Dr Greg Wadley

INFO90002 Database Systems & Information Modelling

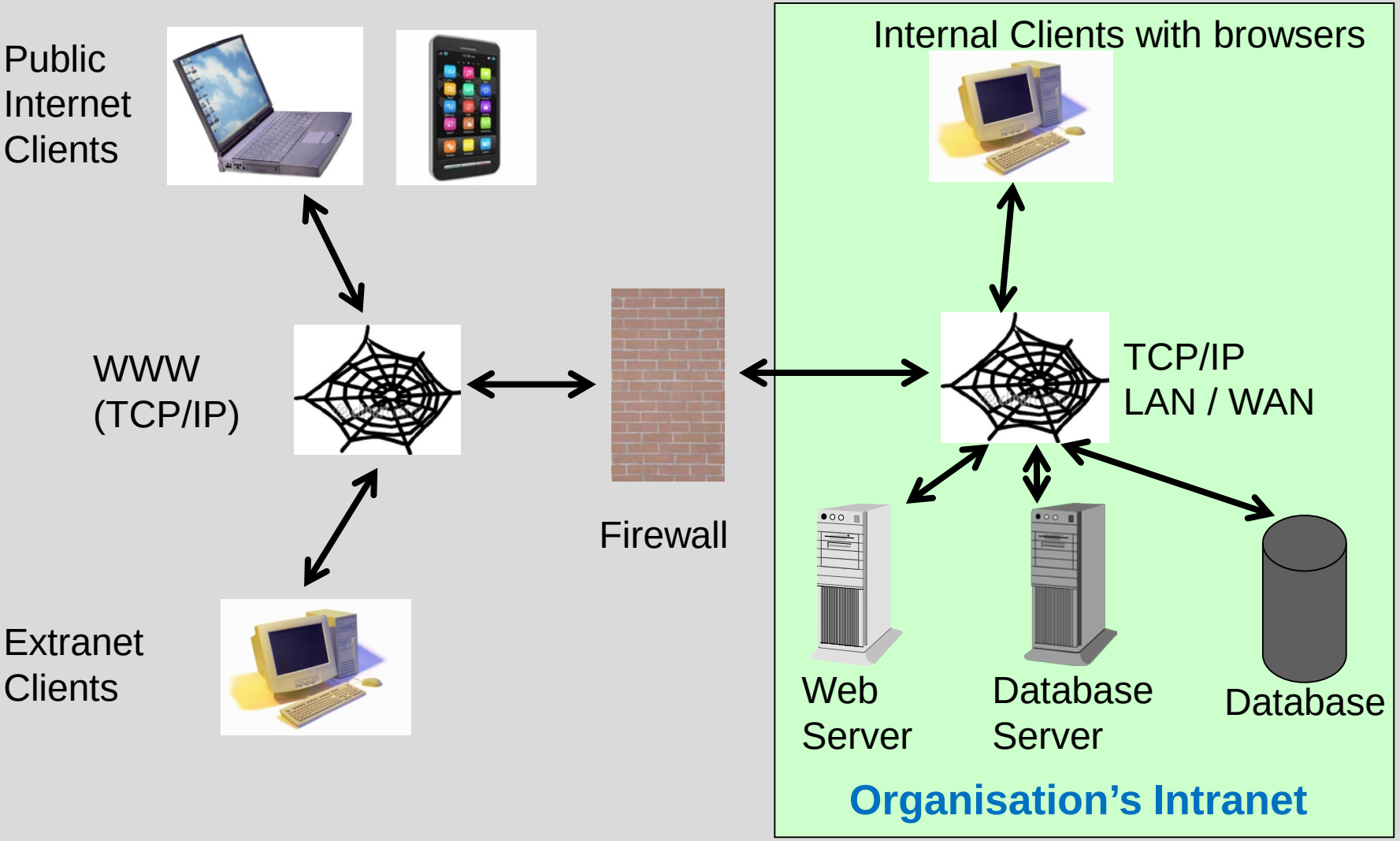
Week 07

Web Apps

Today's Session…

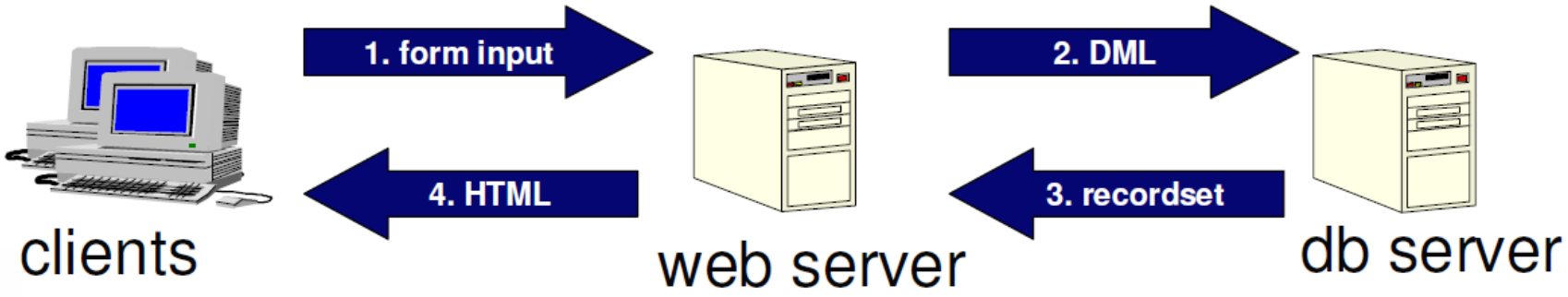
- Why web apps?
- How web apps work
- Making an HTML document
- Connecting to the DB
- Demo web app
- Web services

Architecture of a web app



Why create web applications?

- Web browsers are ubiquitous
- No need to install client software for external customers
- Simple communication protocols
- Platform and Operating System independent
- Reduction in development time and cost
- Has enabled eGov, eBusiness, eCommerce, B2B, B2C



Web infrastructure

- Browser
  - Software that retrieves and displays HTML documents
- Web Server
  - Software that responds to requests from browsers by transmitting HTML and other documents to browsers
- Web pages (HTML documents)
  - Static web pages
    - content established at development time
  - Dynamic web pages
    - content dynamically generated using data from database
- World Wide Web (WWW)
  - The total set of interlinked hypertext documents residing on Web servers worldwide

