

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

System Engineering and Informatics



Bachelor Thesis

Analysis of PHP e-commerce frameworks

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Declaration

I declare that I have worked on my bachelor thesis titled "Analysis of PHP e-commerce frameworks" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any third person.

In Prague, on 14th March 2014

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Analysis of PHP e-commerce frameworks

Analýza PHP e-commerce frameworku

Summary

This bachelor thesis deals with very common e-commerce frameworks in the world.

The main objective of the thesis is to create an online e-shop as a web application, based on analysis of chosen frameworks. “The” Partial goal is to analyses the e-commerce frameworks.

The theoretical part contains main characteristics of PHP and its principles, the common approaches and methodologist to build e-commerce, online shopping applications as a developer point of view.

The Practical part consists of two sections: In the first section, the author analysed four top open-source PHP based e-commerce frameworks. Also, choosing individual e-commerce framework author formulised criteria’s at the beginning of the practical part. In the second section of the practical part, the author found out the best frameworks between them and created ‘an’ online shopping cart system as a web application. ‘The’ Author’s work is tested in a real domain name and in the web hosting provider.

Keywords:

PHP, e-commerce, MVC, OOP, MySQL, frameworks, OpenCart, Magento, PrestaShop, ZenCart.

Souhrn

Tato bakalářská práce se zabývá nejběžnějšími typy (frameworky) e-komerce ve světě. Hlavním cílem práce je vytvoření online e-shopu jako webové aplikace založené na analýze vybraných typů (frameworků) e-komerce. Dílčím cílem práce je analýza typů (frameworků) e-komerce. Teoretická část obsahuje hlavní charakteristiky PHP a jeho principy, obvyklé řešení, a metodologii k vybudování e-komerce, online nákupních aplikací z pohledu vývojáře. Praktická část se skládá ze dvou částí: v té první autor analyzuje nejlepší čtyři open-source PHP typy (frameworky). Ve druhé části pak autor vyhodnocuje, který z výše uvedených frameworků je nejvhodnější a vytvořil online nákupní systém s košíkem jako webovou aplikaci. Autorova práce je otestována na reálné doméně a webovém hostingu.

Klíčová slova:

PHP, e-obchod, MVC, OOP, MySQL, frameworky, OpenCart, Magento, PrestaShop, ZenCart.

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1. Introduction

We cannot imagine our life without internet and also cannot imagine internet without web sites and all web sites in the world would not be as it is without PHP . After ‘the’ invention of PHP commerce, markets, companies ‘and’ banks have come closer to us, this innovations enables us to buying and selling and all sort of transactions by commerce web sites as we called later on E-COMMERCE and PHP is one of the most commonly used for server side programming language. It helps us ‘in’ building e-commerce web based applications, online web portals, e-business opportunities to all types of enterprises, the most commonly used solutions in building online shopping, are done by the help of PHP e-commerce frameworks.

This incredible fast growing e-commerce provides unbelievable opportunities to companies and business, in terms of expansion and flexibility in their operations. Online and business banking, electron shopping, online ticket reservations, e-advertisement, online payable e-learning web sites and all other e-services are now covered by power e-commerce.

Now a days more than 244 million web sites and 2.1 million web servers are running on PHP and PHP is used by 81.8% of all the entire web servers.[18]

In the next few years, every business is suspected to migrate to the e-business, technology is the way forward, every business is looking to stay competitive as well as looking to continuously improve its business models, however there are hundreds of e-commerce platforms or solutions out there, the question most enterprise need to ask, is what solutions or platform suits their requirements the most. That is the reason this author has chosen this topic, in order to analyse the In this bachelor thesis, the author focuses more on the small and new start-ups business, in order to give a better insight into PHP, based on open-source e-commerce frameworks.

2. Thesis objectives and methodology

2.1. Objectives

This Bachelor thesis is focus on PHP based open source e-commerce frameworks, and author made online e-shop as a web application.

Main objective of bachelor thesis is to create on-line shopping cart as a web application.

Partial goals of the thesis are to analysis of some selected PHP e-commerce frameworks and also to identify their differences, advantages and disadvantages.

2.2. Methodology

Methodology of the thesis is based on study and analysis of specialized information sources. For own solution will be used PHP e-commerce frameworks, which will be chosen by analysis of PHP e-commerce frameworks. Based on a synthesis of theoretical knowledge and the results of own solutions. The conclusion of the thesis will be formulated.

References in this bachelor thesis are taking from well-known international books, journals, articles and international actual online statistical sources.

In the practical part for the purpose of the bachelor thesis frameworks selected by the following criteria:

- All chosen frameworks are should be top open source e-commerce systems in the world (explains deeply in the graph)
- All chosen frameworks are Open Source based
- All chosen frameworks are uses PHP
- All chosen frameworks free license
- All chosen frameworks based on MVC design pattern
- All chosen frameworks are functional indecent
- All chosen frameworks are supports cross platforms

- All chosen frameworks can work at least with MySQL database
- All chosen frameworks are using by majority of users

Finally, the following four frameworks were selected: OpenCart, Magento, PrestaShop, ZenCart.

Each chosen frameworks demo versions installed and tested in the real hosting environment and analysed their functionality by following attributes:

- Speed
- Security
- Design
- SEO
- Payment gateways
- Shipment
- Admin panel performance

After all analysis of the frameworks, the author discovered a lot of features between the alternatives, this features enables businesses in choosing the best used MADM model with a finite number of alternatives.

3. Literature Review

3.1.Principles of PHP and E-commerce

All kind of e-commerce frameworks are works very similarly to each other, in my bachelor thesis we are going to look open source e-commerce frameworks how they works, principles and following main technologies we will learn deeply.

3.1.1. LAMP technologies

3.1.1.1. Linux

When we are talking about web based e-commerce, web platforms, online shopping carts, frameworks those are all will definitely deals and placed on operating systems. The first letter “L” in the LAMP stack refers to “Linux” open source operating system based on Unix OS¹ which is widely used by developers, engineers and majority of users. Linux is not so popular for the desktop applications as much as Windows but it is very famous on servers. In our case PHP is server side programming language and all web sites deals with servers, and servers more suitable with UNIX based OS than Windows platform.

Why Linux in LAMP stack?

Because:

- ✓ It is free open source operating system, it means it is more cheaper for the small enterprises than commercial OS
- ✓ Linux as a server is one of the fast OS in the world
- ✓ Highly secure
- ✓ It is fast than other competitors

Linux is number one UNIX based operating system. According to the w3techs.com following graph is shows it is fastest growing operating system in the world.

¹ OS- Operating System

² Mac OS X- is a series of Unix-based graphical interface operating systems developed and marketed by Apple Inc

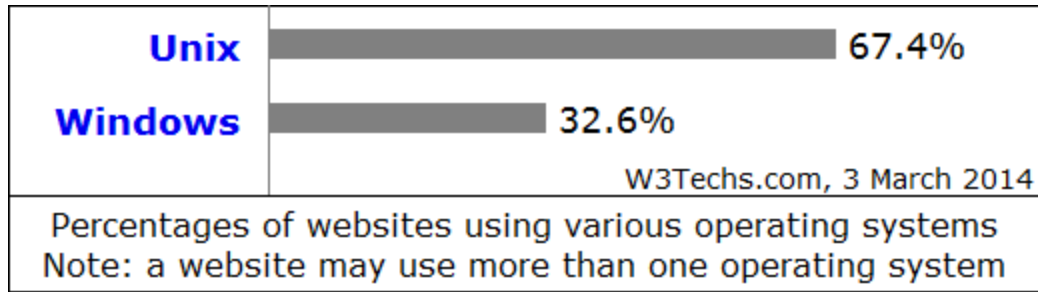


Figure 3-1 Fastest growing operating systems since 1 February 2014

Source:[18]

In addition other OS users can also use other popular stacks. For example: For the Mac OS X² users can use MAMP³, or Microsoft Windows OS users can use WAMP⁴

3.1.1.2. Apache

Apache is an open source software web server application which invented by Robert McCool at 1995. As of February 1, 2014 Apache was estimated to serve 61.3% of World Wide Web usage.

© W3Techs.com	usage	change since 1 February 2014
1. Apache	61.3%	-1.4%
2. Nginx	19.5%	+1.5%
3. Microsoft-IIS	14.3%	-0.1%
4. LiteSpeed	2.0%	
5. Google Servers	1.3%	

percentages of sites

Figure 3-2 Most popular web servers. 1 February 2014

Source:[18]

² Mac OS X- is a series of Unix-based graphical interface operating systems developed and marketed by Apple Inc

³ MAMP- Mac, Apache, MySQL, PHP/Perl/Python

⁴ WAMP- Windows, Apache, MySQL, PHP/Perl/Python

Why Apache in LAMP stack?

Because:

- It is cheap
- It is efficient
- It is most popular web server in the world
- It is open source based web server, which can easily integrate with all server side programming lineages PHP/Python/Perl
- It is well-documented
- It is more reliable than others

3.1.1.3. MySQL

MySQL (pronounced My-Ess-Que-Ell) is a very fast, robust, relational database management system (RDBMS).A database enables you to efficiently store, search, sort, and retrieve data. The MySQL server controls access to your data to ensure that multiple users can work with it concurrently, to provide fast access to it, and to ensure that only authorized users can obtain access. Hence, MySQL is a multiuser, multithreaded server. It uses Structured Query Language (SQL), the standard database query language.[5]

MySQL has been available for the public at 1996 but has a development background going back to 1979. Michael Widenius⁵ is a co-founder of MySQL. Name of this new invention he called with his daughter's name My⁶. As of July 2013 MySQL is a second world's most widely used RDBMS⁷ and it has also won Choice Award from the Linux Journal Readers' on a number of occasions.

The letter "P" refers three main server side programming languages in the world which are starts with the same letters PHP, Python, Perl. In the following chapters I will explain about PHP with more details.

⁵ **Michael Widenius** – Ulf Michael Widenius (often called "Monty") he was born 3 March 1962, Helsinki, Finland

⁶ **My**- Is a first name of Michael Widenius's daughter **My Widenius**

⁷ **RDBC**- Relational database management system

3.1.1.4. How PHP works

Let me explain in a short way about how PHP works. Like all server side programming languages PHP works with Request and Respond principles. Client will start typing name of the side for example `czu.cz` and (now days modern browsers will automatically put `http://` before web site name) and will send request to the server, and server sends request to the PHP, after that PHP identifies which extension can be used and will send to request to the extensions, extension will get information that requested from client extension can get information either from database or from file systems.

