Network : Transport Protocols (1)

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Reference

William Stalling, Data and Computer Communications 10/E, Prentice Hall

Transport Protocols

- End-to-end transport of data that shields the user from the details of the underlying communication systems
  - Reliable, connection oriented : has greater complexity, e.g. TCP
  - Best effort, connectionless : datagram, e.g. UDP
- Connection-oriented transport protocol mechanisms
  - Provides establishment, maintenance and termination of a logical connection between TS(Transport Service) users
  - Most common service for a wide variety of applications
  - Is reliable, but complex

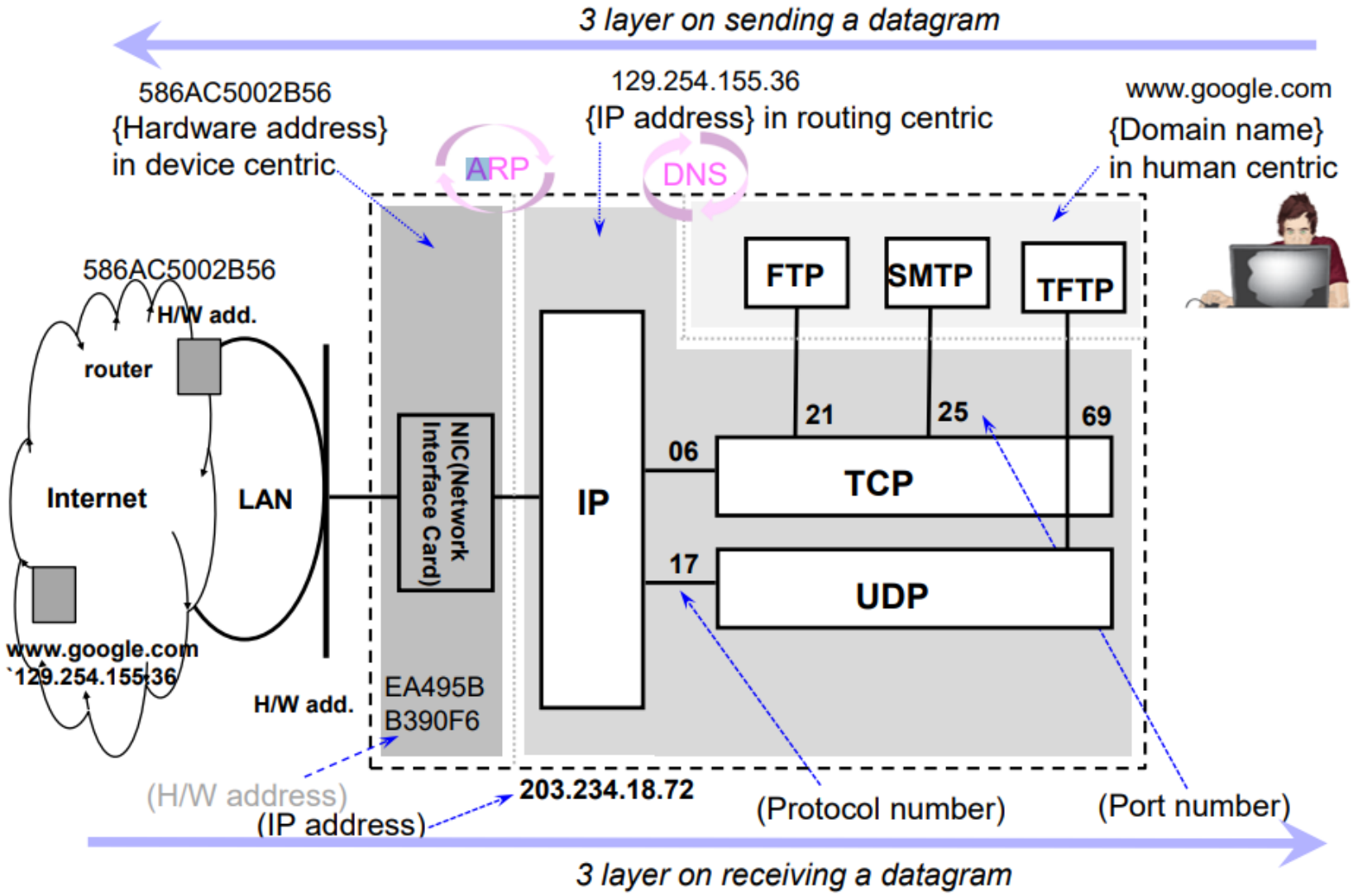
Reliable Sequencing Network Service

- Transport service is a simple end to end protocol between two systems on the same network
- However, its situation on internet would be so complex
  - Because the below layer, so IP, provide a best-effort delivery
- Issues are :
  - Addressing
  - Multiplexing
