

CS343 - Operating Systems

Module-3B

IPC in Client Server Systems



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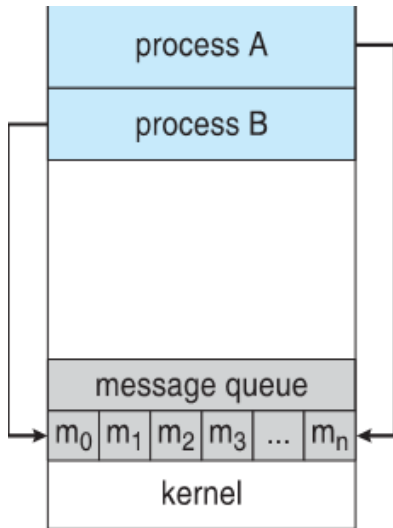
Session Outline

- ❖ **Review of Inter Process Communication (IPC)**
- ❖ **Local Procedure Calls**
- ❖ **Sockets**
- ❖ **Remote Procedure Calls**
- ❖ **Pipes**
- ❖ **Remote Method Invocation**

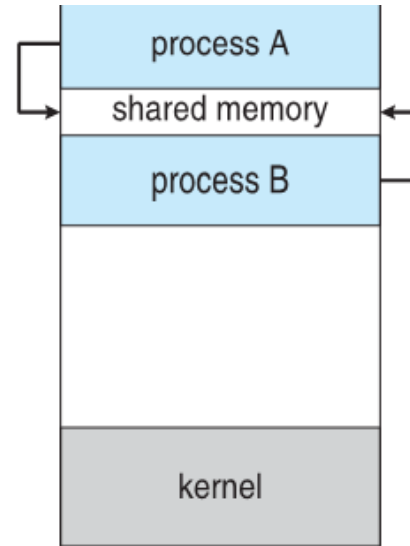
Communications Models

- ❖ Cooperating processes need **interprocess communication (IPC)**
- ❖ Two models of IPC:

Message passing

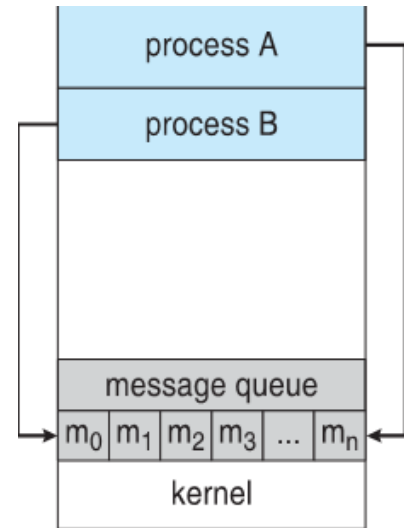


Shared memory

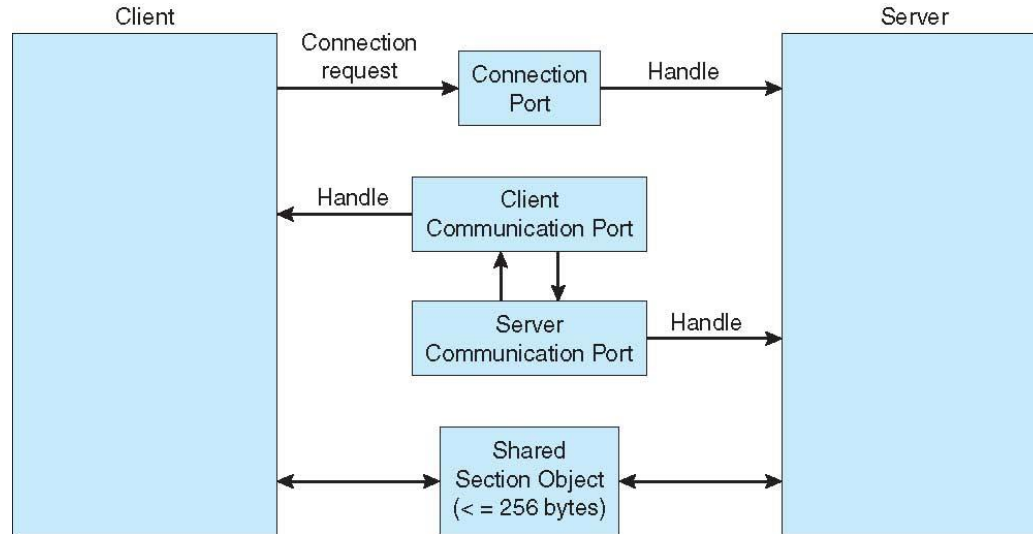


IPC – Message Passing

- ❖ Mechanism for processes to communicate and to synchronize their actions
- ❖ IPC using message passing facility provides two operations:
 - ❖ **send**(message)
 - ❖ **receive**(message)
- ❖ The message size is either fixed or variable
- ❖ Design Issues
 - ❖ Direct or indirect
 - ❖ Synchronous or asynchronous
 - ❖ Automatic or explicit buffering



Local Procedure Calls in Windows



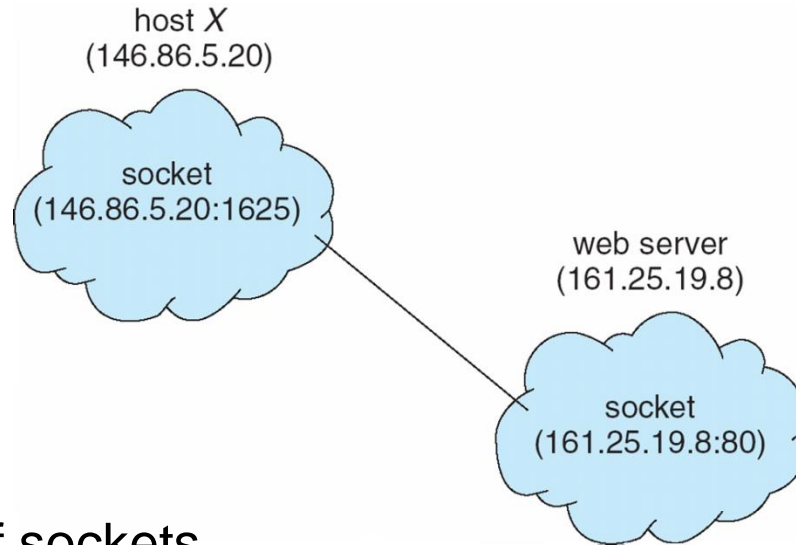
Communications in Client-Server Systems

- ❖ Sockets
- ❖ Remote Procedure Calls
- ❖ Pipes
- ❖ Remote Method Invocation

Sockets

- ❖ A **socket** is defined as an endpoint for communication
- ❖ Concatenation of IP address and **port** – a number included at start of message packet to differentiate network services on a host
- ❖ The socket **161.25.19.8:1625** refers to port **1625** on host **161.25.19.8**
- ❖ Communication consists between a pair of sockets
- ❖ All ports below 1024 are **well known**, used for standard services
- ❖ Special IP address 127.0.0.1 (**loopback**) to refer to system on which process is running