3.1.1.5. History of the PHP

Number one web server side programming language in the world obviously is PHP, if we look for the history of PHP we will find information that “PHP is created at 1995” but it is not correct PHP is actually the continues product of PHP/FI (also called version PHP1) which is created in 1994 by Rasmus Lerdorf, 4 months later at 1995 Rasmus improved and added more functionality to PHP1 which he named after PHP2 and shared it with other developers to improve the future of the language, from this point PHP became very popular and most used server side scripting language.[12]

Danish, Greenlandic Programmer Rasmus Lerdorf (citizen of the Canada) is the author of the PHP, he wrote early versions of PHP1, and PHP2.

```
<!--include /text/header.html-->

<!--getenv HTTP_USER_AGENT-->
<!--ifsubstr $exec_result Mozilla-->
  Hey, you are using Netscape!<p>
<!--endif-->

<!--sql database select * from table where user='$username'-->
<!--ifless $numentries 1-->
  Sorry, that record does not exist<p>
<!--endif exit-->
Welcome <!--$user-->!<p>
You have <!--$index:0--> credits left in your account.<p>

<!--include /text/footer.html-->
```

Figure 3-3 First version of PHP/FI Code, also called PHP1

Source: [12]

At the early life of the PHP was simple CGI⁸ binaries which is written in the C programming language. Lerdorf wrote this interface just to calculate visitors to his online resume (Personal Home Page), and to define receiving traffic for his home page. He named that scripts as a "Personal Home Page Tools," or also called "PHP Tools" after a while, day by day more functionality was asked and desired by his friends, colleagues and other firms who were using those scripts for their web sites, and he added more and more functionalities to his scripts. Until that time websites "world" were just simple static HTML web sites, which means user could not interact with it. This new model was capable as well as database interaction and more, providing a framework upon which users could develop simple dynamic web applications such as personal dynamic home pages, storing online resumes and guestbook web sites. In June of 1995, Lerdorf worked very hard on his scripts and he released the source code for PHP Tools to the public, after this release developers and users allowed to use it as they want. It gave to everybody enjoy with it, with fixing bugs, and improving it in futures.

3.1.1.6. First article about PHP

Now days we can find PHP books and publications (personal blogs, tutorial web sites) almost in all world languages. First article in the world about PHP was not in United States which PHP was created but valuable article with hard copy magazine was published in Czech Republic.

To the best of our knowledge, the first article about PHP in a hard-copy magazine was published in the Czech mutation of Computerworld in the spring of 1998, and covered PHP 3.0. As with books, this was the first in a series of many articles published about PHP in various prominent magazines.[13]

3.1.1.7. First book about PHP

As PHP grew, it began to be recognized as a world-wide popular development platform. One of the most interesting ways of seeing this trend was by observing the books about PHP that came out throughout the years. To the best of our knowledge, the first book dedicated to PHP was 'PHP - tvorba interaktivních internetových aplikací' (PHP - **Creating Interactive Internet**

⁸ CGI- Common Gateway Interface is a standard method used to generate dynamic content on web pages and web applications.

Applications) - a Czech book published in April 1999, authored by Jirka Kosek. Next month followed a German book authored by Egon Schmid, Christian Cartus and Richard Blume. The first book in English about PHP was published shortly afterwards, and was 'Core PHP Programming' by Leon Atkinson. These books covered PHP 3.0. Now days there are in English 400, in German more than 100, in Spain and French around 50 books are available.[14]

3.1.2. Object Oriented Programming in PHP

Thanks to the PHP5 it gave us honourable development for the community of PHP and to the future of the PHP.

When PHP was developed, it did not implement OO⁹ features in itself. After PHP/FI, when Zeev, Rasmus, and Andy rewrote the core and released PHP3, very basic OO features were introduced. When PHP4 was released, OO features got matured with huge performance improvement. But the PHP team rewrote the core engine again to introduce completely new object models and released PHP5.[4]

Object - oriented programming requires a different way of thinking about how you construct your applications. Objects enable you to more closely model in code the real - world tasks, processes, and ideas that your application is designed to handle. Instead of thinking about an application as a thread of control that passes chunks of data from one function to the next, an OOP¹⁰ approach enables you to model the application as a set of collaborating objects that independently handle certain activities.[1]

3.1.3. Golden benefits of OOP

As most of the people consider that PHP is scripting language but after involves OOP itself some literatures are naming it as a server side programming language. My focus in this analysis about e-commerce frameworks those are all those supports OOP methodology. In the following steps I will introduce big advantages of OOP.

OOP is invented to make the developer's life easier. Using OOP you can split your problems into smaller problems that are comparatively easy to comprehend. The main goal of OOP is: everything you want to do, do it via objects. Objects are basically small discrete pieces of code

⁹ OO- Object Oriented

¹⁰ OOP-Object Oriented Programming

which can incorporate data and behaviors together. In an application all these objects are connected to each other, they share data among them and solve problems.[4]

Why all high level programming languages are used OOP? Because OOP features are big advantages to use code many-many times with just inheriting or modifying some functionality of previous classes and objects.

One of the main benefits of OOP is the ease with which you can translate individual business requirements into individual modules of code. Because an OOP approach enables you to model your application based on the idea of real - world objects, you can often identify a direct correlation between people, things, and concepts, and equivalent classes. These classes have the same properties and behaviors as the real - world concepts they represent, which helps you to quickly identify what code must be written and how different parts of the application must interact.[1]

3.1.4. Reusability

An object is an entity which has bundles of properties and methods and can interact with other objects. An object can be sufficient or it may have dependencies over other objects. But an object is usually developed to solve a specific set of problems. So when other developers suffer from the same set of problems, they can just incorporate your class to their project and use it without affecting their existing workflow. It prevents from DRY, which means Don't Repeat Yourself. In functional or modular programming, reusing is possible but complex.[4] DRY principle is magic honorable benefit of OOP

3.1.5. Refactoring

When you need to refactor your projects, OOP gives you the maximum benefit because all objects are small entities and contain its properties and methods as a part of itself. So refactoring is comparatively easier.[4]

3.1.6. Extensible

If you need to add features to your project, you can achieve best results from OOP. One of the core OOP features is extensibility. You can refactor your object to add the feature. While doing it, you can still maintain backward compatibility of this object so that it works fine with an old code base. Or you can extend the object and create a totally new object that retains all the

necessary properties and methods of the parent object from which it has been derived, and then expose new features. This is termed "inheritance" and is a very important feature of OOP.[4]

3.1.7. Maintenance

Object oriented code is easier to maintain because it follows somewhat strict coding conventions and is written in a self-explanatory format. For example, when a developer extends it, refactors it, or debugs it, they can easily find out the inner coding structure and maintain the code time after time. Moreover, whenever there is a team development environment in your project, OOP could be the best solution because you can distribute your code after splitting it into small parts. These small parts could be developed as a separate object, so developers can develop them almost independently. Finally, it will be very easy to merge the code.[4]

3.1.8. Efficiency

The concept of object oriented programming is actually developed for better efficiency and ease of development process. Several design patterns are developed to create better and efficient code. Moreover in OOP, you can think of your solution in a much better approach than procedural programming. Because you first split your problem into a small set of problems and then find solutions for each of them, the big problem is solved automatically.[4]

Another OOP advantage comes from the modularity of classes. If you discover a bug in your Person class, or you want to add to or change the way that class functions, you have only one place to go. All the functionality of that class is contained in a single file. Any processes of the application that rely on the Person class are immediately affected by changes to it. This can vastly simplify the search for bugs, and makes the addition of features a relatively painless task.[1]

3.2. E-commerce application architecture

3.2.1. MVC architecture

From the programmer point of view best practices to create scalable, reusable, easy maintainable information system is of course object oriented methodology. In the early life of OOP programming languages invented designing patterns but there was something needed to use this approach after all MVC came as one of the main design pattern.

It is important to remember, however, that design patterns do not guarantee success. You can only determine whether a pattern is applicable by carefully reading its description, and only after you've applied it in your own work can you determine whether it has helped. One of these patterns is Model-View-Controller (MVC). The programming language Smalltalk first defined the MVC concept in the 1970's. Since that time, the MVC design idiom has become commonplace, especially in object-oriented systems.[11]

MVC stands for the M is a model, the V is a view, and the C is a controller. It means manipulating ICT systems by three basic different approaches, model, view, controller approach is also known as a design pattern, a description of a reusable solution to a recurring problem given a particular context. MVC exist so that the challenges faced when designing large - saleable applications may be approached in a consistent manner. MVC makes developers, engenders life's easy MVC will give us solution of the problem that how to best separate the user interface of a program (the view), the business and utility classes that actually do the complex thinking (the model), and its inner processing and decision making (the controller) in such a way that they represent three distinct, separable components.

3.3.Basics of E-commerce

3.3.1. Major types of E-commerce transactions

There are many different types of e-commerce models and variety of different ways to characterize these types. In this thesis major and common types of models are explained.

Table I: Major types of E-commerce transactions

Transactions collected by: Source: [16]

Transactions	Business	Consumer	Government
Business	B2B	B2C	B2G
Consumer	C2B	C2C	C2G
Government	G2B	G2C	G2G

3.3.1.1. Business to Business transaction

This type of e-commerce means both sides' buyers and sellers are businesses. One business will receive services or business while other side is sells. Example sites for this type: Alibaba.com, GE.com, slaesforce.com, ChemConnect.com etc.

3.3.1.2. Business to Consumer transaction

This types of e-commerce means one side of the business is business company other side is consumer. Business to Consumer transactions are most popular and most used as a e-commerce platform. Example: amazon.com,

3.3.1.3. Consumer to Business transaction

This kind of e-commerce model is deals between consumer and business. This is also known as costumer to business. In this type of model consumer sell their goods or services to the companies who are willing to purchase that goods or services. Especially this transactions is more powerful and most used in the advertising marketing, consumer puts there products or services to the company's board.

Example: elance.com was one of the first companies who offer C2B strategy to the consumers. linkedin.com is also very popular social network which works with the same strategy.

3.3.1.4. Consumer to Consumer transaction

Sometimes known as Customer to Customer, e-commerce involves electronically-facilitated transactions between individuals, often through a third party. One common example is online auctions, such as Ebay, where an individual can list an item for sale and other individuals can bid to purchase it. Auction sites normally charge commission to the sellers using them. They act purely as intermediaries who match buyers with sellers and they have little control over the quality of the products being offered, although they do try to prevent the sale of illegal goods, such as pirate CDs or DVDs.

Another popular area for customer to customer transactions is online classified advertising sites, such as Craigslist and Gumtree. Major online retailers like Amazon also allow individuals to sell products via their sites.

Consumer to Consumer is expected to increase in the future because it minimizes the costs of using third parties. However, it does suffer from some problems, such as lack of quality control or payment guarantees and there can sometimes be difficulties in making credit-card payments.[16]

In addition in Czech Republic very famous Consumer to Consumer e-commerce web sites are Bazos.cz and Aukro.cz. Bazos.cz gives opportunity to its users adding all kind advertising, job offers, and main part of the service is online shopping, which are products submitted by another user. Users can buy almost everything as new or used types of products.

As I explained in the table we can continue with other transactions which are deals with government for example Government to Government, Government to Consumer, Consumer to Government, and Business to Government and so on.