  - Flow control
  - Connection establishment and termination

Addressing

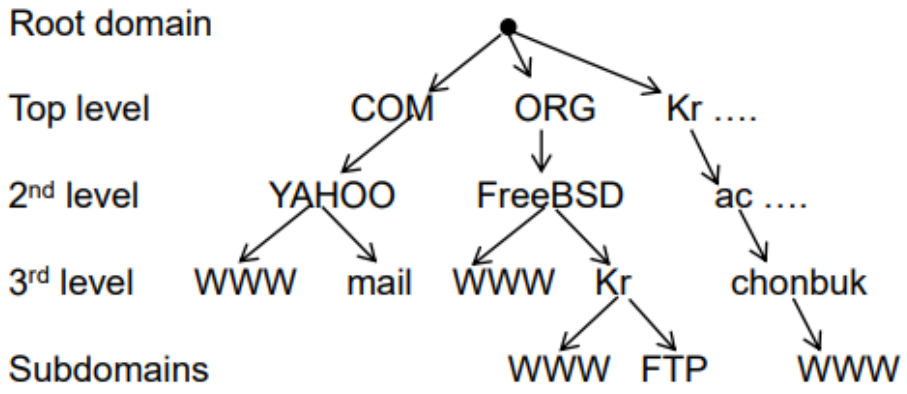
- Transport protocol must be able to derive the following information from the TS user address
- User identification
  - A socket in TCP
  - Port represents a particular transport service user
  - Multiple users employ the same transport protocol and are distinguished by port numbers
- Transport entity identification (on host)
  - Specify transport protocol (TCP, UDP)
- Host address of attached network device
  - In the internet, a global internet address

3-layer Internet Addressing



cf) Domain Name

- Problem statement
  - Average brain can easily remember 7 digits
  - On average, IP addresses have 10.28 digits
- So, we need an easier way to remember IP addresses
  - Makes use of alphanumeric names to refer to hosts
  - Add a distributed, hierarchical protocol (called DNS)
  - Address resolution is to map between host names and IP add.
- Let's re-think our DN
  - www.chonbuk.ac.kr vs www.jbnu.ac.kr



