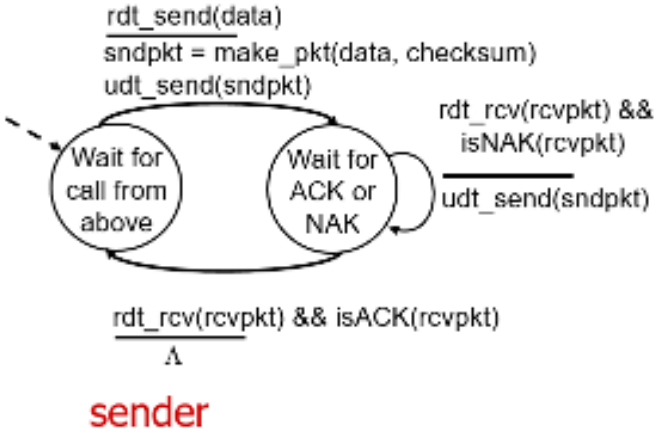
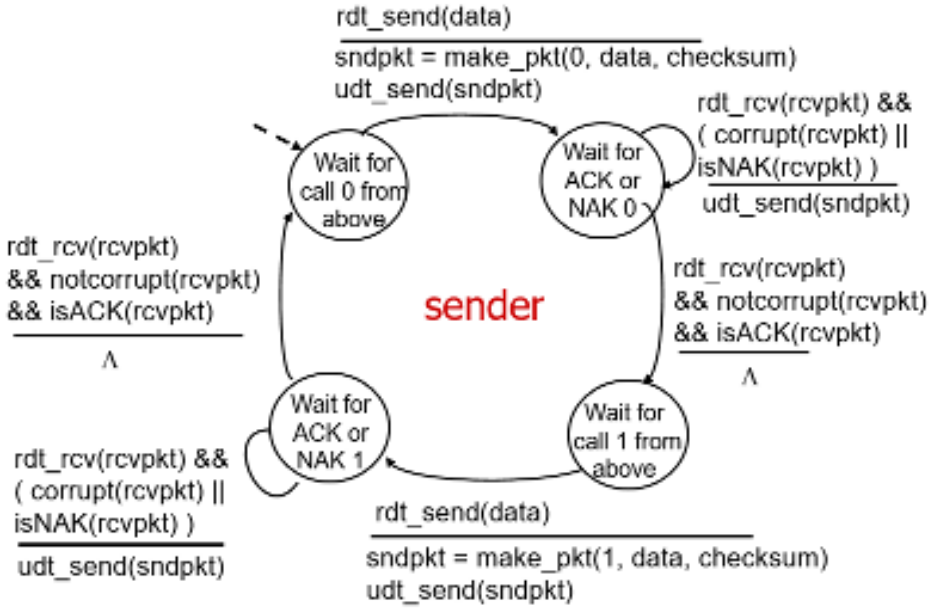
rdt2.0 ⇒ rdt2.1 Senders
Add Sequence Number

