

# Personal Cloud-based Learning Environment

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## **Abstract**

In recent years, E-learning has grown into a widely accepted way of learning, and the usage of the global network is inevitable in every education process. Ubiquitous learning environments should integrate modern pedagogical approaches, and variety of heterogenic learning resources within the educational process. Thus, efficient E-learning should rely on integrated services learning environment as well as, a powerful and scalable IT infrastructure [1].

This research works on the provision of integrated IT solutions in an interactive learning environment that emphasizes on increasing student participation and interaction with colleagues and teachers, also takes into account individual differences between students within the same course. In this paper we produce architecture of Personal Cloud-based Learning Environment (PCLE) and evaluate it.

## **Introduction**

One of the main E-learning characteristics is distributing the learning materials and services through the Internet. Although it was able to achieve this goal, but it still suffers from some of the challenges that hinder the student, and the teacher to access the service at anytime and anywhere. So the modern E-learning strategies seek to take advantage of new technologies such as Cloud Computing to develop E-learning Solutions.

Cloud Computing technology can be a perfect solution to support students, teachers, and anyone interested in educational field by offering on-demand services and paying as using . Different perceptions were developed to define Cloud Computing and still now there is no specific definition but just attempts to visualize it. One of these perceptions is "Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs" [2].

Cloud Computing has proved its worth in many fields, one of them is E-Learning field. Cloud Computing enhances E-learning by providing a scalable infrastructure that can easily and rapidly scale (i.e. scale up, or scale down) as needed, and pay depending on the usage. Also it increases the efficiency of provided services such as the long-term services that may be used temporarily. For example institution can rent the services instead of building from scratch [3].

Cloud Computing can contribute in solving the technical challenges that faces E-learning while there are another type of challenges still in the scope which are the pedagogical challenges that related to the provided content and learning approaches [4].

## **Related Works**

The researchers have worked on addressing the challenges that facing E-learning. Some had focused on developing the E-learning architecture to accommodate new technologies such as Cloud Computing [5], Agent Software [6], and Social Software [7], while others had focused on integrating services to existing E-learning platforms.

Masud, A., et. al. [8] has proposed an open architecture that allow integration and interoperability with external content, services, and social networks by using Cloud standards. In addition to that, Cloud Computing supplies computing resources (i.e. hardware, storage, and some other IT infrastructure) for the higher level of the architecture. The researcher enhanced the underline infrastructure without focusing on the quality of learning process management and the appropriateness of provided content. Babu, S., et. al. [9] have merged Cloud Computing, and Agent Software (i.e. the term software agents borrowed from artificial intelligence field presents a computational autonomous entities capable of sensing and acting as academic experts in environment to accomplish a set of designated goals [10]) to build a generic architecture. The architecture consists of multi-agents. Each agent responsible of specific task such as: interactivity, personalization, adaptation, interoperability, collaboration, and security. The architecture aims to enhance the learning process by having many agents that can collaborate towards achieving the learning goals with the advantages of Cloud Computing. Unfortunately, the proposed architecture is just a conceptual idea and need to be implemented in real time to validate and prove its efficiency.

The other researches had focused on enhancing the provided learning services by accommodating modern web services such as Web 2.0 to increase students' engagements and contributions. Al-Zoube, M. [11] has used a ready gadgets as iGoogle applications to give students the opportunities to build their own environment that achieves their learning goals (i.e. Student can choose Google Docs gadgets to access his own documents, Instant Messenger to send and receive messages, etc.). while Elvira, P. [12] has used Web 2.0 services (i.e. Wiki, Blog, Social bookmarking, and media sharing) to reinforce the social and collaborative aspects among students within the virtual learning environment. And, Lotfi, Z. [13] has relied on using interviews and surveys to determine the effective collaborative tools that can support learning in the virtual world. The researcher classified the collaborative tools into four types: Communication, Shared repository, Group learning, and Assessment tools based on its importance in supporting collaborative.

Most of previous researches had focused on solving one of the problems that face E-learning either using technologies like Cloud Computing or using external services that had succeed outside the learning domain such as Web 2.0.

