

Local Government Enterprise Architecture Towards Cloud

Inita KINDZULE¹, Edzus ZEIRIS² and Maris ZIEMA³

¹*Project Development Division, Information Technology Centre of the Riga City Council
Brivibas 49/53, Riga, LV-1010, Latvia*

Tel: +371 67037025, Fax: +371 67037019, Email: inita.kindzule@riga.lv

²*ZZ Dats Ltd. Elizabetes 41/43, Riga, LV-1010, Latvia*

Tel: +371 67686957, Fax: +371 67686956, Email: edzus.zeiris@zzdats.lv

³*Faculty of Computer Science and Information Technology, Riga Technical University
Meza 1/3, Riga, LV-1048, Latvia*

Tel: +371 67333600, Fax: +371 67686956, Email: maris.ziema@zzdats.lv

Abstract: This paper provides an insight into the experience of Riga municipality in implementing the applicable system's architecture towards the Cloud principle thus satisfying the requirements for an acceptable quality and volume. The information systems' architecture of Latvian local governments, while being comparable to medium scale international business organizations, historically has evolved over the course of many years. As a result it has experienced the transition from local decentralized applications through a client server solutions and SOA to Cloud Computing solutions. Requirements of local government employees for ICT support in their daily work and demand for e-services of citizens make it necessary to create ever new and integrated Cloud Computing solutions for local governments. Implementation of ICT solutions in limited conditions of funding make it necessary to build a system architecture that ensures the fulfilment of requirements in an acceptable quality and volume.

Key words: Cloud Computing, eGovernment, Enterprise Architecture, Economic benefits

1. Introduction

1.1 – Cloud as a fundamental shift in ICT

Cloud Computing is considered as a recent and most relevant future innovation in the field of Information and Communication Technology (ICT) which has significant potential to benefit organizations, whole industries, and even entire economies [1; 2; 3]. Undoubtedly, it is a significant shift in ICT today.

During the last years there has been a constant increase in varying perceptions of Cloud Computing terminology. Many scientists and research institutes have been working on the definition of Cloud Computing and after several years of work and considering more than ten different versions the National Institute of Standards and Technology has come up with the final definition of Cloud Computing: "Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [4].

1.2 – Realizing the Potential of Cloud Computing in Local Government

Cloud Computing is a win-win scenario for governments, for citizens and the economy as a whole [5]. Its effect and significance also confirms the fact that more Cloud Computing solutions are being built that immediately provide valuable results to institutions and their employees [6].

The most significant immediate benefits are considered to be reduced IT costs, increased IT flexibility and improved IT/business processes efficiency. But the potential of the Cloud is tremendous - probably in the long term greater than can be determined [3].

The Cloud Computing field is considered to be particularly sensitive [7]; it is the responsibility of local governments to acquire the advantages and benefits from Cloud Computing as soon as possible. Government agencies increasingly need ICT environments that provide maximum agility and scalability to meet continually changing business needs and new citizen service expectations. Cloud services provide a robust and reliable level of responsiveness and cost-effectiveness with the ability to scale rapidly [6]. Microsoft [8] in their forecasts has also pointed out that it is time for government institutes of any level to understand the benefits that can be achieved by utilizing Cloud Computing and new ICT capabilities. So it is necessary to clarify the main benefits what local governments can gain and what level of Cloud Computing potential can be realized in each government. At the World Economic Forum [3] Cloud Computing has been estimated as “the next wave of information technology for individuals, companies and governments”.

2. Objectives

The aim of this paper is to share the experience of Riga City Council when implementing applicable systems' architecture towards the Cloud principle thus satisfying the requirements for an acceptable quality and volume and achieving significant business benefits.

3. Methodology

There are 119 local governments in Latvia and the biggest one is the local government of capital city Riga due to the fact that 700,000 residents, one-third of all the population of Latvia is residing there. According to Stipraviētis et al.: “The capacity of Riga city is now a key for the development of the governments' ICT systems in Latvia as a whole” [9].

The mission of Riga local government concerning ICT is to develop and support common ICT solutions for employees so that they can provide fast and effective high quality services to residents. To support this mission Riga City Council has set two main objectives to be achieved in the ICT field from 2012 to 2015 [10]:

- 1) to provide means for governments' internal information and documents to be handled electronically and;
- 2) to ensure that services to customers (both internal (employees) and external (citizens)) are delivered as fast as possible while remaining effective and of high quality.

