Computer Network

Lecture-22

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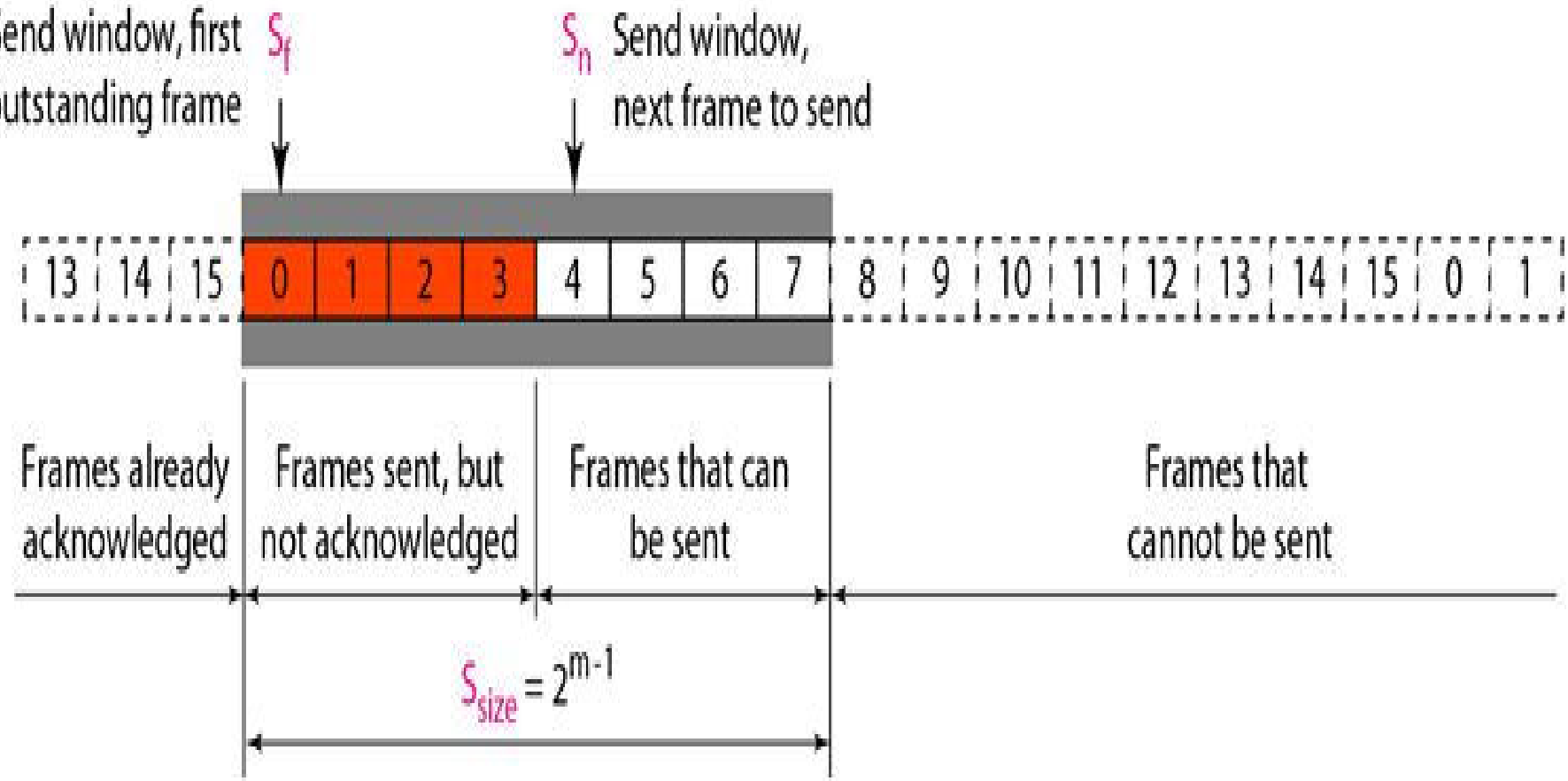
Selective Repeat Automatic Repeat Request

- Go-Back-N ARQ protocol is inefficient for noisy links because in a noisy link a frame has a higher probability of damage, which means the resending of multiple frames. This resending uses up the bandwidth and slows down the transmission.
- For noisy links, there is another mechanism that does not resend N frames when just one frame is damaged; only the damaged frame is resent. This mechanism is called Selective Repeat ARQ.
- It is more efficient for noisy links, but the processing at the receiver is more complex.