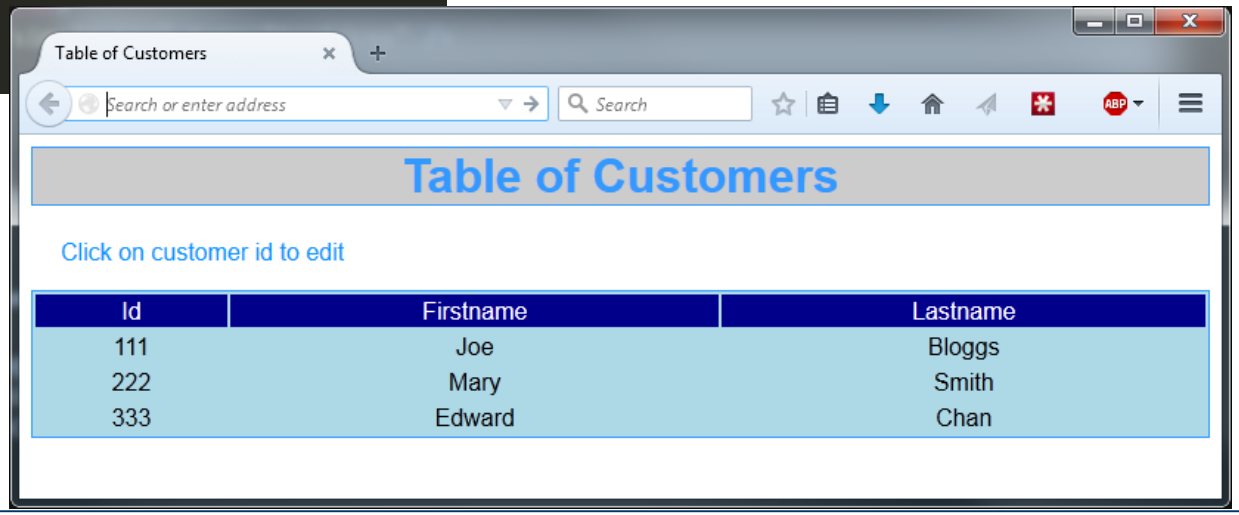
Web-related languages

- Hypertext Markup Language (HTML)
  - Markup language used to define a web page
- Cascading Style Sheets (CSS)
  - Control appearance of an HTML document
- JavaScript (JS)
  - Scripting language that enable interactivity in HTML documents
- Extensible Markup Language (XML)
  - Markup language used to transport data between web services

Web page = HTML document

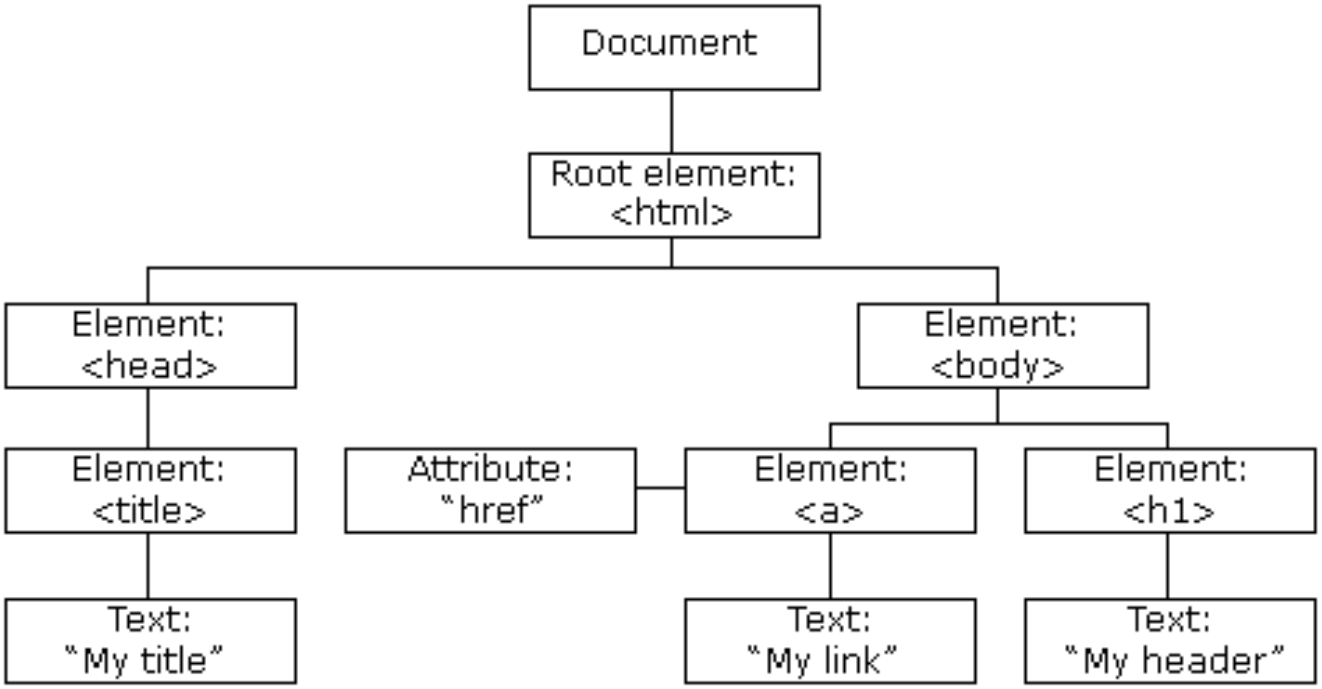
- a structured file of elements defined by HTML tags
- interpreted by web browser for display

```
<head>
    <title>Table of Customers</title>
    <link rel="stylesheet" href="simple.css" type="text/css" />
</head>

<body>
    <h1>Table of Customers</h1>
    <p>Click on customer id to edit</p>
    <table>
        <thead>
            <tr><td>Id<td>Firstname<td>Lastname</tr>
        </thead>
        <tr><td>111<td>Joe<td>Bloggs</tr>
        <tr><td>222<td>Mary<td>Smith</tr>
        <tr><td>333<td>Edward<td>Chan</tr>
    </table>
</body>