When undertaking any major technology initiative, it is necessary to carefully define objectives and requirements, aligning them with the business needs as well as the technology architecture and strategy [11]. According to the needs of Riga City Council to fulfil this mission it was found that it is necessary to build the system architecture towards the Cloud principle thus satisfying the requirements for an acceptable quality and volume.

To ensure the criteria set for the architecture and the mission of ICT in Riga City Council, a modular system architecture that is based on a common database (CDB) and supports Cloud Computing has been selected. It facilitates creating new modules in the Web environment and integration of Legacy applications – either virtualizing them or using Microsoft ClickOnce technologies to access the Cloud. The result is a more flexible and

efficient system that can swiftly respond to changing conditions and requirements. The selected Cloud Computing solution provides local governments with the possibility to collaborate with employees and other institutions or generate new categories of collaborators, so it also helps local governments to adopt new innovations in ICT.

4. Technology Description

In order to support Cloud Computing, the applicable architecture of local governments has to correspond with the following requirements:

- 1) an integrated platform among various local government business function support systems;
- 2) application independence;
- 3) support of Legacy systems;
- 4) integration of inter municipal application data;
- 5) application access from any web site;
- 6) e-services for citizens.

To support confidentiality and interoperability, a custom security solution was chosen that is based on Microsoft Identity framework principles and adopted for Riga City Council needs. The solution uses Security Assertion Markup Language (SAML) 2.0 security tokens to secure web services in Service Oriented Architecture (SOA) that is in the background of entry solution.

The chosen solution is approbated at Riga City Council by creating universal environment for employee (Universal Employee Workplace - UEW) (Figure 1).

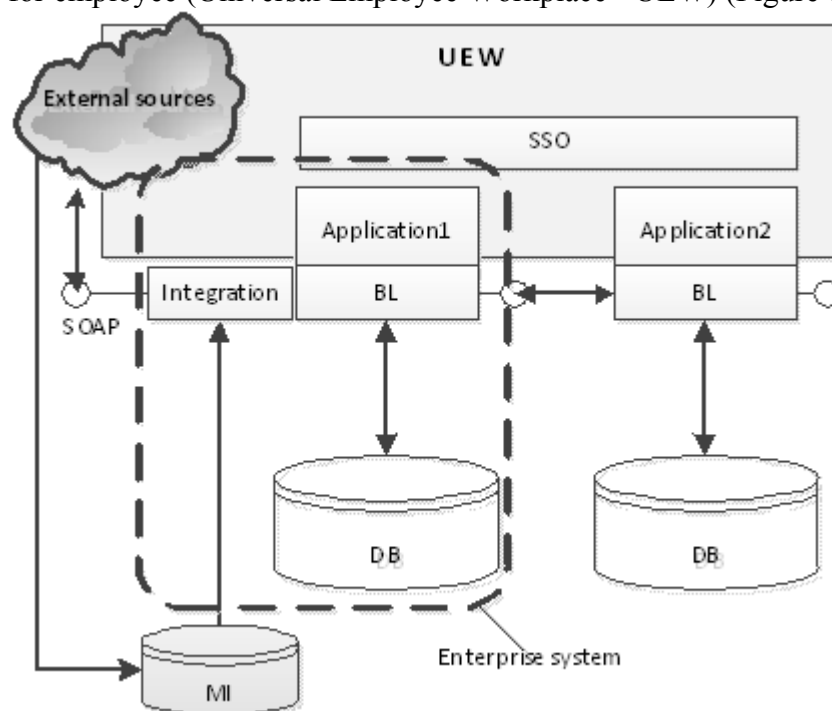


Figure 1: Enterprise architecture

This is a modular system that is joined together by using common security system with Single Sign On (SSO) functionality and module selection menu. The main idea in integration of independent modules is to use common menu source and addressing (URLs) to get integrated UEW system (Figure 2).

