MANAGING A CLOUD-BASED DOCUMENTS SYSTEM

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ABSTRACT: The paper presents characteristics of the Cloud systems and the way multiple users can share available resources. It also presents types of services that may be provided by cloud, compared with classical systems, together with advantages and disadvantages that users can come across when using the cloud systems. The paper approaches the Cloud system manager's tasks compared to organizational management. At the end of the paper we present, as an example, the cloud system implemented at ICI Bucharest and some of its beneficiaries.
KEYWORDS: cloud, system, computing, infrastructure, administrator, platform, manager.

1. INTRODUCTION

The term of “Cloud Computing” involves the storing, processing and usage of data, applications and information systems on remote equipment. Access to Cloud resources is done through Internet-based communication systems.

It is widely recognized that Cloud Computing systems reduce costs on users' side and facilitate the development of numerous services. Usage of cloud computing is increasingly spreading in various fields: energy, environment, health, education and culture, and, especially, in public administration, due to the ways these systems facilitate inter-operability. Some authors consider that “Cloud Computing represents a new phase of industrialization (standardization, expansion, broad availability) in providing computing power as a matter of public interest ("utility computing") comparable to the industrialization of the supply of electricity power plants energy" [1].

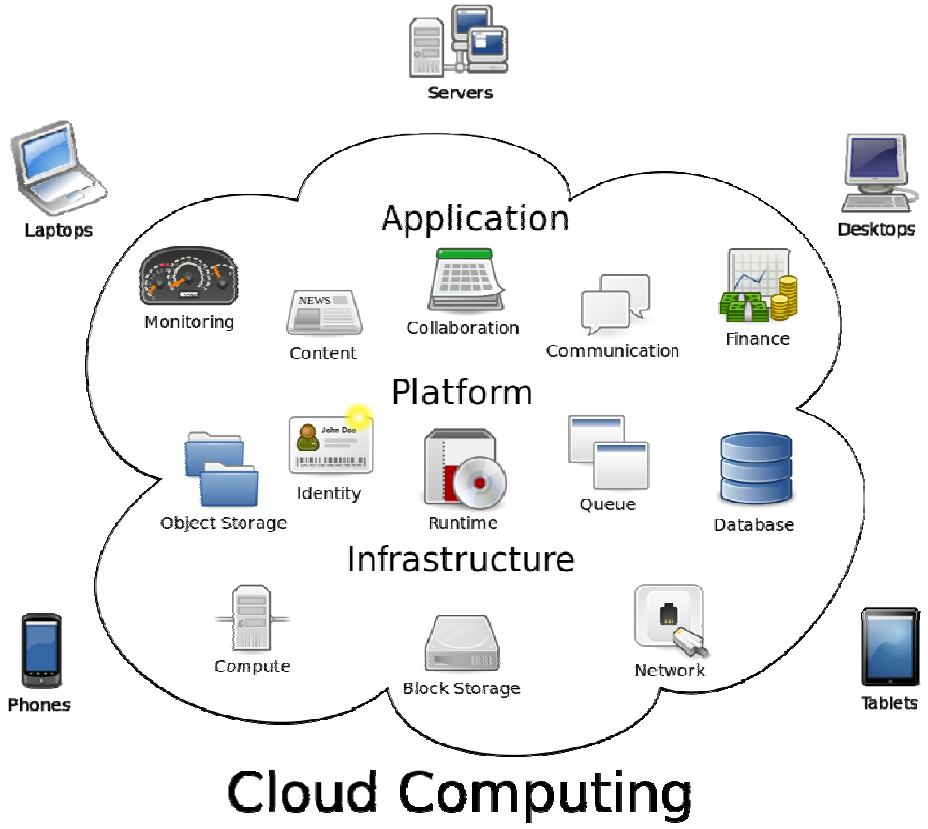
When it comes to IT&C, Romania is not among the EU foremost developed countries, occupying the 67th position f the 142 countries ranking of The Network Readiness Index (NRI) 2012. Romania had fallen from the 59th position out of 133 countries in NRI 2009. In the 2011-2015 plan on e-Government for Europe it is highlighted that the IT system currently used in public administration is characterised by fragmentary access to resources, duplicate systems, poor use of available resources, complicated procurement procedures, and, generally a complicated environment for management and control, with immediate effect on the quality of services provided by the Government to the citizens. An important factor in the development of e-Government services is the Cloud Computing system, that can significantly help the Government through services of high availability, innovative and accessible immediately to the citizens and to the business community.

