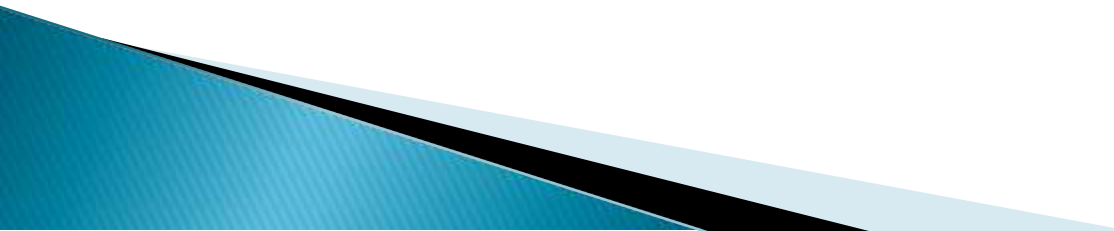


Transport layer

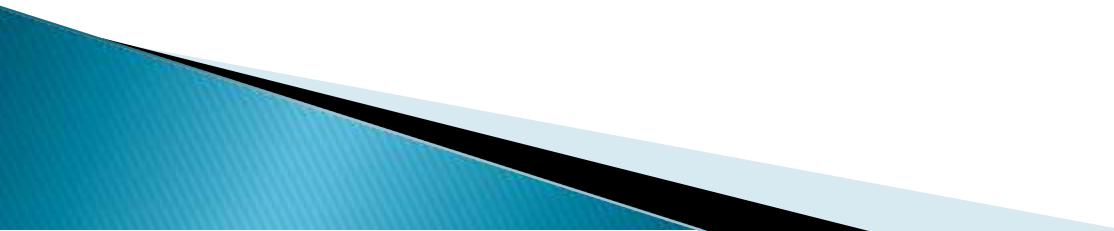
Congestion control and Resource
allocation



What is the purpose of transport layer?



Transport layer (Contd..)

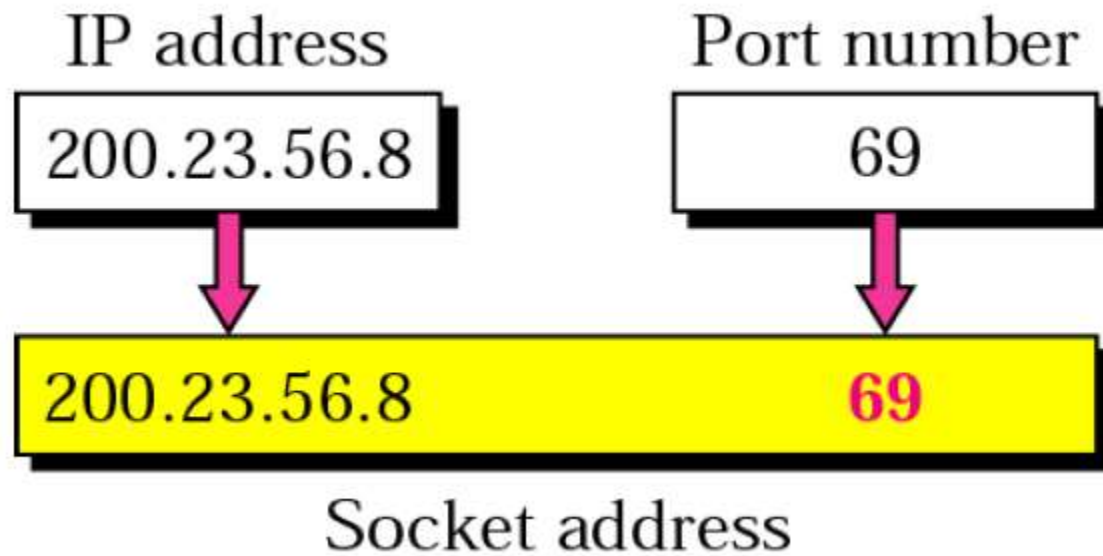
- ▶ Transport Layer is responsible for delivery of message to the appropriate process
 - ▶ Data link layer – node to node delivery
 - ▶ Network Layer – host to host delivery
 - ▶ Transport layer – process to process delivery
- 

- ▶ How is the process to process /end to end delivery possible?