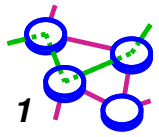
rdt2.0: FSM specification



rdt2.1: sender, handles garbled ACK/NAKs

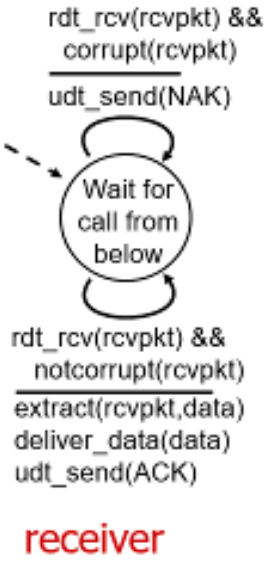


- data now has sequence number
- ACK/NAK can be corrupted



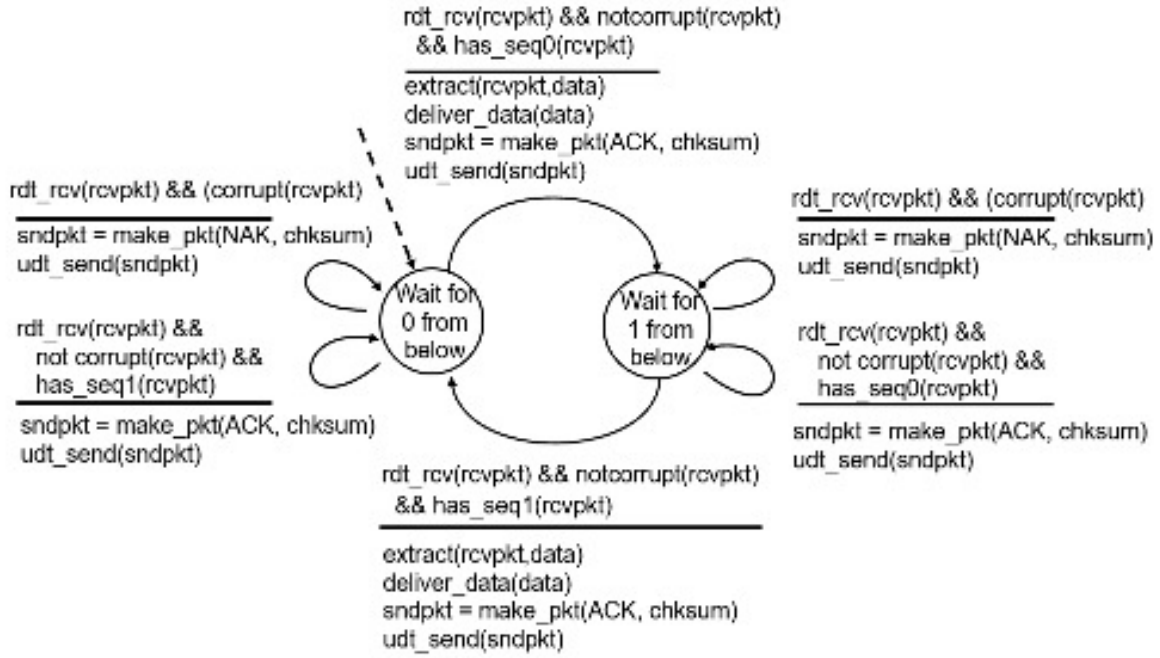
rdt2.0 ⇒ rdt2.1 Receivers
Add Sequence Number

rdt2.0: FSM

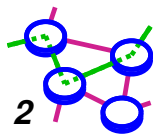


receiver

rdt2.1: receiver, handles garbled ACK/NAKs

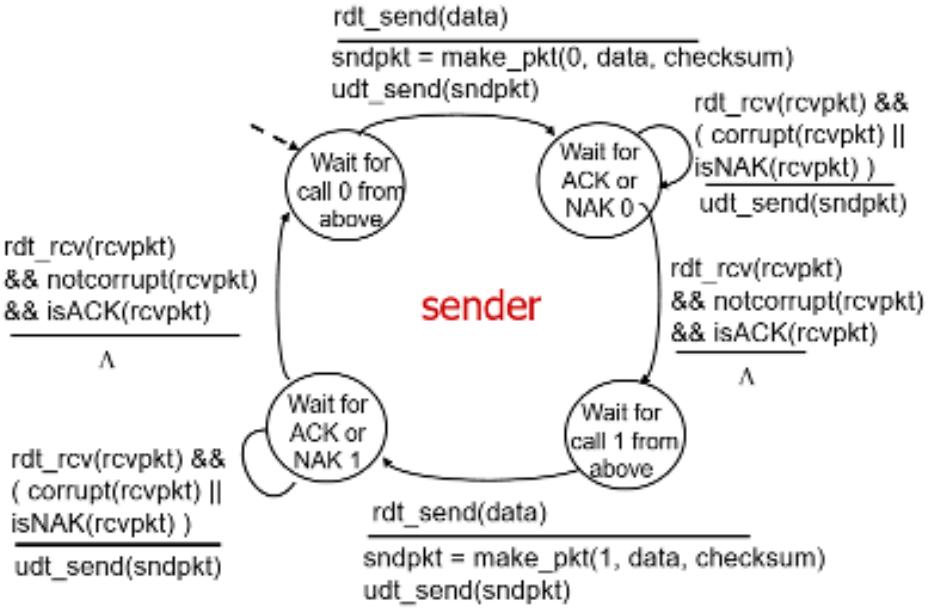


- data now has sequence number
  - need to detect duplicate data packet
- ACK/NAK packet now contains checksum

