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Database Environment

Man Geni Addysg Uwch yng Nghymru
Where Higher Education Began in Wales

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- **Review -Tutorial activity**

The DreamHome Case Study

Objectives:

- About a property rental company called DreamHome
- It provides rental services for both owners and clients

The DreamHome Case Study – An Overview

- The first branch office of DreamHome was opened in 1992 in a city called Glasgow in the UK.
- Since then, the Company has grown steadily and now has several offices in most of the main cities of the UK.
- However, the Company is now so large that more and more administrative staff are being employed to cope with the ever-increasing amount of paperwork.
- Furthermore, the communication and sharing of information between offices, even in the same city, is poor.

→ how to handle these problems??

The DreamHome Case Study

- The Director of the Company, Sally feels that too many mistakes are being made and that the success of the Company will be short-lived if she does not do something to remedy the situation.
- She knows that a database could help in part to solve the problem.
- She requests that a database application be developed to support the running of *DreamHome*.
- The Director has provided the following brief description of how *DreamHome* currently operates.

Mission Statement for DreamHome Database System

'The purpose of the *DreamHome* database system is to maintain the data that is used and generated to support the property rentals business for our c ients and property owners and to facil tate the cooperation and sharing of information between branches.'

The DreamHome Case Study

- DreamHome specializes in property management, by taking an intermediate role between owners who wish to rent out their furnished property and clients of *DreamHome* who require to rent furnished property for a fixed period.

- DreamHome currently has about 2000 staff working in 100 branches.
  - When a member of staff joins the Company, the *DreamHome* staff registration form is used.

Example: The staff registration form for Susan Brand is shown next

Staff Registration form

DreamHome
Staff Registration Form

Staff Number SG5

Full Name Susan Brand

Sex F **DOB** 3-Jun-70

Position Manager

Salary 24000

Branch Number B003

Branch Address
163 Main St, Glasgow

Telephone Number(s)
0141-339-2178 / 0141-339-4439

Enter details where applicable

Supervisor Name _____

Manager Start Date 01-Jun-99

Manager Bonus 2350

Branch Office

- Each branch has an appropriate number and type of staff including
  - a Manager,
  - Supervisors,
  - and Assistants.
- The Manager is responsible for the day-to-day running of a branch
- and each Supervisor is responsible for supervising a group of staff called Assistants.

-An example of the first page of a report listing the details of staff working at a branch office in Glasgow is shown next

The first page of a report listing the details of staff working at a DreamHome branch office in Glasgow

DreamHome
Staff Listing

Branch Number B003

Branch Address
163 Main St, Glasgow
G11 9QX

Telephone Number(s)
0141-339-2178 / 0141-339-4439

Staff Number	Name	Position
SG5	Susan Brand	Manager
SG14	David Ford	Supervisor
SG37	Ann Beech	Assistant
SG112	Annet Longhorn	Supervisor
SG126	Chris Lawrence	Assistant
SG132	Sofie Walters	Assistant

Page 1

Branch office responsibilities

- Each branch office offers a range of properties for rent.
- To offer property through *DreamHome*, a property owner normally contacts the *DreamHome* branch office nearest to the property for rent.
- The owner provides the details of the property and agrees an appropriate rent for the property with the branch Manager.
  - Ex: The registration form for a property in Glasgow is shown next

The *DreamHome* property registration

DreamHome
Property Registration Form

Property Number PG16

Type Flat **Rooms** 4

Rent 450

Address
5 Novar Drive,
Glasgow, G12 9AX

Owner Number (If known) C093

Person/Business Name
Tony Shaw

Address 12 Park Pl,
Glasgow G4 0QR

Tel No 0141-225-7025

Enter details where applicable

Type of business

Contact Name

Managed by staff
David Ford

Registered at branch
163 Main St, Glasgow

Renting process

- Once a property is registered, *DreamHome* provides services to ensure that the property is rented out for maximum return for both the property owner and of course, *DreamHome.*
- These services include:
  - interviewing prospective renters (called clients),
  - organizing viewings of the property by clients,
  - advertising the property in the local or national newspapers (when necessary),
  - and negotiating the lease.
- Once rented, *DreamHome* assumes responsibility for the property including the collection of rent.

Renting process

- Members of the public interested in renting out property must first contact their nearest *DreamHome* branch office to register as clients of *DreamHome.*

- However, before registration is accepted, a prospective client is normally interviewed to record personal details and preferences of the client in terms of property requirements.

  - Ex: The registration form for a client called Mike Ritchie is shown next

The *DreamHome* client registration

DreamHome
Client Registration Form

Client Number CR74
(Enter if known)

Full Name
Mike Ritchie

Enter property requirements

Type Flat

Max Rent 750

Branch Number B003

Branch Address
163 Main St, Glasgow

Registered By
Ann Beech

Date Registered 16-Nov-11

Client services

- Once Client (renter) registration is complete, clients are provided with weekly reports that list properties currently available for rent.

- An example of the first page of a report listing the properties available for rent at a branch office in Glasgow is shown next.

DreamHome property for rent report- listing property available for rental

DreamHome
Property Listing for Week beginning 01/06/13

If you are interested in viewing or renting any of the properties in this list, please contact our branch office as soon as possible.

Branch Address
163 Main St, Glasgow
G11 9QX

Telephone Number(s)
0141-339-2178 / 0141-339-4439

Property No	Address	Type	Rooms	Rent
PG4	6 Lawrence St, Glasgow	Flat	3	350
PG36	2 Manor Rd, Glasgow	Flat	3	375
PG21	18 Dale Road, Glasgow	House	5	600
PG16	5 Novar Drive, Glasgow	Flat	4	450
PG77	100A Apple Lane, Glasgow	House	6	560
PG81	781 Greentree Dr, Glasgow	Flat	4	440

Page 1

Client services

- Clients may request to view one or more properties from the list
- and after viewing will normally provide a comment on the suitability of the property.
- The first page of a report describing the comments made by clients on a property in Glasgow is shown next.
- Properties that prove difficult to rent out are normally advertised in local and national newspapers.

The *DreamHome* property viewing report for a property in Glasgow

DreamHome
Property Viewing Report

Property Numner PG4

Type Flat

Rent 350

Property Address
6 Lawrence St, Glasgow

Client No	Name	Date	Comments
CR76	John Kay	20/04/13	Too remote.
CR56	Aline Stewart	26/05/13	
CR74	Mike Ritchie	11/11/13	
CR62	Mary Tregear	11/11/13	OK, but needs redecoration throughout.

Page 1

The Lease document

- Once a client has identified a suitable property, a member of staff draws up a lease.
- The lease between a client called Mike Ritchie and a property in Glasgow is shown next.
- At the end of a rental period a client may request that the rental be continued.
  - however this requires that a new lease be drawn up.
  - Alternatively, a client may request to view alternative properties for the purposes of renting (a new cycle).

