Sistemas Operativos

Cursada 2022

Comisión S21 y S22

IPC (Comunicación entre Procesos)

Habíamos hablado anteriormente de 2 tipos de procesos o 2 formas de caracterizarlos

- **Independientes**

  No requieren intervención de otros procesos

- **Cooperativos**

  La problemática en lugar de resolverla un solo proceso, lo hacen varios procesos cooperando entre ellos

  Ventajas (solapamiento de tiempos)

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El avance de los procesos cooperativos hizo que el modulo fuera creciendo cada vez mas

- ***Administración de la CPU***
- ***Administración de la memoria***
- ***Administración del Sistema de archivos***
- ***IPC (soporta todos los protocolos de red)***
- ***Seguridad***

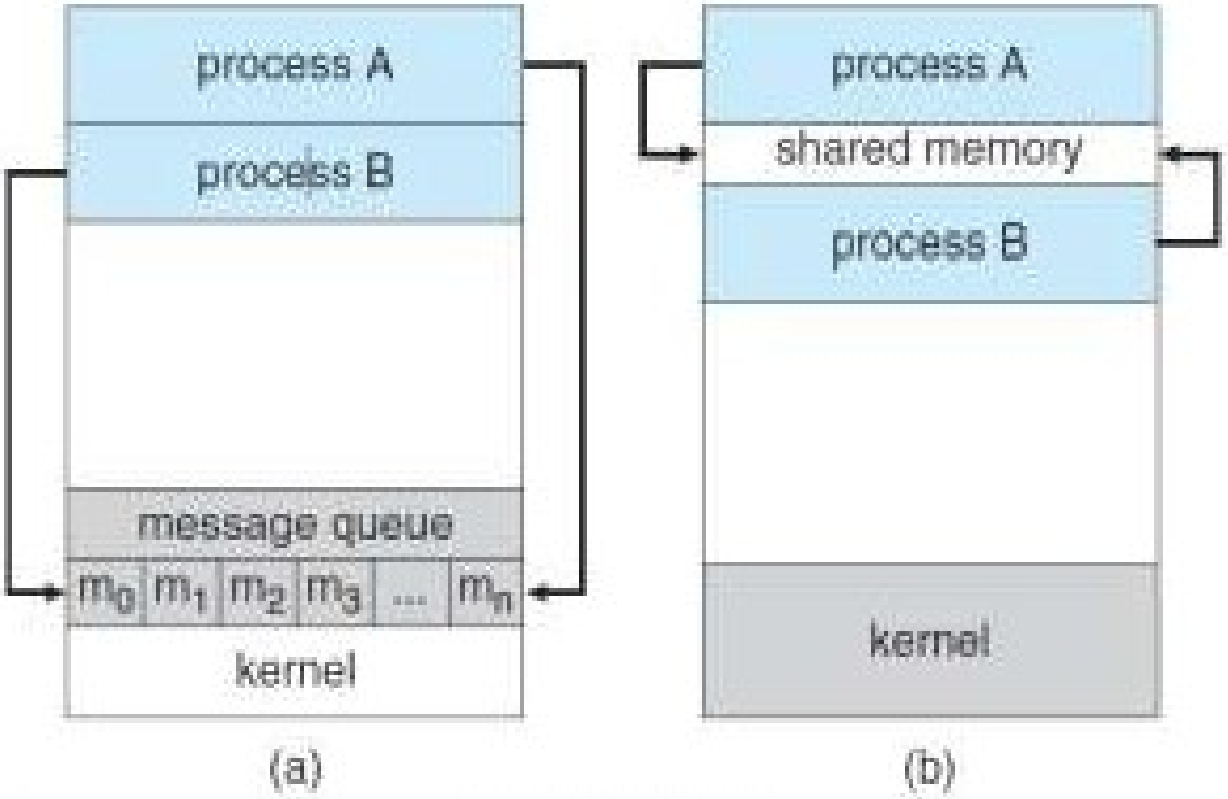
IPC (Comunicación entre Procesos)

