

# Other TCP Connection Establishment Methods

In this lesson, we'll look at some unconventional ways that connection establishment may occur.

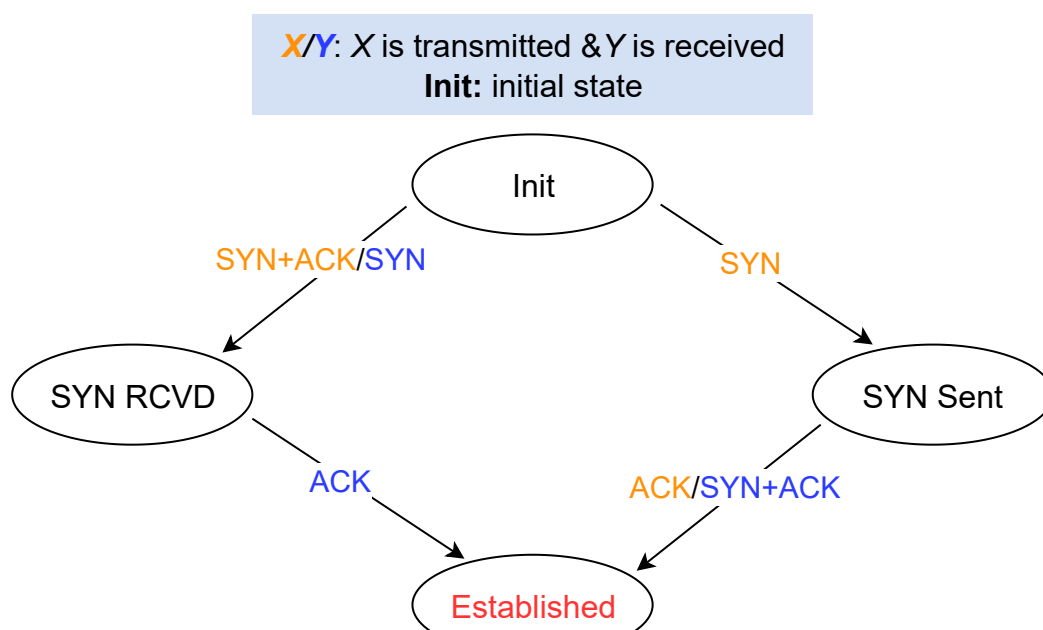
## WE'LL COVER THE FOLLOWING

- A TCP Three-way Handshake FSM
  - Client-Side
  - Server-Side
- Simultaneous Connection Establishment
- Quick Quiz!

In the last lesson, we looked at the most common way that TCP connection establishment could occur. Now, let's look at some other ways it can successfully occur.

## A TCP Three-way Handshake FSM #

TCP connection establishment can be described with a four-state Finite State Machine (FSM) as shown below. In this FSM,  $X/Y$  indicates that segment  $X$  was transmitted and segment  $Y$  was received. *Init* is the initial state



## Client-Side #

Let's carve out the paths in this FSM. Here's the three-way handshake path.

1. A client host starts in the **Init** state.
2. It then sends a *SYN* segment and enters the **SYN Sent** state where it waits for a *SYN+ACK* segment.
3. When a *SYN+ACK* is received in the **SYN SENT** state, it replies with an *ACK* segment and enters the **Established** state where data can be exchanged.

## Server-Side #

1. On the other hand, a server host starts in the **Init state**.
2. When a server process starts to listen to a destination port, the underlying TCP entity creates a TCP control block and a queue to process incoming *SYN* segments. Upon reception of a *SYN* segment, the server's TCP entity replies with a *SYN+ACK* and enters the **SYN RCVD** state.
3. It remains in this state until it receives an *ACK* segment that acknowledges its *SYN+ACK* segment, and with this it then enters the **Established** state.

## Simultaneous Connection Establishment #

Apart from these two paths in the TCP connection establishment, shown in the above FSM, there is a third way that a connection can be established: when both the client and the server send a *SYN* segment to open a TCP connection.



