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Robert Kucęba<sup>1</sup>, Leszek Kiełtyka<sup>2</sup>, and Waldemar Jędrzejczyk<sup>3</sup> Czestochowa University of Technology, Faculty of Management, Al. Armii Krajowej 19B, 42-200 Częstochowa, Poland E-mail: robertk@zim.pcz.pl<sup>1</sup>, lekiel@zim.pcz.pl<sup>2</sup>, waldekj@zim.pcz.pl<sup>3</sup>

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#### Abstract

The present paper stresses the role, indicates the power of influence and the importance of cloud computing services in business areas - both from the supply side - suppliers of these services, as well as the demand side - organizations renting these services. The authors compiled and defined services available on the cloud computing market. The paper presents attributes stimulating development of cloud computing services market. The structure and the Compound Annual Growth Rate (CAGR) of particular sectors of the cloud computing services market are presented in the paper as well.

Keywords: Business Model, IT Services, Cloud Computing

#### 1. Introduction

The choice and the subject matter of the present paper are not a coincidence in the aspect of changes stimulated, among others, by IT technologies, changes observed in the economy as well as in contemporary organizations. This can be justified in the aspect of changes taking place in the technological powers distribution and business models on the IT market itself. In particular, the aggregated in the title model of IT cloud computing services changes the philosophy of organizations and their physical borders. The vital influence of the new generation IT in cloud computing models on the world economy and business - as a kind of business last will - has been noticed by the founder of *Apple*, currently legendary Steve Jobs. Also at the end of the past decade the founder of *IBM* Thomas Watson presents a vision of global centralization of informatics resources: "I think that the world market needs maybe 5 computers".

#### 2. Cloud computing origin

It must be emphasized here that the idea of cloud computing technology dates back to the 1960s of the past century. In 1960 John McCarthy correctly predicted that : *"calculations may one day become organized as a service of general interest"*. The technological foundation of IT services in the Cloud Computing model were mainframe computers - defined as mainframe technologies. Through mainframe technologies in the 1970s and 1980s services of computing power were made available to the workstations users.

The contemporary meaning of the cloud computing definition was introduced for the first time by Ramnath Chellapp in 1997. He emphasized that *"the limit of computing power will be established by economic justification, not technological limitations"*.

At the end of the 1990s and in the first decade of the 21st century the theoretical model of cloud computing became a subject of a growing interest of IT producers and providers. This concerned the transformation from the traditional model of IT technology delivery "in the box" to the model of IT access services in the "cloud". For example, in 1999 the salesforce.com company initiated services concerning providing business applications by means of the Internet webpage. At that time the model of provided IT services was defined as Applications Service Provider (ASP). In the year 2002 in turn, Amazon introduced services in the model, which presently adopts the name cloud computing - to needs of data storing, conducting calculations and services. This company introduced to the market of IT services provided with the use of the Internet - Amazon Mechanical Turk. In 2006 the same company started a platform of services in the cloud *Elastic Compute Cloud* (EC2). These are commercial services available through the global computer network dedicated to organizations from the sector of Small and Medium Size Enterprises as well as private persons. EC2 is an application platform providing software tools which enable users - receivers of these services, to create heterogeneous applications on provider servers. The crucial year in the IT market of services in the cloud computing model was the year 2009. For instance, in 2009 Google introduced the service Google Apps - applications based on the web browser, Microsoft in turn entered the cloud computing services market with its application platform - Windows Azure [1]. Since the year 2009 Compound Annual Growth Rate of the IT cloud computing services market has been observed, which currently reaches 25%.

### 3. Service classification on the cloud computing market

In this place we should also answer the question what we understand under the term cloud computing and cloud computing services market.

In the domain literature as well as on the Internet we can distinguish numerous definitions of cloud computing. However, in Europe the base definition is the one of NITS (National Institute of Standards and Technology). According to the NIST Institute cloud computing is "a model of making available with the use of the Internet shared networks, configurable resources (e.g. computer networks, servers, mass storage, software and services), which can be quickly adjusted and provided at the minimum amount of labor of implementing teams in organizations, including service providers" [6].

It must be also mentioned that from the point of view of organizations making the use of providers' services, cloud computing is a form of informatics outsourcing. In this approach outsourcing does not concentrate, as it is the case with traditional IT resources, on analyzing informatics projects, developing, providing, implementing or maintaining informatics systems in enterprises. It concerns services of making available dynamically through the Internet hardware infrastructure, platforms and software and administering this infrastructure by the providers of services in the "cloud". We want to stress the fact that apart from access to virtual IT resources: applications, hardware, databases - in the "cloud", organizations and individual users can store effects of their work: data, information, codified and aggregated knowledge in the form of generated in this environment reports, text documents, multimedia presentations, spreadsheets [3].

