



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

200
1822 - 2022

ACCA4023—Introduction to Web and Database Concepts

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

www.uwtsd.ac.uk

Learning Objectives

1. Introduction to Database
2. Database Management Systems
3. Data Modelling Basics
4. Introduction to Relational Databases
5. Implementation of database in MS ACCESS

Today's Objectives

The importance of database systems

Some common uses of database systems

The characteristics of file-based systems

The problems with the file-based approach

The meaning of the term “database”

The meaning of the term “database management system”
(DBMS)

The typical functions of a DBMS

Which one of the below doesn't use database?



Why Database Management Systems?

- Data is used everywhere.
- Data is valuable.



- Personal Data
- Product Data
- Media Data, etc.
- ***It needs to be stored somewhere!***
- ***It needs to be managed - controlled access to it.***

Quiz time...



<https://forms.office.com/e/yy1KvNx41e>

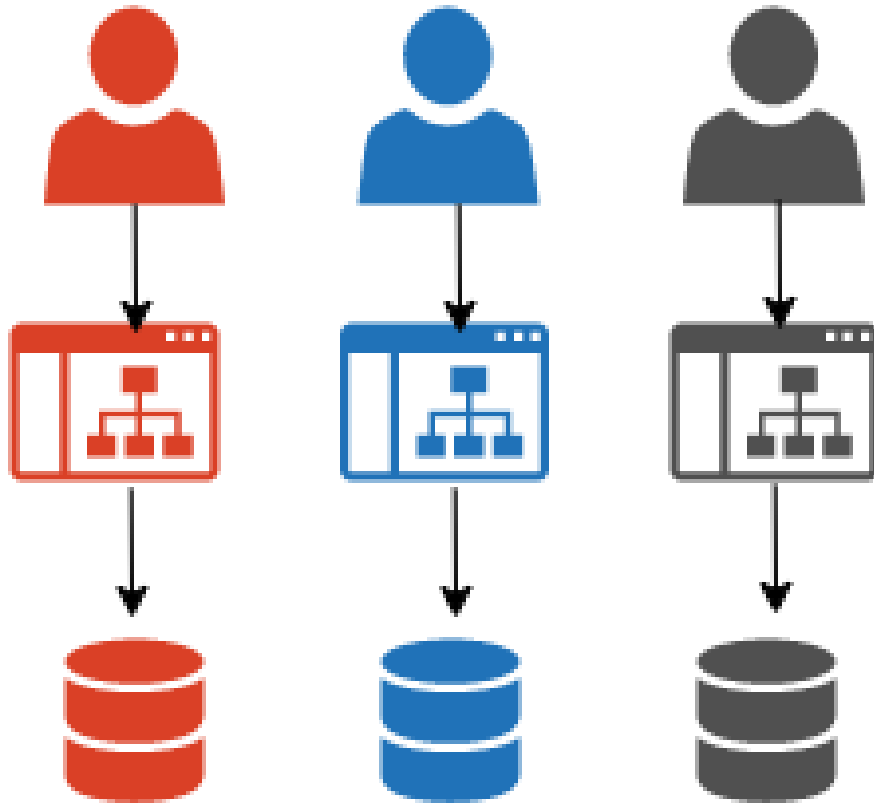


File-Based Approach

- Early attempt to computerize the manual filing system replacing physical files.
- A collection of application programs(reports) that perform services for the end-users

