Database System Architecture

Overview

- Database Users
- Database Administrator
- Database System Architecture
  - Storage Manager
  - The Query Processor
  - Application Architectures

Database Users

- Users are differentiated by the way they expect to interact with the system
- Application programmers
  - Interact with system through application programs.
  - User interfaces are developed using RAD tools.
  - Should thoroughly understand the logical schema or relavant views
- Sophisticated users / Data Analyst
  - Form requests in a database query language
  - Uses SQL to generate answers for complex queries
- Specialized users
  - Write specialized database applications that do not fit into the traditional data processing framework
  - E.g. CAD system, KB and expert systems, system that stores graphics and audio data, environment-modelling systems.

Database Users

- Naïve users / Data entry operators
  - Invoke one of the application programs that have been written previously.
  - Use the GUI provided by an application program.
  - E.g. people accessing database over the web, bank tellers, clerical staff.
  - No deep (technical) knowledge of the database required.

Database Administrator

Coordinates all the activities of the database system;

the database administrator has a good understanding of the enterprise's information resources and needs.

Database administrator's duties include:

Schema definition

Storage structure and access method definition

Schema and physical organization modification

Granting user authority to access the database

Periodical backup to prevent loss of data

Ensuring enough free disk space is available and upgrading disk space

Monitoring performance and responding to changes in requirements

Database System Architecture

The functional components of a database system is divided into:

- Storage Manager
- The Query Processor

Storage Manager

- Storage Manager
  - A program module that provides the interface between:
    - the lowest level data stored in the database and
    - the application programs and queries submitted to the system
  - Translates the DML statements into low-level file-system commands
- Storage manager components:
  - Authorization and Integrity Manager
    - Tests integrity constraints and checks the authority of users to access data
  - Transaction Manager
    - Ensures that the database remains in a consistent state despite failures
    - Concurrent transaction executions proceed without conflicting

Storage Manager

Storage manager components:

- File Manager
  - Manages the allocation of space on disk storage and the data structures used to represent information stored on disk
- Buffer Manager
  - Responsible for fetching data from disk into main memory, deciding what data to cache in main memory

Storage Manager

Storage manager implements several data structures:

- Data files, which store the database itself
- Data dictionary, which stores meta-data about the structure of the database
- Indices, which can provide fast access to data items

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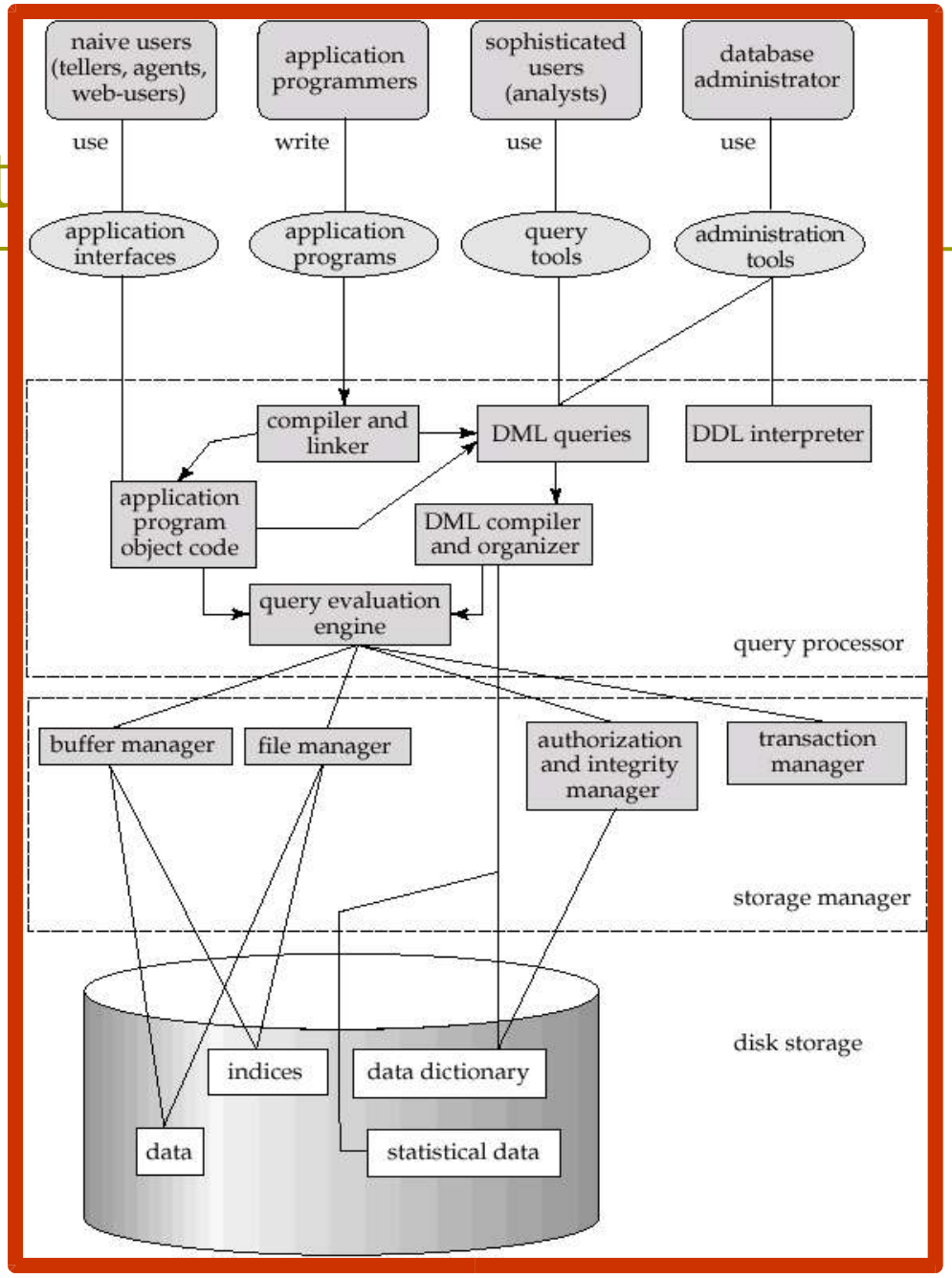

