



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



GERMANY



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2011  
Brasov, 26-28 May 2011

## IMPACT OF CLOUD COMPUTING SOLUTIONS TO NETWORK ENABLED CAPABILITIES

Michal TURČANÍK\*, Marcel HAKAKAL \*, Miloš OČKAJ\*

\*Department of Informatics, Armed Forces Academy, Liptovský Mikuláš, Slovak Republic

**Abstract:** The paper deals with important topic of nowadays - Cloud computing. Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams.

**MSC2010:** 68M14.

**Keywords:** distributed information systems, distributed computing, cloud computing, network enabled capabilities.

### 1. INTRODUCTION

A cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic - a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed Internet and a weak economy, have accelerated interest in cloud computing.

A cloud can be private or public. A [public cloud](#) sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider.) A [private cloud](#) is a proprietary network or a data center that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud,

the result is called a virtual private cloud. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services (1).

Because cloud-based services use the Internet, storing data in the cloud can be risky and can mean less control over your data. How do IT manager decide which kinds of data to store in the cloud, stay compliant with government regulations, and maintain control and protect data in a cloud-based model?

### 2. IMPACT OF CLOUD COMPUTING SOLUTIONS TO NEC

Cloud computing is a new option in information technology. Brings a change in the way of storage and retention and also in the way how applications operate. The company does not own it at individual computers, everything is instead located in the so-called "cloud" - that is in computers and servers that are physically located at the service provider

and to the customer is available via the Internet. Cloud computing is the solution passing from products to services. In the implementation of cloud computing environment in NEC's are new proposed technological solution deeply analyzed and assessed primarily in economic and security terms. Philosophy to shift to cloud computing model is economically advantageous but raises particular safety issues regarding the protection of and access to sensitive data. For the operating environment of warfare in the concept of NEC is discussed in particular the immediate accessibility of services and data that is critical (AFCEA TechNet, 2010).

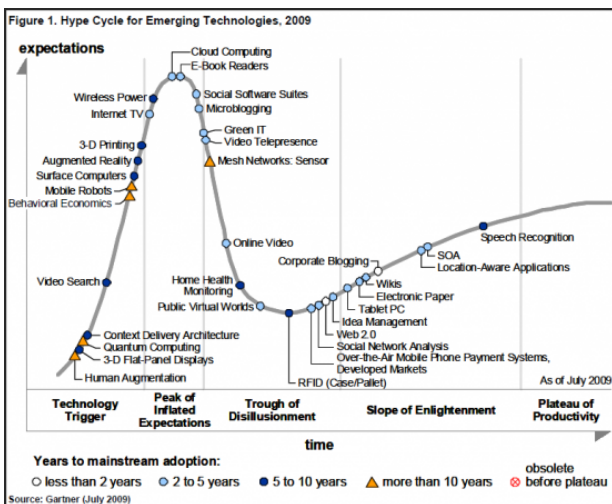


Fig. 1. Analysis of the Gartner 2009 Technology Hype Curve

**2.1 The emergence of cloud computing solutions.** Cloud computing is emerging as a new phase in connection with the introduction of computer technologies, grid, cluster, virtualization and service-oriented architecture (SOA). The turning point for the onset of cloud computing, according to Gartner's analysis was year 2009 as documented in Figure 1. Distributed information processing technologies are being reviewed and a new model of information processing leads to processing in shared computing centers represented by the powerful server that allows dynamic scalability and virtualization resources (Hoffa, 2008).

Cloud computing is mainly a new economic model for IT, which provides

convenient access to a request (on demand) to the network, shared memory, configurable computing resources (eg networks of servers, storage, applications, services) that can be quickly and with minimal modifications prepared to provide security services. This model is based on five main characteristics:

- on-demand self-service,
- ubiquitous network access,
- pooling of resources,
- area of sources - independent of location and homogeneity,
- rapid flexibility resources (services only when they are needed),
- measurable service.

