

Database System Architecture

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Abstract

Discuss the different architectures of database system and why they are designed in that ways.

Keywords:

- DBMS
- Database system architecture
- Centralized and client-server architecture
- Three-layer database architecture
- Server database system architecture
- Cloud DBMS

Introduction

The appearance of database system makes the usage and management of data easier and powerful.

Nowadays every application that needs to store data using DBMS. We always use database management system in our projects without a well understanding how it works.

That is why we want to dive into the architecture of database system to understand the mechanism.

There are many different types of database system existing. They all have their own characteristics.

Characteristics of Database Approach

Self-describing

Database system not only contains data but also contains the complete definition or description of the database structure and constraints.[1]

Insulation

The structure of data files is stored in the DBMS catalog separately from the access programs.

Support of Multiple Views

Ensure user can only access the data they have the right to view.

Sharing of Data and Multiuser Transaction Processing

The database has to deal with the integration and concurrency issue by using transaction to make sure the multiple users would not cause the database corrupted.

The Three-Schema Architecture

1 Internal level

The physical storage structure of the database.[1]

2 Conceptual level

The structure of the whole database for a community of users.[1]

3 External level

Each external schema 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.[1]

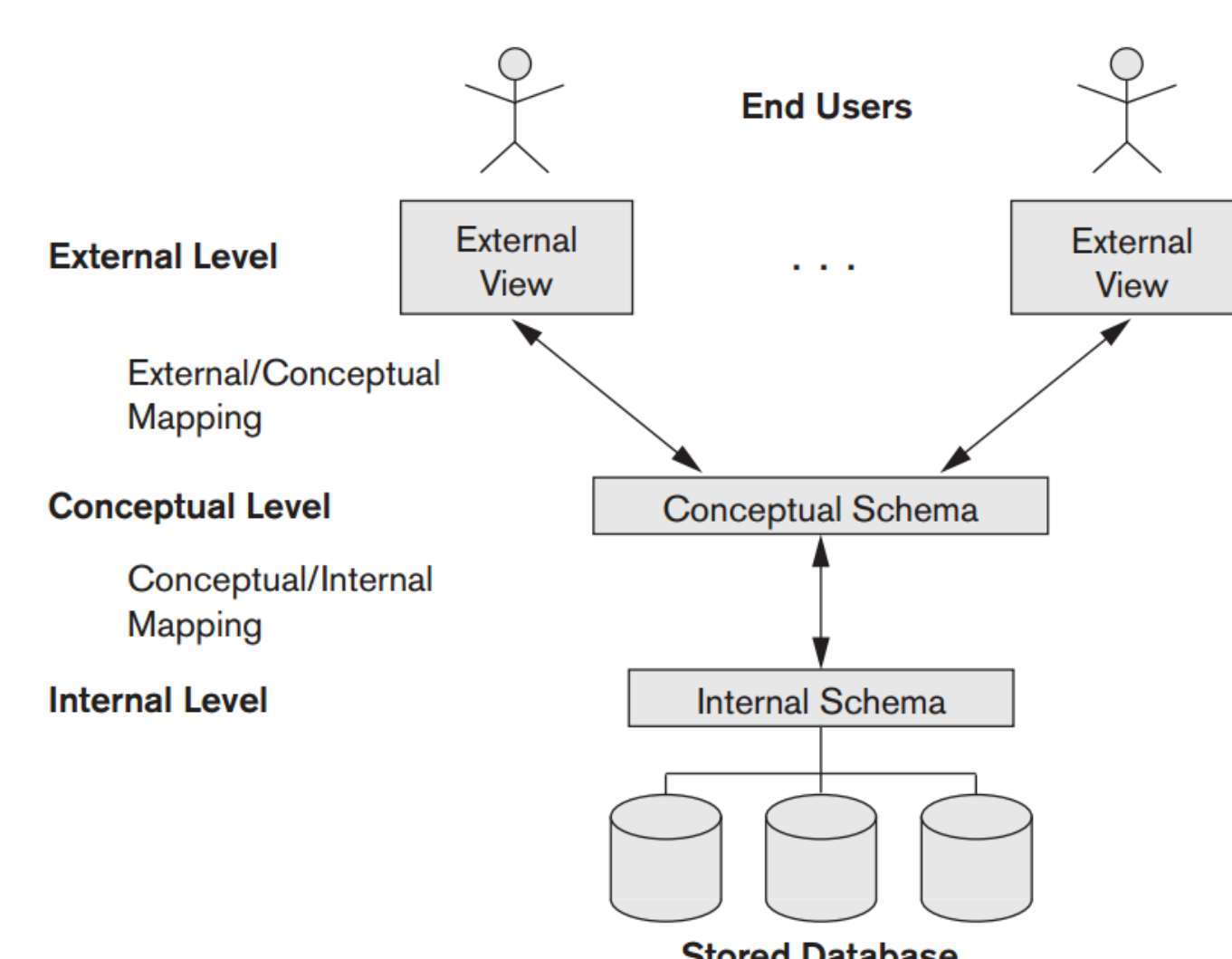


Figure 1. The three-schema architecture[1]

Centralized and Client-Server Architecture

The centralized database system usually runs on a single computer which has several processors and each processor has several cores. They shared system resources.