The Cloud Computing concept is presented schematically in Figure 1.

Immediately after the launch of the Cloud Computing concept, industrialised countries have started studies and research on how to implement Cloud systems in various areas, especially in the public administration domain.

Among the most notable initiatives in the EU member countries are: G-Cloud (United Kingdom), Andromede (France) and Trusted Cloud (Germany). All these projects have demonstrated particular efficiency as a result of optimization of data centers usage. In the United Kingdom there has been a 10% less power consumption in infrastructure compared to standard non-Cloud solutions. Also, at European level, there is a single point of access to a wide range of data relating to institutions and bodies of the European Union, “EUROPEAN UNION OPEN DATE" [2]. It provides free and easy access to data, aiming to promote

innovative use of it and increase its economic potential. Outside the European area, the Open Government initiative (also known as Open Data) from the U.S. Government is noticeable, which aims to increase the transparency of the Government actions, through standardization, consolidation and unified presentation of data.



Source: http://ro.wikipedia.org/wiki/Cloud_computing#mediaviewer/File:Cloud_computing.svg

Figure 1. Cloud Computing conceptual diagram

According to a study conducted by International Data Corporation [3] at European Union level, a direct investment of 45 billion EUR in Cloud Computing Services in 2012, would have had by 2020, an impact on gross domestic product (GDP) of 957 billion EUR. These facts compel the academia and the research community, and also the managers, regardless of the decision-making segment, to pay increased attention to the Cloud systems.

2. CLOUD TECHNOLOGY PATTERNS

Cloud Technology patterns used in organizations are mostly Private or Hybrid type, while service providers use the Public and Hybrid type (Figure 2).

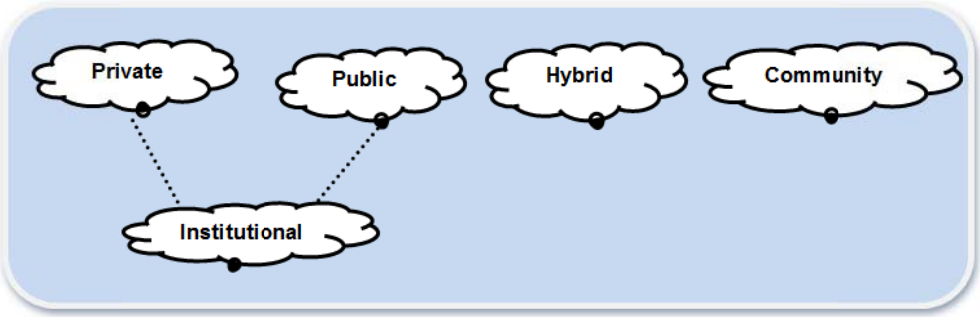


Figure 2. Cloud Technology Patterns

Private Cloud: the IT infrastructure is used by one organisation consisting of several users and can be administered by the organisation itself or outsourced to a third party.

Public Cloud: the IT infrastructure is available to the public or a part of the public, on basis of certain criteria, or a segment or area of interest.

Hybrid Cloud: the IT infrastructure is composed of one or more components of the public or of the private type Cloud technology, taken as a whole while using the same technology.

Community Cloud: the IT infrastructure is shared by several organizations in order to provide services to a particular community, that shares the same functional requirements.

Institutional Cloud: Cloud infrastructure administered by an organization and used by multiple users.

