Cloud for eGov: the state of the art

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Abstract. Specifically, the paper provides a detailed analysis of the state of the art regarding technological, regulatory and interoperability aspects, devoting particular attention to those projects (and related experience) in the field of cloud and distributed computing. The paper's aim is to evaluate benefits and risks of the applicability of solutions that are already in place for the specified areas of interest. The key factors that determine relevant regulations, with particular emphasis on the European target, have been listed in the paper. Finally, the main Italian projects and the situation in some European countries have also been mentioned.

Keywords. Cloud distributed computing, egov

1. Introduction

Any models for cloud computing implementation are bound to feature advantages and disadvantages. The model choice depends on the intended usage of the model itself and on the related requirements. Despite the huge saving of resources and the high potential, the widespread use of a "public cloud" is affected by a number of constraints, such as data control requirements or legal compliance issues. Especially in the e-Government field, criteria such as safety or data protection do play a crucial role.

Several studies have been carried out to investigate the use of cloud computing for public services [10]. Most studies recommend the private use of a cloud for public authorities and public clouds usage for the community. For example, because of the heterogeneity of national laws and regulations, also ENISA recommends these two models for e-Government applications. Basically, they state that "in terms of architecture, private applications and community clouds appear to be the most suitable solutions that are currently available to fulfill the needs of Public Administration bodies (PA), as they offer the highest level of data management, control and visibility " [4].

This paper aims to provide an analysis of the state of the art in relation to regulatory, technological, and interoperability aspects, with regard to existing projects and experiences of cloud computing.

Section 2 provides an analysis of the regulatory aspects. It may be useful to note that the cloud is a relatively new phenomenon, as well as a complex and structured one. Therefore, a careful study of the existing legislation and of similar legal implications may provide useful insights both in relation to the ability to introduce innovations fully supported by current regulations, and to guiding lawmakers in regulating new ones. Another important aspect that should be considered is the study of different types of contracts that may be suitable to define the underlying relationships between stakeholders and, consequently, to indicate the most appropriate framework to fulfil the

interests of the parties involved. A general overview will be provided concerning cloud application scenarios and/or some single aspects of the matter in question, such as open data, transparency, interoperability, federate identity, etc..

As regards the design experiences gathered from national and international projects and described in Section 3, we do not intend to provide a comprehensive guide of the state of the art, but rather to identify different approaches, success stories and solutions that are being developed or are already in place across Europe, and beyond, by providing information about the technical, economic, legal and political perspectives.

2. Analysis of regulatory aspects

Nowadays, many people argue that the introduction of increasingly innovative technology is changing economies and the ideological foundations of society. According to Peter Senge, theorist of the Learning Organization (P. Senge, "The Fifth Discipline: The Art and Practice of the Learning Organization." New York, 1990), the focal point in the evolution of the bases of modern economy is to be found in the replacement of fixed assets (as driving force for development) with information and knowledge. Moreover, that was accompanied by momentous changes that have characterized the western world in the last fifty years, such as the end of the welfare state, the fall of the Fordist model and globalization.

The result is the need for a "governance of change" in order to manage and fully implement the information and knowledge society. Governing the change also means setting forth guidelines aimed at ensuring stability and balance within society, as well as highlighting and exploiting the new opportunities offered by the development of the new society. The digital revolution we have been witnessing is going to transform the existing society into a "post-industrial" one, where technology development, information dissemination and knowledge sharing are going to play a decisive role.

The IT market occupies a significant position within the European economic scenario. According to Eurostat data,[1] the IT sector is amongst the top fifteen industries, in terms of both workforce and added value. When properly used within the public administration domain, Information Technology may provide an important element of selective regularization for the economic system.

Within such a scenario, besides promoting the public sector's efficiency and effectiveness, an e-Gov cloud project could be introduced as a proactive lever from the business world through the identification of initiatives to be implemented and to be developed with reliable timing and methods, in order to take advantage of the opportunities offered by the digitization process. Such initiatives may include: (i) opening of new market opportunities for ICT companies, products and services, which may also promote employment, in line with international trends; (ii) development of new ICT services to be acquired from the market to ensure the internal efficiency of companies and a better service for users.

