The proposal of centralization and development of data centres in state administration

21st May, 2014

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1 Introduction

The Ministry of Finance of the Slovak Republic (hereinafter referred to as the "MF SR") is submitting this material based on the task B.1 of the Resolution of the Government of the SR No. 680 of 27 November 2013 in which the Government of the SR approved a report drawn from a session of the European Council held in Brussels on 24 – 25 October 2013. The submitted material is closely connected also to the Strategy of Informatization of Public Administration which has been approved by the Resolution of the Government of the SR No. 131/2008 and which strives to achieve a continuous growth of satisfaction of citizens with public administration through the provision of services in an attractive and simple manner, while at the same time increasing its efficiency, competence and decreasing the costs of public administration.

The aim of the submitted material is to assess the technical, organizational and legal level of implementation and operation of supra-ministerial data centres (hereinafter referred to as the "DCs") as a provider of central cloud services of the Government cloud.

The session of the European Council held in Brussels on 24 – 25 October 2013 was focused on digital economy, innovation and services. Signs of economic recovery are obvious, but the EU must continue in its effort to increase the growth potential, to improve the creation of jobs and to support the competitiveness of Europe. These areas have a particular potential for growth and employment which must be immediately mobilized. The European Council has provided particular guidance in order to fully use the existing potential.

Several progressive solutions, such as Big Data and Cloud Computing (hereinafter referred to as "cloud"), are important factors helping improve services and increase productivity. Cloud computing as a model of development and of used computer technologies enables users to have access to services or programmes which are stored on Internet servers basically from anywhere. The cloud solution should ensure and facilitate sharing of resources of information and communication technologies (hereinafter referred to as the "ICT") and improve access to data. The purpose of the Big Data technology is to process, collect, store and analyse great volumes of data. Measures of the European Union should help create correct framework conditions for a single market for Big Data and cloud technologies, in particular by supporting strict standards for safe, high-quality and reliable services related to cloud technology. With the help of the so-called European Cloud Partnership, the European Commission and the Member States should continue in their efforts to ensure a leading position of Europe in adopting cloud technology. The European Council calls for creating a strong network of national digital coordinators which should play a strategic role in the development of cloud, Big Data and Open Data technologies.

The intention of supra-ministerial provision of cloud services of state DCs addresses primary requirements for decreasing the costs of public administration by

- unifying the environment for operation of information systems; providing eGov services;
- optimizing the use of resources;
- decreasing procurement and operating costs;
- increasing the efficiency of management at all levels, from operation of infrastructure to management of relationships, including methodological support;
- the focus of organizations only on their key processes and activities (excluding IT);
- simplifying and unifying processes across organizations.

An important area dealt with by the intention is services ensuring the required level of availability and safety for eGov services, what directly contributes to positive experience and perception of public administration services from the point of view of citizens.

The need to address this unfit condition by centralization and development of two state DCs has resulted from an analysis and assessment of the current condition of state administration DCs. The task will consist of several steps which, will eventually lead to the existence of a logical DC consisting of several physical, geographically separate locations, organizational and procedural management, infrastructure at the level of telecommunications, hardware and software, which will enable a transparent operation for organizations using the services of these

DCs.

Centralization of supporting systems operation is also an important precondition for an efficient introduction of changes and development in relation to management of public finance as well as a direct control of finance in real time. Consolidation of internal processes in individual ministerial systems provided in the form of controlled services will bring a significant qualitative shift in this respect.

The processes of centralization and optimization of administration and operation of support systems will have to be supported from the legislative, methodological and coordination point of view by MF SR as an administrator and sponsor of main supra-ministerial public finance control systems.

According to the Resolution of the Government of the SR No. 305/2012, MF SR was supposed to ensure implementation of two ex ante conditionalities for the new programming period 2014 – 2020 within the thematic objective 2: "Improving the access to information and communication technologies, as well as their use and quality" which defines the following three thematic sub-objectives:

- strengthening ICT applications within an electronic state administration, e-learning, e-inclusion, e-culture and e-healthcare;
- developing ICT products and services and e-trade and strengthening the demand for ICT;
- extending the use of broadband connection and implementing high-speed networks and supporting the adoption of future and emerging technologies and networks for digital economy.

Ex-ante conditionalities were fulfilled by the Strategic Document for the Digital Growth and New Generation Access Infrastructure of (2014 – 2020) which was discussed by the Government of the SR on 8 January 2014. The issue of implementation of eGovernment cloud is elaborated as a specific objective for the new programming period in the Strategic Document; it will be consequently supported by the Operational Programme Integrated Infrastructure.

2 Cloud services in general

Cloud solutions enable a simple self-service network access to services of information technologies on request, provided in a virtual environment of configurable computer resources which may be assigned or released with minimum effort and time restriction, based on optional scaling and increasing, regardless of the location of the resources or the location of the access to them and without a personal contact with the provider of the cloud service, while the use of these services is measured and evaluated according to their real use. Cloud appears to be a very attractive option how to improve electronic services and at the same time optimize a part of the costs for operation of ICT solutions. Cloud solutions have been known worldwide for approximately 15 years; though much more intensively in the last 5 years.

The most frequent models of cloud services provision from the point of view of distribution of services are the following three models (hereinafter referred to as "cloud services"), while the division of provision of services between the provider and user of a cloud service is shown in the Picture 1:

- Infrastructure as a Service (referred to also as the “IaaS”), in which the cloud service is represented by provision of virtualized infrastructure such as servers, data storages and network infrastructure. The main advantage of this approach is that the provider looks after the whole hardware and this model is suitable for owners of software (or of its licenses) who do not want to look after hardware;
- Platform as a Service (referred to also as the “PaaS”), in which the cloud service is represented by provision of a hardware and software platform, necessary for creation and administration of applications, enabling their design, development, testing and implementation, while these applications remain to be administered by the cloud services customer;
- Software as a Service (referred to also as the “SaaS”), in which the cloud service is represented by provision of a software, including applications, i.e. users use an application functionality (users purchase access to an application, not the application itself).

In addition to the above-stated, there are other specialized SaaS models, and more of them are still appearing, such as Business Process as a Service, Uniform Communication as a Service, or Safety as a Service. For the purposes of this document, "cloud services" shall be understood as the three most frequent models of provision of cloud services, namely the IaaS, PaaS and SaaS services.

In addition to the above-mentioned service models, cloud may be sub-classified from the point of view of implementation/use into:

- public cloud, where the provided services are available as a public service, i.e. anybody may use them;
- private cloud which includes cloud implementation for users from a closed group, i.e. a certain organization;
- hybrid cloud, i.e. a combination of the two previous models;
- community cloud, where the cloud infrastructure is shared among several organizations using it while these organizations may be connected by the same area of interest or a safety policy.

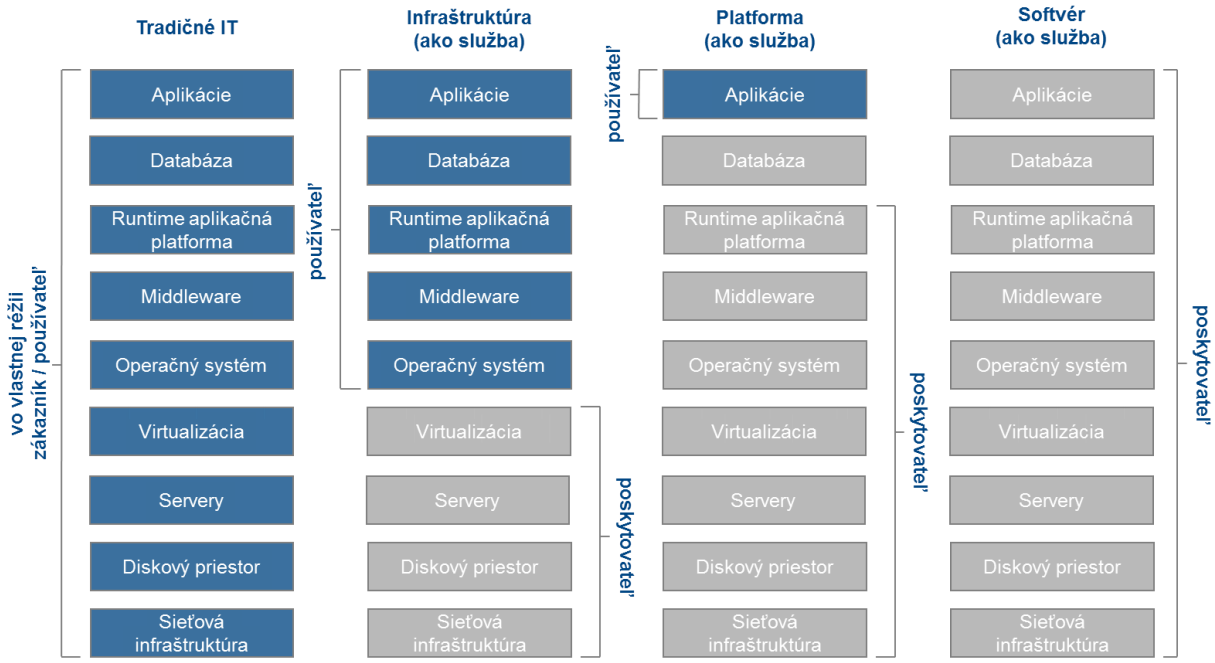
A further development of cloud in the global development is stimulated mainly through expected revenues in the form of:

- more flexible and scalable information systems;
- faster engagement of services (higher agility);
- potential decrease in costs of information technologies and the related transformation of investment costs into operating costs of information technologies;
- increase in availability and robustness of information systems of public administration solutions;
- consolidation of common and supra-ministerial processes of public administration, unification of a methodical management and improvement in their efficiency.

