

Cloud computing system for small and medium corporations

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Abstract

Cloud computing provides services that allocate infrastructure resources using the Internet as a medium and data storage on an external server. Small and medium corporations are the foundation of any flourishing economy for a growing nation which seeks new and innovative methods to reduce the way they manage their resources. Over a couple of decades, Information technology (IT) has created a significant impact in improving the lives of people and also on the global economy due to tremendous digital transformation. With the growth of the Small and medium corporations, IT is creating some real impact in enabling these industries to undergo a digital transformation of their business processes while they continue to grow. Small and medium enterprises (SME's) are usually identified as the dominant force for the growth of any country's economy. In the cloud computing environment, the SME's need not have the in-house infrastructure so they can give up on any initial expenditure for setting up and instead they can utilize the resources available on the cloud and pay as per their requirement and usage. This paper presents the results of a comprehensive interpretation to research some of the most commonly used SaaS (Software-as-a-Service) implementations in the domain of Cloud Computing firstly to identify the weaknesses of the traditional computing approach for SME's, and secondly to identify the aspects of these weaknesses that can be overcome by implementing cloud computing. In this paper, we provided the overview of various cloud computing models and literature survey of these models. This study extends to create an own cloud computing system for small and medium corporations. We will be using Software-as-a-Service (SaaS) approach and see how small and medium corporations can leverage on this for their business operations.

Keywords: Cloud computing, SaaS, small and medium corporations.

1. Introduction

In this era of modern technology, cloud computing is one of the key aspects in enabling the small and medium corporations to access services delivered over the internet. Some of these services include servers, databases, networking, software, and analytics.

When compared to traditional systems like desktop applications or centrally managed applications, cloud computing is more flexible, scalable and dynamic. The users have begun to realize this potential in cloud computing and are starting to adopt cloud applications for their day to day operations, exclusively rely upon network communications for their working.

There are three varieties of cloud computing deployment models :

- **Public Cloud:** In this type of cloud, the cloud service provider makes services available to general public, the resources are shared by multiple users. Some examples of these are Windows Azure Services, Google App Engine, and IBM's Blue Cloud. However, there are few limitations such as security, privacy which might not be the best choice for critical and sensitive data [13],[14].
- **Private Cloud:** This type of cloud is usually suitable for organizations that require to maintain their own data center without giving up cloud capabilities. This setup can be expensive and is most ideal for large

enterprises and not for small and medium enterprises [13],[14].

- **Hybrid Cloud:** This is usually a combination of both public and private cloud. In this type, the companies can maintain their own private cloud infrastructure and also leverage the benefits of public cloud as and when required [14],[15].

Cloud services can be broadly classified into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS) offerings. Users can choose what set of services is right according to their business needs.

- **IaaS ("Infrastructure-as-a-Service"):** IaaS providers deploy and manage pre-configured and virtualized hardware and enable users to use virtual machines or computing power without the server management or initial hardware investments to set up. For example, Amazon Web Services, IaaS is provided through the Elastic Compute Cloud or EC2. IaaS packages cover the storage, networking, servers, and virtualization components, while the customers usually maintain the installation and maintenance of the operating system, databases, security components, and applications whereas the computing power is provided through the cloud [14].
- **PaaS ("Platform-as-a-Service"):** This type of cloud computing is growing immensely in popularity, PaaS solutions are most suitable for developers spend most of their time coding, testing, and deploying their applications instead of wasting time on hardware-

related tasks such as managing the security and operating system updates. Microsoft Azure is a popular PaaS solution, and another PaaS platform would be Google Cloud Platform App Engine. In addition to the managing the infrastructure, PaaS products also contain APIs and various tools that enable developers to make use of features for such as traffic splitting, traffic monitoring, and version control systems [14].

- SaaS (“Software-as-a-Service”): In this type of cloud computing, the cloud computing providers usually host application and make it available to users through a browser-based interface. This is one of the most familiar categories of cloud computing, where users most commonly interact with SaaS applications such as Gmail, Slack, Salesforce, or Dropbox. SaaS users can use the software without having to worry about managing the software, maintenance, development, update, backups or support. The users just need to have a browser-based interface to access the application. Hence this type of cloud computing has gained popularity in recent times [14].

