Cloud Computing Benefits

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Abstract

Using different services, cloud computing offers more benefits than traditional computing. Cost saving, scalability, mobile storage, anytime anywhere access, better security, energy saving, environment benefits are some of benefits of the cloud computing. There is shift from traditional computing to the cloud computing and organizations and individuals are benefiting from it. There are many different cloud computing services available on affordable cost models, for example, subscription and lease based cost models. Services for example, Remote Desktop Session Host (RDSH) used for cloud desktop, Software as a Service (SaaS) used for renting software and Platform as a Service (PaaS) used to rent computing infrastructure. The Storage as a Service (STaaS) is used to rent storage and Security as a Service (SeaaS) is used for cloud based security applications. Similarly, the Infrastructure as a Service (IaaS) is used to lease computing infrastructure. Using services, cloud computing offers more benefits than traditional computing.

Cloud Computing Benefits

Using different services, cloud computing offers more benefits than traditional computing. For example, data access anytime anywhere benefits, cost saving benefits, mobility benefits, scalability, agility, efficiency, environment benefits and flexible security are some of benefits offered by cloud computing (Griffith, 2015). Cloud computing can be used as service rather than hardware based computing, it is cost effective and can be used like utility (Miller, 2009). Another attractive benefit of cloud computing is application processing load shift from local computing to cloud computing. For example using thin client, application can be processed at remote server (Strickland, 2008).

There are different cloud computing services used for different benefits, for example, Remote Desktop Session Host (RDSH) used for cloud desktop, Software as a Service (SaaS) used for renting software, Platform as a Service (PaaS) used by developers as subscription model, Storage as a Service (STaaS) used to rent storage, Security as a Service (SeaaS) used for renting security applications and Infrastructure as a Service (IaaS) used to rent computing infrastructure (Lovell, 2011). Using cloud computing services, individuals and organizations enjoy more benefits than traditional computing. For example, Using RDSH on Windows based server one could divide single machine to create multiple cloud computers is an attractive benefit. Other benefits, for example, licensing software at low cost benefits, renting storage rather than purchasing storage resources benefits, using security applications rather than implementing expensive security systems benefits and leasing computing infrastructure rather than investing to own infrastructure are some of examples of cloud computing benefits not offered by traditional computing. These services and different other services known as cloud computing offer more benefits than traditional computing.

Cloud Computing Services and Benefits

Cloud computing represents range of different cloud computing services enabling organizations and individuals to choose where, when, and how they can use cloud computing. Different cloud computing services, for example, Remote Desktop Session Host (RDSH), Software as a Service (SaaS), Platform as a Service (PaaS), Storage as a Service (STaaS), Security as a Service (SeaaS) and Infrastructure as a Service (IaaS) are some examples of cloud computing services offering more benefits than traditional computing. For organizations and individuals planning to shift to cloud computing, it is important to understand different aspects of cloud computing, assess need and then decide about which cloud computing service is appropriate to use (Kepes, 2011).

The cloud computing services are used for different needs, for example, using Remote Desktop Session Host (RDSH) single, Windows based, machine can be used for creating multiple cloud computers accessible anywhere and anytime via Internet, renting software, renting storage, renting security applications and renting computing infrastructure rather than purchasing. These benefits and many other benefits of cloud computing services are attracting organizations and individuals to shift from traditional computing to cloud computing.

Cloud Computing Services

The Remote Desktop Session Host (RDSH) used for creating multiple cloud desktops on a Windows based machine is one of the best examples offering more benefits than traditional computing. It is session based deployment whereby multiple cloud desktop sessions are used on a single Microsoft Windows Server saving application licensing cost and offering more productivity.

The cloud desktops, created by using RDSH, are used as cloud computers accessible anytime and anywhere via Internet and or via Intranet. Utilizing Windows Server 2012 R2

technology, experiment was conducted to collect data, as shown in Table 1. In this experiment, one Windows server is utilized without RDSH technology and one Windows server is utilized with RDSH technology for comparison of benefits. As shown in Table 1, Windows server without RDSH does not offer productivity as well as does not offer cost saving benefits. Moreover, Windows server without RDSH is not capable to offer enough multiple remote desktop sessions and or does not offer application license cost saving benefits, as shown in Table 1. In this experiment, server with RDSH offers 5 remote desktop sessions converting one machine in to multiple cloud computers, as shown in Table 1. These cloud computers offer mobile computing access anywhere and anytime over the network. Utilizing server with RDSH, one application license is utilized by multiple remote desktop sessions which is huge cost saving benefit, subject to vendor's license scheme, as shown in Table 1.

