

DATABASE TECHNOLOGIES

(September 7, 2016)

BUS3500 - Abdou Illia, Fall 2016 1

LEARNING GOALS

- ❑ Explain basic concepts of data management.
- ❑ Describe traditional file systems and identify their problems.
- ❑ Define database management systems and describe their various functions.
- ❑ Explain how the relational database model works.
- ❑ Explain Object-Oriented databases.
- ❑ Explain Data Warehouse, Data Mart

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What is a database?

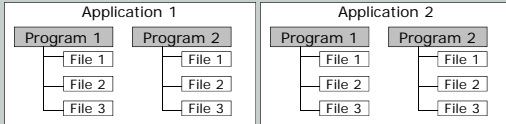
- ❑ Collection of related files containing records on people, places, or things.
- ❑ Databases make data easy to access and manage.

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graph LR; C[Customers Info] <--> A[Accounts Info]; A <--> E[Employees Info]; T[Access and Management tools] <--> C; T <--> A; T <--> E;
```

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Traditional File Systems

- ❑ System of files that store groups of records used by a particular software application
- ❑ Simple but with a cost
 - Inability to share data
 - Inadequate security
 - Difficulties in maintenance and expansion
 - Allows data duplication (e.g. redundancy)



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Traditional File System Anomalies

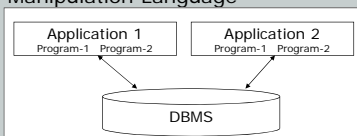
- ❑ Insertion anomaly
 - Data needs to be entered more than once if located in multiple file systems
- ❑ Modification anomaly
 - Redundant data in separate file systems
 - Inconsistent data in your system
- ❑ Deletion anomaly
 - Failure to simultaneously delete all copies of redundant data
 - Deletion of critical data

ClientID	ChildName	ClientName	VisitID	VisitName
2173	Ryan	Barbara Hennessy	27	Pet Visit
4319	Pat	Vivian Noonday	31	Pet Care
4319	Diana	Vivian Noonday	31	Pet Care
8005	Dani	Sandra Amickson	27	Pet Visit
8005	Dani	Sandra Amickson	27	Pet Visit
8112	Pat	Helen Wandzell	24	Pets R Us

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Database Management System (DBMS)

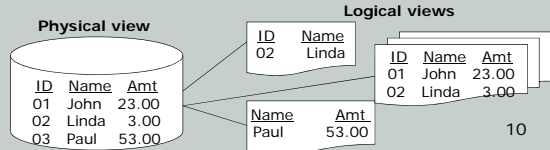
- ❑ Combination of software and data for
 - Collecting, storing and managing data in a database environment.
- ❑ A DBMS includes:
 - Database
 - Database engine (for accessing and modifying the DB content)
 - Data Manipulation Language



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DBMS Functions

- Store data (in tables) on secondary storage
- Transform data into information (reports, ..)
- Provide user with different logical views of actual database content
- Provide security
 - DBMSs control who can add, view, change, or delete data in the database



More DBMS Functions

- Allow multi-user access
 - Control concurrency of access to data
 - Prevent one user from accessing data that has not been completely updated
 - When selling tickets online, Ticketmaster allows you to hold a ticket for only 2 minutes to make your purchase decision, then the ticket is released to sell to someone else – that is concurrency control

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Types of DBMSs

- Desktop
 - Designed to run on desktop computers
 - Used by individuals or small businesses
 - Requires little or no formal training
 - Does not have all the capabilities of larger DBMSs
 - Examples: Microsoft Access, FileMaker, Paradox

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Types of DBMSs (Cont.)



□ Server / Enterprise

- Designed for managing larger and complex databases by large organizations
- Typically operate in a client/server setup
- Either centralized or distributed
 - Centralized – all data on one server
 - Easy to maintain
 - Prone to run slowly when many simultaneous users
 - No access if the one server goes down
 - Distributed – each location has part of the database
 - Very complex database administration
 - Usually faster than centralized
 - If one server crashes, others can still continue to operate.
- Examples: Oracle Enterprise, DB2, Microsoft SQL Server

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Types of DBMSs (Cont.)

□ Handheld

- Designed to run on handheld devices
- Less complex and have less capabilities than Desktop or Server DBMSs
- Example: Oracle Database Lite, IBM's DB2 Everywhere.

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Database Models

□ Database model = a representation of the relationship between structures (e.g. tables) in a database

□ Common database models

- Flat file model
- Relational model (this one is the most common)
- Object-oriented database model

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Flat File Database

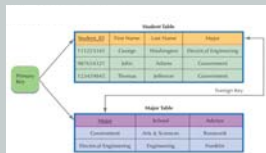
- ❑ Stores data in basic table structures
- ❑ No relationship between tables
- ❑ Used on PDAs for address book

Last Name	First Name	Address 1	Address 2	City	State	Zip	Home Phone	Mobile Phone
Allen	David	123 River Road		Bowie	MD	20716	301-555-1212	
Boyle	Mary	5436 Alley Way		Greenbelt	MD	20770	301-555-9876	301-555-7887
Murray	Rita	3210 Quiet Drive	#205	Rockville	MD	20852	301-555-6677	301-555-8565
Parks	Claire	3021 Bally's Court		Annapolis	MD	21104	410-555-4132	
Smith	Gerry	87663 Colorado Ave.		Calvert	MD	23541	410-555-6971	410-555-3070
Young	Monica	6547 Boteler Land	#234	College Park	MD	20740	301-555-8216	

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Relational Model

- ❑ Multiple tables related by common fields
- ❑ Uses controlled redundancy to create fields that provide linkage relationships between tables in the database
 - These fields are called **foreign keys** – the secret to a relational database
 - A foreign key is a field, or group of fields, in one table that is the primary key of another table



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Object-Oriented DBMS

- ❑ Needed for multimedia applications that manage images, voice, videos, graphics, etc. in addition to numbers and characters.
- ❑ Popular in Web applications
- ❑ Slower compared to relational DBMS for processing large number of transactions
- ❑ Hybrid object-relational DBMS are emerging

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Data Warehouse

- Many organizations need internal, external, current, and historical data
- Data Warehouse are designed to, typically, store and manage data from operational transaction systems, Web site transactions.



Data Mart

- Subset of data warehouses that is highly focused and isolated for a specific population of users
- Example: Marketing data mart, Sales data mart, etc.

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Summary Questions

	Notes
1) What is a database, a table, a field, a record, a primary key, a composite key?	3-6
2) What are the problems with traditional file systems?	7,8
3) What are the major functions of a DBMS?	10,11
4) (a) Name some Desktop DBMSs. (b) Name some Enterprise DBMSs. (c) Handheld DBMSs	12-14
5) What are the differences between Flat File, Relational, and Object-oriented database models?	16-18
6) What is a data warehouse? A data mart	19-20

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