

# Database Management

**Discovering  
Computers 2012**

**Your Interactive Guide  
to the Digital World**



# Objectives Overview

Define the term, database, and explain how a database interacts with data and information

Define the term, data integrity, and describe the qualities of valuable information

Discuss the terms character, field, record, and file

Describe file maintenance techniques and validation techniques

Differentiate between a file processing approach and the database approach

# Objectives Overview

Discuss the functions common to most database management systems

Describe characteristics of relational, object-oriented, and multidimensional databases

Explain how to access Web databases

Identify database design guidelines and discuss the responsibilities of database analysts and administrators

# Databases, Data, and Information

## Database

- Collection of data organized in a manner that allows access, retrieval, and use of that data

## Data

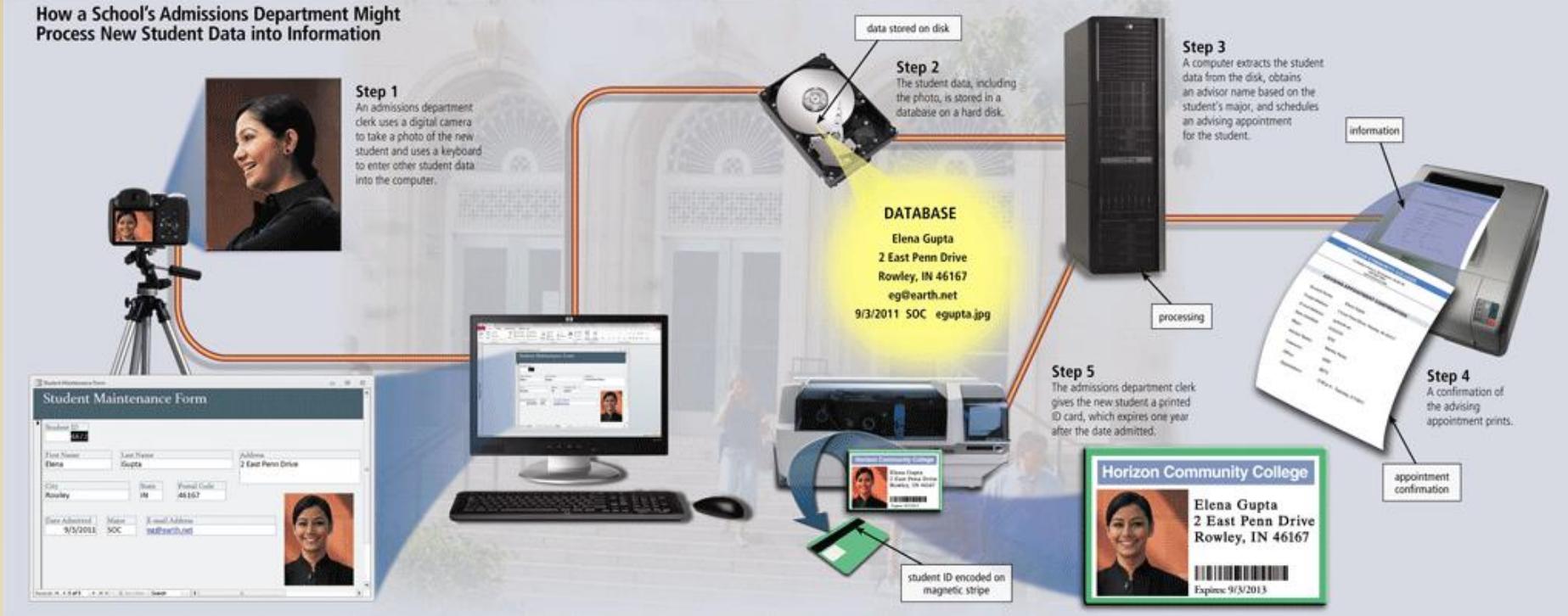
- Collection of unprocessed items
  - Text
  - Numbers
  - Images
  - Audio
  - Video

## Information

- Processed data
  - Documents
  - Audio
  - Images
  - Video

# Databases, Data, and Information

How a School's Admissions Department Might Process New Student Data into Information



# Databases, Data, and Information

- **Database software**, often called a **database management system (DBMS)**, allows users to:



Create a computerized database



Add, modify, and delete data



Sort and retrieve data



Create forms and reports from the data

# Databases, Data, and Information

- Data integrity identifies the quality of the data
- Garbage in, garbage out (GIGO) points out the accuracy of a computer's output depends on the accuracy of the input

# Databases, Data, and Information

- Valuable information should have the following characteristics:

Accurate

Verifiable

Timely

Organized

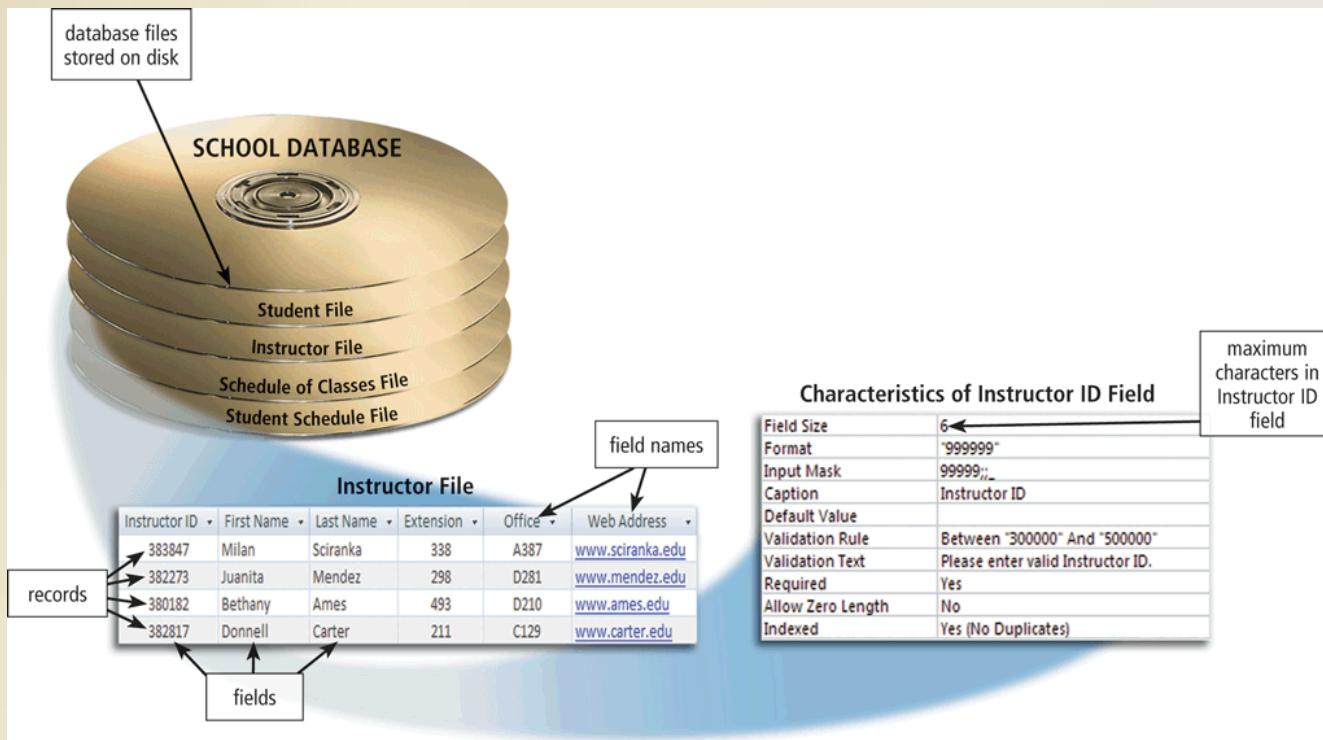
Accessible

Useful

Cost-  
effective

# The Hierarchy of Data

- Data is organized in layers
  - Files, records, fields, characters



# The Hierarchy of Data

- A **character** is one byte
  - Numbers, letters, space, punctuation marks, or other symbols
- A **field** is a combination of one or more related characters
  - **Field name**
  - **Field size**
  - **Data type**

The diagram illustrates the hierarchy of data types. At the top level, there are two tables: 'Instructor file' and 'Student file'. Arrows point from both tables to a central box labeled 'data types'. The 'Instructor file' table contains six fields: Instructor ID (Text), First Name (Text), Last Name (Text), Extension (Number), Office (Text), and Web Address (Hyperlink). The 'Student file' table contains twelve fields: Student ID (AutoNumber), First Name (Text), Last Name (Text), Address (Text), City (Text), State (Text), Postal Code (Number), E-mail Address (Hyperlink), Date Admitted (Date/Time), Major (Text), and Photo (Attachment).

Instructor file	
Instructor ID	Text
First Name	Text
Last Name	Text
Extension	Number
Office	Text
Web Address	Hyperlink

Student file	
Student ID	AutoNumber
First Name	Text
Last Name	Text
Address	Text
City	Text
State	Text
Postal Code	Number
E-mail Address	Hyperlink
Date Admitted	Date/Time
Major	Text
Photo	Attachment

# The Hierarchy of Data

- Common data types include:

Text

Numeric

AutoNumber

Currency

Date

Memo

Yes/No

Hyperlink

Object

Attachment

# The Hierarchy of Data

- A **record** is a group of related fields
  - A **primary key** uniquely identifies each record
- A **data file** is a collection of related records

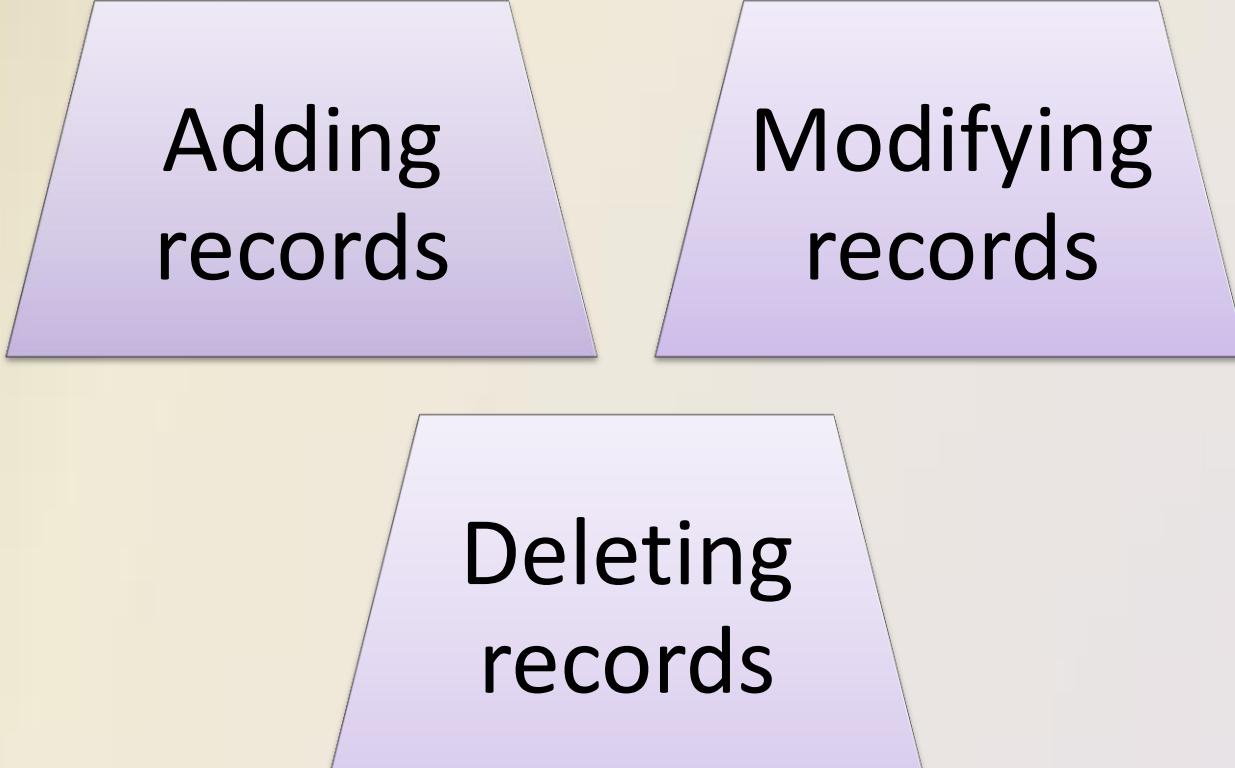
Address	City	State	Postal Code	E-mail Address	Date Admitted	Major	Photo
54 Lucy Court	Charlestown	IN	46176		6/10/2010	EE	mbrewer.jpg
33 Timmons Place	Bonner	IN	45208	<a href="mailto:lou@world.com">lou@world.com</a>	8/9/2010	BIO	ldrake.jpg
99 Tenth Street	Sheldon	IN	46033		10/8/2010	CT	aruiz.jpg
2204 Elm Court	Rowley	IN	46167	<a href="mailto:tu@indi.net">tu@indi.net</a>	11/6/2010	GEN	btu.jpg



