

Engineering Management
Field Project

**Cloud Computing - Software as a Service (SaaS)
CRM Application**

By

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Executive Summary

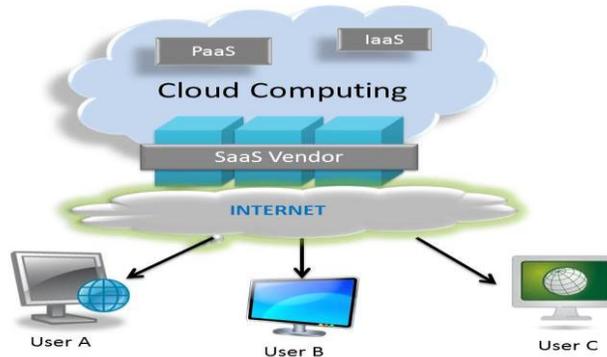
The software industry has a tremendously competitive environment at the global and regional levels and the companies usually follow the differentiation strategy. Most of the software companies are going through a change as a new economical and efficient computing process is evolving known as “Cloud Computing.”

The main characteristic of Cloud Computing is on demand self-service. A consumer can unilaterally obtain computing capabilities, such as server time and network storage, as needed automatically without having to interact with each service’s provider. (See Appendix B).

Cloud Computing has three different service models (or stacks): IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service). In addition, it has four types of deployment models: Private Cloud, Public Cloud, Hybrid Cloud and Community Cloud. (See Appendix B).

SaaS is the most predominant type of cloud computing service model. SaaS is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.

Figure 1 – Cloud Computing Methodology



(Source: Google - Cloud computing methodology images)

The purpose of this paper is to evaluate the SaaS model as an alternative to the classical “on-premises” model used by enterprises. The software model is traditionally expensive and has a complex implementation process. The benefits that the SaaS model could offer to enterprises are best explained by the following case study.

This paper exhibits the case study of the Visiting Nurse Service of New York (VNAs-XY) – a CRM system – that automates home health services with the Service Cloud provided by ABC-Force.com (ABCF). Most of the functionality is accessed entirely through a standard web browser. This is a well-known SaaS implementation with several industry publications. However, some of the information in this paper is based on the personal experience of the author who has been working in the IT industry for 20+ years.

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CHAPTER 1 – Introduction

We are living in the Web era, in which hundreds of millions of people are connected to the Internet, and millions of those people are connecting on social networking sites such as Facebook, LinkedIn, MySpace, and Twitter, using blogs, and posting on YouTube and Flickr.

The vast number of ways in which people can be connected online has sparked the interest in cloud computing services. The cloud computing phenomenon started with vendors offering “real estate” to host applications for businesses. In this model, the businesses would develop an application on the premises and host it at the vendor’s site. The cloud model differs in that the application is not owned or developed by the business but instead software is offered as a service by the SaaS/Cloud vendor. Cloud computing services have been developing ways to tap into the Web world and establish the means of turning the flow of information and communication into business potential. In addition to social networking, cloud computing is also finding its niche in the health care industry.

The Visiting Nurse Agencies of New York (VNAs-XY) is the largest not-for-profit home healthcare organization in the nation, with more than 12,000 employees. In 2007, VNAs-XY made well over 2 million professional home visits, covering everything from pre-natal to end-of life care to more than 131,000 patients throughout New York City and Westchester and Nassau Counties.

The computing environment of VNAs-XY comprises approximately 4,000 mobile nurses with tablet PCs, 8,000 technology accounts, 325 servers and an additional 3,500 endpoints. The company generates vast quantities of messages per second. In the course of an ordinary day, VNAs-XY provides home healthcare services to between 30,000 and 35,000 clients, which generates an enormous quantity of data, all of which must be tracked, securely stored and easily retrieved.

Over time, VNAs-XY's information technology grew into large, unmanaged, and disconnected systems. The company started seriously looking into the SaaS model so that it could provide a simple web interface to the end users, manage huge amounts of data, and comply with HIPAA regulations, all while reaping the benefits of the SaaS model, which include but are not limited to reduced costs, ease of maintenance and scalability. As a pilot project, VNAs-XY wanted to automate home health services with the Service Cloud. In their home health services, the organization takes care of patients of all ages, from infants to the elderly and provides comprehensive services from maternal/child health programs to hospice care.

VNAs-XY evaluated the service providers who could provide them the platform(s) to implement their pilot project. Instead of working with different providers for each service model, they preferred to work with one service provider who had integrated service models to avoid integration and multi-vendor issues. They used the Industry's best known practices and criteria to select the Service Provider. The key criteria used for choosing Service Provider were the following: Reliability and

Reputation, Sustainability, Support and Service Level Agreements, Technology Expertise, Cost, and Security of the Cloud.

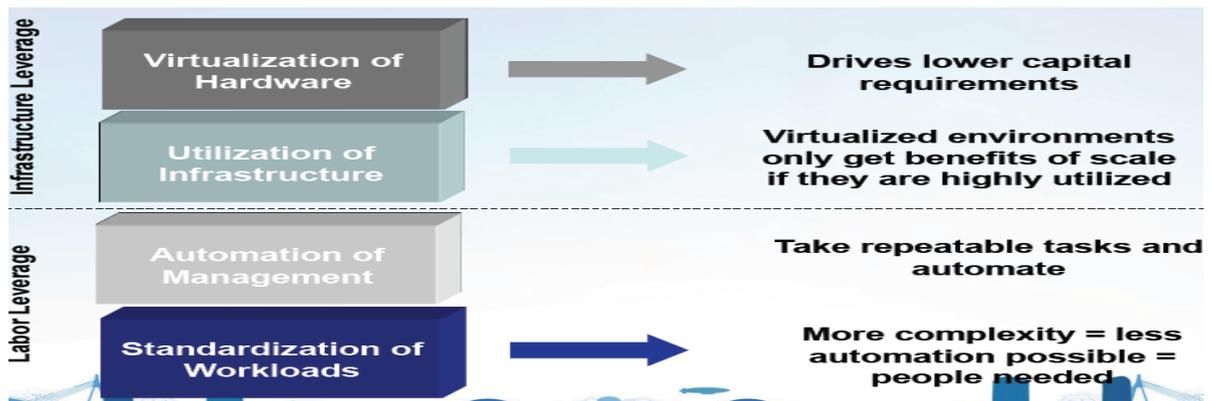
ABC-Force.com (ABCF) was selected as a preferred cloud computing service provider to implement 200+ VNAs sites across the US. ABCF, which specializes in software as a service (SaaS), was established in March of 1999 and is headquartered in San Francisco. ABCF was one of the earliest Cloud Computing companies to be setup with a specific focus on CRM and to function as a SaaS company.

Initially, ABCF picked up 10 different VNAs sites to implement a proposed solution; the first pilot system was developed for the Visiting Nurse Agencies of New York (VNAs-XY) site in 8-12 months. If this system meets all VNAs-XY requirements, then other sites will be implemented in the next 5 - 7 years. (See Appendix A).

CHAPTER 2 – Literature Review

Cloud computing has soared in the software industry since 2006 because of the fervor for the technology and the rapid growth of pioneering technology companies. The lower cost of cloud computing, compared to traditional IT investments (hardware, software, highly skilled labor, service, etc.) was the main reason behind the rise and adoptability of cloud. The cost sensitive industries were adopting clouds increasingly, and the cloud providers responded by expanding their services. Cloud computing could provide economic leverage in terms of infrastructure and labor. The virtualization of hardware resulted in lower capital requirement and utilization of infrastructure gave economy of scale by usage. The labor leverage could be obtained by repeatable and automated tasks and standardization of workloads. Standardization could be a solution provided by cloud computing by allowing for the automation of complex customized applications. A pictorial representation is given below.

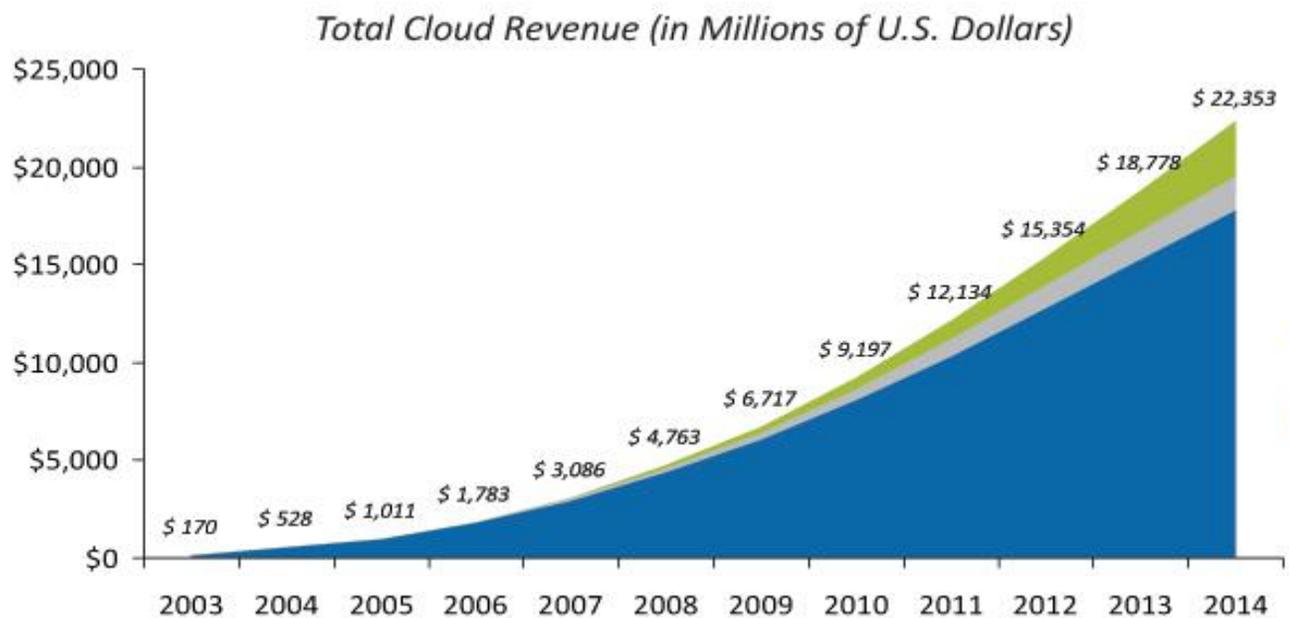
Figure 2 – Major factors driving cloud computing



(Source: IBM Cloud Computing Case Studies by Zhu)

According to the International Data Corporation (IDC), a leading US research firm, by 2011, 80% of the new software was offered and made available through cloud. Another research company, Yankee Group, did a global forecast for cloud computing and predicted a significant revenue growth (shown in the chart below) (Palumbo and Swain 2011).

Figure 3 – Cloud computing growth chart



(Source: Yankee Group Research Report - Posted by Kim, 2011).

The cloud computing can be segmented into three parts: software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS). Software as a service (SaaS) refers to the access of software applications through a thin client interface, usually a web browser. These applications were maintained in a third-party data center and offered as an on demand seat or pay-per-use model. Adoption of SaaS required minimum

investment in software, hardware, maintenance and rapid deployment from the client end. SaaS had a forecast of high growth as shown the table & chart below. (See Appendix A).

