

CLOUD COMPUTING: IN SIMPLE TERMS

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ABSTRACT

Cloud computing is a new terminology that was added to IT jargon in early 2007. Still, people overuse this idiom to refer to things that may not relate to its actual definition and scope. Is it all about web hosting? Is it an old thing in new clothes? Why should organizations consider it? IT, business, and academia folks ask about cloud computing with the intent to understand it better. This paper tries to demystify cloud computing by simplifying its terms to readers with different IT interests.

INTRODUCTION

Cloud computing is a better way to run your business. Instead of running your apps yourself, they run on a shared data center.

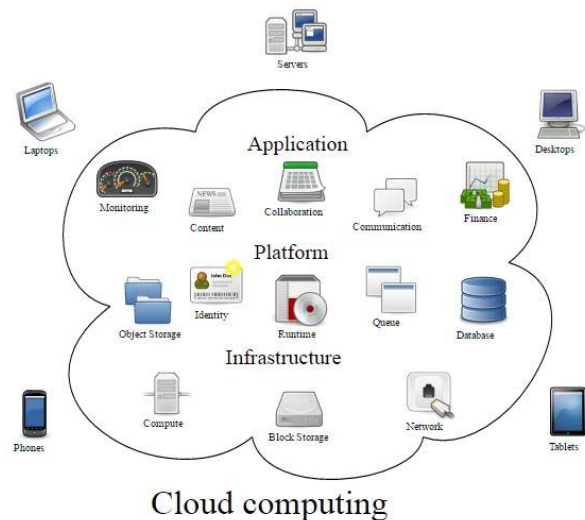
Cloud computing is where software applications, processing power, data and artificial intelligence are accessed over the Internet. Many private individuals now regularly use an online e-mail application such as Gmail, as well as sharing photos and video on social networking sites like Facebook. However, these types of cloud computing activities are just the beginning. Indeed, it is likely that within a decade the vast majority of personal and business computing will be Internet based.

According to IDC, cloud computing was a \$47.4 billion industry in 2013, and will be worth \$107 billion by 2017 (IDC). Like it or loathe it, cloud computing is therefore far more than hype. In fact, I would suggest that cloud computing has now become such an unstoppable force that the only real choice for any of us is whether we want to be part of the cloud computing steamroller or the traditional computing road.

CLOUD COMPUTING DEFINITION

Cloud computing is a model for delivering information technology services in which resources are retrieved from the internet through web-based tools and applications rather than a direct connection to a server. Data and software packages are stored in servers; however, a cloud computing structure allows access to information as long as an electronic device has access to

the web. This type of system allows employees to work remotely.



Cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. The cloud is just a metaphor for the Internet. It goes back to the days of flowcharts and presentations that would represent the gigantic server-farm infrastructure of the Internet as nothing but a puffy, white cumulonimbus cloud, accepting connections and doling out information as it floats.

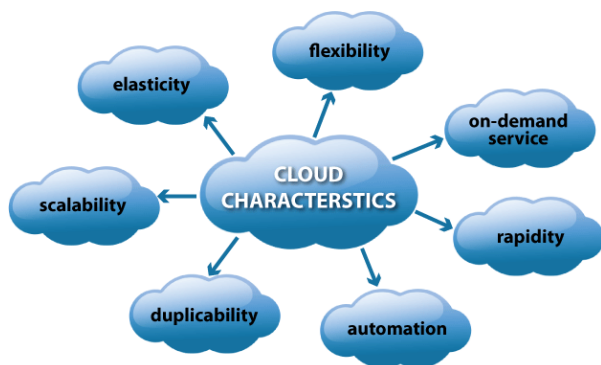
What cloud computing is not about is your hard drive. When you store data on or run programs from the hard drive that is called local storage and computing. Everything you need is physically close to you, which means accessing your data is fast and easy, for that one computer, or others on the local network. Working off your hard drive is how the computer industry functioned for decades; some would argue it is still superior to cloud computing.

CLOUD COMPUTING CHARACTERISTICS

So what, you may reasonably ask, is the cloud? Well, for years the Internet has been represented on network diagrams by a cloud symbol. When, around 2008, a variety of new services started to emerge that permitted computing resources to be accessed over the Internet, the label "cloud computing" therefore emerged as an umbrella term. Does this mean that we really ought to be talking about "Internet computing"? Well, perhaps. However, in the strictest sense, the "cloud" is a label for

online computing resources rather than the entire Internet. The term "cloud computing" is also useful to separate the kinds of things we have been doing online for a couple of decades from a totally new age of online software and processing power.

