

Lecture 10

Database Management Systems
&
Dynamic Web Page Content

Outline Part 1

- Database Management Systems (DBMS)
 - Database
 - Tables or relation
 - Row or Record
 - Column or Field
 - Data Types
 - Keys
 - SQL
 - Joining information from different tables
 - Database Systems

Outline Part 2

- Dynamic Web Page Content
 - Introduction
 - Benefits vs. Shortcomings
 - Applications
 - Examples

Introduction to Database Management Systems (DBMS)

- A software interface between the **database** and the user.
- Controls the organization, storage, management, and retrieval of data in a **database**

Introduction to Database Management Systems (DBMS)

- Examples

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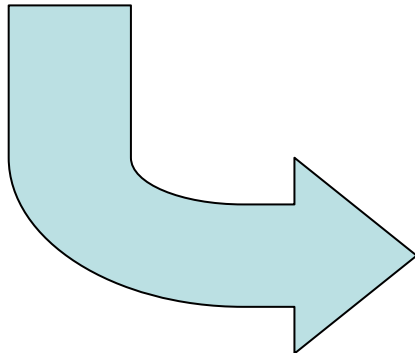
Database

- Is a tool for storing and manipulating information efficiently and effectively
- A Database combines the physical layout of **tables** and the stored data.
- Types
 - Relational databases
 - Object-oriented databases

Database

- Example

Name	Address	Phone	Email
Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
Daniel Petersson	Kristian IV:s väg 3		daniel@assistingystems.se
Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se



The screenshot displays the Microsoft Access interface. The main window shows a table named 'Customer' with the following data:

ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se
*	(AutoNumber)			

Overlaid on the right is a 'Customer List' form. It contains a list of input fields for each customer's details, including Name, Address, Phone, and Email. The form is currently displaying the details for 'Andreas Persson'.

Tables or relation

- A data structure characterized by **rows or records** and **columns or fields**
- Holds the information on one subject
- Table or Relation

Attributes
Fields
Columns

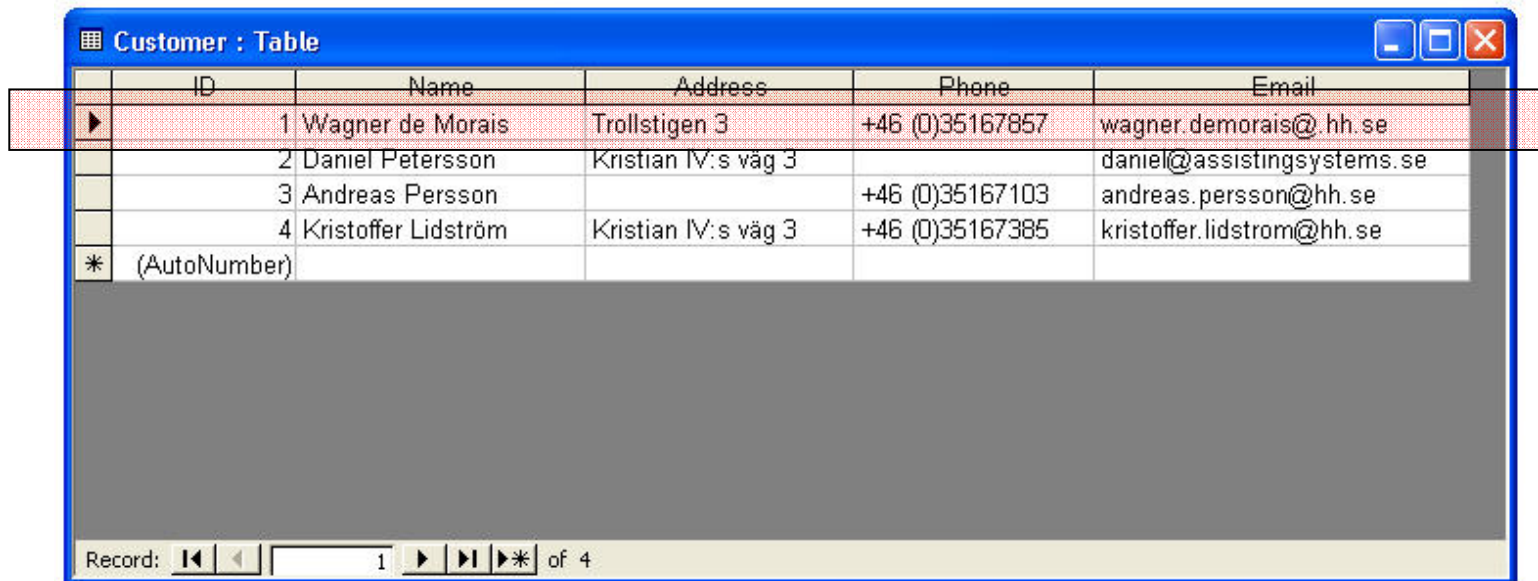
Heading
Tuples
Records
Rows

ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingsystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se
*	(AutoNumber)			

