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The Differences between the Parallel System and the Distributed System

The article mainly explores the differences between parallel & distributed system. The topic would be presented by introducing the parallel and distributed system through several aspects to distinguish their details based on the master course which taught by Dr.Hamid Tahaei. The two concepts have similar meanings, but they also have differences in the operation of society. Consequently, these concepts would be organized in the article to explain their differences.

To begin with, the parallel system means that the multiple processors in a system are used to cope with multiple tasks or multiple instructions simultaneously. Therefore, the processors in a parallel system usually run in the same configuration including both hardware and software which are tightly coupled. While distributed system becomes more independent, different computers connect and cooperate to handle common problems through a communication network. The distributed system could solve the problem that a single computer could not solve, so it has much more powerful computing resources than an individual entity. Therefore, unlike the parallel system, the distributed system is loosely coupled, but they could cooperate when they begin to address the issues. Although they have similar concepts, the two systems also have many different features.

In this paragraph, we would mainly focus on parallel computing and distributed computing. Parallel computing is meaning that multiple computer resources like processors and memory are combined to address the computation problem. It means the computational activities would happen at the same time. Specifically, the computation or emulation would be broken into several parts which may be further broken down into instructions. These instructions would be executed by different processors simultaneously. While in distributed computing, the common goal would be solved through an individual computer which connected through the network. Because these distributed computers would not share resources and every computer has its memory and processors. However, they could cooperate to improve their performance without geographical limitation.

There are several features that parallel computing differentiate with distributed computing, including memory, physical clock control, location, etc. In parallel computing, processors tend to share a common memory. This means that processors are individually, but they could access to any common memory to share the resources. If there is a mistake or change on the memory, the processor that utilizes the memory would be affected. The type of memory from the parallel system could be split UMA and NUMA according to their architecture. Specifically, a multiprocessor system corresponds uniform memory access, while non-uniform memory access usually corresponds to the multicomputer system with a common address space. While the distributed system has its individual memory, which would not be affected by other computers that connected through the common network. Secondly, a parallel system has a global clock for synchronization, while the distributed system uses synchronization algorithms to ensure a global clock. The third difference between the two systems is the processor interconnection. The processor interconnection

in parallel system is the order of Tbps, while that in distributed system is the order of Gbps. There is also a difference in the operation system. The parallel system usually has the same operating system, while a distributed system is much more loosely-coupled. Furthermore, the location of the distributed system is separated. Because of their different features, scientists often use parallel computing to disentangle their professional issues like scientific computing which needs massive computing resources. However, a distributed system is more likely to be used in business or cooperation on account of its reliability and scalability.

The last part is concerning about their advantages and disadvantages. For example, the distributed system has good resiliency, when the computer in the system is broken down, the function of the whole may not be affected because of its independence memory and backup mechanism. Furthermore, the distributed system is easily scalable, which means that users could add or delete one entity according to their demands that would not affect operation in other computers. However, there is a challenge that how to find the synchronization algorithms to handle unexpected situations to ensure the resiliency of the distributed system. Parallel system multiple users can do multiple tasks at the same time. This would save users much cost and time, while its operation would consume much power.

To sum up, in this article, the difference between the parallel system and the distributed system is explained. Actually, for most situations, parallel computing and distributed computing could improve the "efficiency". The difference is that the distributed system is emphasized on "coordination"[1].

References:

1.Michel Raynal. A Look at Basics of Distributed Computing *. EEE ICDCS 2016 - 36th International Conference on Distributed Computing Systems, Jun 2016, Nara, Japan. ffhal-