

Impact of Cloud Computing on Businesses

- *Cloud Computing* has become a disrupting technology that is replacing the IT infrastructure used by small and large enterprises. By using Cloud Computing, enterprises can do away with many captive datacenters and server-storage infrastructure owned and managed by them.
- *Several IT hardware manufacturers, application developers, and datacenter product providers will lose a lot of revenue because of the use of cloud, as customers will stop buying hardware and software applications in preference for cloud services.*
- Pay-per-use invoices and On-demand resource

A cloud service has a few salient features that distinguish it from hosting services. These features are given as follows:

- Cloud services are sold on demand, typically by the minute, hour, or month.
- You as a user can use as much or as little of a service as you want at any time.
- The service can be an application or even hardware resources, such as storage capacity or compute power.
- **The service and underlying infrastructure is fully managed by the provider. All you need is a Web browser and an Internet connection.**

- **A cloud service can be public, private, or a hybrid of the two. A public cloud offers services to anyone on the Internet. Amazon Web Services, Google, and Salesforce.com are some of the leading public cloud providers.**
- **A private cloud is an internal IT infrastructure, usually located within the user's datacenter. It offers application services to a limited number of users within one or a few related organizations.**
- **Like a public cloud, the infrastructure is shared by multiple users and each user gets resources as and when he/she requires.**

Table 1 lists a few public cloud myths and reality:

| Table 1: Public Cloud Myths and Reality | | |
|---|---|--|
| | Public Cloud Myth | Reality |
| 1 | If my organization moves IT services to the cloud, my role as an IT manager becomes less technical and redundant. | The role will still be required, but the scope will change. Some services will move to the public cloud but several will remain for corporate IT managers. They will still have to manage security, user accounts, OS, and applications. There will be several new tasks, such as integrating corporate services with cloud services, keeping a backup of cloud storage, ensuring secure communications between cloud and corporate LAN, maintaining Service Level Agreement (SLA) with the Cloud Service Provider (CSP), and working on escalations to the CSP. |
| 2 | My organization will lose control over the user data. | You will still be responsible for the integrity, security, and backups, regardless of whether the user data is on-premise or off-premise. The most successful cloud deployment is a <i>hybrid cloud</i> , where you can keep critical data on-premise and use the cloud during the peak-load period and for less critical applications. |
| 3 | Only small businesses can benefit from the public cloud. | Compliance is a key factor. Large organizations use the public cloud for applications that are not regulated and required by the government to be hosted within an internal datacenter. Backups, DR, application development, compute-intensive applications whose resource requirements vary drastically over time are the reasons why the cloud is used by large organizations. |
| 4 | To fully take advantage of cloud computing, you will ultimately have to move all services to the cloud. | It is recommended that you keep some applications internal and move a few to the cloud. Apps with fluctuating loads are good candidates for the cloud. Apps with sensitive, financial, or critical data are ideally hosted on-premise. |

Cloud Computing Service Delivery Models

There are three high-level cloud models depending on what resources you use and the benefits you get from the cloud. These are described as follows:

Infrastructure-as-a-Service (IaaS)—In this model, you can either use servers or storage in the cloud. In this model, you do not have to purchase and maintain your own IT hardware. However, you need to install your applications on your cloud-based hardware resources.

Platform-as-a-Service (PaaS)—In this model, you can use the cloud as a platform to develop and sell software applications.

Software-as-a-Service (SaaS)—In this model, you can use various software applications, such as CRM and ERP, and collaboration tools on the Web. You save by not having to buy or maintain IT hardware or applications.

Business Process as a Service (BPaaS)—In this model, you can use a combined model that includes Human Capital Management (HCM) as offered by Workday and parts of ERP, such as Supply Chain Management and Vendor Management.

