

# CS 78 Computer Networks

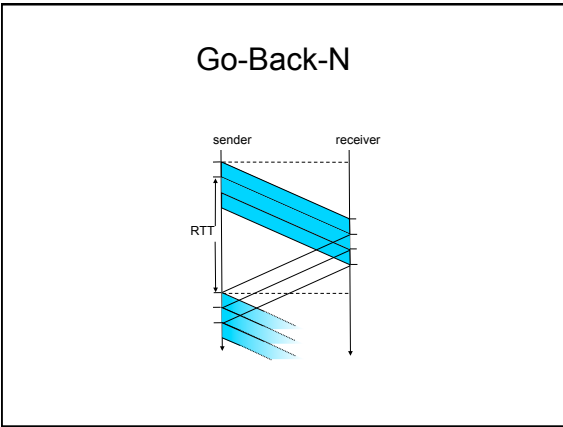
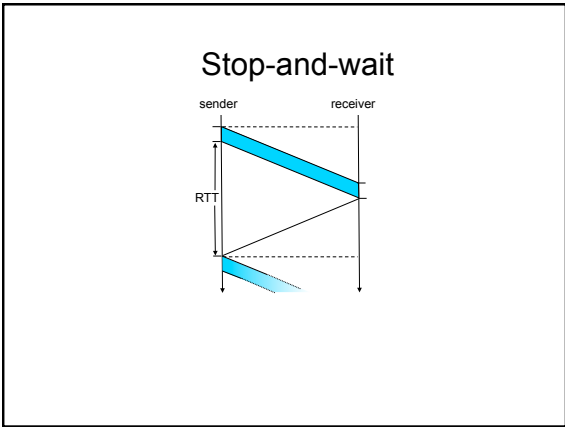
## TCP

Andrew T. Campbell  
campbell@cs.dartmouth.edu

### Internet Checksum Example

- Note
  - When adding numbers, a carryout from the most significant bit needs to be added to the result
- Example: add two 16-bit integers

	1 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0
	1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
	-----
wraparound	1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1
sum	1 0 1 1 1 0 1 1 1 0 1 1 1 1 0 0
checksum	0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 1



### Go-Back-N

**Sender:**

- seq # in pkt header
- "window" of up to N, consecutive unack'd packets allowed

base      next seqnum

Window size N

**Key:**

- Green: Sent, not yet ACK'd
- Grey: Usable, not yet sent
- White: Not usable

- ACK(n): ACKs all packets up to, including seq # n - "cumulative ACK"
  - may receive duplicate ACKs
- Timer for each in-flight packets
- Timeout(n): retransmit packets n and all higher seq # packets in window

### Selective repeat: sender, receiver windows

**a. Sender view of sequence numbers**

send\_base      next seqnum

Window size N

**Key:**

- Green: Already ACK'd
- Light Green: Sent, not yet ACK'd
- Grey: Usable, not yet sent
- White: Not usable

**b. Receiver view of sequence numbers**

recv\_base

Window size N

**Key:**

- Green: Out of order (buffered) but already ACK'd
- Light Green: Expected, not yet received
- Grey: Acceptable (within window)
- White: Not usable

