Which One is Better This or That? Comparison of Preferred LMS

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Abstract—**Learning Management System is a contentmanagement and organization tool where the studentand faculties are able to access and upload content which they are eligible for. However, varieties of LMS are offered for management, documentation, teaching, training, and deliverance of e-learning content and other services. Therefore, the choice ofLMS is a significantcomponent of an institute's e-learning strategy and it will influence the organization. The majoraim of this paper is to make it suitable for instructors to choose best and suitable among available open source LMS. This paper aims at assessmentand contrast of preferred LMSs. First part covers the concise description of each LMS, followed by assessment criteria. Final results are presented in atabular and textual form and the future progress towards LMS are stated.**

Keywords—Learning Management Software (LMS),Moodle, ATutor, Clarolines, Forma LMS,and Sakai.,Open Source software (OSS).

I. INTRODUCTION

Tutoring at institutional levels is shifting as technology is introduced into the curriculum. Today learning prefers and it has become the need to use technology,particularly the Internet. In coming years, Internet has also got hold ofcertain tools for the advancement of societal toolslike chats, discussion forums, youtube etc. Development of web technologies is going faster making the use of learning management systems in education an essential element.

"E-learning has revolutionizedthe way our species carry outteachingand training are done. The development of electronic gadgets and communications has removed barriers of space and time. We can acquire and deliver information anytime anywhere according to individuals pace" (Horton, 2000). Most of the institutes, universities are taking upany of preferred LMS as there eLearning tool and has become an integral part of

their system, to enhance their conventional education arrangement.

"E-learning is defined as anICT tool which is used by instructors and learner to improve their learning and teaching strategy " (Ellis, Ginns, & Piggott, 2009). LMS applications are created to supervise and manage students learning activities, taking into concern the features available that will make it possible. The institutes have to choose the best software available among LMS as per need, as there are dozens of LMS with diverse functionalities. The organizationwilling to use such learning systems need to know the effectiveness of LMS which is open and along with itseffectiveness and flaws.These tools differ in services, technical requirements,cost, and other parameters.[1]

II. OPEN SOURCE AND SELECTED LMS

The organizationis now focusing on the 365/30/7 anytime, anywhere accessibility of learning rather than straightforward face-to-face classroom teaching. E-learning is learning which makes use of ICT tools to access information outside conventional classroom. It is a self-paced and asynchronous process of learning. According to Watson and Ahmad (2004), E-learning is known as animportant component of learning evolution.[2]

OSS is software'swith source code openly availableand is accessible under an open-source license that allows users to study, modify, develop and distribute software free of charge[3,4]. LMS design approach is based on various functions such as follows:

Registration: student registration and administration management

Scheduling: schedules, curriculum organization

Delivery: distributeand deliver content (course), assignment, test result, and grade

Tracking: student's progression.

Communication: communication process with the instructor, or student via discussion forum, chat, mail, etc.

Below five popular LMSs are selected for comparison and evaluation study and are

- Moodle
- Claroline
- Atutor
- FormaLMS
- Sakai

All the LMS are used in the academic world and have their roots, very but few are leading players.

III. INTRODUCTION TO SELECTED LMS

An educational organization is looking for a safe product with all the features which take into account all the components that are essential in the academic world. The components include Online Test, Quiz, Forums, Chats, Blogs, Newsletter, Bulletin,Wikis for Content and Course Management.Plenty of e-learning products are accessible in the globallearning industry, but the academic establishments are focused on open source technologiesbecause of flexibility, the efficiency of these products and most important the cost of the product.

Moodle

The most acknowledged LMS, Modular Object-Oriented Dynamic Learning Environment (Moodle) was initiated in August 2002. Moodle has been built with a background of Social Constructionist pedagogy, however, it can be used to support any style of training and education keeping technology in wits. Moodle has a dynamic development and user community and the recent version of Moodle is 3.4+.

Moodle is most well-liked all over the world because of quite a lot of features. Some characteristic features are a content organization,management,evaluation,corporative learning is:

- Assignment,Wikis.
- Discussion forum, Online Quiz.
- Files download/upload of various formats.
- Grading / Marks System.
- Instant messages/emails.
- Online calendar, news, and announcement ·

It is one of the most reachable, flexible and well documented LMS.