fields

# Maintaining Data

- **File maintenance** refers to the procedures that keep data current



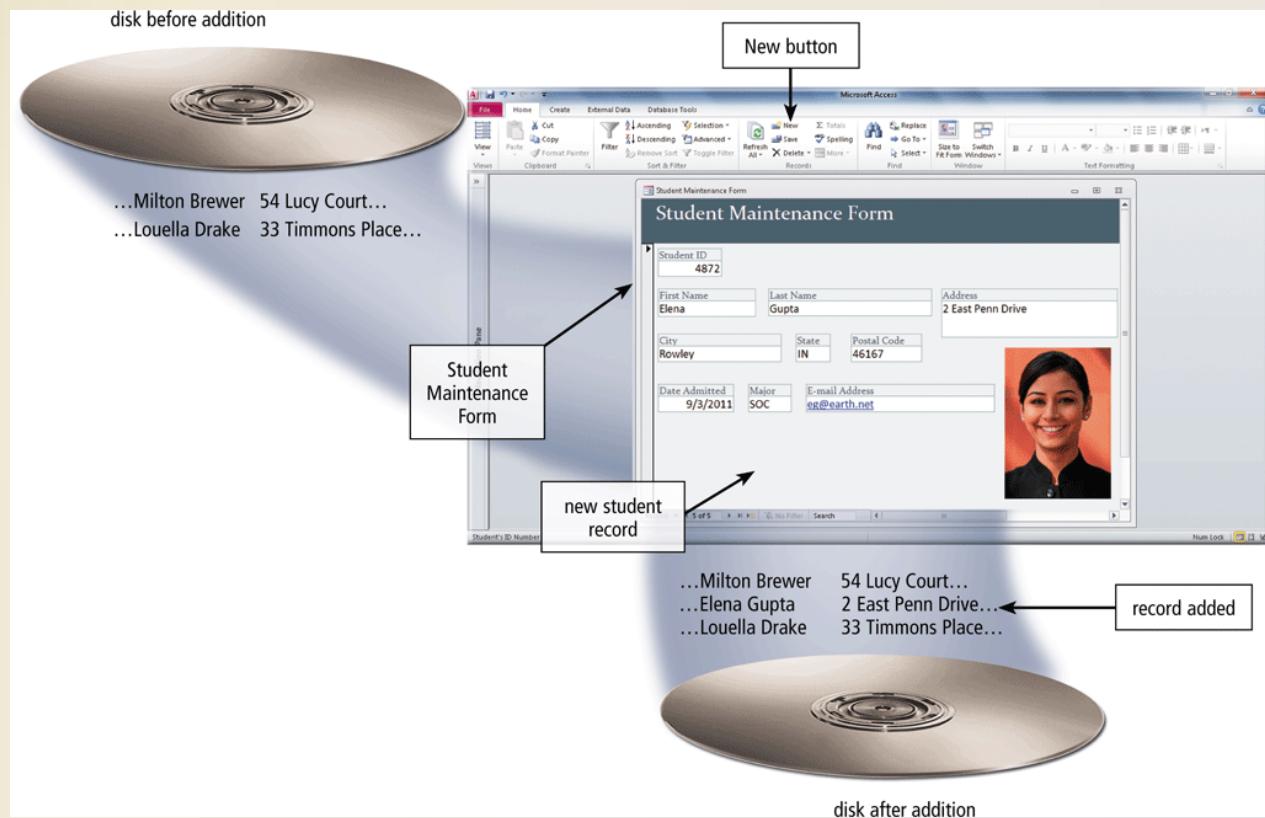
Adding  
records

Modifying  
records

Deleting  
records

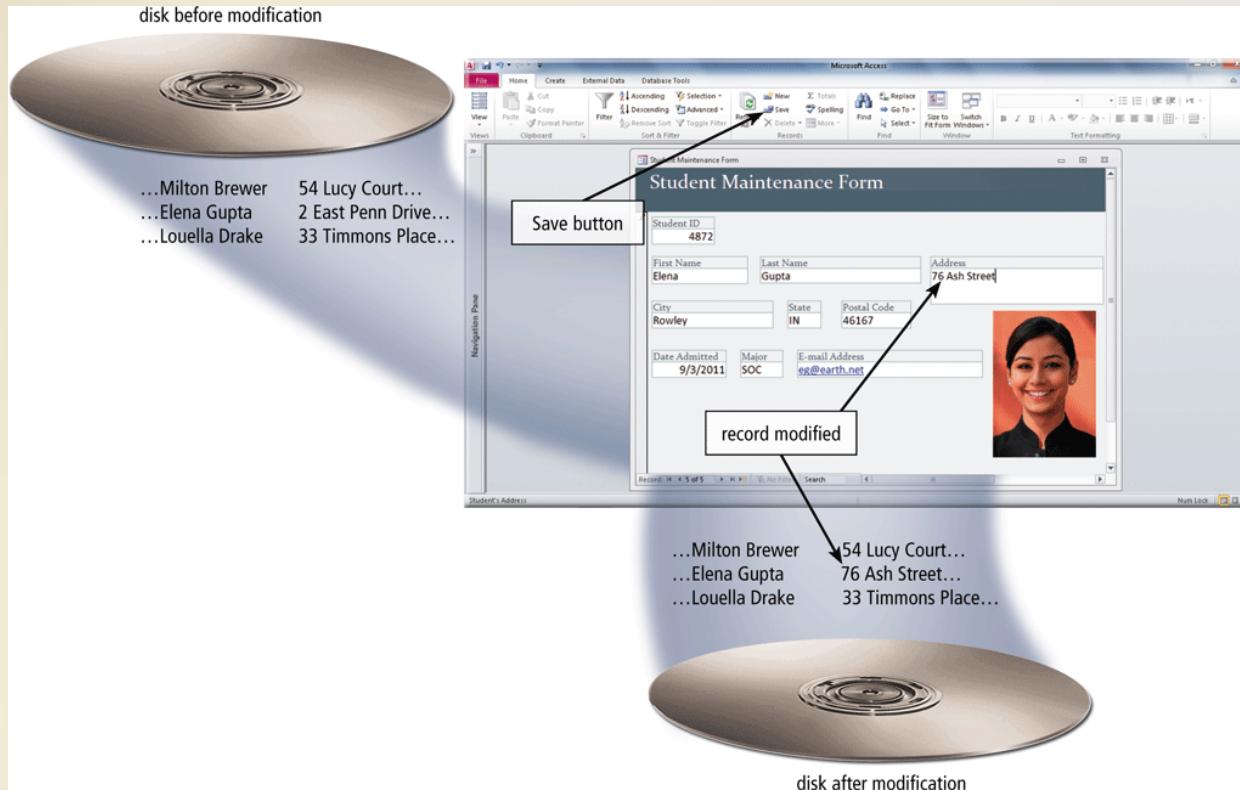
# Maintaining Data

- Users add new records to a file when they obtain new data



