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Private Cloud Computing and Delegation of Control

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Abstract

Cloud Computing has changed the way we are thinking about computer security and the way how corporations organize their internal processes. With more and more Cloud service providers on the market, corporations can outsource IT department and rent the IT services, on that way corporations can cut their operational costs and be more competitive on the market. Before organization take any steps they need to think which way is best to protect sensitive corporate data and how to keep rented services on desired level.

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Keywords: cloud computing; delegate; control; responsibility; security

1. Introduction

The possible migration of information systems, their development, maintenance and operations to locations no longer physically collocated, lead to the shift of paradigmatic approaches to business and information area. Due to paradigm of objective approach to the information systems' development, abovementioned possibilities result in paradigm of Cloud Computing. The basic advantage of Cloud Computing is providing organisations and individuals with a solid environment for planning the needed resources, cutting the business costs and applying the safety standards on the highest level. Finally, the possible implementation of latest hardware technologies and broadband Internet provide a million users with a solid ground for making a business and developing own products.

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Information services have always tried to retain a complete control of information and/or computer system within a belonging business system. Recently, the principle of such control has taken another shape out of several reasons. Probably the most important reason is disappearance of client/server architecture or its evolution to three-layer and (multi-layer) architecture of information system. The actual shape of Cloud Computing (CC) leads to distributed computing and consequently to distributed control. There are two main reasons why IT managers don't want to easily let go of control over the infrastructure: decrease of risk and differentiation of responsibility and forms. Among knowledge management theories prevail theories of pessimistic and optimistic decision making. Subsequently it seems logical that IT managers try to maintain control over their own infrastructure. The lack of control may lead to the worst possible scenarios and enormous damage to business system and its reputation on the market. Some of the possible issues refer to: safety systems' attacks, the violation of law regulations or performance issues.

Market place offers different deployment model of Cloud Computing. Corporations should recognize trend of outsourcing IT services to Cloud. Research shows if and how companies use Cloud Computing services, do they make it part of their business process, which deployment model (public, private, hybrid) is preferred, and on which level company is making decision about strategy and outsourcing IT services in Cloud Computing. Questionnaire also research how employees perceive data security (safety) and compatibility between applications in Cloud Computing.

Propulsion of informatics, from the aspect of recent achievements, and through technical and technological lenses, is in a certain matter considerably afore achievements and aspirations in other sciences. The fact is, management as a scientific discipline, theoretically and practically should be afore such aspirations. To be more specific, safety of information system is a prerequisite for a safe and quality managerial system. In such conditions, several factors are of crucial importance:

- If the information system migrates to Cloud Computing frames, are all workers aware of advantages/disadvantages of such organisation?
- Has organisation developed all required prerequisites for such a migration?
- Have the feasibility study of such organisation and the possible Return-on-Investment been prepared?
- Which form of migration has been anticipated and is it sufficient?
- How does a business system that migrates to cloud reorganise responsibilities and hierarchy?
- How qualitative is a legal support to such organisation?

Paper tried to offer a review of organisations applying Cloud Computing structure with a reflection to business function. It also tried, through a compilation, to demonstrate forms of Return-on-Investment and explain a feasibility of Cloud Computing organisation. However, the main research hypotheses concerned with the analysis of awareness upon all advantages and disadvantages of such organisation. Hypotheses and research were analysed in Chapter 6.

2. Cloud computing and the basic issues: how and what; chaos vs. control

From era of huge mainframe super computers in the last Century's 1960-ies and 1970-ies, hardware and software computer platforms have gone through many changes. During the 1980-ies personal computers become a technology which dominance endures till present days. Recently trend of Cloud Computing is given an important place in business world with a tendency of strengthening its position. Experts' anticipations imply that in the future a majority of global demands for computer resources will be realised within a Cloud. Various technological platforms in Cloud around the globe can perform a whole range of complex tasks defined by final users. Access to Cloud platforms has been simplified through the usage of mobile technologies. [1]