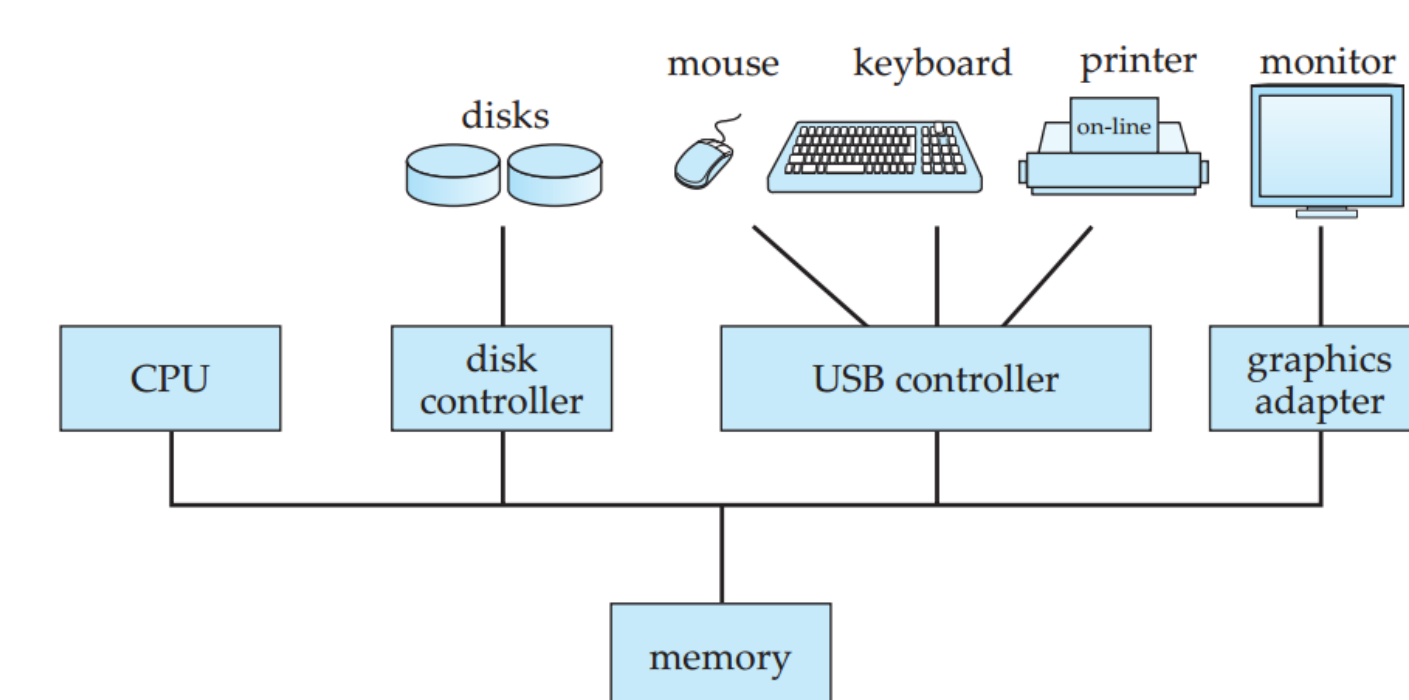


Figure 2. General-purpose computer[2]

The functionality mainly can be divided into two parts: the front end consists of tools such as the SQL user interface, forms interfaces, report generation tools, and the back end manages access structures, query evaluation and optimization, concurrency control, and recovery.