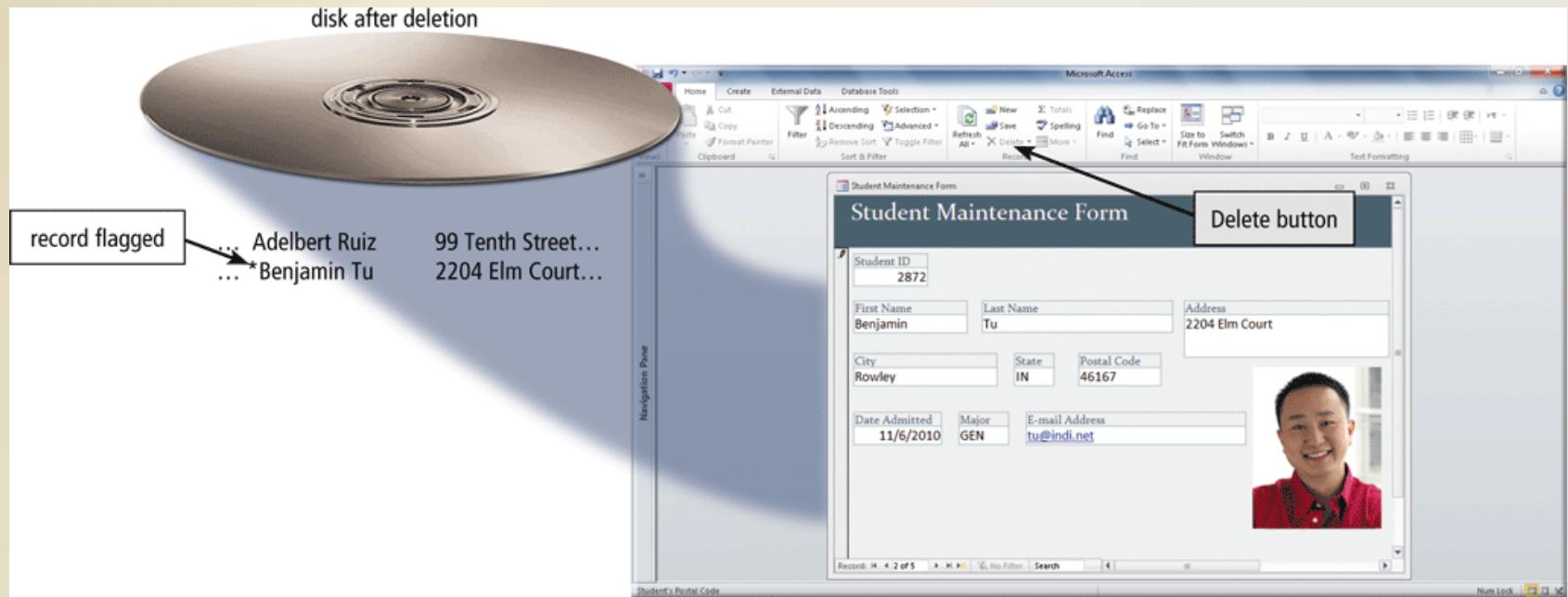
# Maintaining Data

- Users modify a record to correct inaccurate data or update old data



# Maintaining Data

- When a record no longer is needed, a user deletes it from a file



# Maintaining Data

- **Validation** compares data with a set of rules or values to find out if the data is correct