According to evaluation made by networkworld.com portal in 2013 the Cloud industry was evaluated to 47.4 billion US dollars while predictions to 2017 increase the sum to 107 billion US dollars. [2]

Paper [10] offers a review of recent trends in the area of cloud services' transfer with a retrospect to a concrete form of transfer to Cloud Computing, without discussing the certain assumptions. Though it is advisable to have generic samples as a basis for planning modifications, such as transfer to Cloud Computing, it is necessary to provide all other assumptions within concrete situations as well. Paper [11] argues a problem of so called data takeover situation, with a possibility of paralysing the current version of information system and even a worse possibility of

paralysing the business system developed on such information system. Based on these assumptions, the research has been conducted and analysed within chapter 6.

2.1. Definition of Cloud Computing

The modern literature provides several definitions of Cloud Computing. Some definitions of Cloud Computing refer to services provided by data centre, while others define it as a service provided by the Internet. Still, the most quoted definition of Cloud Computing states: Cloud Computing (abbreviated Cloud) represents a wide cluster of computers operating as servers, of the increased performances, located on one spot or geo-redundantly dislocated to several data centres with a broad width optical Internet approach (more than 1Gbps). Such conceptual design enables a large number of users to simultaneously approach resources and undisturbed operations. The stipulation definitions of Cloud Computing emphasize intention, so Cloud Computing is being divided into the private, public and hybrid form. The rest of paper will mainly stick to the private Cloud Computing. [3]

Cloud Computing has considerably shaped defined standpoints on responsibility and control in computer business. Responsibility and control are firmly coupled since making and enforcing decisions demands responsibility. Within Cloud Computing frames there is a specific circumstance that detains control while responsibility is being transferred to the service provider. Responsibility of the provider refers to availability of infrastructure coupled with automated management and the possibility of adjusting environment to the users' requirements. It is necessary that users and Cloud Computing providers clearly define a Service Level Agreement. [4]

Differentiation itself implies a set of measures and organisation actions directed to the achievement of a certain level of recognizable custom products and services as opposed to the competitive products and services. In this sense, there is no need for an independent infrastructure since business systems cannot simply use IaaS (Infrastructure as a Service) and choose a preferred number of processors, working memory, disks and operation systems through which they can choose preferred computer architecture. In case of deficiency or a specific need, users can always require additional PaaS services (Platform as a Service) and chose a narrow specialised operation system such as IMB's AIX UNIX or HP-UX. In case of applications used within an organisation such as Enterprise Resource Planning (ERP) and similar, users can always apply existing solution such as SaaS (Software as a Service) or modify application modules to the current needs. Even if the existing software solutions aren't satisfying, users can combine IaaSs and PaaSs to develop a required solution. In the process a responsibility is being transferred to the service provider while operative costs within same organisation are being reduced. [1]

Technologies such as virtualisation, high availability, wire speed transfer and various safety standards are much easily reachable within a Cloud and similar solutions than developing projects on a local server or transferring data to some external enterprise (outsourcing). Backup, disaster recovery, synchronisation, web based applications and even (physical) servers which just recently had to be located in system room within an office can now be migrated to the virtual environment thus making them a Cloud.[5]

Limits of liability between the user and the cloud provider of cloud services are different for different models of service delivery. In the case of SaaS User is partially responsible for interface; User responsibility increases in the case of PaaS and includes interface and applications. In the case of IaaS Customer is responsible for all events at a virtual machine running the application. [15]

2.2. Cloud (maybe) yes; but what kind?

Mike Schutz, General Manager, Cloud Platform Marketing, Microsoft said "What comes across to me loud and clear from this survey is that even more businesses are no longer thinking 'why cloud?' but will focus the next 12-24 months figuring out 'how I do execute a long-term cloud strategy?'"[12]

Cloud computing as such doesn't necessary refer to the usage of ready third party's solutions, but it may even refer to the migration of private hardware infrastructure that until yesterday was located in the office's system room to modern data centre. Private Cloud encompasses exactly this aspect and reasons why choosing such a form of business solution. The most common reasons for developing private Cloud include:

1) Cost efficiency – to a small user ready Cloud solution represents a favourable choice. The initial investment in

hardware can be substantial. The costs of open source solutions of software implementation are usually negligible. The later investments in private Cloud imply private Cloud being far cheaper than ready virtual or quasi-virtual solutions.
2) Data safety – is the main benefit of a private Cloud. In case of individualised solutions Cloud is being administered by a specific number of persons, that is, just certain people have approach to resources.
3) Better control - control of third parties' Cloud solutions' resources is almost impossible. With private Cloud Computing solutions, users take care of resources' allocation, administration of network and physical virtualizers by choosing software and installing the same virtual machines and services.
4) Flexibility – is the lack of ready Cloud solutions. Private Clouds can be adjusted to temporary purpose or to company's needs and projects whether within hardware or software platform.
5) Speed of data storage and synchronization – if final users don't administer their private Cloud solutions, the appearance of bottlenecks is quite probable, manifested in network or hardware performances. Administration of network and other infrastructure on private Cloud is responsibility of company's system administrators. In such circumstances, users choose network equipment aligned with present and participated needs with a safety redundancy of links and optimized hardware and software components.
6) Integration in company's environment – in development phase of a private Cloud system, integration in the existing LDAP/Active directory domain is simple and it follows a natural flow of the complete solution's integration. Administration and control of user's approach is possible by the existing centralized authentication's system.
7) Unlimited storage system – in case of insufficient space, it is possible to enlarge existing disks, upgrade the existing or procuring new storage systems.
8) Backup control – backup solutions in private Cloud enable modifications according to the personal needs which are impossible with ready solutions.
9) Users' administering - private Cloud solutions enable easier administering and approach to a larger number of users.
10) Compliance – with different information standards and certificates provides a greater safety and a better chance for market placements. Safety standards, such as PCI/DSS compliance, ISO 27000, 9000 and alike provide Cloud platform with a level of value and quality better recognized by potential clients and investors. [6]

2.3. Possible costs of Private Cloud

1. Usability: the average usability of data centre is app 10% (max 25%) implying that in best case scenario 75% equipment stays unused. Organisations specialized in Cloud Computing don't record these problems since providers are always maximally used and there is no additional costs for clients nor service providers.
2. Redundancy: When organisation uses a public Cloud, responsibility for infrastructure and service availability is transferred to the service provider. Besides the issue of redundancy, each acquisition implies a certain period of time required for acquiring a new piece of equipment when responsibility lies on service provider so the user isn't obliged to take care of new equipments' acquisition. The only issue remaining is the service availability and user's satisfaction.
3. Data centre's efficiency: Uptime institute records the majority of data centres operating with the efficiency of electric power of 2.0 implying that only one Watt reaching a provider is being efficiently spent.
4. Personnel: Data centres' operations require a constant maintenance which is a task of informaticians. If organization has a heterogeneous working environment, then it requires specific technologies and information technologies. A requirement of services' availability of 7/24/365 increases the costs in compliance with the number of employees. [7]
Of course these are just more important costs. The list of costs is extensive and very specific for each case of Private Cloud.

3. How to measure ROI in Cloud investments

When developing and constructing a private Cloud the question of investments' cost-effectiveness arises. The following sub-section elaborates metric data necessary for the calculation of Return on investment value.