4. Practical part

Practical part, consist of two parts:

- ➔ First is analysing part, author is analysed very popular and fastest growing open –source, PHP based e-commerce frameworks, focus on characteristics, popularity, main functionalities and targeted areas of alternatives.
- ➔ Second part is author choose one of the best e-commerce framework solution for his requirements and have done own work which is author created online shopping cart based on analysed best alternative. Author will explain deeply about his own work at the Results and Discussions part.

4.1. Analysing of individual chosen frameworks

For the purpose of the comparison, four PHP based e-commerce systems were selected. They were chosen by following criteria's.

- All chosen systems are should be top open source e-commerce systems in the world, see the figure below [Figure 4-1]
- All chosen systems are Open Source based
- All chosen systems are uses PHP
- All chosen systems free license
- All chosen systems based on MVC design pattern
- All chosen systems are functional indecent
- All chosen systems are supports cross platforms
- All chosen systems can work at least with MySQL database
- All chosen systems are using by majority of users

Following chart [Figure 4-1] shows us percentage of e-commerce (shopping cart) technologies used by online stores globally. In the chart you can see WooCommerce that also used by millions of shopping carts, and it is nominated almost 12 % of shopping carts in the world, but author did

not compared it with others because of the choosing criteria, WooCommerce is not a uniq system but it is plugin for Wordpress e-commerce solutions.

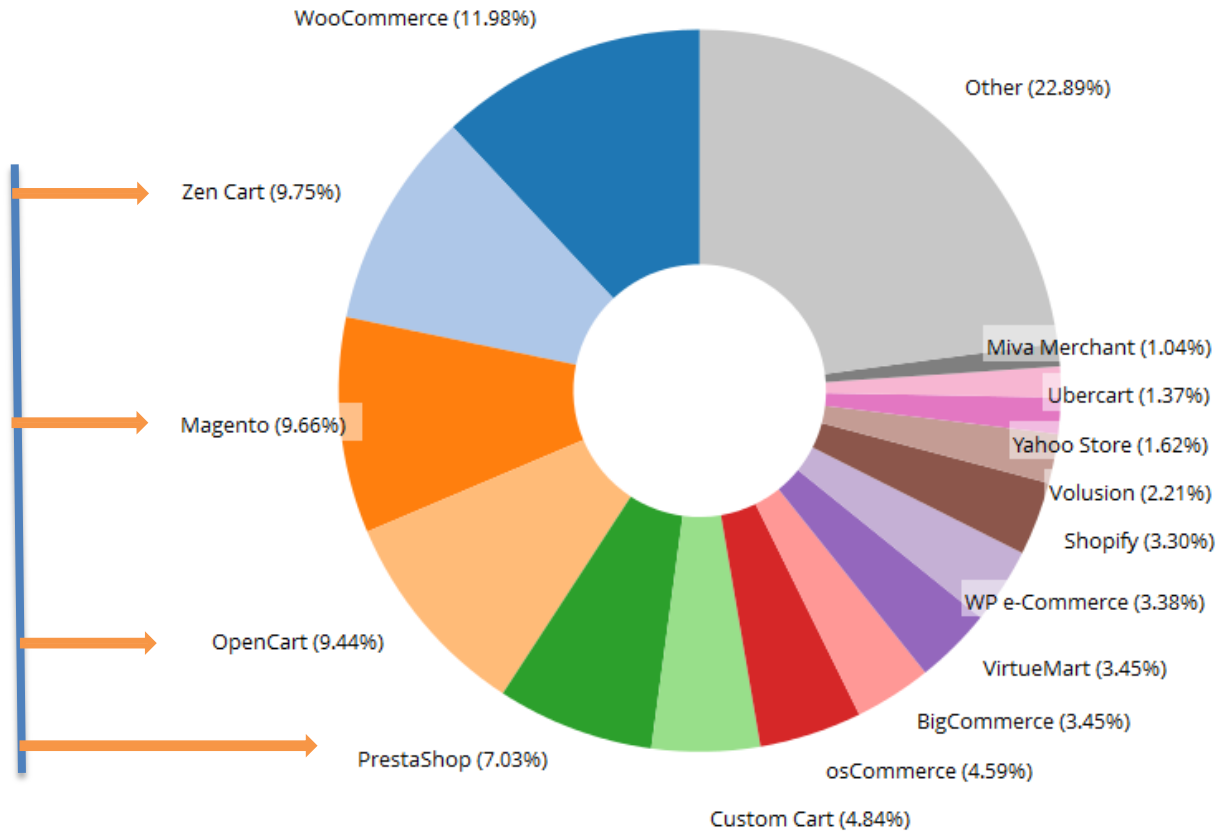


Figure 4-1 Distribution of global e-commerce technology

Source: Last updated Mar 5th 2014, [Error! Reference source not found.]

Main focus of author is to small business, start-up enterprises that is why author chooses open-source based systems because there are:

- Totally free to install, and to modification, start-ups, or small business can play this it for free.
- Very cheap cost for customizing entire source platform and prolonging system by valuable functional extensions, plugins, modules, add-ons which are offers from community of users
- Open source is most used e-commerce shopping cart solution in the world

In the following table author collected main characteristics of systems.

Table II. Main characteristics of chosen systems

Collected by author: Sources:[19,20,21,22]

Characteristics	Magento	OpenCart	PrestaShop	Zen Cart
Developer	Magento Inc	Daniel Kerr	PrestaShop SA	Zen Ventures, LLC
Initial release	2007	2007	2007	2003
Stable release & date	CE 1.8.1.0 PE 1.12.0.2 EE 1.13 / 11.12. 2013	1.5.6 – 25 July 2013	1.5.6 / 19.11.2013;	1.5.1 18.9. 2012
Written in	PHP (Zend)	PHP	PHP	PHP
Operating system	Cross-platform	Cross-platform	Cross-platform	
Type	Shopping Cart	Shopping cart	Shopping cart	Shopping cart
License	OSL Ver. 3 / AFL Ver. 3	GNU, GPL ¹¹	OSL ver 3.0	GNU, GPL
Live web sites using	208,457	218,131	168,277	124,975
More suitable for	Large Business	Small business	Small business	Small Business
Website	Magentocommerce.com	OpenCart.com	PrestaShop.com	zen-cart.com

Analysing continues by individual systems, I have tried to explain systems, by their advantages and disadvantages to each other. During the explaining advantages and disadvantages steps I have tried to write only advantages & disadvantages that competitors has not.

4.1.1. OpenCart

One the most used and very user friendly platform is OpenCart. OpenCart is a very powerful system for start-up enterprises and fast speed to enter the e-commerce market. It provides a powerful ecommerce shopping cart and widely used extensions, plugins with a minimal investment. There are more than 1600 extensions out there that users can interact with them and

¹¹ GPL-General Public License

more than 4000 extensions and plugins for commercial purpose. It is open and big support community as well.

In 2011, OpenCart got award of “Honouring the best of Open source e-commerce”, and at the same year OpenCart forum also nominated by community as “Best open-source e-commerce forum”

OpenCart is free open source ecommerce platform for online merchants. OpenCart provides a professional and reliable foundation from which to build a successful online store. This foundation appeals to a wide variety of users; ranging from seasoned web developers looking for a user-friendly interface to use, to shop owners just launching their business online for the first time. OpenCart has an extensive amount of features that gives you a strong hold over the customization of your store. With OpenCart's tools, you can help your online shop live up to its fullest potential.[19]

Advantages of OpenCart (analysed by author):

- System speed: It is the fastest one between comparing systems, full loads all content in **2.4 sec, [Error! Reference source not found.]**
- Number one fastest growing system ever in the area of open-source systems [Figure 5-1]
- Big community supports
- Requires less server resources than competitors
- Lightweight (23.4 Mb)
- Very easy to learn
- Very easy to administrate for enterprises who are not familiar with coding
- It supports more than near to 30 payment gateways

Disadvantages of OpenCart (analysed by author):

- It is possible to install whatever language extensions we want, but languages are not. come with file itself, PrestaShop has advantage in this case.
- It has SEO¹² futures but it is not efficient SEO friendly as Magento has.
- Uploading product images takes more time than competitors.

¹² SEO- Searching Engine Optimization

Table III. Regional interest for OpenCart, EU countries only

Top three countries via Google Trends; Source:[24]

№	Country name	Interest (%)
1.	Latvia	58
2.	Estonia	55
3.	Czech Republic	49

OpenCart is suitable for verity type of enterprises but it is more recommended to small and medium type of business and start-ups. It cost friendly system which variety of extension futures. OpenCart is more suitable to build online shopping carts in the following chart, we can see it verify it very easily.

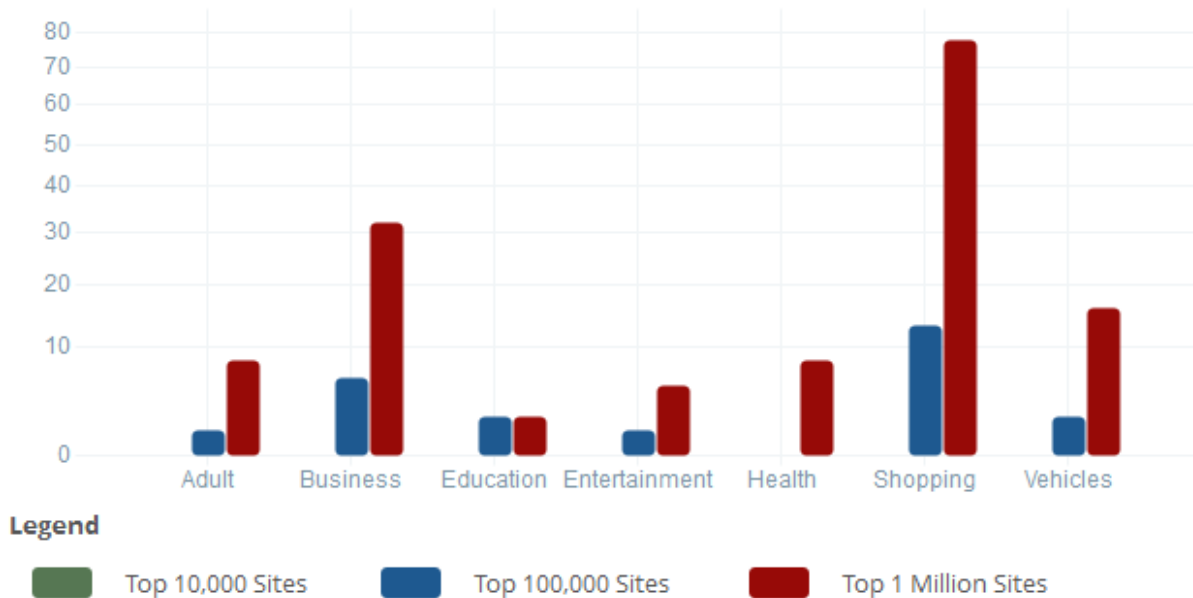


Figure 4-2 OpenCart Popular Website Verticals

Source:[25]

This chart shows the amount of websites within the top 10k, 100k, and 1 million sites groups that are categorized as being in the specific vertical.