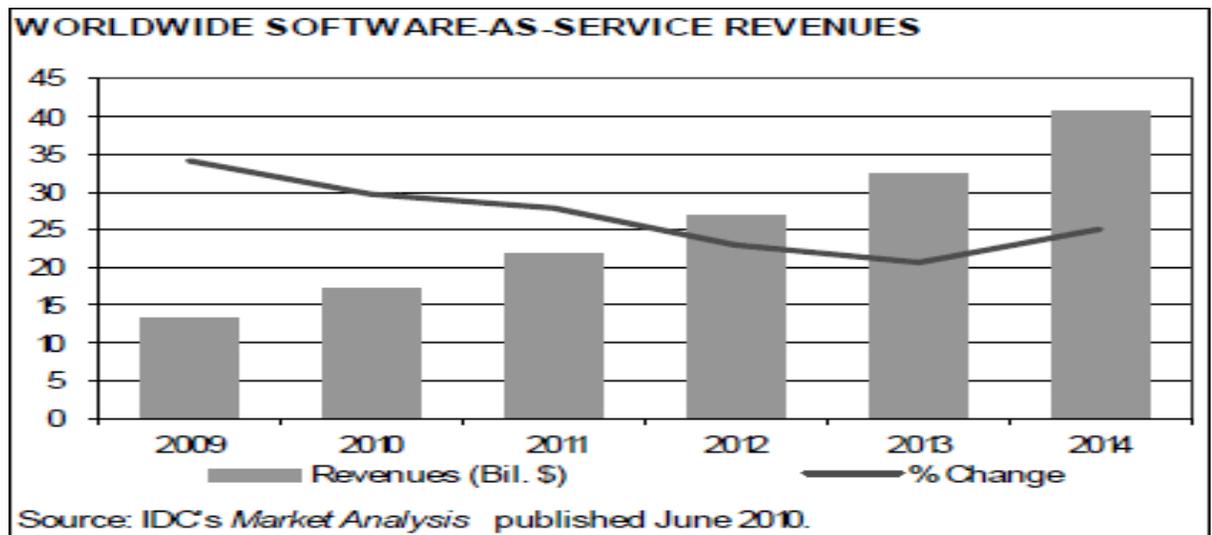
Figure 4 – Worldwide SaaS forecast by segment

WORLDWIDE SOFTWARE-AS-SERVICE REVENUES FORECAST BY SEGMENT							CAGR (%)
	2009	2010	2011	2012	2013	2014	2009-2014
UNITS SHIPPED (THOUS.)							
Systems infrastructure software	3,385	4,381	5,676	7,194	8,877	11,345	27.4
Application development and deployment	1,647	2,264	3,130	4,325	6,075	8,618	39.2
Applications	8,118	10,431	13,040	15,332	17,470	20,580	20.4
Total	13,151	17,076	21,846	26,852	32,422	40,543	25.3
MARKET SHARE (%)							
Systems infrastructure software	25.7	25.7	26.0	26.8	27.4	28.0	...
Application development and deployment	12.5	13.3	14.3	16.1	18.7	21.3	...
Applications	61.7	61.1	59.7	57.1	53.9	50.8	...
YEAR-TO-YEAR % CHANGE							
Systems infrastructure software	34.0	29.4	29.5	26.8	23.4	27.8	...
Application development and deployment	41.0	37.4	38.3	38.2	40.4	41.9	...
Applications	43.0	28.5	25.0	17.6	13.9	17.8	...

Totals may not add due to rounding. CAGR-Compound annual growth rate.
Source: IDC's *Market Analysis* published June 2010.

(Source: IDC's - Market Analysis, Mahowald - 2010)

Figure 5 – Worldwide SaaS Revenues

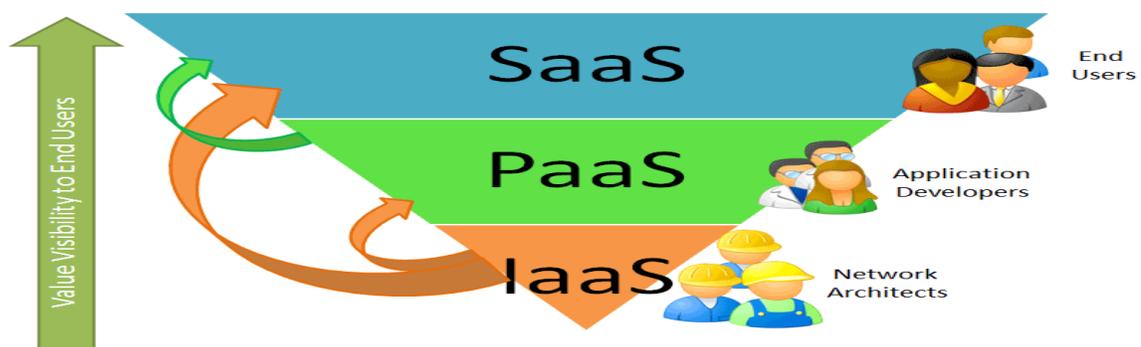


(Source: IDC's - Market Analysis, Mahowald – 2010)

Another type, Platform-as-a-service (PaaS) solutions offered resources to support development, deployment and hosting of software applications created by customers in the cloud. The PaaS market was smaller than that of SaaS. SaaS examples include web based emails (Yahoo, Gmail, Hotmail, etc.) and examples of PaaS are Salesforce.com's Force.com, Google Inc.'s Google App engine, and Microsoft Corp.'s Azure, etc. SaaS were usually the built in applications that could be used by customers directly (without any purchase or installation in the customer's computer), and PaaS was the platform by which the customer could create their customized software programs using resources available with cloud providers. Another type of cloud computing, Infrastructure-as-a-Service (IaaS) gave its solution providers the capability to maintain the hardware while offering access to servers, processing, storage, and data networking resources on a usage basis to customers (Fowler and Worthen 2006).

The goal of these services was to replace a company's entire storage and make it available remotely. These offerings were designed to improve costs and flexibility.

Figure 6 – Cloud computing type, its level and type of users



(Source: SaaS Blogs, Sinclair - 2008).

Economic Trend

According to the IDC, SaaS growth increased markedly from 2008 to 2009 (\$13.1 billion). The growth was 34.2% and the expected growth was sharply rising at \$40.5 billion by 2014 with a compounded annual growth rate of 25.3%. Even the leader in CRM technology software, Salesforce.com Inc. was able to pull a 20.2% market share of worldwide sales in 2009 with 19.9% growth rate, whereas Oracle was in second position with 18.7% share and 2.5% growth, and SAP was in third position with 14.6% share with 3.1% decline in sales. It seemed the demand for the private cloud was increasing at a greater rate than public cloud as more and more companies were choosing private cloud.

A public cloud was defined as a cloud computing type in which resources were dynamically provisioned to the general public on a self-service basis over the Internet. A private cloud was the remote computing infrastructure operated solely for a single organization (customer) and it was hosted and managed internally or by a third-party (cloud providers). The cloud pricing model was metered pay-for-use, seat based or resource based according to different levels of support, memory, security, availability and other parameters, and it was more profitable for customers. Gartner predicted an increase of 21.3% in 2009 to \$56.3 billion in revenue for worldwide cloud services, whereas Merrill Lynch estimated around \$160 billion in revenue in 2011.

Salesforce.com, a newcomer in the industry, became the market leader for on-demand customer relationship management (CRM), which was a part of SaaS (cloud computing) with 46.6% share in 2009 and a growth rate that exceeded overall growth in this category (Wardley and Shirer 2011)

Figure 7 – Worldwide On-Demand & On-Premise CRM Application Revenues

WORLDWIDE ON-DEMAND AND ON-PREMISE CRM APPLICATIONS REVENUES										
<i>(In millions of dollars)</i>										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	CAGR (%) 2009-14
On-Demand	1,040	1,533	2,005	2,307	2,707	3,257	3,857	4,507	5,257	17.9
Growth (%)	55.7	47.4	30.8	15.1	17.3	20.3	18.4	16.9	16.6	...
Share (%)	8.0	10.4	12.4	14.6	16.3	18.5	20.5	22.5	24.5	...
On-Premise	12,007	13,235	14,162	13,476	13,947	14,384	14,926	15,552	16,207	3.8
Growth (%)	8.3	10.2	7.0	(4.8)	3.5	3.1	3.8	4.2	4.2	...
Share (%)	92.0	89.6	87.6	85.4	83.7	81.5	79.5	77.5	75.5	...
TOTAL	13,047	14,768	16,167	15,783	16,654	17,642	18,783	20,059	21,464	6.3
Growth (%)	11.0	13.2	9.5	(2.4)	5.5	5.9	6.5	6.8	7.0	...

CAGR-Compound annual growth rate. Note: Totals may not add due to rounding.
Source: IDC's *Market Analysis* published December 2010.

(Source: IDC's – Market Analysis – 2010)

CRM was a well-built application platform for customized solutions with a pay-per-use or seat based pricing model providing financial leverage to the business. Cloud computing helped the customers in the following economic aspects:

Pay per use: This pricing model not only showed the actual consumption of the resources, but also indicated the important features of the application to the customers. The key characteristics of this model were good customer service, innovative solution, specificity, customization, and help in the customer's accelerated growth.

Cost reduction: With adoption of cloud from a service provider, the cloud customer was ensured less maintenance, huge savings in IT investments, savings on infrastructure, and savings on skilled labor (IT staff).

The cloud helped the customer from a scalability standpoint, too. Businesses always tried to have maximum Return of investment (ROI) through the cloud, but it was not guaranteed. Customers needed to carefully do the risk and benefit analysis along with a feasibility study before adopting the cloud. However, there was no doubt that the cloud reduced overhead costs. Finally, the cloud was relatively quick and easy to adopt as most of the time the platform was already prepared and it did not require a lot of expertise.

Political/legal/regulatory Trend

Broadband Internet Connection: High speed commercial broadband internet connection was a must for cloud computing. Other costs being lower, the company needed to invest in a good internet service provider that could guarantee a good connection. As big corporate companies tapped into cloud computing, smaller companies without access to quality broadband were at a competitive disadvantage. Wireless spectrum, an important component of the broadband deployment, held the key to achieve truly ubiquitous internet access.

One of the wireless internet provider's utmost priorities was pursuing wireless broadband and U.S. spectrum policy changes (calling for additional spectrum) to help wireless broadband proliferate with the growing demand of internet users.

Nondiscrimination: The cloud set up needed to not play unfair or discriminate to certain users. This applied to both cloud service provider and cloud customers. The cloud users needed to watch for the chokepoints to eliminate.

Liability Rules: Cloud computing often faced problems with third party content under threat of liability for the user's action. The 1996 Telecommunications Act and the Digital Millennium Copyright Act contained crucial limitations on Internet and e-commerce businesses, holding them liable for a user's misconduct because these services (many of which deal in petabytes of data each day) lacked the control that brick-and-mortar businesses might have over individual content. The company that was using the cloud needed to be aware of the online content of users with an administrative audit and follow preventive actions if needed.