Socket Communication

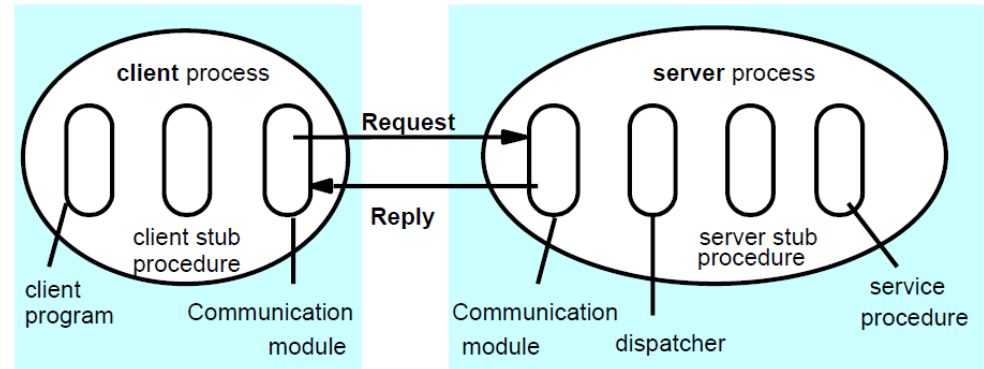
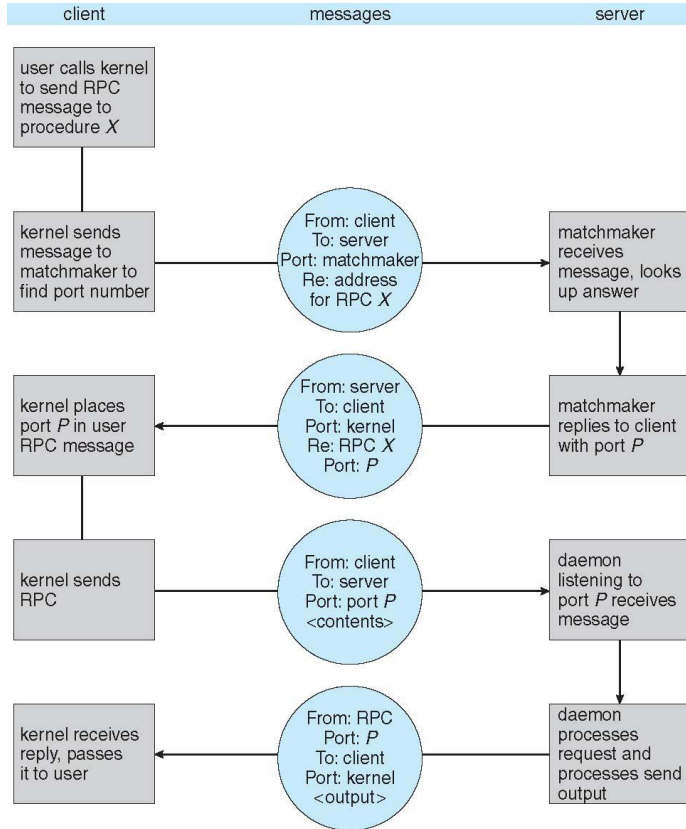


- ❖ Three types of sockets
 - ❖ **Connection-oriented (TCP)**
 - ❖ **Connectionless (UDP)**
 - ❖ **MulticastSocket** class— data can be sent to multiple recipients

Remote Procedure Calls

- ❖ Remote procedure call (RPC) abstracts procedure calls between processes on networked systems
- ❖ RPC uses ports for service differentiation
- ❖ **Stubs** – client-side proxy for the actual procedure on the server
- ❖ The client-side stub locates the server and **marshalls** the parameters
- ❖ The server-side stub receives this message, unpacks the marshalled parameters, and performs the procedure on the server

Execution of RPC

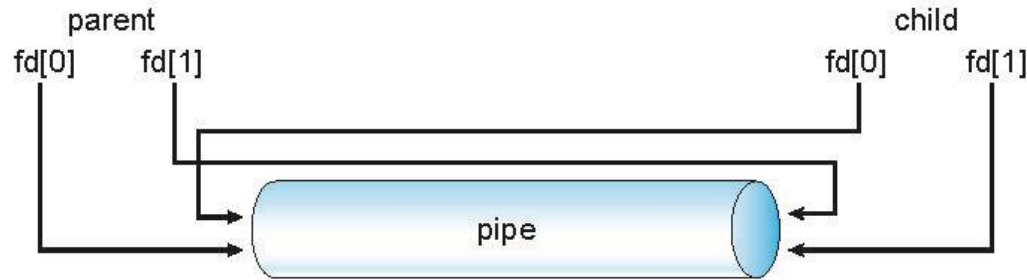


Pipes

- ❖ Acts as a conduit allowing two processes to communicate
- ❖ Issues:
 - ❖ Is communication unidirectional or bidirectional?
 - ❖ In the case of two-way communication, is it half or full-duplex?
 - ❖ Must there exist a relationship (i.e., **parent-child**) between the communicating processes?
 - ❖ Can the pipes be used over a network?
- ❖ Ordinary pipes – cannot be accessed from outside the process that created it. Typically, a parent process creates a pipe and uses it to communicate with a child process that it created.
- ❖ Named pipes – can be accessed without a parent-child relationship.

