SWINBURNE UNIVERSITY OF TECHNOLOGY

COS20031
Computing Technology Design Project

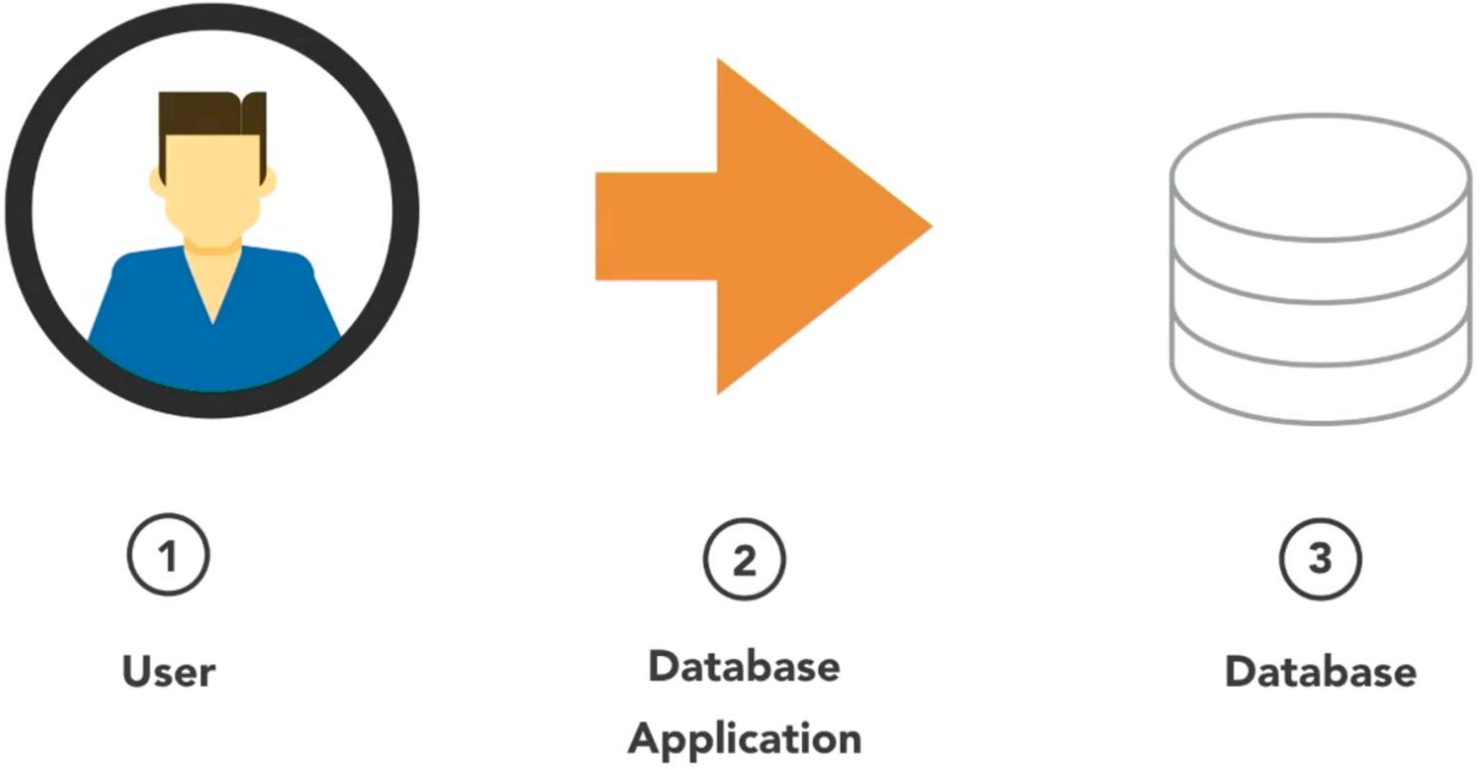
Week 03
Relational Modelling Principles

(A)Relational Database Basics

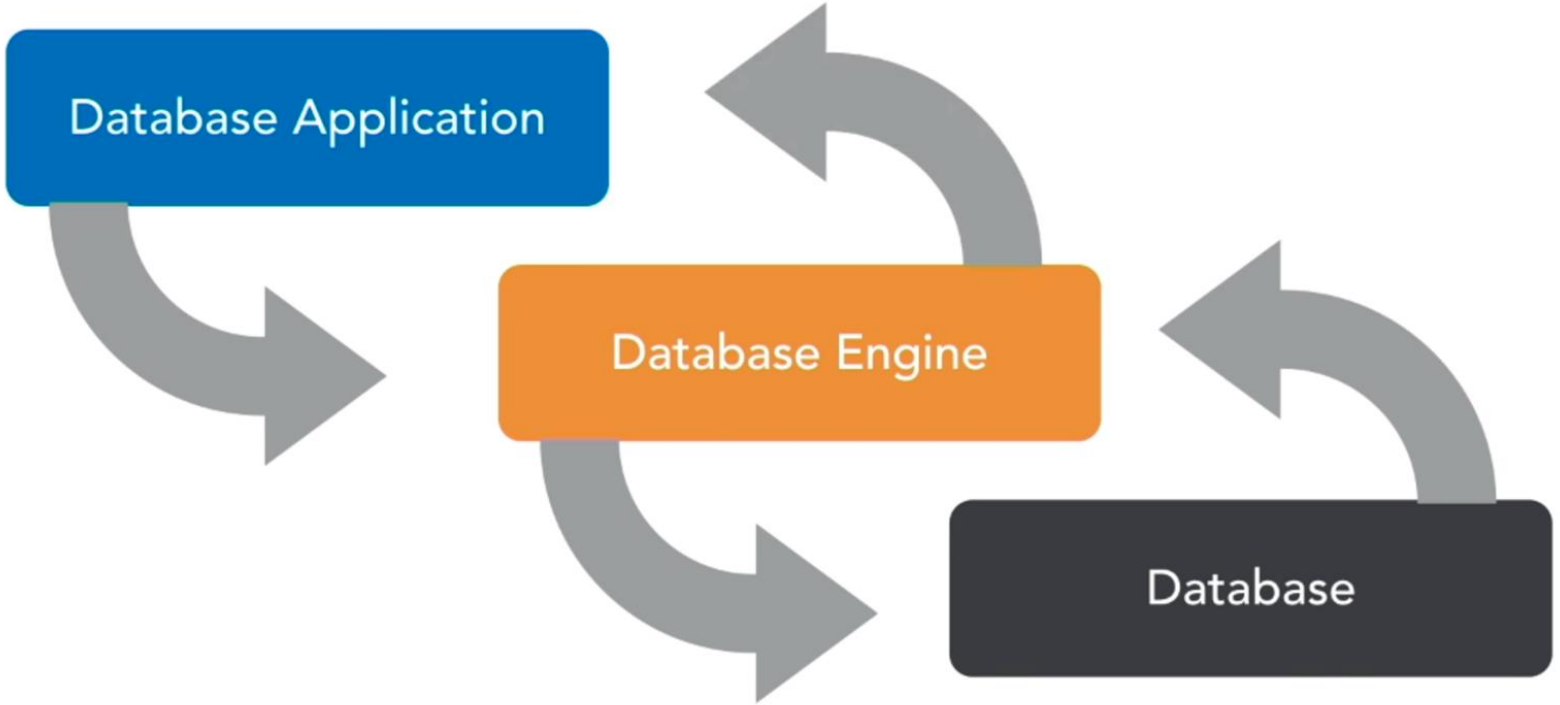
What is a Database?

- **Definition:**
  - A collection of individual data items
  - Stored in a highly structured way
  - Represents a model of reality
  - Data can be stored in a single location or hard drive
  - Or distributed across large networks
- **CRUD tasks:**
  - Create
  - Read
  - Update
  - Delete
  - All performed by a database engine

