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METHODS AND TECHNIQUES FOR INDUSTRIAL DEVELOPMENT

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A WORD FROM THE EDITORS

The scientific monograph METHODS AND TECHNIQUES FOR INDUSTRIAL DEVELOPMENT has been prepared during the realization of the project No.517361-TEMPUS-1-2011-1-IT-TEMPUS-JPHES titled: Technical Education on Resources Savings for Industrial Development, funded with support from the European Commission in frame of TEMPUS IV Programme.

Tempus Programme (Trans-European Mobility Scheme for University Studies) supports the modernization of higher education and creates an area of cooperation in countries surrounding the EU, countries from the Western Balkan, Eastern Europe and Central Asia, North Africa and the Middle East. Tempus Joint Projects for Higher education and Society, such as TERSID Project, aim increasing cooperation and networks building between higher education in the EU Member States and partner countries applying the principles of the "Bologna Process", and networks between higher education and society based of the EU experiences.

In the framework of the TERSID Project, there participate six EU universities: Politecnico di Torino in Italy, University of Maribor in Slovenia, Bochum University of Applied Sciences in Germany, Aristotle University of Thessaloniki in Greece, The University "Dunarea de Jos" of Galati in Romania and Transport and Logistics Institute of Riga in Latvia. The Central Asian universities in the framework of the TERSID Project are: Tashkent Turin Polytechnic University in Uzbekistan, Navoi State Mining Institute in Uzbekistan, Tashkent State Technical University in Uzbekistan, Karaganda State Technical University in Kazakhstan and Kazakh National Technical University of Almaty in Kazakhstan. Also, the Project has involved fourteen partners coming from industries, National governments and NGOs.

As a regional Project, TERSID has been carried out in Uzbekistan and Kazakhstan, focused on the renewal of some curricula for the engineering field, to introduce:

- modern methods and techniques for industrial development to be adopted for competitiveness improvement and economics and social growing,
- modern and efficient technologies to be adopted for saving of natural resource as prevention action and for pollutant treatment as reduction action.

This publication offers comprehensive chapter series from scientific researchers conducted by regional authors, authorities in the fields and summarizes the principal scientific contributions. The chapters deal with range topics from optimization techniques in production development, quality in production processes, product and process development, technologies for business development and factors of social and economic development. Edited by three editors with contributions from chapters' authors, this scientific monograph presents advanced topics for students, educators, and practitioners.

The editors acknowledge with gratitude the European Commission, EACEA Agency who funded TERSID Project under the TEMPUS IV Programme. Finally, the editors would like to thank all chapters' authors and Project Consortium Partners who devoted their work and expertise with the greatest enthusiasm. We encourage all the colleagues involved in the project to continue this successful cooperation, which is highly valuable for all partners, EU partners and Central Asian partners.

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CHAPTER 14

HYBRID CLOUD COMPUTING MODEL AND ITS CHALLANGES

Emilija RISTOVA, Valentina GECEVSKA, Mikolaj KUZINOVSKI, Zoran PANOV

1. INTRODUCTION

The proven success of cloud-based solutions, coupled with the promise of a less expensive and more responsive business solution infrastructure, is prompting many companies of all sizes, from micro, to the mid-market, to enterprises to give the cloud a closer look. The benefits such as including cost-effective, accelerated provisioning in protected environments can no longer be ignored.

The magnitude of change that is affecting industries today is unprecedented. Difficult economic conditions, a broader set of business imperatives, and evolving technology requirements are presenting midsize companies with as many threats as opportunities. At the same time, fundamental shifts are taking place in the way people everywhere live, work and interact. It's becoming increasingly clear that innovative, forward thinking companies can do more than survive in this environment, they can thrive.