Claroline

Claroline which is second most frequently used online learning application in Europe and was designed in 2000 at the Catholic University of Louvain. It is trouble-free, as it has lesser functional intensity in contrast to Moodle. The consortium, created in 2007 a non-for-profit association, unites the Claroline community, coordinates the platform's developments and promotes its use. Claroline, the latest version is Claroline Connect version 17.06, and it has been translated into various languages.

ATutor

LMS ATutor was developed at the Adaptive Technology Resource Centre at the University of Toronto and is a Content Management System[5].E-learning systems are sociable, an adaptable system which is used to build up online courses with the ability to create, share and manage content.

ATutor is unique because of its accessibility features which are specially designed for disabled students. The themes of the system allow administrators to customize the look which gives a fresh and new look, layout according to requirements and can extend its functionalities. ATutor has varieties of features like a discussion forum, data gallery, blogs, glossary, sitemap, chat, assessment,survey, and tool, which follows users navigational patterns that's MyTracker [6]. ATutor holds up Sharable Content Object Reference Model (SCORM) standards and is available in more than 20 different languages.

Forma Lms

Forma LMS is a web-based and open source tool which is used to administer and distribute online training courses. Forma films wereinitiated in 2012, the tool was introduced from the existing LMS,Docebo 4.05.It was designed for corporate,interested in a powerful, customizable and scalable application. The project is up holed by anassociation of companies which supported itsdevelopment and there focus was corporate training rather than on academic requirements.Forma LMS is very corporate oriented, therefore its most powerful features are those related to the Teacher role and to the administration of courses and users. It has various features like User profile management, management of user data, communication tools like messages, newsletter, communications, course forum, community forum,grade book report. The system can be integrated with Google, Linked In and Facebook. Forma without difficultycan be integrated with other commercial applications.

Sakai

Sakai,an open source LMS platform founded by the University of Michigan, Stanford, which facilitates association between educational institutions and is nurturing work on open technologies. It supports innovation in learning, teaching, and research.[7]. Sakai is service-oriented,java based application which provides a variety of capabilities supporting

teaching,learning, instruction, research and is an association platform. The standard set of tools provide flexible to sustain for teaching and learning, communication, group effort, e-portfolios, content and media assimilation, and management [8]. The plug-in appends services to act as an open source collaboration system for tutoring organizations [9].350 institutions around the world are using Sakai, and the software has been translated into 20+ languages approx. Sakai 11.4 is the most up-to-date Sakai release till date.

IV. ARCHITECTURAL DESIGN AND EVALUATION CRITERIA

Open Source LMS features are divided into three major classes as learner tool, support tool and technical specification. Each of these class tools have different types of subclasses. Learner tools includes communication tool , productivity tool and student involvement its portfolio . Support tool comprises of curriculum administration tool, course plan tool and admin tool. Following figure shows architectural design view of administration and security tool. The scrutiny focused on comparing the above selected five LMS systems based on following criteria:

- Initial Comparison Grid based on basic server ,database etc requirement along with target group. [10][11][12][13][14][Table 1]
- Support tools for security mainly authentication of the system.

Table 1 : Initial Comparison Grid

Name Of Platform	Targets	System Requirement				
		Application Server	Database	Operating System	Programming Language	Web Server
Moodle 3.4.1	School, University	PHP 7.0 +	MySQL 5.1.33 PostgreSQL 8.3 MSSQL 9.0 Oracle 10.2 SQLLite 2.0	Windows Linux Solaris Mac Netware (Any)	PHP 4	Apache IIS
ATutor 2.2.3	Government, University	PHP 5.0.2+	MySQL 4.1 +	Windows Linux Mac	PHP 5.0.2+	Apache
Claroline 17 .6	School, University	PHP 4.3 +	MySQL 4.1 +	Linux Unix Windows Mac Os	PHP 4.3	Apache Any
FormaLMS 1.4.3	Corporates	Apache 2 +	Mysql 5.0	Linux Windows, Mac Os Unix Sun	PHP 5.2.x +	Apache 2.0.x
Sakai 11	Colleges, Universities, Governments	Tomcat 8	MySql 5.6or higher / Oracle 12c	Linux Windows Mac Sun	Java	Apache

V. COMPARISON BASED ON SUPPORT FEATURES.

Figure refer to administration and security tool have features like authentication & authorization, security. Authentication and authorization has features like user roles, privileges -access rights and access control. User security has attributes like password guidelines. System security has features like antivirus , IP blocker and HTTP security. Each of these features and its evaluation result with respect to Moodle, Atutor, Forma LMS , Sakai ,Claroline and are discussed below.