The proposed Personal Cloud-based Learning Environment (PCLE) relies on applying service oriented architecture on the learning objects' system to support reusability and interoperability. The PCLE is based on achieving adaptation and personalization to activate the student role and increase the area he owned. The system hosted over Cloud Computing environment. Cloud Computing gives the user the ability to access the services at anytime and anywhere via a compute device such as a laptop, desktop, handheld PDA or cell phone. PCLE environment adopts learning Objects technique to re-use and share content between courses within the same system. PCLE built based on SOA in which functionality decomposed into distinct services, which can be distributed over local or remote networks and can be combined together and reused to create secured application. PCLE provides social and collaborative services plus tailoring the educational content according to each student's needs and goals.

#### a. Architecture.

Cloud Computing provides PCLE as a service which make teaching methods more convenient and flexible. Both teacher and student can choose different times and different locations to complete the curriculum design and self-study by using a variety of learning resources on the PCLE. PCLE is a SOA-based-Personal Adaptive E-learning environment; it consists mainly of three layers, the upper layer is **the user interface layer** which contains a portal user interface that consists of a set of applications: course management, assessment & exams, scheduling & calendar, messaging (main, instance messages), profile management, blogger and search engine to receive the instructions from the user requesting a specific service. The second layer is **the service layer** which includes transaction manager, social activity manager, and Adaptive/personalization manager. Transaction manager controls user requests and links between both user interface layer and data layer in order to provide a personal virtual learning environment. The last layer is **the data layer** which stores user profiles, preferences, personal usage data, blogs and social activities. This layer also is responsible for storing the courses learning materials on the database, with the user's files, assignments, and assessments reports. The layer also contains a question bank.

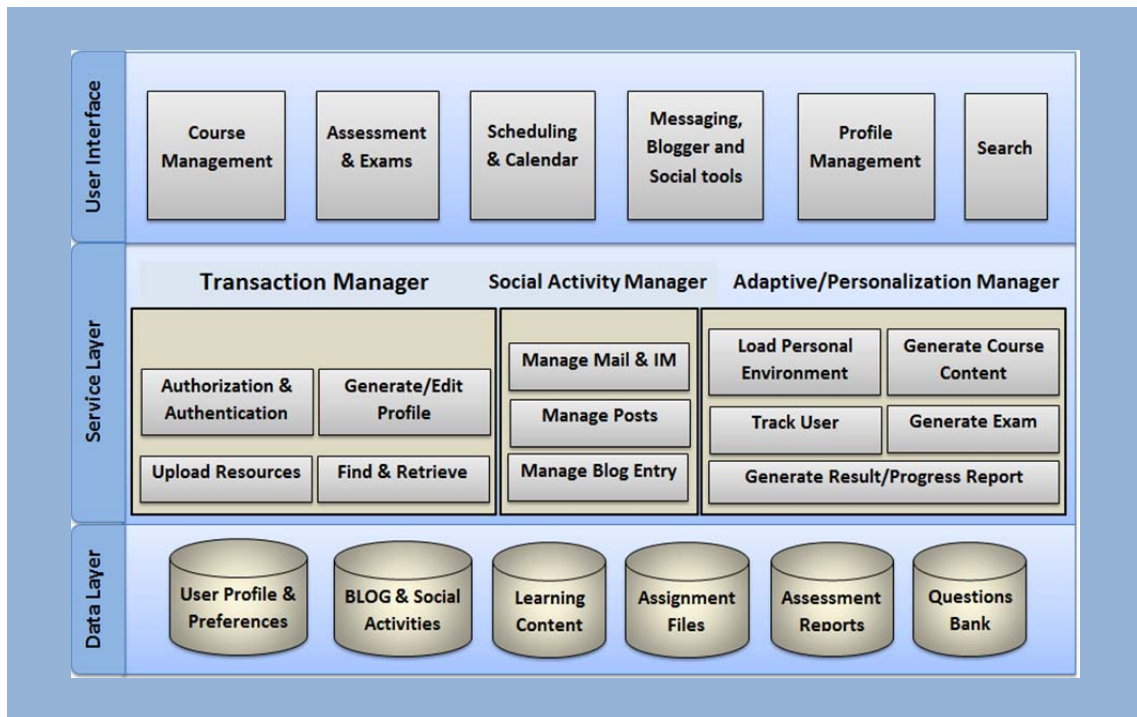


Fig 1 PCLE Architecture

**b. Implementation.**

To validate the usability of the proposed PCLE architecture as an integrated E-learning environment caters students' expectations, a prototype platform has been developed for the PortSaid Technical College.