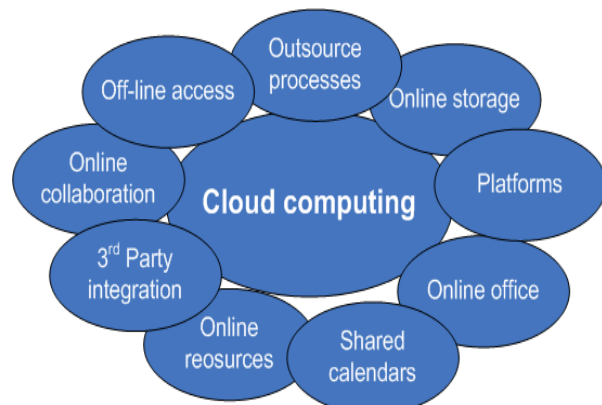


Fig. 2. Integration of IT services in the cloud computing

**2.2 Models of Cloud computing.** There are currently provided in terms of types of services defined under the three models of Cloud computing:

1. **SaaS** ( *Software as a Service* ) - software as a service environment where users can start pre-defined applications directly from a Web browser,
2. **PaaS** ( *Platform as a Service* ) - platform as a service environment, which is available for a rich environment in which they can be processed his application if they are programmed in one of the languages supported platform (eg Java, Python or. Net) ,
3. **IaaS** ( *Infrastructure as a Service* ) - infrastructure as a service environment that provides the user with computing power, networking, storage and other



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



GERMANY



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

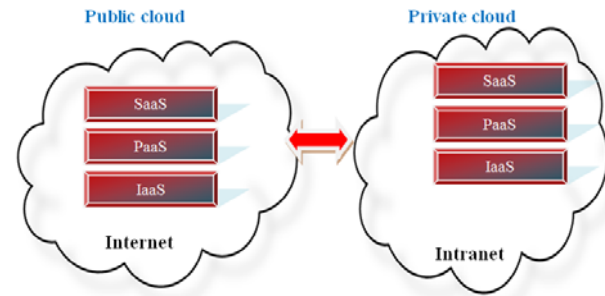
INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2011  
Brasov, 26-28 May 2011

necessary resources to enable it to start the software and applications.

In terms of the infrastructures and access to data-existence of 4 types of implementation of Cloud computing:

- *private* - in the report of the organization or business,
- *community* - a common infrastructure for specific communities (eg. telecom operators),
- *public* - open to any community,
- *hybrid* - consisting of at least two previous models.

Cloud computing solution can be compared to the use of common business applications online, that are accessible through a Web browser, another web service, or used by application software, while software and data are stored on the server. The actual application in the **cloud** is processed virtually in a "cloud" and therefore the processing location (and related data) is not known. This is a fundamental difference about the model client - server, where processing takes place in one or more specific servers that are known. Generally, in dealing with cloud computing customers do not own the physical infrastructure and resources in the form of applications used as a "service", only the for the equipment used.



Public cloud	Common	Private cloud
<ul style="list-style-type: none"> <li>• <u>lower initial cost</u></li> <li>• <u>economical scalability</u></li> <li>• <u>simpler administration</u></li> <li>• <u>OpEX</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>high efficiency</u></li> <li>• <u>high availability</u></li> <li>• <u>scalable performance</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>lower overall costs</u></li> <li>• <u>greater safety</u></li> <li>• <u>easier integration</u></li> <li>• <u>CapEx a OpEX</u></li> </ul>

Fig. 3. Comparison of public and private cloud computing solutions

The idea of cloud computing solutions leads mainly to the economic benefits of saving and spending in connection with the purchase and operation of demanding financial solutions to hardware and software. In the area of communication and information infrastructure is likely that the life of the installation and use of the solution is relatively short and return efficiency rapidly decreases with time. Cloud computing solutions philosophy is based on paying only for services computing power of transmission capacity, and application programs for data storage. The critical factors for the use and deployment of incoming solutions of Cloud computing is now: unresolved legislation, protection of sensitive data security and data access.