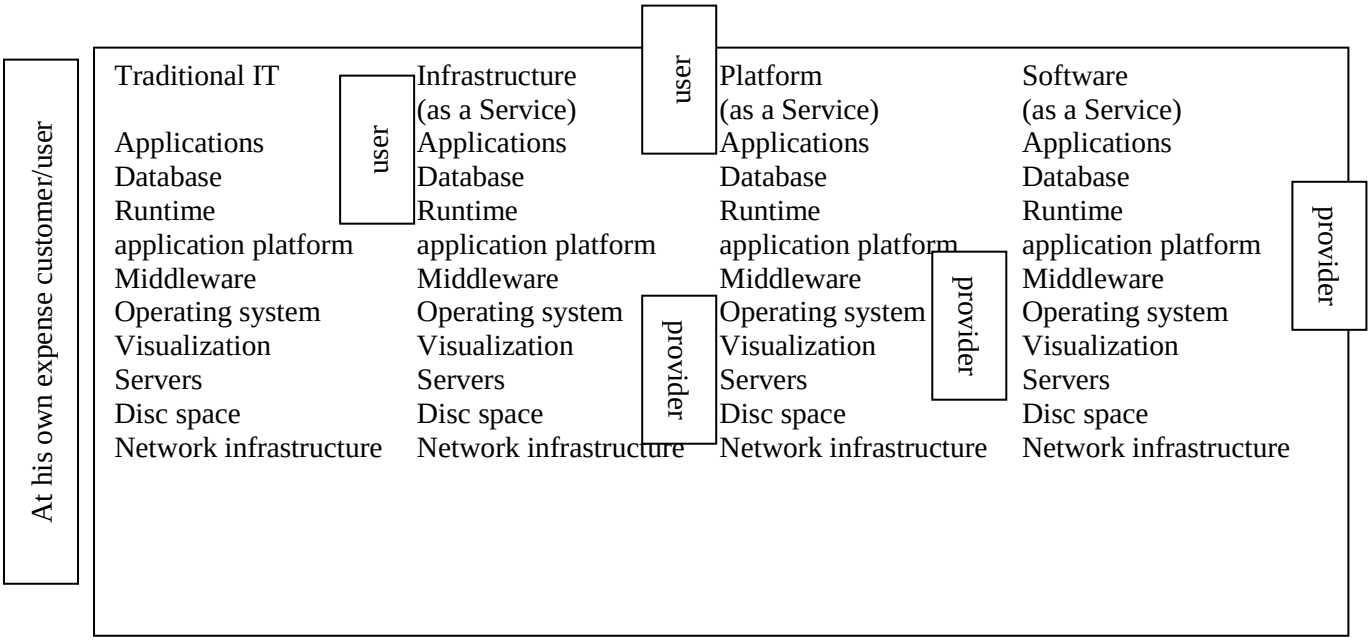
Cloud implementation is connected to risks related to implementation of this solution. The list of risks may be identified as follows:

- performance of requirements for information safety;
- personal data protection;

- data protection and the related legal issues;
- dependence on the supplier;
- quality of guidance for users of cloud services;
- certification and accreditation of suppliers;
- ensuring national and international interoperability;
- availability and costs of network connection;
- the need to foster more rigid operating policies, standards and procedures, necessary for a sustainable long-term operation of the cloud solution.



Picture 1: Control over IT services distribution between the cloud services provider and user.



3 Initial status in the world and in Europe

Cloud services first spread in the USA. In September 2009, a Federal Government Initiative concerning cloud was published in which General Services Administration (GSA) became the chief intermediary of cloud solutions for the USA Federal Government. The aim of implementation of cloud was to achieve 99.95% availability of all potential electronic services with the help of this technology. Other documents published by the USA Government included "IT Reform Plan" in December 2010 in which cloud is identified as the most significant tool for increasing the operating efficiency of federal ISs. Another document approved in 2011 was a Federal Strategy for Cloud which imposed an obligation on all federal agencies to perform migration of at least three existing services to cloud by June 2012. Currently approximately one half of all state institutions use their services through cloud. From the point of view of finance, 1 billion of US dollars from the federal budget will have been used for cloud by 2014. Thanks to a transfer to a cloud solution, GSA annually pays USD 650,000 for operation of the transferred services, while there was a saving of USD 1.7 billion, i.e. 72%. Savings in postal expenditures in the cities of Washington D.C. (48%) and in Los Angeles (23.6%) are also significant.
Some of the important executed projects for state institutions in the USA include:

- In 2010, General Services Administration signed a 5-year contract for transferring 15,000 email users to the Google platform;
- In 2010, the Department of Agriculture decided to transfer 120,000 e-mail users to the Microsoft cloud platform;
- e-mail solution of the American Army has been transferred to the Exchange solution by Microsoft based on the Azure platform since 2011;
- building of a private cloud for NSA by Amazon since 2013.

Since 2011, a number of cloud-related activities have been initiated in the European Union; we must mainly mention the material named "Unleashing the Potential of Cloud Computing in Europe".[1]) The document defined the following key actions for cloud implementation:

- to deal with the standardization "jungle" related to cloud, ETSI will coordinate the creation of standards related to safety, interoperability, data transferability, reversibility, to deal with personal data protection, ENISA, together with other relevant institutions, will prepare certification schemes for providers of cloud services;[2]);
- to define safe and correct conditions of contract between users and providers of cloud services, in particular to create model conditions for contracts between providers and users of services based on EU acquis, to promote the European participation in the global growth of cloud services and to review the standard contractual provisions on the personal data transfer in the cloud environment;
- to cooperate with the industry in order to define ethical principles of cloud service providers in harmony with EU legislation, in particular to create a European Cloud Partnership,[3]) which will ensure the development of cloud by public administration, identification of requirements of public administration for cloud, creation of specifications for joint public procurement of cloud services.

The European Commission will promote implementation of cloud in the programming period of 2014 – 2020, help migration to cloud and management of hybrid environment of cloud systems.

Another important fundamental document which needs to be mentioned has been issued by ENISA (European Network and Information Security Agency). It focused on a safety analysis and assessment of cloud consequences in its use in public administration in the entire EU and it proposed recommendations for EU Member States which are planning implementation of cloud.[4])

[1]) European Commission, 2012: Unleashing the Potential of Cloud Computing in Europe. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0529:FIN:EN:PDF
[2]) http://csc.etsi.org/Application/documentApp/documentinfo/?documentId=180&fromList=Y
[3]) https://ec.europa.eu/digital-agenda/en/european-cloud-partnership
[4] European Union Agency for Network and Information Security (ENISA), 2013: Good Practice Guide for securely deploying Governmental Clouds. http://www.enisa.europa.eu/activities/Resilience-and-CIIP/cloud-computing/good-practice-guide-for-securely-deploying-governmental-clouds

4 Current situation in Slovakia

4.1 Legislative – strategic conditions

This proposal of centralization and development of DC relies on

a) strategic EU documents:
   - European Interoperability Framework for European Public Services 2.0 (2009);
   - Digital Agenda for Europe (2010);
   - Conclusions from the session meeting of the European Council which was held in Brussels on 24 – 25 October 2013;

b) strategic SR documents:
   - Operational Programme Informatization of Society 2007 – 2015;
   - Strategy of Informatization of Public Administration (2008);
   - National Concept of Informatization of Public Administration (2008);
   - National Strategy for Information Safety in SR (2009);
   - Strategic Document for Digital Growth and Next Generation Access Infrastructure 2014 – 2020.

MF SR is currently performing activities focused on creation of better conditions for building cloud:

- in 2012, the activity of the working group for safety standards was extended to include safety standards for cloud. The activity of this working group lead to formulating the requirements for operators and providers of cloud solutions of public administration. These are the subject of the Decree of the MF SR No. 55/2014 Coll. on Standards for ISPA, effective from 15 March 2014;
- in 2013, MF SR issued a guideline for beneficiaries of OPIS projects with the requirement for readiness of ISPA to transfer to a cloud solution (Cloud Ready);
- Partnership Agreement for 2014 – 2020, approved by the Government of the SR on 14 February 2014;
- Operational Programme Integrated Infrastructure 2014 – 2020, approved by the Government of the SR on 16 April 2014;

The following acts are relevant for the provision of cloud services:

- Act No. 275/2006 Coll. on Information Systems in Public Administration and on amendments and supplements to certain acts as amended;
- Act No. 305/2013 Coll. on Electronic Performance of Powers by Public Authorities and on amendments and supplements to certain acts (Act on e-Government);
- Decree of MF SR No. 55/2014 Coll. on Standards for Information Systems of Public Administration;
- Act No. 351/2011 Coll. on Electronic Communications, as amended;
- Act No. 122/2013 Coll. on Protection of Personal Data;
- Act No. 45/2011 Coll. on Critical Infrastructure;
- STN ISO/IEC 20000 Information Technologies. Management of services (36 9788);
- STN ISO/IEC 27001 Information Technologies. Technology Provision. Information Safety Management Systems. Requirements (36 9789);
- Act No. 45/2011 Coll. on Critical Infrastructure; Technology Provision. Good practice in information safety management (36 9787);
- STN ISO/IEC 27005 Information Technology. Safety Methods. Information Safety Risks Management (36 9789).