Interprocess Communication

- Processes within a system may be *independent* or *cooperating*
- Cooperating process can affect or be affected by other processes, including sharing data
- Reasons for cooperating processes:
  - Information sharing
  - Computation speedup
  - Modularity
  - Convenience
- Cooperating processes need interprocess communication (IPC)
- Two models of IPC
  - Shared memory
  - Message passing

Como se comunican los procesos entre si:

- **Pasaje de mensaje**
- **Memoria compartida**



IPC (Comunicación entre Procesos)

Procesos Independientes

- **Espacio de memoria**
- **No interviene el S.O.**

Procesos Cooperativos

- **Intervención de S.O.**
- **Buzones**

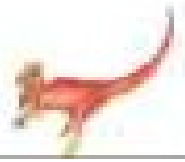
Otros temas relacionados con el IPC

- **Puertos**
- **Socket**
- **Buffering**

IPC (Comunicación entre Procesos)

Interprocess Communication – Message Passing

- Mechanism for processes to communicate and to synchronize their actions
- Message system – processes communicate with each other without resorting to shared variables
- IPC facility provides two operations:
  - **send**(*message*) – message size fixed or variable
  - **receive**(*message*)
- If *P* and *Q* wish to communicate, they need to:
  - establish a *communication link* between them
  - exchange messages via send/receive
- Implementation of communication link
  - physical (e.g., shared memory, hardware bus)
  - logical (e.g., logical properties)



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Implementation Questions

- How are links established?
- Can a link be associated with more than two processes?
- How many links can there be between every pair of communicating processes?
- What is the capacity of a link?
- Is the size of a message that the link can accommodate fixed or variable?
- Is a link unidirectional or bi-directional?

IPC (Comunicación entre Procesos)

Direct Communication

- Processes must name each other explicitly:
  - **send** (*P, message*) – send a message to process P
  - **receive**(*Q, message*) – receive a message from process Q
- Properties of communication link
  - Links are established automatically
  - A link is associated with exactly one pair of communicating processes
  - Between each pair there exists exactly one link
  - The link may be unidirectional, but is usually bi-directional

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Indirect Communication

- Messages are directed and received from mailboxes (also referred to as ports)
  - Each mailbox has a unique id
  - Processes can communicate only if they share a mailbox
- Properties of communication link
  - Link established only if processes share a common mailbox
  - A link may be associated with many processes
  - Each pair of processes may share several communication links
  - Link may be unidirectional or bi-directional

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Indirect Communication

- Operations
  - create a new mailbox
  - send and receive messages through mailbox
  - destroy a mailbox
- Primitives are defined as:

  send(*A, message*) – send a message to mailbox A

  receive(*A, message*) – receive a message from mailbox A

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Indirect Communication

- Mailbox sharing
  - P_1, P_2, and P_3 share mailbox A
  - P_1, sends; P_2 and P_3 receive
  - Who gets the message?
- Solutions
  - Allow a link to be associated with at most two processes
  - Allow only one process at a time to execute a receive operation
  - Allow the system to select arbitrarily the receiver. Sender is notified who the receiver was.

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Synchronization

- Message passing may be either blocking or non-blocking
- **Blocking** is considered **synchronous**
  - **Blocking send** has the sender block until the message is received
  - **Blocking receive** has the receiver block until a message is available
- **Non-blocking** is considered **asynchronous**
  - **Non-blocking** send has the sender send the message and continue
  - **Non-blocking** receive has the receiver receive a valid message or null

Radio

Tel, what

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Buffering

- Queue of messages attached to the link; implemented in one of three ways
  1. Zero capacity – 0 messages
     Sender must wait for receiver (rendezvous)
  2. Bounded capacity – finite length of *n* messages
     Sender must wait if link full
  3. Unbounded capacity – infinite length
     Sender never waits

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Como ejemplos **de Sistemas IPC tenemos los:**

