LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

Disciplina de Gestão de Dados e de Bases de Dados

Ano Letivo 2020/2021

The Database Environment

Parts of this presentation were taken from the backing material of the book

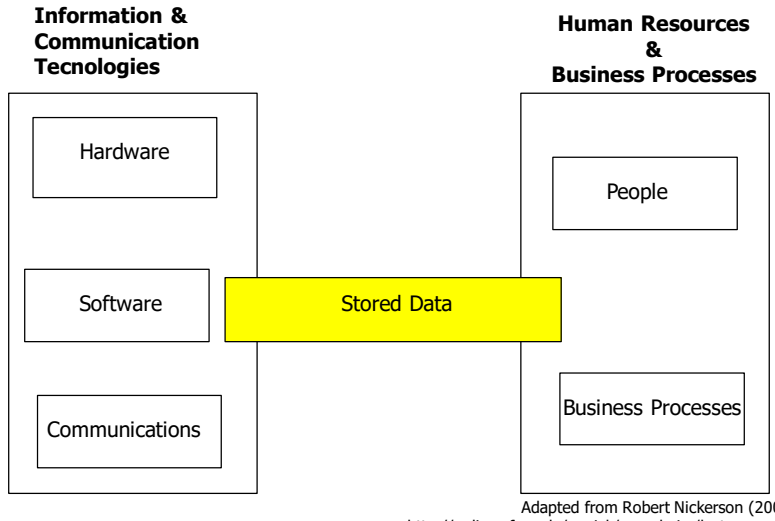
Modern Database Management, 13th Edition, 2019
Jeffrey A. Hoffer, V. Ramesh, Heikki Topi

Information System Definition

An information system (IS) is a socio-technical system, the purpose of which is to process data and provide information to support the operations, management and governance of an organization

Adapted from Robert Nickerson (2009)
http://online.sfsu.edu/~rnick/mannheim/lecturerev.pdf

Information system components model



Adapted from Robert Nickerson (2009)
http://online.sfsu.edu/~rnick/mannheim/lecturerev.pdf

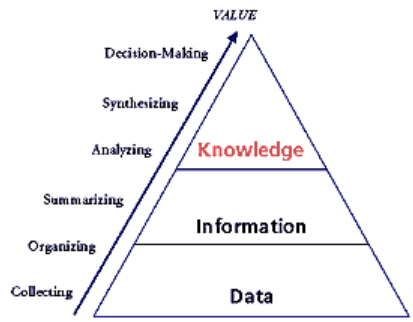
Definitions (1/2)

- **Database:** organized collection of logically related data
- **Data:** stored representations of objects and events that have meaning and importance in the user's environment
  - Structured: numbers, text, dates
  - Unstructured: images, video, documents
- **Information:** data that have been processed in such a way as to increase the knowledge of the person who uses the data

Definitions (2/2)

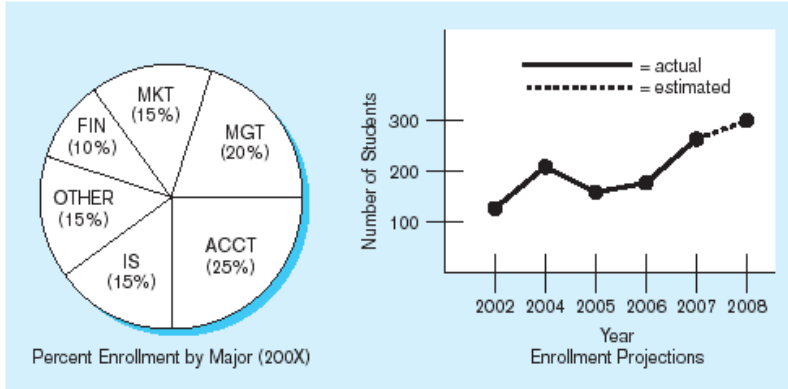
- **Metadata:** data that describes the properties and context of other data
- **Knowledge** is information that changes something or somebody -- either by becoming grounds for actions, or by making an individual (or an institution) capable of different or more effective action Drucker (1989)

Data, Information & Knowledge



http://learningforsustainability.net/knowledge-management/

Summarized data



Graphical displays turn data into useful information that managers can use for decision making and interpretation