The proposal of centralization of development of state DCs is in harmony with the current legislation. It may be stated that there are no legal barriers for implementation of the proposal. In relation to implementation of the proposal, coordination and management competencies result to the MF SR from the Section 7 (1) of the Act No. 575/2001 Coll. on Organization of the Activities of the Government, as amended, and from the Section 4 (1) (e) of the Act No. 275/2006 Coll.

Rights and obligations of operators and users of cloud services in public administration, as well as strengthening the coordination, management and control competencies of the Ministry of Finance of the SR for state cloud services will have to be regulated in more detail in the amendment of the Act No. 275/2006 Coll. on ISPA, as amended.

4.2 Technological condition

In view of the National Concept of Informatization of Public Administration, the characteristic feature of which is ensuring electronic communication of public administration with citizens and businesses, the 24/7 availability of systems is required. In order to ensure such availability, it is necessary that DCs are at least at the level of Tier 3 in view of the ANSI/TIA 942 standard "Standards of Telecommunication Infrastructure for Data Centres" and secured through backup locations for disaster recovery. OPIS projects primarily implement unique agenda information systems which require integration and interconnection with information systems of public administration (G2G).

Public administration institutions are currently operating larger or smaller computer centres. These resources have been built independently for historical reasons from the technological point of view or from the point of view of ICT management.

Projects proposing the support of the cloud solution mainly include the national project for a Data Centre of Towns and Municipalities (hereinafter referred to as the "DCTM"), a project for building a platform for application environment of the project named Efficient, Reliable and Open State Administration (hereinafter referred to as the "ESO project") at the Ministry of Interior of the SR, project "eDemocracy and Open Government" by building central tools for open data and projects of joint modules of “Central Government Portal”. The DCTM project proposes implementation of virtualization tools and cloud elements (SaaS, IaaS, PaaS services). As a consequence of these technologies, employees at local government offices will use a remote access to work with the information systems and clients (citizens/businesses) will have electronic services available. The proposed solution also includes a supply of HW components for local governments and their reproduction cycle which will ensure a long-term necessary technological level. The ESO project proposes a solution which will make central IT resources available to integrated elements of public administration and it represents a shift in management and optimization of the Ministry of Interior of the SR resources.

DTCM is being built with the aim to transfer administrative and support systems of internal administration.[5]) These systems will be operated in DTCM by the use of virtualization technologies in the form of cloud. Virtual space will be provided for each municipality for operation of these applications. Cloud technology and virtualization will enable to the local governments to administer one virtual space which will enable to meet the conditions of operation and safety of information systems more efficiently, instead of local administration of thousands of computers (in combination with dozens of applications and of particular versions of operation systems).

In May 2013, MF SR made a survey among individual state administration organizations from which we may have an overview of certain important areas, such as:

- quantitative overview of the current ICT infrastructure;
- overview of the needs of ICT infrastructure for the next 24 months; and
- current capacity of the organizations in view of the defined needs.

It results from the outcomes that the state administration has a sufficient spare area, electric and cooling performance. However, the following facts are obvious after other important parameters have been assessed:

- redundancy in electric supply – most data rooms do not have redundancy in electric supply;
- UPS redundancy – most data rooms have a zero UPS redundancy; 30% have stated a partial UPS redundancy;
- engine-generator redundancy – 60% of data rooms are not equipped with a redundant engine generator,

[5]) Picture 13 National Concept of Informatization of Public Administration. http://www.informatizacia.sk/narodna-koncepcia-informatizacie-verejnej-spravy/1306s

corresponding to the Tier 1 classification;
- data centres of MF SR, of the Ministry of Interior of the Slovak Republic (hereinafter referred to as the "MI SR") and of the Statistical Office of the SR correspond to the Tier 3 classification.

Strengthening of all areas of state administration to achieve a qualified standard would require an excessive effort and a lot of finances with a non-guaranteed outcome, as a large majority of DCs are in the areas where strengthening to an acceptable standard cannot be performed for technical and spatial reasons.

Significant fragmentation and decentralization of the existing DCs of the public administration is apparent, from the analysis of the existing condition of the public administration DCs. This condition is not efficient in the long run.

The following findings have further resulted from the 2013 analysis:
- the overall requirement for a new ICT area in state administration amounts to 400 – 450 m^2 in total for the following 2 years. Further requirements for a new ICT area will arise with migration to a central solution (this requirement was addressed by the Data Centre for eGovernment project in 2014);
- the current occupation of the present DCs at MF SR and MI SR is over 80% (64% at MF SR and 100% at MI SR);
- most ISPASs require an availability corresponding to DCs at the Tier 3 level for an efficient promotion of processes;
- only several systems are currently highly critical, and thus requiring architecture which fully minimizes outages, while it inter alia requires employment in two simultaneously active nods (active-active) to achieve that. They are primarily certain components of the eHealth system, selected systems of MI SR (e.g. Schengen information system, Register of natural persons) and several other specialized systems;
- in order to ensure the required availability of most ISPAs, it is necessary to count with employment in two locations, while the secondary location serves for operation of the system in the event of unavailability of the primary location, either as a result of maintenance or unforeseen events (failure, accident, natural disaster). These locations should be sufficiently remote from the geographic point of view, mainly to prevent a disaster in one location from affecting the operation of the other one.

4.3 Information systems in the DC at MF SR

DataCentrum as a budgetary organization in the competence of MF SR currently provides services for MF SR as well as for other ministries and certain local government institutions. At the same time, provision of infrastructure in the form of housing is being prepared for other large information systems.

MF SR uses the DataCentrum to operate the following significant information systems which are crucial for management of public finance and critical for operation of the state as a whole:
- Budgetary information system;
- Treasury information system;
- Central public finance consolidation system;
- ARDAL (Agency for management of debt and liquidity) backup system;
- IT monitoring system (of structural funds);
- Fund accounting information system;
- Central e-Folder;
- Register of financial statements;
- Register of offered state property;
- Systems for integration and automated testing centre;
- Group of supporting systems, including e.g. Call Centre system, Service Desk, User Support Centre and Central Operation Monitoring;
- Portals of rozpocet.sk, informatizacia.sk, registeruz.sk, ropk.sk.

For other ministries and local governments, including their subordinate organizations the DataCentrum:
- operates a supra-ministerial economic information system (hereinafter referred to as the "EIS") the users of

which are MF SR, Ministry of Environment of the SR, Ministry of Transport, Construction and Regional Development of the SR, Ministry of Foreign and European Affairs of the SR, Ministry of Education, Science, Research and Sport of the SR and Ministry of Economy of the SR, Slovak Office of Standards, Metrology and Testing, Office of the Public Defender of Rights;
- extension of EIS by other public authorities and accounting spheres is being prepared with the aim to build a central state economic system;
- operates a Treasury payment portal for the self-governing regions of Košice, Nitra and Banská Bystrica and for operation of economic information systems for the self-governing region of Nitra and Banská Bystrica;
- prepares extension of operation of the Treasury payment portal for all self-governing regions and their subordinate organizations (approximately 900 organizations);
- puts into operation the budgetary information system for local governments (RIS.SAM) in all towns and municipalities (approximately 3,000 organizations);
- prepares provision of housing for ICT of the National Centre of Medical Information in the competence of the Ministry of Health of the SR;
- prepares provision of housing for the General Prosecution of the SR, Ministry of Economy of the SR and others; and
- provides user support.

4.4 Information systems in the DC at MI SR

The DC at MI SR acts as ICT service provider for organizations within the competence of MI SR. MI SR is an administrator of the largest number of information systems of public administration. Information systems and their applications in the DC at MI SR are divided into several application domains, namely:
- application domain for the provision of electronic services to citizens and organizations;
- application domain of State Agendas and Police Information Systems;
- application domain of the National Schenghen Information System.

Access to the applications in individual application domains is in the following environments:
- Intranet of MI SR (MI-Net);
- Internet,
- External networks (e.g. Govnet);
- EU net for the Schengen Information System.

The access to the applications is made possible for end users through a graphic user interface (GUI) or for applications through web services. Access to the applications is separated and protected through a safe access zone. Production and testing environments of individual information systems have been created within these domains.

Migration of ICT related to ensuring the defence of the Slovak Republic, safety of the Slovak Republic, protection of confidential facts and sensitive information is not considered in this material[6]).