### 2.3 Features of Cloud computing Solutions.

Importance and benefits of cloud computing solutions can be characterized in several areas:

#### *Reduce costs and total financial impact*

- no capital expenditure, all expenditures are operational in nature,

- lower costs to deploy the service are the efficiency and economy expanded massively scalable and services,
- no expenditure on maintenance, administration and ensure high availability.

#### *Elasticity and Scaling*

- payment only for the capacity at the time of actual need,
- the ability to scale capacity very quickly (but also move to add),
- increase agility to provide new services.

#### *Faster introduction of services on the market*

- reduction in time to pilot and test phases,
- faster adaptability to customer requirements and that adequate services,
- new forms of interaction with customers.

#### *"Infinite" capacity available immediately*

- is not limited to the current physical infrastructure,
- may not be available reserve capacity for peak periods,
- all categories of computing resources required are available immediately.

**2.4 Data centers and migration to cloud computing solutions.** Data Center (DC), respectively data farms provide data services to its historical justification, its own model of governance, management, but also use. In terms of incoming solutions Cloud computing will continue to be possible the existence of data centers under certain assumptions. It will be critical protection and data security. Some elements respectively technology will be replaced by emerging technologies, primarily defined by cloud. Comparison of DC and Cloud computing solutions in terms of philosophy, infrastructure, data and services is shown in Fig. 4.

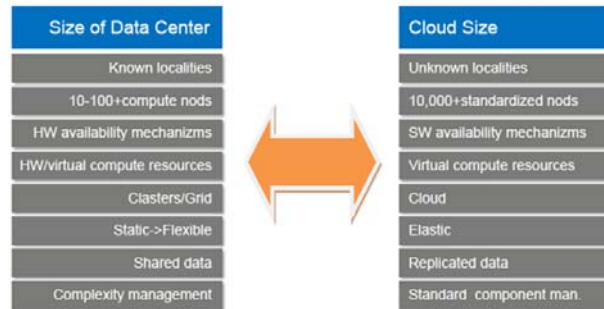


Fig. 4. Comparison of data centers and cloud computing solutions

In the area of data centers and their infrastructure it have been invested enormous resources and therefore it will need to systematically assess which primary services are possible to transform, integrate and indulging in Cloud computing solutions. Primary feature should be elastic services as one of the ideas and making use of cloud computing. Possible migration of services provided to the DC system solutions Cloud computing is shown in Fig. 5. Not all services will be (or not interested) in terms of meaning and security pass to Cloud computing solutions. It is expected that the management of human resources and sensitive data from HR (Human Resources) and also the development environment of their own products on the principle of "know how" to remain in the environment and management of the original owners. Other services eg. CRM (Customer Relationship Management), ERP (Enterprise Resource Planning) will be possible to migrate into the cloud computing environment (Marshall, 2011).

When you migrate from data centers to cloud computing solutions arise fundamental issues determining the success of the transition. The view is from several parties, but concentrated data security issues remain:

1. We guarantee the security of information?
2. We have enough reliable standards?
3. We comply with the requirements for inspection and audit?
4. The basic question - where is our data?



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



GERMANY



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2011  
Brasov, 26-28 May 2011

- Data is replicated between data center - as it should be destroyed?
- Where are the replicas, and backups? What are the processes?
- We do not have tools to locate our data!
- How to get data back (after termination or cancellation of service)?

- creation of the conditions for running applications in a virtualized environment,
- reengineering of the applications on SOA principles,
- standardization and virtualization of IT infrastructure in order to create a coherent environment,
- the introduction of ITIL (Information Technology Infrastructure Library) principles in the management and administration,
- introduction of SLM (Service Lifecycle Management).

