

Economics of Cloud Computing

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Abstract—In an attempt to gain a competitive edge, businesses are increasingly looking for new and innovative ways to cut costs while maximizing profits especially now that the world is experiencing economic downturn. Firms recognize that they need to grow and as a result are under pressure to save money. This has forced the realization that new ideas and methods may produce better results than the tried and tested formulas of old. It is the growing acceptance of innovative technologies that has seen cloud computing become a realizable innovation in information technology (IT). Many have heard of cloud computing, but far fewer actually understand what it is and, more importantly, how it can benefit them. In this research paper, we focused on the economics of cloud rather than technologies; we outline the underlying business benefits it can bring to various users and the economics of scale focusing on what makes it truly different from client/server.

Index Terms— Cloud computing, client/server and Economics of scale.

I. INTRODUCTION

Cloud computing is one of the latest computer and business industry booming words. The term cloud computing is overused and ill-defined, which has led many IT professionals and management to make assumptions as to what cloud computing does and how their companies can best utilize it. Even at that, [10] defined cloud computing as a highly scalable computing resources provided as an external service via the internet on pay-as-you-go basis. Cloud comprises not just cheaper IT, but also faster, easier, more flexible, and more effective IT services as shown in figure 1.

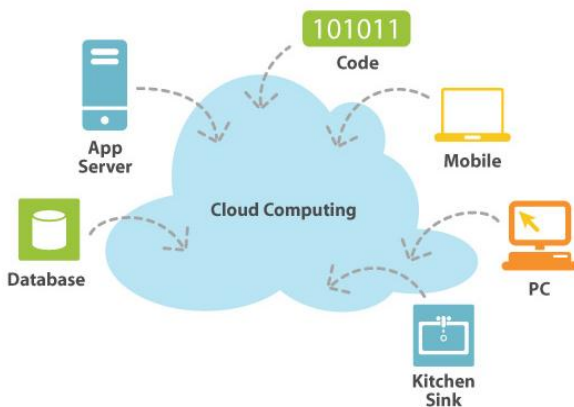


Fig. 1. Cloud Computing Service

Source:<http://www.myrealddata.com/blog/tag/cloud-computing-services>

Economically, the main appeal of cloud computing is that customers only use what they need, and only pay for what

they actually use. Resources are available to be accessed from the cloud at any time, and from any location via the internet. There is no need to worry about how things are being maintained behind the scenes; you simply pay for the IT service you require as you would do to any other utility.

II. LITERATURE REVIEW

There are quite a number of authors that have written on similar topic in the past. Few of such are acknowledged below; According to [1] in their paper titled “towards trusted cloud computing” although this is not totally relating to the subject matter because our research paper will not cover the security of cloud computing but all the same, Cecioni and his colleagues believed that cloud computing infrastructure enable companies to cut cost by outsourcing computation on demands. Outsourcing is a major trait to cloud (pay- as- you go). No wonder, [10] mentioned that on controlling data in the cloud while concentrating on outsourcing computation without outsourcing control.

Economics of cloud computing was a close topic to the discussion but [7] took a new dimension by examining the economic impacts of the diffusion of a new technology as cloud computing. Allows firms to rent computing power and storage from service providers and pay on demand especially as applied to European economy. Also, [8] wrote a fantastic paper on “Cloud Software services” where he reported that one of the defining characteristics of cloud software service is the transfer of control from the client domain to the service provider.

Meanwhile, [10] gave an overview of cloud as regards basic concept, defines the term used in the industry, and outlines the general architecture and applications of Cloud computing. Richard et al gave a summary of Cloud Computing and provides good foundation for understanding. Richard and his colleagues were the only researchers who wrote closely to the topic of discussion though still included other aspects such as architectural and technological issues that is not be part of this discussion.