Alphabetic/Numeric check

Range check

Consistency check

Completeness check

Check digit

Other checks

# File Processing Versus Databases

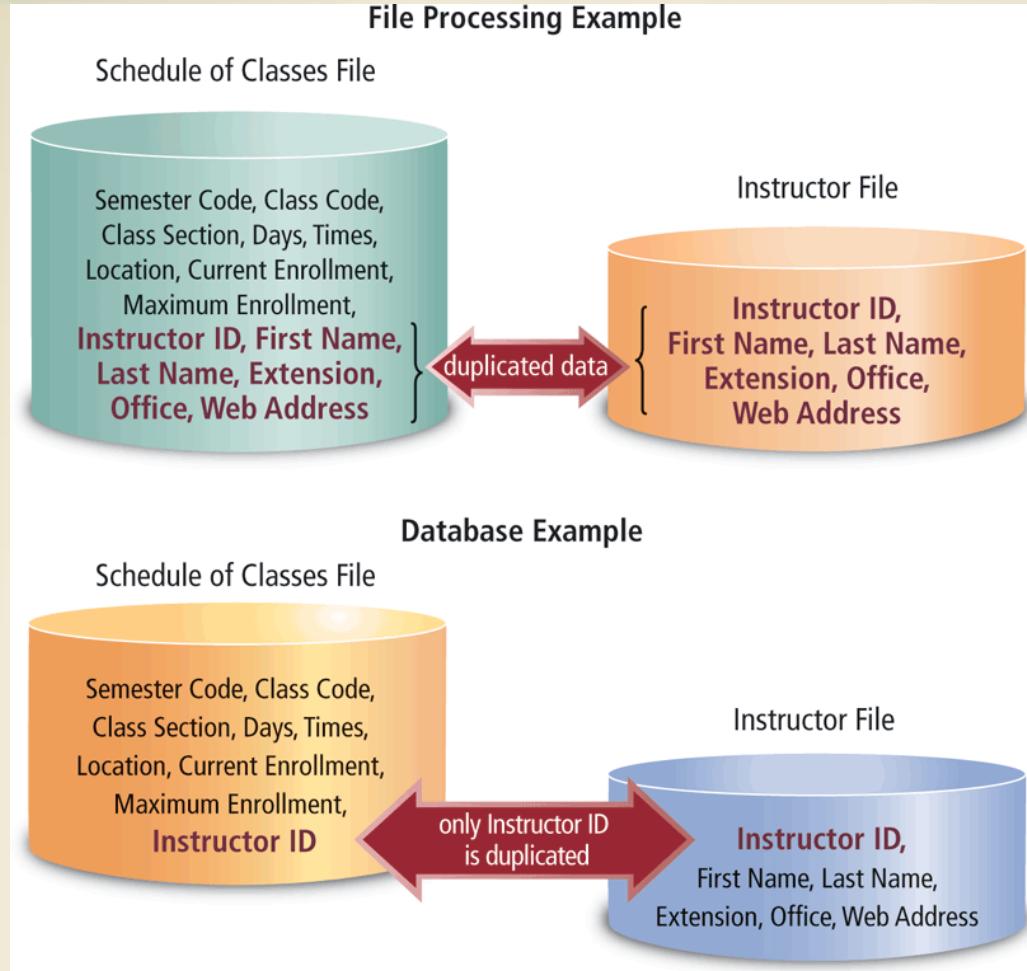
## File processing system

- Each department has its own set of files
- Used for many years
- Have data redundancy
- Isolate data

## Database approach

- Programs and users share data
- Reduce data redundancy
- Improve data integrity
- Share data
- Allows easier access
- Reduces development time
- Can be more vulnerable

# File Processing Versus Databases



# Database Management Systems

Popular Database Management Systems		
Database	Manufacturer	Computer Type
Access	Microsoft Corporation	Personal computer, server, mobile devices
Adabas	Software AG	Server, mainframe
D <sup>3</sup>	Raining Data	Personal computer, server
DB2	IBM Corporation	Personal computer, server, mainframe
Essbase	Oracle Corporation	Personal computer, server, mobile devices
FastObjects	Versant Corporation	Personal computer, server
FileMaker	FileMaker, Inc.	Personal computer, server
GemFire	GemStone Systems	Server
Informix	IBM Corporation	Personal computer, server, mainframe
Ingres	Ingres Corporation	Personal computer, server, mainframe
InterBaseSMP	Embarcadero Technologies	Personal computer, server
KE Express	KE Software, Inc.	Personal computer, server
MySQL	Oracle Corporation	Personal computer, server
ObjectStore	Progress Software Corporation	Personal computer, server
Oracle Database	Oracle Corporation	Personal computer, server, mainframe, mobile devices
SQL Server	Microsoft Corporation	Server, personal computer
SQL Server Compact Edition	Microsoft Corporation	Mobile devices
Sybase	Sybase Inc.	Personal computer, server, mobile devices
Teradata Database	Teradata	Server
Versant	Versant Corporation	Personal computer, server
Visual FoxPro	Microsoft Corporation	Personal computer, server

# Database Management Systems

- A **data dictionary** contains data about each file in the database and each field in those files

fields in Student file			
Field Name	primary key	Data Type	Description
Student ID		AutoNumber	Student's ID Number
First Name		Text	Student's First Name
Last Name		Text	Student's Last Name
Address		Text	Student's Address
City		Text	City Student Lives
State		Text	State Student Lives
Postal Code		Text	Student's Postal Code
E-mail Address		Hyperlink	Student's E-mail
Date Admitted		Date/Time	Date Student Admitted to School
Major		Text	Student's Major Code
Photo		Attachment	Digital Photo of Student

Diagram illustrating the data dictionary for the 'Student' file:

- Primary Key:** The 'Student ID' field is highlighted as the primary key.
- Field Name:** The 'State' field is highlighted, with a callout pointing to its entry in the table.
- Data Type:** The 'Text' data type for the 'State' field is highlighted, with a callout pointing to the 'Field Properties' dialog.
- Default Value:** The 'IN' value in the 'Default Value' dropdown for the 'State' field is highlighted, with a callout pointing to the 'Field Properties' dialog.
- Metadata about State field:** A callout points to the 'Field Properties' dialog, which contains detailed information about the 'State' field, including its length (2), validation rule ('State'), and required status (Yes).

# Database Management Systems

- A DBMS provides several tools that allow users and programs to retrieve and maintain data in the database

Query language

Query by example

Form

Report generator

# Database Management Systems

- A **query language** consists of simple, English-like statements that allow users to specify the data to display, print, or store
- **Query by example (QBE)** provides a GUI to assist users with retrieving data

# Database Management Systems

**How to Use the Simple Query Wizard**

**Step 1** → Select the fields from the Available Fields list you want to be displayed in the resulting query.

**Step 2** Assign a name to the query, so that you can open it later.

**Step 3** ← View the query results on the screen.

The figure illustrates the use of the Simple Query Wizard through three steps:

- Step 1:** The "Simple Query Wizard" dialog shows the "Available Fields list" (containing Student ID, Address, City, State, Postal Code, Date Admitted, Major, Photo) being moved to the "Selected Fields" list (containing First Name, Last Name, E-mail Address). A callout box points to the "query language statement generated by wizard" which is displayed as: `SELECT FIRST NAME, LAST NAME, E-MAIL ADDRESS FROM STUDENT`.
- Step 2:** The "Simple Query Wizard" dialog shows the query titled "Student E-Mail Addresses". It includes options to "Open the query to view information" or "Modify the query design".
- Step 3:** The "Student E-Mail Addresses" query results are displayed in a table, showing five records:

First Name	Last Name	E-mail Address
Milton	Brewer	<a href="mailto:tu@indi.net">tu@indi.net</a>
Benjamin	Tu	<a href="mailto:lou@world.com">lou@world.com</a>
Louella	Drake	<a href="mailto:eg@earth.net">eg@earth.net</a>
Adelbert	Ruiz	
Elena	Gupta	

# Database Management Systems

- A **form** is a window on the screen that provides areas for entering or modifying data in a database

The screenshot shows a Windows Internet Explorer window with the title "DeVry Online Focus Site - Windows Internet Explorer". The address bar displays the URL "http://www.devryonlinedegrees.com/7x/form.jsp". The page content features a banner image of a woman sitting on a beach chair using a laptop, with the text "DeVry University" and "You've just completed the first step toward your online degree from DeVry.". To the right of the banner is a red-bordered form titled "The Last Step...". The form contains fields for First Name, Last Name, Street Address, City, State (a dropdown menu), Zip/Postal Code, Country (a dropdown menu), Primary Phone, Email Address, and a checkbox for "Are you an active member of the Military?". A red "Submit" button is at the bottom of the form.

