FAULT TOLERANCE IN DISTRIBUTIVE FILE SYSTEM

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Topics

1. Introduction
2. Basics Terminologies
3. Phases in the fault Tolerance.
4. Fault Tolerance Techniques
5. Limitations

1.Introduction

- In the early days of computing, Centralized systems were in use.

- Due to the gradual development in the field of networks and micro-electronics, centralized systems lost their ways to Interconnected-multiprocessor systems.

- Interconnected multiprocessor systems

1. Parallel Processing systems-Single system wide memory.
2. Distributed Systems-No shared memory.

1.1 What is a Distributed System

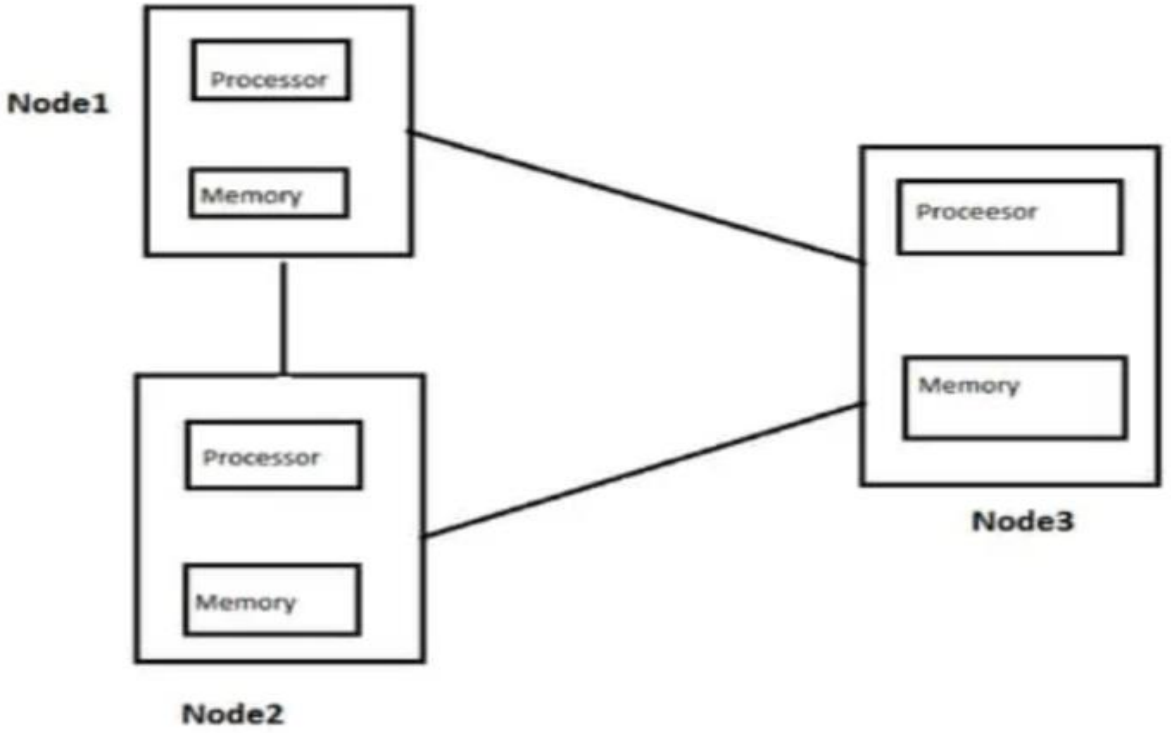
- Collection of independent computers that appear to its users as a single coherent system.
- Every system has its own memory and its own set of resources and they can share some common peripheral devices such as a printer.
- Systems are organized in such a manner so as to hide their existence from the end user.
- Transparency is to be maintained-ISO(8 kind of transperanacy)
- Message passing or RPC technique through communication technology such as TCP/IP.

1.2

- Designing a distributed system is a complex task because of the presence of a large number of components which can be located at distance from each other. some of the major challenges that designers have to face are listed below

- Fault tolerance
- Communication primitives
- Flexibility
- Transparency

1.3Block Diagram of Distributed Syste



2.Faults, Errors and Failures.

- In any distributed system, three kinds of problems can occur.

  1) Faults

  2)Errors(System enters into an unexpected state)

  3)Failures

- All these are inter related.
- It is quite fair to say that fault is the root cause, where a problems starts, error is the result of fault and failure is the final out come.

2.1Types of Faults

Transient Faults	Permanent Faults
Occur for a very short duration.	Permanent
Hard to locate	Easy to be identified
Do not affect the system to a great extent.	Can cause severe damage to the entire system
Network fault, processor fault, Media Fault are some of the examples	Node Level Faults-when an Entire node is unavailable.