User confidence: The cloud data was stored in a remote place and the users usually were not able to see the data storage. Hence, the privacy and security of the data had to be fully maintained along with the infrastructure to protect the data from potential hackers and disasters. The design of the privacy policy of the cloud needed to be so robust as to avoid unnecessary trespassing or surveillance by illegal foreign and domestic authorities. Moreover, policies on intellectual property rights, liability coverage, physical location of the data (country of jurisdiction in case of disputes), and responsibility of the data also had to be considered.

Interoperability: The cloud service provider needed to ensure the interoperability of the environments so that the customers were not locked in with one service. Customers needed to be able to migrate from one service to another service freely.

"Free" Service: The so called "free" concept for emails and different services was becoming more popular day by day. This seemed to be nothing but a ploy to attract users for premium services. Many of the email providers, storage, applications (such as Gmail,

GoogleApps, GoogleDocs, etc.) were serviced as “free.” However, in exchange for that service, companies such as Google collected information from users to place better targeted advertisements beside the email bar. The collection of information was explained in Google’s privacy policy, which was neglected by most of the users (Wyld 2009).

Social-Cultural Trend

Confusion: Though cloud computing started to grow rapidly since 2006, users and cloud computing experts thought about cloud differently, which was the root cause of the problem. The so-called large definition of cloud computing was often confusing as some claimed cloud was public only, some as private only.

Easy cloud concept for users: Most of the users were unaware that they used cloud computing. All web based free email accounts (whether Gmail, Yahoo Mail, Hotmail, MSN Mail, AOL Mail, or any similar service) are examples of cloud computing. The attachments in the emails were saved remotely on the email provider’s server. The chart below shows the cloud activity of American users by age group and usage type.

Figure 8 – Cloud activity by American users

Cloud Computing Activities by Different Age Cohorts
Internet users in each age group who do the following online activities (%)

Use of Internet-Based Cloud Activity	Age				All Ages
	18-29	30-49	50-64	65+	
Use webmail services such as Hotmail, Gmail or Yahoo Mail	77%	58%	44%	27%	56%
Store personal photos	50%	34%	26%	19%	34%
Use online applications such as Google Documents or Adobe Photoshop Express	39%	28%	25%	19%	29%
Store personal videos	14%	6%	5%	2%	7%
Pay to store computer files online	9%	4%	5%	3%	5%
Back up hard drive to an online site	7%	5%	5%	4%	5%
Have done at least one activity	87%	71%	59%	46%	
Have done at least two activities	59%	39%	31%	21%	

(Source: Horrigan – 2008)

Global Trends

Cloud computing was changing the pattern of IT usage around the world. The global recession during 2008-2009 forced companies to cut unnecessary costs and as an alternative, cloud computing was chosen to avoid the overhead costs of in-house IT. This in turn had an impact on broadband deployment, privacy, security, competition policy, and intellectual property reform to adopt cloud computing. The law and policy makers needed to guard against abuses and bottlenecks in the innovation process, which brought international laws into effect. By the design of cloud computing, the servers and data could reside in any foreign country, where it was easy and cheap to maintain.

According to the global industry analysis, cloud computing was expected to reach a market of \$222.5 billion by 2016, backed by a different medium to large size companies. IDC predicted a threefold jump from \$70 billion with an expected growth

rate of 26% annually. According to IDC, by 2009, the cloud market was \$17.4 billion and it would be \$44.2 billion by 2013 (Hickey 2010).

Technological Trends

The technology became more complex day by day with better and faster quality service. Cloud computing was not an exception. Cloud computing was always serviced on-line, over the internet. The off-line option was still not in the limelight. If the internet link went down for any reason, there would be no alternative.

There might be a difference between the perceived security and compliance and the reality. This key factor needed to be addressed while adopting cloud. Also, clear policies had to be revealed about the physical location of the data, who and when anyone (either party) could access it and what were the security measures taken to protect the data. The same question could be asked another way as “How secure was the cloud?” It took time to have an answer, and public clouds like Amazon had an uphill battle addressing security concerns. Amazon had a strict “would not discuss” policy regarding specific data center details, which was a risk posing factor and was not acceptable by its customers for security reasons. On the other hand, private cloud companies answered the security question with dedicated network and storage space (Brodkin 2009).

The disaster recovery definition was changed due to cloud computing as the hardware dependencies were removed. The software application could be virtually migrated to a different cloud and it could be operational very quickly. There was a significant shift in the recovery time and turnaround time for the system along with the

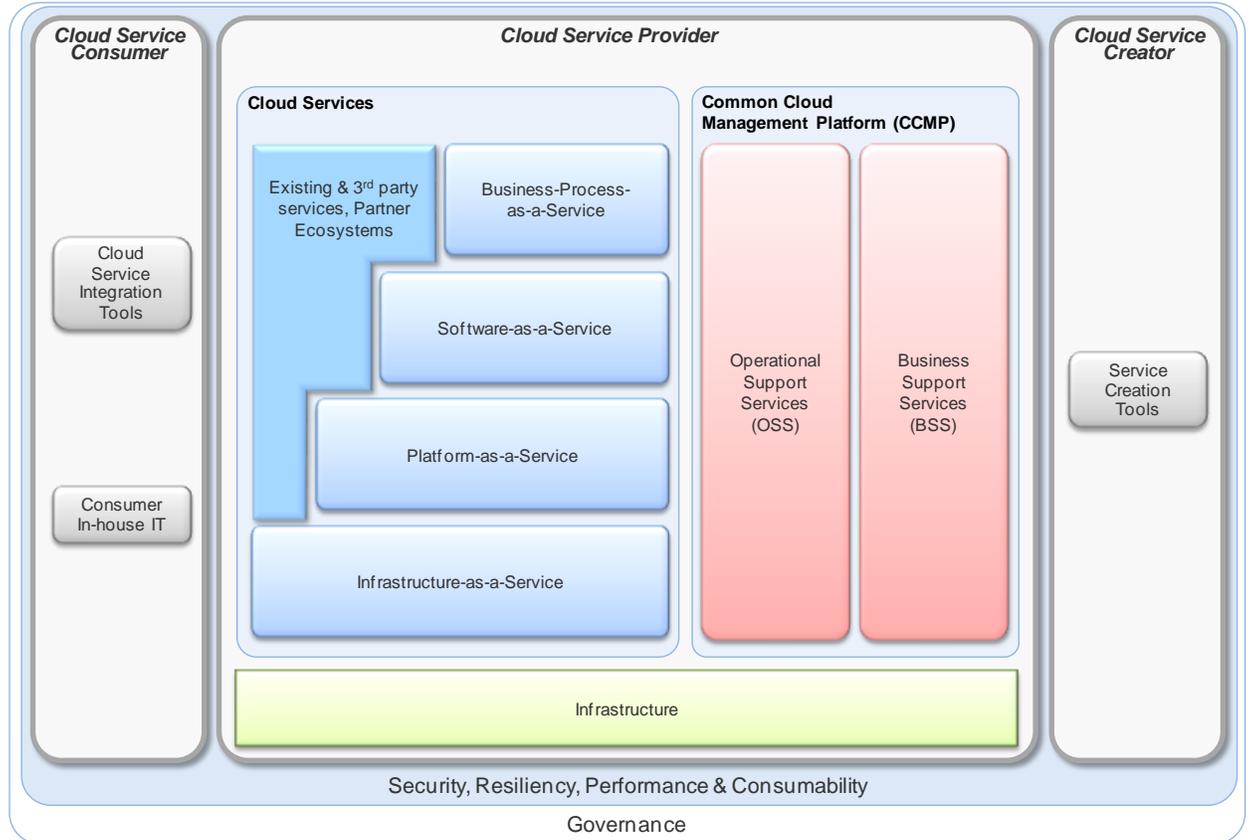
cost. Cloud computing delivered not only faster recovery, but also very low cost compared to the traditional software system.

Reference Architecture

With the growing adoption of cloud computing, there has been a concurrent growth in the number and variety of vendors in the marketplace with cloud offerings. These providers range from established IT industry leaders such as IBM to software as a service vendors such as ABCF that are leveraging cloud computing to broaden their scope, to players leveraging other domain expertise or partnerships to enter the cloud arena, such as Amazon, Google, Cisco and VMware, along with numerous telecommunications and hosting service providers.

The more crowded this marketplace becomes, the more challenging it is for CIOs to select the right cloud vendor to meet the organization's needs. As the applications deployed on private or public clouds move up the value chain and into the enterprise computing realm, the stakes increase as well—with selection criteria shifting from an emphasis on price to considerations such as security, reliability, scalability, control and tooling, and a trusted vendor relationship.

Figure 9 – IBM Cloud Reference Architecture Overview



(Source: IBM – Cloud Computing Central)

IBM's cloud reference architecture addresses the three major roles in any cloud computing environment: cloud service provider, cloud service creator and cloud service consumer.

With this strict separation of concerns, the cloud architecture enables specific perspectives to be assumed in order to understand the requirements, expectations and value propositions placed upon the system, and the supporting capabilities necessary to fulfill these requirements.

From the service consumer's perspective, a simplified interface is needed with well-understood service offerings, pricing and contracts. The value proposition for the service consumer is to get fast, on-demand access to the service they need while only paying for the period of time the service is used.

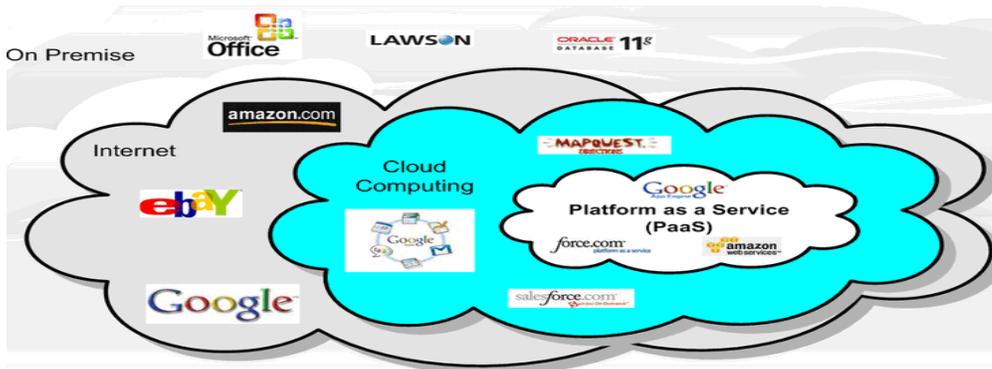
From the service provider's perspective, a highly efficient service delivery and service support infrastructure and organization are needed in order to provide differentiated, well-understood, standardized and high-quality services to end users. Service management makes it possible for significant economies of scale to be achieved. A self-service portal allows exposing a well-defined set of services in a highly automated fashion at a very attractive cost point.

From the service creator's perspective, a tooling environment is needed for modeling and assembling service elements (virtual images, for example) as well as an effective means of managing the service lifecycle.

