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Diploma Thesis

Web Content Management Systems

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DIPLOMA THESIS ASSIGNMENT

Alekcandra Diachkova

Informatics

Thesis title

Web Content Management Systems

Objectives of thesis

Main objective of the diploma thesis is comparison of three the most popular web content management systems (CMS) – Joomla, WordPress, Drupal and use of one of the systems on real project.

Partial goals of the thesis are:

- analysis of the prospects for their further development,
- illustration of working on CMS WordPress create from scratch new template for existing website using recent trends in web design development.

Methodology

Methodology of the thesis is based on study and analysis of specialized information resources. The practical part is focused on analysing of three the most use CMS, using special design programs draw web template and using final template on real project. Based on a synthesis of theoretical knowledge and the results of own solution, the conclusions of the thesis will be formulated.

The proposed extent of the thesis

70 – 80 pages of text.

Keywords

CMS Joomla; CMS Drupal; CMS WordPress; creating new template; comparing CMS Joomla, Drupal, WordPress; recent trends in web design

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Declaration

I declare that I have worked on my diploma thesis titled “Web Content Management Systems” by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on

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Alekcandra Diachkova

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Web Systémy pro Správu Obsahu

Souhrn

Tato diplomová práce obsahuje detailní analýzu a srovnání aktuálně nejpopulárnějších systémů pro správu obsahu (content management systems - CMS) jako WordPress, Joomla! a Drupal, které jsou založeny na třech dimenzích kvality dle ISO/IEC 25010. Na základě výsledku byl vybrán nejvhodnější CMS WordPress, pro který byl dle posledních trendů vývoje webů navržen a implementován template pro již existující microsite.

Metody analýzy zahrnují instalaci použitého CMS na čistý program shell "Denwer" pro vytváření a ladění webových stránek, provedení řady srovnávacích testů a vývoj webové šablony zahrnující všechny kroky vývoje šablony od wireframu a kreslení v programu Photoshop po kódování, testování a umístění hotové webové stránky na hosting. Wireframy webové stránky a grafické znázornění jsou součástí přílohy.

Výsledkem práce je, že všechny tři CMS jsou užitečné nástroje pro správu webu, avšak jsou mezi nimi podstatné rozdíly, takže je nezbytné vybrat ten nejvhodnější systém s ohledem na konkrétní projekt. Je zřejmé, že pro přesnější závěry by byla vhodná detailnější studie zahrnující více srovnávacích kritérií.

Klíčová slova: CMS Joomla; CMS Drupal; CMS WordPress; vytvoření nové šablony; porovnávání CMS Joomla, Drupal, WordPress; Nové trendy v web design

Web Content Management Systems

Summary

The diploma thesis provides the detailed analysis and comparison of the most popular nowadays web content management systems (CMSs) such as WordPress, Joomla! and Drupal based on three dimensions of quality according to ISO/IEC 25010 standard. On the basis of the results was chosen the most suitable CMS WordPress for which was designed and implemented the template for existing microsite according to the latest trends in web design development. Methods of analysis include installation of used CMSs on special clean program shell for creating and debugging websites “Denwer”, conducting of series of comparative tests and web template development including all steps of template creation from wireframing and drawing in Photoshop software to coding, testing and location of finished web site on a web hosting. Web site wireframes and graphical representations can be found in the appendices.

The diploma thesis results say that all three CMSs are powerful tools for managing of the web sites but they have significant differences thus it is important to choose the most suitable system for each specific project. It is understood, that for more conclusive results is required a more detailed study involving more criterions to compare.

Keywords: CMS Joomla; CMS Drupal; CMS WordPress; creating new template; comparing CMS Joomla, Drupal, WordPress; recent trends in web design.

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Introduction

Nowadays amount of web sites is approaching 1 billion websites. “In the January 2015 survey we received responses from 876,812,666 sites and 5,061,365 web-facing computers.” (1) Almost each company, freelancer or usual Internet user has its own web page. To have your own web site in XXI century is not a luxury but a necessity to live with the times, to establish your online presence, to stay in touch with your customers, to earn money through the Internet and so on. So the question of creation of modern and competitive sites is particularly acute now. Hence a good web specialist needs to understand how to create modern, usable web site and make it competitive and popular.

The literature review contains theoretical material and the basic concepts raised and used in the practical part of the work. This knowledge is necessary for understanding of website creation and its operation. In details is done analysis of website functioning based on client/server-side architecture and reviewed all components included in this model. The most convenient way to maintain and manage website nowadays is the use of special computer application – web content management system (WCMS) which allows creation, editing and full control on the web content. Functioning of CMSs, their classification, advantages and disadvantages are also examined in the literature review.

The practical part of current work is divided into two parts. In first part is done comparison between CMSs Joomla!, WordPress and Drupal based on three dimensions of quality according to ISO/IEC 25010 standard: functional suitability, usability and performance efficiency. On the basis of this comparison their strengths and weaknesses are formulated. The second chapter of practical part presents the steps of template elaboration (from wireframing to finished web site) for existing micro site working under WordPress CMS chosen as the most suitable for this purposes. In the template development were revealed and implemented the most recent web design trends.

A particularity of current work is study and implementation only the latest technologies and practices according to modern research of specialists in the field of web development.

Thesis objective and methodology

The diploma thesis focuses on a detailed examination of the three most commonly used in practice web content management systems, their analysis and comparison. During the comparison is revealed the strengths and weaknesses of each system, and on this basis, developed a design template for the website on the most suitable system for this purpose.

Thus, the **main objective of the diploma thesis** is comparison of web content management systems (WCMS) such as Joomla!, WordPress, Drupal and use of one of the systems on real project.

Partial goals of the thesis are:

- analysis of the prospects for their further development,
- creation from scratch new template for existing microsite which purpose is selling electronic books on psychological topics using recent trends in web design development as illustration of working on WCMS WordPress.

Methodology of the thesis is based on study and analysis of specialized information resources. The practical part is focused on analyzing of three the most used WCMS such as Joomla! 3.4.1, WordPress 4.2.2 and Drupal 7.37 which were installed for strict analysis on special clean program shell for creating and debugging websites, titled “Denwer” version 3 running on local PC Samsung 300E5Z-S04. In order to test CMSs in its real environment was used Apache benchmark version 2.3 which creates load on web server.

To test usability of analyzed CMS was applied Visual Aesthetics of Website Inventory test and in particular its shorter version titled “VisAWI-S”.

The performance efficiency of database MySQL version 5.5 was carried out through PHPMyAdmin interface where were made different types of queries.

Template creation part is focused on phased development of template for website running on WordPress. First, using special online tool HTML5 App titled "Moqups" a series of frames was created which is essential step in modern website development. After, as a design program for graphical representation of website was chosen Photoshop CS5 which is multifunctional graphics editor used also for professional web design creation. Coding part of theme development was made in powerful text editor Sublime Text 2 and

supported by browser Mozilla Firefox 41.0.1 which includes web inspector with very useful functions such as editing HTML, CSS, JavaScript code, 3D modeling and so on.

Based on a synthesis of theoretical knowledge and the results of own solution, the conclusions of the thesis will be formulated.

1. Literature review

1.1 Concept WWW

“The Web, formally called the World Wide Web, is a collection of a bunch of text and graphics files [...] that make up Web pages” (2 p. 10). People get access to this information using Internet technology.

For navigation of WWW the special programs are used - Web-browsers that make the journey through the vast expanses WWW much easier. The Web browser is a technological tool that allows access to networked Web pages. Philip Crowder mentioned the standard core of browser features:

- Fetching,
- Decoding,
- Faithfully rendering Web pages, history, and bookmarks,
- Cross-platform compatibilities,
- Scripts,
- Embedded objects,
- Interactive forms (3 pp. 4 - 8).



Figure 1 - How browser works (4 p. 9)

Philip Crowder also thinks that the most popular Web browsers are Microsoft Internet Explorer; Mozilla Firefox (the successor to the once all-conquering Netscape Navigator); Opera, a standards-compliant Web browser from a small company; and Safari, Apple’s browser for Macintosh computers (2 p. 10).

The underlying idea behind the Web is hypertext — text that can contain links to other pieces of text and other files, such as graphics files, stored anywhere on the Internet.

All this information and files are stored on millions of servers all over the world. If necessary, a web browser automatically links to the corresponding server in the network, and requests the document to which link is made. Such a link is called hyperlink.

When user connects to the Internet his computer gets unique number – an IP address. “IP (or Internet protocol) is the standard for how data passed between machines on the Internet” (4 p. 2). For example, 192.165.0.456. Every time when user connects he gets new IP. After that user types the Web address of some Web site on the web browser. The Web page, if online, is found by that address. The address is in the format of `http://www.goto.com/going/gone` and is frequently referred to as a Uniform Resource Locator (URL) (3 p. 9). The domain name is commonly part of a larger Internet address – URL. For example, `goto.com`. “A URL goes into much more detail than domain name, providing much more information, including the specific page address, folder name, machine name, and protocol language” (5). Typing the domain name user specifies the IP address of the domain name server where is allocated tables of machine names and their IP addresses. Thus domain name is translated into number, which identifies the computers, where requested Web site is allocated. “The browser asks a domain name server to translate the domain name you requested into an IO address. The browser sends a request to that server for the page you want, using a standard called Hypertext Transfer Protocol or HTTP” (4 pp. 2 - 3). Thus a Web browser uses HTTP to request a Web page from a Web server.

From the above it follows that in the Internet technologies prevalent client-server architecture. To understand how web site works, it is necessary to know the basic concepts of server and client side system.

1.2 Client- side and server – side architecture

So-called two-part architecture consists of client and server. Typically, the server part is a database server that hosts shared data. A client side is an application that communicates with the database server performs to it requests and receives responses. Such systems are used in local area networks, as there is no trouble with the installation of the client. Also systems with such architecture are safer, because they may use their own data transfer protocols, unknown to attackers.

“Client-side means that the action takes place on the user’s (the client’s) computer. Server-side means that the action takes place on a web server [...] When we say action we mean all that work that programming languages do” (6).

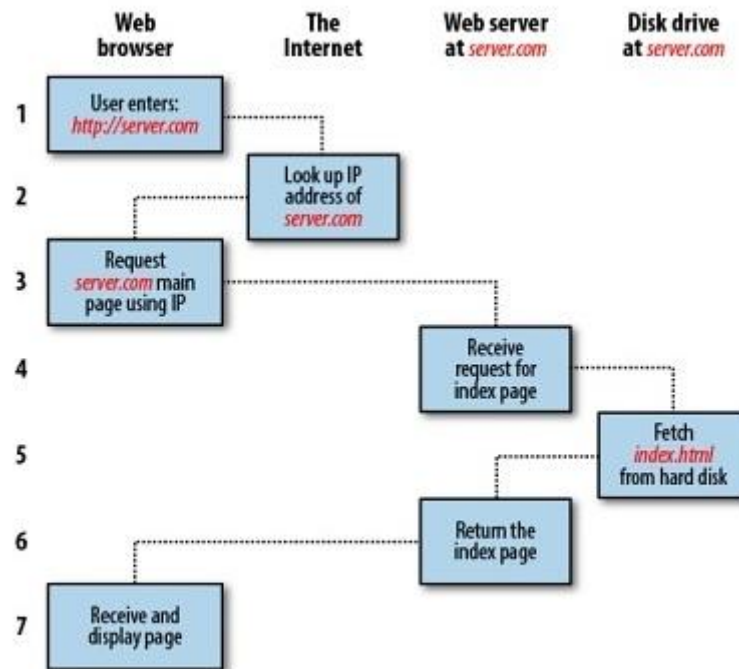


Figure 2 - The basic client/server request/response sequence (16 p. 3)

Server-side Programming

Server-side programming is the general name for the kinds of programs which are run on the Server.

Uses of the server – side programming are following:

- process user input,
- display pages,
- structure web applications,
- interact with permanent storage (SQL, files).

Examples of languages are following:

- PHP;
- ASP.Net in C#, C++, or Visual Basic;

- Nearly any language (C++, C#, Java). These were not designed specifically for the task, but are now often used for application-level web services.

Client-side programming

Much like the server-side, Client-side programming is the name for all of the programs which are run on the Client.

Use of the client – side programming is following:

- Make interactive webpages.
- Make stuff happen dynamically on the web page.
- Interact with temporary storage, and local storage (Cookies, localStorage).
- Send requests to the server, and retrieve data from it.
- Provide a remote service for client-side applications, such as software registration, content delivery, or remote multi-player gaming.

Examples of languages are following:

- JavaScript (primarily),
- HTML,
- CSS,
- any language running on a client device that interacts with a remote service is a client-side language.

1.3 Client side

In this chapter the client side part will be considered. As was mentioned earlier any language which is running on a client side and interacts with a remote service is client side language. These languages primarily include JavaScript, HTML and CSS.

JavaScript

During the web page generation there is the dilemma connected with architecture “client – server”. In 1995 specialists of the Netscape Company created the management mechanism of web pages on the client side, developed the JavaScript programming language. Now JavaScript is the most popular programming language used for

development of web applications on the client side (7). The basic idea JavaScript is the possibility of changing the attribute values of HTML-containers and display properties of the medium in the process of viewing HTML-page user. In this case there is no page reload. In practice it is expressed that it is possible to change, for example, color of a background of the page or the picture integrated into the document, to open a new window or to issue the prevention.

On the Mozilla Foundation web site is written that JavaScript[®] (often shortened to JS) is a lightweight, interpreted, object-oriented language with first-class functions, most known as the scripting language for Web pages [...] It is a prototype-based, multi-paradigm scripting language that is dynamic, and supports object-oriented, imperative, and functional programming styles (8).

JavaScript is the compact object based language for development of client and server network applications. Through the use of scripting language JavaScript, static Web-page acquire high-quality animation design, the ability to work interactively with input-output data, the preliminary test data before it is sent to the server.

According to TIOBE Index which is based on data of Google search engines, MSN, Yahoo! Wikipedia and YouTube, in June, 2011 of JavaScript was on the 11th place (a year ago on 12) (9).

JavaScript is initially designed to interact with web pages and includes three parts:

- The Document Object Model (DOM), which provides methods and interfaces for working with the content of a web page.
- ECMAScript, which is defined in ECMA - 262 and provides the core functionality.
- The Browser Object Model (BOM), which provides methods and interfaces for interacting with the browser (10 p. 11).

Hypertext Markup Language

All information in the Web-browser is displayed as Web-pages, which are a key element of the WWW. A Web page is a document that is written in (or convertible to) HTML and that is accessible to Web browsers so that they can upload or download content. Web-page supporting multimedia technology, combine different types of information: stylized text, graphics, sound, animation, video, hyperlinks to the different

Internet resources. To realize all these opportunities, there was developed special language called HyperText Markup Language (HTML). Hypertext is a way to organize information so that you can click links to jump from one piece of information to another... Markup refers to the symbols that indicate how the text or images should be displayed in a browser (11 p. 2).

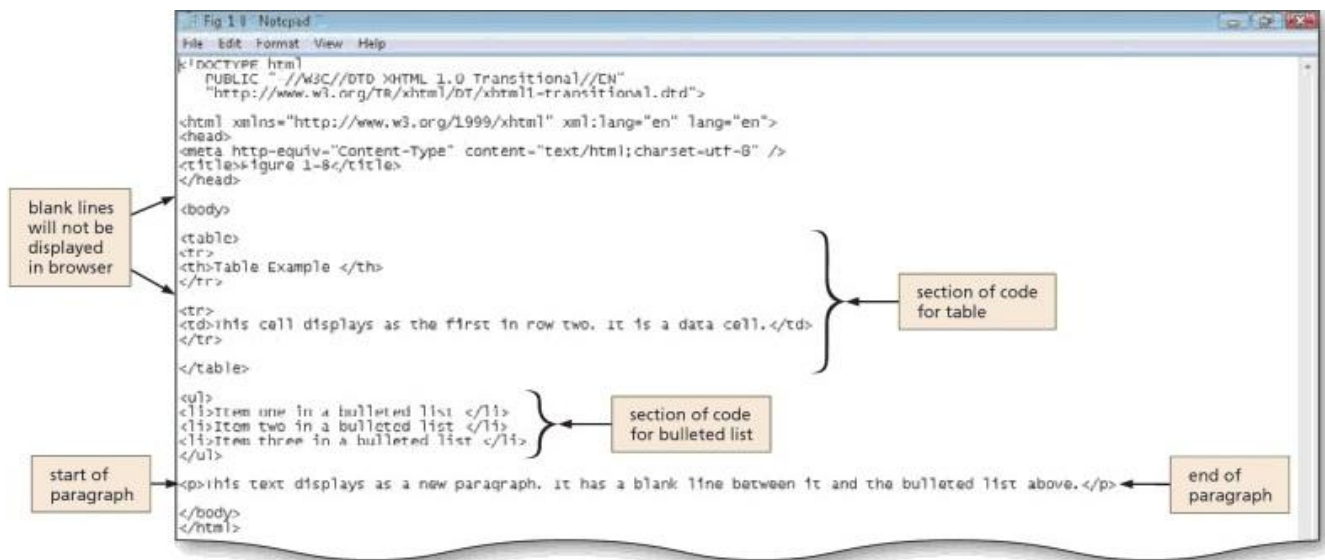


Figure 3 - Web page in HTML code (50 p. 23)

HTML tells browsers how to display the contents of a web page, using special instructions (called tags) that instruct the browser when to start a paragraph, italicize a word, or display a picture (12 p. 20). According to these instructions (tags) the program has the text on the screen, includes in it pictures which is stored in separate graphic files, and forms hyper communications with other documents or the Internet resources.

