

# Transmission Control Protocol (TCP)

## *Header*

TCP/IP Guide: [http://www.tcpiptguide.com/free/t\\_TCPMessageSegmentFormat-3.htm](http://www.tcpiptguide.com/free/t_TCPMessageSegmentFormat-3.htm)

## *Establishing a virtual connection: the 3-Way Handshake*

- SYN bit
  - Short for "synchronize"
  - This bit is used to establish a virtual connection
- ACK bit
  - Short for "acknowledgment"
- procedure
  - TCP/IP Guide:

[http://www.tcpiptguide.com/free/t\\_TCPConnectionEstablishmentProcessTheThreeWayHandsh-3.htm](http://www.tcpiptguide.com/free/t_TCPConnectionEstablishmentProcessTheThreeWayHandsh-3.htm)

## *Reliability and Flow Control*

- PAR – Positive Acknowledgment and Retransmission
  - TCP/IP Guide:  
[http://www.tcpipguide.com/free/t\\_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-3.htm](http://www.tcpipguide.com/free/t_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-3.htm)
- Message identification and time limits
  - By adding metadata that identifies messages and time limits, we can improve performance.
  - TCP/IP Guide:  
[http://www.tcpipguide.com/free/t\\_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-4.htm](http://www.tcpipguide.com/free/t_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-4.htm)
- Sliding window
  - TCP uses a sliding window approach.
  - TCP/IP Guide:
    - State -  
[http://www.tcpipguide.com/free/t\\_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-5.htm](http://www.tcpipguide.com/free/t_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-5.htm)
    - The window -  
[http://www.tcpipguide.com/free/t\\_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-6.htm](http://www.tcpipguide.com/free/t_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-6.htm)
    - After transmission -  
[http://www.tcpipguide.com/free/t\\_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-8.htm](http://www.tcpipguide.com/free/t_TCPSlidingWindowAcknowledgmentSystemForDataTranspo-8.htm)

### *Termination*

- TCP/IP Guide:  
[http://www.tcpipguide.com/free/t\\_TCPConnectionTermination-2.htm](http://www.tcpipguide.com/free/t_TCPConnectionTermination-2.htm)
- TIME\_WAIT: Time to wait to receive last "fin" response.
- The network stack will handle this problem, but you will see sockets in this state when viewing the output of netstat.

### *Congestion avoidance*

- TCP uses an algorithm known as Slow Start in order to regulate traffic flow.
- In brief, TCP sends a small amount of data when it first begins transmission and increases the amount sent until a packet is dropped.
- At that point, TCP throttles back the amount of data being sent.
- This approach avoids congesting the network.

### *Functions performed by TCP*

- Multiplexing/demultiplexing by way of port number
- Connection management
- Provides reliability
- Controls flow of data, primarily to avoid congestion

### *Functions not performed by TCP*

- It imposes no constraints on how applications use it
- It is a streaming protocol, meaning that it does not maintain any message boundaries
- It does not guarantee communication, although it provides a significant degree of reliability

### *Important characteristics*

- Connection oriented
- Streaming
  - Thus, one call to the send function on a socket may result in multiple TCP packets being sent or vice versa.
- Bidirectional
- Flow managed