Cloud technology is in the news quite often these days, but it still seems to be mysterious and confusing to the non-techie crowd. Cloud options are enticing various industries across the board, which is why it is important to know its essential characteristics as a software offering. Here are the five main characteristics that cloud computing offers businesses today.



On-demand capabilities: A business will secure cloud-hosting services through a cloud host provider, which could be your usual software vendor. You have access to your services and you have the power to change cloud services through an online control panel or directly with the provider. You can add or delete users and change storage networks and software as needed. Typically, you are billed with a monthly subscription or a pay-for-what-you-use scenario. Terms of subscriptions and payments will vary with each software provider.

Users only have to consume the amount of online computing resources they actually want. Just as we are used to drawing as much or as little electricity as we need from the power grid, so anybody can now obtain as many or as few computing resources from the cloud as they require at any particular point in time.

Cloud vendors including Amazon Web Services (AWS) now quite literally sell computer-processing power by the hour. For example, anybody can now rent "virtual server instances" from Amazon's Elastic Compute Cloud or "EC2" service for as little as \$0.02 an hour (or indeed you even sign up for a one-year trial of the AWS Free Usage Tier for nothing). As Amazon explain, "EC2 reduces the time required to obtain and boot new server

instances to minutes, allowing [customers] to quickly scale capacity, both up and down, as [their] computing requirements change".

Broad network access: Your team can access business management solutions using their smartphones, tablets, laptops, and office computers. They can use these devices wherever they are located with a simple online access point. This mobility is particularly attractive for businesses so that during business hours or on off-times, employees can stay on top of projects, contracts, and customers whether they are on the road or in the office. Broad network access includes private clouds that operate within a company's firewall, public clouds, or a hybrid deployment.

Cloud computing is device-independent because cloud computing resources can be accessed not just from any computer on the Internet, but also any type of computer. If it has an Internet connection and a web browser, it really does not matter if the computer being used is a traditional desktop or laptop PC, or a tablet, smartphone or smart TV. Such device independency is also a killer feature of cloud computing because it means that users can move between computing devices -- such as their work PC, home PC, laptop and tablet -- without having to worry that they will always have access to the latest versions of their files.

Resource pooling: The cloud enables your employees to enter and use data within the business management software hosted in the cloud at the same time, from any location, and at any time. This is an attractive feature for multiple business offices and field service or sales teams that are usually outside the office.

Cloud computing is task centric because the usage model is based entirely around what users want to achieve, rather than any particular software, hardware or network infrastructure. Users do not have to purchase or install anything before using a cloud computing resource. Nor do they have to maintain or pay for anything during periods in which no resources are being used.

The above means that cloud computing empowers its users to just get on with what they want to do. Today, nobody sits down to use a pencil. However, many people do still consciously sit down to use a computer. Cloud developments may, however, start to catalyze a mentality shift from tool-in-hand to task-at-hand computer application.

Rapid elasticity: If anything, the cloud is flexible and scalable to suit your immediate business needs. You can quickly and easily add or remove users, software features, and other resources.

Cloud services can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

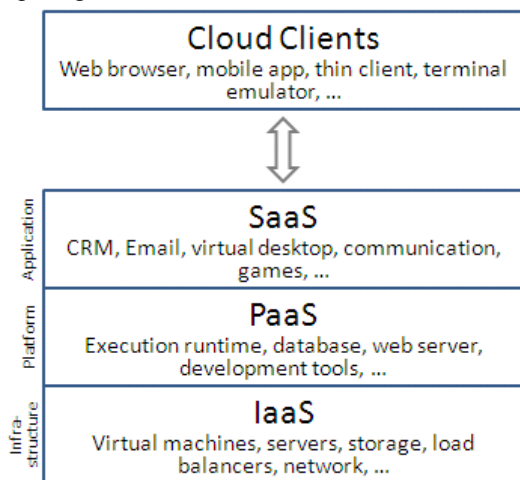
Measured service: Going back to the affordable nature of the cloud, you only pay for what you use. You and your cloud provider can measure storage levels, processing, bandwidth, and the number of user accounts and you are billed appropriately. The amount of resources that you may use can be monitored and controlled from both your side and your cloud provider’s side, which provides transparency.

The cloud introduces many options to your IT department and services that can improve productivity, cut IT expenses, and improve both profitability and customer services.