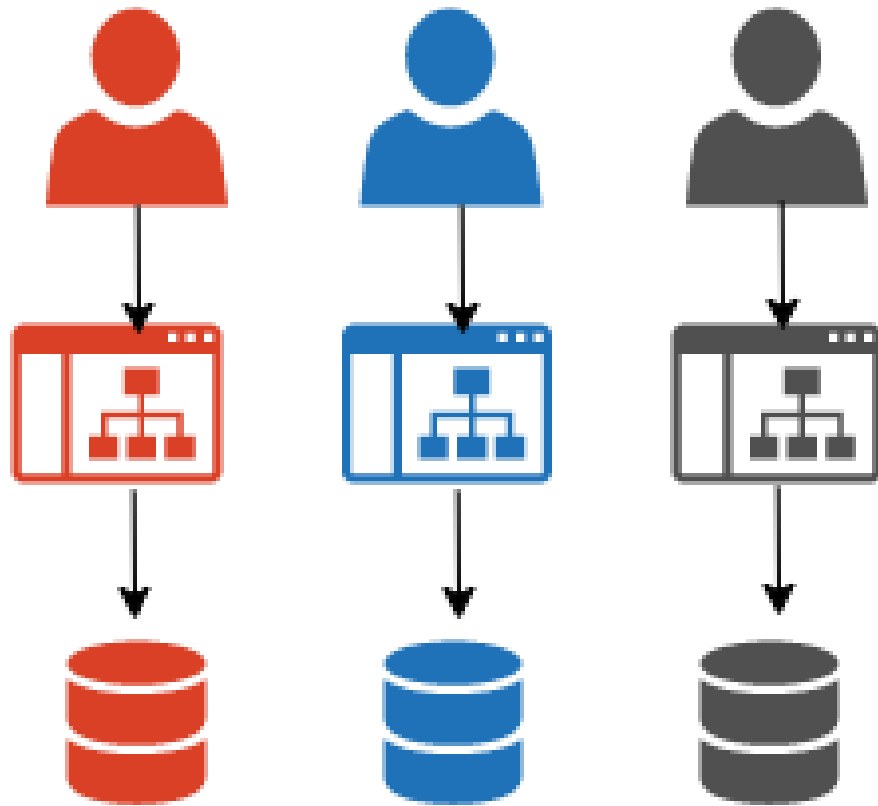


File-Based Systems



- All application was tailor-made
- Applications store (& persist) their data in files
- Each file has its own format
- ⑩ Program must know format
- ⑩ The physical structure & storage of data files are all defined in the application's code.

File-Based Systems



- All application was tailor-made
- Applications store (& persist) their data in files
- Each file has its own format
- 10 Program must know format
- 10 Any other program using file has to know format
- 10 **Issues?**

☒		CSS
☒		CSS
☒		CSS-part 2
☒		HTML
☒		HTML

Limitations of File-Based Approach

- **Separation and isolation of data**

- Each program maintains its own set of data.
- Thus, users of one program may be unaware of potentially useful data held by other programs.

- **Duplication of data**

- Same data is held by different programs.
- Wasted space and potentially different values and/or different formats for the same item.
- Duplication can lead to loss of data integrity.

Scenario:

DreamHome Rental Agency manages both **residential and commercial properties** available for rent. The agency operates through two main departments — the **Sales Department** and the **Contract Department**.

Currently, they maintain several forms to record key business information, including:

- **Property for Rent**
- **Owner Details**
- **Staff Details**
- **Client Details**
- **Lease Details**
- However, all this data is stored in **separate text files**.

Scenario:

DreamHome Property for Rent Details Property Number: <u>PG21</u>	
Address <u>18 Dale Rd</u> City <u>Glasgow</u> Postcode <u>G12</u> Type <u>House</u> Rent <u>600</u> No. of Rooms <u>5</u>	Allocated to Branch: <u>163 Main St, Glasgow</u> Branch No. <u>B003</u> Staff Responsible <u>Ann Beech</u>
Owner's Details	
Name <u>Carol Farnel</u> Address <u>6 Achray St</u> <u>Glasgow G32 9DX</u> Tel. No. <u>0141-357-7419</u> Owner No. <u>C087</u>	Business Name _____ Address _____ Tel. No. _____ Owner No. _____ Contact Name _____ Business Type _____

Sales Department

DreamHome Client Details Client Number: <u>CR74</u>	
First Name <u>Mike</u> Address <u>18 Tain St</u> <u>PA1G 1YQ</u>	Last Name <u>Ritchie</u> Tel. No. <u>01475-392178</u>
Property Requirement Details	
Preferred Property Type <u>House</u> Maximum Monthly Rent <u>750</u> General Comments <u>Currently living at home with parents</u> <u>Getting married in August</u>	
Seen By <u>Ann Beech</u> Branch No. <u>B003</u>	Date <u>24-Mar-13</u> Branch City <u>Glasgow</u>