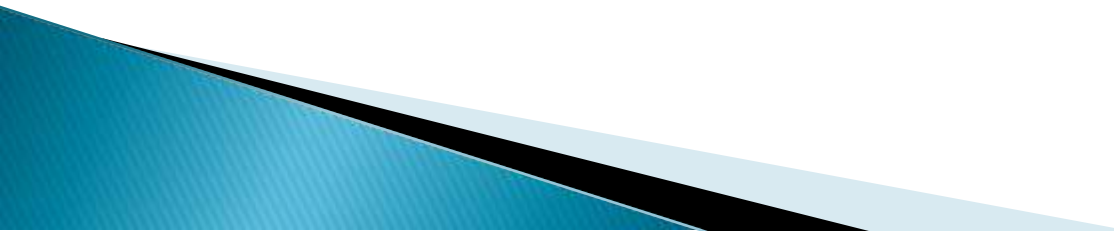
Socket address

- ▶ Socket address is the combinations of IP address and port number

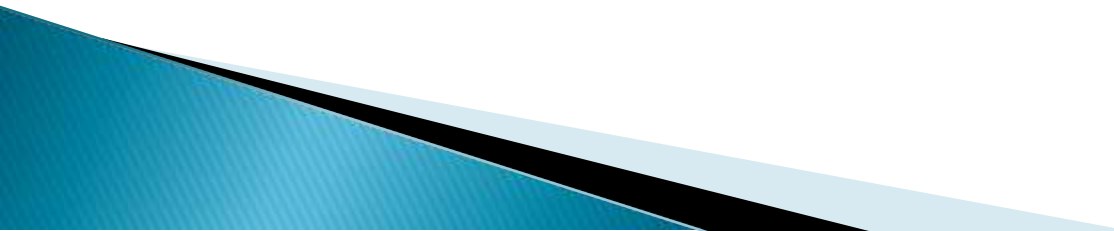
Socket Address



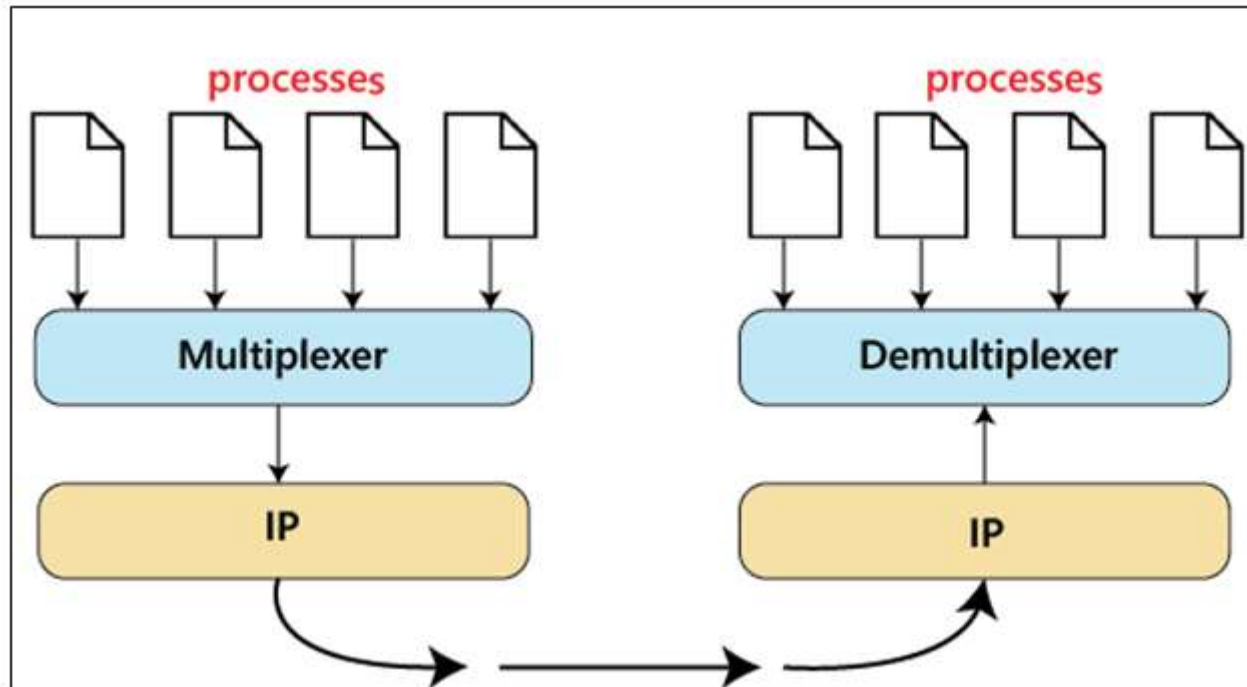
Responsibilities of a Transport Layer

- ▶ The Process to Process Delivery
 - ▶ End-to-End Connection between Hosts
 - ▶ Multiplexing and Demultiplexing
 - ▶ Congestion Control
 - ▶ Data integrity and Error correction
 - ▶ Flow control
- 

Process to Process Delivery

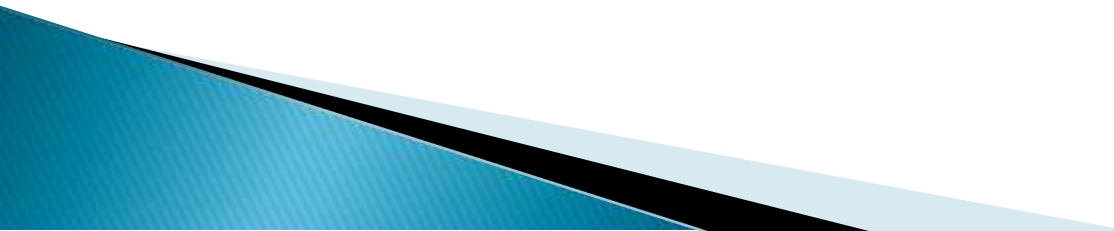
- ▶ Transport Layer requires a Port number to correctly deliver the segments of data to the correct process amongst the multiple processes running on a particular host