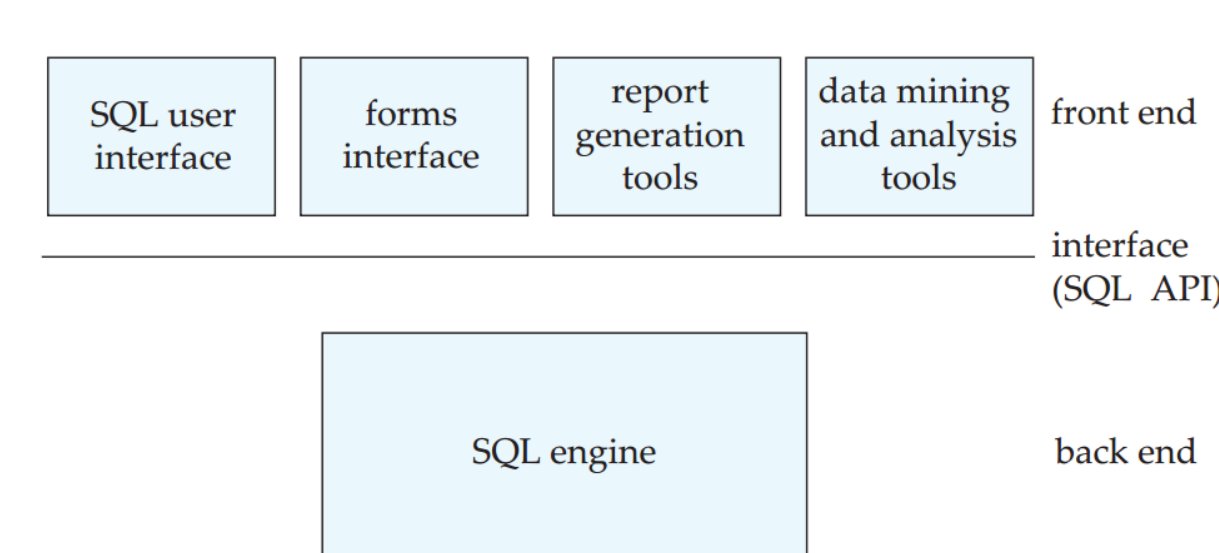


Figure 3. Front-end and back-end functionality[2]

Server System Architectures

Transaction-server systems

Provides an interface to which clients can send requests to perform an action, in response to which they execute the action and send back results to the client.[2]