Cloud computing is also frequently perceived as a business model of contemporary organizations. "Establishing" the operations of economic organizations in the "cloud" increases their business flexibility, resource access flexibility, stimulates creation of new organizational structures: network ones, virtual ones, learning organizations, smart organizations as well as new employment forms - for instance in the form of teleworking. Table 1 contains aggregated prominent attributes of the cloud computing business model.

Influence of IT technology in the cloud computing model on changes in management				
1	2			
Reinforcing cooperation in value creation chains	Automation and integration of processes taking place between business users and trade partners. Reducing asymmetry of knowledge and information - occurring due to its common availability, especially in the virtual environment.			
Cost effectiveness improvement	Shorter period of return on investment through deceasing or reducing totally the cost of infrastructure, implementation and maintenance - increase in the profitability of ROI, ROA, ROE. Cost incurred for the used IT resources and services in the model pay-per-use [10]. Decrease in transactional costs and marginal costs.			
Resources use optimization	Flexible on-line access to IT resources and IT services offered by the "cloud" providers. Relocating resources in the "cloud", decrease in the IT resource cost per one unit of created value resulting from the organization's operation.			
Business flexibility growth	Acceleration of the organization's flexibility in the turbulent environment of its functioning, in particular organizational structure and architecture and reconfiguration of the organization's resources in the virtual management environment. Safe and simple bidirectional migration of information resources and work results through the Internet, between the "cloud" and the user's desktop.			

Table 1 Attributes of the Cloud Computing Business Model

1	2		
Marketing operations reinforcement	Time compression in case of introducing new products to the market. Shortened time of entering the market ( <i>time-to-market</i> ). The new model of market shaping and studying with the use of social media allocated in the "cloud".		
Decision-making engine	Fusion of modern intelligent tools facilitating: processing web pages content and content available indecision centres (e.g. virtual information agents - indexing bots) as well as facilitating: filtering and aggregation of "purified knowledge sources" in the decision making processes.		
New forms of employment.	Natural environment for teleworking and virtual teams. Growth of employment in the cloud computing model (according to IDC prognosis published in "White Paper Cloud Computing's Role in Job Creation" in the year 2013 - 8,8 million of employed, 23,8 million of employed in 2015 [3].		
Basic management resources	Basic resources in organizations functioning in the cloud computing model are non-material resources, basic products in turn, are digital and digitalized products.		
New organizational structures	Natural environment of creating structures of network economic organizations - often virtual ones replacing highly formalized structures.		

Source: Own analysis on the basis of [1, 3, 4, 9, 10, 11, 14]

It should also be stressed that indirectly, from the point of view of organizations functioning in the cloud computing model, elements which stimulate balanced development are fairly important. For example, from the economic and ecological point of view decrease in energy consumption and cost. The greater use of computational power in Data Center influences lower energy consumption (energetic resources, decrease in greenhouse gases emission - as a result lower external costs) per unit of processed data. Energy consumed by cluster of servers working for many clients is lower (even up to 70%) than in case of servers working individually for each user.

Describing advantages, frequently added value for IT providers and users (organizations) in the cloud computing model, it is worth quoting the research conducted in a group of respondents from the business area (entrepreneurs) by the European Network and Information (ENISA) – see Figure 1 [2].

Adopting a quantitative criterion over 60% of the respondents (entrepreneurs) recognized as a priority benefit minimizing capital expenditures on IT technologies (68,10%), flexibility and scalability of IT resources (63,9%).

A high percentage value was attributed to business continuity and the possibility of data recovery (52,8%). Indicated benefits according to the research conducted by ENISA prove that

organizations notice not only technological benefits, but also measurable economic benefits. There is also a belief that implementing a new model of IT services will not have a negative effect on business continuity, and thus, realizing determined goals of the organization.



Source: European Network and Information Security Agency [2]



Obviously, there are also fears connected with implementing a new business model of cloud computing. Figure 2 presents the fears of business respondents, intentionally for inversion to ENISA - on the basis of the research by International Data Center (IDC). In order to aggregate the most relevant fears of the entrepreneurs, Figure 2 shows a compilation of respective indications, adopting also the quantitative criterion over 60% of indications from the respondents population (entrepreneurs).



Source: download.parallels.com/summit/2010/IDC\_Keynote\_Melanie\_Posey\_Shown.pdf [4]

Figure 2 Fears of Entrepreneurs Connected with Implementation of Cloud Computing Model

The strongest fears of the respondents with reference to the above indications concern, in particular:

- Lack of user's physical control over the data,
- Uncertainty concerning file privacy, continuous access to these files and security in case of provider's machines breakdown,
- Freedom restrictions and imposing by providers their own solutions without user's consent,
- Making users dependent on the provided externally storage space and applications, the use of which will become more and more expensive over time.