```



Structure of an HTML document

- elements are structured as a tree (one web page = one tree)
- divided into a HEAD and a BODY
- the BODY is what you see displayed in the browser
- BODY is divided into elements such as headings, paragraphs, tables, lists …



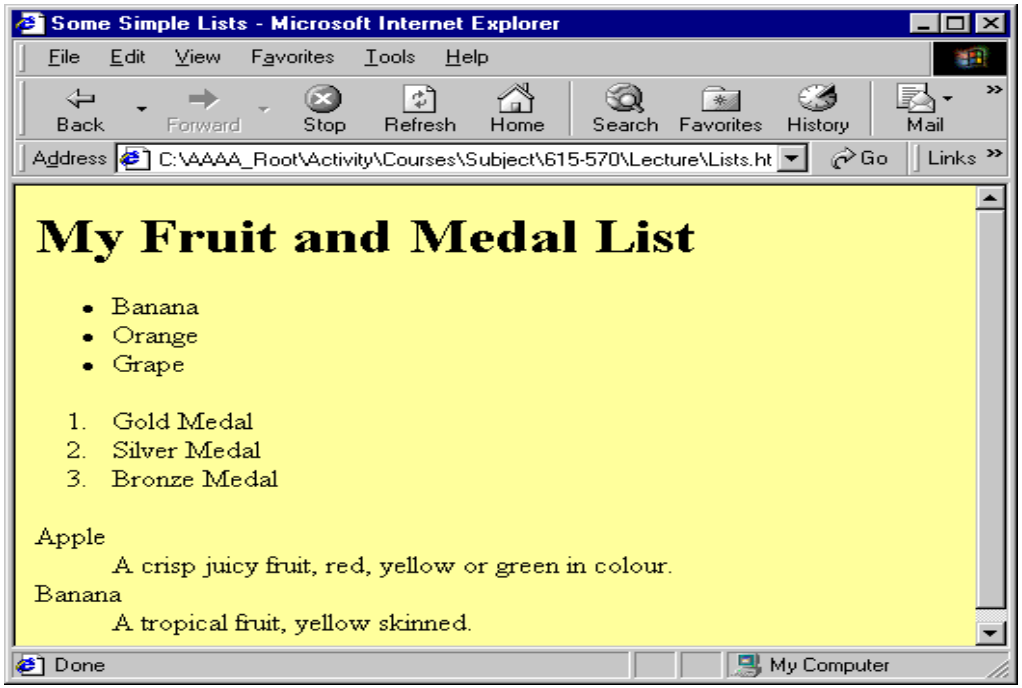
picture source: W3 Schools

Important HTML elements

<HEAD> … </HEAD>	• document header.
<BODY> … </BODY>	• document body
<H1> … </H1>	• Heading type 1
<H6> … </H6>	• … to Heading type 6.
<P> … </P>	• paragraph.
<TABLE>	• table
<TR>	• table row
<TD>	• table data
<UL>	• list
<LI>	• list item

