CS241 System Programming Introduction to Communication (I)

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Lecture 34

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Motivation

- Share: workstation, PC, Cray, database, radio telescope, work
- resource sharing
- computation speed up
- reliability
- communication

Network Category

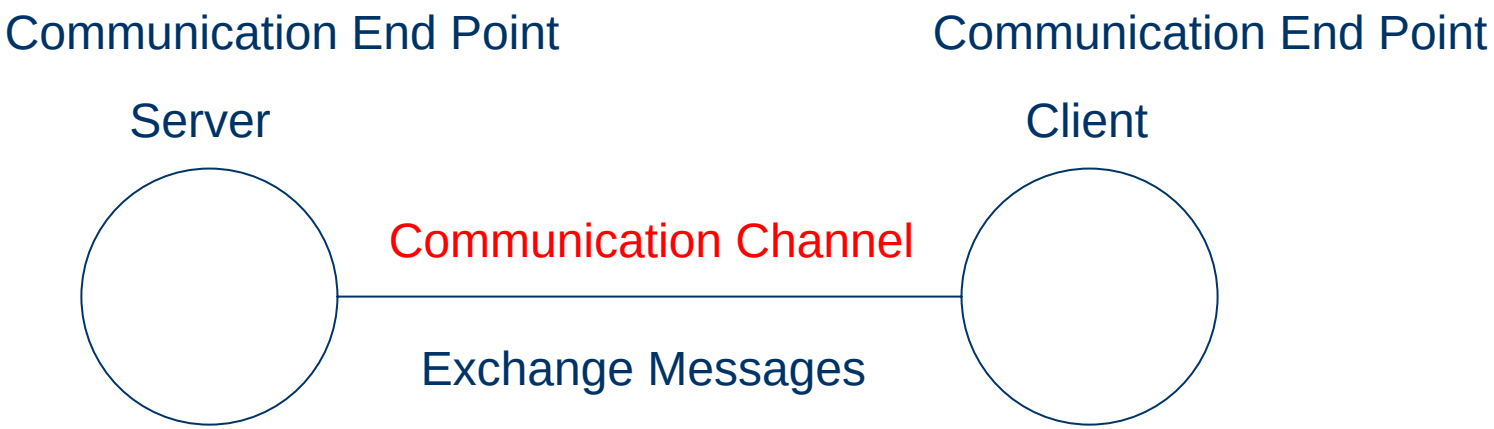
- Resource Sharing Networks.
  - Communication is typically between a user process on one host and a resource manager process on another host.
  - Examples:
    - Access remote files
    - Transfer files between hosts
    - Database distributed among hosts
    - Access peripheral device (e.g., printer) on remote host
- Distributed Computation Networks.
  - A group of processes cooperating in one activity are distributed over several hosts throughout a network.
  - Examples:
    - Large database systems
    - Real time process-control systems