The above fears of the respondents (entrepreneurs) paradoxically, in the opinion of these services providers, are determinants of IT development in the cloud computing model. Naturally, these divergences between the providers and entrepreneurs may be explained by the fact that cloud computing services are just at the beginning of the "experience curve".

Answering in turn the question concerning the issue of cloud computing services market, it can be synthetically determined as a virtual space created on the Internet, where balancing of the demand for informatics services and their supply takes place. This is also the space whose users are more and more competing IT services providers and more and more demanding users, in this case informatics services hirers in the cloud computing model.

Cloud computing services available on the IT market depending on the type of provided informatics resources are divided into [5, 7]:

- *Infrastructure as a Service (IaaS)* individual users/organizations hire hardware and netware hosted and made available by the provider in order to create own applications. A primary IaaS service was a collocation consisting in providing by external subjects air-conditioned places for server rooms with access to the Internet;
- *Platform as a Service (PaaS)* individual users/organizations hire a platform for a programming work environment hosted/made available by the provider;
- *Software as a Service (SaaS)* individual users/organizations hire software hosted and made available by the provider;
- *Communications as a Service (CaaS)* cloud computing service provider ensures the platform for telecommunication work environment;
- *Business Process as a Service (BPaaS)* the provider supplies a complete IT environment to economic organizations: computer infrastructure, application infrastructure as well as programming and operating environment.

Table 2 presents a catalogue of sample IT services available on the cloud computing market.

Types of services on the cloud computing market	Sample available informatics resources on the cloud computing market				
Infrastructure as a Service	Virtual machines, Web hosting, server rooms with hardwa (collocation), information flow integrators (e.g. router LAN/WAN/WLAN/ SAN computer networks, workstation memory stations.				
	The biggest provider according to TOP10 searchcloudcomputing – Amazom Web Services (incomes in 2011 in the cloud computing model 5 billion USD) [14].				
Platform as a Service	Operating Systems, API (Application Programming Interface), Backups, BCP (Business Continuity Planning), databases.				
	The biggest provider according to TOP10 <i>searchcloudcomputing</i> – <i>Microsoft, Google [14].</i>				
Software as a Service	BI, ERP, BPM, CRM, GIS, e-commerce, analytics tools, asset management tools, tracking and monitoring tools, travel management tools. The biggest provider according to TOP10 <i>searchcloudcomputing - SalesForce [14]</i> .				
Communications as a Service	Multimedia communicators				
Business Process as a Service	IaaS+PaaS+SaaS+CaaS Resources				

**Table 2** Sample IT Services Available on the Cloud Computing Market

Source: Own analysis

In the processes of classifying services on the cloud computing market the property-based criterion is also applied - it is defined as an access criterion to the IT resources by heterogeneous groups of receivers. According to this classification we can distinguish [5, 7]:

- *Virtual Public Cloud (VPC)* infrastructure is owned by an individual organization (Data Centre), which sells "cloud" services directed at the whole of the society, particular economic trades or organizations.
- *Enterprise Private Cloud (EPC)* infrastructure is owned by one organization/corporation and it is used by this organization/corporation only.
- *Virtual Private Cloud* infrastructure is hired (acceptable ownership) by one organization and it is used by this organization only. Processing services are available in the cloud, but implemented on servers of a particular organization.
- *Hybrid cloud (HP)* infrastructure is a composition of two or more "clouds" (private, shared or public ones), which constitute unique units, but are connected with each other by one technology.
- *Community cloud (CC)* infrastructure is used by many organizations and it supports particular communities, which share the same goals (e.g. politics, mission, security requirements). A social "cloud" may be managed by an element of the organization or by a third party.

# 4. Cloud computing provider market

Currently, the global market of cloud computing services is dominated by the biggest IT providers. According to IDC (Worldwide and Regional Public IT Cloud Services 2010 - 2014 Forecast. Netherlands 2010), the value of cloud computing services market in the year 2014 will amount about 55 billion USD, which constitutes the annual growth rate CAGR - 27,4%. In the year 2020 in turn, according to Forrester Research this value will exceed 240 billion USD [4, 10].

