



## RAČUNARSTVO U OBLAKU I OBEZBEĐENJE KVALITETA U MALIM I SREDNJIM PREDUZEĆIMA

### CLOUD COMPUTING AND DATA AND PROCESSES QUALITY ASSURANCE IN SMALL AND MEDIUM SIZED ENTERPRISES

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**Rezime:** Računarstvo u oblaku je postalo paradigma distribuiranog računarstva baziranog pre svega na Internetu. Pošto su resursi virtuelizovani, korisnici usluga dobijaju utisak neograničenih mogućnosti zanemarujući sve složenosti primene velikih distribuiranih računarskih sistema. Korišćenje nesumnjivih prednosti računarstva u oblaku dovodi do mnogih dodatnih izazova ali istovremeno i režijskih troškova. U radu će, pored prednosti računarstva u oblaku, posebno biti istaknuti problemi pouzdanosti, tolerancije na greške, održivost i razmeštanje infrastrukture i obezbeđenje kvaliteta usluga. Na kraju rada biće predložena i metodologija za uvođenje računanja u oblaku za mala i srednja preduzeća.

**Abstract:** Cloud computing has become a paradigm of distributed computing based primarily on the Internet. Since resources are virtualized, service users get the impression of limitless possibilities ignoring all the complexity of distributed computing systems application. Use of the benefits of cloud computing leads toward many additional challenges, and at the same time, overhead costs. In the paper, in addition to the benefits of cloud computing, the problems of reliability will be highlighted in particular, as well as fault tolerance, sustainability, and deployment of infrastructure, and the service quality assurance. A methodology for introduction of cloud computing in small and medium sized enterprises will be proposed at the end of the work.

**Keywords:** cloud computing, quality assurance, SME, reliability.

## INTRODUCTION

### Cloud computing

The rapid development of telecommunications, Internet, hardware and software, which is evident in recent years, has enabled a new era in the application of computers, the era that will fundamentally change the way of thinking in the field of doing business, enabled the emergence of proliferation of computing in the cloud.

Different experts define “cloud computing” on different ways. For example, (Geelan, 2009) Reuven Cohen define it as “internet centric software”, or Jeff Kaplan: “Cloud computing is a broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities

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on a 'pay-as-you-go' basis that previously required tremendous hardware/software investments and professional skills to acquire. Cloud computing is the realization of the earlier ideals of utility computing without the technical complexities or complicated deployment worries." In cited article twenty one expert gave twenty one definition of cloud computing. Some analysts and vendors define cloud computing narrowly as an updated version of utility computing: basically virtual servers available over the Internet. Others go very broad, arguing anything you consume outside the firewall is "in the cloud," including conventional outsourcing. (Cnorr & Gruman, 2010) That shows that there is still no single definition of "cloud computing". For us, the term "cloud computing" means: all software and hardware resources outside the user's place, especially on Internet, although that could be also private networks or some other networks.

What one can expect from cloud computing? First of all, these are up-to-date network based software and large storage capacities. This is the basic idea of cloud computing: "compaction" of IT resources in a particular area, some kind of "warehouse", so they could then be leased to interested users, companies or individuals. A rough analogy to cloud computing could be rent-a-car company that invests in the purchase of lot of cars to be rented to those who have expressed a need for them, or, for example, a library as a kind of meeting place of knowledge that are then rented to those who are interested in reading a work that is in disposal.

Under the NIST definition of cloud computing (Mell & Grance, 2011) the cloud model is composed of:

- Five essential characteristics:
  - On-demand self-service;
  - Broad network access;
  - Resource pooling;
  - Rapid elasticity; and
  - Measured service.
- Three service models:
  - Software as a Service (SaaS);
  - Platform as a Service (PaaS); and
  - Infrastructure as a Service.
- Deployment Models:
  - Private cloud;
  - Community cloud;
  - Public cloud; and
  - Hybrid cloud.

More detailed information about named characteristics, service and deployment models could be found in the literature, for example Mell & Grance (2011).

Depending on their needs, small and medium sized enterprises (SMEs) could be interested in all of three service models, but the most interesting deployment model for SMEs is public cloud. The reason lies in limited funds.

## **Quality assurance**

The definition of quality assurance has been re-framed and re-worded by different quality experts from time to time. It also varies from industry to industry. American Society for Quality (ASQ) defines assurance of quality as "the planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled". (TQAS, 2012) Although the terms quality assurance and quality control are often used interchangeably, there are significant differences between them. While activities of quality control are done during the manufacturing process, quality assurance deals with preventive actions required in the processes, and it consists of a set of preventive activities. These activities are focused on processes in order to meet the customer requirements. They consist of procedures and activities developed and done before the product is manufactured or service was done. For the quality assurance could be said that present a proactive approach.