Body

Row or Record

- Set of data values aligned horizontally in a table
- Data structure that is a collection of **fields**, each with its own name and **type**

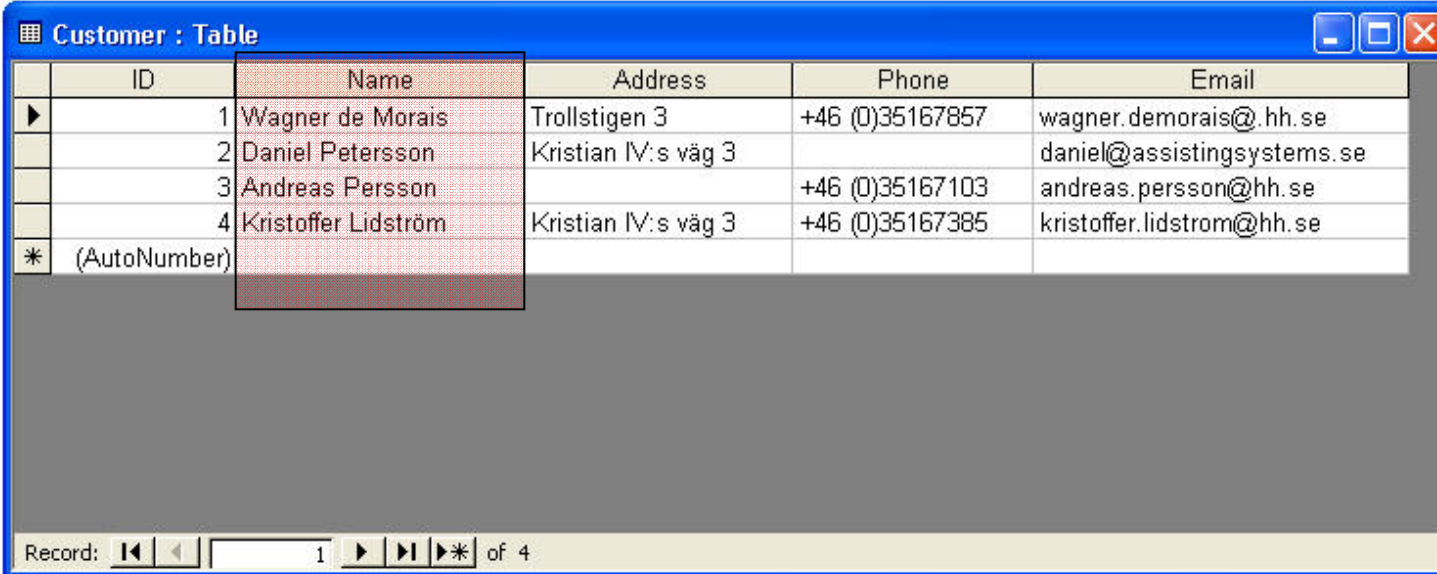


ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingsystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se
*	(AutoNumber)			

Record: 1 of 4

Column or Field

- Collection of column values that form the description of a particular row.
- A location in a record in which a particular **type of data** is stored



The screenshot shows a database window titled "Customer : Table" with a table containing 4 records. The columns are ID, Name, Address, Phone, and Email. The "Name" column is highlighted with a red box. The table data is as follows:

ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingsystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se

At the bottom of the window, there is a record navigation bar showing "Record: 1 of 4".