Legacy business applications have always been expensive and complicated. The amount of hardware and software required to keep them running is daunting which is overcome by Cloud computing by providing few of the features such as Adaptability, Reliability, Security, Scalability, and Multi-tenancy. Realizing these benefits, most of the traditional businesses and small and medium companies are migrating to the cloud. This provides them a cost-effective pay as per usage model through which they can run their applications on the cloud without the need for any expensive hardware or computational power. This kind of solution has also facilitated the growth of E-Commerce and have enabled many small-scale businesses to go online and reach to a large user base and thus increase their revenue.

2. Literature review

There has been extensive research in the area cloud computing which has, in turn, produced various products and services to the customers. Many vendors provide the cloud services such as Oracle, Zoho, Google, Microsoft, IBM, Amazon, VMware, and EMC. With the increasing number of adoption of cloud technologies by enterprises, there is a vast scope for the cloud adoption by Small and Medium Enterprises (SME's). Cloud computing often leverages Massive scale, Homogeneity, Virtualization, Resilient computing (no stop computing), Low cost/free software, Geographic distribution, Service orientation Software and Advanced security technologies. In this paper, we review various SaaS approaches and the adoption of these methods in different fields.

SME's are presently presented with more prominent open doors of opportunities than ever for expanding their businesses across various sectors. The world economy is proliferating, and entrepreneurs are making remarkable improvements and revolutionizing multiple Industries like Information Technology, Engineering design, Retail, Pharmaceutical, Healthcare, Agro, and Service sector.

Cloud computing adoption

According to a survey conducted by the *Cloud Security Alliance* (CSA) [1] for understanding the cloud computing trends in India, it was observed that Software as a Service (SaaS) is the most preferred cloud service delivery model as it is preferred by 88.3% of the organizations in India. The report also highlights that the main functionality of the cloud was for a business application which was the preference of 88.3 % respondents. Moreover, 48.3 % of the respondents have already moved their HRM (Human-Resource Management) to the cloud.

There are over 35 million SME in India, and therefore SME will play a huge role in the growth of cloud computing in India [2].

The 2016 IDG Enterprise cloud research report indicates that cloud computing has become a powerhouse. Traditional cloud computing models such as SaaS, PaaS, and IaaS continue to be a necessity in an organization's IT environment, companies are focusing their resources and investing to be aware about latest cloud technologies and find the best one for hosting their IT applications – 56% of organizations are currently trying to find the IT operations that are suitable for hosting in the cloud.

IDG Enterprise's 2016 Cloud Computing survey dives deep into the research to find out how organizations are integrating cloud and future adoption. Cloud technology is becoming a necessity for any corporation's IT infrastructure as 70% of the corporations are hosting minimum one application in the cloud. Less total cost of ownership, excellent return-on-investment, on-premise legacy technology and enabling business continuity are the top business goals that continue to drive cloud investments. [3]

According to a survey conducted by McAfee, cloud services are widely used in some form, with 93% of organizations utilizing Software-as-a-Service, Infrastructure-as-a-Service, or Platform-as-a-Service offerings. [4].

Software as a Service provides the organization the distinct advantages of a lower total cost of ownership since the organization does not require any development investment nor an IT competency to maintain the given software [5].

Cloud computing models

E. Chovancova, L. Vokorokos and M. Chovanec analyzed the benefits of cloud computing and proposed a cloud computing system for small and medium corporations [6].

In the proposed solution, Vsphere, which is a software from VMw are was used for designing an IaaS cloud (Infrastructure-as-a-Service) service. This paper concludes that the fact that the creation of a functional cloud computing system with a suitable cloud-based platform is a good step for small and medium businesses, it was convinced during the creation of the practical part of this work. It was provided a simple model of a private cloud, which is not enormously difficult for the configuration, as well as for regular traffic.