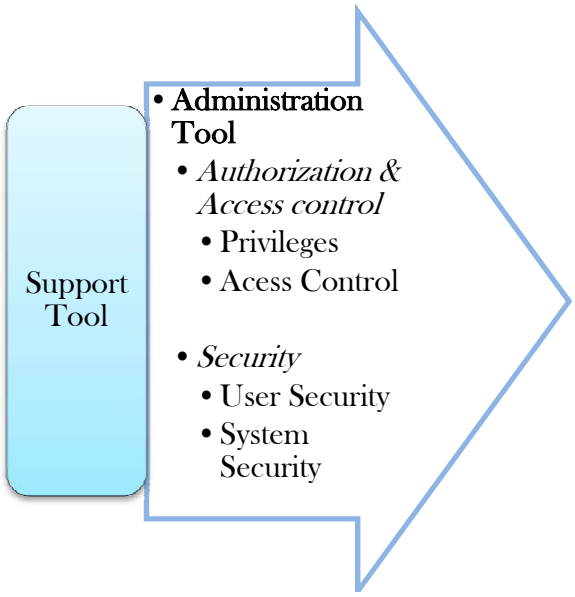

Figure 1: Architectural design and position of support tools and its sub tools.

Authentication and Two Factor

Authentication is the process of authenticating the individuality of a user with the help of identification. These identification may be user credentials or password. If the credentials are legitimate, then it means that authentication process is accomplished. After that authorization process starts[14][19] Authentication is of three types what you know ,what you are and what you have. What you know is id and password, what you have is any device which proofs your identity like a smart card or it can be any kind of special hardware device running special software or justan application installed on a smart phone and what you are is biometric .

Authorization is requisite whenever user required to carry out some tasks or wanted to access some resources. Authorization is the method of implementingguidelines for determining type of actionspermissible, sort of resources that can be accessed. Usually, authorization achieve authentication. For each type of user function it is necessary to carry out authentication and authorization process. [15][16]

The fundamentalplan is to take in another factor in the authentication process. The user has a username and a password. This is what the user knows. The other factor is something that the user has.The point is to attach a special type of data to the login process, data that cannot be figured out without that device. At each login attempt this piece of data is generated in real time, and its validity is lost after a short period of time, e.g. in 60 seconds. Anyone can apply for a two-factor authentication by merely setting it up under the account settings which can be accessed from any Google web applications. There is a free application available for all the major smart phone platforms to generate the one-time passwords. It is named as Google authenticator.

Access Control

Access control mechanism determines how, information and resources will be accessed by user. It also determines interaction between users and systems.[17].The role creation and access control comparison is done for selected LMS .(Table 2)

Users Security

Recognition and authentication of a user is significant aspect for protection of information. There are two category of security, user level security and system level security. The table below shows list of available antivirus related to selected LMS .

Password Guidelines

Password guidelines may include minimum password length, number of digits, special symbol, uppercase and lowercase alphabets . Password should be selected in such a way that it should be hard to break. The table below shows list of available antivirus related to selected LMS .

Antivirus capability

Antivirus software is used to avoid ,detect, and eliminate software viruses. The table below shows list of available antivirus related to selected LMS .

System Security

It includes features such as login with the help of secured HTTP and IP blocker

IP Blocker

IP blocker is used to specify list of allowed IP addresses and IP addresses to be denied. An admin can lay down a list of permissible and/or blocked IPaddresses.

HTTPS security

HTTPS stands for Hyper Text Transfer Protocol Secure. HTTPS encodes username and password before transmitting it from user's browser to the server.