4.1.2. Magento

Early starting point of this project was at 2007, at August 31,2007 first version is released and was called “Bento”. Bento was developed by Varien company which changed it is name later to “Magento” . June 6, 2011eBay owned Magento.

Table IV Regional interest for Magento, EU countries only

Top three countries via Google Trends; Source:[24]

№	Country name	Interest (%)
1.	Netherlands	83
2.	Estonia	54
3.	Germany	40

Magento has a big market share because it has three different types of products company also calls them “**Editions**”. I will explain characterizes of editions in the following steps.

Enterprise Edition

This edition is not free it’s more suitable for large businesses and enterprises. It has got the business-class features and it is very flexible you need to create an eCommerce solution tailored to your unique needs. And to help you drive more traffic to your store, convert browsers into buyers and boost online revenue.

Magento Go Edition

This edition is Magneto’s hosted e-commerce edition for small business that is just getting started in e-commerce. Small business enterprises can customize the design of the store, and they can extent functionality of the store via using extensions.

Disadvantages of Magento Go:

- It’s is payable software , enterprise can use only trial version for one month only, and after that they have to pay
- Hosting limited enterprise should register web store to Magento hosting services only

Community Edition

Magento Community Edition is perfect if you're a developer or tech-savvy merchant that wants to explore the flexibility of the Magento platform. You can modify – and even contribute to – the core code and engage with our passionate community for support and guidance.[20]

In this bachelor thesis author analysed and tested Magento Community edition, because only this edition of Magento is satisfied author's criteria's.

Advantages of Magento (analysed by author):

- Multi-store, multi product functionality, most of the systems will have a system problem after 1500 of products uploaded i.e. Zen Cart but, Magento has advantage in this case
- Fully scalable
- Out-of-the –box futures

Disadvantages of Magento (analysed by author)

After analysing four of systems, following steps will be explain disadvantages of Magento:

- It is quit big application (installation file 104 Mb) to store data to the hosting takes more than 5 hour (Rest of the systems 30-60 minutes only)
- Buggy files more than 12,000¹³ files itself
- It is not lightweight as rest of the platforms. It can consume gigabytes of RAM¹⁴ during the application life.
- Speed: It is very slow because large number of files inside
- It is not easy to learn especially for users who doesn't have experience with OOP and PHP
- And the last disadvantages of Magento it has build on PHP, I will explain with following comment “Authors of Magneto made a bicycle, but they are using it as a car” (Author conclusion)

¹³ Bachelor thesis objectives focus on Magento Community Edition (CE), and number of files explains about community edition files. But as a whole Magento has more than 21,000 files itself.

¹⁴ **RAM** - Random access memory

4.1.3. PrestaShop

Another open source, PHP based e-commerce platforms is PrestaShop. It has also huge community as well. As other competitors PrestaShop is community based support from their forum and available huge number of online tutorials. PrestaShop has a good record and even was awarded the title of the Best Open Source E-Commerce Application in the Packt 2010 Open Source Awards and the “Best Open Source Business Application” in the 2011 Open Source Awards.

Advantages of PrestShop (analysed by author):

In the followings are spatial advantages of PrestaShop then alternative platforms.

- It is SEO friendly:
- Animated add to cart: PrestaShop has in-built animated add to cart feature. Only PrestaShop has this feature between competitors.
- Multilingual support: Admin panel and frontend application supports all major languages.

Disadvantages of PrestShop (analysed by author)

After analysing four of systems, following steps will be explain disadvantages of PrestShop:

- Most important and necessary modules are very costly
- Not user friendly for multi user interface
- Poor marketing futures, i.e. it has not crass sell products which others have

Table V Regional interest for PrestaShop, (EU countries only)

Top three countries; Source:[24]

№	Country name	Interest (%)
1.	Czech Republic	37
2.	Spain	35
3.	France	34

4.1.4. Zen Cart

Between comparing systems Zen Cart is older one, life of this platform started from June, 2003. It works under GNU General Public License.

Zen Cart during the analysis of systems author found that futures are not so popular as competitors has, during the testing web site speed demo version of Zen Cart nominated as a second fastest (full loading entire page speed 2.8 seconds) system but after enabling JavaScript, (as all rest of the systems has), speed of the system nominated as a last fastest between comparing systems, full loading entire page speed was tested 5.0 second, see the figure [**Error! eference source not found.**].

During the analyzing of e-commerce systems author found out Zen Cart is more searchable in Czech Republic, By Google Trends is shows 100% interest

Table VI Regional interest for Zen Cart, (EU countries only)

Top countries; Source:[24]

№	Country name	Interest (%)
1.	Czech Republic	100
2.	Slovakia	39

Advantages of Zen Cart (analysed by author):

- Big community support, a lot of tutorials for learning
- Hundreds and hundreds of add-ons
- Demo versions come lightweight works very fast without JavaScript

Disadvantages of Zen Cart (analysed by author)

After analysing four of systems, following steps will be explain disadvantages of Zen Cart:

- Interface is seems very old, and out-dated

- Poor layouts both front and backend, enterprises can customize their Zen Cart web shop but this future will come with cost
- After uploading more than 1000 products lagging problems (not tested by author)
- Upgrades issues - Zen Cart update often goes beyond bugs and creates fundamental issues for its users when custom coding is lost or erased. There are many complaints of difficulties with upgrades.
- It requires PHP knowledge only people can customize who has enough experience of PHP
- SEO compatibility is very poor- Information on SEO enhancement is hard to find. On the internet there a lot of extensions or plugins but they do not exactly have raving success reviews.