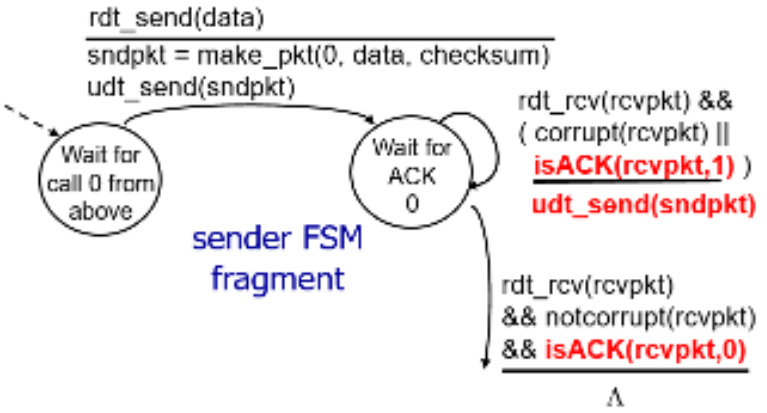


rdt2.1 ⇒ rdt2.2 Senders Replace NAK with DupACK

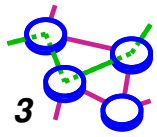
rdt2.1: sender, handles garbled ACK/NAKs



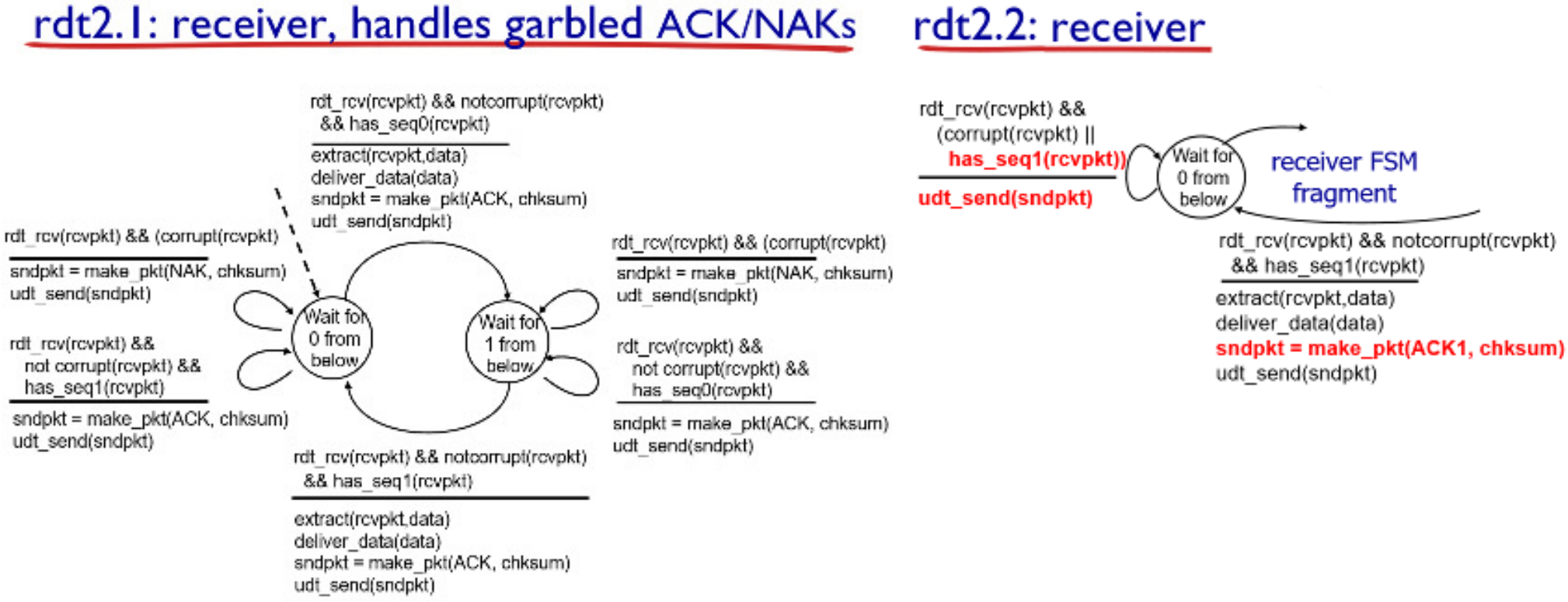
rdt2.2: sender



- ACK now has sequence number for last packet received
- NAK and DupACK are the same thing, can merge transitions
  - DupACK = ACK with the wrong sequence number



