Abstract

The evolution of cloud computing over the past few years is one of the major advances in the history of computing. It is Internet based computing in which large numbers of remote servers are networked to allow the centralized data storage and online access to computer services or resources. It is a paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, laptops, entertainment centers, tablet computers, notebooks, handheld devices and sensors etc.. In cloud computing, different computing resources such as memory, storage and processor are not physically present at the user’s location. Instead, they are located outside the premises and managed by a service provider. Cloud computing is the result of evolution and adoption of existing technologies and paradigms. The goal is to allow users to take benefit from all of these technologies, without the need for deep knowledge of each of these technologies. The cloud aims to cut costs and help the users concentrate on their core business instead of being impeded by IT obstacles. The present economic crisis experienced by all the states of the world require IT industry towards more and more efficiency. Cloud computing is one of the technology that can provide efficiency to an organization. Simultaneously, an organization is also striving to become intelligent and to achieve competitive advantage through the use of Business Intelligence. While a lot of research is currently taking place in the technology itself, there is an equally urgent need for understanding the business-related issues surrounding cloud computing. This paper introduces the core practices of cloud computing such as need for cloud computing, essential characteristics, cloud computing architecture, service models, deployment models and business model of cloud computing from commercial perception. In this paper, various aspects of the Cloud Computing and Business Intelligence has also been discussed to identify various areas of research that need attention so that we are in a position to advice the industry in the years to come.
1. Introduction

Cloud computing [1, 2, 3] refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services. Instead of keeping data on your own hard drive or updating applications for your needs, you use a service over the Internet, at another location, to store your information or use its applications. Doing so may give rise to certain privacy implications. A cloud means to a distinct IT environment that is designed for the purpose of remotely provisioning scalable and measured IT resources. The term originated as a metaphor for the Internet which is, in essence, a network of networks providing remote access to a set of decentralized IT resources. Cloud computing to put it simply, means “Internet Computing.”

With cloud computing user can access database resources via the Internet from anywhere, for as long as they need, without worrying about any maintenance or management of actual resources. Besides, databases in cloud are very dynamic and scalable. In recent year Cloud Computing has emerged as a new computing paradigm in which various users share the resources in pay per site/ per service basis. This technology allows consumers and businesses to use applications without installation and to access their personal files at any computer with Internet access. Cloud computing services are broadly divided into three categories: Infrastructure-as-a-Service, Platform-as-a-Service and Software-as-a-Service. The cloud aims to cut costs and help the users concentrate on their core business instead of being impeded by IT obstacles. The resources in such a computing paradigm are located at distributed sites with control from the Service Providers (SPs). The following definition of cloud computing has been developed by the U.S. National Institute of Standards and Technology (NIST):

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction as shown in figure 1. This cloud model promotes availability and is composed of five essential characteristics, three service models and four deployment models.”

Cloud computing is mainly for those persons who regularly moving one city to another city. In general, Cloud computing customer avoid capital expenditure of company thereby also reducing the cost of purchasing physical infrastructure by renting the usage from a third party provider. The companies devour the resources and pay for what they use. The most common example of cloud computing is yahoo mail or gmail. We just need an Internet connection to send emails through them. There is no need of any software to use them. They are simply available on Internet. Some examples are:

(a) **Google**

It has a private cloud that offers online productivity software including email access, document applications, text translations, maps, social networking etc.

(b) **Microsoft**

It currently makes its office applications available in a cloud which includes online storage, file sharing, website design and hosting.

(c) **Salesforce.com**

It allows us to deliver revolutionary customer service from anywhere, anytime on any device.

A prominent amount of research is going on the cloud computing but there is an equally urgent need for understanding the business-related issues [4] surrounding cloud computing.
2. Need For Cloud Computing

It is simply difficult to manage today’s complex businesses environments by traditional IT solutions. Some of the reasons for need of cloud computing [3] are given below:

- **Explosive growth in applications**: Web 2.0 social networking, YouTube, Facebook, biomedical informatics, space exploration, and business analytics
- **Extreme scale content generation**: e-science and e-business data deluge
- **Extraordinary rate of digital content consumption**: digital gluttony: Apple iPhone, iPad, Amazon Kindle
- **Exponential growth in compute capabilities**: multi-core, storage, bandwidth, virtual machines (virtualization)
- **Very short cycle of obsolescence in technologies**: Windows Vista to Windows 8; Java versions; C to C#; Python
- **Newer architectures**: web services, persistence models, distributed file systems/repositories (Google, Hadoop), multi-core, wireless and mobile.

