

# FLOW CONTROL

Flow control is a technique for assuring that a transmitting entity does not overwhelm a receiving entity with data. 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.

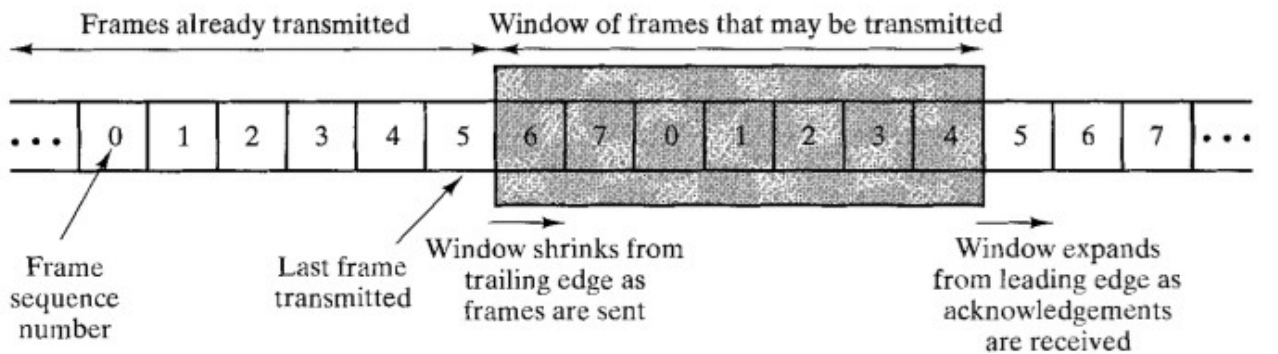
## Stop and wait Flow Control:

A source entity transmits a frame. After reception, the destination entity indicates its willingness to accept another frame by sending back an acknowledgment to the frame just received. The source must wait until it receives the acknowledgment before sending the next frame. The source must wait until it receives the acknowledgment before sending the next frame. The destination can thus stop the flow of data by simply withholding acknowledgment. With the use of multiple frames for a single message, the stop-and-wait procedure may be inadequate. The essence of the problem is that only one frame at a time can be in transit. For very high data rates, or for very long distances between sender and receiver, stop-and-wait flow control provides inefficient line utilization.

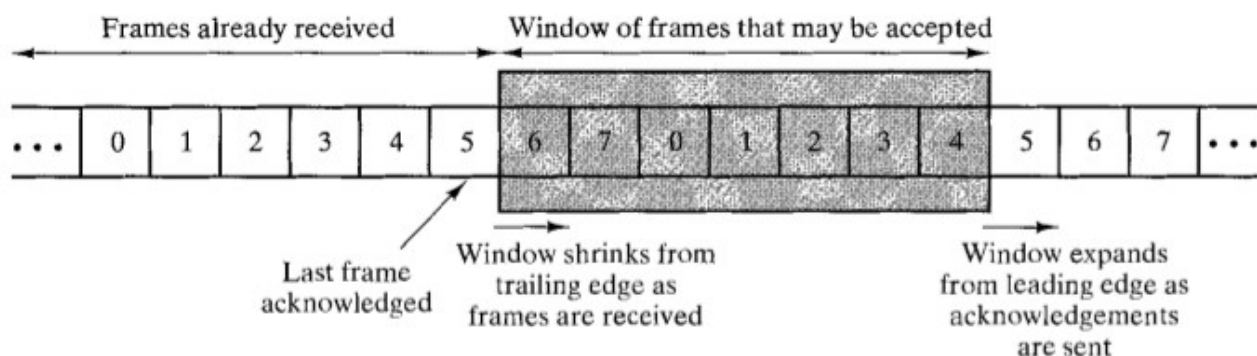
## Sliding Window Flow Control:

Major draw back of stop-and-wait flow control is only one frame can be transmitted at a time; this leads to inefficiency if propagation delay is much longer than transmission delay. Sliding window flow control allows the transmission of multiple frame. It assigns each frame a k-bit sequence number and the range of sequence no. is  $[0..2^k - 1]$ .

