

A COMPARATIVE STUDY BASED ON OPEN SOURCE CONTENT MANAGEMENT SYSTEMS

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Abstract :

Development of websites using traditional technologies involve large amount of coding and huge efforts in small tasks. Moreover, to store data the designers need to use and maintain a database and connect the website through JDBC and ODBC for database transactions and verifications. Such development and management of websites is a difficult task and consumes large human resources and investments. Even for regular updation of websites, the professionals need to be hired. A content management system (CMS) is a system used to manage the contents of a web site. It is a collection of (manual or computer-based) procedures used to manage work flow in a collaborative environment. The procedures are designed to allow for a large number of people to contribute to and share stored data; control access to data, based on user roles; aid in easy storage and retrieval of data; reduce repetitive duplicate input; improve the ease of report writing; and improve communication between users. In a CMS, data can be defined as nearly anything, i.e., documents, movies, pictures, phone numbers, scientific data, etc. The features of a CMS system vary but most include web-based publishing, format management, revision control, and indexing, search, and retrieval. A CMS can be easily embedded into a live website so as to help the owner update its content at its own having bare minimum knowledge about coding of the websites. It keeps websites well organised and comprehensive, increases the data security, and reduces the site maintenance costs. In this paper we present a review of some of the popular content management system packages.

Keywords : website development, content management systems

1. Introduction

Earlier websites were developed using Hyper Text Markup Language (HTML), and with further developments in technology website designers started using XHTML, CSS, JavaScript, DHTML, VBScript, AJAX and XML. Development of websites using such technologies involve large amount of coding and huge efforts in small tasks such as alignment of its contents.

Web designers used to maintain a database (in MS-ACCESS or in Oracle) and connect the website through JDBC and ODBC for database transactions and verifications. But such development and management of websites was quite a difficult task which consumed large human resources and investments. Moreover for regular updation of website contents, the professionals need to be hired. For regular maintenance, entire coding needs to be changed or updated and the website needs to be re-hosted. It became quite trouble-some for organisations to keep their sites working when their contracts with the website developing firms were about to end.

Content Management System (CMS) is a collection of procedures used to manage work flow in a collaborative environment. These procedures can be manual or computer-based. The procedures are designed to allow for a large number of people to contribute to and share stored data; control access to data, based on user roles; aid in easy storage and retrieval of data; reduce repetitive duplicate input; improve the ease of report writing; and improve communication between users. In a CMS, data can be defined as nearly anything, i.e., documents, movies, pictures, phone numbers, scientific data, etc. CMSs are frequently used for storing, controlling, revising, semantically enriching, and publishing documentation [1].

2. Content Management Systems

A content management system is a system used to manage the content of a web site. Typically, a CMS consists of two elements: the *Content Management Application (CMA)* and the *Content Delivery Application (CDA)* [2]. The *CMA* element allows the content manager or author, who may not know Hypertext Markup Language (HTML), to manage the creation, modification, and removal of content from a web site without needing the expertise of a Webmaster. The *CDA* element uses and compiles that information to update the web site. The features of a CMS system vary, but most include web-based publishing, format management, revision control, and indexing, search, and retrieval [2].

The web-based publishing feature allows individuals to use a template or a set of templates approved by the organization, as well as wizards and other tools to create or modify web content. The format management feature allows documents including legacy electronic documents and scanned paper documents to be formatted into HTML or Portable Document Format (PDF) for the web site. The revision control feature allows content to be updated to a newer version or restored to a previous version. Revision control also tracks any changes made to files by individuals. Additional features are indexing, search, and retrieval. A CMS system indexes all data within an organization. Individuals can then search for data using keywords, which the CMS system retrieves. [2].

A CMS is composed of various subsystems that interact with each other:-

- (1) **Collection** : A subsystem that handles the creation and/or acquisition of information. It must provide support for the processes of content creation, workflows, syndication and integration of external sources. In addition, it must provide support to conversion processes between different formats as well as for the incorporation of contents from different sources within specific structures.
- (2) **Management** : The subsystem in-charge of the management and control of information repositories, user groups, and support processes for other subsystems. It handles the defining and controlling of information flows used by other subsystems, as well as the definition of parameters for the functioning of the system.
- (3) **Publishing** : The subsystem in-charge of final production of publications and digital information products in an automatic or semiautomatic manner. It makes use of a model based on templates and must provide personalization options for users as well as the possibility of producing for a variety of platforms and/or customers [3].