On this the moment such HTML versions are actual:

- HTML 4 (it is developed in 1997);
- XHTML (is the HTML4 expansion on the basis of XML);
- HTML5 (is in a development stage, but already has wide popularity).

The special case of HTML is DHTML. Dynamic HTML (Dynamic HTML, DHTML) is not any special markup language of pages. According to the World Wide Web Consortium (W3C): "Dynamic HTML is a term used by some vendors to describe the combination of HTML, style sheets and scripts that allows documents to be animated" (13).

These three DHTML components are connected among themselves by object model of the document (DOM, Document Object Model), being in fact the application programming interface (API). DOM connects together three listed components, giving to the simple document HTML new quality – possibility of dynamic change of the contents without page overload.

The object model of the document does all elements of the page by programmable objects. With its help through languages of scenarios it is possible to get access and to operate everything that is in the document. Each HTML element is available as individual object, and it means that it is possible to change value of any parameter of any tag of the HTML page, and, as a result, the document it becomes valid dynamic. Any action of the user is treated by object model of the document as an event which can be intercepted and processed by scenario procedure.

Cascading Style Sheets

“Cascading Style Sheets (CSS) is a simple mechanism for adding style (e.g., fonts, colors, spacing) to Web documents” (14). Using styles during Web page creating is comfortable, practical and effective tool for location text, images, links and other design elements.

The Web site is the integral and interconnected arrangement with uniform design of blocks on each page. A unified style for all pages of the site allows creating smooth dynamics of transition between pages that is an important point for perception and work with site contents for visitors. And for a Web master use of styles considerably simplifies layout design of a site.

“CSS styles can be stored directly in an HTML web page or in a separate style sheet file [...] When used externally, style sheet rules placed in an external style sheet document with the file extension .css” (15 p. 60). But links to this file are written on each page. At change of style in the general file, there is an automatic updating of design of elements on all pages of a site. Individually for a certain element, style is written directly on the page.

In comparison to HTML CSS styles have a much bigger range of possibilities to design of page elements of a site. “For example, not only can you style any HTML element to change its dimensions, colors, borders, spacing and so on, but now you can also add

animated transitions and transformations to your web pages, using only a few lines of CSS” (16 p. 9).

The specifics of writing and layout styles can significantly reduce the overall size of the pages, which in turn reduces the time and increases the speed of loading web - pages in the browser.

1.4 Server side

Server-side belongs to operations which are performed on server in client-server relationship (network field). As a rule server is computer program, for example web-server, which works on remote server, which could be reached from local user computer or work station. Operations may be executed on server side because they need the access to information or functionality, which are inaccessible or unreliable on client side. Server operations include also processing and data storage. Examples of server-side processing include the creation and adaptation database using MySQL.

Further we will consider in more detail such concepts as a web server, PHP programming language, MySQL database and so on running on the server side.

Web-server

When user types a web address into a browser, a web server receives the browser’s request and sends back the correct web page. For a busy website, this basic task can require a lot of work. Instead, most people get a commercial company, called a web host, to give them a little space on one of their servers, usually for a monthly fee (12 p. 12).

Web-server is a server that accepts HTTP requests from clients. Typically, the client is the web-browsers issuing HTTP responses, HTML pages, images, files, media or other data. Web-servers are the basis of the World Wide Web. In fact, web-server is both software and computer on which this software works. Clients access the web-server through a single resource locator - URL address of desired web page or another resource resides on the server.

Initially URL (Uniform Resource Locator) intended for designation of the locations of resources (most often files) in the World Wide Web. Now URL is positioned as part more the general system of identification of the URI (Uniform Resource Identifier) resources, the term URL gradually accepts wider value.

Among web servers the most popular are: Apache HTTP-Server from the Apache and IIS company from the Microsoft company.

“The Web Server (IIS) role includes Internet Information Services (IIS) 7, which is a unified Web platform that integrates IIS, ASP.NET, Windows Communication Foundation, and Windows SharePoint Services. IIS 7 lets you share information with users on the Internet, an intranet, or an extranet” (17).

On the iis.net, official IIS server web site, is written that the latest version 7 has modular architecture. It offers following benefits:

- componentization,
- extensibility,
- ASP.NET Integration (18).

Microsoft .NET Framework is a platform for creating, deploying, and running Web-based services and applications. ASP.NET – the part of technology .NET used to write a client-server web applications. It allows developer to create dynamic pages HTML. It also contains a set of ready elements of management, using which developer can quickly create interactive web-sites. In ASP.NET compiled languages are used. Compilation happens on the server at the time of the first appeal of the user to the page. If the programmer changed the page text, the program will be recompiled automatically.

“Apache HTTP Server is the most widespread Web server in the world” (19). This web server is so popular because of following features:

- Extends with an open initial code. It provides the possibility to correct errors and to make necessary additions to a program code.
- The application is available for a wide range of operating systems, including, Linux, Microsoft Windows, Novell, Mac OS X, GNU, Solaris, NetWare, OS/2, TPF, FreeBSD, Unix, and eComStation (20).
- Free distribution.
- The developers purpose is creation of the safe, effective, flexible and expanded server answering to modern standards.
- Some language interfaces sustain PHP, Tcl, Python, and Perl.

“The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows NT” (21).

The latest version 2.4.9 was announced in 2014.

From comparison of IIS and Apache servers can be concluded following:

- If the cost of licenses for developer is the main criterion, the combination of LAMP will be much cheaper as there are no expenses on licensing. LAMP - «standard – set” to create a web-site (Apache, MySQL, Linux, PHP (Perl or Python)).
- Apache is known as safer web server.
- If developer uses any OS, except the Windows OS on his servers, he is not able to use Internet Information Services.
- If developer needs to execute the scenario which is necessary only on ASPX or he prefers user-friendlier means of administration, the linking of IIS on the Windows platform is necessary to him.

PHP

PHP is a server-side HTML scripting language designed to generate HTML pages on the web-server and database work. It is probably the most effective way to create browser-independent dynamic Web pages, and it is an open source project, so no single company has control over its development (3 p. 533). PHP is currently supported by the overwhelming majority of web hosting providers. It is included in LAMP.

Nirav Mehta writes, that “PHP (<http://www.php.net>) was designed "to solve the Web problem", and it is no surprise that most CMSs are written in PHP” (22 p. 32).

In the area of programming for the Web, PHP is one of the most popular scripting languages (along with JSP, Perl and languages used in ASP.NET) due to its simplicity, speed of execution, rich functionality and source code distributed under license PHP. PHP is characterized by the presence of the core and plugins "extensions": to work with databases, dynamic graphics, cryptographic libraries, PDF documents, etc. PHP interpreter is connected to the web - server or through a module created specifically for this server (e.g. Apache or IIS), or as a CGI application.

As an alternative developers can find CMSs in .Net, Java, Ruby, Perl and Python.

1.5 Database MySQL

A database is a structured collection of data. To add, access, and process data stored in a computer database, you need a database management system such as MySQL Server.

- “MySQL is a database management system.

- MySQL databases are relational.
- MySQL software is Open Source.
- The MySQL Database Server is very fast, reliable, scalable, and easy to use.
- MySQL Server works in client/server or embedded systems.
- A large amount of contributed MySQL software is available” (23).

MySQL software is a very fast multi-threaded, multi-user secure SQLs access the server database (SQL - Structured Query Language). MySQL Server is intended for critical tasks on production systems with a heavy load, as well as for embedding into mass distribution of software.

Many of the world's largest and fastest-growing organizations including Facebook, Google, Adobe, Alcatel Lucent and Zappos rely on MySQL to save time and money powering their high-volume web sites, business-critical systems and packaged software (24).

MySQL is a solution for small and medium-sized applications. Usually used as a MySQL server that is accessed by local or remote clients, but in the distribution includes a library of internal server that allows to include MySQL in independent programs.

Flexibility of MySQL provides support for many types of tables: users can select as table type MyISAM, support full-text search and tables InnoDB, supporting transactions at the level of individual records. In the MySQL database constantly appear new types of tables due to open architecture and GPL licensing.

MySQL is a key part of LAMP (Linux, Apache, MySQL, PHP / Perl / Python), the fast-growing open source enterprise software stack. More and more companies are using LAMP as an alternative to expensive proprietary software stacks because of its lower cost and freedom from platform lock-in (25).

MySQL ported to a large number of platforms: AIX, BSDi, FreeBSD, HP-UX, GNU / Linux, Mac OS X, NetBSD, OpenBSD, OS / 2 Warp, SGI IRIX, Solaris, SunOS, SCO OpenServer, SCO UnixWare, Tru64, Windows 95, Windows 98, Windows NT, Windows 2000, Windows XP, Windows Server 2003 and Windows Vista. There is also a port of MySQL to OpenVMS.

MySQL has an API for the languages C, C ++, Java, Perl, PHP, Python, Ruby, Smalltalk, and Tcl, libraries platformy.NET languages.

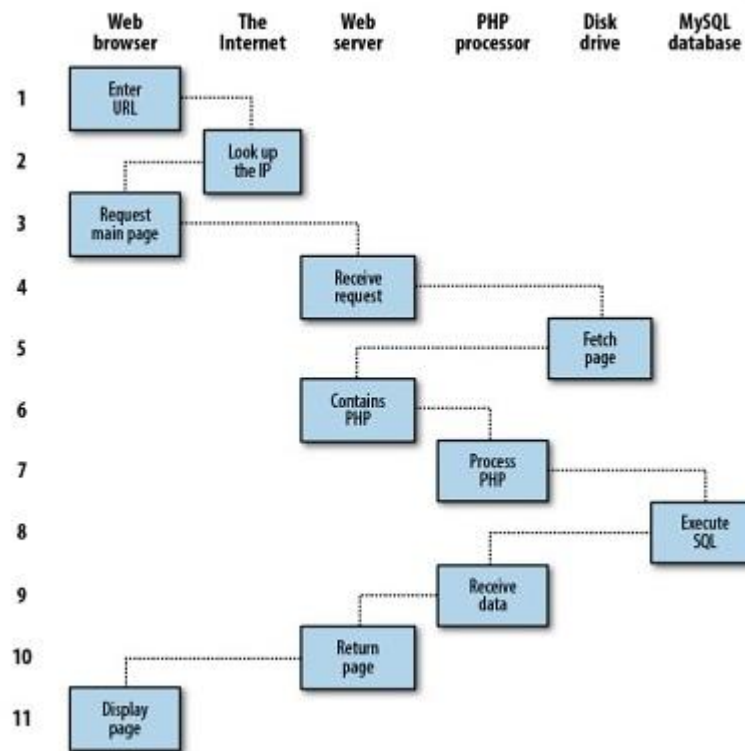


Figure 4 - Server, Database, PHP processor, Web browser interaction (16 p. 4)

“Thus the real beauty of PHP, MySQL, JavaScript, and CSS is the wonderful way in which they all work together to produce dynamic web content: PHP handles all the main work on the web server, MySQL manages all the data, and the combination of CSS and JavaScript looks after web page presentation” (16 p. 10).

Server side and client side architectures are the basis of Internet technology and knowledge how they work together make easier understanding how web site works.

1.6 Web site and work with it

Web site and web page concepts

“Web site (web — «network» and site — «place») is a set of interconnected webpages, usually including a homepage, generally located on the same server, and prepared and maintained as a collection of information by a person, group, or organization” (26). Web pages are text files containing HTML. These files are downloaded to the visitor’s computer, processed by the browser and displayed by the output device

(monitor, printer, speech synthesizer, etc.). HTML format allows not only text, but also denote it semantic elements, create hyperlinks, insert images into text and other multimedia content. Also HTML pages of modern sites apply CSS, JavaScript, and other technologies. Pages sites can be simple static files or are created by special program on the server – CMS.

Web site components

Mattehew MacDonald thinks that the main ingredients of the web site are following:

1. Web pages. Definition of web page we explained above.
2. Web space, where web site is stored (web server).
3. A domain name is web site address that user types on browser.
4. Web design tools. Special tools that can help web master to build qualitative web site – web design layouts, program Dreamweaver and so on.
5. Hyperlinks which connect all web pages together on the specific web site and with other web site forming thereby World Wide Web.
6. Indispensable extras include adding video, establishing community forum, selling products, creating interactive pages with JavaScript and so on. (4 pp. 17 - 18).

Goals and objectives of a website

Nowadays modern web sites have following functions:

- Advertising products, services and ideas. Good established website easily leads the client to the conclusion that he needs to purchase goods or services.
- Sale of goods, services, information and ideas. Today people are too busy to go shopping. Therefore, the possibility of ordering goods and services without leaving computer, greatly enhances both the client and the seller;
- Free provision of information or services. It could be information, education, entertainment and other portals which offer not only free information, but also advertisement.
- Customer support.

Web site topology

There is no single accepted typology of Web sites. Web sites may be divided into several types and subtypes, such as the following:

- static and dynamic,
- individual or group.

Domain types (such as gov, mil, co, com, net, edu, mobi) grouped by shared interests (such as download or humor sites, review sites, news sites, or search sites) (3 p. 13).

For all practical purposes, however, there are only five basic types of sites:

- personal,
- informational,
- organizational,
- political,
- commercial (3 pp. 15 - 16).

1.7 Content and content management concepts

Any web site includes content. In the broad sense content is any information filled the web page. Site content is related to the design of the web site. In the more narrow sense content is materials posted on web site, mostly text, pictures, audio and video. In other words, the content referred to everything that can be found using search engines. Currently Goggle and Yandex able to search for text, pictures and videos, but not audio.

Content consists of essence and metadata (27 p. 4). Essence in this case is “raw materials” – text, video, audio, pictures. Metadata gives the information about essence. For example, pictures parameters, the date of the addition it to the site, its link are the metadata of some picture on the web site.

As indicated above content does not exist without web site, therefore the concept “content management” is considered further.

Mark Kerr defines a content management as “the process of collecting, storing, delivering and monitoring information vital to the organisation. In web site terms, this includes uploading, storing and serving the information to those who need it, but only to those authorised to see it. As a concept, content management is often seen as a technical

activity based around intranet, knowledge management or archive systems and processes, but it can also encompass the whole life-cycle of information from creation to deletion” (28 p. 24).

“In its simplest form, content management does just three things:

1. Asset Management: Organizing units of content.
2. Transformation: Presenting that content.
3. Publishing: Delivering the content to your audience” (29 p. 44).

Content management system is computer program, which used for management of content of something (usually this content is considered as unstructured data of a subject task contrary to the structured data, usually being under control of DBMS). A CMS is a web application that allows you to create articles or any other pages directly online, from a secured administration area (30 p. 3). Usually such systems are used for storage and the publication of a large number of documents, images, music or video. CMS are typically browser-based and user do not need the deep knowledge about technical details (such as HTML or CSS) to maintain his web site. „Individual content management systems provide additional specific features such as authentication, authorization, locking, versioning, workflow, audit, internationalization, and localization of the content, as well as separation of work-in-progress data from the published websites” (31 p. 2).

Content management systems, widely spread lately, facilitate the development of complex Web systems, but none of them have conquered the market because each system is intended for a certain scope of application and has several advantages.

1.8 CMS benefits

A CMS typically provides a number of features that simplify the process of building, deploying, and managing websites, including the following:

1. an administrative interface;
2. a database repository for content;
3. a mechanism for associating information that is stored in the database with a physical page on the website;
4. a toolset for authoring, publishing, and managing content;

5. a component for creating and managing menus and navigational elements the tools required to define and apply themes;
6. user management;
7. a security framework;
8. web 2.0 capabilities such as forums, blogs, wikis, polls, and surveys;
9. taxonomy and tagging;
10. online forms;
11. e-Commerce capabilities (32 p. 1).

1.9 CMS trends

Wolfgang Maass, Tobias Kowatsch consider following challenges and trends for CMS solution:

1. Deeper integration with core business solutions, in particular Enterprise CMS and Business Process Management solutions.
2. Real-time responses to user activities by strong integration of real-time business.
3. Intelligence in CMS solutions with solutions such as Apache Hive.
4. Re-designing CMS architectures by leveraging of cloud service and big data infrastructures.
5. Making contents meaningful by adding computational semantics, e.g. tags, taxonomies, and ontologies
6. Balancing between client and server-sided computations, e.g., client-sided and server-sided Javascript.
7. Rise of 3D contents and 3D interaction spaces rendered at run-time, e.g. WebGL and holographics.
8. Seamless integration of mobile content delivery infrastructures Real-time integration and processing of large-scale sensor data.
9. Positioning CMS solutions within future browser/operating systems battles in mobile, cloud, and stationary infrastructures.
10. Long-term persistency and archiving of digital contents.
11. Security of contents, CMS, and ICT channels.

12. Global and unambiguous ownership of digital contents with full and barrier-free.
13. Control for all those contents (33 p. 6).

1.10 Classification of CMS

Nirav Mehta divides content management systems into following groups:

1. portals or general-purpose CMSs,
2. blog CMSs,
3. e-Commerce CMSs,
4. wiki CMSs,
5. forum CMSs,
6. eLearning CMSs,
7. collaboration CMSs (intranet) (22 pp. 16 - 29).