Network Categories

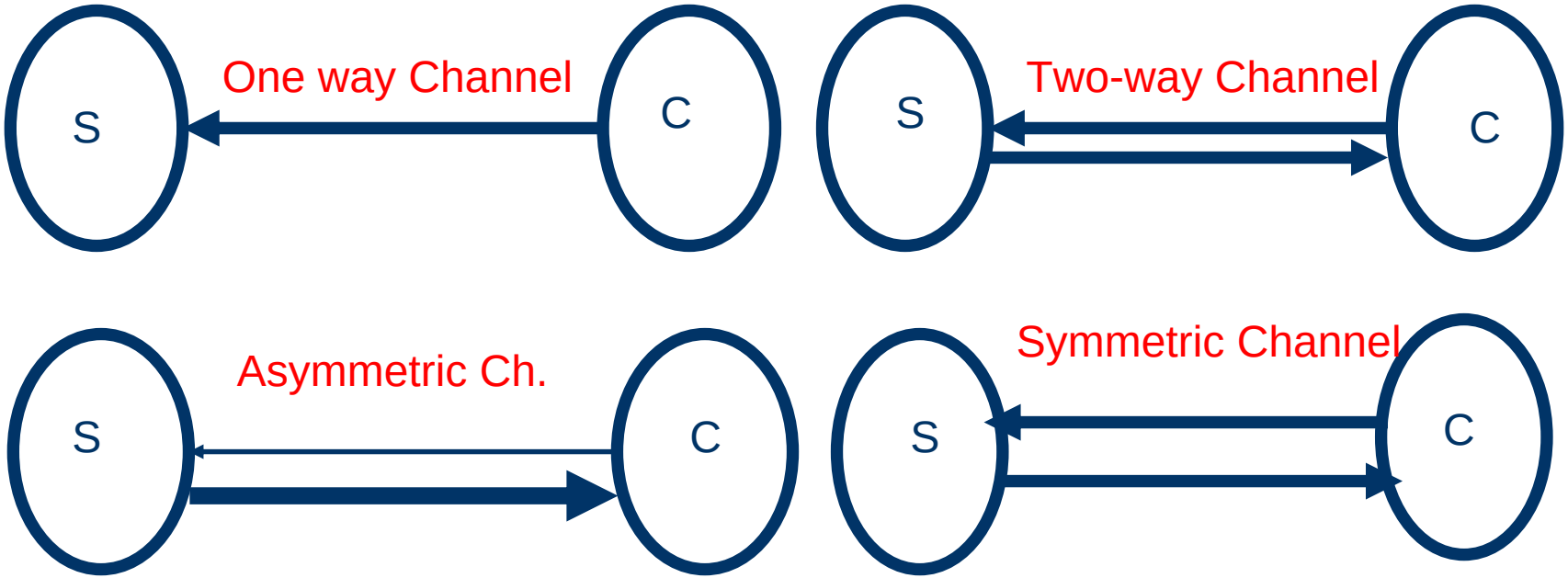
- Remote Communication Networks.
  - Typically a batch system with most facilities in one or a few central locations, accessed from many remote locations.
  - Examples:
    - Bank ATMs

Client-Server Model

- The client-server model is used in many types of network communication including mail, ftp, telnet, rlogin, http, and nfs.
- In this model, the server waits for requests and the client makes requests for service from the server.

