Course:

Database Management Systems

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References

[1] R. Elmasri & S.B. Navathe (2011). Fundamentals of Database Systems, 6th Edition, Addison-Wesley

[2] H. G. Molina, J. D. Ullman, J. Widom, *Database System Implementation*, Prentice-Hall, 2000.

[3] H. G. Molina, J. D. Ullman, J. Widom, *Database Systems: The Complete Book,* Prentice-Hall, 2002

[4] A. Silberschatz, H. F. Korth, S. Sudarshan, *Database System Concepts –3rd Edition*, McGraw-Hill, 1999.

References

[1] R. Elmasri & S.B. Navathe (2011). Fundamentals of Database Systems, 6th Edition, Addison-Wesley

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Course outline

- C0. Overview of a DBMS

- C1. Disk Storage, Basic File Structures, and Hashing

- C2. Indexing Structures for Files

- C3. Algorithms for Query Processing and Optimization

- C4. Introduction to Transaction Processing Concepts and Theory

- C5. Concurrency Control Techniques

- C6. Database Recovery Techniques

Course outline - Timetable

- C0. Overview of a DBMS (**w. 1**)

- C1. Disk Storage, Basic File Structures, and Hashing (**w. 1, 2**)

- C2. Indexing Structures for Files (**w. 3, 4, 5**) – Test 1

- C3. Algorithms for Query Processing and Optimization (**w. 6, 7, 8**) – Test 2

- C4. Introduction to Transaction Processing Concepts and Theory (**w. 9, 10**)

- C5. Concurrency Control Techniques (**w. 11, 12**) – Test 3

- C6. Database Recovery Techniques (**w. 13, 14**)

Three parts

- **Storage management**: how secondary storage is used effectively to hold data and allow it to be accessed quickly

- **Query processing**: how queries expressed in a very high-level language such as SQL can be executed efficiently

- **Transaction management**: how to support transactions.

Assignments

- **File structure**
  - Oracle
  - MS SQL Server
- **Index**
  - Index in Oracle
  - R-Tree/ Hilbert R-Tree
  - Bitmap index
- **Cache**
  - Oracle
  - MySQL
- **Query Processing**
  - Oracle
  - MS SQL Server

- **Transaction**
  - Oracle
  - MS SQL Server
- **Recovery**
  - Oracle
  - MS SQL Server
- **Distributed DBMS**
  - Oracle
- **Object-relational DBMS**
  - PostgreSQL
- **Big Data**
  - MongoDB
  - Hadoop

Assessment

- ## Midterm: 50%
  - Preliminary tests in class: 30%
    - Test 1 (c. 1 + 2; w. 5): 10%
    - Test 2 (c. 3; w. 8): 10%
    - Test 3 (c. 4 + 5; w. 12): 10%
  - Assignment: 20%
    - Deadline for assignment submission: w. 15

- ## Final exam: 50%
  - multi-choice & written.
  - Reviews: c. 0-6

Chapter 0

An Overview of a Database Management System

What is a DBMS?

- The power of database comes from a body of knowledge and technology that has developed over several decades and is embodied in a specialized software called a **database management system**, or DBMS.

- A DBMS is a powerful tool for creating and managing large amount of data efficiently and allowing it to persist over long periods of time safely.

DBMS Capabilities

The capabilities that a DBMS provides the user are:

- **Persistent Storage**. A DBMS supports the storage of very large amounts of data that exists independently of any processes that are using the data.
- **Programming Interface**. A DBMS allows the user to access and modify data through a powerful query language.
- **Transaction management**. A DBMS supports concurrent access to data, i.e., simultaneously access by many distinct processes (called transaction) at once. To avoid some of the undesirable consequences of simultaneous access, the DBMS supports:
    - isolation
    - atomicity
    - resiliency

History of database systems and DBMS

1960s: Flat-File, Hierarchical, Network Databases.