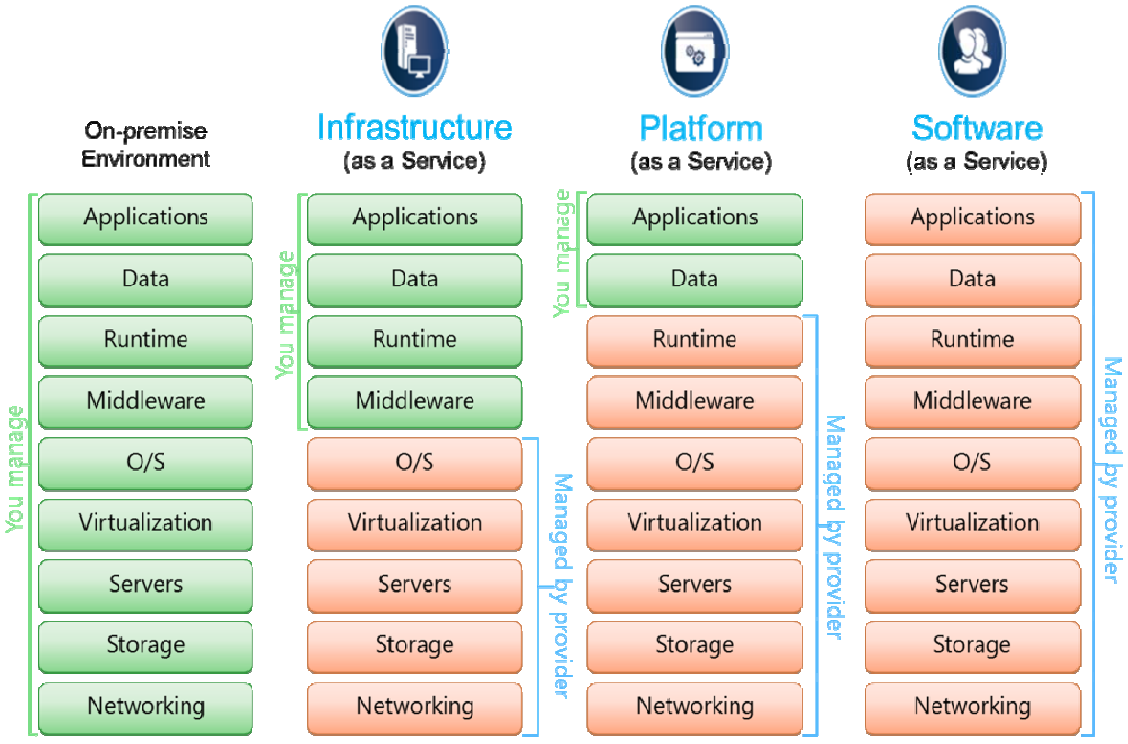
The Cloud System manager has several functions similar to an organization Manager. We can make a direct parallel between the functions of a Cloud System manager and those of an organizational manager. In Table 1 are shown the main attributions of a Cloud System manager compared to the ones of an organizational manager.

Table 1. Comparison of functions between an organizational manager and a Cloud System manager

Manager	Cloud Manager
Foresight	Planning users' activities (access rights, resource allocation, planning teams working in the cloud)
Organising	Organizes physical paths in the Cloud Organises operational and maintenance technical teams (number of shifts, appointing responsibilities, etc.) Organizing security systems
Command	Deciding how to implement security systems Assigning tasks according to abilities and job requirements
Control	Checks compliance with the appointed tasks Checks compliance with the users' data/resources security and privacy regulations Checks system's functionality

3. CLOUD COMPUTING SERVICES

Cloud Computing Systems can provide many types of services. Figure 3presents some of these services [4].



Source: https://www.simple-talk.com/iwritefor/articlefiles/cloud/2011/11/cloud-service-model.png

Figure 3. Types of services in Cloud Computing

The service types were specified by NIST (National Institute of Standards and Technology) [5], and grouped into three main categories or "service models."

