Unit -04 (Subject: -Advance Database Management System)

Chapter Name: Parallel Databases

4.6. Key elements of parallel database processing: Speed-up, Scale-up Synchronization and Locking

Parallel database:

A variety of hardware architectures allow multiple computers to share access to data, software, or peripheral devices.

A parallel database is designed to take advantage of such architectures by running multiple instances which "share" a single physical database.

In appropriate applications, a parallel server can allow access to a single database by users on multiple machines, with increased performance.

A parallel server processes transactions in parallel by servicing a stream of transactions using multiple CPUs on different nodes, where each CPU processes an entire transaction. Using parallel data manipulation language, you can have one transaction being performed by multiple nodes.

Nowadays organizations need to handle a huge amount of data with a high transfer rate. For such requirements, the client-server or centralized system is not efficient. With the need to improve the efficiency of the system, the concept of the parallel database comes in picture.

A parallel database system seeks to improve the performance of the system through parallelizing concept.

Multiple resources like CPUs and Disks are used in parallel.

The operations are performed simultaneously, as opposed to serial processing. A parallel server can allow access to a single database by users on multiple machines.

It also performs many parallelization operations like data loading, query processing, building indexes, and evaluating queries.

This is an efficient approach because many applications consist of online insert and update transactions which tend to have short data access requirements.

In addition to balancing the workload among CPUs, the parallel database provides for concurrent access to data and protects data integrity.

Advantages of Parallel database:

Performance Improvement – By connecting multiple resources like CPU and disks in parallel we can significantly increase the performance of the system.

High availability – In the parallel database, nodes have less contact with each other, so the failure of one node doesn't cause for failure of the entire system. This amounts to significantly higher database availability.

Proper resource utilization –Due to parallel execution, the CPU will never be ideal. Thus, proper utilization of resources is there.

Increase Reliability – When one site fails, the execution can continue with another available site which is having a copy of data. Making the system more reliable.

You can measure the performance goals of parallel processing in terms of two important properties:

- **Speedup**
- **Scaleup**

Speedup

Speedup is the extent to which more hardware can perform the same task in less time than the original system. With added hardware, speedup holds the task constant and measures time savings.

Scaleup

Scaleup is the factor m that expresses how much more work can be done in the same time period by a system n times larger. With added hardware, a formula for scaleup holds the time constant, and measures the increased size of the job which can be done.

Synchronization: A Critical Success Factor

Coordination of concurrent tasks is called synchronization. Synchronization is necessary for correctness.

The key to successful parallel processing is to divide up tasks so that very little synchronization is necessary. The less synchronization necessary, the better the speedup and scaleup.

In parallel processing between nodes, a high-speed interconnect is required among the parallel processors.

The overhead of this synchronization can be very expensive if a great deal of inter-node communication is necessary. For parallel processing within a node, messaging is not necessary: shared memory is used instead. Messaging and locking between nodes are handled by the Integrated Distributed Lock Manager (IDLM).

The amount of synchronization depends on the number of resources and the number of users and tasks working on the resources.

Little synchronization may be needed to coordinate a small number of concurrent tasks, but lots of synchronization may be necessary to coordinate many concurrent tasks.

Locking

Locks are fundamentally a way of synchronizing tasks. Many different locking mechanisms are necessary to enable the synchronization of tasks required by parallel processing.

The Integrated Distributed Lock Manager (Integrated DLM, or IDLM) is the internal locking facility used with Oracle Parallel Server.

It coordinates resource sharing between nodes running a parallel server.

The instances of a parallel server use the Integrated Distributed Lock Manager to communicate with each other and coordinate modification of database resources.

Each node operates independently of other nodes, except when contending for the same resource.