Portals or general-purpose CMSs (or Web Content Management System (WCMS or Web CMS))

This CMS allows user without deep technical skills manage their web sites – add images, articles, widgets, change site design using a predesigned template and so on. The definition from the thesis of Deborah L.Dalhouse applies very well to this type of CMS: “Web site content management systems are defined by Gerry McGovern (2005) as “computer software based tools that assist humans to create, manage, deliver, and navigate or browse content” (34 p. 5). The general-purpose CMSs can be used for online newspaper, magazine, personal site and other.

Examples of this type of CMS are following: Joomla! (<http://www.joomla.org/>), Drupal (<http://www.drupal.org/>), CMS Made Simple (<http://www.cmsmadesimple.org/>), SilverStripe (<http://www.silverstripe.com/>).

Blog CMSs

Dave Taylor considers that the fundamental elements of most weblog systems are following:

- Creates new Web pages that are visually consistent with the existing site.

- Links all pages together.
- Organizes content based on the entry date and user-defined categories.
- Offers readers alternative methods of keeping track of what's new.
- Works within a Web browser (35 p. 294).

Usually blog as a content management system is maintained by person, regularly adding description of different events, photo and video from them. Commentaries are also the essential part of blog. Commonly articles are appears in reverse-chronological order.

Nowadays blogs are very popular. “In fact, a new blog is created somewhere in the world every half a second [...] 172,800 blogs are added to the internet every day” (36). The following are some top blog CMSs: WordPress (<http://www.wordpress.org/>), Movable Type (<http://www.movabletype.org/>), Expression Engine (<http://expressionengine.com/>).

E-Commerce CMSs

The purpose of this type of content management system is running an online store. It must allow to manage the products, sell, rank and compare them. In particular complete online store must include product, customer and site management, shopping card, marketing tools, attributes of Search Engine Optimization.

Phillip Crowder divides online shops into five categories:

- single-product sites and specialty stores,
- general stores,
- service sites,
- shopping malls,
- affiliate stores (3 p. 681).

The most popular CMS for ecommerce are following: Business Catalyst (<http://businesscatalyst.com/>), Magento (<http://magento.com/>), PrestaShop (<http://www.prestashop.com/>), OpenCart (<http://www.opencart.com/>), osCSS (<http://www.oscss.org/>) (37).

Wiki CMSs

Michael Aaron Dennis defines a Wiki as following: “A wiki is a web application which allows people to add, modify, or delete content in collaboration with others... While

a wiki is a type of content management system, it differs from a blog or most other such systems in that the content is created without any defined owner or leader, and wikis have little implicit structure, allowing structure to emerge according to the needs of the users” (38). Each user can simply create and edit articles on the Wikipedia web site using simple formatting markup syntax, link them to other pages. The disadvantages of Wikipedia as a content management systems I think are: user’s article can be easily modified by any user possibly in undesirable way; user cannot employ Wiki for ecommerce and blogging purpose and so on. Thus in our opinion Wikipedia as a CMS shall be used only for a limited goals.

The most used Wiki CMSs: MediaWiki (<http://www.mediawiki.org/>), DokuWiki (<http://www.dokuwiki.org/>), PmWiki (<http://www.pmwiki.org/>), TWiki (<http://twiki.org/>).

Forum CMSs

There are many definition for the concept “Forum”. “A Web forum is a website or section of a website that allows visitors to communicate with each other by posting messages. Most forums allow anonymous visitors to view forum postings, but require you to create an account in order to post messages in the forum” (39). Or “Also called a "discussion board" or "discussion group," an Internet forum is similar to an Internet newsgroup (see below), but uses the Web browser for access” (40).

Web page based on forum CMS looks like hierarchical (threaded) discussions, where users post their public messages with their names (nicknames) and other information about message. All messages are grouped into topics for easier search of needed information. Also forum includes private messages, “smile” attachment (smile is special picture representing the emotion of user), subscribe to topics, profile page, search, RSS.

Forums exist as an independent web site, or complement to another type of site.

The most popular forum solutions are: Vanilla Forums (<http://vanillaforums.org/>), NodeBB (<https://nodebb.org/>), Simple Machines Forum (<http://www.simplemachines.org/>), VBulletin (<http://www.vbulletin.com/en/>), Invision Power Board (IPBoard) (<http://www.invisionpower.com/>) (41).

eLearning CMSs

Recently e-Learning becomes more popular and fashionable. There are more sites where user can learn online foreign languages, Information Technology, and even get a higher education through the Internet. For organizing such an opportunities special systems are needed.

E-Learning CMS gives the possibility to manage studying through the Internet without face-to-face interaction with educational institution or teacher. It must meet the following requirements: organize courses, students, and teachers; manage study schedule; import-export special document, study materials, pictures; conduct examinations and tests; creation of chat, blog and many more.

As examples of this type of systems we can mention the following: eFront (www.efrontlearning.net/), Moodle (<https://moodle.org/>), ATutor (atutor.ca/), Docebo LMS (www.docebo.com/).

Collaboration CMSs (intranet)

“A collaboration CMS is generally designed for internal users of an organization. Users could be all employees, partners, or customers. The needs of every organization may be different, and an Intranet may have variety of systems—from HR to groupware to ERP” (22 p. 27).

Generally speaking this type of CMS is intended to more efficient and easier organization functioning: corporate blog and forum, record and document management, remote desktop access APIs, third party integration and many more.

The following intranet’s CMSs can be good choice: OpenAtrium (<http://www.openatrium.com/>), Plone (<http://plone.org/>), Vauzo Intranet (<http://www.vauzo.com/>).

Another opinion about classification of content management systems have Wolfgang Maass and Tobias Kowatsch. They classify the CMSs the following way:

1. online CMS,
2. web CMS,
3. enterprise CMS,
4. cross Media CMS,
5. eLearning CMS (33 p. 4).

In order to extend the topology of CMS they could be divided into following parts

- free and paid CMS.

Paid CMS:

- NetCat,
- Bitrix,
- Saitistika,
- UMI CMS and so on.

Free CMS:

- Joomla!,
- Xoops,
- WordPress,
- Textpattern,
- Drupal and others.

1.11 Advantages and disadvantages of free and paid CMSs

Advantages of free CMS:

1. A big amount of companies, especially freelancers engaged in development.
2. Sufficiently high functionality.
3. Not limited possibilities for customization. In addition, there are many free add-ons and modules.
4. Normally, the base version of the system is quite reliable.
5. Do not demanding hosting.
6. Free.

Disadvantages of free CMS:

1. No official support.
2. Technical support mainly carried out by freelancers, it means that user need to find qualified specialist by himself.
3. Often after making any changes to the system it would be almost impossible correctly update it.
4. Despite the fact that the basic version is usually very reliable, but sometimes needs more functionality, it must be supplemented by an addition functionality, which can

lead to security problems of the system. Also free CMS is very vulnerable to careless user actions.

5. To configure the system, the user must have sufficient technical skills - knowledge of html, fundamentals of programming and working with databases. Still, free system created by programmers for programmers, due to this they develop.

Benefits of paid CMS:

1. Official support. Thus, when problems arise user can easily get needed support.
2. A lot of companies involved in technical support, often there is an entire affiliate network with which is easier to work than with freelancers.
3. Good updatable, which will not be disturbed functional extension.
4. Flexibility is usually much higher than free CMS's have and thus do not require high technical skills.
5. Excellent documentation such as user guide, developer guide, etc. For some systems, customers are trained to use the system.

Disadvantages of paid CMS:

1. Sometimes they are more demanding to the hosting than free CMS's. Information about resource use is usually not available.
2. High cost.

Thus for big commercial web resource it is better to use paid CMS where good technical support is available. For such a resources it is not recommended to develop their own CMS if there are no highly qualified specialists. Also it takes much time to study specially developed CMS for new users and developers. For medium and small web sites without any specific demand it could be better to use free CMS. The main question is to choose the right one for each project.

1.12 Content Management System functioning

Most open source CMSs use PHP as the server-side programming language and MySQL as the database. Typically, they are hosted on Linux servers with Apache as the web server (22 p. 65). Further will be considered on an example how such a CMS works.

The figure 5 shows how web administrator works with CMS interface through web browser.

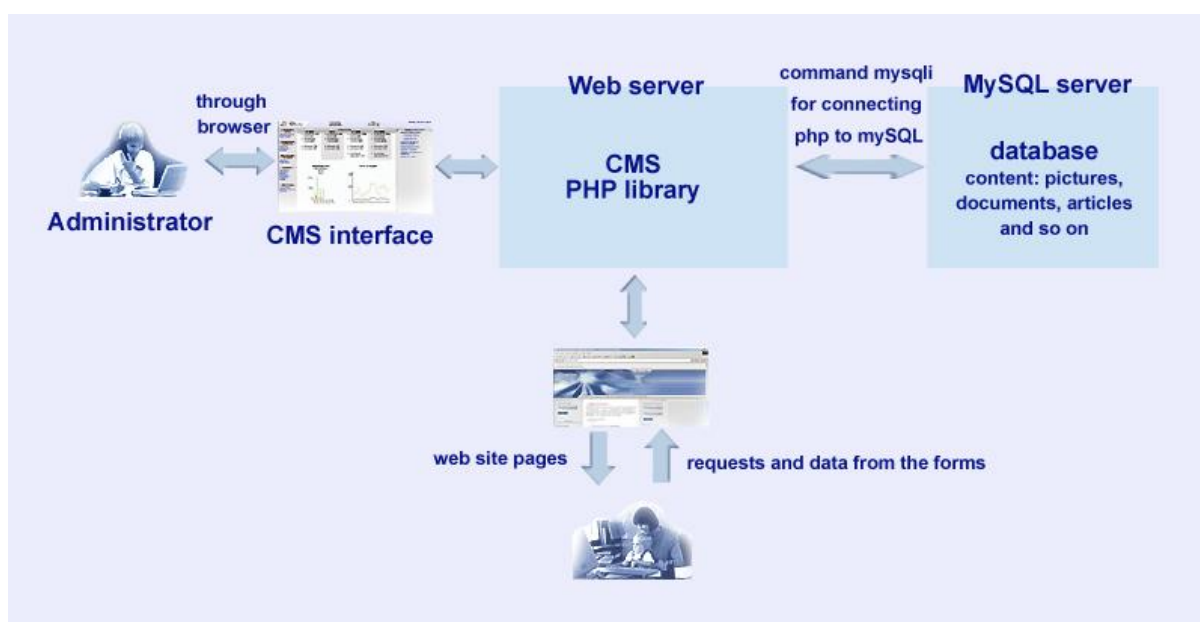


Figure 5 - CMS functioning. Source: author

In order to connect to Wordpress CMS administrator types special address in browser, for example, <http://sila-misli.ru/wp-login.php>, where „sila-misli.ru“ is domen name, „wp-login“ means, that login and password are needed, „.php“ means, that CMS is working on PHP language. Nowadays the optimal variant is a three-column interface that is used for CMS as Bitrix and WordPress. Separations columns on the main content, the main and sub-menu allow effectively manage the content of the site. This grouping is considered to be more convenient for widescreen monitors. Initially it was created for tablets and Apple company first applied it to mail client iPad. Then the similar interface used Google, Rambler and Yandex.

Besides the standard CMSs, which are built on HTML, it should be mentioned content management system running on Flash. There are two types of this technology for the CMS. The first assumes entire site in Flash (the administration module can be HTML with PHP), and the second is a site on HTML, but the administration module is made entirely in Flash.

CMS is located on special web server. Also PHP language works on this web server (Apache, for example). In order web server to understand PHP language, standard PHP library (SPL) is uploaded to this web server. SPL is a collection of classes and interfaces

providing an API for built-in PHP functions, allowing developers to write fully object oriented code with standard tools, using PHP in a much more elegant way. (42). Data base MySQL works on different server – official MySQL server. On this data base server is stored all data, that user can see on the web site – articles, pictures, all elements of web site design and so on. PHP connects to data base, makes a request and get a data which it requested. For connection PHP with data base is used command “mysqli”. In CMS is written special function for connection to data base – for page generation, saving data and so on. Web site users see only web site interface – web pages. They can send some requests (for example, to find something on the web page or to buy a product) or to send some information through special form (for example, for web site support).

Further will be considered some example of what is happening in this architecture if administrator wants to open the link “Posts – Open Post” on his CMS. When administrator clicks on such a link the request to the server is generated. Server is trying to find the specific post, but could not find it. After web server addresses to index.php file and sends this request PHP to perform. PHP “reads” the link where post is located and starts the special controller, which is responsible for processing articles. Content is stored on the data base. Controller establishes the connection to database generates a request and sends this request to data base server. Data base server gets the request, processes it and sends the result to PHP. PHP in its turn gets the result, processes it, generates the page and sends it to the CMS administrator.

Summing up modern information technology is growing very rapidly. A number of web sites increases, people are more and more willing to learn how to manage their own web site. Accordingly, web developers try to improve CMS and make them more accessible, easier to use, so that they could be used by almost anyone, even without any special knowledge.

Nowadays in the Internet technologies is prevalent client-server architecture. Common client side includes CSS, HTML, JavaScript and server side comprises PHP language, web server, data base and so on. CMS is intended to manage and organize data on the data base server. A need for the administrative part is convenience access to CMS which is located on different server. Mostly CMSs use PHP as the server-side programming language, MySQL as the database and Apache as the web server. In this

literature review was examined in detail which topologies of CMS exist, what are the benefits and trends of the modern CMS and how they work.

Further is considered the most popular modern CMS – WordPress, Drupal and Joomla!, and made a comparison between them and shown the implementation of the design layout on CMS WordPress.

2. Practical part

The success of the site in many cases depends on correct choice of CMS. A good system is convenient for users, and they will leave some site because half the features does not work as it should. Then user does not have to waste time on import / export data to another CMS when he realizes that he made the wrong choice.

In this part of our research the comparison between the most popular web content management systems will be made. For detailed consideration are taken Joomla!, Drupal and WordPress WCMS. Nowadays there exist a lot of versions of these WCMS but for review were taken the modern ones such as Joomla! 3, Drupal 7 and WordPress 4. They are distributed under license GPL (General Public License), which allows user to install them on an unlimited number of nodes, and completely free. Basic principles of GPL are free distribution programs and source code, so the source code of chosen CMS is distributed in an unencrypted form.

According to W3 tech surveys (January, 2015) 61.4% of the websites use none of the content management systems. WordPress is used by 23.4%, Joomla! by 2.9%, Drupal by 2.0% of all the websites. But a content management system market share of WordPress is 60.7%, of Joomla! is 7.6%, of Drupal is 5.1%. For more detail see the diagram below:

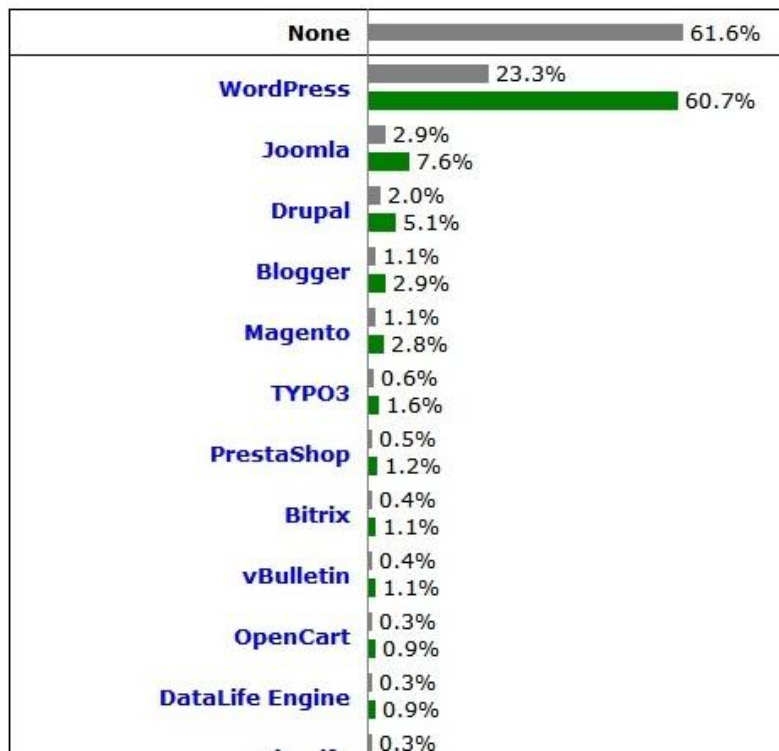


Figure 6 - Usage of content management systems for websites (65)

2.1 Web content management systems descriptions

Web content management system Joomla! description

Joomla! is content management system written in PHP and JavaScript, is used as a repository content database MySQL. It is free software.

Below is shown the table with brief characteristics of Joomla! CMS.

