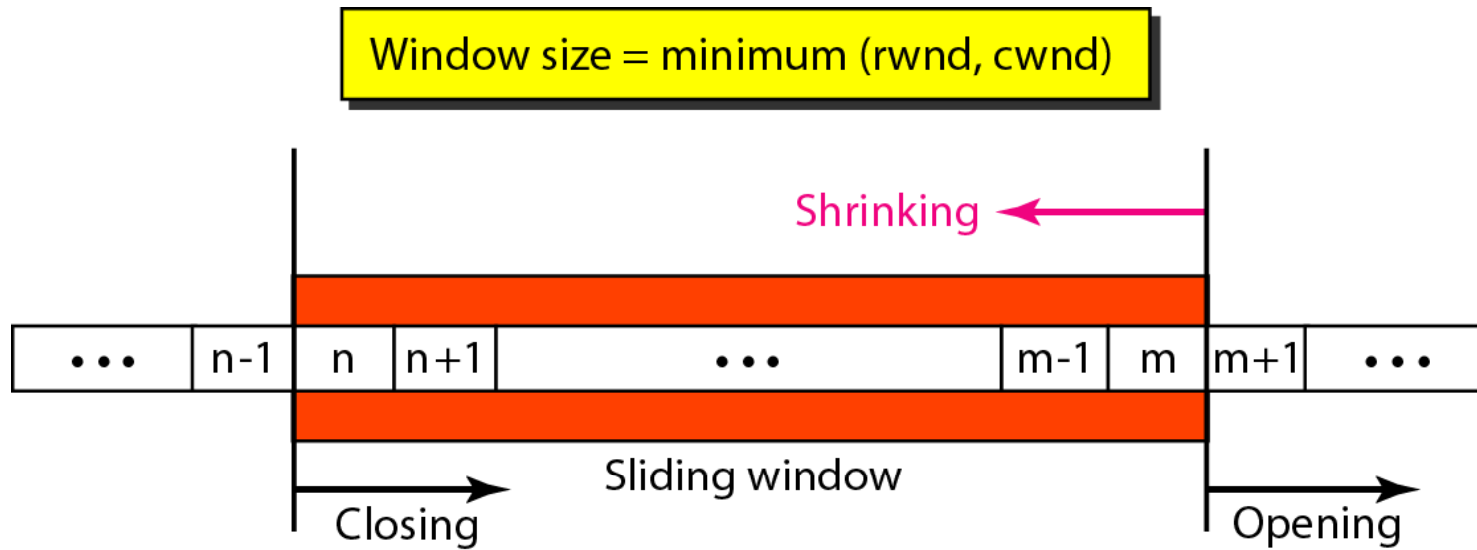


*TCP Flow Control
and
Error Control*

Sliding window





Note

**A sliding window is used to make transmission more efficient as well as to control the flow of data so that the destination does not become overwhelmed with data.
TCP sliding windows are byte-oriented.**



Example

What is the value of the receiver window (rwnd) for host A if the receiver, host B, has a buffer size of 5000 bytes and 1000 bytes of received and unprocessed data?

Solution

The value of $rwnd = 5000 - 1000 = 4000$. Host B can receive only 4000 bytes of data before overflowing its buffer. Host B advertises this value in its next segment to A.



Example

What is the size of the window for host A if the value of $rwnd$ is 3000 bytes and the value of $cwnd$ is 3500 bytes?