The Software as a Service (SaaS) is cloud computing service. It is software owned and developed by vendor and organizations and individuals rent and access it via Internet. Unlike traditional software that users install on their traditional computers, the SaaS vendor owns the software and runs it on computers in its data centre and organizations and individuals do not own it but rent it and or buy subscription based service from cloud computing vendors (Levinson, 2007). The SaaS licensing is more economical than buying perpetual software license and customer always gets updated version providing same benefits as standalone and perpetual software licensing model (Sehlhorst, 2012). Using the SaaS, organizations and individuals can enjoy cost saving and mobility benefits. The SaaS enables organizations and individuals to reduce dependency on in-house IT department adapting cloud computing quickly (Hinchcliffe, 2009).

The Storage as a Service (STaaS) is cloud computing service offering affordable cloud computing based storage available anytime and anywhere on the rent basis and or buy

subscription based service from cloud computing vendors. The STaaS is used to rent storage saving cost for organizations and individuals. For example, STaaS can be used to store data backups in cloud computing and access it anytime and anywhere which is very attractive benefit (Kundu, Banerjee, & Saha, 2010). Using STaaS, organizations and individuals can enjoy cost saving benefits and storage mobility benefits.

The Security as a Service (SeaaS) is also cloud computing service used for renting security applications. The SeaaS applications are highly affordable offering multiple security products without running them on local computer leading to enhance computing performance and reducing resources management burden (Kundu, Banerjee, & Saha, 2010). There are many benefits of SeaaS, for example, shifting mail and applications security to cloud computing on affordable cost.

Cloud Computing Benefits

The Remote Desktop Session Host (RDSH) is used for creating multiple cloud desktop sessions on Windows based operating system which is one of the best examples offering more benefits than traditional computing. It is session based deployment whereby multiple cloud desktop sessions can be used on a single Microsoft Windows Server. The cloud desktop can be accessible anywhere and anytime via Internet or Intranet making it very convenient, affordable and productive to organizations and individuals. One could use cloud desktop as personal mobile desktop available for 24 hours and 7 days without turning it off. During this study, utilizing Windows Server 2012 R2 technology, experiment was conducted on two servers, for example, server without RDSH and server with RDSH, as shown in Table 1.

Using RDSH technology, an organization can use one accounting software application as one license installed on one single server, subject accounting software vendor licensing scheme. The server uses RDSH to create multiple desktop sessions utilized by an organization for

different staff members located virtually anywhere. The staff members can access these different desktop sessions from anywhere and anytime via Internet and or via Intranet. The multiple desktop sessions work same way as dedicated desktop computers work enabling staff members to perform their work without with flexibility. Depending on security model adapted by organization, the desktop session offers secure environment as well as offers all features of dedicated desktop computer. For example, staff member can generate and print invoices, staff member can work on any other document, send emails, browse Internet, listen music, watch video and perform any work similar to performing any work on a physical desktop computer without affecting other staff members work on same single machine. This saves organization's cost to purchase dedicated hardware based desktop computer for each staff member, saves cost of purchasing separate accounting software license for each staff member, saves maintenance cost and offers convenience and mobility benefits to increase productivity.

The RDSH experiment as shown in Table 1, proves that how cloud computing offers more benefits than traditional computing. For example, converting one Windows machine in to more computers offers more productivity benefits, offers cost saving benefits, computing resources accessible anywhere and anytime benefits, mobility benefits, licensing cost saving benefits, energy saving benefits and reducing burden of IT resources benefits are some of examples of benefits offered by cloud computing.

The Software as a Service (SaaS) offers benefits of renting software from a cloud computing vendor on affordable cost rather than buy on high cost to own and manage it. Vendor may offer SaaS as managed service on rental basis which makes it affordable as well as reduces maintenance cost (Levinson, 2007). The Software as a Service (SaaS) reduces software acquisition risk of an organization enabling it to meet business goals quickly. For example, Information Technology (IT) department of an organization would be able to utilize Software as

a Service (SaaS) for meeting organization's business goals quickly without worrying about software update burden and resources maintenance burden. Software as a Service (SaaS) has potential to enable IT department to work as computing services provider helping organization to meet business goals without investing in software acquisition which is very attractive benefit of cloud computing (Carraro & Chong, 2006).

There are different options for using the Storage as a Service (STaaS), for example, public and private service. The private service offers dedicated environment inside the organization's environment and the public service is offered by different vendors. The STaaS is highly scalable and easy to manage storage becoming popular choice as cloud computing storage. Small companies and individuals can enjoy cost saving and scalability benefit of Storage as a Service (STaaS). One can benefit by storing, archiving and retrieving data seamlessly in secure way to grow. It is fast growing area of IT where organizations and individuals are ready to work with vendors those offering attractive Storage as a Service (STaaS) solutions in current economic climate offering more benefits than traditional computing.