As a growing phenomenon within the national and European scenario, Cloud Computing, seen as a set of technologies facilitating the use of IT resources (infrastructures, platforms, processing power, applications), such as services provided

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[1] http://ec.europa.eu/eurostat/data/browse-statistics-by-theme

through Internet, is the great promise in the ICT world. This seems to have the potential to modernize the IT systems of Italian companies and PA bodies, besides making them less expensive and more efficient too, and to encourage small and medium enterprises to use IT more intensively, stimulating, therefore, an expansion of the ICT market.

Hence, Cloud Computing is going to be one of the most interesting scenarios within the public sector in the coming years. To rationalize and contain expenditure, PA bodies could start to develop a Cloud process, by responding to stimuli coming from the European Union within the G-Cloud. In March 2010, the European Commission tried to understand the state of "GovernmentCloud Computing" in Europe (amongst the members of the European CIO Network – through an informal roundtable for national representatives in the Management Committee of the European ISA programme - Interoperability Solutions for European Public Administrations[2]). The results obtained were as follows:

- Four EU member states already have a GovernmentCloud Computing strategy in place;
- Half of the member states stated that they had already used the Cloud for some centrally provided public services;
- Over half of the member states foresee to have some pilot projects ready by 2010-2011, national strategies in place by 2011 and public services in operation by 2012.

In actual fact, the route towards the Cloud is not free from obstacles. There are still many issues that may slow down the implementation of such systems. The main ones are related to protection and safety of the data stored in the Cloud, to a guarantee of service continuity, to regulations (that may not be the same as those in the country hosting the service), and to the actual interoperability/integration with internal systems. Other uncertainties are related to the types of contracts and to the service levels to be agreed upon, to the few best practice policies to be used as a comparison, to the fear of limitations imposed by third parties for critical activities, resulting in an excess of bargaining power that providers may enjoy. Through an analysis of the Italian context, the main problem to overcome seems to be the presence of a culture based on the physical possession of data, which hinders cooperation between the various PA bodies, in addition to some particular regulatory constraints. [2,9].

In addition to the above-mentioned concerns, there remains an opportunity for all businesses and PA bodies, whether large or small, to become more efficient and closer to their citizens. The Cloud concept is going to be increasingly pervasive and the "Cloud Economy" (i.e. productive systems based on Cloud usage) is a topic that's already being discussed. According to the CloudDividend report, in Italy, the benefits obtained through the Cloud Economy by 2015 were estimated as amounting to Euro 35 billion, in terms of increased productivity. [1,5]

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[2] http://www.eurocio.org/

3. The current regulatory framework by areas of interest

3.1. Data and availability

This is the main problem that is encountered when any cloud computing activities/services are to be carried out or provided. Further issues are also linked to that, such as those concerning data access, sharing, free data usage by end users, besides the implications related to recent phenomena such as open data, open access, open government and all the "open" movements that, by now, seem to belong to the entire PA apparatus. This means that, nowadays, it's just impossible to disregard the need for instant access to data (either from a timing point of view or in relation to any intermediary intervention between users and data) and the ease of data "withdrawal", whenever requested by the user. [3,8]

With regard to the context illustrated above, the relevant basic regulations are listed here following:

a) Regulations concerning the plain and simple "Data Protection".

   i. In Italy, general data protection has to be specified pursuant to the main relevant regulation, i.e. the Legislative Decree No. 196 of 2003 (the so-called "Privacy Code").

   ii. In Europe, to date, it is still necessary to specify the compliance with the EC Directive 2006/24/EC on data storage and communication services (the so-called "*Data Retention*").

b) Data handling and safety.

   i. In Italy, the basic relevant regulation is still the "Privacy Code" mentioned above, with some further requirements specified in the section concerning safety (see relevant section).

   ii. In Europe, reference is made to the EC Directive 2006/24/EC on the Data Retention phenomenon.

c) Data accessibility, as regards the ease and speed of use.

   i. In Italy, the accessibility of data and platforms, or of IT systems involved in the handling of data, is governed by the so-called "Stanca Law" (Law No. 4/2004) and by the Digital Administration Code (the Italian CAD) (Legislative Decree No. 82/2005), especially as regards PA websites.

   ii. In Europe, the number of EU's accessibility policies continues to grow[3], together with many further references, such as the e-inclusion campaign, the EU's e-inclusion website, with some sections devoted to mature users, e-accessibility, broadband divide, e-Government for everybody's benefit, IT literacy and culture; in addition to the progress made in the field of e-accessibility in Europe.

