Tsegaye Beka Ture

Practical Guide to Cloud Services

Helsinki Metropolia University of Applied Sciences
Bachelor of Network Engineering

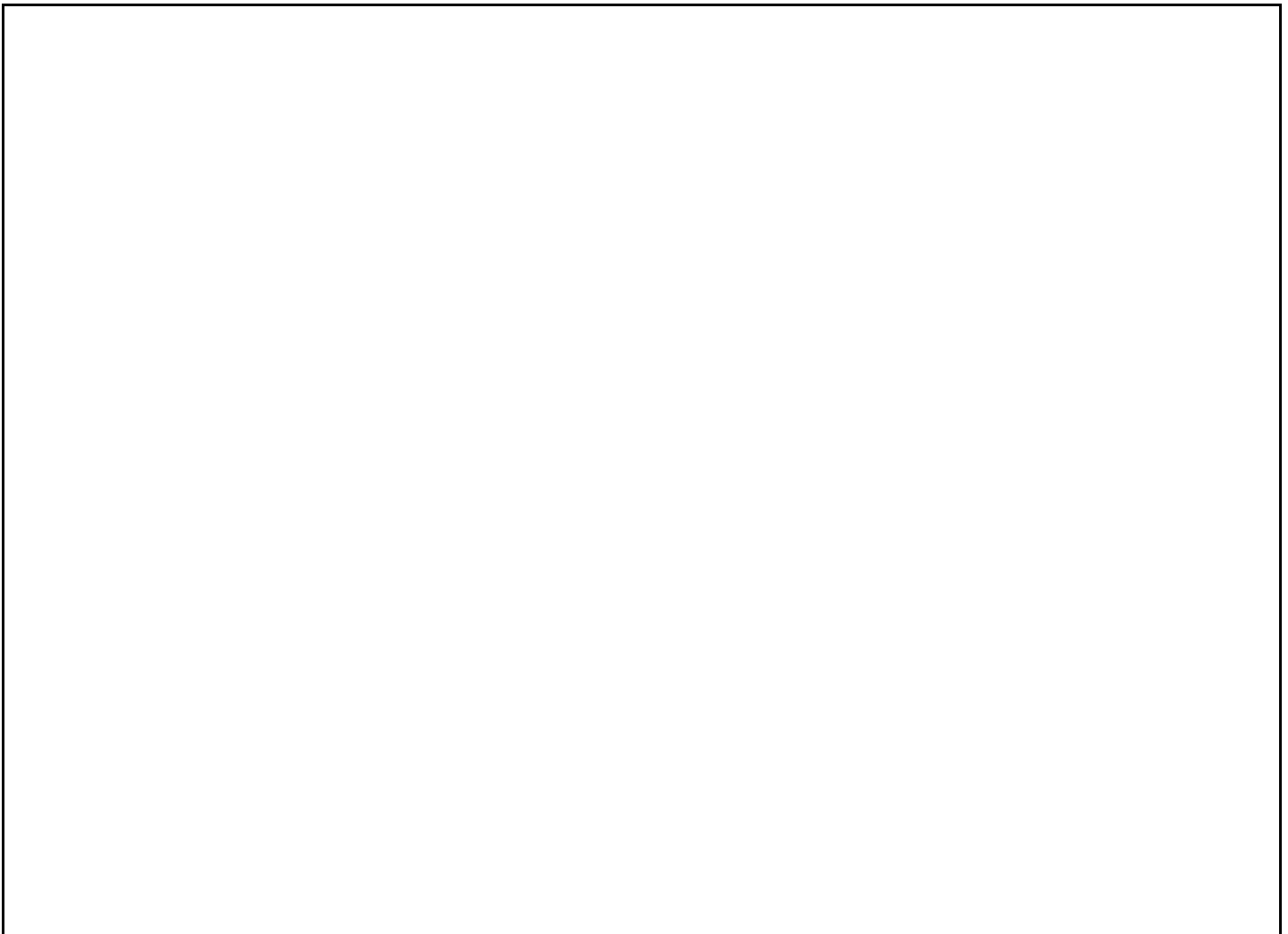Degree Programme in Information Technology

Practical Guide to Cloud Services

30 April 2016

Helsinki
Metropolia
University of Applied Sciences

Author(s)	Tsegaye Beka Ture
Title	Practical Guide to Cloud Services
Number of Pages	45 pages
Date	30 April 2016
Degree	Bachelor of Network Engineering
Degree Programme	Degree Programme in Information Technology
Specialisation option	Communications Engineering, Database Management Systems, Big Data
Instructor(s)	Kari Aaltonen, Principal Lecturer

The goal of this project is to investigate thoroughly about the currently available giant cloud computing services like Amazon Web Services, Microsoft Windows Azure, and IBM Cloud etc. with respect to small businesses which plan to migrate their transaction platforms from local premise based to cloud services. The study strives to scrutinize the implementation of Software as a service (Desktop as a service), Platform as a service and Infrastructure as a service. It also grapples to elucidate in details about the cloud computing services deployment models like private, public, hybrid and community cloud computing deployment models. The study also highlights Big data and some of the big data analytics software like SAP ERP, Microsoft Dynamics Nav, Hadoop and IBM Content Analytics as well as Database Management Systems like MSSQL, MySQL, Oracle and IBM DB2 in relation to cloud computing services.

The project is carried out in a self-teaching research methodology, by referring publicly available resources and the prior understanding and knowledge of the research area in which the student had acquired from precedent related courses. The project will enable the student to have a rigorous understanding about Big Data, Cloud Computing Services, Database Management Systems and so much more, in which the student has familiarity with as well as peculiar concepts in the study area and enhances the student's research skills and obtain important findings about the research topic thereby the student ultimately achieves the desired objective.

Helsinki
Metropolia
University of Applied Sciences

| Keywords | Cloud, DBMS, Big Data, SaaS, PaaS, IaaS, Services |

Contents

Abbreviations and Acronyms

IAAS	Infrastructure as A Service
PAAS	Platform as A Service
SAAS	Software as A Service
SLA	Service-level agreement
ARPANET	Advanced Research Project Agency
AWS	Amazon Web Service
DBMS	Database Management System
DDL	Data Definition Language
DML	Data Manipulation Language
HTML	Hyper Text Mark-up Language
IBM	International Business Machine
SQL	Sequential Query Language
UTF	Uniform Transformation Format
ASCII	American Standard Code for Information Interchange
ASP	Application Service Provider
API	Application Programming Interface
SOA	Service-Oriented Architecture
ITIL	Information Technology Infrastructure Library
ERP	Enterprise Resource Planning
SAP	Systems Application Program
CMS	Content Management System
CRM	Customer Relation Management
CDM	Content Delivery Management
CPU	Central Processing Unit
GPU	Graphics Processor Unit
HP	Hewlett Packard
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Secure Transfer Protocol

1   Introduction

The purpose of this research study is to meticulously investigate the commercial and managerial benefits of cloud services for boosting small businesses into a lucrative empire. Cloud computing provides infrastructures that are the backbone of business transaction platforms. What attributes and characteristics of cloud computing services, small scale businesses need to consider rigorously when they contemplate to migrate from their local premise based business transaction infrastructures into cloud computing. These include factors like the merits and demerits of implementing cloud services over the local based system regarding cost and security vulnerability threats, the deployment models as well as the trustworthiness of the service provider company and so much more. This research study is intended mainly to provide a type of manual that will serve as a referential documentation for small companies conceiving the idea of moving their business platform into cloud computing services but have some indecisiveness and need a robust guidance or for those who have already made the decision and need some convincing well organized documentation that corroborates the measure taken to migrate from local premised based to cloud services. Cloud Services are merely the providers of the tools, platforms, infrastructure and facilities required to accomplish the roles of the physically available spacious and resource intensive Information services over the internet or dedicated network. These services are provided from client companies based on requirements that are influenced by amount of usage and meeting consumers demand. Cloud services have a proven track record of booming businesses that range from small scale to giant lucrative businesses by enhancing the technological capability of companies which in turn boosts profitability by increasing the production and productivity which results in cost effectiveness. Thanks to virtualization and other features which play crucial roles, cloud services give businesses the opportunity to avoid installing physical servers. These services provide information services which facilitates collaboration among colleagues, business partners and other pertinent entities via the ubiquitous browser which provides access to sophisticated technology. Needless to say that most of the demands of businesses are merely fulfilled with cloud computing services. However, many businesses are avoiding the demerits of absolute reliance on cloud based services by incorporating versatile solutions, which is parallel side by side deployment of local based solutions with cloud service to guarantee availability which avoids complete dependency. Thanks to the full-fledged versatile features of cloud services, the number of business and individuals migrating to cloud computing services is increasing recently.