The Platform as a Service (PaaS) is used to rent computing infrastructure. For example, organizations and individuals can rent or subscribe cloud computing infrastructure for applications accessible via Internet. Using PaaS service, vendors can provide customized solutions on affordable cost leading them to generate more revenue compared to customized traditional computing based solutions. For example, application development platforms, web based application add-on platforms, standalone application platforms and open platforms are some examples of solutions. Instead of offering virtualized infrastructure, cloud computing can offer Platform as a Service (PaaS) where systems could be hosted on required resources easily and on affordable cost (Kulkarni, Sutar, & Gambhir, 2012). These benefits make PaaS more attractive than traditional computing.

The Infrastructure as a Service (IaaS) is also cloud computing service offering many benefits. For example, IaaS is used to rent computing infrastructure including virtual machines, operating systems, middleware, applications, network and other infrastructure (Hess, 2007). Utilizing Infrastructure as a Service (IaaS), infrastructure vendors are able to scale and allocate cloud computing resources on demand to develop systems meeting customers' need quickly (Kulkarni, Sutar, & Gambhir, 2012). Utilizing the IaaS model, computing capabilities can be standardized where consumer is responsible to configure and operate infrastructure, whereas vendor focuses on service covering the performance and availability of the infrastructure (Loeffler, 2011). It reduces vendor's support burden and maintenance cost enabling vendor to offer completive price. Utilizing IaaS service, CPU, memory, storage, network and other resources can be selected as per application requirements on subscription based from IaaS vendor as per need basis whenever required.

Cloud computing offers better security and with proper planning and with proper security control, level of risk can be reduced. For security purposes, cloud computing resources can be dynamically reallocated which is one of the attractive benefits (ENISA, 2009). Though security of cloud computing is suspected, but with proper planning and security control, it could offer better security. The cloud computing offers real-time backups to recover data loss, businesses get maximum uptime and it is difficult for hackers to attack as it is hard to find actual location of cloud computing resource, for example, finding origin of web server while using Content Delivery Network (CDN) makes cloud computing security attractive (Kumar & Callow, 2011). Multi-factor authentication is good example of cloud computing security and due diligence for applying security patches to cloud computing resource makes cloud computing more secure (Wood & Tracy, 2011). In traditional computing, security is a real challenge but in cloud computing clear security policy and proper planning can make it more secure offering better confidentiality, integrity, and availability of information (Friedman & West, 2010). With proper

security measures, proper assets monitoring and regularly assessing security policies, cloud computing offers better security environment (Jansen & Grance, 2011). Shift to cloud computing is opportunity to rethink about security and reliable security for cloud computing can be implemented using combination of best practices, proper planning and technology (Hoover, 2011). These and many other benefits of cloud computing security are hardly available in traditional computing security.

One of the primary benefits of the cloud computing is significantly low cost compared to traditional computing cost. Organizations and individuals feel that using cloud computing they are able to reduce IT infrastructure cost and reduced IT operations costs (Leung, 2010). Cloud computing is highly affordable compared to traditional computing because it is more subscription and rent based model. The traditional computing requires to invest for purchasing resources, requires lengthy installation procedures and puts maintenance burden of expensive resources (Christian, 2011). When comparing to traditional computing, cloud computing does not require high-power and high cost computing, all resources can be low cost and efficient (Miller, 2009). Cloud computing is virtual infrastructure based and is Internet based compared to traditional computing which is physical infrastructure based which does not offer better scalability (Koomey, 2011).

Mobility benefits of cloud computing make it perfect for anytime and anywhere access. For example, accessing information whenever required and wherever required, staff can access information from home, access information from clients' offices or even from a smartphone such as a BlackBerry or iPhone, can work collaboratively on files and documents on the go are some of examples of cloud computing mobility benefits (Christian, 2011). Cloud computing is sustainable to deliver IT technologies anywhere anytime as mobile platform, replicates the capabilities of traditional computing in better way, allows updates and changes such as additions

and deletions of applications in smart way hardly available in traditional computing (Clark, 2009). Cloud computing enables to access information from anywhere while traditional computer is fixed location based (Huth & Cebula, 2011). One of the attractions for users to move to cloud computing is that they are able to use different devices including mobile devices to access shared data anywhere anytime make it more attractive than traditional computing.

