Cloud computing for business

Khayyam H. MASIYEV
Qafqaz University
Baku, Azerbaijan
xmesiyev@qu.edu.az

Ilkin QASYMOV, Vusale BAKHISHOVA, Mammad BAHRI
Qafqaz University
Baku, Azerbaijan
ilkins.email@gmail.com, baxisova_vusale@mail.ru, mammadb@bakcell.com

***Abstract*— Nowadays the implementation of information technologies in organizations is a high resource-consuming process associated firstly with the effect of high costs and uncertainty on organizational performance and, secondly, with storage and maintenance issues. This paper will overview the usage of cloud computing in business as one of the effective ways of dealing with the issues mentioned above by describing the essentials of cloud computing, business processes and their convergence. Essentials of cloud computing covers definition, layers, types, advantages and disadvantages of it, while business processes covers business activities, types of business processes and their management, and finally convergence reveals the offerings of cloud computing for businesses, as well as the integration of cloud infrastructure to business processes and practical outcomes from the usage of cloud computing in real-word companies.**

***Index Terms*— cloud computing, business, hardware, software, high costs, infrastructure, computation, performance.**

I. INTRODUCTION

The problem of rising costs and uncertainty reinforced by the issues of deployment of technologies requires considerable attention of managers. Lack of rationale on decision making associated with the implementation of information technologies will lead to extreme costs and increased complexity of systems and also, eventually, to a broadening gap between business and technologies – misalignment. This situation points out to the necessity of cost-effective and easily maintained solutions providing considerable benefits for organizations. The idea is to achieve efficiency, streamlining, decentralization, and improved customer relationship management (CRM).

Cloud computing solutions are powerful instruments designed to realize this idea in the form of services. Hardware and software, infrastructure and platform solutions can be offered as a single service accessible via the Internet. Giants like Amazon, Google, Cisco, IBM, Oracle and also the Federal Government of the United States, the Cabinet Office of the United Kingdom have defined their own strategies to implement cloud computing solutions in business, public and government sectors to deliver efficiency, agility, innovation.

A. Abbreviations and Acronyms

- CRM – customer relationship management
- IaaS – infrastructure as a Service
- SaaS – software as a Service
- PaaS – platforms as a Service
- XaaS – everything as a service
- BPR – business process reengineering
- BPM – business process management
- BPMS - business process management system
- TQM – total quality management
- LAP – language actions perspective
- VPN – virtual private network
- PDF – portable document format
- ODF – open document format

II. THE ESSENTIALS OF CLOUD COMPUTING

A. The meaning of cloud computing

Cloud computing can be defined as "an all-inclusive solution in which all computing resources (hardware, software, networking, storage, and so on) are provided rapidly to users as demand dictates". This definition provides the following specifics of cloud computing:

- All-inclusiveness – multiple solutions are provided in a single one service (hardware, software, infrastructure, operations systems, etc).
- Remote access – users of cloud computing do have access to their data via remote connection
- Rapidity – computational resources are available anytime by request.

With cloud computing users do not require an extremely powerful computer to handle large volumes of data. Instead they can have an internet connection to the server providing the whole infrastructure for handling user data.

Cloud computing has the following key characteristics:

- Computation as a Service – computation is remote. This process is offered as a service.
- Transparency – the structure and the process of data handling is transparent to users.
- Significant cost reduction in hardware and software – users may not need to purchase hardware and software solution to manage data. It is done by remote infrastructure.

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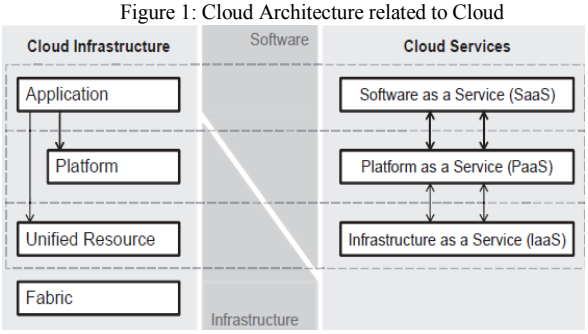
- Elasticity and scalability – users can easily purchase computation resources and scale it up to particular extent.
- Disaster-proof and business continuity – remote infrastructures can be secure from force-major occurrences.

The greatest effect of cloud computing in today`s organization as mentioned is cost-efficiency. In the long run it also triggers economies of scale for a company. As their business becomes bigger and more complex, the "cloud" will need to become bigger and the system, using economies of scale, will become bigger without even knowing about it.

