`Cloud Computing’- Architecture, Applications and Advantages

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1. Abstract
Many people are confused as to exactly what cloud computing is, especially as the term can be used to mean almost anything. Roughly, it describes highly scalable computing resources provided as an external service via the internet on a pay-as-you-go basis. 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’s no need to worry about how things are being maintained behind the scenes – you simply purchase the IT service you require as you would any other utility. Because of this, cloud computing has also been called utility computing, or ‘IT on demand’. This new, web-based generation of computing utilizes remote servers housed in highly secure data centers for data storage and management, so organizations no longer need to purchase and look after their IT solutions in-house.

Keyword: - cloud computing, pay-as-you-go, utility computing, remote servers, data storage, IT.

2 Cloud computing architecture
This section describes the architectural, business and various operation models of cloud computing.

A layered model of cloud computing
Generally speaking, the architecture of a cloud computing environment can be divided into 4 layers:
the hardware/datacenter layer, the infrastructure layer, the platform layer and the application layer, as shown in Fig We describe each of them in detail:
The hardware layer: This layer is responsible for managing the physical resources of the cloud, including physical servers, routers, switches, power and cooling systems. In practice, the hardware layer is typically implemented in data centers. A data center usually contains thousands of servers that are organized in racks and interconnected
through switches, routers or other fabrics. Typical issues at hardware layer include hardware configuration, fault tolerance, traffic management, power and cooling resource management.

The infrastructure layer: Also known as the virtualization layer, the infrastructure layer creates a pool of storage and computing resources by partitioning the physical resources using virtualization technologies such as Xen, KVM and VMware. The infrastructure layer is an essential component of cloud computing, since many key features, such as dynamic resource assignment, are only made available through virtualization technologies.

The platform layer: Built on top of the infrastructure layer, the platform layer consists of operating systems and application frameworks. The purpose of the platform layer is to minimize the burden of deploying applications directly into VM containers. For example, Google App Engine operates at the platform layer to provide API support for implementing storage, database and business logic of typical web applications.

The application layer: At the highest level of the hierarchy, the application layer consists of the actual cloud applications. Different from traditional applications, cloud applications can leverage the automatic-scaling feature to achieve better performance, availability and lower operating cost. Compared to traditional service hosting environments such as dedicated server farms, the architecture of cloud computing is more modular. Each layer is loosely coupled with the layers above and below, allowing each layer to evolve...
separately. This is similar to the design of the OSI model for network protocols. The architectural modularity allows cloud computing to support a wide range of application requirements while reducing management and maintenance overhead.

3 Cloud Application
This is the apex of the cloud pyramid, where applications are run and interacted with via a web browser, hosted desktop or remote client. A hallmark of commercial cloud computing applications is that users never need to purchase expensive software licenses themselves. Instead, the cost is incorporated into the subscription fee. A cloud application eliminates the need to install and run the application on the Customer’s own computer, thus removing the burden of software maintenance, ongoing operation and support.

Cloud Platform
The middle layer of the cloud pyramid, which provides a computing platform or framework as a Service. A cloud computing platform dynamically provisions, configures, reconfigures and de-provisions servers as needed to cope with increases or decreases in demand. This is a distributed computing model, where many services pull together to deliver an application or infrastructure request.

4. Cloud Infrastructure
The foundation of the cloud pyramid is the delivery of IT infrastructure through virtualization. Virtualization allows the splitting of a single physical piece of hardware into independent, self governed environments, which can be scaled in terms of CPU, RAM, Disk and other elements. The infrastructure includes servers, networks and other hardware appliances delivered as Infrastructure “Web Services”, “farms” or "cloud centers”. These are then interlinked with others for resilience and additional capacity.

Public Cloud
Public cloud (also referred to as ‘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 a ‘utility’ basis.

Private Cloud
Private cloud (also referred to as ‘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 to ‘customers’ within the corporation. However, it negates many of the benefits of cloud computing, as organizations still need to purchase, set up and manage their own clouds.

