

The **TCP 3-Way Handshake** is the process used to **establish a reliable connection** between a client and server in the **Transmission Control Protocol (TCP)**.

⌚ What is TCP?

TCP (Transmission Control Protocol) is a **connection-oriented protocol** that ensures:

- Reliable data delivery
- Ordered data transfer
- Error checking

Before data is sent, a **connection must be established**, and that's where the **3-way handshake** comes in.

🤝 What is the 3-Way Handshake?

The **3-way handshake** involves **three steps** between the **client** and **server**:

📍 Step 1: SYN (Synchronize)

- The **client** wants to start a connection.
- It sends a **SYN** packet to the server.
- This packet includes a **random initial sequence number (ISN)**.

👤 Client → Server:

“Hey! I want to connect. Here's my ISN = 1000.”

📍 Step 2: SYN-ACK (Synchronize-Acknowledge)

- The **server** receives the SYN.
- It replies with a **SYN-ACK** packet:
 - ACK: Acknowledges the client's ISN.
 - SYN: Sends its own ISN to the client.

👤 Server → Client:

“Got it! Acknowledging your ISN = 1000.

Here's my ISN = 2000.”

📍 Step 3: ACK (Acknowledge)

- The **client** sends an **ACK** packet:
 - Acknowledges the server's ISN.

👤 Client → Server:

“ACK for your ISN = 2000.

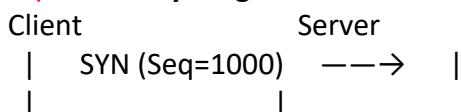
Let's start sending data!”

✅ Connection Established!

Now both client and server have agreed on:

- Initial sequence numbers
- Reliable data path

🧠 Summary Diagram:



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| <--- SYN+ACK (Seq=2000, Ack=1001) |
|                                     |
| ACK (Ack=2001)   --->  |

```

Why is it Needed?

- Ensures both sides are **ready** for communication
- Establishes **sequence numbers** for tracking data
- Prevents **half-open connections**

