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Security Issues in Cloud based e-Learning Part 2(Architectural Aspects)

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In this exploratory paper (2nd Part), we revealed Cloud computing Architecture, Public & Hybrid Cloud, PLE etc

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Cloud computing architecture

Cloud computing architecture mainly consists of three layers called IAAS, PAAS, and SAAS. These three layers are helpful to serve the variety of services to their customers from cloud vendors.

IAAS: Infrastructure as a service is a provision that offers from the cloud vendors to their clients through the sources like storage, hardware, severs, networking components. The maintenance of these hardware resources are maintained by cloud vendors. Usually in this case, the clients using this kind of cloud resources need to pay money only for their needs, and they do not need to pay after their work gets finished. The cloud clients can resize or extend this kind of service from their cloud vendors, so the cloud suppliers resize or ad-hoc the services to their clients based upon the user needs. The IAAS facility is offered with the help of virtualization, there are two different kinds of virtualization:

1. **Full virtualization:** when one system or installed software from one machine can run another entire virtual system by its own emulation in it.

2. **Para virtualization:** This is a kind of extension from full virtualizations, but it differs only to enable and run many operating systems at a same time.

SAAS: Software as a service, the name itself implies that the software's like word processors are offered to their customers through the cloud for almost free or low cost. So the cloud users need not waste huge amount of money on get licence to use certain software applications. In some cases, certain software applications like excel, the users are even able to access in offline mode, and the data processed in that application are synchronized in cloud once they come to online.

PAAS: Platform as a service which offers the development environment for building, testing and delivering software applications or any other services through cloud without any download or installs applications in cloud user's machine.

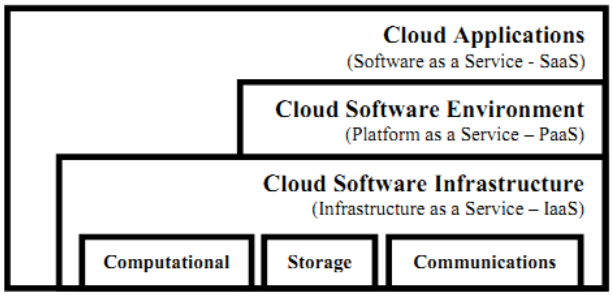

Figure : Cloud computing architecture [1]

Cloud computing clients may use one or more services of cloud computing based on their business needs. There are plenty of ways to access cloud computing through various forms of clients. Hardware devices like PDAs, mobile phones, regular PCs, notebooks, and software applications like regular web browser are such examples to access cloud computing from various clients. Cloud computing becomes most popular on all business sectors nowadays because it helps a lot to reduce the cost of use of software applications and hardware usage. Cloud computing helps to reduce the processor and memory usage through its online backup and applications. The clients may get online memory space on demand from cloud vendors with minimal cost while the real physical memory depends on their work needs. Many online applications like spreadsheet and software applications are helpful to clients to use the applications at minimal cost or free on demand and it helps to avoid purchase the license to use real time software applications. In some cases, some software applications like spreadsheet have offline support also from cloud vendors, in this case the process in offline mode get synchronized once it gets refreshed in an online mode. There are plenty of multi-national companies now offering best cloud computing solutions, like as Google, Amazon, IBM, Yahoo, and Microsoft. Google's API is best example for the cloud computing applications; Google offers plenty of software applications with the help of cloud such as YouTube, Google apps, Picasa. The main advantage of cloud computing is that one need not worry about client machine, because all our data is stored safely in online cloud. But still cloud computing have few disadvantages, such as subscription fee for the access cloud sources may become costlier for long term use, and it is always recommended for clients to use more than one client vendors to avoid data loss

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in case of any problems affected to cloud vendors like bankruptcy. (Pocatilu et al., 2010)

Types of cloud

Cloud computing have four different clouds which vary on their modes of deployment of computing:

Public cloud: Public cloud is conventional way of cloud computing, where the third party vendors are provide the IAAS, SAAS, and PAAS. In this methodology, the user can have the access to these services on an ad-hoc basis through the cloud.

