Video - TCP Reliability - Sequence Numbers and Acknowledgments (4 min)

This video depicts a simplified example of TCP operations. It is not necessarily a realistic depiction. TCP is a connection oriented protocol in that a connection is established first using a three-way handshake before data is sent. Another characteristic of TCP is that it's a reliable protocol. Two things that make it reliable are sequence numbers and acknowledgements. Every TCP segment that's sent in a TCP conversation gets a sequence number. So every byte of data is numbered basically in a sequential list. This allows a receiving host to rebuild the data from the ordered numbered segments. If data arrives out of order at the receiving end, the data can be put back together in the proper order thanks to the sequence numbers. Acknowledgements come into play by helping the sender know that the data that's being sent is actually being received. The way this works is the sending host sends TCP segments in bytes and the receiving host acknowledges bytes received by sending acknowledgements. There is a limit to the amount of data the sending host can send before it receives an acknowledgement from the receiver. This amount is called the window size. The window size is the total number of bytes sent in TCP segments that can be sent before receiving an acknowledgement. Using TCP window scaling, computers able to achieve large window sizes of up to one gigabyte. So as the sending host sends bytes of data in TCP segments, the receiving host returns acknowledgements as it processes bytes received and frees up its buffers. We can see this depicted in this graphic. Let's start by reading the message from the sending host here. "Start with byte number one. "I am sending 10 bytes." In this scenario, the 10 bytes is the window size. In reality, the window size would be a lot larger than 10 bytes, since today window sizes are typically 16 megabytes or larger. But this works nicely for this example. So the host is sending 10 bytes, starting with byte number one. The receiving host, the server here, says, "I received 10 bytes starting with byte number one. "I expect byte 11 next." This is the acknowledgement. The server acknowledges it received the 10 bytes and now is expecting number 11. If we look down here we can see that in this segment, starting with sequence number one, 10 bytes have been sent. The receiver sends an ack. 11. Starting with one, 10 bytes were sent, so the next sequence number it's expecting is an 11. This acknowledgement is sent back to the originating host. Now the originating host sends 10 more bytes starting with sequence number 11. If we were to ask ourselves, "What would be the next ack. "that the server would send back to the originating host?" We would have to ask ourselves, "What's the last sequence number sent?" Starting with 11, 10 bytes were sent, so the last sequence number that was sent was 20. So the ack. would be an ack. 21. That's the next expected sequence number. You can see how sequence numbers and acknowledgements, including the window size, make TCP a very orderly and reliable protocol.