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Mobile Public e-Government Cloud Services Platform

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Abstract

The mobile public e-Government cloud services platform solution will encompass new technologies, and through the Big Data concept for data collection and exchange it will enable innovative channels of communication and collaboration among different players. The major benefit of the cloud-based platform is the efficient execution of heavy computation algorithms in the cloud simply by using Big Data storage and processing platforms. This new approach will address the mismatch between labour demand and supply to make the services of the public employment agencies more efficient, more effective, user-friendly and personalized. The main focus is given on the positive impact of e-services for employability prospects of young unemployed people, those with disabilities, and older workers. The platform will facilitate the matching of people for job openings, and more specifically, the job search by people with special skill-profiles, including special needs or time requirements. It will provide a networking platform and information services to address socio-economic side-effects of labour market exclusion. The main purpose of the model of mobile public e-Government cloud services platform is to provide an integrated environment where public institutions will receive complete data analysis.

Keywords: *mobile public services, mobile information systems, social care, public sector information system*

1. Introduction

New cloud-based services are being developed constantly in order to meet the need for new faster, reliable and scalable methods for accessing public services. Cloud-based services and Big Data are introducing new possibilities for data-driven decision making in public bodies [1]. Therefore, we have proposed a platform that provides e-services that are available to public users on their demand. The client simply chooses appropriate e-service, inserts personal data to the web-form and lets the platform do the data processing in order to deliver the results.

In EU, long-term employment contracts are less and less present on the labour market. Employed are interested in changing their jobs and developing their careers even in different sectors. Effective matching of jobs to skills, of labour supply to labour demand, is an important mechanism for shortening temporary unemployment. With labour markets going online, it is important to bring all segments of the labour force on board. Unemployment is a crucial social problem in European countries. The low rate of participation in the labour market of certain groups, such as low-skilled youth, people aged 55 and older, people with disabilities, long-term unemployed, people at risk of poverty and other disadvantaged groups, remains a structural problem that must be addressed. The mismatch between the skills in demand on the labour market and the labour supply is a major challenge facing the EU societies. Public employment services thus need to react swiftly to changing circumstances and to replace short-term

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interventions with sustainable solutions, organizational responsiveness, creativity and a personalized and mobile approach.

Proposed solutions can be adapted to different areas. ICT solutions are cost-effective and thus sustainable once implemented. ICT solutions can, if properly implemented, provide guarantees against discrimination based on gender, nationality, disability, age or any other criteria, and specific actions can be designed to provide special opportunities to otherwise disadvantaged groups (such as people with disabilities). Such benefits can be seen when studying e-governance in various contexts, so solutions from one area can provide relevant knowledge for other more specific areas. In this proposed solution the Estonian e-governance experience provides the funding model against which specific tools for public employment services will be evaluated and understood.

The system will give recommendations to job seekers by taking into account: the profile of the job seeker and the job openings by performing the text-based analysis. It will also give periodical recommendations with respect to where and which job openings relatively close to the seeker's profile have accumulated. For example, recommendations will be given if the demand for the job seeker's profile has increased in a certain city or geographical area, or if certain sub-specializations close to the seeker's profile are needed. Finally, the system will take into account the social network and based on the social connections of the users it will recommend job openings. For example, if a commonly connected node/user exists between the job seeker and the company that has posted the job opening that person could serve as a person to give a recommendation letter or if a very short chain of social acquaintances exist it can be activated to obtain information and also to give personal recommendations.

This research proposal has an objective to develop a revolutionary personalized (user-friendly) e-Government platform for career development through the usage of a bottom-up User Profile Bank Big Data concept and personalized interface.

Specific research objectives are as following:

- To ease the labour market search and enhance access to public e-services.
- To create online profiles with available required skills and positions on the labour market.
- To develop easy to use, quick publishing job advertisement market store.

2. Public e-Government Cloud Services Platform

Estonia’s experience of e-governance is offering a multitude of e-services that can be of great value as a model for other countries. Since regaining its independence 24 years ago, Estonia has become a leader in the use of e-technologies, both in the public and private sector. Also, means to bring these sectors together and to involve civil society through the use of ICT has been innovative in Estonia. The recent and rapid expansion of ICT use as well as the necessarily related reform of the legal system to support it means that the Estonian model is useful for other countries. This is shown not least through the fact that the Estonian e-Governance Academy is and has been active in about 40 countries all over the world. The experiences of using e-technologies to provide services and to design user-centric e-services can be applied to many different government areas. The issue of data protection and data security are key issues for any governmental services using personal citizen data.

The concrete results of the Big Data storage User Profile Bank includes:

- To enable storage of real-time job skills for training needs to be increased skill transparency and matching supply and demand side of the labour market.
- Efficient algorithms for reliable and secure Big Data storage of citizen and related data in clouds (public and private).

- Reduced storage requirements for the storage system decreased bandwidth requirements for geographical replication between connected organizations and increased security and improved reliability of services provided.

