

# Everyday Cloud Computing with SaaS

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**Abstract** - This paper consists of three major sections that describe cloud computing services. The first section explains what is cloud computing and also summarizes the: (1) benefits of cloud computing from a business prospective and (2) different levels of cloud computing architecture such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure/Hardware as a Service (IaaS/HaaS). The Second section compares three major SaaS providers' services. The following companies were selected for a comparative analysis: Google, Zoho and Salesforce. The comparative analysis compares applications of the three companies that are similar products; such as: 1) Zoho and Google online office suit applications, 2) Zoho CRM and Salesforce CRM and 3) application markets that been launched by all three companies. The final section describes the future of software-as-a-service provided by cloud computing.

**Keywords:** Cloud Computing, SaaS, Zoho, Salesforce.com, GoogleApps

## 1 Background

### 1.1 Cloud Computing Definition

In the Information Technology world, cloud computing is one of the hottest and most popular topics. With the appearance of Web 2.0 and Web 3.0 technologies, the management of applications and data storage has begun to shift from the personal servers to "the cloud." For many users, cloud computing is not a new service as Google Docs has been in use for many years. National Institute of Standards and Technology (NIST) currently defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." [1] This Cloud model promotes availability and is composed of five essential characteristics: On-demand self-service; Broad network access; Resource pooling; Rapid elasticity; Measured Service. Figure 1 shows a typical cloud computing system.

Cloud Computing provides hosting different applications and information technology services so that

they can be deployed and scaled quickly. Cloud providers accomplish this by investing in large, general-purpose compute infrastructures and using virtualization to divide this infrastructure up between multiple consumers and services. Cloud capacity can be easily added or removed to a specific service. As total capacity demands grow, the cloud provider deploys additional low-cost.

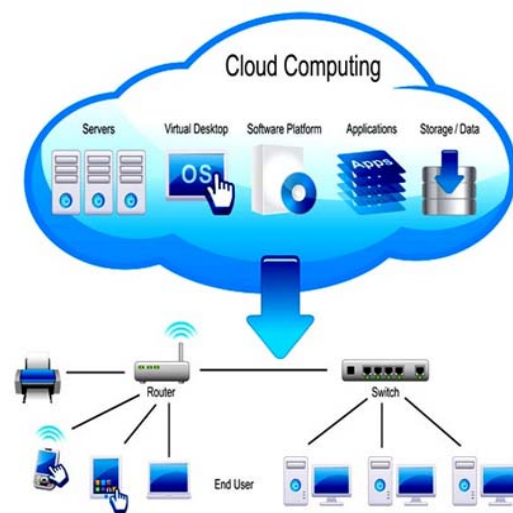


Figure 1: Cloud Computing System. [2]

### 1.2 Benefits of Cloud Computing

Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski detailed several business benefits to building applications in the cloud [3]:

*Almost zero upfront infrastructure investment:* If a company is considering the development of a large-scale system, it may cost a *fortune* to invest in real estate, physical security, hardware (racks, servers, routers, backup power supplies), hardware management (power management, cooling), and operations personnel. Due to the high upfront costs, the project would typically require several rounds of management approvals before the project could even be initiated. With utility-style cloud computing, there is no fixed cost or startup cost.

*Just-in-time Infrastructure:* In the past, if your application became popular and the systems or the ... infrastructure did not scale, you became a victim of your own success. Conversely, if you invested heavily and did not get a ROI, you became a victim of your failure. By

deploying applications in-the-cloud with just-in-time self-provisioning, you do not have to worry about pre-procuring capacity for large-scale systems. This increases agility, lowers risk and lowers operational cost because you scale only as you *grow* and only pay for what you use. Source of these ideas?

*More efficient resource utilization:* System administrators usually worry about procuring hardware (when they run out of capacity) and higher infrastructure utilization (when they have excess and idle capacity). With the cloud, they can manage resources more effectively and efficiently by having the applications request and relinquish resources on-demand. Insufficient or excess computing power / resources are not issues...