Solution

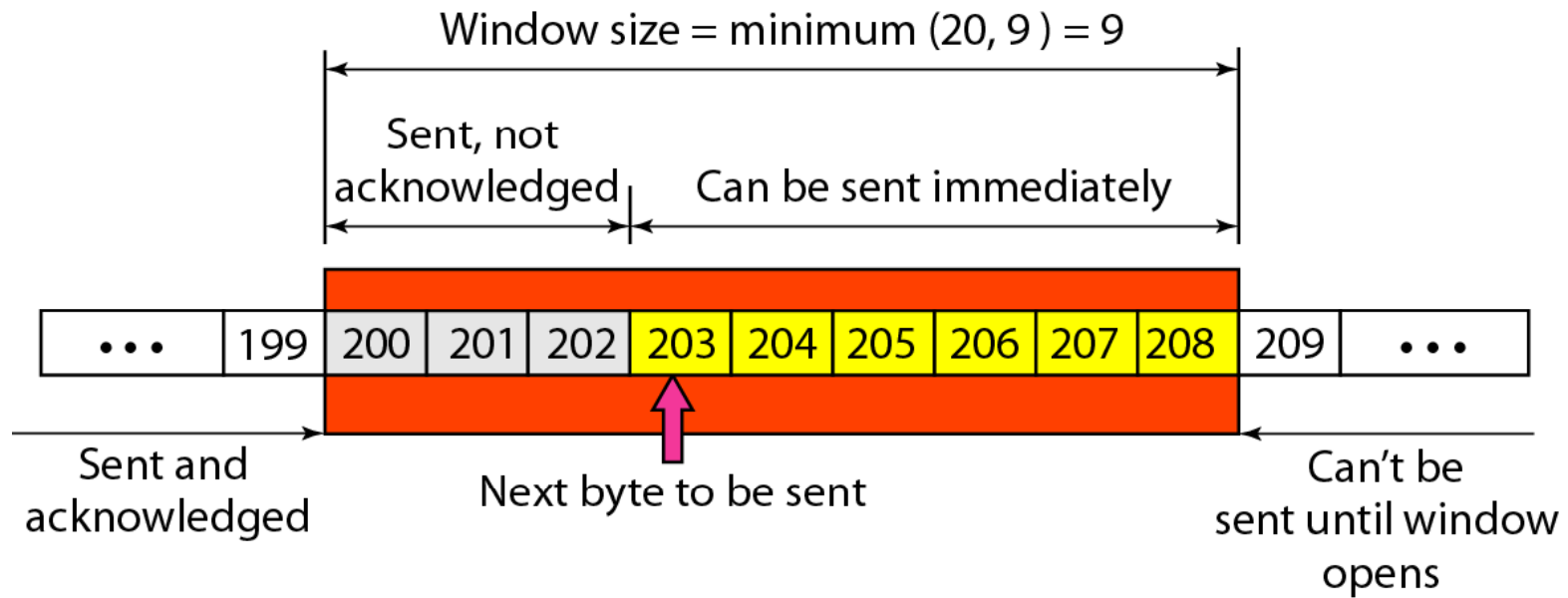
The size of the window is the smaller of $rwnd$ and $cwnd$, which is 3000 bytes.



Example

Next figure shows an unrealistic example of a sliding window. The sender has sent bytes up to 202. We assume that $cwnd$ is 20 (in reality this value is thousands of bytes). The receiver has sent an acknowledgment number of 200 with an $rwnd$ of 9 bytes (in reality this value is thousands of bytes). The size of the sender window is the minimum of $rwnd$ and $cwnd$, or 9 bytes. Bytes 200 to 202 are sent, but not acknowledged. Bytes 203 to 208 can be sent without worrying about acknowledgment. Bytes 209 and above cannot be sent.

Example



Some points about TCP sliding windows:

- ❑ The size of the window is the lesser of rwnd and cwnd.**
- ❑ The source does not have to send a full window's worth of data.**
- ❑ The window can be opened or closed by the receiver, but should not be shrunk.**
- ❑ The destination can send an acknowledgment at any time as long as it does not result in a shrinking window.**
- ❑ The receiver can temporarily shut down the window; the sender, however, can always send a segment of 1 byte after the window is shut down.**



Note

**ACK segments do not consume
sequence numbers and are not
acknowledged.**



Note

In modern implementations, a retransmission occurs if the retransmission timer expires or three duplicate ACK segments have arrived.



