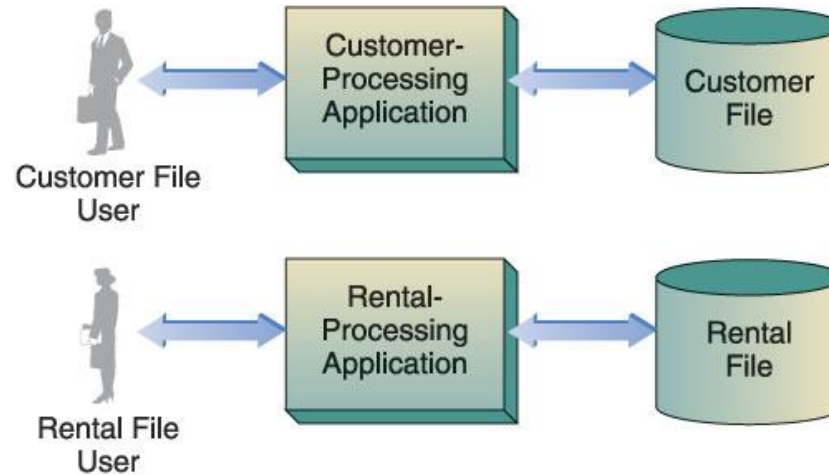


History of Database Systems (I)

File systems

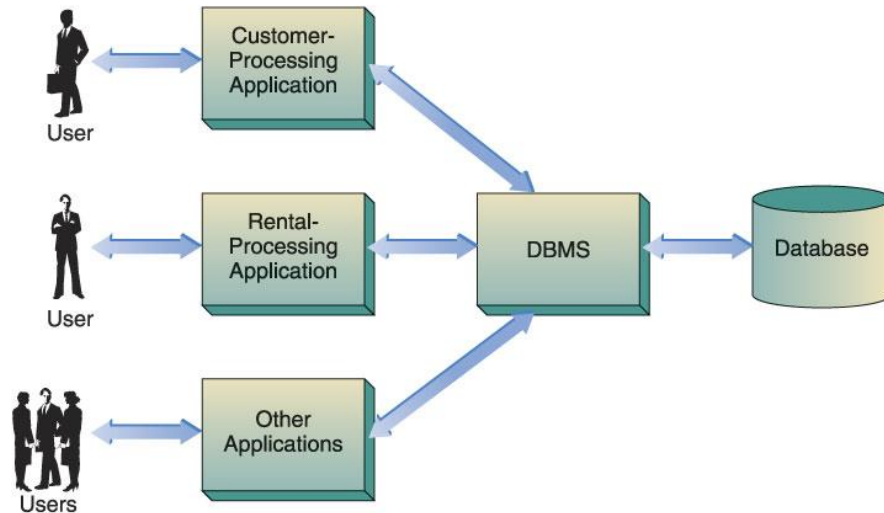


Some problems

- ❑ Data dependence
- ❑ Data separation and isolation leading to multiple incompatible file formats
- ❑ Data duplication and resulting data redundancy and inconsistency
- ❑ Difficulty in accessing and querying data since a new program has to be written to carry out each new task
- ❑ Integrity constraints have to be expressed in the program code, and it is difficult to add new constraints or change existing ones

History of Database Systems (II)

Database systems



Some benefits

- Database systems solve all problems of file systems
- Data independence (logical, physical)
- Data integration
- Data consistency, lack of data redundancy
- Concurrent access, transactions, recovery, backup
- Querying (SQL)

History of Database Systems (III)

- ❑ 1950s and early 1960s:
 - Data processing using magnetic tapes for storage
 - Tapes provided only sequential access
 - Punched cards for input

- ❑ Late 1960s and 1970s:
 - Hard disks allowed direct access to data
 - **Hierarchical and network data models** in widespread use
 - ❖ IBM's DL/I (Data Language One)
 - ❖ CODASYL's DBTG (Data Base Task Group) model
→ the basis of current DBMSs
 - Ted Codd defines the **relational data model**
 - ❖ IBM Research develops System R prototype
 - ❖ UC Berkeley develops Ingres prototype
 - **Entity-Relationship Model** for database design

History of Database Systems (IV)

□ 1980s:

- Research relational prototypes evolve into commercial systems
 - ❖ DB2 from IBM is the first DBMS product based on the relational model
 - ❖ Oracle and Microsoft SQL Server are the most prominent commercial DBMS products based on the relational model
- **SQL** becomes industrial standard
- **Parallel and distributed database systems**
- **Object-oriented database systems (OODBMS)**
 - ❖ Goal: store object-oriented programming objects in a database without having to transform them into relational format
 - ❖ In the end, OODBMS were not commercially successful due to high cost of relational to object-oriented transformation and a sound underlying theory, but they still exist
- **Object-relational database systems** allow both relational and object views of data in the same database

History of Database Systems (V)

❑ Late 1990s:

- Large decision support and **data-mining** applications
- Large multi-terabyte **data warehouses**
- Emergence of Web commerce

❑ Early 2000s:

- **XML** and XQuery standards
- Automated database administration

❑ Later 2000s:

- **Web databases** (semi-structured data, XML, complex data types)
- **Cloud computing**
- Giant data storage systems (Google BigTable, Yahoo PNuts, Amazon Web Services, ...)
- Advanced databases (mainly non-relational (e.g., graph-based, text-based) but also advanced relational)

History of Database Systems (VI)

□ Timeline

1960s

1970s

1980s

1990s

2000+

File-based

Hierarchical

Network

Relational

Entity-Relationship

Object-oriented

Object-relational

Web-based

- Advanced Databases are predominantly located to the right of this timeline (with some exceptions).

Literature Study – Some Principles (I)

- ❑ Purpose: Get to know the state-of-the-art of a topic area
- ❑ Step 1: Which sources are available in your environment?
 - Libraries
 - Book stores
 - Electronic libraries
 - ❖ CiteSeerX – Scientific Literature Digital Library and Search Engine at <http://citeseerx.ist.psu.edu/>
 - ❖ Any search engine like Google, Yahoo! Search, Bing, etc.
 - ❖ UF Libraries at <http://www.uflib.ufl.edu/>
 - ❖ ACM Digital Library (ACM DL) at <http://dl.acm.org/>