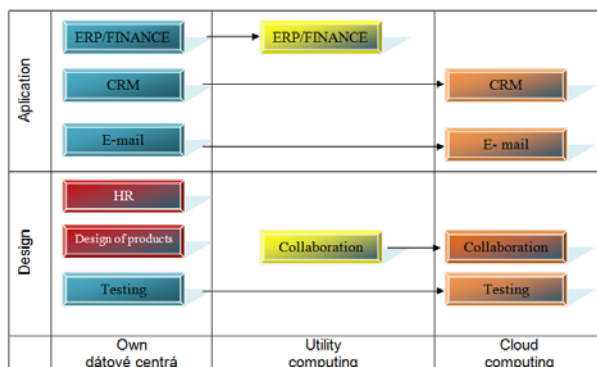


Fig. 5. Migration services from data centers to cloud computing solutions

Based on the answers to those questions is chosen the adequate model. Practicable at this time for DC migration from a solution to Cloud computing is considered particularly advantageous model, private clouds, which offers existing solutions. An important dimension is the organization and scope of services. Private Cloud computing solution model, providing services, that are in principle dealt with the application of existing technologies currently in building data centers and service:

- Cloud uses the principles of solution services in data centers to maximize the total utilization,

Before the actual deployment of the Cloud computing solutions is necessary to analyze the state of organization, efficiency and the transition mainly safety aspects (Padmanabhuni, 2009).

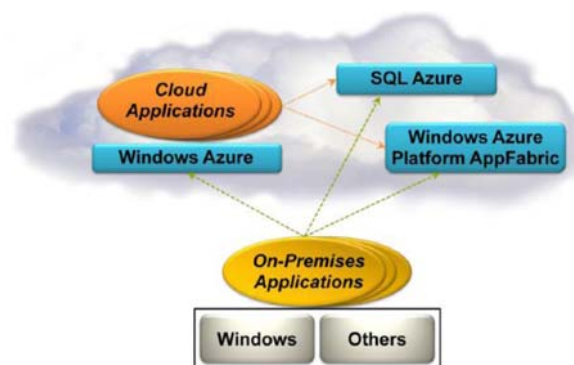


Fig. 6. Microsoft Azure Platform Cloud computing

### 3. CLOUD COMPUTING SOLUTION IN PRACTICE

Microsoft as a provider and supplier of software no longer works for the establishment of the Microsoft Azure. Azure platform consists of Windows Azure, which is essential

to the host and development platform. Azure is SQL relational database in the cloud (of course with similar functionality as MS SQL Server) and Azure Services, which provides additional services necessary for running user applications and deployment. Azure fills principled strategy - a concept Microsoft titled "Software + Services (S + S) as the next paradigm in the IT industry. Concept S + S is Microsoft's perspective on the design of applications in the near future.

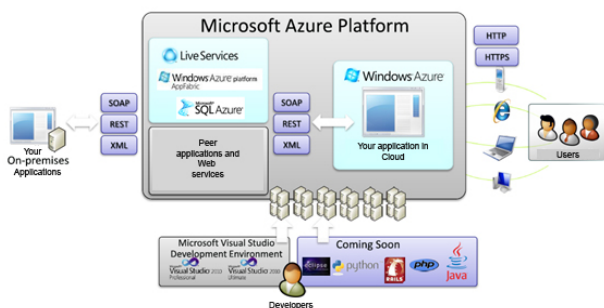


Fig. 7. The interoperability of the Microsoft Azure Cloud computing solutions for other technologies (eg PHP, Java, Python, ...)

Microsoft Azure platform for Cloud computing solution consists of three components:

- **Windows Azure** – the data center staffed by servers (eg Microsoft servers) prepared for virtual environment, enabling Web services start, store information in the data storage and manage applications. A typical feature of the center is the scalability of computing power, depending on the requirements for application performance.
- **SQL Azure** – the functionality of SQL Server that provides services and expansion of storage capacity.
- **Windows Azure Platform AppFabric** – development environment for building the system, the possibility to implement SOA architecture.

Microsoft's strategy with regard to the emerging requirement for interoperability tends to support the entry of other technology platforms and environments. Example private cloud computing solutions provided by VM Ware can also be seen in Fig. 8 (Drobný, 2011).