2   Research Methodology

The purpose of this research study to organize a documentation scrutinizing profoundly, the role of cloud Services for small companies. The objective is to create a small reference book for the personnel of small companies who are interested in running their business activities using cloud computing services as their primary commercial transaction platform. This study focuses especially on explaining the financial ramifications of using cloud services for small scale lucrative businesses relative to the local premise based services. In order to get a deep insight about cloud computing services and the potential benefits for companies, this dissertation conducts a research study of the strengths and weaknesses of cloud computing services. It strives to answer the following questions mainly: What does cloud computing service mean? What are the important attributes of cloud computing? How was the concept of cloud computing conceived and how did it evolve over time? What imminent security threats and vulnerabilities are in cloud computing services? What are the different types of cloud computing services providers available in the market? As stated above, the outcome of this report is to create a reference manual that is helpful for the personnel who run companies of various scales and who are looking for such resources to substantiate their decision of migrating to the cloud, before implementing cloud services for running their businesses. In brief the following research questions generalize the objectives this dissertation is trying to answer.

1. What is cloud computing service?

2. What are the favorable attributes of cloud computing services?

3. How was cloud computing conceived and how did it evolve over time?

4. How feasible is the practical implementation of cloud computing services for small companies to do business transactions?

5. What are the imminent security threats and vulnerabilities in cloud computing service?

6. What are the correlations of cloud computing services with big data and database management systems?

3   The conception and evolution of cloud computing services

The birth of cloud computing

One of the crucial technologies that paved the way and laid the cornerstone for the emergence of cloud computing services is virtualization, which is approximately 50 years old. Virtualization was first conceived for IBM mainframes in mid 60s, although after the transition of computer technologies from costly mainframes to much smaller and affordable personal computers based on x86 architecture, attention was not heed to virtualization for a very long period of time. In the meantime, virtualization was still a privilege only for those, who had the capabilities to afford mainframes. It was not until mid-2000s when the trend began to change swiftly. Until then the x86 VMware predominantly controlled virtualization market, although in time its hegemony was challenged by both commercial and open-source projects. The apparent influence of these projects inspired VMware to make the desktop version of the software for launching virtual machines free. In 2006 Microsoft also made a free version of MS Virtual PC. Nowadays Oracle VMware's are widely utilized.

The first company that enormously realized the commercial potential of abundantly available virtualization technologies was Amazon. Until 2006 virtualization was seen as an opportunity to run required number of virtual servers on your own hardware. Amazon Elastic Compute Cloud acquainted the idea of running virtual servers on rented hardware, which is synonymous to the Infrastructure as A Service model. The merits of such rental system is noticeable, all you have to do is pay for the service, and you will immediately get a complete virtual server, which is just as absolute and comfortable as your own local premise based server.

Although virtualization played a vital role for the advent of cloud computing services, it is not the only technology that laid the milestone for the phenomenal emergence of cloud computing services. Among the other scenarios that contributed immensely for modern cloud computing services were Service-Oriented Architecture (SOA), Application Service Provider (ASP), Information Technology Infrastructure Library (ITIL), IT Service Management (ITSM) etc. Some of those concepts embraced very limited technological approaches, while others were merely used as a marketing glossary of words and terminologies.

Availability of prevalent high-speed Internet connections contributed hugely and takes the lion's share contribution for data exchange between computers in the cloud. Enhancement of Web 2.0 enabled interactions with functionally opulent applications right in the web browser, without the need to download them and launch on a local computer or in the local network. Internet services that allow access to resources via special Application Programming Interfaces (API) also contributed to the success of cloud computing services. Cloud computing accumulated a lot of ideas from preceding corroborating concepts, and that is why it is a very versatile terminology. It is a technical trend besides being marketing and promotion strategy. Cloud computing allured IT industry ideas from the couple of past decades.

According to reliable resources, by November 2014, the total number of cloud computing users went over 300 million. It is difficult to give the exact figure for the total value of the cloud market revenue, although it exceeds 100 billion dollars per year, and it is going to grow beyond that over time. According to the data available on the Internet, the popular cloud storage, Dropbox had been gaining about 100 million users per year in the last few years.

Cloud computing services Sophistication

Nowadays cloud is getting widespread reputation for running all types and scales of businesses entirely alone or by adopting it with the traditional local premise based services as a hybrid solution to avoid complete dependency as availability is a determining factor, and there are convincing motives for that. The primary reason for increasing migration to the cloud is the booming market trend, along with new opportunities come along. There are tremendous cloud computing services options now than before that substitute most of the essential attributes of almost any local premise based business platforms. There are cloud storages, content delivery management software, project management software, enterprise resource management software, customer relation management systems software, network management software, accounting software, cloud platforms for software development etc., you name it and cloud computing services have it. And all of these important services often do not come solitary, there are always alternatives that fulfil the essential requirements. And even if there is no convenient application for your needs to accomplish particular tasks, it could be possible to develop an application from the scratch to tailor it to fulfil your specific needs and acquisition.

Despite the fact that cloud computing is based on relatively old technologies, its implementation was somewhat restricted until a decade ago. At the moment we are in the final stages of development of cloud technologies, still open for inventions, innovations or mitigations regarding business and other models. The term cloud computing became popular around 2007, although it has much longer history. Virtually almost all of the technologies that constitute the cloud trend had existed long before, although the market did not have the mechanism that would embrace them in a commercially alluring scenario. During the past decade or so public cloud services that have substantial advantages for both developers and business owners emerged.

Figure 1   Top Cloud Computing Services Providers

http://reviewcloudserviceproviders.com/top-biggest-cloud/2016-top-and-biggest-cloud-providers-expected-520.html

Accessed on March, 23, 2016 at 4:30 PM GMT

Figure 2   Evolution of Cloud Computing

https://www.safaribooksonline.com/library/view/the-enterprise-cloud/9781491907832/ch01.html

