MZUMBE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

COMPUTING SCIENCE STUDIES

GROUP ASSIGNMENT

DISTRIBUTED SYSTEMS

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Questions:

1. **Identify types of communication in Distributed Systems**
2. **For each type, explain its strength and weakness**
3. **Explain the concept of microservice with an example. Using the same example, determine types of inter-process communication that can be used for successful service provision.**

Types of communication in Distributed Systems

Communication in a distributed system is archived by the means of Inter-Process Communication (IPC) were defined as the heart of all communication.

Inter-process Communication is a process of exchanging data between two or more independent processes in a distributed environment

There are two types of communication in Inter-Process Communication in IPC, namely are:

- Shared Memory
- Message Passing

Shared memory

This is the fundamental model of inter-process communication a shared whereby in the address space region the cooperating communicates with each other by establishing the shared memory region. If the process wants to initiate the communication and it has some data to share, then establish the shared memory region in its address space.

Strength of shared Memory in distributed system

- Communication is fast because there is no overhead related to system calls.
- Memory mapping of a file, improves I/O performance, chiefly on large files.
- it can support message passing like pipes

Weakness of Shared Memory in the distributed system

- It needs concurrency control mechanisms and memory protection which leads to complications in programming because the programmers have to make sure to control all the critical regions effectively.
- It does not support the persistence of data which means if the system crash for any reason, the data are lost.
- When the number of processors in the machine is ever-increasing, it progressively makes it difficult and expensive to construct shared memory.

Message passing

Refers to a mechanism to allow processes to communicate and to synchronize their actions without sharing the same address space. It is used in distributed environments where the communicating processes are present on remote machines which are connected with the help of a network

Strength of Message Passing in distributive system

- It does not require concurrency control mechanisms like semaphores, which results in performance improvement
- processes tend to exchange a large amount of data in the distributed system

Weakness of message passing

- Transferring large files over a busy network is time-consuming.
- It appears when they tend to exchange data so that they have to copy the data which is a quite time-consuming and tedious operation, especially for large-scale data.
- Involvement isolation is that if one process requires passing some data to another, the data must be copied, which can be a relatively costly operation for an immense amount of data.

Microservice and Inter-Process communication

Over the past few years, microservices have earned giant consideration and gained popularity in the technology industry. Microservice technology helped a number of large organizations in this world like Amazon, Google, and Netflix to serve a million requests per minute. Microservice is also having its architecture called microservice architecture which refers to the way or style used to develop software as a collection of independent services.

In a microservice architecture, each service is running on its own process that is independent of other processes and sometimes each service can be deployed separately from other services. Designing software based on microservices involves answering questions and overcoming technical challenges that often do not exist in monolithic architecture, like inter-process communication (IPC).

Despite the growth and importance of microservices in industry, there has not been sufficient research on microservices, partly due to lacking a benchmark system that reflects the characteristics of industrial microservice systems and one of the important challenges of microservice architecture is inter-process communication.

Inter-process communication is at the heart of all distributed systems. It makes no sense to study distributed systems without carefully examining the ways that processes on different machines can exchange information. In distributed systems communication is always based on low-level message passing as Offered by the underlying network. Modem-distributed systems often consist of thousands or even millions of processes scattered across a network with unreliable communication such as the Internet. An example is Google.

Shared Memory

Processes are located in different address spaces in order to not touch each other. The main drawback of this isolation is that if one process requires passing some data to another, the data must be copied, which can be a relatively costly operation for an immense amount of data. To manage the problem, shared memory is used. As its name implies, through shared memory two or more processes have access to the same memory location and would be able to transfer data.

Shared memory does not handle the concurrency problems of the processes involved. To achieve this goal, it often exploits concurrency control techniques such as semaphore. One of the significant benefits of shared memory is that processes tend to exchange a large amount of data.

Message Passing

Another notable IPC concept that is routinely investigated is message passing. In message passing, processes communicate by passing messages just using two operations: send and receive. The message-passing concept relatively seems simple, but it requires multiple design options to be made. There are many methods that employee message passing to communicate.