Using cloud computing, shared computing resources can be distributed to applications efficiently for maximum performance. One of the benefits of cloud computing is the programs requiring storage and processing power running off-site offering low maintenance more economical benefits. Using servers as cluster to maintain cloud computing offers better reliability compared to traditional computing (Ganore, 2010). Cloud computing is more reliable compared to traditional computing, for example, in clustered environment, if one cloud computing resource fails, transaction can be carried over using other cloud computing resource without disruption. It makes cloud computing more beneficial than traditional computing.

Cloud computing offers better scalability and its resources are more on-demand and need basis, can meet growing need of storage and network resources, allows to develop, deploy and run applications on reliable cloud computing clusters that rarely fail (Smyth, 2009). Cloud computing is highly scalable, for example, as per need applications can demand and acquire more computing resources dynamically scaling to meet user's requirements. Cloud computing offers flexibility and scalability and provisioning is done on-demand which allows to accommodate traffic surges of cloud computing based applications reducing time to implement services and meeting the customer requirements on time on affordable cost (Spivey et al., 2009). Scalability is one of the main benefits of cloud computing as scalable solutions are implemented quickly and resources can be utilized whenever required saving time, saving money and increasing efficiency. Cloud computing also offers on-demand network access to configured

shared resources and is highly scalable. The scalability is one of the many benefits of the cloud computing attracting organizations and individuals to move to cloud computing (Sridhar, 2009). If compared, cloud computing offers better scalability than traditional computing.

Cloud computing also offers energy saving benefits attracting service providers to offer outsourcing solutions (Weissberger, 2011). Efficiency, scalability and flexibility makes cloud computing perfect for outsourcing sector which attracts organizations and individuals to outsource their services to cloud computing vendors (Stevens, 2009). Cloud computing meets organizations' and individuals' computing needs quickly where they can see improved efficiencies compared to traditional computing. Cloud computing offers better opportunity to focus on innovation for product growth which is more beneficial than traditional computing (Spivey et al., 2009). If compared, cloud computing is more efficient, scalable and flexible than traditional computing.

Cloud computing offers environment benefits, for example, it enables vendors to offer tailor made solution reducing power consumption which reduces emission, dangerous for environment (Kumar and Callow, 2011). Cloud computing uses Internet which has significant environmental benefits, infrastructure is always at peak performance and saving more energy (Guilbert, 2010). Cloud computing is expanding quickly offering energy saving and green environment benefits to organizations and individuals.

Conclusion and Future Study

This paper discusses cloud computing benefits compared with traditional computing. There are different cloud computing services offering different benefits, for example, Remote Desktop Session Host (RDSH) used for creating multiple desktop sessions using single Windows based machine offering cost saving benefits, mobility and productivity benefits, as shown in Table 1. There are different cloud computing services, for example, Software as a Service (SaaS) used for renting software, Platform as a Service (PaaS) used by developers as subscription model, Storage as a Service (STaaS) used to rent storage, Security as a Service (SeaaS) used for renting security applications and Infrastructure as a Service (IaaS) used to rent computing infrastructure (Lovell, 2011). These cloud computing services offer different benefits, for example, data access anytime anywhere benefits, cost saving benefits, scalability benefits, security benefits, energy saving benefits and environment benefits (Griffith, 2015).

The Platform as a Service (PaaS) can be studied further. It is rent based model offering to rent cloud infrastructure which helps vendors to attract organizations and individual for renting cloud infrastructure rather than investing to own it. Similarly, the STaaS can also be studied further. For comparing its benefits as renting storage and accessing it from anywhere and anytime offers scalability, saves cost and time which attracts organizations and individuals to move from traditional storage to cloud storage. Moreover, the Security as a Service (SeaaS) is also good candidate for further study. There is tremendous need of cloud based security applications. For example, cloud based firewall has seen tremendous demand in recent years.

Future study can be conducted on other cloud computing services as well. For example, Software as a Service (SaaS), Storage as a Service (STaaS), and Infrastructure as a Service (IaaS) are some examples of other cloud computing services for conducting future study.

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Table 1

Remote Desktop Session Host (RDSH)

S. No.	Without RDSH / with RDSH	Remote Desktop Sessions	Licensing	Benefits
01	Server without RDSH	One remote desktop session utilizing entire server resources	Single application license used for single session only	Limited productivity and high cost burden
02	Server with RDSH	5 remote desktop sessions (in this experiment) used as cloud computers on single server	One application license acquired for single machine is utilized by multiple remote desktop sessions	Single server enables to create 5 cloud computers offering more productivity and cost saving benefits (5 for this experiment). Moreover, there are additional benefits of saving computer license cost and saving application license cost