Data Types

Data Type	Use	Size
Text	Text , postal codes, phone numbers	Up to 255 characters
Memo	Long texts, such as notes	64.000 characters
Number	Numeric data to be used for mathematical calculations, except calculations involving money	1, 2, 4, or 8 bytes
Currency	Currency values	8 bytes
Date/Time	Dates and times	8 bytes
AutoNumber	Unique sequential (incrementing by 1) or random numbers automatically inserted when a record is added	4 bytes
Yes/No	Fields that will contain only one of two values, such as Yes/No, True/False, On/Off	1 bit

Data Types

- Example

The screenshot shows the 'Customer : Table' design view in Microsoft Access. The table structure is as follows:

Field Name	Data Type	Description
ID	AutoNumber	
Name	Text	
Address	Text	
Phone	Text	
Email	Text	
City	Text	

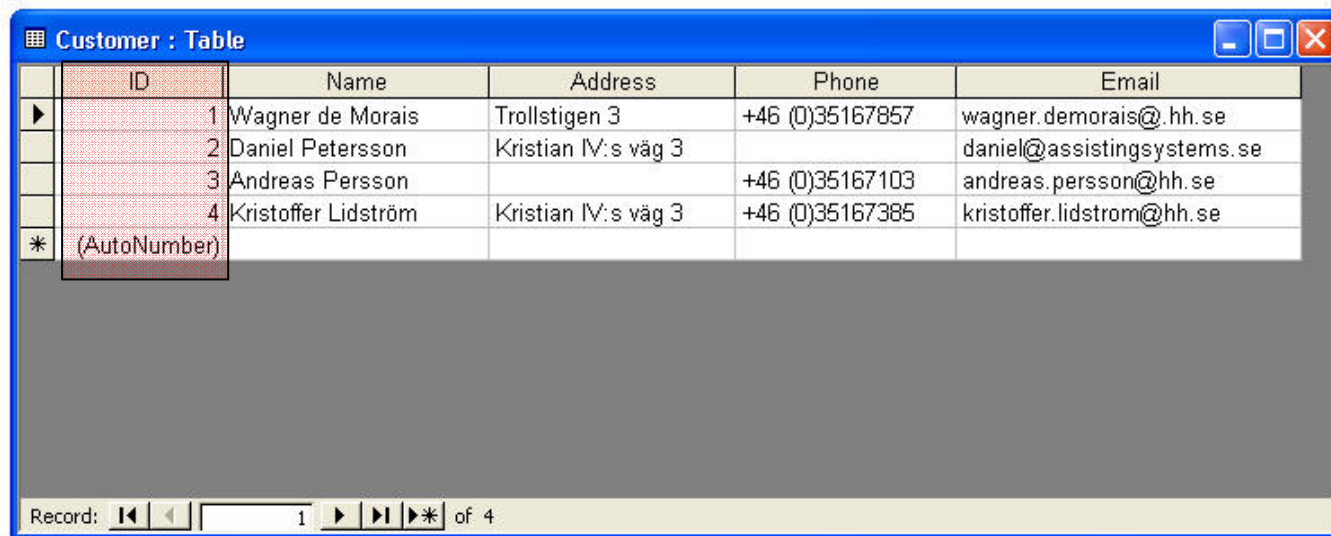
The 'City' field's data type dropdown menu is open, showing the following options: Text, Memo, Number, Date/Time, Currency, AutoNumber, Yes/No, OLE Object, Hyperlink, and Lookup Wizard...

The 'Field Properties' pane is visible below the table, with the 'Lookup' tab selected. The 'Field Size' property is set to 50. Other properties include Format, Input Mask, Caption, Default Value, Validation Rule, Validation Text, Required (No), Allow Zero Length (Yes), Indexed (No), Unicode Compression (Yes), IME Mode (No Control), and IME Sentence Mode (None).

A text box on the right side of the 'Field Properties' pane contains the following text: "The data type determines the kind of values that users can store in the field. Press F1 for help on data types."

Keys

- An identifier for a record or group of records
- Primary Key
 - Key field that serves as the unique identifier of a specific row or record



The screenshot shows a database window titled "Customer : Table". The table has five columns: ID, Name, Address, Phone, and Email. The ID column is highlighted in red, indicating it is the primary key. The data rows are as follows:

ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@.hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingsystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se

At the bottom of the window, there is a status bar that reads "Record: 1 of 4".