4.2. Testing speeds of chosen frameworks

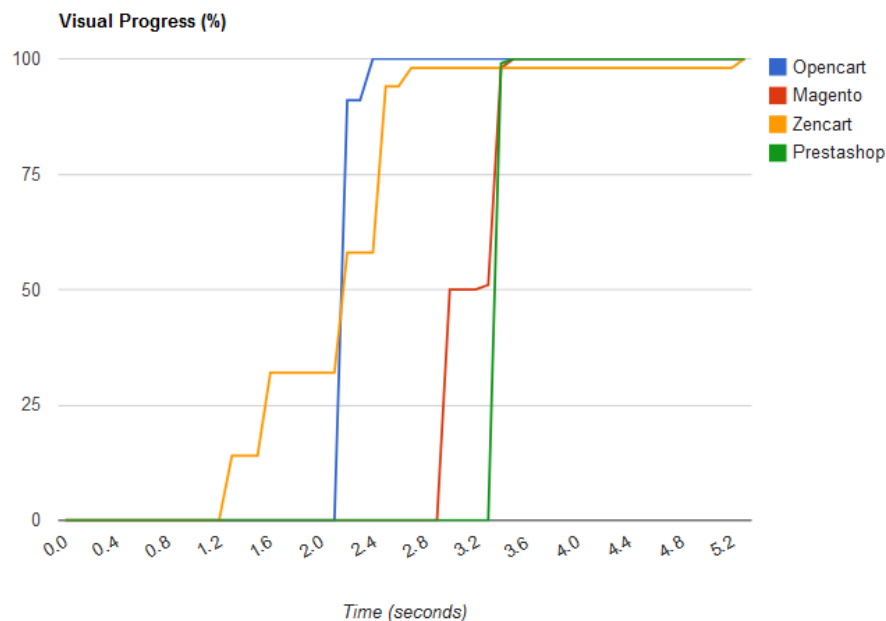


Figure 4-3: Author speed demo versions of chosen frameworks

Source: Author test

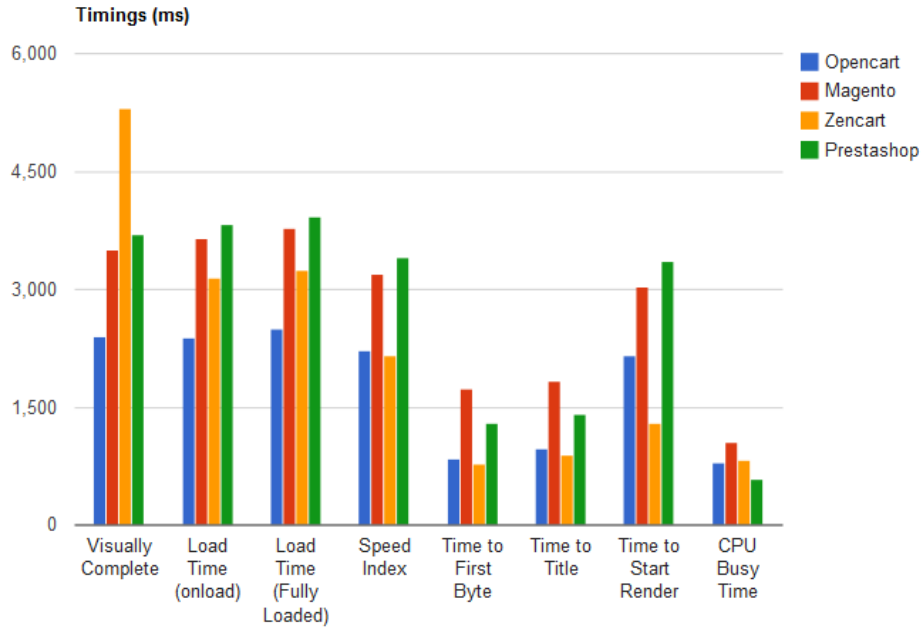


Figure 4-4: Timings speed

Source: Author test

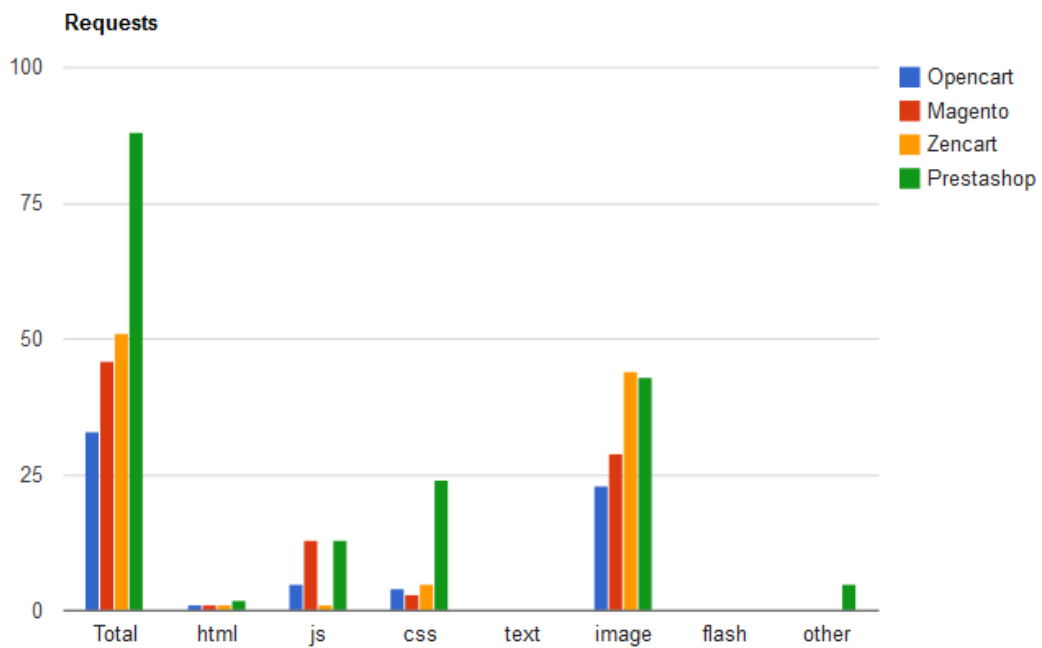


Figure 4-5: Requests speed

Source: Author test

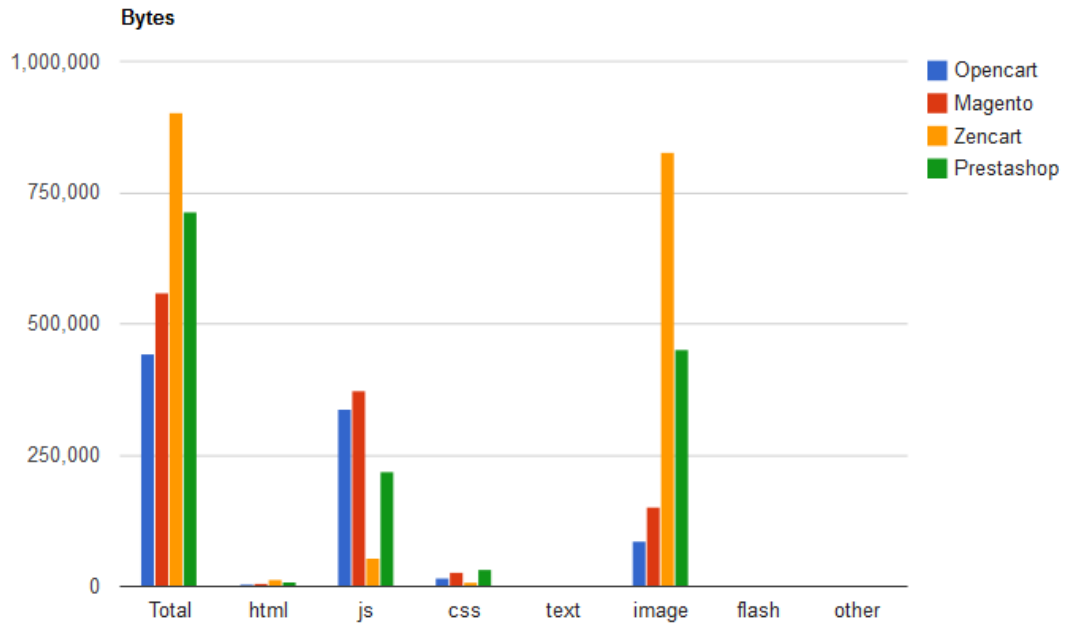


Figure 4-6: Bytes speed

Source: Author test

4.3. Multiple Attribute Decision Making

After analysis all systems author found out there is a lot of best futures between alternatives, to choose the best one, we use MADM model with finite number of alternatives approach.

After evaluation of all alternatives with respect to attributes author summarized them in the following table.

Table VII Systems evaluation via MADM Sequence method, by author

Using Sequence method (4 is the best)

Sytems	Speed	Security	Design	SEO	Payment gateways	Shipment	Admin panel performance	SUM
OpenCart	4	4	4	3	4	4	4	27
Magento	3	4	4	4	3	4	4	26
PrestaShop	2	1	3	3	2	3	3	17
Zen Cart	1	2	2	3	2	1	1	12

Table will be explain in the results and discussions part.

Table VIII Systems evaluation via MADM Scoring method, by author

Using Scoring method (scale from 1-10)

Sytems	Speed	Security	Design	SEO	Payment gateways	Shipment	Admin panel performance	SUM
OpenCart	10	9	9	8	10	8	9	63
Magento	7	9	9	9	9	8	9	60
PrestaShop	6	7	8	8	8	6	8	51
Zen Cart	9	8	6	8	7	4	5	47

Table will be explain in the results and discussions part.

5. Results and Discussions

In the previous part we have analysed all chosen frameworks and we have decided to choose the best alternative and nadir alternative from the competitors. By evaluation with MADM model, I choose Zen Cart as a nadir alternative because of it is popularity, and functionality inefficiency.

I decided to choose and use in my projects OpenCart shopping cart system as the best, ideal alternative and I preferred it then other computers.

Why author choose OpenCart?

First reasons:

- It is the fastest shopping cart system between alternatives.
- It is free to download and develop with free software upgrades and support.
- Launch a store faster: Simple installation steps, this is a very good future for OpenCart majority of small enterprises can install and can extend it without any knowledge of IT¹⁵
- It saves investment costs: Free, cost-effective extensions, plugins themes, modules, add-ons, huge number of ready templates.
- It uses vQmod¹⁶.

¹⁵ IT-Information technology

- It keeps the store run smooth.
- Gives better response time: Lightweight, very easy to download and easy to host (OpenCart has 2680 files insight, Magento Community Edition).
- During the life of the application it requires small number of process at RAM.
- Handle easier: Ideal for end users to control their OpenCart stores.
- Catch up with e-commerce trends, very fast growing community.
- Very easier to use.
- Scalable, GUI¹⁷ and user friendly control panel, allows for simple administration.
- Information and tutorials are easily available on the web and the developer community is robust.
- Offers a variety of payment gateways: near to 30 payment gateways i.e. Payment Software, PayPal, SagePay, WorldPay etc.

¹⁶ VQmod-virtual “Q” mod it gives the ability to create modification override "scripts" for required files in a web applications who are supports controllers.

¹⁷ GUI-Graphical user interface

Second reason: In the following graph we can easily compare how fast it's growing than any other opensource shopping cart systems, graph showing us very highly growing of OpenCar in the last two years.

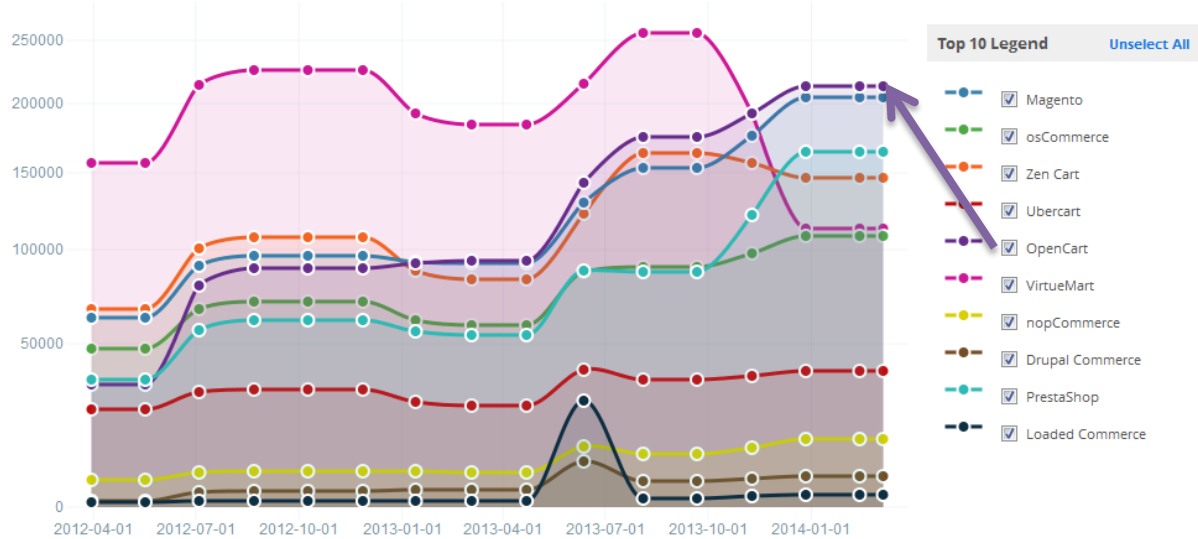


Figure 5-1 Open Source usage statistics for e-commerce web sites

Statistics for websites using Open Source technologies based on the entire internet (all web sites on the internet are covered); Source:[27]

Third Reason:

Its fastest then competitors speed sees image and figures [Figure 9-1,Figure 4-3,Figure 4-4,Figure 4-5,Figure 4-6]

5.1. Online shopping cart application

Application Architecture

After analyzing all top open-source PHP frameworks author created online shopping cart as a web application with OpenCart, because author found out OpenCart is only suitable framework to build his online shopping web application.

OpenCart uses MVC+L architecture pattern, it stands for Model, View, Controller, and Language, OpenCart extends well known architecture pattern MVC to MVCL because of the

adaptation and internationalization of the application in a global area, and this is one of reason that it's growing very fast.

As a common approach our application consists of two interstate frontend (client) and backend (admin).

Backend file directories

Backend interface consist of following directories, files names of the directories explained with the same structure of application.

abiyecz_admin_panel

controller- In this directory **.php** files are stored to controls entire application from backed. In this directory functional code logic are stored, and controller stands between model and view to controls their logic.

language- This directory one of the OpenCart future, there will be stored languages as a single sub directory and in the subdirectories will be stored directories with the same name directors as controller has, and sub and sub files and directories with the same naming hierarchy with controller directory.

model-In this directory we can interact more with databases it will get data from database and will restructure of data which is will be suitable to view, OpenCart doesn't use ORM¹⁸ but we can use direct database queries.

view – HTML¹⁹, JavaScript, CSS²⁰ and all other frontend files are stored, it has **.tpl**²¹ suffix

config.php – server, database, file systems, configuration file.

index.php - default page

¹⁸ **ORM**-Object Relational mapping

¹⁹ **HTML**- Hypertext Transfer Markup Languages

²⁰ **CSS**- Cascade Style Sheets

²¹ **.tpl** - stands for the word “template”, “.tpl” one of the most used extension for template open-source e-commerce frameworks

php.ini – PHP extensions and other important configurations

Admin panel interface

Admin panel interface is the place to administrate whole e-shop application. Users are three types to administrate e-shop

Top administrator → has 100% access right to modify entire e-shop application, can insert, delete, not only products can insert different types payment gateways, shipping methods etc.

Administrator → has can only insert categories, new products, can delete them as well

User (admin panel user) → has access to only limited categories.