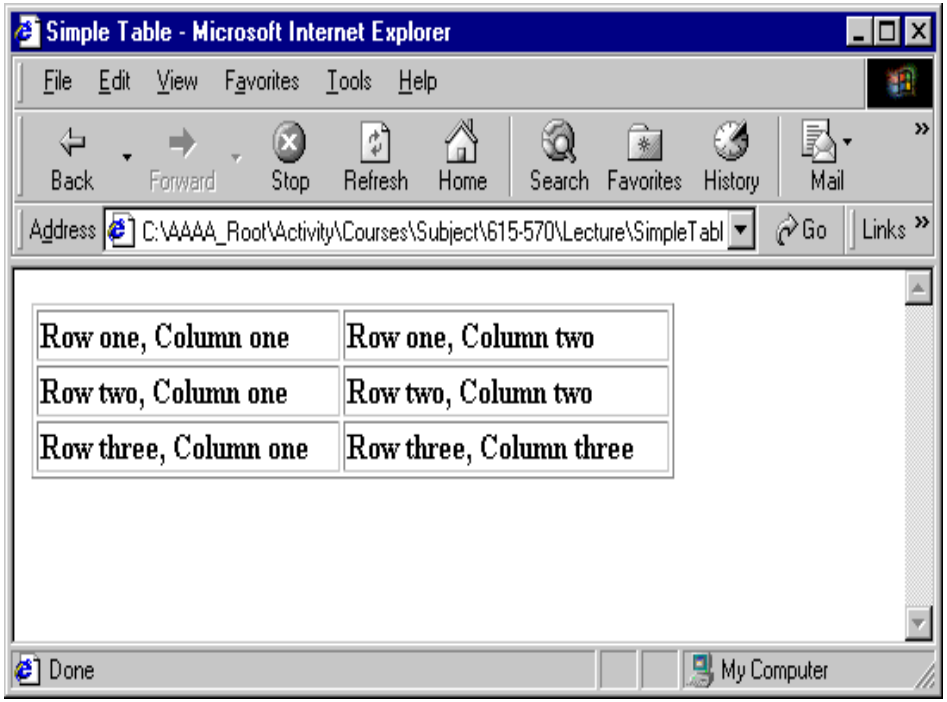
HTML list

```
<HTML> <HEAD> <title>Some Simple Lists</title> </HEAD>
<BODY bgcolor="#FFFF99">
<H1>My Fruit and Medal List </H1>
<UL>
  <LI>Banana</LI>
  <LI>Orange</LI>
  <LI>Grape</LI>
</UL>
<OL>
  <LI>Gold Medal</LI>
  <LI>Silver Medal</LI>
  <LI>Bronze Medal</LI>
</OL>
<DL>
  <DT>Apple
    <DD>A crisp juicy fruit, red, yellow or green in colour.
  <DT>Banana
    <DD>A tropical fruit, yellow skinned.
</DL>
</BODY> <HTML>
```



HTML table

```
<HTML>  <HEAD> <TITLE>Simple Table</TITLE>
<META http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
</HEAD>
<BODY>
<TABLE>
  <TR>
    <TD>Row one, Column one</TD>