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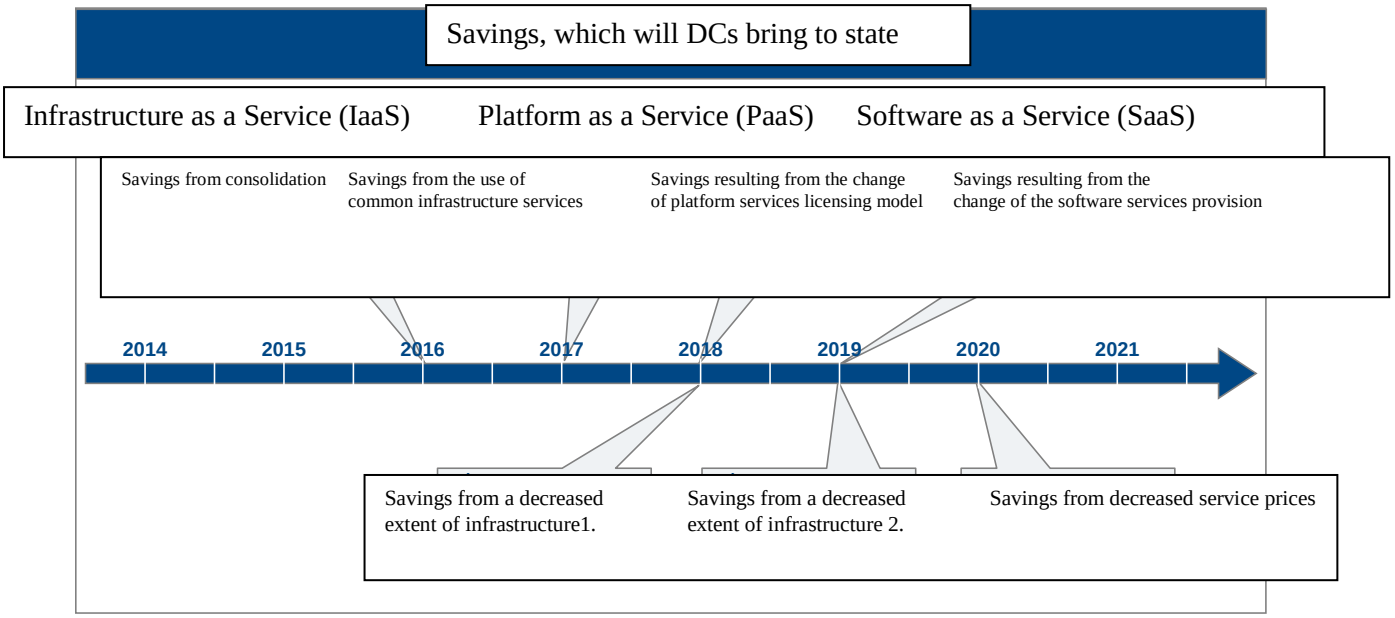
[6]) Section 11 (1) (i) of the Act No. 211/2000 Coll. o on Free Access to Information and on amendments and supplements to certain acts (Freedom of Information Act), as amended by the Act No. 382/2011 Coll. And Section 3 (14) and (15) of the Act No. 541/2004 Coll. on Peaceful use of Nuclear Energy (the Atomic Act) and on amendments and supplements to certain acts, as amended.
Section 2 (a) of the Act No. 215/2004 Coll. on Protection of Classified information and on amendments and supplements to certain acts.

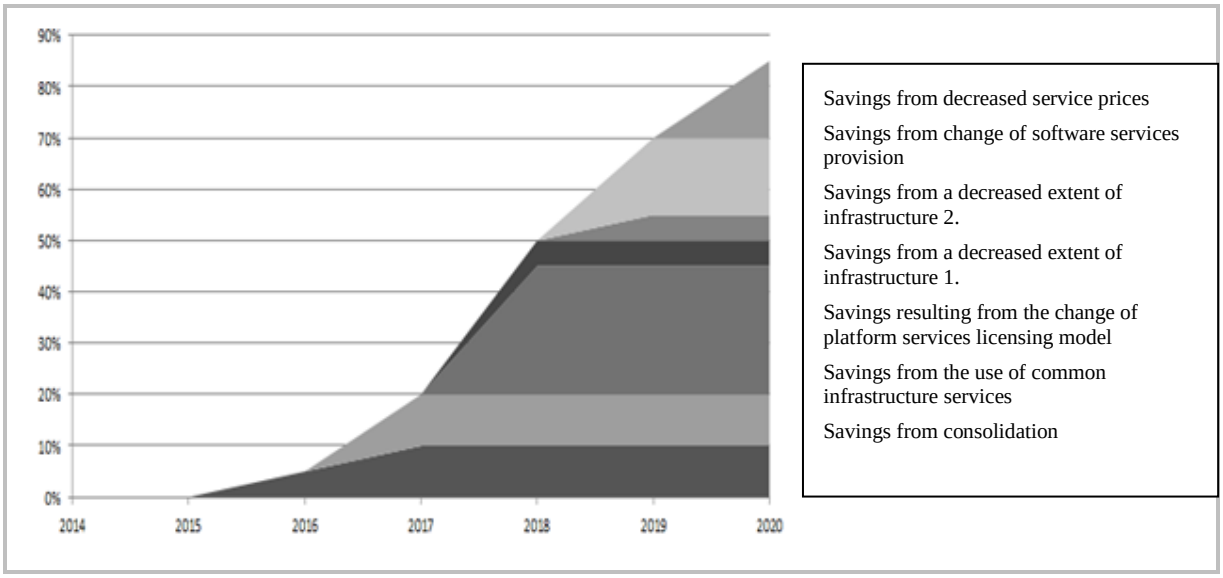
5 Proposed solution

5.1 Motivation of the solution

In order to achieve long-term sustainability in line with the requirements for quality and requirements for flat savings, the proposed solution gradually involves several ways to achieve savings, and individual measures are adapted to it as well.



Picture 2: Expected areas of savings



Picture 3: Estimated savings (in %) within the expected areas of savings

Savings	Expected decrease in operating

	costs of an obligatory person after transition to the cloud solution in %
Housing services - Common supervision - Cheaper energy (bulk consumption) - Renewal of obsolete HW - Common network infrastructure - Common backup infrastructure - Common helpdesk	10%
Infrastructure as a Service - Only actually consumed resources (computer, storage and backup) - Better infrastructure sharing	10%
Platform as a Service - Shared software infrastructure licenses (OS, DB, middleware) - Application with a common maintenance of software infrastructure - Common solution of infrastructure safety and safety monitoring - Development and testing environment (as currently needed)	25%
Software as a Service - Shared support and administrative applications (ERP, DMS, HR, collaboration platform, analytical tools, e-learning…) - Application with a common maintenance of a software application - Common application safety solution and safety monitoring solution	30%

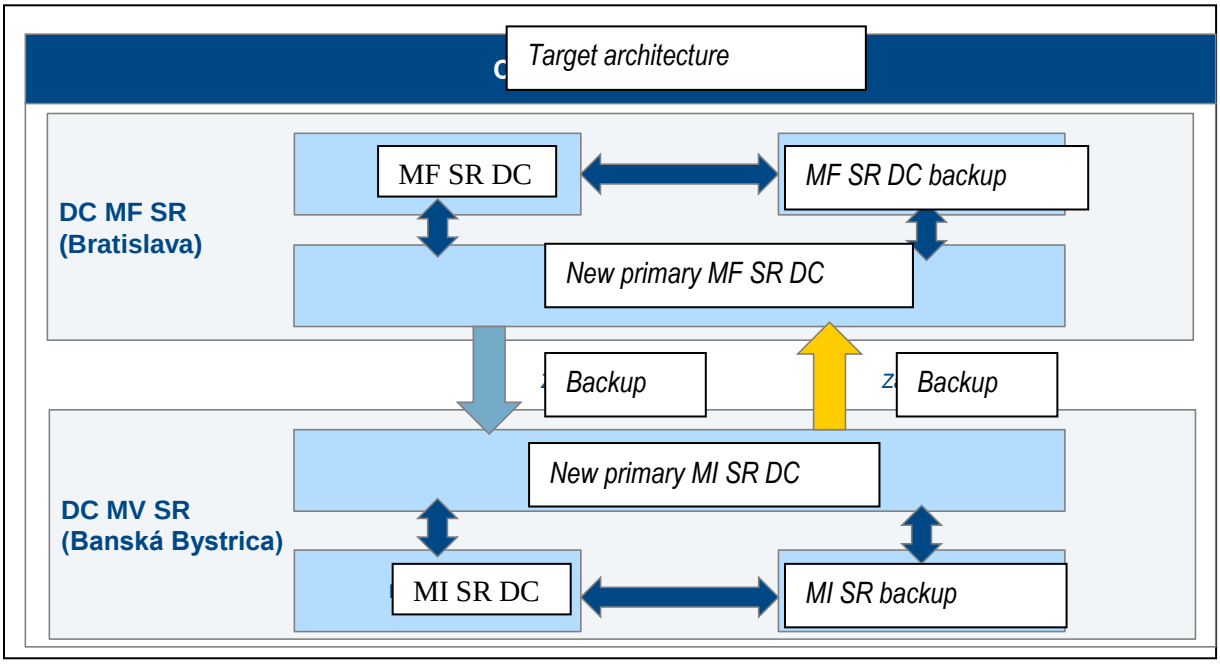
Chart 1: Expected decrease of operating costs of the obligatory person after the transfer to the cloud solution

5.2 Performance stages

Based on the assessment of the current DC condition, of the development plan of infrastructure of individual ministries and the above-stated aspects, reasons prevail in favour of centralization of development of two state DCs:

- DC at MF SR, operated in the Data Centre; and
- DC at MI SR,

with the following target architecture of the state DCs:



Picture 4: Target architecture of the state DCs

In the first stage of centralization and development of the state DCs:

- DCs of state administration ministries will be built and centralized in two state DCs in the competence of the MF SR and MI SR, meeting at least the Tier 3 level;
- DC at MF SR will provide backup for the DC at MI SR and the DC MI SR will provide backup for the DC at MF SR;
- the state DCs will provide services of hardware housing for public authorities, including operation management support, telecommunication services and use of Internet services with an expected start date on 1 June 2014;
- construction of a central infrastructure of management of services will be finalized as a preliminary stage of the cloud solution in order to support centralized operation of housing services;
- an analysis and assessment of the types of cloud services (IaaS, PaaS, SaaS), which are suitable for individual organizations of public administration and their ISPAs, will be performed;
- a schedule of gradual implementation based on priorities will be determined based on the analysis;
- infrastructure of the original DCs will be connected to the state DCs, using an assigned public administration network (Finnet, MVnet, Govnet);
- the existing ISPAs will be placed in the state DCs gradually at the time when it is necessary to renew ICT due to their technological and moral obsolescence;
- beneficiaries will preferably use housing services of the state DCs when addressing the OPIS projects initiated in 2014;
- purchase of infrastructure will be subsidized from the financial means of the Operational Programme Integrated Infrastructure (hereinafter referred to as the "OPII"), exclusively for projects related to the construction and development of state DCs which will ensure the infrastructure necessary for placement of ISPAs in the state DCs and for provision of cloud services.