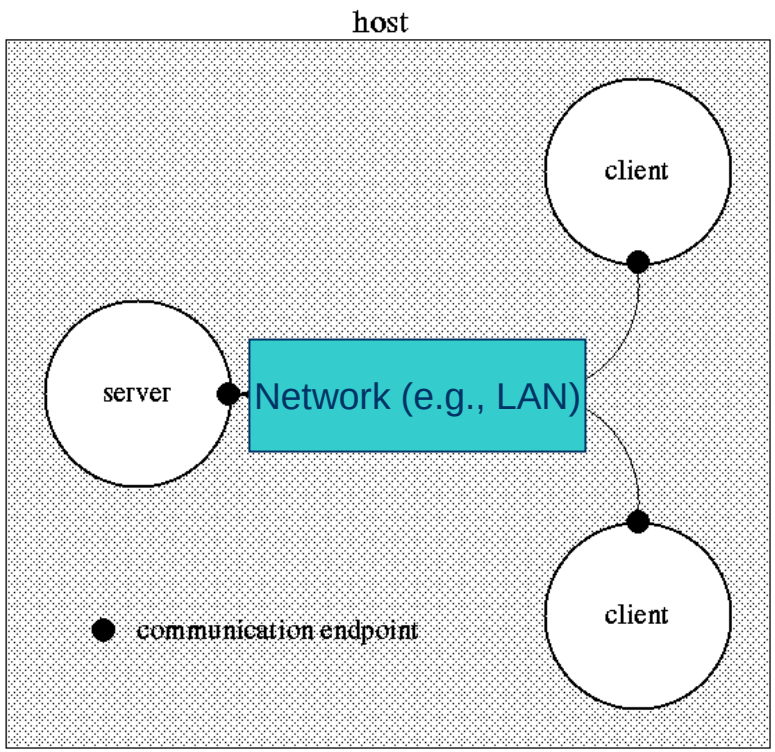


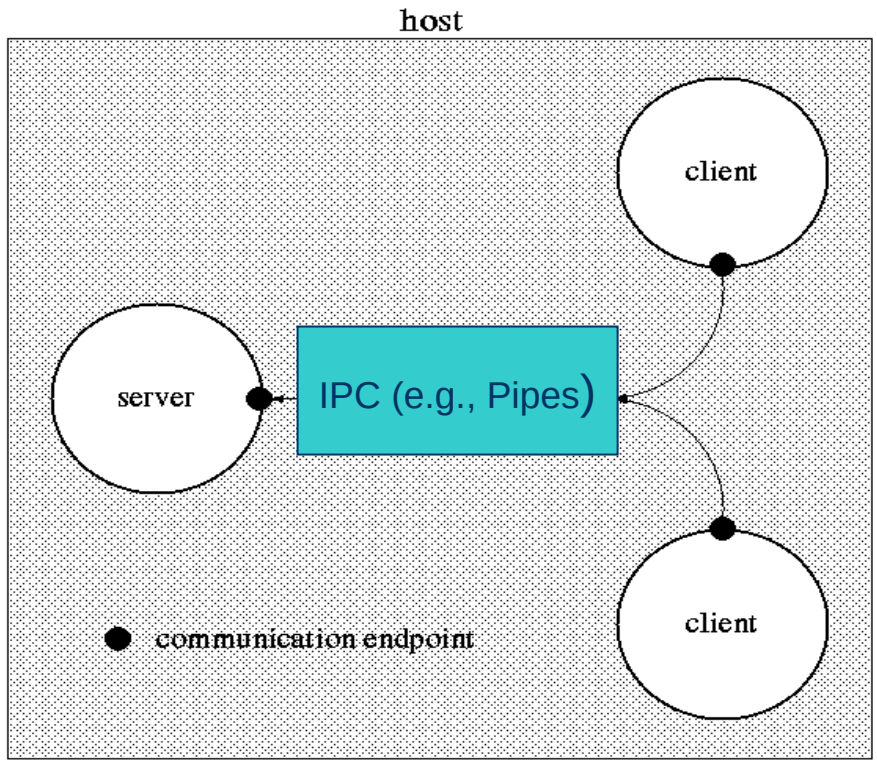
Communication Channel



-- Shared Channel
-- Private Channel

Client-Server Model/Examples





Naming of Servers and Clients

- In Network environment – naming is difficult
- Possible Server naming by Process ID and Host ID
  - Problem: Client cannot know the process ID of the server process on a host in advance
- Most common naming – use address of host (Internet address) and an integer called port number

Ports

- Ports < 1024, standard
- Ports > 1024, user created
- Well-known Port Numbers
  - mail: 25
  - ftp: 21
  - telnet: 23
  - rlogin 513
  - http: 80
  - nfs: 2049
- IP address (161.25.19.8)