3. Architecture

In a simple, topological sense, a cloud computing is made up of several components: clients, the datacenter and distributed servers as shown in figure 2. Each of the components [3, 5] has a specific purpose and play an important role in delivering a functional cloud based application.

A. Clients

Clients are, in a cloud computing architecture, the exact same things that they are in plain, old, everyday local area network (LAN). They are the computers that just sit on your desk. But they might also be laptops, mobile phones, tablet or PDAs. Clients are the devices that the end users interact with to manage their information on the cloud. Clients generally are of three types:

(a) **Mobile**: Mobile devices include smart phones, PDA or iPhone.

(b) **Thin**: The computers those do not have internal hard drives, but rather let the server do all the work, but then display the information.

(c) **Thick**: This type of client is a regular computer, using a web browser like Internet Explorer, Firefox or Google Chrome to connect to the cloud.

B. Datacenter

The datacenter is the collection of servers where the application to which you subscribe is housed. It could be a large room in the basement of your building or a room full of servers on the other side of
the world that you access via the Internet. A growing trend in the IT world is virtualizing servers. That is, software can be installed allowing multiple instances of virtual servers to be used. So you can have half a dozen virtual servers running on one physical server. The number of virtual servers that can exist on a physical server depends on the size and speed of the physical server and what applications will be running on the virtual server.

![Cloud Computing Architecture Diagram]

**C. Distributed Servers**

These are the servers which are not housed in the same location but are in geographically disparate locations. But for the cloud subscriber, these servers acts as if they are housed in the same location right next to each other. This gives the service provider more flexibility in options and security. Amazon has their cloud solution in servers all over the world. If something were to happen at one site, causing a failure, the service would still be accessed through another site. Also, if the cloud needs more hardware, they need not throw more servers in the safe room but they can add them at another site and make it part of the cloud.

4. **Essential Characteristics**

The essential characteristics [3, 5, 6] of cloud computing, shown in figure 3, are summarized as given below:-

(a) **On-Demand Self-Service**

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

(b) **Broad Network Access**

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

(c) **Resource Pooling**

The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.
(d) **Rapid Elasticity**
Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

(e) **Measured Service**
Cloud systems automatically control and optimize resource use by leveraging a metering capability1 at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Figure 3: Essential Characteristics

5. **Service Models**
In the cloud computing stack, there are three basic layers [3, 7] that together create cloud environment. They are:

1. **Infrastructure as a Service (IaaS)**
2. **Platform as a Service (PaaS)**
3. **Software as a Service (SaaS)**

These three layers provide different services for the cloud. The layers are shown in figure 4.

**Infrastructure as a Service (IaaS)**
This is the foundation, or “base layer,” of cloud computing, and includes physical infrastructure such as servers, storage disks and facilities. Organizations benefit from pay-as-you-go, on-demand storage and web hosting, which can be easily scaled bigger or smaller as need fluctuates. According to the different types of resource offered, IaaS cloud can be further divided into three sub-categories:

(a) **Computing as a Service** offers customers access to raw computing power on virtual servers or virtual machine instances. Computing as a Service provides self-service interfaces for on-demand provisioning and management (i.e. starts, stop, reboot, destroy) of virtual machine instances. Computing as a Service provider may also provide self-management interfaces for auto-scaling and other automatable management facilities.

(b) **Storage as a Service** offers online storage services allowing on-demand storing and access to data on third-party storage spaces.

(c) **Database-as-a-service** includes standardized processes for accessing and manipulating (i.e. write, update, delete) data through database management systems (DBMS) that are hosted in the cloud.
Platform as a Service (PaaS)
This “middle layer” of cloud computing provides the operating system from which applications run. Here, the service operator provides a programming language and web server, which allows application developers to create and run their software solutions.