Each major Cloud vendor has its own Cloud Reference Architecture. Amazon, HP, AT&T, Oracle, and several others follow their own architectures for the Cloud Service implementation. Microsoft has one for private cloud as well. There is a movement in the software industry to define some portions of Cloud computing as vendor neutral and/or to follow an open source model (Behrendt et al. 2001).

Competitor Profiles

Figure 10 – Cloud computing companies



(Source: Google - Cloud Computing Images)

Microsoft

Microsoft had a slow but steady start in the cloud arena compared to its competitors. Microsoft came up with Windows Azure in 2009, to host and scale web applications through Microsoft datacenters. Azure was categorized as PAAS and various on-demand services could be hosted on this platform using Microsoft datacenters. Microsoft targeted big businesses and signed deals with cities and states in October 2010. Among these arrangements was a five-year deal with the city of New York, which was estimated to lead to a savings of \$98 million under the plan.

Amazon

Amazon started the Elastic Compute Cloud (Amazon EC2) back in 2006 and access was granted on a first come, first served basis. In October 2007, it added two new instance types (Large and Extra-Large) and in May 2008, it added CPU Medium and High-CPU Extra Large. As the market leader, Amazon was primarily a cloud infrastructure as a service (IAAS) vendor. Elastic Compute Cloud (Amazon EC2) and S3 were the two most popular services available as part of Amazon Web Services.

There were indications that Amazon might have a total of 1.8 million deployed instances and showed 10% overall growth in deployments. Amazon had total revenue of 220 million USD from the Cloud business and over 100,000 customers using Amazon Web Services worldwide (Amazon Web Services Blogs, Barr, Jeff, comment posted 2006; Barr, Jeff, comment posted 2008; Varia, Jinesh, comment posted 2007).

SalesForce.com

Salesforce.com, headquartered in San Francisco, was established in March 1999 by former Oracle executives Marc Benioff, Parker Harris, Dave Moellenhoff, and Frank Dominguez. As a company specializing in software as a service (SaaS), Salesforce was one of the earliest Cloud Computing companies. The company focused especially on the CRM application and functioned as an SaaS vendor. Salesforce.com had grown significantly from its initial launch with a continuous focus on CRM. Salesforce.com launched as a custom application development platform in 2007 as an entry into the

PaaS product market, but it faced some challenges because of competition and was not able to hold a significant client base.

Though the companies had similar products and services in the arena, Amazon and Rackspace might have ranked higher on this list, but Salesforce had higher revenue by comparison. Salesforce.com provided its services translated into 16 different languages and as of 2010, Salesforce had 82,400 customers and over 2,100,000 subscribers (Was and Harris 2009).

SAP Business by Design

SAP business by design deals with financial, human resource, sales, procurement, customer service and supply chain duties. It can be used in a number of industries including professional services, wholesale distribution, and manufacturing. The main benefit of SAP business by design is that it provides timely insights and reporting capability, which helps increase efficiency across an organization.

Google

Google Inc. is an American multinational public corporation that was founded by Larry Page and Sergey Brin in 1996 as a research project when they were PhD students at Stanford. Google was a pioneer in Internet search and advertising technologies. Google made a late entry into the Cloud Computing business and the Google cloud connect offered two services. Google Apps was one, which provided an SaaS based

environment, and another was Google App Engine, which provided a PaaS model platform for customers to deploy their customized web apps. Google Doc was a free web based SaaS modeled application.

Google Apps Marketplace boasted more than 200 applications targeting different segments including customer management, project management, productivity, accounting, education, legal and a host of other concentrations. Both Google products were very popular as Google Apps had 1 million customers and approximately \$50 million in revenue. The Google App Engine was relatively new in the market and the customer adoption was not yet known (Guest 2011; CloudTimes 2010).

Rackspace

Rackspace is headquartered in San Antonio, Texas and has offices in Australia, the United Kingdom, the Netherlands and Hong Kong, with data centers operating in Texas, Illinois, Virginia, the United Kingdom, and Hong Kong. Rackspace was an old IT hosting company that started cloud service in 2009. Rackspace has been a highly successful company and has provided excellent customer service all year and around the clock according to users' needs.

In August 2008, Rackspace opened its IPO for trading on the New York Stock Exchange under the ticker symbol "RAX" and it raised \$187.5 million. Rackspace was mainly a cloud infrastructure as a service (IAAS) provider and provided two key services, Cloud Servers and Cloud Files, which were the equivalent of EC2 and S3 from Amazon. Rackspace indicated to have 100% growth in Cloud Revenues from 2008 to

2009. Rackspace added around 40,000 new customers with revenue of 56 million USD in 2009 (Rackspace website; Montalbano 2008).

hSenid Mobile

hSenid Mobile Solutions (HMS) was founded in Colombo, Sri Lanka in 1997 as a mobile app developer and IT consulting firm with Service Delivery Platform (SDP) and middleware and integration as its specialization. Though hSenid is not a very large company with a staff of only about 275 skilled engineers worldwide, it had a significant growth in the cloud market. Within a short time, it had a presence all over North America, and had bigger clients all over the world, such as Telcel (Mexico), Lucent Technologies, M1 (Singapore), Todo1 (Florida, USA), DST (Brunei), Tigo (Sri Lanka), Sampath Bank (Sri Lanka), and Valista (Ireland). hSenid launched its mChoice™ Aventura, the Cloud Enabled Telco Platform with a state-of-the-art mobile applications developer portal during June 2010.

The revolutionary Cloud Telco Application Portal (Cloud TAP) brought end-to-end service creation, which helped the telecom operators to roll out “Telco Applications” based on the operator’s network capabilities such as SMS (short message service or text message), MMS (multimedia message service), USSD (Unstructured Supplementary Services Data), and location capabilities to reach out to almost every GSM based Mobile Device. With the cloud TAP, based on open standards & technologies, the App Developers were able to connect to the Telecom Operator’s

backend with extreme ease. Cloud TAP consisted of Cloud SDP, Telco App Store, and Telco Developer Portal by which Telecom Operators could leverage by enabling rapid service creation, tapping into abundant sources of innovation, monetizing hSenid's network assets while maintaining modest capital and operational bases (hsenid, website 2010).

CHAPTER 3 – Procedure and Methodology

Project Background

Visiting Nurse Agencies (VNAs) provides a broad range of essential home healthcare and support services to patients of all ages, from infants to the elderly. These services are delivered in the security and comfort of the patients' homes. Additionally, VNAs offers comprehensive services from maternal/child health programs to hospice care. These services can include skilled nursing, rehabilitation therapies, e.g., physical, occupational and speech-language. Specialized services such as medical and social services and counseling, case management, and home health aide are also offered through their program.

VNAs want to automate the above services with the Service Cloud services to save cost, time and ease of maintenance. These services would allow them to increase their scalability as they are the largest not-for-profit home health care provider in the United States and need an expandable, robust, Web-based case-management system to track incoming referrals.

Currently, their case handling is taking an inordinate amount of time because agents have to toggle between more than 10 systems, and compliance with the Health Insurance Portability and Accountability Act (HIPAA) is imperative.

This is a significant undertaking for both VNAs and the ABC-Force.com SaaS vendor. ABC-Force.com will pick up 10 different VNAs sites to implement a proposed

solution; the first prototype will be developed for the VNAs-XY (New York) site in 8-12 months. If the prototype solution meets all of VNAs' requirements, then other sites will be implemented in the next 5-7 years.

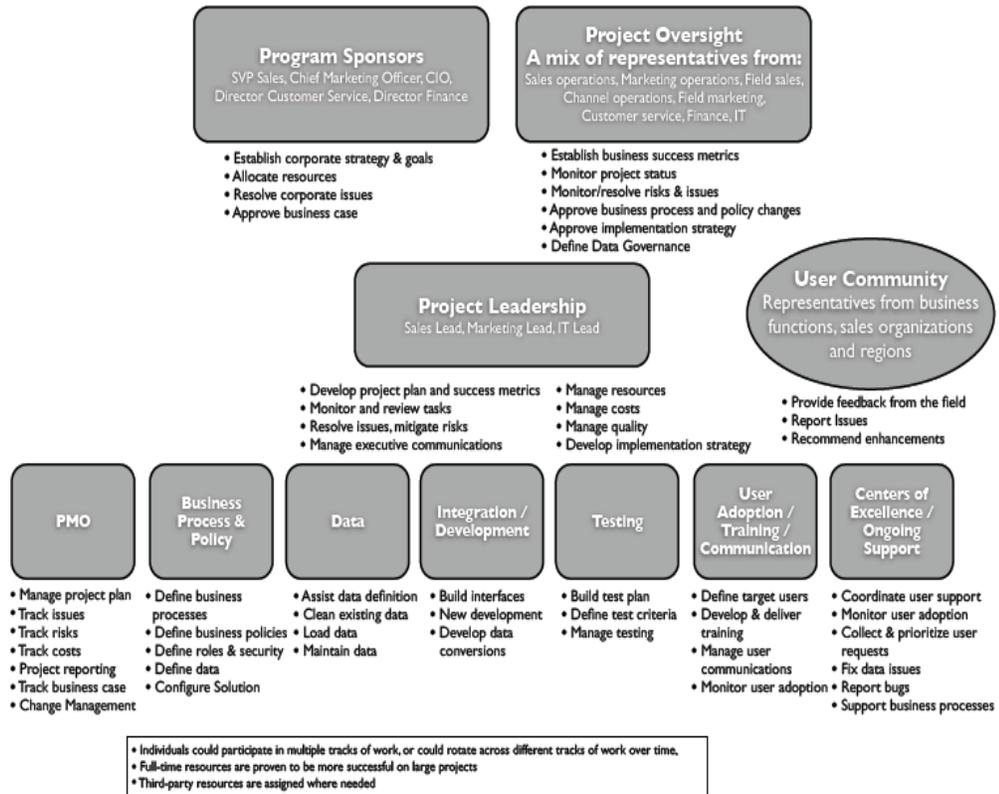
Figure 11 – Location of two hundred VNA's sites across US



(Source: Visiting Nurses Agencies)

Once the scope of the project was defined and accepted, a formal team structure was created. The structure was not too different from a traditional software implementation, but some specifics related to SaaS implementation were introduced with the help of ABCforce consultants who used a recommended structure for the VNA type project. The structure below was adopted and created for the VNA project. (See Appendix A).