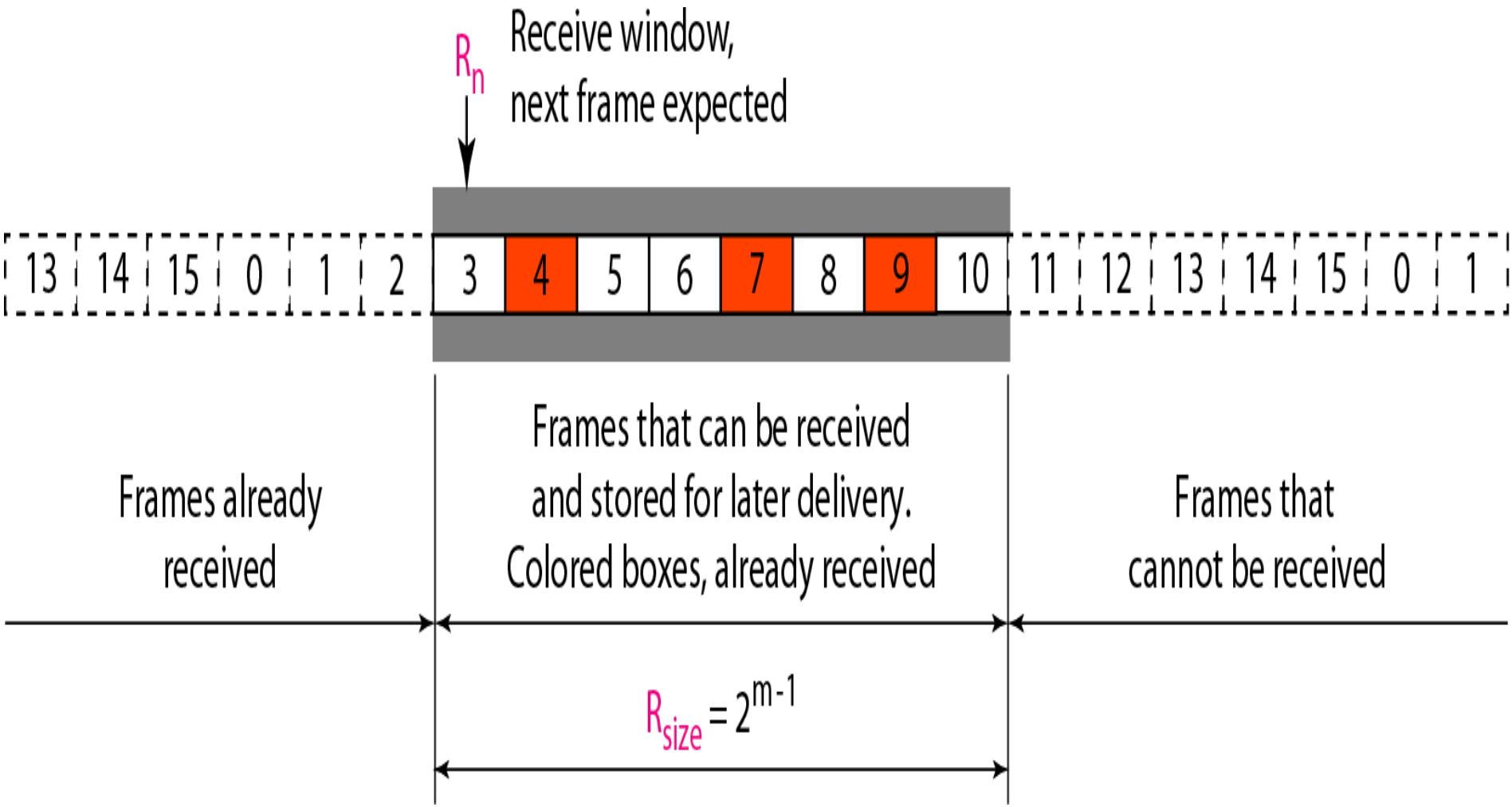
Selective Repeat Automatic Repeat Request

The size of the sender window is 2^{m-1}.