The DreamHome lease form

***DreamHome* Lease**
Number 00345810

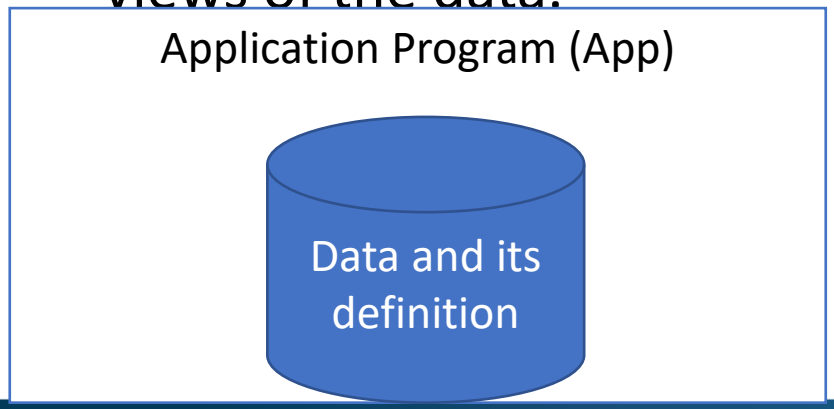
Client Number (Enter if known) CR74	Property Number PG16
Full Name (Please print) Mike Ritchie	Property Address 5 Novar Dr. Glasgow
Client Signature	
Enter payment details	Rent Start 01/06/12
Monthly Rent 450	Rent Finish 31/05/13
Payment Method Cheque	Duration 1 year
Deposit Paid (Y or N) Yes	

Objectives

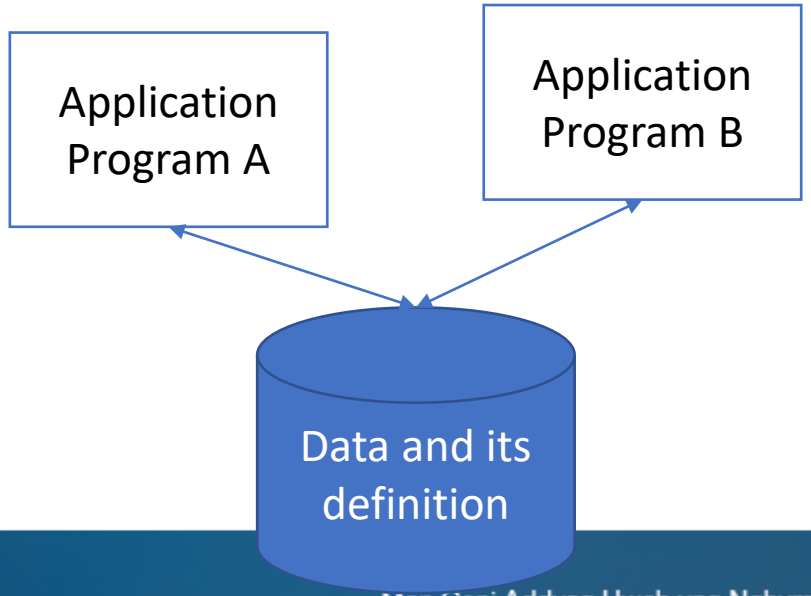
- **The purpose and origin of the three-level database architecture.**
- **The contents of the external, conceptual and internal levels.**
- **The purpose of the external/conceptual and the conceptual/internal mappings.**
- **The components of a DBMS.**

File-Based vs. Database

- **Data-dependence**: data is managed by storing it in separate files.
- definition of data is embedded in apps.
- Access is limited to what app provides.
- Does not allow different views of the data.



- **Data-independence**: Definition of data is separate from applications (apps).
- Allows each app to present different views of the same data.



Database: Step 1

The starting point of any database is to:

Define the ***abstract and general description*** of:

- **Information gathering:**

  - getting specific details

  - Eg: library database(title, author, publication date of books,names of borrowers, and so on.

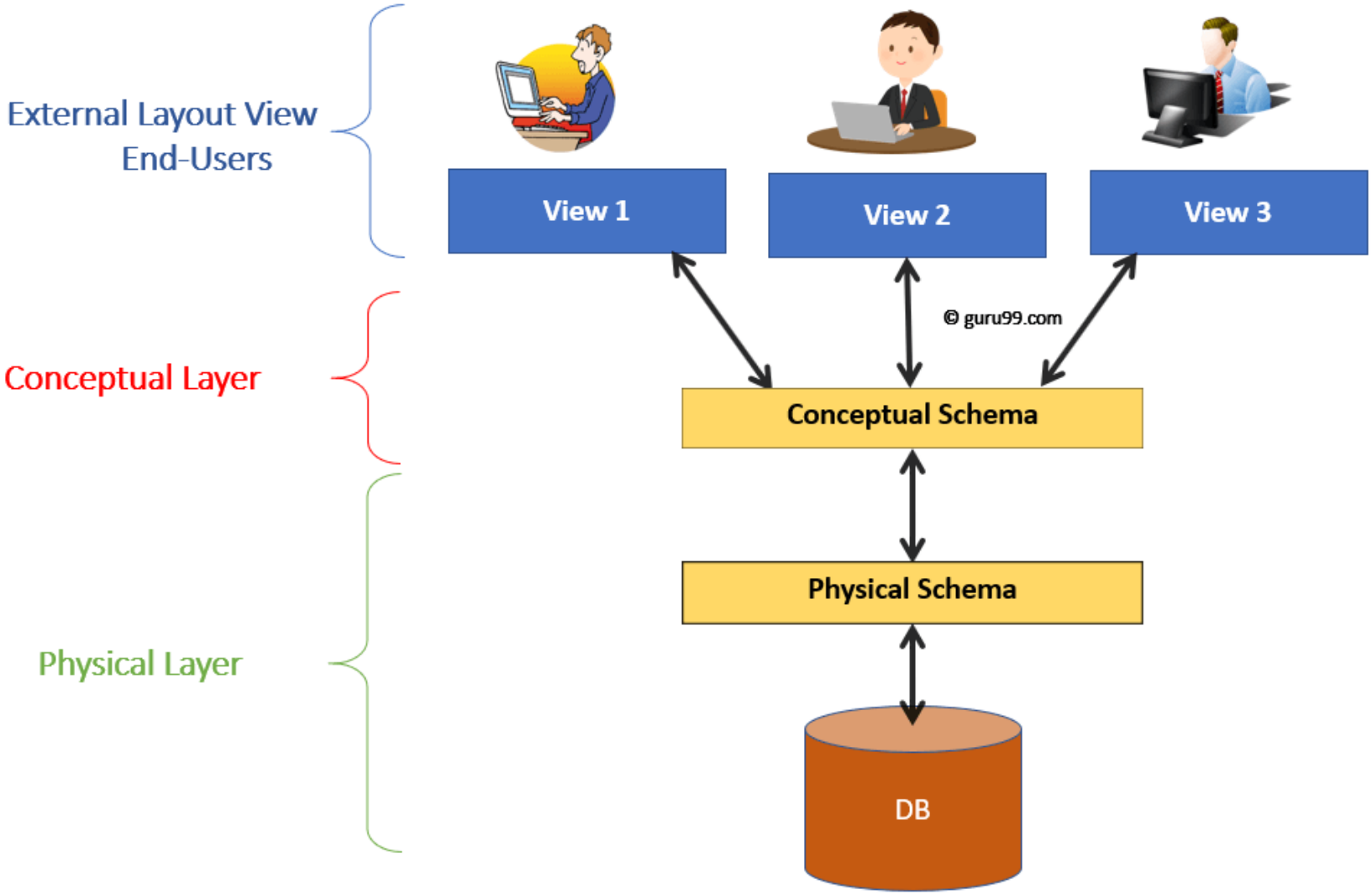
- **Representation in the Database:**

  - plan how to organize it in your database (deciding tables)

