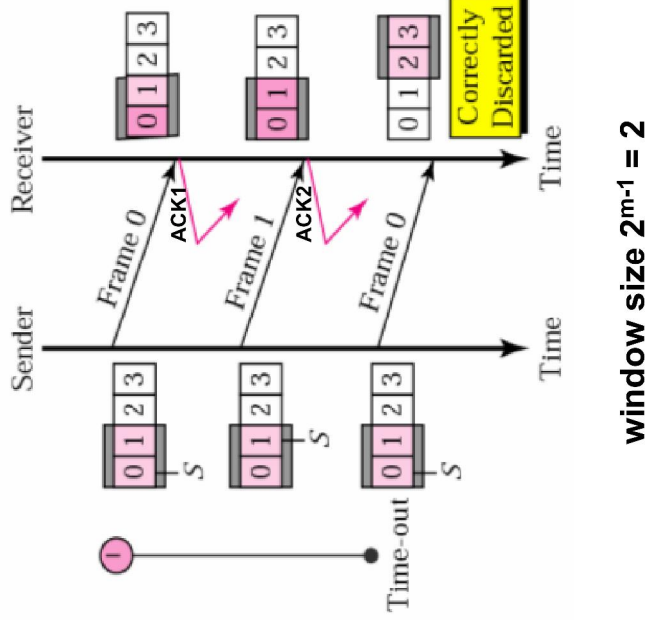
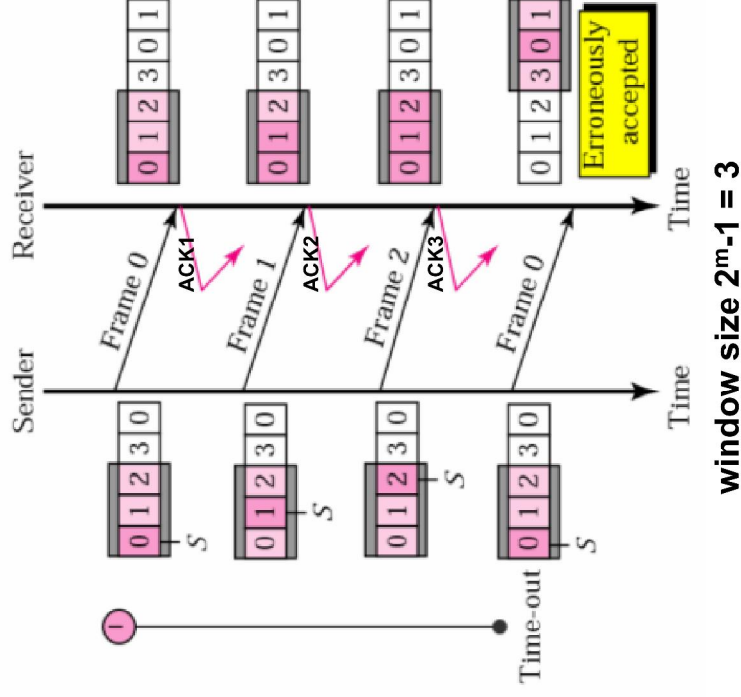


**Window Sizes** • m bits allotted within a header for sequence numbers  
 $\Rightarrow 2^m$  possible sequence numbers

- how big should the windows be!?
- $W_S$  and  $W_R = 2^{m-1}$  cannot be accepted due to possible ambiguity as shown below
- **$W = 2^m/2 = 2^{m-1}$  acceptable !!!**



