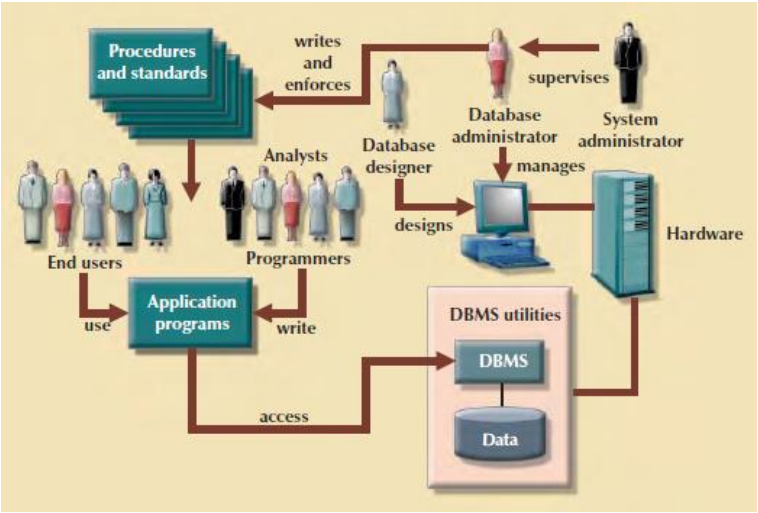
Chapter 2
Database Environment

Objectives

- Database system environment
- Purpose of three-level database architecture.
- ANSI-SPARC Architecture
- Schemas
- Instances

The database system environment



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The database system environment

- Database
  - A shared collection of logically related data, designed to meet information needs of an organisation.
- Database Management System
  - Software that manages and controls access to the database
- Database Application
  - Program that interacts with the database at some point in its execution
- Database System
  - A collection of application programs that interact with the database along with the DBMS and the database itself

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- Purpose of three-level database architecture
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The Three-Level Architecture

- Major aim of database system:
  - To provide users with an abstract view of data
  - To hide certain details of how data is stored and manipulated
- Hence the three levels of abstraction at which data items can be described.
  - External level
  - Conceptual level
  - Internal level

Database Support Roles and Responsibilities

Task	DBA	DA	SA	Management	Operations	Applications	End Users
DBMS budget	X		X	P		X	X
DBMS installation	P		X		X	X	X
DBMS upgrade	P		X	X	X	X	X
Database usage policy	P	X		X			
Capacity planning	X		P	X	X	X	
Data modeling and analysis	X	P					X
Metadata policy	X	P		X			X
Governance and compliance	X	X	X	X			P
Database design	P	X				X	
Database creation	P						
System performance	X		P				
Database performance	P		X			X	
Application performance	X		X			P	
Backup and recovery	P		X		X	X	
Disaster recovery	P		X		X		
Database security	P		X		X		
Stored procedures	X					P	
Triggers	P					X	
User-defined functions	X					P	
Application design	X					P	
Application turnover	X				X	P	X
Application design reviews	X	X	X	X	X	P	X

Note: P stands for primary responsibility

Objectives of Three-Level Architecture

- Purpose of three-level database architecture
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- The objective of the three-level architecture is to separate each user's view of the database from the way the database is physically represented.
- There are several reasons why this separation is desirable:
  - Users should not need to know physical database storage details.
  - Database Administrator (DBA) should be able to change database storage structures without affecting the users' views.

ANSI-SPARC Three-Level Architecture

- Purpose of three-level database architecture
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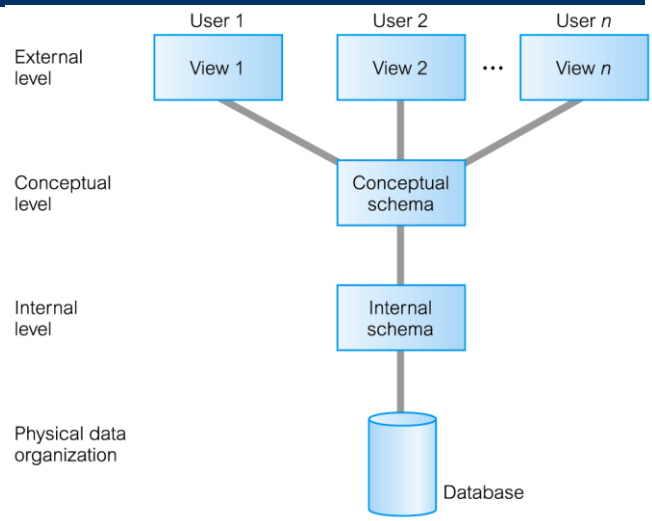