Software as a Service (SaaS)
Finally, at the “top layer,” we find software applications specifically developed for the Internet. Here, consumers generally pay a monthly or yearly fee in order to use a certain software in the cloud. Because pricing is pay-per-user, organizations can quickly add or remove users without having to accordingly scale their associated platform and infrastructure. This on-demand approach allows for rapid, efficient adjustments in staffing. Examples include Sales Force, Google Apps (Gmail, Google Calendar, Google Docs). Figure 5 depicts the access of server by the client via these three layers:
6. Deployment Models

Deployment Models [3, 7, 8] generally is of four types Public, Private, Hybrid and Community Cloud as shown in figure 6.

Public Clouds

Public clouds are made available to the general public by a service provider who hosts the cloud infrastructure. Generally, public cloud providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access over the Internet. With this model, customers have no visibility or control over where the infrastructure is located. It is important to note that all customers on public clouds share the same infrastructure pool with limited configuration, security protections and availability variances. Public Cloud customers benefit from economies of scale, because infrastructure costs are spread across all users, allowing each individual client to operate on a low-cost, ―pay-as-you-go‖ model. Another advantage of public cloud infrastructures is that they are typically larger in scale than an in-house enterprise cloud, which provides clients with seamless, on-demand scalability. These clouds offer the greatest level of efficiency in shared resources; however, they are also more vulnerable than private clouds.

Private Cloud

Private cloud is cloud infrastructure dedicated to a particular organization. Private clouds allow businesses to host applications in the cloud, while addressing concerns regarding data security and control, which is often lacking in a public cloud environment. It is not shared with other organizations, whether managed internally or by a third-party, and it can be hosted internally or externally. There are two variations of private clouds:

(a) On-Premise Private Cloud: This type of cloud is hosted within an organization’s own facility. A businesses IT department would incur the capital and operational costs for the physical resources with this model. On-Premise Private Clouds are best used for applications that require complete control and configurability of the infrastructure and security.
(b) Externally Hosted Private Cloud: Externally hosted private clouds are also exclusively used by one organization, but are hosted by a third party specializing in cloud infrastructure. The service provider facilitates an exclusive cloud environment with full guarantee of privacy. This format is recommended for organizations that prefer not to use a public cloud infrastructure due to the risks associated with the sharing of physical resources.

Hybrid Clouds
Hybrid Clouds are a composition of two or more clouds that remain unique entities but are bound together offering the advantages of multiple deployment models. In a hybrid cloud, you can leverage third party cloud providers in either a full or partial manner; increasing the flexibility of computing. Hybrid cloud architecture requires both on-premise resources and off-site server based cloud infrastructure. By spreading things out over a hybrid cloud, you keep each aspect of your business in the most efficient environment possible. The downside is that you have to keep track of multiple cloud security platforms and ensure that all aspects of your business can communicate with each other.

![Figure 7: Types of Cloud Computing](image)

Community Clouds
Community cloud is a multi-tenant cloud service model that is shared among several or organizations and that is governed, managed and secured commonly by all the participating organizations or a third party managed service provider. Community clouds are a hybrid form of private clouds built and operated specifically for a targeted group. These communities have similar cloud requirements and their ultimate goal is to work together to achieve their business objectives. The goal of community clouds is to have participating organizations realize the benefits of a public cloud with the added level of privacy, security, and policy compliance usually associated with a private cloud. These cloud computing types can be understood by figure 7.

7. Cloud Business Model From Commercial Perception
In the present scenario, cloud computing incline profoundly towards the business world. Most of the prominent companies focus on pioneering business models on various aspects of cloud computing. A cloud business model [9] from commercial perception, shown in figure 8, has been discussed to reach a better understanding of the technology with description of three layers as given below:-

Infrastructure Layer
The infrastructure layer in the cloud focuses on enabling technologies. In this model, there are two categories: those providing storage capabilities and those supplying computing power. For example, amazon.com offers services based on its infrastructure as a computing service and a storage service.
The pricing models for utilization of cloud service are mostly pay as per use or it is based on subscription. Sun Grid Computing Utility, http://www.network.com, focuses on providing computing on demand through a server grid.

