Sample output

100-byte file transmission without loss

Client-side:

SEND 2254 0 SYN

RECV 25157 2255 SYN ACK

SEND 2255 25158 ACK

SEND 2355 0 FIN

RECV 25158 2355 ACK

RECV 25158 2356 ACK

RECV 25158 0 FIN

SEND 2356 25159 ACK

Server-side:

RECV 2254 0 SYN

SEND 25157 2255 SYN ACK

RECV 2255 25158 ACK

SEND 25158 2355 ACK

RECV 2355 0 FIN

SEND 25158 2356 ACK

SEND 25158 0 FIN

RECV 2356 25159 ACK

Large file transmission without loss

Client-side:

SEND 2254 0 SYN

RECV 25157 2255 SYN ACK

SEND 2255 25158 ACK

SEND 2767 25158

SEND 3279 25158

SEND 3791 25158

SEND 4303 25158

SEND 4815 25158

SEND 5327 25158

SEND 5839 25158

SEND 6351 25158

SEND 6863 25158

RECV 25158 2767 ACK

SEND 7375 25158

RECV 25158 3279 ACK

SEND 7887 25158

RECV 25158 3791 ACK

SEND 8399 25158

RECV 25158 4303 ACK

SEND 8911 25158

RECV 25158 4815 ACK

SEND 9423 25158

RECV 25158 5327 ACK

SEND 9935 25158
RECV 25158 5839 ACK
SEND 10447 25158
RECV 25158 6351 ACK
SEND 10959 25158
RECV 25158 6863 ACK
SEND 11471 25158
RECV 25158 7375 ACK
SEND 11983 25158
RECV 25158 7887 ACK
SEND 12495 25158
RECV 25158 8399 ACK
SEND 13007 25158
RECV 25158 8911 ACK
SEND 13519 25158
RECV 25158 9423 ACK
SEND 14031 25158
RECV 25158 9935 ACK
SEND 14543 25158
RECV 25158 10447 ACK
SEND 15055 25158
RECV 25158 10959 ACK
SEND 15567 25158
RECV 25158 11471 ACK
SEND 16079 25158
RECV 25158 11983 ACK
SEND 16591 25158
RECV 25158 12495 ACK
SEND 17103 25158
RECV 25158 13007 ACK
SEND 17615 25158
RECV 25158 13519 ACK
SEND 18127 25158
RECV 25158 14031 ACK
SEND 18639 25158
RECV 25158 14543 ACK
SEND 19151 25158
RECV 25158 15055 ACK
SEND 19663 25158
RECV 25158 15567 ACK
SEND 20175 25158
RECV 25158 16079 ACK
SEND 20687 25158

RECV 25158 16591 ACK
SEND 21199 25158
RECV 25158 17103 ACK
SEND 21711 25158
RECV 25158 17615 ACK
SEND 22223 25158
RECV 25158 18127 ACK
SEND 22735 25158
RECV 25158 18639 ACK
SEND 23247 25158
RECV 25158 19151 ACK
SEND 23759 25158
RECV 25158 19663 ACK
SEND 24271 25158
RECV 25158 20175 ACK
SEND 24783 25158
RECV 25158 20687 ACK
SEND 25295 25158
RECV 25158 21199 ACK
SEND 206 25158
RECV 25158 21711 ACK
SEND 718 25158
RECV 25158 22223 ACK
SEND 1230 25158
SEND 1742 0 FIN
RECV 25158 22735 ACK
RECV 25158 23247 ACK
RECV 25158 23759 ACK
RECV 25158 24271 ACK
RECV 25158 24783 ACK
RECV 25158 25295 ACK
RECV 25158 206 ACK
RECV 25158 718 ACK
RECV 25158 1230 ACK
RECV 25158 1742 ACK
RECV 25158 1743 ACK
RECV 25158 0 FIN
SEND 1743 25159 ACK

Scenarios of different loss:

1. Client SYN loss or server SYN-ACK loss
2. Data packet loss
3. ACK loss
4. Client FIN loss or Server FIN-ACK loss
5. Server FIN loss or Client FIN-ACK loss

1: SYN loss or SYN-ACK loss (A 100-byte file)
Scenario: packet loss or ack loss triggers retransmission after timeout.
SYN loss from the client->server (SEND 2254 0 SYN **is lost**