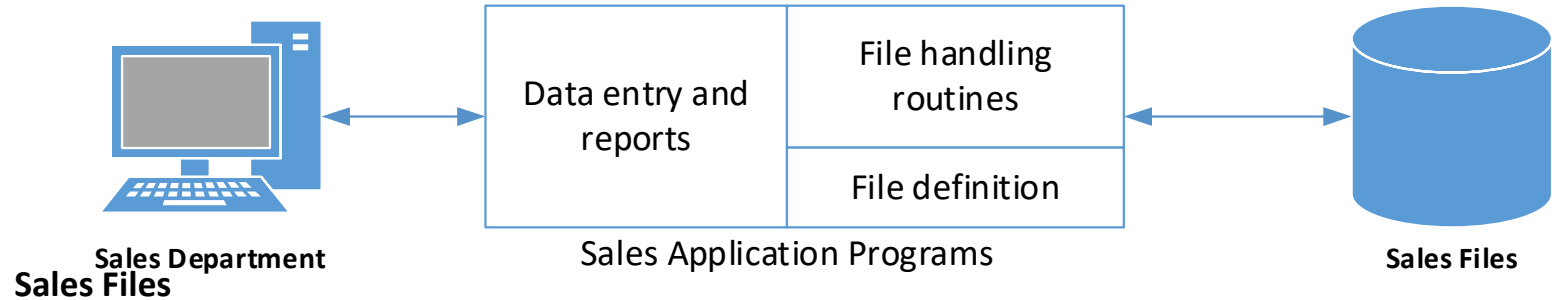
Sales Department

DreamHome Lease Details Lease Number: <u>10012</u>	
Client No. <u>CR74</u> Full Name <u>Mike Ritchie</u> Address (previous) <u>18 Tain St</u> <u>PA1G 1YQ</u> Tel. No. <u>01475-392178</u>	Property No. <u>PG21</u> Address <u>18 Dale Rd</u> <u>Glasgow G12</u>
Payment Details	
Monthly Rent <u>600</u> Payment Method <u>Cheque</u> Deposit <u>1200</u> Paid (Y or N) <u>Y</u>	Rent Start Date <u>1-Jul-13</u> Rent Finish Date <u>30-Jun-14</u> Duration <u>1 Year</u>

Contract Department

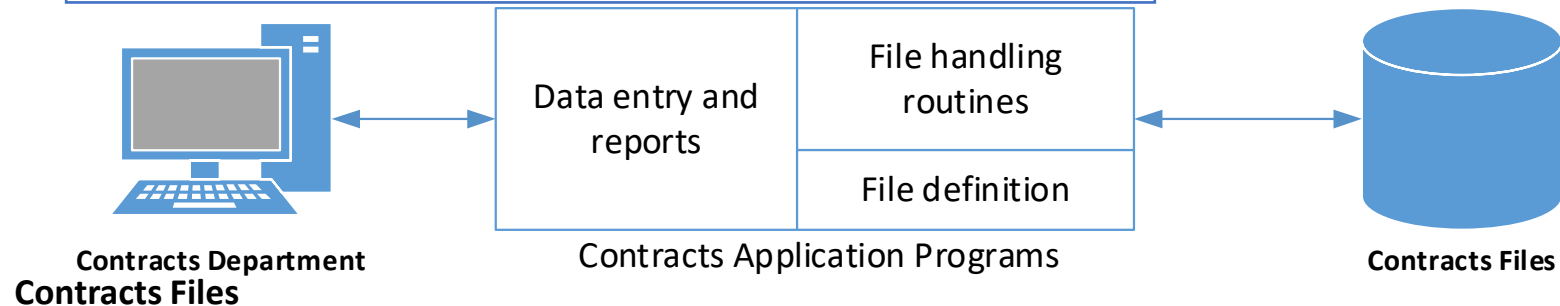
Limitations of File-Based Approach

- Sales and Contracts each have their own separate data and some of it is duplicated.