Accessed on March, 23, 2016 at 4:30 PM GMT
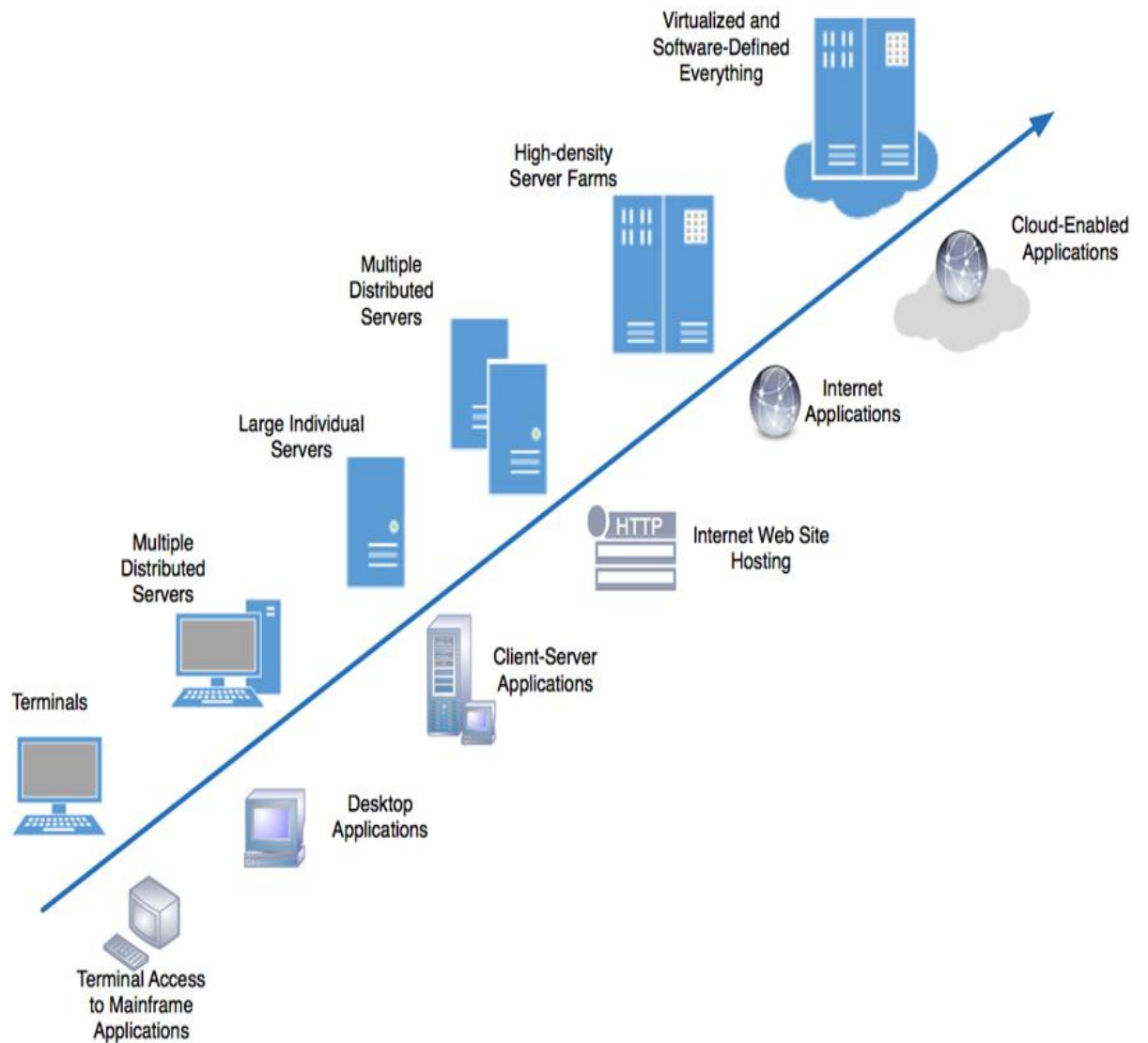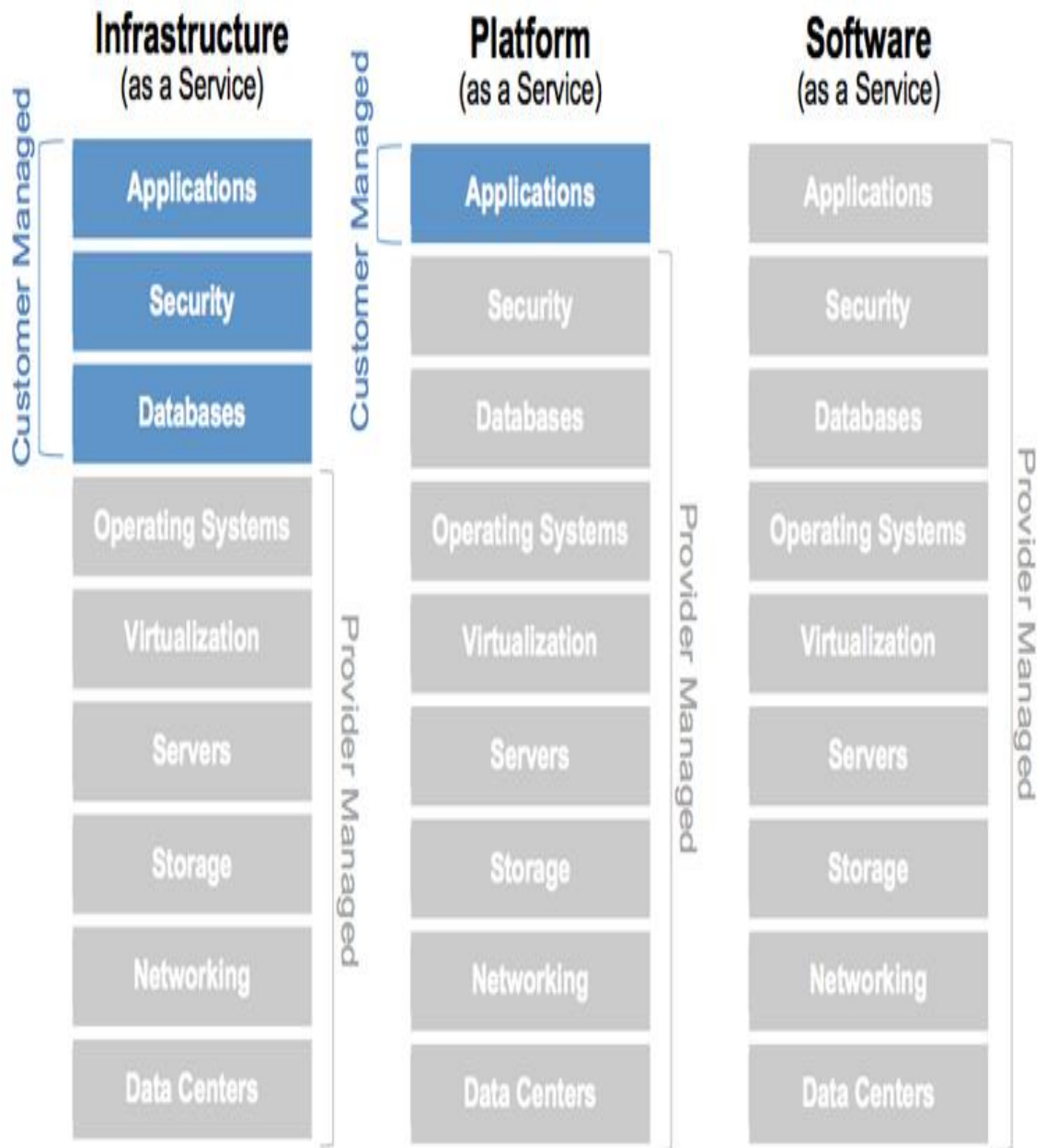
Figure 3   Evolution of Cloud Computing

https://www.safaribooksonline.com/library/view/the-enterprise-cloud/9781491907832/ch01.html

Accessed on March, 28, 2016 at 4:30 PM GMT

4   Cloud computing services Implementation

Many dispute that the concept of cloud computing services is merely a marketing promotion strategy and terminology to define centralized, mainframe computing which is web hosting services. Nevertheless, the pattern of the nowadays cloud computing services has disparity from that of the terminal solution of the former times. Primarily the enormous magnitude of resources available makes the meantime cloud computing services relatively sophisticated and more reliable than the terminal solutions of the previous times. It is like as easy as peeling a banana for cloud services vendors to instantly increase additional GB of space for the consumer merely at the client's inquiry, owing to the expandable and agile cloud computing resources hosted by the giant cloud service vendors like Amazon. The capability of providing cloud computing services is attributed to speedy network connection availability at comparatively reasonable costs. Cloud is a huge entity which encompasses a multitude of sub-categories. Cloud computing for companies includes: Infrastructure as a service, platform as a service and desktop as a service, also known as software as a service.

4.1   Cloud computing services layers and architectural hierarchies

Platform-as-a-Service (PaaS)

Platform as a service enables individuals and businesses to have a platform on which they can develop and deploy customizable applications, databases and line-of-business intelligence services integrated into one platform. Examples of PaaS cloud computing include Windows Azure, Google App Engine etc.