Client-side:	Server-side:
SEND 2254 0 SYN	RECV 2254 0 SYN
TIMEOUT 2254	SEND 25157 2255 SYN ACK
RESEND 2254 0 SYN	RECV 2255 25158 ACK
RECV 25157 2255 SYN ACK	SEND 25158 2355 ACK
SEND 2255 25158 ACK	RECV 2355 0 FIN
SEND 2355 0 FIN	SEND 25158 2356 ACK
RECV 25158 2355 ACK	SEND 25158 0 FIN
RECV 25158 2356 ACK	RECV 2356 25159 ACK
RECV 25158 0 FIN	
SEND 2356 25159 ACK	

SYN-ACK loss from the server->client (SEND 25157 2255 ACK SYN **is lost)**

Client-side:	Server-side:
SEND 2254 0 SYN	RECV 2254 0 SYN
TIMEOUT 2254	SEND 25157 2255 SYN ACK
RESEND 2254 0 SYN	RECV 2254 0 SYN
RECV 25157 2255 SYN ACK	SEND 25157 2255 SYN DUP-ACK
SEND 2255 25158 ACK	RECV 2255 25158 ACK
SEND 2355 0 FIN	SEND 25158 2355 ACK
RECV 25158 2355 ACK	RECV 2355 0 FIN
RECV 25158 2356 ACK	SEND 25158 2356 ACK
RECV 25158 0 FIN	SEND 25158 0 FIN
SEND 2356 25159 ACK	RECV 2356 25159 ACK

2: data packet loss (SEND 12858 0 is lost)

Client-side:
SEND 12345 0 SYN
RECV 4321 12346 SYN ACK
SEND 12346 4322 ACK
SEND 12858 0
SEND 13370 0
SEND 13882 0
SEND 14394 0
SEND 14906 0
SEND 15418 0
SEND 15930 0
SEND 16442 0
SEND 16954 0
RECV 4322 12858 ACK
SEND 17466 0
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
RECV 4322 12858 ACK
TIMEOUT 12858
RESEND 12858 0
RESEND 13370 0
RESEND 13882 0
RESEND 14394 0
RESEND 14906 0
RESEND 15418 0
RESEND 15930 0
RESEND 16442 0
RESEND 16954 0
RESEND 17466 0
...

Server-side:
RECV 12345 0 SYN
SEND 4321 12346 SYN ACK
RECV 12346 4322 ACK
SEND 4322 12858 ACK
RECV 13370 0
SEND 4322 12858 DUP-ACK
RECV 13882 0
SEND 4322 12858 DUP-ACK
RECV 14394 0
SEND 4322 12858 DUP-ACK
RECV 14906 0
SEND 4322 12858 DUP-ACK
RECV 15418 0
SEND 4322 12858 DUP-ACK
RECV 15930 0
SEND 4322 12858 DUP-ACK
RECV 16442 0
SEND 4322 12858 DUP-ACK
RECV 16954 0
SEND 4322 12858 DUP-ACK
RECV 17466 0
SEND 4322 12858 DUP-ACK
RECV 12858 0
SEND 4322 13370 ACK
RECV 13370 0
SEND 4322 13882 ACK
RECV 13882 0
SEND 4322 14394 ACK
RECV 14394 0
SEND 4322 14906 ACK
RECV 14906 0
SEND 4322 15418 ACK
RECV 15418 0
SEND 4322 15930 ACK
RECV 15930 0
SEND 4322 16442 ACK
RECV 16442 0
SEND 4322 16954 ACK
RECV 16954 0
SEND 4322 17466 ACK

3: ACK packet loss (SEND 4322 13370 ACK is lost)

Client-side:
SEND 12345 0 SYN
RECV 4321 12346 SYN ACK
SEND 12346 4322 ACK
SEND 12858 0
SEND 13370 0
SEND 13882 0
SEND 14394 0
SEND 14906 0
SEND 15418 0
SEND 15930 0
SEND 16442 0
SEND 16954 0
RECV 4322 12858 ACK
SEND 17466 0
RECV 4322 13882 ACK
SEND 17978 0
SEND 18490 0
RECV 4322 14394 ACK
SEND 19002 0
RECV 4322 14906 ACK
SEND 19514 0
RECV 4322 15418 ACK
SEND 20026 0
RECV 4322 15930 ACK
SEND 20538 0
RECV 4322 16442 ACK
SEND 21050 0
RECV 4322 16954 ACK
SEND 21562 0
RECV 4322 17466 ACK
SEND 22074 0
RECV 4322 17978 ACK
SEND 22586 0
...