Sales Files

- PropertyForRent (propertyNo, street, city, postcode, type, rooms, rent, ownerNo)
- PrivateOwner (ownerNo, fName, lName, address, telNo)
- Client (clientNo, fName, lName, address, telNo, prefType, maxRent)



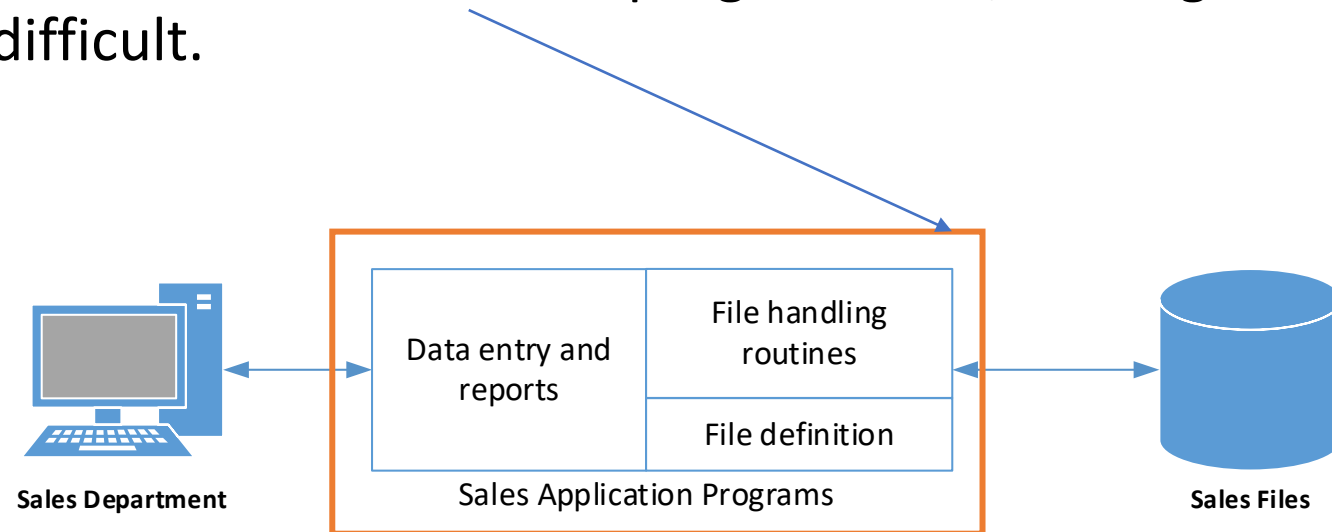
Contracts Files

- Lease (leaseNo, propertyNo, rent, paymentMethod, deposit, paid, rentStart, rentFinish)
- PropertyForRent (propertyNo, street, city, postcode, rent)
- Client (clientNo, fName, lName, address, telNo)

Limitations of File-Based Approach

- **Data dependence**

- The file structure is defined in the program code, making changes to an existing structure difficult.



- **Incompatible file formats**

- Structure of files are dependent on the application's programming language.
- Application programs written in different languages cannot easily access each other's files.

Limitations of File-Based Approach

Fixed queries or proliferation of application code

- Program's are written for particular functions with fixed reports and queries - no support for ad hoc/dynamic queries.
- New requirements meant *new* application program code.

Example: real estate agent's office



What apartments do you have for rent within three miles from city Centre?

What is the annual total for staff salaries?

What is the average rent for a two-bedroom apartment?

Database – What is it?

If you had to explain what a database is to someone who has never heard of it before, how would you describe it?