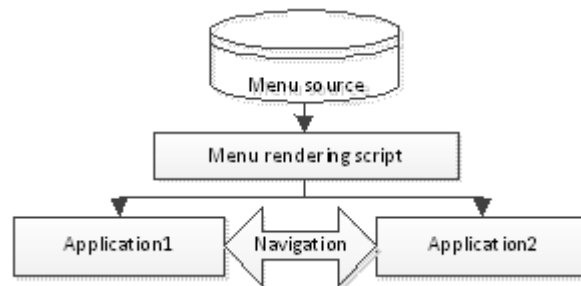


Figure 2: Enterprise architecture

At this moment UEW is also integrated with:

- 1) Microsoft Live@edu Cloud solution;
- 2) one legacy system using Microsoft ClickOnce solution that is a Microsoft technology enabling the user to install and run a Windows application by clicking a link in a web page;
- 3) one legacy system using Citrix virtualization platform, that is one of the virtualization platforms enabled by Cloud Computing;
- 4) as well as created more than ten new application modules and developed digital signature solution that is working with cryptographic devices using Java Applets.

For applications interoperability inside the UEW environment the SSO solution is developed and used. To support data integration with external resources, notably other municipalities, a master index solution has been integrated [9] that allows finding and using the necessary data from other local databases. To provide e-services to residents in Cloud, Riga City Council has developed e-service portal www.eriga.lv and Local government interoperability framework [12]. It provides that services and provision has remained much more effective.

All these solutions are very important because the ICT systems of Riga City Council (including other Latvian municipalities) has been in development since 1997 and there are many Legacy systems and solutions to integrate and to make them available in the municipality Cloud UEW solution.

5. Developments

The Cloud Computing solutions evolved also from practical necessity. Riga City Councils' biggest challenge in 2011/2012 was ICT centralisation and UEW solution implementation in local authorities including Education, Culture and Sports Department subordinate institutions – schools. There are more than 100,000 school employees and school children in Riga city schools.

The main business challenge was in inability to distribute information electronically as there was no managed e-mail solution for Riga schools. It was possible to identify personal e-mails as prettyboy@hotmail.com but this was not considered to be a good email address for work related activities for teachers. The main goal of using Microsoft Live@edu e-mails is to send internal documents for employees such as salary information and personal income tax notices that are required by law in Latvia. The existing procedure is to send salary and tax information to employees in printed format. In 2011 there was no access to official e-mails for all employees and this resulted in more than 30,000 personal income tax notices being printed and sent in paper form (Figure 3).



Figure 3: Printed tax notices

The scope of Microsoft Live@edu project includes providing e-mails for all employees and pupils using Microsoft Live@edu Cloud solution. The creation of this e-mail support means not only the need for new hardware and network infrastructure, but also additional workforce to support and administer it.

Cloud e-mail was an obvious early opportunity because of the large number of employees and pupils at schools and the immediate applicability of relatively simple consumer market style email services such as Microsoft Live@edu. These Cloud services have actually now fully measured up to enterprise grade requirements and can fully satisfy regulatory obligations of Riga City Council.

6. Business Benefits

The decision to move to Cloud Computing needs to be seen as a strategic move toward a new model of sourcing ICT capabilities to drive innovation, not simply as a tactical initiative to cut costs. Cloud Computing solutions offer the possibility to local governments to achieve immediate benefits and is an important strategic perspective on the long-term benefits. The Cloud innovation edge offers agencies at all levels of government, local, state, and federal, an alternative strategic path forward to address their innovation/efficiency dilemmas [13].

The most significant business benefits for Riga local government by implementing Cloud Solutions are:

6.1 Reduced IT costs

Cloud Computing environments offer the most dynamic, configurable, and adaptable - and very likely the most cost-effective - ICT solutions to accommodate government business needs in a rapidly changing economic, social, and public safety climate [6]. The Cloud can reduce expenses associated with servers, hardware/software licenses, maintenance fees, data centre space and related labour costs [14] and even air conditioning and electricity [15]. Taking into account that government budgets are extremely tight, it is more than necessary. Resource optimisation is the main goal achieved thanks to applicable systems' architecture towards the Cloud principle.

Financially, the motivation to move to Cloud was compelling. The Microsoft Live@edu Cloud solution provides a streamlined and less expensive way to license and manage technology for Riga City Council. It provides more storage space and an improved web-based e-mail experience at considerable savings. According to information given by the Data centre of Riga City Municipality similar infrastructure with such a mailbox space would cost a lot of money to upgrade the exchange server solution to offer 100,000 users 25-gigabyte mailboxes with privacy protection.

As it needs to be maintained as well it can be estimated that the Cloud solution will save expenses, to include on-going costs for hardware refreshment and software upgrades.