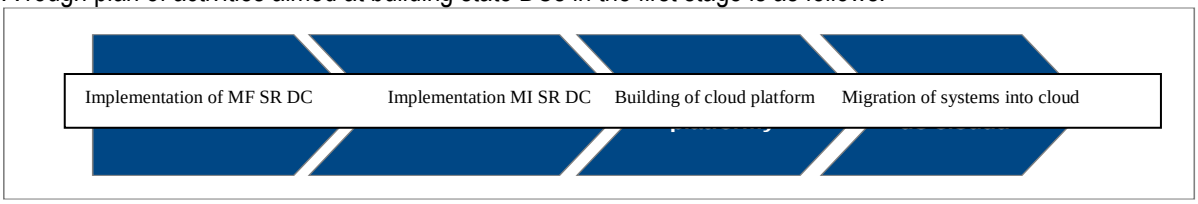
In the second stage of centralization and development of the state DCs:

- a cloud solution will be implemented, services on the basis of IaaS, PaaS, SaaS, and financed from the OPII, will be built and extended;
- a Catalogue of Cloud Services will be created, registering all services and their parameters, and users of cloud services may manage their consumption through it;
- new solutions of agenda ISPAs will be implemented in cloud from the project initiation, so the project definition itself will contain information on technical requirements for the type of cloud services (IaaS, PaaS, SaaS) which the ISPA will use, while the obligatory person will choose from the offered DC cloud services or several requirements will arise and it will be necessary to assess and then perform them;
- solutions for the provision of central support and administrative information systems of internal management in the form of SaaS cloud services will be gradually provided;
- SaaS cloud services will be set for the needs of individual obligatory persons;
- migration of supporting and administrative ISPAs to cloud will be carried out;
- MF SR will set up a centre of methodical and procedural support for users of cloud services;
- the following savings are expected to be achieved:
    - 2017 – savings from the use of common infrastructure services;
    - 2018 – savings in the change of a license model of platform services;
    - 2018 – savings from a decreased extent of infrastructure by optimization of load in time;
    - 2019 – savings from the change in the manner of the software services provision;
    - 2019 – savings from decreasing the extent of infrastructure, by covering the DC load by a short-term temporary use of the infrastructure services of third parties (SK, EU);
    - 2020 – use of affordable services within the EU interoperability.

With regard to the possibility of meeting specific requirements of the Ministries, requiring different safety levels for their referential data, it seems to be the most efficient option to build two independent cloud platforms in a common infrastructure. This solution will enable to introduce flexibility to the operated systems of public administration. In addition to the above-mentioned facts, it will be necessary to ensure support of the management of the Ministries and cooperation with providers of cloud services, supervise the balance between potential benefits and risks and cooperate with the private sector.

5.3 First stage of state DCs construction

A rough plan of activities aimed at building state DCs in the first stage is as follows:



Picture 5: Framework plan of activities

State DCs will have to ensure a sufficient capacity of the basic technological infrastructure for migrated ISPA systems and for the provision of cloud services. MF SR has already started taking the necessary steps within OPIS to ensure the provision of central services of the data centre, namely through the performance of the "Data Centre for eGovernment" project where the first stage involves acquiring a building for the data centre and some basic technological infrastructure which is a precondition for operation of information systems of public administration and at the same time enables construction of a platform for the future public administration cloud. Performance of the DC at MF SR and DC at MI SR will run simultaneously. Construction or perhaps adaptation of projects for the DC MI SR for the reason of a non-existence of suitable premises is considered in the vicinity of Banská Bystrica. This step will last approximately until the end of 2015 for the DC at MI SR, when the available infrastructure should be made accessible.

Building a cloud platform

Building a cloud platform will consist of selecting an appropriate concept for the cloud solution and equipping the premises with appropriate ICT, preparing processes and organizational issues. The planned activities within the first stage will run simultaneously, as ISs may be operated also on a smaller infrastructure in the initial stage. Migration of ISPAs to cloud requires a detailed preparation for gradual migration.

Housing services

State DCs will provide elementary housing services in the first stage, i.e. a room assigned for installation of the technical infrastructure of the consumer in the state DCs in the form of:

- a data rack;
- part of a data rack;
- basic DC area.

In addition to space itself, the provided housing service includes:

- redundant connection including a back-up power supply;
- redundant cooling;
- network connectivity to the spinal DC network.

The agreed capacity of the infrastructure and data storage on the disk array of an agreed class will be specified more closely by:

- capacity;
- band width;
- latency.

In addition to the space itself, the provided housing service will include provision of an agreed class and capacity of the backup infrastructure for the infrastructure placed in the DCs, including its:

- redundant power supply including a back-up power supply;
- cooling;
- safe space for backup storage (safe deposit).

The housing service will ensure a redundant broadband Internet access as an addition to other services and a high-speed connection to WAN networks of the Ministries. The service will include creation of virtual networks and provision of remote accesses.

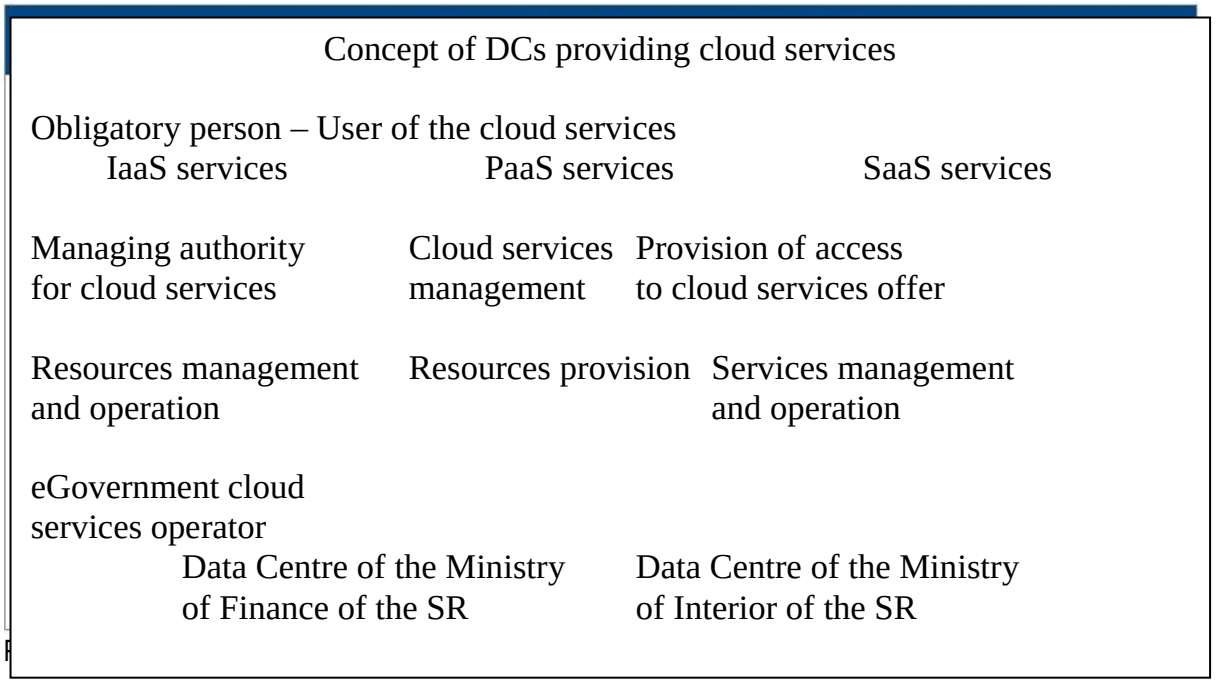
Centralization of the operation will require employment of common operation support services for ISPAs placed in the DCs. The support will be at least in the extent of incident management and problem management for mixed responsibility for operation.

Activities of the state DCs

State DCs will perform a set of activities in line with the cloud architecture defined in the Annex 7 of the Decree of the MF SR No. 55/2014 Coll. on Standards for ISPAs. More significant changes in both operation and safety models are expected in implementing the cloud solution. Multiplication of the operated infrastructure to almost a triple of the infrastructure in the existing DCs and a potential installation of critical systems requiring a constant support will bring requirements to increase the number of employees at both DCs which will operate the infrastructure.

5.4 Second stage of development of state DC

The second stage of DCs development will include extension of cloud services, as results from the Strategic Document for Digital Growth and Next Generation Access Infrastructure (2014 – 2020), laying down the Theme 10: Preparation of legislative, organizational and procedural measures for building a common infrastructure and platform in cloud.[7)]



DCs will provide IaaS, PaaS and SaaS cloud services. The use of the cloud solution will lead to minimizing the requirements for administration and maintenance of information systems of public administration. Cloud services will become a tool of efficient building and operation of information systems, while achieving a high level of safety, protection of personal data and of other sensitive information. Provision of cloud services will be free of charge for public authorities. In the role of the managing authority, the MF SR will closely cooperate with the MI SR. DCs at MF SR and MI SR will operate cloud services.

