step 2: The sender starts sending the packets through the transmission channel, which has a capacity of 8 bits. The receiver begins receiving the packets. As soon as the receiver successfully receives a packet, it generates an acknowledgement (ACK) for that packet, indicated by the colour Green. The receiver simultaneously sends the ACK to the sender through another transmission channel while continuing to receive other packets.

Step 3: However, when the receiver receives the 3rd packet, it detects errors in the packet. Instead of generating a Green ACK, it generates an acknowledgement for the 3rd packet in the color Red. This indicates that there was an error in the received packet.

Step 4: After receiving all the acknowledgements from the receiver, the sender becomes aware of the error in the 3rd packet due to the Red ACK.

Step 5: The sender regenerates only the 3rd packet (White) for retransmission. It sends this retransmitted packet to the receiver through the transmission channel.

Step 6: The receiver receives the retransmitted packet and successfully detects and receives it without errors. It generates a green acknowledgement for this packet, indicating successful receipt.

Step 7: The receiver sends the green acknowledgement to the sender through another transmission channel.

Step 8: The sender receives the acknowledgement, confirming the successful receipt of the retransmitted packet.