1) Speed of changes – reduction and acceptance of the adjustment costs is much faster in Cloud. Cloud Computing creates additional conveniences in transforming costs due to the reduced time space in decision making mainly caused by the quick acceptance of ready services and faster degree of transition to the novel possibilities.
2) Total costs of the ownership's optimization – users can adjust Cloud according to the present needs. Traditionally this option wasn't available, mostly due to extracting the projects out of its production environment. These two components are today coupled within a Cloud. (Figure 1)

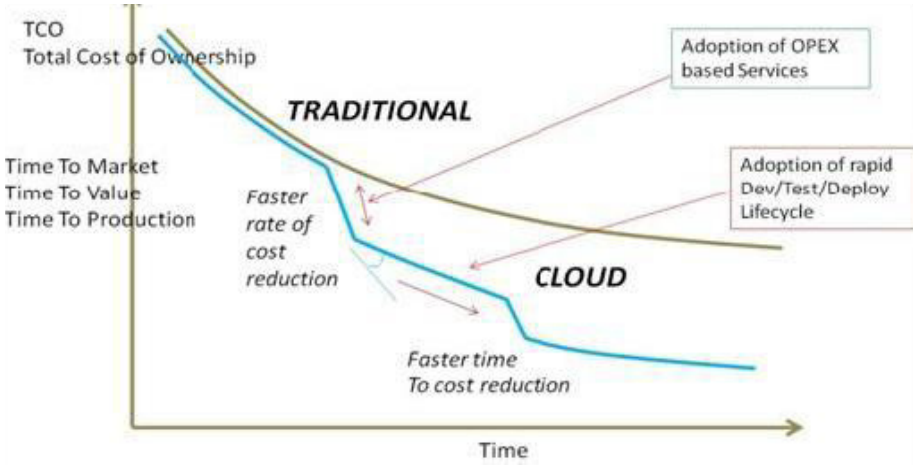

Fig. 1. Speed of costs' reduction [8].

3) Fast procurement – resource scaling is being made daily due to monitoring the company's business activities.
4) Increased margin and costs' control – Possibilities of increased gain and costs' control enable companies to pursue new clients and markets thus increasing a chance of business' enlargement and improved quality of service. (Picture 2)
5) Dynamic usage of resources – flexible procurement and services' usage are directed towards defined final users and business goals.
6) Improvement of compliance and risk - risk control and compliance with different IT standards can be empowered through shared services or certification and standardization of products.

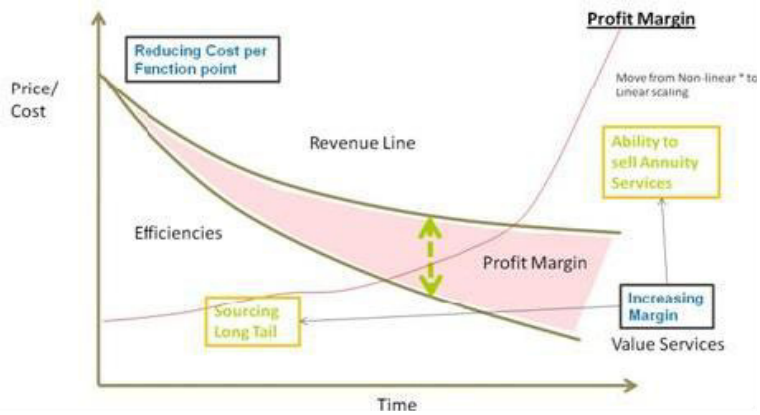

Fig. 2. Increase of margin and costs' control [8].

7) Improved usage of capacities - IT avoids excessive procurement of resources (whether overdrawn or insufficient)

thus improving the usability of business ideas and services.
8) Access to business skills and improved capabilities - Cloud Computing enables access to new skills and solutions through Cloud sourcing or a constant modification and improvement of a private Cloud.

4. Price ratio between private Cloud and ready solutions

Present Cloud solutions can be categorized into three basic modes: ready software (virtual) solutions rather simple to configuration, users limited to the creation of virtual machine and resources given by service provider, ready hardware (quasi-virtual) solutions more demanding in terms of configuration since they depend on service providers' technicians' interventions when the final user rents ready hardware with precisely defined specifications and private in-house solutions thus making it the most demanding choice due to the construction and collocation of the physical equipment.

Table 1. Final solutions.