    <TD>Row one, Column two</TD>
  </TR>
  <TR>
    <TD>Row two, Column one</TD>
    <TD>Row two, Column two</TD>
  </TR>
  <TR>
    <TD>Row three, Column one</TD>
    <TD>Row three, Column three</TD>
  </TR>
</TABLE>  </BODY> </HTML>
```



HTML form

- Forms allow users to input data to a web page
- The web server process the user's input using the file named in the 'action' attribute.

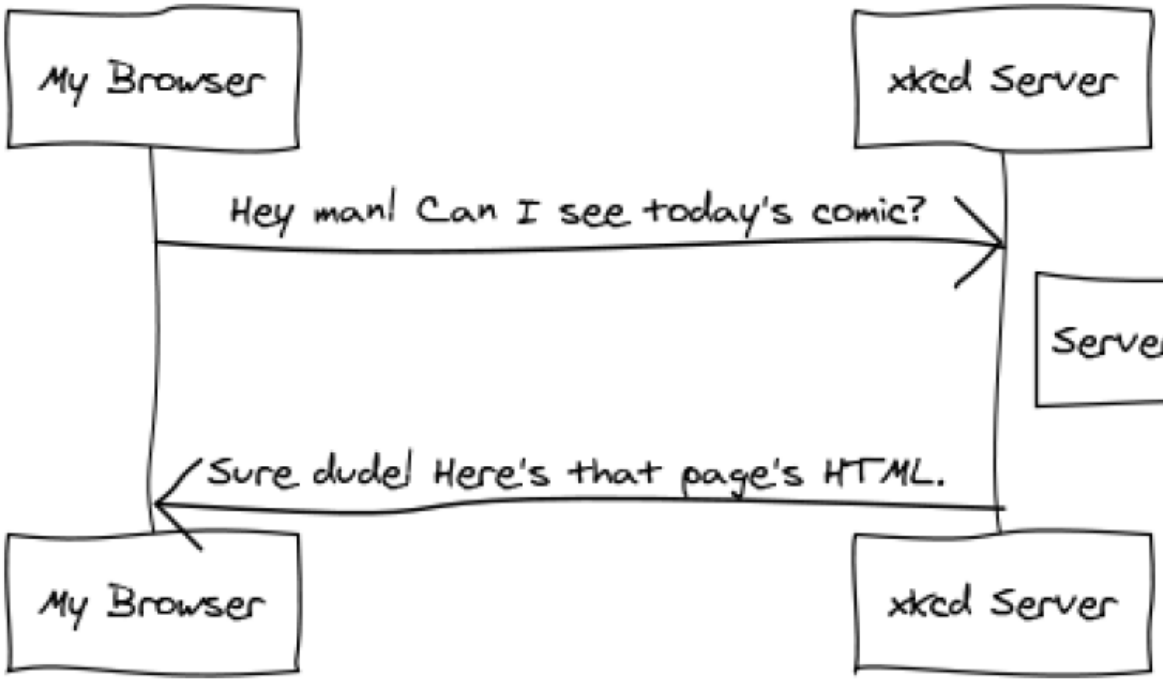
```
<form action = "buy.pl" method="post">

<p> What would you like to buy? <br>
<input type="text" name="product">

<p> How many? <br>
<input type="text" name="quantity"> <br>

<input type="submit" value="Do e-Commerce">
</form>
```