Mohammad Nazim Kabiri and Muhammad Wannous proposed a model for the “Use of Cloud Computing and Mobile Technologies to Facilitate Access to an E-Learning Solution in Higher Education Context” [7]. In this suggested system, a solution based on cloud computing and mobile technologies to facilitate access to courses and learning materials anytime, anywhere was built. The solution consists of two parts: (i) Google Course Builder (An Open Source e-Learning Platform) which was customized and deployed on Google App Engine (GAE) and (ii) an Android Application which was developed to facilitate quick and easy access to learning contents on mobile devices. The solution saw an increase of 12 % in the average score of the students who had used the cloud solution.

Nacera Boussoulim and Youcef Aklouf presented a method to help customers to choose a better SaaS product satisfying most of their conditions and alternatives [8]. They made use of the analytic hierarchy process (AHP) which is a structured technique for organizing and analyzing complex decisions, based on psychology and mathematics. The users of AHP first decompose their decision problem into smaller hierarchies of more easily visible minor issues, each of which can be independently analyzed. This method helped us in the understanding of the importance and the significance of the quantitative method used to solve SaaS selection problem. This work also has discussed the major parameters, which are useful in a SaaS selection.

Francisco Kelsen de Oliveira, Max Brandao de Oliveira, Alex Sandro Gomes and Leandro Marques Queiros proposed a SaaS

model for Sharing of Educational Resources [9]. In this approach development model of Units of Learning (UoLs), Initial results have shown how Recreio is essential to incorporate tools of authorship of Units of Learnings, usually, online and free.

In addition, users' reports made an explicit need for a space for sharing and dissemination of the resources that are developed LMS, as well as another space which would be needed for exchanging experiences and learning the courses among multiple users.

A suitable framework for SaaS application business logic customization is proposed in [11]. Through this framework the complexity of customization is reduced, the capabilities of customization are expanded and the flexibility and effectiveness of customization are improved.

Adam Smith, JagdevBhogal and Mak Sharma provide an extensive intuitive on how cloud computing is revolutionizing the businesses and the information technology industry [12].

3. Research question/problem definition

The scope of the present study aims at developing a secure, reliable and scalable application which reduces the time for setup and capital expenditure. The question here arises that would it be possible to create such a cloud application that is also cost-effective and easily adoptable specially designed for SME's that are still using the traditional computing software. This proposed model aims to develop a SaaS model which can be used by SME's which is scalable, cost-effective and can improve their business operations when compared to the traditional business systems.

4. Objectives

Following are the objectives to be achieved from this research project:

1. To identify the scope of cloud computing for small and medium corporations.
2. Design and develop a sample application using SaaS approach.
3. Compare the SaaS approach with the existing approach and explain how it can benefit small and medium corporations.

5. Existing solutions

We have observed from the literature survey that most of the corporations have moved to cloud and a large number of small and medium corporations are planning to move adapt to cloud computing. These corporations use the traditional systems which are usually an On-Premise Model in which traditional data centers which consist of different hardware, such as a desktop computer, which is connected to a network generally via a remote server. The server is typically installed on the premises and provides all employees who use the hardware, access to applications and stored data [16].

Businesses with the traditional IT model must purchase additional hardware and upgrade their software and operating systems in order to scale up their storage and services to support a large number of users. Mandatory upgrades are required with this kind of IT infrastructure to ensure that the systems are fail proof safe and are in place to in case of a hardware failure. For many businesses with hosted IT data centers, an in-house IT department is necessary to install and maintain the hardware. Cloud computing model overcomes this by providing a reliable, easy to setup, scalable solution [16].

6. Methodology

Software on demand refers to computer applications that are delivered as a service via the Internet. This type of software is also referred to as on-demand software, SaaS (Software-as-a-Service) and Applications-as-a-Service. Software on demand is a new paradigm for the industry that provides the primary benefit of lowered operational and capital expenses for enterprise information technology services. When an organization decides to implement software on demand as a solution for their enterprise software needs, internal information technology services can become more efficient. This is brought about since IT personnel is no longer required to focus on the installation, maintenance and support of enterprise software and the hardware that supports such software. The efficiency gains delivered by software on demand free up IT personnel for the more critical task of managing IT resources as a strategic tool to optimize their business operations.

In this paper we develop a sample model using SaaS approach for small and medium enterprises.