PaaS (Platform as a service) is the second layer in cloud computing services. This layer is usually utilized by application developers, because based on IaaS they devise solutions and resources required for storage, database organization, scalability, flexibility, security support, new operating systems or programming languages. Professionals working with PaaS devise the complete system to be used by software for its functioning. This blend of the first two layers enables a more regular and coherent access to the next layer, SaaS.

Infrastructure-as-a-Service (IaaS)

Organizations can make acquisition of infrastructure as a service from vendors as emulating resources. The elements that can be purchased include servers, memory, firewalls, intrusion detection and prevention systems, site to site virtual private networks etc. Amazon EC2, Rackspace, Google Compute Engine and others are a few examples of IaaS. Virtually almost all small businesses actually require not more than SaaS services out of the three layers. For these businesses, SaaS offers a cluster of software and technical solutions that would otherwise be cost-restrictive and complex to administer if they were implemented on premise, local based solutions.

IaaS is the fundamental architectural hierarchical layer to the functioning of Cloud Computing services. It embraces all the physical parts such as server farms, database centers, physical hardware, power and cooling systems that enable the storage and transmission of data and applications instantly via the Internet. It is this feature that insures the functionality of the service and allows the platform to work in compatibility with the settings. The infrastructure can be implemented both within the company, demanding the implementation of essential hardware that are necessary for the process, and externally, in third-party providers that may be located even in other countries. The ISP avails all services remotely, from the infrastructure to the end application used in the company. All this activity is organized by professionals called infrastructure architects, who are responsible for the operation and maintenance of the service in order to function effectively.

Software-as-a-Service (SaaS)

Software as a service also known as desktop as a service is when a software application or service is provided to a customer as a subscription. Dropbox, Google Drive, OneDrive are a few examples of SaaS. Software runs on computers possessed and administered by the SaaS provider, synchronized with user computers. The software is accessible via public Internet and overall provided on a monthly or yearly subscription.

SaaS is the last hierarchical architectural layer among cloud computing services that is closest to the user end who are basically the target customers. This is solely because of the fact that the most renowned applications like Gmail, OneDrive, ICloud, Googled rive, Facebook, Internet Banking, Netflix and many others, fall under this category of the three layers. SaaS functions as a software dissemination trend in which applications are hosted by service vendors and offered through a dedicated network where physical implementation on the customer's computers is not required. Besides SaaS makes company's official information, confidential data and corporate documents accessible remotely from a server that has a network connectivity using virtual private network securely.

Briefly explaining the cloud computing services architecture, the lowest level in cloud computing services architecture is infrastructure-as-a-service (IaaS). This is where pre-configured hardware is provided via a virtualized interface or hypervisor. There is no high level infrastructure software offered or provided by the service provider such as an operating system, this must be provided by the service recipient client, embedded with their own virtual applications. Platform as a service (PaaS) goes a stage further than IaaS and accompanied by the operating environment which includes the operating system and application services. PaaS is most convenient to companies that have dedicated allegiance to a given development environment for a given application but like the idea of someone else taking care of the maintenance of the deployment platform for them. SaaS provides efficient and effective services and applications on-demand to provide particular services such as email management, Customer Resource Management (CRM), Enterprise Resource Planning (ERP), telepresence endpoint, online collaboration, web conferencing and an increasingly broad range of other applications.
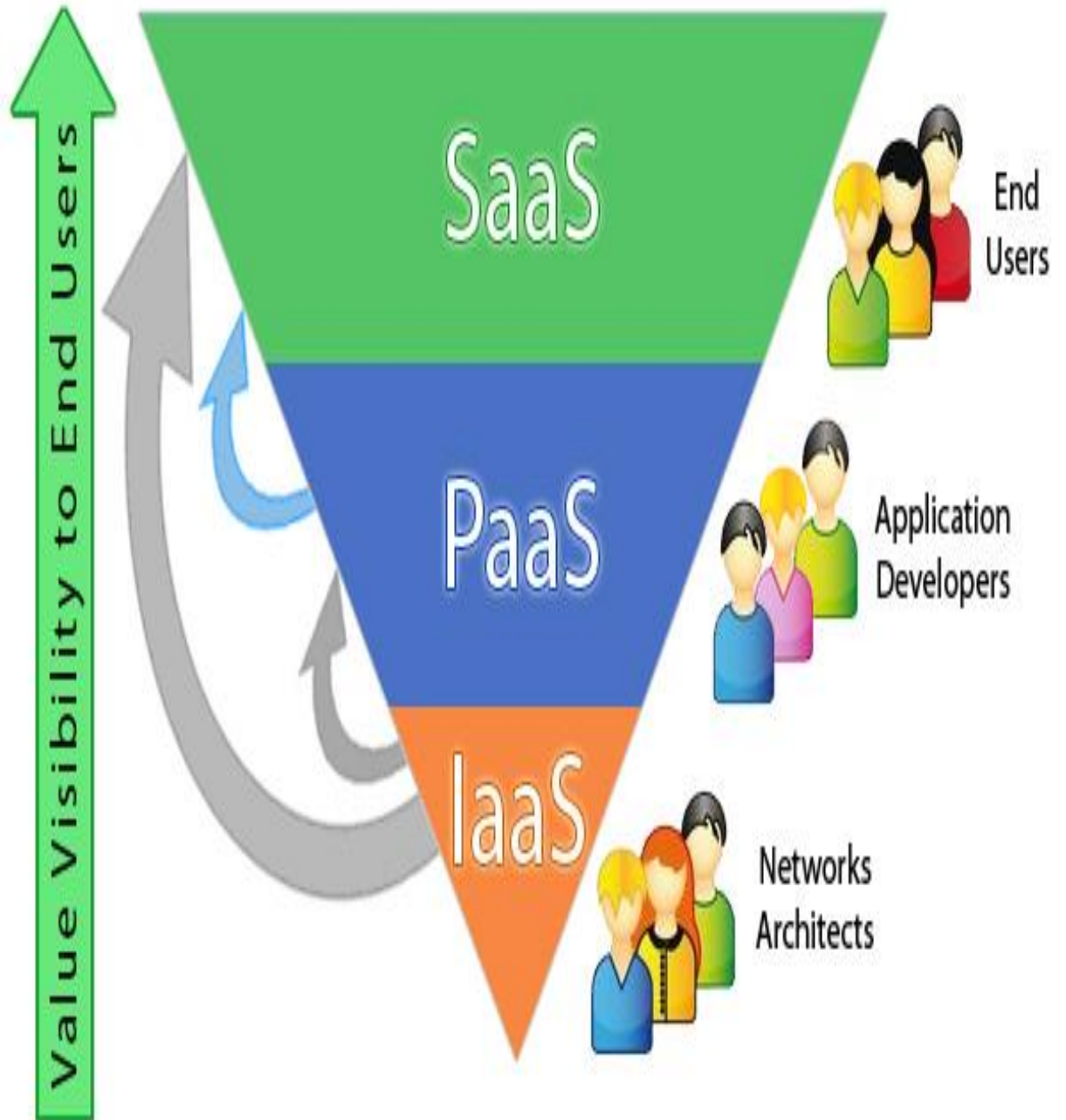
Figure 4 SaaS, PaaS and IaaS Cloud Computing Services hierarchy

http://cloudserver-vps.com/what-is-saas-paas-and-iaas-in-cloud-computing/

Accessed on March, 23, 2016 at 10:30 AM GMT

Figure 5 SaaS, PaaS and IaaS Providers

http://www.computerweekly.com/photostory/2240109268/The-Computer-Weekly-guide-to-Cloud-Computing/2/The-difference-between-Saas-Paas-and-Iaas

Accessed on March, 23, 2016 at 5:30 PM GMT

Figure 6 IaaS, SaaS, PaaS Services

https://www.computenext.com/wp-content/uploads/2013/08/iaas-saas-paas.png

Accessed on March, 23, 2016 at 8:30 PM GMT

4.2   Cloud Computing Services Deployment Models

Public Cloud

A public cloud is one that is derived from the referential cloud service trend, in which a service vendor provides elements, such as applications and storing space to the entire publicity via a dedicated network. Public cloud services may be at no cost or delivered on the amount and magnitude of usage mode.

