Transmission Control Protocol

PRESENTED BY:

SABIN NEPAL

RAJAN BHATTARAI

ACHUT DAHAL

ARUNA SHRESTHA

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Introduction to TCP

- A reliable, connection-oriented transport protocol
- protocol for data transmission in communication network such as internet
- provides a reliable stream delivery and connection service to applications
- corresponds to the transport layer of TCP/IP suite

- Used in World Wide Web (WWW),E-mail, File Transfer Protocol, Secure Shell, peer-to-peer file sharing, and some streaming media applications.

Features

- Numbering system
- Sequence number
- Acknowledgement number
- Error control
- Flow control

Services

- Process to process communication
- Stream delivery service
- Full duplex-communication
- Connection-oriented service
- Reliable service

TCP header

TCP Header

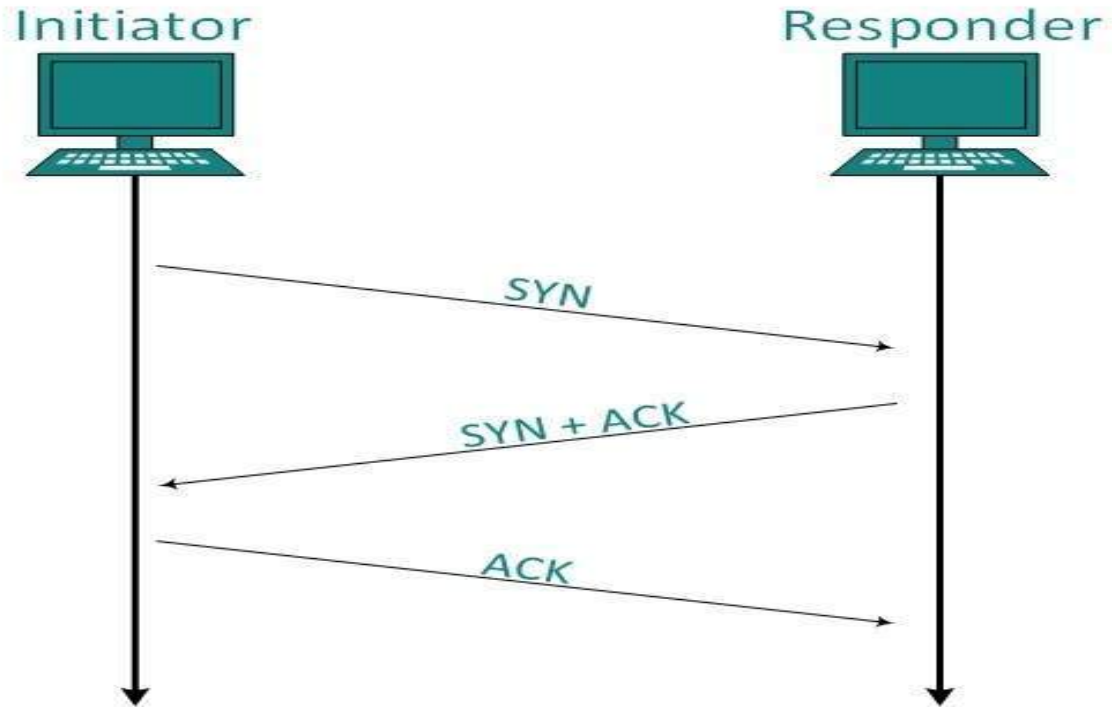
Offsets Octet		0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Source port																Destination port														
4	32	Sequence number																														
8	64	Acknowledgment number (if ACK set)																														
12	96	Data offset				Reserved 0 0 0				NS	CWR	ECE	URG	ACK	PSH	RST	SYN	FIN	Window Size													
16	128	Checksum																Urgent pointer (if URG set)														
20 ...	160 ...	Options (if Data Offset > 5, padded at the end with "0" bytes if necessary) ...																														