Figure 12 – Example of a program governance chart



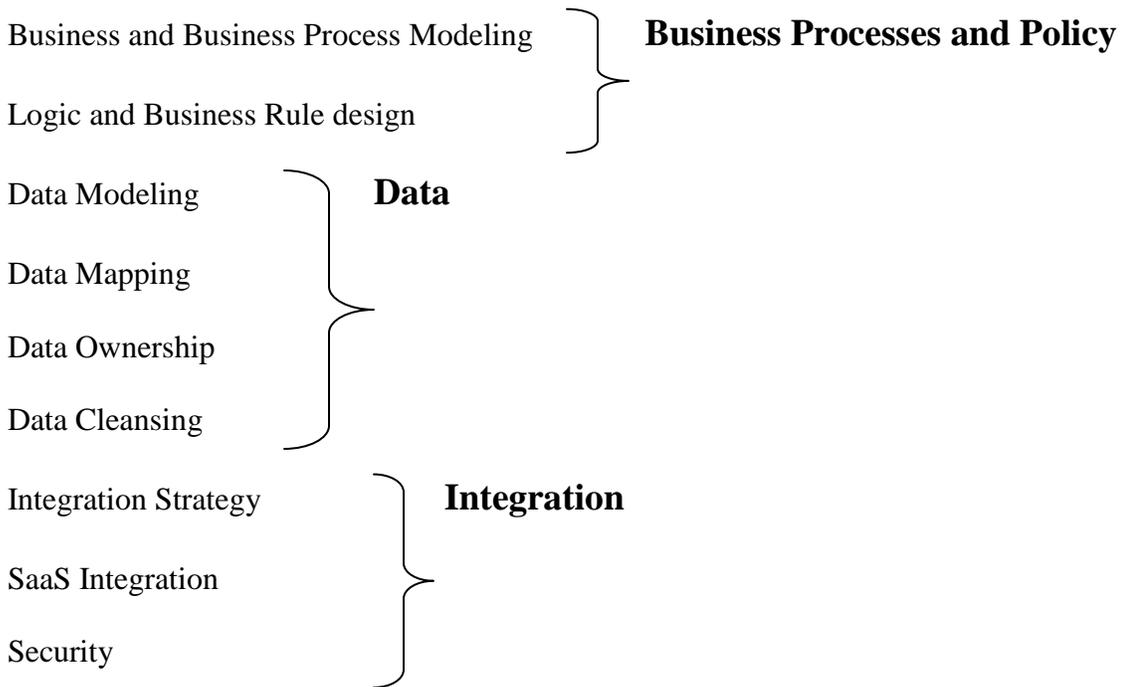
(Source: Salesforce.com, CRM project)

This paper does not cover the project structure and activities of Program Sponsors, Project Oversight, Project Leadership, User Community, PMO and User Adoption/Training Communication. These were not too different from VNA’s current project implementation structure or organization, and therefore no changes were made in either the structure or the activities.

This chapter focuses on Business Process and Policy, Data, Integration/Development, Testing, and Ongoing Support.

Key Planning Considerations for Business Processes, Data, and Integration

A typical SaaS project like VNA's requires careful planning for (re)modeling business processes and policy. This planning should be reflected in the logic and business rule design; the data modeling, mapping, ownership, and cleansing; and integration, which includes security.



Business and Business Process Modeling

Proper implementation of an SaaS solution provides the opportunity to modernize business processes and provide users with an integrated experience. To realize the full potential impact of this new technology, SaaS implementation projects must start with business process modeling. This includes taking steps to identify and develop a high-level understanding of changes in business processes and business level interactions

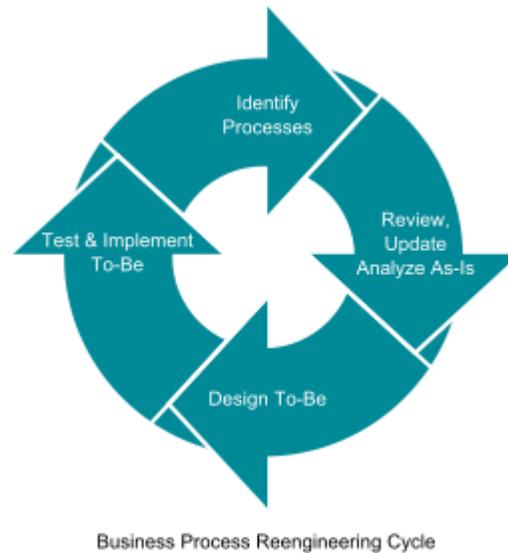
between systems that leverage SaaS and internal systems. Process models should be developed with key stakeholders on the business side to understand and to take into account the longer-term vision and its potential business integrations (and avoid integrating unneeded processes and data).

Most of the systems are built based on a company's business structure and the processes between their different entities denoting workflow to accomplish task(s). The formal manifestation of the business structure and the processes are done by formal business and business process modeling. There are many proven methodologies and tools available for business modeling.

Usually, a new company builds the business model and the system from scratch. However, in the case of VNA, the migration to SaaS provided the opportunity to revisit the existing business model and processes and reengineer the portions of the model and processes that have become decadent from various updates. Each of these updates added a layer of complexity, making the model inefficient and un-maintainable.

For this project, the business process modelers followed a methodology consisting of a) identifying target processes to modify, b) reviewing, updating, and analyzing as-is, c) designing to-be, and d) testing and implementing to-be. This methodology is depicted in the figure below.

Figure 13 – Re-Engineering Cycle



(Source: Google - Business Re-Engineering Cycle Images)

The outcome of this activity, which is usually composed of the Process and Data Model, went to System and Data Architects, and Analysts of ABCF.

Logic and Business Rule Design

Data Modeling

Although reengineering provided VNA a golden opportunity to fix the legacy business model and associated processes, a challenge arose regarding how to implement the updated process and data models in SaaS. Two approaches were considered, each of which had advantages and disadvantages. The first approach was to first enhance pre-SaaS systems with the new recommended business and data model, and then migrate as-is to the SaaS system. The advantage of this approach was that the system would be

verified and tested with the updated models, and migration to SaaS would become relatively easier, while the disadvantage was that it would be costly in terms of both time and money. In addition, by the time the legacy systems would be updated, the previous analysis would potentially become stale, requiring re-analysis and costing resources.

The second approach would be to directly provide the SaaS designers and implementers the unchanged business model and data model, and the updates provided by the business modelers. The obvious advantage would be cost and time saving, but the disadvantage would be that it would be too risky to implement the SaaS model for the first time. This is very important because the re-engineered portions should work perfectly with the legacy; otherwise, much of the business process would become risky. The second approach was chosen, but a prototype was required to mitigate the risk.

The SaaS environment and framework is different from the conventional in-house systems and architecture. The SaaS is embedded in other services of the cloud, namely IaaS and PaaS. Therefore, the components of SaaS are not visible. Most of the activities are done through exposed APIs. Some bulk load features are available, but are limited and are only provided by the vendor API framework.

Data Mapping

The SaaS system comes with its own CRM data model and was different from VNA's updated data model. As with any migration from one data model to another, the mapping was required between the two. This exercise was accomplished by the data

architects of both ABCforce.com and VNA. All client data was ensured to be reflected in the SaaS data model; some customization was required in SaaS to accommodate the client's data. The customary relationship rules of one-to-one, one-to-many, and many-to-many was observed and created. Other activities such as creation of unique IDs in the SaaS CRM database and building a relationship between various entities within SaaS CRM were performed. In some situations, the unique IDs were stored temporarily outside the SaaS system during the integration and migration stage.

Data Ownership

It is often the case that line of data ownership in a corporation becomes blurred over time. In the case of multiple values for the same data originating from several systems, the architects should make extensive effort to clarify the ownership. Once the ownership is determined and the right value obtained, it should be propagated to all the systems to ensure the integrity of the data and the system. In the case of VNA, the data architects established the ownership and synched up the data with other systems before integrating and migrating with ABCforce.com.

Data Cleansing

It is often said that a system is as good as the data it portrays. There are both challenges and opportunities during an SaaS implementation. There is an opportunity for some data cleansing while migrating and integrating to the SaaS system. The methodology is pretty well-known in the industry and is widely adopted. However, it is time consuming and laborious, and if careful planning is not done, it consumes very

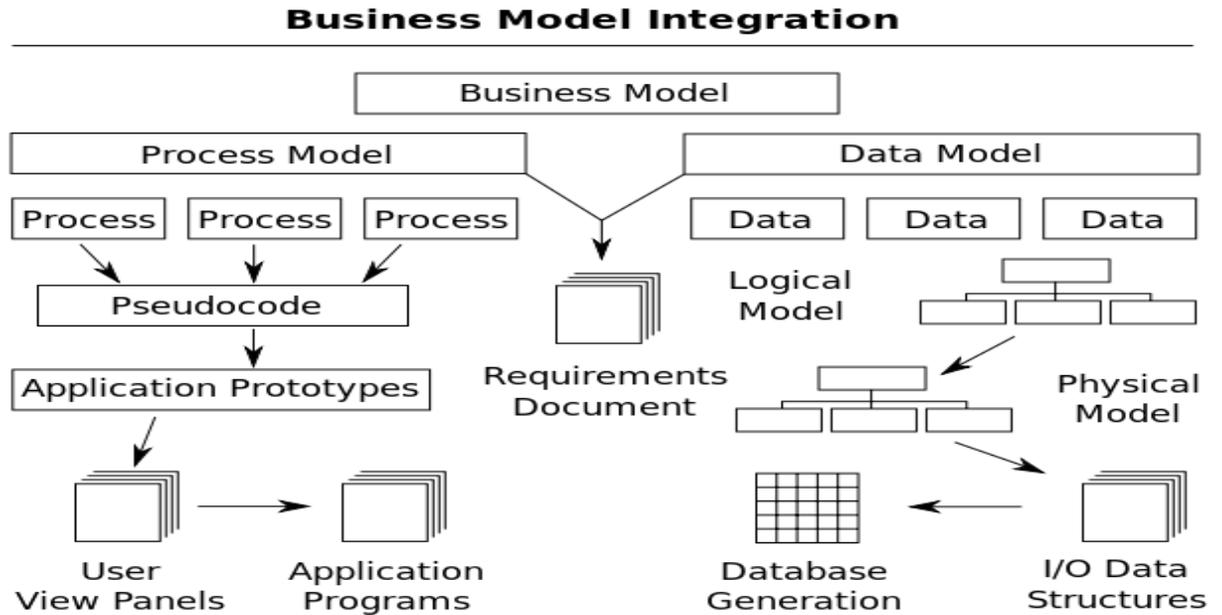
valuable time of the project. The VNAs data architects used the opportunity and cleaned based on 20-80 rule.

Another challenge comes from the intentions and constraints posed by the new SaaS application. The constraints should be well understood and identified early during the migration and integration. There are several approaches to address this challenge, but a well-known method – Master Data Management (MDM) – addresses data enterprise-wide. Several software packages support this methodology, but VNA worked with ABCforce.com and used the tried and true Trillium Software for data cleansing.

Integration Strategy

The business model integration is the end game for migrating and integrating with an SaaS based application, but it needs to be defined first before embarking on any activity. At a higher level, the business model for VNA was revisited for scope. Some parts were reengineered to fill the gaps, increase efficiency, and for integration purposes. The updated business process models were implemented in ABCforce.com CRM following cloud's SDLC methodology. The data models were updated through data mapping, ownership and cleansing, and migrated to the CRM database. This essentially was the process to migrate the legacy application to the ABCF- CRM.