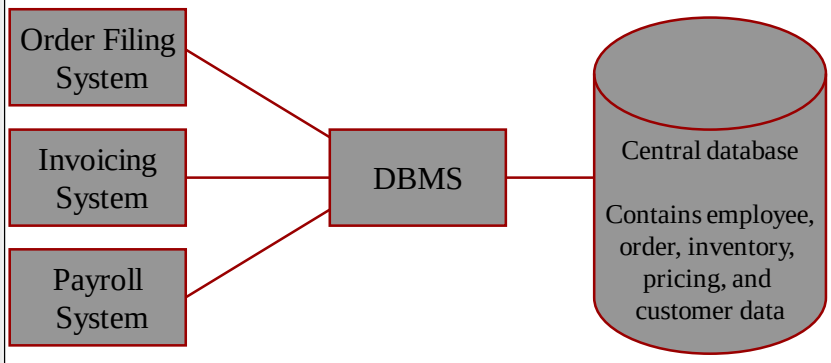
The DATABASE Approach

- Central repository of shared data
- Data is managed by a controlling agent (DBMS)
- Stored in a standardized, convenient form

Requires a Database Management System (DBMS)

Database Management System

A software system that is used to create, maintain, and provide controlled access to user databases



Magic Quadrant for Operational Database Management Systems

Magic Quadrant for Data Warehouse and Data Management Solutions for Analytics

Figure 1. Magic Quadrant for Data Management Solutions for Analytics

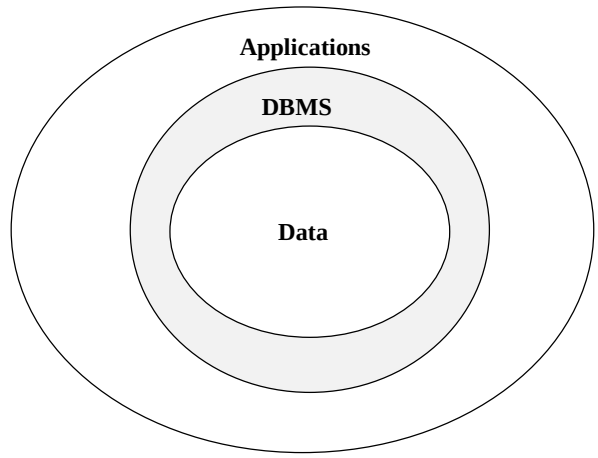
Source: Gartner (January 2019)

Data Independence

Data independence is the idea that generated and stored data should be kept separate from applications that use the data for computing and presentation

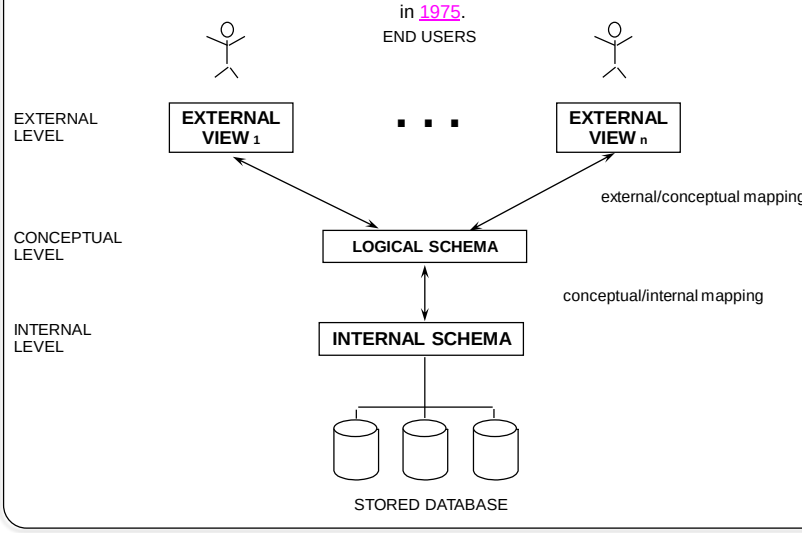
https://www.techopedia.com/definition/1178/data-independence

Data Independence



ANSI-SPARC Architecture

American National Standards Institute, Standards Planning And Requirements Committee) is an abstract design standard for a Database Management System (DBMS), first proposed in 1975.



