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DATA COMMUNICATION WKK6

24SEPT 2025

1.

During a Wi-Fi file transfer between a laptop and a smartphone, error detection plays a crucial role in ensuring data integrity. As the laptop sends a large video file, each data packet includes a checksum—a small value calculated from the packet's content. The smartphone receives these packets and recalculates the checksum for each one, comparing it to the transmitted value. When a packet is corrupted due to interference or weak signal, the recalculated checksum does not match the original. The smartphone then requests a retransmission of the corrupted packet, ensuring that the file remains accurate. This process happens continuously and automatically, so the user experiences a seamless transfer. Error detection techniques, such as cyclic redundancy check (CRC), help identify and correct errors in real time. By detecting errors efficiently, Wi-Fi transfers maintain reliability and prevent data loss, even in environments with fluctuating signal strength

2.

Cyclic Redundancy Check (CRC) is an error-detection technique widely used in digital communications and data storage to ensure data integrity. It works by treating the data as a large binary number and dividing it by a predetermined polynomial, producing a remainder called the CRC value or checksum. This checksum is appended to the data before transmission. When the receiver obtains the data, it performs the same division and compares the calculated remainder with the transmitted CRC value. If they match, the data is assumed to be error-free; if not, an error is detected, and corrective actions, such as retransmission, can be initiated. CRC is highly effective at detecting common transmission errors, including single-bit errors, burst errors, and noise-induced corruption. Its efficiency, simplicity, and low computational requirements make it ideal for applications like Wi-Fi, Ethernet, and storage devices. By providing reliable error detection, CRC ensures accurate communication and data integrity across networks and systems.

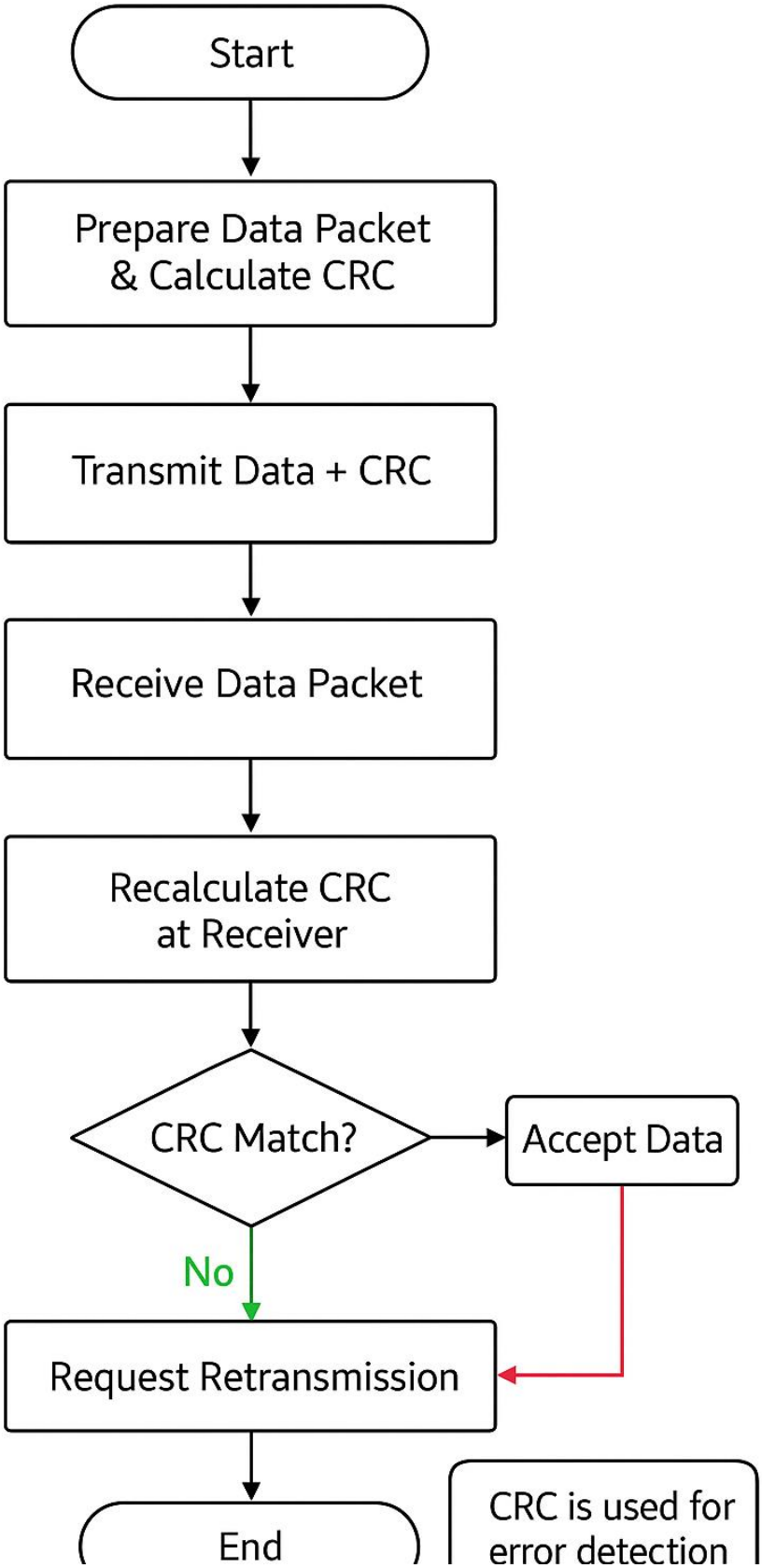
3.

To test error detection using Wireshark, I captured packets during a file transfer over Wi-Fi. Wireshark allowed me to observe each packet's details, including the frame check sequence (FCS), which is a type of checksum used for error detection. By intentionally introducing minor interference on the network, I could see that some packets were marked as containing

errors or were retransmitted. This hands-on exercise helped me understand how protocols like Ethernet and Wi-Fi use CRC to maintain data integrity. I noticed that even when errors occurred, the network automatically retransmitted corrupted packets, ensuring the complete file was delivered accurately. Using Wireshark made the abstract concept of error detection tangible, as I could visually track which packets were corrupted and how the system responded. This practice reinforced the importance of CRC and other error-detection methods in real-world networking, highlighting their role in maintaining reliable and seamless communication between devices.

4.

The error detection flowchart illustrates how data integrity is maintained during digital communication. The process begins with the data preparation stage, where the sender calculates a CRC checksum for the data packet. Next, the data transmission stage sends both the packet and its CRC over the network. At the receiver side, the system recalculates the CRC for the received packet and compares it with the transmitted checksum. If the values match, the data is accepted as error-free. If they do not match, an error is detected, and a retransmission request is triggered. The flowchart highlights the continuous loop of sending, checking, and retransmitting data until it is correctly received. By visualizing this process in Draw.io, students can clearly see the role of CRC in detecting and correcting errors. This diagram emphasizes the importance of error detection in ensuring reliable communication, particularly over networks susceptible to interference or noise.


Start
Prepare Data Packet & Calculate CRC
Transmit Data + CRC
Receive Data Packet
Recalculate CRC at Receiver
CRC Match?
Accept Data
No
Request Retransmission
End
CRC is used for error detection