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[3] http://europa.eu/geninfo/accessibility_policy_it.htm

d)   An additional problem concerning cloud computing may be the one originating from an excessive fragmentation of data, or rather from their extreme "delocalization". In fact, it may happen that data which have been "sprayed" somewhere else on the web have to be brought back to the local server. In such circumstances the regulatory function should also tackle the delicate aspect of interrupting business dealings with a given provider (in this particular case, with the provider-administrator of the "cloud" web server).
The most relevant regulatory tool for such cases, at both national and European level, remains a written contract, which should be particularly articulated and detailed and suitable to govern the relationships to be established between the parties involved in relation to the cloud computing service.

e)   Another aspect (still related to data and their "usability") is the open data one. In this case too, there are regulatory indications by Italian and European lawmakers (and Italian lawmakers should adjust to the European provisions).

  i.   In Italy, the emerging phenomena concerning open data, openGovernment etc. are regulated by the following laws: first of all, by Art. 97 of the Italian Constitution, which states the principle of good administration; then by Law No. 241/1990, which governs, amongst other things, the so-called access right; by the Legislative Decree No. 82/2005 (CAD); and by some other special regulations.

  ii.   As regards Europe, the EC Directive 2003/98/CE on the re-use of information within PA bodies can be referred to.

3.2. Data privacy

Moreover, it should be pointed out that, in Italy, the Privacy Guarantor has tackled the cloud computing phenomenon through some special provisions. A particularly interesting one was titled "**Cloud computing**: indications for an informed use of services" (*"Cloudcomputing: indicazioni per l'utilizzo consapevole dei servizi"*) and was published on the following website:
www.garanteprivacy.it/garante/document?ID=1819933 (please refer to such a provision).
At European level, several regulations have also been issued (data privacy directives). Amongst them the "old", forerunner Directive on data privacy stands out (95/46/CE) and, in spite of everything, it still offers a kind of legal protection that not all the countries outside the EU are able to ensure.

3.3. Copyright protection

Another "industry" that cloud services can reach is that concerning the distribution of data for which intellectual property rights can be claimed. In this case, a reasonable risk exists about difficulties in controlling user access to such data, as currently defined by law.

For example, that has already occurred with the Google book service which is quite "**cloudy**", (see http://books.google.it/). The service is very interesting and complex because of the implications it entails. The most immediate problem is the one associated with possible copyright infringement. Google's aim was to provide a tool for the promotion of books and not to break intellectual property laws, but the whole matter needs to be ascertained. In this context, the reference standards are as follows:

     i.   In Italy, the **copyright law (Law No. 633 of 1941, better known in Italian by the acronym "l.d.a.", which aims at governing copyright infringements)** and an Industrial Property Code (Legislative Decree No. 30 of 10th February, 2005) that was developed to provide a general protection for intellectual/industrial property. The protection of the intellectual property and of the copyright holder is also widely "spread" over the Civil Code (Art. 27).

    ii.   European legislation on copyright is part of the regulations set forth by the World Intellectual Property Organization (WIPO), which was created to achieve a double aim: protecting the financial interests of authors of art works, such as books, films, music, as well as those of databases, without hampering creativity and innovation.

3.4. Education and information rights

Another area where cloud computing services could be used is the education and training one. In Italy, cloud services have recently started being provided to students at Rome's La Sapienza University and University of Camerino. In fact, cloud technology may be used by university all over the world, as it's already happening in the United States where 66 out of 100 most prestigious universities, including Berkeley and Harvard, have implemented Google Apps for Education. Future applications may involve sharing **e-learning** platforms and **cloud computing** devoted to education. Reference regulations are listed here following:

- In Italy, the Constitution works as "guarantor" of personal rights:
  - Right to inform and be informed (Art. 21);
  - Right to education – research and teaching (Art. 33);
  - Right to full personal development (Art. 2 – so-called "open provision" that should also include the recent right to Internet).
- In Europe, relevant regulations are mainly based on the Universal Declaration of Human Rights (UDHR) issued by the United Nations in 1948.