- In each of the above cases, you pay a monthly fee to the cloud provider for the hardware or applications you use. **Figure** shows the projected market size for the public cloud, which it is expected to touch by the end of this decade:

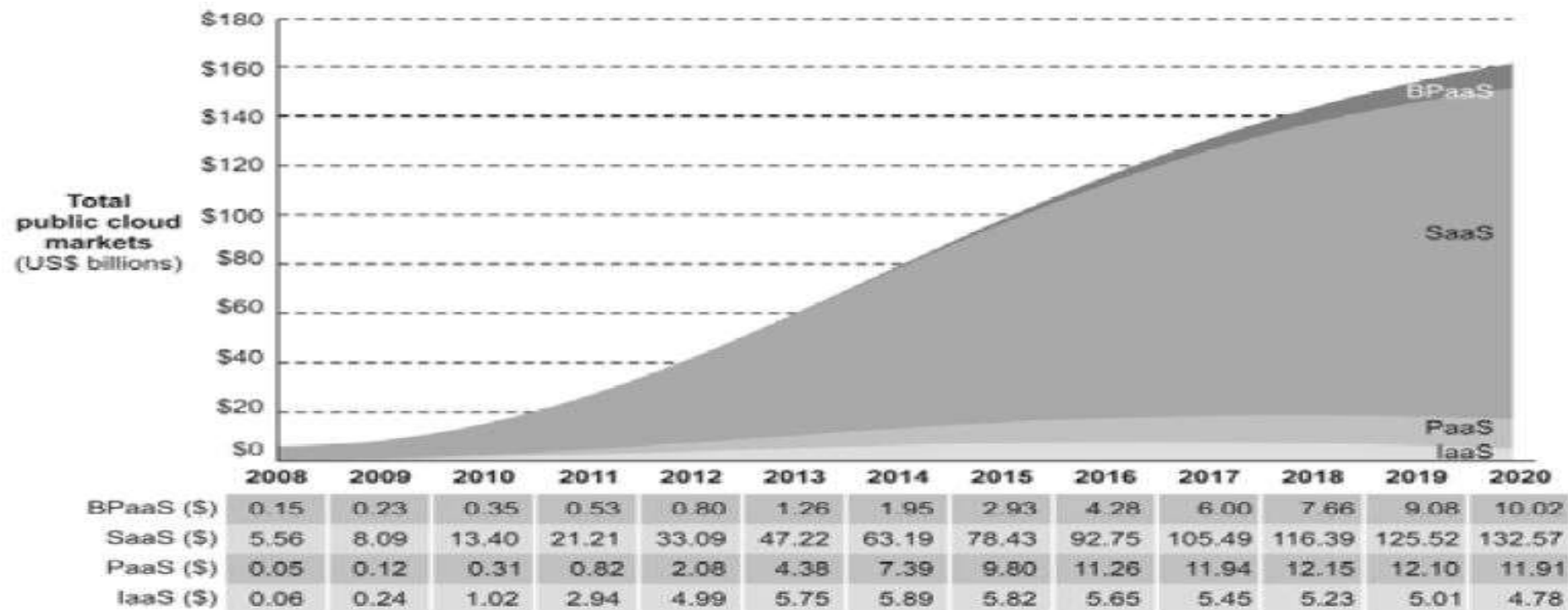


Figure 14: Global Public Cloud Market Size, 2011–2020 (Source: Forrester Research)

The fastest growing segments in SaaS are Content, Communications and Collaboration (CCC), Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), and Supply Chain Management (SCM).

- **A strong SaaS adoption will lead to more growth of IaaS and PaaS.**

Key Drivers for Cloud Computing

Several organizations are proactively looking at various disruptive technologies to ensure that the IT services they offer are flexible enough to meet the demands of growth in business. Cloud models are able to provide this flexibility and thus feature high in the list of such desired technologies. The cloud market is growing fast and witnessing many new entrants, which have large amounts of capital to invest. They are expected to offer a broad range of solutions and play key roles in the cloud market.

