WP 3 – Model of Cloud Computing Services for SMEs in Montenegro

DEV 3.3 - Creation of CCS model for SMEs in ME

Table of Contents

[ANALYSIS CONCERNING OF THE CLOUD SERVICE DEVELOPMENT 5](#_Toc507583392)

[1. QUALITY, AVAILABILITY AND ACCESSIBILITY OF INFRASTRUCTURES FOR INTERNET ACCESS 5](#_Toc507583393)

[DEVELOPMENT AND ACCESSIBILITY OF THE SERVICE OF STATE ADMINISTRATION, LOCAL SELF-GOVERNMENTS AND BANKS, FOR CITIZENS AND PRIVRED 13](#_Toc507583394)

[LEGAL FRAMEWORK FOR CLOUD SERVICE DEVELOPMENT 16](#_Toc507583395)

[EDUCATION AND HUMAN RESOURCES 17](#_Toc507583396)

[IT SECTOR IN MONTENEGRO 18](#_Toc507583397)

[MODEL ANALYSIS OF THE CLOUD SERVICE DEVELOPMENT IN MONTENEGRO 19](#_Toc507583398)

[Cloud models designed for the SME market 20](#_Toc507583399)

[Cloud models intended for the educational and scientific-research community 21](#_Toc507583400)

[MINISTRY OF EDUCATION 22](#_Toc507583401)

[UNIVERSITY OF MONTENEGRO, Center of Information System 23](#_Toc507583402)

[Cloud model u public administration 24](#_Toc507583403)

[Cloud model for local authorities 25](#_Toc507583404)

Conducted survey and additional analyzes published with the ICT Committee of the Economic Chamber of Montenegro as well as an analysis of the legal and strategic documents of the State of Montenegro in scope of ICT showed that, in our opinion, Montenegro has still not reached satisfactory the level of information society development and that in the further development properly usage of cloud services can be both a generator and a catalyst for further development. All the elements of importance for the development of information society are at the same time the preconditions for the development of cloud services:  
- The development, availability and accessibility of telecommunication infrastructure, ie its segments that enable and define internet access,  
- Development and accessibility of state administration services, local self-government and banks, intended for citizens and business,  
- The existing legal framework and its adaption to the dynamic changes brought by digitalization of all elements of social and economic life recognized as digital transformation.  
- Intensive human resource development, dynamic change of education system and continuous education of citizens through elements of formal and informal education and continuous promotion of information society.  
- IT sector development in Montenegro,

Each of these assumptions directly affects the widespread availability of cloud services, unfortunately, presently neglected in social and economic life in Montenegro.

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# ANALYSIS CONCERNING OF THE CLOUD SERVICE DEVELOPMENT

## QUALITY, AVAILABILITY AND ACCESSIBILITY OF INFRASTRUCTURES FOR INTERNET ACCESS

The access and quality of available cloud infrastructure is directly conditioned by the quality of telecommunication infrastructure that depends on:

• The ISP number (internet service provider), currently in Montenegro there are 11 commercially active ISPs, of which the largest Montenegrin Telecom,

• Offer - accessibility and availability of fixed broadband Internet access

• Offer – accessibility and availability of mobile broadband access to the Internet

In the future, as the development of information society, as well as the potential development of the number and quality of the cloud service offerings by the state towards the citizens and the economy as well as within the state administration, will be put into function of the existing optical and radio-relay infrastructure owned by state enterprises.

According to the data of the EKIP (Electronic Communications Agency and Post Office) participation of fixed broadband technology in the Internet is at a satisfactory level, and technology and available speeds are often at the EU average level. The same goes for the quality and speed of mobile Internet and the penetration of fixed and mobile internet in households and businesses. **Viewed from the aspect of ACCESSIBILITY of telecommunication infrastructure as a prerequisite for the development of cloud service to citizens and the economy, this element is at a satisfactory level. But by analyzing the prices that the ISPs offer on the market and their comparison with the prices in the environment, especially in the use of higher speeds and static addresses (especially in the interest of the economy), we realize that the degree of availability is greater than the degree of REAL ACCESSIBILITY. This is a serious constraint on cloud computing, but also information society in Montenegro.**

Same data of the EKIP (Electronic Communications Agency and Post Office) on the availability of telecommunication infrastructure as a prerequisite for Internet access necessary for the use of cloud services are shown in the following pictures:

Figure 1 - Participation in fixed broadband technology in the Internet

Figure 2. - Penetration of fixed broadband Internet access in relation to the number of households

Figure 3. - Penetration of fixed broadband Internet access in relation to the number of households by region

Figure 4 - Distribution of Fixed Broadband Internet Access to Download Speed

The analysis of the number of connections and the degree of coverage of the territory as elements of availability suggests that there is really no significant lag behind the European average, even in some elements in Montenegro there is better performance of availability

**Situation in Montenegro (EKIP data):**

* NGA – 66.5 % of broadband connections
* FTTH/B – 25 % of broadband connections
* FTTH/B – 34.7% coverage
* 24.2 % broadband access speeds > 30 Mb/s

**Situation in EU (Izvor: Europe's Digital Progress Report 2017 – Connectivity)**

* NGA – 42 % of broadband connections
* FTTH/B – 11 % of broadband connections
* FTTH/B – 24 % coverage
* 37 % broadband access speeds > 30 Mb/s

The information society development strategy in Montenegro from 2016 to 2020 is envisaged to enable:

* + Availability of broadband access to 2Mb / s for 100% of population by 2018.
  + Broadband access speeds up to> 30Mb / s for 100% of population by 2020.
  + Using ultra-fast broadband access at speeds> 100Mb / s - 50% of households should be subscribers by 2020

It has already been noted that special quality and potential for cloud service development can be achieved by unifying the existing capacities - optical and radio-relay infrastructures owned by state enterprises of the Regional Waterworks, Railway Infrastructure, Radio Diffusion Center and the Montenegrin Electro-Transmission System (CGES). This infrastructure is now used inadequately and partially from the aspect of the development of an information society.

Figure 5. -Optique Infrastructure of ŽICG (Red), CGES (Green) and Regional Water Supply (Blue)

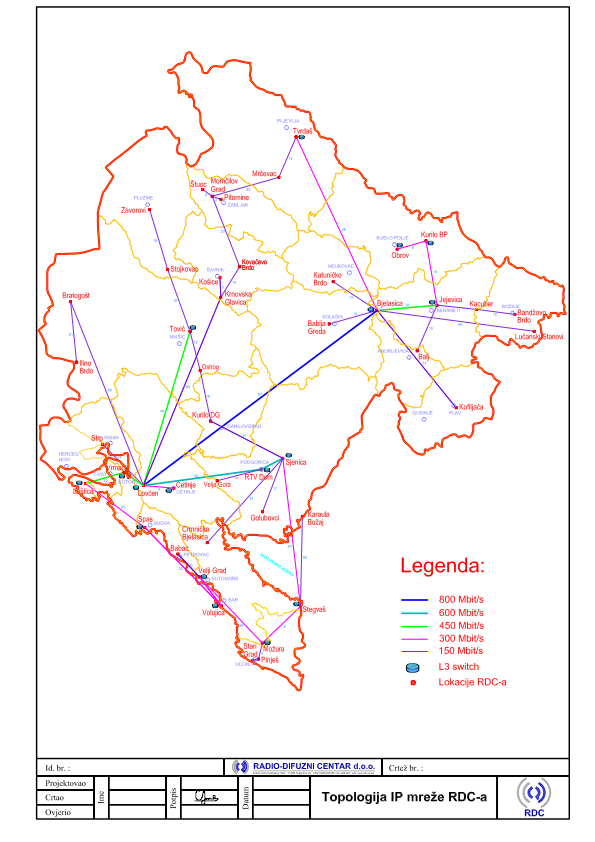


Figure 6 - Topology of the IP Network of the Radio Diffusion Center

# DEVELOPMENT AND ACCESSIBILITY OF THE SERVICE OF STATE ADMINISTRATION, LOCAL SELF-GOVERNMENTS AND BANKS, FOR CITIZENS AND PRIVRED

The ultimate goal of digital services provided by state administration and local self-government to citizens and businesses is to enable all natural and legal persons to use personalized cyber space under the control and protection of state or local governments through public portals. By accessing these specially-personalized cloud resources, users are able to manage personal information, finance, communicate with state bodies, or local self-government and use all the software resources that the state administration provides through cloud services to facilitate communication and regulation of rights and obligations.