Admin panel consist of following main navigation menus:

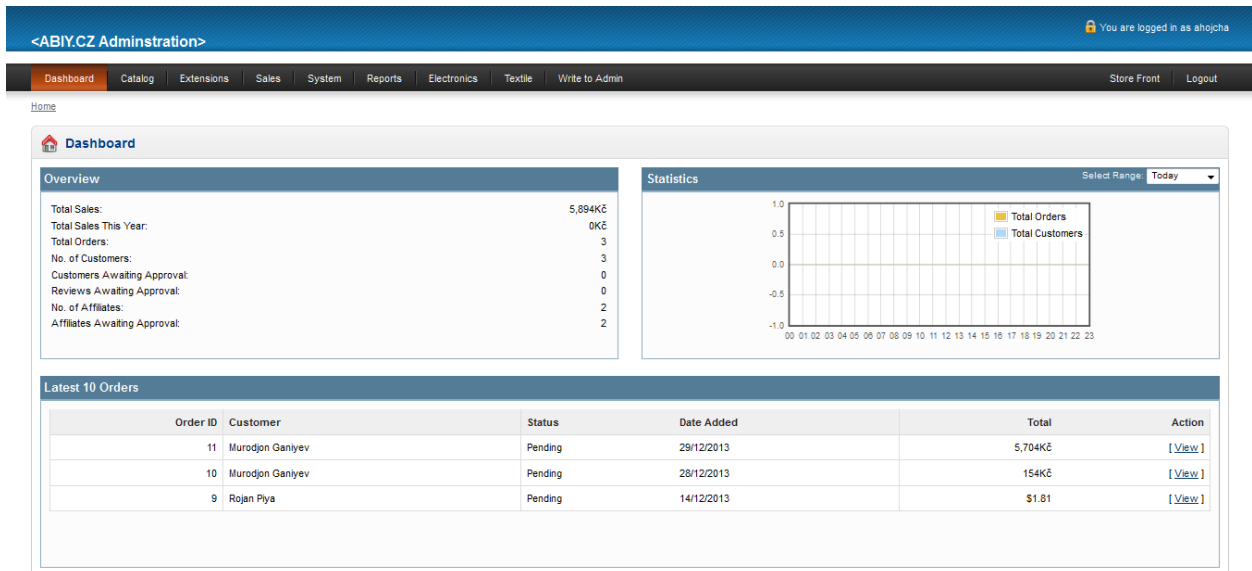
Dashboard: Consist of three visual boards:

- Overview
- Statists
- Last 10 Orders

Catalog – All types of products

Extensions- Stored modules, payment and shipment gateways

Sales- Informs statists of sales, daily, monthly, yearly etc.



Frontend file directories

Thanks for MVCL architecture pattern it gives magically scalable application for developers in my application frontend files directories are the same names as backend has.

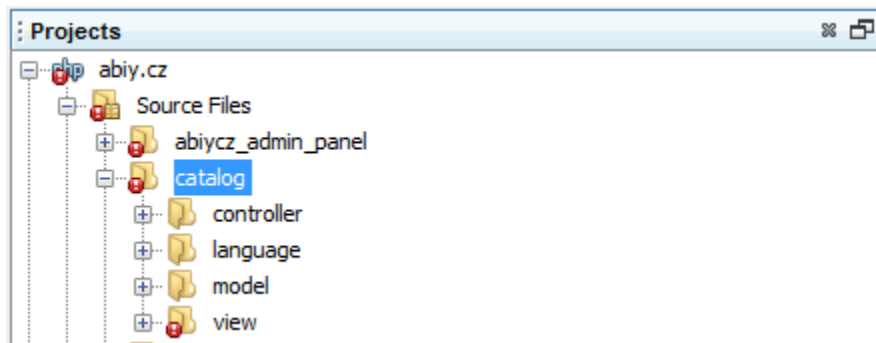


Figure 5-2 Web application frontend directories

Source: By author of the thesis,(snipped from NetBeans IDE, ver 7.4)

Frontend file interface

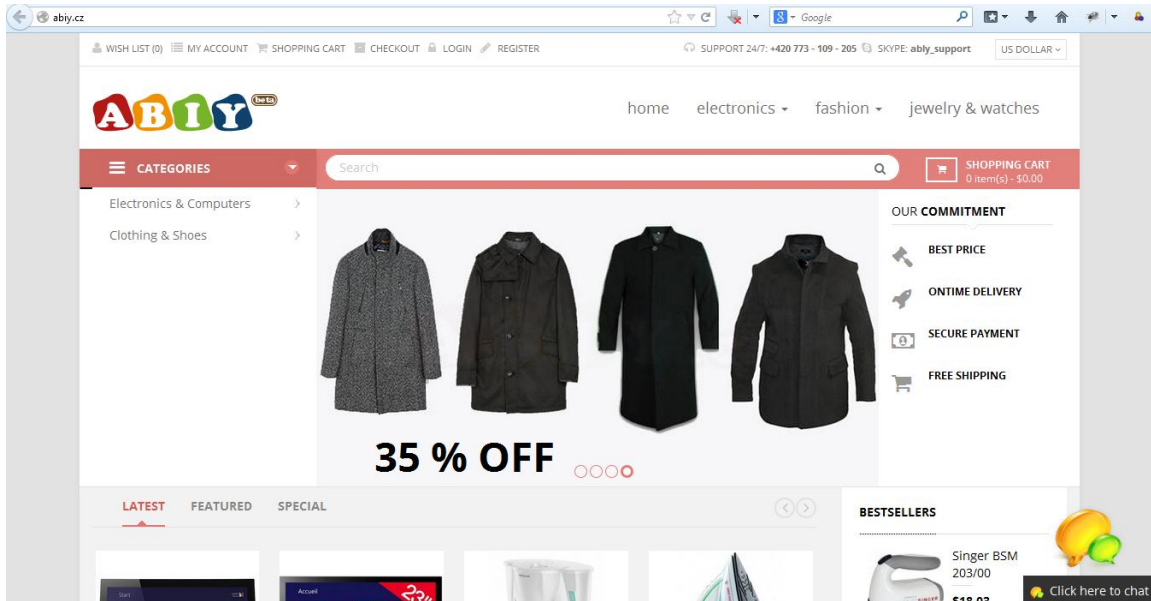


Figure 5-3: Overview of main page

Next figure explains how this explications works



Figure 5-4: Simple explanation how our online shop works

Source: By author of the thesis

Because of time and page limited I will explain only very important mages by their source code
Product page on the frontend, 4 main files stored and they are deals with MVC pattern:

model: \catalog\model\catalog\product.php

view: \catalog\view\theme\default\template\product\product.tpl

controller: \catalog\controller\product\product.php

language: \catalog\language\english\product\product.php

How products and in the visual interface we can see

```
55 <div class="image-additional slide carousel" id="image-additional">
56 <div class="carousel-inner">
57 <?php
58 if( $productConfig['product_zoomgallery'] == 'slider' && $thumb ) {
59 $images = array( 0=> array( 'popup'=>$popup, 'thumb'=> $thumb ) );
60 $images = array_merge( $images, $images );
61 }
62 $icols = 3; $i= 0;
63 foreach( $images as $image ) { ?>
64 <?php if( (++$i)$icols == 1 ) { ?>
65 <div class="item">
66 <?php ?>
67 <a href="<?php echo $image['popup']; ?>" title="<?php echo $heading_title; ?>" class="colorbox" data-zoom-image="<?php echo $
68 image['popup']; ?>" data-image="<?php echo $image['popup']; ?>"
69 config->get('config_image_additional_width');?>
70 %px" title="<?php echo $heading_title; ?>" alt="<?php echo $heading_title; ?>" data-zoom-image="<?php echo $image[
71 'popup']; ?>" class="product-image-zoom img-responsive" />
72 </a>
73 <?php if( !$i$icols == 0 || $i==count($images) ) { ?>
74 </div>
75 <div class="carousel-control left fa fa-angle-left" href="#image-additional" data-slide="prev"></div>
76 <div class="carousel-control right fa fa-angle-right" href="#image-additional" data-slide="next"></div>
77 </div>
```

Figure 5-5 Product quick view pop up page, (product.tpl file)

Source: By author of the thesis (Snipped from Sublime Text 2, version 2.0.2)

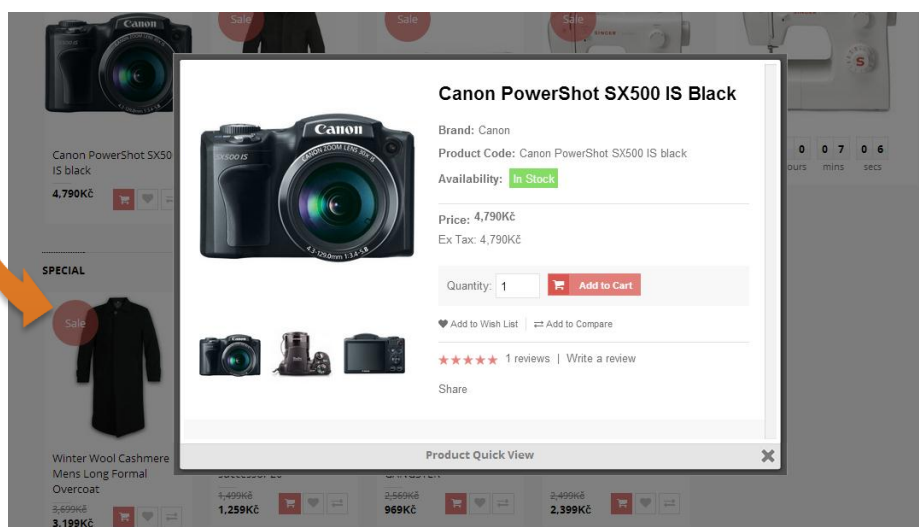


Figure 5-6: Quick view pagee to see products very quickly

In the following schema we can see fields of products table

product							
Fields							
Field	Type	Collation	Null	Key	Default	Extra	Privileges
product_id	int(11)	(NULL)	NO	PRI	(NULL)	auto_increment	select,insert,update,references
model	varchar(64)	utf8_general_ci	NO		(NULL)		select,insert,update,references
sku	varchar(64)	utf8_general_ci	NO		(NULL)		select,insert,update,references
upc	varchar(12)	utf8_general_ci	NO		(NULL)		select,insert,update,references
ean	varchar(14)	utf8_general_ci	NO		(NULL)		select,insert,update,references
jan	varchar(13)	utf8_general_ci	NO		(NULL)		select,insert,update,references
isbn	varchar(13)	utf8_general_ci	NO		(NULL)		select,insert,update,references
mpn	varchar(64)	utf8_general_ci	NO		(NULL)		select,insert,update,references
location	varchar(128)	utf8_general_ci	NO		(NULL)		select,insert,update,references
quantity	int(4)	(NULL)	NO		0		select,insert,update,references
stock_status_id	int(11)	(NULL)	NO		(NULL)		select,insert,update,references
image	varchar(255)	utf8_general_ci	YES		(NULL)		select,insert,update,references
manufacturer_id	int(11)	(NULL)	NO		(NULL)		select,insert,update,references
shipping	tinyint(1)	(NULL)	NO		1		select,insert,update,references
price	decimal(15,4)	(NULL)	NO		0.0000		select,insert,update,references
points	int(8)	(NULL)	NO		0		select,insert,update,references
tax_class_id	int(11)	(NULL)	NO		(NULL)		select,insert,update,references
date_available	date	(NULL)	NO		(NULL)		select,insert,update,references
weight	decimal(15,8)	(NULL)	NO		0.00000000		select,insert,update,references
weight_class_id	int(11)	(NULL)	NO		0		select,insert,update,references
length	decimal(15,8)	(NULL)	NO		0.00000000		select,insert,update,references
width	decimal(15,8)	(NULL)	NO		0.00000000		select,insert,update,references
height	decimal(15,8)	(NULL)	NO		0.00000000		select,insert,update,references
length_class_id	int(11)	(NULL)	NO		0		select,insert,update,references
subtract	tinyint(1)	(NULL)	NO		1		select,insert,update,references
minimum	int(11)	(NULL)	NO		1		select,insert,update,references
sort_order	int(11)	(NULL)	NO		0		select,insert,update,references
status	tinyint(1)	(NULL)	NO		0		select,insert,update,references
date_added	datetime	(NULL)	NO		0000-00-00 00:00:00		select,insert,update,references
date_modified	datetime	(NULL)	NO		0000-00-00 00:00:00		select,insert,update,references

6. Recommendations

After all analysis I would recommend OpenCart to

- Small business
- Start-up companies
- All kind of developers who want to build online shop in a short term and with efficient way.
- To all who has no money to spend for building online store

I would also recommend Magento to the big enterprises; Magento is best solution for large business.