Figure 14 – Business Integration Model



(Source: Google - Business Model Integration Images)

The integration part, which dealt with connecting the migrated system with other parts of the legacy systems, required key decisions on some system aspects, most of which were mainly driven by the business environment and the requirements. These aspects and decisions are:

Synchronous vs. Asynchronous transactions:

Synchronous transactions mean that data flows from end-to-end systems in real time and transactions are considered complete only when transactions in all systems are successful. Any failure in a transaction in any part of the system in the middle will cause the transaction to be a failure and incomplete. In distributed systems such as this one, there is a major overhead in adopting synchronous transactions. All systems should be

error free including the interfaces between them. The major advantage of synchronous transactions is that there is no wait in completing the transaction and the customers do not need to wait for their orders to be completed. This works very well in smaller to midsized companies with a moderate number of transactions.

Asynchronous transactions are sent in batches or queues. The sender of the transaction does not wait on the transactions to become complete, but instead statuses from systems participating in the transaction determine success or failure of the transaction. Queuing technology is used in this mode of transaction. This type of transaction is adopted in large systems where large numbers of transactions are executed. VNA adopted a mix of synchronous and asynchronous transactions mode. Synchronous transactions were adopted for critical transactions, whereas asynchronous transactions were employed for non-critical day old transactions.

Upload vs. download:

This mode of transaction is referred to as Push vs. Pull. This mainly determines the directional capacity required for the transactions. If it is all Push or Pull transactions, then it is one directional, but if it is both, then the capacity needed would be bi directional. For VNA, both upload and download transactions were required; however, download transactions were needed more than upload transactions. Since all transactions were coming from the internal network, no explicit firewall considerations and designs were required.

Timing and frequency:

Timing and frequency requirements have multiple implications on the design of the system, operations, and even staffing. VNA adopted both synchronous and asynchronous transactions models with synchronous transactions happening during the day and asynchronous transactions occurring during the night. Since VNA is a US-only company, there were no synchronous transactions flowing after US business hours, leaving the capacity to asynchronous transactions. The volume of asynchronous transactions is huge since the patients' non-critical data addressed many aspects; this was broken in smaller chunks and was pushed with a higher frequency during the night. The bulk load mechanism of the SaaS product was utilized especially for setting the timing and frequency of the transactions.

Full vs. Partial data replication:

Data replication is a required activity in distributed applications. Replication is asynchronously done to keep databases synchronized. Full or partial replication is done based on the need and the available capacity. Usually, replication is done once a day during the night time. The volume of replication is usually large with the total duration in hours. For VNA, both partial and full replication were employed with smaller databases doing full replication and medium to bigger databases performing partial replication. The replication data was periodically reviewed and the replication amount was accordingly tuned.

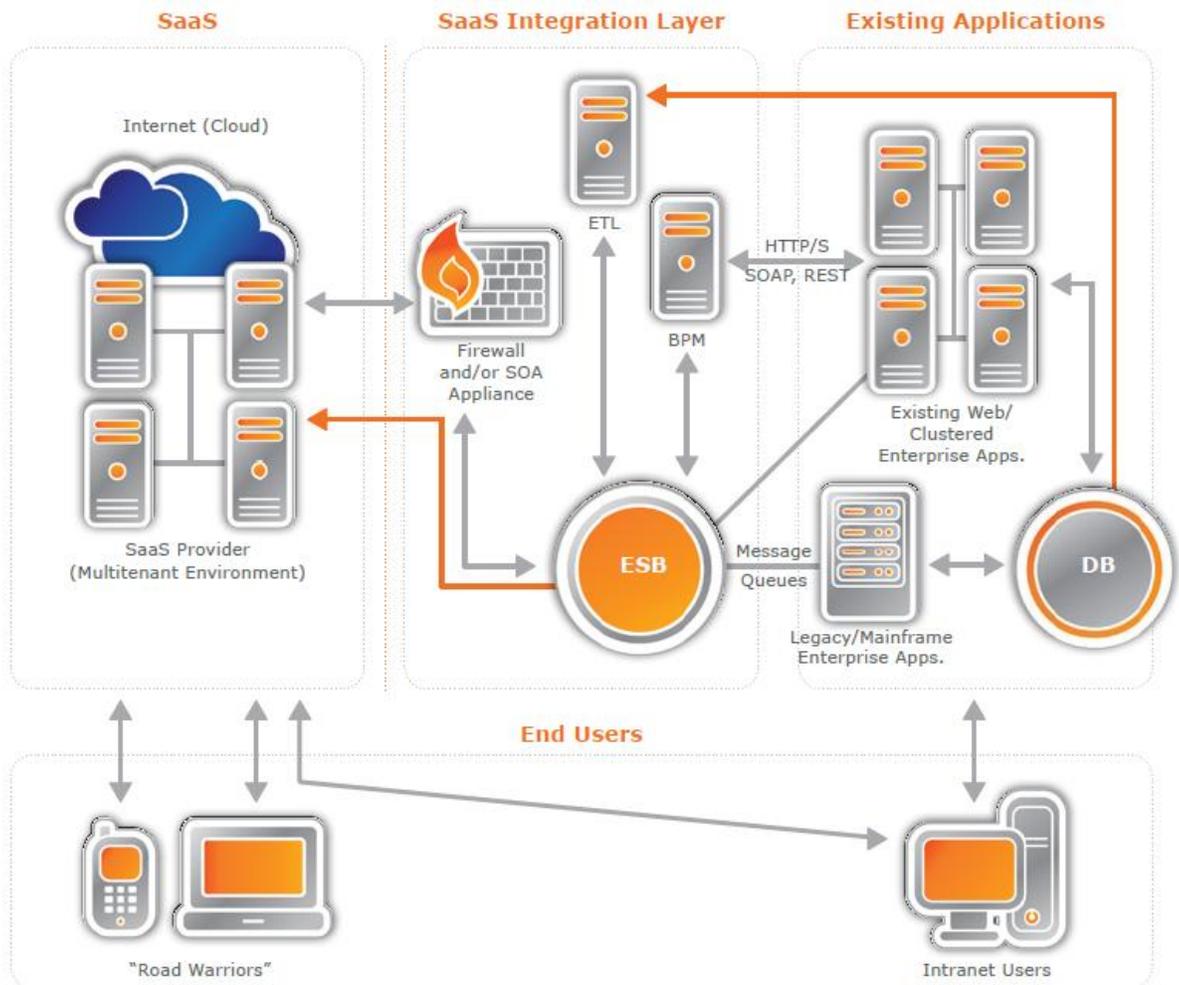
SaaS Integration

There are many considerations to account for when integrating with Software as a Service (SaaS) solutions. SaaS integration is often underestimated in complexity and effort.

Depending on the business requirements and the integration capabilities of the chosen SaaS product, the integration approach may not be trivial. While a comprehensive API offered by SaaS is a must-have, in most scenarios a custom SaaS integration layer will be needed to comply with SOA (Service Oriented Architecture) principles and to facilitate integration with existing systems. This section provides an overview of capabilities that a typical SaaS integration layer needs to provide, as well as which integration products best fit those capabilities.

The following diagram depicts what an SaaS Integration layer may look like and how it interacts with existing systems and the SaaS solution:

Figure 15 – Planning for SaaS Integration



(Source: Planning for SaaS Integration – summa)

From an implementation perspective, SaaS integration projects tend to be very similar to typical integration projects. Unless the integration requirements are very simple, it will make more sense to use an integration product as the foundation of the SaaS integration layer, instead of custom building homegrown integration middleware. For many organizations, there will be an off-the-shelf integration product or a defined architecture strategy established within an organization, which should be leveraged for integrating the SaaS solution.

It is not uncommon for the SaaS Integration layer to be composed of one or more integration products in conjunction with an Enterprise Service Bus (ESB), a popular integration product that will address most customers' integration needs. This is true because there is no one-size-fits all.

These needs are divided into seven major categories or steps, which are followed throughout the integration cycle:

Transformation

The first, and perhaps most basic, requirement that an integration layer will need to provide is Transformation. The main goal of this step is to abstract and hide internal details about the SaaS data model from existing applications. This will help to mitigate downstream upgrades or migration pains in future releases. The integration layer will be responsible for transforming data to and from the SaaS data schema, and vice versa. This is often accomplished with an intermediate schema based on industry standards.

Transport Protocols

This second category addresses support of multiple transport protocols. This is an area where good Enterprise Service Bus (ESB) products excel. The supported protocols should range from message queues through HTTP/S, S/FTP file directories and proprietary packaged application integration adapters. An ideal integration product will

provide retry and error handling capabilities, timeout intervals and the ability to customize certain parameters such as specifying encryption protocols.

Workflow

Following the Transport Protocols is the workflow capabilities. Assuming it needs to support a complex business process, an ESB may not be the best integration approach or will need to be augmented with a separate Business Process Management System (BPM). These systems are better equipped to handle long running transactions, i.e., workflows that require manual and/or offline steps, thus requiring continuing the state of the transaction for some period of time while people or other systems respond. They are also better suited to perform conditional steps based on the completion of the previous steps.

Bulk Data Load Capabilities

The fourth category is Bulk Data Load Capabilities (BDLC), and assuming there is a need for heavy bulk load, a third integration product category should be considered: ETL (Extract, Transform and Load). These ETL solutions are often used for large direct database-to-database data loading. It is not uncommon for most SaaS solutions to not allow direct access to their underlying database and in almost all cases will be hosted by a third-party (i.e., the SaaS provider) in the “cloud.” In some instances, the SaaS system may already provide basic data load capabilities, which may be sufficient. However, if this is not the case, the ten ETL products can help significantly, especially if the data

transformation is very complex. Traditional ETL vendors, such as IBM and Informatica, also offer adapters for select SaaS platforms.

Transaction Failure Compensation

Following Bulk Data Load Capabilities is the Transaction Failure Compensation category. Because most services in SOA (Service Oriented Architecture) integration do not provide support for two phase commit/rollback of transactions across services, a common approach to provide this capability is through compensation paths. A compensation path may delete a record that was recently inserted as one of many steps from a transaction that spans multiple systems. BPM systems provide support for compensating transactions through the WS-BPEL (Web Services Business Process Execution Language) standard, which includes definitions for compensation handlers. Frequently, a manual intervention process may be required for legacy systems that cannot be modified to support the process needs.

Identity Correlation

The sixth category is Identity Correlation; most likely, the existing system will have its own identifiers for data elements. Many integration use cases will require correlating among these identifiers. This correlation can be delegated to a system at either end of the integration (e.g., the SaaS system, or one of the existing systems).

It is important to keep in mind that there may be additional systems with their own identifiers brought into the picture later. Because of this, a good practice is to create a cross-reference database that is independent from the end systems. The SaaS integration

layer is a good fit to expose this cross-reference database as a service to other systems, i.e., to allow establishing new cross references, or to query for existing ones. This approach reduces the need to carry multiple IDs throughout the integration flows.

Adapters

The final categories, Adapters are often tailored for a specific product or technology. Salesforce.com offers an AppExchange™ marketplace, which provides over 900 application extensions for Salesforce.com, some of which offer additional integration capabilities for external products or technologies.