III. TYPES OF CLOUD

Public Cloud: Public cloud (also called ‘external’ cloud) describes the conventional meaning of cloud computing: scalable, dynamically provisioned, often virtualized resources available over the Internet from an off-site third-party provider, which divides up resources and bills its customers on ‘utility’ basis. An example is Think Grid, a company that provides a multi-tenant architecture for supplying services such as Hosted Desktops, Software as a

Service and Platform as a Service. Other popular cloud vendors include Salesforce.com, Amazon EC2 and Flexi scale. [9].

The type of outsourcing provided by Yahoo and other vendors are termed “public cloud” to differentiate it from an application that an organization has more control over and is managed by the organization itself locally, which is termed “private cloud.” Basically, the “public cloud” provider is making the capital investment, as opposed to a “private cloud” in which the company internally makes the capital investment for the infrastructure. Therefore, when a company is thinking about whether to use a public or private cloud, the company is making a decision on whether or not to outsource the capital expense.

Private Cloud: Private cloud (also called ‘corporate’ or ‘internal’ cloud) is a term used to denote a proprietary computing architecture providing hosted services on private networks. This type of cloud computing is generally used by large companies, and allows their corporate network and data centre administrators to effectively become in-house ‘service providers’ catering for ‘customers’ within the corporation. However, it negates many of the benefits of cloud computing, as organisations still need to purchase, set up and manage their own clouds.

Hybrid Cloud: This is a term that combines the resources from both internal and external providers which will become the most popular choice for enterprises. For example, a company could choose to use a public cloud service for general computing, but store its business critical data within its own data centre.

IV. ECONOMICS OF THE CLOUD

Economies of scale: Cloud computing customers can benefit from the economies of scale enjoyed by providers, who typically use very large-scale data centers operating at much higher efficiency levels, and multi-tenant architecture to share resources between many different customers. This model of IT provision allows them to pass on savings to their customers. Other benefits of public cloud are; Amazon’s Elastic Computing Cloud (EC2) offering computational services that enable people to use CPU cycles without buying more computers, Storage services such as those provided by Amazon’s Simple Storage Service, Companies like Nirvanix allowing organizations to store data and documents without adding a single on-site server.

Hosted Desktops: Hosted desktops remove the need for traditional desktop PCs in the office environment, and reduce the cost of providing the services that you need. A hosted desktop looks and behaves like a regular desktop PC, but the software and data customers use are housed in remote, highly secure data centers, rather than on their own machines. Users can simply access their hosted desktops via an internet connection from anywhere in the world, using either an existing PC or laptop or, for maximum cost efficiency, a specialized device called a thin client is used.

Hosted Email: All firms look for a secure, reliable email solution that will not cost more than its usefulness. Using the world’s premier email platform, this service lets organizations both large and small reap the benefits of using MS Exchange accounts without having to invest in the costly infrastructure themselves. Email is stored centrally on managed servers, providing redundancy and fast connectivity from any location. This allows users to access their email, calendar, contacts and shared files by a variety of means, including Outlook, Outlook Mobile Access (OMA) and Outlook Web Access (OWA).

Hosted Telephony (VOIP): VOIP (Voice over IP) is a means of carrying phone calls and services across digital internet networks. In terms of basic usage and functionality, VOIP is no different to traditional telephony, and a VOIP enabled telephone works exactly like a ‘normal’ one, but it has distinct cost advantages. A hosted VOIP system replaces expensive phone systems, installation, handsets, BT lines and numbers with a simple, cost-efficient alternative that is available to use on a monthly subscription basis. Typically, a pre-configured handset just needs to be plugged into your broadband or office network to allow you to access features such as voicemail, IVR etc.

Cloud Storage: Cloud storage is growing in popularity due to the benefits it provides, such as simple, CapEx-free costs, anywhere access and the removal of the burden of in house maintenance and management. It is basically the delivery of data storage as a service, from a third party provider, with access via the internet and billing calculated on capacity used in a certain period.