The major advantages of using a public cloud are:

- Simple and cost effective implementation because the service provider covers hardware, application and bandwidth costs

- Scalability and flexibility that meets needs and requirements

- Resources are utilized without wastage as you are charged for what and for how long you made use of the resources available.

Private Cloud

Private Cloud is a kind of cloud service that offers relatively same advantages to public cloud, that embraces expandability and autonomy, but via a corporate internal infrastructure. Apart from public clouds, which offer services to multiple institutions, a private cloud is committed to a single institution. As a result, private cloud suits best for businesses that have scalable or unprecedented computing requirements that need instantaneous control over their platform.

There is disparity between public and private cloud computing service deployment models. Public clouds, such as those from Amazon Web Services or Google Compute Engine, share a computing architectural infrastructure among different clients and businesses which is known as multi tenancy which allows concurrent usage of resources from the service provider simultaneously by clients. Nevertheless, these shared computing platforms aren't convenient for all businesses, such as those with critical workloads, inevitable security vulnerability threats and concerns, availability requirements or administration needs. However, these businesses can use hybrid solutions.

A private cloud delivers similar advantages just like public cloud. These include self-service and scalability; multi-tenancy; the capability to provision machines; altering resources on-demand; and creating multiple machines for complex computing jobs, such as big data. Postpaid charging meters' track accounting and auditing information of the client which is basically authenticated and authorized client's usage of the resources, amount and timing. Individuals and businesses reimburse for the amount of resources they made use of, the duration and a number of requirements are the influencing factors.

Besides, private cloud delivers hosted services to a specific number of individuals and businesses behind a firewall, so it reduces concerns on vulnerability threats with respect to security in which certain organizations have regarding cloud computing services. Private cloud gives organizations the opportunity to have direct control over the resources from the service provider.

However private clouds have certain demerits for example, on local premises based Information Technology rather than a third-party cloud provider -- is responsible for managing the private cloud. As a result, private cloud deployments carry the same skilled man power recruitment, administration, maintenance and capital expenditures as traditional data center acquisition. Marginal private cloud costs include virtualization, cloud software and cloud management tools.

Cloud bursting a capability that offers individuals and companies the opportunity to utilize hybrid solutions which is adopting both private and public cloud computing services.

Hybrid Cloud

Cloud services infrastructure that comprises the desirable features of both on premise local based, private cloud and third-party, public cloud services swaying in between these infrastructures. By reinforcing and balancing the magnitude of the work stress to balance between private and public clouds as computing demands and pricing varies,

hybrid cloud offers greater opportunity to businesses to be flexible and additional data implementation alternatives.

Hybrid cloud is especially crucial for extremely varying work stress. For instance, a business transaction ordering system that exhibits tremendous market rises during special public holidays is a best hybrid cloud alternative. The application could be implemented in private cloud, but utilize cloud bursting to explore marginal computing elements from a public cloud during marketing rises. For the interaction and integration of cloud private and public cloud computing models, a hybrid cloud infrastructure is needed.

Big data analytics is one but not the only other application of hybrid cloud computing. For instance, an enterprise could utilize hybrid cloud to maintain its accrued business, which could be vital to the expansion of the capacity of the system.

The agility, variability, expandability and elasticity of Public cloud avoids the need for a company to make extraordinarily exaggerated capital expenditure in order to meet demands during marketing rises. The public cloud vendor delivers all the necessary elements and then organizations pay for the amount and magnitude of resources they consume.

Despite its merits, hybrid cloud can impose technical, business and administration challenges. Private cloud workloads must access and interact with public cloud providers, so hybrid cloud requires API compatibility and robust network connectivity.

For the public cloud, piece of hybrid cloud, there are potential connectivity issues, Service Level Agreement breaches and other possible public cloud service disruptions. To mitigate these challenges, enterprises can architect hybrid workloads that interoperate with multiple public cloud providers. However, this can complicate workload design and testing.

Community cloud

Cloud infrastructure is intended for the exclusive use of a particular group of individuals from organizations sharing common ideologies and challenges. The cloud may be in the ownership, management and maintenance of one or more organizations in the community, to a third party, or a combination of these, and is both within organizations and beyond.

5 Attributes and merits of Cloud Computing Services

5.1 Benefits of cloud computing services

Cloud computing services have many similar features:

- ➢ Virtualization- cloud computing utilizes server farms and data storage virtualization exhaustively to deliver resources rapidly

- ➢ Multi-tenancy -resources are allocated to and shared among multiple users simultaneously to gain access to the resources concurrently

- ➢ Network-access - resources are accessed via the ubiquitous web-browser with a multifarious networked device (computer, tablet, smartphone etc.)

- ➢ On demand - resources are allocated based on requirements and subscription package

- ➢ Elastic -resources are upgraded or downgraded automatically or based on customer requirements

- ➢ Metering/chargeback -resource consumption is audited and accounting information is documented based on authenticated and authorized access

Cloud computing services deliver tremendous benefits which include:

- ➢ Quick implementation and time saving

- ➢ Ubiquitous anywhere access to applications and content, reliability and availability

- ➢ Rapid scalability (enhancement) to fulfill requirement

- ➢ Efficient resource consumption on the basis of investment portfolio

- ➢ Cost Effectiveness and boosting productivity

- ➢ Facilitating Collaboration and cooperation among the pertinent bodies

- ➢ Advanced security and protection of information assets

5.2   Demerits of Cloud Computing Services

There are different potential advantages of cloud computing enterprises which are discussed above in detail but still some limitations need to be considered by company's management when making the decision to migrate their business platform from on premise local based solutions. Therefore, cloud computing services have some disadvantages.

Absence of direct control

Cloud computing services are entirely possessed, administered and monitored by service providers and thus customers have little or no control over their information assets availability in which downtime could result in the losing access to the resources and this can happen at any instance of time. Therefore, customers only have control over services, data, and applications. Moreover, customers do not have access to administrative tasks like firmware, hardware and managerial procedures.

Absolute Reliance on Network Connectivity

Cloud computing is utterly internet dependent service at least for the time being. This is the major impediment of cloud computing services because absolute reliance and dependency of cloud over internet connectivity could lead to critical service interruptions at any time. Service disruptions can occur at any phase of the business transaction process such as during real-time financial transactions, during file transmission, during data storage, real time communication or other tasks and as a result services can be delayed.

Security Vulnerability Threats

Almost all the elements that constitute the cloud computing framework are easily accessible via internet browser. As a result, both the providers and consumers of cloud computing services are affected by the security breaches from malicious attackers.

Ramifications of Migration to Cloud

Migration to cloud computing is tricky and controversial at the same time. There are some common challenges in this regard, which consist of identification of right cloud vendors, effective management of cloud resources, and transitions of IT hardware and investments from on premise, local based solutions to cloud based services. Therefore, the shift to cloud services is a meticulous decision that challenges the decision making and managerial proficiency of the responsible IT professional. The decision should be made indisputably embracing the interest and benefits of the company in every aspect. Otherwise the result might be more destructive than being conducive.

Dynamics of Cloud Computing

Cloud computing, storage, networking, and interfaces requirements of the customers are continuously changing. Such evolving parameters show that cloud computing is not stagnant and therefore it is continuously changing with the passage of time. This routine advancement and versatile changes create challenges for customers to cope up with the rapid infrastructural and other related evolutions with respect to the on premise, on the spot technological and architectural components adjustment to meet the demands of the service provider's cloud based services mitigations.