Depending on the degree of interaction, electronic administration services are divided against EU standards into the following levels:

* Level 1 - Information: online information
* Level 2 - One way interaction: information and download forms
* Level 3 - Two-way interaction: online submission of forms, authentication
* Level 4 - Transaction: complete processing of items, with online payment service
* Level 5 - Personalization: My Portal

The first four levels are classical portal communication, and level 5 is enabled thanks to the overarching portal over cloud resources.

In Montenegro there are about 250 different e-government services available to citizens and businesses, but the degree of interaction is unsatisfactory and far from level 5. Although there are level 4 electronic services, there is no strategy for personalization of cloud resources, there is no strategy either plan for developing these cloud resources

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| --- |
| **20 BASIC SERVUCES OF eGOVERNANCE** |
| **NAME OF SERVICE** | Max. level | Level in MN | Service name | Max.level | Level in MN |
| **SERVICES FOR CITIZENS** | | | **SERVICES FOR COMPANIES** | | |
| **Tax application submission** | 5 | 4 | **Social Security for Employees** | 4 | 2 |
| **Looking for employment** | 4 | 3 | **Calculation, registration and payment of taxes** | 4 | 4 |
| **Social assistance** | 5 | 1 | **VAT** | 4 | 2 |
| **Personal Documents** | 5 | 1 | **Registration of the company** | 4 | 3 |
| **Car registration** | 4 | 1 | **Send data to the statistical service** | 5 | 4 |
| **Building permits** | 4 | 2 | **Customs declaration** | 4 | 4 |
| **Report to the police** | 3 | 2 | **Ecological permits** | 5 | 2 |
| **Public libraries** | 5 | 3 | **Public procurement** | 4 | 2 |
| **Documents (list of births, deaths, wedding ...)** | 4 | 4 |  |  |  |
| **Registration and enrollment at high school** | 4 | 2 |  |  |  |
| **Change of permanent residence** | 5 | 1 |  |  |  |
| **Health service** | 4 | 2 |  |  |  |

Figure 7 - Basic Electronic Services for Citizens and Companies

## LEGAL FRAMEWORK FOR CLOUD SERVICE DEVELOPMENT

Montenegro has a satisfactory legal framework defining the conditions and rules of conduct and development standards in the area of information-communication technologies. The basic laws in this area are:

- The Law on Electronic Administration

- The Law on Electronic Commerce

- Law on Electronic Communications

- Information Security Law

- Electronic signature Law

- Law on Central Register of Population

- Electronic Document Law

Also, a large number of bylaws have been issued in the form of a statute and a rulebook, which has been regulated in a satisfactory manner by creating the right assumptions for the development of information society. Contrary to this, in the Law on Electronic Administration it is explicitly defined that the registers of personal data of citizens can not be kept outside the borders of Montenegro, which is a powerful limiting factor for the use of cloud services offered to citizens in the cyber space. This law neglects the fact that cyber space has no boundaries and this provision currently negatively affects public opinion about the security of using the cloud system. This also destabilizes development of awareness of the need to build local cloud services.

There are ongoing activities in the adoption of the new Electronic Administration Act, but all controversial provisions regarding the use of cloud space have remained in the new proposal

## EDUCATION AND HUMAN RESOURCES

Personnel potential and human resources represent a very important element for the development of cloud services as an important information society, not only at the level of employees in the IT sector but because of the state of necessity and the development of IT awareness and the culture of all social factors. At all educational levels, it is incalculable to spread awareness of the possibilities of using the cloud system as the most profitable resource of infrastructure, hardware and software for citizens and especially for the SME segment of the economy.

Survey results show insufficient level of knowledge and need for using cloud services and it is necessary to significantly increase efforts both in formal and informal education. The lack of a critical level of cloud service needs has a negative impact on potential investors as well. Understanding the cloud system is directly proportional to the development of information society and IT education of citizens. Knowing that these elements are not at a satisfactory level then there is a clear lack of a strong cloud's need for citizens.  
The fact that in Montenegro there is a lack of skilled IT staff and that demand for them will be increasing in the near future is more motivated by the leasing of cloud resources along with the unified maintenance of the system to neutralize this disadvantage.

## IT SECTOR IN MONTENEGRO

In general, the impression is that the IT sector in Montenegro is insufficiently, even poorly developed. The development of this sector is directly proportional to the degree and speed of development of the information society and the needs of citizens and the economy. Unfortunately, in Montenegro, IT is not on the list of priorities either governmental or citizens. The result is an insufficiently developed IT sector that does not have enough strength and knowledge to initiate changes in awareness among citizens, businessmen and politicians, and establishes and imposes a new look at the capacity and capabilities of information technology.