 - ▶ A port number is a 16-bit address used to identify any client-server program uniquely
- 

Process to Process Delivery

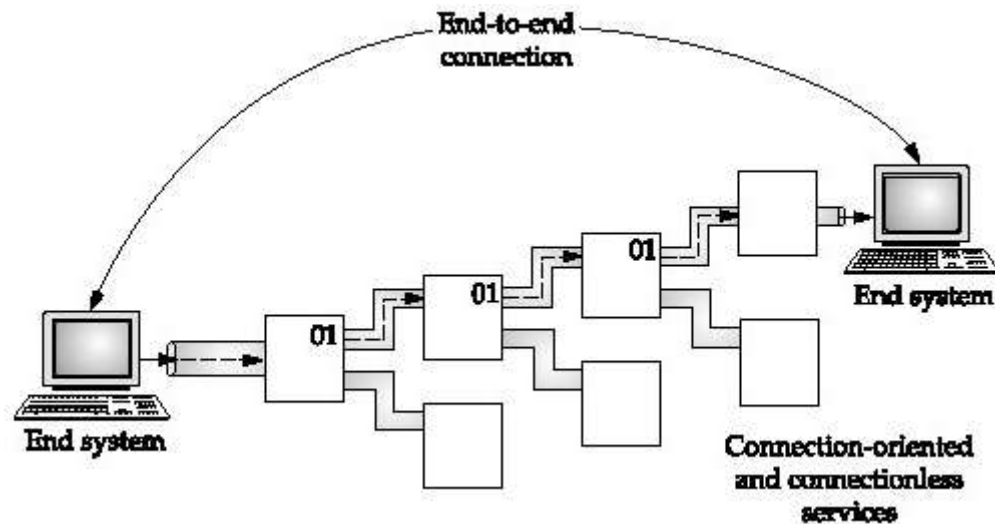


Process to Process Delivery

End-to-end Connection between Hosts

- ▶ The transport layer is also responsible for creating the end-to-end Connection between hosts for which it mainly uses TCP and UDP
 - ▶ TCP is a secure, connection-orientated protocol that uses a handshake protocol to establish a robust connection between two end hosts.
 - ▶ TCP ensures the reliable delivery of messages
 - ▶ UDP is a stateless and unreliable protocol that ensures best-effort delivery
- 