<https://padlet.com/dchidambaram1/IntroDB>



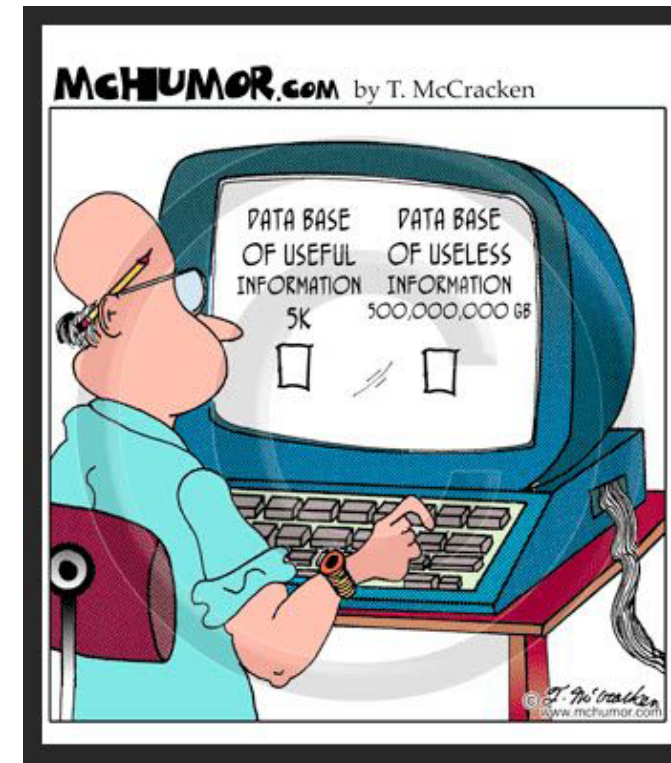
Database is

A collection of related pieces of data

- **Representing/capturing the information** about a real-world enterprise or part of an enterprise
- **Collected and maintained** to serve specific data management needs of the enterprise
- Activities of the enterprise are supported by the database and **continually update** the database

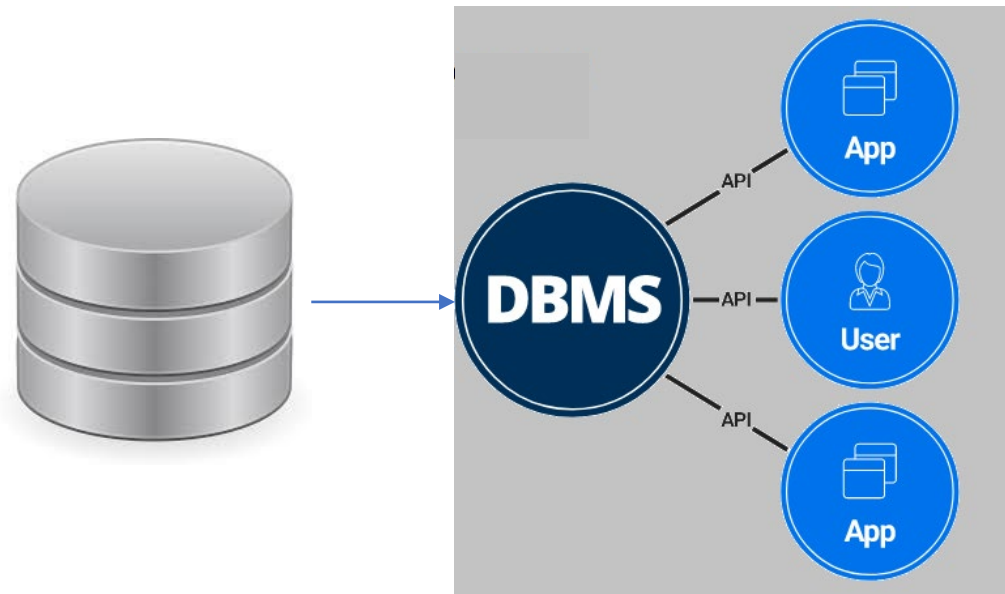


What is a Database Management System (DBMS)?



What is Database Management System?

- software systems used to store, retrieve, and run queries on data
- serves as an interface between an end-user and a database, allowing users to create, read, update, and delete data in the database.



Why Database Management Systems?

- Data is not information!

Information is data made meaningful – typically by applications. E.g.:

- Consumer applications
- Search engines
- Online banking
- Travel reservation sites
- Health care
- Libraries
- Etc.
- Registration services
- Price comparison sites



- ***It needs to be shared!***

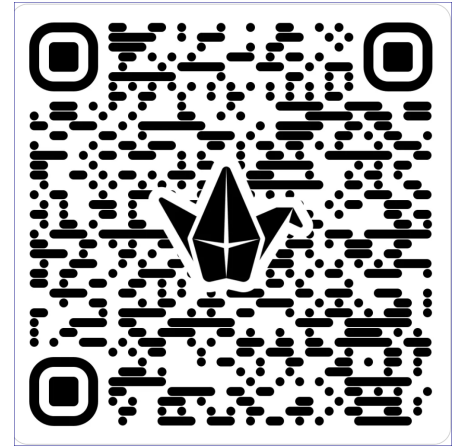
- Accessed by applications that can make it meaningful
- Simultaneous, multiple access to it too

Database Example

What is the purpose of having database?

What data would be stored in this database?