Hybrid Cloud
It has been suggested that a hybrid cloud environment combining resources from both internal and external providers 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. This may be because larger organizations are likely to have already invested heavily in the infrastructure required to provide resources in-house – or they may be concerned about the security of public clouds.

5. Cloud services
There are numerous services that can be delivered through cloud computing, taking advantage of the distributed cloud model. Here are some brief descriptions of a few of the most popular cloud-based IT solutions:

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 centre’s, 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.

Hosted Email
As more organizations look for a secure, reliable email solution that will not cost the earth, they are increasingly turning to hosted Microsoft Exchange email plans. 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 and more.
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 (e.g. per month).

Dynamic Servers
Dynamic servers are the next generation of server environment, replacing the conventional concept of the dedicated server. Provider gives its customer’s 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. Typically, you can make changes to your dynamic server at any time, on the fly, without the costs associated with moving from one server to another.

Removal / 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. Cloud computing offers a simple operational expense that is easier to budget for month-by-month, and prevents money being wasted on depreciating assets. Additionally, customers do not need to pay for excess resource capacity in-house to meet fluctuating demand.

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.

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. Customers benefit from greater elasticity of resources, without paying a premium for large scale.

Quick and easy implementation
Without the need to purchase hardware, software licenses or implementation services, a company can get its cloud-computing arrangement off the ground in minutes. Helps smaller businesses compete
Historically, 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. Selected vendor should
offer 24/7 customer support and an immediate response to emergency situations.

Guaranteed Uptime, SLAs
Always ask a prospective provider about reliability and guaranteed service levels – ensure your applications and/or services are always online and accessible.

Anywhere Access
Cloud-based IT services let you access your applications and data securely from any location via an internet connection. It’s easier to collaborate too; 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. It has been pointed out that if your internet connection fails, you will not be able to access your data. However, due to the ‘anywhere access’ nature of the cloud, users can simply connect from a different location – so if your office connection fails and you have no redundancy, you can access your data from home or the nearest Wi-Fi enabled point. Because of this, flexible / remote working is easily enabled, allowing you to cut overheads, meet new working regulations and keep your staff happy!

Disaster recovery / backup
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. Providers can provide an array of disaster recovery services, from cloud backup (allowing you to store important file from your desktop or office network within their data centre’s) to having ready-to-go desktops and services in case your business is hit by problems. Hosted Desktops technology provided by few reputed enterprise offers the remedy, according to it you don’t have to worry about worry about data backup or disaster recovery, as this is taken care of as part of the service. 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.

Security Concerns
Many companies that are considering adopting cloud computing raise concerns over the security of data being stored and accessed via the internet. What a lot of people don’t realize is that good vendors adhere to strict privacy policies and sophisticated security measures, with data encryption being one example of this. Companies can choose to encrypt data before even storing it on a third-party provider’s servers. As a result, many cloud-computing vendors offer greater data security and confidentiality than companies that choose to store their data in-house. However, not all vendors will offer the same level of security. It is recommended that anyone with concerns over security and access should research vendors' policies before using their services.

6. Conclusion
When your business grows, your IT needs grow too. The scalability and speed of deployment offered by cloud computing means you can expand your IT provision instantly to meet increased requirements, and you can also scale it down again whenever you want. Security is typically greatly enhanced, along with resilience, and the flexibility and responsiveness of cloud-based IT services
mean that you can react quickly to a changing business environment. Waste (of both time and resources) is reduced, allowing you to effectively do more with less. This provides you a leaner, more efficient IT model, available on demand. Moving to a cloud computing model can help your organization to survive in a tough economic climate, equipping you with the latest business tools and giving you access to advanced technologies at a fraction of the cost of purchasing and running the same systems in-house. Check that your provider can deliver the type/s and quality of service you require, and before you know it you’ll be able to enjoy the advantages of cloud computing.

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