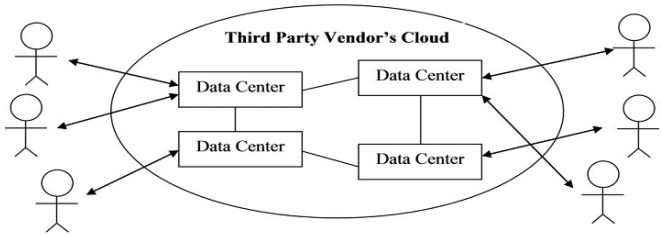

Figure 4: Public cloud deployment model [1]

Hybrid cloud: Hybrid/enterprise cloud has both In-house and third party providers. In these kinds of clouds, some portion is private where it can be accessed only internal and the remaining portion is public which can be accessed externally.

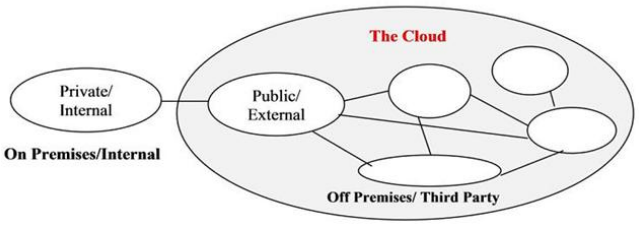

Figure : Hybrid cloud deployment model [1]

Private cloud: This is an internal cloud which maintains and owns the services like PAAS, SAAS, and IAAS by the company. But still this cloud can be accessed by other cloud users through a private network.

Community cloud: This is an external private cloud which is shared by many companies having the similar requirements. Third party cloud vendors offer this cloud, but this can be accessed by the companies who operate in the community.

E-Learning Environments

E-Learning environment is nothing but the environment which offers through E-Learning applications to the students to get the access the materials and tools relating their studies. Virtual learning environment and personal learning environment are two important E-learning environments which offer the wide range of facilities to students through e-learning applications for their studies.

Virtual Learning environment

Virtual learning environment (VLE) is simply another term used to represent the E-Learning systems, where the students are able to get face to face class room environment through computer applications with the help of web sources. VLE is enhanced application from blended learning approach. The main objective of VLE is to provide the e-learning facility to large number of student communities to provide the virtual class room environment. There are many terms which are very similar to Virtual learning environment. They are learning management system (LMS), Content management system (CMS), Learning content management system (LCMS), Managed learning environment (MLE), Learning support system (LSS), Online learning centre (OLC), Open courseware (OCW), Learning platform (LP). Virtual learning environment basically works with the help of internet and provides the learning materials and tools to e-learning users for uploading files, chatting, and web conferencing. It also gives information regarding student group management systems, 20
questionnaires, peer assessment, wikis, blogs, 3D virtual learning classrooms, online feeds like RSS. Many universities and institutions are using VLE to improve the intractable learning environment and break the interaction barrier on learning environment. The foreword of the book ―Virtually There‖ by Yorkshire and Humber Grid for Learning Foundation (YHGfL) (Wikipedia, 2011) is quoted here:

"Learning is breaking out of the narrow boxes that it was trapped in during the 20th century; teachers' professionalism, reflection and ingenuity are leading learning to places that genuinely excite this new generation of connected young school students — and their teachers too. VLEs are helping to make sure that their learning is not confined to a particular building, or restricted to any single location or moment." [1]

The main advantage of VLE, it is capable of storing many courses at a time, so it creates better environment for the instructor as well as the student when they are moving from one course to another. Apart from this facility, VLE provides some other provisions:

1) Notice board for up to date course information

2) Students can take their courses at any time and from any convenient place to them.

3) Students are allowed with special needs and restrictions to use this kind of e-learning systems.

4) It provides the geographical wide spread education.

5) It offers the education facility through internet which helps students as it is cost effective and flexible.

6) Small universities which don't have many elective courses are able to provide wide range of elective courses for their students in their institutions.

7) It enables more intractability among the students and lecturers.

Personal Learning Environment

Personal learning environment (PLE) is a single user E-Learning system which helps the E-Learners to manage and modify their own learning. PLE is mainly used to integrate the WEB 2.0 technologies like Wikis, blogs, online feeds, online social communities with the independent E-Learners. PLE offers wide range of supporting features to their users, some of the important provision are:

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1) Users can fix their learning goals on their own in the e-learning system.
2) Users can manage the E-Learning systems both the learning materials and processes in the system.
3) Users can communicate with other users in the same e-learning system in the learning process.