*Usage-based costing:* With utility-style pricing, you are billed only for the infrastructure that has been used. You are not paying for allocated but unused infrastructure. This adds a new dimension to cost savings. You can see immediate cost savings (sometimes as early as your next month's bill) when you deploy an optimization patch to update your cloud application. For example, if a caching layer can reduce your data requests by 70%, the savings begin to accrue immediately and you see the reward right in the next bill. Moreover, if you are building platforms on the top of the cloud, you can pass on the same flexible, variable usage-based cost structure to your own customers.

*Reduced time to market:* Parallelization is the one of the great ways to speed up processing. For example, assume that for one compute-intensive or data-intensive job that can be run in parallel takes 500 hours to process on one machine. With cloud architectures, it would be possible to spawn and launch 500 instances and process the same job in 1 hour. [4] Having available an elastic infrastructure provides the application with the ability to exploit parallelization in a cost-effective manner reducing time to market.

### 1.3 Cloud Computing Architecture

Cloud Computing aims to be global and to provide such services to the masses, ranging from the end user that hosts its personal documents on the Internet to enterprises outsourcing their entire information technology infrastructure to external data centers.

Figure 2 represent the layered organization of the cloud stack from physical infrastructure to applications. These abstraction levels can be viewed as a layered cloud computing architecture where services of a higher layer can be composed from services of the underlying layer. The cloud computing architecture consists of: *Software as a Service (SaaS)*, *Platform as a Service (PaaS)*, and *Infrastructure/Hardware as a Service (IaaS/HaaS)*.

*Infrastructure as a Service (IaaS)* provides general on-demand computing resources such as

virtualized servers or various forms of storage (block, key/value, database, etc.) as metered resources. It is also known as *Hardware as a Service (HaaS)*. This is often viewed as a direct evolution of shared hosting with added on-demand scaling via resource virtualization and use-based billing.

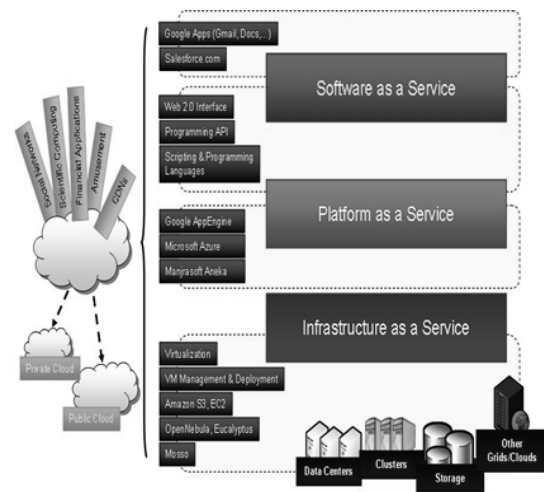


Figure 2 - Cloud Computing Architecture. [5]

*Platform as a Service (PaaS)* provides an existent managed higher-level software infrastructure for building particular classes of applications and services. The platform includes the use of underlying computing resources. PaaS offers a faster, more cost-effective model for application development and delivery. PaaS provides the entire infrastructure needed to run applications over the Internet.

*Software as a Service (SaaS)* is a software distribution model in which applications are hosted by a cloud service provider and made available to consumers over a network (usually the Internet). Organizations do not install software on their own computers; instead, they simply use their browser to access the software as it is provided over the Internet (software provided as a service). SaaS is becoming an increasingly prevalent delivery model as underlying technologies that support web services and service-oriented architecture (SOA) mature and new developmental approaches become popular. SaaS is most often implemented to provide business software functionality to enterprising customers at a low cost while allowing those customers to obtain the same benefits of commercially licensed, internally operated software. In addition to be cost efficient, it allows users to avoid the complexity of installation, management, support, licensing, and high initial cost of commercially licensed, internally operated software.

As a part of a business model of cloud computing, SaaS has significant value. *Controlling software licensing costs* are reduced by utilizing a software service provider licensing, patches, upgrades. An organization pays for what it needs

(software elasticity). A cloud service provider allows the customer to establish an approved applications list and keep it enforced. Also IT departments do not need to support random applications specific to one of users. Further, streamlining application support improves efficiencies, expertise and keeps everyone working and *controlroque software installations*. Finally, *infrastructure expenses* are reduced because web-based application access, which allows companies to purchase only the amount of desktop power needed for company service requirements.