End-to-end Connection between Hosts

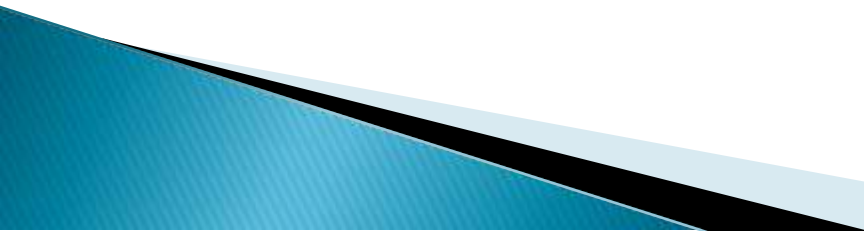


Transport layer protocols

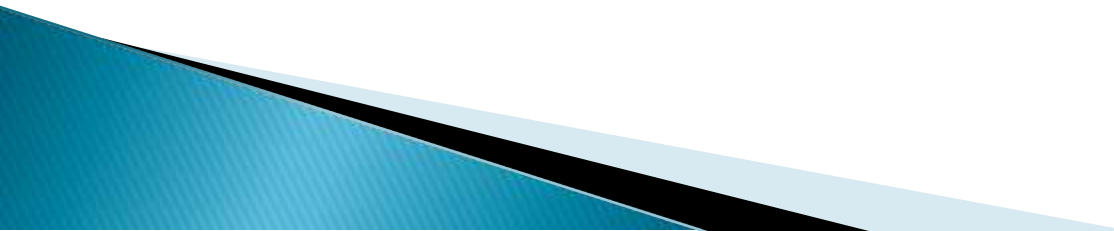
UDP

- ▶ Connectionless protocol
- ▶ Unreliable protocol
- ▶ UDP stands for User Datagram Protocol

TCP

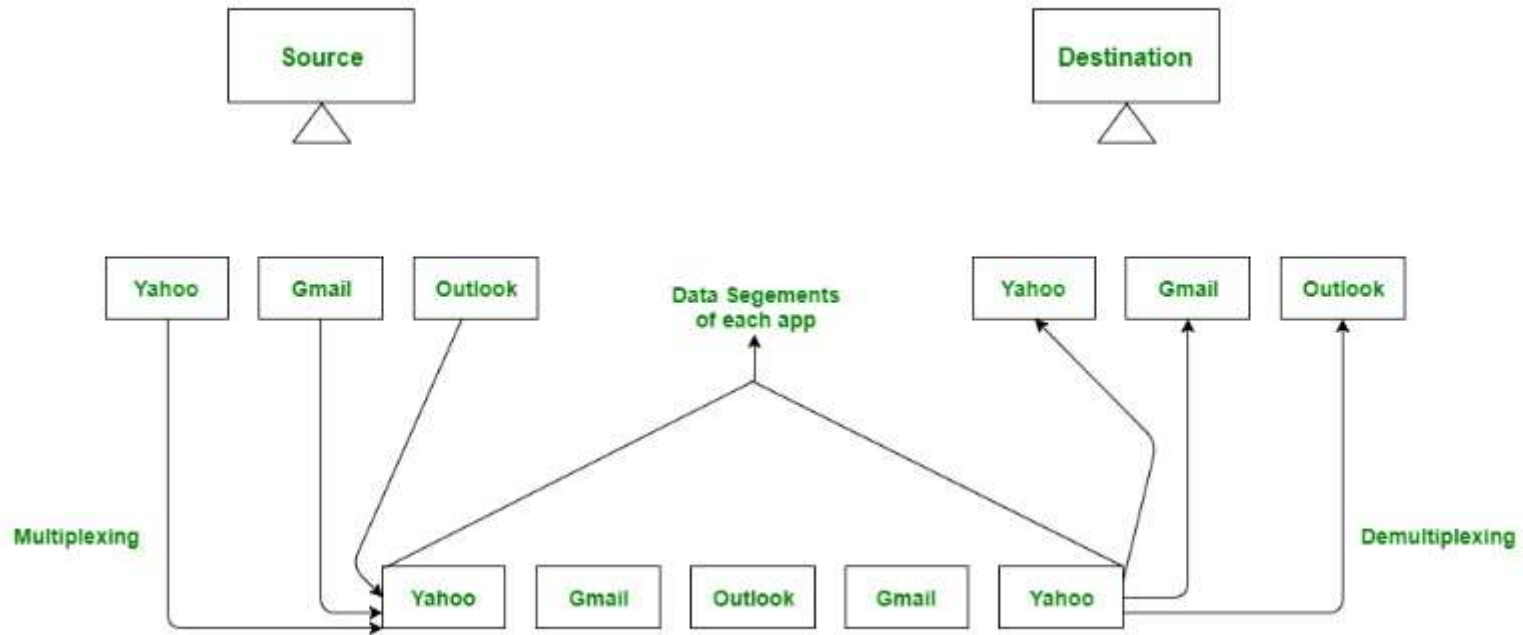
- ▶ Connection-oriented protocol
 - ▶ Reliable protocol
 - ▶ Provide error and flow control
 - ▶ TCP stands for Transmission Control Protocol
- 

