Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India
(Autonomous College Affiliated to University of Mumbai)
End Semester Examination
May 2019

Max. Marks: 60 | Duration: 3 Hrs
Class: T.E. | Semester: VI
Course Code: IT61 | Branch: Information Technology
Name of the Course: Distributed Systems

Synoptic

1 a. Discuss the edge-chasing algorithm. Give examples to show that it could detect phantom deadlocks.

edge-chasing algorithm 2 marks

diagram 2 marks

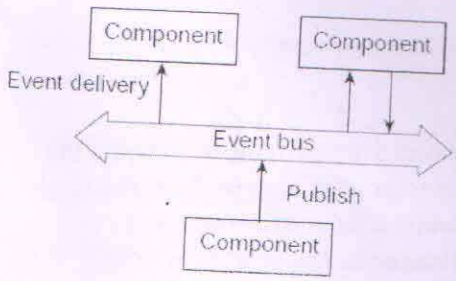
b) What is CUDA? When to use CUDA?

CUDA 1 mark

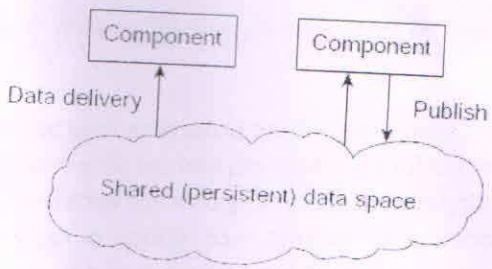
Use of CUDA 3 marks

c) In distributed systems how to analyze the event based and shared data space architecture with example.

Diagram 2 marks



(a)



(b)

Explanation 2 marks

(a) Publish/subscribe [decoupled in space] (event-based architecture)

- Event-based arch. supports several communication styles:
  - Publish-subscribe
  - Broadcast
  - Point-to-point

- Decouples sender & receiver; asynchronous communication
- Event-driven architecture (EDA) promotes the production, detection, consumption of,
and reaction to events.
- An event can be defined as "a significant change in state". For example, when a consumer purchases a car, the car's state changes from "for sale" to "sold". A car dealer's system architecture may treat this state change as an event to be produced, published, detected and consumed by various applications within the architecture.

(b) Shared dataspace [decoupled in space and time] (data-centered + event-based)
Access and update of data store is the main purpose of data-centered system. Processes communicate/exchange info primarily by reading and modifying data in some shared repository (e.g database, distributed file system)

e.g. processes of many web-based distributed systems communicate through the use of shared Web-based data services.

2 a. What is RMI? How to apply parameter passing techniques such as passing object by reference or by value in RMI with suitable diagram?

Definition 1 mark

Diagram 2 marks

Explanation 3 marks

OR

A client makes the remote procedure calls to server. The client takes 5 milliseconds to compute the arguments for each request, and the server takes 10 milliseconds to process each request. The local operating system processing time for each send or receive operation is 0.5 milliseconds, and network time to transmit each request or reply message is 3 milliseconds. Marshalling or unmarshalling takes 0.5 milliseconds per message. Calculate the time taken by the client to generate and return from two requests:

i) if it is single threaded, and

ii) if it has two threads that can make requests concurrently on single processor.

You can ignore context switching time.

```
Single-threaded
time per call
      = calc. args + marshal args + OS send time + message transmission +
        OS receive time + unmarshallargs + execute server procedure +
marshall results + OS send time + message transmission +
        OS receive time + unmarshalargs
      = 5 + 4 * marshal/unmarshal + 4 * OS send/receive +
        2 * message transmission + execute server procedure
      = 5 + 4 * 0.5 + 4 * 0.5 + 2 * 3 + 10 ms = 5 + 2 + 2 + 6 + 10 = 25
ms.

        Time for two calls = 50 ms.

     (1.b) Two-threaded
threaded calls:
client does calc. args + marshal args + OS send time (call 1)
      = 5 + .5 + .5 = 6 ms
thencalcargs + marshal args + OS send time (call 2)
      = 5 + .5 + .5 = 6 ms
after 12 ms client waits for reply from first call
```

Time : 36 ms

b) Construct with neat diagrams and give example of different forms of communication, such as persistent asynchronous , persistent synchronous, transient asynchronous, receipt based transient synchronous , delivery based transient synchronous and response based transient synchronous communication.