Stephen Downes [1] describes the PLE as ―one node in a web of content, connected to other nodes and content creation services used by other students. It becomes, not an institutional or corporate application, but a personal learning center, where the content is reused and remixed according to the student's own needs and interests. It becomes, indeed, not a single application, but a collection of interoperating applications—an environment rather than a system‖.

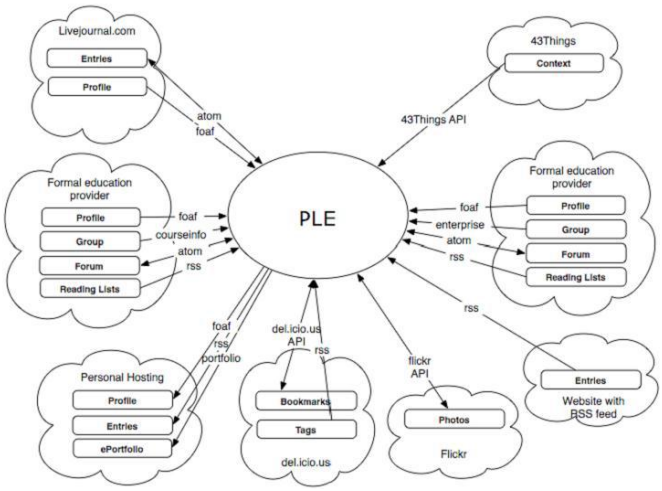

Figure 7: Conceptual model of a PLE [1]

Future trends on e-learning

Since the E-Learning technology is a not a new technology, it comes with the combination of latest technologies to enhances its provisions to e-learners. There are many new forms of e-learning methodologies to provide educational facilities to e-learners with variety of new provisions to enhance the functionality and e-learning environment. In those e-learning 2.0 plays a vital role on bring the e-learning to next level of internet based learning. After the evolution of web 2.0, e-learning is adopted the web 2.0 with the combination of iPLE (Institutional Learning environment) to bring the new technology called e-learning 2.0. E-learning 2.0 is nothing but to make e-learning environment to be more efficient than before with lot of new provisions to e-learners using online sources like blogs, forums, wikis, online communities, streaming videos, cloud sources, video/audio conferencing etc. There are so many sub forms created for e-learning after the evolution of e-learning 2.0 namely mobile learning, cloud based e-learning, blended learning. (Casquero et al., 2010) 22

Blended learning

Blended E-Learning is a concept which was used initially in UK in 1997. There are so many definitions given by many researchers for Blended learning and mentioned in the journal:

1) ―A learning programme where more than one delivery mode is used.‖
2) ―Blended learning is the learning that is facilitated by the effective combination of different modes of delivery, models of teaching, and founded on transparent communication amongst all parties involved in a course.‖
3) ―Blended learning combines face-to-face instruction with computer mediated instruction. It is the combining of these two different learning environments, taking the specific benefits that each environment provide, greater access to improved learning experiences and doing so in cost-effective manner.

Blended learning is the integration of traditional face to face class learning with e-learning techniques and applications. In this way, there are many e-learning tools used to create a class room environment through computer applications. Blended learning approach involves various kinds of teaching methodologies, learning strategies, education materials, learning skill development programs to improve the learning for e-learners. Blended learning helps to integrate the synchronous and asynchronous learning approach, so that every process taken in learning is pre-planned effectively to give high standard of education to students. In blended learning, students have the full rights and freedom to take the decisions and can make changes they want on their course. So blended learning is also called student centred approach. Even though students have more advantage in this approach, teachers also have more freedom and they can structure the student lessons, improve the speed of course period to facilitate quick learning ability to students. Moreover, teachers are able to give the course material which they like to teach to students through this blended learning approach [1]. There are many ways to improve the student interaction through blended learning, they are:

1) Group discussion
2) Seminars
3) Workshop
4) Debate
5) Brainstorming
6) Collaborative learning
7) Cooperative learning
8) Interview
9) Field visit

Many kinds of technical materials are used to improve the quality of education through blended learning, they are:

1) CD/DVD
2) E-Mail
3) Chat
4) Video conferencing
5) YouTube
6) Online presentations
7) Wiki
8) Discussion forums

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