



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

200
1822 - 2022

Database Environment

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

www.uwtsd.ac.uk

•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 clients and property owners and to facilitate 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 <u>SG5</u>	Branch Number <u>B003</u>
Full Name <u>Susan Brand</u>	Branch Address <u>163 Main St, Glasgow</u>
Sex <u>F</u> DOB <u>3-Jun-70</u>	Telephone Number(s) <u>0141-339-2178 / 0141-339-4439</u>
Position <u>Manager</u>	
Salary <u>24000</u>	
Enter details where applicable	Manager Start Date <u>01-Jun-99</u>
Supervisor Name _____	Manager Bonus <u>2350</u>

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 <u>B003</u>		Branch Address <u>163 Main St, Glasgow</u>																					
Telephone Number(s) <u>0141-339-2178 / 0141-339-4439</u>		<u>G11 9QX</u>																					
<table border="1"><thead><tr><th>Staff Number</th><th>Name</th><th>Position</th></tr></thead><tbody><tr><td>SG5</td><td>Susan Brand</td><td>Manager</td></tr><tr><td>SG14</td><td>David Ford</td><td>Supervisor</td></tr><tr><td>SG37</td><td>Ann Beech</td><td>Assistant</td></tr><tr><td>SG112</td><td>Annet Longhorn</td><td>Supervisor</td></tr><tr><td>SG126</td><td>Chris Lawrence</td><td>Assistant</td></tr><tr><td>SG132</td><td>Sofie Walters</td><td>Assistant</td></tr></tbody></table>			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
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

<i>DreamHome</i> Property Registration Form	
Property Number <u>PG16</u> Type <u>Flat</u> Rooms <u>4</u> Rent <u>450</u> Address <u>5 Novar Drive,</u> <u>Glasgow, G12 9AX</u> <u> </u> <u> </u>	Owner Number <u>C093</u> (If known) Person/Business Name <u>Tony Shaw</u> Address <u>12 Park Pl,</u> <u>Glasgow G4 0QR</u> Tel No <u>0141-225-7025</u>
	Enter details where applicable Type of business _____ Contact Name _____
Managed by staff <u>David Ford</u>	Registered at branch <u>163 Main St, Glasgow</u>

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

<i>DreamHome</i> Client Registration Form	
Client Number <u>CR74</u> (Enter if known)	Branch Number <u>B003</u>
Full Name <u>Mike Ritchie</u>	Branch Address <u>163 Main St, Glasgow</u> <u></u>
Enter property requirements	Registered By <u>Ann Beech</u>
Type <u>Flat</u>	Date Registered <u>16-Nov-11</u>
Max Rent <u>750</u>	

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		Telephone Number(s)																																					
<u>163 Main St, Glasgow</u>		<u>0141-339-2178 / 0141-339-4439</u>																																					
<u>G11 9QX</u>																																							
<table border="1"><thead><tr><th>Property No</th><th>Address</th><th>Type</th><th>Rooms</th><th>Rent</th></tr></thead><tbody><tr><td>PG4</td><td>6 Lawrence St, Glasgow</td><td>Flat</td><td>3</td><td>350</td></tr><tr><td>PG36</td><td>2 Manor Rd, Glasgow</td><td>Flat</td><td>3</td><td>375</td></tr><tr><td>PG21</td><td>18 Dale Road, Glasgow</td><td>House</td><td>5</td><td>600</td></tr><tr><td>PG16</td><td>5 Novar Drive, Glasgow</td><td>Flat</td><td>4</td><td>450</td></tr><tr><td>PG77</td><td>100A Apple Lane, Glasgow</td><td>House</td><td>6</td><td>560</td></tr><tr><td>PG81</td><td>781 Greentree Dr, Glasgow</td><td>Flat</td><td>4</td><td>440</td></tr></tbody></table>					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
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

<i>DreamHome</i> Property Viewing Report																							
Property Number <u>PG4</u>		Property Address																					
Type <u>Flat</u>	<u>6 Lawrence St, Glasgow</u>																						
Rent <u>350</u>																							
<table border="1"><thead><tr><th>Client No</th><th>Name</th><th>Date</th><th>Comments</th></tr></thead><tbody><tr><td>CR76</td><td>John Kay</td><td>20/04/13</td><td>Too remote.</td></tr><tr><td>CR56</td><td>Aline Stewart</td><td>26/05/13</td><td></td></tr><tr><td>CR74</td><td>Mike Ritchie</td><td>11/11/13</td><td></td></tr><tr><td>CR62</td><td>Mary Tregear</td><td>11/11/13</td><td>OK, but needs redecoration throughout.</td></tr></tbody></table>				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.
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

<i>DreamHome</i> Lease Number 00345810	
Client Number <u>CR74</u> (Enter if known) Full Name <u>Mike Ritchie</u> (Please print) Client Signature _____	Property Number <u>PG16</u> Property Address <u>5 Novar Dr. Glasgow</u>
Enter payment details Monthly Rent <u>450</u> Payment Method <u>Cheque</u> Deposit Paid (Y or N) <u>Yes</u>	Rent Start <u>01/06/12</u> Rent Finish <u>31/05/13</u> Duration <u>1 year</u>

Tutorial 1

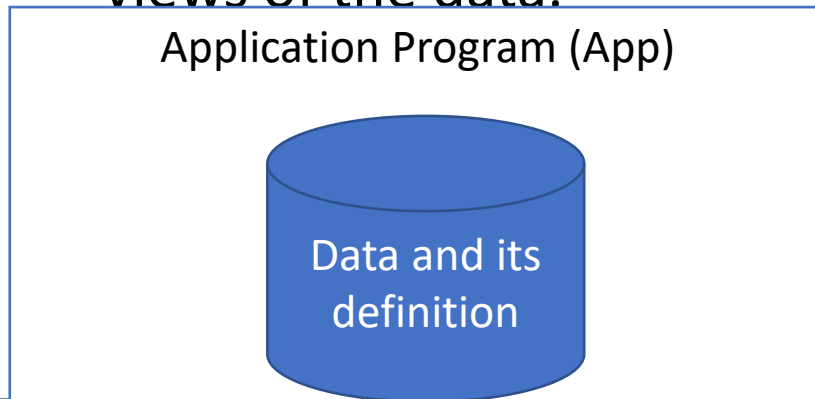
- (a) In what ways would a DBMS help this organization?
- (b) How would you describe the connections or associations that you believe exist among these main entities (Staff, Branch Offices, Property Owners, Properties, Clients)
- (c) what details do you think need to be stored in the database?
- (d) What queries do you think are required?