![Figure 8: Cloud Business Model [9]](image)

**Platform Layer**
The platform layer provides value-added services from both a technical and a business perspective. This business model noticeably distinguishes between development and business platforms. Development platforms allow developers to write their applications and upload their code into the cloud, where the application is accessible and can be run in a web based manner. For example, Morph Labs, www.mor.ph and Google’s App Engine, http://code.google.com/appengine, provide platforms for deploying and managing Grails, Ruby on Rails, and Java applications in the cloud. Business platforms such as Salesforce, www.salesforce.com, with its programming language Apex and Microsoft with its business platform xRM, www.xrm.com (still in the development phase) have also gained attention by enabling the development, deployment, and management of tailored business applications.

**Application Layer**
The application layer in the cloud represents the actual interface for customers. This layer delivers applications via the platform and infrastructure layers. This business model distinguishes between SaaS applications and the elementary web services on demand. The most famous example is Google Apps, with their broad catalogue of Microsoft Office applications such as Word and Excel as well as...
easy-to-use email and calendar applications that are entirely accessible through a Web browser. An example from the B2B sector is SAP, www.sap.com/solutions/sme/businessbydesign, which delivers its service-oriented business solution ‘business by design’ on a pay-per-use hosting model over the Web. Xignite, www.xignite.com, offer web services hosted on a cloud on a pay-per-use basis as well.

8. Business Intelligence And Cloud Computing

In present global crisis, the organizations can expect the increased uncertainty of their existence. The nature and the structure of the current dynamic world cause that nowadays, in times of uncertainty, risks and incomplete information, the crisis becomes a feature of modern business. Meanwhile, the current economic crisis increasingly oriented ICT industry to effectiveness by providing new models of provision, management and IT security. In the present economy, each organization tends at becoming an intelligent organization and at gaining competition advantage on the market by the use of new and innovative BI solutions. Under the conditions of recession, businesses must use all the opportunities to maximize performance and minimize costs. Under these conditions, large investments in traditional BI solutions are often unpractical and unattractive, while popular solutions based on Cloud Computing, called Cloud BI [10] are increasingly popular. Integration of a Cloud BI solution has special interest for organizations that desire to improve agility while at the same time reducing IT costs and exploiting the benefits of Cloud Computing. Integration of a Cloud BI solution needs a very well defined strategy that would involve Cloud Computing capabilities. Success of the implementation depends on the existence of a service oriented strategy at the level of the organization, which would provide the necessary infrastructure for the cloud implementation. In order to be successful, cloud strategy has to be in accord with the business strategy of the organization. Based on recent research on integration of a BI solution and transition to Cloud Computing, the following strategy of implementation of a Cloud BI solution in six stages, as shown in figure 9, was proposed [10].

![Figure 9: Stages of Cloud BI integration strategy [10]](image-url)
9. Cloud Computing Providers

In current trends, the end users require a number of Internet services on demand. Prominent providers [9] such as Amazon, Google, Sun, IBM, Oracle, and Sales force have extended their computing infrastructures and platforms to provide top-level services for computation, storage, databases, and applications, including those for email, MS Office programs, finance, media, and data processing. Table 1 [9] gives an overview of some of them, the service types they offer, their pricing models, and a mapping to aforementioned business model. The services have been categorized as: infrastructure, storage, database, business process management, marketplace, billing, accounting, email, data sharing, data processing, and Web services.

Table 1: Offering of Services on Demand [9]