2.1 Need of Content Management Systems

CMS is the fastest way to keep one's website content updated. It also allows creating new pages in one click, and inactivating old pages, without worrying about breaking the design. Having a content management system saves money as a user won't need to pay a web developer every time he wants to modify the content of his website. A CMS has the following advantages [4] and is thus preferred over programs like Dreamweaver etc.

- Is web-based and doesn't require to be installed on each computer.
- Allows to not only change but add/remove text, images, and videos.
- Allows to edit the page titles, descriptions (meta tags) and URLs (address of the page).
- Allows to create/delete new sections and pages on our website.
- Allows to edit the "Alt" tags of the images.
- Allows to create redirects to pages using the 301 standard.
- Change the text of the navigation bar.

A CMS can be easily embedded into a live website so as to help the owner update its content at its own having bare minimum knowledge about coding of the websites. It keeps websites well organised and comprehensive, increases the data security, and reduces the site maintenance costs. Several open source content management systems are available that may be of much use while designing a website. In this paper we present a review of some of the popular content management system packages.

3. Open Source Content Management System Packages

Till now we have defined what is content management system and what are the needs that led to the popularity of content management system in the field of web development. There are several content management system packages that are available in the market for the user, each having their own set of features and uniqueness designed to fulfil the need of the user. Of them a certain number of packages are available under Open Source

GNU liscence. The benefit of being released under such liscence terms and conditions is that it allows more flexibility and extensibility to the user without compromising the basic functionality. In this documentation we shall try to compare a few such packages that are available as open source and has been very popular among the users.

3.1 *Drupal*

Drupal is another popular Content Management System Software which has grown in popularity since it was launched and have a strong base of developers and followers and users.

In 2000, in order to share the ADSL connection between a few students at University of Antwerp, Dries Buytaert and Hans Snijder setup a wireless bridge. On the bridge Dries also launched a small internal news site with built in web board to allow the members to stay in touch. Later he launched the site under “drop.org” (original intention was to launch the site as “dorp.org” where ‘dorp’ means ‘village’ in Dutch). As the popularity of the site grew as well did the number of members, finally in January 2001, Dries decided to release the software behind the drop.org as “Drupal”. The idea was to allow others to use and extend the platform. The word Drupal derives from the English pronunciation of Dutch word “drupel” which means “drop”.

Although Drupal is often described as a "Content Management System", it is also a "Content Management Framework(CMF)". In other words, unlike a typical CMS, it is geared more towards configurability and customization. Picture a range of measurement where one end of the scale is labelled “specific” and the other end “abstract”. On the “specific” end of the spectrum, we would have something whose form is very specialized because it is meant for a specific purpose. On the other end of the spectrum, we would have something much more abstracted, which is available to be configured any way we like, for a variety of purposes [5].

3.1.1 Drupal Architecture

Integral to understanding, Drupal is having the right concept of how things flow within the system. Drupal is cleanly separated into different layers that keep things organized and flexible. There are five main layers in the Drupal system as shown in Fig. 1:

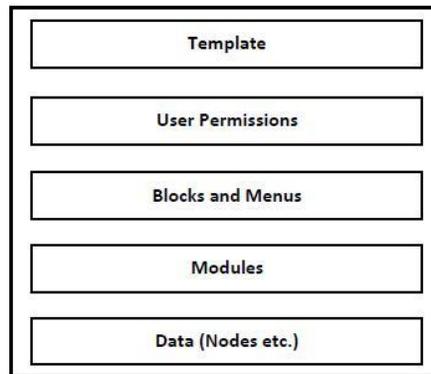


Fig. 1. Layers in the Drupal

At the core of the system is the big bucket of node, the data pool. Before anything can be displayed on the site, it must be input as data. The next layer out from the center is where modules live. Modules are functional plug-ins that are either part of the Drupal core (they ship with Drupal) or they are contributed items that have been created by members of the Drupal community. Modules provide various functionality to expand website’s capabilities to include things like the creation of custom data points (fields) for our nodes; event calendars; e-commerce; programmatic sorting and display of content and more. There are hundreds of different options within the fast growing repository of contributed Drupal modules. They represent the work of everyone from individuals to large corporations who use and rely on Drupal and are working to extend its power and usefulness.

The next layer has blocks and menus. Blocks often provide the output from a module or can be created to display whatever we want, and then can be placed in various spots in our template (theme) layout. Blocks can be

configured to output in various ways, as well as only showing on certain defined pages, or only for certain defined users.