naive users (tellers, agents, web-users)
application programmers
sophisticated users (analysts)
database administrator
use
write
use
use
application interfaces
application programs
query tools
administration tools
compiler and linker
DML queries
DDL interpreter
application program object code
DML compiler and organizer
query evaluation engine
query processor
buffer manager
file manager
authorization and integrity manager
transaction manager
storage manager
disk storage
indices
data dictionary
data
statistical data

The Query Processor

The query processor components include:

DDL interpreter – interprets DDL statements and records the definitions in the data dictionary

DML compiler – translates DML statements into an evaluation plan (low-level instructions) that the query evaluation engine understands

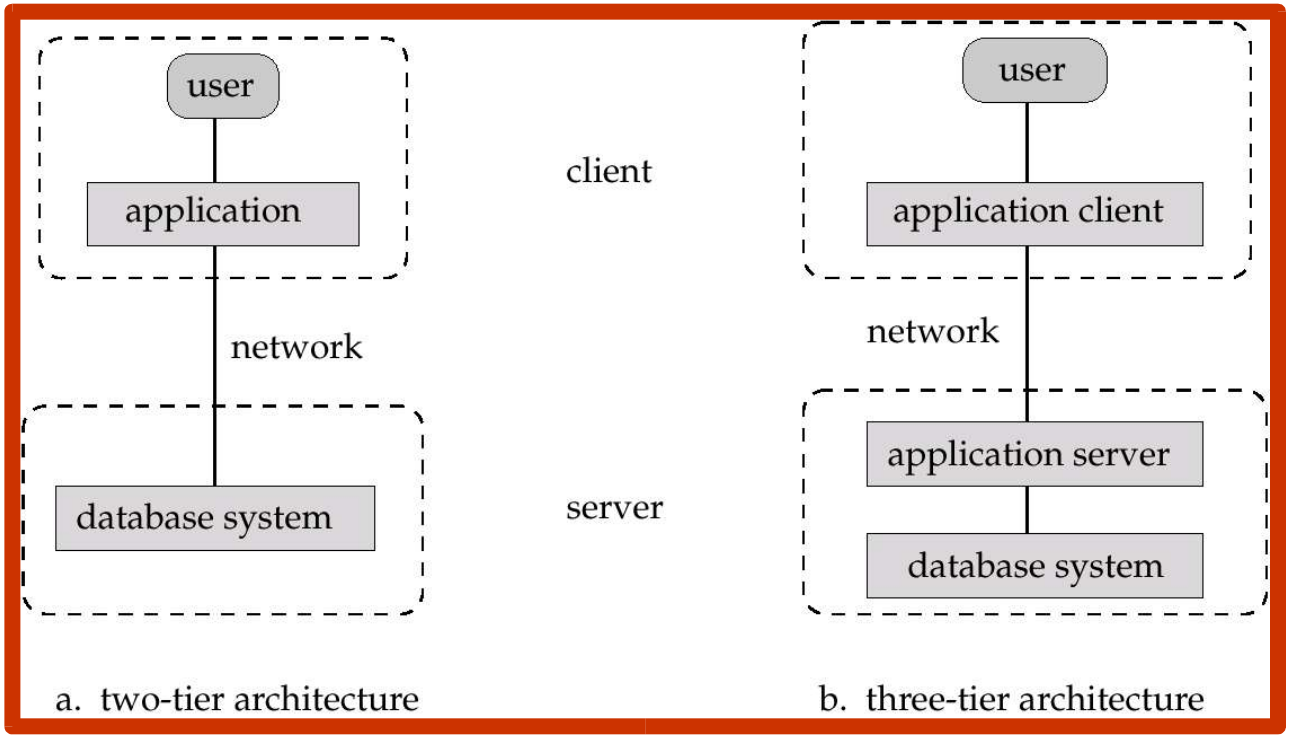
Performs *Query optimization* – picks the lowest cost evaluation plan

Query evaluation engine – executes low-level instructions generated by the DML compiler

Application Architectures

Two-tier architecture: E.g. client programs using ODBC/JDBC to communicate with a database

Three-tier architecture: E.g. web-based applications, and applications built using "middleware"



Reference

Database System Concepts,

Abraham Silberschatz, Korth, Sudarshan 5th Edition, Tata McGraw Hill

Thank You!