Objectives

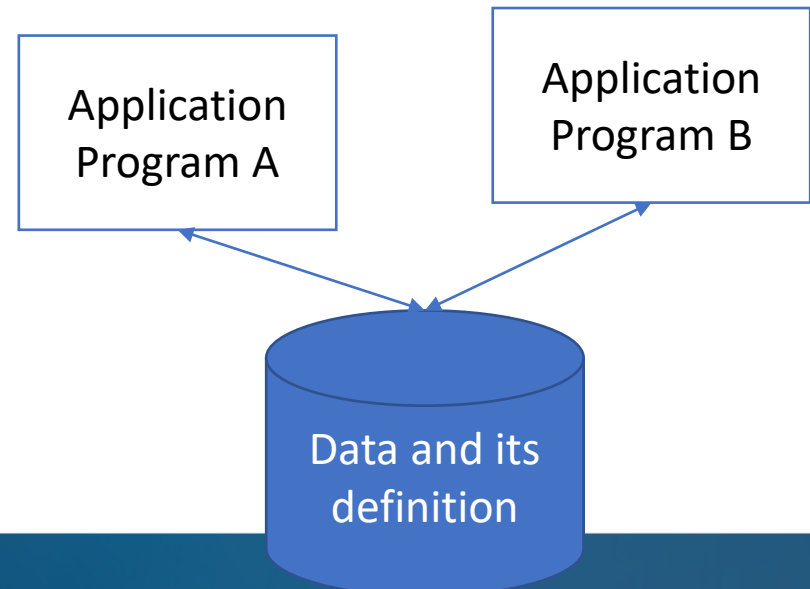
- **The purpose and origin of the three-level database architecture.**
- **The contents of the external, conceptual and internal levels.**
- **The purpose of the external/conceptual and the conceptual/internal mappings.**
- **The components of a DBMS.**

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

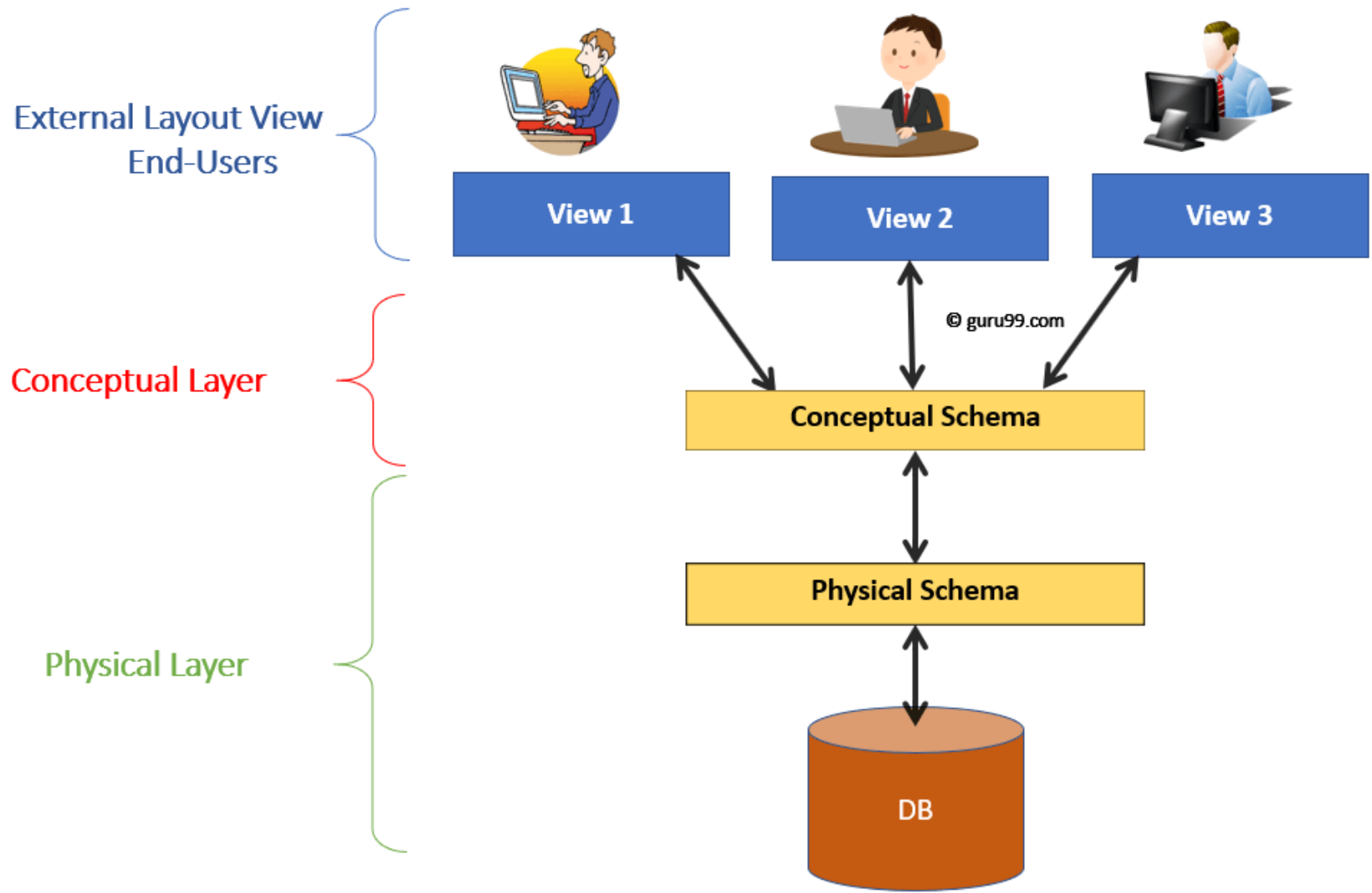
The starting point of any database is to:

- Define the ***abstract and general description*** of the information requirements to be represented in the database.
- **Representation in the Database**

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

External Layout View
End-Users



DBMS-Three Level Architecture

External Layout View
End-Users



View 1



View 2

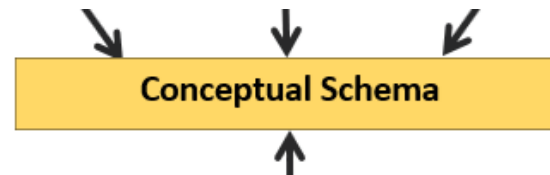


View 3



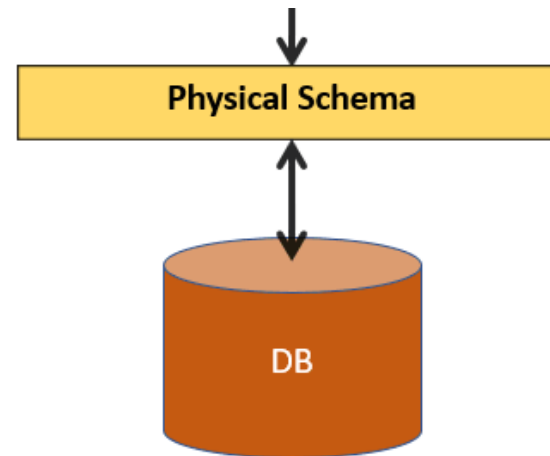