The prototype is built using Java programming tools, MySQL for database implementation, and JS Charts library was used for the graphical visualization. Figure 2 represents the PCLE home page.



Figure 2 – PCLE Home Page.

PCLE environment provides three major educational tracks Network track, Graphics track, and HW/SW Maintenance track. In the research case, the Network track is activated and provides an advanced

network course. PCLE main actors' controls the educational process are the coordinator, instructor, and student. The coordinator is responsible of coordinating the educational process through the E-learning environment where he schedules courses. While PCLE provides the course's instructor a simple control panel helping him accomplishes his tasks. From the control panel menu, the instructor can: i) upload measurable questions on each chapter and categorize into three levels (hard, medium, and easy); ii) upload course chapters; iii) review blog articles published by course's students; in addition to iv) follow course students' performance within the whole course using student's time line.

PCLE environment gives instructor the ability to **monitor students' activities**. This tracking and monitoring performed individually (based student-level) using timeline menu which contains all activities of each student in addition to provide a comprehensive view of the students' performance within the whole course as shown in figure 3.

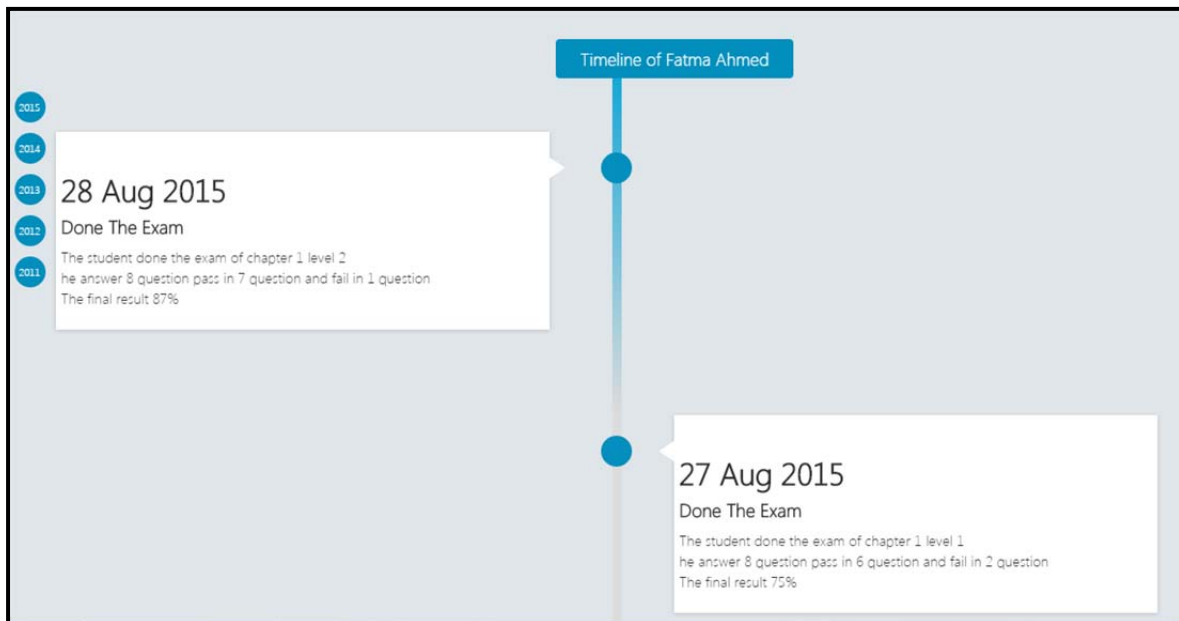


Figure 3 – Monitoring Student's Performance using Student Timeline.

PCLE follows Student-centred-Learning approach, thus it focuses on student, connecting him/her to information and communities formed his self-controlled personal network. The PCLE main part is the adaptive/personalized engine that designed based on executing a series of if-then statements to determine the student's knowledge level through numbers of exams and quizzes for each chapter. The system adapts the learning content depending on the students' results to meet the student needs as shown in figure 4.