Given that the IT sector is not only the provider of implementation of the cloud system implementation and its services, but also a potential investor, it is clear that the level of IT sector development has an adverse effect on the development and use of cloud resources in Montenegro

# MODEL ANALYSIS OF THE CLOUD SERVICE DEVELOPMENT IN MONTENEGRO

Applying the Cloud enables either leasing or merging existing infrastructure, hardware or software resources. Reducing investment and operating costs through the cloud resource utilization model becomes a prominent business model in the IT world, both in the economy and in state administration bodies, local self-government units of educational and scientific research communities. Renting or pooling resources within a cloud system enables financially understaffed SMEs as well as institutions to have at their disposal the better IT resources needed for quality work.

In Montenegro, it is possible to develop cloud systems for the use of different social and economic groups. The analysis of existing and predicting future needs identified four potential models:

1. Cloud models designed for the SME market

2. Cloud models intended for the educational and scientific-research community

3. Cloud model in state administration

4. Cloud model designed for local self-government

## Cloud models designed for the SME market

Digital transformation requires actively involving all elements of society and the economy. As a precondition, it is assumed that there are a number of elements of IT standards such as the existence of qualified IT professionals in the company, standardized IT network infrastructure, high-standard and high-end protected data centers (eg EN 1047-2 as the highest level of so-called secure rooms) storage equipment, backup equipment, and the necessary application and system applications, etc. It is necessary to mention the physical and technical resources and electrical energy consumed by the equipment in the data centers, as well as the electricity required for the cooling of the rooms where the equipment has a high heat dissipation. Knowing that most Montenegrin SMEs do not have a large financial capacity, it is logical to conclude that this sector of the economy in digital transformation that cannot be avoided can only involve using the leased resources. There are few and developed companies within and beyond the SME segment that have developed all of the above elements. For one and the other uses of cloud offers is an optimal and efficient way to participate in the digital economy and a mandatory survival condition in the digital future.

As potential cloud service providers, ISPs are required, at the first place Montenegrin Telecom, which has the most developed infrastructure. Of the 11 existing ISPs, the current capacity and the possibility of their expanding for rent with the aforementioned CT have only Telenor yet. Unfortunately, none of the other providers have yet offered their public capacities, the presumed cause is the low demand and the high cost of these services.

Montenegrin Telecom has been trying to offer Hungary's capacity, but that idea did not survive, and the work has come about a limited service - leasing of hardware resources. Currently the same CT service can offer it through its owner - Croatian Telecom, but it is not yet available.

Other companies, especially the underdeveloped IT sector, have no capacity to emerge as providers of cloud computing, primarily because of the (un) availability of telecommunication infrastructure they have to provide in their potential data centers. Unavailability is reflected in the high rental infrastructure costs required for hosting cloud services.

Essentially, the SME sector is directly addicted to the business assessment of leading ISPs when, when and with what capacity and pricing will offer cloud services.

## Cloud models intended for the educational and scientific-research community

As potential bearers of cloud capacities, the University of Montenegro and the Ministry of Education are recognized. Apart from being the cornerstones and centers of educational and scientific research in Montenegro, these two institutions also have satisfactory elements necessary for hosting cloud services - equipment and infrastructure. It is also necessary to mention the benefits obtained through contracts with Microsoft corp. which provides free Microsoft Cloud resources to all education employees at all levels, as well as all students and students in Montenegro. Office 365 plans.

MINISTRY OF EDUCATION

If we analyze the assumptions necessary for cloud services aimed at the educational and scientific community we conclude that:

-Ministry of Education has a small data center with spatial capacity and a data center that does not meet the strictest standards, with server and storage equipment that has long been not only EOL (end-off life), but also EOS (end-off support). Replacement of equipment is a serious investment and this is an indispensable operation in the future, and it is close

- IT support for this system is made by experienced staff who are insufficient, but this number can be increased with additional budget burdens.

- The Ministry of Education's storage system contains applications such as the Electronic Journal used by ALL Montenegrin institutions of primary and secondary education, accessing a well-designed (and insufficiently fast) infrastructure, which in itself is a feature of cloud services, but not a classic "software as a service "Cloud service.