Multi Tenacity: is the sixth characteristics of cloud computing advocated by the Cloud Security Alliance. It refers to the need for policy-driven enforcement, segmentation, isolation, governance, service levels, and chargeback/billing models for different consumer constituencies. Consumers might utilize a public cloud provider’s service offerings or actually be from the same organization, such as different business units rather than distinct organizational entities, but would still share infrastructure.

CLLOUD COMPUTING IN PRACTICE

As already mentioned, cloud computing can encompass activities such as the use of social networking sites and other forms of interpersonal computing as examined on the Web 2.0 page. However, most of the time cloud computing is concerned with accessing online software applications, data storage and processing power. The fundamental, practical building blocks of cloud computing are therefore what are known as **software as**



a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS).

SaaS, PaaS and IaaS all involve a cloud vendor supplying servers on which their customers can store data and run applications. However, there are differences in the level of control provided to the customer, as well as the type of cloud hardware on which a customer's cloud applications are run.

In very simple terms, when businesses opt for SaaS they can only run those applications that their cloud supplier has on offer. When they opt for PaaS they can create their own applications but only in a manner determined by their cloud supplier. And when they opt for IaaS they can run any applications they please on cloud hardware of their own choice. OK, that may at this stage be as clear as well stirred pond water! So let’s now work through it again in more detail.

Software as a service

Software as a service is where computer applications are accessed over the Internet rather than being installed on a local computing device or in a local data center. So, for example, people may use an online word processor like Google Docs, an online database application like Zoho Creator, an online photo editor like Pixlr, or an online invoicing application such as Zoho Invoice. Many SaaS applications are free to use, at least initially.

SaaS can provide its users with many benefits. These include the general cloud computing advantages of dynamic scalability and any device independence, as well as the benefit of being able to use an application without incurring fixed costs. Many SaaS applications are also collaborative. This allows multiple users to share documents and even to work on them at the same time. For example, in the Google Sheets spreadsheet different users can work on different cells simultaneously. The cells different users are working on are locked-off and highlighted in different colours. A real-time chat window can also be opened up alongside the spreadsheet to further enhance collaboration. For more information on collaborative working using Google's cloud computing apps, you can watch the now classic video Google Docs in Plain English.

Taking collaboration further still, the outputs of some SaaS applications can be embedded in other web pages as web service gadgets. For example, a Google Sheets or Zoho Sheet chart can be mashed into another website. There it will automatically update when the data in the online spreadsheet that is generating it is changed. SaaS applications are also constantly updated, which can free users from the "upgrade hell" of a major traditional software package revision.

The disadvantage of SaaS is that it is basically a take-it-or-leave-it form of cloud computing. This means that businesses and individuals who require direct access to cloud computing hardware on which they can run their own applications cannot use SaaS. Rather, they need to cloud compute at the platform or infrastructure level using either platform as a service (PaaS) or infrastructure as a service (IaaS).

Platform as a Service (PaaS)

A platform is a software environment used to develop and run applications. For example, Microsoft Word is an application that runs on the Microsoft Windows platform. When people choose to cloud compute using platform as a service or 'PaaS', they obtain access to an online platform provided by a cloud-computing vendor. They can then use this platform to develop and deliver their own online (SaaS) applications.

Just one or a few users within a particular company may use applications developed using PaaS privately. However, they can also be offered free or for-a-fee to anybody on the web. This means that if you have a great idea for a new online application then you can use PaaS to turn it into a reality.

Several cloud suppliers now offer PaaS tools. These notably include Google App Engine, Microsoft Azure, and Force.com. All such offerings effectively provide their customers with a box of cloud computing Lego. New applications are then constructed from the plastic bricks on offer. With Force.com, some applications can even be built using a simple drag-and-drop interface. Relatively non-technical people can therefore create new online applications very quickly. Indeed, Force.com claim that their "simplified programming model and cloud-based environment mean [customers] can build and run applications five times faster, at about half the cost of traditional software platforms."

Whilst PaaS is great in many situations, its users do need to be mindful of the involved flexibility versus power trade-off. What this means is that whilst PaaS makes it relatively easy to create new online applications, users are nevertheless constrained by the particular programming languages and tools provided by their PaaS supplier. In other words, PaaS vendors have total control over which Lego bricks they allow their customers to build with. Whilst this ensures that applications built using the tools on offer will always function correctly, it is nevertheless restrictive. It is for this reason that many companies and some individuals choose to cloud compute at the infrastructure level.