Amazon ec2	Rack Space	IBM softlayer
R3.8 LARGE	120G PERFORMANCE	Xeon 4650
Vcpu 32	Vcpu 32	quad core
244 GB RAM	120	32
SSD 2X320	40 GB + 1,2 TB	8 TB
27.560,48	49.561,60	51.480,00

To enable a comparison of prices, an example of Amazon AWS (Amazon Web Services) was used in combination with Rack Space Cloud as momentarily the most applied virtualization platforms. Ready hardware solutions will be compared through IBM's platform Soft layer.

Table 2. Private cloud.

No	Sort	Description	Annual price
1	Physical collocation	FRANKFURT, DE good geo position, excellent Internet (dark fiber optic) connectivity. Price includes annual rent of closet, double electrical charge of 10 A, costs of electricity and interconnections.	13.320,00
2	Internet link	10 GB, 254 IP, 2 ISP service providers due to redundancy, RIPE allocates private AS and 254 public IPV4 addresses for advertising private AS over BGP multihoming	832,60
3	Firewall	2 x Cisco ASA 5555x, traffic filtration, IPS/IDS functionality, and IPSEC VPN configuration	5550,80
4	Switch	2 x Cisco catalyst 3750 48 ports, possibility of clustering, 10 GB optic modules for connecting ISP links.	2.220,00
5	BGP Router	2 x Cisco 2901 for BGP network advertising through 10 GB optic modules	400,00
6	Server	HP Proliant G8 DL 380 (Xeon E series, 256 GB RAM, 4 TB+1 TB SSD)	3.608,00
		Totally	25.931,40

Private Cloud will be analysed through new generation's servers, of the same or similar performances at the third party solutions combined with the additional costs of developing a private Cloud such as: collocation, Internet costs, network equipment's costs and alike. Production requirements (conditions of work) in Cloud are of production nature, with a high workload on components and traffic. [8]

Table 1 displays third party's solutions. Main disadvantage of the above mentioned solutions is an expensive upgrade of present options, lack of redundant ISP link, the improbable quality administering of network etc. The speed of link in suggested options of Amazon and Rack Space is 1 GB. Soft layer offers 10 GB of unlimited bandwidth, eight public IP addresses and the possibility of installing software firewall into the solution.

Table 2 displays development costs of a private Cloud solution. Prices are set on annual level, derived from the official pricelists of closet collocation's providers, while prices of equipment are taken out of the official producers' pricelists. Amortisation period of information equipment was set to five years.

Main features of private Cloud solution in this example are modularity, redundancy and high availability, combined with the amortisation capability of the components included in the installation.

5. Problems occurring in private Cloud

Cloud Computing transfers capital costs into the operative costs since instead of costly investments made in computer hardware and software, system itself pays services recorded as operative cost. If business system prefers a private Cloud, then it is necessary to invest substantial assets in the construction of needed infrastructure. Cloud Computing offers flexibility in terms of resources themselves. With the private Cloud this can be the case as long as the company has available computer resources that can be provided to users on request, while public Cloud makes an advantage due to greater resources secured through company's own line of business.

5.1. Legal regulation of services

Service Level Agreement (SLA) is an official document containing defined quantitative and qualitative data on service which buyer/user chooses to use. Metrics in this formal document should encompass data on service definition so that independent body could use it and perform required measurement in case of conflict and complaint of any included party. [4]

Besides qualitative and quantitative measures, this document also embeds a detailed list of responsibilities which service provider accepts and description of possible modifications of document during the time. Using services of Cloud Computing begins with an insight into the business goals. Consequently the company makes decisions on Cloud Computing usage and creates a list of services needed to be rented. After the list of business goals has been arranged, it is necessary to clearly and precisely define responsibilities. For instance, document can state that service provider is obliged to ensure a constant connectivity to rented providers while the issue of licences remains in domain of clients implying their legal responsibility in case of violating the copyrights. In present time companies make business continuously worldwide imposing a need for availability of all business services regardless to tome zone and geo-location. When agreeing on Cloud Computing service, included parties should define when and how will the service provider accept development of safety copy and how he will protect it in case there is no clearly defined safety policy. The care of data is crucial since data are grounds that enable companies to make decisions and plans according to which it will conduct its whole business. From the standpoint of information safety it is necessary to organise a complete monitoring of the location intended for data storage implying that service provider should, according to the user's request, enable entrance to the official sites of data centre thus enabling clients to make on-the-spot decisions upon location's compliance. Checking is performed by informaticians working for clients or the independent auditors.