Let us examine how this might work for two stations, A and B, connected via a full-duplex link. Station B allocates buffer space for n frames. Thus, B can accept n frames, and A is allowed to send n frames without waiting for any acknowledgments. To keep track of which frames have been acknowledged, each is labeled with a sequence number. B acknowledges a frame by sending an acknowledgment that includes the sequence number of the next frame expected. This acknowledgment also implicitly announces that B is prepared to receive the next n frames, beginning with the number specified. This scheme can also be used to acknowledge multiple frames



(a) Transmitter's perspective

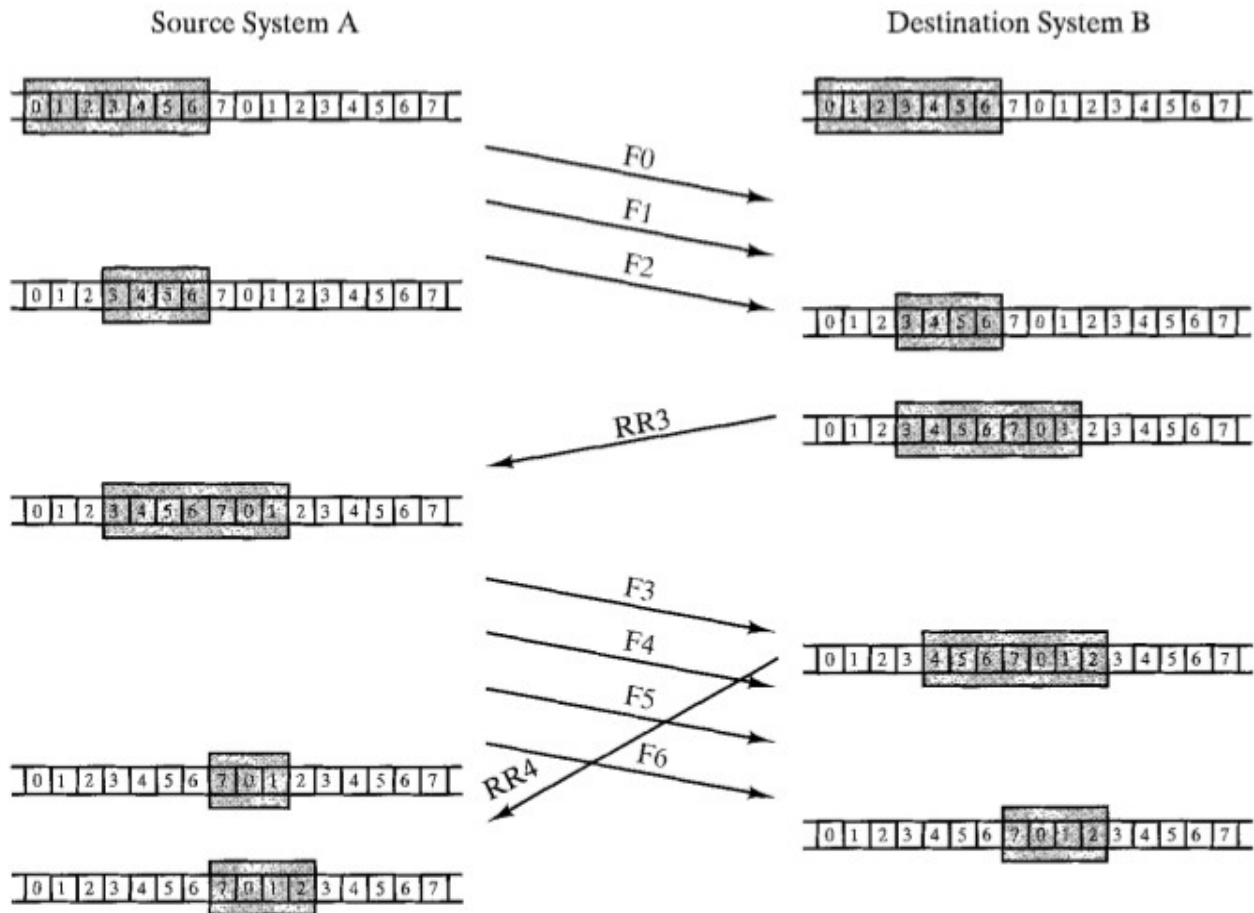


(b) Receiver's perspective

**How Flow control is achieved?**

- Receiver can control the size of the sending window.
- By limiting the size of the sending window data flow from sender to receiver can be limited .

The example assumes a 3-bit sequence number field and a maximum window size of seven frames. Initially, A and B have windows indicating that A may transmit seven frames, beginning with frame 0 (F0). After transmitting three frames (F0, F1, F2) without acknowledgment, A has shrunk its window to four frames. The window indicates that A may transmit four frames, beginning with frame number 3. B then transmits an RR (receive-ready) 3, which means: "I have received all frames up through frame number 2 and am ready to receive frame number 3; in fact, I am prepared to receive seven frames, beginning with frame number 3." With this acknowledgment, A is back up to permission to transmit seven frames, still beginning with frame 3. A proceeds to transmit frames 3, 4, 5 , and 6. B returns an RR 4, which allows A to send up to and including frame F2.



*Example of Sliding window Protocol*