SNAPSHOT

In its research report in August 2012, the International Data Corporation (IDC) estimated the Indian cloud market to be in the region of \$535 million in 2011, with a growth of more than 70% in 2012. The IDC expects a growth of almost 50% for the next 3 years.

In the case of cloud computing, in addition to economics, there are various other reasons for its rapid adoption. The key benefits that lead to the adoption of cloud computing are listed in Table 1:

| Table 1: Benefits of Cloud Adoption among Users and Providers | |
|--|--|
| Benefits to Cloud Users | Benefits to Cloud Providers |
| Anytime-anywhere access to cloud-based applications and data | Easier for service providers to reach new clients |
| No upfront capital expenses for datacenters, servers, storage, security appliances, etc. | Low cost of delivering and supporting applications |
| No ongoing onsite IT personnel, power, and other datacenter-related expenses | Opportunity to use low-cost commodity servers, storage, etc. to form redundant IT infrastructure |
| Flexibility and on-demand provisioning of computing and storage resources | Ability to provide multiple services from a single IT infrastructure |
| Pay-per-use model where payment is made only for the time of use | Increased resource utilization due to a multi-tenant model |

- *The popularity of cloud computing, especially among Small and Medium Businesses (SMBs), is undeniable, and they use cloud computing for internal and mission-critical purposes.*
- **Large corporations use public clouds** for less critical applications such as **Disaster Recovery (DR) and backups**. However, now, they are evaluating or using cloud computing for mission-critical services such as **Customer-Relationship Management (CRM) and Enterprise Resource Planning (ERP)**. They are also motivated by the cloud's large-scale, on-demand resource availability and ease of use. The key benefits for SMBs and enterprises are as follows:

Scalability—It is the ability of the cloud service or application to grow or diminish the resources(CPU, RAM, bandwidth, storage) based on need. This is often done without human intervention.

Ease of Use—A self-service portal makes it easy to configure and use cloud resources. If a new virtual machine is required for test, development, or production, it can be quickly setup and put to use in a matter of minutes, compared to on-premise procurement and configuration, which takes more than a week.

Risk Reduction—SMBs and enterprises can use the cloud to build IT configurations to experiment with new business ideas, technologies, and models, before making large-scale investments.

Reduced Capital Expenses (CapEx)—There is no upfront capital investment in the physical resource procurement, maintenance, upgrade, or administrative costs.

Pay-for-What-You-Use—The organization is billed for what they have used during the month.

Lower Operating Expenses (OpEx)—The cost for cloud resources and support manpower is shared by many consumers and the utilization percentage is high. Thus, the consequential economies of scale help lower the cost for consumers.

Flexibility to Hire Talent—A business can have employees spread across the world and have them work on a common cloud-based platform. This enables an organization to use the best talent available at the lowest cost.

Collaboration—Anytime-anywhere access enables employees and partners to work concurrently on common projects.

Assurance with Service Level Agreements (SLAs)—The consumer or business has an agreement with the provider for a certain level of uptime, performance and problem response, and resolution time.

Cloud Computing and Outsourcing

- **The justification for IT outsourcing and cloud computing has been instrumental in lowering of costs. Contracting a business or IT function to another organization characterizes outsourcing. Cloud sourcing is about leveraging of services hosted at a third-party site for computing resource or applications.** It replaces the need for dedicated IT capabilities and staff, which are usually more expensive.
- Cloud-sourcing can provide substantial economic benefits, but there are disadvantages to consider too such as security, loss of control, and performance. However, it is important to understand the similarities and differences between the two, as shown in Table :

