

Module 1

Fundamentals of Database Systems

**Teknik Informatika Fakultas Teknik
Universitas Dr. Soetomo Surabaya**

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Sept '03

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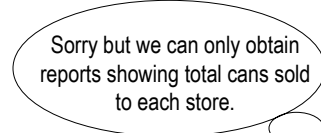
Module 1 - Motivation

Fundamentals of Database Systems

- The design and implementation of the database component is a most significant aspect of Information system development
- Success of the Information system depends on the design of the database !



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Module 1 - Contents

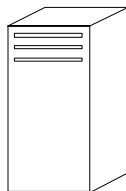
Fundamentals of Database Systems

- Introduces the concept of a database
- Introduces the concept of a database management system
- Describes the functions of a database management system

What is a Database?

A collection of related facts

Filing Cabinet



Hard disk full of data



Diary



Library

What is a DBMS?

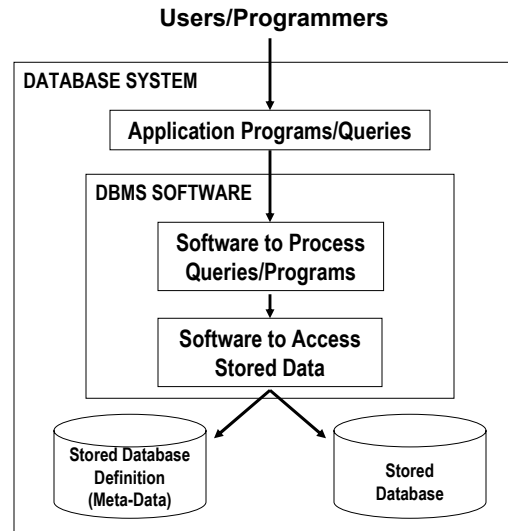
- DBMS - **DataBase Management System**
- Multiple Billion dollar market for DBMS products and services !
- A software system for *defining, constructing* and *manipulating* databases for various applications
- DBMS may be general purpose (business applications) or special purpose (biological databases, geographic information, ...)

The DBMS facilitates ...

- Defining a database
 - Specifying the types, structures, and constraints for the data
- Constructing a database
 - Storing the data on a storage medium
- Manipulating a database
 - Querying and updating the database

What is a Database System?

**DBMS
+
Database
=
Database System**



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Database System Components

- The Stored Database
 - A collection of related facts
- The DBMS
 - The software that defines, constructs and manipulates a database
- The Applications
 - The programs (in specific languages) that manipulate the database
- The Users
 - People who use the database system, through the DBMS interface or through application programs

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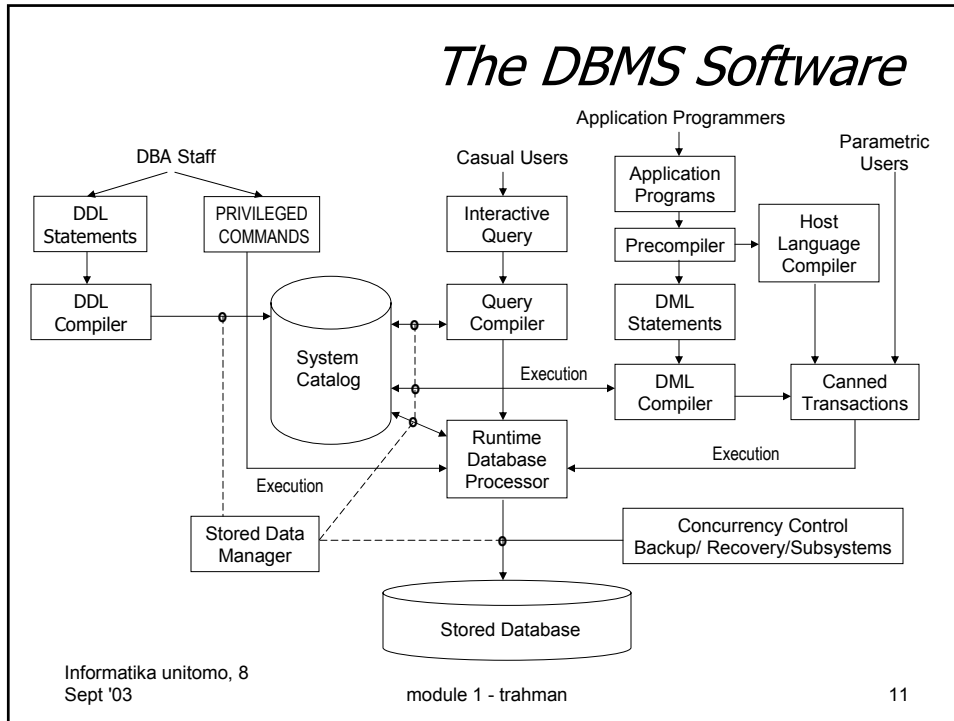
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Users of the Database System