6   Top security vulnerability threats to cloud computing

Lack of control and security threats rank the top among the main disadvantages of cloud computing services. Data breaches and cloud service abuse rank among the greatest cloud computing security threats and vulnerabilities. In this chapter a closer attention heed to these prevalent security threats to cloud computing services.

Security Breaches of Data

A malicious attacker need not go through sophisticated complex procedure to extract the information needed. If a multi tenancy cloud service does not have a secure and properly designed database, a minor pitfall could result in an Overwhelmingly critical information asset loss and damage not only on a particular clients' resources but also the entire clients in that multitenancy environment. Therefore, a perilous ordeal will be the fate of the involved bodies. The challenge here is that the measures taken to mitigate one can aggravate the other. Encryption of the data stored could enhance the security level however, losing the encryption key accidentally means loss of the precious information asset, which is data. However, if you retain duplicate of your data properly and securely to minimize loss of precious information asset which is data, you lessen the risk of exposing your data to breaches by encrypting your exquisite information asset.

Information Asset loss

A malicious hacker could damage the client's data spontaneously out of disguise. You could also exhibit loss of your valuable data to a negligent cloud service vendor or to a natural calamity such as tornado fire, flood, or earthquake which are any providers and consumer's uncontrollable catastrophes. The multifarious predicaments, data encryption could result in data loss by itself if you lose the encryption key and also complications with the law enforcement agents if you are required by law to keep the encryption key in a secure place and you failed to do so.

Account service traffic hijacking

The third cloud computing security vulnerability is service traffic hijacking. Cloud exasperates this challenge. If a malicious attacker gains access to users' data like login credentials, they can eavesdrop on activities and transactions, intercept services transmissions, modify data and interrupt services, retrieve fraudulent data, and redirect clients to fraudulent malicious sites. Malicious attackers will leverage the power of service provider's reputation to establish intermittent attacks. A counter example of this threat is an XSS (Cross Site Scripting) attack on Amazon in 2010 that gave attackers the chance to credentials to the site. XSS is a JavaScript attack where the attacker uses a malicious code or attack script payload to steal the user's session cookies. These can be reflected where an action is required from the user for the execution of this malicious code or stored where no action is required from the victim. The entire process could be automated without the victim knowing what is really happening.

Implementing strong two-factor authentication and one-time password authentication mechanisms, that are time bound techniques where possible, protection of credentials from theft are some of the solutions from these security vulnerability threats.

Unsecured interfaces and APIs

It is vital for organizations to recognize the security threats accompanied with the implementation, administration and monitoring of cloud. Vulnerable interfaces and APIs can expose an organization to such security issues pertaining to confidentiality, integrity, availability, and accountability.

Denial of service

DoS has been a headache for loss network connectivity for years and the problem exasperated in the era of cloud computing when businesses are reliant on the 24/7 availability and reliability of one or more services. DoS disruptions can bankrupt service providers and customers extremely in which clients who are billed based on amount and duration of subscription package and consumption. Although a malicious hacker may not succeed to disrupt the entire service completely, but can they make it consume tremendous amount of resources in an automated fashion that makes it costly for customers to run in which consumers are obliged to relinquish their subscription. Denial of Service can

result an enormous damage that gives the rogue spoofing attacker for interception, interruption and even modification of the data. This enormously affects reliability, confidentiality, availability and integrity of data transmission.

Malicious insiders

A malicious access to valuable information assets gained by former employee, business partner or contractor or any entity that had authorized access to these resources during normal operation and now had certain disputes with the owner of these resources or evil intentions and want to impose harm to this pertinent body, could cause an overwhelming damage. In as poorly designed cloud scenario, a malicious insider can cause even greater pandemonium. From IaaS to PaaS to SaaS, the malicious insider has increasing hierarchical trends of access to more critical systems and eventually to data. In situations where a cloud service provider is solely responsible for security, the risk is enormous. If the encryption keys are accessible to the customer only during usage and not kept with the customer, there is still a risk of fraudulent attacker claiming access to the resources by impersonating the authentic user which is called identity theft. And also even if the encryption keys are kept with the customer, the customer might handover them to malicious outsiders nonchalantly.

Misuse of Cloud

Another example might be a malicious hacker using cloud servers to launch a DDoS attack, propagate malware, or share software piracy. The challenge here is for cloud providers to define what constitutes abuse and to determine the best procedures that acknowledges management issues governing the customer's ethics of resource usage.

Inadequate due diligence

Organizations implement cloud computing services without perfectly understanding the cloud environment and challenges that accompanies it. Organizations should make sure they have adequate resources and perform due diligence before diving into the cloud. Organizations should have the mission, vision and business strategies for why preferring on premise local based solutions.

Technology vulnerabilities

Cloud service providers allocate facilities such as infrastructures, platforms and applications to deliver their services in a scalable way. The technological vulnerabilities include infrastructures (e.g. CPU caches, GPUs, etc.) that were not designed to offer robust separation properties for a multi-tenant architecture (IaaS), re-deployable platforms (PaaS), or multi-customer applications (SaaS), the risk of penetrative security vulnerabilities exists in all delivery models .If one element in a shared cloud computing service is compromised by malicious attackers who have evil agendas ,the damage is prevalent to all the other users that are under similar multitenancy environment platform

7 Implementation Costs of Cloud Services

Although most experts agree that cloud have passed the preliminary stage and started delivering tangible financial and operational benefits that are primarily scalability, ubiquity agility and flexibility, there are latent costs that are accompanied with the migration to cloud. These costs should be meticulously assessed by the users in their cost analysis of the commercial boost versus the hidden financial payroll balancing in a long term follow up.

7.1 The Real Costs of Cloud Computing Services

Data storage and Migration Costs

It costs an overwhelming large amount of money to migrate data and sore it in the cloud for a long period of time. Organizations do not notice these costs usually until they put their feet into hot water. Moving everything to the cloud at once will cost enormously. Bandwidth takes the lion's share in these costs. Service providers charge for data uploading and downloading, although the data is stored offline, there is still charges for taking care of it. A number of different factors amount to the accumulated costs of cloud computing services as one of the direct repercussions.

But these costs are unprecedented only if you don't perfectly understand the cloud infrastructure. Overall using public cloud computing for purposes other than storage avoids the need to deploy and maintain applications internally.

Costs of Integrating Apps from Multiple Vendors

The challenge of adopting software from multiple vendors is where the additional costs are incurred during integration such as management and compatibility expenditures. Integration gives customers the opportunity to synchronize tasks. Similar integration challenges dwell between larger, complex applications, such as integration ERP, CRM etc.

Costs of Software Trial Periods

Free trial period offers from cloud computing service providers are tricky and should be examined cautiously. Some organizations offer very little trial time period and it gets into paid services immediately without you noticing that the trial period is already over. You need to be careful with the subscription type and the duration before it turns into paid service. Avoid automatic charging services after the trial period is over, you may forget the fact that you have even subscribed to the paid service after the trial period is over. Hence scrutinize the offers vigilantly from the service providers before agreeing to the contractual statements.

Rent and Utilities Costs

Unprecedented costs are inevitable when migrating from the local based on premise services to the cloud in which most of them are not even noticeable to the professionals at the first glance. Three are, of course, costs with hosting a system internally, but not all of them, like power and rent, are remunerated out of the client's Budget. In cloud computing services, rent and power expenses are inherent and included in the contract added in the service charge monthly or according to the agreement type. Cloud is a novice idea and still open for improvements and companies moving to the cloud should assess the potential risks and benefits before they make a decision to migrate to the cloud.

7.2   Vital Steps for Successful Cloud Computing Services Implementation

If you're intending to enhance the deployment of cloud computing to boost your business, the following important checklists worth your sincere consideration

If your business is ready to be deployed on the cloud

Evaluating the preparedness of the applications you want to run in the cloud via a potential free trial service provider is a wise decision as to get the indications to what type of cloud services you need to adopt for your applications. This might be the type of cloud computing services like private, public or hybrid as well as the cost analysis. This will

exhaustively give you the tangible benefits of migrating your applications to the cloud. It helps you to make a decision that you won't regret for adopting.