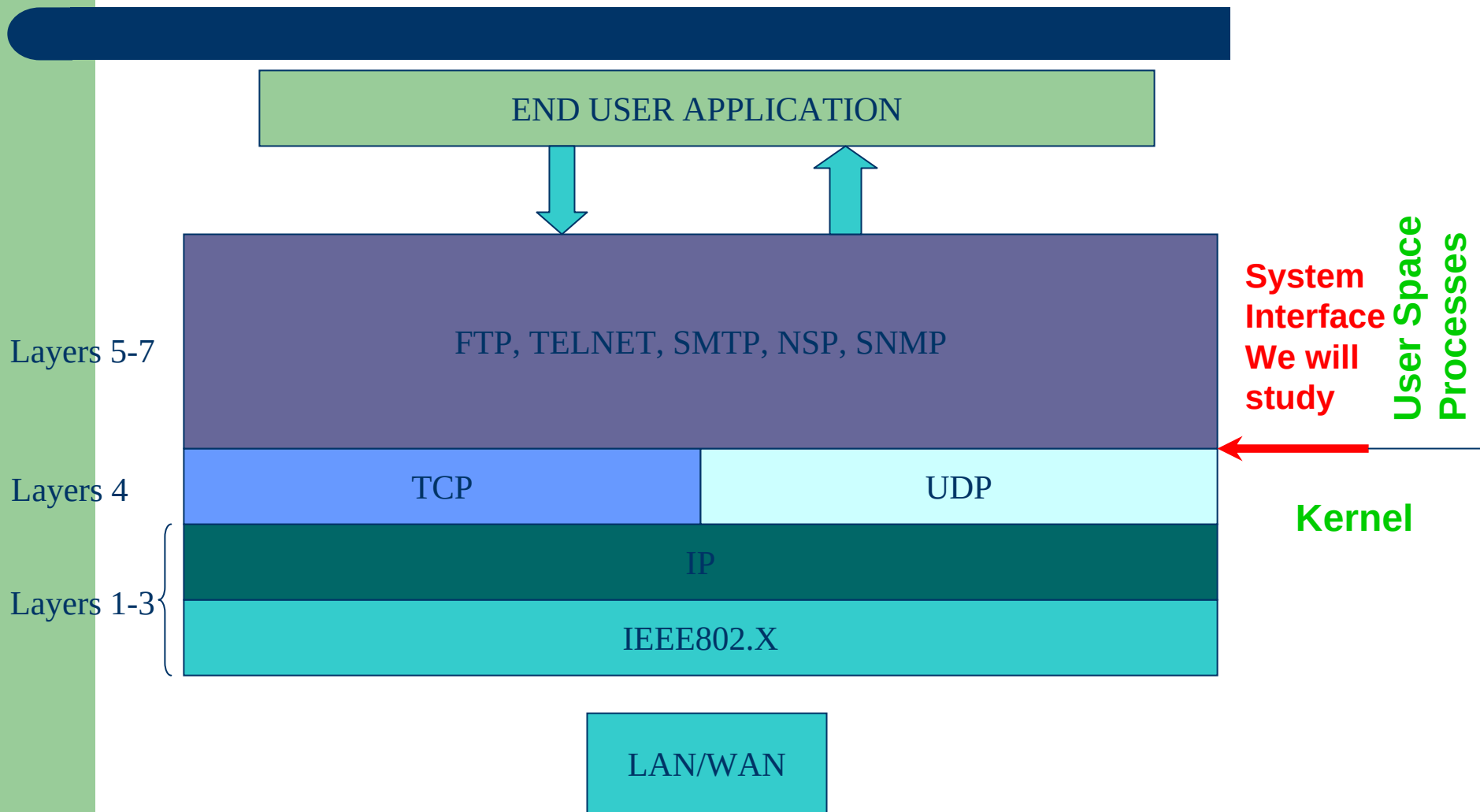
Kinds of Communication

- In connectionless communication, the client makes a request to an endpoint on a server and the server can respond to the client's endpoint (that is included in the client request).
- In connection-oriented communication, the client sets up a connection using the server's well-known port number and then communicates over a private communications channel as shown

Examples of Protocols for Client-Server Process Communication

- Connectionless – UDP (Unreliable Datagram Protocol)
  - Unreliable – no retransmission
- Connection-oriented – TCP (Transmission Control Protocol
  - Three-way hand-shake between initiator and destination
  - Receiver sends acknowledgement
  - In case sender does not get acknowledgement within certain time, it retransmits message (packet)
  - Flow Control