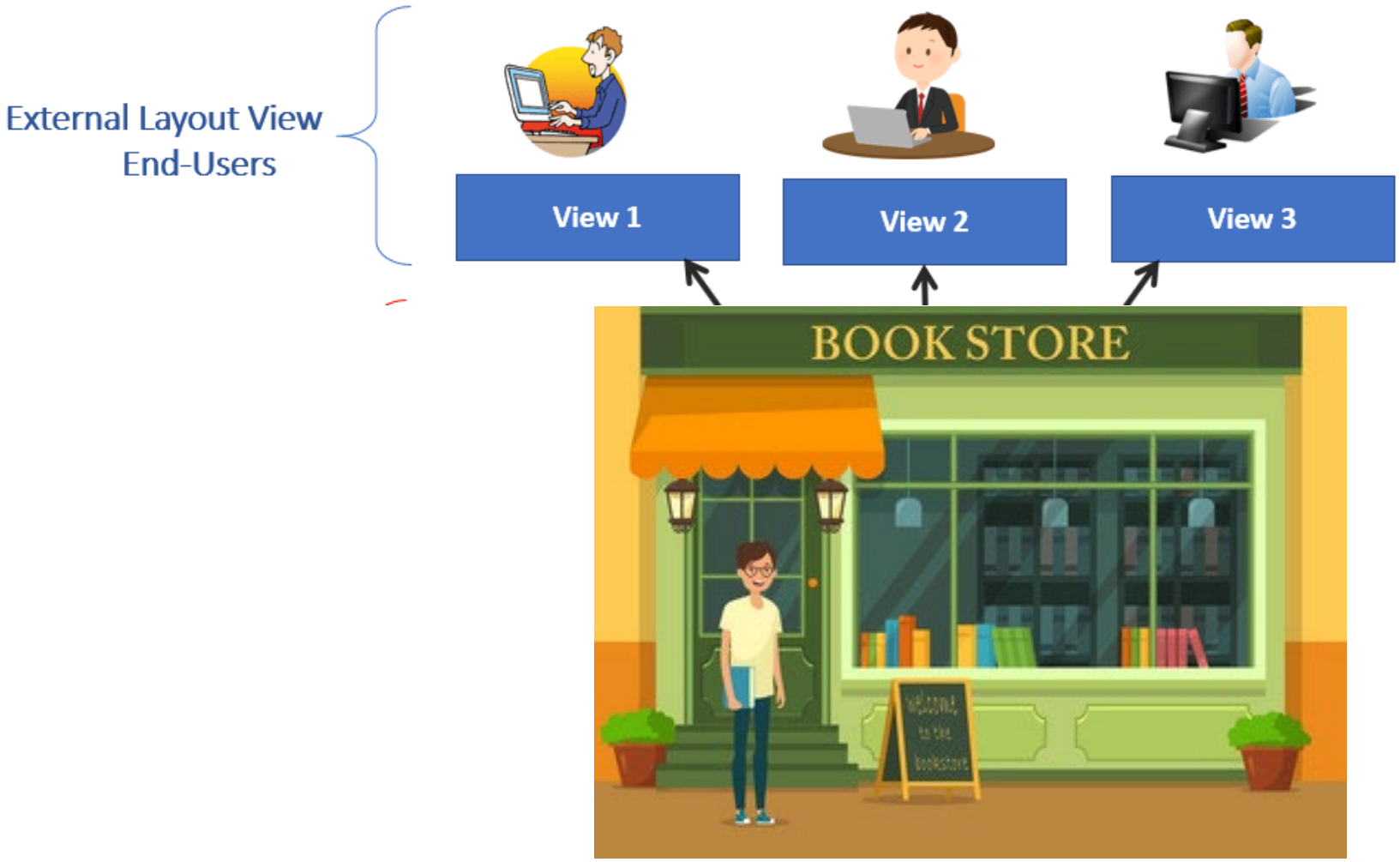
DBMS Architecture

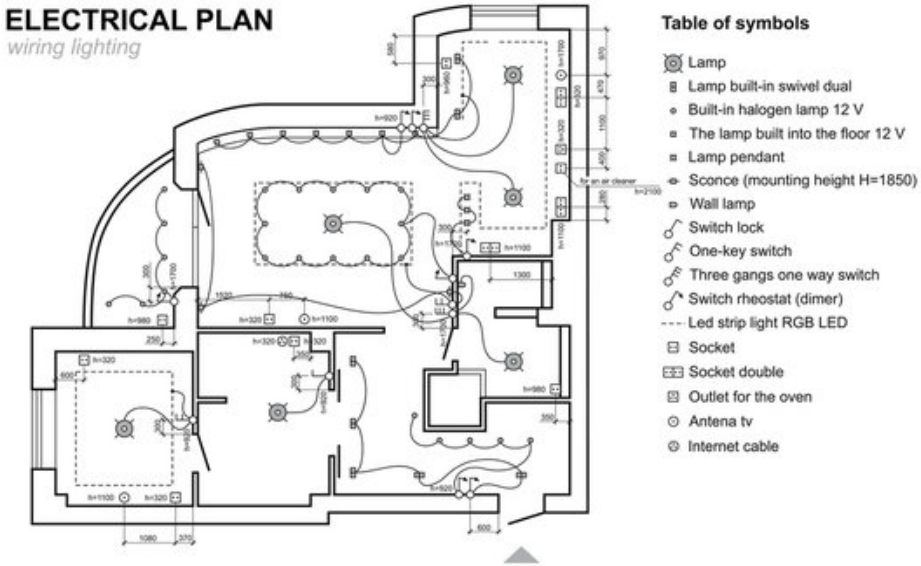
- The description of the structure of the database ***must satisfy different user needs***.
- It is also desirable to have ***distinct levels at which data items can be described***.
- A **DBMS architecture** is needed.
- Most commercial system DBMSs are based on **the ANSI-SPARC architecture**.

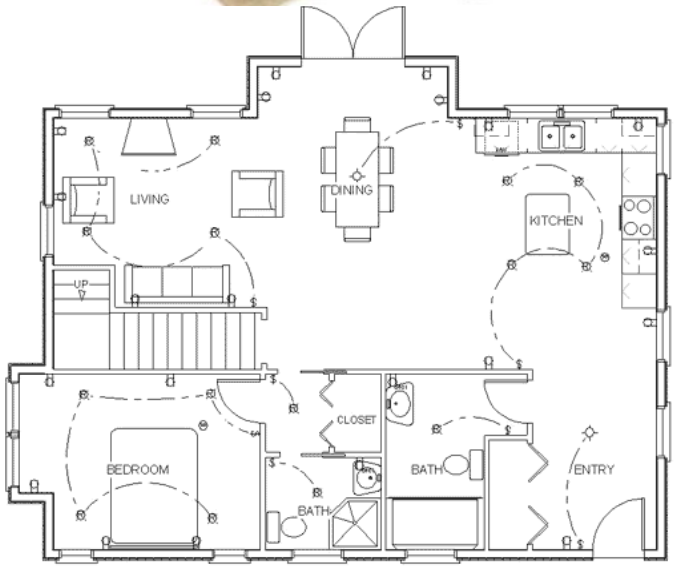
DBMS-Three Level ANSI-SPARC Architecture