A survey conducted by Opinion Research Corporation and information technology decision makers at midsize businesses (100-1000 employees) among 17 countries across various industries (banking, retail, healthcare, consumer products, manufacturing) state that they need a technology partner who can help them work smarter, build an infrastructure to support their growing business, and identify ways to use the information they have to make better business decisions. The study reveals distinct mindsets that are actively shaping the business strategy and related IT priorities at midsize companies [3].

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Roughly half (53%) of surveyed companies are concentrating their efforts on increasing efficiency and lowering costs-strategic imperatives that can be supported by virtualization, energy efficiency, process optimization, IT standardization and other initiatives focused on reducing complexity and expense [3].

In this chapter, an attempt has been made to introduce the way how the companies can utilize Public Cloud computing in conjunction with a secure Private Clouds, or so-called Hybrid Cloud Computing as a new IT paradigm within the testing and demo phases of business cycles at vastly information system software packages and its easy migration into the production phase. Cloud Computing can play an important role among mass customization and its collaboration in Clouds, driven by preference of funding sources, sharing of resources and expertise, division of labor/separation of concerns and it is enabled by advances in communication and collaboration technologies [4].

2. HYBRID CLOUD COMPUTING

The evolution of Cloud Computing over the past few years is potentially one of the major advances in the history of computing. Cloud Computing might be one of the alternatives for strategic investments in information technology and infrastructure due to the information systems adoption having in mind the following: companies have to increase innovation and flexibility in meeting the requirements of the market/customers (so they should focus on innovation, not solving problems associated with the infrastructure implementation and its maintenance), „start-up“ companies as well as small and medium enterprises cannot afford large investments in information technology and infrastructure, greater flexibility and speed up launching new products on the market offering the opportunity to access and use of already defined data, etc. [7,8,9].

The basic notion of the Cloud computing refers to the technology infrastructure model that enables several types of computing tasks to be performed over a network. The network can be a local area network or a wide area network like the Internet. As mentioned before, the Cloud computing model promotes availability and it is composed of five essential characteristics, three service models, and three deployment models – Private, Public or Hybrid Cloud computing service.

Private cloud services enable IT departments to do more with the infrastructure that they already have. In a typical private cloud deployment, companies undertake the consolidation of distributed IT resources and apply virtualization to those resources in the data center. This enables IT to provide more cost-effective management while spinning up services faster. However, private cloud deployments can put significant strain on existing resources and work processes. As IT departments consolidate resources, applications and data are typically moved further away from many end users. Branch office employees and mobile workers now are required to go further across the wide-

area network (WAN) to get the information they need. The resulting latency can often dramatically reduce performance, and make the business less productive overall. At the same time, the consolidation will put more strain on the available bandwidth connecting branch offices to the data center. With consolidated resources, many more user requests will go back to the data center. The WAN will be responsible for carrying significantly more traffic, which could lead to and width congestion, or even force the enterprise to purchase more bandwidth. Utilizing a service provider's infrastructure or platform allows companies to integrate the public cloud into their IT infrastructure. A public cloud service allows the company to rent compute power and storage, and is usually billed on a discrete basis. Public cloud services are compelling because of scale and elasticity – a service provider supporting thousands of businesses can drive lower costs than any one business alone, and can provide adaptability for changing workloads as an operating expense rather than a capital expense. One of the major challenges with the adoption of public clouds is performance. Moving services to a public cloud means that companies must accept that their applications can potentially be run from anywhere in the world – wherever the data center of the service provider happens to be. Most public cloud services do not specify data center locations in their terms of service, maximizing their freedom to migrate work to reduce their operating costs. In essence, the distance (and latency) in accessing applications may significantly increase for everyone in the company. More surprisingly, those distances may change unpredictably.

Concerns about privacy and security of data have contributed to many companies' interest in developing private cloud environments, where company data remains inside the firewall or to consider hybrid cloud environments, which incorporate some elements of a private cloud and some elements of a public cloud [10].