Table 1 - Characteristics of Joomla! CMS. Source: author

Type of software	Content management system, content management framework
Developer	The Joomla! Project Team
Written in	PHP, JavaScript
Operation system	Cross-platform software
The latest release	3.3.6 (October 1, 2014) (43)
Development status	Active
Lisence	GNU GPL v2
Size	7.6 MB (compressed), 20.9 MB (uncompressed)

Available in	Multilingual
Official website	www.joomla.org

Joomla! 2.5 is very different from Joomla! 3.0 and higher. Changes were made in design of interface, in functionality, in security, etc. Below is published dashboard of new Joomla! 3:

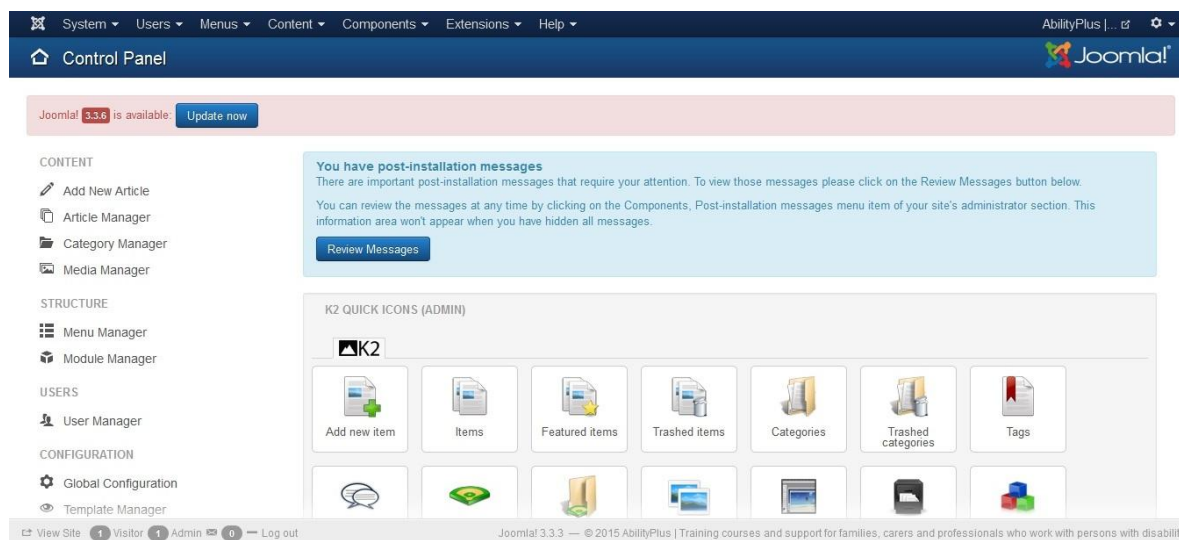


Figure 7 - Joomla! 3 Dashboard. Source: author

Web content management system WordPress description

WordPress CMS was first released on May 27, 2003. Founders are Matt Mullenweg and Mike Little. WordPress is open-source content management system distributed under the license GPLv2 from Free Software Foundation. It is based on PHP and as a database uses MySQL. Scope of application is ranked from blogs to quite complex news resources and online stores. The built-in system of "templates" and "plugins" together with successful architecture allows designing almost any projects.

Below is presented brief analysis of the WordPress CMS.

Table 2 - Characteristics of WordPress CMS. Source: author

Type of software	Content management system, blog software
Developer	WordPress Foundation
Written in	PHP
Operation system	Cross-platform software

The latest release	4.1 (December 18, 2014) (44)
Development status	Active
Lisence	GNU GPL v2+
Size	6.4 MB (compressed), 17.4 MB (uncompressed)
Available in	Multilingual
Official website	www.wordpress.org

For comparison to Joomla! 3 dashboard interface is published screenshot from official web page of WordPress 4.0 (the newest WordPress 4.2). See it below:

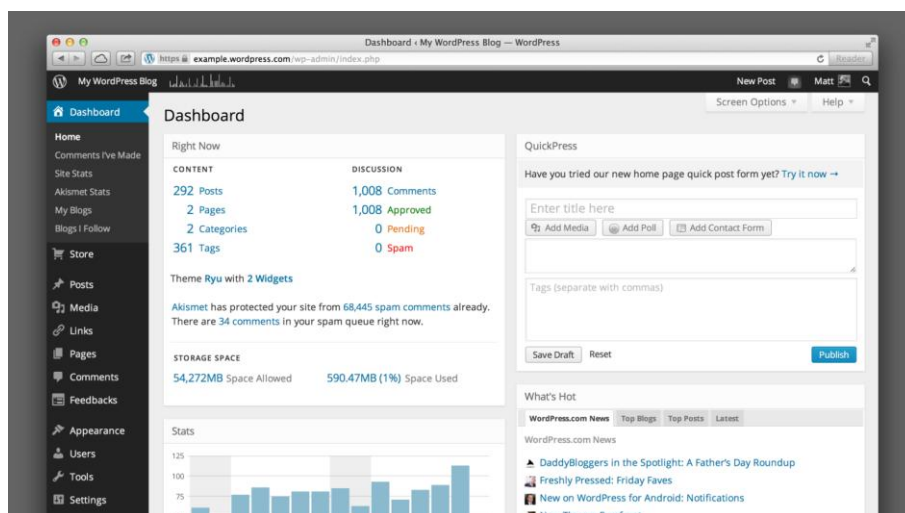


Figure 8 - WordPress 4.0 dashboard (56)

It is necessary to say that firstly WordPress was intended to support blogs - handling a minimal number of content types (pages and discussion) in a chronological display order. But later this system was growing and now “WordPress is one of the most popular open source content management systems available, with global and vibrant user, developer, and support communities [...] With the rise of self-publishing, low-cost web hosting, and freely available core components like the MySQL database, blogging software followed the same trend as most other digital technologies, moving from high-end, high-cost products to widely available, low-cost consumer or “hobbyist” systems” (45 p. 2).

Web content management system Drupal description

Drupal is a free and open source CMS written in PHP and distributed under the GNU General Public License (32 p. 2). Drupal used as a data store relational database (supports MySQL, PostgreSQL and others and is developed by enthusiasts from around the world.

Table 3 - Characteristics of Drupal CMS. Source: author

Type of software	Content management system, content management framework
Developer	Dries Buytaert
Written in	PHP
Operation system	Cross-platform software
The latest release	7.34 (November 19, 2014) (46)
Development status	Active
Lisence	GNU GPL v2+
Size	11.7 MB (uncompressed)
Available in	Multilingual
Official website	www.drupal.org

Below is published the dashboard of Drupal 7:

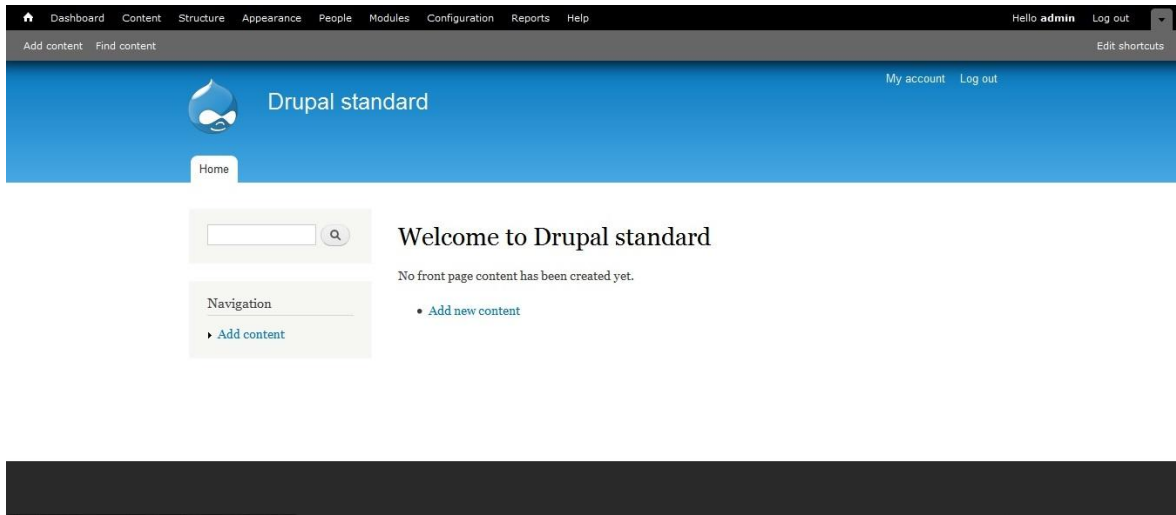


Figure 9 - Drupal 7 dashboard. Source: author

2.2 Minimal hosting requirements of Joomla!, WordPress, Drupal

Below is shown the comparison table between the CMS's in basic configuration for minimal hosting requirements.

Table 4 - Hosting requirements of Joomla! 3.4.1, WordPress 4.2.2, Drupal 7.37. Source: author

	Joomla! 3.4.1 (48)	WordPress 4.2. (49)	Drupal 7.37 (50)
PHP	PHP version 5.3 or higher version with extensions MySQL, XML, Zlib. Increased memory limit for the execution of PHP script - 64 MB or higher	PHP version 5.2.4 or greater (recommended: PHP 5.4 or greater)	PHP 5.2.5 or higher (5.4 or higher recommended).
Database	MySQL version MySQL 5.1 and higher or MSSQL 10.50.1600.1 and higher or PostgreSQL 8.3.18 and above.	MySQL version 5.0 or greater (recommended: MySQL 5.5 or greater)	MySQL 5.0.15 or higher with PDO, PostgreSQL 8.3 or higher with PDO, SQLite 3.3.7 or higher
Web server	Apache version 2.2. or Microsoft IIS. The most suitable operating system for servers - Linux. But most of Joomla!	Apache or Nginx as the most robust and featureful server for running	Apache 2.x hosted on UNIX/Linux, OS X, or Windows. Or Nginx legacy versions (0.7.x, 0.8.x, 1.0.x, 1.2.x), stable 1.4.x versions,

	extensions work without problems only under Linux.	WordPress, but any server that supports PHP and MySQL will do.	and mainline 1.5.x versions hosted on UNIX/Linux, OS X, or Windows. Or Hiawatha. Or IIS 5, IIS 6, or IIS 7
Disk space	At least 150 MB	No specific requirements	A minimum installation requires 15 MB. 60 MB is needed for a website with many contributed modules and themes installed.

From the table below WordPress is less resource demanding CMS in comparison to Joomla! and Drupal. The last ones are a set combined with each other separate components, modules, of which, as of bricks, is constructed the web site. Therefore web sites powered by Joomla! and Drupal are quite resource demanding for their installation and stable operation, thus the requirements for hosting are special. The most demanding CMS is Drupal due to its flexibility and complexity.

Further CMSs were compared based on three dimensions of quality according to ISO/IEC 25010 standard: functional suitability, performance efficiency and usability.

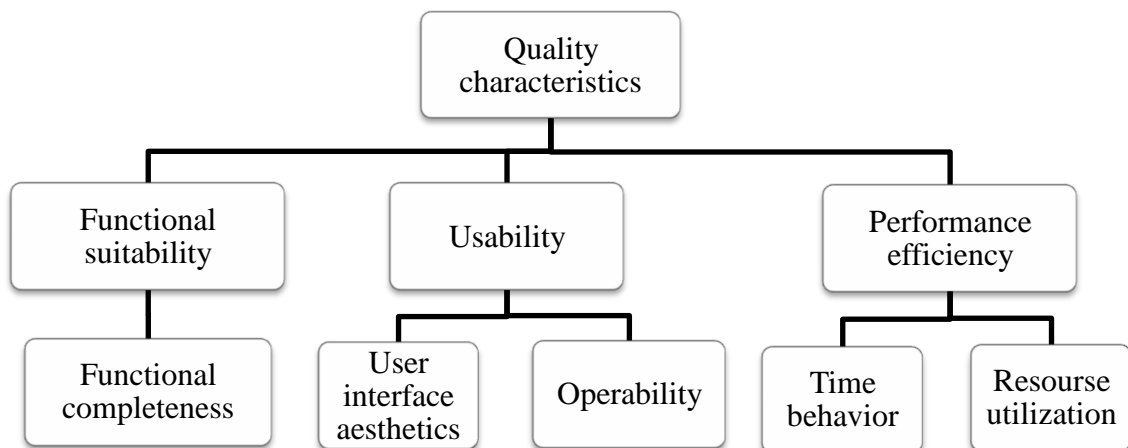


Figure 10 - Dimensions of quality according to ISO/IEC 25010 standard. Source: author

In order to objectively compare chosen CMSs was used method of scoring, because this method is usually used in complex cases. For each of these dimensions was determined measurable criteria, to each of which a value was assigned. The sum of points of each variant is a guide indicating that option with the smallest scoring contains the best conditions for achieving the objectives.

Following scores were applied:

Grade 1 – CMS fully satisfies decision criterion (76% - 99%).

Grade 2 – CMS partially satisfies decision criterion (51% - 75%).

Grade 3 – CMS partially dissatisfies decision criterion (26% - 50%).

Grade 4 – CMS fully dissatisfies decision criterion (1% - 25%).

Scoring options cannot be considered as an absolute measure for the decision, but it gives information about the positives and negatives of various alternatives under uncertainty and brings a certain scale.

2.3 Functional suitability

Before choosing the most appropriate CMS for web site user needs to know its main functionality. All CMS's have quite big set of functions what in some cases can lead to slowdown of web page. It means that for each individual web project is necessary install suitable CMS.

According to ISO/IEC 25010 standard “functional suitability is the degree to which the product provides functions that meet stated and implied needs when the product is used under specified conditions” (50).

Functional suitability has some sub-characteristics from which functional completeness was analyzed and measured. Functional completeness means extent to which set of functions meet all the user requirements and objectives.

Default CMSs configuration are being compared on a range of following criteria.

Yes – Function is available;

No – Function is not available.

Full table with notes see in Appendix F.

Capabilities of default CMS configuration

1.1. Management and administration

Installation process of three chosen CMS is quite similar. User needs to download installation package with stable version from official web site, upload it to the server and go through the installation process which consists of following steps:

1. CMS needs to be connected to database. Drupal 7 and Joomla! 3 allow user to choose among 3 types of database, WordPress offers user only MySQL.
2. Write required site information: name, password, description, admin e-mail, etc.
3. Choose language of CMS and make some small settings which are insignificantly different in chosen CMSs.
4. Finalization.

Very important feature is responsiveness of administration panel. With regard to Drupal 7 this CMS is still not responsive. Joomla! 3 back-end is responsive because it was constructed using Bootstrap framework and front-end inherits this features. Also in Joomla! is added LESS – dynamic language for CSS for template development. WordPress became responsive only from version 4.1.

All three analyzed CMS support such modern administrative features as:

1. Role model, where administrator can restrict the access of any user. Also users can have their own profiles and manage visibility of this data on web page. Possibility to add unlimited amount of users.
2. Authorization with OpenID. OpenID is open standard decentralized authentication system allows users to create a single account for authentication on the set is not connected with each other online resources using third party services. Joomla and WordPress support OpenID only through specially installed components, in Drupal it is default feature.
3. Localization of interface and Multilanguage.
4. UTF – 8 encoding.
5. Nested categories. Drupal 7 in this case is the most advanced. It supports a wide range of properties under construction rubricators: flat lists, hierarchies, hierarchy with common ancestors, synonyms, related categories.

6. All three chosen CMSs allows user to create scalable web sites. Scalability is achieved through plugins, widgets, themes for WordPress, modules, plugins, themes for Joomla and blocks, modules, themes for Drupal.
7. Multiple sites is different site configuration for various virtual hosts (“multiple sites”), including their own set of modules and themes for each sub site. Drupal and WordPress support “multisiting”, furthermore for Drupal there is the ability to create sites with overlapping content (e.g. common base of users or the general settings). Joomla! lacks this feature.

1.2. Content management

In order to extend functionality of web site developers use custom fields and custom content types. The contents of these fields are called meta-data. Fields may include some further information. Custom content types are special types of contents which user may create additionally and manage them through administrative panel. I found out that of the considered CMs only Drupal supports adding custom fields and custom content types via administrative panel. In WordPress and Joomla! developer needs to add special plugins for that or code them in php files of CMS.

Functions of compared CMSs relating to management and administration are considered below.

Table 5 - Management and administration function CMS's comparison. Source: author

Capabilities	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Responsive dashboard	yes	yes	no
User management	yes	yes	yes
Authorization with OpenID	no	no	yes
Localization of interface and Multilanguage	yes	yes	yes
Multiple sites*	yes	no	yes
UTF-8	yes	yes	yes
Media Manager	yes	yes	no
Nested categories	yes	yes	yes
Scalability**	yes	yes	yes
File Editor***	yes	yes	no

* Different site configuration for various virtual hosts (“multiple sites”), including their own set of modules and themes for each sub site.

** Possibility to extend functionality due to blocks, modules, themes, etc

*** Allows editing code directly from the dashboard

With regards to blogs and forums creation and maintenance was examined the following:

1. WordPress and Drupal supports blogs by default but Joomla! needs special components installation.
2. Drupal allows creation of forum by default but for better functionality is recommended to use extended modules (Advanced Forum, Quote, BBCode). WordPress and Joomla! lack its feature but could be compensated by special plugin (e.g. Mingle Forum) and component (e.g. Kunena) for each CMS respectively.

For security or commercial reasons sometimes there is the need to restrict some part of web site by password. In Drupal CMS it is possible only using special modules. In case of WordPress by default there is the possibility to restrict access to separate pages only. As it was discovered Joomla! is the most advanced in password protection. It allows creating a closed password restricted section of the site without using third-party plugins.

Content capabilities are analyzed further.

Table 6 - Content capabilities comparison of CMSs. Source: author

Capabilities	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Forum realization	no	no	yes
Custom fields	yes	no	yes
Custom Content Type	no	no	yes
Blogs	yes	no	yes
Password protection	yes	yes	no
Built-in comments	yes	no	yes

1.3. Promotion

On the Internet nowadays there is such a big amount of competitive among each other web sites that search engine optimization (SEO) cannot be underestimated. Therefore it is very important to understand which CMS is more adapted to successful promotion.