Infrastructure as a Service (IaaS)

Infrastructure as a service or "IaaS" is where a cloud supplier provides online infrastructure on which their customers can store data, develop, and run whatever applications they please. IaaS therefore allows companies to move their existing programs and data into the cloud and to close down their own local servers and data centers.

Whilst computing applications run on platforms, platforms in turn run on computing infrastructure. Therefore, for example, whilst the Microsoft Word application runs on the Microsoft Windows platform, in turn the Microsoft Windows platform runs on the infrastructure of an IBM-compatible PC.

The fundamental building block of cloud computing infrastructure is the server. Cloud computing servers are basically computers on which online applications can be run and data can be stored. When provided by an IaaS vendor, cloud servers can also be real or virtual.

Real or "dedicated" servers are individual, physical computers – known as blades – mounted within equipment racks in a data center. In contrast virtual servers – also known as "virtual server instances" – are software-controlled slices of real, physical servers. Virtual servers are created by a process called virtualization that allows many users to share the processing power of one physical server.

Dedicated physical servers and virtual server instances can perform exactly the same functions. However, there are also some important differences between them. For a start, virtual server instances are cheaper to supply, as each does not require its own piece of physical hardware in a cloud data centre. On the other hand, virtual server instances are sometimes seen as less secure by those who do not want to share server hardware with other customers. For this reason, four categories of IaaS are available. These are most commonly known as "private clouds", "dedicated hosting", "hybrid hosting" and "cloud hosting".

IaaS Categories

The four categories of IaaS are represented in the figure below. In each case, a large rectangle outlines a cloud data center. In this data center there are then a number of dedicated physical servers (shown as small rectangles), together with a number of virtual server instances (shown as circles within a cloud). Dedicated physical servers or virtual server instances in the figure are shown in solid rather than outline when they are part

of a particular IaaS category. Under the first IaaS category of a private cloud (or more fully a vendor managed private cloud), a customer rents a number of co-located servers in part of a data center. This means that their cloud hardware is as separate as possible from that of other users. Private clouds are therefore considered the most secure form of IaaS. However, a private cloud cannot be dynamically scaled and is the most expensive form of IaaS as a block of servers is permanently dedicated to one customer. (As an aside, it should be noted that an increasing number of IT companies are also starting to use the term "private cloud" to refer to the building of a cloud computing infrastructure -- or "internal cloud" -- within a company's own data center. Such a development is not really cloud computing at all, and may be regarded as a final attempt to maintain the status quo. Under any sensible definition, a "private cloud" has to be a cloud computing arrangement where the hardware concerned is owned and housed in a vendor's shared data center. OK, rant over and back to the three remaining IaaS categories!).

In the second IaaS category of dedicated hosting, a customer rents dedicated physical servers on demand from anywhere within a data center. Whilst this means that the hardware they use is mixed-in with that of other customers, in this IaaS category once again customers do not share the particular servers they use with anybody else. As well as being less costly than a private cloud, dedicated hosting can therefore be dynamically scaled. This means that the customer is able to increase or decrease the number of servers they are both using and paying for on a daily or even hourly basis.

Under the third IaaS option of hybrid hosting, a customer rents on demand a mix of dedicated physical servers and as well as some less expensive virtual server instances. For example, a company may run all of its applications on dedicated physical servers, but store its data on virtual server instances. Alternatively, a business may rent virtual service instances by the hour to cope with occasional peak processing demands. Once again, the whole offering is dynamically scalable, with both dedicated and virtual servers able to be added or taken away as required.

Finally, in the last IaaS category of cloud hosting, a customer rents as many or as few virtual server instances as they require on demand. This means that customers share all of the servers they use with other customers. Some companies subsequently see this as too risky. However, cloud hosting is also the lowest-cost and by far the most technically and environmentally efficient form of IaaS. This is because cloud hosting allows an

IaaS provider to run all of their physical servers in use to capacity and to close down those not required.

CLLOUD COMPUTING BENEFITS

Why are so many businesses moving to the cloud? It is because cloud computing increases efficiency, helps improve cash flow and offers many more benefits...Here's ten of the best .

1. Flexibility

Cloud-based services are ideal for businesses with growing or fluctuating bandwidth demands. If your needs increase it is easy to scale up your cloud capacity, drawing on the service's remote servers. Likewise, if you need to scale down again, the flexibility is baked into the service. This level of agility can give businesses using cloud computing a real advantage over competitors – it is not surprising that CIOs and IT Directors rank 'operational agility' as a top driver for cloud adoption.