Keys

- Foreign keys
 - Referential constraint between two tables
 - The foreign key identifies a column or a set of columns in one (referencing) table that refers to a column or set of columns in another (referenced) table

	ID	Description	Color	Price
+	1	Rose	1	10,00 kr
+	2	Rose	2	15,00 kr
+	3	Tulip	3	50,00 kr
+	4	Tulip	4	50,00 kr
▶	(AutoNumber)		0	0,00 kr

Record: 5 of 5

	ID	Color
▶ +	1	White
+	2	Red
+	3	Pink
+	4	Yellow
*	(AutoNumber)	

Record: 1 of 5

SQL

- SQL (Structured Query Language)
 - Language used in querying, updating, and managing relational databases
 - Data Definition Language (DDL)
 - A language to define attributes and properties of a database, especially record layouts, field definitions, key fields, etc
 - Data Manipulation Language (DML)
 - A language that is used to insert, update and delete data in a database
 - Query
 - Operation to retrieve data from a databases, which is performed with the SELECT keyword

SQL examples

- Data Definition Language (DDL) example

```
CREATE TABLE Customers(  
  ID          Long,  
  Name        TEXT(50),  
  Address     TEXT(50),  
  Phone       TEXT(50),  
  Email       TEXT(50),  
  Constraint Customers_PK Primary Key (ID));
```

```
ALTER TABLE Customers ADD COLUMN City TEXT(25);
```


SQL examples

- Data Manipulation Language (DML) example

```
INSERT INTO Customers (Name, Address, Phone, Email)
VALUES ('Wagner de Morais', 'Trollstigen 3', '+46 (0)35167857',
'wagner.demorais@.hh.se')
```

```
INSERT INTO Customers ('Wagner de Morais', 'Trollstigen 3', '+46
(0)35167857', 'wagner.demorais@.hh.se')
```

```
UPDATE Customers SET Address = 'Laholmsvagan 4' WHERE ID
= 4
```

SQL examples

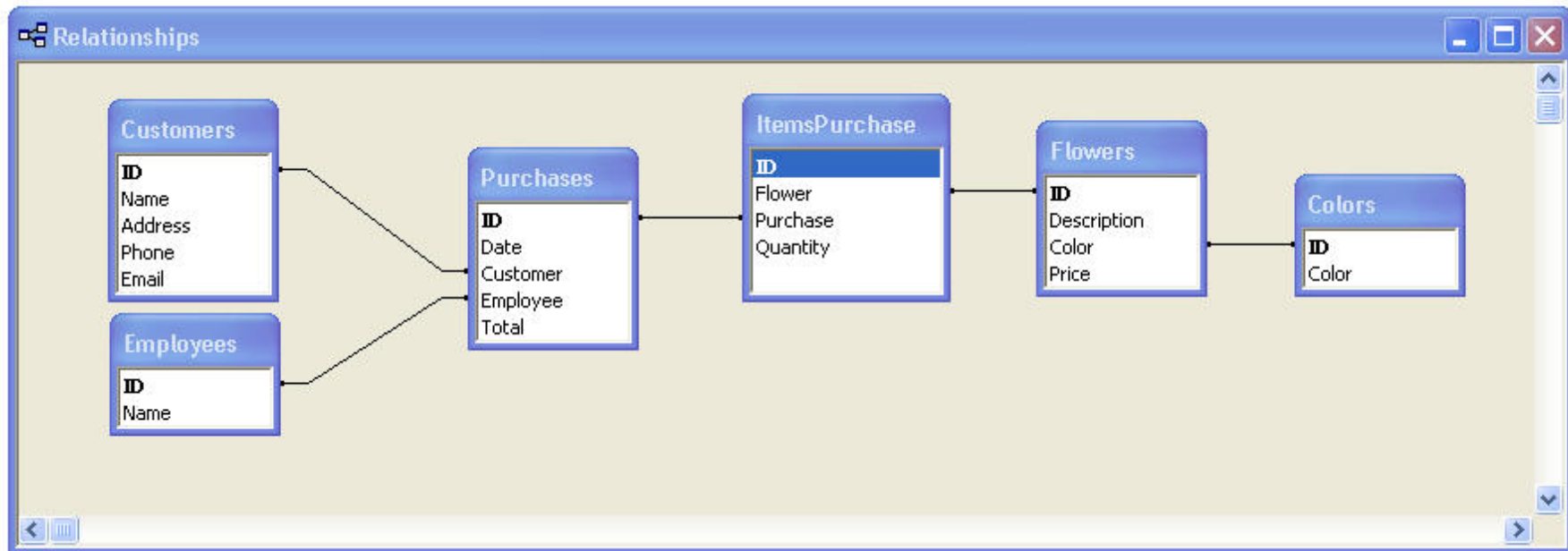
- Query example

```
SELECT Name, Address, Phone, Email FROM  
Customers
```

```
SELECT Name, Address, Phone, Email FROM  
Customers WHERE ID = 1
```

```
SELECT * FROM Customers
```

iFlower Database Model



iFlower Database Tables and Data

Customers : Table

ID	Name	Address	Phone	Email
1	Wagner de Morais	Trollstigen 3	+46 (0)35167857	wagner.demorais@hh.se
2	Daniel Petersson	Kristian IV:s väg 3		daniel@assistingsystems.se
3	Andreas Persson		+46 (0)35167103	andreas.persson@hh.se
4	Kristoffer Lidström	Kristian IV:s väg 3	+46 (0)35167385	kristoffer.lidstrom@hh.se

