

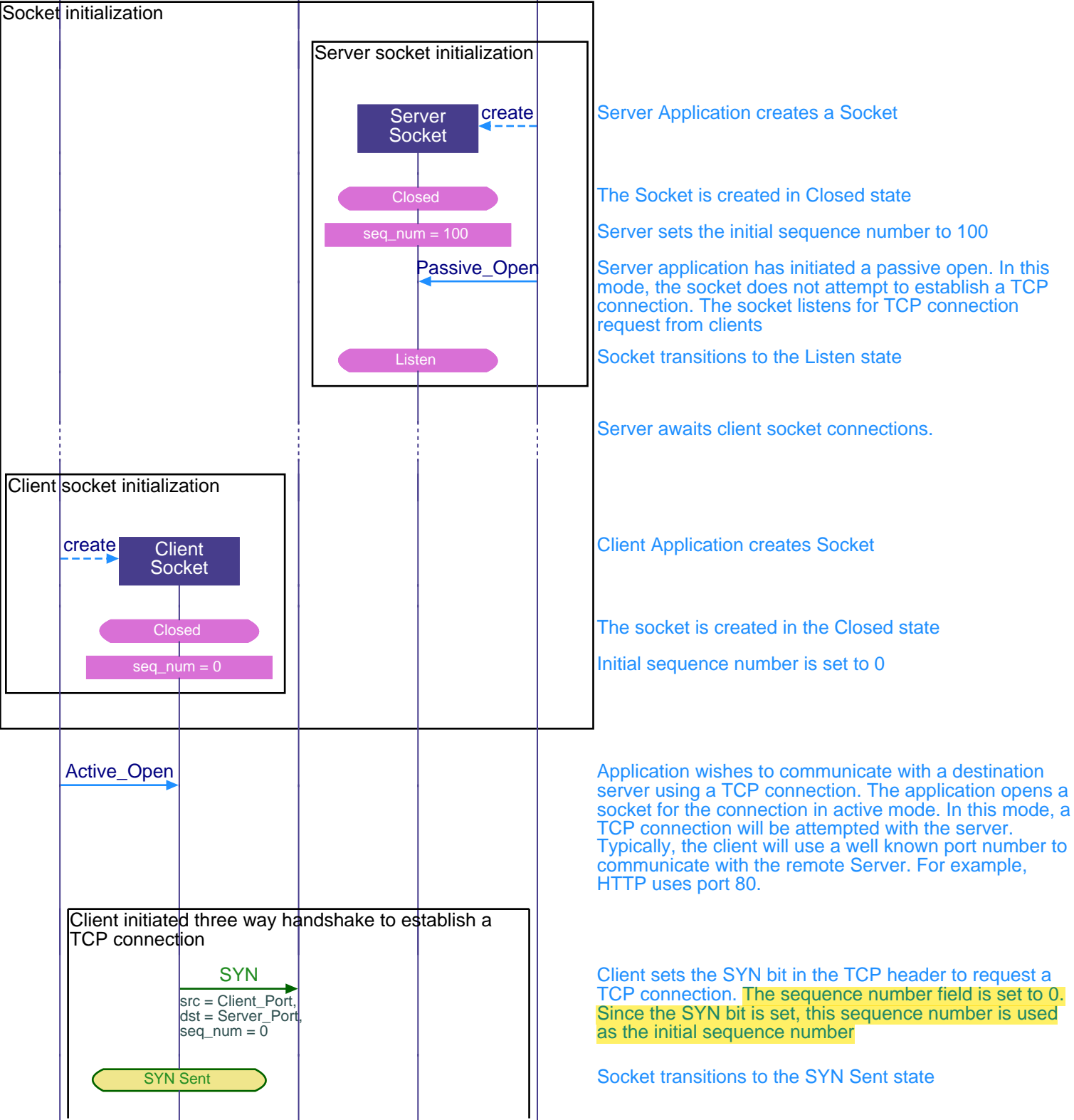
TCP - Transmission Control Protocol (TCP Connection Setup and Release)				
Client Node		Internet	Server Node	
Client		Net	Server	
Client App		Network		Server App
EventStudio System Designer 6				
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This sequence diagram was generated with EventStudio System Designer (<http://www.EventHelix.com/EventStudio>).