TCP connection

- Establishes a virtual path between source and destination
- works in Server/Client model
- TCP uses the services of IP to deliver individual segments, but it controls the connection itself
- Transmission requires 3 phases
  - Connection established
  - Data transfer
  - Connection termination

Connection Establishment

- SYN:
  - Synchronization of sequence no’s
  - Consumes 1 sequence no
  - Carries no real data
- SYN+ACK
  - SYN segment for communication in other direction and ACK for the received SYN,
  - Consumes 1 sequence no
- ACK
  - Just an ACK segment
  - Does not consume any sequence number

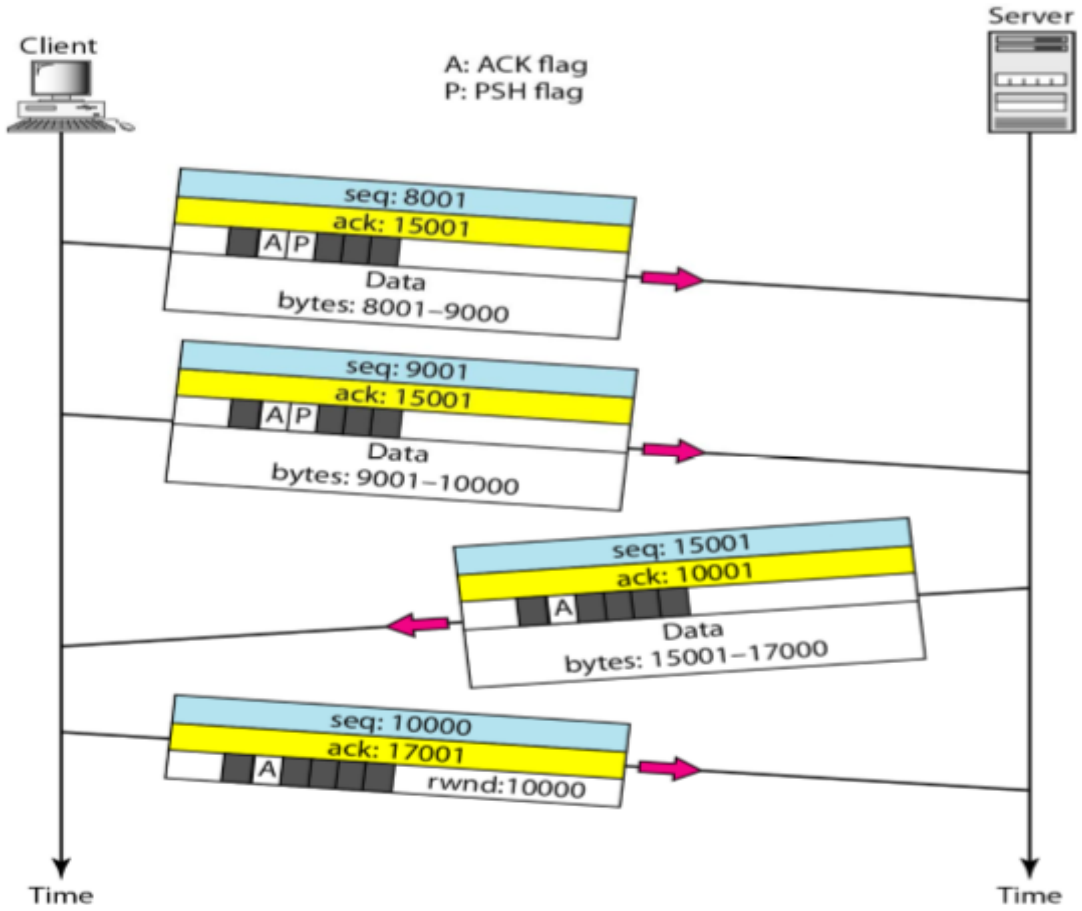


Data Transfer

- Pushing data
  - Increase efficiency of data
  - Sending and receiving buffers the data
  - Delivers to application program on ready
- Urgent data
  - Application program send urgent bytes
  - Sending application program want a piece

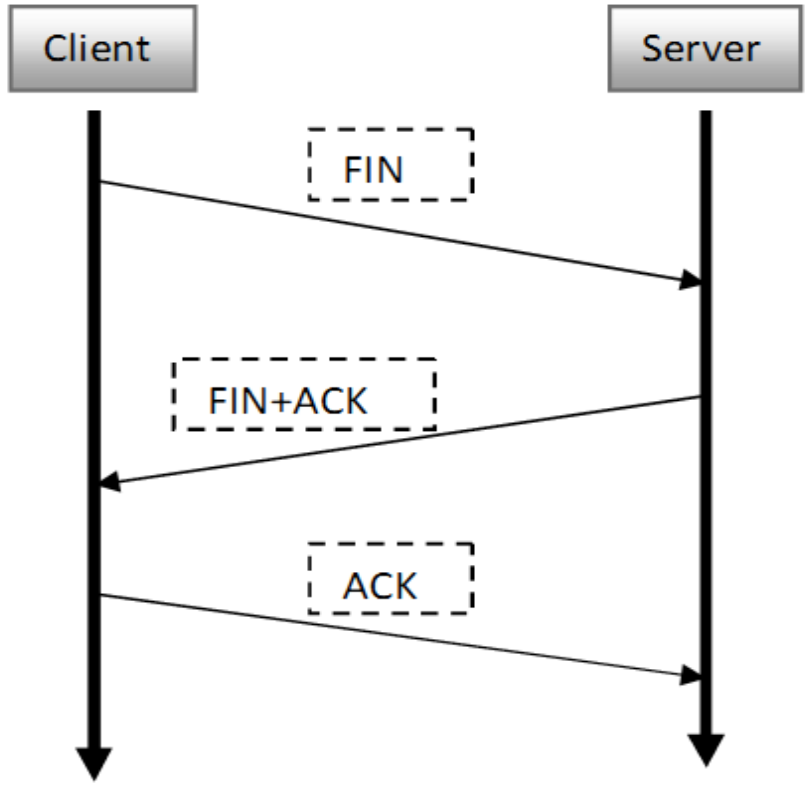
  Of program to read out which is handled by