3.5. Safety

With regards to IT safety, our country has implemented the provisions against IT Crimes a long time ago, in compliance with European Directives already in place.

Therefore, the relevant regulations set forth by lawmakers to govern IT system violation issues may be summed up as follows:

    i.   In Italy, Law No. 48 of 2008, Legislative Decree No. 109 of 30th May, 2008 – implementation of the Directive on data retention;

    ii.   In Europe, the Budapest Convention of 23rd November, 2001, in addition to the above-mentioned Directive No. 24 of 2006 on data retention (…).

4. Existing solutions for PA bodies and best practices

4.1. The Italian experience with SmartGov, territory and taxation

As regards SmartGov, territory and taxation tools available online, a short description of some projects and related experiences is provided here following.

Mcloud Project[4]: Marche's Regional Government has been working for some time on an advanced cloud computing infrastructure named "Software As A Service", in cooperation with the National Nuclear Physics Institute (CNAF at Bologna and Perugia), the University of Camerino and the Polytechnic University of Marche (Information Engineering Department). Within such a context, the Mcloud pilot project was deployed in order to evaluate the most effective method to implement the cloud system and, at the same time, to provide a safe service for electronic medical reporting to patients and regional health system users.

CloudToscana Project[5,6,7]: Through the development of the new TIX (Tuscany Internet Exchange), Tuscany's Regional Government has achieved a most important goal, i.e. creating a new service oriented centre. The project's guiding principle was a vision based on the XaaS paradigm that would allow for the development of a solid bridge between the management of supply and demand for ICT by the Regional Government to satisfy its stakeholders.

CleanMoon Project[8]: The Clean MooN Project (Clean Mooring Network) OLBIA has been primarily applied within the *smart culture* and tourism sectors. In fact, it tackles the issue of handling the international nautical tourism in favour of cities which have tourist harbours. The project is aimed at offering special tourist routes that enhance the value of the surrounding territory by highlighting its peculiarities, typical products, culture and art. Local economy and companies are going to benefit from the project and, thanks to a smart governance of the tourist flow, the quality of hospitality and of the environment can be improved too, so that the tourist season may last longer and be more profitable.

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[4] http://www.ecommunity.marche.it/AgendaDigitale/MCLoud/tabid/156/Default.aspx

[5] http://open.toscana.it/web/cloud

[6] https://www.tix.it/web/guest/Cosa-offre-il-TIX

[7] http://open.toscana.it/web/cloud

[8] http://nuke.valorizza.info/Portals/0/Monografie/Clean%20Moon.pdf

Cloud4eGov Project[9]: The project's mission is developing a cloud computing platform to enable the association and interoperability of open or proprietary cloud solutions, in order to support new means of interaction between citizens and PA bodies. Another goal of the project is to offer PA bodies an environment that should allow for the development of eGovernment applications for citizens and companies, and for the subsequent opening of the service to the outside world without having to set up dedicated IT and TLC infrastructures.

Prode Project[10]: The name is a synonym for "Dematerialization Project". This is an interregional project aimed at defining a dematerialization system model. The PA bodies involved have developed a first vision of the issue and, at a later stage, have also designed an actual project to define and share the specific techniques, as well as the subsequent planning of activities to be carried out throughout the territory in every Autonomously Governed Region and Province district, so that individual systems could adjust to the shared specifications.

4.2. National experience in the field of infomobility and video surveillance

Vi.So.Re. Project - Treviso[11]: The project includes the development of two integrated sub-systems – one for video surveillance, for both municipal authorities and the State Police, and one that allows reading car registration plates which is used by the State Police. Such systems enable users to collect, exchange and analyze information through a connecting, integrated network. It is just the connection between the two sub-systems that makes the project unique, to the point that it has become an experimental model nationwide.

Cagliari 2020 Project[12]: It is an initiative aimed at optimizing city transport, by reducing traveling time and, above all, by improving air quality. Such a project (that relates to smart cities and communities efforts) also involves Vitrociset (a company that is partly owned by Finmeccanica, and is specialized in innovation), Space Spa (Pmi), University of Cagliari (Electronic Engineering Department), CTM (the local public transport company), under the sponsorship of Cagliari's municipality, INFN (National Nuclear Physics Institute).