IaaS services

[7] Strategic Document for Digital Growth and Next Generation Access Infrastructure (2014 – 2020). http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=23177

IaaS services will be one of the elements of the solution (storage, computer resources and storage services) provided on the basis of actually needed resources.

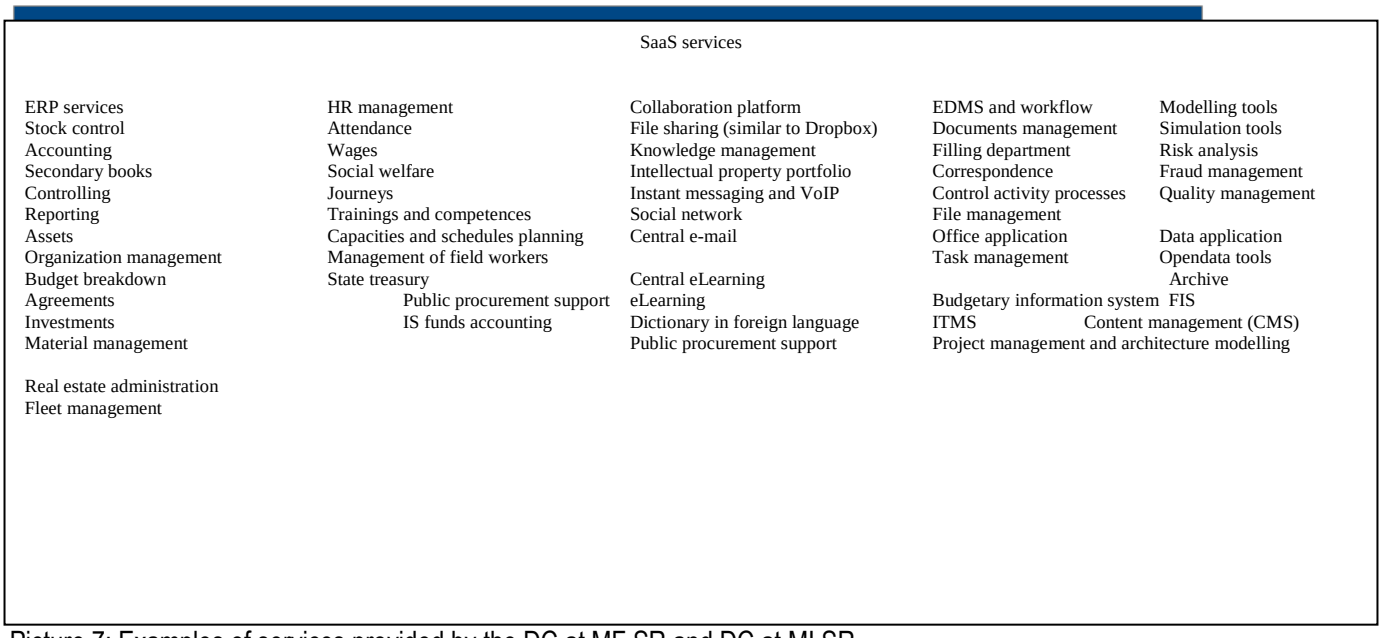
PaaS services

PaaS services will represent a group of solutions which will provide the users with particular environments for ISPA operation with additional services. PaaS services mostly applied in the state DCs include:

- services aimed at comprehensive management and administration of the information environment placed in the DCs, e.g. application monitoring, helpdesk
- Safety as a Service – safety and connection to the central system to monitor the safety:
  - management of roles and authorizations (Identity and Access Management, single sign on to information systems of public administration);
  - incident management;
  - safety monitoring;
  - anti-virus protection;
- computer platform for individual technologies:
  - web server;
  - database server;
  - operation systems;
- development environment for individual technologies:
  - development tools;
  - testing environment.

SaaS services

Provision of more comprehensive software in the form of SaaS services will be achieved by gradual extending and acquiring the target conditions. Standardized support processes of internal administration will be supported by central support and administrative information systems of internal administration applied in cloud, promoting centralization of operations and thus simplifying and unifying the processes across organizations.



Picture 7: Examples of services provided by the DC at MF SR and DC at MI SR

An example of services of information systems which will be performed is stated in the Annex 1. More comprehensive information systems are divided into modules which might be performed independently, if necessary.

However, an excessive variety in the environment in the IaaS model may complicate the operation of cloud and decrease its efficiency in cost optimization. At the same time, an effort to unify environments for operation of information systems is shifting the strategic concept of the solution towards more comprehensive PaaS and SaaS models. The trend of consolidation and increasing the efficiency of common systems of support and administrative activities implies the use of the model of services "Business Process as a Service". With regard to comprehensive and intensive communication flows among ISPAs, creation of a common communication platform, ideally in line with the model of unified Communication as a Service, will also address maintenance of control in communication.

Cloud services quality

The definition and responsibility for the quality of services will be declared in a Service Level Agreement. Cloud services will be employed and operated in different categories of services with regard to the requirements for their quality.

Catalogue of cloud services

Users will have a catalogue of services at their disposal. Employing and enabling cloud services will be a dynamic environment from the point of view of the need to introduce new or update the existing services due to legislative changes or increasing the quality of the provided services. High-quality infrastructure and tools for implementation and update of services are important factors which have an impact on the productivity of the cloud services operation. Information systems developed within the OPII projects must be performed within the "cloud only" rule.

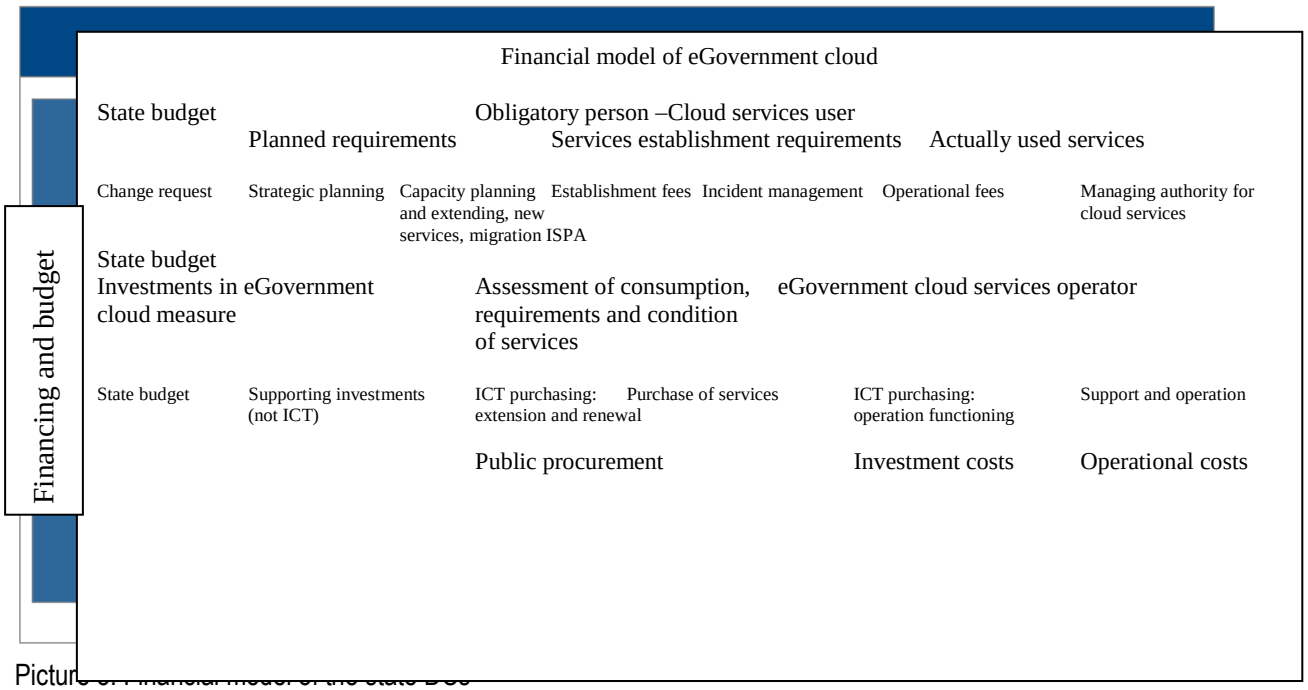
A single space in the form of the catalogue of available services will serve to obtain access to the services. The single space will ensure at least the following functionality for users of cloud services:

- making the current offer of cloud services accessible;
- ordering cloud services and monitoring the process of order processing and service establishment;
- reporting problems and monitoring the problem solving process;
- monitoring the volume of consumed resources.

Information systems of public administration will gradually migrate to the state DCs. Another way how to cut the costs of operation of information and communication technologies is virtualization of client operation systems and introduction of simple terminals and clients instead of PC (desktop virtualization).

Financial model

Major areas which have to be considered from the funding point of view are displayed in the following picture. The scheme contains all proposed roles and expected flows of funds as well as their distinction based on their investment or operational nature.