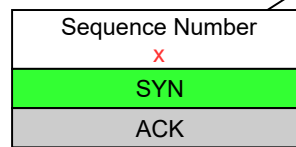
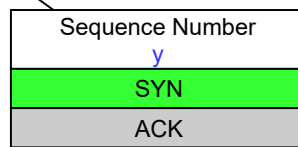
Client



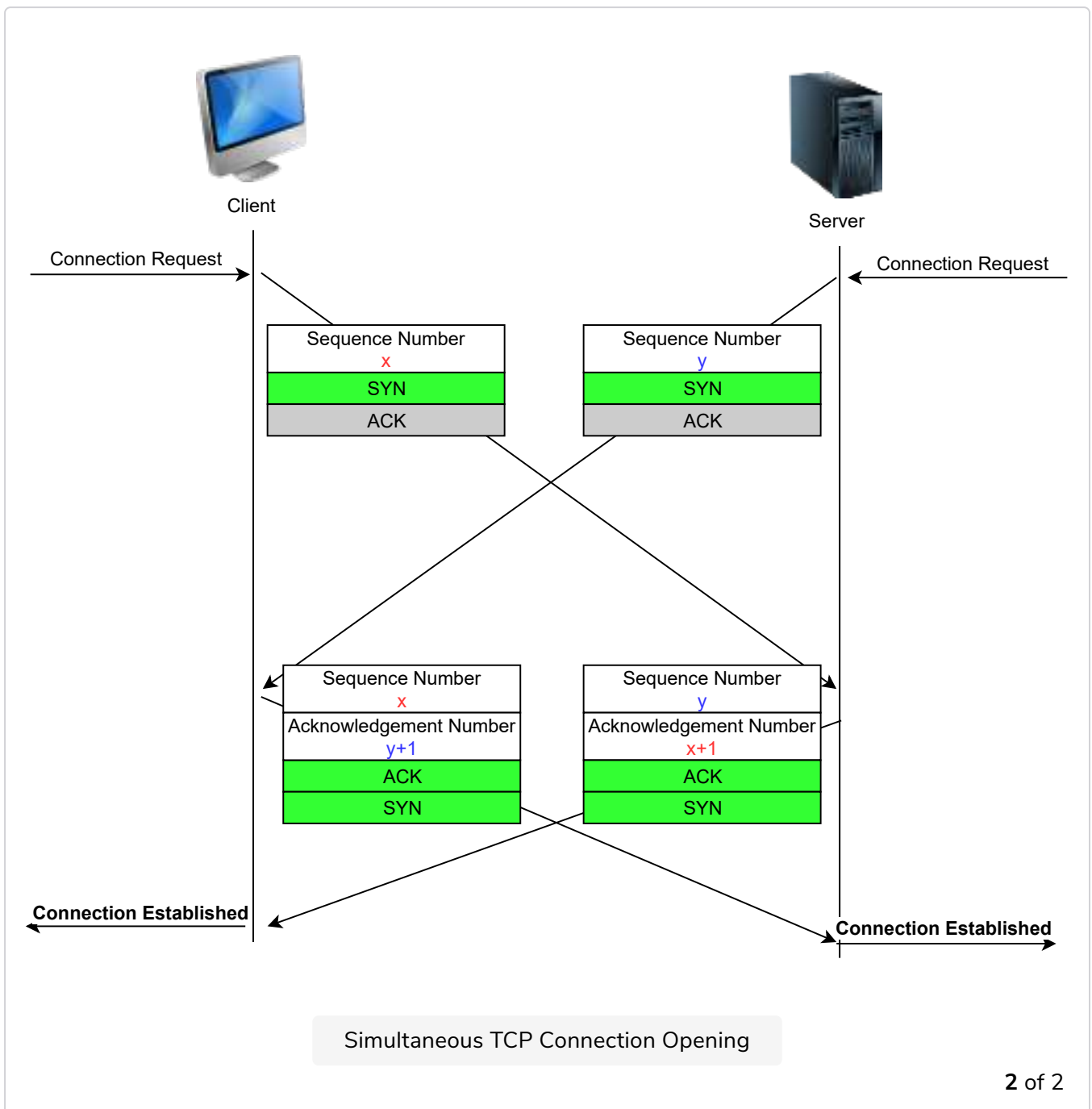
Server

Connection Request

Connection Request



Simultaneous TCP Connection Opening



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Both sides must know the port number for each other in this case. It doesn't have to be a well-known port number or the same on both sides.

## Quick Quiz! #

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Simultaneous connection may result in more segments being exchanged than a regular three-way handshake.

COMPLETED 0%



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Coming up, we'll look at a few scenarios in which connection establishment can go wrong and how TCP handles it.