

# A New Approach toward Locating ERP Components on Cloud Computing Architecture

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**Abstract** Nowadays, Cloud Computing [1] is an emerging phenomenon, which is subject of discussion in many Enterprises. Therefore, numerous studies have been done in this context and some well-known IT solution providers such as IBM and Oracle have provided a particular cloud architecture which can be deployed in cloud environments. On the other hand, modern Enterprises looking for standard structures and they use standard best practice LANSA ERP Frameworks and A McKinsey 7S Model-Based Framework for ERP [7]. So, using these best practice frameworks and ERP systems in cloud architecture can lead to more popularity of cloud environments and increase reliability of organizational users. The purpose of this paper is to provide a new approach toward locating a suitable ERP system in management layer of cloud computing architecture with the aim of integrate and standardize cloud environments and improving cloud architecture. This architecture is finally compared with other architecture in a form of statistical graphs.

**Keywords:** *Cloud Computing, MVC Architecture, Ruby on Rails frame work, Enterprise Resource Planning, Everything as a Service.*

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## 1. Introduction

The cloud computing is not a new concept. This concept was first introduced in 1960 when John McCarthy predicted that computation may someday be organized as a public utility and with the increase of Internet communications, the importance of this concept became more apparent. The rapid development of new technologies, success and acceptance of Internet communications and migration of organizations into service-oriented environments has created complete storm for success of cloud computing. On the other side, today across various businesses, administrative and senior managers seeking for new technologies and approaches in which they can utilize it. So according to, interest of cloud computing in the modern world and attention of organizations to it, cloud architecture is tremendous important. Today, large company such as IBM, Oracle, Microsoft and etc. are provided specific architecture accordance with the requirements for cloud computing. National Institute of Standards and Technology defines "cloud computing as an access model to configurable computing resources at any location appropriately and through the network based on demand." Networks, servers, storage facilities, applications, and services are examples of these resources. In other words, cloud computing is Internet-based computing whereby information, IT resources, and software applications are provided to computers and mobile devices on-demand.

Cloud computing not only improves business processes and operational efficiency. There are three type of cloud services delivery model. **Software as a Service (SaaS)** [5], in this model, consumers can use provider's applications running on a cloud infrastructure. **Platform as a Service (PaaS)**, in this model consumer can develop and execute their own applications within an environment offered by the service provider. **Infrastructure as a Service (IaaS)**, in this model, consumers access to collections of virtualized computer hardware resources, including machines, network, and storage.

The decision about implementation and deployment of cloud is important and quite different. There are four main cloud deployment models. **Public**, in this model, cloud resources are available for the general public over the internet. It should be mentioned that these resources are owned by organization which selling cloud services. **Private**, in this model, cloud resources hosted within an organization and these resources are dedicated particularly for that organization's users. This model is suitable for an organization's infrastructure. **Community**, in this model, cloud resources are shared by several organizations with the same policy, issue and requirements. **Hybrid**, in this model, cloud resources implement in hybrid model. This means one or more esources are deployed in public model and one or more resources are deployed in private model.

There are several reference architectures for cloud computing, such as IBM, Oracle, Cisco, HP, NIST, VMware, MVC [3] and etc. These architectures along with MVC are the main references for this paper.

In following section the MVC architecture will be briefly introduced.

Recently, Ruby on Rails framework [4] has become more structured by the help of some IT service and business processes management frameworks.. Frameworks are the main references for this paper which are used in Cloud environments services and business processes management in order to improve the structure of the cloud and its integration.

On the other hand, other systems and applications which can help cloud environments structure and integrity improvement are enterprise resource planning (ERP) systems. There are different definitions for ERP systems. An ERP system automates and fully integrates core enterprise business processes and business management system. As an example, ERP system covers functional area of an enterprise, like logistics, productions, finance, accounting, human resource and etc. it should be mentioned that an ERP system is kind of information system and always have a common database. An ERP system has several modules and organizations sometime choose some of them.