While many business executives are attracted to the idea of the public cloud, just as many are interested in achieving the benefits of the cloud but on an internal basis. There are different reasons why companies investigating a cloud might want a private cloud instead of using a public one. The most obvious reason is privacy and security of data. Another reason that some companies are considering the private cloud is that they have already invested in a lot of hardware, software, and space and would like to be able to leverage their investments, but in a more efficient manner.

In most situations, a hybrid environment will satisfy many business needs. Here are some examples:

- A company likes a SaaS application and wants to use it as a standard throughout the company; top management of the company it is concerned about security. To solve this problem, the SaaS vendor creates a private cloud just for the company's needs inside their firewall. They provide the company with a virtual private network (VPN) for additional security. In this manner, the company has both public and private cloud ingredients.

- A company offers services that are tailored for different markets. For an example, a company might offer to handle claims payments for insurance

agents, shipping services for manufacturers, or similar. The company may want to use a public cloud to create an online environment so each of the company's customers can send the requests and review their account status. However, the company might want to keep the data that they manage for these customers within their own private cloud.

3. CHALLANGES - MASS CUSTOMIZATION AND ITS COLLABORATION IN CLOUDS

Mass customization is the capability, realized by companies, to offer individually tailored products or services on a large scale. Mass customization systems have three key capabilities: elicitation, process flexibility, and logistics. Any company considering a mass customization strategy should carefully analyze its ability to deliver on the three key capabilities: elicitation (a mechanism for interacting with the customer and obtaining specific information); process flexibility (production technology that fabricates the product according to the information); and logistics (subsequent processing stages and distribution that are able to maintain the identity of each item and to deliver the right one to the right customer) [5]. Mass customization systems have three those elements that are connected by powerful communications links and thereby integrated into a seamless whole.

Elicitation is hard, customers often have trouble deciding what they want and then communicating influence on their decisions. That creates problems for any company aiming to serve those customers. There are situations in which customers clearly articulate their requirements. More commonly, however, customers are unsure. They are easily overwhelmed by too many selections on a store shelf or a Web page. Any elicitation process is an artful means of leading customers through the process of identifying exactly what they want. The difficulty of eliciting customer-specific information varies with the information required. Deeper levels of customization, however, require more information. Thus mass customization often requires an elaborate enabling mechanism (sometimes called a configuration). Improvements will no doubt be aided by progress in customer relationship management (CRM). CRM collects information about customers, aims to predict their individual desires and behaviors, and targets marketing messages accordingly. Although a targeted marketing message is different from a physical product or a customized service, the goals and technologies of CRM are somewhat similar to those of mass customization. *And again, the question of IT deployment model arises. What about CRM deployment models, what about different sizes of companies and sensitivity of data they managed? What is the role of Cloud computing model?*

The core capabilities is to provide full product space for customers with low cost and high efficiency in customized manufacturers, and ultimately to meet the individual demand of customers [6]. A cloud based platform for mass customization, as a framework given bellow for an instance, by advantages of

Clouds might effectively achieve the company's core capabilities and integration of resources and meet the supply and demand between the fluctuation in orders and the long lasting manufacturing capabilities.

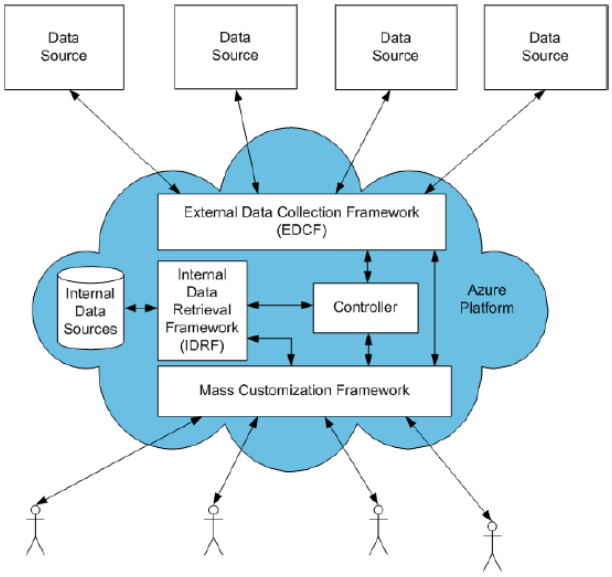

Figure 1. *A framework for mass customization and its collaboration in Clouds [4]*