Chosen CMSs were examined in following criteria:

1. Search Engine Friendly URL. All three CMS support such a URL.
2. Joomla! and Drupal have surveys and polls embedded. WordPress needs additional plugin installation.

3. In case of WordPress this CMS supports RSS 1.0, RSS 2.0 and ATOM. Pingback and TrackBack are two very useful way to connect to other blogs and provide opportunities to connect to your one. In Joomla! feeds are created with built-in Newsfeeds component. Drupal supports XML-formats: output documents in RDF / RSS; aggregation of material from other sites; BlogAPI materials for publication by external applications.
4. SEO. WordPress by default do not provide wide SEO capabilities but powerful plugins were found for that. First All in SEO pack which includes SEO settings for home page, titles, keywords, content types, media files, sliders, indexing (adding tag <noindex>), search engines (Bing, Google) and many more. Second plugin is Google XML maps for generating a XML map helping better indexation of web site.

Joomla! has some basic functionality for SEO. In configuration user can enable URL rewriting, add suffices to URL, write site and description name, set metadata and tags at the page level and allow indexing for search engine robots. I would say that Joomla! lacks advanced SEO capabilities and has only basic ones but it could be extended by special components, for example, SEO Generator v4.6.

In terms of SEO, everything is built in Drupal quite competently. The basic installation package already has the support of user friendly URL, tags and the file robots.txt is already configured. However, for the successful promotion of the site there is a need for more flexibility options with third-party modules: Google Analytics, Page Title, Path Redirect, Meta Tags, XML Sitemap, etc.

Features related to promotion are compared below.

Table 7 - Promotion function comparison of CMSs. Source: author

Capabilities	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Search Engine Friendly URL	yes	yes	yes
Feeds and RSS	yes	yes	yes
Surveys and polls	no	yes	yes

1.1. Search and Backup

The last functionality features which are considered search and backup. My research has shown that search function is present in all three considered CMSs but it has different level of advancement. WordPress supports simple search only: between posts, results are listed in chronological order, no filters. Joomla! has two types of search: “Search” (com_search) has irrelevant results of search and just a few options for configuration; “Smart Search” (com_finder) has relevant result of search, filters, easy to configure, but increases database (tables_finder) after making the search index and database load. Drupal in its turn has advanced search. It has relevant results, filters, applies for content on the site, including search in taxonomy and users.

For good maintenance of web site it is essential to make backups. In WordPress For backup of whole web site (database, configuration, etc) usually used special plugin (WP-DB-Backup) or through C-Panel. Akeeba backup in Joomla! is built-in component and allows making front-end backup. In Drupal backup and migrate modules support gzip, bzip and zip compression as well as automatic scheduled backups.

Search and back-up functions of CMSs are analyzed below.

Table 8 - Search and back-up functions of CMSs. Source: author

Capabilities	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Search	yes	yes	yes
Advanced search	no	yes	yes
Back-up	no	yes	yes

The results of comparison are presented further.

Table 9 - Final results of functional suitability CMS's comparison. Source: author

CMS	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Result, sec	16/22	14/22	18/22
Grade	Grade 1	Grade 2	Grade 1

2.4 Usability

In ISO/IEC 25010 standard usability is defined as “degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”¹.

¹ <http://iso25000.com/index.php/en/iso-25000-standards/iso-25010?limit=3&start=3>

It is very important to mention that web-based CMS is not a web site but application. However the main principle of design usability remains the same: respecting the user experience. The measures and attributes are focused on that, in which extent is application understandable for users, how easy to operate and learn it and how it is attractive for them. Since it comes about subjective user experience, source of data is opinion of some target group of users. As a target group was chosen eight information technology specialists. As an information technology specialist is understood a person who is certified specialist in information technology field or (and) has two and more years work experience in information technology.

In relation to usability two sub-characteristics were analyzed: user interface aesthetics and operability.

User interface aesthetics

User interface aesthetics means the extent to which the interface of software provides pleasurable and satisfying interaction with its user. Users could be concentrated on system as a unit or on attractiveness of some individual functions.

To measure interface aesthetics special standardized test Visual Aesthetics of Website Inventory (VisAWI-S) based on seven-point Likert scale will be applied. VisAWI test consists of four parts with questions from categories: simplicity, diversity, colorfulness, craftsmanship and contains 4 questions in total (short form). It was developed by Moshagen and Thielsch in 2010 as a special tool to evaluate visual aesthetics of an interface. Likert scale is an ordinal scale of measurement: it allows evaluating the intensity of the human opinion, to compare different people opinion intensity. Respondents have to score their responses from 1 „do not agree at all“ to 7 “do fully agree”.

Table 10 - VisAWI User Questionnaire. Source:

http://www.researchgate.net/publication/274649948_VisAWI_Manual_%28Visual_Aesthetics_of_Websites_Inventory%29_and_the_short_form_VisAWI-S_%28Short_Visual_Aesthetics_of_Websites_Inventory%29

No	Factor 1: Simplicity
1	Everything goes together on this interface.
	Factor 2: Diversity
2	The layout is pleasantly varied.

	Factor 3: Colourfulness
3	The color composition is attractive.
	Factor 4: Craftsmanship
4	The layout appears professionally designed

The way of interpretation of VisAWI-S is based on subjective character of the evaluations. The mean value of the results shows the general factor of aesthetics and should be interpreted as positive or negative evaluation of factor. High value of the mean indicates the positive evaluation, low value – negative.

Table 11 - VisAWI-S test results. Source: author

Question	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
Factor 1: Simplicity	40	34	26
Factor 2: Diversity.	40	33	36
Factor 3: Colourfulness	47	29	43
Factor 4: Craftsmanship	50	36	45
Overall mean	45.5	33	37.5

WordPress has the positive evaluation in all factors. Joomla! has the negative evaluation of Diversity, Colorfulness and Craftsmanship factors. Drupal in its turn has the negative evaluation only in Simplicity factor.

WordPress has the highest value of the overall mean what indicates the positive evaluation of level of design’s general aesthetics. Regarding to results of Joomla! this CMS has in general negative evaluation of VisAWI-S test. Drupal shows the middle results.

Operability

Operability is the extent to which a system has such features that make it easy to control and operate. To clearly identify the usability of a particular system special test was conducted.

On each CMS was implemented the same sequence of actions by information technology specialists. The tasks are aimed to analyze blogging, categorization and organization capabilities. Note that convenience and speed control on structure and content of site considered in this study are the main but not the only criteria for choosing the best CMS for users.

To conduct the test were involved 8 respondents. Tasks content and the results are shown below:

Table 12 - Tasks for operability test. Source: author

Task	Wordpress 4.2.2	Joomla 3.4.1	Drupal 7.37
Add the new content type, add title „Hello world!”, save as a draft	8 min 33 sec	14 min 25 sec	19 min 2 sec
Add given image and text in saved post, see preview and publish	19 min 12 sec	22 min 32 sec	24 min 7 sec
Add new menu and add this article as a new item of menu	17 min 11 sec	32 min 48 sec	11 min 22 sec
Given anti-spam modul (plugin): install, enable	11 min 36 sec	9 min 8 sec	14 min 8 sec
Overall, sec	3392 sec	4733 sec	4119 sec

Following scores were applied to the results:

Grade 1 – the best result

Grade 2 – better than average

Grade 3 – worse than average

Grade 4 – the worst

Table 13 - Results of operability test. Source: author

CMS	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Result, sec	3392 sec	4733 sec	4119 sec
Grade	Grade 1	Grade 4	Grade 3

According to the test done CMS WordPress showed the best operability results which means that users oriented in this system better than in others. Joomla! showed the worst results, which indicates its complexity and incomprehensibility for users. CMS Drupal showed middle results, but worse than average.

2.5 Performance efficiency

Performance efficiency is next quality characteristic of software according to ISO/IEC 25010 which measures the amount of resources used under some special conditions.

In order to uniform test results all CMSs were installed on clean program shell for creating and debugging websites, titled “Denwer” version 3 (web applications, other dynamic content web pages) on the local PC for OS Windows, created only for research purposes.

Local PC characteristics:

Type of machine: Samsung 300E5Z-S04

RAM: 4096 Mb

Type of memory: DDR3-1333 (PC3-10600) 2x667 MHz

CPU: Intel Pentium, 2.1 GHz

“Denwer” components characteristics:

Apache 2.2.22 + SSL, PHP 5.3.13 + XDebug, MySQL 5.5.

In order to create the real environment of CMS work was used specific tool for load testing of the application - Apache benchmark (ab.exe) version 2.3. The main task of Apache benchmark is to show how many http-requests (concurrent or sequential) can run a web server and how fast they run. Starting and working with Apache benchmark is through the command line.

Within performance efficiency were measured following sub-characteristics of CMS: time behavior and recourse utilization.

Time behavior is “the response and processing times and throughput rates of a system when performing its function, under stated conditions in relation to an established benchmark” (51).

As a measure of time behavior of CMSs was taken speed of loading script on server (phpload_time).

Resource utilization is “the amounts and types of resources used when the software performs its function under stated conditions in relation to an established benchmark” (51).

As a measure of recourse utilization was used size of memory usage (phpload_memory).

Also Apache benchmark allows to measure following characteristics:

- Time taken for tests(sec)
- Complete requests
- Failed requests
- Requests per second(#/sec)
- Time per request(ms)
- Transfer rate

Following scores were applied to the results:

Grade 1 – the best result

Grade 2 – better than average

Grade 3 – worse than average

Grade 4 – the worst

In index.php of each CMS was added code which allowed storing the result of the script execution time and the amount of memory consumed:

```

$_test_loadstart = microtime(true);
//CMS code
$_test_loadend = microtime(true);
$_test_loadtime = number_format($_test_loadend - $_test_loadstart,
3);
$_test_memory = number_format(memory_get_usage()/1048576, 3);
file_put_contents('test.txt', $_test_loadtime . ';' .
$_test_memory."\r\n", FILE_APPEND);

```

Using parameter `-n1000` tool will make 1000 sequential requests to specific URL:

```

Z:\usr\local\apache\bin>ab -n1000 http://www.wordpress-test.loc/
Z:\usr\local\apache\bin>ab -n1000 http://www.joomla-test.loc/
Z:\usr\local\apache\bin>ab -n1000 http://www.drupal-test.loc/

```

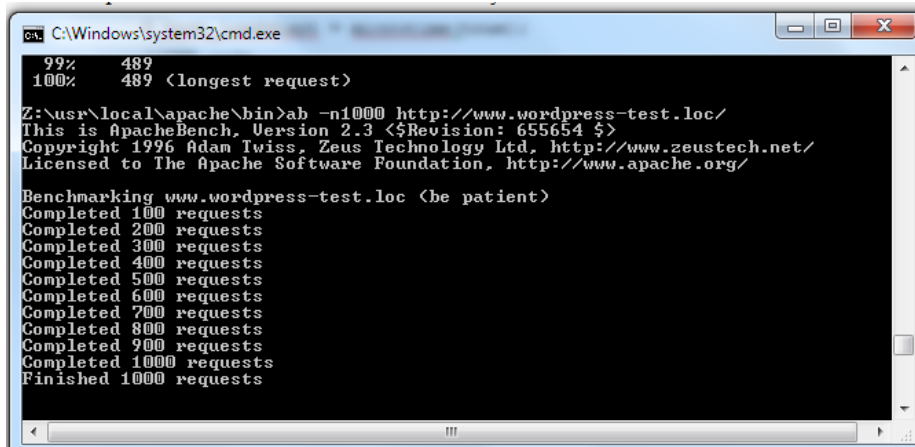


Figure 11 - Wordpress CMS. Creating sequential http-requests to URL. Source: author

After measuring following comparison tables were created:

Table 14 - Sequential requests. Time behavior. Source: author

Test/CMS	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
MIN loadtime (sec)	0,315	0,302605	0,211
MAX loadtime (sec)	0,567	3,671	0,989
AVG loadtime (sec)	0,39787	0,255	0,25176
Points	9	8	4

Table 15 - Sequential requests. Resource utilization. Source: author

Test/CMS	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
MIN memory (mb)	22,149	11,719	18,278
MAX memory (mb)	22,149	11,719	18,278
AVG memory (mb)	22,149	11,719	18,278
Points	12	3	6

For a more productive analysis should be used parameter `-c`, determines the number of simultaneous requests sent. Using parameter `-n1000 -c 10` tool will make 1000 requests and serve them by 10 at time:

```

Z:\usr\local\apache\bin>ab -n1000 -c10 http://www.wordpress-test.loc/
Z:\usr\local\apache\bin>ab -n1000 -c10 http://www.joomla-test.loc/
Z:\usr\local\apache\bin>ab -n1000 -c10 http://www.drupal-test.loc/

```

After measuring tables of comparison were made for concurrent requests.

Table 16 - Concurrent requests. Time behavior. Source: author

Test/CMS	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
MIN loadtime (sec)	0,43	0,314	0,237
MAX loadtime (sec)	4,98	4,133	3,267
AVG loadtime (sec)	2,083844	1,412715	1,339049
Points	12	6	3

Table 17 - Concurrent requests. Resource utilization. Resource: author

Test/CMS	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
MIN memory (mb)	22,149	11,719	18,278
MAX memory (mb)	22,149	11,719	18,278
AVG memory (mb)	22,149	11,719	18,278
Points	12	6	3

Table 18 - Apache benchmark. Sequential and concurrent requests. Source: author

Test/CMS	Sequential			Concurrent		
	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37	WordPress 4.2.2	Joomla 3.4.1	Drupal 7.37
Time taken for tests(sec)	379,848	335,474	282,927	233,264	220,855	172,889
Complete requests	1000	1000	1000	1000	1000	1000
Failed requests	0	0	0	0	0	0
Requests per second(#/sec)	2,67	2,98	3,53	4,29	4,53	5,78
Time per request(ms)	378,848	335,747	282,927	2332,643	2208,547	1728,889
Transfer rate	23,9	18,49	27,49	38,93	27,8	172,889
Summary points	16	12	6	16	12	6

Table 19 - Total results of performance efficiency comparison of CMSs. Source: author

Test/CMS	Sequential			Concurrent		
	WordPress	Joomla	Drupal	WordPress	Joomla	Drupal

	4.2.2	3.4.1	7.37	4.2.2	3.4.1	7.37
phpload_time	9	8	4	12	6	3
phpload_memory	12	3	6	12	6	3
Apache benchmark	16	12	6	16	12	6
Summary result	37	23	16	40	24	12

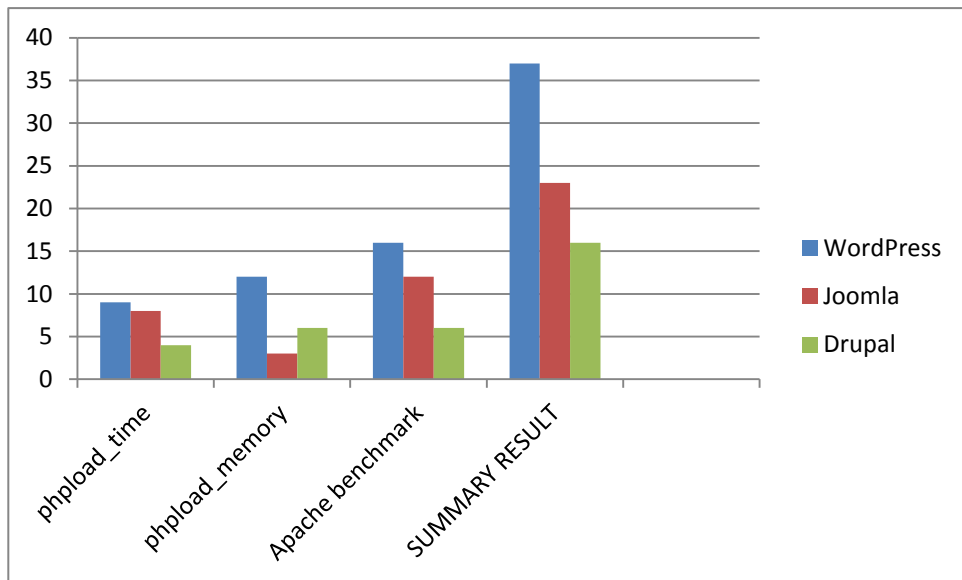


Figure 12 - Summary results of performance efficiency of CMSs. Graphical representation. Sequential requests. Source: author

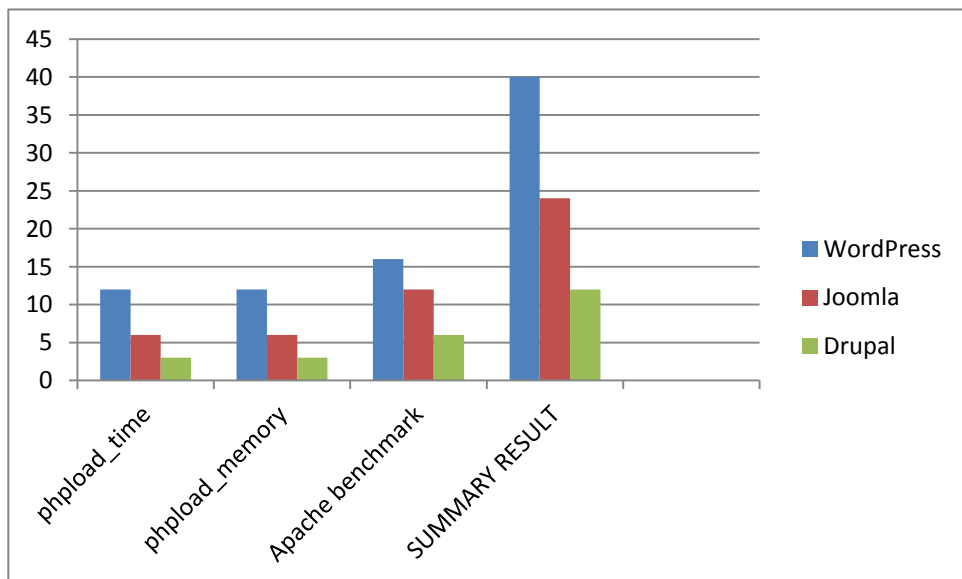


Figure 13 - Summary results of performance efficiency of CMSs. Graphical representation. Concurrent requests. Source: author

On the whole CMSs under sequential and concurrent http-requests got the same results.