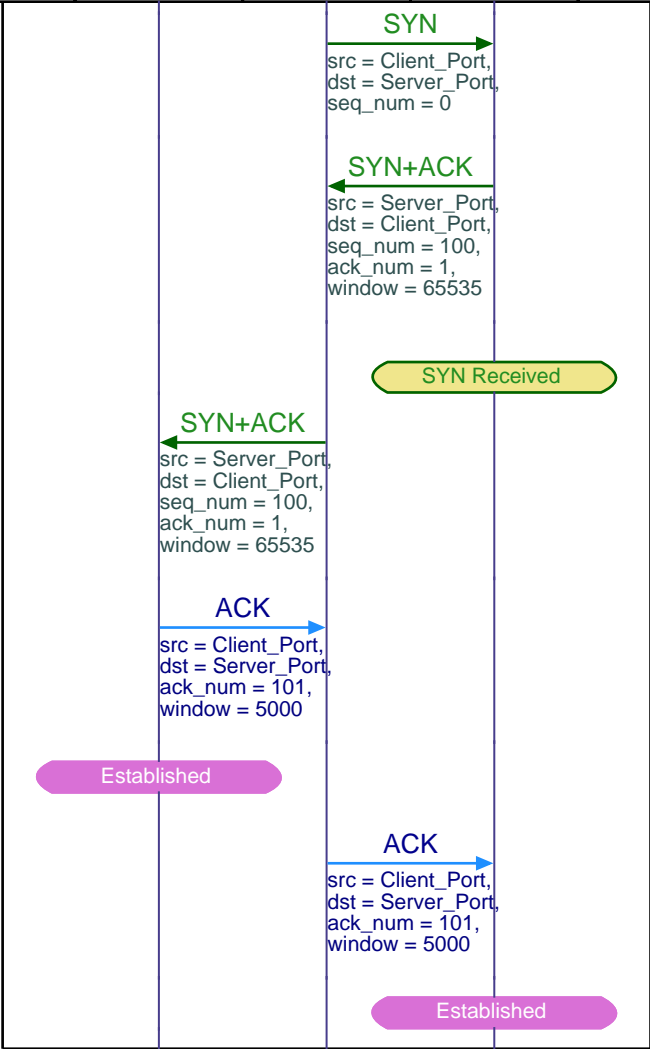
TCP (Transmission Control Protocol) provides a reliable end to end service that delivers packets over the Internet. Packets are delivered in sequence without loss or duplication.

This sequence diagram explores following: (1) The three-way handshake to establish a TCP (2) Data transfer using the byte oriented sequence numbers (3) Release of a TCP connection.

The TCP socket creation and deletion on the server and client is also covered.



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SYN TCP segment is received by the server

Server sets the SYN and the ACK bits in the TCP header. Server sends its initial sequence number as 100. Server also sets its window to 65535 bytes. i.e. Server has buffer space for 65535 bytes of data. Also note that the ack sequence number is set to 1. This signifies that the server expects a next byte sequence number of 1

Now the server transitions to the SYN Received state

Client receives the "SYN+ACK" TCP segment

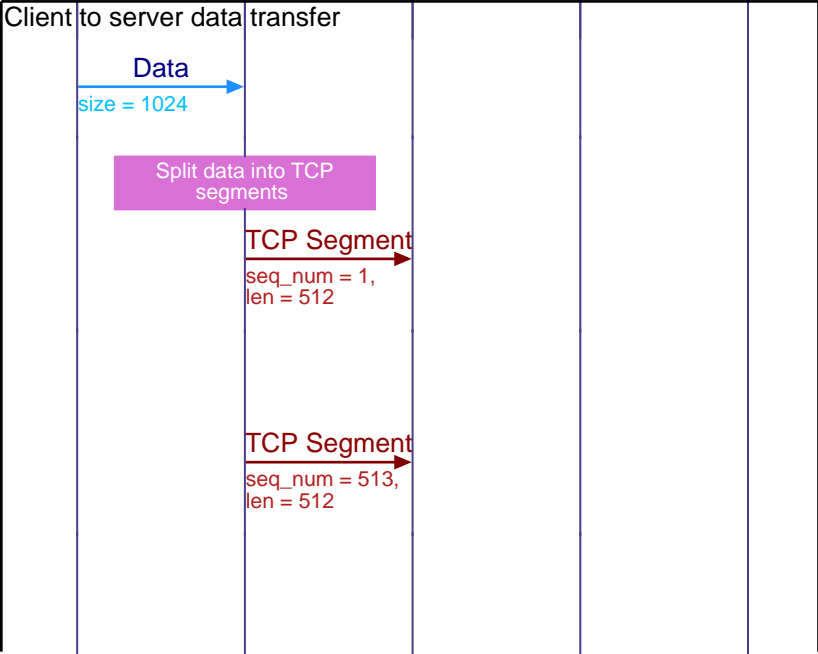
Client now acknowledges the first segment, thus completing the three way handshake. The receive window is set to 5000. Ack sequence number is set to 101, this means that the next expected sequence number is 101.