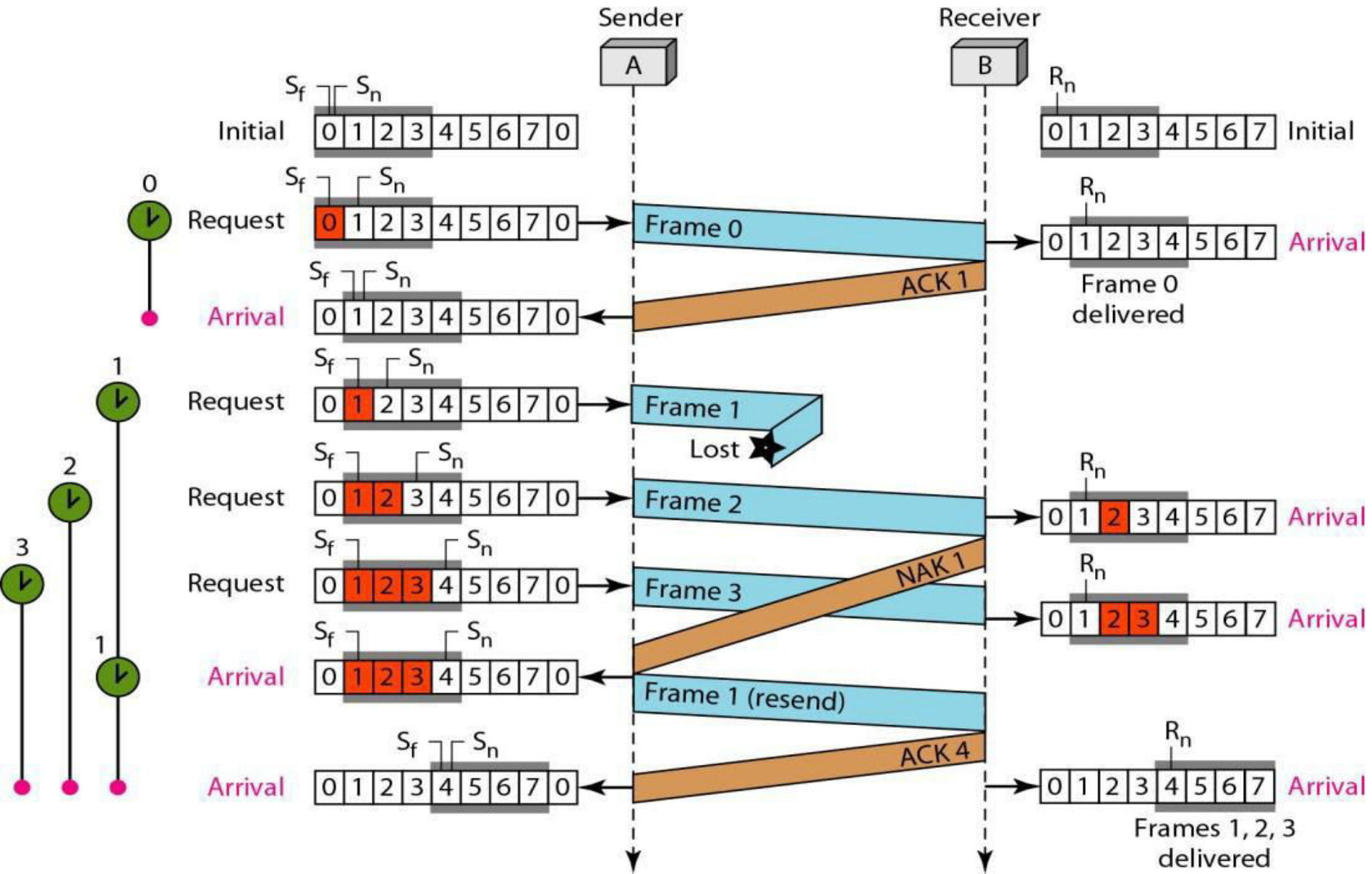
The size of the receiver window is 2^{m-1}.