What will be the repercussions if there's no database maintained?



Database Example

What is the purpose of having University database?

To keep an accurate track of the academic activities of the University.

What data would be stored in this database?

Data about:

- a. students,
- b. Faculty
- c. Courses
- d. Research-laboratories,
- e. Course registration etc.

What will be the repercussions if there's no database?

Database Example

StudentID	FirstName	LastName	Department	Course	CourseProfessor	GPA
1001	John	Smith	Computer	COMP101	Dr. Johnson	3.5
1002	Jane	Doe	Biology	BIO201	Dr. Davis	3.7
1003	Michael	Johnson	Computer	COMP101	Dr. Johnson	3.2
1004	Sarah	Davis	Biology	BIO201	Dr. Davis	3.9
1005	David	Brown	Computer	COMP102	Dr. Anderson	3.1
1006	Laura	Turner	Biology	BIO202	Dr. Williams	3.8
1007	Brian	Anderson	Mathematics	MATH101	Prof. Turner	3.6
1008	Emma	White	Computer	COMP102	Dr. Anderson	3.4
1009	Mark	Taylor	Physics	PHYS101	Prof. Davis	3.2
1010	Olivia	Clark	Mathematics	MATH102	Prof. Turner	3.9

Database Example

StudentID	FirstName	LastName	Department	GPA
1001	John	Smith	Computer	3.5
1002	Jane	Doe	Biology	3.7
1003	Michael	Johnson	Computer	3.2
1004	Sarah	Davis	Biology	3.9
1005	David	Brown	Computer	3.1
1006	Laura	Turner	Biology	3.8
1007	Brian	Anderson	Mathematics	3.6
1008	Emma	White	Computer	3.4
1009	Mark	Taylor	Physics	3.2
1010	Olivia	Clark	Mathematics	3.9

Course	CourseProfessor
COMP101	Dr. Johnson
BIO201	Dr. Davis
COMP102	Dr. Anderson
BIO202	Dr. Williams
MATH101	Prof. Turner
PHYS101	Prof. Davis
MATH102	Prof. Turner

Popular DBMS??

- MySQL
- Microsoft Access
- Microsoft SQL Server
- Oracle Database
- MongoDB
- PostgreSQL
- NOSQL
- NEWSQL