Section 1 introduced the popular ERP system modules .The rest of this paper is organized as:

Section 2 introduces related works briefly. Section 3 introduces MVC architecture as the focal reference model and then a simple comparison between cloud architectures is shown. Section 3 introduces one of popular ERP with their modules and later a simple comparison between ERP systems is shown. In section 4 the main purpose of this paper is provided about core implementation. In this section and Subsections the new architecture of cloud computing based on famous MVC cloud architectures and Ruby on Rails and also with new ERP modules are introduced and finally conclusions and future works are listed.

## 2. Related Works

Cloud Computing makes the dream of computing real as a tool and in the form of services. This technology has realized service-oriented idea too. Due to needs of organizations to move toward new technologies and reach service orientation and also changes in customer demand, cloud computing has been in the center of attentions and organizations have turned to it. For cloud computing several reference architecture have provided, which few of them are the basis of the proposed architecture in this paper. Some of these reference architectures will be introduced briefly in the following:

a. IBM reference architecture, which is the most popular and useful for cloud computing environments [6]. This architecture will be introduced in the next sections.

b. HP Cloud System architecture which is provided by HP Company. This architecture is an integrated system for building and managing services across all cloud environments. There are three layers of supply, delivery and demand for service delivery therein .

c. NIST reference architecture for cloud computing is one of the most well-known reference architecture. In the architecture, there are five main roles, which are called cloud consumer, cloud provider, cloud carrier, cloud auditor and cloud broker. In this architecture, there is also

an orchestration module which is responsible for the composition of the system components to support their activities and management .

d. Oracle reference architecture for cloud computing. In this architecture, cloud management capabilities and policies is developed in five cloud business management, security and policy management, cloud operations, orchestration and design-time categories and also there is cloud portfolio to have roadmap for selection is shown in this architecture.

e. Another important architecture of reference is Rackspace cloud computing. The Rackspace Cloud is a set of cloud computing products and services billed on a utility computing basis from the US-based company Rackspace.

It provides web application hosting or platform as a service ("Cloud Sites"), Cloud Storage ("Cloud Files"), virtual private server ("Cloud Servers"), load balancers, databases, backup, and monitoring.

Nowadays, some best practices frameworks have been created in order to standardize and organize services, processes, business processes , educational services are generally associated with ICT and IaaS. These frameworks are too useful and suitable to improve service oriented and IT-based environment such as cloud computing environments. Some of the most important frameworks are introduced briefly in the following:

a. IT Service Management (ITSM) drives enormous benefits from best practices. The Information Technology Infrastructure Library (ITIL) is a set of best practices for ITSM that focuses on aligning IT services with the needs of business. ITIL has five core parts; each of these parts covers an ITSM lifecycle stage [9].

b. The IBM Process Reference Model for IT (PRM-IT) is a generic representation of the processes involved across the complete IT Management domain. PRM-IT presents a framework that uses eight process categories which are Governance and Management System, Customer Relationships, Direction, Realization, Transition, Operations, Resilience .

c. Enhanced Telecom Operations Map (eTOM) [8] is Business Process Framework which defines a model for the telecommunications industry. The model describes business processes required by a service provider and defines key elements and they interact. This framework fall into three broad sections which are Strategy, Infrastructure and Product, which covering planning and lifecycle management, Operations, which covering the core of operational management and Enterprise Management, which covering corporate or business support management .

Another system that can improve structure and integrity of service-oriented cloud environments is ERP systems. ERP systems usually a suite of integrated applications and always have some different modules. The major modules of ERP systems typically are placed in finance, account, payable, human resource, manufacturing, supply chain, project and front office and reporting category. Different companies provide ERP systems. The popular ERP system providers are Foradian, SAP, Oracle, Ramco, People Soft, EMIS, Microsoft, Netsuite, SAGE, Epicor and etc. The Fedena ERP will be introduced in the next sections.