DBMS-Three Level Architecture

Conceptual Layer

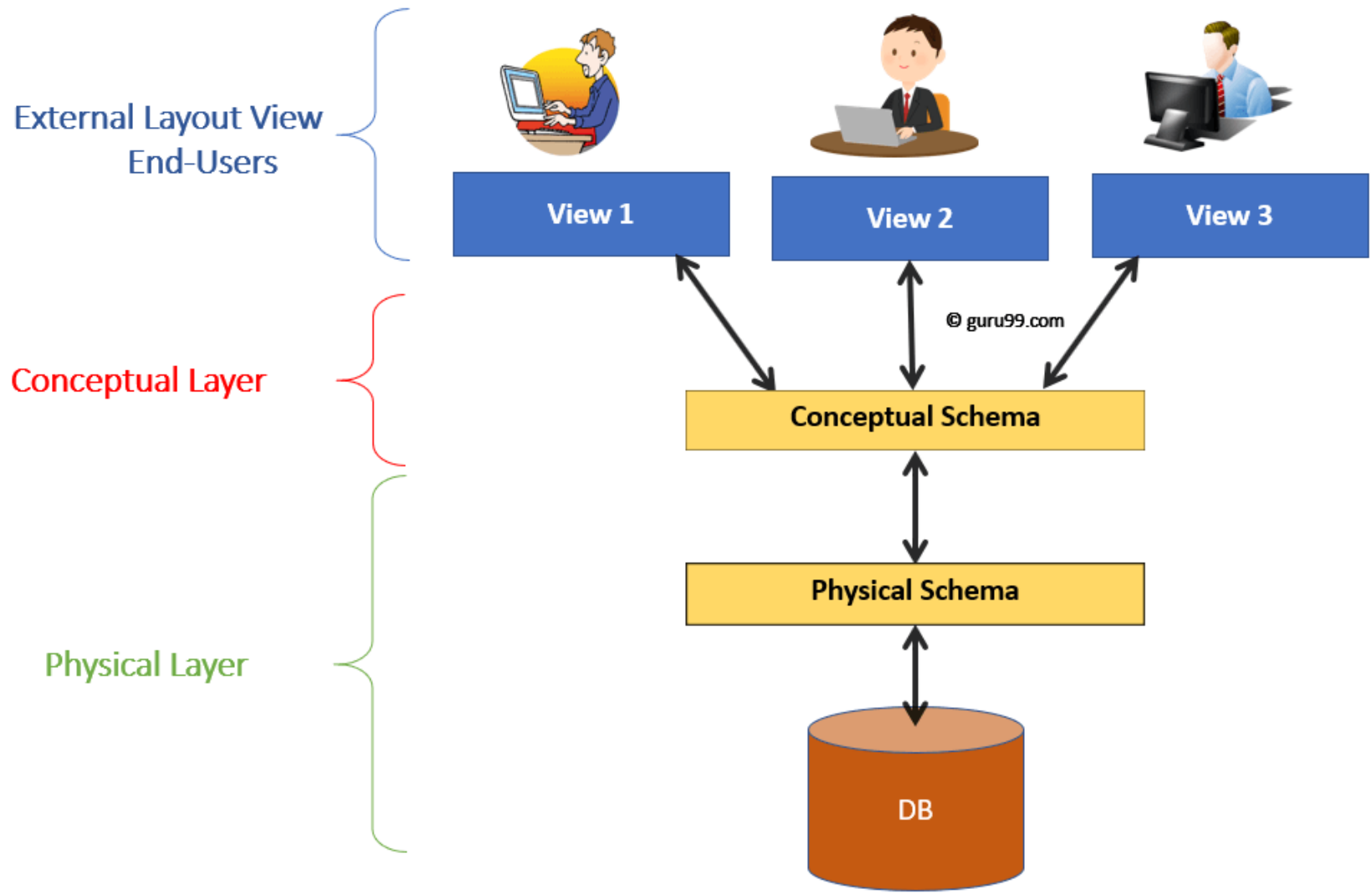


DBMS-Three Level Architecture

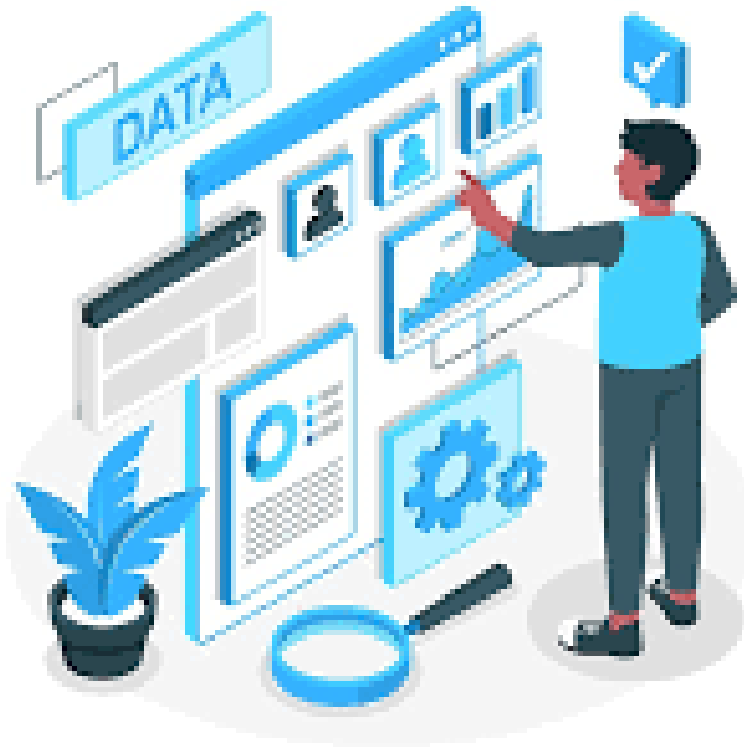
Physical Layer



DBMS-Three Level ANSI-SPARC Architecture



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?



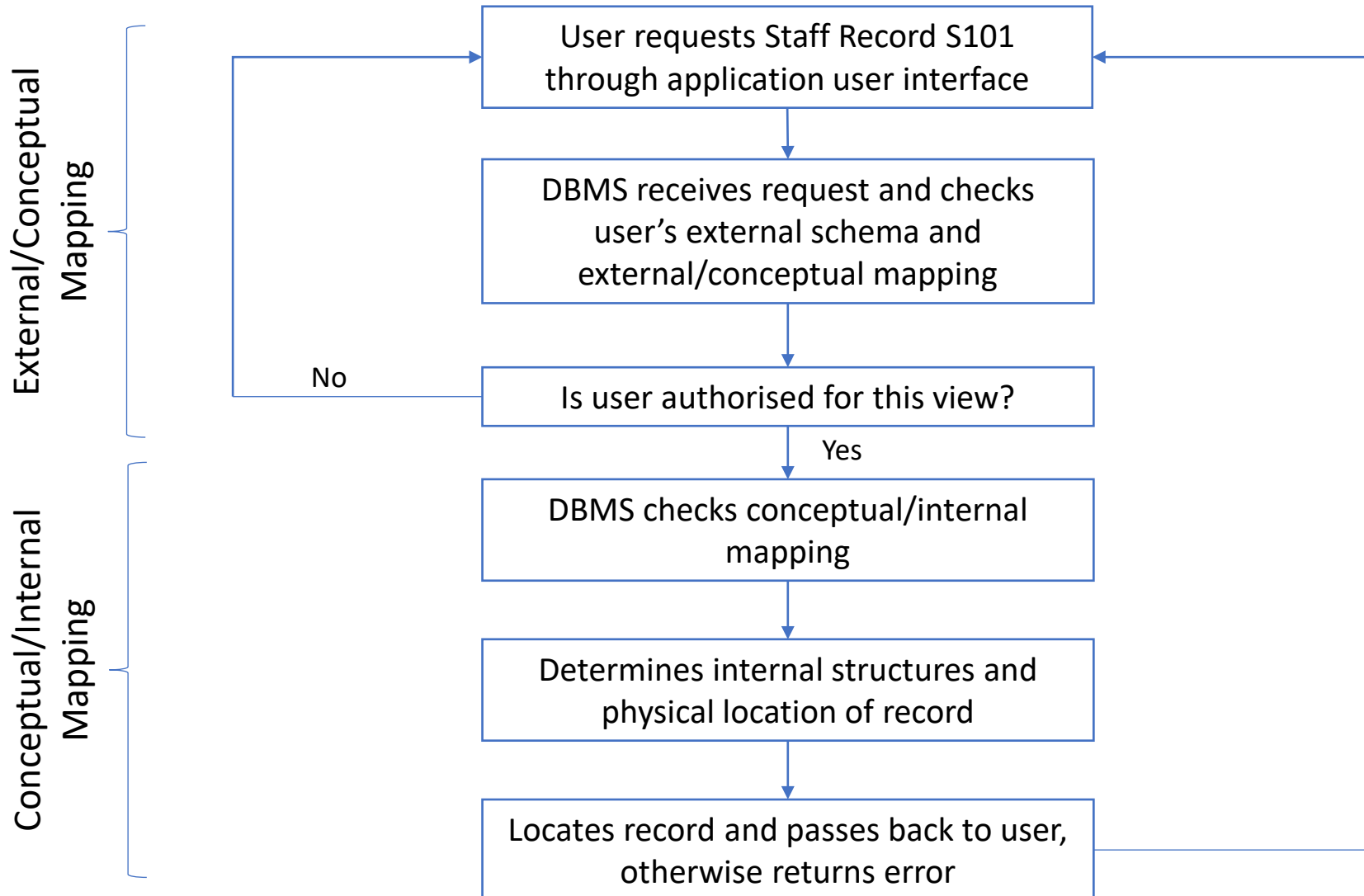
**Reduced
Redundancy and
Duplication**

Database Architecture is needed. Why?