If the service provider offers technical assistance

Most of the cloud service providers are known for their simplicity to use for consumers ranging from novice no technical background to those who are enriched technically. However, there might come up a critical time where you need to receive technical support from the providers for the smooth operation of your business. Before you sign the contract with the cloud-based service of your choice, make sure that you will be able to get adequate technical support whenever you need it most.

Possession and availability of your valuable asset

The application, the hardware and the operating system will be owned by the cloud provider. Nevertheless, the valuable data asset is your intellectual property and this should be clearly recognized and indisputable acknowledged in the contractual statements you are signing with the service provider. In the annual or monthly subscription, you are agreeing to, make sure that you will have access to your data even after the contract for using the platform, application or any other services you are using has ended. These is vital if you want to move your data to another service provider or download it to your local on premise based service for your future usage even if you relinquished the service from the cloud computing service provider.

If the infrastructure is owned by a single provider or intermediate chain of subcontractors involved

Cloud computing sometimes might be provided through a chain of subcontractors which provide the service in collaboration. In some countries like in Europe, the customer need to sign contractual agreements with each and every entity that involved. It might not be enough to have agreement with the main cloud service provider if the service involves many other providers in the way before you are able to enjoy the comfort and ease of cloud computing. You need to agree to the terms of usage and different other contractual statements with everyone involved.

Compliance

In reality the service requirements you requested and the actual service the service provider is offering to you have certain disparities. You need to make analysis of the tolerance level you can acknowledge based on the service level agreement and transparency. Evaluating whether the service provider is complying to your demands to an acceptable level is your assignment to take care of before you delve into the service level agreement.

Financial Benefits

Cost analysis is the crucial part of making the decision to migrate your business platform to the cloud. You need to compare and contrast the costs of investing in cloud infrastructure and the returns you will gain as a result of adopting the cloud services versus the on premise local based solutions. The cost analysis should include capital expenditure, management costs, operational costs and head costs involved with migration.

Handling the failure of availability or downtime

The other vital feature in addition to all the factors including cost effectiveness of the cloud computing services is the way the service provider promises to deal with downtime. The service level agreement should be alluring to consumers and should warranty approximately 100% availability of the service. As most of the cloud service provides have redundancy due to the multitude of data centers they own, nearly 99.999% uptime availability is the acceptable level customers should be guaranteed. The service level agreement should clearly state the duration that will take until the service up again in case the availability is lost due to different reasons.

Data Migration

Cloud computing services vendors should warranty the security of the sensitive customer data so that their customers will have the confidence and faith for letting their information

asset to be kept by safe hands. Security, cost effectiveness and availability are important factors that determine the quality of the service provider and the privilege customers have to choose between vendors.

All of the above steps should be carefully considered by any business before they proceed to cloud computing. The merits and attributes of cloud computing services will be reaped if and only if the right vendor is selected.

7.3 Four Reasons Small Businesses Should Migrate to the Cloud

Cloud computing could be a fundamental progress for small businesses. The cloud is redefining the way small businesses do business. Below are the lists of robust motives why small businesses should migrate to the cloud.

Cost Effectiveness

One of the most important features of moving from the on premise local based solutions to the cloud is the significant amount of savings small businesses can reap as one of the merits of the move to the cloud. These savings arise from minimal hardware requirements such as storage space, power, installation as well as maintenance. These attributes are the benefits reaped as a result of virtualization which enables businesses and vendors to have the opportunity to do more with less expense in terms time, energy and capital investment.

Enhanced collaboration

Cooperation, collaboration, coordination or whatever you name it, is one of the obvious attractive features of the cloud that corroborates your decision to move to this robust system. Employees can edit, comment, share, upload, download and do so much more from the same master document thanks to the tools available for cloud computing such as google drive, One Drive, Dropbox and etc. This is not the only enhanced feature involved when we mean collaboration. Employers can also limit the data access privileges of their employees and check on the progress and efficiency of the employees.

Ubiquity

One of the most alluring merits of cloud computing is the capability to access files any time anywhere as far there is network connectivity of course. Those old days where files are stuck in a computer located somewhere and accessible only form that computer The world we live is moving fast in terms of technological advancement. This dynamic progressed from fixed device access to (Choose Your Own Device CYOD) to Bring Your Own Device (BYOD), Online Collaboration, Telepresence endpoint or Web Conferencing making the file accessible via the ubiquitous browser or applications like WINSCP.

Greater integration

The other benefit of cloud computing is the flexibility of applications to integrate with others. Cloud service providers can provide different types of applications ranging from accounting to architectural applications to medical solutions. With the cloud these are easily integrated thanks to the militancy platform.

7.4   Comparison between Cloud service providers price plan

Cost Comparison between Cloud and on premise local based solutions

It's like apples and oranges until understanding how the services work. Comparing pricing in the cloud is extremely complex and laborious process.
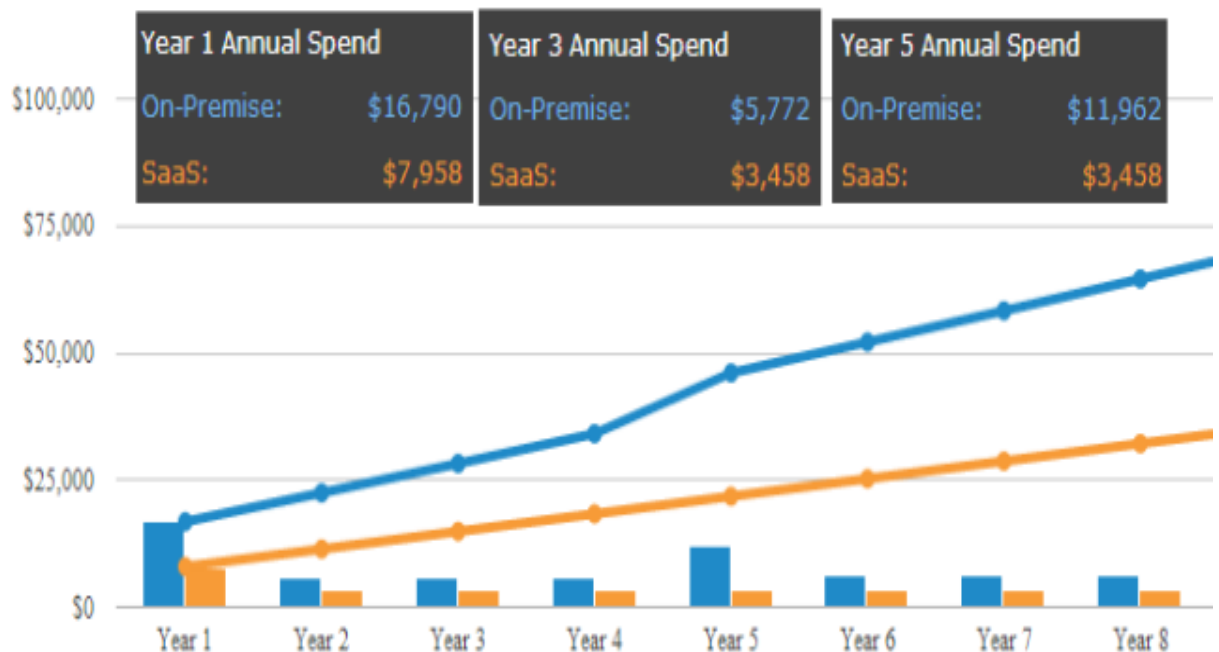

Figure 7 Comparison between Clouds versus On-Premise

http://betanews.com/2013/11/04/comparing-cloud-vs-on-premise-six-hidden-costs-peo-ple-always-forget-about/

Accessed on March, 28, 2016 at 8:30 PM GMT

A list of the factors that determine the decision to move to the cloud, as discussed in this study involves cost effectiveness, integration, support, collaboration, flexibility and ubiq-uity which are generic features of the cloud. Security and compliance are dependent on the cloud computing service vendors.