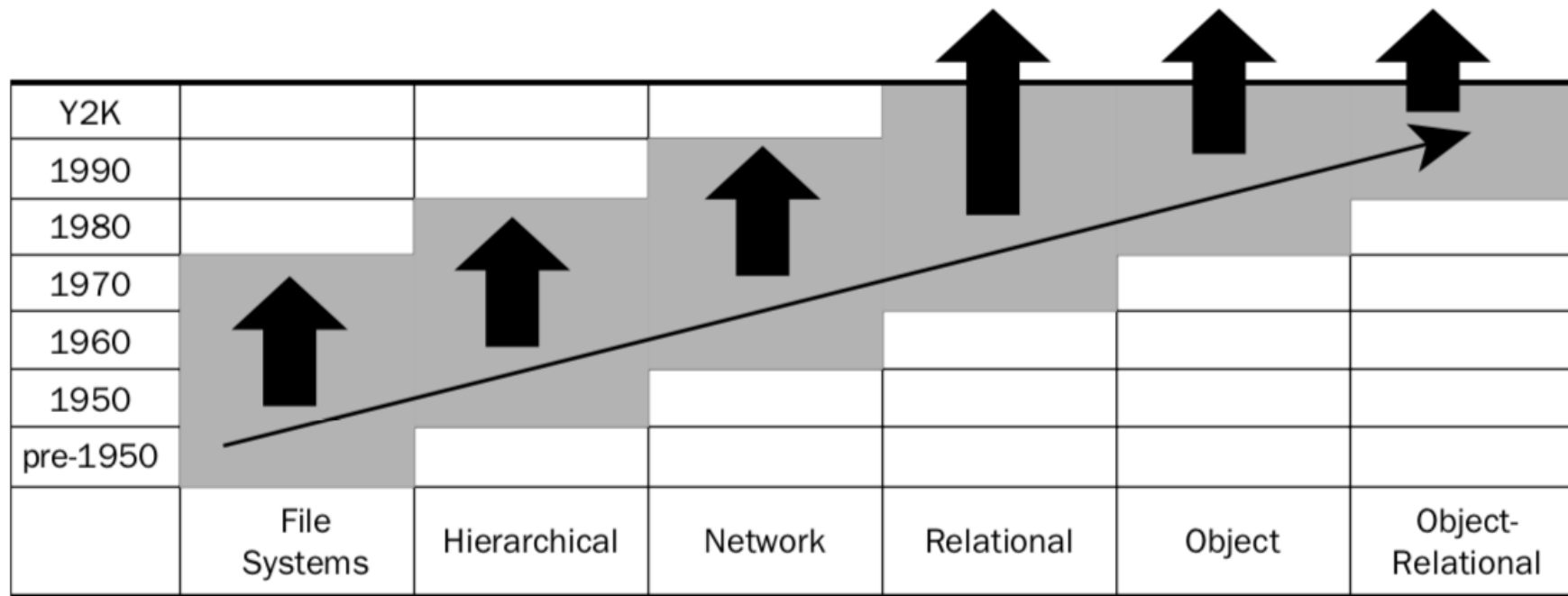


Historical Development of Databases

TIMEFRAME	DEVELOPMENT	COMMENTS
1960s (onwards)	File-based systems	Precursor to the database system. Decentralized approach: each department stored and controlled its own data.
Mid-1960s	Hierarchical and network data models	Represents first-generation DBMSs. Main hierarchical system is IMS from IBM and the main network system is IDMS/R from Computer Associates. Lacked data independence and required complex programs to be developed to process the data.
1970	Relational model proposed	Publication of E. F. Codd's seminal paper "A relational model of data for large shared data banks," which addresses the weaknesses of first-generation systems.
1970s	Prototype RDBMSs developed	During this period, two main prototypes emerged: the Ingres project at the University of California at Berkeley (started in 1970) and the System R project at IBM's San José Research Laboratory in California (started in 1974), which led to the development of SQL.
1976	ER model proposed	Publication of Chen's paper "The Entity-Relationship model—Toward a unified view of data." ER modeling becomes a significant component in methodologies for database design.
1979	Commercial RDBMSs appear	Commercial RDBMSs like Oracle, Ingres, and DB2 appear. These represent the second generation of DBMSs.
1987	ISO SQL standard	SQL is standardized by the ISO (International Standards Organization). There are subsequent releases of the standard in 1989, 1992 (SQL2), 1999 (SQL:1999), 2003 (SQL:2003), 2008 (SQL:2008), and 2011 (SQL:2011).
1990s	OODBMS and ORDBMSs appear	This period initially sees the emergence of OODBMSs and later ORDBMSs (Oracle 8, with object features released in 1997).
1990s	Data warehousing systems appear	This period also see releases from the major DBMS vendors of data warehousing systems and thereafter data mining products.
Mid-1990s	Web-database integration	The first Internet database applications appear. DBMS vendors and third-party vendors recognize the significance of the Internet and support web-database integration.
1998	XML	XML 1.0 ratified by the W3C. XML becomes integrated with DBMS products and native XML databases are developed.

Figure 1.10 Historical development of database systems.

History of Databases Summarised



Database(Recap)

- The database is *collection of integrated records* because it stores:
 - the organisation's operational data,
 - and also a description of this data.
- It is this self-describing nature of databases that provides **data independence**, which file-based systems lacked.

Database Management System (DBMS) Recap

A DBMS is software system that enables users to define, create, maintain and control access to the database.

Access to the database is through the DBMS.

The DBMS interacts with users (individuals on workstations and users' application programs) and the database.

- Example DBMSs include PostgreSQL, Access, Oracle, MySQL, MS SQL Server, etc.

Roles in the Database Environment

- Data Administrator (DA)-*What data do we need, and how should it be managed across the organization?*
- Database Administrator (DBA)-*backup, user permissions, performance monitoring, db making available*
- Database Designers (*Logical and Physical*)
- Application Programmers-*Develop applications to **insert, update, delete, and retrieve** data.*
- End Users

Further Reading :

Chapter 1: Introduction to Databases

Database Systems: A Practical Approach to Design, Implementation, and Management Sixth edition by

• Thomas Connolly • Carolyn Begg