According to a study by Mertz, SaaS is becoming increasingly important in most enterprise application software (EAS) markets. Worldwide software revenues for SaaS delivery are forecasted to grow by 19.4% overall between 2008 and 2013. [6] Researchers see promising opportunities for the successful adoption of SaaS, especially in those application markets requiring low levels of system customization (e.g., Office suites).[7]

Today, SaaS is visible in such applications as Salesforce.com and Google Apps. Salesforce.com, which relies on the SaaS model, offers business productivity applications (CRM) that reside completely on their servers. This allows costumers to customize and access applications on demand. Companies have also unveiled SaaS applications for individual customers. Examples include Google’s spreadsheets and Microsoft’s OneCare service; the latter provides virus and spyware cleanup for personal computers.[8] Other examples offered by variety of cloud providers include: Customer Service, HR, Project Management, Web Conferencing, Helpdesks, Wikis, Blogs and other intranet like applications.

There are several different cloud providers. Depends on your business goal, needs and budget, you always can find a suitable cloud computing provider.

## 2 Google, Zoho, and Salesforce Comparison

According to David Hilley, cloud computing is a promising industry on the cusp of high growth that is attracting many potential entrants.[9] There exists a variety of software-as-service providers and vendors that offer tailored services depending on client’s business needs and budget. Figure 3 shows major players in cloud computing world.

The business and economical reasons for cloud computing are a direct result of various advantages enjoyed by Cloud Computing technology heavy weights such as Google, Amazon, Salesforce, Zoho and others. Three competitive companies were selected for this study: Google Apps, Zoho and Salesforce. All three companies

offer wide spectrum of services that are competitive with each other. For example, both Google and Zoho offer office suite applications that provide consumers virtually everything needed in terms of office software that are available online through their respective websites. The services are comprehensive, reliable, and surprisingly inviting. These services include e-mail service, calendar, document editor, spreadsheet, and other secondary office applications. Zoho also offers Customer Relationship Management (CRM) that is similar to CRM services offered by Salesforce (i.e., accounts, contacts, quotes, etc.). However, Salesforce offers more comprehensive and advanced services versus ZoHO. From the consumer’s prospective, it is prudent to compare services and pick the perfect service matching one’s own business needs.

Cloud Computing Provider	Layer
Akamai	PaaS, SaaS
Amazon Web Services	IaaS, PaaS, SaaS
EMC	SaaS
Eucalyptus	IaaS open source software
Google	PaaS(AppEngine), SaaS
IBM	PaaS, SaaS
Linode	IaaS
Microsoft	PaaS (Azure), SaaS
Rackspace	IaaS, PaaS, SaaS
Salesforce.com	PaaS, SaaS
VMware vCloud	PaaS, IaaS
Zoho	SaaS

Figure 3: Major Cloud Computing Providers. [10]

Table 1 (See Appendices) shows the compatible services of three different cloud computing providers. The table was created after detailed research of service spectrum of three SaaS providers.

What follows below is more focus comparative review of the major cloud computing services; such as: 1) Zoho and Google online office suit applications, 2) Zoho CRM and Salesforce CRM and 3) application markets that have launched by all three companies.

### 2.1 Zoho and Google Office Suit Applications

With the advancement of web technologies over the past several years, Internet tools offer many of the same features as MS Office at a greatly reduced cost or for free. These tools or applications work within any web browser. This past year, Google received significant attention with its Google Docs and Spreadsheets, and Gmail applications. The Zoho Suite, probably a better integrated but less-known, offers the same tools as Google suite free to individuals at a lower price. For example, the Google Apps suite is priced at \$50 per user/year and the equivalent Zoho Business service is priced at \$40 per user/year. Zoho supporter Raju Vegesna has stated that “Zoho is targeted at business users while Google’s aiming

for consumers, Zoho offers 20-30% more functionality than Google". [11]

Both Google Apps and Zoho Business Service offer browser-based office applications such as word processor and spreadsheet; communication tools like chat and email, and collaboration tools like project managers and wikis. However the business-oriented Zoho and the consumer-oriented Google applications do vary slightly in offered services. This section of the study compares Zoho and Google's currently offered office web services.