Access Database

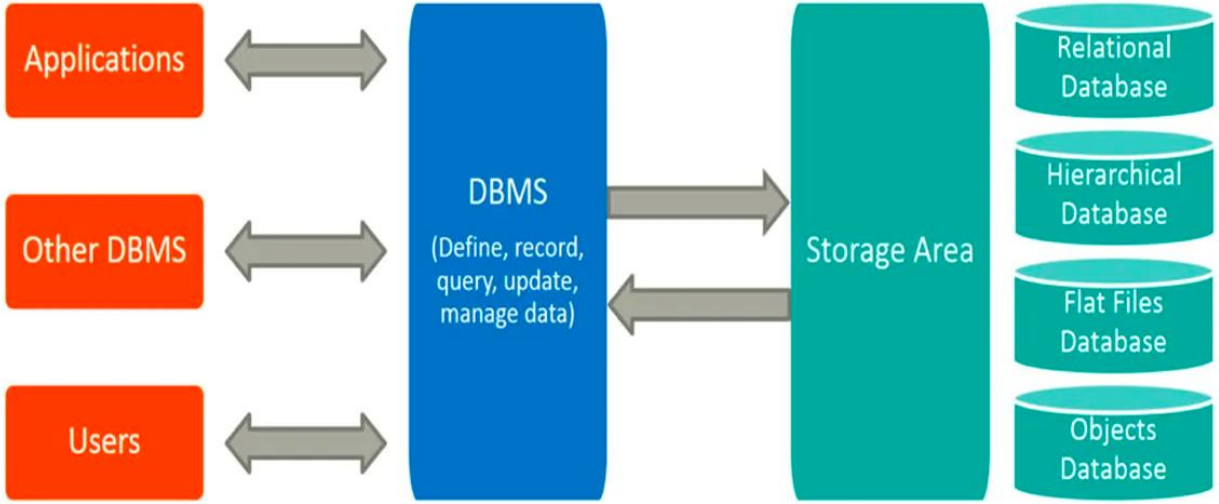


Progress



Database Management System

- Abbreviated by DBMS
- Desktop system such as Microsoft Access
- Server-based system such as SQL Server or Oracle



Relational structures

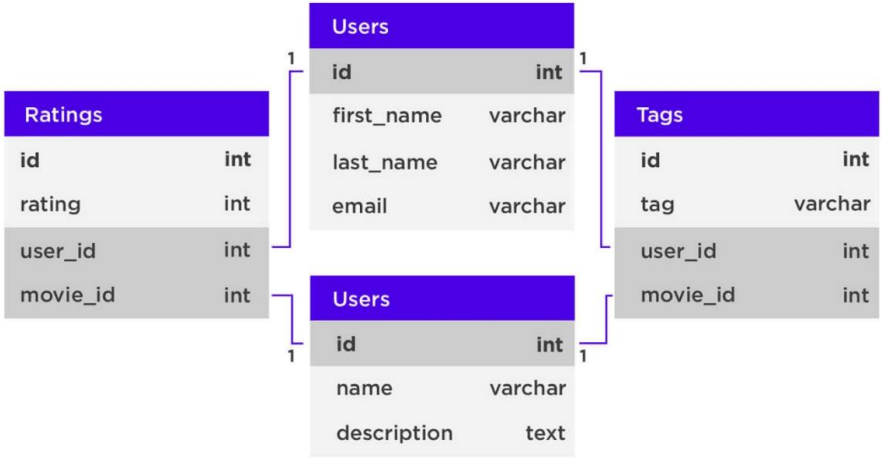
- Columns:
  - Attributes
  - Values
  - Fields
  - Store a single piece of information
- Rows:
  - Records
  - Made up of a series of values
  - Every record represents a single identity

Tables store data in rows and columns.

Database table design is more structured than a typical spreadsheet.

The rules of Relations

- Cells contain single values
- Columns store a single type of information
- Column names are unique
- Order is significant
- Rows are unique



RDBMS Options - System Categories

- Server Database Management Systems
  - Faster and more robust
  - More simultaneous users
  - Major server DBMS vendors
    - Microsoft SQL server
    - Oracle
    - DB2
    - PostgreSQL
    - MySQL
- Desktop Database Management Systems
  - Easy installation and management
  - Designed for lighter weight applicaitons
  - Major vendors:
    - Microsoft access
    - FileMaker Pro
    - Base

What is SQL?

- Structured Query Language
- Used by the DBMS to interact with the database
- Create new tables
- Insert and update data
- Retrieve information across tables
- Interacting with the DBMS
  - Command-line interface: Requires more upfront understanding of syntax, Easily programmable
  - Graphical user interface

How to choose a DBMS?

- Use the one your company provides
- Conduct research into the features and benefits
- Compare implementation costs

Database Development Lifecycle

1. Planning
2. Requirement gathering
3. Conceptual design
4. Logical design
5. Physical design
6. Construction
7. Implementation and rollout
8. Ongoing support

(A)Preventing Data Anomalies

Relational Database Advantages

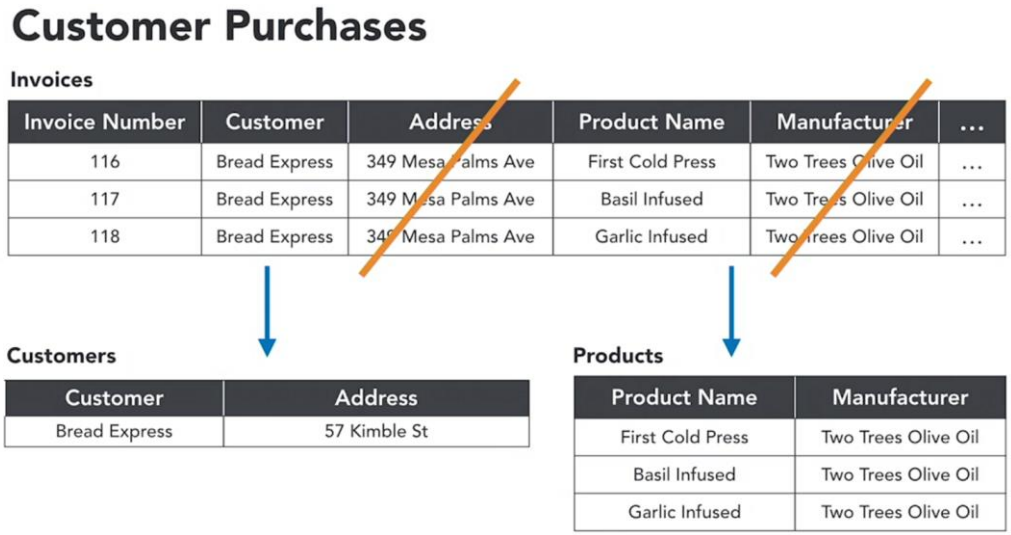
The database development life cycle outlines the steps to creating a well-considered solution.