1970s: Relational DBMS – RDBMS)

1980s: Object-Oriented, Distributed DBMS

1990s: Object-relational model) – ORDBMS, OLAP, data mining, data warehouse, multimedia DB

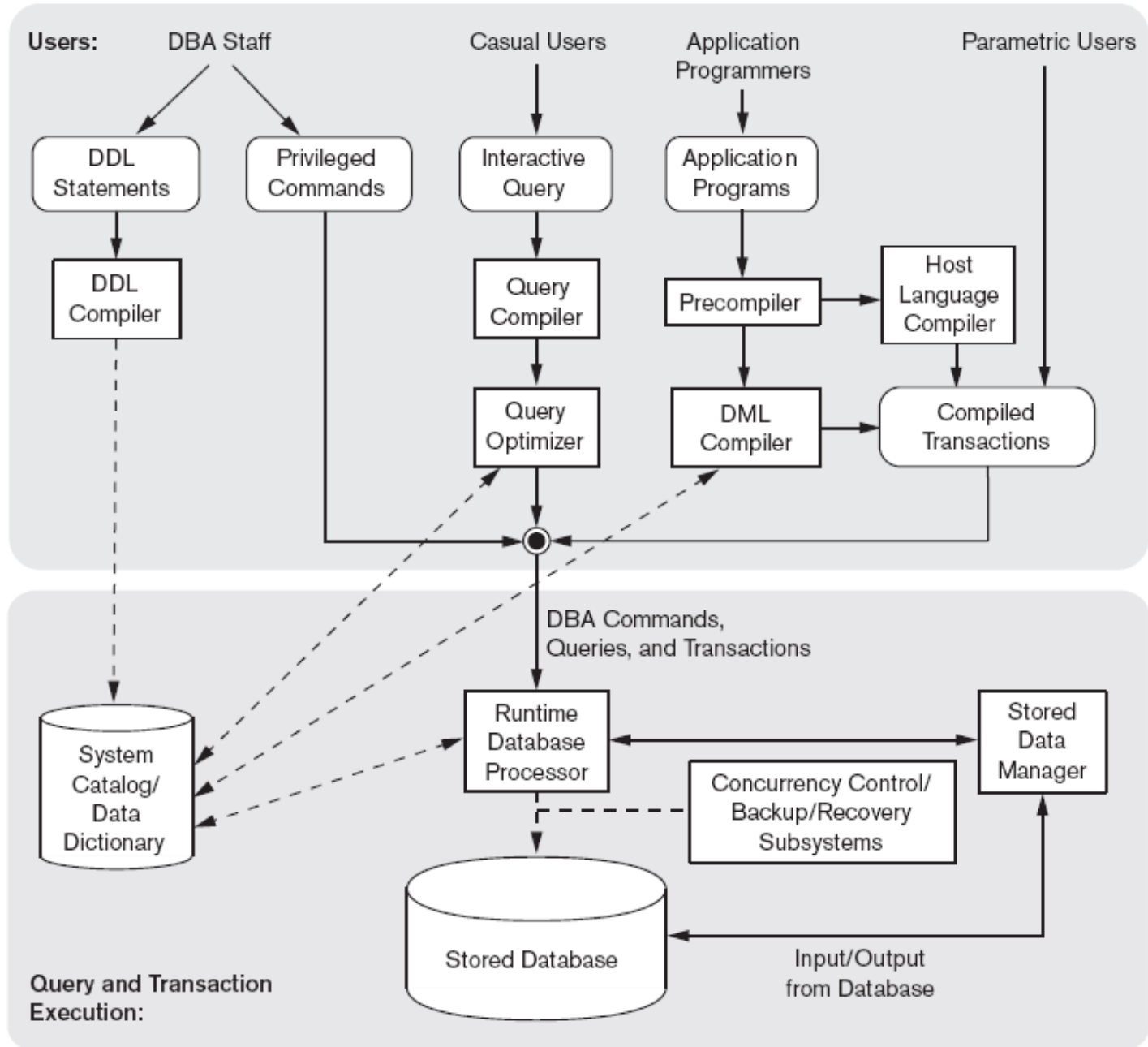2000s: XML DB, bioinformation, data stream, sensor network, NoSQL

Figure 2.3
Component modules of a DBMS and their interactions.

The Database System Environment (1)

- DBMS component modules
  - **Buffer management**
  - **Stored data manager**
  - **DDL compiler**
  - **Interactive query** interface
    - Query compiler
    - Query optimizer
  - **Precompiler**

The Database System Environment (2)

- DBMS component modules
  - **Runtime database processor**
  - **System catalog**
  - **Concurrency control system**
  - **Backup and recovery system**

(Relational) DBMSs in Practice

- MySQL

- Oracle

- MS SQL Server

- IBM DB2

- …