Both Google Docs and Zoho Business Service are available as stand-alone products and offer reasonably full-featured word processing capabilities. Google Docs has a simple look to it, but it contains most of the basic formatting options available in Word. More advanced features such as pagination and adding footnotes are not available with Google Docs. Fortunately, users can save their Google documents in different formats—including Word, RTF, PDF, HTML and OpenOffice. Zoho Writer has the appearance of a traditional word processor interface offering all the features of Google Docs plus a few more. On the file-sharing side, both Google and Zoho have the ability to collaborate document production with other users including in real-time. Zoho makes it easier to work with MS Word with its recently introduced plug-in, which lets a user create a document in Word or Excel then exports it directly to Zoho so other participants can collaborate. In addition, both Zoho and Google also have a Publishing feature, which sends your document directly to a Web site or blog without requiring any knowledge about HTML or other Web software.

Generally speaking, the Google Calendar is easier to use than Zoho's. It is simple to add a meeting to the calendar and update scheduled events. One of its finer features is the ability to receive notifications by e-mail or by SMS text message for event reminders, daily agenda and invitations. The disadvantages include not being able to sync it with other calendar programs.

Unlike Google Calendar, the Zoho Calendar is not available as a stand-alone product. To use it, you must register for the Zoho Virtual Office Suite. Although it is similar to Google Calendar, Zoho's Calendar is not as easy to use. However, Zoho does provide a task list as well as the ability to export your calendar to other applications; features Google Calendar does not provide.

Google Spreadsheets and Zoho Sheet offer basic spreadsheet functions as well as more advanced formulas. They differ, though, in a couple of respects. Google does not allow the creation of charts while Zoho provides four basic chart templates. Also, Google permits real-time collaborative editing, but Zoho does not.

Zoho offers Zoho Show, which lets users create, edit, publish and show presentations remotely. It is important to note that Zoho, as with other web-based

applications, cannot match the features offered by PowerPoint. Perhaps Google understands this because it does not provide a presentation application.

Gmail was one of Google's first efficient tools, and it continues to be the most popular. All users receive at least 2.8GB of mail storage, if not more. Gmail is quick and is accessible on your mobile phone. Zoho's E-Mail component, like its Calendar, is offered only through the Zoho Virtual Office Suite, but Zoho E-mail offers many more options than Gmail. In addition to being able to organize your e-mail by folders, you can save an e-mail as a task, calendar item, note, document or other item.

## 2.2 Zoho and Salesforce CRM Comparison

The following table (Table 2) compares different characteristics of the Zoho CRM and Salesforce CRM services:

Both Zoho and Salesforce CRM are similar in functionality and base features. Therefore, cost and business needs are the driving factors in determining which one to utilize. Zoho is a good choice for small companies with limited budgets as it is free for the first 3 users. Additionally, it is also scalable allowing for future growth while providing many initial features. On the other hand, larger companies tend to benefit from Salesforce and the integration that has been developed between Salesforce and other business applications. Salesforce is a building out platform development offering excellent and comprehensive enterprise solutions.

While Salesforce is not a better option than Zoho as far as a CRM service is concerned, Salesforce is a safer choice for a larger companies and enterprises. However, Salesforce cloud services do potentially offer superior ROI than Zoho. Salesforce CRM can be integrated with Google Apps (Docs, Gmail, etc) if a company is using Gdocs.

## 2.3 Application Market from Zoho, Google and Salesforce

Table 3 (See Appendix) compares the cloud service applications offered by the three companies. The comparative table is based off of information provided several resources including websites of each provider [12], [13], [14] and web-based articles concerning the Zoho Marketplace, [15] Google Apps Marketplace [16] and AppExchange [17].

