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## The Development of Dynamic Web Pages – Practice and Methodology

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First and foremost, it is worth clearing up what the word "dynamic" means in the case of web pages. Contrary to static web pages, here it is not necessary to prepare a distinct static file to each appearing page because the output of the web page is generated on-line, according to the actual parameters, data, the 'state' of the world. Moreover, as there is an interaction between the user and the program, the user's choices can change the outputs.

For instance, let us take a list with the current exchange rates on. As it changes continuously, it cannot be built into to the HTML source text while writing the program code. In this case we have to save the list elements and the exchange rates to a database, and generate the values with our program while it is running. When it is finished, the result will appear on the client computer which is using the web page.

- A. The browser of the client computer sends its request to the web server.
- B. The web server investigates the request and starts the suitable method (e.g. the PHP interpreter) to satisfy the request.
- C. The PHP program generates the HTML pages on the basis of the data , which usually come from a database
- D. The web server sends back the generated HTML page to the client as if it was a static page.
- E. The browser of the client computer interprets and shows the HTML page.

The so-called "client server connection" is an indispensable condition of the operation of dynamic web pages. A server computer, network connection and a client computer, which logs on to the server computer, are needed.

The server must contain a number of software components as well: the software of the web server (Apache), a database system (MySql, PSql, ORACLE) and a

programming language compiler, which supports the construction of web pages (.NET, JAVA).

In the teaching process I should recommend the use of the Apache-MySql-PHP4 configuration because they are free, easy to use and this is the most wide-spread configuration of all.

It is important, that these software components must be connected to each other. The workstation logs into that system, sends the request and receives the answers. Therefore the user can click on a web link – which starts the whole process – and can see the actual, on-line generated information on his own web browser. The user does not have to know anything about the background events – they are invisible for him.

This technology is used in almost every field in the world – including internet trade or e-business, other fields of business, education and open-university (e-learning), the Civil Service, tourism, entertainment, on-line banks etc. Therefore it is obvious that a newly graduated information technology teacher must know this field well.

The is a rather important question to ask: can we expect students to learn this topic individually – or does it have to be built in the material?

The first case is hard to imagine – the students need a lot of technical conditions during the learning, e.g. a fully configured web server and database system. Using the dynamic web page techniques they have to look out for numerous security considerations as well.

It is best if these parts are pointed out and highlighted by a professional during the learning process when needed. Another good reason to teach this subject is that it completes, fulfils the following areas: graphics, programming languages, database management, operating systems and networks.

Before taking up this subject, the students are expected to have acquired:

- at least one programming language (e.g. Turbo Pascal)
- the basic principles of object oriented programming paradigm
- how to use a pixel-oriented graphical software
- how to use linux operating system, an ftp client
- basic database operations

The brand new knowledge to be acquired in this subject:

• a new programming language called PHP

- HTML language
- improve the knowledge about networking, mostly on web server operations
- how to use the style sheet to unify the web pages' appearance
- use the graphical imagine creation to improve the page layout

The most difficult problem in the teaching methodology is the following: the students must learn these techniques simultaneously. They need a lot of time to get a real sense of achievement using this method.

Our suggestion is to use the PHP object oriented programming support. In this case the students do not know anything about the topics mentioned above.

The students get a fully operating source code of a web site which was developed in PHP. This source code includes an OOP class, and its methods generate the parts of the web site. Each student must understand the task of the methods, and then can modify its operation by modifying the input parameters of the methods, or, at a higher level, its body.

In this case the students do not have to know deeply any of the topics above at the beginning. However, after learning bits, one can use every bit to reach the goal, modifying the source code in the suitable place.

Let take an example from this source code:

```
Class DW_Object {
function Header ($Head,$HeaderStr,$Backgound,$FStyle){ ...};
function Menu ($MenuItems[],$ItemIndex,$Slides) { ...};
function DataBaseConnect ($Server,$Database) { ...};
function DataSelect ($QueryString,$ListStyle) { ...};
...}
```

As we can see the names of the methods suggest their main task. So a student can easily find the point where one must modify the source code to modify the web page's layout or operation.

One can instantiate from this class to create a web page like this:

\$Obj=new DW\_Object(); \$Obj->Header('header.gif', 'HeaderStr', 'BackgColor', 'FontStyle'); \$Obj->Menu('MenuItems', 'ItemIndex', 'Slides'); \$Obj->DataBaseConnect('Server', 'Database'); \$Obj->DataSelect('QueryString', 'ListStyle'); ...

In this example the Header function draws the header of the page according to the actual parameters. Then the Menu function generates the list of the menu points using a static list of menu or reading them from a data table. When this site uses a database, the DataBaseConnect function creates the necessary connection making it possible to read data from the tables.

What are the main problems?

The syntax of the PHP language is very similar to C language syntax. As the students know the Pascal language, they must learn a new syntax as well as the other services of the scripting languages e.g. using the associative arrays.

The second problem is that the PHP is an interpreter-based scripting language, therefore a program may contain syntactical as well as semantic errors. The syntactical errors appear only on-the-fly, when the web server starts the program.

The fact that we do not have a suitable debugging system in this topic, because the developer never starts the program directly, but through a web request, is another problem. If it contains a semantic error, the developer must read the generated '*static*'-look-like html page, and must deduce the program flow and find the error. A program can include comments or remarks in the generated web page to put fingerprints of the generator program, and watching the html source code one can find them and it can help to locate the errors. The common debugging methods, including the watch windows and breakpoints, cannot be used in this environment.

Another interesting problem is that this 'program' is stateless – the web server starts this program when the web request arrives, then this program unloads from the memory immediately. So when the same user asks for pages from the same site – the generator program runs twice, but isolated. It cannot store information between the two requests. So a developer cannot use static variables because the meaning of 'static' is a little bit different in this environment.

The documentation of the web server and the PHP is rich, but contains mostly references of the functions, and is written in English. The students should acquire a brand new method to give data to the program – giving parameters, including them into the web link, e.g.

http://our.web.site/our\_index.php?name=roland&tim=1231. These parameters can be examined in the PHP program.

If we need to store data between the request (which is very frequent in ebusiness), we can use three methods: one is by using web forms, and we can store variables in the form using hidden elements, which are sent back automatically when a new request is generated. The second method is to store variables in cookies, which are stored in the client computer, and are sent back automatically. The third method is to store variables in the server in a special place called session variables.

In our method this new knowledge is built in the source code, and the students do not have to know them in advance. It may cause problems to do the homework for those students who do not have internet connection or web server at home. But one can install a personal web server and a database server to one's own home computer. Our suggested configuration contains only free softwares, which can operate on Windows operating systems as well.

When a student is deeply interested in a field, one can learn that topic by an individual research, and develop and attach useful methods to the OOP class, as well as explain and discuss it with the group and the expert. Supervising it is highly recommended to avoid the security holes and apply the common web development method.

This method has already proved its effect in practice. At the end of the semester the students are able to solve such high class problems like:

- user identification and authentication
- counting of visitors, generating charts
- administration module for the webmaster
- on-line generated lists from data tables

The best proof is that the students are highly interested in this subject. Again, the above mentioned method is useful, too, as numerous theses about dynamic web pages are being prepared at present, written by graduates who have been taught web development with it.

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