Next are user permissions, where settings are configured to determine which things different user types have access to. Permissions are assigned to various roles, and in turn, users are associated with those various roles in order to grant them the associated permissions.

On the surface layer is the site template. This is made up predominately of XHTML and CSS, with some PHP tokens sprinkled throughout to insert content from the system into the correct spots. Also included with each template is a set of functions that can be used to override standard functions in the modules in order to provide complete control over how the modules generate their markup at output time. Templates can also be assigned on-the-fly based on user permissions [5].

The core Drupal distribution provides a number of features [6] :

- Access statistics and logging
- Advanced search functionalities
- Blogs, books, comments, forums, and polls
- Caching and feature throttling for improved performance under load
- Descriptive URLs (for example, "www.example.com/products" rather than "www.example.com/?q=node/432")
- Multi-level menu system
- Multi-site support
- Multi-user content creation and editing
- OpenID support
- RSS Feed and Feed Aggregator
- Security/new release update notification
- User profile
- Various access control restrictions (user roles, IP addresses, email)
- Workflow tools (Triggers and Actions)

3.1.1.1 Abstract framework

Drupal's architecture follows Presentation-abstraction-control (PAC) which is a software architectural pattern, somewhat similar to Model-View-Controller (MVC). PAC is used as a hierarchical structure of agents, each consisting of a triad of presentation, abstraction and control parts. The agents (or triads) communicate with each other only through the control part of each triad. It also differs from MVC in that within each triad, it completely insulates the presentation (view in MVC) and the abstraction (model in MVC), this provides the option to separately multithread the model and view which can give the user experience of very short program start times, as the user interface (presentation) can be shown before the abstraction has fully initialized [7].

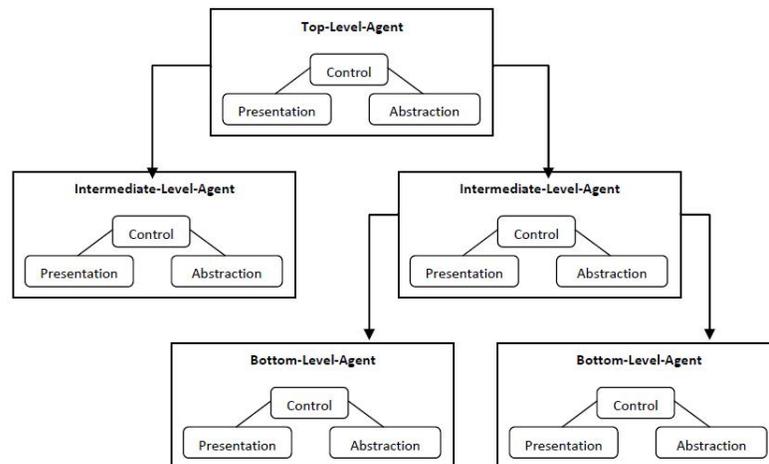


Fig. 2. Abstract Framework

3.2 Joomla!

Joomla! is an open source content management system platform for publishing content on the world wide web and intranets as well as a MVC web application framework. It is written in PHP, stores data in MySQL and includes features such as page caching, Really Simple Syndication (RSS) feeds, printable versions of pages, news flashes, blogs, polls, search, and support for language internationalization [9].

Joomla! is an open source PHP & SQL based application that's really easy to learn, easy to navigate and allows us to build fantastic websites even if we're a stranger to PHP and the Joomla! environment.

Joomla! came into existence as a result of the folk of the Mambo (another popular open source WCS) in August 17, 2005, when its development team quit and started off Joomla! The name Joomla! was derived from an Arabic and Swahili word "jumla" meaning "all together" or "as a whole" Joomla! 1.0.0 was then released on September 16, 2005 which was primarily a re-branded release of Mambo 4.5.2.3. Joomla! Won the Packt Publishing Open Source Content Management System Award in 2006 as well as in 2007 and the popularity grew day by day.

Joomla! version 1.5 introduced The Three Tiered Framework and The MVC design pattern that enhanced the product capabilities significantly. Some of the notable results of the enhancements were :-

- (1) Code manageability became easy and standards bases.
- (2) Code quality improved and making the product more stable.
- (3) Helped bring about standardization in community developed extensions.