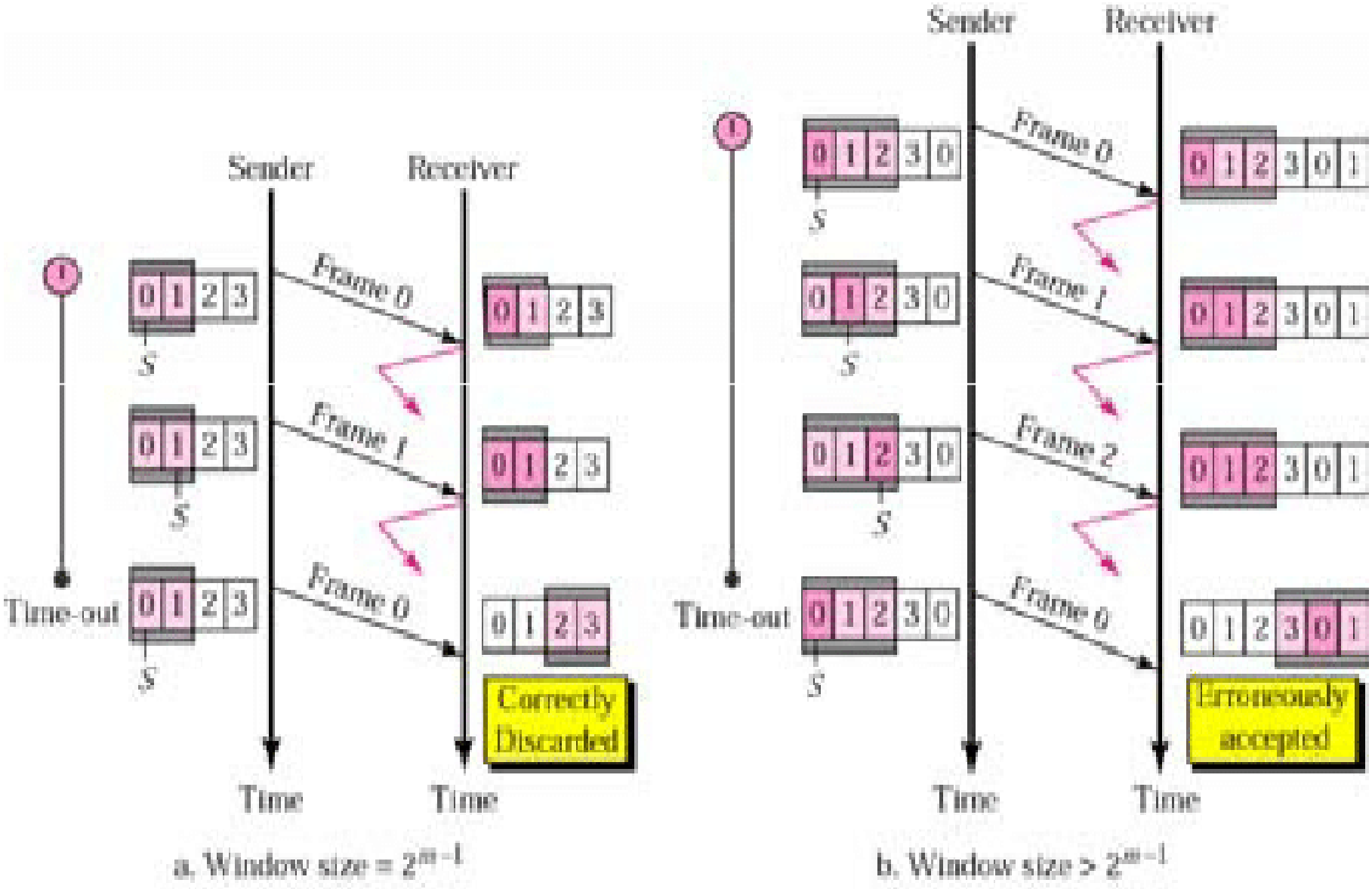
Selective Repeat Automatic Repeat Request



Selective Repeat Automatic Repeat Request



Selective Repeat Automatic Repeat Request



Selective Repeat Automatic Repeat Request

Efficiency:

The efficiency of selective repeat protocol is the same as of Go-Back-N ARQ protocol's efficiency.

$$\text{Efficiency} = N/(1+2a),$$

Where N is the size of sender window and $a = T_p/T_t$.

Piggybacking

A technique called piggybacking is used to improve the efficiency of the bidirectional protocols. When a frame is carrying data from A to B, it can also carry control information about arrived (or lost) frames from B; when a frame is carrying data from B to A, it can also carry control information about the arrived (or lost) frames from A.

Data Link Layer

Exercise

1. A sender sends a series of packets to the same destination using 5-bit sequence numbers. If the sequence number starts with 0, what is the sequence number after sending 100 packets?

2. Using 5-bit sequence numbers, what is the maximum size of the sender and receiver windows for each of the following protocols?

a. Stop-and-Wait ARQ

b. Go-Back-N ARQ

c. Selective-Repeat ARQ

Data Link Layer

3. A system uses the Stop-and-Wait ARQ Protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000 Km and the propagation speed is 2×10^8 m? Ignore transmission, waiting, and processing delays. We assume no data or control frame is lost or damaged.

4. Repeat Exercise 3 using the Go-back-N ARQ Protocol with a window size of 7. Ignore the overhead due to the header and trailer.

5. Repeat Exercise 3 using the Selective-Repeat ARQ Protocol with a window size of 4. Ignore the overhead due to the header and the trailer.

6. Consider a selective repeat sliding window protocol uses a frame size of 1KB to send data on a 15Mbps link with a one-way latency of 50 ms. To achieve a link utilization of 60%, find the minimum number of bits required to represent the sequence number field.

7. Consider the sliding window flow-control protocol operating between a sender and a receiver over a full-duplex free link. Assume the following:

(i) The time take for processing the data frame by the receiver is negligible.

(ii) The time taken for processing the acknowledgement frame by the sender is negligible.

(iii) The sender has infinite number of frames available for transmission

(iv) The size of the data frame is 2,000 bits and the size of the acknowledgement frame is 10 bits.

(v) The link data rate in each direction is 1 Mbps (10^6 bits per second)

(vi) One way propagation delay of the link is 100 milliseconds

The minimum value of the sender's window size in terms of the number of frames, (rounded to the nearest integer) needed to achieve a link utilization of 50% is _____.