2.1. Personalized Public Services

This research offers a revolutionary personalized (user-friendly) e-Government platform for career development through the usage of Big Data concepts and a personalized interface.

- Addressing the new challenges posed by the society;
- Fostering the efficiency of the public services;
- Introducing new technologies into the existing system in order to achieve increased connectivity;
- Usage of the open and Big Data concepts;
- Services' personalized design based on the needs of the end users (public sector, private sector, services' users);

2.2. Intelligent and Innovative use of Crowdsourced Large Volumes of Publicly Available Data for New, Smart and Mobile Public Services

Hadoop is the defacto platform for Big Data and storing and processing unstructured data. The KTH's BiobankCloud project [2] provides a Big Data platform, called Hops (Hadoop Open Platform-as-a-Service) that scales to store petabytes of both unstructured and as well as structured data. Hops provide support for automated installation, multi-tenancy, and interactive analysis with Apache Zeppelin. Hops have PaaS support for both private and public clouds, through Karamel/Chef support (www.karamel.io). Hops will be reused in the mobile public e-Government cloud services platform (MPeG-CSP). The revolutionary idea in the mobile public e-Government cloud services platform will be to gather both structured and unstructured data for all job seekers and required job positions needed by employers (government or private) on a national level and store it in the Hops Big Data platform. This will allow us to use the processing power of Hadoop and develop both advanced and nation-wide scalable algorithms for matching skills owned by employees with the specific requirements in job positions published by employers.

Pro-active and personalized citizen-centric public service applications can be created according to a user profile and controlled by the user in structured form around modular public services.

3. Concept and Approach

The main objective is to deliver smart, efficient and inclusive provision of public services by ensuring that the providers target the right and proper beneficiaries of their services, that they do so at minimal cost (in terms of both resources and number of transactions) and that they make the services available to those who may have difficulty in accessing them.

The e-Profile account will provide citizens an online "*mypage*" with an easy to use structure to digitally collect and beautifully present all kinds of skills acquired during all kinds of career transitions for every customer. This e-Profile account will also collect relevant personal information and introduce self-service functions among them to ease the administrative burden in relation to the public employment services.

The profound difference in this approach to the traditional public employment services efforts of building top-down classification trees of occupations and skills is that we will go the *google* direction and let the crowd generate the skills and their preferences of their job search in free text. With the real time skills-bank, we can later add statistical analysis of skills and building automatic relations between occupations and skills with a bottom-up approach.

The skills gathered from the employers and job vacancies will also be collected with the same bottom-up approach. The employers will not be guided through a structured tree of occupations and drop down menus of predefined occupational skills but rather in a user-friendly way type in the occupations and skills sought in a free manner. Then the system can instead be supportive in suggesting autocompleted words and offer spell correction automation. The same goes with translations that will be statistically semi-automated to build multilingual occupation-skill ontology.

By furnishing information in the e-Profiles and job vacancies about the real time evolutions in labour supply and demand public employment services through this bottom-up collection of skills and storage in the Big Data SkillBank will help both employees and employers in identifying skill gaps and development perspectives.

International labour organization (ILO) recommendations will be used as a guiding tool, suggesting probability for gaining certain type of employment based on the different types of skills/qualifications of the job-seekers:

Vocational skills sample questions:

- Were you ever employed/did you ever work (also voluntary, for no pay)? (if yes) What were the tasks you carried out in that job/experience?
- Which job-related skills do you have (or do you think you have)?
- Can you summarize your personal experience in terms of job-related activities?
- Which are the work activities you do best and enjoy the most?
- Can you list at least five skills and abilities you have acquired (on the job, at school) which can be useful for a job/occupation?
- Have you chosen the type of work you want? (if yes) How is it related to your experience, skills and abilities?

Job search and work-readiness skills

This area of interest helps to judge whether the job search and work readiness skill affect the client's ability to get a job. These skills include self-awareness, work readiness (ability to write a CV, sit an interview, identify his/her skills and present them to an employer), motivation to work, and career planning (wage requirements, shift preferences, work flexibility).

Sample employment questions:

- Which are the work activities you do best and enjoy most?
- Can you list at least five skills and abilities you have which can be useful for a job?
- Can you summarize your personal experience in terms of work, education and job-related activities?
- Have you chosen the type of work you want? (if yes) Why did you choose it? (If not) What is the most important thing in a job you are looking form (money, free time, personal prestige, social standing)?
- Have you already searched for a job? (if yes) How? Did you compile a CV or responded to add? What did you include in your CV/response to ads? (if not) How do you plan to search for a job?

The aim is to create a user-friendly e-Profile system for job seekers and employers and promote skills sought in job vacancies. It will increase transparency of skill and career supply and demand on the labour market and optimize the labour market information broker function of the public employment services. The developed platform will offer transparent, clearly organized market of job offers and vocational training. On-line services should enable preparation of on-line documents for a job application and will bring the employers and job seekers closer through the usage of e-services.