3.2.1 The Three Tier Architecture

The three tier architecture was the basic underlying architecture of the entire Joomla!, though it was more keen on the MVC design pattern. The entire internal architecture (Fig. 3), can be divided into three layers namely Extension layer, Application layer and Framework layer.

The following diagram shall give a brief description of the layers and their organization.

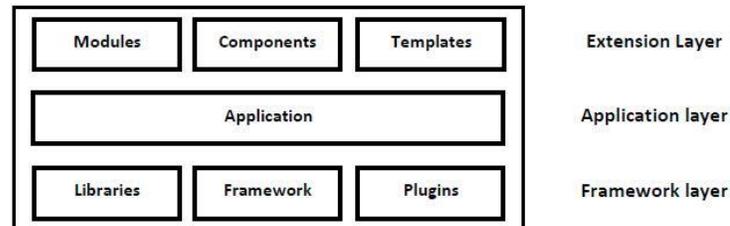


Fig. 3. Internal Architecture of Joomla!

Extensions layer is the topmost layer that comprises of extensions to the core Joomla Framework & the application layer and include Components, Modules and Tempalates. Components are the custom independent applications that are developed to provide functionality to our portal. Although it leverages Joomla core and services, it can be rated as an independent application. Modules extend the capabilities of Joomla! component by giving it a new functionality. Templates control the overall user interface of the portal, look and feel as well as the layout. A combination of PHP, HTML & CSS provides extremely flexible yet easy mean to define the user experience of the website.

Application layer is the middle layer that consists of applications that extend the Framework JApplication class. The four applications currently included in the Joomla distribution are -

- JInstallation is responsible for installing Joomla on web server and is deleted after the installation procedure has been completed.
- JAdministrator is responsible for the back-end Administrator.
- JSite is responsible for the front-end of the website.

XML-RPC supports remote administration of the Joomla website.

Framework layer is the bottom layer that consists of Framework, Libraries and Plugins. Framework is the Core; the heart of Joomla! Libraries comprised of a set of core services required by the framework as well as the

extension installed by developers. Plugin or mambot (as they were called in 1.0) are small, task-oriented functions that intercept and manipulates content before it is displayed. Joomla! provides a number of Plug-ins in the core distribution.

With release 1.5, Joomla! cleaned and revamped its code and introduced the MVC design pattern – in addition brining about standardization and flexibility in the architecture. The MVC design pattern help in reducing the code complexity by separating the Business Logic from, Data access and the data presentation logic In Joomla!, the MVC pattern is implemented using three classes, i.e., JModel, JView and JController.

Regarding the performance, Joomla! is a very light weight application and it doesn't really have any glaring performance bottleneck [10].

3.3 DotNetNuke

DotNetNuke is an open source platform for building websites based on Microsoft .NET technology. It is written in VB.NET and distributed under both a Community Edition BSD-style license and a Professional Edition proprietary license. It is extensible and customizable through the use of skins, modules, data providers, language packs and templates [12].

In January 2002, Microsoft Corp. published a download named the IBuySpy Portal to demonstrate how to implement specific functionality of ASP.net 1.0 platform. Though it was functional yet it lacked the features needed by the developers. Thus on December 24th 2002, Shaun Walker released a modified version of the original IBuySpy Portal with enhancement and innovative features. As it was made available on the developer network, its popularity among the developers grew rapidly and on February 28, 2003 was named DotNetNuke. In September, 2006 along with some of his long-time associates Shaun Walker formed DotNetNuke Corp.[12]

It allows non-technical users to create and edit content, and add custom features and personalize the site look and feel. It can be further expanded with addition of third party modules and tailored with custom graphics and layouts in the form of skins. The open source version (Community Edition) includes access to the source code of the framework and basic modules, and an MIT license allowing flexible modification and distribution rights. The Community Edition a popular web content management (WCM) system and application development framework for ASP.NET, with over 6,000,000 downloads and 400,000 production web sites as of September 2009 [13].

DotNetNuke is a highly interesting and potent web creation tool that demonstrates once again that the open source philosophy has a very important part to play, even in the world of Microsoft and the areas surrounding it. Transformed through its own merits into the benchmark platform with reference to portal creation in ASP.NET, DotNetNuke is in itself the most extensive user community regarding any product based on ASP.NET [14]. It is a web application framework which offers solutions to all the above necessities, “out of the box”. This is one of the prime aspects that make DNN so interesting: the enormous potential on offer to the programmer to create advanced web applications using a highly exhaustive and extended base infrastructure [14]. DotNetNuke incorporates many of the elements necessary to construct content web sites: easily updateable, online edition of contents, file management, delegation of edition roles, etc [14].