4. CHALLANGES - THE MID MARKET UTILIZATION OF HYBRID CLOUD COMUTING

Despite its critics, cloud computing technology has successfully transitioned from a "trend" to a trusted technology source relied upon by company's of all sizes, from start-up's, to the mid-market, to enterprises. Its proven benefits such as including cost-effective, accelerated provisioning in protected environments, etc., can no longer be ignored.

4.1 Eliminating Cloud Computing confusion

Cloud computing has been driven to the forefront of technology and business by companies such as Amazon.com, Salesforce.com and Rack space. Although these large-scale cloud providers are leading the way in this space, their approaches are fundamentally identical: they offer the same public cloud solution to all of their customers. While this solution is favorable for some cost conscious businesses, it is not tailored for the business processes and unique needs of the mid market. Every company maintains vastly different IT infrastructures.

Therefore, it is important for implementers to understand the distinction between these cloud infrastructures, known as public clouds, and the solutions

and services that comprise a private cloud model, a custom configuration built from the ground up with dedicated hardware including clusters of servers, storage area networks, firewalls, databases and load balancers.

While the public cloud is highly economical and can be utilized to meet company utility computing needs, the option a “one size fits all” approach, often introducing risks such as reduced availability of critical applications, or potential data compromises. These weaknesses are among the most common concerns cited by cloud computing cynics who are quick to overlook its overwhelming benefits.

As mentioned before, private clouds offer the counterpart. In the private cloud, computing resources and applications can be provisioned on-demand using virtualization and workload balancing, while simultaneously providing a secure environment for proprietary data and software.

While both have their benefits, we tout that the hybrid cloud, a combination of public and private, is the best solution for the mid market. For an example, by utilizing public clouds, service providers can create demo environments for multiple customers in a matter of hours, rather than weeks. From there, customers can easily be accommodated by quickly moving them from a demo environment into development, quality assurance and testing, and finally production with a private cloud. This entire process can be managed in a secure environment, backed by zero down-time.

4.2 Reliability in the Private Cloud

Virtualization is an easy solution for limiting expansive growth of physical IT infrastructure, which often wastes vital resources due to vast server sprawl. Installing applications on virtual machines greatly reduces the amount of physical assets needed, which introduces significant cost savings and eliminates unnecessarily complex IT infrastructures. Additionally, applications running on virtual machines are protected from downtime and disruption via scalable, high-class enterprise servers, enabling to company to increase their ability to maintain data integrity security controls. These solutions have all of the logging, auditing, and prevention mechanisms of traditional operating models to determine who has access to information, and how that information is stored, processed, or transferred.

A new approach can be preconfigured within hybrid cloud solution that is tailored to the client’s business needs. In that way, the full visibility into operational and development areas and the power to control availability at all times through dynamic resource scheduling, as well as workload balancing (a capability especially key for multi-tenant environments) is available.

Data, applications, and development projects can be monitored constantly (24/7), migrated from one virtual machine to another without downtime, or automatically re-allocated according to your business needs.

4.3 Scalability in a Hybrid Cloud Computing

It is evident that the time consuming process of procuring hardware, testing and securing it, then rolling it out, can delay sales. Typically, when conducting demos and navigating clients through an application lifecycle, companies can be restricted to a equal ratio between applications layers and servers (an expensive setup that impedes the ability to swiftly prepare services for customers). Once up and running, these dynamic testing environments can often become inactive, posing additional challenges for users.