Note

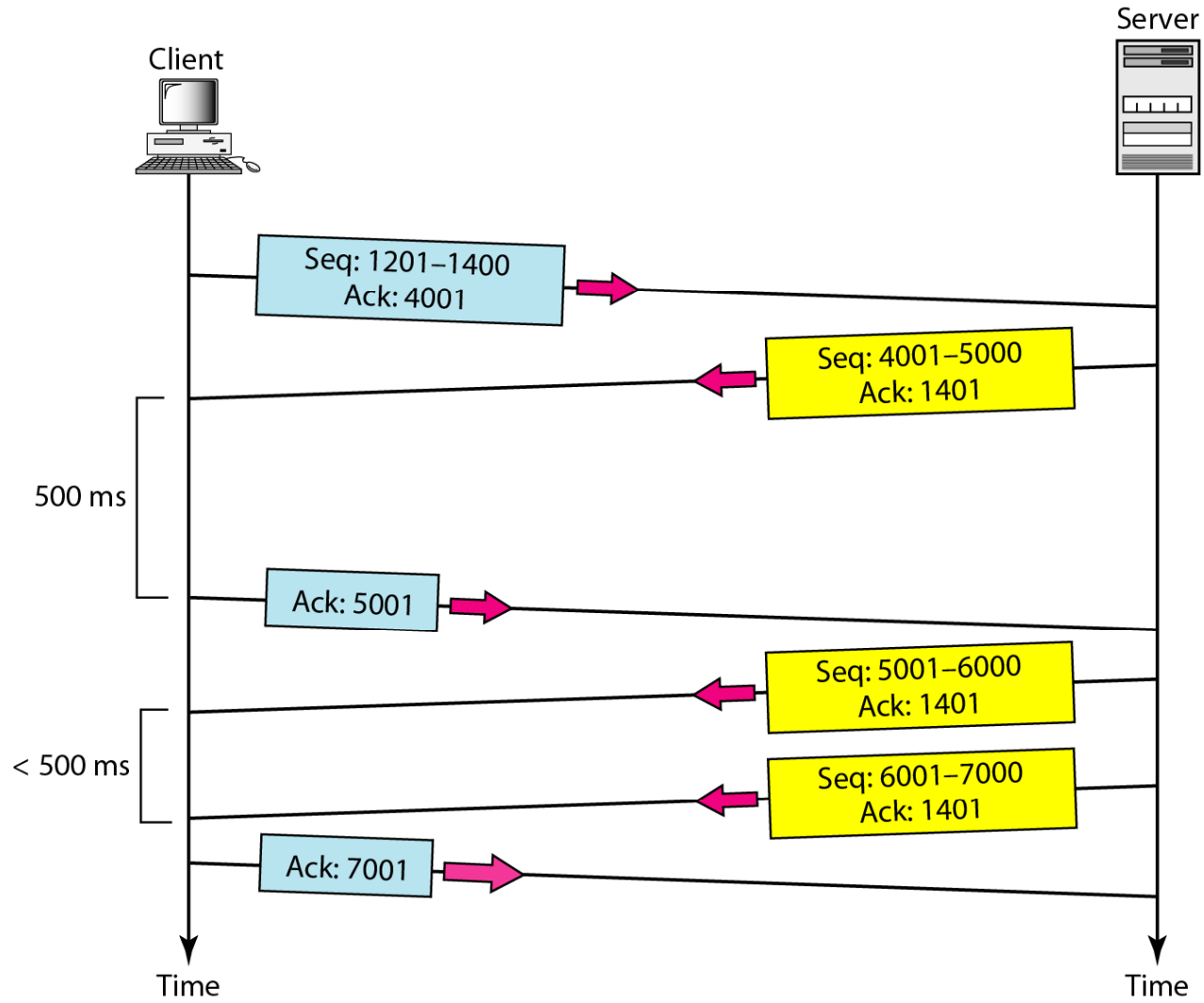
**No retransmission timer is set for an
ACK segment.**