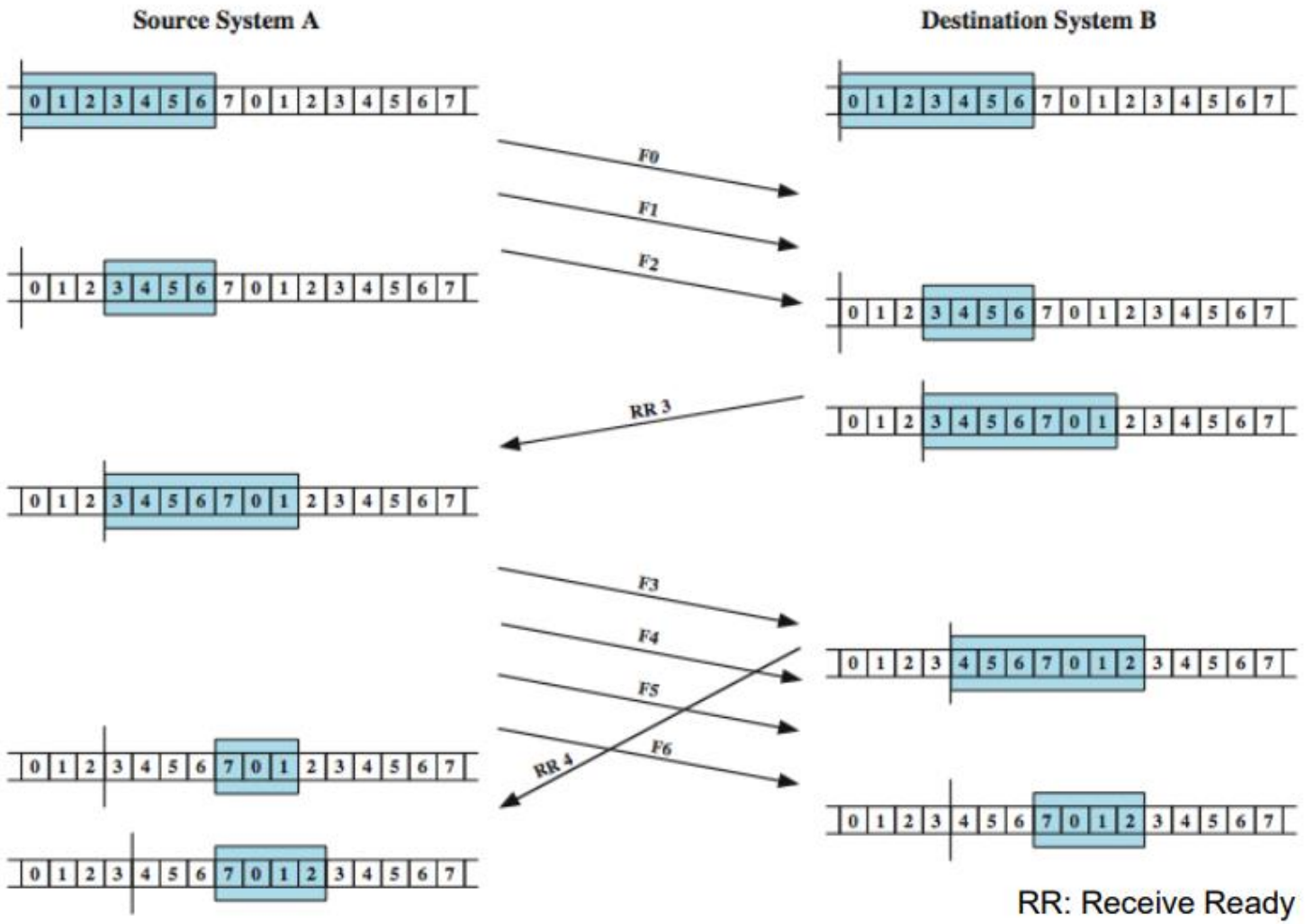
Flow Control

- Complex at the transport layer:
  - Considerable delay in the comm. Of flow control information
  - The transmission delay may be highly variable, making it difficult to effectively use a timeout mechanism for retransmission of lost data
- Reasons for control:
  - User of the receiving transport entity cannot keep up with the flow
  - Receiving transport entity itself cannot keep up with the flow of segments

Alternative to Flow Control Requirements

- Do nothing
  - Segments that overflow are discarded
  - Sending transport entity will fail to get ACK and will retransmit
  - Thus further adding to incoming data
- Refuse to accept further segments from the network service
  - Relies on network service to do the work
  - clumsy
- Use a fixed sliding widow protocol
  - With a reliable network service this works quite well
- Use a credit scheme
  - A more effective scheme to use with an unreliable network service