The cloud solves each of these issues by eliminating hardware dependency, allowing service providers to manage multiple customers in one environment at any given time. Service providers can quickly and easily provision new stand alone test environments on demand for themselves, current clients, and prospective clients with little fuss.

Those challenges aside, developers struggle with additional obstacles after clients move forward with the next phase for a project, ranging from burdensome, data intensive applications that are difficult to migrate, to real time operations, to evolving project requirements.

However, within a virtualized cloud environment, resource intensive applications can be easily moved, enabling users to move clients from development to production, and meet the demands of projects that are constantly in flux.

4.4 Customized Private Clouds depend on the vendor

As businesses continue to move toward on-demand service models to operate their IT infrastructures, infrastructure providers must evolve with them. Finding the perfect fit to support a developer's IT needs depends on operational environments that enable companies to develop and test comprehensive, turnkey services that can be managed or handed over to clients.

Hosted at multiple top tiers, world class data center facilities, vendor's hybrid cloud solutions should be protected by the highest levels of security.

What do these partnerships mean for company's business? To surpass competitors, vendor's public cloud features a group of pre-defined virtual machines, allowing service providers to create a grouping of custom virtual machines that mimic any given test or demo environment being pushed out. By replicating a pre-configured VMware Apps, rather than a cluster of applications, deployments are made faster and more efficient, saving hours of time and eliminating manual tasks.

How to overcome dependability? Vendor's private clouds ensure that data and resources are protected by completely redundant servers, providing high-availability and 100% uptime; all supported by customizable file level backup and restoration capabilities.

What about security issue? Vendors of the cloud solutions should offer the ability to conduct development within a segregated environment. In this way,

separation provides a secure area that can be used for demonstration, training, development, and testing purposes without jeopardizing enterprise information resources.

New approach created to help meet company's growing business demands, the unified management portal can seamlessly shift workloads to and from the private cloud to the vendor public clouds without reloading data, changing IP addresses, or encountering DNS (Domain Name System) issues.

5. CONCLUSION

When it comes to information systems, in today's complex business environment, companies are beginning to focus more and more on the individual productivity, application productivity and IT productivity. These three factors must be balanced and optimized at moderate cost. This is particularly challenging for small and medium sized companies who don't want to tie up their investment resources in major IT systems particularly within the testing and demo phases of business cycles.

The benefits of using on demand solutions for SME's means:

- Improved cost efficiency, lower TCO (by using standardized applications, the costs of rollout, service and operation, user training and ordering and billing processes can be reduced significantly. This is the basis for ensuring a much lower „time to value" and total cost of ownership (TCO) [11])
- Flexibility trough the "pay-per-use" model
- Improved service quality through standardization
- Faster implementation (on average less than three months following kick-off in a typical user environment)
- No implementation risks
- Higher reliability thanks to the limited need for fine-tuning
- Higher reliability thanks to the limited need for fine-tuning.

As businesses continue to move toward on-demand service models to operate their IT infrastructures, many providers of on-demand and custom cloud solutions are paving the way for companies to better serve customers by combining the reliability, scalability and flexibility of the cloud. The burden of short scheduling requirements within the testing and demo phases of business cycles at vastly information systems is eliminated through swift provisioning of resources. The expensive hassles of dealing with aging hardware, server refresh, and the need to quickly adapt to unexpected frequent changes can all be offloaded and managed by cloud services. By relegating these tasks to the private cloud, businesses can focus on innovation, rather than keeping the lights on.

In that manner, reliability in Private Clouds as well as scalability that Public Clouds offer, ensure the future of Hybrid Cloud Computing in conjunction with SME's. As previously emphasized, Cloud computing can play an important role among mass customization and its collaboration in Clouds, the most driven by preference of funding sources, sharing of resources and expertise, division of labor/separation of concerns and it is enabled by advances in communication and collaboration technologies. The service platform architecture and the core technology can improve the service capacity of mass customization business through the integration of resources, demand integration and optimal configuration.

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