Record: 1 of 4

Employees : Table

ID	Name
1	Eve
2	Alice
3	Bob

Record: 1

Flowers : Table

ID	Description	Color	Price
1	Rose	1	10,00 kr
2	Rose	2	15,00 kr
3	Tulip	3	50,00 kr
4	Tulip	4	50,00 kr
0		0	0,00 kr

Record: 5 of 5

Purchases : Table

ID	Date	Customer	Employee	Total
1	2008-10-03	1	1	100,00 kr
2	2008-10-03	4	1	45,00 kr
3	2008-10-04	1	3	300,00 kr
0		0	0	0,00 kr

Record: 4 of 4

Colors : Table

ID	Color
1	White
2	Red
3	Pink
4	Yellow

Record: 1

ItemsPurchase : Table

ID	Purchase	Flower	Quantity
1	1	1	10
2	2	1	2
3	2	2	2
4	3	1	10
5	3	2	10
6	3	3	1
0	0	0	0

Record: 7

Joining information from different tables

- Query

```
SELECT
```

```
    Purchases.Date,
```

```
    Customers.Name AS Customers_Name,
```

```
    Employees.Name AS Employees_Name,
```

```
    Purchases.Total
```

```
FROM Purchases, Employees, Customers
```

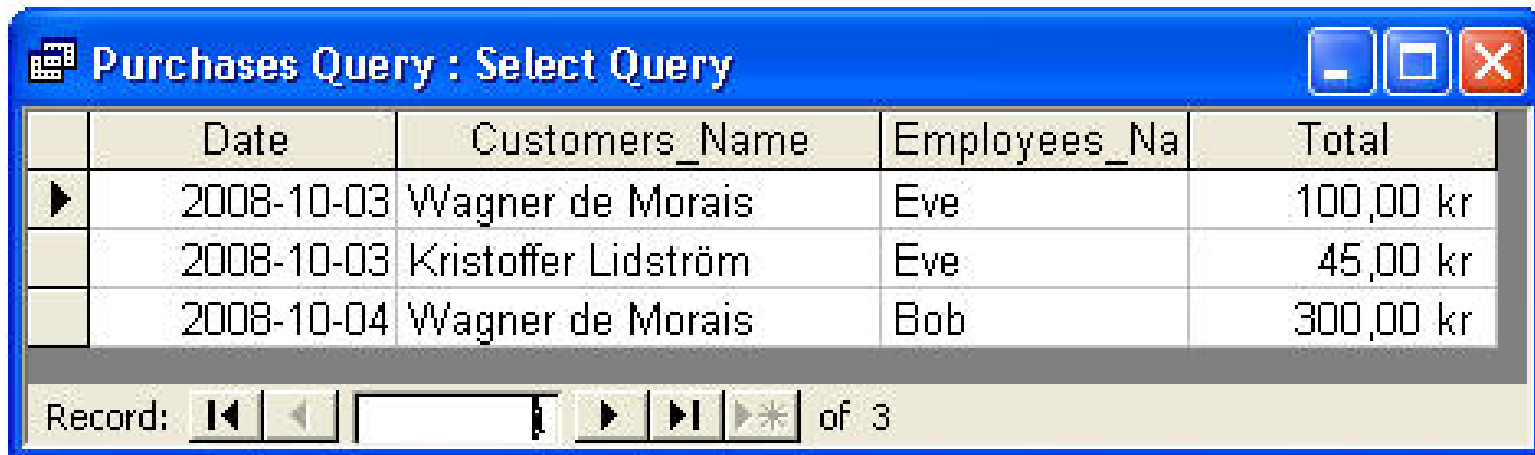
```
WHERE
```

```
    Customers.ID=Purchases.Customer AND
```

```
    Employees.ID=Purchases.Employee
```