ANSI-SPARC Three-Level Architecture

- Purpose of three-level database architecture
- ANSI-SPARC Architecture
- Schemas
- Instances

- External Level
  - Users' view of the database.
  - Describes that part of database that is relevant to a particular user.
- Conceptual Level
  - Community view of the database.
  - Describes what data is stored in database and relationships among the data.
  - Contains the logical structure of the entire database as seen by DBA.
  - Is the middle level providing the mapping and the desired independence between the external and internal views.

ANSI-SPARC Three-Level Architecture (cont'd)

- Purpose of three-level database architecture
- ANSI-SPARC Architecture
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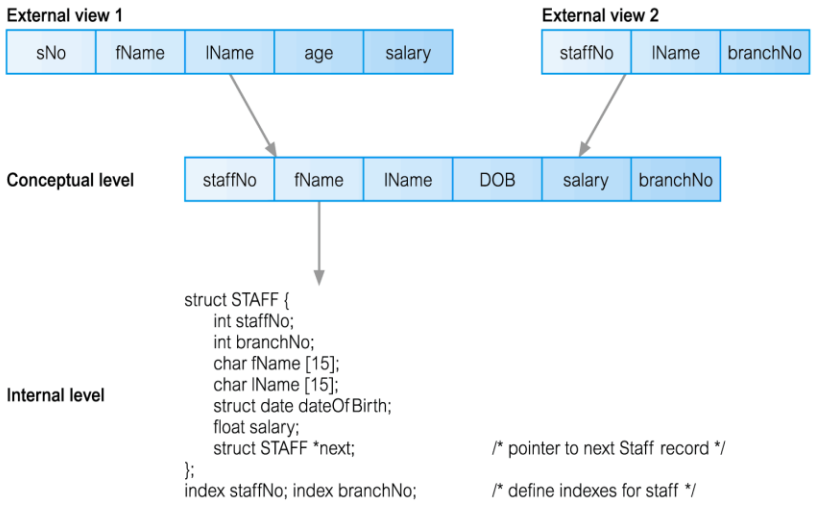
- Internal Level
  - Physical representation of the database on the computer.
  - Describes how the data is stored in the database.
  - The way the DBMS and the OS perceive the data.
  - It covers the data structures and file organizations used to store data on storage devices.

Differences between Three Levels of ANSI-SPARC Architecture



Views

- Base Relation
  - Corresponding to a named relation in conceptual schema, whose tuples are physically stored in database.
- View
  - Dynamic result of one or more relational operations operating on base relations to produce another relation.
  - A virtual relation that does not necessarily exist in the database
  - Contents of a view are defined as a query on one or more base relations

Purpose of Views

- Provides powerful and flexible security mechanism by hiding parts of database from certain users.
- Permits users to access data in a customized way, so that same data can be seen by different users in different ways, at same time.

Schemas

- **Database / Conceptual Schema**
  - Overall description of the database.
  - Specified during the design process.
  - Not expected to change frequently.

Schemas

- In relational model, the **Schema** (or description) of a Relation is denoted by **R(A1, A2, ...An)** where
  - R is the **name of the relation**
  - The **attributes of the relation are A1, A2, ..., An**
- Example:

  Staff (staffNo, sName, position, salary, branchNo)

Instances

- **Instances**
  - Data in the database at any particular point in time is called a database instance.

Staff Branch

staffNo	sName	position	salary	branchNo
SL21	John White	Manager	30000	B005
SG37	Ann Beech	Assistant	12000	B003
SG14	David Ford	Supervisor	18000	B003
SA9	Mary Howe	Assistant	9000	B007
SG5	Susan Brand	Manager	24000	B003
SL41	Julie Lee	Assistant	9000	B005

Summary

We have covered the following:

- Difference of **Database**, **Database Management System**, **Database Application** in a database system environment
- **ANSI-SPARC Architecture**
  - External Level
  - Conceptual Level
  - Internal Level
- **Terms:**
  - **Views, Schemas and Instances**