6.2 *Greater IT flexibility*

Cloud capabilities also assure that governments are up and running and always available regardless of the circumstances. The result is a more agile and efficient organization that can swiftly respond to changing conditions and requirements [11]. Effective use of Cloud Computing can be part of an overall strategy to reduce the need for multiple data centres and the energy they consume. Thanks to the Cloud, government will not be stuck with obsolete legacy systems and outdated hardware that require expensive maintenance [16].

This solution saves not only the time of Data Center employees but it is also an important advantage because of necessary everyday monitoring of e-mail systems and night supervision work. Otherwise they would need not only technical support but also IT personnel to be available 24/7 to ensure adequate monitoring and supervision.

6.3 *More efficient business processes*

Cloud solutions provide benefits in the business process of:

- Riga local government

Cloud Computing allows local governments to improve services and respond to changing needs and regulations much more quickly [17]. Cloud Computing, combined with high speed connectivity, offers major opportunities to dramatically improve the speed, quality and availability of services across all levels of government, but particularly for local governments based in regional and remote areas. The Cloud has great potential to improve efficiency in local government as it allows sophisticated solutions to be used by small and cash-poor local government [18].

From a functional service level, Cloud services offer easier group collaboration. Sharing applications, documents, and storage space can not only enhance project collaboration but also begin to open business processes and capabilities across government organizations. While this will likely start in shared services environments that are largely internal to government operations, Cloud Computing offers a much quicker rationalization of processes and applications that can accelerate the move to enabled enterprise eGovernment [6].

In addition to improved services, GSA [16] anticipates that Cloud Computing will be a major factor in reducing the environmental impact of technology and help achieve important sustainability goals. Effective use of Cloud Computing can be part of an overall strategy to reduce the need for multiple data centres' and the energy they consume.

It is easy to implement these solutions because there is no need to purchase hardware, software licenses or implementation services.

- Business users
- Employees

Users do not need to look for and use more information systems; UEW combines multiple systems together and provides the Cloud system independence. UEW is single access point for all systems and provides a single authorization and the menu.

Live@edu is a secure e-mail solution that makes it possible to distribute centralized and electronically sensitive information to staff (e.g. information about salary) and school children (e.g. assessment results). Riga city municipality saves not only the money what was used for printed paper, but also save the time, as information is distributed by e-mails.

School employees and also school children keep their information and mailboxes even when changing school within the municipality.

Cloud solution improves communication and collaboration skills for school employees and school children.

It can be an important tool and opportunity to develop 21st century skills for teaching and school children can improve learning and teaching process and the quality of education not only in Riga, but all Latvia. Cloud has relatively simple access from anywhere.

- Citizens - Services and provision has remained much more effective.

At the end it is important to mention that it is an important strategic perspective on the long-term benefits.

7. Conclusions

It is important to note that Cloud services are not a one-size-fits-all solution. Nor is a potential move to the Cloud an all-or-nothing proposition. As with any paradigm shift, a gradual and incremental approach to adoption typically yields the best results.

Government can maximize Cloud Computing value by maximize Cloud Computing value by moving from single-tenancy to multi-tenancy environments, which may be the ultimate goal for realizing Cloud's full potential benefit [6].

Riga city municipality assessing its business needs and specific has applied the most appropriate Cloud solutions. Riga city municipality can say that they are on the right track with the chosen UEW architecture. An important and successful case study has been the Live@edu Cloud solution, which provides e-mails for all Riga school employees and school children. A significant achievement is the UEW which provides benefits not only for local government and its employees but also citizens. Taking into account the potential of the Cloud, Riga city municipality is beginning to achieve all the benefits that this solution can provide as the municipality is just at the beginning of implementation of Cloud solutions.

This is good example that shows the importance of Cloud Computing technologies, support of ICT and the economic benefits from it are obvious. There is no doubt about the need to go towards Cloud Computing in Local governments as well.

Other local governments can apply technological solutions for single system integration, but when undertaking any major technology initiative, it is necessary to carefully define objectives and requirements, aligning them with the business needs as well as the technology architecture and strategy. It is also imperative to understand the risks and develop plans for mitigating them. This approach is critical in order to maximize success and return on investment.

Local governments need to be educated about the issues associated with Cloud Computing – opportunities, risks and current best practices. Riga city municipality is a good example for other local municipalities with its implementation of applicable systems architecture towards Cloud principle thus satisfying the requirements for an acceptable quality and volume.