<table>
<thead>
<tr>
<th>Company/product</th>
<th>Service type</th>
<th>Pricing model</th>
<th>Ontology concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon EC2 and S3, SimpleDB, SQS, FPS, DevPay</td>
<td>Computing, storage, database, payment, billing</td>
<td>Pay per use</td>
<td>Infrastructure/platform as a service</td>
</tr>
<tr>
<td>Appian Anywhere</td>
<td>Business process management</td>
<td>Pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>Box.net</td>
<td>Storage</td>
<td>Pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>Flexiscale</td>
<td>Infrastructure</td>
<td>Pay per use</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Google App Engine</td>
<td>Infrastructure, Web applications</td>
<td>Pay per use</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Gmail Drive</td>
<td>Storage, email</td>
<td>Free/pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>MuxCloud</td>
<td>Data processing (video); uses Amazon's EC2</td>
<td>Pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>Nirvanix</td>
<td>Storage</td>
<td>Pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>Network.com</td>
<td>Infrastructure</td>
<td>Pay per use</td>
<td>Infrastructure/platform as a service</td>
</tr>
<tr>
<td>OpSource</td>
<td>Billing</td>
<td>Subscription</td>
<td>Applications</td>
</tr>
<tr>
<td>Process Maker Live</td>
<td>Business process management</td>
<td>Pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>Salesforce.com</td>
<td>Platform</td>
<td>Pay per use</td>
<td>Platform as a service/ applications</td>
</tr>
<tr>
<td>MS SkyDrive</td>
<td>Storage</td>
<td>Free</td>
<td>Applications</td>
</tr>
<tr>
<td>SmugMug</td>
<td>Data sharing (photo)</td>
<td>Subscription</td>
<td>Applications</td>
</tr>
<tr>
<td>Strikerion</td>
<td>Web services</td>
<td>Subscription/pay per use</td>
<td>Applications</td>
</tr>
<tr>
<td>XDrive</td>
<td>Storage</td>
<td>Subscription</td>
<td>Applications</td>
</tr>
<tr>
<td>XCalibre</td>
<td>Infrastructure</td>
<td>Subscription</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Zimory.com</td>
<td>Marketplace</td>
<td>Dynamic pricing</td>
<td>Applications</td>
</tr>
</tbody>
</table>

10. Advantages Of Cloud Computing

Multi-tenancy: Public cloud service providers often host the cloud services for multiple users within the same infrastructure

Elasticity and Scalability: Ability to expand and reduce resources according to your specific service requirement. e.g., you may need a large number of server resources for the duration of a specific task. You can then release these server resources after you complete your task.

Pay-per-use: Pay for cloud services only when you use them, either for the short term (e.g., for CPU time) or for a longer duration (e.g., for cloud-based storage or vault).

On Demand: One can invoke cloud services on need basis, need not to be part of IT infrastructure - a significant advantage for cloud use as opposed to internal IT services.

Resiliency: Cloud can completely isolate the failure of server and storage resources from cloud users.

Workload Movement: It is important for resiliency and cost considerations, service providers can migrate workloads across servers - both inside the data center and across data centers (even in a
different geographic area). Typical reasons for workload movement are due to a catastrophic event in a geographic region (say Hurricane Sandy in the US). Then the workload can be moved to some other geographic region for the time being, or there can be some other business drivers for the workload movement to get these advantages:

(i) **Less Cost:** It is less expensive to run a workload in a data center in another area based on time of day or power requirements.
(ii) **Efficient:** Better resources / network bandwidth availability. For example, US nightly processing in India day time is less costly and more efficient.
(iii) **Regulatory Considerations:** For certain types of workloads, e.g. New York stock exchange processing from India

### 11. Conclusion And Future Scope
Cloud Computing offers benefits for organizations and individuals. Although Cloud computing can be seen as a new phenomenon which is set to revolutionize the way we use the Internet, there is much to be cautious about. Cloud Computing releases the world of computing to a wider range of uses and increases the ease of usage by giving access through any kind of internet connection. Cloud computing is poised to be a significant player in the tech industry now and in the foreseeable future. This paper has surveyed the cloud computing, and its issues like performance, security and storage. This paper gives the better understanding of cloud computing with examples, why we need cloud computing, its architecture, benefits and services provided etc. and research directions as well. Although much progress has already been made in cloud computing, we believe there are a number of research areas that still need to be explored. Issues of security, reliability, and performance should be addressed to meet the specific requirements of different organizations, infrastructures, and functions.

(a) **Security**
As different users store more of their own data in a cloud, being able to ensure that one user’s private data is not accessible to other users who are not authorized to see it becomes more important. While virtualization technology offers one approach for improving security, a more fine-grained approach would be useful for many applications.