Cast Iron Systems (recently acquired by IBM) takes this approach to another level with the OmniCast™ platform. OmniCast is integration solution—delivered as an appliance or as a service—that provides many of the capabilities mentioned above, but it is tailored for SaaS Integration. It offers pre-configured integration templates for Salesforce.com, NetSuite, GoogleApps and Microsoft Dynamics™ along with adapters for many traditional packaged enterprise software products such as SAP, Oracle E-Business Suite, JD Edwards and Siebel.

Security

Security for the healthcare industry is paramount due to HIPAA laws. Because of the mixed system architecture of on-premise and cloud, these systems require additional check and balances to safeguard patient confidential information. Failure in security may result in loss of credibility with legal implications.

In the case of VNA, the first level of security was provided by VNA itself and once it was cleared, it was then passed to the ABCforce.com CRM for additional authentication and authorization. ABCforce.com provided their own built-in authentication capabilities. The single-on in its truest sense was not adopted but to the user, the sign-on process was very transparent. The authentication from VNA used the API in ABCforce.com for delegated authentication. The authorization was based on the appropriate role as mandated by HIPAA law and defined by VNA. Much precaution was taken to prevent exposure of sensitive information especially during the daily integration process. Two emerging standards for authorization protocols – OAuth and AuthSub – were utilized (Balderas 2011).

Testing

As with any software implementation project, types of testing, testing scenarios, scope, and acceptable failure rates were determined in the initial planning stage of the project.

Some of the testing in the SaaS implementation was very similar to traditional testing; for example, unit testing was performed for customized portions of the ABCF CRM. System testing was performed on the complete ABCF with VNA's test data, which essential interface simulators. Once the system passed the required threshold for defects, integration testing was performed with all the live interfaces. Part of the integration testing also tested the replication, synchronization, and other elements of the integration layer. Once the integration testing passed all the key test scenarios, the software was

introduced to super users for functional and end-to-end testing, and reported defects and bugs were fixed. Other tests such as load and stress testing were also performed with a large amount of data and many users, respectively. Last but not least, once the CRM application went live, the user acceptance testing was performed by key stakeholders and users.

Ongoing Support

Once the ABCforce.com was put into production, the project and related teams worked on the closure of the project and after a specified time, these teams were dissolved. The ownership of the application was transferred to the relevant VNA's CRM application team. This application fell into an ongoing support pattern where the business like VNA owned the changes and first line support while ABCforce.com provided second line of support. The procedures and service level agreements were defined and adopted.

CHAPTER 4 – Results

An SaaS solution is quicker, and provides faster “go live” implementation timeframes than traditional packaged software. The SaaS solution does not require procurement and setup of new servers, time for installation or system administration costs. A VNAs-XY New York site can be easily up and running in few months, allowing users to focus on functionality. For the SaaS functionality to be useful and efficient, it must integrate with other business processes and data. It is important to note throughout the implementation that properly integrating an SaaS solution with existing or legacy systems is not a trivial task but can be accomplished successfully.

After SaaS is successfully implemented at all VNAs-XY sites, the following results are expected to be achieved.

- Referral process and caseload management is streamlined for more flexibility and quicker access to patient information.
- Management has the ability to monitor staff productivity through timely reporting and ensuring productivity expectations are met, which in turn will lead to patients being seen in a timely manner.
- Increased efficiency and minimizing paperwork while complying with HIPAA requirements.
- Increased customer satisfaction among medical doctors due to ease of usage and saving time when accessing patient information and collaborating between the members of the healthcare team.

- Widely dispersed workforce with workflow capabilities can be optimized by easy Web-based access.
- Increased documentation of calls from patients, leading to quicker call handling and improving patient satisfaction.
- Improved patient care by centralizing information on ABC-Force.com cloud, which reduces legacy systems and improves accessibility by the multidisciplinary teams.
- Ability to expand and include other informatics as they are added, e.g., pharmacy, labs, e-scripting and storage of data that pharmacies and health professionals can access to better serve the patient population. This ability also prevents duplicates of lab tests and medication orders, leading to savings in vital federal and state as well as private insurance dollars.
- Would be the route to include the future era of EHR nationwide for patient care to be exchanged and managed from anywhere in the nation in compliance with the HIPAA and state laws.
- The above would be designed and expanded as such to include access to the various specialists that the patient has on board, thus giving rise to multi-specialty access for medical care and creating the best model of communication between sub-specialty doctors for their mutual patient.
- Could quickly become standardized software to be used as we move toward healthcare reform, saving much needed money to continue to fund other programs and avoid duplication and frustration and time delays when accessing information at an ER outside the patient's county/state.

- The VNA personnel affected by cloud implementation were retrained to take new roles in the new organization. Some of the resources were dedicated to the Cloud Computing support, enhancements, and future transformations.

Therefore, when undertaking an SaaS project, the SaaS integration requirements, design and implementation should be considered and tracked as a separate sub-project with dependencies and tasks assigned to corresponding teams. This will help ensure that the integration aspect is not underestimated and the full value of the SaaS solution may be realized. Planning and designing for an SaaS integration layer upfront is crucial for a successful delivery of the overall SaaS implementation and future expansion. (See Appendix D: Gartner group survey shows that economic benefits are key drivers of IT cloud services adoption).

CHAPTER 5 – Suggestions for Additional Work

As an organization, VNAs-XY should also consider that cloud computing has risks and assumptions in the areas of data integrity, recovery, and privacy. Furthermore, legal issues should be evaluated in areas such as e-discovery, regulatory compliance, and auditing.

Here are seven of the specific security issues as mentioned in a Gartner survey report that the SaaS customer should consider and that warrant further research:

Privileged user access

Sensitive data processed outside the enterprise brings with it an inherent level of risk, because outsourced services bypass the “physical, logical and personnel controls” IT shops exert over in-house programs. Users should get as much information as they can about the people who manage their data. Users should ask providers to supply specific information on the hiring and oversight of privileged administrators, and the controls over the administrators’ access.

Regulatory compliance

Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider. Traditional service providers are subjected to external audits and security certifications. Cloud computing providers who

refuse to undergo this scrutiny are “signaling that customers can only use them for the most trivial functions.”

With the above mentioned accessibility for better communication comes the greater risk of regulatory compliance and security of personal data. With vast operations and multiple fields’ usage in an organization, such security checks may be challenging.

Data location

Storage of data on the cloud also means the location of the information is unknown. In fact, it may be located in another country unbeknownst to the customers. Therefore, Gartner advises that it may be worth asking the providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers. This in turn may drive up the cost more than initially predicted by the providers.

Data segregation

Aside from the points discussed above, another complex challenge may arise in the form of Data segregation in the cloud as it is typically in a shared environment alongside data from other customers. Encryption is effective but is not a cure-all. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. “Encryption accidents can make data totally unusable, and even normal encryption can complicate availability.”

This can affect the efficiency and the speed on retrieval of the much-needed information, or at the extreme level, a loss of all vital information, which will lead to the next point Recovery issues.

Recovery

Even if data location is unknown, a cloud provider should provide a disaster and recovery process. Any offering that does not replicate the data and application infrastructure across multiple sites is vulnerable to a total failure. Users should always confirm that the provider has the ability to do a complete restoration, and how long it will take.

Any recovery process taking more than a few minutes may cost the organization numerous man hours, which could affect addressing the patients' needs right at that moment.

Investigative support

Investigating inappropriate or illegal activity may be impossible in cloud computing: "Cloud services are especially difficult to investigate, because logging and data for multiple customers may be co-located and may also be spread across an ever-changing set of hosts and data centers. If you cannot get a contractual commitment to support specific forms of investigation, along with evidence that the vendor has already successfully supported such activities, then your only safe assumption is that

investigation and discovery requests will be impossible.” At its extreme, this can be a risk factor and lead to a breach of confidential information.

Long-term viability

Ideally, the cloud computing provider will never go broke or get acquired and swallowed up by a larger company. However, users must be sure their data will remain available even after such an event. “Ask potential providers how you would get your data back and if it would be in a format that you could import into a replacement application.”

Training

Introducing a new technology/paradigm that can potentially affect the existing personnel requires change management. Part of this management is to remove anxiety by education and provide a proper forum in which to have discussions. Another suggestion is to provide training to some of the existing personnel in the new paradigm or technology. Human resources should also get involved in helping personnel find new roles and positions in the company.

This year’s top three IT cloud services challenges – security, availability and performance – also topped last year’s challenges list according to the Gartner survey report. These are the challenges/issues that need to be addressed in any future additional work for cloud implementation.

Figure 16 – Disadvantages of Cloud Computing



Source: IDC Enterprise Panel, 3Q09, n = 263

(Source: IDC's – Cloud Computing Challenges Survey)

As the survey results show, security is the number one issue again, and thus remains the top opportunity for IT suppliers to tackle as they position themselves as market leaders in the cloud era. Availability and performance were tied at number two last year, and are in the same dead heat again this year. For the purposes of this paper, these factors are considered together under a label of “dependability.” This survey result is a clear call for suppliers to offer service level agreements, and – more important – service level assurance. Consequently – as noted in IDC Predictions 2010 – the industry expected many traditional IT suppliers to charge more forcefully into the cloud services business in 2010, with a focus on “enterprise-grade” IT cloud services.

The next two challenges represent very interesting shifts from last year's survey. At #4, users' concerns that the cloud model will actually cost them more rose from #6 in last year's survey. Cost worries may seem counterintuitive, given that economics show up very strongly on the "benefits" side of the ledger, but the reason is simple. Smart IT executives should ask, "What if my end-users, enabled by the cloud model or self-service provisioning capabilities, use more than I (or they) have budgeted for?" This concern opens up an excellent opportunity for suppliers to introduce services/solutions that help customers better anticipate, monitor and manage the real demands (and costs) of cloud services offerings.

Appearing at #5 on the challenges list is "lack of interoperability standards." This item was not offered as a choice in last year's survey, but it was an issue that those in the industry have certainly heard a lot more about this year. Customers are wondering whether choosing cloud services will lead to the same kind of lock-in they have endured for decades, or whether standards will give them greater freedom of action in the cloud era. Interestingly, this concern about cloud standards is echoed in the challenges that #6 raises (bringing back in-house may be difficult) and #7 (hard to integrate with in-house IT). Even though standards cut against the grain of many leading suppliers' traditional strategies (at least when it comes to standards that impact their core offerings), this survey suggests that suppliers who take a more aggressive and customer-friendly stance toward cloud standards may be able to grab larger market share at this important "crossing the chasm" stage of the cloud market.

From one point of view, security could improve due to centralization of data and increased security-focused resources. On the other hand, concerns persist about loss of control over certain sensitive data, and the lack of security for stored kernels entrusted to cloud providers. If those providers have not done a good job securing their own environments, the consumers could be in trouble. Measuring the quality of cloud providers' approach to security is difficult because many cloud providers will not expose their infrastructure to customers. It is necessary to develop a survey more specific to the different security issues and the associated challenges that have emanated in the cloud computing system.

Conclusions

Cloud Computing is an emerging technology; many organizations are adopting this new computing paradigm to increase performance, throughput, and reduce cost. It has distinct benefits such as on-demand services, reliability, scalability, performance security, maintenance, virtualization, and multi-tenancy.