- **Sistemas POSIX (mundo unix)**

  Ej pipe en linux

  ls –l | wc -l

- **LPC – Local Process Call (mundo windows)**

  Windows usa lo que se conoce también como RPC

  Lo trabaja con el mismo mecanismo que para el modelo cliente/servidor

  type aa.txt |findstr 22

Ejemplo de IPC Windows

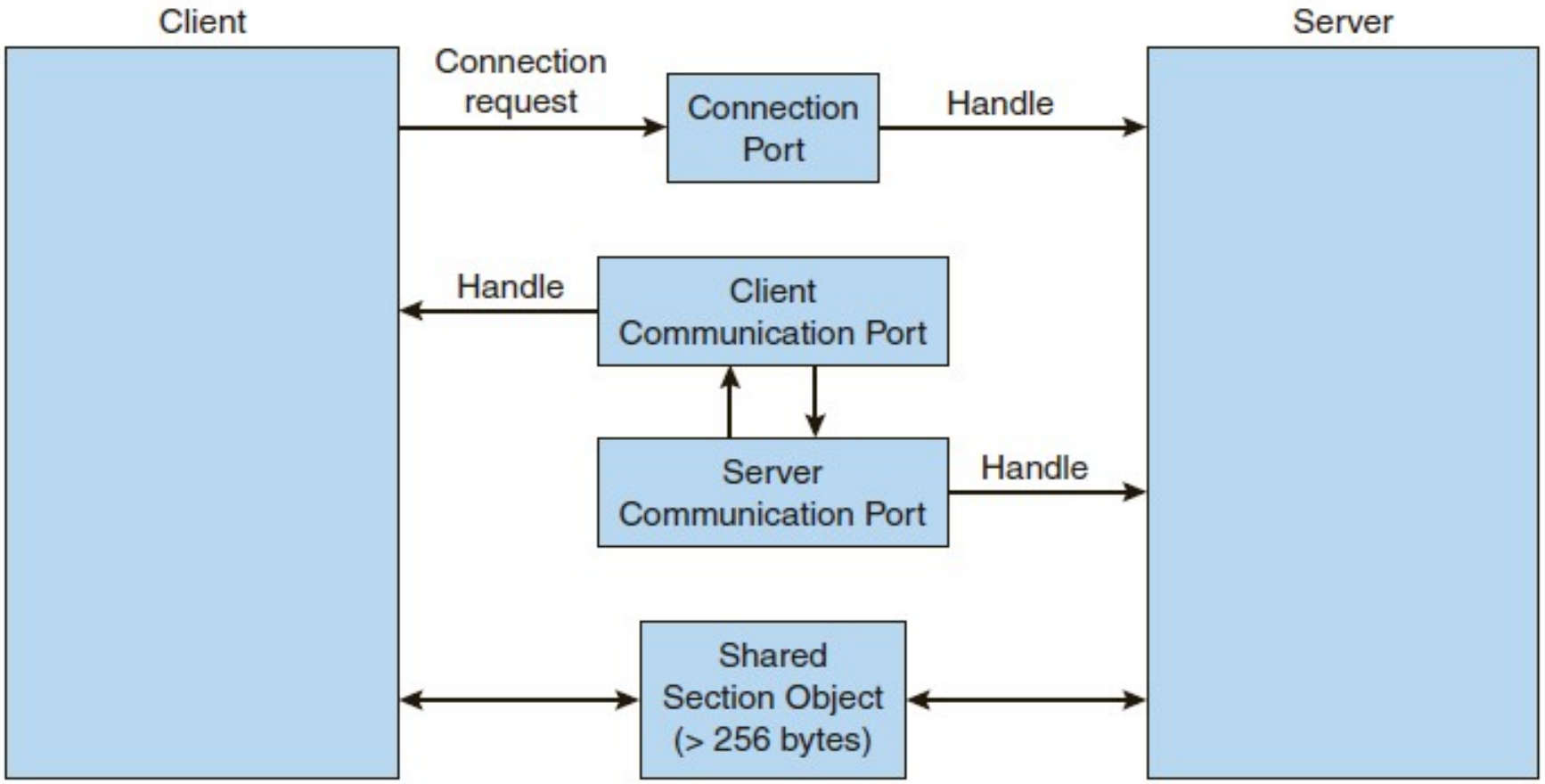

Figure 3.19 Advanced local procedure calls in Windows.