Use of standards and procedures is very usefully for quality assurance. Many researchers, providers and users of cloud computing consider cloud computing as a new phenomenon that needs new standards, but the truth is that the most of released standards are applicable to the world of Service-Oriented Architecture (SOA) in cloud computing. Cloud computing is simply a new platform, and the power of existing architectural standards should be transferred appropriately to the new space. So, the application of ISO 9000, ISO 20000, ISO 27000, and ISO 31000 family standards, as well as some other ISO standards, depending of the type of business activities, can take a place. Conformance to named standards can guarantee that company's products and services are delivered in standard quality.

## **CLOUD AND QUALITY ASSURANCE IN SMALL AND MEDIUM SIZED ENTERPRISES**

It is not necessary here to discuss about the importance of small and medium sized enterprises (SMEs) when it is well known that for example, in Germany, where in the year 2009, 98% of new jobs were opened in SMEs, which accounted for 50% of total exports. According to official data, SMEs in Serbia make two-thirds of work places in the economy, acquire 60% of gross national product, and make 40% of total exports. (Bojović, Zdravković-Mihajlov, & Živković, 2009) For their success quality is the goal. Today, there is no company that has no need for some kind electronic business in doing business and quality assurance. The use of IT is visible in every step of production and services, either on a production line, in marketing, administration or in a management.

### **Data**

Like the large corporations, small and medium-sized enterprises mostly rely on software and storage of their important data on their own servers. This give unlimited availability of own resources, but also it limits resources.

The reliance of small and medium-sized enterprises on the software and hardware they own, and on the classic backup of their servers may be an adverse decision in some situations, especially in the situations of sudden disasters. Then a basic backup provides protection to a small extent. Periodically recording data to a backup tape or disk may endanger SME's data and may lead toward the loss of time in unacceptable quantities. A prerequisite for a speedy recovery and return into the operational state is a comprehensive disaster recovery plan, which includes quick access to copies of the data that are constantly updated by the so-called system "up-to-the-minute copy". (Čekerevac, Anđelić, & Radović, 2011)

It is extremely important that one copy of the data, also, is stored on another location. The reasons are numerous, including the possibility of fires, floods, earthquakes, theft, etc... The cheapest alternative is when the data are stored on a secure location that is hundreds of kilometers away from the server's location. That way, one can avoid risk of all mentioned risks. However, the problem of data protection appears at the remote location. One of possibilities is to store data on servers of the Internet service provider, as it is shown on the figure 1.

### **Quality costs**

Each of the companies that want to survive and prosper in the market has to invest in quality.

As it is well known, quality costs are the total costs incurred by:

- Investment in prevention of non-compliance with the requirements.
- Evaluation of compliance with the requirements for a product or service.
- Failure in the application (costs of poor quality – internal and external). (Čekerevac, 2011)

Cloud computing can be the most effective in the range of prevention costs, although the appraisal costs and costs of poor quality could be reduced with application of cloud computing technology.

In regulated economies, SMEs and large corporations, they are subjects to the same requirements in the terms of quality and data availability, and, also, data protection. In the United

States, there are established sets of very specific rules about the availability, organization, and regulatory data protection laws, such as: HIPAA, DOD 5015, FDA Part 11, Sarbanes-Oxley, SEC Rule 17th ... [3], and very severe penalties are provided for violations. The problem of SMEs is the lack of funds to undertake necessary measures. In addition, any disruption in cash flow is often fatal for SMEs. In his article "A Small Business Approach to Computer Downtime", Adian McDermot estimated that each incident can cost a small business between \$ 200 and \$ 800 per incident, and PC. (Otey, 2010)

In Serbia, legislation of this kind is still in its infancy, but here, also, existing laws such as:

- the Law on E-Commerce,
- the Law on Protection of Personal Data ... etc.

Also, a variety of different software is available today. Some of available software is free, but the most of proved software is licensed. SMEs chronically suffer of limited funds and resources. For them, cloud computing could be a favorable solution. So, SMEs can consider "cloud" as a resource.