Security, privacy dependency (loss of control), cost, decreased flexibility, knowledge, and integration are the challenges that need to be addressed for any Cloud implementation.

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Appendices

Appendix A: Acronyms

CRM: Customer Relationship Management

EHR: Electronic Health Record

EMR: Electronic Medical Record

ESB: Enterprise Service Bus

HIPAA: Health Insurance Portability and Accountability Act

IA: Confidentiality, Integrity and Availability

IaaS: Infrastructure as a Service

IBM: International Business Machines

ICT: Information and Communication Technology

IT: Information Technology

ITU: International Telecommunication Union

NIST: National Institute of Standards and Technology

VNAs: Visiting Nurses Agencies

PaaS: Platform as a Service

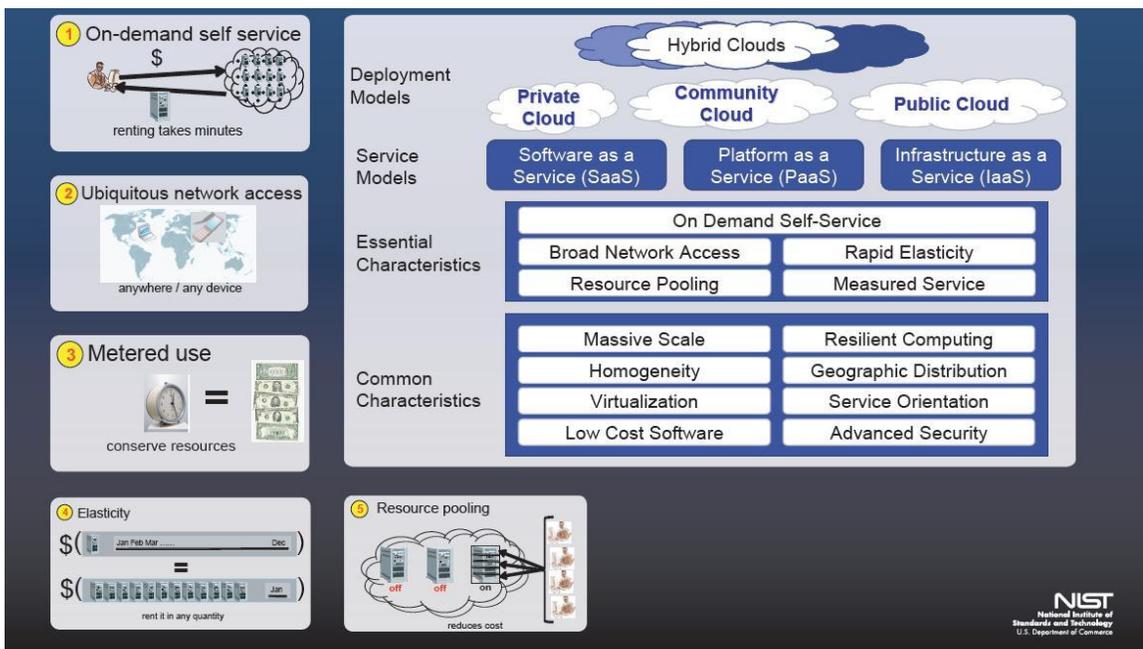
SaaS: Software as a Service

SLA: Service Level Agreement

SP: Service Provider

Appendix B: Definitions of Cloud Computing - National Institute for Standards and Technology (NIST) - An agency of the US Department of Commerce

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.



Visual Model of NIST Working Definition of Cloud Computing

Service Models

Cloud Software as a Service (SaaS) The capability provided to the consumer is to use the provider’s applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client

interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Cloud Platform as a Service (PaaS) The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

Cloud Infrastructure as a Service (IaaS) The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

Deployment Models

Private cloud The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

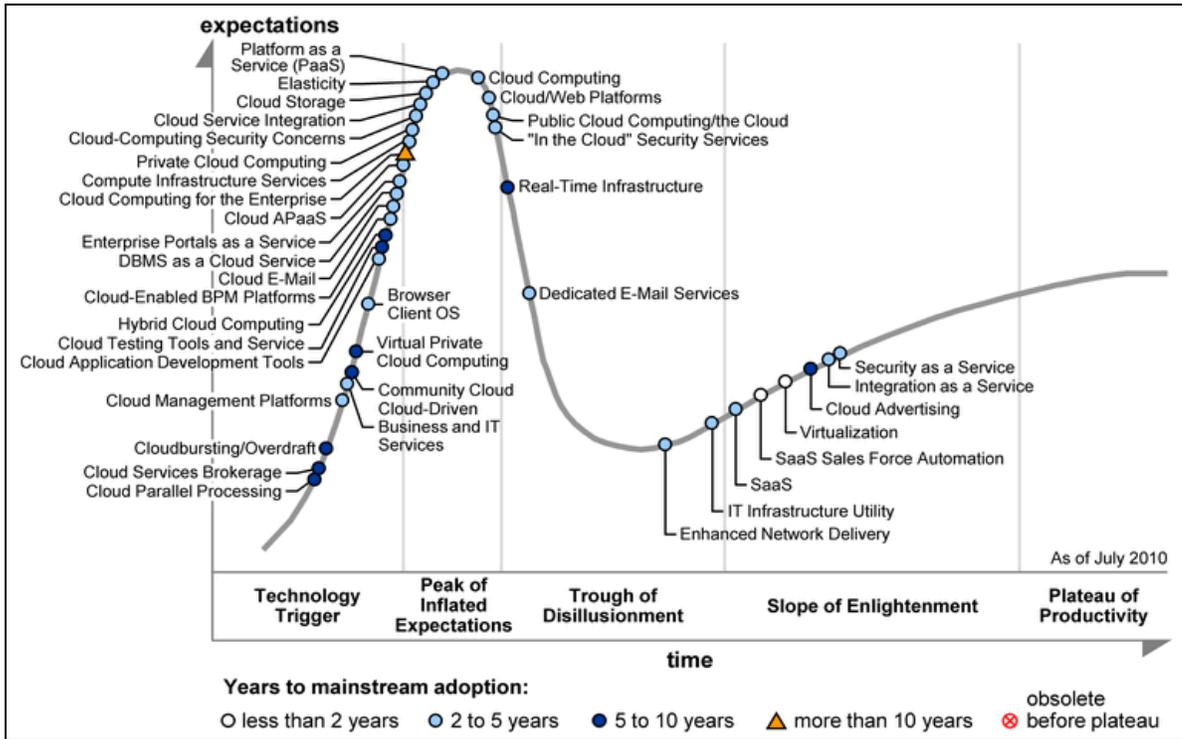
Community cloud The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise.

Public cloud The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Hybrid cloud The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).

Appendix C: Gartner Hype Cycle for Cloud Computing, 2010, identifies which aspects of cloud computing are in the hype stage, applications/technologies approaching significant adoption, and those that are reasonably mature. While “security as a service” is closer to the plateau of productivity than “virtualization”: for example, the former still has 2 to 5 years to mainstream adoption, while the latter less than 2 years. This essentially means that market penetration is higher for virtualization, while maturity of the technology and business models is more advanced for security as a service.

Due to cloud computing being at the peak of the hype cycle, agencies that seek to transition to a cloud computing arrangement may have to consider increased risks at this time.

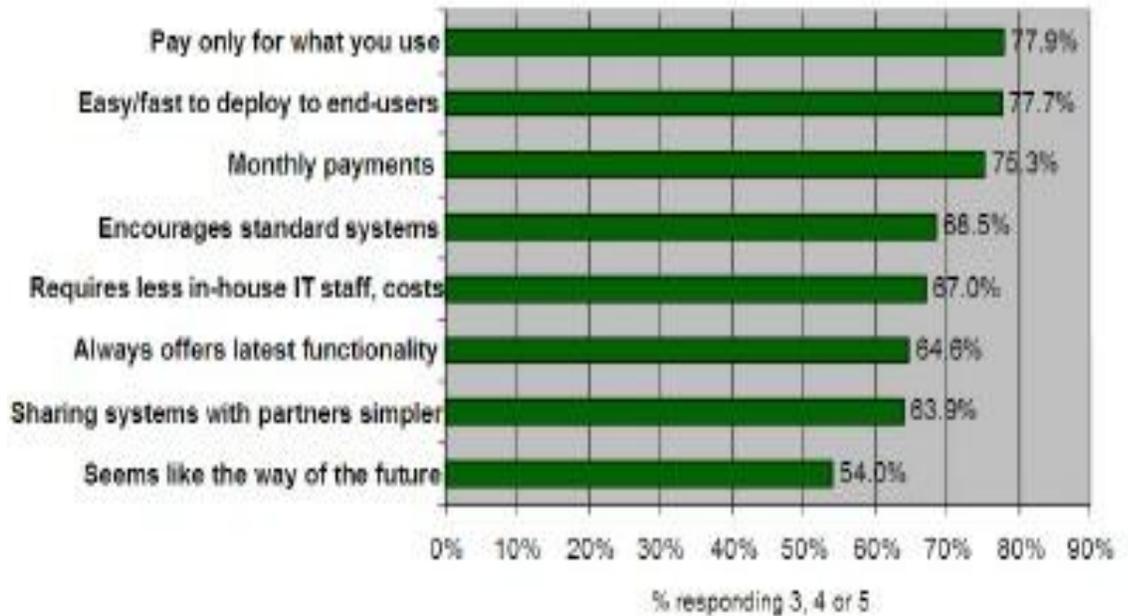


Gartner Hype Cycle for Cloud Computing, 2010

Appendix D: This year's Gartner group survey shows once again that economic benefits are key drivers of IT cloud services adoption.

Q: Rate the *benefits* commonly ascribed to the 'cloud'/on-demand model

(Scale: 1 = Not at all important 5 = Very important)



Source: IDC Enterprise Panel, 3Q09, n = 263

Three of the top five benefits were about perceived cost advantages of the cloud model: #1 was pay for use, #3 was payments streamed with use and #5 was shift of IT headcount and costs to the service provider. While pay-for-use slightly edged out last year's #1 – easy/fast to deploy – these two are essentially in a tie for the top position. It is safe to ascribe the slight edge for pay-for-use to the enormous pressure that the Great Recession has put on IT budgets, and the consequent increased focus on cloud economics in the minds of customers. However, it is still clear that speed/simplicity of adoption remains a key driver of demand for cloud services.

One benefit that moved up the list from last year's survey – from #6 to #4– was the cloud model's ability to “encourage standard systems.” This upward movement reflects a growing sophistication in users' understanding of the cloud services model, and how it can apply to their environment. One of the largest sources of IT complexity and cost is the huge sprawl of distinct, yet functionally redundant, systems and applications in most organizations. It is an open secret that the lack of standardization – of things that could, and should, be standardized – is perhaps the number one brake on IT's ability to respond quickly and efficiently to businesses' changing needs. Cloud services – by definition – are built on the premise of standard, shared systems.

This survey finding suggests that IT executives increasingly see, and will promote, standardization as an additional – and important – justification for migrating to both public and private cloud offerings.