Joining information from different tables

- Result

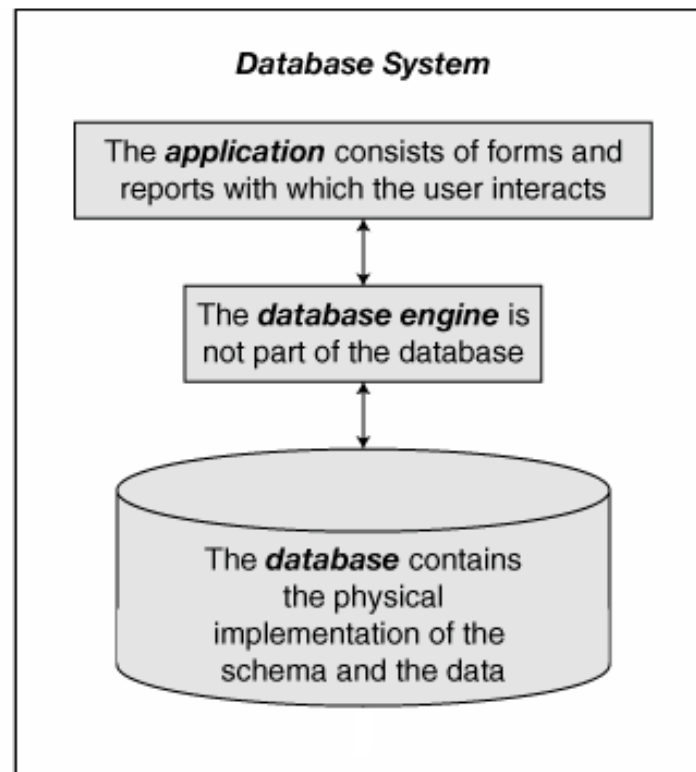


	Date	Customers_Name	Employees_Na	Total
▶	2008-10-03	Wagner de Morais	Eve	100,00 kr
	2008-10-03	Kristoffer Lidström	Eve	45,00 kr
	2008-10-04	Wagner de Morais	Bob	300,00 kr

Record: [Navigation icons] of 3

Database Systems

- Combination of the database application, database engine, and database



Database System Architecture

- 2 tiers
 - Client workstation
 - User interface, presentation logic, data processing logic, business rules logic
 - Database server:
 - Database storage, access, and processing
- 3 tiers
 - Client workstation
 - User interface
 - Application Server
 - Presentation logic, data processing logic, business rules logic
 - Database server:
 - Database storage, access, and processing

Dynamic Web Page Content

- Pages with the ability to change and update themselves dynamically
- Two ways to achieve dynamic content
 - Client-side scripting
 - Change interface behaviors within a specific web page, in response to mouse or keyboard actions or at specified timing events
 - Server-side scripting
 - Change the supplied page source between pages, adjusting the sequence or reload of the web pages or web content supplied to the browser

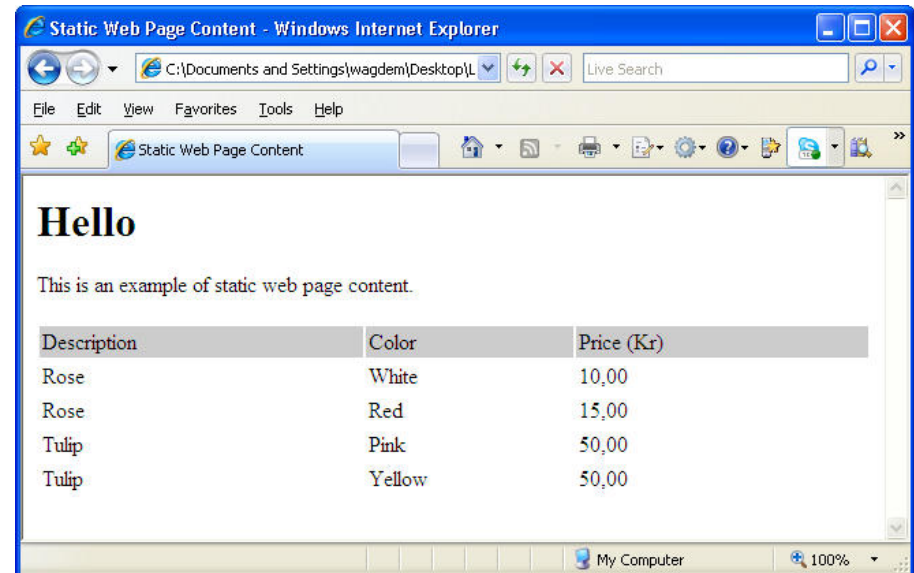
Static vs. Dynamic Web Page Content

- Static
 - Displays the same information for all users, from all contexts, providing the classical hypertext, where navigation is performed through "static" documents.
 - Advantages
 - Demonstrations
 - Disadvantages
 - Maintenance
 - Management
 - Personalization