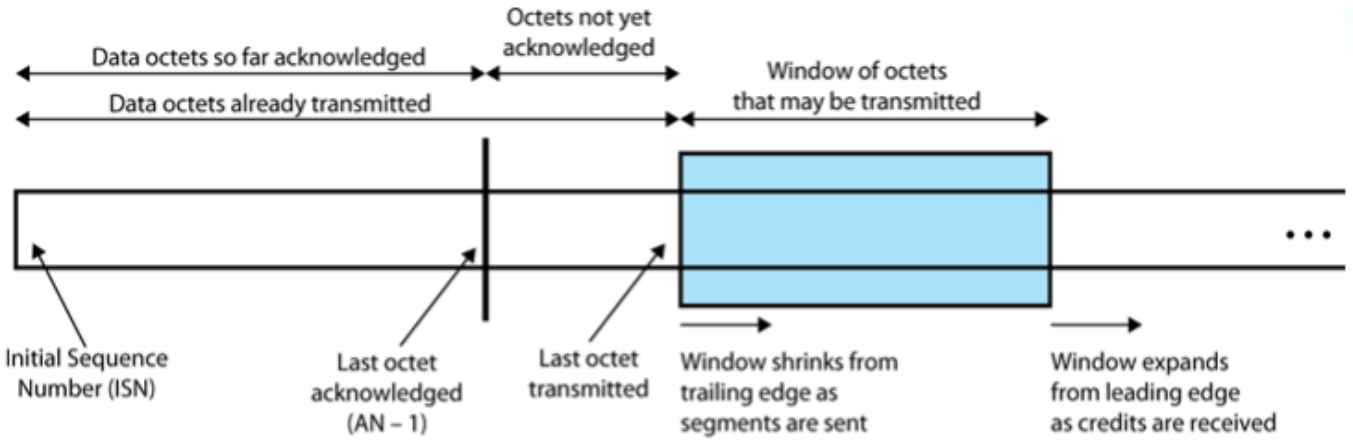
An Example of the Fixed Sliding Window



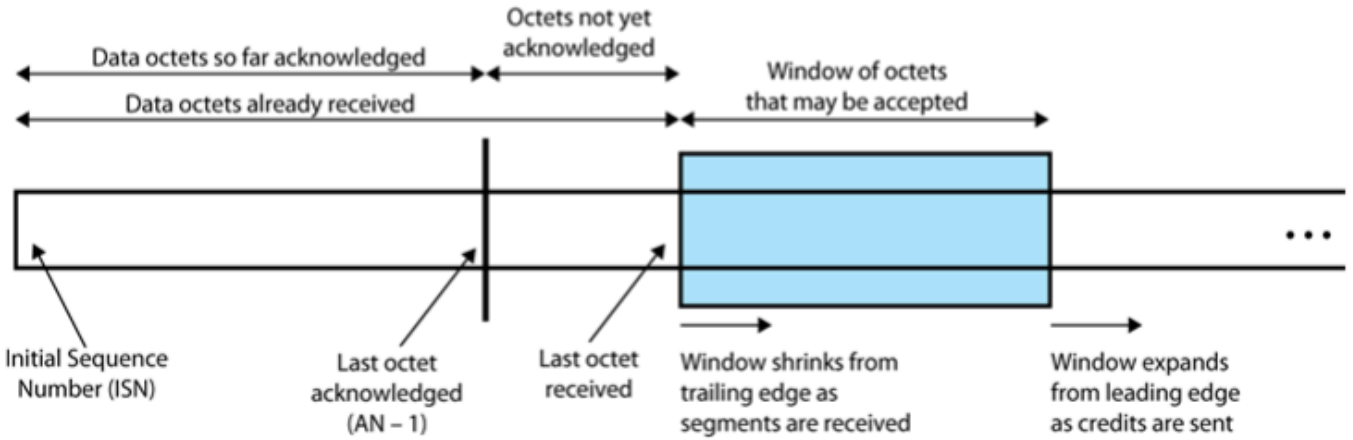
Credit Scheme

- Decouples flow control from ACK
  - Then, credit scheme mainly rules the flow control
- Each octet has sequence number
- Each transport segment has sequence number (SN), Ack. Number (AN) and window size (W) in header
- Sends sequence number of first octet in segment
- ACK includes (AN=I, W=j) which means
  - All octets through SN=i-1 acknowledged, want I next
  - Permission to send additional window of W=j octets