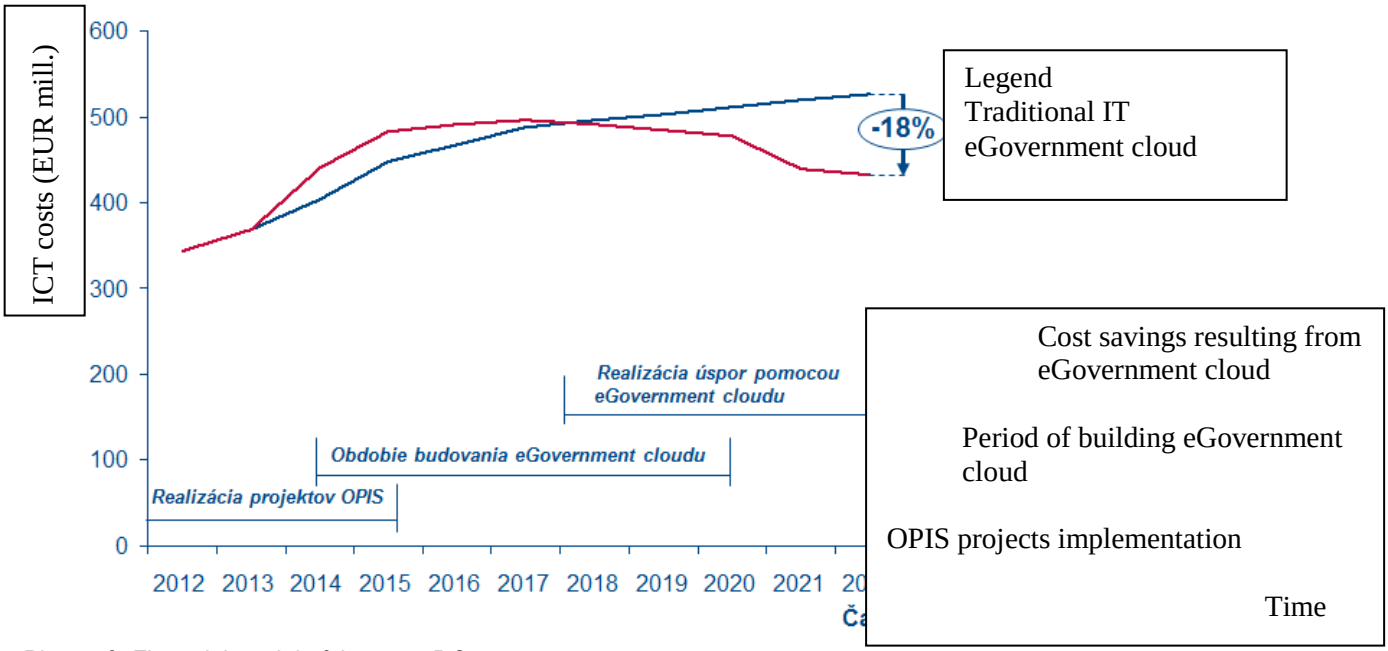
Pictur

The basic principle of the model is a strategic planning of financing the development and operation of ICT infrastructure in public administration which is performed at the level of the managing authority for cloud services. An important element ensuring efficiency is mainly a feedback in the form of an activity named "Assessment of Consumption, Requirements and Condition of Services", the main task of which is to provide outputs for creation of the budget and an efficient allocation of funds based on the planned and actual consumption of cloud services (services used by information systems of public administration).

Investment and operating costs of the solution

Development of the state DCs, the aim of which is provision of cloud services, will require increased investments at the time of building the resources and the platform (approximately EUR 250 million, evenly allocated throughout the period of 2014 – 2020), while one of the main sources of funding will be the OPII. We may expect benefits as early as four years after the start of implementation, in the form of savings in investment and operating costs.

Operating costs of information systems built from OPIS projects will be the same as in the previous solution (traditional provision of ICT) for the period of 5 years from the start. After that time period and with regard to the expected need for renewal of the used HW, ISPAs built from OPIS projects will be re-migrated to the state DCs. At the time when the potential of the solution is fully manifested, we may expect the total difference amounting to 18 per cent. The break-even point in which the costs of the alternative of the traditional ICT will exceed the costs in the cloud solution may be expected in early 2018.



Picture 9: Financial model of the state DCs

Safety

Compared to the traditional environment of information and communication technologies, different aspects of safety need to be considered in the cloud solution. Safety situation of the data and applications is changing as well as the origin, nature and significance of potential threats; therefore, it will be very important to adopt measures to achieve a demonstrable safety level of the cloud solution. Three basic principles related to information safety are connected to the data stored in cloud, similarly as if it was stored anywhere else: trust, integrity and availability. Prevention from an unauthorized access to information in cloud is one of the key roles of an efficient data protection. Protection of data against unauthorized users may be ensured in two ways – by controlling the access to it and its coding.

Increased attention will be paid to securing cloud services from the information safety point of view. This issue is also closely connected to categorization of data of information systems of public administration mainly from the point of view of their sensitivity (confidentiality), criticality and availability. Types of safety storages and safety requirements which they have to meet will be proposed based on an exact data categorization. From the confidentiality point of view, relevant cryptographic tools will be employed and management of cryptographic keys which will be managed by the particular IS provider and not the provider of cloud services will be ensured. The information system of public administration working with a certain type of data may be migrated only to a solution of a provider of cloud services who meets such safety requirements.

It is typical for cloud that the user is outside cloud. Therefore, data protection must be set not only inside cloud, but also between the provider and user or third parties. In this connection it is necessary also to include models of cooperation and access as well as management of tasks and rights and used digital identities (management of identity and accesses with technology, organization and processes) using constructed solutions and extending them.

Ensuring communication infrastructure

In this respect, the proposed cloud solution will significantly increase the requirements for the need of communication between operators and users of cloud services. It will be necessary to ensure a high-speed connection among end-stations and DC operators by extending access points and data transmission efficiency of the used networks (e.g. Finnet, MVnet, Govnet).

Informedness

Education and popularization among public administration employees at different management levels will be an important part of implementation of the cloud solution. From this perspective, it will be necessary to distinguish at least the following levels:

- popularization of cloud services before implementation/migration of ISPAs;
- technical education for ICT in relation to migration and support of a new form of service provision;
- education for users and presentations for users at different management levels.

As for education, an emphasis must be laid on sufficient explanation of advantages and risks connected to the transition to provision of cloud services through the state DCs and relevant technical and economic indicators related to a different form of operation must be provided.

6 Measures to ensure state DCs centralization

ICT infrastructure of state administration is transformed into the form of cloud services at all levels. It is a significant conceptual change in the form of ICT operation functioning. The basic characteristics is building a state cloud solution in the form of a private cloud based on selected public administration institutions, with experience and a quality level of DCs. The aim of centralization and development of the state DCs is to provide ICT services with a higher added value for public administration entities.

State DCs will be centralized and developed in two stages. The first stage will include centralization of the existing public administration DCs to two state DCs which will cover the requirements of information systems of state administration for placement and operation of the existing ICT in a consolidated manner by providing the IaaS service in the form of housing in the state DCs, while at the same time applying the principle of infrastructure virtualization.

The second stage will include development of the state DCs the aim of which is to provide IaaS, PaaS and SaaS cloud services through these DCs, to ensure optimization of the quality and costs with a long-term sustainability guaranteed.

6.1 Ensuring a coordination, management and control competence of MF SR

MF SR as the bearer of the coordination, management and control competence will perform the following measures in close cooperation and after a discussion with MI SR:

- to lay down the rules for the provision and use of DC cloud services and the form of enforcing rights and obligations;
- to design, manage, coordinate and supervise the plan of implementation, centralization and development of DCs;
- to create and keep the catalogue of cloud services with a list of technical and functional parameters about the service;
- to ensure planning and preparation of an offer of DC services, changes in the existing services and development of resources necessary for operation of these services;
- to assess the consumption, requirements and the condition of services, to provide outputs for creation of the budget and for efficient allocation of finances based on the projected and actual consumption of cloud services;
- to ensure coordination of requirements of users, to supervise the quality and settlement of professional relationships (SLA);
- to decide in the event of a dispute and non-compliance with SLA;
- to verify a service before placing it in the catalogue of services;
- to perform audit of meeting the criteria set for cloud services and related information systems from the point of view of their performance, securing and other parameters agreed upon in the terms of use;
- to standardize the categorization of cloud services according to the safety level in connection to data categorization;
- to regulate the rights and obligations of operators and users of state cloud services through an amendment of the act on ISPAs;
- to ensure a methodical, procedural and application support for support and administrative systems and their transfer to SaaS.

6.2 Ensuring operation of the state DCs by the operators

It is necessary to perform the following measures through state DC operators:

- secure and consolidate any technical, organizational and procedural conditions of DCs functioning;
- provide safe cloud services;

- take care of the development and administration of services, a systematic development of resources and a supplier chain in which resources will be ensured on the basis of a clear delimitation of competencies between the MF SR and MI SR for individual centrally provided cloud services;
- comply with the cloud architecture laid down in the Annex 7 of the Decree of the MF SR No. 55/2014 Coll. on Standards for ISPAs;
- manage resources in an optimum manner;
- manage relationships with users of cloud services based on the concluded SLAs;
- analyse and deal with any incidents in line with the agreed conditions;
- perform corrective measures after identifying a defined incident;
- provide information on the condition of ICT;
- make designated persons of the customer familiar with defined incidents;
- generate and provide reports and statistics;
- elaborate a safety project; implement safety processes and implement safety measures;
- provide supporting documents before placing a service in the catalogue of services and when performing audit.

6.3 Ensuring a transition to cloud services by obligatory persons

The following measures must be performed through administrators of information systems of public administration:

- elaborate a plan of a gradual migration of ICT to the state DCs;
- ensure implementation of the ICT migration plan to the state DCs in cooperation with state DC operators;
- offer their own infrastructure for use to the state DCs;
- act in line with the proposed rules for the use of cloud services;
- manage the transition to cloud services in their Ministries.

7 Conclusion

Until now, each public administration institution has dealt with ICT infrastructure and ensuring licenses in their own manner. However, the growing operating costs of information systems of public administration are creating a significant pressure on the budget and this problem needs to be addressed in a systemic manner, through centralization and development of state data centres.