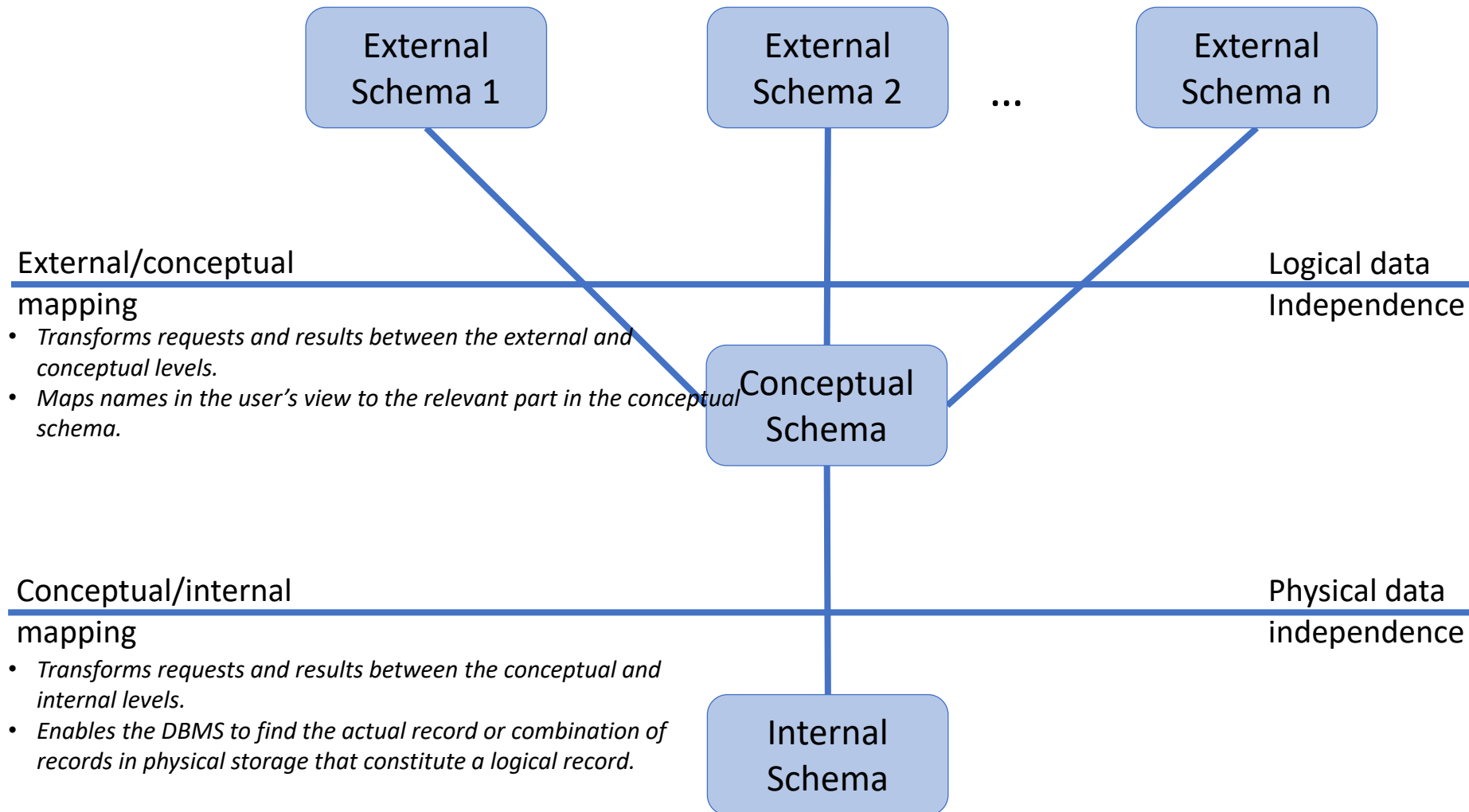


Disaster Recovery and Backup

DBMS Mapping Between the Schemas (A simplified view)