### 3. Fedena ERP

Foradian [2] is a software company which provides enterprise resource planning (ERP) named as FEDENA [2]. It provides services to school and educational institutes customer relationship management (CRM), supply chain management (SCM), and human capital management (HCM) software to educational institutes. Fedena ERP has several modules such as Academic management controls every aspect of a institute's interaction with its students. It broadens the scope of student information to everyone within and across the organization. Fedena Exam Management delivers a

complete suite that enables to manage and produce students' performance. Fedena Library Management service acts as central knowledge repository to manage and enquire about the availability of books. Fedena Employee Leave Management helps employee to apply for leave and the institution can maintain the record on a real-time basis. Fedena Financial Management is providing a suite of accounting applications to help organizations about financial management. Fedena Collaboration Module helps to integrate Google Docs and other such tools to upload/download academic documents. Fedena ERP also has human resource management too. Table 1 show some company which are provided ERP system:

Table 1. Some ERP System providers company

| Company Name | Suitable for Institutes/Business size | Modules  |
|--------------|---------------------------------------|--|
| Foradian     | For Schools/Institutions              | Exam Management, Employee Leave Management, Library, Finance, Discipline, Inventory Management, Fee Module, Hostel Module, Transport Module, Alumni Module.    |
| Ramco        | For Medium Businesses                 | Accounting - Human Resources - Inventory Management - Manufacturing - Project Management - Supply Chain Management - Procurement                               |
| SAP          | For Large Enterprise                  | CRM - Business Intelligence - Accounting - Human Resources - Inventory Management - Manufacturing - Project Management - Supply Chain Management - Procurement |
| NetSuite     | For Medium Businesses                 | CRM - Business Intelligence - Accounting - Human Resources - Inventory Management - Manufacturing - Project Management - Supply Chain Management - Procurement |
| eCampus      | For Schools/Institutions              | Exam Management, Employee Leave Management, Library, Finance, Discipline, Inventory Management, Fee Module, Hostel Module, Transport Module, Alumni Module.    |
| Panacea      | For engineering and medical colleges  | Exam Management, Employee Leave Management, Library, Finance, Discipline, Inventory Management, Fee Module, Hostel Module, Transport Module, Alumni Module.    |
| TCS IoN      | For engineering and medical colleges  | Exam Management, Employee Leave Management, Library, Finance, Discipline, Inventory Management, Fee Module, Hostel Module, Transport Module, Alumni Module.    |

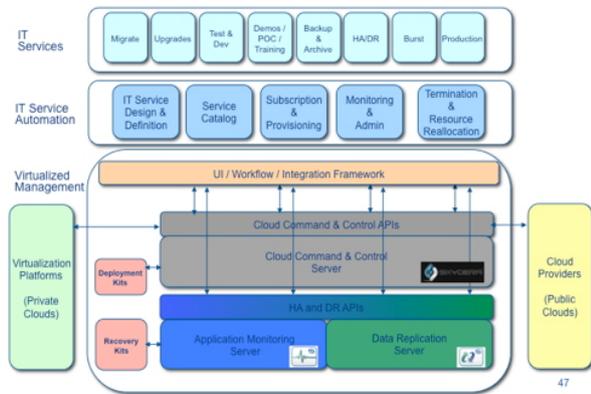


Figure 1. Rackspace cloud computing reference architecture

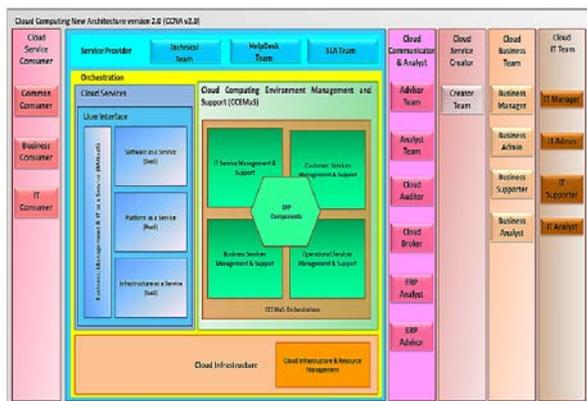


Figure 2. The conceptual and high level model of proposed architecture

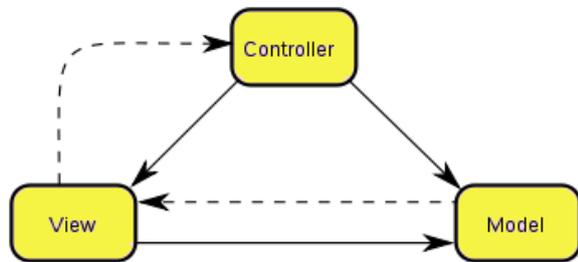
The CloudStation [10] solution includes the following components:

- CloudStation Web Client: a customized web-based UI for administrators allowing them to manage across internal and external clouds.
- Cloud Command & Control Server: software application that provides cloud migration, management and monitoring.
- High Availability Server: software application that ensures the continuous availability of applications by monitoring system and application health, maintaining client connectivity and providing uninterrupted data access regardless of where clients reside.
- Data Replication Server: software application that provides continuous real-time host-based block-level replication of data insuring multiple copies of your data is available at all times.
- APIs: application programming interfaces necessary for access between the Cloud Station web client and the various server applications, as well as providing ease of customization for customers.
- Deployment Kits: Skydera -specific deployment commands created for various Cloud Station end-user use-cases.
- Recovery Kits: Life Keeper-specific templates used to configure for specific application recovery (e.g. Oracle, DB2, MySQL, WebSphere MQ, SAP, SQL Server, Exchange Server, etc.)

### 4. Implementation Using MVC Architecture

MVC Design Pattern: This design pattern is used for managing your web application. M stands for MODEL classes, C stands for Controller and V stands for VIEW Pages.

MVC design pattern provides a centralized management for your web application. also gives role based development. You can separate task based upon the nature of the task. like if the task is related to business logic or handling Database you will write Bean classes or Java classes, these classes comes under MODEL .All the representation type stuff like JSP page, HTML page, CSS, page layouts style sheets can be used to create a beautiful page to show the application response to the customer. all this stuff come under VIEW. now we have business logic processors and pages to show the processed result to the customer, but think about your application it might server several different type of request like Login, Create my shopping cart, add item to shopping cart, checkout, billing and so on. for each request you will write MODEL and View. then how to control the flow? who will decide which MODEL and VIEW needs to be used and when? Here our controller will come into the picture. your controller will decide which and when Model class needs to be call and which VIEW needs to be use for represent the response.



### **MVC Architecture**

All the request will come to your controller and controller will send those request to the Model class followed by the particular view. SFDC MVC: You can write your VIEW pages using SFDC visual force (VF pages). VF pages are similar to our JSP pages. Each VF page is associated with a Controller. you can make use to already built Standard controllers or you can write your own controller using Apex language. Apex is OO and very much similar to our JAVA. you can also write Model Classes using Apex.

Visualforce [11] uses the traditional model-view-controller (MVC) paradigm, with the option to use auto-generated controllers for database objects, providing simple and tight integration with the database. You can write your own controllers, or extensions to controllers, using Apex Code. Visualforce also provides AJAX components, and embeds the formula expression language for action, data and component binding interaction.

Salesforce.com is award winning tool to manage all the data of sales team of an organization. The flexibility and assurance of safe data provided by Salesforce.com results into nonparallel development capabilities to the developer.

SFDC MVC pattern contains below three modules:

1. Model
2. View
3. Controller

Model : What schema and data does salesforce uses to represent the system completely. In salesforce, we can say that sObjects are the model as every entity in salesforce is mapped to some sObject.

View: How the schema and data is represented. Visualforce is used to present the data to users.

Controller: How the interface actions. Controllers are used to perform the actions whenever users interact with visual force.

## **5. Conclusion**

While employing an ERP system may be expensive, it offers organizations a cost efficient system in the long run.

ERP software works by integrating all the different departments in on organization into one computer system allowing for efficient communication between these departments and hence enhances productivity.

The organizations should take extra precautions when it comes to choosing the correct ERP system for them. There have been many cases that organizations have lost a lot of money due to selecting the 'wrong' ERP solution and a service provider for them.

With the advent of Web-based ERP solution working environment started witnessing a tremendous change. Web-based simplified back-office process automation for mid-sized and growing business. It provided real-time information about finance, order management, purchase, inventory, employee management, e-commerce and much more. With web-based ERP solution, you can accelerate business cycles, improve productivity and reliability, and provide higher levels of service to customers, suppliers and partners.

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