Shortcutting the process can lead to undesirable results and wasted effort.

Careful consideration can actually protect the database from mistakes and discrepancies.

Removing Duplicate Information

- WHY?
  - Slow performance
  - Maintenance issues
  - Inconsistencies and anomalies
- HOW?
  - Remove the dependent column
  - Copy the subject column



Eliminate Inconsistent Data

- Problems:
  - Typographic errors, spelling mistakes
  - Different entry styles
- HOW?
  - Make a copy of the redundant information
  - Place it into a new table with a clear name

Products

Product Name	Manufacturer
First Cold Press	Two Trees Olive Oil
Basil Infused	Two Trees Olive Oil
Garlic Infused	2 Trees Olive Oil
…	…

Manufacturers

	Manufacturer
	Two Trees Olive Oil
	Mary's Dipping Oils

Products

Products Name	Manufacturer ID
First Cold Press	1
Basil Infused	1
Garlic Infused	1

Manufacturers

Manufacturer ID	Manufacturer Name	Address	…
1	Two Trees Olive Oil	575 East Hills Corner	…
2	Mary's Dipping Oils	169 Table Rock Road	…

Break Data Down into its components

- How to ensure that database remains flexible?
  - Making fields as descriptive, and specific, as possible.
  - The fields also become quite short and to the point.
- Breaking Up Name Fields

Employees

Employee Name	...
Lilah Douglas	...
Karyn Reese	...
Chester Levine	...

Employees

First Name	Last Name	...
Lilah	Douglas	...
Karyn	Reese	...
Chester	Levine	...

Prevent Data Conflicts

- **When?**
  - Stored values are simply calculated from other information that we're storing or keeping track of.
  - One value changes → ensure update the calculation as well.

If Price Each changes → ?

If Quantity changes → ?

Invoices

Invoice Number	Customer Name	Product Name	Quantity
121	Delish Food	First Cold Press	2

Products

Product Name	Manufacturer ID	Price Each
First Cold Press	1	10

Require Complete Information

- **WHEN?**
  - While performing some data entry task and there's some piece of information that you don't know.
  - You think to yourself, "I'll put in the parts that I know now, "and I'll come back and fill in the rest later." Only you get busy and you move onto other tasks, and completely forget to fill in the blanks.
  - Unfortunately this happens all too often to a lot of people.
  - We've already seen that incorrect or mistyped data is problematic for a database.
- HOW?
  - Determine Required Fields

Invoices

Invoice Number	Customer Name	Product Name	Quantity	...
121	Delish Food	First Cold Press	2	...
122	Bread Express	Basil Infused	1	...
123	Snazzy Snacks	Garlic Infused	3	...

Additional Invoice Fields	Required?
Customer Name	Yes
Product Name	Yes
Quantity	Yes
Billing Address	
Billing Apartment	
Billing City	
Billing State	

Maintain a consistent structure

- **Problems?**
  - Multiple pieces of information of the same type in a singl
- **Open/Closed Principles**
  - Tables should be open for extension and closed for mod
- Resolving Multivalue Fields

Employees

First Name	Last Name	Children
Lilah	Douglas	Cassidy, Gretchen
Karyn	Reese	Rafael
Chester	Levine	Sylvester, Geoffrey

Employees

EmployeeID	First Name	Last Name
1	Lilah	Douglas
2	Karyn	Reese
3	Chester	Levine

Children

EmployeeID	Child
1	Cassidy
1	Gretchen
2	Rafael
3	Sylvester

Employees

First Name	Last Name	Child 1	Child 2
Lilah	Douglas	Cassidy	Gretchen
Karyn	Reese	Rafael	
Chester	Levine	Sylvester	Geoffrey

Tutorial & Workshop

See Canvas.