At this point, the client assumes that the TCP connection has been established

Server receives the TCP ACK segment

Now the server too moves to the Established state

Data transfer phase: Here a short data transfer takes place, thus TCP slow start has little impact



Client application sends 1024 bytes of data to the socket

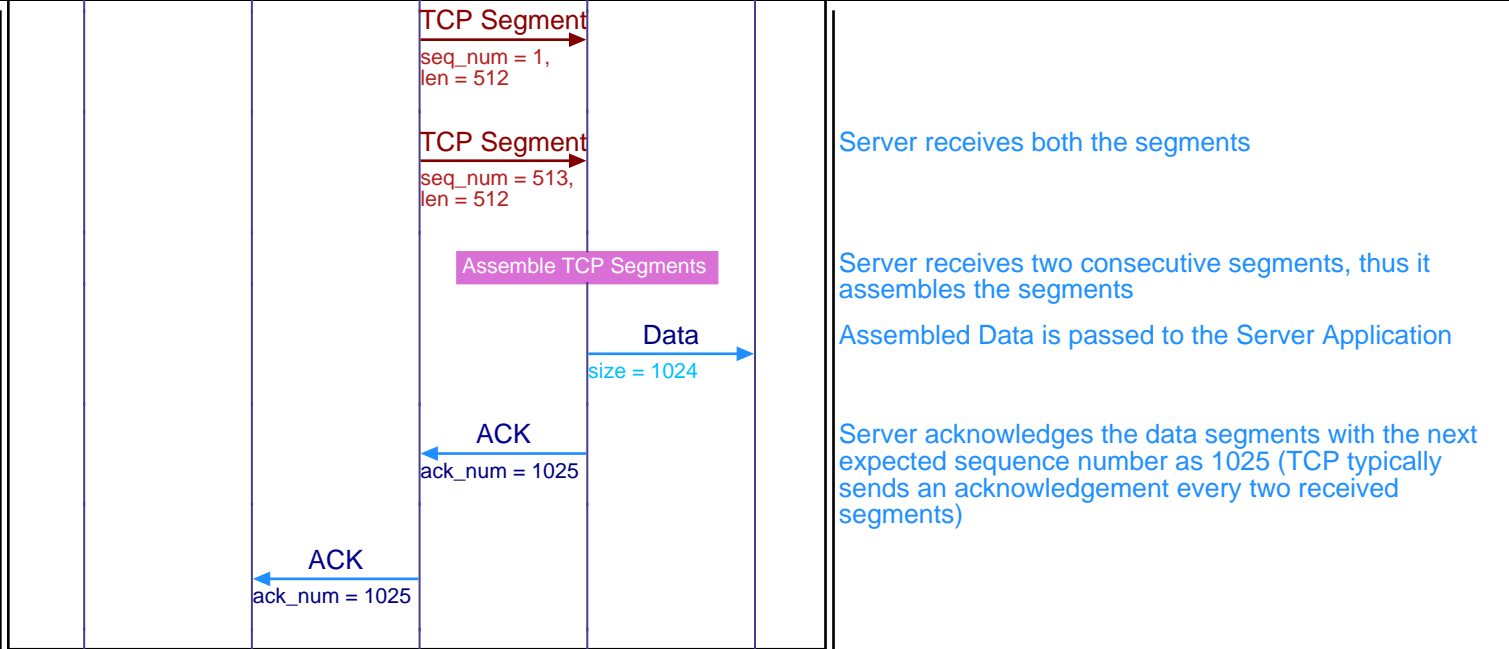
This TCP connection limits TCP segments to 512 bytes, thus the received data is split into 2 TCP segments

The first TCP segment is sent with a sequence number of 1. This is the sequence number for the first byte in the segment.
(Note that unlike other protocols, TCP maintains sequence numbers at byte level. The sequence number field in the TCP header corresponds to the first byte in the segment.)

