

Web Applications

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Server-side computation is essential to e-commerce, online services, blogs and other types of Web site that do not simply provide static pages.

Server-Side Technologies

CGI (the Common Gateway Interface) specifies a mechanism for passing data from an HTTP request to a separate program.

Programming languages commonly used for CGI scripting usually provide some convenient means of accessing the values contained in the request.

FastCGI is an extension to CGI, which avoids the overhead associated with creating a new process for every request that invokes a script.

Apache modules allow scripts to run inside the server process. ASP.NET uses a similar approach employing dynamically loaded libraries.

Programming languages used for server-side scripting are usually dynamically typed, and provide automatic garbage collection, regular expression pattern matching and libraries giving access to databases.

Several languages provide a mechanism for embedding executable code among the markup of an XHTML document.

Popular languages for server-side scripting include Perl, Python, Ruby and PHP. PHP is almost always embedded in XHTML.

Java can be used to write servlets, which execute within a servlet container, not a conventional HTTP server. JSP (Java Server Pages) is a form of embedded servlet.

Web application frameworks incorporate all the repetitive code for tasks common to most applications, allowing a developer to plug in only the code specific to a particular application.

Most Web application frameworks are based on the Model View Controller (MVC) pattern.

Jakarta Struts, Zope and Ruby on Rails are frameworks for Java, Python and Ruby, respectively.

Ready-Made Applications

Open Source Web software which can be customized for individual sites is available for most classes of Web application.

Content Management Systems (CMS) are used to create Web pages dynamically from content that is stored in a database.

The functions of a CMS are content creation, uploading, presentation, archiving and supporting collaboration.

Databases

Data stored on a server and used by a Web application is usually organized as a relational database, and accessed by programs interacting with a database management system (DBMS).

SQL is a standard query language and data definition language.

A relational database is organized as a collection of tables, each of which contains rows of data. Each table cell contains a single value.

title	date	category	rating
Sunset Clouds	2005	Sky/Clouds	****
The Sea	2002	Sea	*****
Orange Flowers	2002	Flowers	****
Blue Flower	2003	Flowers	***

A database table

Databases should be normalized to prevent inconsistencies resulting from insertion, deletion and modification operations.

title	date	category	rating
Sunset Clouds	2005	Sky/Clouds	****
The Sea	2002	Sea	*****
		Blue-grey	
Orange Flowers	2002	Flowers	****
		Orange	
Blue Flower	2003	Flowers	***
		Blue-grey	

A table with multiple values

title	date	category	rating
Sunset Clouds	2005	Sky/Clouds	****
The Sea	2002	Sea	*****
The Sea	2002	Blue-grey	*****
Orange Flowers	2002	Flowers	****
Orange Flowers	2002	Orange	****
Blue Flower	2003	Flowers	***
Blue Flower	2003	Blue-grey	***

A relational database table with multiple values

images

id	title	date	rating
1	Sunset Clouds	2005	****
2	The Sea	2002	*****
3	Orange Flowers	2002	****
4	Blue Flower	2003	***

categories

id	name
1	Flowers
2	Sky/Clouds
3	Sea
4	Orange
5	Blue-grey

categorization

imgid	catid
1	2
2	3
2	5
3	1
3	4
4	1
4	5

Normalized tables

A database schema is a description of the structure of a database.

An SQL select query of the form

```
select columns from table  
      where condition;
```

is used to retrieve values in specified columns that satisfy a given condition.

Duplicates are removed if `distinct` appears after `select`.

Results can be ordered by adding
order by *column* at the end of the query.

Join queries, where more than one table name appears after `from`, can be used to combine data from several tables.

```
select title, name
from images, categories, categorization
where images.id = imgid and
       categories.id = catid
order by name;
```

A join query involving three tables

title	name
The Sea	Blue-grey
Blue Flower	Blue-grey
Orange Flowers	Flowers
Blue Flower	Flowers
Orange Flowers	Orange
The Sea	Sea
Sunset Clouds	Sky/Clouds

The result of the join query (on slide 32) involving three tables

Data can be added to tables with an `insert` statement, deleted with a `delete` statement and modified with an `update` statement.

Dynamically Generated Pages

PHP's syntax resembles JavaScript.

Arithmetic and Boolean operations, conditionals, loops, function definitions and calls are the same in both languages, but string concatenation is written with a `.` instead of `+`.

Variable names must begin with a \$ character.

This allows variables to be interpolated into double-quoted strings.

The foreach loop is used to iterate over arrays.

The foreach loop has the form

```
foreach ($a as $x) statement
```

for numerically indexed arrays and

```
foreach ($aa as $k => $v) statement
```

for associative arrays.

The `define` function is used to give names to constants.

The `require` function is used to include external files.

PHP statements within an XHTML document must be enclosed between the characters `<?php` and `?>`.

A sequence of the form
 $\langle ? = \textit{expression} ? \rangle$ is replaced by the
value of the expression.

The PHP library includes functions for passing queries to a DBMS and carrying out other operations on a database.

The functions `mysql_connect` and `mysql_select_db` are used to set up a connection to a MySQL database and choose a database.

The library function `mysql_query` takes a string, which it treats as an SQL query, and sends it to the MySQL server to be executed. If any rows are retrieved, `mysql_query` returns a resource.

The function `header` is used to send raw HTTP headers. If the header begins with `location:` it causes the browser to be redirected to a new page (for error messages, etc.)

PHP passes the values of all query variables to the script in an associative array called `$_REQUEST`, which is indexed by the variables' names.

Setting the magic quotes option or explicitly calling `mysql_escape_string` prevents SQL injection attacks.

The library function `mysql_num_rows` takes a resource returned by `mysql_query` and returns the number of rows retrieved.

A sequence of calls to `mysql_fetch_array` with the resource as argument will return each row of the query result in turn, in the form of an associative array, whose keys are the names of the columns in the query result and whose values are the corresponding values in one row.

The associative array `$_COOKIE` contains elements for each cookie in the request. The `set_cookie` function is used to send a `Set-Cookie` header.

The `mail` function can be used to send email from a script, to report errors to a site's developer, for example.

**End of the key point slides for
Chapter 8, pages 435–502 of
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