6 diagrams 3 marks

Example 3 marks

3a. In Apache web server how multithreading is applied justify with example.

Diagram 2 marks

Explanation 4 marks

OR

What are the different reasons for code migration? With the help of diagram how client dynamically configure the server.

Reasons 2 marks

Diagram 2 marks

Explanation 2 marks

b. What is global state of distributed system? With the help of diagram explain the distributed snapshot algorithm.

Definition 1 mark

Diagram 2 marks

Explanation 3 marks

Q4 a. What are the functions of any three distributed computing system models and how this models are used in distributed systems explain with diagrams?

Three diagrams 3 marks

Explanations 3 marks

b. Explain how election is done when any particular system crashes using bully algorithm and ring based algorithm?

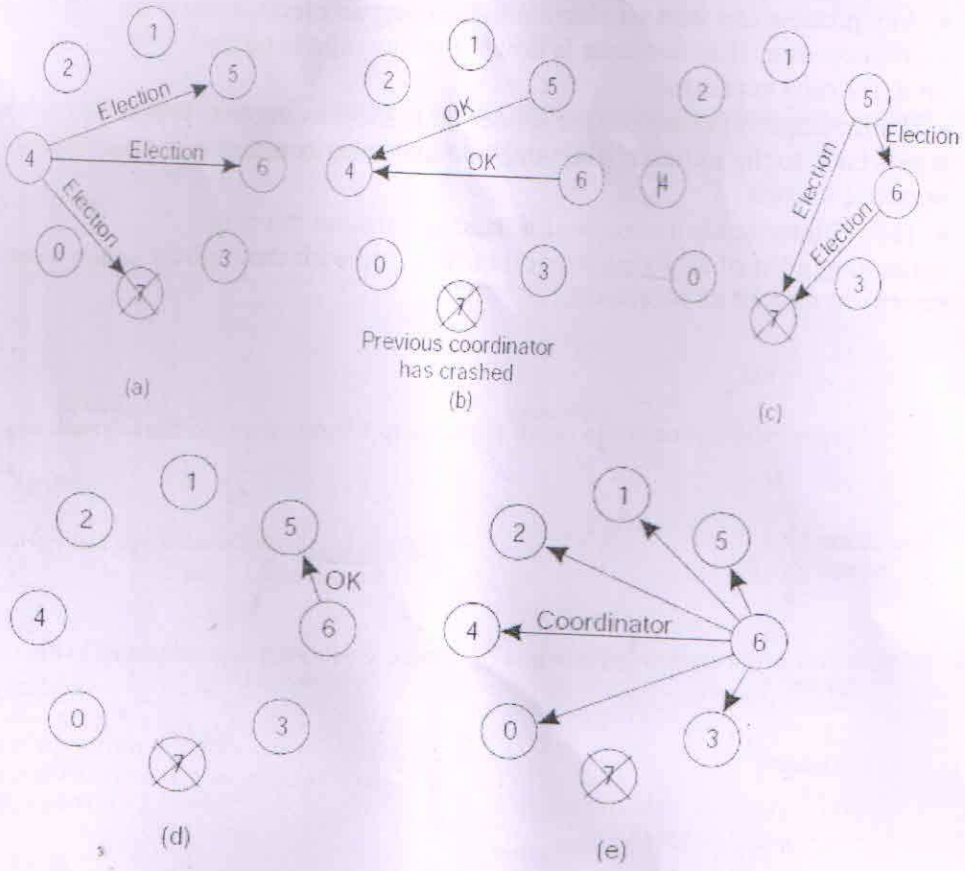
Election algo 3 marks

Ring algo 3 marks

Each process has an associated priority (weight). The process with the highest priority should always be elected as the coordinator.

Issue
How do we find the heaviest process?

- Any process can just start an election by sending an election message to all other processes with higher numbers.
- If a process P_{heavy} receives an election message from a lighter process P_{light}, it sends a take-over message to P_{light}. P_{light} is out of the race.
- If a process doesn't get a take-over message back, it wins, and sends a victory message to all other processes.