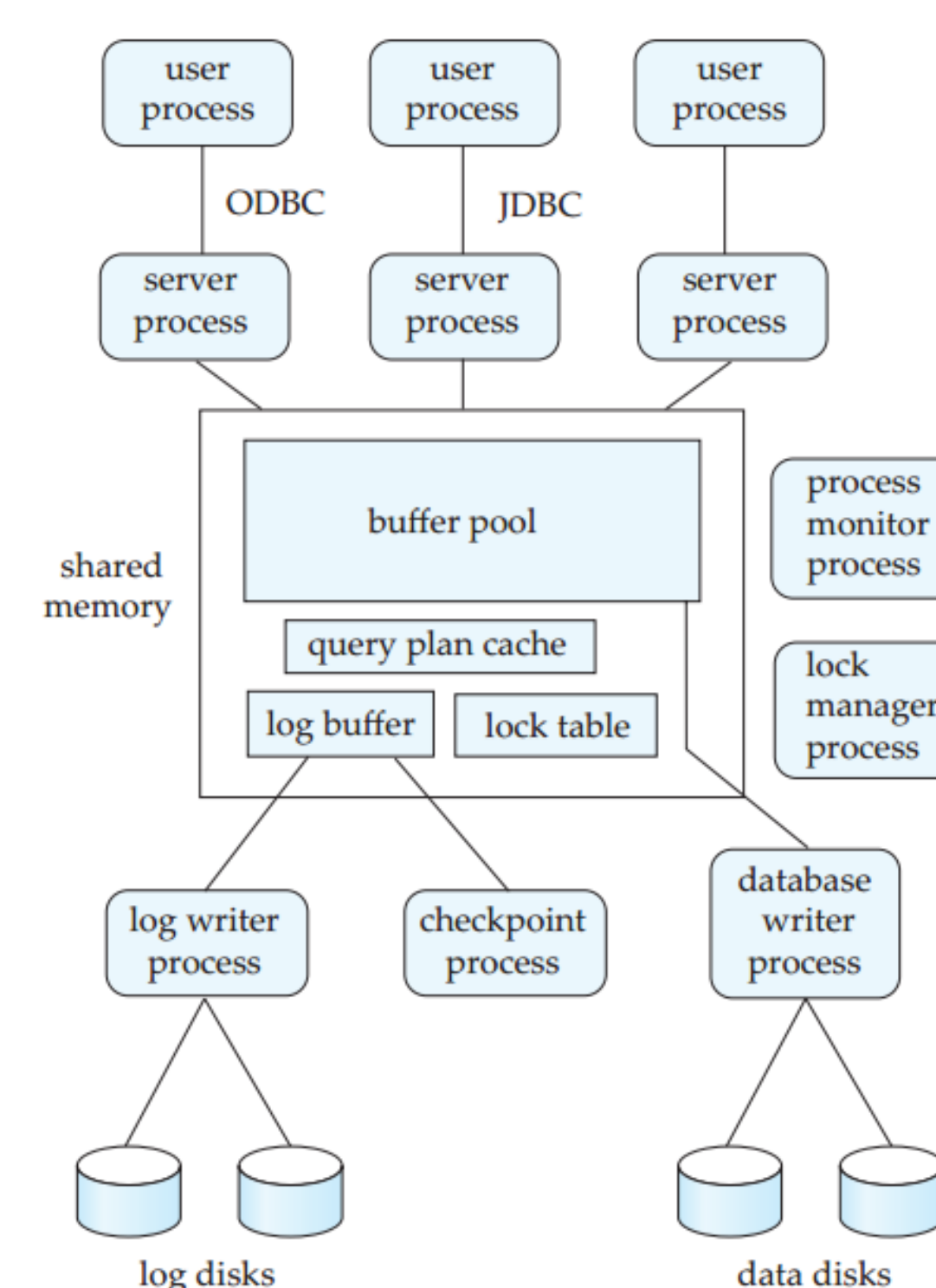


Figure 4. Shared memory and process structure[2]

Data Servers

Data-server systems use high-speed connection between the clients and the server.[2]

Cloud-Based Servers

Servers are usually owned by the enterprise, but there is an increasing trend for service providers to rely at least in part upon servers that are owned by a "third party" that is neither the client nor the service provider:

- One model for using third-party servers is to outsource the entire service to another company that hosts the service on its own computers using its own software.

This allows the service provider to ignore most details of technology and focus on the marketing of the service.[2]

- Another model for using third-party servers is cloud computing, the service provider runs its own software, but runs it on computers provided by another company.