IaaS (**I**nfrastructure **a**s **aS**ervice): the first model that respects the Cloud Computing characteristics as specified by NIST (National Institute of Standards and Technology). In this case, a service provider leases the IT infrastructure.

IaaS examples: Amazon Web Service (AWS), Google Compute Engine (GCE), Rackspace Open Cloud, IBM SmartCloud Enterprise, HP Enterprise Converged Infrastructure.

PaaS (**P**latform **a**s **aS**ervice): the provider maintains and offers pre-configured components including programming languages, application servers and databases for developers of web applications.

PaaS examples: Engine Yard, Red Hat OpenShift, Google App Engine, Heroku, AppFog, Windows Azure Cloud Services, Amazon Web Services AWS, Caspio.

SaaS (**S**oftware **a**s **aS**ervice): the provider offers to users applications "on-demand".

SaaS examples: Microsoft Office 365, Google Gmail, Google Docs, Zoho Office, Salesforce, Citrix GoToMeeting, Cisco WebEx.

Each of these services has advantages and disadvantages for the end user. In this regard, users must make a detailed analysis of the cost / performance elements, and take a decision accordingly.

4. ADVANTAGES AND DISADVANTAGES OF CLOUD COMPUTING

A survey conducted in 2011 by the European Commission shows that, following the adoption of Cloud-Computing, 80% of organizations reduce their costs by 10-20%, with significant increases in the following components: labour mobility (46%), productivity (41%), standardization (35%), as well as, new business opportunities (33%) and markets (32%) [3].

Table 2 compares Cloud model characteristics to the traditional ones.

Table 2. Cloud model characteristics compared to the traditional ones

Traditional model	"Cloud" Model
Each entity maintains its own IT infrastructure	The infrastructure is shared and used as needed by several entities
The systems are heterogeneous and complex	The platform is homogeneous, simplified and controlled as a unit
Infrastructure management is carried out by those in charge with the processes	The infrastructure is virtualized, optimized and managed by a specialized team
The level of assistance from authorized staff is low	High level of operational support
The security level is low and each component of the process needs to be secured	High security over the entire system
Intensive use of energy resources in order to operate a large number of data centres	Optimized use of energy resources by aggregating data centres

Cloud Computing presents a number of features and benefits:

- Cloud Computing provider manages the systems and the storage devices (hardware), not the user that interacts with it through the Internet;
- The systems are virtualized within a network, and the user does not know precisely the exact location of data or the processes, only the access point to the infrastructure;
- The user can very easily and quickly change the hardware volume he/she uses, i.e. increasing storage capacity;
- The user can access data and programs when needed through a device (PC, laptop, tablet, smartphone) connected to the Internet;
- For a user who uses multiple devices connected to the Cloud, data synchronization is simplified;

- The Cloud service provider can migrate certain client processes optimizing available resources;
- User pays according to usage, very much like a public utility service (eg.: electricity), with no costs related to configuring and operating the systems.
- Disadvantages of Cloud Computing regard several key aspects presented below:
- Fast Internet and secure communications - the user needs a stable and fast connection to the Internet;
- Data Security - all data and records are held by the service provider and this can lead to user distrust in the provider keeping the data confidentiality and integrity;
- Unwanted attacks - DDoS (Distributed Denial of Service) type attacks are more common in Cloud Computing;
- Processing of personal data and the free movement of such data (lack of user control over that data and insufficient information on how, where and which entity is processing that data), the user does not know whether the personal data is stored domestically or abroad;
- Concentrated infrastructure - hardware, software data - in the event of a major incident, the user can lose programs and data entirely, if the Cloud Computing system lacks specific safeguards (data recovery, back-up systems);
- Appropriate legal framework - the operational legal framework is not comprehensive enough to cover possible, sometimes unwanted, scenarios [6].