- Database Administrators
- Database Designers and Application Programmers
- End Users
 - Casual End Users
 - Parametric End Users
 - Sophisticated End Users

Why use a Database System?

- The database approach provides a central store of data and meta-data, and thus
 - Is not internal to an application program, as in traditional file processing environments
 - Provides shared access for multiple users
 - Relieves the application programmer from various tedious book keeping tasks
 - Provides the facility to change the data without affecting the applications



- ### *Typical Functions of the DBMS*
- Controlling redundancy
 - Restricting unauthorized access
 - Providing multi-user interfaces
 - Representing complex relationships
 - Enforcing integrity constraints
 - Providing backup and recovery
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Controlling redundancy

- Users of traditional file processing systems, each had a “copy” of relevant data, causing
 - Duplication of effort
 - Wastage of storage space
 - Inconsistent data
- However, redundancy sometimes enhances performance - DBMS provides an environment where redundancy can be *controlled*

Stud-No	Name	Degree	Subject Grade
90	Smith	BA	CS182 7
87	Brown	BA	CS182 7
98	James	BSc	CS181 6
90	Smith	BIT	CS181 6

Stud-No	Name	Degree	Finance-Type
90	Smith	BIT	Self
87	Brown	BA	UQ Scholar
98	Harrison	BSc	Self

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Restricting unauthorized access

Different user groups may have different *access privileges* (Create/Alter, Update, and Retrieve), which are controlled through DBMS security sub-system, through the use of Accounts & Passwords

- Casual users may not have access to confidential data, e.g medical records, salary packages, police reports
- Parametric users may be given update access, but are generally not allowed to change the structure of data
- Database administrators (DBAs) generally have highest privileges, create user accounts and enforce restrictions

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Providing multi-user interfaces

- Query Languages for Casual End Users
- Programming Language Interfaces for Application Programmers
- Forms and Commands for Parametric Users
 - Graphical User Interfaces (GUI)
 - Interface for Web Enabling
 - Natural Language Interfaces

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Complex relationships

DBMS has ability to *represent* complex relationships among the data

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90	Smith	BA	CS182	7
87	Brown	BA	CS182	7
98	James	↔ BSc	CS181	6
90	Smith	BIT	CS181	6

James is doing BSc

CS181 is the code for
Software Engineering

Sub-Code	Title	Credit	Department
CS181	Software Eng	12	CSEE
CS182	Intro to Info Sys	12	CSEE
CO362	Business Info Sys	10	Commerce

CO362 is offered by the
Commerce Department

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Enforcing integrity constraints

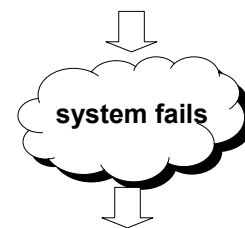
- The DBMS has the capability to define and enforce *integrity constraints* which are restrictions placed on the data, based on the *semantics* or meaning of the data
 - Every Subject must have a unique Code
 - A student cannot have 2 different grades for the same subject
 - A student cannot enroll in more than four 12-credit subjects in a semester
 - Student No must be a 9 digit integer
- DBMS cannot check spelling or typing errors, for example, if 5 was entered as the grade of a student getting 7 - DBMS will not identify the error!

Providing backup and recovery

DBMS provides facility to recover from hardware and software *failures* through its backup and recovery sub-system

- An update program is executing
- Computer System fails in the middle of the update
- DBMS restores the database to a *state* prior to the update and restarts the update program

Deposit \$200 into ATM



Deposit not recorded in
your a/c

Module 1 - Review

Key definitions:

- Database
- DBMS (Many Functions)
- Database System = DBMS + Database

Recommended Readings

Elmasri & Navathe
Chapter 1

Next ...

Module 2

Relational Model

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