After the physical safety control, another control is being made in terms of service provider's abiding to the legal regulations when handling data classified as business secret or personal data. Agreement should, aside availability of service, also define whether service provider has a right to process corporate data. If this right is allocated to the service provider, then agreement should define a volume of processing combined with the clauses that define information procedure in case of data transfer (e.g. service provider can rent disk space of another service provider) implying that during transfer legal property hasn't been compromised. Data should be ensured constantly implying agreements should encompass measures for securing data and time in which data should be available in systems after agreement has been terminated thus giving a company enough time to consider further steps.

One of the challenge is also compatibility factor during data and process migration and integration in cloud. Data exchangeability, process integrability and vendor interoperability [14] will need special attention in Service Level Agreement between customer and provider.

Besides agreeing on services and defining rights and responsibilities, all undersigned parties should define auditing checks as well.

5.2. Open issues in data protection

Cloud Computing is globalised since within Cloud itself there are no limits. Computers used for data processing, data storage and ICT network infrastructure itself can be located anywhere around the globe. Legal regulations set

standards for using the individuals' private data. Legal regulations are based on transparent knowledge of individual's data location, their processing and responsible persons authorised to their analysis. Cloud Computing is opposed to the classic legal regulations since users' data can be saved anywhere around the globe with the service provider operating in the USA while data originate from Asia or a service provider being a client of even greater service provider. The EU regulations state three basic concepts referring to the protection of personal data these being: conditions under which data can be transferred to the third parties for processing, conditions under which data can be transmitted outside the EU territory and data safety. [9]

Security risks can be considered from the perspective of customer, service providers and government. Customer may confront with cloud computing environment downtime, leak of business secrets and concerns about service providers reliance. Service providers confronts with assuring long term operative tasks while eliminating security risk at minimum, satisfying customers various demands, and block malicious activity. Government should enhance data centres security protection legislative regulation, manage and rank various service providers due to security level. [13]

Security and trust are important factors perceived as: data security, truthfulness of the cloud service provider, contractual agreements and geographical location. [14]

As it was already mentioned in text, management should anticipate business needs and services offered by service providers. If the right provider is located, he should be tested for the highest level service (audit of equipment, safety software and procedures); time frame for transferring a part of infrastructure should be defined together with data remaining within organisation itself instead of data being transferred to the service provider's data centre. Legal subjects which prepare agreement for clients should provide such terms protecting clients from service provider's arbitrariness by clearly stating rights and obligations and the procedure for solving the issue of damage compensation if some of the agreed services become unavailable or a loss of business data occurs.

6. Research

Transfer from the traditional forms of structure, and especially architecture of information systems, moves the centre of responsibility towards the legal profession. It is not questionable whether data, software and hardware will be outsourced, the problem occurs with detailed and efficient contract of all services derivable from such relations. By reducing information services to services of communal character, problem of service itself should be analysed from several different aspects. To a user, information system is a unit symbiotically connected to a business system. From this aspect, every uncertainty represents a possible threat to a business function.

It should be mentioned research has been conducted within the Republic of Croatia, during the conditions of a deep recession, so it is not possible to expect completely relevant data. Nevertheless, research has been directed towards examination of following hypotheses:

- H1- analysed environments recognize CC possibilities and modalities of their realisation
- H2 –if there are possibilities for CC transfer, then there must be strong tendencies
- H3- management, regardless of hierarchy, reliably knows the CC advantages so it leverages its decisions accordingly
- H4 – individuals, regardless to the management's attitudes, strive to create their personal CC frames

Though hypotheses are connected to the information-educated cadre (the questionnaire is purposely directed towards that population), described circumstances of a recession and lack of active business can lead to mistakes in the assumptions.