Static vs. Dynamic Web Page Content

- **Static**

```
<HTML>
  <HEAD>
    <TITLE>
      Static Web Page Content
    </TITLE>
  </HEAD>
<BODY>
  <H1>Hello</H1>
  <P>This is an example of static web page
  content.</P>
  <TABLE CELLSPACING="2" WIDTH="100%">
    <TR>
      <TD
        BGCOLOR="#CCCCCC">Description</TD>
      <TD BGCOLOR="#CCCCCC">Color</TD>
      <TD BGCOLOR="#CCCCCC">Price
        (Kr)</TD>
    </TR>
    <TR>
      <TD>Rose</TD>
      <TD>White</TD>
      <TD>10,00</TD>
    </TR>
  </TABLE>
</BODY>
</HTML>
```



Server-side dynamic pages

- Dynamic
 - Web pages are not stored on the server in the same form as the user will view them
 - Web page content changes automatically
 - The web page code is constructed dynamically, piece by piece.
 - The web page content displayed varies based on certain criteria. The criteria may be pre-defined rules or may be based on variable user input.

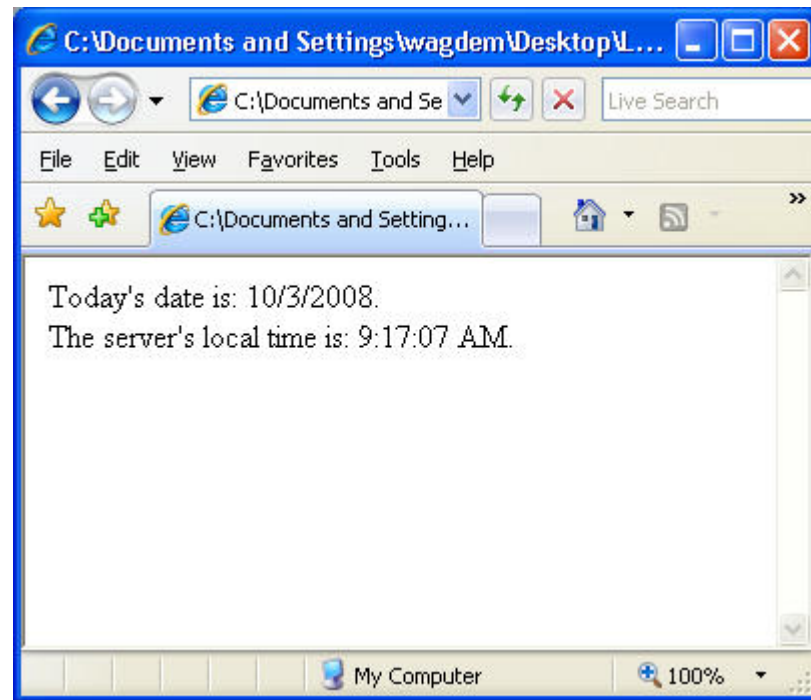
Server-side dynamic content

- Dynamic

```
<html>
  <body>

    Today's date is:
    <%response.write(date())%>.
    <br />
    The server's local time is:
    <%response.write(time())%>.

  </body>
</html>
```



ASP, PHP

- ASP (Active Server Pages)
 - Is a program that runs inside IIS (Internet Information Server)
 - An ASP file is just the same as an HTML file
 - An ASP file can contain text, HTML, XML, and scripts
 - Scripts in an ASP file are executed on the server
- HTML vs. ASP
 - When a browser requests an HTML file, the server returns the file
 - When a browser requests an ASP file, IIS passes the request to the ASP engine. The ASP engine reads the ASP file, line by line, and executes the scripts in the file. Finally, the ASP file is returned to the browser as plain HTML

ASP, PHP

- PHP (Hypertext Preprocessor)
 - Is a server-side scripting language, like ASP
 - PHP scripts are executed on the server
 - PHP is free to download and use
 - PHP files may contain text, HTML tags and scripts
 - PHP files are returned to the browser as plain HTML
 - PHP runs on different platforms (Windows, Linux, Unix, etc.)