Program-Data independence (1/2)

- **Physical data independence**

  Changes to the physical level (how the data is stored, whether in arrays or linked lists etc.) must not require a change to an application based on the structure

- **Logical data independence**

  Changes to the logical level (tables, columns, rows, and so on) must not require a change to an application based on the structure

Program-Data independence (2/2)

- **Integrity independence**

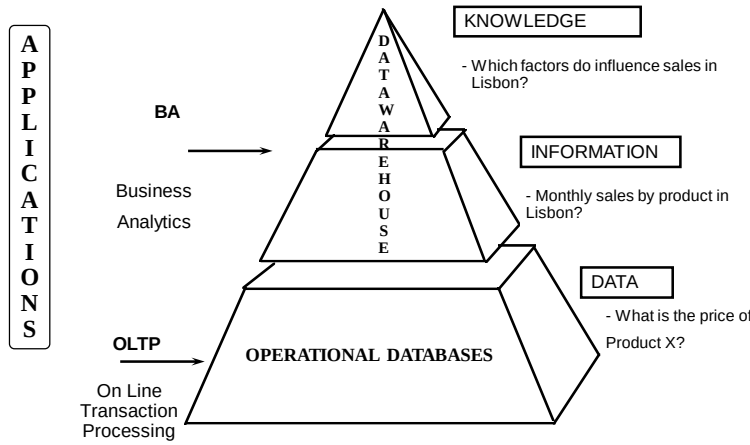
  Integrity constraints must be specified separately from application programs and stored in the catalog. It must be possible to change such constraints as and when appropriate without unnecessarily affecting existing applications

- **Distribution independence**

  The distribution of portions of the database to various locations should be invisible to users of the database. Existing applications should continue to operate successfully :

  1. When a distributed version of the DBMS is first introduced; and
  2. When existing distributed data are redistributed around the system

Classification of Databases According to the type of use

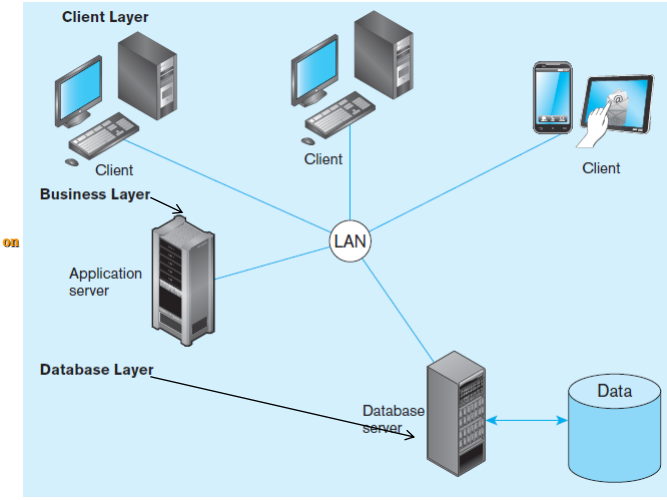


Three Tier Architecture

Occupies the top level and displays information related to services available on a website	**Presentation Tier**
Controls application functionality by performing detailed processing	**Application Tier**
Data in this tier is kept independent of application servers or business logic	**Data Tier**

Generic three-tier architecture

Thin clients



Business rules on application server

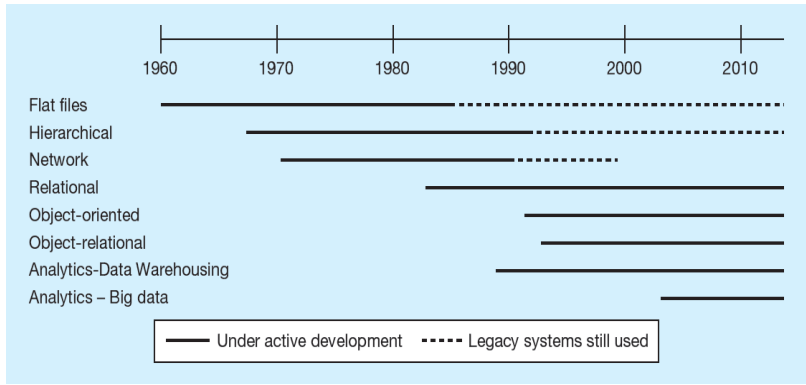
DBMS only on DB server

Evolution of Database Systems

Driven by four main objectives:

- Need for program-data independence ➔ reduced maintenance
- Desire to manage more complex data types and structures
- Ease of data access for less technical personnel
- Need for more powerful decision support platforms

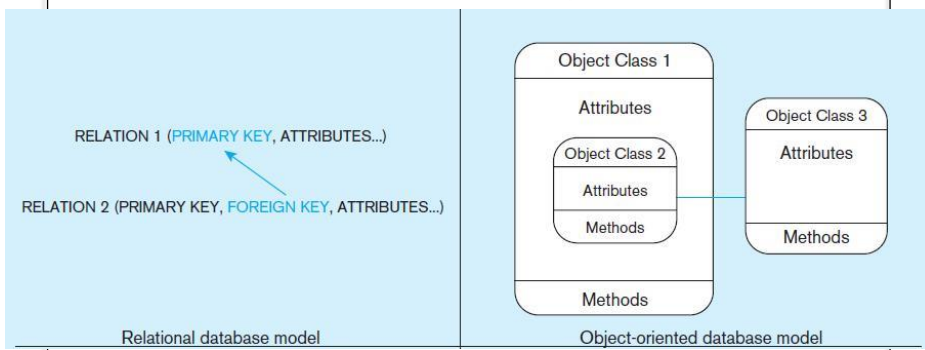
Evolution of DBMS



Database architectures

Relational Model

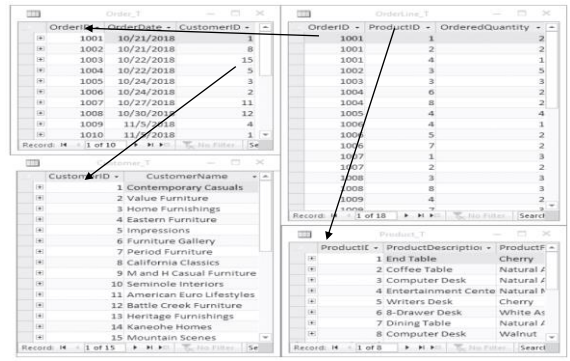
Object Oriented Model



Database architectures (cont.)

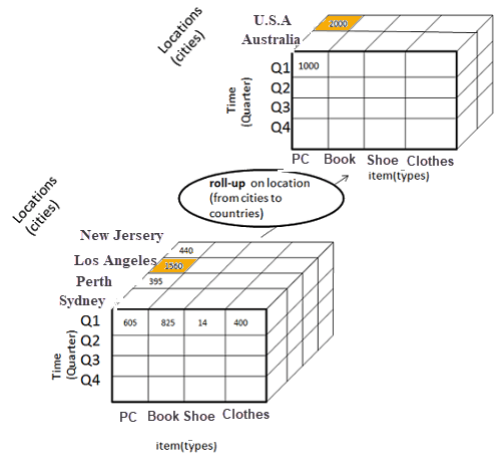
Relational Databases

Database technology involving tables (relations) representing entities and primary/foreign keys representing relationships



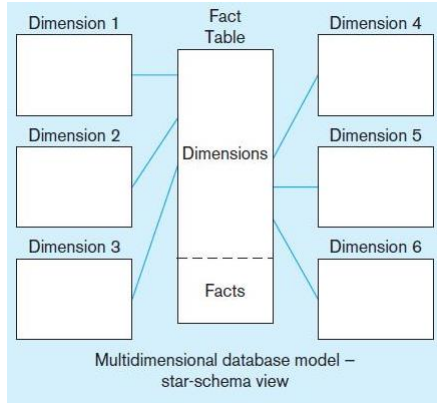
Database architectures (cont.)

Multidimensional Model (OLAP)



Database architectures (cont.)

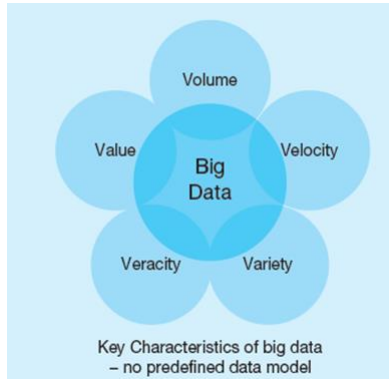
Multidimensional Model (ROLAP)



Multidimensional database model – star-schema view

Database architectures (cont.)

Big Data (NoSQL databases)



Key Characteristics of big data – no predefined data model