7. Conclusion

After all creating online shop and analysis individual popular PHP e-commerce frameworks, I decide to conclude what kind of e-commerce framework we will choose it depends very much on what our store target is, it's functionality and target area, selling products area, estimated location of online sore, and payment and shipment gateways, what kind of payment strategy and models we want, what kind of shipping shape we would use are

- Both frameworks OpenCart and Magento are great open source ecommerce technologies options
- OpenCart is best solution to small business, start-up companies, and for all kind of developers who want to build online shop in a short term and with efficient way
- Magento is a best framework for large enterprises who has enough money to develop large application interface.
- ZenCart and PrestaShop are very popular frameworks in Czech Republic and very easy to devolve small online web platforms.
- OpenCart fastest growing framework between competitors
- OpenCart is the best framework, ideal solution to every kind of developer, and each kind of companies.
- OpenCart has not any limit for the size of the company. It is very scalable, and can adapt to all kind of purposes of e-commerce.

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9. Supplements

9.1. Supplement A-List of Figures

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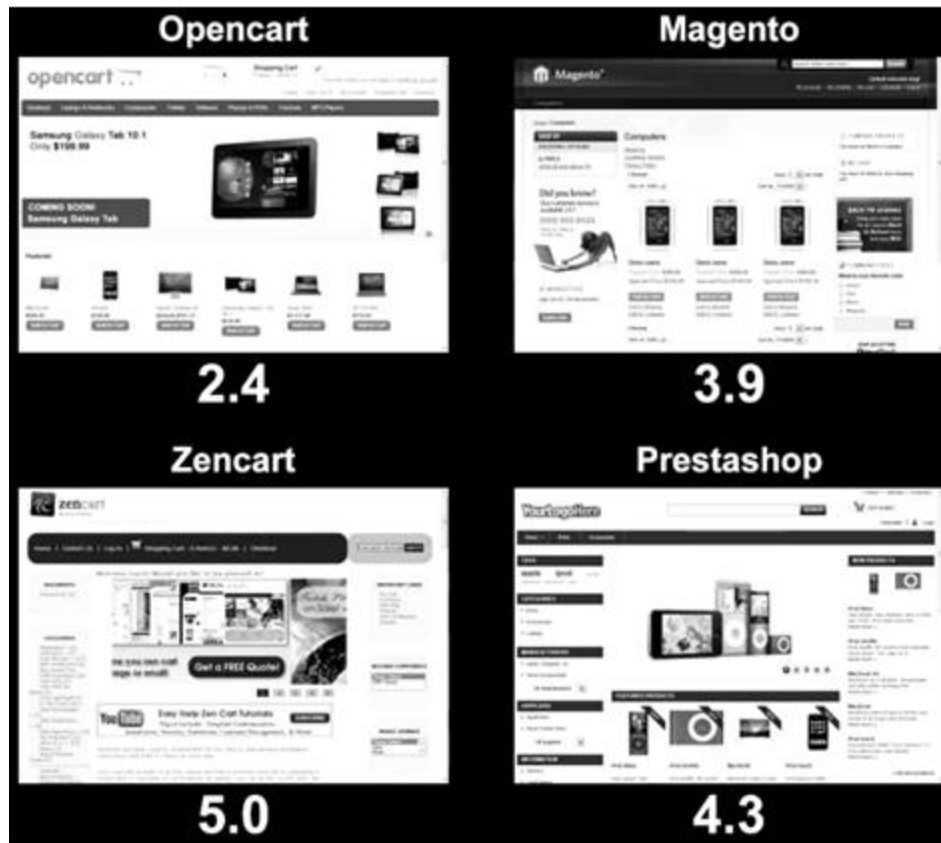


Figure 9-1 Selected e-commerce systems speed, by author tests

Speed scores in a second [26]

This image snipped from video which is shows speed of chosen frameworks, it is attached to CD drive.

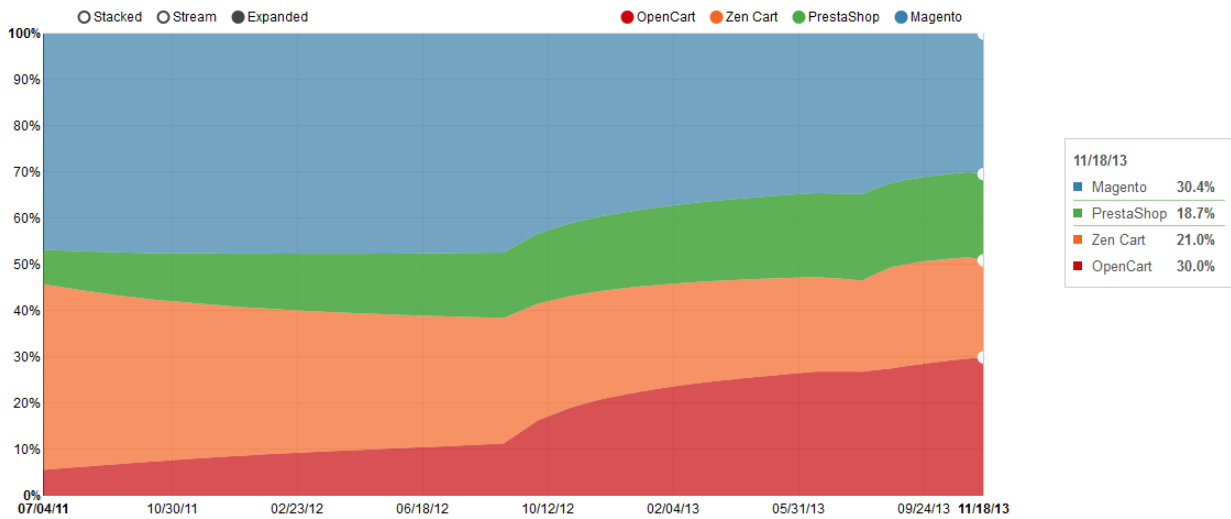


Figure 9-2 The active web sites within in Builtwith system's in the last two years average.

Source:[28]

Under the expanded view, an increasingly larger wedge shows a technology growing faster than its competitors. This chart is not based on a fix list of sites that our technology trends data shows, but the amount of sites within the BuiltWith Pro system that were added/removed cumulatively.

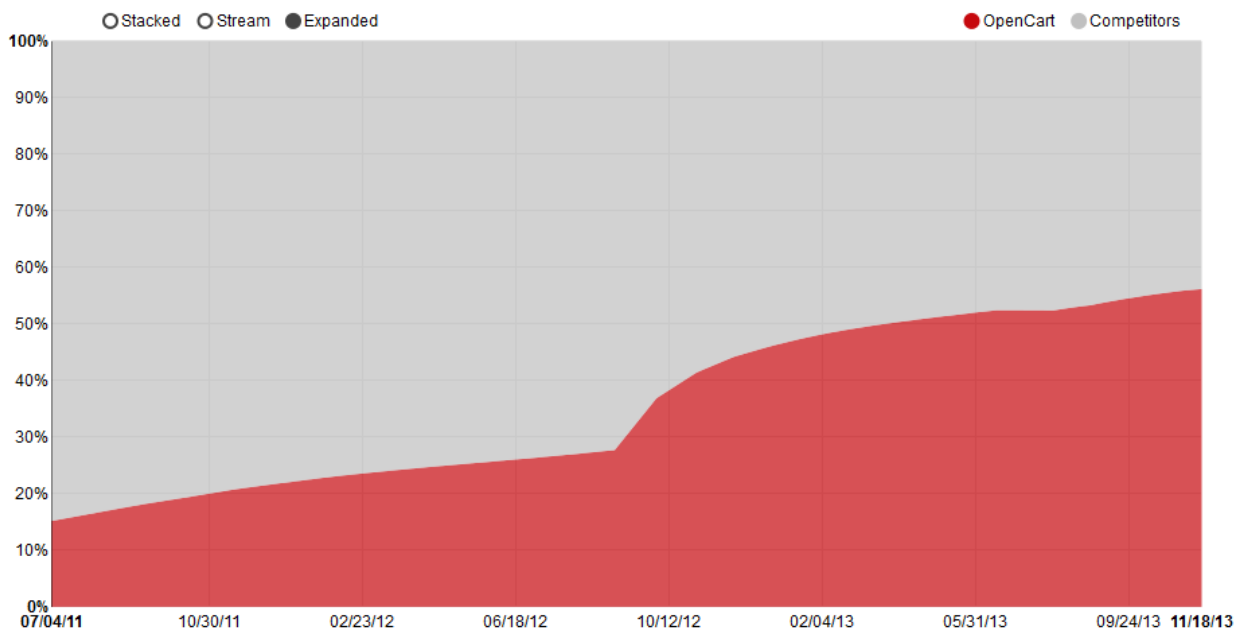


Figure 9-3 OpenCart take up vs. Comparison Technologies

Source:[28]

How to understand this chart?

If the grey area is accelerating in size in relation to the base technology area, the competitors may be increasing their market share at a faster rate than the base technology.