The following additional features are used to compare service providers

- **Service Charge Plan**-flexibility to pay monthly or annually or pay as you use and get discount packages
- **Service charge amount**-The cheaper the service charge with same level of service provision separates vendors and consumers choose
- **Service Level Agreement (SLA)** - The uptime SLA offered that involves technical support as well as dealing with downtime if it happens
- **Redundancy to warranty availability** - The number of datacenters offered as a choice when deploying cloud servers.
- **Certifications** – If the service provider or vendor has trustworthiness certified by standardization organizations
- **Capacity Upgrade** - If the vendor has the ability to upgrade hardware such as Storage, CPU, Memory demand
- **Support** – Three levels of quality indicators: Poor, Average and Excellent
- **Monitoring** - Three levels of quality indicators: Poor, Average and Excellent
- **APIs** - If the company offers APIs to interact with the servers or not.
- **Free Trial**- Availability of free service trial from vendors letting clients to test
- **Supported operating systems** – The number of operating systems supported with different versions
- **Customization**- How flexible the resources provided by vendors is customized based on demand
- **Outbound data transmission price** –The cost of data transferred from the vendor to the client
- **Inbound data transmission price** - The cost of data transferred from the consumer to the vendor

| | User Concerns | | | | | | |
| | Security Features | | Ease of Migration | | Reliability | | |
	Certifications	Protection	Standards	VM Upload	Service Age	SLA	Support
Providers							
Top-of-Mind							
Amazon (EC2)	Yes	Medium	No	No	5+ Years	99.95%	Poor
Rackspace	Yes	Poor	OpenStack	No	5+ Years	100%	Extensive
GoGrid	No	Medium	No	No	4 - 5 Years	100%	Extensive
Microsoft	Yes	Poor	No	No	< 1 Year	99.95%	Average
Terremark	Yes	Medium	VMware	Yes	2 - 3 Years	100%	Poor
IBM	Yes	Medium	No	Yes	1 - 2 Years	99.90%	Poor
AT&T	Yes	Poor	VMware	Yes	4-5 Years	??	Poor
Google	Yes	Poor	No	No	< 1 Year	??	Poor
OpSource	Yes	Medium	VMware	Yes	5+ Years	100%	Extensive
Softlayer	Yes	Medium	OpenStack	No	5+ Years	100%	Extensive
HP	No	Poor	OpenStack	No	< 1 Year	??	Extensive
Upstarts							
Hosting.com	Yes	Poor	VMware	Yes	5+ Years	100%	Extensive
BitRefinery	Yes	Poor	VMWare	Yes	2 - 3 Years	100%	Extensive
Lunacloud	No	Poor	No	No	< 1 Year	??	Average
Nephoscale	No	Poor	No	No	1 - 2 Years	99.95%	Extensive
Tier 3	Yes	Poor	VMWare	No	5+ Years	99.999%	Extensive

Figure 8 Cloud Service Providers

http://www.techrepublic.com/blog/the-enterprise-cloud/side-by-side-comparisons-of-iaas-service-providers/

Accessed on March, 28, 2016 at 10:00 PM GMT

8   Top Big Data Analytics Platforms

Data Analytics is crucial part of evaluating the performance of businesses. In this chapter we will try to highlight the big data analytics providers from Hadoop, Microsoft Windows Azure, IBM Content Analytics to Amazon Web Services.

Figure 5 Top Big Data Analytics Providers

http://bigdataanalyticsnews.com/16-top-big-data-analytics-platforms/
Accessed 23/03/2016 at 12:20 PM GMT

Big data is a terminology that elucidates the enormous volume of structured and unstructured data that involves a business's daily activities. It is not the volume of data that is important but what companies can achieve from it that is vital.

Data Analytics is an emerging elegant application that paved the way for big data analytics, pretty much describes the data analysis time in which we live. Businesses grapple with huge quantities and varieties of data on one hand, need faster analysis these data.

The following are the main characteristics of big data

Volume. Companies gather data from different sources such as social media, their own business transactions and others. Storing these large volume of data has been a problem in the past but thanks the technological advancement solutions like Hadoop Content Analytics and Microsoft Azure that made all these easy. Volume of data is the amount of collected usable data.

Velocity. Th rate big data is changing its dynamics.

Variety. The different formats of data from structured to unstructured from databased to traditional file storages.

Why is Big Data Important?

The significance of data is not how much it is in terms of measures but what it enables business to accomplish. Big data helps businesses to gain savings on time, financial as well as skilled man power efficiency. These helps businesses to make mature decisions. Big data analytics will help in dealing with the following important points

- Pointing out root causes of failures
- Accounting the customer's data usage and meeting the demands according to the customer's interests and habits
- Risk analysis
- Detection, prevention and reaction to scamming, spamming etc.

Conclusion and Recommendation

Cloud computing services as many have been claiming it to be just a marketing terminology did not remain as a promotion strategy but has passed that preliminary stage and commenced delivering tangible financial, operational, administration benefits. The scalability, flexibility, ubiquity and agility are favorable attributes of cloud that have emerged as the merits that have allured users. The anytime anywhere attribute has been challenged by service outages from the providers due to different reasons and also the absolute network dependency and reliance, remote areas that network access is a privilege for some. Security vulnerability threats are the other challenge cloud computing is facing. Losing precious information assets with in a fraction of a second due to natural catastrophe or because of improperly designed cloud infrastructure costs both consumers and providers. If the challenges facing cloud are addressed thoroughly and consumers get awareness and exposure to the delicacy of this sophisticated infrastructures and avoid negligence during resources usage, if service providers address the challenges of security vulnerability threats in a multitenant environment and overall all the predicaments are alleviated, cloud is going to be an overwhelmingly advanced and desirable technology.

References

1   https://aws.amazon.com/what-is-cloud-computing/

2   http://www.pcmag.com/article2/0,2817,2361500,00.asp

3   http://www.smallbusinesscomputing.com/slideshows/10-top-cloud-storage-ser-vices-for-smbs.html

4   http://www.businessnewsdaily.com/5851-cloud-storage-solutions.html

5   https://www.vmware.com/smb/cloud-services-hosting

6   http://www.investopedia.com/articles/personal-finance/090715/8-best-cloud-stor-age-solutions-small-business.asp

7   http://business-cloud-storage-services.toptenreviews.com/

8   https://www.telstra.com.au/small-business/cloud-services

9   https://www.salesforce.com/uk/blog/2016/01/10-great-cloud-apps-and-services-for-small-business-.html

10   http://www.entrepreneur.com/article/245784

11   http://www.networkworld.com/article/2175580/cloud-computing/nine-free-cloud-storage-options-for-small-businesses.html

12   http://uk.businessinsider.com/cloud-infrastructure-providers-2016-3?r=US&IR=T

13   http://www.information-management.com/gallery/top-10-big-data-companies-by-revenues-10026248-1.html

14   https://www.computenext.com/blog/when-to-use-saas-paas-and-iaas/

15   http://bigdataanalyticsnews.com/16-top-big-data-analytics-platforms/

16   http://www.computerweekly.com

17   http://www.computerworld.com

18   https://www.theseus.fi/

19   Cloud computing bible, Barrie Sosinsky , John Wiley & Sons, 8 Dec 2010

20   Cloud Computing For Dummies, Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper ISBN: 978-0-470-48470-8

21   Cloud Computing, A Practical Approach Toby Velte, Anthony Velte, Robert Elsenpeter , McGraw Hill Professional, 22 Oct 2009

22   Cloud Computing Insights into New-Era Infrastructure Dr. Kumar Saurabh , Wiley India Pvt. Limited, 1 Apr 2011

23   Cloud Computing: Automating the Virtualized Data Centre Venkata Josyula, Malcolm Orr, Greg Page , Cisco Press, 29 Nov 2011