rdt2.1 ⇒ rdt2.2 Receivers Replace NAK with DupACK



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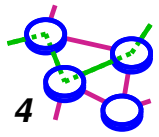
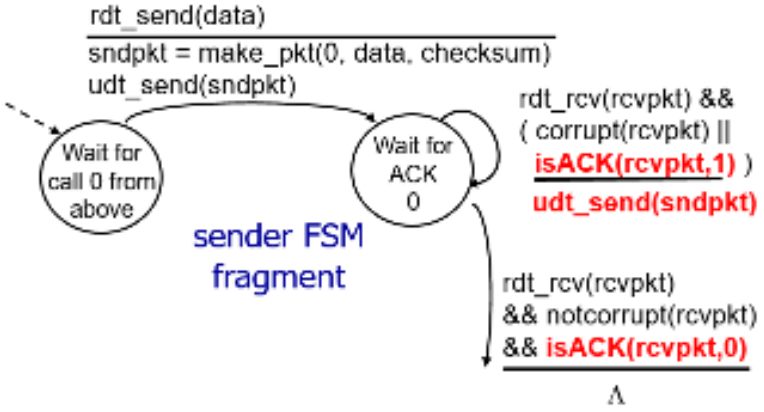
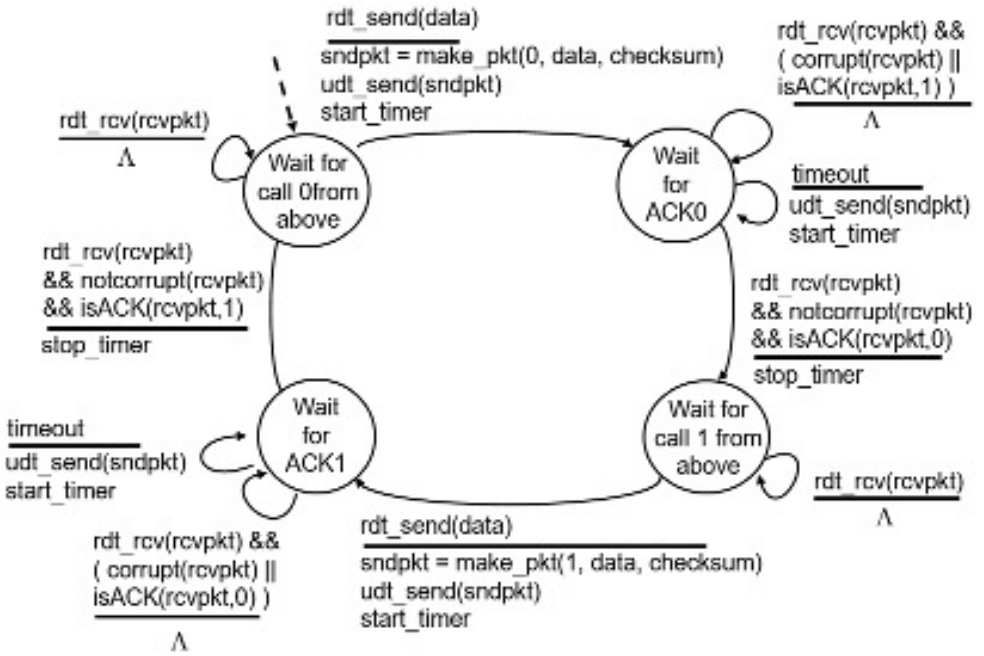


rdt2.2 ⇒ rdt3.0 Senders Add Timeout

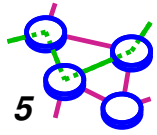
rdt2.2: sender



rdt3.0 sender



- udt_send(sndpkt) is followed by *start_timer*
- when ACK is received, *stop_timer*
- retransmit when *timeout event* occurs



rdt3.0

- rdt3.0 is sometimes known as the *alternating-bit protocol*
  - this is a *working reliable data transfer protocol*
  - ingredients:
    - checksums
    - sequence numbers
    - timers
    - ACKs and NACKs