Dynamic Servers: Dynamic servers are the next generation of server environment, replacing the conventional concept of the dedicated server. There are a quite number of service providers willing to serve such as Think Grid which gives its customers access to resources that look and feel exactly like a dedicated server, but that are fully scalable. You can directly control the amount of processing power and space you use, meaning you don't have to pay for hardware you don't need.

V. ADVANTAGES OF CLOUD COMPUTING

Reduction of capital expenditure: Customers can avoid spending large amounts of capital on purchasing and installing their IT infrastructure or applications by moving to the cloud model. Capital expenditure on IT reduces available working capital for other critical operations and business investments.

Reduced administration costs: IT solutions can be deployed extremely quickly and managed, maintained, patched and upgraded remotely by your service provider. Technical support is provided round the clock by reputable providers no extra charge, reducing the burden on IT staff. This means that they are free to focus on business-critical tasks, and businesses can avoid incurring additional manpower and training costs.

Improved resource utilization: Combining resources into large clouds reduces costs and maximizes utilization by delivering resources only when they are needed. Businesses needn't worry about over-provisioning for a service whose use does not meet their predictions, or under-provisioning for one that becomes unexpectedly popular. Moving more and more applications, infrastructure, and even support into the cloud can free up precious time, effort and budgets to concentrate on the real job of exploiting technology to improve the mission of the company. Sharing computing power among multiple tenants can improve utilization rates, as servers are not left idle, which can reduce costs significantly while increasing the speed of application development.

Scalability on demand: Scalability and flexibility are highly valuable advantages offered by cloud computing, allowing customers to react quickly to changing IT needs, adding or subtracting capacity and users as and when required and responding to real rather than projected requirements. Even better, because cloud-computing follows a utility model in which service costs are based on actual consumption, you only pay for what you use.

Quick and easy implementation: Without the need to purchase hardware, software licenses or implementation services, a company can get its cloud computing arrangement only with a click.

Helps smaller businesses compete: There has been a huge disparity between the IT resources available to small businesses and to enterprises. Cloud computing has made it possible for smaller companies to compete on an even playing field with much bigger competitors. 'Renting' IT services instead of investing in hardware and software makes them much more affordable, and means that capital can instead be used for other vital projects.

Quality of service: Your selected service provider's offer 24/7 customer support and an immediate response to emergency situations.

Global Access: Internet would make assessment of cloud based services available anywhere and anytime. It's easier to collaborate with both the application and the data stored in the cloud, multiple users can work together on the same project, share calendars and contacts etc.

Technical Support: A good cloud computing provider will offer after sales service such as technical support. This type of support model allows a provider to build a better understanding of your business requirements, effectively becoming an extension of your team.

Disaster recovery: Recent research has indicated that around 90% of businesses do not have adequate disaster recovery or business continuity plans, leaving them vulnerable to any disruptions that might occur [9] Experienced providers can provide an array of disaster recovery services, from cloud backup to having ready-to-go desktops and services in case your business is hit by

problems. Files are stored twice at different remote locations to ensure that there's always a copy available 24 hours a day, 7 days per week.

VI. CLOUD SERVICE CHARACTERISTICS

Cloud computing facilities are characterized by four key factors: necessity, reliability, usability, and scalability and are explained below:

- i. **Necessity:** refers to the idea that prevalence users depend on the service to satisfy everyday needs.
- ii. **Reliability:** refers to the expectation that the service will be available when the user requires it.
- iii. **Usability:** refers to the requirement that the service is easy and convenient to use when needed regardless of the complexity of the underlying infrastructure.
- iv. **Scalability:** refers to the fact that the service has sufficient capacity to allow the users to experience the benefits of an expandable service that provides economy of scale as discussed above.

VII. CONCLUSION

However, before an organization decides to make the jump to the cloud, it is important to understand what, why, how and from whom. Not all cloud computing providers are the same. The range and quality of services offered varies tremendously, so we recommend that you investigate the market thoroughly, with a clearly defined set of requirements in mind.

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