DBMS-Three Level Architecture

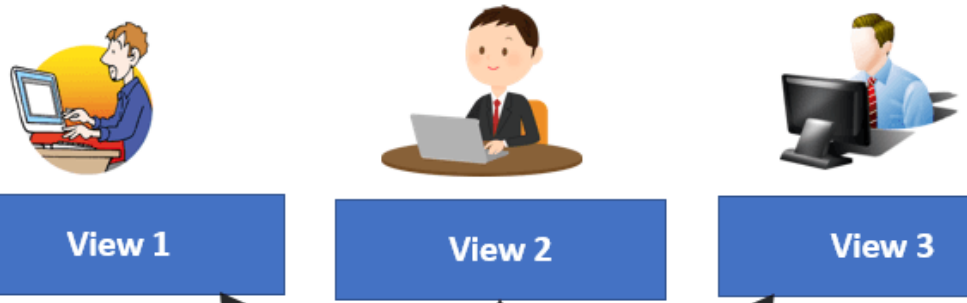



ELECTRICAL PLAN
wiring lighting
Table of symbols
Lamp
Lamp built-in swivel dual
Built-in halogen lamp 12 V
The lamp built into the floor 12 V
Lamp pendant
Sconce (mounting height H=1850)
Wall lamp
Switch lock
One-key switch
Three gangs one way switch
Switch rheostat (dimer)
Led strip light RGB LED
Socket
Socket double
Outlet for the oven
Antena tv
Internet cable


LIVING
DINING
KITCHEN
UP
CLOSET
BEDROOM
BATH
BATH
ENTRY

DBMS-Three Level Architecture

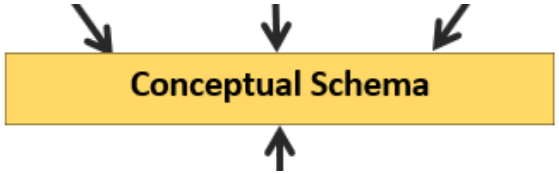
External Layout View
End-Users



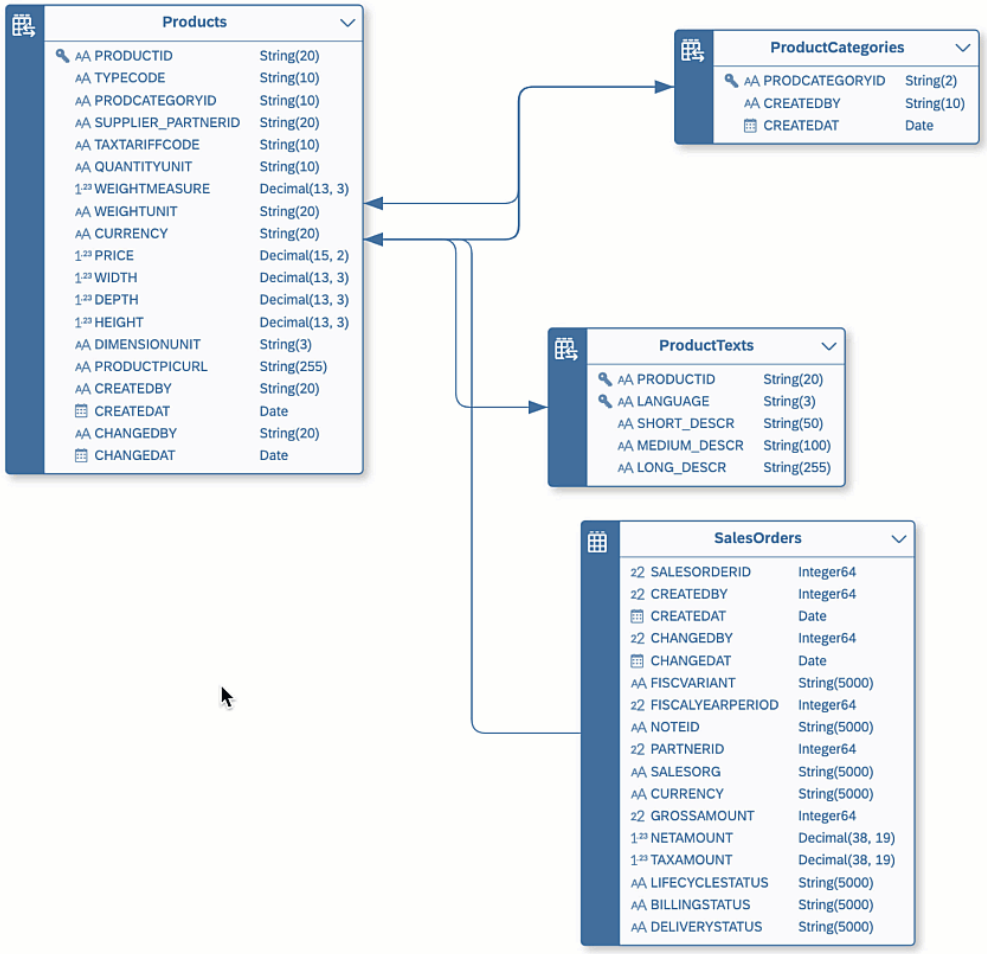
View 1 | View 2 | View 3

DBMS-Three Level Architecture

Conceptual Layer

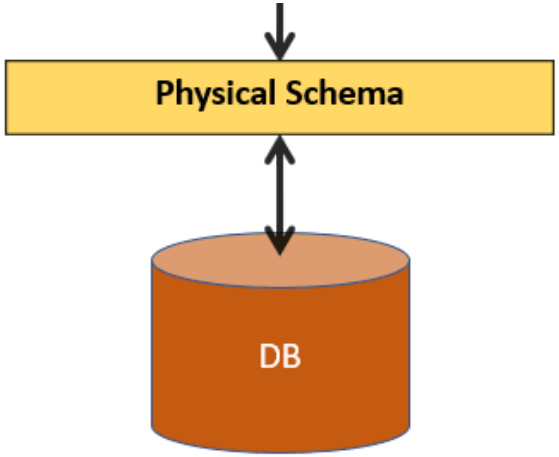


ANSI-SPARC Level 2: Conceptual Level



DBMS-Three Level Architecture

Physical Layer



ANSI-SPARC Level 3: Internal Level

Three Level ANSI-SPARC Architecture

Database schema (staff details)