  URG bit



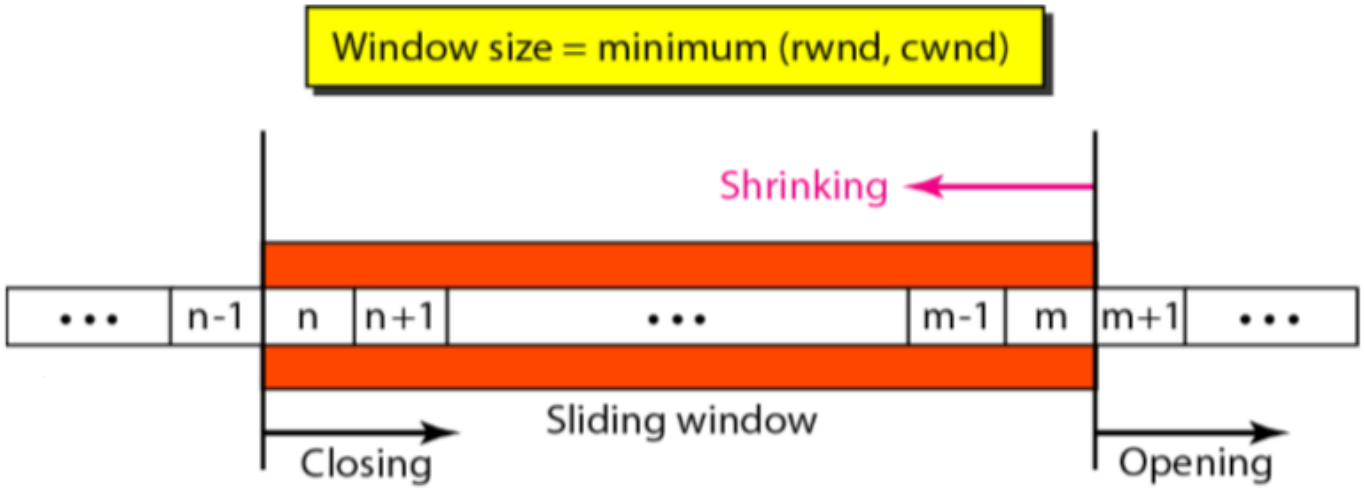
Connection termination

- FIN
  - Consumes 1 sequence no
  - May or may not consume data
- FIN+ACK
  - Consumes 1 sequence no
  - FIN announce closing of connection In other Direction and ACK for received FIN
- ACK
  - Does not consume any sequence no



Flow Control

- TCP uses sliding window to handle flow control
- Technique to properly match the transmission rate of the sender to that of the receiver and network



Error Control

- Error detection and correction is achieved of three simple tools
  - Checksum
    - Includes 16-bit checksum in every segment which is used to check for corrupt segment
    - If corrupted, it is discarded by destination TCP and is considered lost
  - Acknowledgement
    - TCP uses acknowledgement to confirm the receipt of data segments

- ACK segments are never acknowledged

- Retransmission
  - Lost, delayed or corrupted data are retransmitted
  - Segment is retransmitted either when a retransmission timer expires or when sender receives three duplicate ACK’s
    - Retransmission after RTO
    - Retransmission after 3 duplicate ACK’s
    - Out of order segments

References

1. https://www.tutorialspoint.com/data_communication_computer_network/transmission_control_protocol.htm
2. https://www.slideshare.net/k33a/transmission-control-protocol-tcp-31902778
3. https://www.slideshare.net/k33a/transmission-control-protocol-tcp-31902778