Sending and Receiving Perspectives

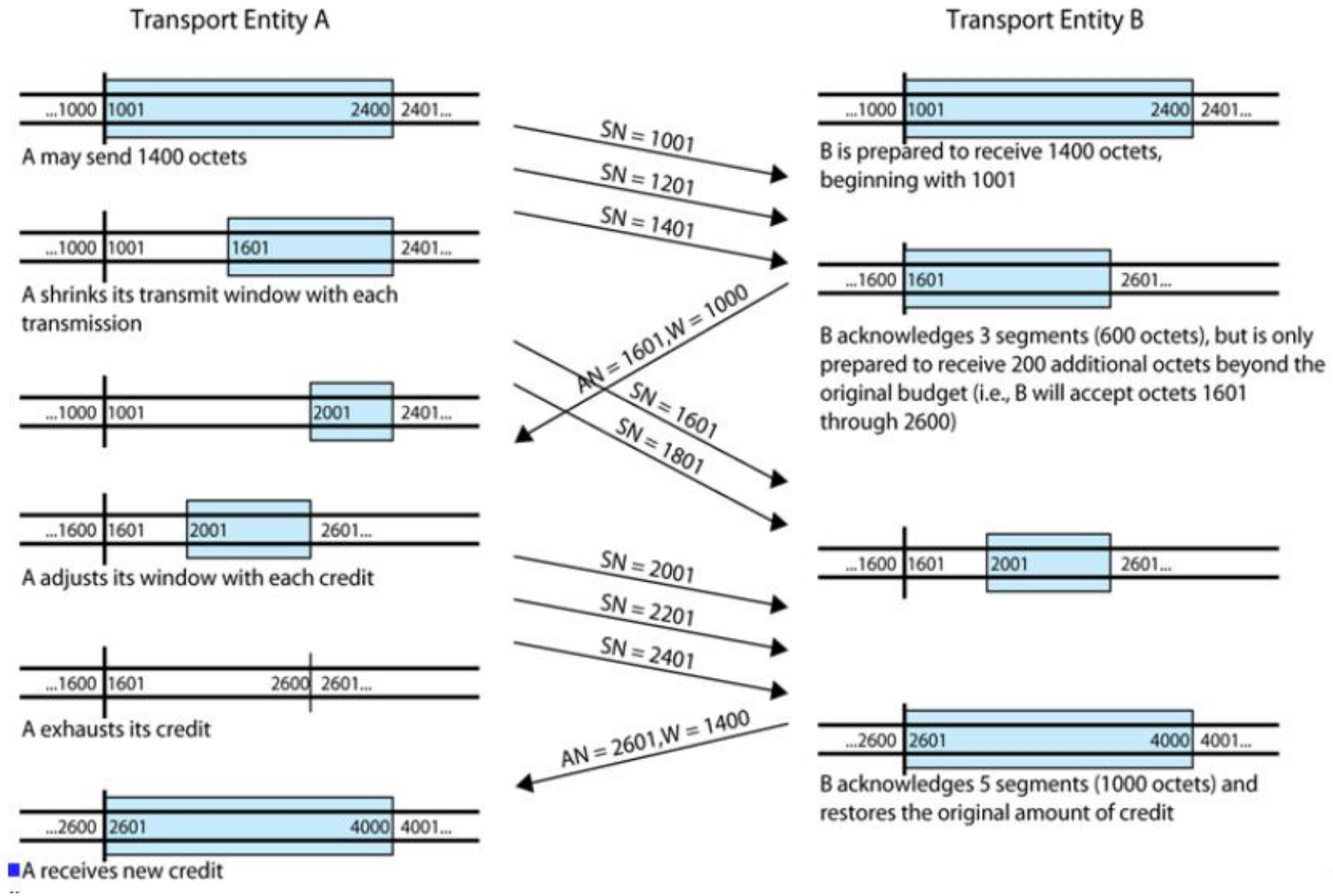


(a) Send sequence space



(b) Receive sequence space

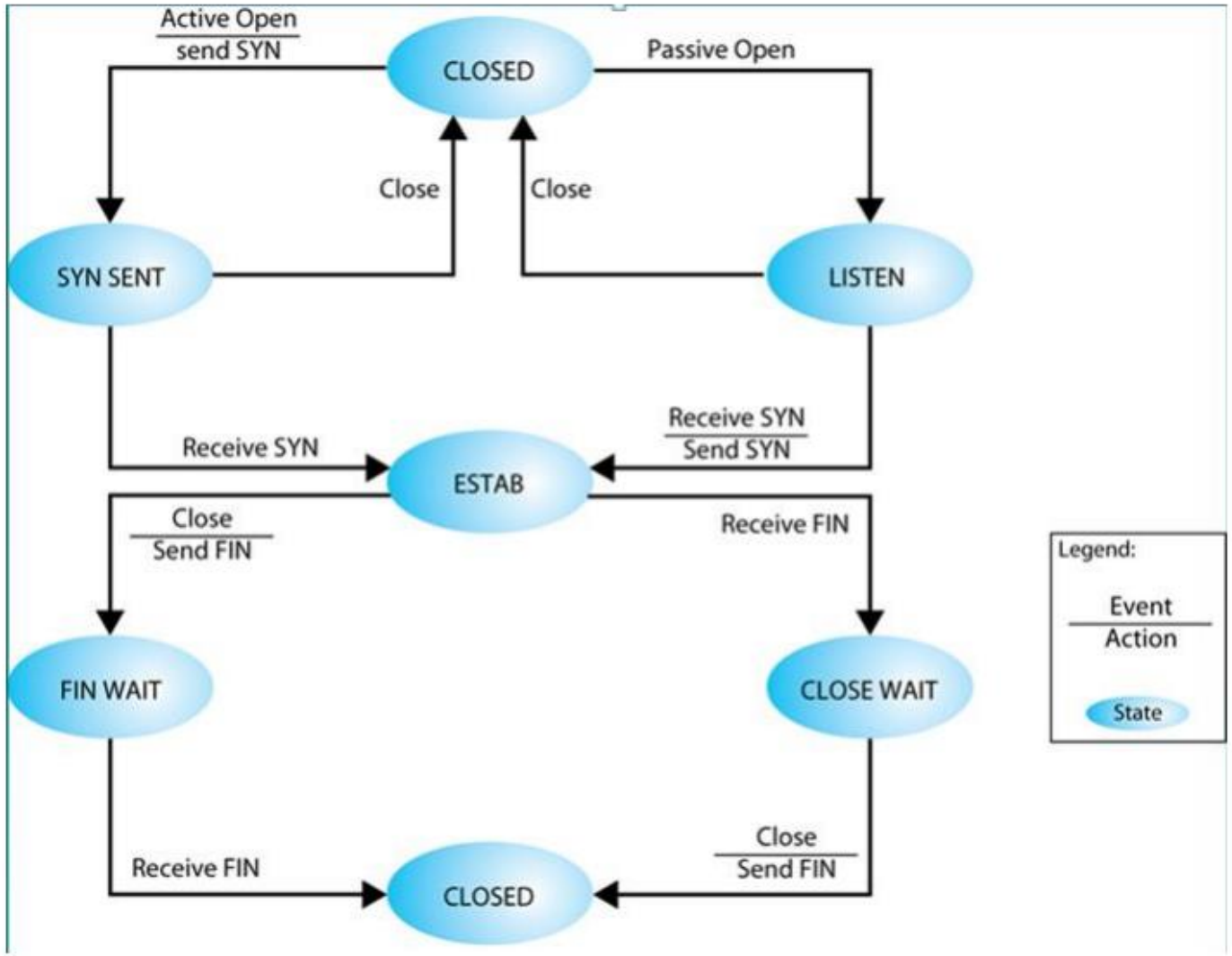
Credit Allocation Mechanism



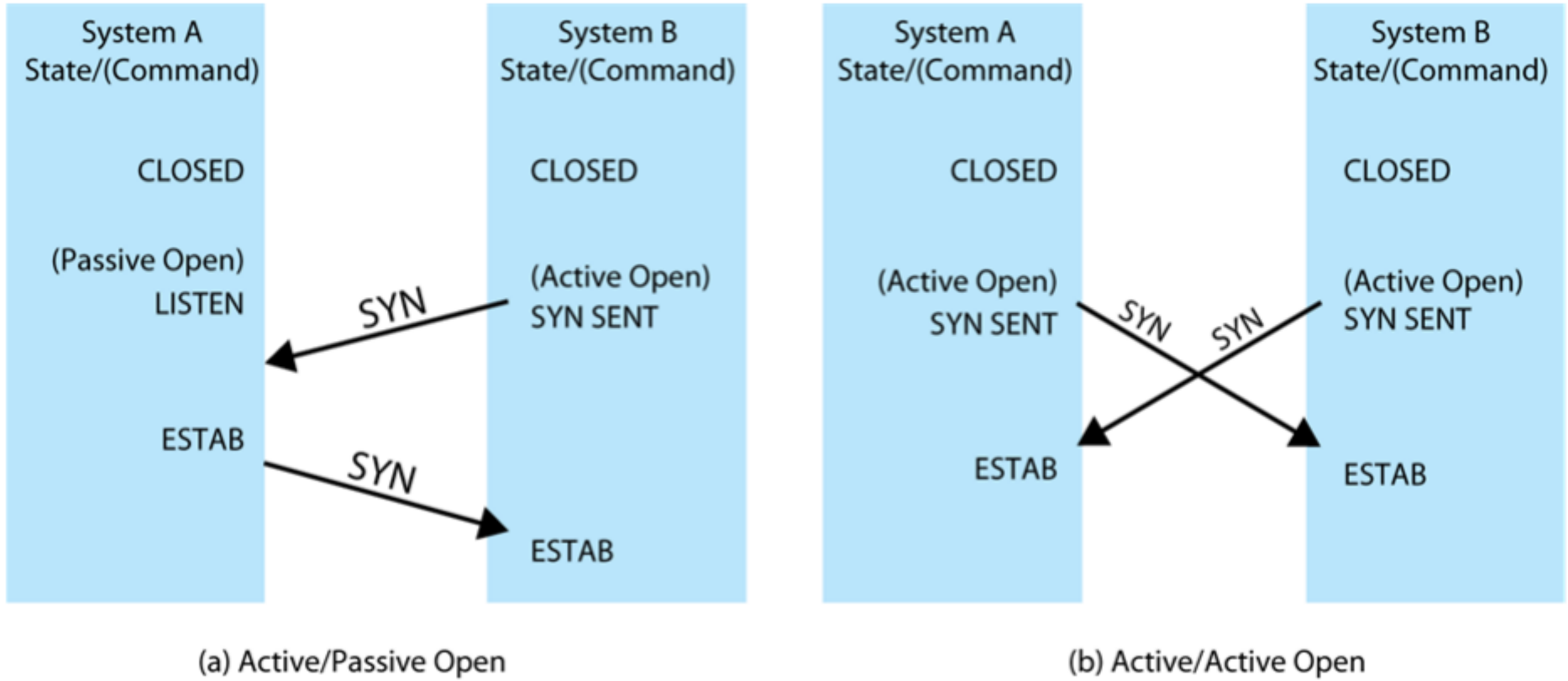
Connection Establishment and Termination

- Serves three main purpose:
  - Allow each end to assure that the other exists, and the other's intension to communicate with the initiator
  - Allows exchange or negotiation of optional parameters
  - Triggers allocation of transport entity resources
- By mutual agreement

Simple Connection State Diagram



Connection Establishment Scenario



(a) Active/Passive Open

(b) Active/Active Open

Unreliable Network Service

- More difficult case for transport protocol since
  - Segments may get lost and/or arrive out of order
- Examples include
  - Internetwork using IP
  - IEEE 802.3 with unacknowledged connectionless LLC service
- Issues:
  - Ordered delivery
  - Retransmission strategy
  - Duplication detection
  - Flow control
  - Connection establishment & termination
  - Crash recovery