Table 2: Comparison of IT Outsourcing and Cloud Computing

| | Criteria | IT Outsourcing | Cloud Computing |
|----|---|---|--|
| 1 | Vendor Lock-in | Yes and transition to another vendor is expensive and arduous and may lock into an inflexible contract | Yes, however, with adoption of standards, it is easier to transition to another vendor |
| 2 | Utility Model Billing | Yes for manpower hiring and no for project-based outsourcing | Has a utility-like billing for actual resource utilization |
| 3 | Commitment | Long term, usually for a year or more | Short-term, could be terminated within a month's time |
| 4 | SLA-based Relationship | Yes | Yes |
| 5 | Customized Services Development | Can be customized for large outsourcing projects, and work can be done using Windows, Linux, or vendor Unix operating systems such as <i>HPUX</i> , <i>Sun Solaris</i> , mainframes, or IBM AIX | No, most of the work is done on Windows and Linux servers |
| 6 | Loss of Control | Yes | Yes for public clouds |
| 7 | Involves Working with Staff of Vendor Companies | Yes | Yes |
| 8 | Faster Development Cycle | No | Yes |
| 9 | Costs | Reduced capital expenditure; usually it has a fixed and variable component of cost | No capital expenses; variable component only |
| 10 | Scalability and Elasticity | Limited | Highly scalable especially for large public clouds |
| 11 | Location of Data | Known | Can be known for primary data copy, but not known for backup and DR copies |

It is important to realize that there are compliance and government regulations for location of data and it applies to both cloud computing and outsourcing.

Other concerns for both are:

Security at a vendor site

Loss of control

Latency of using an application at a remote site

Types of Scalability

The scalability of changing resources allocated to a cloud service can be implemented in various ways. The main techniques are:

- ❑ **Vertical Scalability or Scaling Up**—In this case, you add resources, such as CPU, memory, and storage space, to a server. This helps improve performance and capacity. On the other hand, you can also add non-IT components, such as power supplies, NICs, and HBAs, to a server, which helps improve fault tolerance.
- ❑ **Horizontal Scalability or Scaling Out**—In this case, instead of adding resources within a server or device, you add more servers or nodes to improve performance, capacity, and redundancy.
- ❑ **Diagonal Scalability**—This gives you flexibility to use both vertical and horizontal scalability.

Use of Load Balancers to Enhance Scalability

Load balancers can be used to efficiently manage and spread incoming user traffic among multiple servers. A load balancer monitors the traffic and available servers, and uses a round-robin algorithm where the idlest server is allocated the load. It improves performance for the user. It also protects against server failure. If a server fails, the other servers continue to provide the services, although the performance may be slower. On a larger scale, a load balancer can distribute traffic to servers in different regions of the world.

EXAM PRISM

Load balancers improve performance and availability. If a certain site is down, the load-balancer avoids the failed site and continues to service the regional users, using healthy servers in other regions.

Load balancers are commonly used for services such as Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), etc. They are suitable for use in applications where the incoming load can vary greatly. They are also suitable where the connections are intelligent and must be tuned for performance, security, or other parameters. Load balancers help by enabling an intelligent management interface to application services.

Case Study 1: Cloud Makes for a Green Earth

Cloud computing is a part of the Green IT initiative. By sharing resources at a service provider's location, you reduce the number of IT equipment and energy consumption. Technically, you can virtualize and consolidate your IT hardware and deploy Power Manager to automatically soft-power off idle servers. However, cloud providers contribute more due to their unique positioning. They host several customers (multi-tenancy) and enable elasticity (give more resources to those who need it and only when they need it). Although there is very little hard data from cloud service providers on their energy efficiency, they have forced enterprises of all sizes to consolidate, improve utilization, and contribute toward Green IT.

Variable Operating Costs Using Cloud Computing

The variable operating cost model of cloud computing is an undeniable motivator for SMBs and enterprises. It avoids the risk of investing upfront on IT equipment or talent. It also helps organizations protect their cash flow from operations, during times when more IT infrastructure is required to meet grown business needs and when less IT infrastructure is needed as business volumes decline. Organizations can experiment with technical ideas and create proof of business concepts using cloud resources. If a business idea does not seem feasible to continue, it can be quickly be withdrawn from the cloud. The cloud provides an agile platform on a pay-per-use basis. It is responsive to changing market needs. The enhanced utilization of cloud resources helps reduce the cost per user. Smart, power-saving technologies turn off resources during periods of low-load, thus, saving on power-related costs.