Data Independence and the ANSI-SPARC Three-Level Architecture



Further Reading

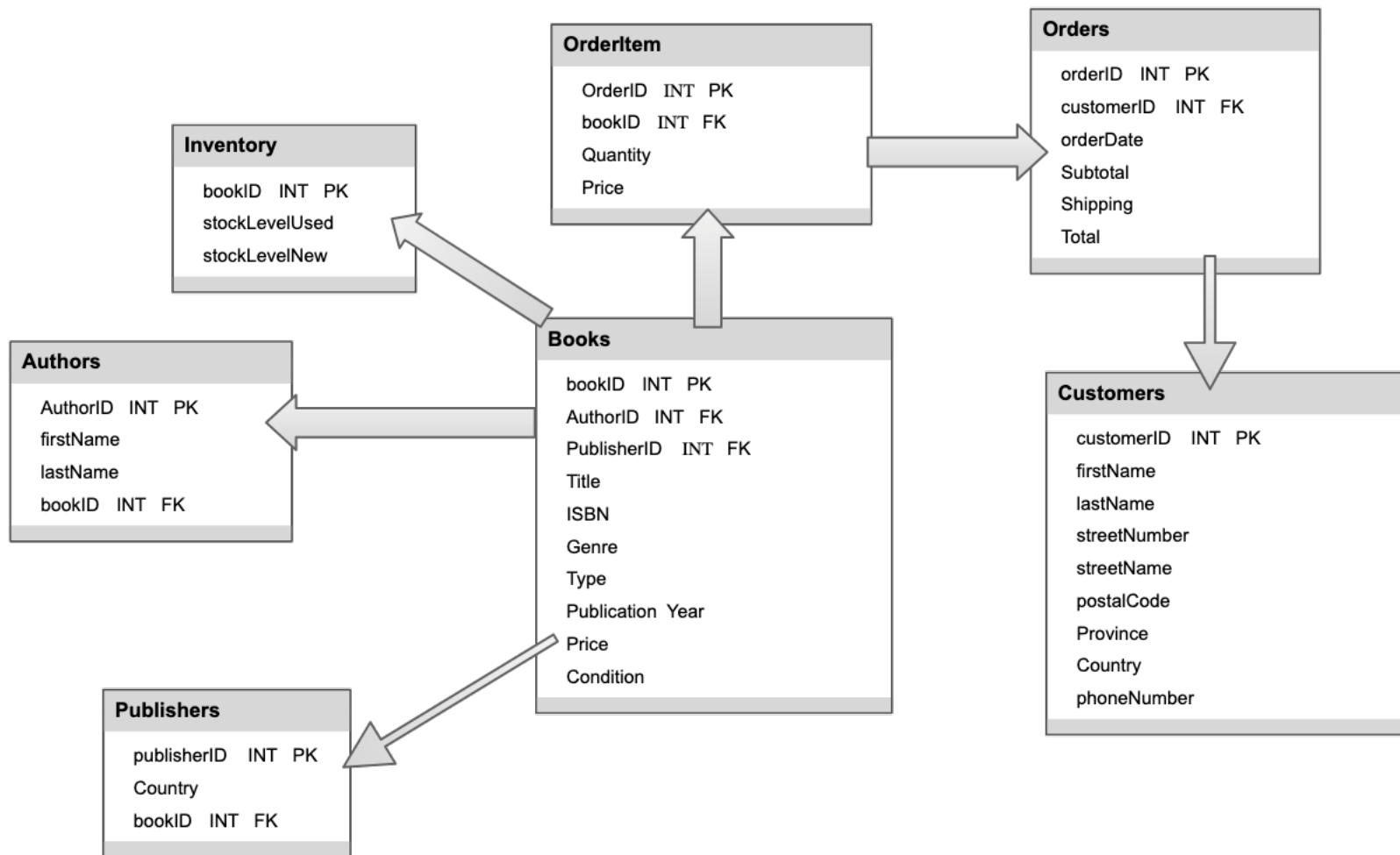
- Part 1 Chapter 2 in

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

Activity - Database Schema Design

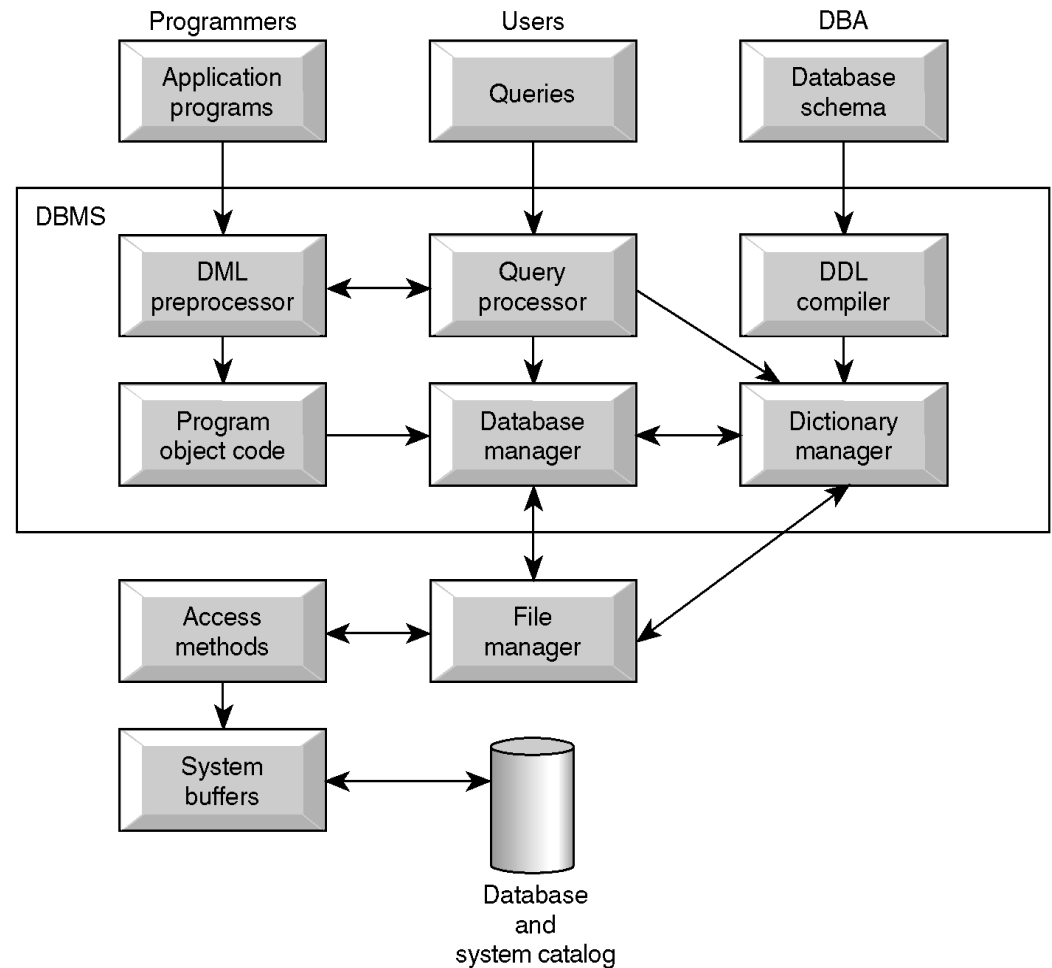
- Choose a real-life example of database
- design a database schema for the scenario, (identifying tables, columns, and relationships)
- Present it with justification of your choice