IPC (Comunicación entre Procesos)

Communications in Client-Server Systems

- Sockets
- Remote Procedure Calls
- Remote Method Invocation (Java)

Windows utiliza dentro de sus propios procesos el modelo cliente/servidor

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Sockets

- A socket is defined as an *endpoint for communication*
- Concatenation of IP address and port
- The socket **161.25.19.8:1625** refers to port **1625** on host **161.25.19.8**
- Communication consists between a pair of sockets

Puertos Públicos
Puertos Privados

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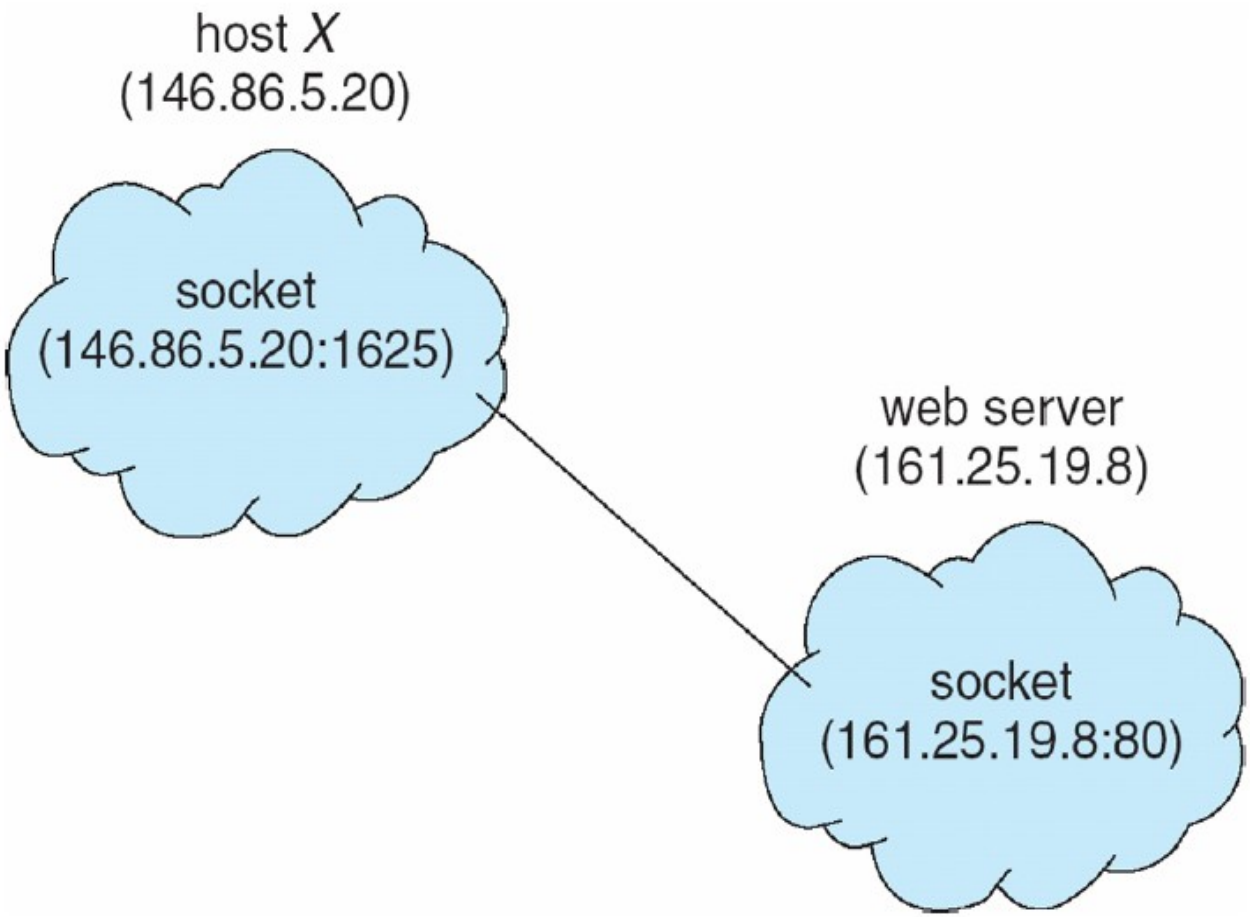
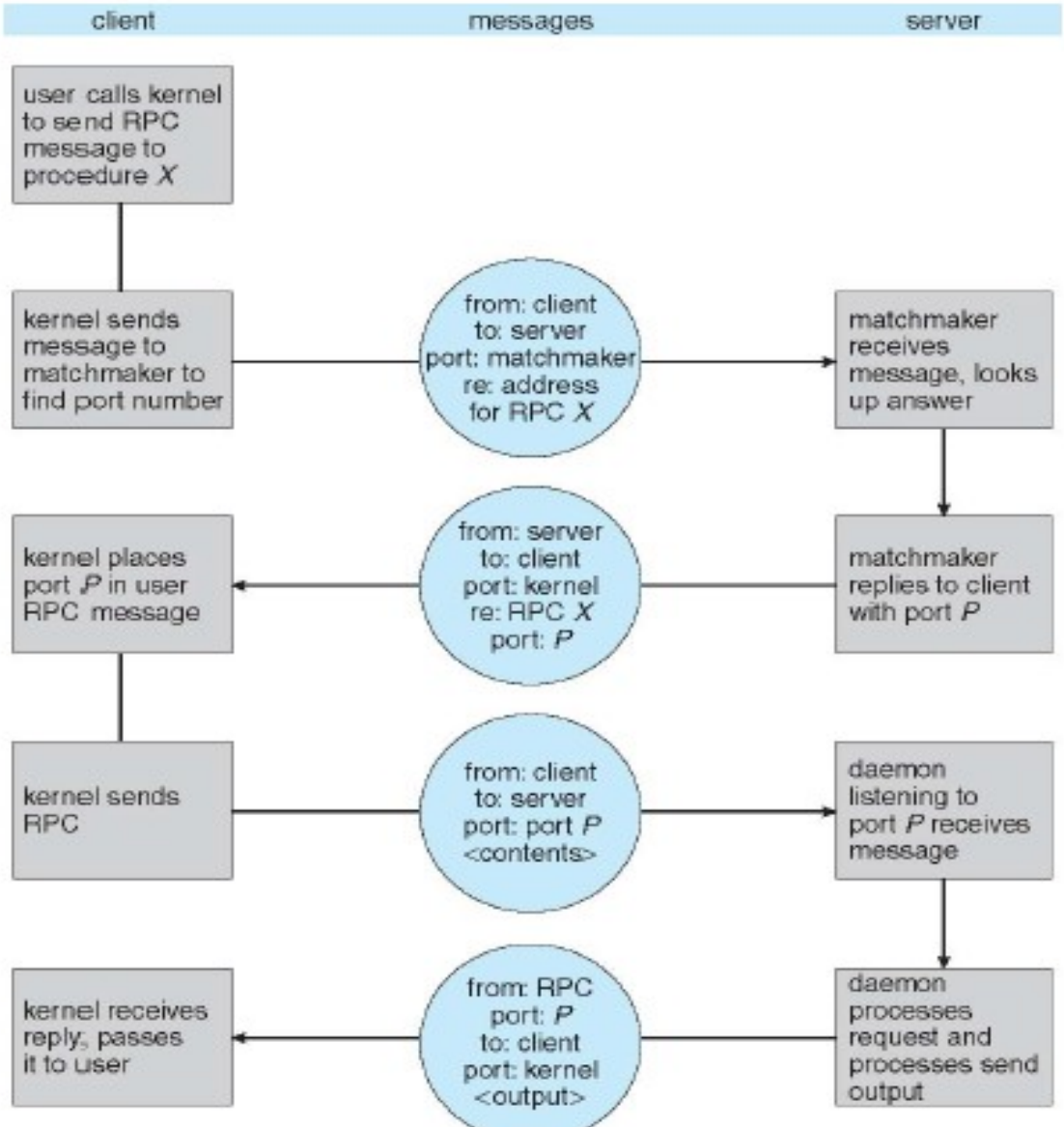


Execution of RPC



Fin clase