Example HTML form

browser displays form, sends input data to a script called 'buy.pl'

HTTP: how HTML documents move

- User wants to see a web page
- Types URL into browser
- Browser fetches page from server and displays it



could simply load a pre-prepared HTML file (static), or query the database to produce a tailored HTML file (dynamic)

picture source: Symfony Book

Static vs Dynamic web pages

- STATIC web page
  - the URL identifies a file on the server's file system
  - server fetches the file and sends it to the browser
  - the file contains HTML
  - browser interprets the HTML for display on screen
- DYNAMIC web page
  - URL identifies a program to be run
  - web app runs the program
  - program typically retrieves data from database
  - elements such as TABLE, LIST are populated with data
    - web app uses LOOPS to fill the contents of TABLEs and LISTs.
    - e.g. SELECT * FROM Product; (returns a set of product entities)
    - FOR p IN ProductList, print a row in HTML table

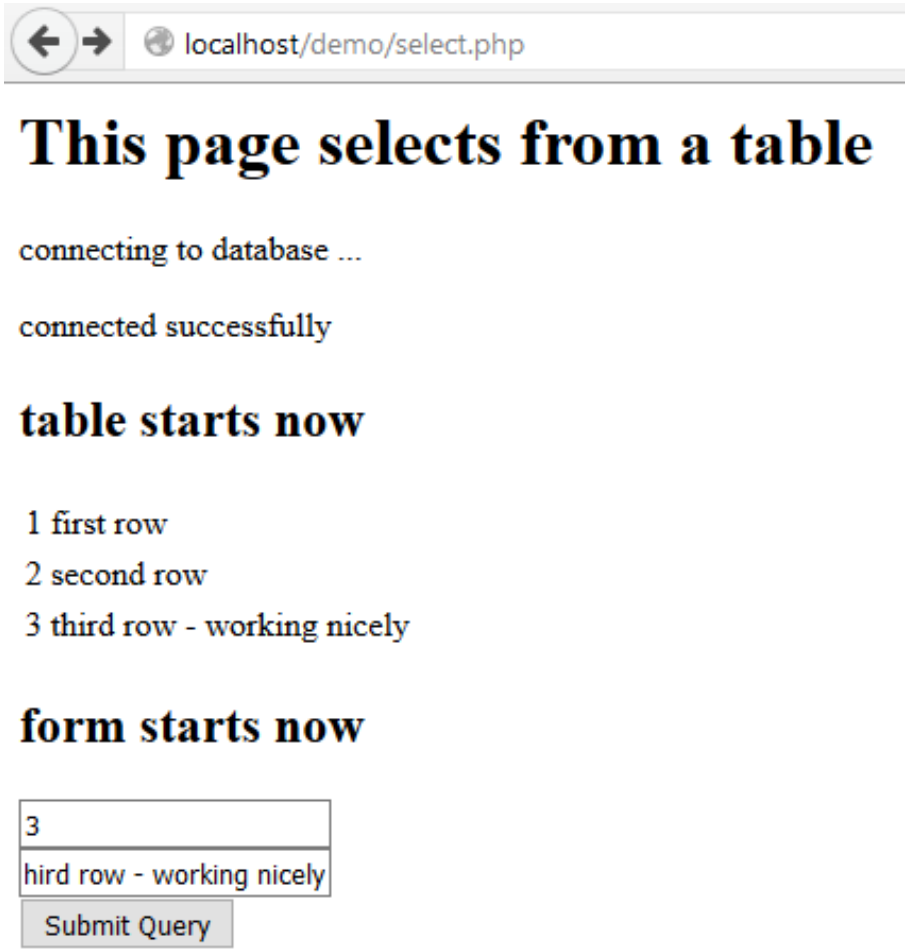
Simple web app using PHP and SQL

- program logs into db
- selects all rows from database table
- displays them inside an HTML table

```php
<?php

print '<h1> This page selects from a table </h1>';

print '<p> connecting to database ... </p>';
// connect to server, select database
$link = mysql_connect('localhost', 'root', '')
    or die('Could not connect: ' . mysql_error());
print '<p> connected successfully </p>';
mysql_select_db('webappdemo') or die('could not select database');

// perform SQL query
$query = 'SELECT * FROM mytable';
$result = mysql_query($query) or die('Query failed: ' . mysql_error());

print '<h2> table starts now </h2>';

// print results in an HTML table
print "<table>\n";
while ($line = mysql_fetch_array($result, MYSQL_ASSOC)) {
    print "\t<tr>\n";
    foreach ($line as $col_value) {
        print "\t\t<td>$col_value</td>\n";
    }
    print "\t</tr>\n";
}
print "</table>\n";
```

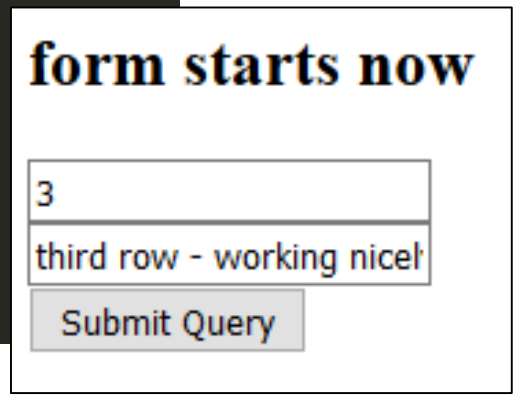
Simple web app: *select*

```php
<?php

print '<h1> This page selects from a table </h1';

print '<p> connecting to database ... </p>';
// connect to server, select database
$link = mysql_connect('localhost', 'root', '')
    or die('Could not connect: ' . mysql_error(
print '<p> connected successfully </p>';
mysql_select_db('webappdemo') or die('could not

// perform SQL query
$query = 'SELECT * FROM mytable';
$result = mysql_query($query) or die('Query fai

print '<h2> table starts now </h2>';

// print results in an HTML table
print "<table>\n";
while ($line = mysql_fetch_array($result, MYSQL
    print "\t<tr>\n";
    foreach ($line as $col_value) {
        print "\t\t<td>$col_value</td>\n";
    }
    print "\t</tr>\n";
}
print "</table>\n";
```