Activity - Database Schema Design



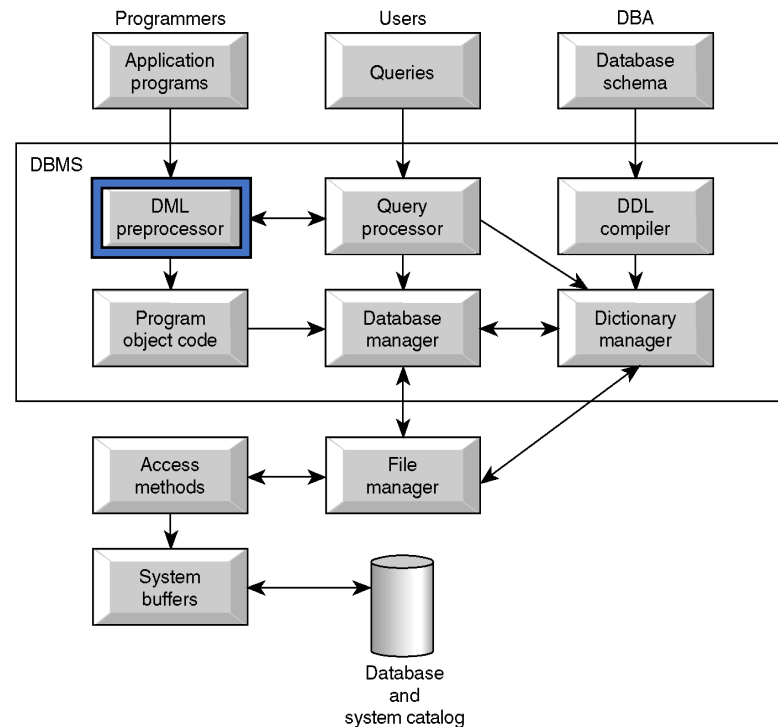
Activity

- Describe the functionalities of the database components



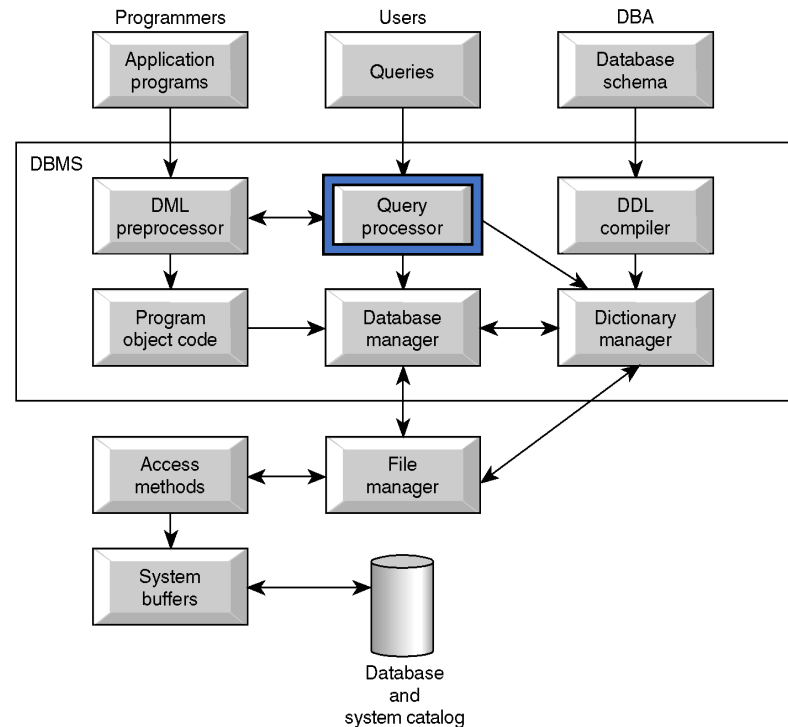
DML Pre-processor

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



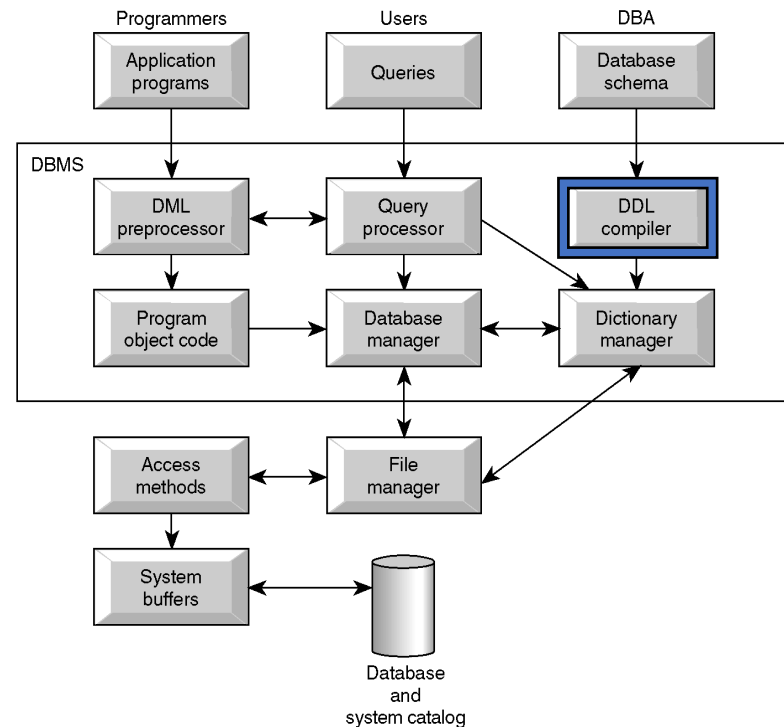
Query processor

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