Bytes in the first TCP segment correspond to 1 to 512 sequence numbers. Thus, the second TCP segment contains data starting with 513 sequence number

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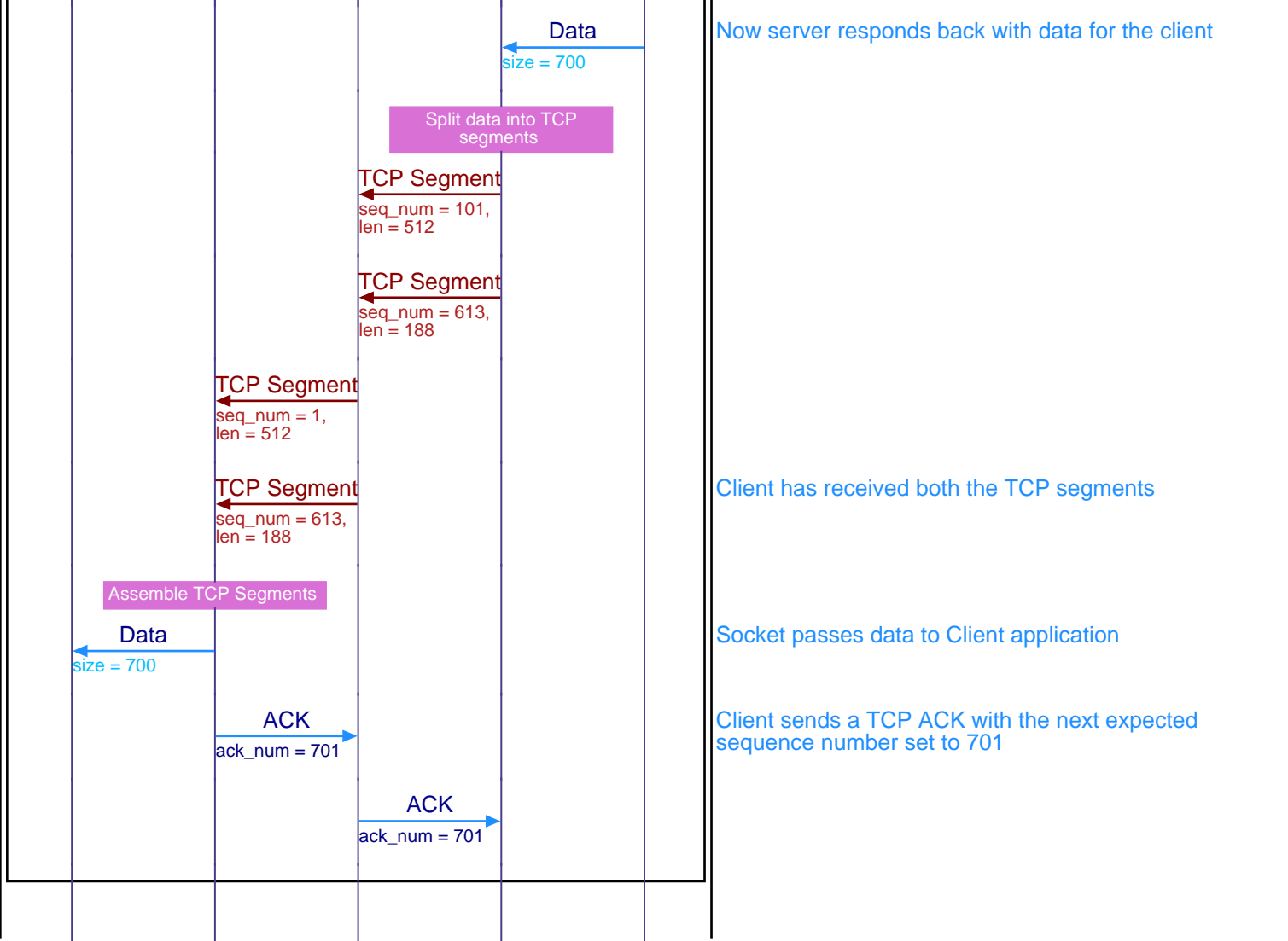
Server receives both the segments

Server receives two consecutive segments, thus it assembles the segments

Assembled Data is passed to the Server Application

Server acknowledges the data segments with the next expected sequence number as 1025 (TCP typically sends an acknowledgement every two received segments)