Multiplexing and De multiplexing

- ▶ Multiplexing(many to one) is when data is acquired from several processes from the sender and merged into one packet along with headers and sent as a single packet
 - ▶ De multiplexing(one to many) is required at the receiver side when the message is distributed into different processes.
- 

Multiplexing and Demultiplexing

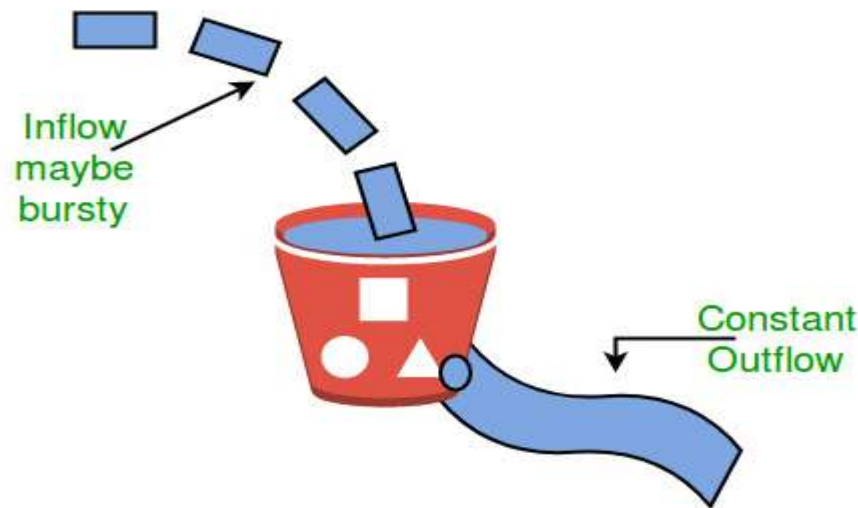
Multiplexing / Demultiplexing



Multiplexing and Demultiplexing

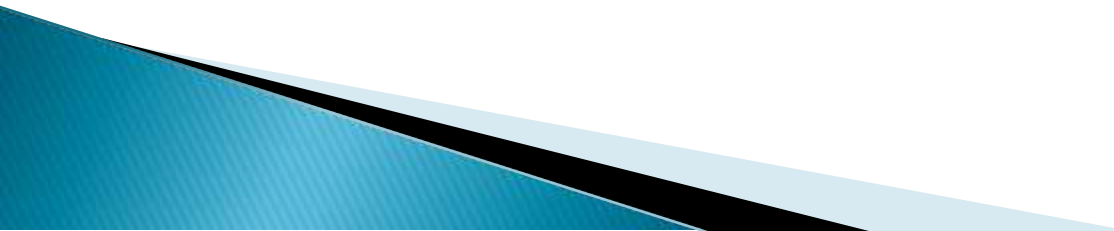
Congestion Control

- ▶ Congestion is a situation in which too many sources over a network attempt to send data and the router buffers start overflowing due to which loss of packets occurs