INFOCITY Project[13]: The project's objective is to develop an open, multimode, infomobility system that should be independent, integrated and interoperated, to provide statistical and dynamic information before and during the trip (pre-trip and on-trip), in relation to the overall transport offer and traffic conditions. The information

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[9] http://www.toscana-notizie.it/documents/735693/1369400/Cloud4eGov.pdf

[10] http://www.progettoprode.it/

[11] http://www.infracom.it/it/categoria-comunicati-stampa/145-infracom-italia-l-hi-tech-della-videosorveglianza-evoluta-si-aggiudica-il-progetto-vi-so-re-di-treviso-insieme-a-kapsch-trafficcom

[12] http://www.unica.it/pub/12/show.jsp?id=18989&iso=913&is=12

[13] http://www.progettoinfocity.it/

should be provided in real time, and should be georeferenced and customized according to the actual needs of end users.

4.3. National experiences in the field of "Health"

Here following a brief description is provided of those projects, and related experiences, concerning the health sector and which are available online.

Mcloud Referti Service[14]: It is a reference pilot service within the Mcloud Project implemented by Marche's Regional Government. The service allows users to view the results of clinical tests carried out at laboratories belonging to the Regional Health Authority network and to the Ancona's Hospital Corporation.

G-Cloud Lazio Project[15]: The experimental phase of G-Cloud for PA bodies has been a technological opportunity that, by superseding expensive data-centres and by making the basic application platforms converge, facilitates the consolidation and concentration of IT resources. This translates into significant financial benefits for both local authorities and small-medium sized companies. It is available to Lazio's Regional Government bodies, companies and other bodies partly owned/controlled by Lazio's Regional Government, and Lazio's 12 Local Health Authorities.

Cloud4CARE Project[16] (Cloud4CAncerREsearch): It was the first "scientific-banking cloud project" implemented in Italy, in order to support cancer research through safe network connections and IT systems running within safe environments. It is a flexible and scalable solution that, since its first phase, has been enabling users to significantly reduce (by about 90%) the time devoted to the analysis of data concerning a research on ovarian tumors, thanks to faster calculation speed (around 4,000 CPU and one terabyte of RAM).

5. Conclusions

This paper analyzes the state of the art of the components of open-source cloud applications and of Smart City governance through an analysis of solutions and synergies amongst existing projects. Our investigation focused on specific interest areas, and on the analysis of issues, benefits and difficulties found in each area.

The analysis of regulatory aspects was articulated by considering two levels of legislative reference, i. e. the European and the national ones. With regard to the latter, special attention was devoted to the implementation of the European Digital Agenda and the related technical and technological solutions developed in pilot projects within individual local PA authorities.

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[14] http://www.ecommunity.marche.it/AgendaDigitale/MCLoud/tabid/156/Default.aspx

[15] http://www.lazioeuropa.it/45_progetti_per_il_lazio-3/consolidamento_e_razionalizzazione_dei_data_center_regionali-35/

[16] http://www.01net.it/cloud4care-al-mario-negri-nuvola-privata-per-ricerca-pubblica/0,1254,1_ART_153999,00.html

Regulatory issues concerning the relatively new phenomenon of cloud computing (especially if involving PA) are going to evolve and change over time. Therefore, only a thorough and timely analysis of current regulations may guide lawmakers in their efforts to define new laws, and IT providers in the development of new services.

Over the last decade, several projects concerning distributed computing infrastructures (DCI) and cloud computing have been financed by national or European funds (with the involvement of various countries). In this paper, such projects were analyzed with the specific objective of collecting experiences and solutions that may be useful to make future projects successful.

To conclude, by analyzing different aspects of technology and regulatory issues concerning existing cloud computing solutions for PA bodies, this paper aimed at providing a solid starting base for the evolution of later projects and for the advancement of the respective Relational Objectives, by doing what follows:

- favouring the re-usage of standards and technological components;
- verifying whether current regulations may be suitable and up to date;
- highlighting experiences and solutions from other projects.

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