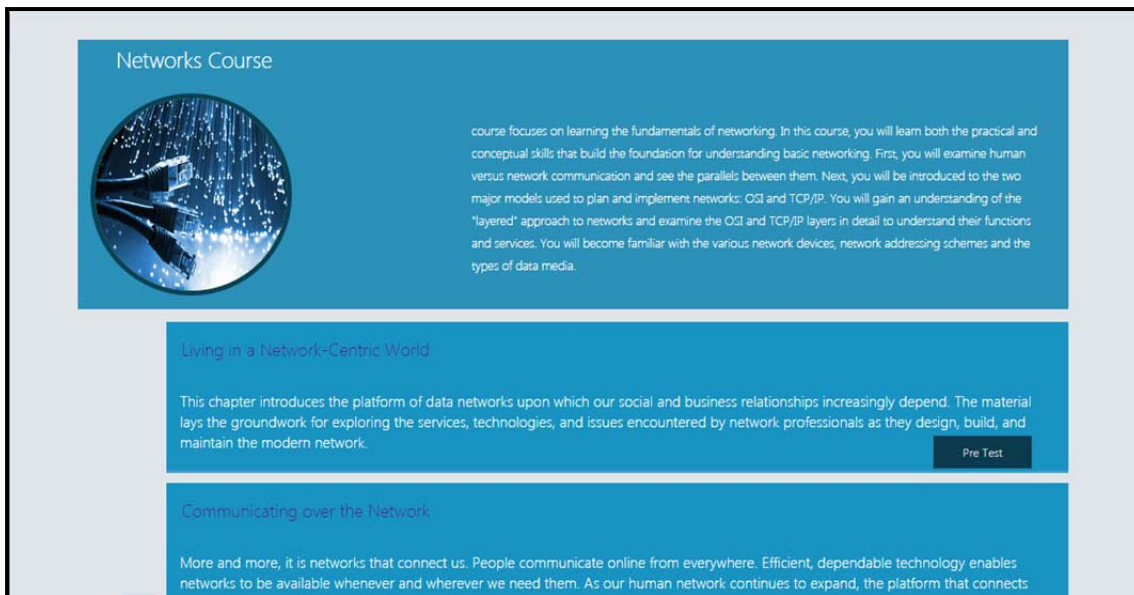


Figure 4 – Chapter Adaptive Content.

The student also can resort to social as social stream figured 5 to share his ideas, problem with peers and collaborative tools as the blogger tool presented into enhance the E-learning outcomes and students' success rates.

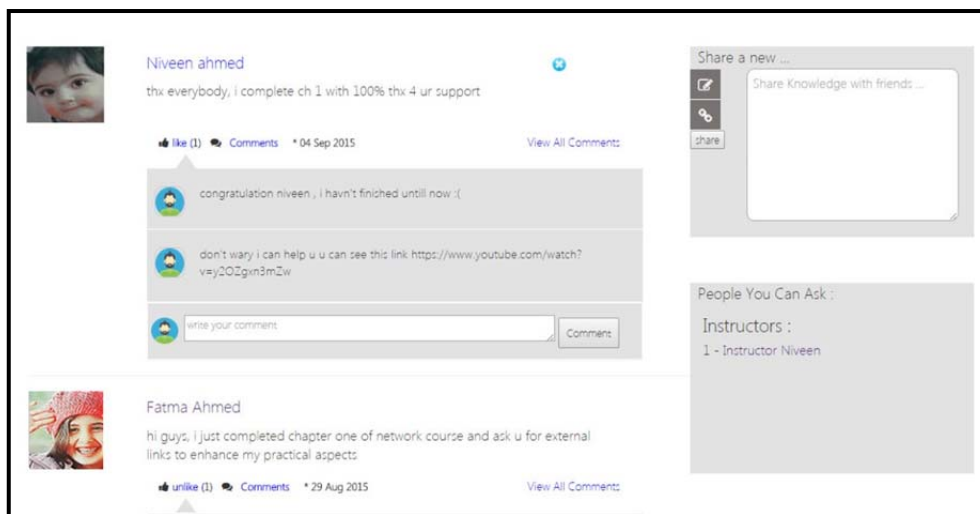


Figure 5 – PCLE Social Stream.

**Conclusion**

In this paper, PCLE architecture is proposed to solve technical, financial, and pedagogical challenges that face E-learning and affect the quality of electronic learning process. The PCLE uses Cloud Computing to provide a scalable and reliable infrastructure and reduce the cost to an acceptable limit as you use. Modern pedagogical learning approaches (such as Social, Collaborative, Adaptive, and Personalized learning approach) are used to cater students' different abilities and learning styles.

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