All three companies generated the cloud service market in order to expand their own already existing services. Zoho, Google and Salesforce have increased their presence by letting third-party companies or developers create, sell or buy applications that integrate with their cloud service applications. Understanding the dominate presence of cloud giants like Google, Zoho has

collaborated with Google Apps creating one of the biggest partners of the Google Marketplace. Applications are created using Zoho Creator that easily integrate with Google Apps. Salesforce has not collaborated with Google and has its own platform to create custom applications for AppExchange.

The cloud computing market continues to grow each year with AppExchange having the most number of existing applications on market; around 1300 applications. AppExchange leads the market due in part to the fact that Salesforce launched it in 2006; several years before Zoho and Google started their cloud application marketing.

The corporate environments and business strategies are very different among these three companies. Zoho offers complete freedom to developers and does not charge for transactions. Their main revenue stream is generated from license fees for another edition of Zoho Creator. Google is not as generous to developers; third-party companies keep just 80% of revenue and pay a \$100 to become a vendor. Out of the three companies, Salesforce has the most expensive service.

### **3 Future: Cloud and SaaS**

Cloud computing has the potential to be as routine as traditional services such as electrical, telephone or water utilities. Cloud computing users would simply subscribe and pay for the usage in the same manner as traditional utilities. The primary attraction likely for continued growth is that it allows users and businesses to have access to needed technological infrastructure without having to invest in costly servers and information technology. The saving in capital expenditures allows users to concentrate on their core businesses.

The universal application of new applications is also likely to result in cloud computing use and growth. Developers would simply making new applications available to the cloud computing service provider who in turn place the new applications on its servers making new resources instantly available to every subscriber at the same time. The cost of marketing and selling new applications would be avoided significantly reducing indirect and direct overhead costs. This universal application of the new resource would lead to huge savings in computer time as newer software would be instantly available without any need for downloading it on to individual computers and system specific reconfigurations would be avoided.

In addition, the system requirements of end users would be less of a factor. Computers would not require high capacity hard drives as storage would be provided by the service providers. This could greatly reduce the cost of setting up information technology departments, which again need their own service setups. It will also allow users to keep what would otherwise obsolete computers in

production be for much longer. The key infrastructure needs would be simple upgrades of present systems to ensure fast access to the internet and the ability to use all the services that are on offer.

As all users will be using the same applications. The portability of data and information will be easy allowing companies to work worldwide by having all the same information and data available to all departments/offices/employees. This will greatly reduce the investment of time and resources traditionally expended on logistically managing uniformity across a given company's landscape.

The need for very costly high end servers for individual companies and institutions will become almost zero, as they would have full access to the servers of the service provider. What is expected is that the development of services will include providing huge resources for parallel computing. This expectation is just one aspect of the possible future development of cloud computing.

In Janna Anderson's report, she mentions that some experts predict that by 2020 most people will access software applications online and share and access information through the use of remote server networks rather than depending primarily on tools and information housed on individual, personal computers.

The highly engaged, diverse set of respondents to an online survey included 895 technology stakeholders and critics. The study was fielded by the Pew Research Center's Internet & American Life Project and Elon University's Imagining the Internet Center. Approximately 71% of the respondents agreed that "By 2020, most people won't do their work with software running on a general-purpose PC. Instead, they will work in Internet-based applications such as Google Docs, and in applications run from smart phones. Aspiring application developers will develop for smartphone vendors and companies that provide Internet-based applications, because most innovative work will be done in that domain, instead of designing applications that run on a PC operating system." [18]

The 27% that disagreed with the above statement believed that "By 2020, most people will still do their work with software running on a general-purpose PC. Internet-based applications like Google Docs and applications run from smartphones will have some functionality, but the most innovative and important applications will run on (and spring from) a PC operating system. Aspiring application designers will write mostly for PCs." [19]

Among the other observations made by those taking the survey were: "large businesses are far less likely to put most of their work 'in the cloud' anytime soon because of control and security issues; most people are not able to discern the difference between accessing

data and applications on their desktop and in the cloud; low-income people in least-developed areas of the world are most likely to use the cloud, accessing it through connection by phone". [19]

So cloud computing software-as-service has a promising future. However, this promising future is contingent on infrastructure of a very high caliber so that connections to the Internet are not interrupted because of poor power or other problems.