(b) **Reliability**
As more users come to depend on the services offered by a cloud, reliability becomes increasingly important, especially for long-running applications. A cloud should be able to continue to run in the presence of hardware and software faults. Google has developed an approach that works well using commodity hardware and their own software. Other applications might require more stringent reliability that would be better served by a combination of more robust hardware and software-based fault-tolerance techniques.

(c) **Vulnerability to Attacks**
If a cloud is providing compute and storage services over the Internet such as the Amazon Approach, security and reliability capabilities must be extended to deal with malicious attempts to access other user’s files and to deny service to legal users. Being able to prevent, detect, and recover from such attacks will become increasingly important as more people and organizations use cloud computing for critical applications.

(d) **Cluster Distribution**
Most of today’s approaches to cloud computing are built on clusters running in a single data center. Some organizations have multiple clusters in multiple data centers, but these clusters typically operate as isolated systems. A cloud software architecture that could make multiple
geographically distributed clusters appear to users as a single large cloud would provide opportunities to share data and perform even more complex computations than possible today. Such a cloud, which would share many of the same characteristics as a grid, could be much easier to program, use, and manage than today’s grids.

(e) Network Optimization

Whether clouds consist of thousands of nodes in a computer room or hundreds of thousands of nodes across a continent, optimizing the underlying network to maximize cloud performance is critical. With the right kinds of routing algorithms and Layer 2 protocol optimizations, it may become possible for a network to adapt to the specific needs of the cloud application(s) running on it. If application level concepts such as locality of reference could be coupled with network-level concepts such as multicast or routing algorithms, clouds may be able to run applications substantially faster than they do today. By understanding how running cloud applications affects the underlying network, networks could be engineered to minimize or eliminate congestion and reduce latency that would degrade the performance of cloud-applications and non-cloud applications sharing the same network. Some of the critical obstacles and opportunities for researchers in the field of cloud computing is summarized below in table 2:-

<table>
<thead>
<tr>
<th>Obstacles</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Service:</td>
<td>• Use Multiple Cloud Providers</td>
</tr>
<tr>
<td></td>
<td>• Use Elasticity to Prevent DDOS</td>
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<tr>
<td>Data Lock-In:</td>
<td>• Standardize APIs</td>
</tr>
<tr>
<td></td>
<td>• Compatible SW to enable Surge Computing</td>
</tr>
<tr>
<td>Data Confidentiality and Audibility:</td>
<td>• Deploy Encryption</td>
</tr>
<tr>
<td></td>
<td>• VLANs, Firewalls</td>
</tr>
<tr>
<td></td>
<td>• Geographical Data Storage</td>
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<tr>
<td>Data Transfer Bottlenecks:</td>
<td>• Data Backup/Archival</td>
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<td></td>
<td>• Higher BW Switches</td>
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<tr>
<td>Performance Unpredictability:</td>
<td>• Improved VM Support</td>
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<tr>
<td></td>
<td>• Flash Memory</td>
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<tr>
<td></td>
<td>• Gang Schedule VMs</td>
</tr>
<tr>
<td>Scalable Storage:</td>
<td>• Invent Scalable Store</td>
</tr>
<tr>
<td>Bugs in Large Distributed Systems:</td>
<td>• Invent Debugger that relies on Distributed VMs</td>
</tr>
<tr>
<td>Scaling Quickly:</td>
<td>• Invent Auto-Scaler that relies on ML</td>
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<tr>
<td></td>
<td>• Snapshots for Conservation</td>
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<tr>
<td>Reputation Fate Sharing:</td>
<td>• Offer reputation-guarding services like those for</td>
</tr>
<tr>
<td></td>
<td>email</td>
</tr>
<tr>
<td>Software Licensing:</td>
<td>• Pay-for-use licenses</td>
</tr>
</tbody>
</table>

The popularity of the pay-per use and subscription pricing models has been discussed. Users and providers apparently prefer simple static models in which it’s easy to forecast payments. However, it has been found that dynamic pricing policies could achieve more economically proficient allocations and prices for high-value services. In current competitive scenarios, cloud providers have scarce resources and thus high demand, therefore, capacity allocation depends on customer choice, classification and appropriate pricing. Cloud providers can gain more revenue by offering customized products with additional services according to the vibrant demands of customer.
References