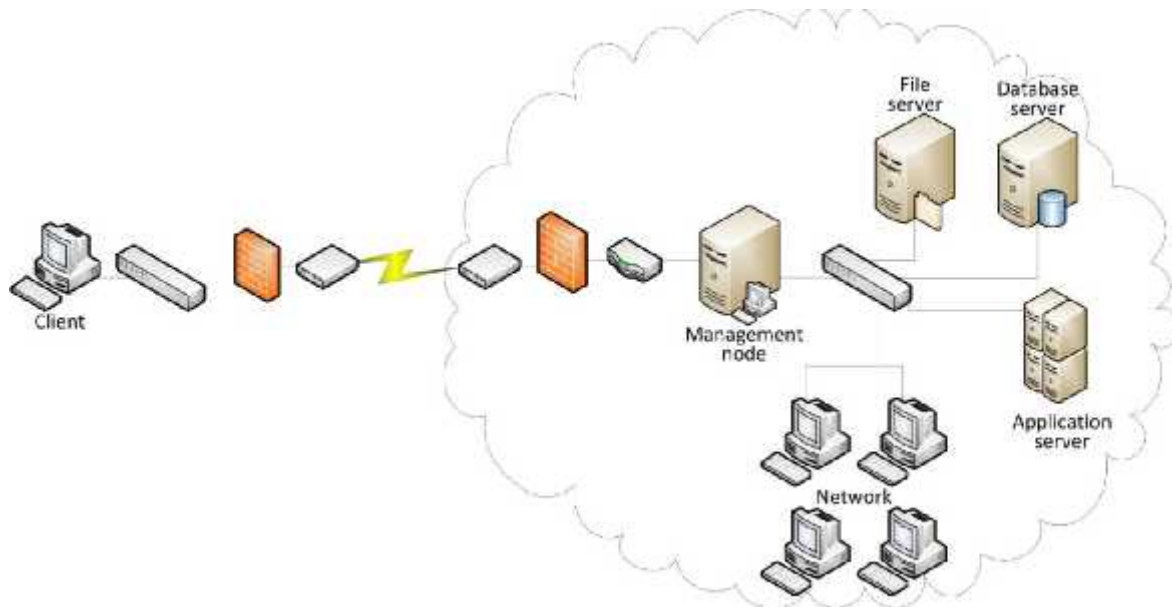


Figure 1 Client PC and the cloud computing resources

## Software

Microsoft® Windows® Small Business Server (SBS) allows, to a limited extent, to small businesses to use many functions that also large companies use:

- basic network services: DNS, DHCP, ..., SSH;
- Windows networking: files and printers sharing;
- Web server;
- FTP services;
- e-mail server, and, optional, database server;
- support for mobile devices, as well as
- backup and restore functions.

Linux Small Business Server (LSBS) offers many of the same services as Microsoft® Windows® Small Business Server, but, also, offers the Wiki as a document management system, as well as advanced networking tools - Nagios, Nessus and Nmap.

SBS and LSBS, they make available tools to create periodic backups. However, relying on the built-in basic backup, to protect all bases in an emergency or disaster, can leave work damaged due to potential gaps in protection. Tapes and disk backups can only return data to the point of the last good backup, which probably was the end of the previous day. All data entered since the last good backup

will be lost. If the most recent backup is incomplete or damaged, then the previous in order backup will be used. That will cause a loss of even more data and so on.

Cloud computing covers everything that involves the delivery of hosted services over the Internet. The point of the idea is that computing is not performed on the user's computer, but in the cloud (somewhere on the Internet). This strategy can be a cost effective solution for SMEs. It is enough that the SME has simple PC computers connected to the Internet, and to conduct its operations with the help of service provider that can be located anywhere in the world. Assuming that the SME chose good service providers, the successful operation requires only a secure the Internet connection. Computer located in the premises of the SME can be any "thin" client. The Internet or, more precisely, service providers act as a server. Today's prices are very moderate, and SMEs may find their interest to move gradually to the cloud technology.

The new tendencies in a software development are going toward cloud computing, new operating systems, and new office's applications.

### **Maintenance**

As mentioned, cloud computing activities are focused to the Internet, and a small part of the activities is performed inside the company. This way the company does not need the entire IT team to perform activities of the IT part of business. Since most of the activities perform on the provider's server, professionals and IT experts are located at the provider, not the company, the customer. So, SMEs can realize substantial savings. In addition, the service provider provides a 7x24 service that should guarantee the safe operation and continuous availability of company to its clients.

The range of services is diverse, ranging from basic services, such as renting infrastructure, up to fully advanced services, such as the entire IT service.