Eventually WordPress 4.2.2 CMS showed the worst results in performance efficiency test with the biggest time of page loading on server, resource utilization and results according to Apache benchmark. Drupal CMS is the fastest and the less resource consuming. Joomla CMS showed the middle results.

Performance efficiency of database

CMSs store all its data in a database. Databases were initially created during the CMSs installation. For this analysis was used MySQL version 5.5 database for all three CMSs. In order to test performance efficiency of databases was measured the time of request execution. All queries were made through PhpMyAdmin panel where stored databases of all analyzed CMSs. PhpMyAdmin is an application written in PHP which provides full, including remote, work with the MySQL database through a browser.

Since structure of databases in various CMSs is different, queries which were made similar only in its substance.

As a measure of performance efficiency was measured time in seconds.

Following scores were applied to the results:

Grade 1 – the best result

Grade 2 – better than average

Grade 3 – worse than average

Grade 4 – the worst

Since default assembly of CMS practically does not content some entries for research purposes into local websites were uploaded five identical posts.

The results and content of queries are presented below.

1. First query represents replacing of string in set of posts/entries on database.

This request could be useful when is needed to change some content on the website very quickly instead of doing it manually.

Table 20 – Short query to CMSs database. Source: author

Query	CMS	Duration	Points
UPDATE wp_posts SET post_content = REPLACE (post_content,	WordPress 4.2.2	0.0422 sec	3

'European', 'Central european');			
UPDATE moiyl_content SET introtext = REPLACE(introtext, 'European', 'Central european');	Joomla 3.4.1	0.0598 sec	4
UPDATE field_data_body SET body_value = REPLACE (body_value, 'European', 'Central european') ;	Drupal 7.37	0.211 sec	1

2. Second query outputs posts which:

- have the same tags, that some concrete post has
- some concrete post is not presented in output
- post status of the posts is publish or future

The results are presented below:

Table 21 – Long query to CMSs database. Source: author

Query	CMS	Duration	Points
<pre> SELECT * FROM wp_posts WHERE ID IN (SELECT object_id FROM wp_term_relationships as R WHERE R.term_taxonomy_id IN (SELECT R2.term_taxonomy_id FROM wp_term_relationships as R2 LEFT JOIN `wp_term_taxonomy` as T ON R2.`term_taxonomy_id` = T.`term_taxonomy_id` WHERE object_id = 11 AND taxonomy = 'post_tag') GROUP BY object_id) AND ID != 11 AND post_status IN ("publish", "future"); </pre>	WordPress 4.2.2	0,015 sec	3
<pre> SELECT * FROM moiyl_content WHERE id IN </pre>	Joomla 3.4.1	0,016 sec	4

<pre>(SELECT content_item_id FROM moiyl_contentitem_tag_map as R WHERE R.tag_id IN (SELECT R2.tag_id FROM moiyl_contentitem_tag_map as R2 LEFT JOIN `moiyl_tags` as T ON R2.`tag_id` = T.`id` WHERE content_item_id = 1 AND published = '1') GROUP BY content_item_id) AND id != 1 AND state = 1;</pre>			
<pre>SELECT * FROM node WHERE nid IN (SELECT R.nid FROM taxonomy_index as R WHERE R.tid IN (SELECT R2.tid FROM taxonomy_index as R2 LEFT JOIN `taxonomy_term_data` as T ON R2.`tid` = T.`tid` WHERE nid = 2) GROUP BY R.nid) AND nid != 2 AND status = 1;</pre>	Drupal 7.37	0,0001 sec	1

Table 22 - Summary results of performance efficiency of database. Source: author

CMS	WordPress 4.2.2	Joomla! 3.4.1	Drupal 7.37
Points	3	4	1
Grade	Grade 3	Grade 4	Grade 1

It is understood, that for more conclusive results deeper study of performance efficiency of CMS's databases is necessary, but from this testing can be seen that in both

cases with short and long queries CMS Drupal showed the best result, while Joomla! showed the worst.

2.4 Template development for WordPress CMS. Overview

More and more people everyday thinks about creating their own website. Therefore developers of extensions and (in particular WordPress) try to make CMS easy to use even for people without special programming skills. They create special plugins and widgets in order to minimize programming part.

The partial goal of current diploma is the creating new template using recent trends in WordPress and design development according to theme development of WordPress Codex (52). The purpose of this website was initially to be an advertising and information platform for introducing e-books. All payments are realized on special payment system with was connected to current website. Thus CMS for this microsite must be not demanded, fast, free, have good usability, contain certain functions (excessive functionality can slow down the site).

Based on the analysis, which was conducted before and studied literature sources, the choice was made in favor of CMS WordPress for following reasons:

- WordPress is free CMS and for such a small website there is no need to pay for administration of website;
- WordPress CMS has grade 1 in functional suitability comparison but as opposed to Drupal less recourse demanding CMS (in case of minimal hosting requirements). It has all necessary functions for such a website, for example, custom fields (for specifying title, price of e-book), built-in comments and so on.
- WordPress has the positive evaluation in all factors in VisAWI-S test indicating user interface aesthetics.
- Operability test WordPress has grade 2 but in this case it is enough because administration of such a website will not require some special skills.
- WordPress CMS has the worst results in performance efficiency test and middle result in database efficiency test but such a website is microsite thus will not have a lot of content which can slow down the page loading.

New template is called Twinkle 1.0 and was developed based on WordPress version 4.2.2. According to new trends in web design development it is essential to create several templates for different types of devices. This theme was developed for three types of screen: less than 768px, 768px and higher, 992px and higher.

It consists of following pages:

- Front page
- Blog (contain list of post pages)
- Nine pages of different post formats
- Custom post type page „Books“

Plugins, which are installed on WordPress:

- Akismet version 3.1.2 is intended to protect blog pages comment and trackback spam
- Page Builder version 2.1.2 is drag and drop tool for building pages
- Revolution Slider version 4.6.0 is responsive slider
- Types version 1.6.6.5 is plugin to define custom taxonomies, custom post types and custom fields

For further customization of this website could be used other plugins from WordPress database.

In order to develop new template the following action took the place:

1. At the first step of development was built wireframe template. Wireframes represent simple layouts that outline the specific size and placement of page elements, site features without color, font choices, logos or any real design elements. The wireframes of the main pages (Content type “Books”, Front page, Post format in general) were created with the help of a Mockflow online application for type of screen: desktop (see Appendix B).
2. Using special design program Photoshop version 12.0 x 32 was drawn the graphical representation for the main pages: content type “Books”, front page, post format “Quote” (see Appendix C).

The finished website working on Twinkle 1.0 template is located at sila-misli.sila-misli.ru.

2.5 Modern trends used in template development

1. **Microsite.** It is a small branded site, focused on effective interaction with a narrow segment of the target audience. As a rule, microsites consist of several pages devoted to a particular product or service. The main task of the microsite is a high level of conversion. Microsites are usually created as an addition to the main site, and can be placed in a sub-domain or a separate web resource. In current this web site is created in addition to psychological website Sila-Misli.ru.
2. **Full-width slider.** In order to implement it on the home page was used plugin “Revolution slider”.
3. **Responsive design (mobile first).** It was developed using Bootstrap v3.2.0 framework.
4. **Parallax scrolling.** In web design parallax effect or parallax scrolling is a special technique where the background image is moving slower than foreground elements. This effect is achieved by the three-dimensional space by means of several layers which overlap each other, and move at different scrolling speeds. The main disadvantage of the parallax is site performance issues. The use of JavaScript / jQuery which creates the effect of parallax reduces the rate of page loading. It was the reason why on this template parallax scrolling was implemented by CSS3. The idea is to fix and cover this background-attachment (background-attachment: fixed; background-size: cover;) and assign it such a z-index in order this background lies below content.
5. **Fonts with Personality.** As a main font for this template was used Google font Roboto Condensed. Font was connected in function.php file to Google fonts library. But as a alternative also possible to change the fonts to others using “Customize panel”.
6. **Flat Design.** This type of design is represented by following elements: no gradients, reflections, beveled edges and drop shadows.
7. Large text and pictures, less text.
8. **Transition and animation.** It is represented through CSS3 properties: transform, transition-duration, animation-timing-function and so on.



Figure 14 - Transition and animation representation on button. Source: author

9. **HTML5, CSS3.** In current template development were used special tags from HTML5/CSS3 languages such as: <section>, <article>, <footer> and so on.
10. **Fixed position navigation.** Such a feature when user scrolls down and the navigation stays on the page. Implemented using in Bootstrap through CSS class `.navbar-fixed-top`.
11. **SVG Icons.** In this theme were used Font Awesome Icons as a third-party applications.

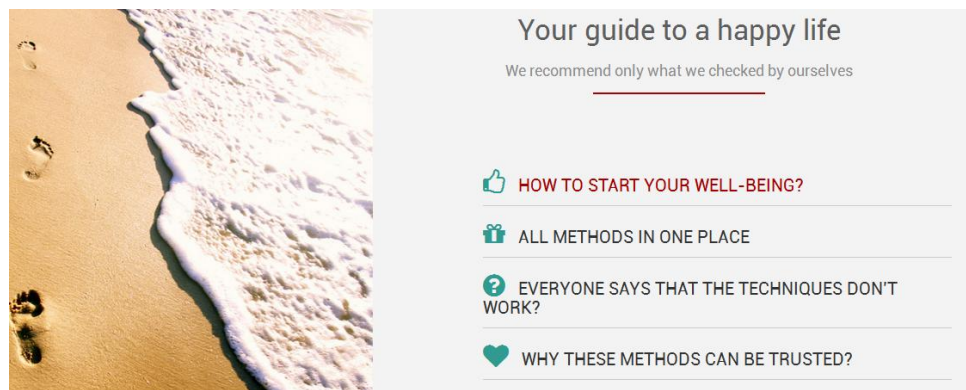


Figure 15 - SVG Icons example. Source: author

12. **Lazy-Loading Animations (JavaScript)** are transition effects applied onto elements, but they only animate when user scrolls them into view. This feature was implemented using JavaScript `wow.js`, which was connected in `functions.php` file and classes `.wow` `.name_of_animation` `.animated` were applied to element needed.
13. **Custom content types and custom fields.** In this template were implemented these recent trends which extended functionality of the WordPress project. In Wordpress 3.0 first was introduced the possibility to

create custom type of content. Custom post types is a new set of administrative settings that are used along with standard types such as posts, pages and media. Custom post type can store any type of information. It has its own editor and media downloader. It uses the existing table structure WordPress for easy data management. The main advantage of building custom post types using the WordPress API is convenient to use with existing themes and templates. Custom record types and SEO-friendly because of its constant references. There is a possibility to add to any post (also to custom post type) custom fields, which contains the various data needed for user. In order to customize the web site based on WordPress through the use of custom post types, taxonomy and custom fields was used special plugin Types version 1.6.6.5 developed by “OnTheGoSystems”.

14. **Custom sections in Customizer WordPress API.** WordPress customizer API was firstly introduced in WordPress version 3.4. and it allows setting up WordPress site in real time. For this template default WordPress customize panel” was supplemented by following configuration settings:

- Front page colors. This panel allows adjust some colors of front page widgets: Books, Testimonials, Blockquote, Call-to-action, developed specially for this theme.

- Colors. Here user can change some colors of web site .

- Widgets (for footer).

- Fonts. Using this panel is possible to change types and size of H1 – H6 headings and body fonts.

- Navigation. This section supports changing of menu.

- Background image. Here user can change background image.

15. **Full-width front-page.** For the front page are used specially created custom widgets without any sidebars.

16. **Cross-browser compatibility** is a concept that describes the properties of a site and appear to work identically in all browsers (usually considered only the most common). Under the identity meant the collapse of the layout and the lack of ability to display material with the same degree of readability. Usually for Internet Explorer designers should adapt website. In this

template were used, for example, HTML5Shiv - JavaScript workaround, which enable styling of HTML5 elements in Internet Explorer; using special prefixes for different browsers for compatibility, such as: -moz-, -webkit-, -o-.

17. **Social buttons.** Social media now are highly visited by millions of users. In order to promote web project it is necessary to add there these buttons in order user can share with others interesting details. In this theme were implemented buttons below each book and on the sidebar.
18. **Accessibility.** In this website was used special CSS class `.screen-reader-text`, which added to some elements in order to provide this context to the people with disabilities using non-visual method to access it.
19. **WordPress post formats implementation.** Post format is function of theme design introduced in WordPress version 3.1. Formats are metadata, which could be used to determine what type of post that user publishes: text, images, video or others.

Further is considered implementation of some modern trends in details.

2.6 Menu development. Fixed top navigation

Menu area in current template by default contains one drop-down menu based on Bootstrap framework version 3. This framework makes it collapsed on small displays (less than 992px). In order to activate the control mechanism in WordPress menu is needed to register menu in `functions.php`:

```
register_nav_menus( array(
    'primary' => __( 'Primary Menu', 'twinkle' ),
) );
```

After menu should be added in admin panel and in `header.php` in tags `<header></header>` and styled using Bootstrap framework. Type of navigation is sticky which means fixed to the top:

```
<header>
    <nav class="navbar navbar-custom navbar-fixed-top"
        role="navigation">
        <?php wp_nav_menu( array( 'theme_location' => 'primary' ) ); ?>
    </nav>
</header>
```

But then problem of overlapping of WordPress admin bar with bootstrap fixed navigation occurs when user is logged in. This bug was fixed by using the WordPress function to query if the toolbar is displayed, and after creating an empty <div> below the navigation <div>:

```
<?php
if ( is_admin_bar_showing() ) echo '<div style="min-height:
40px;"></div>';
?>
```

The last step is to style dropdown menu in main style.css file using media queries for different types of displays.

2.7 Custom Widgets development

WordPress widgets are independent blocks of content that can be placed in the sidebar or in special areas provided by template. Widgets allow developers to add functionality to their products, enabling users to access it without having to write any code. By default WordPress contains thirteen widgets including Pages, Text, Archives, Calendar, Links and so on. But for this template designed for e-books sale were created seven special widgets such as:

- Blockquote. Includes title, description, image, text and caption text.
- Call-to-Action. Contains title, description, link to button, title for button and image for uploading.

Other five widgets includes title, description and background image which gets parallax effect. More functionality to them will be added using custom fields in custom post types (see later). These widgets will be displayed only if content types for them exist.

- Books,
- Reasons,
- Properties,
- Testimonials,
- Writers.

Further we consider the algorithm how widget Books for this template is created.

Code is placed in fp-books. php in Widgets folder. For the organization of the widget requires only three basic functions:

```
function widget ()
function update ()
function form ()
```

1. In file functions.php is needed to register new widget and load it. For this purpose are used following functions respectively:

```
//Register new widget
register_widget( 'Twinkle_Books' );
add_action( 'widgets_init', 'twinkle_widgets_init' );
//Load new widget
require get_template_directory() . "/widgets/fp-books.php";
```

2. Widget code enclosed in the class. The class name is important. The class name and function name registration should coincide.

```
class Twinkle_Books extends WP_Widget {}
```

3. Now give some settings in this class.

```
function twinkle_books() {
    $widget_ops = array('classname' => 'twinkle_books_widget',
        'description' => __( 'Display your books in a stylish way.', 'twinkle' )
    );
    parent::WP_Widget(false, $name = __('Twinkle FP: books', 'twinkle'), $widget_ops);
    $this->alt_option_name = 'twinkle_books_widget';
```

4. Now create a form template that will serve as input values. Here the user will determine the installation and value. The function form () will contain code to create input fields for title, description and image. See example for input field Title below:

```
// Widget form creation
function form($instance) {
    // Check values
    $title = isset( $instance['title'] ) ? esc_attr(
$instance['title'] ) : '';
```

Output echo get_field_name('title') is styled using HTML.

5. Function update () gets the user settings and saves them.

```
function update($new_instance, $old_instance) {
    $instance = $old_instance;
    $instance['title'] = strip_tags($new_instance['title']);
    return $instance;
}
```

6. Widget () function applies to the display of widget. It has two arguments. The first argument is derived from the theme, it is passed the name and other settings. A second argument - an instance of class.

```
function widget( $args, $instance )
```

After value from the argument should be extracted, because they have to be available locally.

```
extract( $args );
```

As a result widget Books looks like following.