## Selective Repeat ARQ Operation

### Receiver:

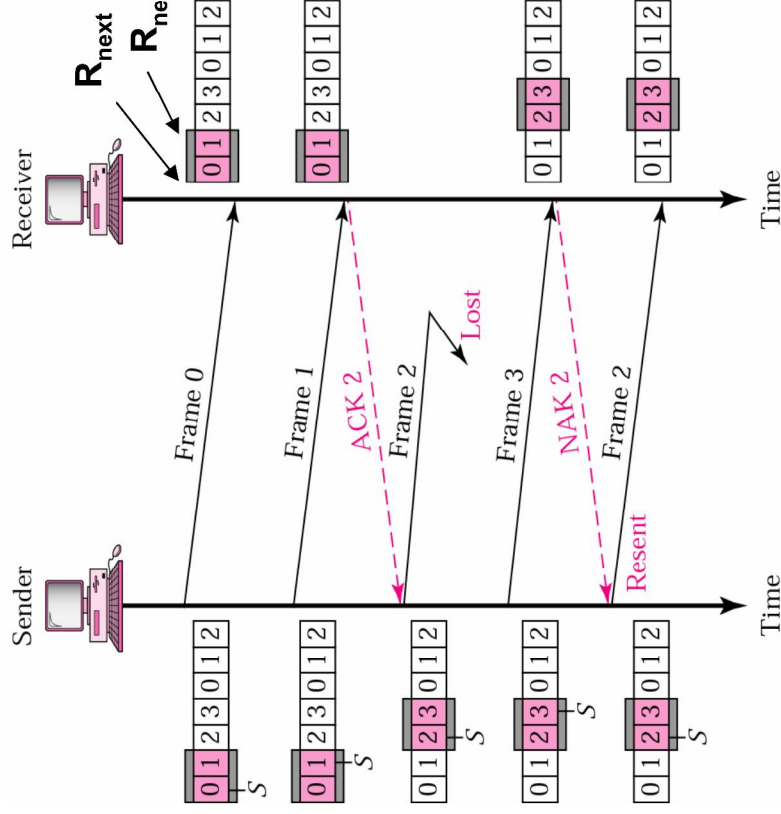
- window advances whenever next in-order frame arrives
- out-of-order frames are accepted only if their sequence numbers satisfy  $R_{\text{next}} + W_s - 1$

$$R_{\text{next}} < R_{\text{frame}} < R_{\text{next}} + W_s$$

- a negative ACK (NAK) with sequence number  $R_{\text{next}}$  is sent whenever an out-of-sequence frame is observed

### Sender:

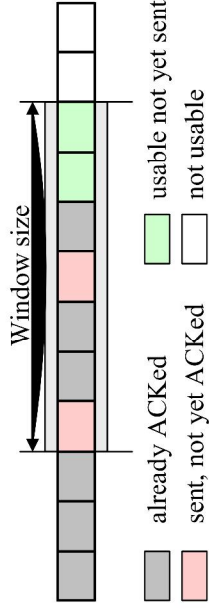
- window advances whenever an ACK arrives
- if a timer expires, the corresponding frame is resent, and the timer is reset
- whenever a NAK arrives,  $R_{\text{next}}$  frame is resent



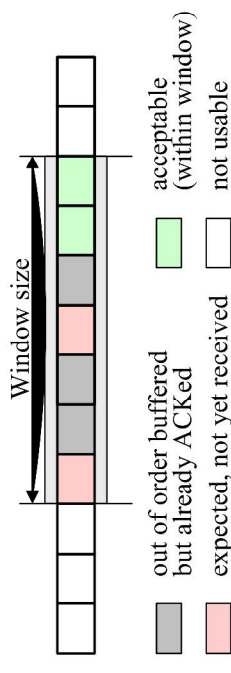
# Selective Repeat ARQ

28

- Selective Repeat ARQ** • Go-Back-N is NOT suitable for ‘noisy links’ – in case of a lost/damaged frame a whole window of frames need to be resent
  - excessive retransmissions use up the bandwidth and slow down transmission
- Selective Repeat ARQ overcomes the limitations of Go-Back-N by adding 2 new features
  - (1) **receiver window > 1 frame**, so that **out-of-order but error-free frames can be accepted**
  - (2) retransmission mechanism is modified – **only individual frames are retransmitted**
- **Selective Repeat ARQ is used in TCP !!!**



sender window of size  $W_s$



receiver window of size  $W_r$

### **(3) Selective Repeat ARQ**