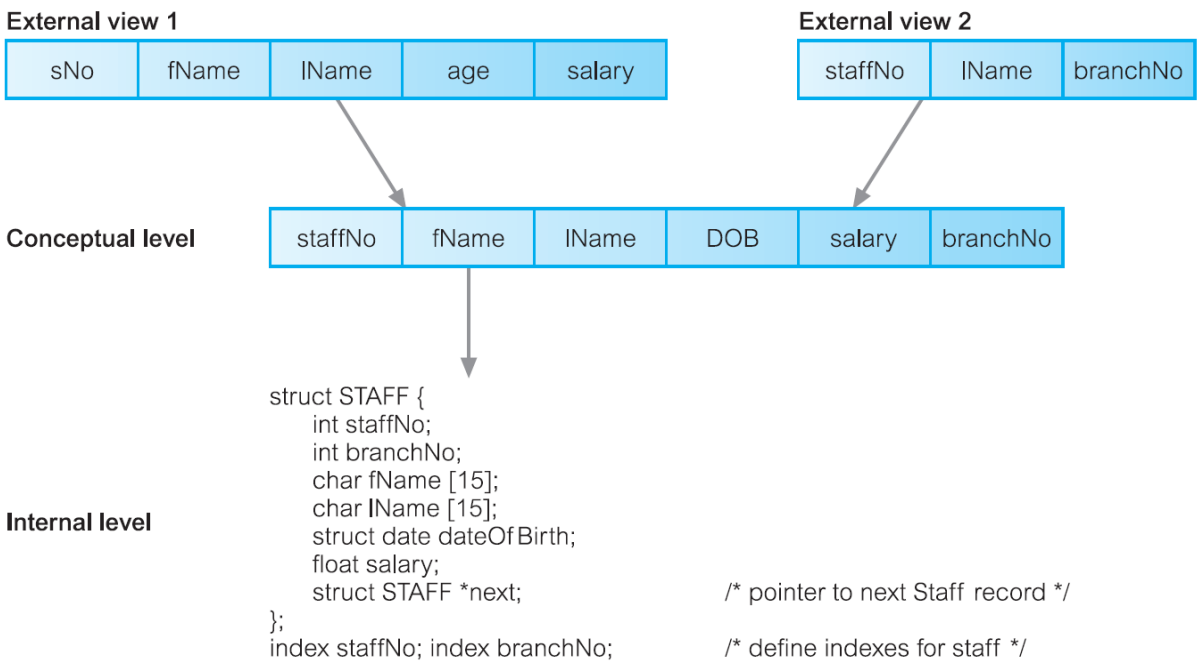


Figure 2.2 Differences between the three levels.

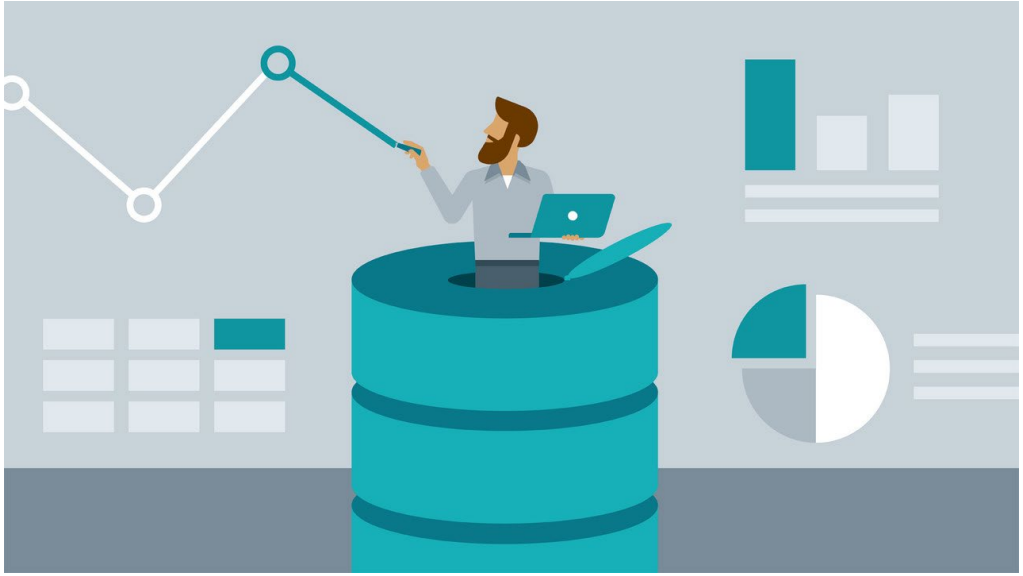
Database Architecture is needed. Why?

DATA
ORGANIZATION

Database Architecture is needed. Why?

Fast and Accurate Retrieval

Database Architecture is needed. Why?



Data Integrity and Consistency

Database Architecture is needed. Why?

Data Security and Access Control

Database Architecture is needed. Why?

"If you don't reveal some insights soon, I'm going to be forced to slice, dice, and drill!"

Scalability and Flexibility

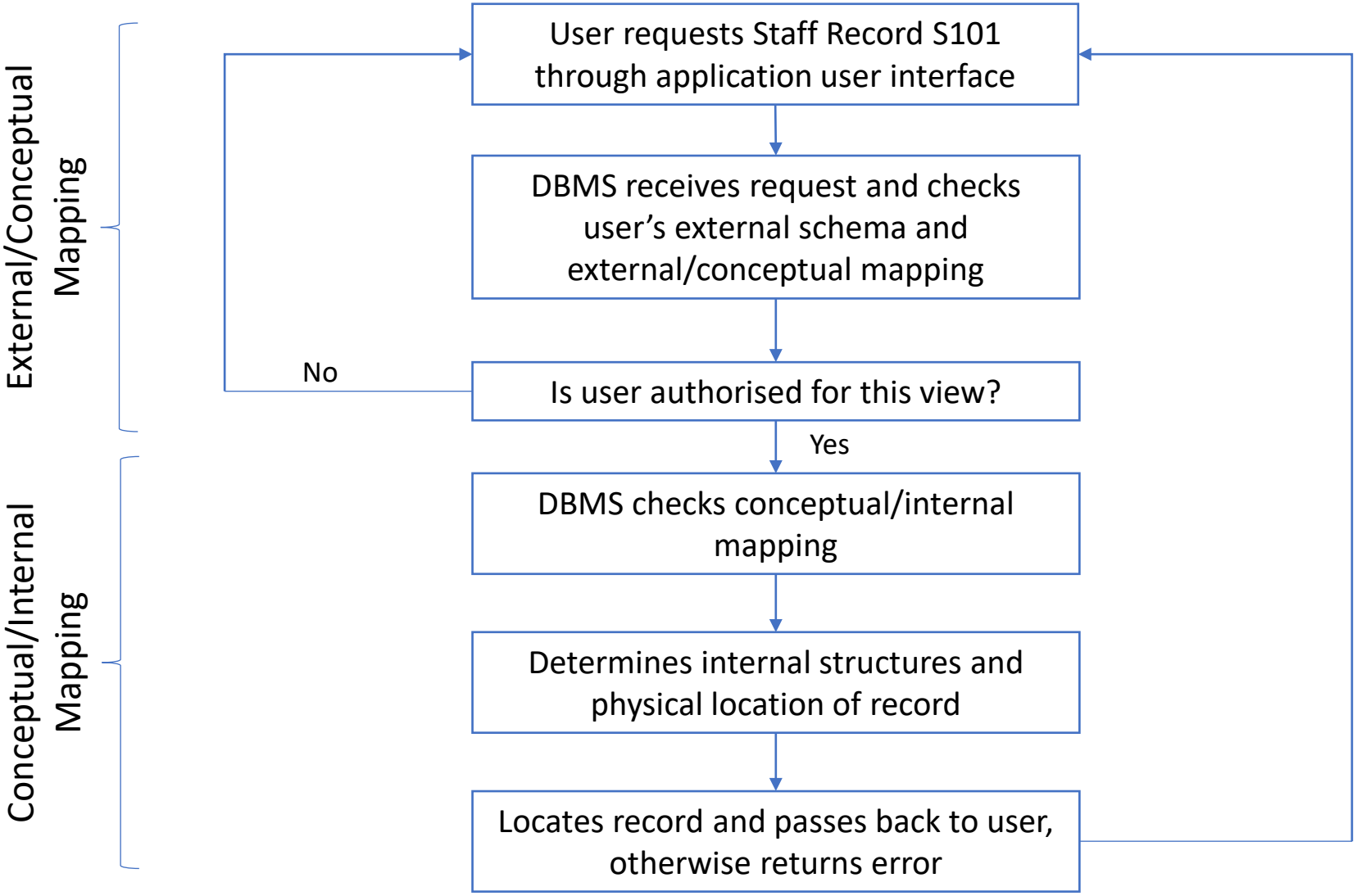
Database Architecture is needed. Why?