3.3.1 DotNetNuke's Architecture

DNN's architecture (Fig. 4) is so powerful and modularized, and makes our life easier to identify the necessary components. Various layers it contains are Presentation layer, Business layer and Data Access layer. Presentation Layer is the layer where User Controls (forms for our modules) reside. So, its everything that we see in the browser for our module – the user interface. Business Layer is where all the backend code for our Modules, the Business Logic resides. Data Access Layer is where we access the database by means of Data Provider, Concrete Data Providers and Application Blocks. Data Provider is an abstract class and the concrete data providers inherit the Data Provider class to do database operations. Concrete Data Providers help users to write Data Providers for any database like Microsoft SQL Server, MySQL etc. The whole Data Layer corresponds to Microsoft Patterns and Practices. The Data Access Application Block simplifies development tasks that implement common data access functionality. Applications can use the application block in a variety of situations, such as reading data for display, obtaining data to pass through application layers, and submitting changed data back to the database system [13].

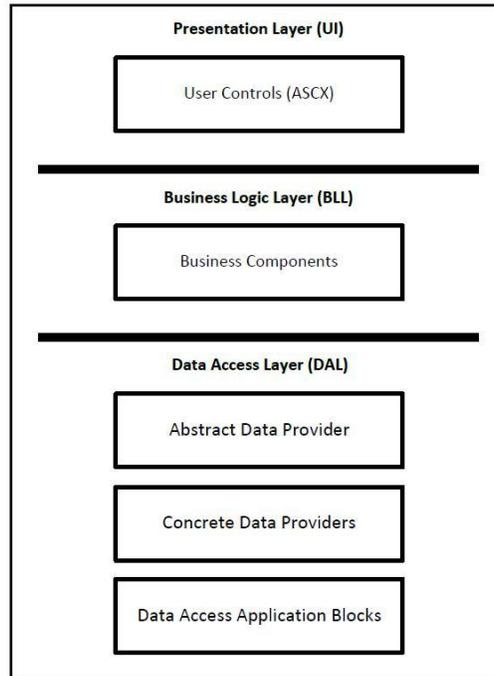


Fig. 4. DotNetNuke Architecture

3.3.3.1 Provider model

One of the important concepts of the architecture of DotNetNuke is that it is designed to get the most benefit out of the provider model so widely used in ASP.NET 2.0. In fact, ever since the ASP.NET 1.1 versions, DNN has used this structure, yet more evidence of the system’s vision of the future and its growth capacities. DNN used to offer a dual platform version: versions 3.x for ASP.NET 1.1 and versions 4.x for ASP.NET 2.0. DNN version 3.3 was the last supported version for ASP.NET 1.1.

The provider model (Table 1) [14] is based on the possibility of replacing sections of the system’s core functions without the necessity to modify it. It consists of the publication of a public API and the separation of the implementation on a separate module. Thanks to this model, it is possible, at any time, to substitute a part of the system for another version more in line with the needs of each individual. The objective is to construct functions (the functions to be carried out by the system) without them having to depend on details from other parts (the specific implementation to solve the problem).

Table1: Provider model implementation in DotNetNuke

<i>Provider</i>	<i>Description</i>
Data	Offers independence from the database
Scheduling	Allows the execution of scheduled tasks
Logging	Offers a service for logging of errors, security, events...
HTML Editor	Allows use of any HTML editor in the system
Search	It is possible to personalize contents indexing
Friendly URL	Allows the generation of personalized URLs
Membership, roles, profiles	The system’s security management can be personalized to interact with any other context

3.4 WordPress WordPress is an open source blog publishing application powered by PHP and MySQL which can also be used for content management. It has many features including a plugin architecture and a templating system. Used by over 2% of the 10,000 biggest websites, WordPress is the most popular blog software in use today [14]. WordPress was born out of a desire for an elegant, well-architected personal publishing system built on PHP and MySQL and licensed under the GPL. It is the official successor of b2/cafelog. WordPress first appeared in 2003 as a joint effort between Matt Mullenweg and Mike Little. The name WordPress was suggested by Christine Selleck, a friend of Mullenweg.

WordPress started in 2003 with a single bit of code to enhance the typography of everyday writing and with fewer users than we can count on our fingers and toes. Since then it has grown to be the largest self-hosted blogging tool in the world, used on millions of sites and seen by tens of millions of people every day. WordPress started as just a blogging systems, but has evolved to be used as full content management system and so much more through the thousands of plugins, widgets, and themes [15].