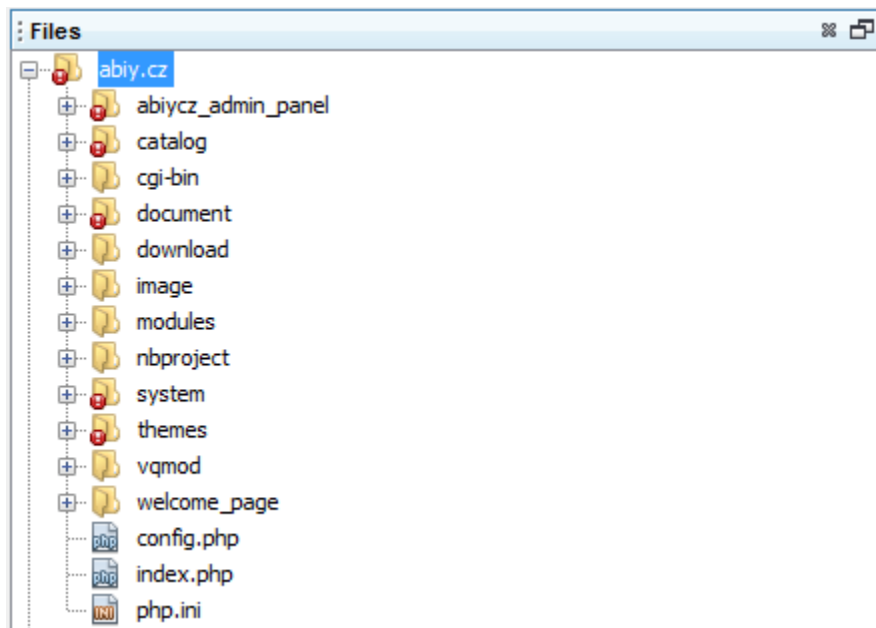


Figure 9-4 E-Shop web application shop file directories

Source: By author of the thesis

```

CREATE TABLE `product` (
  `product_id` int(11) NOT NULL AUTO_INCREMENT,
  `model` varchar(64) NOT NULL,
  `sku` varchar(64) NOT NULL,
  `upc` varchar(12) NOT NULL,
  `ean` varchar(14) NOT NULL,
  `jan` varchar(13) NOT NULL,
  `isbn` varchar(13) NOT NULL,
  `mpn` varchar(64) NOT NULL,
  `location` varchar(128) NOT NULL,
  `quantity` int(4) NOT NULL DEFAULT '0',
  `stock_status_id` int(11) NOT NULL,
  `image` varchar(255) DEFAULT NULL,
  `manufacturer_id` int(11) NOT NULL,
  `shipping` tinyint(1) NOT NULL DEFAULT '1',
  `price` decimal(15,4) NOT NULL DEFAULT '0.0000',
  `points` int(8) NOT NULL DEFAULT '0',
  `tax_class_id` int(11) NOT NULL,
  `date_available` date NOT NULL,
  `weight` decimal(15,8) NOT NULL DEFAULT '0.00000000',
  `weight_class_id` int(11) NOT NULL DEFAULT '0',
  `length` decimal(15,8) NOT NULL DEFAULT '0.00000000',
  `width` decimal(15,8) NOT NULL DEFAULT '0.00000000',
  `height` decimal(15,8) NOT NULL DEFAULT '0.00000000',
  `length_class_id` int(11) NOT NULL DEFAULT '0',
  `subtract` tinyint(1) NOT NULL DEFAULT '1',
  `minimum` int(11) NOT NULL DEFAULT '1',
  `sort_order` int(11) NOT NULL DEFAULT '0',
  `status` tinyint(1) NOT NULL DEFAULT '0',
  `date_added` datetime NOT NULL DEFAULT '0000-00-00 00:00:00',
  `date_modified` datetime NOT NULL DEFAULT '0000-00-00 00:00:00',
  `viewed` int(5) NOT NULL DEFAULT '0',
  PRIMARY KEY (`product_id`)
) ENGINE=MyISAM AUTO_INCREMENT=63 DEFAULT CHARSET=utf8

```

Figure 9-5: Sample snippet from product table structure

Source: By author (Snipped from MySQL database)

9.2. Supplement B- List of Tables

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9.3. Supplement C-List of Abbreviations

	Abbreviations	Explanations
1.	PHP	Hypertext Preprocessor
2.	CMS	Content Management System
3.	CGI	Common Gateway Interface
4.	OOP	Object Oriented Programming
5.	DRY	Don't Repeat Yourself
6.	LAMP	Linux, Apache, MySQL
7.	WAMP	Windows, Apache, MySQL, PHP/Perl/Python
8.	MAMP	Mac, Apache, MySQL, PHP/Perl/Python
9.	OS	Operation System
10.	MVC	Model, View, Controller
11.	CD	Compact Disk
12.	DVD	Digital Video Disk
13.	CE	(Magento) Community Edition
14.	EE	(Magento) Enterprise Edition
15.	OSL	Open Software License
16.	GNU	GNU is not Unix
17.	GUI	Graphical user interface
18.	GPL	General Public License
19.	SEO	Searching Engine Optimization
20.	IT	Information technology
21.	RAM	Random access memory
22.	MADM	Multiple Attribute Decision Making
23.	ORM	Object Relational mapping
24.	SQL	Structured Query Language

9.4. Supplement D-List Tools

Following platforms, tools, environments are used to create own web site and to test performances of other technologies.

	Platforms	Versions
1.	Microsoft Windows	Ultimate 7
2.	PHP	5.5.10
3.	Apache HTTP server	2.4.7
4.	MySQL	5.6.16
5.	WAMP Server	2.4
6.	OpenCart	1.5.6.1
7.	Magento	1.8.1.0
8.	PrestaShop	1.5.6.2
9.	ZenCart	1.5.1
10.	NetBeans IDE	7.4

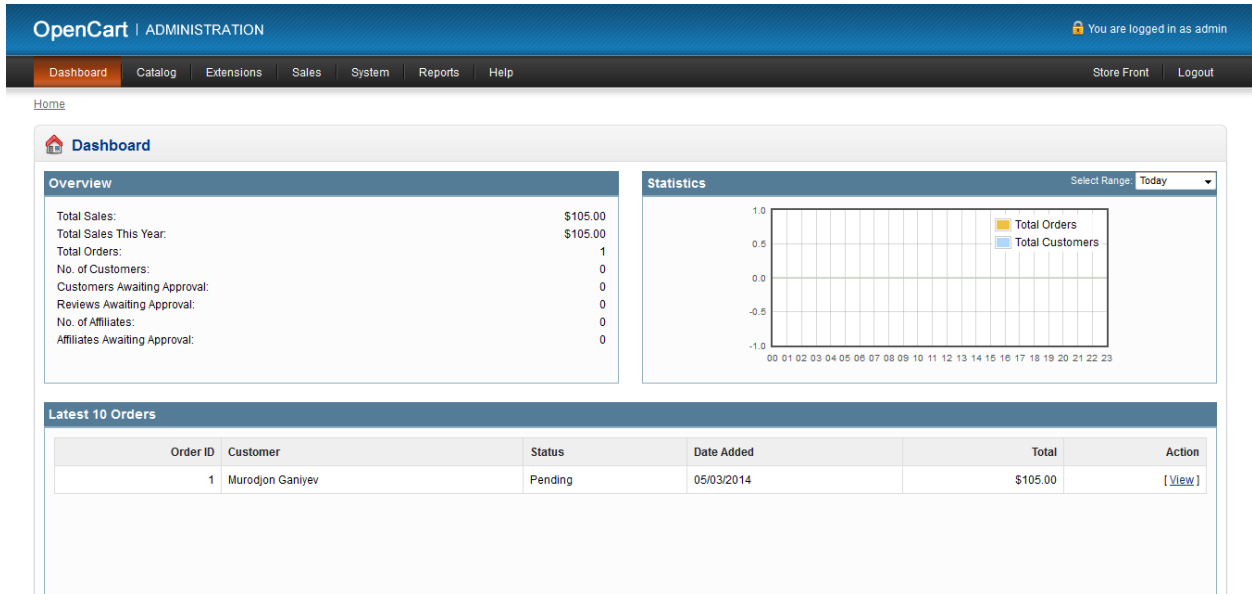


Figure 9-6 OpenCart admin panel

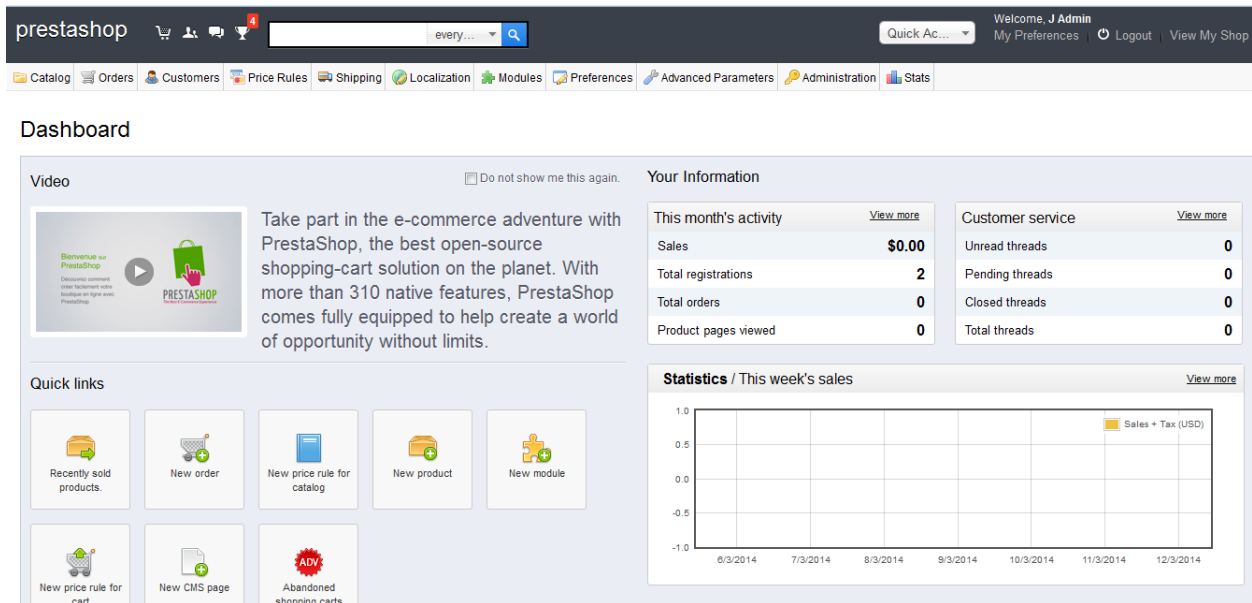


Figure 9-7 PrestaShop admin panel

Statistics		New customers:		New orders:	
Hit Counter Started:	03/09/2014	Bill Smith	01/21/2004		
Hit Counter:	67				
Customers:	1				
Products:	125				
Products deactivated:	0				
Reviews:	1				
Reviews Pending Approval:	0				
Newsletter subscribers:	0				
Specials Expired	2				
Specials Active	27				
Featured Products Expired	1				
Featured Products Active	9				
Sales Expired	2				
Sales Active	6				
Orders					
Pending:	0				
Processing:	0				
Delivered:	0				
Update:	0				

Counter History for last 2 recorded days		Session	Total
03/12/2014		4	4
03/09/2014		33	62



Figure 9-8 ZenCart admin panel