For future research it is important to expand the UEW functionality to integrate more applications in a single architecture environment. The problems, that must be solved is how to integrate software that are developed in different programming environments e.g Java, .NET, Ruby, PHP, etc. For the current solution UEW in background uses WS-* for security integration that can be useful in .NET and Java environments, but is very difficult to use in e.g. PHP. The next challenge will be to use more open standards such as OAuth 2.0 and Open ID for security data transitions.

References

- [1] M. Iansiti, G.L. Richards, *Economic Impact of Cloud Computing - White Paper*, June 30, 2011. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1875893
- [2] F. Etro, *The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe*, Review of Business and Economics, June 2009, Vol. 4, 2, pp.179-208.;

- [3] *Exploring the Future of Cloud Computing: riding the next Wave of technology-driven transformation*, World Economic Forum in partnership with Accenture, 2010, p.21. Available at: <https://members.weforum.org/pdf/ip/ittc/Exploring-the-future-of-cloud-computing.pdf>
- [4] P. Mell, T. Grance, *The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology*, National Institute of Standards and Technology U.S Department of Commerce. Gaithersburg, September 2011, pp.800-145.;
- [5] *Governments Need to Get into the Cloud*, Global services: The gateway to the global sourcing of IT and BPO services, February 20, 2012. Available at: <http://www.globalservicesmedia.com/Specials/Cloud-Computing/Governments-Need-to-Get-into-the-Cloud/28/35/0/GS1202172010513>;
- [6] T. Rubel, S.P. McCarthy, *Cloud Computing in Government: The Case and Considerations: White paper*, IDC Government Insights, Sponsored by: Cisco, VMware, Intel, June 2010, p.9. Available at: http://www.cisco.com/web/strategy/docs/gov/IDC_cloud_computing_wp.pdf;
- [7] M. Malhère, *Cloud Computing, a power tool for economic growth* Europolitics: The European affairs daily, 31 Jan., 2012. Available at: <http://www.europolitics.info/business-competitiveness/cloud-computing-a-power-tool-for-economic-growth-art324757-9.html>;
- [8] *Forecast: Improved economy in the cloud – An introduction to cloud in government*, A Microsoft U.S. government white paper, Microsoft, March 2010, p.20.
- [9] P. Stipravietis, I. Kindzule, I. Pruse, E. Zeiris, *Design of Horizontal Data Integration//eChallenges e2011 Conference Proceedings*, Italy, Florence, 26-28 October 2011, p. 11.;
- [10] *Riga municipality goals in ICT for years 2012 - 2015.*, Riga City Council, 2012.
- [11] *Realizing the Potential of the Cloud in Government - Maximizing Return on Investment with Cloud Services*, CISCO, 2010, p.14 Available at: http://www.cisco.com/en/US/services/ps10658/ps11786/services_realizing_the_potential_cloud_in_government_wp.pdf;
- [12] I. Pruse, E. Zeiris, *eRiga.lv: Local Government Interoperability Framework// MeTTeG10 Proceedings of the 4th International Conference on Methodologies, Technologies and Tools enabling e-Government*, Olten, Switzerland, 1-2 July 2010, p.11-20.;
- [13] S. Hodgkinson, *Why Government Agencies need the Cloud*, Ovum, February 2012, p.19. Available at: <http://www.telstra.com.au/business-enterprise/download/document/business-ovum-government-cloud-whitepaper-17-feb-2012-aus.pdf>;
- [14] B. Eggers, *Cloud computing in government explodes*, Deloitte, February 02, 2011, available on: <http://globalblogs.deloitte.com/deloitteperspectives/2011/02/cloud-computing-in-government-explodes.html>;
- [15] *Orchestrating the New Paradigm KPMG's Business Guidelines to Cloud Computing and Beyond*, KPMG Advisory, 2011. Available at: <http://www.kpmg.com/TT/en/IssuesAndInsights/ArticlesPublications/Documents/Cloud-Paradigm-Art.pdf>
- [16] D. McClure, *Cloud Computing: Statement*, General Services Administration, July 1, 2010. Available at: <http://www.gsa.gov/portal/content/159101>
- [17] V. Kundra, *Federal Cloud Computing Strategy*, February 8, 2011, p.39. Available at: <http://www.cio.gov/documents/federal-cloud-computing-strategy.pdf>
- [18] *Global Access Partners Task Force on Cloud Computing: Final Report*, GAP, May 2011, Australia, p.59. Available at: <http://www.globalaccesspartners.org/Cloud-Computing-GAP-Task-Force-Report-May-2011.pdf>;