5. ICIPRO PROJECT - EXAMPLE OF CLOUD COMPUTING SYSTEM

National Institute of Research - Development in Informatics - ICI Bucharest implemented through ICIPRO Project (Cloud-type Infrastructure for Public Institutions in Romania), a Cloud-type platform with the following services:

- IaaS - Infrastructure as a Service - represented by virtualized servers, data storage space, virtualized sets of resources with access to the self-service-type interface. This service offers to various institutions a “self-service” type software interface for access and management of virtualized computing resources. ICIPRO platform is a platform for cloud services hosted within the ICI data centers, and based on Windows Azure technology.Through the self-service Portal within the infrastructure services, users having the necessary clearance level will be able to allocate and administer infrastructure services. Specifically, through this portal they will be able to define virtual workstations, they will be able to manage the parameters of these virtual workstations, they will be able to define and manage complex services running on multiple virtual machines.
- Virtual Library service offers public institutions access to electronic archiving services and the opportunity to publish electronic documents through a public access portal. The electronic documents archive implemented within this service ensures storage of documents in professional conditions regarding security and safety, and also grants management rights at document level for the owner of the document.
- Through the Open Data Service, public institutions are able to publish in a standardized manner public information, generated by the institution itself or as replies to public requests. For each data set published through the portal, there are made available to the users metadata describing the data set: brief description, source (the institution which has generated the data), status (e.g. work in progress, finished version), the type of data (e.g. Statistical, Legislative Initiative, map, etc.) notes from the authors, authors' contact info.
- Inter-operability Platformis a middle-ware and integration solution that provides process management and operational abilities, leading to the development of a SOA type architecture (Service Oriented Architecture) and implementation of infrastructure for:
    - Inter-connectivity of applications that already exist within an organization - EAI (Enterprise Application Integration);
    - Inter-connectivity of applications from different, partner, organizations, - Business-to-Business (B2B) integration;

- Definition and management of business processes and regulations - BPM (Business Process Management)[7].

The schematic diagram of the system is shown in Figure 4.