Ordinary Pipes

- ❖ Ordinary Pipes allow communication in standard producer-consumer style
- ❖ Producer writes to one end (the **write-end** of the pipe)
- ❖ Consumer reads from the other end (the **read-end** of the pipe)
- ❖ Ordinary pipes are therefore unidirectional
- ❖ Require parent-child relationship between communicating processes

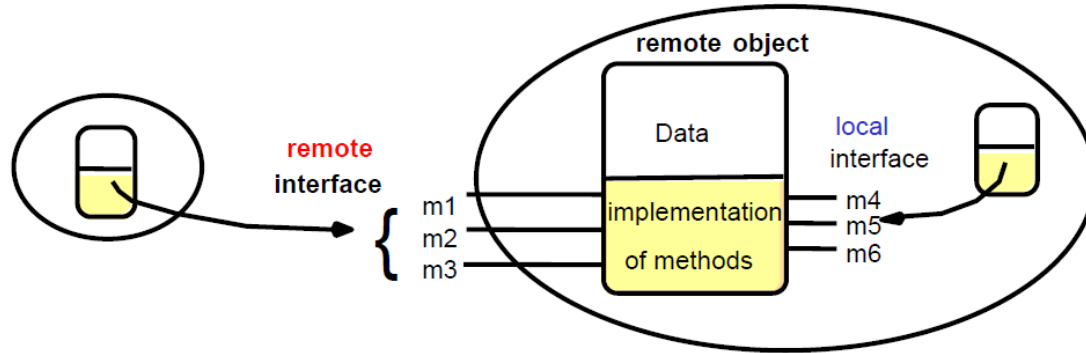


Named Pipes

- ❖ Named Pipes are more powerful than ordinary pipes
- ❖ Communication is bidirectional
- ❖ No parent-child relationship is necessary between the communicating processes
- ❖ Several processes can use the named pipe for communication
- ❖ Provided on both UNIX and Windows systems

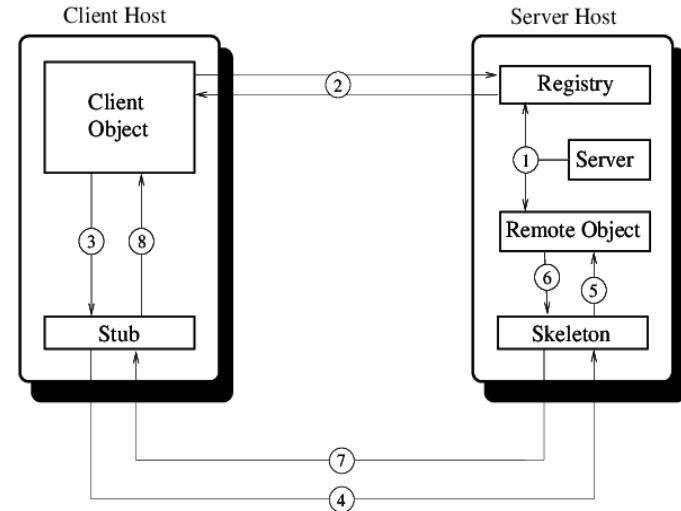
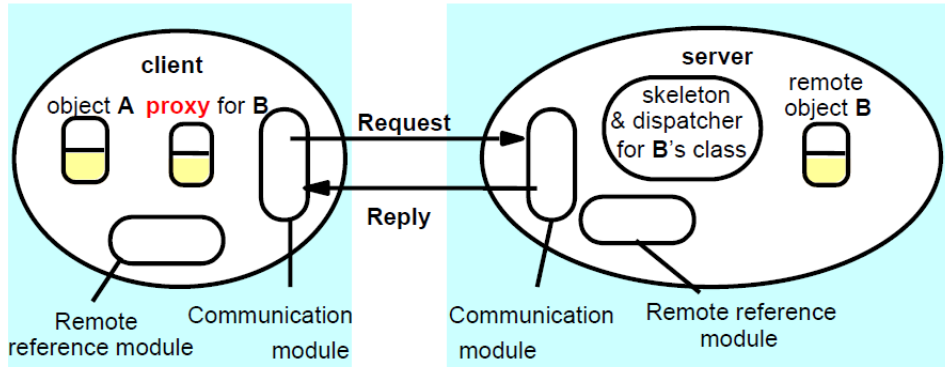
Remote Method Invocation

- ❖ RMI is a Java feature similar to RPCs.
- ❖ Allows a thread to invoke a method on a remote machine.
- ❖ RMI can be between two methods under two JVMs in the same machine.



Remote Method Invocation

- ❖ Client
- ❖ Stub and skeletons
- ❖ Parcel – remote method + marshalled parameters
- ❖ RMI registry



Thank you

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