Reduced Redundancy and Duplication

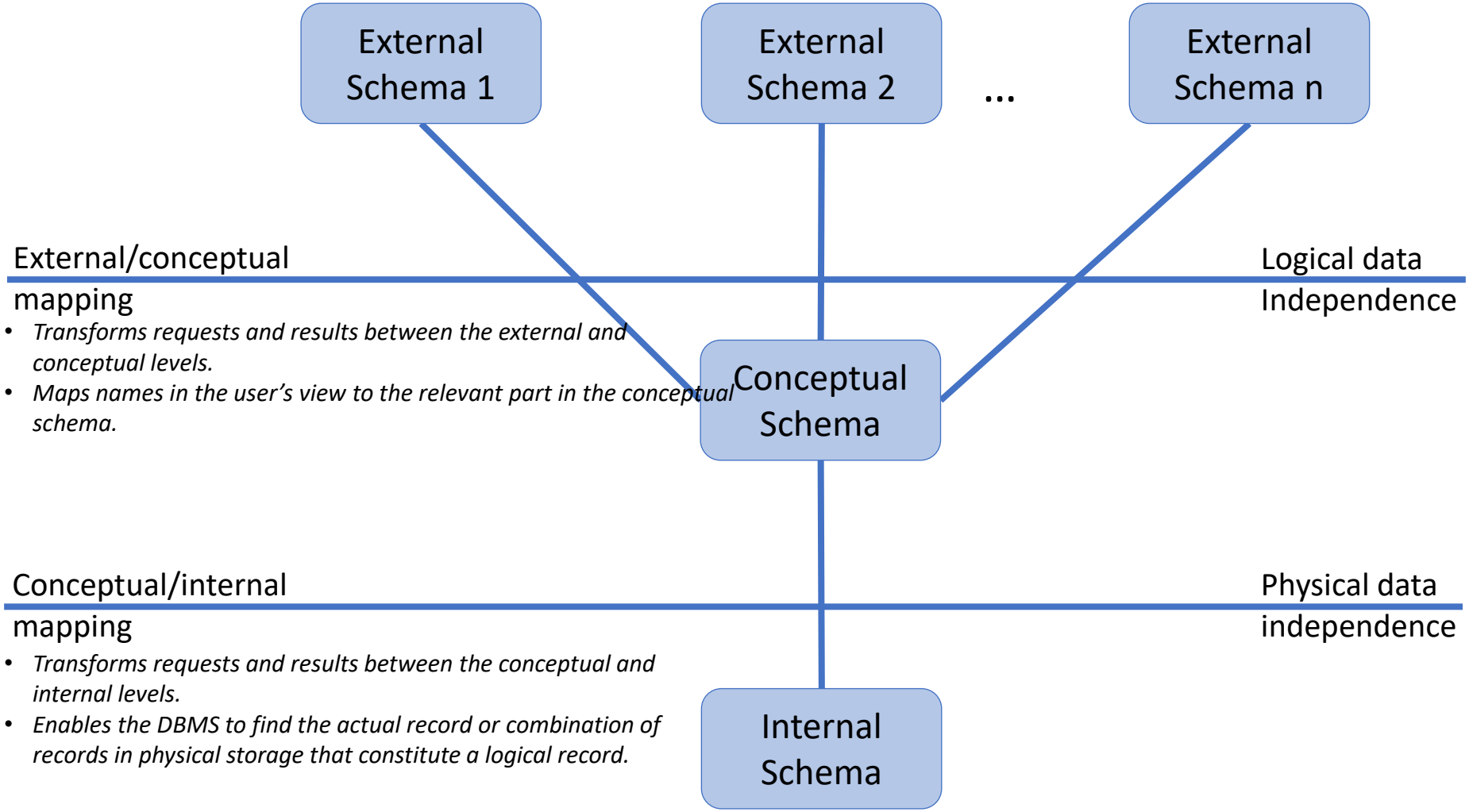
Database Architecture is needed. Why?

Disaster Recovery and Backup

DBMS Mapping Between the Schemas (A simplified view)



Data Independence and the ANSI-SPARC Three-Level Architecture



External/conceptual mapping

- *Transforms requests and results between the external and conceptual levels.*
- *Maps names in the user's view to the relevant part in the conceptual schema.*

Conceptual/internal mapping

- *Transforms requests and results between the conceptual and internal levels.*
- *Enables the DBMS to find the actual record or combination of records in physical storage that constitute a logical record.*

Further Reading

- Part 1 Chapter 2 in

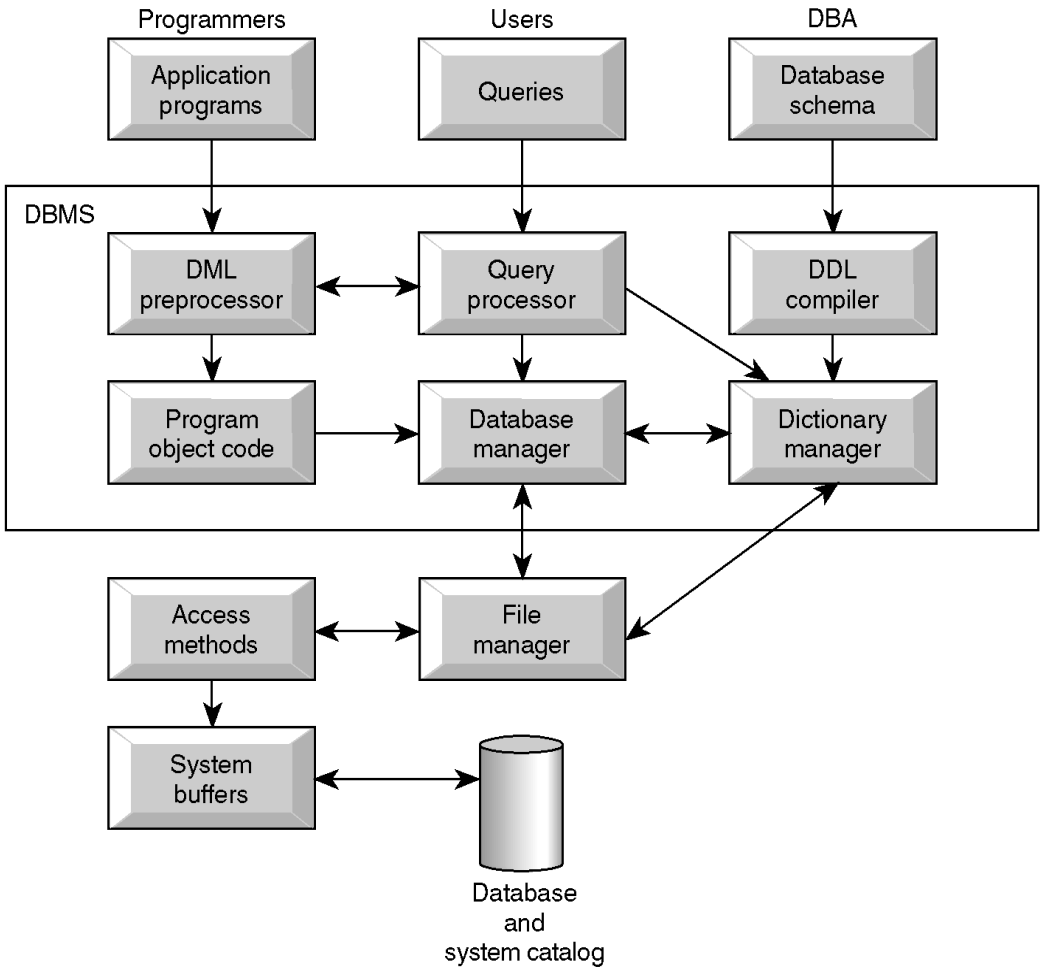
Connolly, T., Begg, C., 2015, Database Systems: A Practical Approach to Design, Implementation and Management, 6th Edition, Addison Wesley