Principles of the proposed solution

The proposal of centralization and development of state DCs represents a concept which is shifting the operation of public administration information systems to a professional level. Information systems and information and communication technologies in public administration may be understood as services which will be provided with a view of the following principles:

- efficient use and sharing of resources;
- scalability and elasticity in relation to the needs;
- provision of services on demand;
- the financial model will be built on the basis of actually consumed resources;
- the services will be available online 24/7.

In order to reach the desired effect, it is necessary to observe all the above-mentioned principles in the proposal, provision and use of shared services.

Benefits of the proposed solution

Performance of the proposal of centralization and development of state DCs will bring several benefits which are important for the provision of electronic services to the public as well as for further development of ICT in public administration towards modern procedures and technologies. This will considerably promote the innovation potential of public administration, bringing a positive impact on the whole digital economy.

Implementation of the cloud solution will mainly lead to gradual procurement costs saving and operation of public administration information systems. This saving mainly consists of:

- infrastructure consolidation which enables sharing and an efficient use of available resources and, in connection to virtualization and standardization, it creates conditions for such capacities management which enables to cover the planned requirements and minimizes the volume of unused resources;
- platform consolidation which will enable to save SW licenses purchasing and administering costs;
- saving energy costs which currently represent 15 – 20% of the total costs of ownership (TCO), as large DCs are able to purchase energy for more advantageous rates, thanks to their consolidated infrastructure they are able to dynamically optimize the load and resources use and thus to efficiently manage the current energy consumption;
- labour costs saving, as the environment of large DCs enables automation of repeated tasks and ICT environment management which is not cost effective for smaller DCs; the automation will then enable the DC staff to attend to a higher number ICT elements and to focus on tasks with a higher added value.

Such progressive solution will also enable to significantly increase the quality of safety measures in the work with data and personal data of citizens. Flexibility and scalability of resources will increase as well, ensuring their efficient use when necessary.

Vision

The goal is that the state DCs will provide ICT services on demand to individual state administration institutions in such extent which will decrease their burden of looking after their ICT resources, such as the purchase of any necessary equipment, regular software updates, maintenance of hardware and software applications, etc. At the

same time, it will enable them to decrease the cost of information and communication technologies. It is essential to transfer the responsibility for ICT operation to state DCs as providers of comprehensive services. It represents a significant shift in functioning of the state administration towards high support activities professionalization in line with the public administration reform.

MF SR and MI SR will be the state DC operators. It means that two data centres interconnected for the purposes of backup and the consecutive potential disaster recovery will be gradually created. Cloud services in the required high quality and safety will be provided in the state DCs.

Public administration institutions will be able to use all forms of cloud services (infrastructure, platform and software). Services will be available through a catalogue of services for the purpose of simplification of this use. The offer and demand for cloud services will be managed, coordinated and controlled by the Ministry of Finance of the SR in close cooperation and after discussion with the MI SR.

Proposal implementation

Implementation of the necessary measures will be carried out in two stages. In the first one IaaS cloud services will be implemented in the form of housing, and in the second one the services of the state DCs will be gradually extended by other services enabling the provision of cloud services with a higher flexibility and a possibility of a more dynamic administration of allocated resources, namely the IaaS, PaaS and SaaS services.

Such implementation of the state DCs represents a demanding logistic and organizational task where it will be necessary to migrate the information environments and data, in addition to the building of the solution itself. There will also be procedural changes in operation of relevant public authorities and a new form of ICT financing in public administration will be introduced. Investments costs will be funded through the Operational Programme Integrated Infrastructure.

The most important outcome of this proposal is the fact that public administration will spend its resources for procurement, implementation and operation of ICT solutions in a more efficient manner. Acceptance of progressive cloud solutions by the public sector will increase, and the expertise and cloud solutions portfolio provided in digital economy will be enhanced as well. Last but not least, electric energy consumption and CO2 emissions of data centres will decrease by implementation of green information and communication technologies.

Rationalization of information systems operation through the state DCs is expected to decrease the total costs of information systems ownership in public administration by 18 per cent by 2022.[7]) All public administration authorities should gradually start to use cloud services.

Annex 1
Example of information systems services which will be provided in the form of SaaS

More comprehensive information systems are sub-divided into modules which may be implemented separately, if necessary. State DCs will provide the following information systems services in the form of SaaS services:

- **ERP (Enterprise resource planning) services** –represent the solution of the entity administrative activities (public administration institution – obligatory person). It is a set of integrated applications which can manage the resources use throughout the life cycle of processes in real time. This will help to obtain an overview of the economic activity and condition of the organization from the global level to individual transactions (invoices, orders, payments). ERP will be dealt with together with a methodological unification of administrative processes in state administration within the ongoing project of CES (central economic system) implementation as well as the centre of methodological and procedural support. We may consider the following modules as the basic modules within ERP:
    - stock control (administration of warehouses, management of stocks);
    - accounting (ledger, liabilities and claims, cashdesk and payments);
    - controlling;
    - assets administration (immovable assets, stock-taking, depreciation management);
    - budget administration (budget planning and allocation, funds-drawing control);
    - contracts (contracts creation and record-keeping, partners management);
    - financial reporting;
    - material management.

- **Real estate administration** – the system will enable real estate's record keeping (catalogue of real estates and their technical documentation) and their use management: rent, sale, contracts related to real estates (costs settlement) and processes related to maintenance of real estates. The system will be mainly used for the needs of state real-estates administration.

- **Human resources management** -–set of applications which will ensure a comprehensive management and development of human capital in public administration institutions which will be integrated with ERP, in particular:
    - attendance (including the system for arrivals and departures management, mobile entering the completed tasks);
    - wages (calculation and distribution, wage slips);
    - social welfare (record-keeping and calculations, communication with Social Insurance Company);
    - trainings and competencies (human capital management, record-keeping and planning trainings and personal development);
    - journeys (business trips planning, mobile solution of costs, billing);
    - planning of capacities and schedules (creation of work plans, defining tasks and requirements, schedules for individual days and employees).

- **Management of field workers** – services for institutions the employees of which deal with field tasks. It is composed of a central console and a mobile application for employees. The central console will ensure geo-location (central overview of the location and condition of employees), allocation of tasks, summary of tasks performance, etc. The mobile application will enable employees time schedule management and tasks performance support.

- **EDMS** (Electronic document management system) and workflow is a set of applications for record-keeping, monitoring and creation of documents in institution's processes. Documents circulation for selected expert processes, which several institutions deal with, will be offered as another service. Basic modules:
    - document management (record-keeping, templates, generating);
    - filing department (filing service, filing room);
    - correspondence (management of incoming and sent communications and consignments, templates for the types of consignments, automatic generation of consignments);
    - controlling activity processes (from planning through inspection to assessment of outcomes);
    - the investigation file management (workflow which will connect prosecution, judiciary and police in the work with documents included in the investigation file);
    - administrative and appellate proceedings (workflow with pre-set steps and dates for basic types of proceedings);
    - office applications (documents, spreadsheets, presentations, web pages);
    - task management (dealing with electronic tasks in the life cycle, their creation, assigning, delegation and termination – suitable also in integration of client centres with support ISs).

- **Central email** – email server for state administration employees, unification of account management.

- **Electronic record storage** (also ERMS – Electronic Record Management System) services for storage of electronic records and their consequent accessibility through searching.

- **Collaboration platform** – a set of applications will enable a simple exchange of information, experience and tasks, simplifying mainly expert work and policies creation.
    - filesharing (similarly to dropbox, for file sharing);
    - knowledge management (placement of created outputs to topics, searching);
    - intellectual property portfolio;
    - instant messaging and VoIP (communication platform for exchange of messages and calls through IP);
    - social network (contacts, project teams and topics creation, interesting contents sharing, messages).

- **Analytical tools** – set of applications which will support processes through statistical methods and data analysis methods. Their aim is mainly to offer the outputs to address general problems for particular applications. Possibilities of algorithms creation and launching will form an important part:
    - fraud management (network and chart analyses, data filters, automatic pattern learning and recognition);
    - risk analysis (risk categorization, modelling and calculation, rules).

- **Central eLearning** – the service will ensure comprehensive education of public administration employees in the eLearning form, creation of courses and topics, discussion, testing, attendance of courses. Modern technologies such as openEDX and coursera will thus appear in public administration.
    - eLearning (platform);
    - foreign-language dictionaries.

- **Project management and architecture modelling** – the service will provide tools for project management according to set methodologies (PRINCE2, PMI), resource, budget and activities planning, schedule and the subsequent performance, control and outputs quality management and enterprise architectures modelling tool.

- **Public procurement support** – the service will support public procurers in all steps of the procurement life cycle. From the standardized preparation of supporting documents, through automated communication with the Public Procurement Authority, bidders, through the tender (auction) process to disclosure of contracts and results.

- **Quality management** – of public administration outputs and results. It will be a system which will enable to define and monitor selected KPIs and to plan optimization strategies.

- **Opendata tools** – set of data processing tools (cleaning, connecting, interconnecting) into a form suitable for publishing in the linked-data open format.

- **Geographic information system** – information system which will enable to create and use specific layers above the system of spatial information and map documents.

- **Contractual budget** – extension of accounting by a secondary book, system monitoring liabilities and claims of entities (natural persons and legal entities).

- **Fleet management** (AVL) – application set for a comprehensive fleet management, checks and maintenance planning, movement monitoring, tasks assigning, etc.