(a) Pocess 4 holds an election.
(b) Processes 5 and 6 respond, telling 4 to stop.
(c) Noew 5 and 6 hold an election.
(d) Process 6 tells 5 to stop.
(e) Process 6 wins and tells everyone.

Issue
Suppose crashed nodes comes back on line:

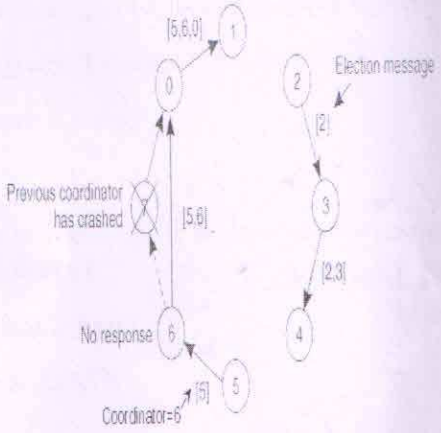
- Sends a new election message to higher numbered processes
- Repeat until only one process left standing
- Announces victory by sending message saying that it is coordinator (if not already coordinator)
- Existing (lower numbered) coordinator yields

Hence the term 'bully'

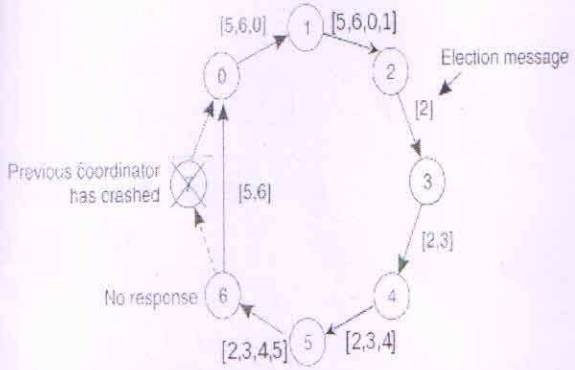
Election in a ring

Principle
Process priority is obtained by organizing processes into a (logical) ring. Process with the highest priority should be elected as coordinator.

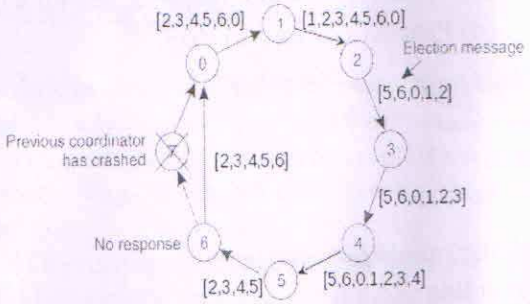
- Any process can start an election by sending an election message to its successor. If a successor is down, the message is passed on to the next successor.
- If a message is passed on, the sender adds itself to the list. When it gets back to the initiator, everyone had a chance to make its presence known.
- The initiator sends a coordinator message around the ring containing a list of all living processes. The one with the highest priority is elected as coordinator.



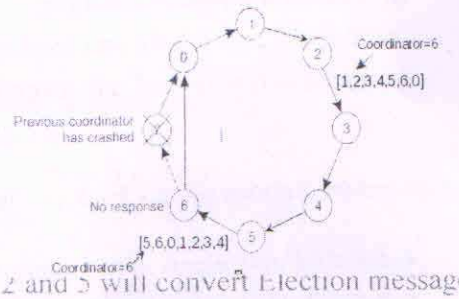
2 and 5 start election message s independently.



Both messages continue to circulate.



Eventually, both messages will go all the way around .



2 and 5 will convert Election messages to COORDINATOR messages. All processes recognize highest numbered process as new coordinator.

OR

Explain the working of distributed mutual exclusion algorithm with example. Give the disadvantages of distributed mutual exclusion algorithm.

Working 3 marks

Example 2 marks

Disadvantages 1 mark

5a. Draw the CORBA architecture and Discus how CORBA provides language independent, platform independent for writing distributed object oriented applications.

Diagram 2 marks

Explanation 4 marks

b. What are the reasons of replication? Explain strict data centric consistency model.

Reasons 2 marks

Strict data centric consistency model 4 marks

OR

With the help of example how Berkeley's algorithm and averaging algorithms are used for clock synchronization.

Berkeley's algorithm 4 marks

averaging algorithm 2 marks