Distributed Systems
Bachelor In Informatics Engineering
Universidad Carlos III de Madrid
Midterm
2010/2011

Exercise 1. Answer the following questions briefly, justifying your answer:

a) In POSIX message queues, the call *mq_open* can accept some flags that modify some default behavior. Describe what is the meaning of the flag O_NONBLOCK provided by *mq_open* the call.

The O_NONBLOCK flag provided in the call specifies that in *mq_open*, the *mq_send* and *mq_receive* operations are non-blocking or asynchronous. Non-blocking *mq_send* operation, implies that if the queue is full, the operation is blocked waiting mq_send not able to copy the data, but returns immediately and returns -1. The non-blocking operation *mq_receive* implies that if you try to read from a queue is empty, the operation does not block but returns immediately and returns -1

b) What is the process portmapper and what it is used?

It is in charge of making the binding or dynamic link between the client and server RPCs. On one hand, it enables the RPC server to register a remote program, a version that is running, and port. No need to specify the IP address as the portmapper running on the same machine as the RPC server. On the other hand it allows to locate RPC client to the RPC server. The client asks the portmapper remote program name and version, and the portmapper returns the port where the server runs.

The portmapper running on a well-defined port, the TCP and UDP 111, for easy reference by clients.

c) What is the purpose of distributed computing? And for parallel computer?

The goal of distributed computing is to share resources of both hardware and software. The goal of parallel computing is to increase the speed of application execution.

d) List and briefly describe the functions performed by the client stub and server stub in remote procedure calls.

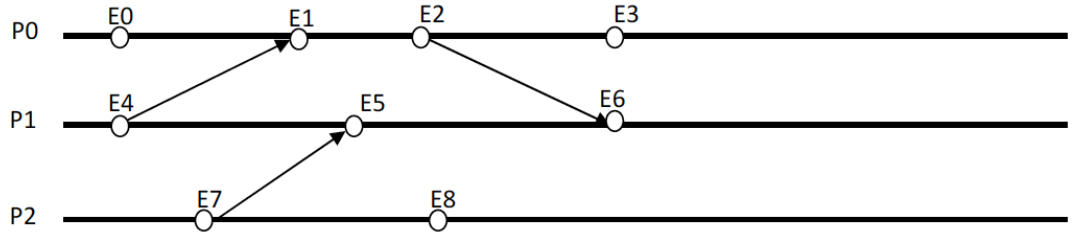
The client stub must be provided for each remote procedure:
1) Remote Service Location
2) Pack a message with arguments (marshalling)
3) Send the message
4) Get server response
5) Unpack the answer (unmarshalling)
6) Return client

The server stub must:
1) Register the remote service
2) Receive remote procedure request
3) Unpack the request (unmarshalling)
4) Invoke the procedure locally
5) Get the response procedure
6) Package response (marshalling)
7) Send the response to the client
8) Return to (2)

e) What is marshalling or flattening the data? List the known functions that perform this function.

Marshalling consists in transforming the data generated in a computer to be sent over the network as a standard format for data representation, which is independent of the representation used in the computers. The inverse function is called unmarshalling and consists of transforming the data received from the standard format to the data representation used on the target machine. In particular, the problem takes care of marshalling the byte ordering (Little Endian, Big Endian) on machines that communicate. The standard format for data transmission network (or network order) is Big Endian.

Exercise 2. Consider the processes P0, P1 and P2 running in a distributed system. These processes generate events marked in the figure below.



a) Obtain the potential causal relationships between Lamport events, shown in the figure.

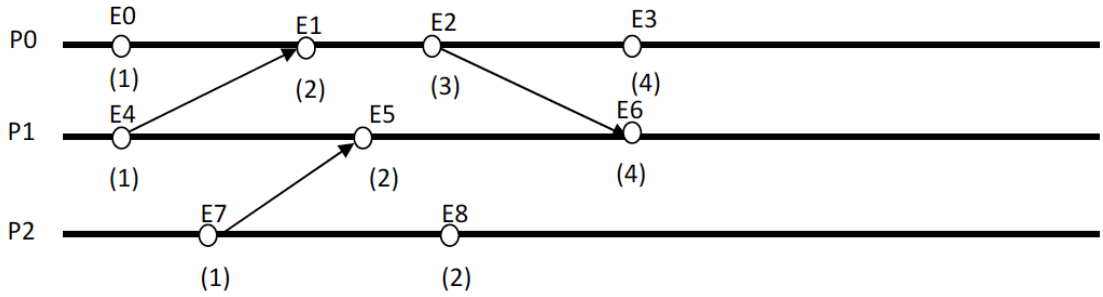
E0->E1, E1->E2,E2->E3,E0->E2,E0->E3,E1->E2,E1->E3
E4->E5,E5->E6,E4->E6
E7->E8
E4->E1,E4->E2,E4->E3
E7->E5,E7->E6
E2->E6

b) What events can not extract an order relation (concurrent) and why?

Unable to extract potential Lamport causal relationships for those pairs of events which are not met either previous observations. These events are said to be concurrent, denoted as a | | b. The events occurring in the example are:

E0||E4,E0||E7,E0||E8,E0||E5
E1||E5,E1||E7,E1||E8
E2||E5,E2||E7,E2||E8
E3||E5,E3||E6,E3||E7,E3||E8
E4||E7,E4||E8
E5||E8,
E6||E8

c) Using Lamport logical clocks, obtain the timestamps for the events of the previous processes.



d) Using vector clocks, obtain the timestamps for the events of the previous processes.