- Office 365 free capacity available for all Office suite applications, One Drive capacity (1TB for each student and student), Free Mail System, Developer Tools, Audio and Video Collaborative Content, MS SharePoint Server etc. are presently the best cloud resource available to Montenegrin citizens, or to the academic community. Unfortunately, this resource is minimally used. Within the project, recognizing the strength and value of this resource, pilot training of professors was organized in three schools with the aim to begin its more serious use

Regardless of the observed deficiencies, with appropriate investments that are not of a relative magnitude of potential use, the Ministry of Education can become a serious hosting service cloud for the education community. Additional quality exists in the current offer of Office 365 MS Clouds for which use only a few training missions and a clear directive for teaching staff about the mandatory use of its tools in teaching and communicating with students and between them.

## UNIVERSITY OF MONTENEGRO, Center of Information System

CIS UCG has significant spatial capacities of data center that does not meet strict DC standards, but can be simply upgraded with basic elements defined by standardized requirements of modern DCs, with appropriate quality of server and storage equipment.

IT support department of CIS employs enough experienced ICT professionals – system engineers, network engineers, software developers.

On CIS storage system, there are applications that all university units, with a well-organized and generally high-quality infrastructure. This is some kind of cloud services, but not a classic "software as a service" cloud solution. In addition to the student service software, there are also financial software, and particularly noted as an excellent potential cloud service (which is not used enough) is the Distance Learning Software.

Students can also to access to Office 365, and use all its benefits without any restrictions, but unfortunately they do not use it.

UCG CIS is also an Internet Exchange Point (IXP) of Montenegro. The fact that University is the main Internet hub in the country, allows it to access to the fastest and most accessible Internet resources and to have control over them.

The conclusion is that with adequate financial investments in equipping and security of the data center, and with offering a larger number of applications, not only for the academic society, but also for the scientific research community and the other stakeholders (from the student to the researchers and lecturers with the best qualifications), University of Montenegro can play a revolutionary role in the development of cloud services in Montenegro. In this way, UCG will raise its educational offer to a higher level, completing the standards of modern higher education.

## Cloud model for public administration

In the public administration sector, it is necessary to be developed two cloud models – one for the intern needs of public institutions - Private Cloud, and the other for the communication at G2C (Government To Citizens) level and G2B (Government To Business) level – Public Cloud.

Private Cloud Service has established in Government of Montenegro, 7 years ago. Service is based on Microsoft infrastructure softwares - System Center Virtual Machine Manager, System Center Configuration Manager, System Center Operation Manager and System Center Data Protection Manager, situated on HP storage and DELL server infrastructure. This Private cloud service provide public administration institution access to the following softwares – Active Directory, Exchange (system elements), Document Management System (e-DMS), Electronic Government track (e-government), etc. By expanding the number of users, existing resources become the bottleneck of the system and it is necessary to expand it in the part of the capacity for sharing resources and data, as well as development of new application services.

Public Cloud is a system that will be established only when the so-called personalized My Space will be provided for each individual and legal entity, unlike Private Cloud that develops along with the development of the offered resources. The need for the development of a public cloud is directly proportional to the quality of services the state offers to the audience.

These two types of cloud service should have separated infrastructure.

## Cloud model for local authorities

Providing cloud services to the citizens, with joint investment in equipment, and later joint using of cloud services, is an absolute need for local governments, especially those with worst financial situation. Currently, their own data centres with relevant performances, and standardized in accordance with equipment and establishment requirements, have only municipalities of Podgorica, Bar and Pljevlja. Equipment in data centres in Pljevlja and Bar is EOL and EOS, while Municipality of Podgorica has recently renewed a part of equipment and moved in new data centre. In Bar and Pljevlja, there are missing: aggregates, security systems, PP doors, alarm systems, access control, etc. Other municipalities in Montenegro significantly lag in the process DC establishment. The problem is human resources, as well as infrastructure resources. The offer of application solutions for citizens is also at low level and insufficient.

The fact that all municipalities in Montenegro are members of Municipalities Association is mitigating circumstance, thus this institution can be the central point for organisation of cloud services for local authorities and its citizens. It is necessary to build up new or to lease current cloud resources from Telekom, or to use governmental Public Cloud. Also, Cloud versions of this software should be developed: local ERP and treasury software for municipality intern needs, municipality DMS, system for communication with citizens (communal problems, proprieties, etc), system for communication with municipality companies. This is the great solution for reduction of costs, because all applicative services will be distributed to all municipalities from one place. Also, this will have significant impact on improvements of quality of citizen services.