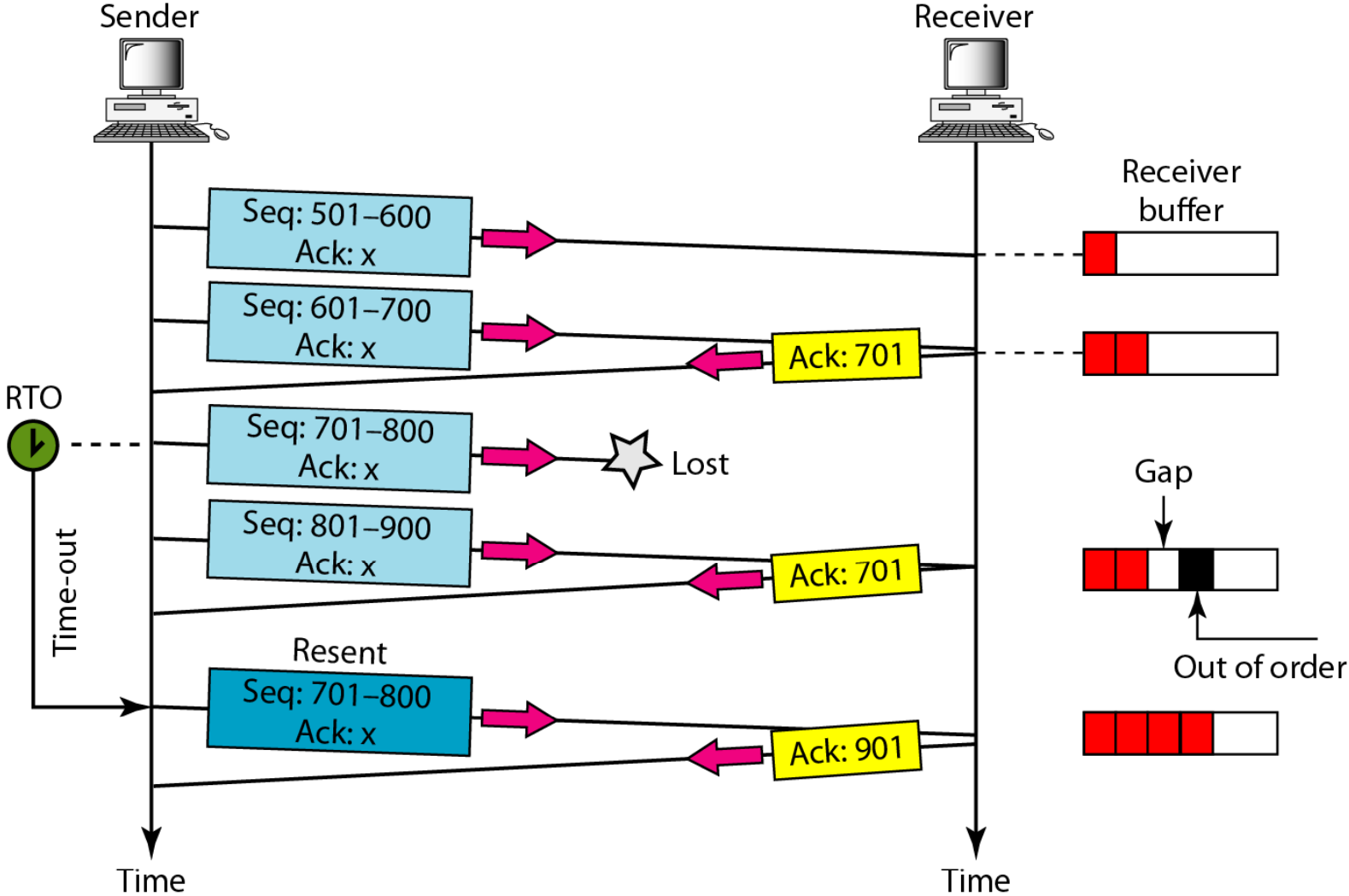
Note

Data may arrive out of order and be temporarily stored by the receiving TCP, but TCP guarantees that no out-of-order segment is delivered to the process.