2. Disaster recovery

Businesses of all sizes should be investing in robust disaster recovery, but for smaller businesses that lack the required cash and expertise; this is often more an ideal than the reality. Cloud is now helping more organizations buck that trend. According to Aberdeen Group, small businesses are twice as likely as larger companies to have implemented cloud-based backup and recovery solutions that save time, avoid large up-front investment and roll up third-party expertise as part of the deal.

3. Automatic software updates

The beauty of cloud computing is that the servers are off-premise, out of sight and out of your hair. Suppliers take care of them for you and roll out regular software updates – including security updates – so you do not have to worry about wasting time maintaining the system yourself. Leaving you free to focus on the things that matter, like growing your business.

4. Capital-expenditure Free

Cloud computing cuts out the high cost of hardware. You simply pay as you go and enjoy a subscription-based model that is kind to your cash flow. Add to that the ease of setup and management and suddenly you are scary; hairy IT project looks at lot friendlier. It has never been easier to take the first step to cloud adoption.

5. Increased collaboration

When your teams can access, edit and share documents anytime, from anywhere, they are able to do more together, and do it better. Cloud-based workflow and file sharing apps help them make updates in real time and gives them full visibility of their collaborations.

6. Work from anywhere

With cloud computing, if you have an internet connection you can be at work. Moreover, with most serious cloud services offering mobile apps, you are not restricted by which device you have to hand.

The result? Businesses can offer more flexible working benefits to employees so they can enjoy the work-life balance that suits them – without productivity taking a hit. One study reported that 42% of workers would swap a portion of their pay for the ability to telecommute. On average, they would be willing to take a 6% pay cut.

7. Document control

The more employees and partners collaborate on documents, the greater the need for watertight document control. Before the cloud, workers had to send files back and forth as email attachments to be worked on by one user at a time. Eventually – usually sooner – you end up with a mess of conflicting file content, formats and titles.

In addition, as even the smallest companies become more global, the scope for complication rises. According to one study, "73% of knowledge workers collaborate with people in different time zones and regions at least monthly."

When you make the move to cloud computing, all files are stored centrally and everyone sees one version of the truth. Greater visibility means improved collaboration, which ultimately means better work and a healthier bottom line. If you are still relying on the old way, it could be time to try something a little more streamlined.

8. Security

Lost laptops are a billion dollar business problem. In addition, potentially greater than the loss of an expensive piece of kit is the loss of the sensitive data inside it. Cloud computing gives you greater security when this happens. Because your data is stored in the cloud, you can access it no matter what happens to your machine. Moreover, you can even remotely wipe data from lost laptops so it does not get into the wrong hands.

9. Competitiveness

Wish there was a simple step you could take to become more competitive. Moving to the cloud gives access to

enterprise-class technology, for everyone. It also allows smaller businesses to act faster than big, established competitors do. Pay-as-you-go service and cloud business applications mean small outfits can run with the big boys, and disrupt the market, while remaining lean and nimble. David now packs a Goliath-sized punch.

10. Environmentally friendly

While the above points spell out the benefits of cloud computing for your business, moving to the cloud is not an entirely selfish act. The environment gets a little love too. When your cloud needs fluctuate, your server capacity scales up and down to fit. Therefore, you only use the energy you need and you do not leave oversized carbon footprints. This is something close to our hearts at Salesforce, where we try our best to create sustainable solutions with minimal environmental impact.

CLOUD COMPUTING APPLICATIONS

A wide range of Cloud services are currently available to the public. The following are just a few examples of Cloud applications.

Software-as-a-Service (SaaS)

Software-as-a-Service commonly refers to applications delivered to the end user through a web browser or any other web-rich client. Examples include Microsoft OfficeLive, DropBox, and CloudNumbers.

Platform-as-a-service (PaaS)

Platform-as-a-Service provides more customisation room, for example, for a developer to acquire a bespoke platform (such as operating system, software, and libraries) that is usually used to carry out a very specific task. Examples include Google AppEngine, Salesforce VMforce, and Joyent Accelerator.

Infrastructure-as-a-service (IaaS)

Infrastructure-as-a-Service provides maximum control where a computing infrastructure can be assembled from the operating system upwards.

Many companies now offer IaaS services. For example, as already noted, Amazon has a product range called Amazon Web Services or "AWS". This falls under the fourth IaaS category of cloud hosting, with Amazon offering the rental of virtual server instances.

At the heart of AWS is Amazon Elastic Compute Cloud or "EC2". This allows customers to run either new or existing applications in Amazon's data centers. EC2 is described as "elastic" because customers can increase or decrease the infrastructure capacity they are using within minutes.