Common Gateway Interface

- CGI
 - Specifies how server-side programs are called from the client
 - Server-side program can be anything:
 - Java
 - Perl
 - C/C++
- The web-server calls the local program, passes the input parameters and returns the output to the browser client

CGI, example



The screenshot shows a Mozilla Firefox browser window with the title "CGI web - Google Search - Mozilla Firefox". The address bar contains the URL "http://www.google.com/search?hl=en&q=CGI+web&btnG=Search". The search bar contains the text "CGI web" and a "Search" button. Below the search bar, there is a "Web" tab selected, and the search results for "CGI web" are displayed. The first result is "CGI - WebReference.com" with a description: "CGI programming; informational reasources and script repositories. From WebReference.com, the Webmaster's Reference Library." and a link to "www.webreference.com/programming/cgi.html - 42k - Cached - Similar pages".

File Edit View History Bookmarks Tools Help

http://www.google.com/search?hl=en&q=CGI+web&btnG=Search

Most Visited Kom igång Senaste nytt (en) THE LIST JAVA API SWT API

Web Images Maps News Shopping Gmail more

Google™ CGI web Search [Advanced Search](#) [Preferences](#)

Web

[Web / Programming / CGI - WebReference.com](#)
CGI programming; informational reasources and script repositories. From WebReference.com, the Webmaster's Reference Library.
www.webreference.com/programming/cgi.html - 42k - [Cached](#) - [Similar pages](#)

CGI, example

`http://www.google.com/search?hl=en&q=CGI+web&btnG=Search`

The server

The program

Input to the program

Language variable: `hl=en`

What we searched for: `q=CGI web`

Which button we clicked: `btnG=Search`

Client-side dynamic content

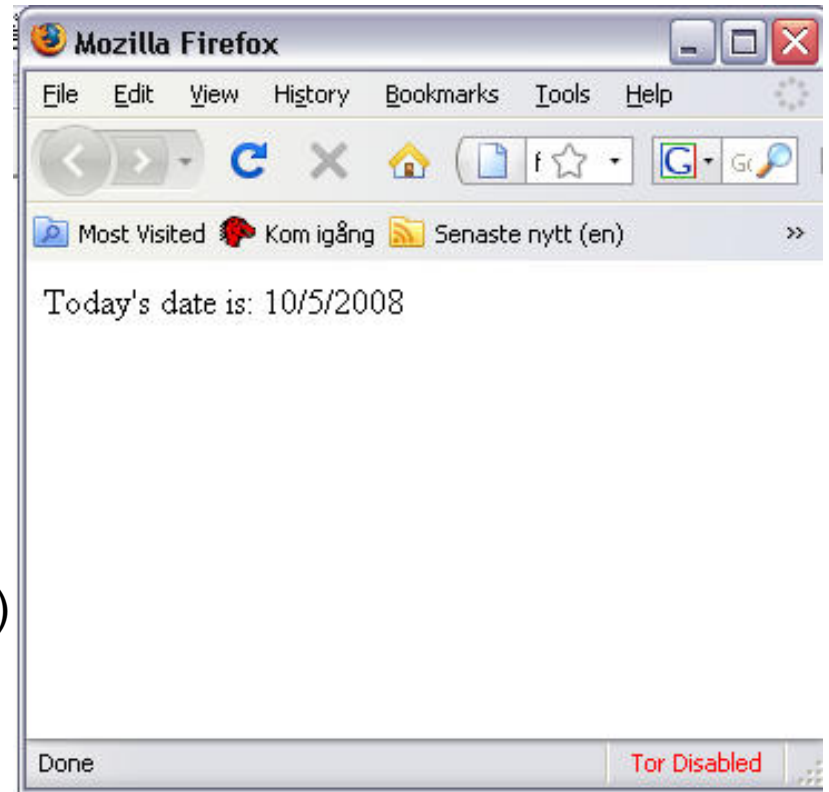
- The web page contains code that is executed on the client
- Advantages
 - Offloads server CPU
 - No/less communication with server
 - No special server setup
- Disadvantages
 - Code is sent to client
 - Client has to support the language used

Client-side languages

- JavaScript
- Java Applets
- Flash
- ActiveX Controls

JavaScript example

```
<html>
<body>
Today's date is:
<script type="text/javascript">
<!--
var currentTime = new Date()
var month = currentTime.getMonth() + 1
var day = currentTime.getDate()
var year = currentTime.getFullYear()
document.write(month + "/" + day + "/" + year)
//-->
</script>
</body>
</html>
```



Server-side + Client-side

- Execute some parts on the client
 - User-interface, etc.
- Use server for some parts
 - Database lookups etc.
- Example: Google Maps