Twinkle FP: books

In order to display this widget, you must first add some books from the dashboard. Add as many as you want and the theme will automatically display them all.

Title

Enter your description for the title.

Upload an image for the background if you want. It will get a parallax effect.

[Delete](#) [Duplicate](#)

Figure 16 - Widget "Book" representation. Source: author

After widgets created they could be added on the page (in demo template onto front page) using specially installed plugin “Page Builder by SiteOrigin”.

Parallax scrolling

According to modern trends of web design for some widgets was implemented parallax scrolling. Code for parallax area (for example, for Call-to-Action area), where `$image_uri` is background fixed image, looks like this:

```
<?php if ($image_uri != '') : ?>
  <style type="text/css">
    .action-area {
      display: block;
      background: url(<?php echo $image_uri; ?>) no-repeat;
      background-position: center top;
      background-attachment: fixed;
      background-size: cover;
      z-index: -1;
    }
  </style>
<?php endif; ?>
```

2.8 Custom post types and custom fields

The algorithm of adding custom post types using plugin Types is covered in details in Types documentation (53). First new custom post type is added from the dashboard of WordPress. It is required to add name in singular and plural and slug of future post. In order this post to be visible it is needed to make it public. After that new post type will appear on the admin menu.

In custom post types could be added also custom fields. It is mark in which post type it will appear, select type of fields from the list (single line, e-mail, numeric and so forth), enter field name and slug which will be used as `$key` when display the custom field.

For this template was developed five specific custom post types, five groups of custom fields with custom fields in it, which could be customized by users trough WordPress dashboard.

Custom post types:

- Books,
- Reasons,
- Properties,
- Testimonials,

- Writers.

Groups of custom fields:

- Books info (display on content type “Books”). Contains custom fields: my-link, photo, my-price, my-description and URL fields for social networks.
- Reason icon (display on content type “Reasons”) with custom field: reason icon.
- Properties-info (display on content type “Properties”). Custom field which is added to this group is property-icon.
- Testimonial (display on content type “Testimonials”). Contains custom fields client function, client photo.
- Writers info (display on content type “Writers”). Contains following custom fields: w-name, w-place, w-about, w-email, w-photo.

After types and fields creations it is necessary to display it on website. On current template it was accomplished in custom widget’s PHP-files in `twinkle / widgets` directory

Consider all of the functions that are used in the template for custom posts/fields creation:

- **WP_Query()** - setting various parameters it could be made a selection and sorting posts. It looks like a database query. `$WP_query` determines what type of query it is dealing with (in current case it is title of custom post type which was entered using plugin earlier), and fetches the requested posts.
- **have_posts ()** – checks if the current query WordPress has results for the output.
- **the_post ()** - counter for the cycle.

Then the output of custom field follows:

- **get_post_meta (\$ post_id, \$ key, \$ single)** - returns the data from custom field. Each field which is created for the type has its own custom field that can be derived through this function.
- **\$ post_id** (number) (required) - ID post custom fields to fetch (in current template it is `get_the_ID()` function).
- **\$ key** (string) (required) - the name of custom field which value is to be fetched.
- **\$ single** (logical) - If you set the parameter to true, the function returns a single value as a string. If the parameter is set to false or not set, the function returns an array of values of custom fields

In case of output of picture of book in custom post type “Book”) code is following:

```
$photo = get_post_meta( get_the_ID(), 'wpcf-photo', true );
```

Prefix “wpcf-” is prefix generated by Types plugin in order this to be always unique. Function `get_the_ID()` returns the ID of the current post in the cycle.

After the fetching custom field values it is necessary to set up its position. Position of custom fields on the web page is styled using HTML classes (including Bootstrap classes). Example with `$photo` is following:

```
<div class="book col-md-4 col-sm-6 col-xs-6">
<?php if ($photo != '') : ?>
">
<?php endif; ?>
</div>
```

Condition checks if `$photo` is present and if yes, output it on page through `echo esc_url($photo)`.

`esc_url ($argument)` – function which cleans URL and prepares string to the output.

Except `esc_url` function in this template were used several default WordPress functions with and without arguments according to type of data displayed:


- `the_content()` is used to filter the content of post after the content is obtained from the database, but before it is displays.
- `the_title()` – displays or returns the title of the post.
- `esc_html ($argument)` – replaces special characters to HTML entities in transmitted text, returns the formatted text.
- `the_ID()` – it displays the ID of the current post.

As a result custom fields appear after the custom post type Books and look like following:

Books info

my-link

photo



my-price

Figure 17 - Custom fields "Book info" representation. Source: author

Custom post type Books implementation

In current template displaying of custom fields and custom post types are set for front page except for post type Books.

For this product presentation was created special page where clients can order the book. Custom post type and fields for Books were created before using plugin Types.

For this post type were several new types added:

- my-download-link – single line field (string). Used to display button
- my-order-link - single line field (string). Used to output button
- author-book - single line field (string). Used to display name of author
- book-format - single line field (string). Used to show format of book

Now it is needed to create custom post type template for Books.

The WordPress template engine follows a special hierarchy when it decides what template associated with a post to display. In case of this theme the hierarchy is following:
 content-book.php – template associated directly with a post Books
 single.php – if no specific post type template was found, is used the default single.php.

index.php – if there is no single.php file in directory, WordPress defaults the index.

In order to display post type Books is used special function `is_singular($post_types)` where `$post_types` is replaced by `'books'`. After concrete part of template connected with function `get_template_part()`. As a result code in single.php looks like following:

```
<?php if ( is_singular( 'books' ) ): ?>
    <?php get_template_part( 'content', 'book' ); ?>
<?php endif; ?>
```

After displaying content-book.php was customized using HTML and CSS, loaded new custom fields. Following code makes WordPress understand which post opened:

```
<article id="post-<?php the_ID(); ?>" <?php post_class(); ?>
```

As a result new post type for Books looks like following.

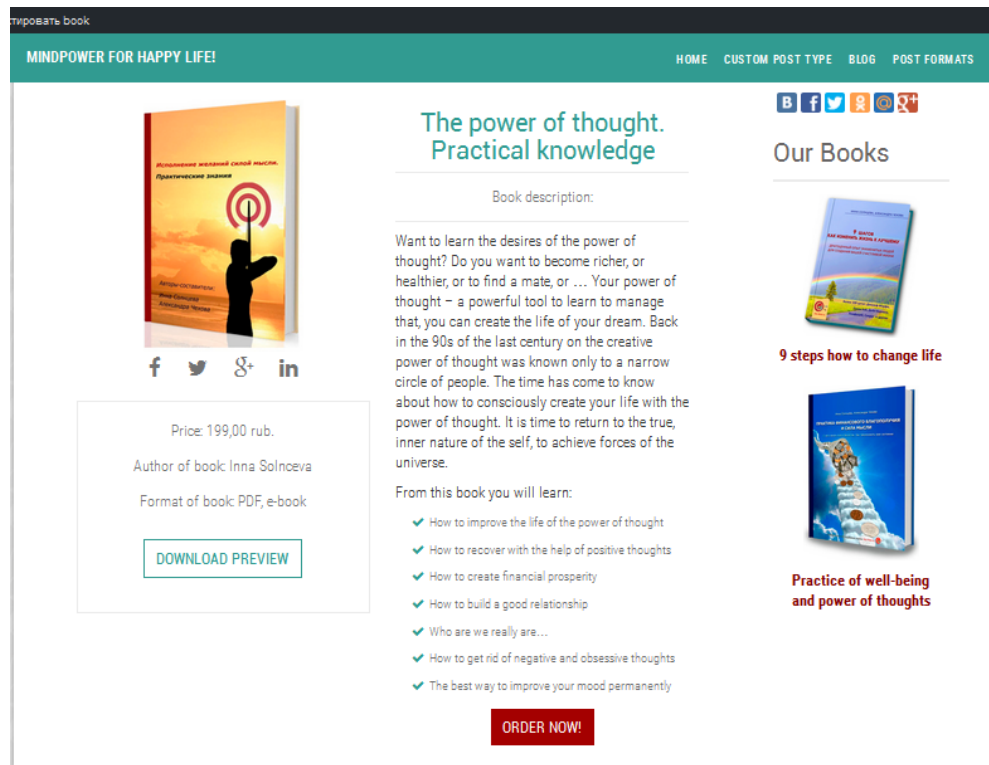


Figure 18 - Post type for Books representation. Source: author

2.9 WordPress post formats

In this template were added following post formats:

- **Aside** is usual text. Usually displayed without title.
- **Audio** consists of audio file. It can be used for podcasting.
- **Chat** contains chat records.
- **Image.** As an image will be used first tag `` in the record.
- **Link** contains links to other sites. As an external reference is used first tag `` in a post.
- **Status** is short string, usually up to 140 characters.

- **Quote.** It consists of a text and source citations. The citation is to be recorded in the `post_content` in the form:
 - `<blockquote>text<p><cite>source</cite></p></blockquote>`.
- **Video** contains a single video. The video will be used as the first tag `<video />` or embedded objects in the content record.
- **Gallery.** It is image gallery.

In order to add these post formats support in template following code is added into `functions.php`:

```
add_theme_support( 'post-formats', array(
    'aside', 'image', 'video', 'quote', 'link', 'audio', 'status', 'chat',
    'gallery' )
);
```

After that support of these formats will appear in settings of any post:

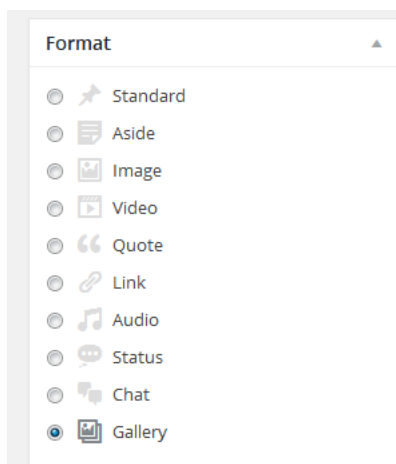


Figure 19 - Post formats in dashboard of WordPress representation. Source: author

Like all other posts these post formats will be listed on archive and category pages. That is why they should be added into `archive.php` file. Example for adding post format Video is following:

```
if ( is_category() ) :
elseif ( is_tax( 'post_format', 'post-format-video' ) ) :
// When the archive page for Post Format "Video" is displayed.
_e( 'Asides', 'twinkle' );
else :
```

```
_e( 'Archives', 'twinkle' );
endif;
```

As a result post format type Video looks like following:



Figure 20 - Post video format in WordPress. Source: author

2.10 Theme Customizer API

For development purposes were created following files: `customizer.js`, `customizer.php`, `style.php` and `enqueued in functions.php`. Three special hooks were used:

`customize_register`. Using this hook could be defined new Customizer panels, controls, settings and sections.

`wp_head`. It allows to output correct custom-generated CSS after changes in real life mode.

`customize_preview_init`. This hook is used to enqueue JavaScript on the Customizer screen.

In file `customizer.php` were defined settings, sections and controls using `customize_register ()` and created a hook for `'customize_preview_init'`:

```
function twinkle_customize_register( $wp_customize ) {
}
add_action( 'customize_register', 'twinkle_customize_register' );
```

After we created new section in Customizing panel and set some settings there:

```
$wp_customize->add_setting('twinkle_options[info]', array(
```

```

        'type' => 'info_control',
        'capability' => 'edit_theme_options',
    )

```

Then controls need to be added. This interface elements that are used to change settings. Each setting must have the appropriate controls to be displayed on the configuration page of the theme. Controls are added using the method `add_control()`.

```

$wp_customize->add_control( new Twinkle_Info( $wp_customize,
'books_section', array(
    'label' => __('Books section', 'twinkle'),
    'section' => 'twinkle_fp_colors',
    'settings' => 'twinkle_options[info]',
    'priority' => 18
) )
);

```

For preventing from inappropriate user data input special function the `theme_name_sanitize_type_of_input()` was used.

Life preview mode configuration requires JavaScript file `customizer.js`. Example for changing background of Book thumbnails continues:

```

wp.customize('books_bg',function( value ) {
    value.bind( function( newval ) {
        $(' .books-area').css('background-color', newval );
    } );
});

```

In order to fetch the settings and output CSS set by user function `get_theme_mod()` is used (in `style.php`). Example for changing background of Book thumbnail is following:

```

$books_bg = esc_html( get_theme_mod( 'books_bg' ) );

```

As a result section `Customize` in template `Twinkle 1.0` looks like following.

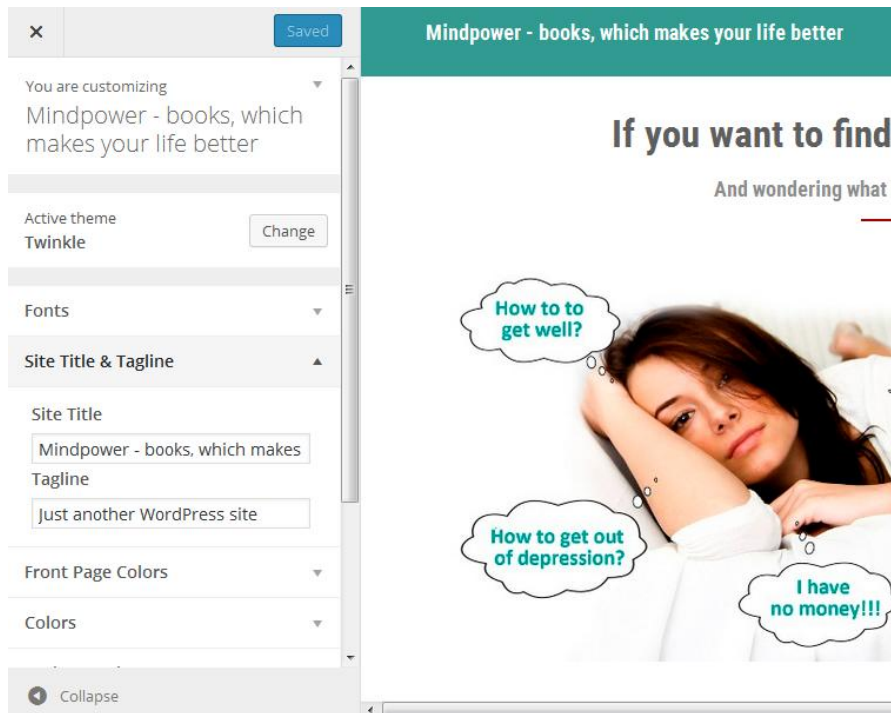


Figure 21 - Representation of section Customize in Theme Twinkle 1.0. Source: author

Thus the layout for CMS WordPress for microsite was developed and considered all the highlights of its implementation.

Conclusion

The diploma thesis is focused on study and comparison of three the most popular nowadays web content management systems WordPress 4.2.2, Joomla! 3.4.1 and Drupal 7.37 on based on three dimensions of quality according to ISO/IEC 25010 standard: functional suitability, usability and performance efficiency. Minimal hosting requirements are also were included into comparative analysis. In order to achieve the goals of the thesis was analyzed information about web sites and CMSs functioning and their types and thoroughly studied web template development materials and recent technologies of its creation.

The main objective of the diploma thesis – comparison of CMSs WordPress, Joomla! and Drupal was achieved. For this purpose was used clean virtual machine and conducted special tests for different measurements using special tools such as Apache benchmark. The results of comparison show that all three CMSs are very powerful instruments of managing web sites and it is impossible to declare “the best CMS” by all criteria. They have a lot in common: open-source, cost free, one click installation availability, cross-platform, active development status, multilanguage and so on.

In the same time it is important to distinguish for which purposes can be used a particular system because these CMSs have some differences. The tests indicated that the most functional, fastest (from the viewpoint of database efficiency and page loading) was Drupal CMS. The evident disadvantages were lack of consistent interface and workflow what leads to steep learning curve, and high hosting requirements due its complexity and functionality.

With regard to Joomla! CMS in all tests it showed the worst or middle results such as high hosting requirements, low functional suitability and usability and middle results in performance efficiency.

Summing up Drupal CMSs is most suitable for advanced developers who are working with complex projects where flexibility and scalability are required. Joomla! is not so complex and difficult to learn as Drupal. This CMS is suitable for e-shops web sites and web-portals with quite big page loading. WordPress CMS could be used for small and middle size web sites (blogs, magazines, some portals) by people without or with limited programming skills.

The partial goals of the diploma thesis - analysis of the prospects for the further development of CMSs and creation from scratch new template were also achieved.

On the basis of the comparison was chosen the most appropriate CMS WordPress for microsite intended for selling e-books online and was designed and implemented template according to the most recent web design trends. WordPress CMS was chosen for template development for microsite due to its high usability, functionality (functions which are included in the core of WordPress were enough for proper work of given web site), quite high performance efficiency of database. The only disadvantages of this CMS were the biggest time of page loading on server and resource utilization. In case of complex web site development this drawback could be a problem because it requires significant server resources to keep up but in case of micro site including less than ten pages this disadvantage is acceptable.

Regarding the forecast for the future development and popularity Google Insight predicts significant growth for WordPress CMS at the same time as demand for usage of Joomla! and Drupal CMSs will gradually decrease. This could be explained by low usability leading to steep learning curve, complexity of these CMSs and the growing popularity of one page web sites and blogs.