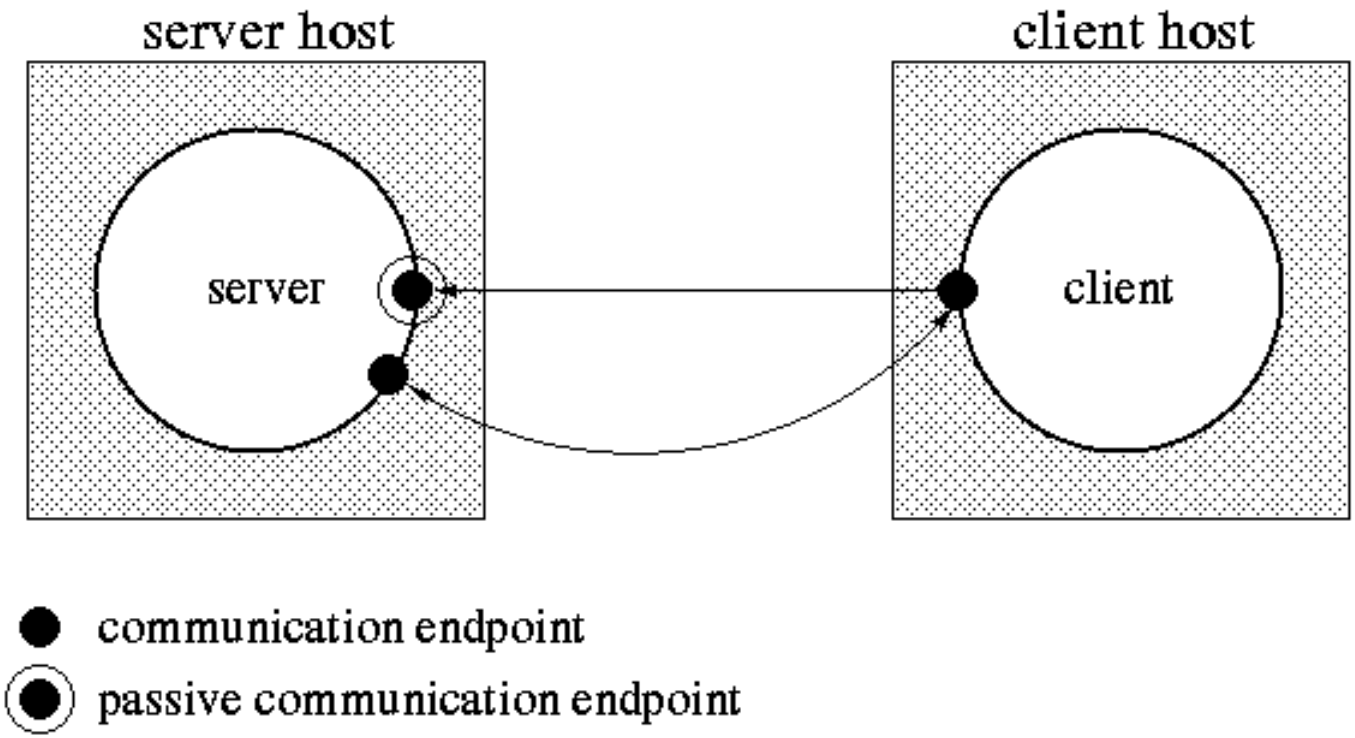
TCP/IP Protocol Layers



Connection-oriented Communication Protocol

1. Server monitors a passive end-point whose address is known to clients
    1. Listening (passive) endpoints have resources for queuing client connection requests and establishing client connections
2. Action of accepting a client request creates a new endpoint for private, two-way symmetric communication with that client
3. Client and server communicate by using handles (file descriptors) and do not explicitly include addresses in their messages
4. When finished, client and server close their file descriptors, system releases resources associated with the connection

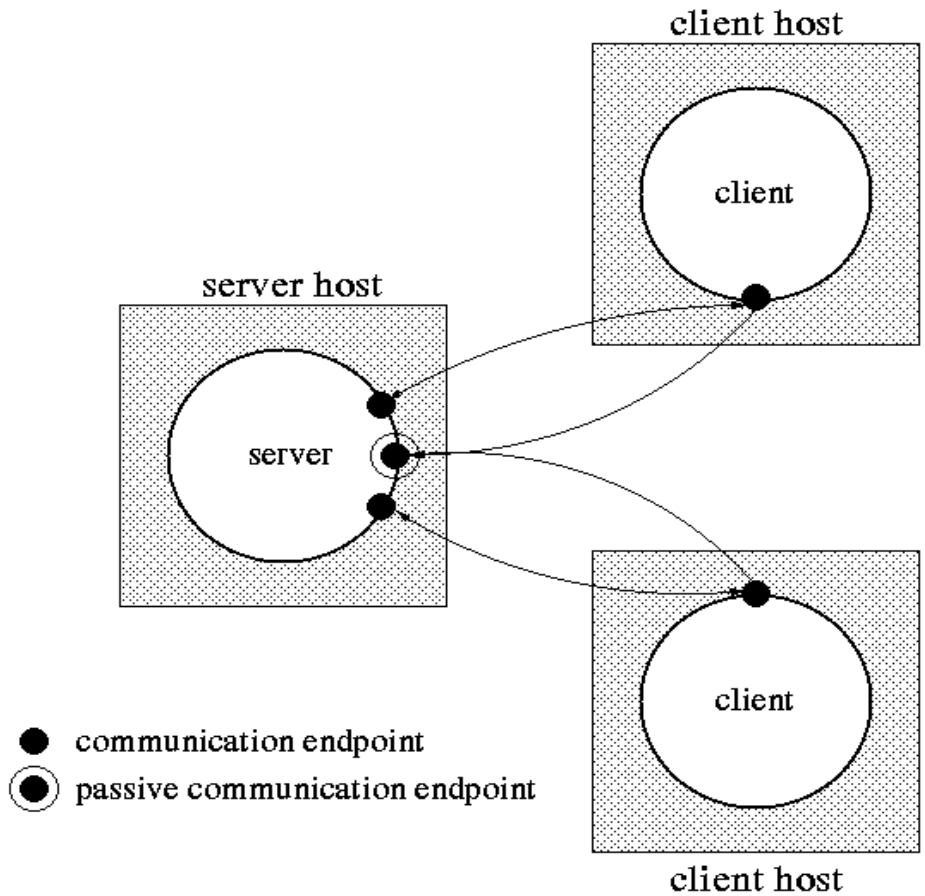
Connection-Oriented Communications Illustration



