

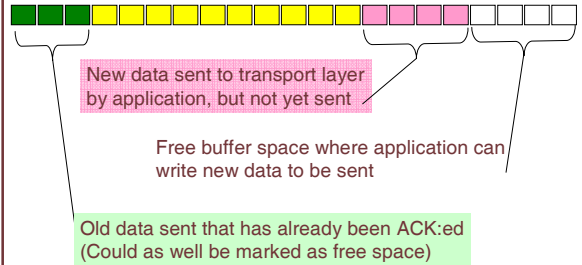
Sliding Window

Sliding window - Sender side

Cumulative Acknowledgments

Not sent Sent, no ACK ACK:ed Free

Sending buffer at the sender:

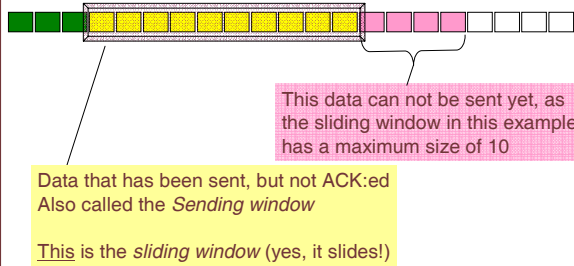


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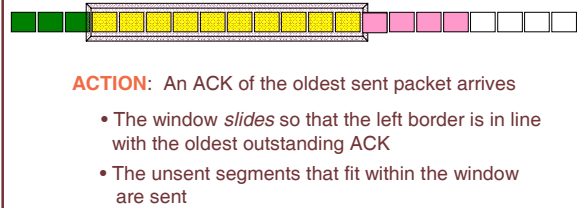


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Sending buffer at the sender:

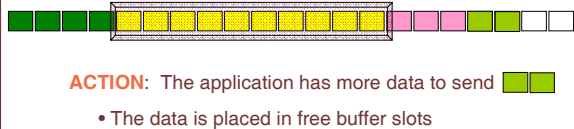


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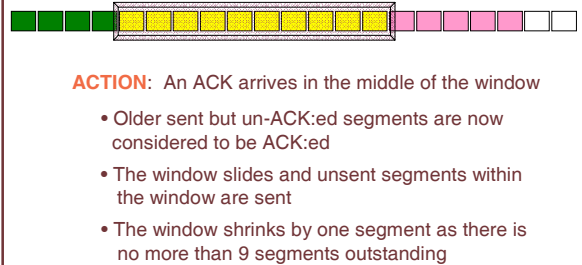


Sliding window - Sender side

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Sending buffer at the sender:



Sliding window - Sender side

Cumulative Acknowledgments

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 ■ Sent, no ACK
 ■ ACK:ed
 Free

Sending buffer at the sender:

ACTION: The application has more data to send ■■

- The data is placed in free buffer slots
- As the window is currently 9 segments wide, it can grow by one segment
- The new data that fits within the window is sent

Sliding window - Sender side

Cumulative Acknowledgments

■ Not sent
 ■ Sent, no ACK
 ■ ACK:ed
 Free

Sending buffer at the sender:

ACTION: An ACK of already ACK:ed segments arrives

- The ACK is silently ignored

Sliding window - Sender side

Cumulative Acknowledgments

- Must keep track of outstanding data
 - Data sent, but not ACK:ed
- Must not exceed maximum window size
 - Configuration parameter
 - Affects memory consumption
- Must adjust window size when
 - An ACK inside the window arrives
 - New data that can fit within window arrives from application

Sliding window – Receiver side

Cumulative Acknowledgments

■ Not received
 ■ Received
 ■ Read
 Free
 N/A

Read buffer at the receiver:

Data that was previously received, but not yet delivered to the application

Data not yet received

Data that was previously received and that has been delivered to application

Sliding window – Receiver side

Cumulative Acknowledgments

■ Not received
 ■ Received
 ■ Read
 Free
 N/A

Read buffer at the receiver:

The sliding window holds data received but not yet read. Must also be able to keep "holes" like segment Y in the segments

Free buffer space where new segments that are received can be stored

Space unavailable to new segments

This sliding window has size 12, max size 14

Sliding window – Receiver side

Cumulative Acknowledgments

■ Not received
 ■ Received
 ■ Read
 Free
 N/A

Read buffer at the receiver:

ACTION: Segment X arrives

- Store in read buffer, register as received
- Send cumulative ACK Y to indicate that receiver is waiting for Y ■

Sliding window – Receiver side

Cumulative Acknowledgments

Not received
 Received
 Read
 Free
 N/A

Read buffer at the receiver:



ACTION: Segment X+2 arrives

- Can not fit into the buffer, must be discarded
- Send cumulative ACK Y to indicate that receiver is waiting for Y Y

Sliding window – Receiver side

Cumulative Acknowledgments

Not received
 Received
 Read
 Free
 N/A

Read buffer at the receiver:



ACTION: Applications try to read 5 segments

- Only two segments are returned, still waiting for Y
- Application is informed of how much data was read
- The unavailable segment at the end of the buffer becomes available

Sliding window – Receiver side

Cumulative Acknowledgments

Not received
 Received
 Read
 Free
 N/A

Read buffer at the receiver:



ACTION: Segment Y arrives

- Store in read buffer, register as received
- Send cumulative ACK (X+1) to indicate that receiver is waiting for (X+1) X+1

Sliding window – Receiver side

Cumulative Acknowledgments

Role of sliding window is different at receiver

- Represents the maximum buffer size for segments received but still not read
- If a segment that does not fit inside the window arrives (either too new or too old), it is discarded.
 - However, an ACK is sent
- To avoid running out of buffer space, receiver can inform sender about available buffer space in each ACK