EC2 users can purchase and activate one, hundreds or even thousands of virtual server instances simultaneously. They do this by setting up Amazon Machine Images or "AMIs" that contain all of the applications, data and configuration settings that their virtual servers will need. AMIs can be created from scratch, or chosen from a range of pre-configured templates. AMIs can even be pre-loaded with licensed software from vendors including IBM.

Another key component of AWS is the Amazon Simple Storage Service or "S3". This enables customers to store data online in so-termed "buckets". As Amazon explain, "S3 provides a simple web interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web. It gives any developer access to the same highly scalable, reliable, fast, inexpensive data storage infrastructure that Amazon uses to run its own global network of web sites."

Another IaaS provider is Rackspace, which provides private clouds, dedicated hosting, and cloud hosting services. The latter include Rackspace Cloud Servers (as a competitor to Amazon EC2) and Rackspace Cloud Files (as a competitor to Amazon's S3). IaaS services can also be purchased from most major players in the computing industry, including IBM.

CLOUD COMPUTING DEPLOYMENT MODELS

Cloud hosting deployment models represent the exact category of cloud environment and are mainly distinguished by the proprietorship, size and access. It tells about the purpose and the nature of the cloud. Most of the organizations are willing to implement cloud as it reduces the capital expenditure and controls operating cost. In order to know which deployment model matches your website requirements it is necessary to know the four deployment models.



Public Cloud: is a type of cloud hosting in which the cloud services are delivered over a network, which is open for public usage. This model is a true representation of cloud hosting; in this, the service provider renders services and infrastructure to various clients. The customers do not have any distinguishability

and control over the location of the infrastructure. From the technical viewpoint, there may be slight or no difference between private and public clouds' structural design except in the level of security offered for various services given to the public cloud subscribers by the cloud-hosting providers.

Public cloud is better suited for business requirements, which require managing the load; host application that is SaaS-based and manage applications that many users consume. Due to the decreased capital overheads and operational cost, this model is economical. The dealer may provide the service free or in the form of the license policy like pay per user. The cost is shared by all the users, so public cloud profits the customers more by achieving economies of scale. Public cloud facilities may be availed free an e.g. of a public cloud is Google.

Private Cloud: is also known as internal cloud; the platform for cloud computing is implemented on a cloud-based secure environment that is safeguarded by a firewall which is under the governance of the IT department that belongs to the particular corporate. Private cloud as it permits only the authorized users, gives the organization greater and direct control over their data. What exactly constitutes a private cloud? It is difficult to define because when it is classified according to the services there are significant variations. Whether the physical computers are hosted internally or externally, they provide the resources from a distinct pool to the private cloud services. Businesses that have dynamic or unforeseen needs, assignments that are mission critical, security alarms, management demands and uptime requirements are better suited to adopt private cloud. Obstacles concerning security can be evaded in a private cloud, but in case of natural disaster and internal data theft, the private cloud may be prone to vulnerabilities.

Hybrid Cloud: is a type of cloud computing, which is integrated. It can be an arrangement of two or more cloud servers, i.e. private, public or community cloud that is bound together but remain individual entities. Benefits of the multiple deployment models are available in a hybrid cloud hosting. A hybrid cloud can cross isolation and overcome boundaries by the provider; hence, it cannot be simply categorized into public, private or community cloud. It permits the user to increase the capacity or the capability by aggregation, assimilation or customization with another cloud package / service. In a hybrid cloud, the resources are managed and provided either in-house or by external providers. It is an adaptation among two platforms in which the workload exchanges between the private cloud and the public cloud as per the need and demand.

Resources that are non-critical like development and test workloads can be housed in the public cloud that belongs to a third-party provider. While the workloads that are critical or sensitive must be housed internally. Consider an e-commerce website, which is hosted on a private cloud that gives security and scalability, since security is not a prime concern for their brochure site it is hosted on a public cloud, which is more economical as compared to a private cloud. Businesses that have more focus on security and demand for their unique presence can implement hybrid cloud as an effective business strategy. When facing demand spikes the additional resources that are required by a particular application can be accessed from the public cloud. This is termed as cloud bursting and is available with the hybrid cloud.

Organizations can use the hybrid cloud model for processing big data. On a private cloud, it can retain sales, business and various data and can initiate analytical queries over the public cloud, as the public cloud is effective to meet the demand spikes. Hybrid cloud hosting is enabled with features like scalability, flexibility and security. If one is ready to overlook a few challenges like application program interface incompatibility, network connectivity issues and capital expenditures, then the hybrid cloud would be an appropriate option.