B. *The three layers of cloud computing*

Cloud computing solutions are composed of cloud services offered by a service provider. Currently three major services are avaliable:

Figure 1: Cloud Architecture related to Cloud



- Infrastructure as a service (IaaS) – At this level, the product is the hardware and related services (data centers, physical hardware, networking equipment and firewalls, etc). General processing, servers, storage devices, database management, and all other hardware-related services offered as a service to the end user.
- Platform as a service (PaaS) – this layer offers hardware-independent solutions to software developers (operating systems, virtual machines, infrastructure softwares). Developers can write their applications according to the specifications of a particular platform without needing to worry about the underlying hardware infrastructure (IaaS). standardized interfaces and a development platform for the SaaS layer.
- Software as a service (SaaS) – most visible layer of cloud computing for end-users, SaaS, is software that is owned, delivered and managed remotely by one or more providers and that is offered in a pay-per-use manner, because it is about the actual software applications that are accessed and used.

Users often demand not a single cloud computing solution, but all solutions in a single service. It is called XaaS, meaning "everything as a service". Thus XaaS includes IaaS, PaaS and SaaS.

C. *Types of clouds*

Cloud Computing can be classified and deployed to end customers as Public, Private or Hybrid clouds. Organizations choose deployment models for IT solutions based on their specific business, operational and technical requirements. Let us consider each type:

- Public clouds – public clouds are cloud services provided by third parties but hosted and managed by the service providers. Providers are responsible for installation, management, provisioning and maintenance. Customers access and use the services and physical resources and are charged only for the resources and services they use.
- Private clouds – private clouds are proprietary networks, often data centers for the exclusive use of the organization. These are shared environments built on highly efficient, automated and virtualized infrastructures..
- Hybrid clouds - combination of Private and Public Clouds. They combine on-demand external capacity with on-premises resources and in-house compliance. In this case, the management responsibilities are often split between the enterprise and the public cloud providers, which can often become an issue of concern.

D. *Drawbacks of cloud computing*

Cloud computing might be seen as a remedial solution to all problems but despite its advantages has several considerable drawbacks that should be taken into consideration:

- Security – issues related to the location of data, its accessibility to third parties and its sustainability to losses.
- Cost – issues related to some hidden costs and future charges for the customers.
- Integration – this problem is related to the obstacles the company may face while integrating cloud computing to the business architecture.
- Knowledge – integration of cloud computing may indeed require special knowledge and skills and even may lead up to higher costs associated with attraction of specialists.
- Flexibility – cloud computing in contrast to private infrastructure may not provide fair feature customization.

III. BUSINESS PROCESSES

A. *The meaning of business processes*

Business processes are the set of activities that deliver value to the customers. The main features of business processes are following:

- Large and complex, involving the flow of materials, information and business commitments.
- Very flexible, responding to demands from customers and to changing market conditions.

- Long running –It means a single process can take much more time in order to accomplish it.
- Automated – Routine and standard tasks should be performed by computers and other automated systems in order to reduce the time and energy.
- People perform tasks that are too unstructured to delegate to a computer or that require personal interaction with customers.
- Difficult to make visible. In many companies the processes are not conscious or explicit, but undocumented and implicit, embedded in the history of the organization.

Business process management is the capability to discover, design, deploy, execute, interact with, operate, optimize and analyze end to end processes at the level of business design, not technical implementation.

There are two kinds of approach to business processes: Transformation and Coordination approach. According to Transformation approach business processes consist of transformations of inputs to outputs. Coordination approach is also called the Language Action Perspective.

There are several business process methods based on the coordination approach. One of them is Action Workflow which was developed by Medina-Mora in 1992.

Figure 2: The Action Workflow loop

B. Business process management

Business process management (BPM) is a system approach to an organization's processes. Its purpose is to make the business more competitive and successful by better serving its customers. BPM focuses process effectiveness, efficiency and flexibility to adapt to the constantly changing business environment.