It is worth analyzing here the CAGR growth for particular sectors of the cloud computing market. In order to this the authors created Table 3 (on the basis of William Blair&Co, Bain Analysid Forrester, IDC, Gartner, 2012 [12]), where they aggregated values of particular sectors of the cloud computing market - such as: SaaS (*Software as a Service*), PaaS (*Platform as a Service*), IaaS (*Infrastructure as a Service*), VPC (*Virtual Private Cloud*) and EPC (*Enterprise Private Cloud*). The compilation of value growth of particular market sectors comprise three years between 2011(the base year - real market value) and 2013 (reference year - predicted market value).

**Table 3** The Growth of CAGR Value of Particular Sectors of the Cloud Computing Market in the

 Years 2011-2013

Sectors of cloud computing global market	Market value/ Market share 2011	Market value/ Market share 2013	Average market growth rate 2011-2013	Biggest providers According to TOP 10 search- cloudcomputing [14]
SaaS	13,0 billion USD /45,8%	17,5 billion USD /40,0%	+16	SalesForce/Savvis
PaaS	2,1 billion USD /7,4%	8,0 billion USD /18,3%	+94	Microsoft, Google Apss
IaaS	3,1 billion USD /10,9%	6,5 billion USD /14,8%	+45	QuestNet, Amazon WebServices
VPC	3,6 billion USD /12,7%	6,5 billion USD /14,8%	+34	IBM, Terremark/Verizon Rockspace
EPC	6,6 billion USD /23,2%	5,3 billion USD /12,1%	-12	

Source: Own analysis on the basis of William Blair&Co, Bain Analysid Forrester, IDC, Gartner, 2012 [12]

It ensues from the tabular compilation (Table 3) that the largest component of the total value of the cloud computing services market constitutes the sector of services connected with making software available by providers to end users. The value of this market sector amounted 13 billion USD and it is predicted that at the end of 2013 it will reach 17,5 billion USD, which constitutes the market value growth by 16% within 3 years. The most dynamically developing sector of cloud computing services is the market of access services to programistic platforms and operating systems. in the year 2011 the value of PaaS market was 2,1 billion USD. It is estimated that at the end of 2013 it will amount 8,0 billion USD, which constitutes 94% of this sector growth in the years 2011-2013. The value growth of the cloud computing services market can be also observed in IaaS and VPC sectors, respectively 45% and 34%.

Analyzing the structure of the global market of cloud computing services with relation to the increase of its elements value, we should turn our attention to the EPC sector (Enterprise Private Cloud) - private clouds of large global corporations. In the year 2011 this market's value amounted 6,6 billion USD. In turn, the value decrease is predicted to 5,3 billion USD in 2013, which constitutes the average decrease by 12% according to CAGR, in the period of the three analyzed years. This results first of all from the unit cost reduction by corporations and migration of their informatics resources to hired VPC clouds or public SaaS, PAAS or IaaS clouds. According to Microsoft (The Economics of the cloud For the EU public sector. Microsoft November 2010, p. 14) the cost of private corporate cloud for 1000 of model computers is 40 times higher than the cost of hiring these computers in the public clouds [9]. It must be emphasized here that the migration is also one of the reasons of the remaining sectors of cloud computing growth.

The value growth of the cloud computing services market and migration of enterprise informatics resources to the "cloud" can be also observed in Poland (the country of the authors of the present paper). The value of the Polish IT outsourcing market in the year 2010 was over 520 million USD - in this over 36 million USD (7% of the market value) - constituted the sales of cloud computing services. It is estimated that in the years 2011-2015 the average annual growth of sales on the cloud computing services market will reach 25%. In contrast to this and also to show how dynamic the growth of the cloud computing services market is, it should be indicated that in case of the traditional IT solutions the value growth of the Polish market of these services in the years 2011-2015 will be four times smaller - and it will amount 5%. The biggest Polish providers of IT services in the cloud computing model according to *Computerworld Report TOP200 – 2012* include *home.pl –* 21,4 million USD of income and *Comarch –* 16, 2 million USD of income [8].

# 5. Conclusion

To sum up, the new model of IT cloud computing services changes the philosophy of the organization and its physical borders, as well as the structure of the global market of IT services.

According to the aggregated in the present paper attributes of the cloud computing model, contemporary organizations reduce their financial and operational burden connected with the use of IT environment. At the same time they can concentrate on their basic activity resulting from realizing their missions and goals, developing the company and build its position on the competitive market.

The demand for services in the cloud also changes the structure of the cloud computing market. On the global market of cloud computing services we can observe a dynamic value growth of its sectors, such as: SaaS, IaaS, VPC, and in particular the PaaS sector (in the years 2011-2013 growth by 94%). At the same time in this relation it should be indicated that there has been a decrease in the interest in private corporate clouds, which is connected with the increased trust in security of hired services, as well as decrease of costs connected with IT resources migration to public clouds or hired private clouds.

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