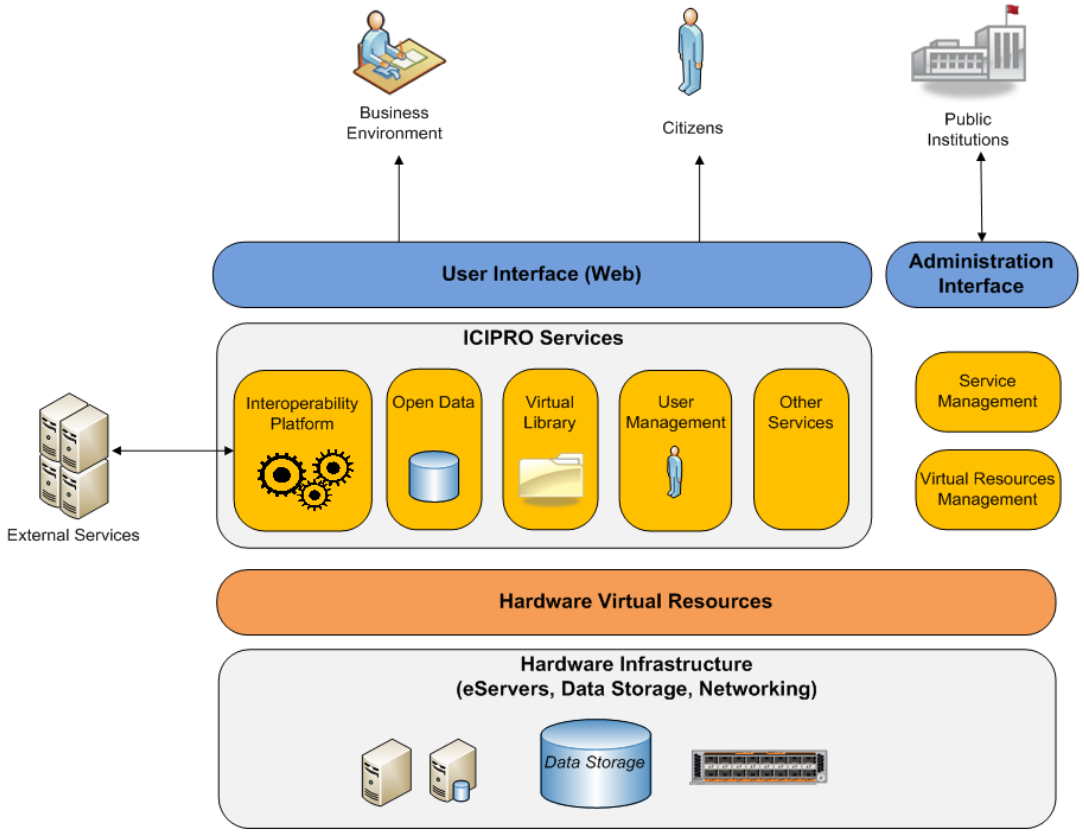


Figure 4. Schematic diagram of the ICIPRO system

ICIPRO project is an institutional Cloud. Management of the system is entirely ensured by ICI Bucharest, through all the functions presented in Table 1. Most of these features are carried out by a centralized management system, developed within the Cloud (Microsoft System Center), ensuring the following functionalities:

- Provisioning and service management in a virtualized environment;
- Application monitoring (operating systems, middle-ware, databases);
- Management of virtual machines' configuration (e.g.: management of updating the virtual machine's operation system);
- Management of the virtualization system;
- Optimize performance and capacity through analytical tools, dashboards and alerts;
- Ability to create and implement recovery plans, and also the possibility of extending them through scripts.

Currently the system has several beneficiaries, apart from ICI-Bucharest - the owner - that has moved 70% of its IT infrastructure into the Cloud.

The Cloud platform provides services to 27 entities, while for other entities the Institute is in the process of establishing the specific usage procedures. Totally, there are 31 subscribed Public Institutions as follows:

- 10 public libraries;
- 11 public Universities, and Research and Development Institutions;
- 7 central public institutions (ministries);
- 3 local public institutions.

Each institution has its own secure system for generation, assignment and management of passwords and of the resources that it has requested.

For maintenance of these systems 3 categories of human resources are necessary:

- Staff for permanent maintenance (access control, video surveillance, fire detection and monitoring, monitoring air-conditioning equipment, power supply monitoring, monitoring the building etc. - 4 persons);
- Permanent stand-by (3 shifts of 2 persons each);
- Staff for technical services (account validation and allocation of IT resources to users, system monitoring and updating etc. - 4 persons);
- Customer service (2 persons).

6. REFERENCES

1. ***:http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0529:FIN:RO:PDF
2. ***: European Union Open Data Portal, http://open-data.europa.eu/ro/data/
3. ***: Quantitative Estimates of the Demand for Cloud Computing in Europe and the Likely Barriers to Take-up **IDC (2012)**
4. ***: An Introduction to Cloud Computing Characteristics and Service/Deployment Models, http://cloud.dzone.com/articles/introduction-cloud-computing
5. ***: National Institute of Standards and Technology, http://www.nist.gov/
6. Banciu, Doina; Andrei, Neculai; Dumitrache, Mihail; Sandu, Ionut-Eugen. *CLOUD COMPUTING – Noțiuni generale* (http://www.icipro.ro/cursuri/Curs_CLOUD_COMPUTING.pdf)
7. Dumitrache, M. *Servicii publice electronice oferite instituțiilor publice prin proiectul ICIPRO (Infrastructură de tip Cloud pentru Instituțiile Publice din România)*, In: Revista Româna de Informatică și Automatică, Vol. 25, nr. 4, pp. 27–32, București, 2015, ISSN: 1220 – 1758.