BPM is most effective in process intensive industries such as health care, insurance, finance, utilities and government. These businesses rely on human knowledge, information databases and process flows to produce an end result, such as a home loan or a business license. The main advantages of BPM are described following table:

TABLE I. ADVANTAGES OF BPM

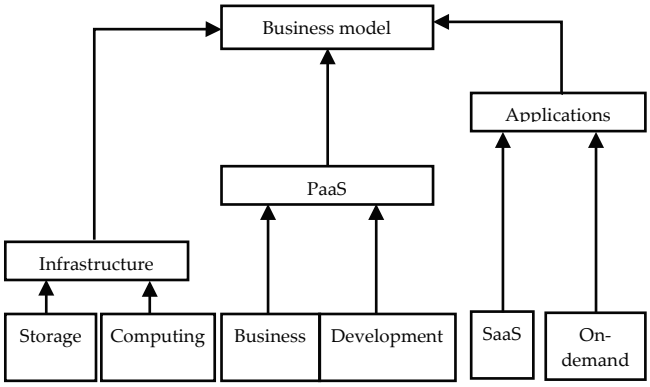
Advantages of BPM	
Direct	Indirect
1. Editing processes in real time 2. Reducing internal and overhead expense 3. Automation of key decisions 4. Reduced maintenance costs 5. The decrease in operating expenses 6. Increase in productivity	1. The reduction of the production cycle 2. Improved accuracy of forecasting 3. Improving the quality of customer service 4. Process optimization of supply

IV. THE ROLE OF CLOUD COMPUTING IN THE BUSINESS

A. The offerings of cloud computing for the business

As mentioned before cloud computing is an effective solution to ever existing problem of complexity of information systems within business domain. Actually if left unmanaged, complexity of technologies rises rapidly leading to an even more misalignment between business and information technologies. In this case cloud computing offers clarification (simplifications) or complexity reduction. By virtualizing the infrastructure, getting resources (either hardware or software) as a remote service, organizations can significantly reduce the level of complexity and count on higher cost cutting. Cloud computing offers a different way to procure and use software and computing services. The continuing evolution of technology will enable cloud computing to make possible a complete breakthrough in the way IT services are provisioned and consumed. Improvements in security, bandwidth, technology standards and virtualization have will motivate to use cloud computing more frequently.

Figure 3: Cloud business model framework



Another offerings of cloud computing are related to responsiveness, connection and specialization. Responsiveness of business comes out of the idea that modern business requires massive data handling and sharing. Thus, high performance hardware and software is required to carry it out.

Organizational resources can be directed at short and long term strategic goals and innovations rather than at secondary problems.

Cloud also makes exploration and entry into new geographic markets and product segments faster, cheaper and less risky, thus, providing secured business.

B. *Cloud computing as a business model*

A business model refers to ways of creating value for customers, and to the way in which a business turns market opportunities into profit through sets of actors, activities and collaboration. A business model describes how inputs (resources) are transformed into outputs (value). Cloud computing can be considered as an emerging business model, as it provides layers of purchasable services offered to end users. The Cloud computing business model includes three elements according to the layers of cloud computing:

- Infrastructure;
- Platform-as-a-service;
- Applications;

The three elements of the cloud business model framework describe organizations business model according to a type of service. The framework reveals different roles of the business among customers. Organizations can decide on the specific direction(s) of business:

- Infrastructure provider;
- Platform provider;
- Service provider;
- Aggregate services provider;
- Consulting;

In fact all of abovementioned roles can be combined into a single value chain – cloud computing value chain.

C. *Integration of cloud computing into business processes*

As effective solution to many obstacles in modern business cloud computing can be integrated into business processes.

In practice prominent companies like Amazon, Microsoft, and Google, Dropbox etc. offer cloud computing solution, typically SaaS and PaaS.

Amazon`s Cloud Drive is an online storage solution that allows users to upload and manage various types of data files including music, videos, photos, and documents over the internet to store on Amazon's secure servers. Brief features of this service:

Google Drive is another cloud computing solution offered by Google with the first 5 GB of stuff for free, access everything in Google Drive from all devices and file synchronization. 25GB cost $2.49 and 16 TB cost $799.99 per month.

Microsoft SkyDrive offers free file storage and access up to 7 GB, with accessing files on the go, simple file sharing and other services. 20 GB of storage cost $20, and maximum 100 GB cost $50.

CONCLUSION

Cloud computing is rapidly evolving technology with a considerable value for business. If properly implemented and integrated it can be quite benefitting for businesses. More and more companies offer IaaS, SaaS, PaaS or even XaaS to create business values and to attract customers.

Despite advantages of cloud computing its drawbacks are quite serious and risky to deal with. It is especially important for business operations with considerable investments in them. Security in cloud computing is its major disadvantage. Service providers need to put efforts to secure personal and business data and provide committed level of reliability. Without security concerns cloud computing may not justify business` expectations.

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