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Time-to-market Benefits of Cloud Computing

Cloud services enable an organization to develop new services and release them to the market in a shorter time span. The cloud provides quick and easy access to vast amounts of resources. Organizations can use it to rapidly develop, test, deploy, and manage applications. Application vendors, for example, can be used to integrate with other cloud-based services such as storage, database, user authentication, or security.

The vendors get quick access to services on a pay-per-use model. Cloud, thus, helps to reduce engineering time to create and deploy new services. Without the use of cloud, application development is an expensive and time-consuming process. The key factors that favor cloud-based application development are:

- a. It can add or remove resources easily, using a self-service portal.
- b. It has pay-per-use billing for development and production.
- c. It has support for three-tier or multi-tier application architecture.
- d. It has an easy mechanism to migrate existing virtual server images to the cloud.

Distribution Over the Internet

Access to cloud computing is done over the Internet. This makes it easier for users anywhere to connect to cloud services at any point in time. When cloud providers select a site for building a new datacenter, the key factors they consider are as follows:

- ❑ Availability of low-cost and renewable sources of power
- ❑ Access to inexpensive IT talent in the area for IT administration
- ❑ High-speed Internet connectivity from multiple Internet service providers
- ❑ Low cost of land and green-field sites
- ❑ Obtaining tax breaks from the local and state government
- ❑ Abundance of water supply throughout the year
- ❑ Earthquake-free or low seismic zone

Most cloud providers have multiple datacenters for DR and better performance, and provide the most reliable user experience. Optimizing the above factors yield the highest ROI on datacenter costs for cloud providers. Greenfield sites are preferred, because they save money on land acquisition costs and are usually eligible for tax rebates.

Levels of Business Value from Cloud Computing

In general, business owners, profit-center heads, and Chief Financial Officers (CFOs) prefer the concept of cloud computing due to its economic savings, pay-per-use billing, and absence of fixed costs. However, a disadvantage of cloud computing is that the cloud costs are variable and do not linearly increase or decrease with change in the utilization pattern, making it difficult to forecast the billing amount each month. From a business viewpoint, cloud computing offers value to an organization at three different levels. These are described in Table 3:

| Table 3: Different Levels of Value for Cloud Consumer Organizations | | |
|---|--------------------------------------|---|
| | Level of Value from Using the Cloud | Description |
| 1 | Basic Level (Utility Level Value) | Consumer organizations benefit from fundamental features of cloud such as lower IT costs, higher service levels, scalability to meet peak loads, absence of fixed or capital expenses, and pay-per-use billing. Focus is on labor, IT resources, and power. |

Table 3: Different Levels of Value for Cloud Consumer Organizations

| | Level of Value from Using the Cloud | Description |
|---|---|--|
| 2 | Intermediate Level (Process Transformation Level Value) | <p>Enterprises find it difficult to improve business processes, because they are usually ineffectively supported by traditional in-house IT infrastructure and teams. A cloud, on the other hand, allows business units to regulate to meet their specific requirements.</p> <p>For example, sales teams can use cloud-based CRM to improve sales tracking and customer relations. Human Resource (HR) departments can use cloud-based human capital management applications. Cloud users can introduce new processes by taking advantage of pooled and scalable resources in the cloud. It facilitates better collaboration between geographically-dispersed teams and users with mobile and remote access.</p> |
| 3 | Advanced Level (Business Innovation Level Value) | <p>The business innovation level aims to create new value chains between organizations and customers and novel and pioneering business models. This is achieved by rewiring the way organizations can operate using cloud resources, making choices of competitive advantage, and deriving new values from cloud-based services. It can be used to collaborate between users, customers, and partners. Cloud resources can be combined to create entirely new business eco-systems.</p> |