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APPENDIX 1. Capabilities of basic CMS configuration

Capabilities	WordPress 4.1. (59)	Joomla! 3	Drupal 7
1.1. Management and administration			
Installation	Five minutes installation is easy and simple for user at any level of experience.	Joomla! 3 installation consists of three steps (instead of 7 steps in Joomla! 2.5).	Drupal 7 installation consists of 8 steps and requires no special knowledge
Responsive administration panel	From version 4.1 only	Joomla! 3 back-end is responsive because it was constructed using Bootstrap framework and front-end inherits this features. Also in Joomla! is added LESS – dynamic language for CSS for template development.	-
User management	Administrator can restrict the access of any user. Also users can have their own profiles and manage visibility of this data on web page. Possibility to add unlimited amount of users	Access level for users – role model. Possibility to add unlimited amount of users	Access level for users – role model. Possibility to add unlimited amount of users
Authorization with OpenID	With plugin only	With component only	+
Localization of	+	+	+

interface and Multilanguage	For translation and possible localization “gettext” is used.		
Multiple sites*	+	-	+ The ability to create sites with overlapping content (e.g. common base of users or the general settings)
UTF-8	+	+	+
Media Manager	+	+	With modules (Drupella File Manager, File Force)
Nested categories	+	+	A wide range of properties under construction rubricators: flat lists, hierarchies, hierarchy with common ancestors, synonyms, related categories.
Scalability**	Plugins, widgets, themes, etc	Modules, plugins, themes, etc	Blocks, modules, themes, etc
File Editor***	+	+	- Only modules

1.1. Content management			
Forum realization	- With plugin only (e.g. Mingle Forum)	- With component only (e.g. Kunena)	+ (but better to use extended modules:

			Advanced Forum, Quote, BBCode)
Custom fields	Administration panel and coding in php file of theme	Special plugin	+
Custom Content Type	Special plugin	Special plugin	+
Blogs	+	With components only	+
Password protection	Password protection: administrator can give passwords to individual posts.	Creating a closed password protected section of the site without using third-party plugins.	Only with modules

1.1. Design			
Design flexibility	Limited design capabilities: 2 sidebars, header, 2 parts in footer. More advanced blocks localization is possible to reach making changes in existing template	Customizable layout modules in five areas, including the left, right and center blocks menu. It is possible to see the module position. For that user needs to enable preview module position in global configuration of Joomla! and after site URL add ?tp=1.	Drupal 7 is so flexible and functional that allows user to put any block to any place with minimum code changing. It means unlimited possibilities custom website design changes but usually using code not visual tools

1.1. Promotion			
-----------------------	--	--	--

Search Engine Friendly URL	+	+	+
	<p>1. RSS 1.0, RSS 2.0 and ATOM are supported by WordPress.</p> <p>2. WordPress supports Pingback and TrackBack. They are two very useful way to connect to other blogs and provide opportunities to connect to your one.</p>	Feeds are created with built-in Newsfeeds component.	<p>support XML-formats</p> <ul style="list-style-type: none"> - output documents in RDF / RSS - aggregation of material from other sites - BlogAPI materials for publication by external applications
Surveys and polls	With plugins only	+	+

1.1. Discussion and comments			
Built-in comments	+	-	+
Comments features	<p>1. Flexible moderation of incoming comments.</p> <p>2. HTML- tags in comments are allowed but strictly controlled by WordPress for security reasons.</p> <p>3. Notification about new comments to e-mail,</p>	Managing of comments in Joomla! is possible only with extended modules: K2, Jcomments and so on.	<p>1. Location of comment submission form</p> <p>2. Preview comment</p> <p>3. Post comment without approval, etc</p>

	etc		
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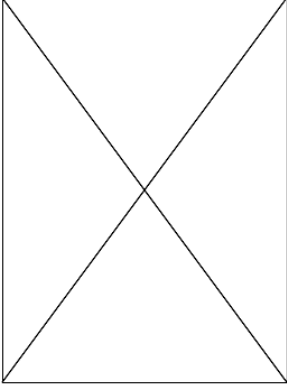
1.1. Search and Backup			
Search	+	+	+
Search features	1. Search between posts only 2. Results in chronological order 3. No filters	“Search”(com_search) has irrelevant results of search and just a few options for configuration.	+
Advanced search	-	“Smart Search”(com_finder) has relevant result of search, easy to configure, filters but increases database (tables_finder) after making the search index and database load.	Advanced search for content on the site, including search in taxonomy and users
Backup	For backup of whole web site (database, configuration, etc) usually used special plugin (WP-DB-Backup) or through C-Panel	Akeeba backup is built-in component and allows making front-end backup.	Backup and Migrate module supports gzip, bzip and zip compression as well as automatic scheduled backups.


* Different site configuration for various virtual hosts (“multiple sites”), including their own set of modules and themes for each sub site.

- ** Possibility to extend functionality due to blocks, modules, themes, etc
- *** Allows to edit code directly from administrative panel

APPENDIX 2. Wireframe for post type Books

MINDPOWER
MENU







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DOWNLOAD

Book Title


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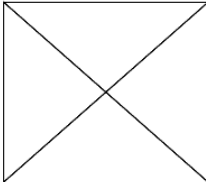


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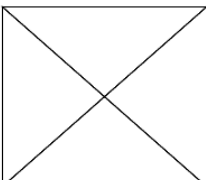
ORDER



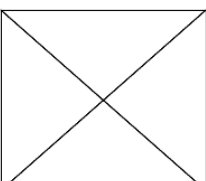
OUR BOOKS



Book Title 1



Book Title 2



Book Title 3

Edit

Link to another post

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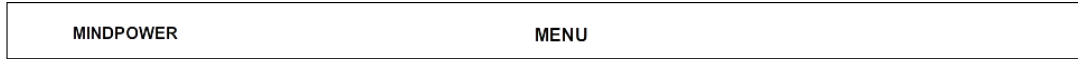
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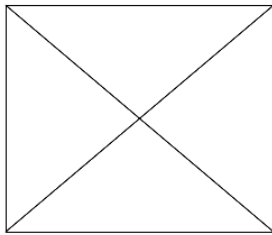
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APPENDIX 3. Wireframe for Post Format



TITLE OF POST FORMAT

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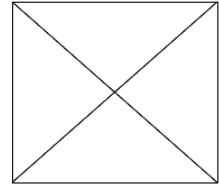
Button

Button

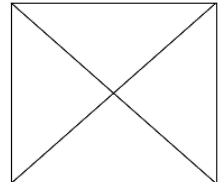
Leave a reply



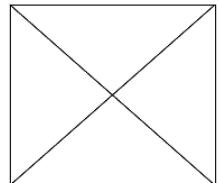
OUR BOOKS



Book Title 1



Book Title 1



Book Title 1

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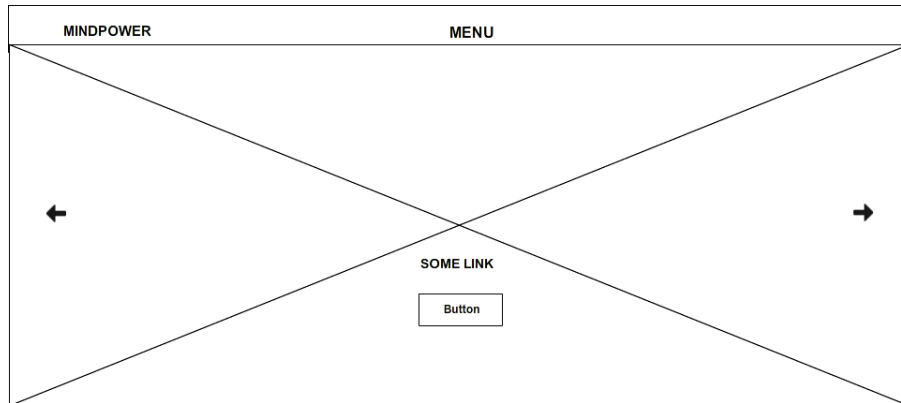
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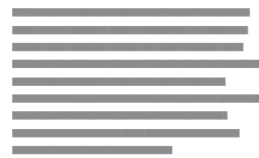
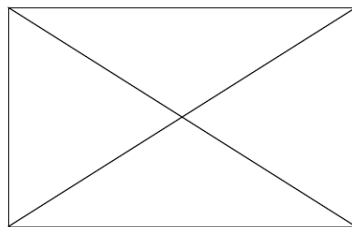
Copyright Your Company © 2015. All Rights Reserved.

APPENDIX 4. Wireframe for front page. Top part



BLOCKQUOTE WIDGET TITLE

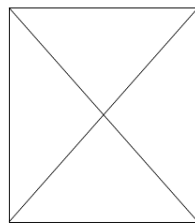
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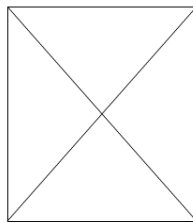
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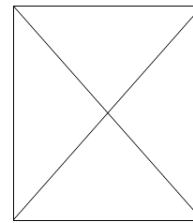
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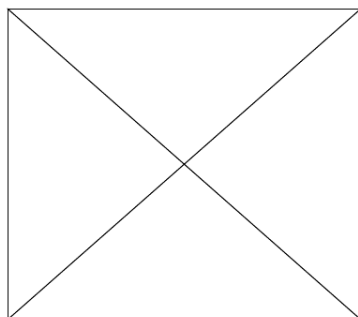
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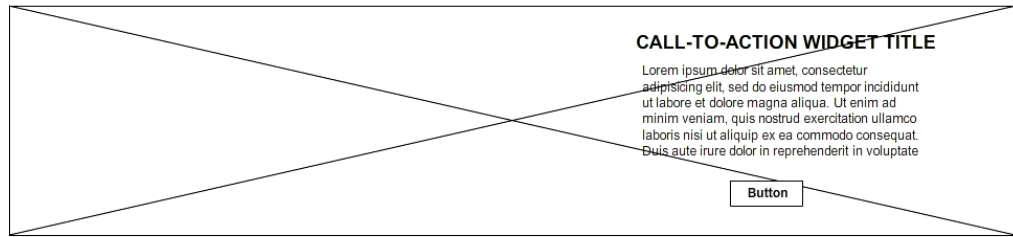


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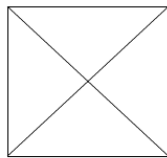


APPENDIX 5. Wireframe for front page. Bottom part

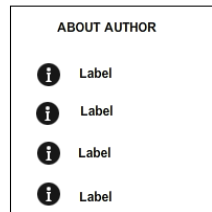


WRITERS WIDGET TITLE

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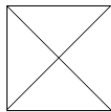


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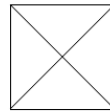
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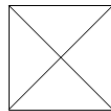
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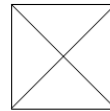
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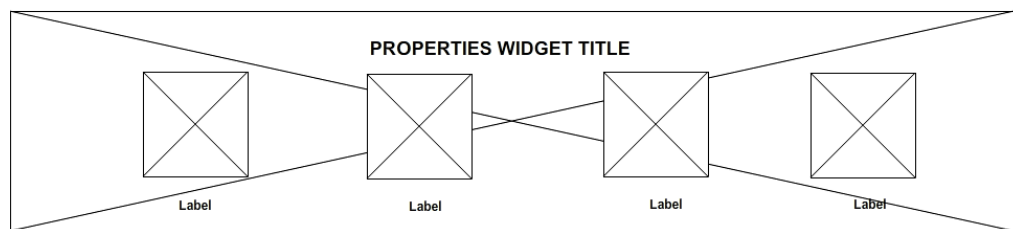
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APPENDIX 6. Graphical representation of custom post type “Books”

The screenshot displays a WordPress website with a teal header. The main content area features a book post for "The power of thought. Practical knowledge" by Inna Solneva. The post includes a book cover image, social media sharing icons, a price of 199.00 rub., and a "DOWNLOAD PREVIEW" button. The book description discusses the power of thought and its benefits. A list of learning outcomes is provided, such as "How to improve the life of the power of thought" and "How to recover with the help of positive thoughts". An "ORDER NOW" button is located at the bottom of the post. To the right, there is a section titled "Our Books" with two book covers: "9 steps how to change life" and "Practice of well-being and power of thoughts". The footer contains contact information for "Mindpower for happy life" and mentions the website is powered by WordPress.

MINDPOWER FOR HAPPY LIFE! HOME CUSTOM POST TYPE BLOG POST FORMATS

The power of thought. Practical knowledge

Book description:

Want to learn the desires of the power of thought? Do you want to become richer, or healthier, or to find a mate, or ... Your power of thought – a powerful tool to learn to manage that, you can create the life of your dream. Back in the 90s of the last century on the creative power of thought was known only to a narrow circle of people. The time has come to know about how to consciously create your life with the power of thought. It is time to return to the true, inner nature of the self, to achieve forces of the universe.

From this book you will learn:

- ✓ How to improve the life of the power of thought
- ✓ How to recover with the help of positive thoughts
- ✓ How to create financial prosperity
- ✓ How to build a good relationship;
- ✓ Who are we really are...
- ✓ How to get rid of negative and obsessive thoughts
- ✓ The best way to improve your mood permanently

ORDER NOW!

Price: 199.00 rub.
Author of book: Inna Solneva
Format of book: PDF, e-book
[DOWNLOAD PREVIEW](#)

Our Books

9 steps how to change life

Practice of well-being and power of thoughts


Footer

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MTWTFSS
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30
+ Post

Proudly powered by [WordPress](#). Developed by [Alexander Sachenko](#). For [study only](#).

APPENDIX 7. Graphical representation of front page Twinkle 1.0 layout. Top part


MINDPOWER FOR HAPPY LIFE!
HOME CUSTOM POST TYPE BLOG POST FORMATS



HOW TO MAKE YOUR LIFE BETTER?

If you want to find answers to questions ...

And thinking what to do next, how to solve your problems ...



How to get well?
How to pay off debts?
How to get out of depression?
I have no money!!!
How to find love?

Dear our readers! Finally, we are pleased to announce our series of books that contains practical recommendations on how to improve their lives, to learn the desires and finally solve their problems! Where to find these answers?

Irina Soboleva


Our Books

We wrote these books for you




The power of thought. Practical knowledge
199,00 rub.

How to fulfill your dreams and change life for the better, using the power of your mind.



The practice of financial well-being and wealth
199,00 rub.

Get out of debt and become successful and rich. Form a successful person thinking



9 Steps how to change lives for the better
199,00 rub.

Make all 9 Steps to a prosperous and happy life. Recommendations famous people

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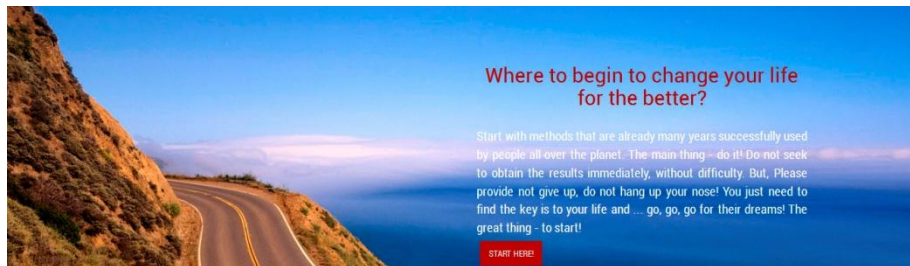


Your guide to a happy life

We recommend only what we checked by ourselves

- ✔ HOW TO START YOUR WELL-BEING?
- 📁 ALL METHODS IN ONE PLACE
- ❓ EVERYONE SAYS THAT THE TECHNIQUES DON'T WORK?
- ❤ WHY THESE METHODS CAN BE TRUSTED?

APPENDIX 8. Graphical representation of front page Twinkle 1.0 layout. Bottom part



Our authors

We really want you to find your key to a happy life...



Inna – a woman of great faith. She received two higher education (including psychological), and raised three children. The problems of the power of thought and positive thinking has been since 1996, when, after the severe divorce and serious health problems realized that it is time to radically change everything, as the map was her own life. She survived cancer surgery, many personal setbacks ... She suffered so long until I realized – everything in it, in her mind. Since this all started. Her stubborn nature of Capricorn would not let her stop.

She collected the crumbs of invaluable information as ... How to be happy and healthy? Difficulties tempered her character and led to who she is today – a wise, sympathetic, understanding, always willing to help and happy ...! Now Inna – practicing psychologist. Behind Multiyear helping people. And she is constantly improving their skills. Its library contains more than 1,000 books on general psychology, the psychology of thinking, the power of thought, self-esteem, etc. In this book the whole experience of her difficult life. We hope it will be very helpful to you !!

About author

- Inna Gohceva
- Psychologist
- Moscowcity
- inna@gmail.com


Opinions of famous and ordinary people about these methods

Thousands of successful people around the world have long used these methods



It was all bad, my husband left me, little children, all from the hands of falls, and even the health of junk. Stumbled on the internet for books I. Solntseva. Not believing bought. Read in one breath. I realized – this is my last hope and started to work on yourself, use the technology. THANKS YOU !!! I get by.

Catherine Manannikova
accountant and mother of two children



All are fully responsible for all of the events in his life – and the most good, and worst. Literally every thought we think creates our future ... All the events that took place in your life so far, were the result of your thoughts and beliefs from the past ... Every word and action contribute to the violation or the establishment of equilibrium in the cosmos.

Louise Hay
Famous psychologist, a millionaire, she cured herself of cancer

MindPower.com



Wishes come true!



Be rich!



Be loved!



Be healthy!

Footer

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