Database Architecture

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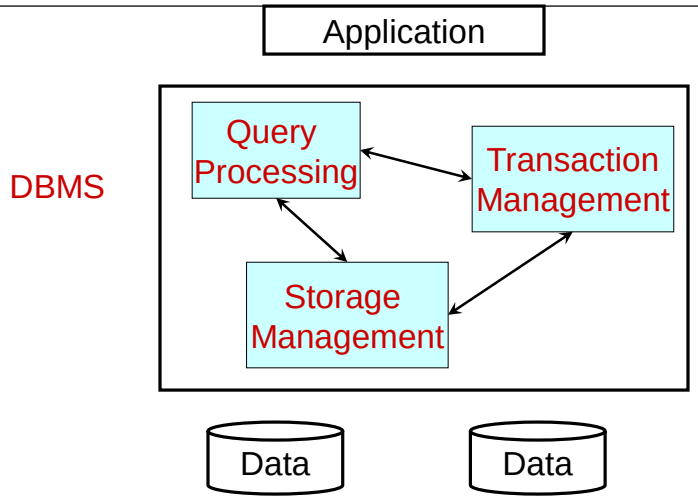
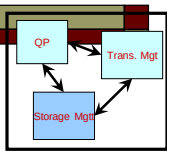
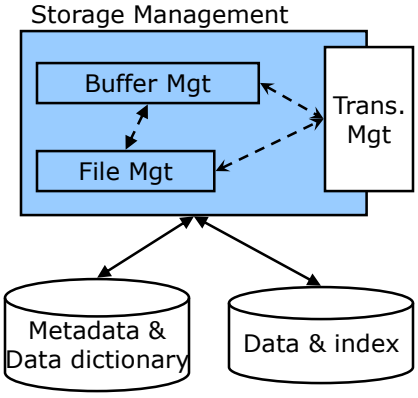
Architecture



Storage Management

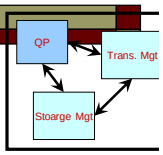


- Responsible for storing and accessing data.
- Buffer manager
  - responsible for partitioning the available main memory into buffers
- File Management
  - responsible for interacting with file system



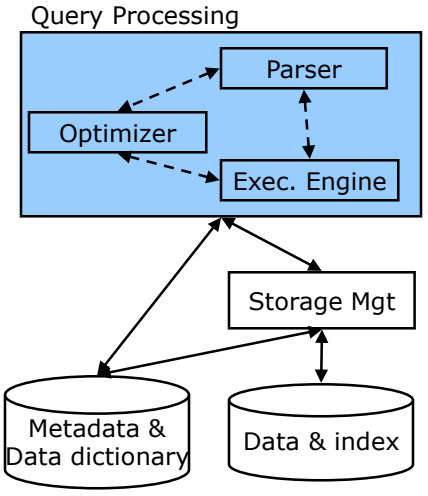
Stored Data

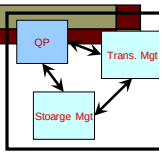
- Data: the contents of database itself
  - Metadata:
    - the database schema that describes the structure of and constraints on the database
  - Statistics
    - information gathered and stored by the DBMS about data properties such as the size of, and values in, various relations or other components of the database
  - Indexes
    - data structures that support efficient access to the data.



Query Processing

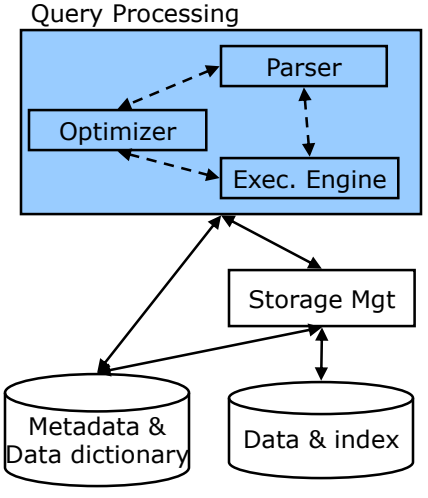
- Composed of
  - Parser
  - Optimizer
  - Execution Engine
- Parser
  - responsible for verifying query syntax and semantic and translating query into query plan
  - Query plan is a sequence of operations implementing relational algebra operation, to be performed on the data.





Query Processing (2)

- Optimizer
  - responsible for performing query plan transformation for the best evaluation
- Execution engine
  - Responsible for executing each of steps in the chosen query plan.
  - interacts with most of the other components of the DBMS



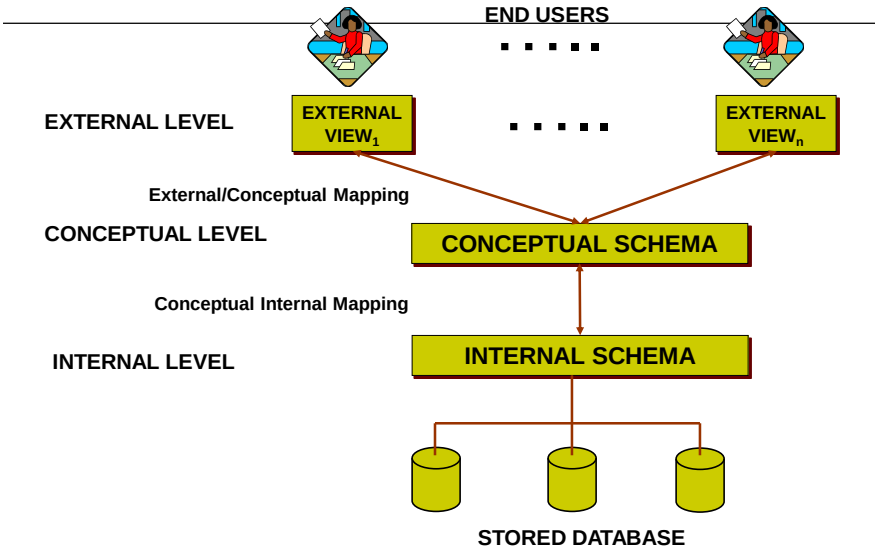
Transaction Management

- Accept transaction commands from an application which tell the transaction manager when transactions begin and end, as well as information about the expectations of the application (some may not wish to require atomicity, for example).
- The transaction processor performs the following tasks:
  - Logging
  - Recovery
  - Concurrency control

Transaction Management

- Logging
  - every change in the database is logged separately on disk.
  - The log manager follows one of several policies designed to assure that no matter when a system failure or crash occurs.
- Recovery manager
  - able to examine the log changes and restore the database to some consistent state.
- Concurency control
  - transactions must appear to execute in isolation.
  - the schedeler (concurrency control manager) must assure that the individual actions of multiple transactions are executed in such an order that the net effect in the same as if the transactions had in fact executed in their entirely, once-at-a-time.
  - A typical scheduler does its work by maintaining locks on certain pieces of the database.

3-tier Schema Model (ANSI-SPARC Architecture)



- Internal schema
  - describes the physical storage structure of the database.
- Conceptual schema
  - describes the structure of the whole database for a community of users.
- External schemas or user views.
  - describes the part of the database that a particular user group is interested in and hides the rest of the database from that user group.

DBMS Utilities

- Loading
  - To load existing data files into the database
- Backup & recovery
  - To create a backup copy of the database
  - To recovery an old state of DB from a backup file
- File reorganization
  - To reorganize a database file in order to improve performance
- Report generation
  - To generate reports based on the information from the database
- Performance monitoring
  - To provide the DBA with statistical data about the DB usage.