

Transport Layer

Overview

- Transport layer is an intermediate layer in computer networks, which bridges the application layer and network layer.
 - *Application Layer*: needs reliable, bidirectional stream-oriented service (continuous flow of data)
 - *Network Layer*: provides unreliable datagram service
 - Transport layer follows the **End-to-End Principle**
 - it tries to keep the network as simple as possible
 - so, all “smarts” are implemented at the end nodes
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Functions of Transport Layer

- Addressing
 - we know that transport layer uses port numbers, why?
 - transport layer: identify logical communication between processes
 - network layer: maintain logical communication between hosts
 - Error control
 - packet loss detection and retransmissions
 - Flow and congestion control
 - controlling the transmission rate
 - Session management
 - establish, manage, and terminate connections
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Error-control Method

- We will first talk about the error control method in the transport layer, which provide the reliability for this layer.
- The reliability is achieved if packets are delivered despite unreliability of the network layer or it detects that delivery is impossible.
- The error-control method used in the transport layer is **Automatic Repeat reQuest** (ARQ). This method has six components:
 1. **acknowledgement**
 - receiver explicitly tells sender that a packet is received OK
 - negative acknowledgments (NAK): receiver explicitly tells sender that pkt had errors (this is unnecessary, since duplicate ACK at sender addresses this)
 - so, sender will know whether the packet is delivered or whether the packet needs to be retransmitted.

2. timeout

- how long should the sender wait for ACK? what if ACK/data is lost? how does sender know whether the packet is received or not?
- timeout is used to solve the problem. Sender triggers a timer immediately after transmit a packet. If sender does not receive ACK within a certain time (we call it timeout), retransmit the packet.