Server-side:
RECV 12345 0 SYN
SEND 4321 12346 SYN ACK
RECV 12346 4322 ACK
SEND 4322 12858 ACK
RECV 12858 0
SEND 4322 13370 ACK
RECV 13370 0
SEND 4322 13882 ACK
RECV 13882 0
SEND 4322 14394 ACK
RECV 14394 0
SEND 4322 14906 ACK
RECV 14906 0
SEND 4322 15418 ACK
RECV 15418 0
SEND 4322 15930 ACK
RECV 15930 0
SEND 4322 16442 ACK
RECV 16442 0
SEND 4322 16954 ACK
RECV 16954 0
SEND 4322 17466 ACK
RECV 17466 0
SEND 4322 17978 ACK
RECV 17978 0
SEND 4322 18490 ACK
RECV 18490 0
SEND 4322 19002 ACK
RECV 19002 0
SEND 4322 19514 ACK
RECV 19514 0
SEND 4322 20026 ACK
RECV 20026 0
SEND 4322 20538 ACK
RECV 20538 0
SEND 4322 21050 ACK
RECV 21050 0
SEND 4322 21562 ACK
...

4: Client FIN loss or server FIN-ACK loss (A 100-byte file)
FIN loss from the client->server (SEND 2355 0 FIN is lost)

Client-side:	Server-side:
SEND 2254 0 SYN	RECV 2254 0 SYN
RECV 25157 2255 SYN ACK	SEND 25157 2255 SYN ACK
SEND 2255 25158 ACK	RECV 2255 25158 ACK
SEND 2355 0 FIN	SEND 25158 2355 ACK
RECV 25158 2355 ACK	RECV 2355 0 FIN
TIMEOUT 2355	SEND 25158 2356 ACK
RESEND 2355 0 FIN	SEND 25158 0 FIN
RECV 25158 2356 ACK	RECV 2356 25159 ACK
RECV 25158 0 FIN	
SEND 2356 25159 ACK	

FIN-ACK loss from the server->client (SEND 25158 2356 ACK is lost)
Note: The client replies with ACK when receiving the server's FIN since all data has been sent and acknowledged. The server then closes the connection after finishing FIN procedure. So the server already closed the connection when the client resends the FIN. The client will fail to resend the FIN and directly close the connection.

Client-side:	Server-side:
SEND 2254 0 SYN	RECV 2254 0 SYN
RECV 25157 2255 SYN ACK	SEND 25157 2255 SYN ACK
SEND 2255 25158 ACK	RECV 2255 25158 ACK
SEND 2355 0 FIN	SEND 25158 2355 ACK
RECV 25158 2355 ACK	RECV 2355 0 FIN
RECV 25158 0 FIN	SEND 25158 2356 ACK
SEND 2356 25159 ACK	SEND 25158 0 FIN
TIMEOUT 2355	RECV 2356 25159 ACK
RESEND 2355 0 FIN (failed)	

5: Server FIN loss or client FIN-ACK loss (A 100-byte file)
FIN loss from the server->client (SEND 25158 0 FIN is lost)

Client-side:
SEND 2254 0 SYN
RECV 25157 2255 SYN ACK
SEND 2255 25158 ACK
SEND 2355 0 FIN
RECV 25158 2355 ACK
RECV 25158 2356 ACK
RECV 25158 0 FIN
SEND 2356 25159 ACK

Server-side:
RECV 2254 0 SYN
SEND 25157 2255 SYN ACK
RECV 2255 25158 ACK
SEND 25158 2355 ACK
RECV 2355 0 FIN
SEND 25158 2356 ACK
SEND 25158 0 FIN
TIMEOUT 25158
RESEND 25158 0 FIN
RECV 2356 25159 ACK

FIN-ACK loss from the client->server (SEND 2356 25159 ACK is lost)

Client-side:
SEND 2254 0 SYN
RECV 25157 2255 SYN ACK
SEND 2255 25158 ACK
SEND 2355 0 FIN
RECV 25158 2355 ACK
RECV 25158 2356 ACK
RECV 25158 0 FIN
SEND 2356 25159 ACK
RECV 25158 0 FIN
SEND 2356 25159 DUP-ACK

Server-side:
RECV 2254 0 SYN
SEND 25157 2255 SYN ACK
RECV 2255 25158 ACK
SEND 25158 2355 ACK
RECV 2355 0 FIN
SEND 25158 2356 ACK
SEND 25158 0 FIN
TIMEOUT 25158
RESEND 25158 0 FIN
RECV 2356 25159 ACK