Community Cloud: is a type of cloud hosting in which the setup is mutually shared between many organizations that belong to a particular community, i.e. banks and trading firms. It is a multi-tenant setup that is shared among several organizations that belong to a specific group, which has similar computing apprehensions. The community members generally share similar privacy, performance and security concerns. The main intention of these communities is to achieve their business related objectives. A community cloud may be internally managed or a third party provider can manage it. It can be hosted externally or internally. The cost is shared by the specific organizations within the community, hence, community cloud has cost saving capacity. A community cloud is appropriate for organizations and businesses that work on joint ventures, tenders or research that needs a centralized cloud computing ability for managing, building and implementing similar projects.

Organizations have understood that cloud hosting has a lot of potential. To be the best among the rest, selection of the right type of cloud hosting is needed. Thus, you need to know your business and analyze the demands. Once the appropriate type of cloud hosting is selected, you can achieve your business related goals more easily,

you can channelize all your efforts to take those strategic steps that will help your business to succeed.

CLOUD COMPUTING PROS

Cloud computing as a business and technical model derives many of its benefits from other terminologies such as economies of scale, distributed computing, and SOA. These benefits are on hand to both providers and clients.

Provider Benefits:

•**Better Hardware Utilization:** In most organizations, hardware resources rarely operate at full capacity; consequently, the value of these resources is extremely minimized versus the cost paid to obtain them. Cloud computing can help organizations with large investments in hardware resources to lease unused parts to others.

•**Higher Revenues:** It gives specialties that never existed before in the market the chance to run new businesses that make high incomes. Furthermore, the ability to lease unused hardware resources gives organizations the ability to make extra profits that could be exploited to run and enhance their IT infrastructure.

•**Bigger Software Markets:** Software vendors can deliver their applications in a form of services to their clients at lower costs on a subscription basis. This feature could encourage clients to increase their use of these applications, which in turn, would minimize the rate of software piracy, allowing providers to gain higher revenues.

•**Activities Monitoring:** Providers are able to monitor actions and activities performed by their clients. In doing so, providers can promote other services and products to clients with opportunities to make more money.

• **Better Release Management:** SaaS providers are freed from sending different patches, releases, and upgrades to each single client separately. Given that all software applications are being hosted on provider servers, updates can be instantly and automatically applied without client intervention.

Consumer Benefits:

•**Reduced Costs:** Cloud computing enables SMEs to have low cost startups by allowing them to rent resources offered by cloud providers instead of having their own sets. Also, large enterprises can take advantage of cloud computing as a tactical solution to face seasonal peaks without spending big sums to acquire resources that will be idle for most of the time. Operational expenses including salaries and energy

costs are equally reduced for both small-to-medium and medium-to-large corporations.

- **Reduced Setup Time:** Organizations can acquire and operate necessary resources in almost no time versus much time needed to plan, buy and install their own resources.

- **No Installation/Upgrade Hassles:** With on-premises, organizations spend much time and effort to setup and run IT resources. Conversely, cloud computing put all these complexities on provider sides enabling clients to easily operate hardware and software appliances. Additionally, fixes and upgrades are all made by providers giving their clients the chance to focus on the business.

- **Higher Scalability:** Organizations can effortlessly install any number of hardware/software instances wanted by business. Additionally, clients can freely delete unused instances to save costs. This elasticity gives adopters two main advantages over on-premises models. First, it frees organizations from spending high up-front costs on IT resources that may not be fully utilized in the future. Second, it allows them to face occasional spikes by flexibly adding more resources at whatever time needed.

CLOUD COMPUTING CONS

Cloud computing is still in its early years. Organizations usually prefer to adopt proven methodologies that come with success stories and best practices from previous adopters. Some of the risks of adopting cloud computing include:

- **Standards:** Cloud computing lacks the standards needed for loose coupling between providers and clients. Each client should use APIs offered by providers in order to allow its application to make use of available services. That is to say, each provider has its own technologies and standards making it impossible for clients to move from one provider to another.

- **Dependability:** The first question that every client usually asks about adopting cloud computing is, “Is the cloud provider going to be around in future?” Can they get their mission critical information, and is there a way to use it somewhere else? Organizations do not want to invest in IT solutions that may depart with important information if cloud providers decide to leave the market.

- **Transparency:** Because providers have full control over cloud resource, they can make changes to the infrastructure and services without notifying their clients. These issues must be stated in SLAs to guarantee continuity and reliability of solutions used by the clients.