2.2 Types of Failures

Crash Failure	Occurs when a server crashes or any other hardware related problem occurs.
Omission Failure	Occurs when a server does not receive incoming requests from client or fails to send messages in response to clients request.
Timing Failure	Occurs when a server fails to respond with in a particular amount of time.
Response failure	Occurs when a server sends incorrect message in response to the client's message.
Arbitrary Failure	Occurs when a server sends any arbitrary message.

2.3 What is Fault Tolerance?

- Ability of a system to continue functioning in the event of a partial failure.
- Though the system continues to function but overall performance may get affected.
- Distributed systems are made up of a large number of components, developing a system which is hundred percent fault tolerant is practically very challenging.
- Two main reasons for the occurrence of a fault

  1)Node failure -Hardware or software failure.

  2)Malicious Error-Caused by unauthorized Access.

2.4 Why do we need fault tolerance

- Fault Tolerance is needed in order to provide 3 main feature to distributed systems.

  1)Reliability-Focuses on a continuous service with out any interruptions.

  2)Availability - Concerned with read readiness of the system.

  3)Security-Prevents any unauthorized access.

- examples-Patient Monitoring systems, flight control systems, Banking Services etc.

3.Phases In The Fault Tolerance

- Implementation of a fault tolerance technique depends on the design , configuration and application of a distributed system.

- In general designers have suggested some general principles which have been followed.

  1)Fault Detection

  2)Fault Diagnosis

  3)Evidence Generation

  4)Assessment

  5)Recovery

4.Fault Tolerance Techniques

Replication

- Creating multiple copies or replica of data items and storing them at different sites
- Main idea is to increase the availability so that if a node fails at one site, so data can be accessed from a different site.
- Has its limitation too such as data consistency and degree of replica.

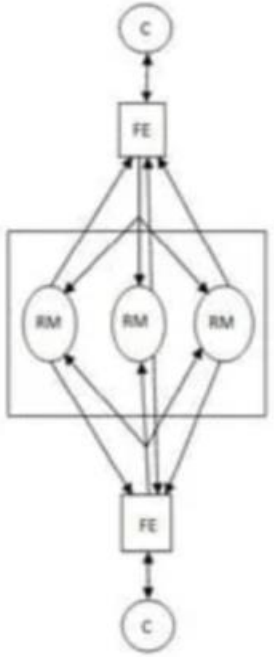
Check Pointing

- Saving the state of a system when they are in a consistent state and storing it on a stable storage.
- Each such instance when a system is in the stable state is called a check point.
- In case of a failure, system is restored to its previous consistent state.
- Saves useful computation.

4.2 Types of Replication

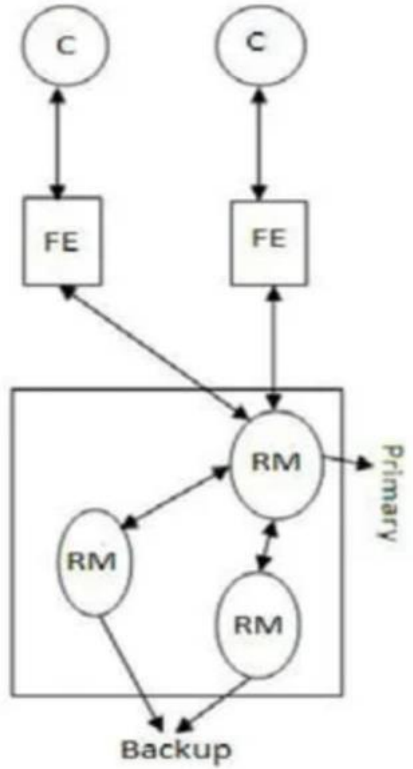
Active Replication

- Can be used only for deterministic processes.
- Client's request is processed by all the servers.
- Requires an atomic broadcast protocol ,to forward the requests to all the servers in the same order.



Passive Replication

- Can be used for non deterministic processes also.
- There is only one server that processes client's request known as primary server .
- Other servers act as back up servers.
- Response time is high as there is only one server which process many client's request.



4.3 Check Pointing

- Every system has some information associated with it which defines its state at a particular moment.
- This information include process state, environment, value of the active registers and variable.
- All this information are collected and stored and each such instance is called a check point.
- In the event of a failure, system is restored to a previously stored check point rather than starting it from the beginning.
- Check pointing is useful but time consuming.


Thank you!