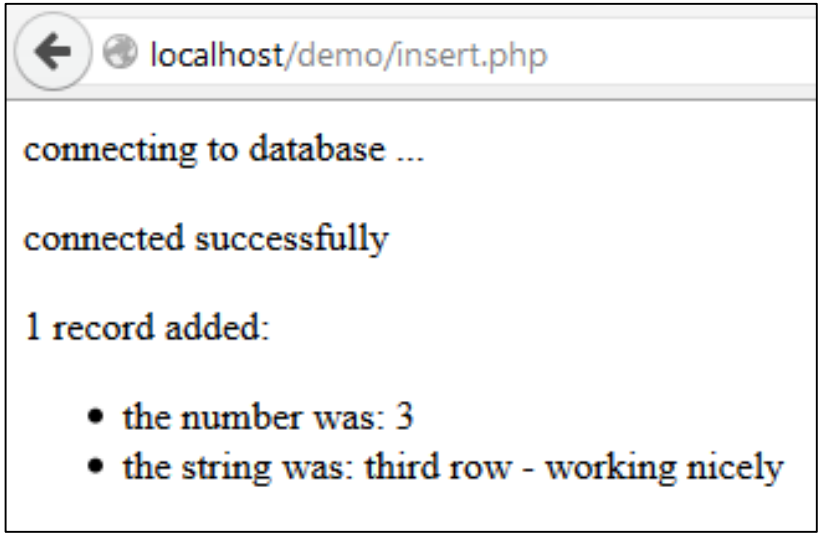


Simple web app: *insert*

```
37  print '<h2> form starts now </h2>';
38
39  // display a form for entering data
40  print '<form action="insert.php" method="post">';
41  print '<input type="text" name="number" value="type a number" />
42  print '<input type="text" name="string" value="type a string" />
43  print '<input type="submit" value="send to database" />';
44  print '</form>';
45  ?>
```




```
1   <?php
2
3   print '<p> connecting to database ... </p>';
4   // connect to server, select database
5   $link = mysql_connect('localhost', 'root', '')
6       or die('Could not connect: ' . mysql_error());
7   print '<p> connected successfully </p>';
8   mysql_select_db('webappdemo') or die('could not select database');
9
10  // form the INSERT statement from the user's input
11  $sql="insert into mytable values ('$_POST[number]','$_POST[string]')";
12
13  // run the INSERT statement
14  if (!mysql_query($sql,$link))
15    die('Error: ' . mysql_error());
16
17  // print friendly message
18  print "<p> 1 record added:  </p>";
19  print "<ul>";
20  print "<li>the number was: " . $_POST['number'];
21  print "<li>the string was: " . $_POST['string'];
22  print "</ul>";
23
24  // close connection to database
25  mysql_close($link);
26
27  ?>
```



Problems with old-style web apps

```
30  $sql = "insert into EVENT values (null, null, 'L', '" . $_SESSION["thisClient"] . "', 'logged in')";
31  mysql_query($sql);
```

- Placing “raw” SQL inside PHP/HTML files
  - Mixes presentation, business, database logic
  - Hard to maintain when things change
  - Want separation of concerns e.g. MVC
- Lots of reinvention of wheels
  - each dev writes their own solution to common features
  - e.g. login security, presentation templates, database access
- Increasing variety of clients e.g. phones and tablets
  - Manually program for different platforms
- => web application frameworks
  - examples: Ruby on Rails, .Net, Symfony, AngularJS, Django

Web Services

- The WWW allows humans to access remote databases
- Web Services allow *computers* to access remote databases
- 2 major approaches: SOAP and REST
  - Simple Object Access Protocol
  - Representational State Transfer
- structured data usually returned in XML or JSON format
- REST nouns are resources, addressed via URIs
- REST verbs correspond to DML statements
- GET (select), POST (insert), PUT (update), DELETE (delete)
- Try this example web service
  https://www.googleapis.com/books/v1/volumes?q=quilting

XML and JSON data formats

- used by web services for data exchange

- XML
  eXensible Markup Language
- JSON
  JavaScript Object Notation

(example sourced from W3 schools)

The following JSON example defines an employees object, with an array of 3 employee records:

JSON Example

```
{"employees":[
    {"firstName":"John", "lastName":"Doe"},
    {"firstName":"Anna", "lastName":"Smith"},
    {"firstName":"Peter", "lastName":"Jones"}
]}
```

The following XML example also defines an employees object with 3 employee records:

XML Example

```
<employees>
    <employee>
        <firstName>John</firstName> <lastName>Doe</lastName>
    </employee>
    <employee>
        <firstName>Anna</firstName> <lastName>Smith</lastName>
    </employee>
    <employee>
        <firstName>Peter</firstName> <lastName>Jones</lastName>
    </employee>
</employees>
```