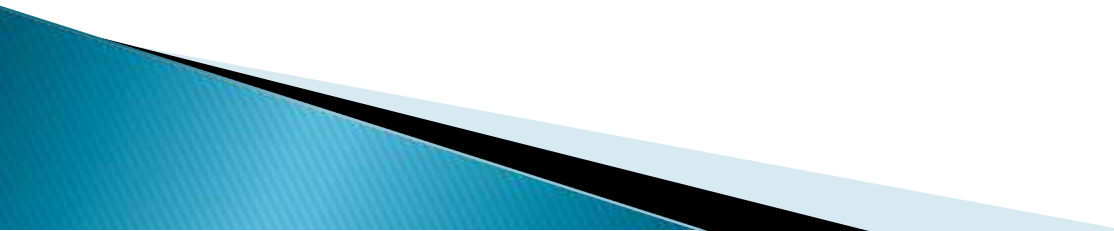


Data integrity and Error Correction

Transport Layer provides data integrity by:

- ▶ Detecting and discarding corrupted packets
 - ▶ Tracking of lost and discarded packets and re-transmitting them
 - ▶ Recognizing duplicate packets and discarding them.
 - ▶ Buffering out-of-order packets until the missing packets arrive
- 

Flow control

- ▶ The transport layer provides a flow control mechanism between the adjacent layers of the TCP/IP model
 - ▶ TCP also prevents data loss due to a fast sender and slow receiver by imposing some flow control techniques
- 

Congestion

- ▶ In network, if the load on the network is greater than the network load capacity, then the congestion may occur

Resource allocation

- How to *effectively* and *fairly* allocate resources among a collection of competing users?
- 

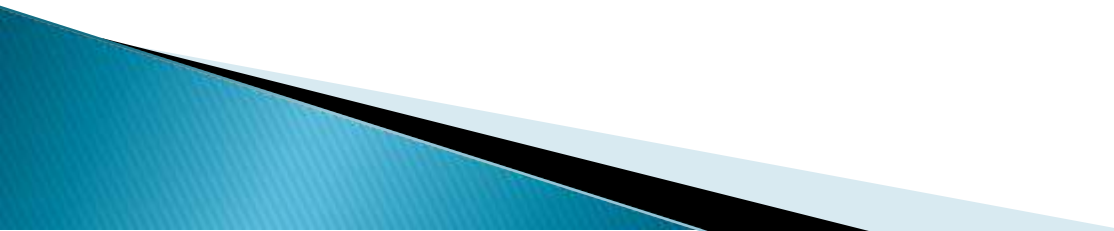
Resource allocation(Contd..)

- ▶ Resources
 - Bandwidth of the links
 - Buffers at the routers and switches


Congestion Control and Resource Allocation

- ▶ When too many packets are contending for the same link
 - The queue overflows
 - Packets get dropped
 - **Network is congested!**
- ▶ Network should provide a congestion control mechanism to deal with such a situation

Congestion control

- ▶ Congestion Control refers to the mechanisms and techniques to control the congestion and keep the load below the capacity
 - ▶ The transport layer recognizes overloaded nodes and reduced flow rates and takes proper steps to overcome this
- 

Congestion Control and Resource Allocation

- ▶ Congestion control and resource allocations involve both hosts and network elements such as routers
 - ▶ In network elements
 - Various queuing disciplines can be used to control the order in which packets get transmitted and which packets get dropped
 - ▶ At the hosts' end
 - The congestion control mechanism paces how fast sources are allowed to send packets
- 

Thank you