### **CONCERNS AND DISADVANTAGES OF CLOUD COMPUTING**

Although cloud computing brings many advantages, it also brings some concerns to SMEs. They are mostly connected with security, availability and reliability of services. According to (Mendler, 2011), "barely 10% of the 70 or more telecom operators now offering cloud services worldwide". Telecom operators know more than a start-up SMEs, but while that statement is mainly truth, there also exists the fact that their services mostly are not customized, not tailored for each firm needs.

All cloud services providers declare that their services are absolutely safe, but managers of many SMEs are in doubt, if is really true. The most advanced technologies are applied, but the question exists: "Is it enough?"

Also, there could appear a problem with availability. Cloud computing seems cheap, \$10 to \$50 per PC and month, service providers declare 99%, or 99.5% or even 100% availability, but are their services always available? To protect themselves, providers to contracts always add a clause that the availability of services is related to all, up to date, well known risks and situations. So, SMEs have to know that there are also possible risks which are not included in guaranty. The problem could be even worse if SME uses public internet for service delivery. Success of SME that use the cloud is ultimately connected with quality.

Every SME that wants to use the cloud computing as the basis for doing business has to bear in mind:

- This strategic decision must be a result of careful planning and risks weighting.
- SME must have always the plan "B", that is a realistic plan for leaving the cloud.
- During the introduction of cloud computing, SME must go step by step, from simple to more challenges applications.
- A company that decide to use cloud computing has to take measures to control its activities over the application's environment. SME must not leave everything up to the provider.
- Experience talk that consistent communication with provider is of use; close contact with the provider gives to the user higher quality of services.

Following named considerations, SME has a chance to overcome problems that could appear while using the cloud computing in its business.

## CONCLUSIONS

After detailed analysis of the business technology of SMEs, potential risks, possible concepts and technical solutions, before a leasing cloud computing services it is necessary to re-examine whether all the factors are considered and taken into account.

Particular attention should be given to answering the question: Is the cloud services reliable, available and secure, but, also, how fast, it is possible to recover the system and applications of possible disasters and make data available to users?

The possibility of eventual abandonment of the system, changes in individual services and modifying the business should always be kept in mind.

Finally, the cloud-concept will continue in its development. It is still not, but it is to expect that in the next ten years the cloud-concept will appear as a standard solution for small and medium-sized enterprises.

## WORKS CITED

1. Bojović, J., Zdravković-Mihajlov, M., & Živković, M. (2009, 03). *PROGRAM PODRŠKE ZA POSTOJEĆA PREDUZEĆA*. Retrieved 02 21, 2012, from Stalna konferencija gradova i opština: <http://www.skgo.org/bz/data/7%20Methodologies%20-%20Metodologije/SER/BRE%20Methodology%20SER.pdf>
2. Čekerevac, Z. (2011). *Upravljanje kvalitetom*. Čačak: Visoka poslovna škola strukovnih studija.
3. Čekerevac, Z., Anđelić, S., & Radović, D. (2011). Data Protection in Small and Medium Sized Enterprises. *Proceedings of international conference "Small and Medium Enterprises - Possibilities and Perspectives 2011"*. Novi Pazar.
4. Cnorr, E., & Gruman, G. (2010, 07 08). *What cloud computing really means*. Retrieved 2 19, 2012, from Info World: <http://www.infoworld.com/d/cloud-computing/what-cloud-computing-really-means-031>
5. Geelan, J. (2009, 01 24). *Twenty-One Experts Define Cloud Computing*. (J. Geelan, Ed.) Retrieved 02 19, 2012, from Cloud Computing Journal: <http://cloudcomputing.sys-con.com/node/612375>
6. Mell, P., & Grance, T. (2011, 09). *Special Publication 800-145*. Retrieved 02 19, 2012, from NIST National Institute of Standards and Technology U.S. Department of Commerce: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>
7. Mendler, C. (2011, 06 22). *Compliance in the Cloud: Risk or Reward?* Retrieved 02 25, 2012, from Alcatel Lucent: <http://www2.alcatel-lucent.com/enrich/en/v5i2/compliance-in-the-cloud-risk-or-reward/>
8. Otey, M. (2010, April 26). *The Rise of Cloud Computing*. Retrieved 02 25, 2012, from WindowsITPro: <http://www.windowsitpro.com/article/cloud-computing2/the-rise-of-cloud-computing>
9. TQAS. (2012). *Definition of Quality Assurance and Control*. Retrieved 02 19, 2012, from Total Quality Assurance Services: <http://www.totalqualityassuranceservices.com/definition-of-quality-assurance-and-control/>