Normal operation



Lost segment

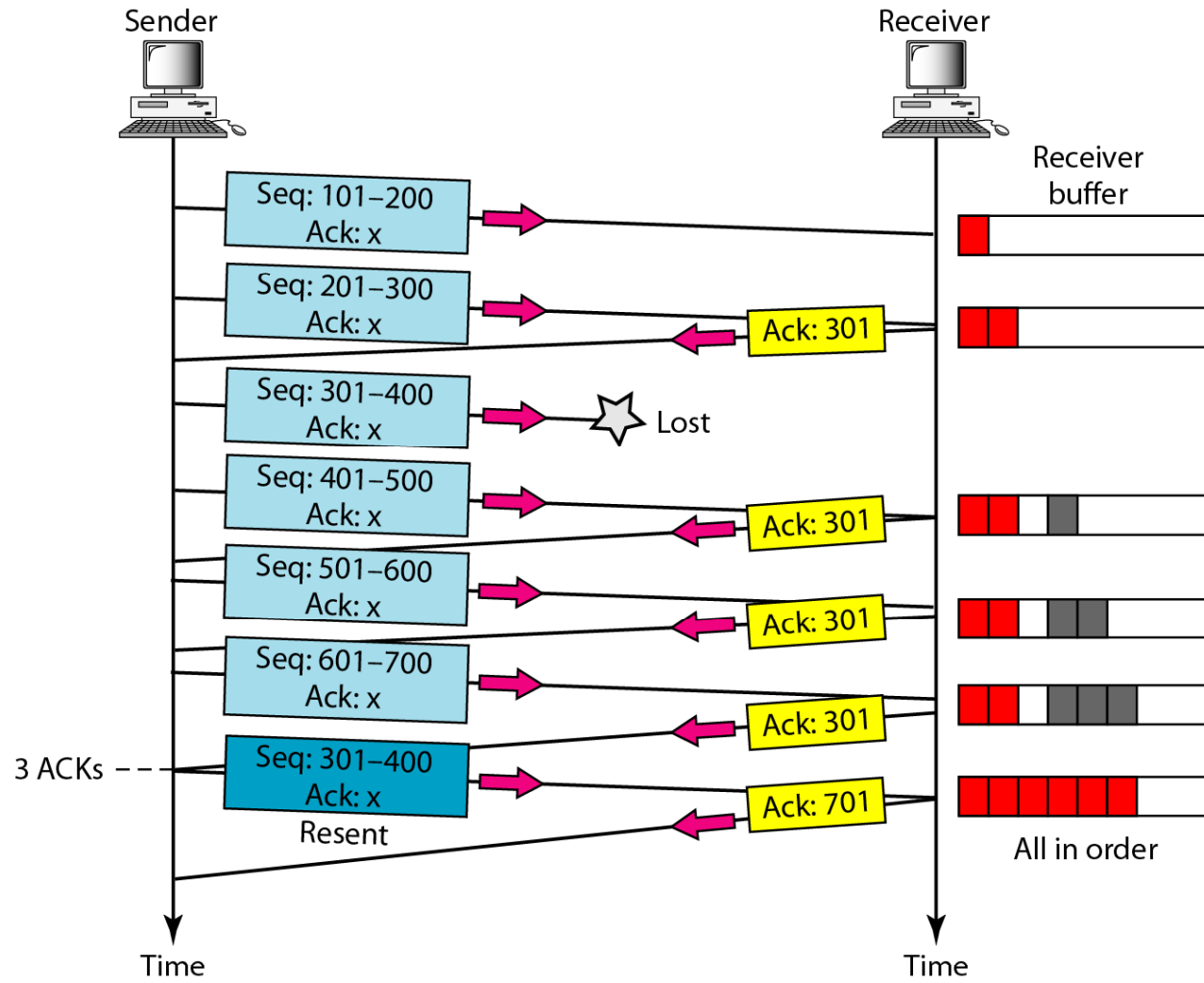




Note

The receiver TCP delivers only ordered data to the process.

Fast retransmission



References

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 - 2. Data Communications and Networking, B.A. Forouzan, Tata McGraw Hill Education Private Limited.***
 - 3. Data and Computer Communications, William Stallings, Pearson-Prentice Hall.***
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