

PARALLEL VS. DISTRIBUTED COMPUTING

1. What is Parallel Computing?

In parallel computing multiple processors performs multiple tasks assigned to them simultaneously. Memory in parallel systems can either be shared or distributed. Parallel computing provides concurrency and saves time and money.

Advantages of Parallel Computing

- **Increased Speed:** In this technique, several calculations are executed concurrently hence reducing the time of computation required to complete large scale problems.
- **Efficient Use of Resources:** Takes full advantage of all the processing units it is equipped with hence making the best use of the machine's computational power.

- **Scalability:** Also the more processors built into the system, the more complex problems can be solved within a short time.
- **Improved Performance for Complex Tasks:** Best suited for activities which involve a large numerical calculation like, number simulation, scientific analysis and modeling and data processing.

Disadvantages of Parallel Computing

- **Complexity in Programming:** Parallel writing programming that is used in organizing tasks in a parallel manner is even more difficult than that of serial programming.

- **Synchronization Issues:** Interaction of various processors when operating concurrently can become synchronized and result in problem areas on the overall communication.
- **Hardware Costs:** The implementation of parallel computing does probably involve the use of certain components such as multi-core processors which could possibly be costly than the normal systems.

2. What is Distributed Computing?

In distributed computing we have multiple autonomous computers which seems to the user as single system. In distributed systems there is no shared memory and computers communicate with each other through message passing. In distributed computing a single task is divided among different computers.

Advantages of Distributed Computing

- **Fault Tolerance:** The failure of one node means that this node is no longer part of the computations, but that is not fatal for the entire computation since there are other computers participating in the process thereby making the system more reliable.
- **Cost-Effective:** Builds upon existing hardware and has flexibility in utilizing commodity machines instead of the need to have expensive and specific processors for its use.
- **Scalability:** The distributed systems have the ability to scale and expand horizontally through the addition of more machines in the networks and therefore they can take on greater workloads and processes.

- **Geographic Distribution:** Distributed computing makes it possible to execute tasks at different points thereby eliminating latencies.

Disadvantages of Distributed Computing

- **Complexity in Management:** The task of managing a distributed system itself can be made more difficult since it may require dealing with the latency and/or failure of a network as well as issues related to synchronizing the information to be distributed.
- **Communication Overhead:** Inter node communication requirements can actually hinder the package transfer between nodes that are geographically distant and hence the overall performance is greatly compromised.

- **Security Concerns:** In general, distributed systems are less secure as compared to centralized system because distributed systems heavily depend on a network.

Difference between Parallel Computing and Distributed Computing:

| S.NO | Parallel Computing | Distributed Computing |
|------|--|--|
| 1. | Many operations are performed simultaneously | System components are located at different locations |
| 2. | Single computer is required | Uses multiple computers |

| S.NO | Parallel Computing | Distributed Computing |
|------|--|--|
| 3. | Multiple processors perform multiple operations | Multiple computers perform multiple operations |
| 4. | It may have shared or distributed memory | It have only distributed memory |
| 5. | Processors communicate with each other through bus | Computer communicate with each other through message passing. |
| 6. | Improves the system performance | Improves system scalability, fault tolerance and resource sharing capabilities |

Conclusion

Parallel Computing and Distributed Computing are effective computational models developed with an aim to solve large calamities. Parallel computing is suitable for accelerating computations of a single machine or clustered machines, with emphasis on the rate of processing. On the other hand, distributed computing has many separate and independent computers that are connected over the network focusing on scalability and fault tolerance. Each of the models presented has its own strength and weakness, therefore, the choice between them depends on the conditions of the particular application or system.