## ARQ Protocols

Where are we?

- Stop-and-Wait ARQ: "Safe" and "Live"

Next:

## - Can we implement Stop-and-Wait ARQ <br> - Is Stop-and-Wait ARQ efficient?

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## Sequence Numbers/Request Numbers

## Stop-and-Wait ARQ Using Modulus 2



## Is Stop-and-Wait Efficient?



## Go-Back $n$ ARQ




Already ACK'd


Useable, not yet sent

Sent, not yet ACK'd
Not useable

## Go-Back $n$ ARQ



## Go-Back $n$ ARQ



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## Go-Back $n$ ARQ



## Selective-Repeat ARQ: Sender



Already ACK'd


Useable, not yet sent
Sent, not yet ACK'd
Not useable

## Selective-Repeat ARQ: Receiver




Out of Order (buffered) but already ACK'd


Acceptable (within window)

Expected, not yet received Not useable

## Selective Repeat ARQ



## Conditions for Modulus $m$

- Go-Back $n$ ARQ: $m>n$
- Selective Repeat ARQ: $m \geq 2 n$