Under this model, the third party does not provide any of the application software; it provides only a collection of machines. These machines are not "real" machines, but rather simulated by software that allows a single real computer to simulate several independent computers. Such simulated machines are called virtual machines. [2]

Cloud DBMS VS Traditional DBMS

1 Economy

Lower cost both on hardware and software. Users can fully focus on the development of the product.

2 Multi-tenancy

The entity owns the entire resources in traditional DBMS, while Daas users use shared disk architecture or shared nothing architecture.

3 Security

External layer

User authentication and authorization.

Conceptual layer

prevents sensitive data being accessed by any unauthorized users

Physical layer

Transforming raw data into an unreadable form using encryption.

4 Manageability

The *external layer* of **Cloud DBMS** keeps status of user payment.[3]

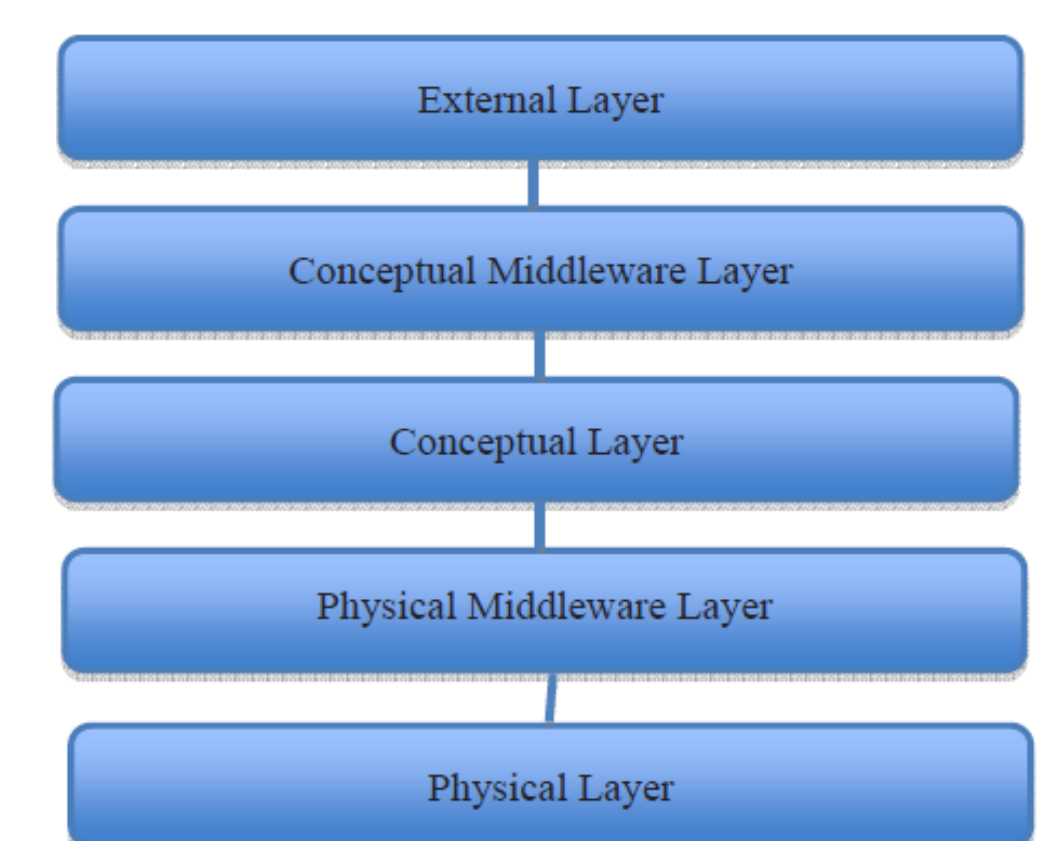


Figure 5. Layered architecture of cloud database management system[3]

References

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- [3] Bashir Alam, MN Doja, Mansaf Alam, and Shweta Mongia. 5-layered architecture of cloud database management system. *AASRI Procedia*, 5:194–199, 2013.