WordPress is not PHP, rather powered by PHP, but uses a simple template system which uses PHP for its designing but to use it one doesn't have to know PHP. The intuitive and easy-to-use administrative interface makes it real simple and easy to create great looking blog or website in less time [16]. Some of the features of WordPress that led to its popularity among the users are :-

- Full W3C standards compliance
- No need for regenerating static pages to reflect changes
- Ease of managing non-blog content
- Intelligent text formatting and work-flow
- Support for multiple authors
- Inbuilt spam protection and Password Protected Posts
- Support for comments on posts
- Cross-blog communication tool
- XML-RPC interface
- Easy installation and upgrades and easy importing

WordPress 2.9 which is the latest release [17].

4 Comparative Study

Drupal is extremely developer friendly. Strong community to help discern the dozens (hundreds) of functions and tags available. It can be used to create some really awesome websites that can outperform a majority of other sites out there.

It is not very designer and user-friendly. It's hard for someone with little code knowledge to make the leaps required to do the very cool things that Drupal is becoming known for. Theming of Drupal has been a huge case of fail (until recently). Probably because it has been developers, not designers, that are making the themes. Getting a Drupal website published could cost you more time, and thus more money, than WordPress or Joomla [8].

Joomla! is friendly for all types of users ,i.e., Designers, Developers and Administrators. It has been rapidly growing and improving itself for the past three years and a huge community is awesome for assisting with creation of websites. With all such features Joomla! is still not user-friendly enough for everyone to understand. It is not quite as powerful as Drupal, and can be a bit confusing for some to jump into. Recently rebuilt the entire system from ground-up, and so there are still many out there sticking to the old versions [11].

WordPress is simple to use ,i.e., no need for modifications. It is excellent for blogging or sharing thoughts in a sequential manner and is even the most elderly of users can get the hang of it quickly.

Although it is not developer friendly and the community seems to like to complain. Installing upgrades bring more bugs than fixes sometimes [18].

Table 2. Comparision table

Features	DotNetNuke 5.0.0	Drupal 6.10	Joomla 1.5.10	WordPress 2.1.1
Database	MSSQL	MySQL	MySQL	MySQL
Database Creation	Manual	Manual	Automatic	Manual
Operating System	Windows only	Platform Independent	Platform Independent	Platform Independent
Programming Language	VB	PHP	PHP	PHP
Captcha	Yes	Free add on	Free add on	No
Kerberos Authentication	No / Free add on	No	No	No
Drag-N-Drop Content	Yes	Free add on	No	Yes
Image Resizing	Yes	Free add on	Yes	Limited
Spell Checker	Free add on / Yes	Free add on	No	Free add on
Zip Archives	Yes	No	No	Free add on
Advanced Caching	Yes	Yes	Yes	Free add on
Database Replication	No / Yes	Limited	No	No
Static Content Expert	Yes	No	No	Limited
Package Deployment	Yes	No	No	No
Trash	Yes	No	Yes	No
FTP Support	Yes	Limited	Yes	Free add on
CGI-mode Support	No / Yes	Yes	Yes	No
Multi-lingual Content	Free add on / Yes	Yes	Free add on	Free add on
Chat	Yes / Costs extra	Free add on	Free add on	Free add on
Discussion / Forum	Yes	Yes	Free add on	Free add on
Graphs and Charts	Yes	No	Free add on	No
HTTP Proxy	Yes / Costs extra	No	No	No
Search Engine	Yes	Yes	Yes	Yes
Inventory Management	Costs extra	Free add on	Free add on	No

5. Conclusion

From the study of different Content Management System packages, this paper gives a detailed comparison of the main features of the different packages we wish to compare. From comparison point of view these are the features which gives all these packages their own flavour and uniqueness. But these features also makes the differences more prominent. For a Content Management System package the central idea is to manage the contents easily and efficiently. And these are the parameters that helps us in measuring and defining how good they are at it.

Since content management is of main concern to us but there is nothing that separates these packages in their ability to create or manage content. But there are differences in the usage and intuitive interface and security and other aspects. From our study we may conclude that Joomla! is the best package available for its ease of installation, user friendliness, intuitive interface, rich features, ability to adopt new features as per requirement, its open source nature, vast developer network and availability of plugins.

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