Activity - Database Schema Design

- Choose a real-life example of database
- design a database schema for the scenario, (identifying tables, columns, and relationships)
- Give justification of your choice

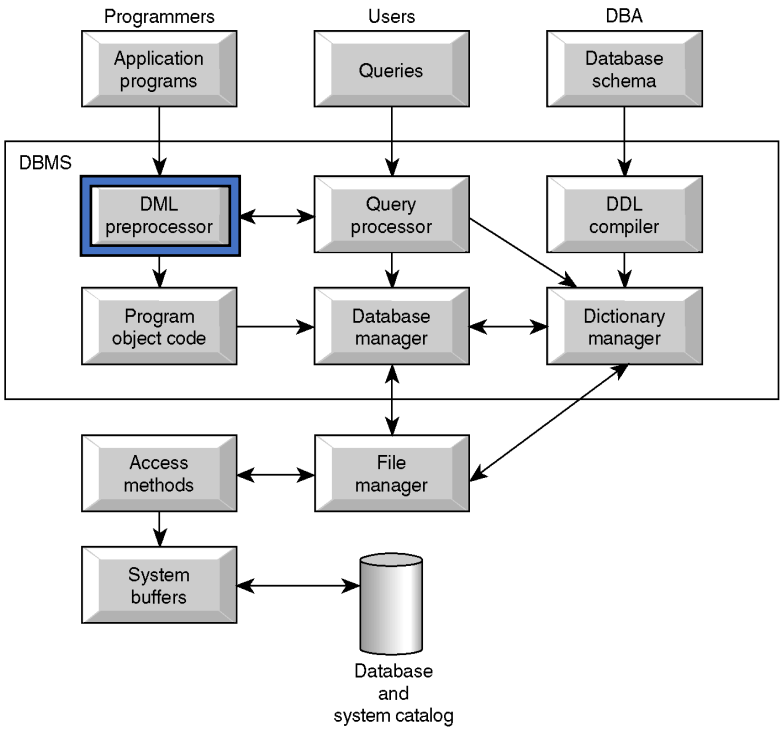
Activity

- Describe the functionalities of the database components



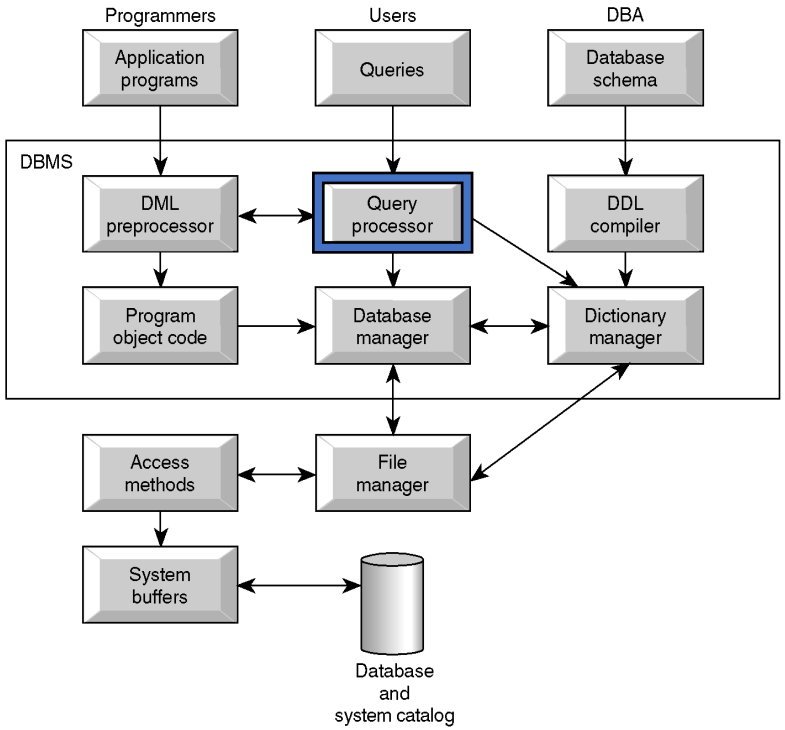
DML Pre-processor

- **Syntax Verification**
- **Semantic Checking**
- **Query Optimization**
- **Access Path Selection**
- **Transaction Handling**
- **Security Verification**
- **Error Handling**
- **Data Integrity Enforcement**



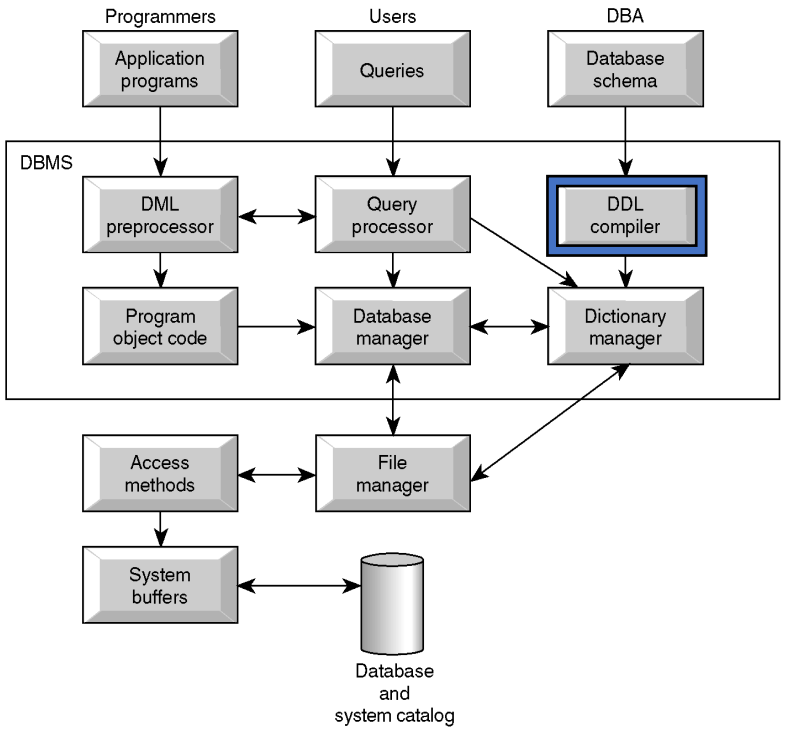
Query processor

- **Parsing and Lexical Analysis**
- **Semantic Analysis**
- **Query Optimization**
- **Logical Plan Generation**
- **Physical Plan Generation**
- **Execution Plan Execution**
- **Result Formation and Presentation**