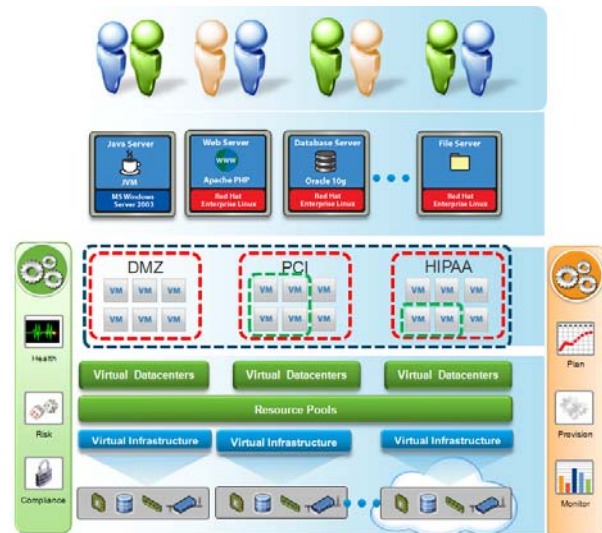


Figure 8 - Example of Private Cloud computing solutions based on technologies VM Ware

#### 4. NEC - SAFETY ASPECTS OF THE TRANSITION TO CLOUD COMPUTING SOLUTION

International conference "TechNet International - Integrating into Cyberspace Battlespace" was held on the 27th to 29th October 2010 in London. This conference is held annually at changing venue throughout Europe and contents dynamically monitor the most current issues of NATO and the armed forces. This year held in London and in the organization participated the AFCEA Europe. The conference program was prepared and managed by an international committee with the support of NATO C3 Agency and NCAS. The main theme of the conference was the integration of cyberspace in the process of struggle. The conference gathered some 90 participants from 12 NATO member states, who presented the latest findings and pointed to key problems of cyber war. In speeches experts raised contributions and aimed at



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



GERMANY



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2011

Brasov, 26-28 May 2011

addressing key Cloud Computing, cyberspace and cyber defense.

In addressing the issue of cloud computing has expressed the opinion that it is primarily an **economic model of savings funds** for infrastructure development and use of the information a communication systems. Despite the solutions offered by IT firms NATO position is that in this area, the deployment of cloud computing will be necessary to strictly distinguish between public and private level. **Private level** in terms of security procedures and protection of information remains **permanently preserve by armed forces**. The civilian companies will be able to enter the public level of this process.

#### 4.CONCLUSIONS

Cloud computing solution is invisible to users (we can not determine dislocation of services and also do not know who operates it). Anonymity gives the impression of loss of security. The solution is a declaration that the processing takes place according to precise rules and standards.

Physical presence of firms in a particular legislative environment and geographically unlimited existence of Cloud computing solutions raises the problem of personal data respectively sensitive data regulated requirements and regulations of each country.

The problem now is the different standards and consistent procedures that would accept the legal aspects of the country.

Content importance of data and access to them is not a single assessment at the

organization, but also higher state clusters States (eg NATO).

#### BIBLIOGRAPHY

1. Drobný, M. (2011): Cloud computing na platforme Microsoft, Microsoft Slovakia, Press Digital Visions, s. r. o.
2. Padmanabhuni, S. (2009): Cloud computing, Business innovation trough technologies, SETLabs Briefings, Infosys Technologies, Ltd.
3. Marshall, P., Keahey K., Freeman, T. May (2011): Improving Utilization of Infrastructure Clouds,. Accepted to IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (CCGrid 2011), Newport Beach, CA.
4. Hoffa, C., Mehta, G., Freeman, T., Deelman, E., Keahey, K., Berriman, B., Good, J. December (2008): On the Use of Cloud Computing for Scientific Workflows, SWBES 2008, Indianapolis, IN.
5. Series of lectures on Cloud computing, NDU iCollege Conference (2010), AFCEA TechNet, London, October 27, 2010