## 4 Conclusions

It is expected that Cloud Computing will be the wave of the future in terms of computing. It is only logical that the cloud's economies of scale and flexibility will impact how technology evolves and how users implement these technologies.

Cloud computing offers real alternatives to IT departments for improved flexibility and lower cost. Markets are developing for the delivery of software applications, platforms, and infrastructure as a service to IT departments over the "cloud." These services are readily accessible on a pay-per-use basis and offer great alternatives to businesses that need the flexibility to rent infrastructure on a temporary basis or to reduce costs.

Architects in larger enterprises find that it may still be more cost effective to provide the desired services in-house in the form of "private clouds" to minimize cost and maximize compatibility with internal standards and regulations. If so, there are several options for future-state systems and technical architectures that these users should consider in order to find the right trade-off between cost and flexibility. Using an architectural framework will help users evaluate these trade-offs within the context of the business architecture and design a system that accomplishes the business goal. All of which will increase the return on investment as well as decrease operational costs normally involved with in house systems processing the same data as in the cloud.

Cloud platforms are not yet at the center of most people's attention. The odds are good, though, that this will not be the case in the next five years. The attraction of cloud-based computing, including scalability and lower costs, are significant and will unlikely be ignored. Application developers should expect the cloud to play an increasing role in the future.

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	Google	Zoho	Salesforce
Word Processor	Google Docs	Zoho Writer	
Spreadsheet	Google Spreadsheet	Zoho Sheet	
Slideshows	Google Presentation	Zoho Show	
Web Clippings	Google Notebook	Zoho Notebook	
Email	Gmail	Zoho Mail	Email and calendaring (one of CRM <sup>1</sup> features)
Chat	Google Talk	Zoho Chat	Chatter
Wiki	(Google acquired JotSpot)	Zoho Wiki	
Application Market	Google Marketplace	Zoho Marketplace	AppExchange
Online Database		Zoho DB	
Project Management		Zoho Projects	
Web Conferencing	(Google acquired Marratech)	Zoho Meeting	
Customer Relationship Manager		Zoho CRM	Salesforce CRM solutions
Personal Organizer		Zoho Planner	Email and calendaring (one of CRM features)
Web site hosting	Google Page Creator		
Feed Reader	Google Reader		
Personalized Homepage	iGoogle	(Zoho Start Page only for Zoho Apps)	

Table 1: Comparative table of providing services of three main SaaS providers

Characteristics	Zoho CRM	Salesforce CRM
<i>Charges</i>	\$12 or \$25 per user per month	\$65 per user per month
<i>Free service</i>	Free version	Free 30-day trial
<i>Integration</i>	Integration with their complete suite of Zoho Apps	Integration via a web services API
<i>Business focus</i>	Small to medium business	Medium to large business
<i>CRM Features</i>	Sales force Automation, Marketing Automation, Support Management, Order Management, Reporting & Analysis, Workflow Management, Outlook Edition	Sales force Automation, Marketing Automation, Document Management, Contract Management, Customer Service & Support, Analytics, Mobile CRM, AppExchange
<i>Company strengths</i>	<ul style="list-style-type: none"> <li>- Lowest TCO with a rich feature set at a competitive price</li> <li>- Flexible deployment options (On-Demand as well as On-Premise CRM solution)</li> <li>- Ease of usage with web-based user interface, and Total customizability</li> <li>- Affordability</li> </ul>	<ul style="list-style-type: none"> <li>- Sales force automation</li> <li>- Ease of use</li> <li>- Intuitive interfaces</li> <li>- Established status</li> <li>- Flexible customization</li> <li>- Integration and extensibility</li> </ul>

Table 2: Comparison of the Zoho CRM and SalesForce CRM

<sup>1</sup> Customer Relationship Management (CRM)