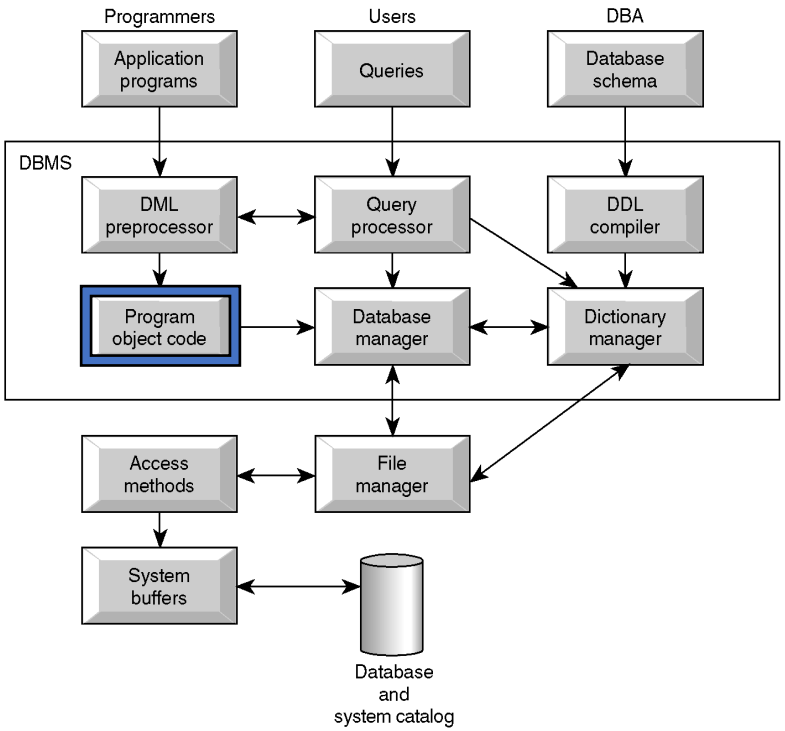
DDL Compiler

- **Syntax and Semantic Analysis**
- **Schema Validation**
- **Query Optimization**
- **Transaction Handling**
- **Metadata Update**
- **Error Handling**
- **Execution of DDL Statements**



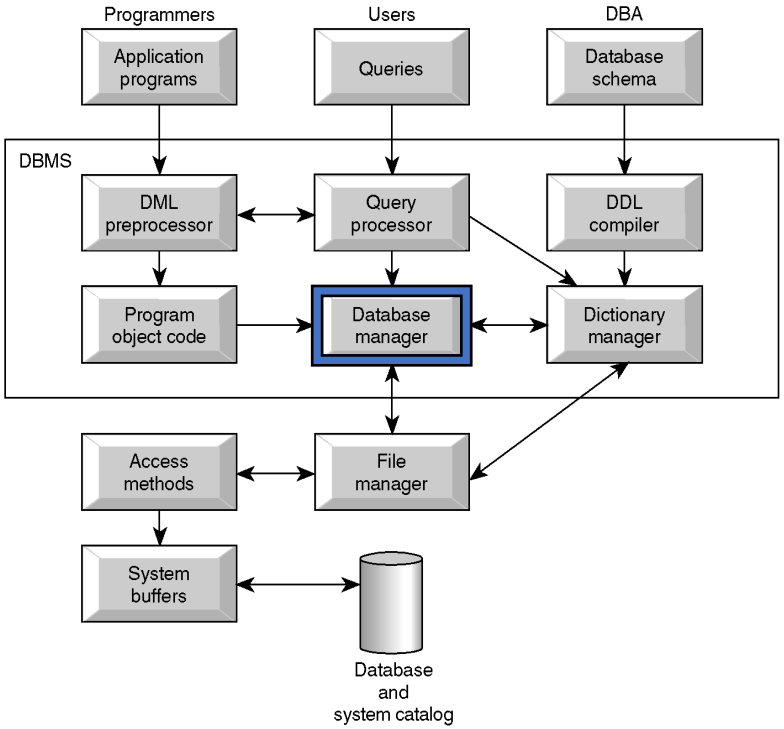
Program Object Code

- **Storage and Retrieval**
- **Dependency Tracking**
- **Metadata Management**
- **Access Control and Security**
- **Query and Analysis**
- **Integration with Build Systems**



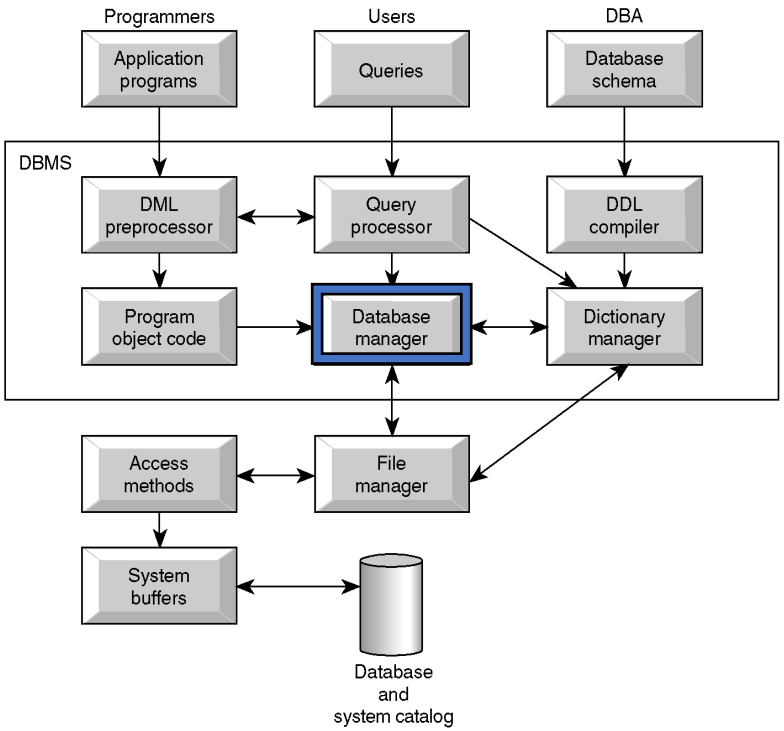
Database Manager

- **Storage and Retrieval**
- **Query Processing and Optimization**
- **Transaction Management**
- **Concurrency Control**
- **Data Integrity and Constraints**
- **Database Backup and Recovery**
- **Metadata Management**
- **Optimization of Database Performance**



Database Manager

- **Metadata Storage**
- **Metadata Retrieval**
- **Metadata Update and Maintenance**
- **Metadata Search and Query**
- **Data Relationship and Dependency Management**



Summary

- DBMS Architecture
- DBMS Mapping Between the Schemas
- Database components

Next Session

- Data Modelling