In the continuance, paper offers a description of questionnaire, analysis of collected data and conclusions in line with defined hypotheses. This paper was prepared according to data gathered within a research analysis conducted through questionnaires distributed to users by email. Tough questions were primarily distributed to information scientists – due to the subject of the paper – the exclusiveness wasn't a criterion. The reason is, according to the author's acknowledgment, the fact that user himself decides whether or not to transform his information system to a cloud. Questionnaire included 21 questions, divided into 4 category: personal knowledge and experience in IT

industry, personal usage of Cloud environments including subjective view of data security in Cloud, does company use Cloud Computing and in which way, and who, in behalf of company, decides about IT strategy.

6.1. Analysis of survey data

The final results were a certain surprise since 51% respondents didn't finish the questionnaire. Hereafter follows a descriptive analysis of the collected data:

Totally 124 persons participated in the questionnaire. Social structure and gender weren't a prerequisite since the authors considered them irrelevant. Among the participating organisations, the most represented were the ones with more than 100 employees (47.62%). When questioned about the number of IT workers in organisation, 76% respondents weren't sure about the right answer, while the other 34% enumerated 5-10 workers in 52% organisations. This fact only implies that trend of outsourcing the IT department still urges certain confusion when specific information is required. 76% respondents involved in IT department have experience shorter than two years, while 52.38% respondents try to keep informed by following the recent accomplishments within this field. The same percentage of respondents considers having an outstanding education within ICT sector. The knowledge of Cloud Computing 42% is noticeable by 11% respondents claiming to have an initial level of knowledge, while 47.37% respondents claim to actively use clouds. This confirms the hypothesis H1. 57.08% respondents believe management is making decisions upon Cloud Computing. Although it is more than 50%, declaration is questionable, however, the hypothesis H3 can be considered highly probable. 57.89% respondents claims their organisations don't use Cloud Computing (hypothesis H2 is not confirmed) while 68.42% respondents believe of using it in personal matters (confirming hypothesis H4). When considering data safety in Cloud Computing the opinions are divided tough the majority, 36.84% consider data to be safe.

When making a decision upon the sort of a cloud, respondents choose equally between the public and private cloud. When deciding upon IaaS they are uniformly divided between public, hybrid and private cloud. The majority or 42.86% prefers a private cloud for PaaS. The unusual fact is that 2/3 respondents prefer private cloud in the case of SaaS.

From the aspect of safety, each third respondent considers data to be safe in a public cloud. 84.62% respondents believe that applications are more compatible when they are in a private cloud. 26.67% (out of 49% respondents) would have insisted on backup of service providers tough 84.68% would also develop a local backup. The unusual fact is that 38.46% respondents don't keep a record of agreeing SLAs with the service providers.

Finally, it can be concluded that there is still certain confusion in perceiving all possibilities and advantages within Cloud Computing frames. The procedure and a need for delegating responsibilities within Cloud Computing is equally important matter which solution demands a serious and thorough approach.

Conclusion

Delegating responsibility is important in organisation's business activities. The process itself should include following phases: analysis of the present situation, defining new set of rules, adjustments to legal frames and choice of service provider to whom certain segment of business will be transferred. Service provider should pass through strict evaluation and should participate in delegation of responsibilities confirmed by agreement itself. Agreement shouldn't harm client nor service provider. Once it is signed, the complete organisation should implement business process reengineering. Final result should reflect increased efficiency of business system and decreased business operative costs.