# Database Management Systems

- A **report generator** allows users to design a report on the screen, retrieve data into the report design, and then display or print the report

Student List by Major						
Major	Last Name	Student ID	First Name	Address	City	Date Admitted
<b>BIO</b>						
	Drake	3876	Louella	33 Timmons Place	Bonner	8/9/2010
<b>CT</b>						
	Ruiz	3928	Adelbert	99 Tenth Street	Sheldon	10/8/2010
<b>GEN</b>						
	Tu	2928	Benjamin	2204 Elm Court	Rowley	9/4/2010
<b>SOC</b>						
	Brewer	2295	Milton	54 Lucy Court	Charlestown	6/10/2010
	Gupta	4872	Elena	76 Ash Street	Rowley	9/3/2011

# Database Management Systems

A DBMS provides means to ensure that only authorized users access data at permitted times

- Access privileges
- Principle of least privilege

# Database Management Systems

- A DMBS provides a variety of techniques to restore the database to a usable form in case it is damaged or destroyed

Backup

Log

Recovery  
utility

Continuous  
backup

# Database Management Systems

Student ID 4872	First Name Elena	Last Name Gupta	Address 2 East Penn Drive
City Rowley	State IN	Postal Code 46167	
Date Admitted 9/3/2011	Major SOC	E-mail Address eg@earth.net	

**Address**  
**76 Ash Street**

Student ID 4872	First Name Elena	Last Name Gupta	Address 76 Ash Street
City Rowley	State IN	Postal Code 46167	
Date Admitted 9/3/2011	Major SOC	E-mail Address eg@earth.net	

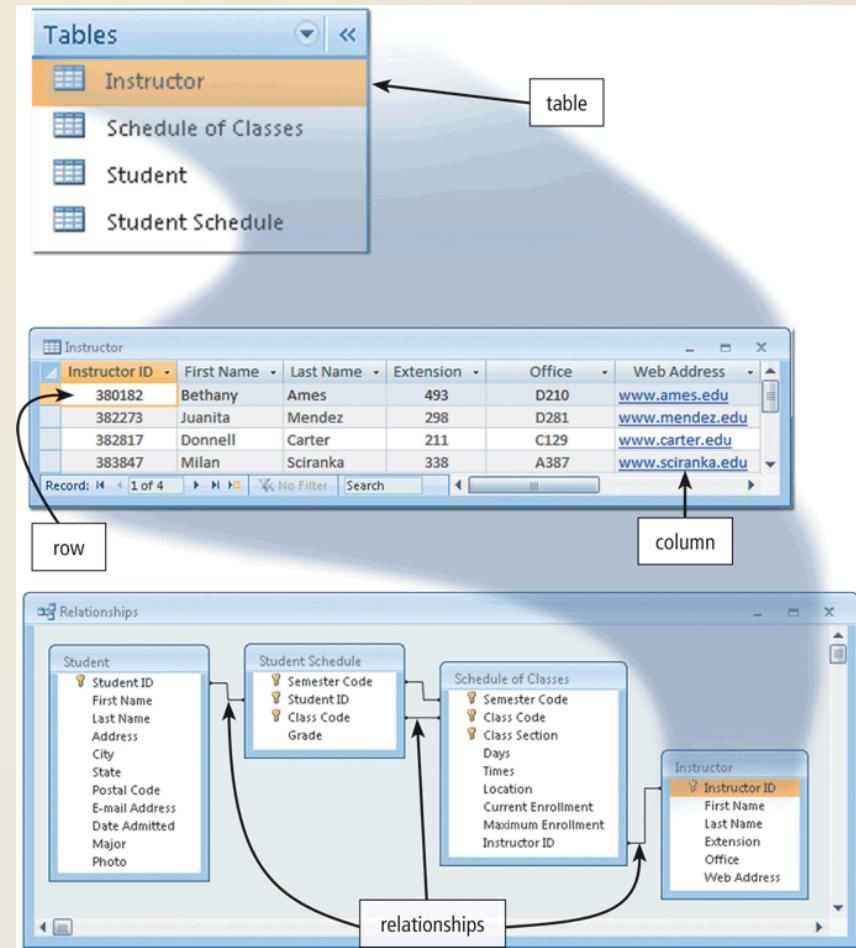
# Relational, Object-Oriented, and Multidimensional Databases

- A **data model** consists of rules and standards that define how the database organizes data

Data Models for Popular DBMSs					
Data Model	Popular DBMSs		Data Model	Popular DBMSs	
Relational	Access Adabas FileMaker Informix Ingres InterBase MySQL	SQL Server Sybase Teradata	Object-relational	DB2 Oracle Polyhedra PostgreSQL Visual FoxPro Teradata	
Object-oriented	FastObjects GemFire KE Texpress	ObjectStore Versant	Multi-dimensional	D <sup>3</sup> Essbase	Oracle Express Edition

# Relational, Object-Oriented, and Multidimensional Databases

- A **relational database** stores data in **tables** that consist of rows and columns
  - Each **row** has a primary key
  - Each **column** has a unique name
- A **relationship** is a link within the data



# Relational, Object-Oriented, and Multidimensional Databases

- **Structured Query Language (SQL)** is a query language that allows users to manage, update, and retrieve data

```
SELECT CLASS_TITLE, CLASS_CODE, MAXIMUM_ENROLLMENT -  
    CURRENT_ENROLLMENT AS SEATS_Remaining  
FROM SCHEDULE_OF_CLASSES, CLASS_CATALOG  
WHERE SCHEDULE_OF_CLASSES.CLASS_CODE =  
    CLASS_CATALOG.CLASS_CODE  
ORDER BY CLASS_TITLE
```

Class Title	Class Section	Seats Remaining
Algebra 1	51	14
Art Appreciation	52	19
English Composition 1	02	5
Introduction to Sociology	01	14

# Relational, Object-Oriented, and Multidimensional Databases

- An **object-oriented database (OODB)** stores data in **objects**
- Examples of applications appropriate for an object-oriented database include:

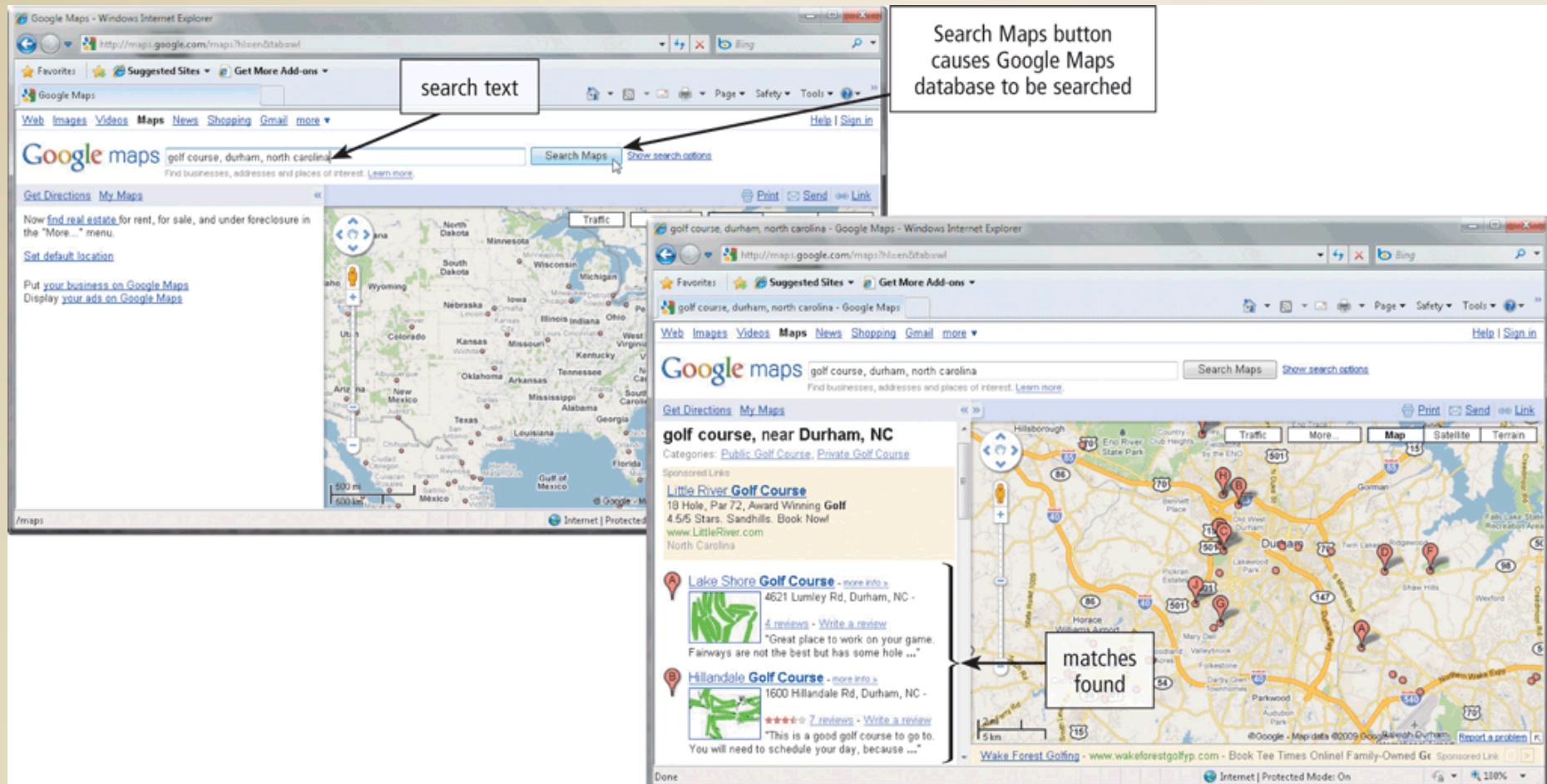
Multimedia  
database

Groupware  
database

Computer-  
aided design  
database

Hypertext  
database

# Relational, Object-Oriented, and Multidimensional Databases



# Relational, Object-Oriented, and Multidimensional Databases

- A **multidimensional database** can store data in more than two dimensions of data
  - Sometimes known as a hypercube
  - Can consolidate data much faster than a relational database
- A **data warehouse** is a huge database that stores and manages the data required to analyze historical and current transactions

# Web Databases

- Databases on the Web allow you to:

Shop for products or services

Buy or sell stocks

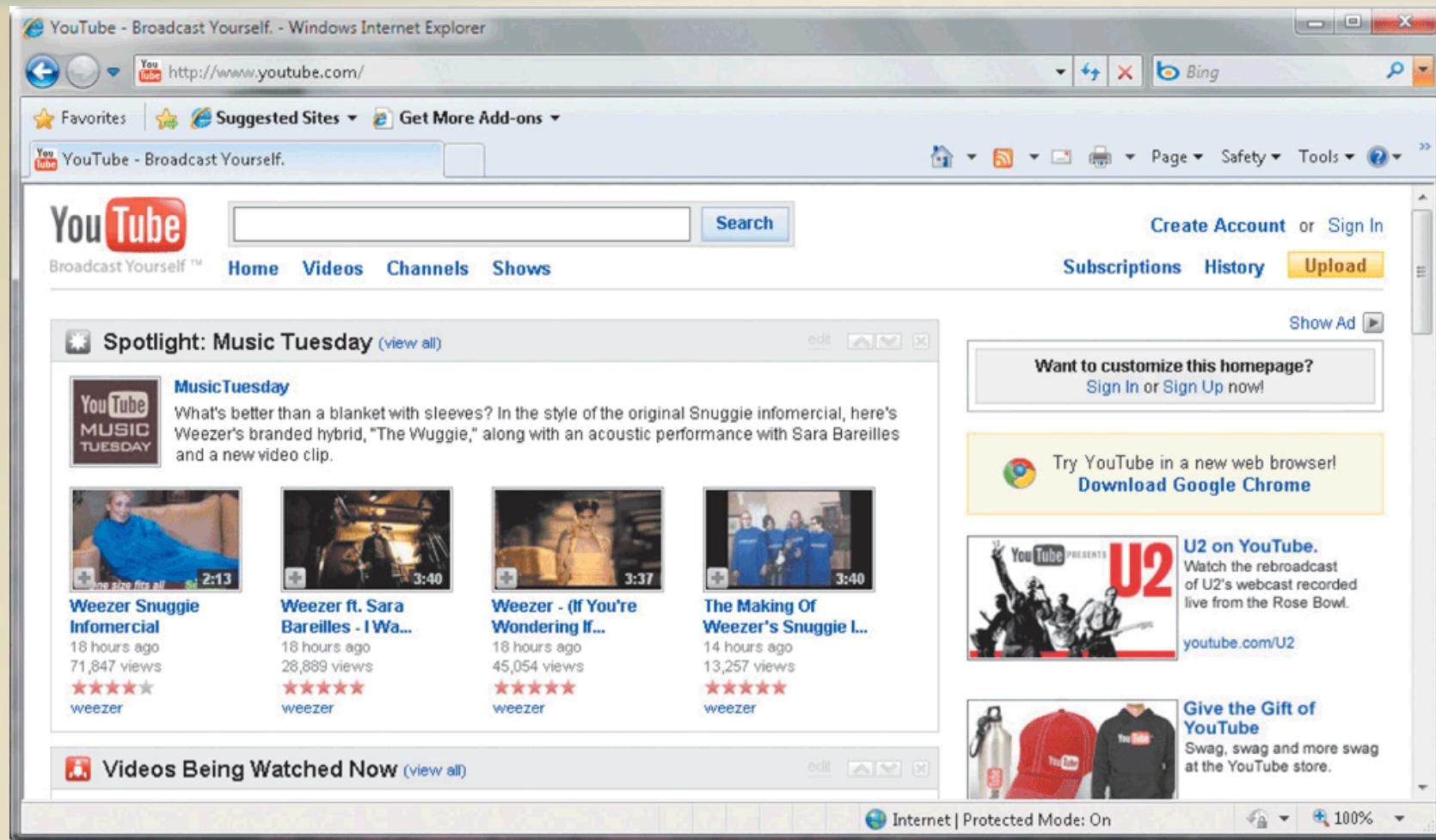
Search for a job

Make airline reservations

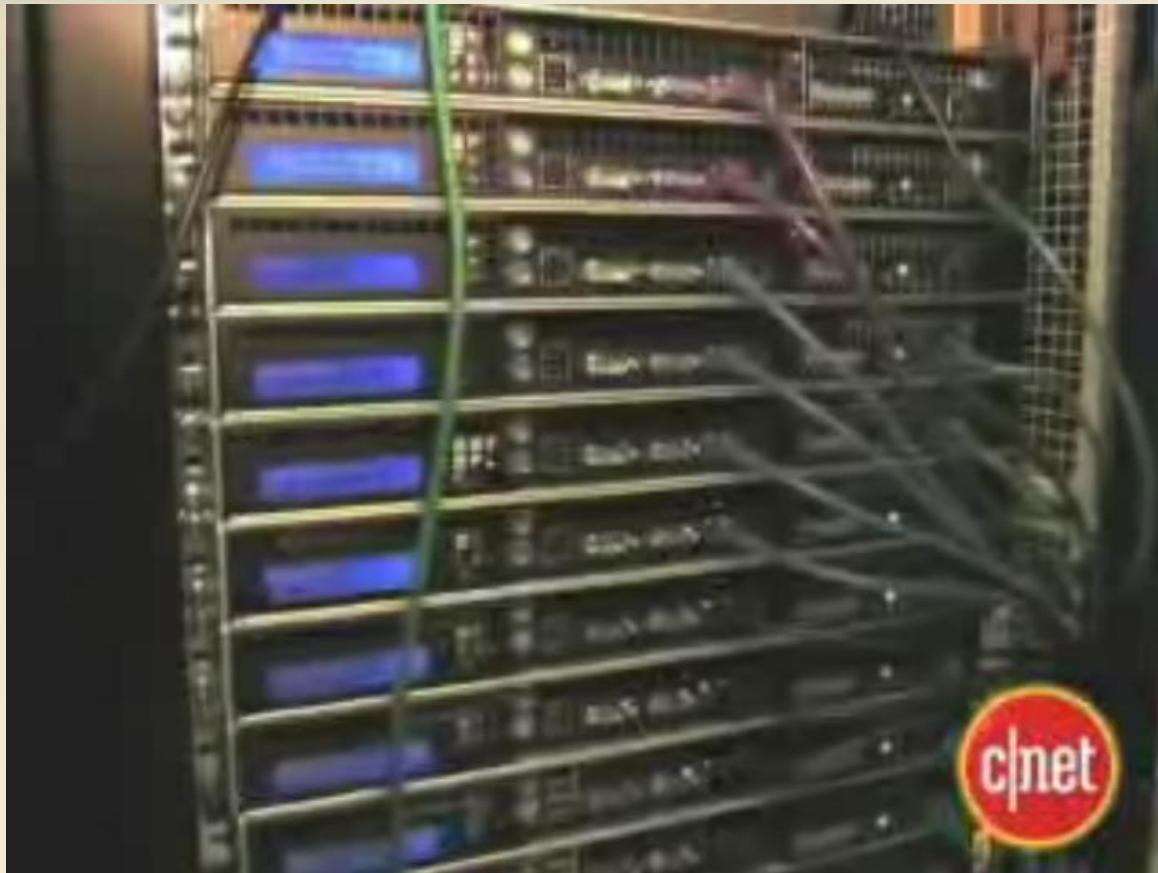
Register for college classes

Check semester grades

# Web Databases



# Video: How a Photo Sharing Site Keeps Its Data



[CLICK TO START](#)

# Database Administration

- It is important to have a carefully designed database

## Database Design Guidelines

1. Determine the purpose of the database.
2. Design the tables or files.
  - Design tables or files on paper first.
  - Each table or file should contain data about one subject. The Student table, for example, contains data about students.
3. Design the records and fields for each table or file.
  - Be sure every record has a unique primary key.
  - Use separate fields for logically distinct items. For example, a name could be stored in six fields: Title (Mr., Mrs., Dr., etc.), First Name, Middle Name, Last Name, Suffix (Jr., Sr., etc.), and Nickname.
  - Do not create fields for information that can be derived from entries in other fields. For example, do not include a field for Age. Instead, store the birth date and compute the age.
  - Allow enough space for each field.
  - Set default values for frequently entered data.
4. Determine the relationships among the tables or files.

# Database Administration

Database analysts and administrators are responsible for managing and coordinating all database activities

## **Database Analyst (DA)**

Decides on proper field placement, defines data relationship, and identifies users' access privileges

## **Database Administrator (DBA)**

Creates and maintains the data dictionary, manages security, monitors performance, and checks backup and recovery procedures

# Database Administration

- Employees should learn how to use the data in the database effectively
  - Interact with database
  - Identify new data for the database
  - Maintain the database



# Summary

How data and information are valuable assets to an organization

Methods for maintaining high-quality data

Assessing the quality of valuable information

Advantages of organizing data in a database

Various types of databases

Roles of the database analysts and administrators

# **Database Management**

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**Chapter 10 Complete**