TABLE 2.1: :AUTHENTICATION & AUTHORIZATION FEATURES MOODLE

Feature	Availability
Define and Manage Users Role	Yes
Catpcha	Yes with Recaptha
Exchanging User Privileges	Yes
Email Verification	Yes
Audit Trail	Yes

TABLE 2.2: USER AND SYSTEM SECURITY FEATURES MOODLE

Feature	Availability
Password policy	Strong by default
Protects Username	Yes
Antivirus	ClamAV
3rd party authentication	Yes, with auxiliary module (OAUTH)
Enabling email-based self-registration	Yes
IP Blocker	Yes
HTTPS support	No
SSO(Single Sign On) Central Authentication Service	Yes
Brute-force attack mitigation	No
Two-step authentication	No but can be added via 3rd party authentication method (Goggle)

TABLE 3.1:AUTHENTICATION & AUTHORIZATION FEATURES A TUTOR

Feature	Availability
Define and Manage Users Role	Yes
Catpcha	Yes with Recaptha
Exchanging User Privileges	Yes
Email Verification	Yes
Audit Trail	Yes

TABLE 3.2:USER AND SYSTEM SECURITY FEATURESA TUTOR

Feature	Availability
Password policy	Strong by default
Protects Username	Yes
Antivirus	No
3rd party authentication	Yes, with auxiliary module (OAUTH)
Enabling email-based self-registration	Yes
IP Blocker	No
HTTPS support	No
SSO(Single Sign On) Central Authentication Service	Yes
Brute-force attack mitigation	No
Two-step authentication	No but can be added via 3rd party authentication method (Goggle)

TABLE 4.1 : AUTHENTICATION & AUTHORIZATION FEATURES CLAROLINE

Feature	Availability
Define and Manage Users Role	Yes
Catpcha	Yes with Recaptha
Exchanging User Privileges	Yes
Email Verification	Yes
Audit Trail	Yes

TABLE 4.2 : USER AND SYSTEM SECURITY FEATURES CLOROLINE

Feature	Availability
Password policy	Strong by default
Protects Username	Yes
Antivirus	No
3rd party authentication	Yes, with auxiliary module (OAUTH)

TABLE 4.2 : USER AND SYSTEM SECURITY FEATURES CLOROLINE

Feature	Availability
Enabling email-based self-registration	Yes
IP Blocker	No
HTTPS support	No
SSO(Single Sign On) Central Authentication Service	Yes
Brute-force attack mitigation	No
Two-step authentication	No but can be added via 3rd party authentication method (Goggle)

TABLE 5.1 : AUTHENTICATION & AUTHORIZATION FEATURES FORMALMS

Feature	Availability
Define and Manage Users Role	Yes
Catpcha	Yes with Recaptha
Exchanging User Privileges	Yes
Email Verification	Yes
Audit Trail	Yes

TABLE 5.2: USER AND SYSTEM SECURITY FEATURES FORMA

Feature	Availability
Password policy	Strong by default
Protects Username	Yes
Antivirus	No
3rd party authentication	Yes, with auxiliary module (OAUTH)
Enabling email-based self-registration	Yes
IP Blocker	**No**
HTTPS support	No
SSO(Single Sign On) Central Authentication Service	Yes
Brute-force attack mitigation	No
Two-step authentication	No but can be added via 3rd party authentication method (Goggle)

TABLE 6.1:AUTHENTICATION & AUTHORIZATION FEATURES SAKAI

Feature	Availability
Define and Manage Users Role	Yes /No(Limited)
Catpcha	Yes with Recaptha
Exchanging User Privileges	Yes
Email Verification	Yes
Audit Trail	Yes

TABLE 6.2 : USER AND SYSTEM SECURITY FEATURESSAKAI

Feature	Availability
Password policy	Strong by default
Protects Username	Yes
Antivirus	ClamAV / Magento
3rd party authentication	Yes, with auxiliary module (OAUTH)
Enabling email-based self-registration	Yes
IP Blocker	No
HTTPS support	No
SSO(Single Sign On) Central Authentication Service	Yes
Brute-force attack mitigation	No
Two-step authentication	No but can be added via 3rd party authentication method (Goggle)

VI. CONCLUSIONS

Moodle is a type of e-learning system and it is at the present extensively used all over the world by companies, autonomous educators, schools, organizations and universities, It has immense potential for building a successful e-learning experience by providing abundance of outstanding tools that can be used to augment conventional classroom teaching in any e-learning system. This paper has made a comparative study between Moodle and four other selected elearning systems, and this was based on two kinds of comparison. It is to create more secure and consistent learning environment, it is necessary to remove all the security defects of the Moodle. Securing our login identification and hardening the authentication process could be done in a few steps with comparatively little effort on systems where two-factor authentication is available.

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