Cloud Computing offers an excellent frame for solving one of the burning issues of the IT industry: planning the resources' exploitation. Dream of each start-up company is to develop a custom product and to become popular over night hoping that bunch of clients will recognise and start using their products. Cloud Computing enables companies to automatically use available resources thus helping them to process larger number of clients. During the intervals when the increased Internet connectivity isn't expected, company reduces its operative costs to minimum using only those resources in Cloud momentarily needed. Disadvantage of this type of technology is that initial is rather high, which in start cannot justify cost-effectiveness of such investment. As with the abovementioned example, quality of present information components, being hardware or software, ensures their exploitation and amortisation in much

longer period, thus making such an investment long-term and better compared to the short-term solutions provided by third parties.

References

[1] Jamsa, K., Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning, 2012, ISBN-10: 1449647391, ISBN-13: 978-1449647391.
[2] Skilton, M., Building Return on Investment from Cloud Computing, Capgemini, April 2010, (http://www.opengroup.org/cloud/whitepapers/ccroi/index.htm , viewed November 2014, 04.11.2014.)
[3] Bahga, A., Madisetti, V., Cloud Computing: A Hands-On Approach, 2013, CreateSpace Independent Publishing Platform, ISBN-10: 1494435144, ISBN-13: 978-1494435141.
[4] Wieder, Ph., Joe M. Butler, J.M., Theilmann, W., Yahyapour, R., Service Level Agreements for Cloud Computing, Springer, 2011, ISBN-10: 1461416132, ISBN-13: 978-1461416135.
[5] Pogarcic, I. Krnjak, D., Ozanic, D., Business Benefits from the Virtualization of an ICT Infrastructure. // International Journal of Engineering Business Management. 4 (2012) , 25; 1-8, ISSN 1847-9790, DOI 10.5772/3.
[6] Wallen, J., 10 reasons you should build your own cloud, (http://www.techrepublic.com/blog/10-things/10-reasons-you-should-build-your-own-cloud/3637/?s_cid=e101&tag=nl.e101&ttag=e101, viewed November 2014 , 04.11.2014.).
[7] Vogels, W., The hidden costs of a private cloud,(http://www.computerweekly.com/opinion/The-hidden-costs-of-a-private-cloud, viewed November 2014, 04.11.2014.).
[8] OpenGroup, Building Return on Investment from Cloud Computing, (http://www.opengroup.org /cloud/whitepapers/ccroi/roi.htm, viewed November 2014, 4.11.2014.).
[9] ***, Digital Agenda for Europe, European Cloud Computing Strategy, A Europe 2020 Initiative, Europian Commission, http://ec.europa.eu/digital-agenda/en/european-cloud-computing-strategy, November 2014, 04.11.2014.
[10] Kostoska, M., Gusev,M., Ristov, S.: A New Cloud Services Portability Platform, 24th DAAAM International Symposium on Intelligent Manufacturing and Automation, 2013, Procedia Engineering, Elsevier, 2014.
[11] Pogarcic, I., Pap, K., Ziljak-Vujić, J.: Some Aspects of Information System Integration/Migration // Annals of DAAAM for 2006 & Proceedings of the 17th International DAAAM Symposium / Katalinic Branko (ed.).Vienna : DAAAM International Vienna, 2006. 307-308.
[12] Skok, M.J., The Future of Cloud Computing, 4th Annual Survey 2014, North Bridge & Gigaom Research, (http://www.slideshare.net/mjskok/2014-future-of-cloud-computing-4th-annual-survey-results, viewed September 2014, 15.09.2014)
[13] Che, J., Duan,Y., Zhang, T., Fan, J.: Study on the security models and strategies of cloud computing// 2011 International Conference on Power Electronics and Engineering Application // Procedia Engineering 23 (2011) 586 – 593
[14] Stieninger, M., Nedbal, D., Wetzlinger, W., Wagner, G., Erskine, M.A.: Impacts on the organizational adoption of cloud computing: A reconceptualization of influencing factors// CENTERIS 2014 - Conference on ENTERprise Information Systems// Procedia Technology 16 (2014) 85–93
[15] Marinescu, C.D.: Cloud Computing: Theory and Practice, Morgan Kauffman(an imprint of Elsevier), 2013, ISBN: 978-0-12404-627-6, 92-94