TCP/UDP

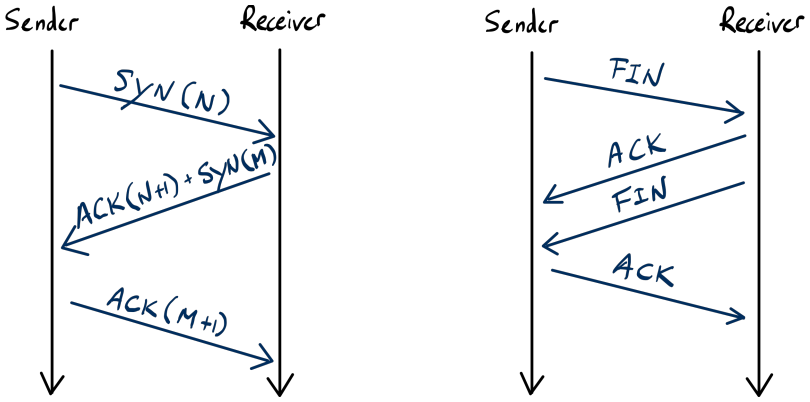
- **Purpose**:
  - **TCP (Transmission Control Protocol)** and **UDP (User Datagram Protocol)** transport application-layer messages between endpoints.

Transmission Control Protocol (TCP)

- **Key Characteristics**:
  - **Connection-Oriented**: Establishes a connection before transmitting data.
  - **Reliable**: Guarantees the delivery and order of application-layer messages.
  - **1-to-1 Connection**: Between sender and receiver.
  - **Reliable but Slow**: Due to additional mechanisms for reliability.

TCP Handshaking

1. **3-Way Handshake**: Establishing a connection.
   - **SYN → SYN-ACK → ACK**
2. **4-Way Handshake**: Terminating a connection.



Flow Control

- Prevents the sender from overflowing the receiver's buffer.

1. **Stop-and-Wait**:
   - Sender transmits a message and waits for an **ACK** from the receiver.
   - Retransmission occurs if **ACK** is not received.
2. **Sliding Window**:
   - Sender transmits packets of size **N** without waiting for individual ACKs.
   - N represents the number of packets that can be sent without acknowledgment.

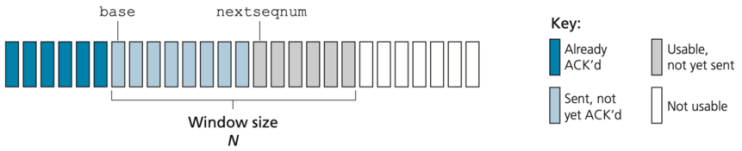


Figure 3.19 ♦ Sender's view of sequence numbers in Go-Back-N

(Diagram from Computer Networking: A Top-Down Approach, Global Edition 8th Edition)

Congestion Control

- Regulates the data transmission rate to prevent congestion in the network.