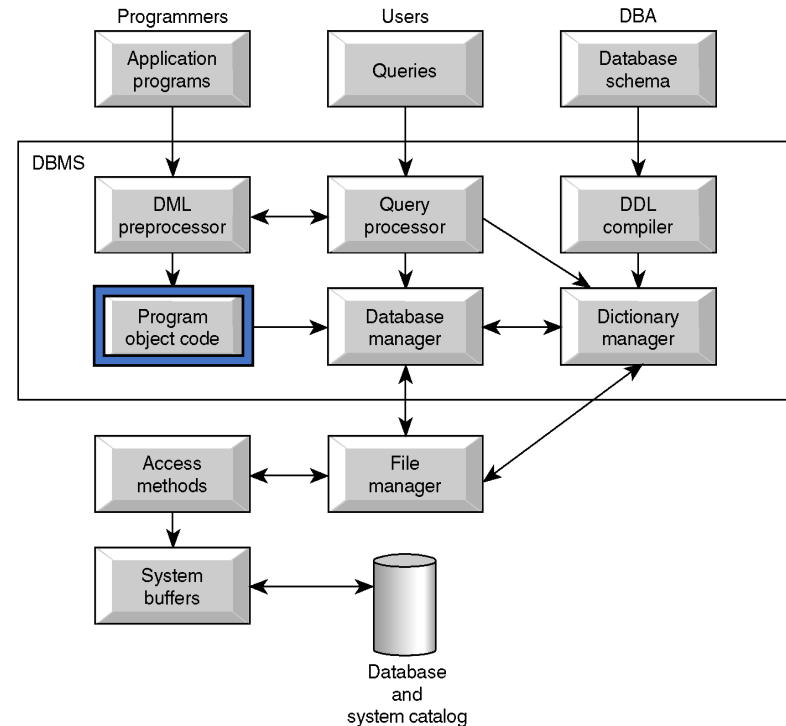
DDL Compiler

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



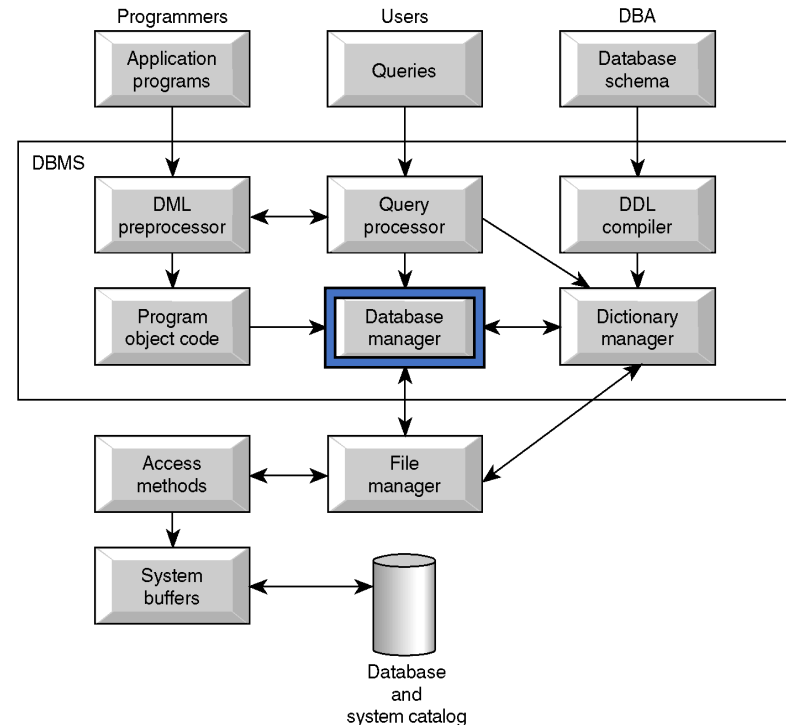
Program Object Code

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



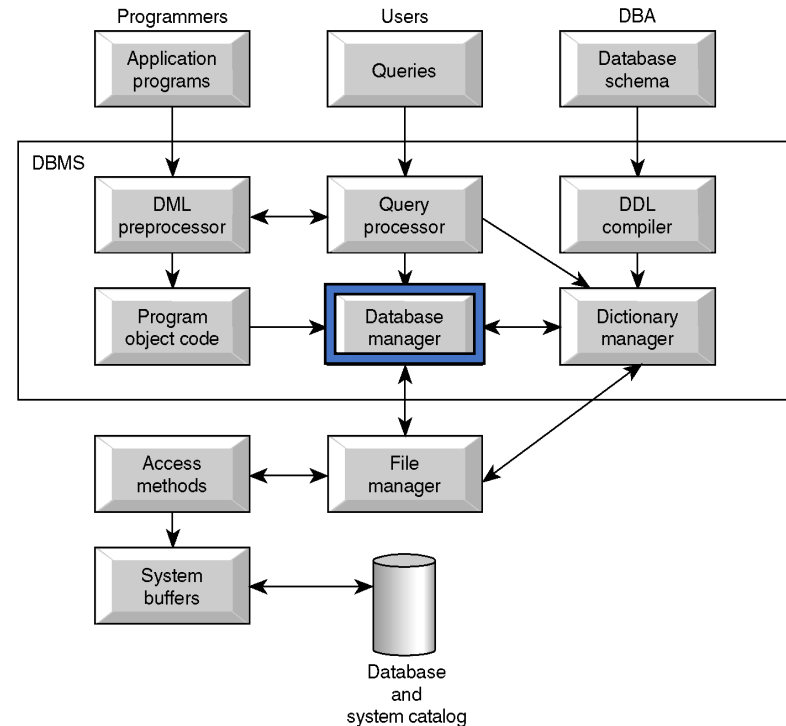
Database Manager

- **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