Assignment (Video- 40 to 42): Database System Impl. (COP6726)

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1) **Database Recovery:** when a database system suffers a failure in that case database recovery is used to restate the system into previous stable consistent state. the database system failure could occur for any reason it could be either a hardware or software error. Generally, database system uses save checkpoints in order to do recovery. when an operation is performed on the database which could be read/write or any other type of transaction, the database use already saved checkpoints to revert back to the consistent state in case if any failure occurs during the transaction process. The number of recovery techniques that are used are based on the atomicity property of transactions. A checkpoint is a saved consistent state which can help database to recover from failure by reverting back to consistent state from inconsistent state.

2) **Conflicts in Databases:** A database is a system which saves data records. This data is written or read from the database from multiple entities for example in a banking central database multiple user can login and try to access the data at the same time. A transaction is a set of instruction or operation performed on the database. When multiple users or entities try to do transaction with the database then sometimes there might be some data inconsistencies occurring due to multiple accesses happening at the same time which result into data conflicts. Conflict can occur when multiple entities trying to access the same data record and for example data after transaction is not committed properly and other entity accesses it in that case the second entity is not getting the updated data this is data consistency which causes data conflicts. There are several types of data conflicts and strategies and architectures to handle them. some of the popular data conflicts are Write-Read (WR) conflict, Read-Write (RW) conflict, Write-Write (WW) conflict.
    a) Write-Read (WR) conflict: This conflict occurs when a transaction reads the data which is written by another transaction before committing.

    b) Read-Write (RW) conflict: This conflict occurs when a transaction writing data which is previously read by another transaction.

    c) Write-Write (WW) conflict: This conflict occurs when a transaction writes data which was previously written by another transaction and overwrites it.

3) **Database Logs:** database logs record the transactions and operations happening on the database as they occur. database logs can record different types of activity occurring in databases. Database logs are useful in case of failure, by using logs database can revert back to the previous consistent state in case of any failure that makes data in database inconsistent.

4) **Scratch Space:** scratch space is the disk or memory space which is used to store temporary data in database. For example, when a database is performing transaction it generates intermediate data which has to be stored somewhere, these intermediate files are stored in scratch space. This space is temporary storage and data stored here is not saved forever. When a database system has multiple nodes then there are different types of scratch spaces like global scratch space and local scratch space. global scratch space is shared by all the nodes however local scratch space is personal to a specific node and used by that only.

5) **Cloud Based Database Systems:** a cloud-based database is the database system which is built and accessed through cloud platforms. The main advantage of cloud-based database system is that the user does not need to maintain the dedicated hardware for getting the database up and running. There are different types of cloud-based database services by different cloud providers. The database could be setup on cloud machines manually or nowadays various providers do provide ready to use database system which are already configured and optimized, hence it could be used as a service. Services like amazon web services and azure are some of the cloud platforms which provide such services.

6) **SQL Injection Attack:** a SQL injection attack is a security vulnerability where the attackers can modify the SQL queries made by the software systems to backend database. By modifying these queries attackers can access the data which they is private to users or the system. By using this attack attackers can compromise user's sensitive information as well as compromise the system also.

7) **Tableau:** Tableau is the data visualization tool which can project data in form various pictorial representation of charts, these visualizations are helpful to easily understand data. Not just that the main advantage of tableau is that unlike excel where data has to be put in form of rows and columns in order to create visualizations, tableau can convert queries directly into visualization hence there is no need to save data in form of rows and columns.