- **Security:** Organizations cannot imagine hosting mission critical information beyond their borders. They

believe that losing physical access to and control of servers that host such information means losing information itself. Such an issue makes sensitive information vulnerable to security breaches and surveillance activities of intelligence agencies and/or business competitors.

- **Internet Connections:** Since cloud computing relies on the Internet to host information, having reliable, redundant, and high-speed Internet connections is critical to successful implementations. Although broadband is available to many parts of the world, some countries still do not have dependable access to the Internet. Another concern related to this point is that although small/micro organizations can have Internet access, they cannot afford having multiple Internet service providers for service availability and reliability. Saving money resulting from leasing resources rather than buying them can be lost on redundant Internet connections and bandwidth. These limitations undoubtedly make it impossible for some organizations to move to the cloud.

- **Availability:** This is a crucial requirement for business stability and success. Key cloud providers invest several hundred million dollars in their hardware resources to guarantee the high level of service provided to their clients. Redundancy of datacenters owned by providers is an essential strategy followed to assure reliability of offered solutions. However, availability and reliability of cloud services are not 100% guaranteed due to unmanaged circumstances. For instance, an Internet connection may be lost for some reason, server(s) crashes may happen on the provider side, human error may cause servers to go down, etc. Lack of availability encourages organizations to locally backup their information for emergency use during cloud outages. Of course, local backup may not be an affordable solution for smaller organizations as it adds more overall cost.

- **Legislation:** Laws related to cloud computing issues such as reliability of presented solutions, availability of providers, and secrecy of information, as well as providers’ financial rights, are still missing. Moving to cloud computing depends a great deal on trust between providers and clients and vice versa. With strong and effective legislation, trust between cloud implementers can be built and sustained.

CASE STUDIES

A number of case studies have been published both on providers’ websites and in technical reports to give new adopters an inside look at some scenarios that led enterprises to adopt cloud computing and the benefits gained from that turn. A small list of cloud computing examples in different sectors is presented below :

In SMEs:

• Razorfish, a digital advertising agency, needed to improve its ability to quickly respond to customers demands to support both highly visible web campaigns and high volume short run campaigns. Razorfish employed Rackspace infrastructure solutions to be able to build micro sites, web pages, and blogs more cost effectively. Cloud computing allowed Razorfish to set up web hosting space in 24 to 48 hours rather than 6 to 8 weeks for about \$3,000 to \$5,000 rather than tens of thousands of dollars.

In Large Enterprises:

• JohnsonDiversey, a global provider of commercial cleaning solutions for business, was motivated to move to the cloud for two reasons. First, to allow better collaboration and integration between its systems that was hard to accomplish with its legacy on-premise systems. Second, inefficiencies resulted from storage limitations. JohnsonDiversey adopted a number of cloud solutions such as Gmail to replace in-house e-mail; Google Docs to replace Microsoft Office environment; Google Sites for team collaboration; and Oracle CRM On Demand for remote sales force. Cloud solutions allowed JohnsonDiversey to cut operating costs of e-mail and collaboration environment by 70%; reduce bandwidth consumption for messaging and collaboration by 20%; and increase user satisfaction by more than 25%.

In Government:

• Japan's Ministry of Economy, Trade and Industry needed to build a public web application to enable clients to exchange old appliances for credits toward new appliances and merchandise. This application was planned to work fine for high-scalability requirements to support potentially large transaction volumes—40 million consumers were expected to access the site at peak times. The ministry was able to build the needed application in only three weeks by utilizing Salesforce.com sites and a Force.com API.

CONCLUSION

The cloud could be the next evolution in the history of computing, following in the footsteps of mainframes, minicomputers, PCs, servers, smart phones, and so on, and radically changing the way enterprises manage IT. Cloud computing has many benefits, but it also has different issues that could be raised. When stored in big datacenter around the world, the data could become a target for hacker attacks or be misused by cloud computer providers' employees. Moreover, stored in different locations, the data could be under other laws

that their owners are not familiar. In addition, professionals involved with cloud computing must ensure that cloud computing does not become a service where just a few users can use it. No different from any new technology in a capitalist world, cloud computing was first commercialized and then its pros and cons were taken into consideration.

This paper presented essential terms related to cloud computing with the aim to answer questions frequently asked by people who are in the computer field. These terms included its Introduction, benefits, characteristics, services types, applications, deployment models, benefits to both providers and clients, pros and cons and finally case studies.

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