Server to client data transfer



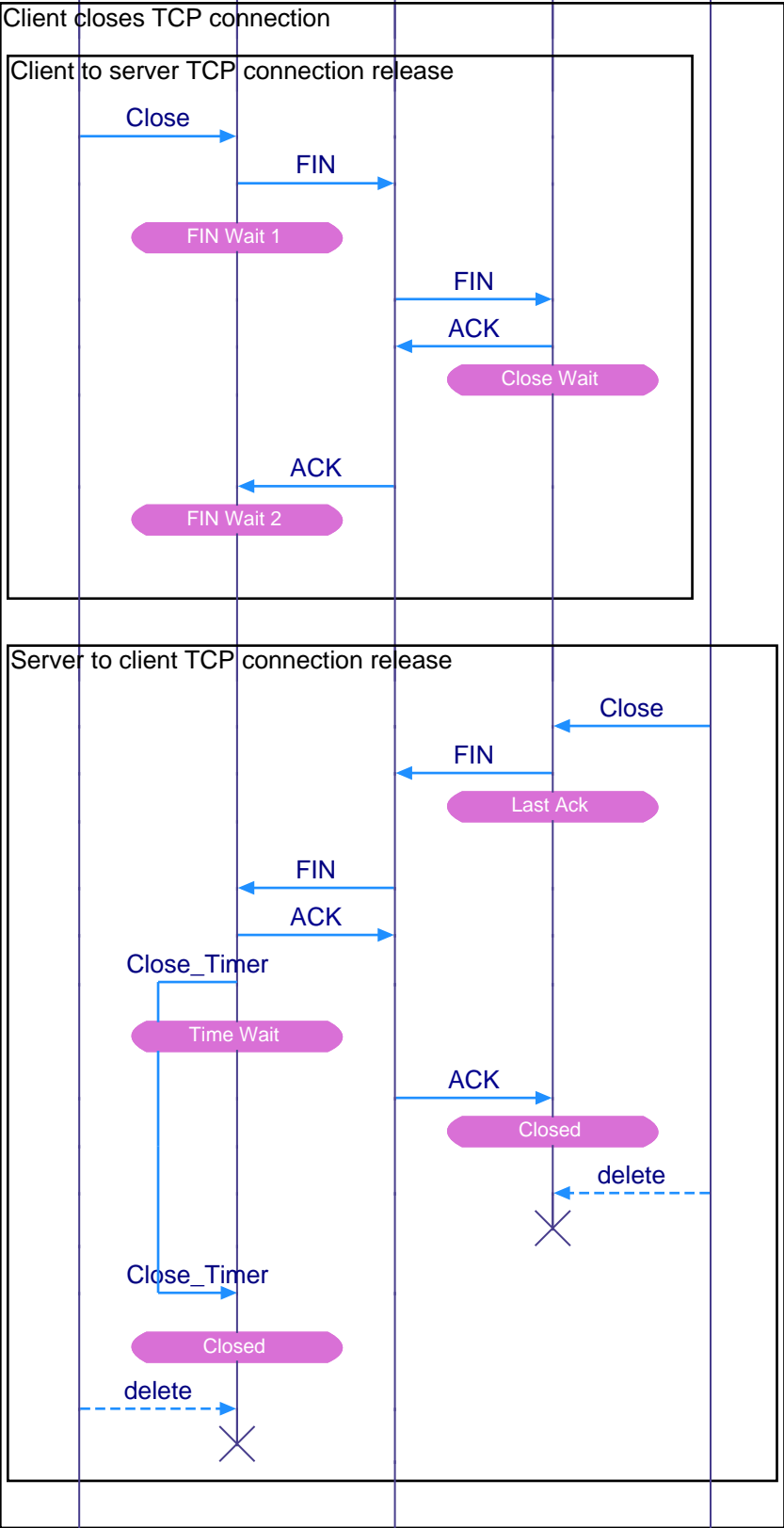
Now server responds back with data for the client

Client has received both the TCP segments

Socket passes data to Client application

Client sends a TCP ACK with the next expected sequence number set to 701

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Client application wishes to release the TCP connection

Client sends a TCP segment with the FIN bit set in the TCP header

Client changes state to FIN Wait 1 state

Server receives the FIN

Server responds back with ACK to acknowledge the FIN

Server changes state to Close Wait. In this state the server waits for the server application to close the connection

Client receives the ACK

Client changes state to FIN Wait 2. In this state, the TCP connection from the client to server is closed. Client now waits close of TCP connection from the server end

Server application closes the TCP connection

FIN is sent out to the client to close the connection

Server changes state to Last Ack. In this state the last acknowledgement from the client will be received

Client receives FIN

Client sends ACK

Client starts a timer to handle scenarios where the last ack has been lost and server resends FIN

Client waits in Time Wait state to handle a FIN retry

Server receives the ACK

Server moves the connection to closed state

Close timer has expired. Thus the client end connection can be closed too.