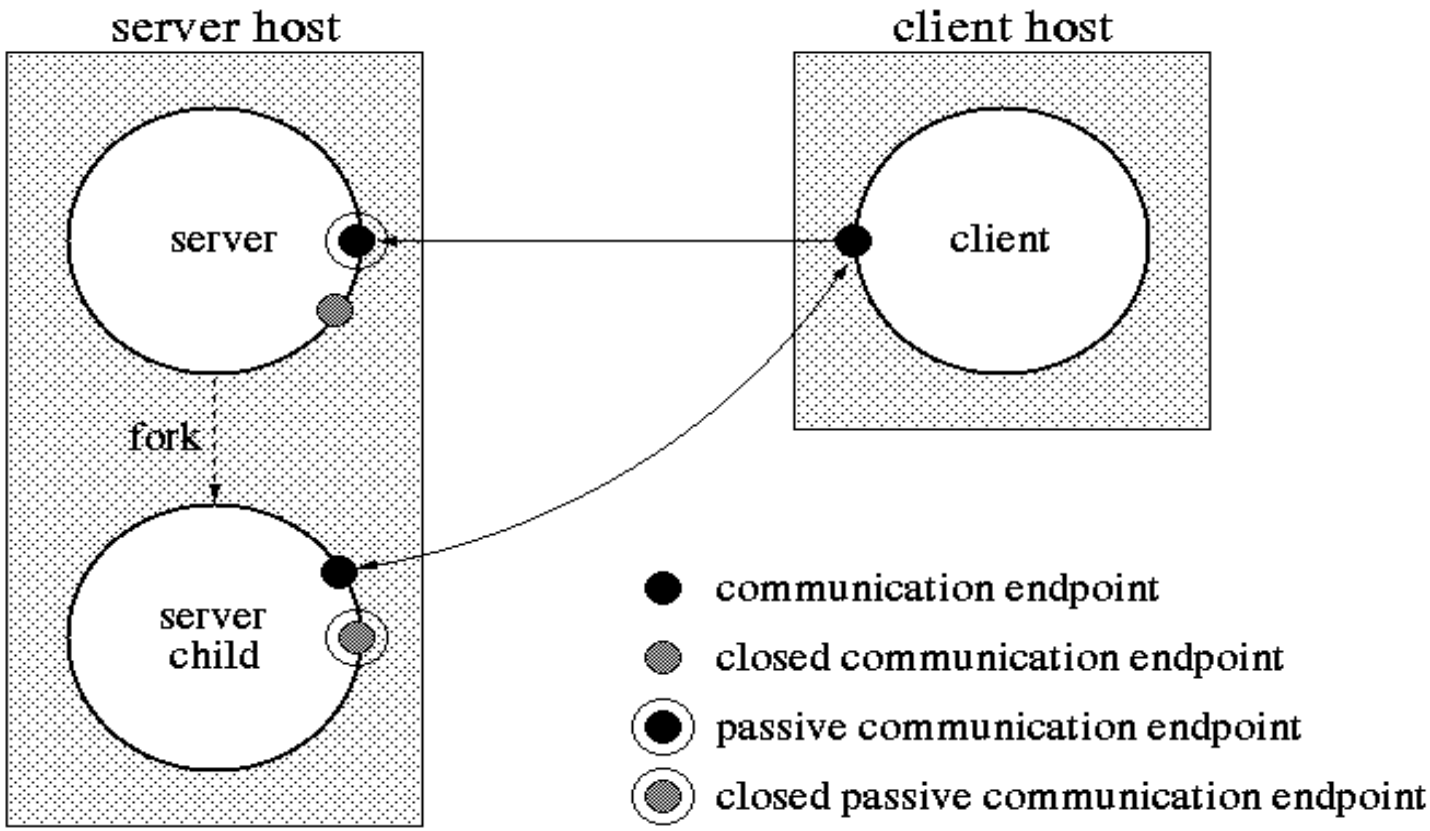
Connection-Oriented Server Strategies

- Serial-server strategy
- Parent-server strategy
- Threaded-server strategy

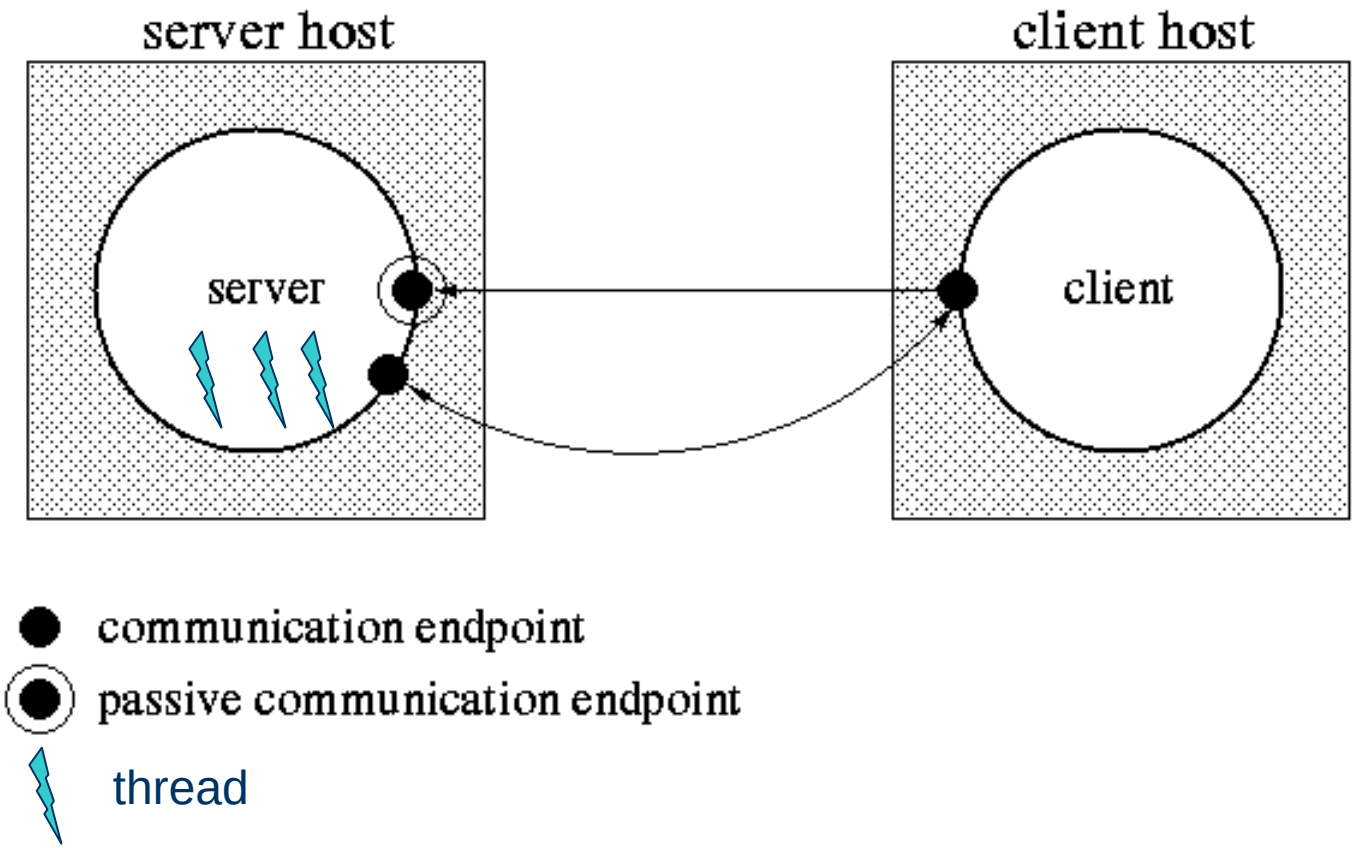
Multiple Clients (Serial-server Strategy)



Parent-server Strategy



Threaded-server Strategy



Summary

- Client-Server Process Communication
  - Communication Channel
  - Communication Protocols
  - Connectionless vs Connection-oriented
  - Connection-oriented Server Strategies