7. Implementation details

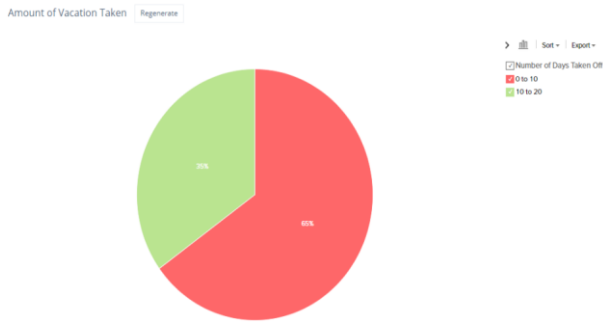
We have implemented cloud computing in this paper using Software-as-a-Service(SaaS). In our approach, we have tried to streamline one of the key operations in any small and medium corporation that would be HR(Human Resources) management. For this we would be considering one function of HR, i.e Employee leave Management. We have created an application for Employee Leave Management using a tool called Zoho creator by Zoho Corporation. Zoho Corporation is an information technology and business management SaaS provider. The application allows the employee to request for leave and the admin/manager to approve/reject the request. It also provides customized reports and calendar integration to the user.

Main interface of the application

Here the employee can request for leave based on his need. The user has to provide a start and end date for the leave period. The maximum number of days he can avail in a financial year would be 20.

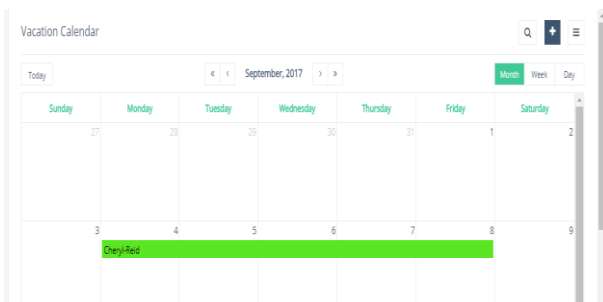
Generating reports

Here we have generated a Pie Chart based on the number of days of leave taken by the employees. Users can create custom reports based on their request, which helps them to get an analytical view of the data.



Calendar integration

The leave requests requested by the user are integrated with the calendar. The admin can view this calendar to check if there would be any clashes in the schedule and then approve/reject the request based on employee availability.



8. Result analysis

In this work, we have seen how we can develop a sample SaaS application with minimum setup time and efficiently when compared to the traditional approach. When we compare this with the traditional method, we can find the below advantages.

- Ease of development.
- No separate hardware was required.
- Easily scalable.
- Can efficiently streamline business operations in less time.

Table 1 compares the cloud computing approach with the earlier traditional approach on different parameters.

Table 1: Cloud Systems vs Earlier Traditional Systems

Parameter	Traditional System	Cloud computing system
Software	Needs to be installed on each system	Need to be installed on the cloud provider server.
Software Update	On Each system	Can be remotely managed
Accessibility	Individual System	Accessible from any device with internet.
Data Recovery	Difficult	Easy
Setup	Initial Setup cost is more	Cost is less for initial setup.
Pay Amount	Pay for resources	Pay as-per-go service
Scalability	Limited to existing resources	Easily scalable as resources can be scaled on the cloud
Manpower	Need DBA'/SA's to maintain the physical system	Maintenance can be done by the service provider on the cloud
Application Development	Manual	Can be done in the cloud

9. Conclusion and future work

Cloud computing has become a backbone in enabling the small and medium corporations to go online. In this paper, we have

seen how small and medium corporations are adapting to cloud computing technologies and the vast opportunity cloud computing poses for these. We have also seen how cloud computing can benefit the small and medium corporations over traditional computing. We have also seen how different SaaS models have helped in various domains. Traditional ERP systems involve a higher level of difficulty in terms of adaptability than the Cloud computing services. The dream of rapidly using an application on the cloud without maintaining, upgrade or install any apps on the cloud will be achieved SaaS. In future, we wish to incorporate definite steps that would enhance the efficiency and productivity of SME'S. This could be in the form of creating a SaaS model for streamlining the business of small and medium enterprises and add specific backup and recovery features which would prevent data loss in case of an attack.

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