Few key steps that can give a job seeker an edge in the job hunt are a presentation of soft skills, discovering person's passion, targeting the job hunting strategies and expanding personal networks. While those already employed are always learning on the job, few have the opportunity to focus on deepening their knowledge and skills. This may

explain why so many employers say they cannot find employees with the full skill sets they are looking for.

The advantage of having online profiles will increase the users and employers visibility on the market. The development of e-account will increase the transparency of the public employment agencies and at the same time will provide openness of public institutions. Job seekers and employers will be motivated to open an e-account by providing them with the benefit of using governmental subsidies. These way employers will be able to publish advertisements that will reflect the specific job skills for the certain job position.

Another important point is to bring into the global picture the vocational centres, in order to reduce the gap between the job seekers and employers. By using the online e-services for job profiling, we will have a clear view on real labour market demands for hiring skilled personnel.

3.1. Development of Public Online Profile for Job-seekers

This module of the platform will focus on developing a new product to help job seekers with their personalized profile and other aspects of the employment process. The e-services will enable development of the on-line profile where general data will be pulled out from the official database will allow for adding different skills. Beside general skills and abilities, the application will assist with adding job-specific skills along with the level of competency and experience. Recognition by peers and management would feed in the personalized profiles and will allow skills to be renewed by other people in the network. This profile will later feed-in the Big Data platform that will support the job-seeking process.

This approach, very informal in the way it is pursued, but also very interactive and open for the new and challenging environment will help job seekers to develop their career path. Profiles created with the LinkedIn popular site will also become part of a personal folder that can be imposed to potential employers. This is an innovative approach in terms of breaking the formal frame of the existing job seekers profile kept by the public employment services and moving from a very rigid format where the only limited number of data is presented to the skills reach profile that will enable presentation of different skills beyond those obtained with formal education.

Other modules of the on-line profile will allow for a short presentation of the previous work experience and acknowledgment and recognition by previous employers. The job seekers will choose to make the file publicly available.

The expected result of the pilot is to provide a user-friendly (online) LinkedIn-like e-Career account for all users. This scalable system will be able to include all unemployed customers, but also to enlarge the User Profile Bank (UPB) toward new customers (workers, job seekers, job-changers, employers, inactive groups).

During the process of development of the job-seekers profile, the end user’s needs (job seekers) will be assessed in order to develop the personalized type of profile. Assessment will be conducted on a national level on the information stored for job seekers. Personalized job seekers profile will give priority to publishing skills, previous working positions, certificates completed of professional training etc. The profile will be intuitive and user-friendly to allow easy creation and navigation of an e-account.

3.2. Development of the Public Online Profile for Employers

This work package will allow creating online profiles of the employers in which they will be able to place required skills and positions needed on the labour market. The process of developing the e-account for job seekers and employers will be motivated by introducing scores (Researchgate-like scoring).

The design of the employers account will foster easy to use, quick publishing of job advertisement market store, with following components:

- Bottom-up approach skills based publishing of job vacancies
- Automatic validation of fields
- Compliance with existing regulatory/legal system.

It will allow the private companies to use the system through:

- Reviewing the pool of unemployed persons' qualifications (of those registered unemployed that have agreed to share their personal information)

- Placing a job advertisement where the focus will be given on skills and occupation/preferences input fields.

3.3. Develop Online Employer Subsidies Calculator

Part of the employment e-services will also offer a customized online employer subsidies calculator. The process of determining the subsidies for employees that are receiving state insurance is always unclear. In order to increase the transparency of their own state benefits and health insurance exchanges, the employer subsidies calculator will be introduced. The calculator will include different incomes, ages, and family sizes to get an estimate of the eligibility for subsidies and how much can be gained from health insurance. Because each country has its unique system for calculating the employee subsidies we propose to have national e-service that will do the calculation. The proposed e-service will provide transparency in determining the subsidies for employees.

4. Big Data Storage User Profile Bank for Skills Matching

The Big Data storage and processing approach will form the basis of the open-market space platform that will enable the search/matching service between citizens, the private sector and the state. Functionalities of the platform will be:

- Job search to be done automatically by search forms in which case clients receive an immediate match of their skills with those offered on the labour market. This will be offered also through a mobile app in order to better respond to the needs of youth.
- Qualifications of the applicant's profile will be compared with the requirements of the job offers. In the results list the job offers that match the qualifications the most will be placed at the top.
- Narrowing of the search could be done by clients (job seekers and employers) to *e.g.*, job offers from a specific industry.

The platform will provide relevant and real-time information that can be taken into consideration for regional and national level analysis of labour demand. The open-market platform will combine data from the profiles of job seekers and the accounts of employers. It will have the following key features:

- Scalable eProfiles and Skill-Bank with different database models.
- Semi-automated occupational-skill ontology structure. This structure can be both manually and automatically populated by means of text extraction and machine learning methods.
- Extendable multilingual support with dictionaries for Swedish, Macedonian, Estonian, English, and other European languages.
- Machine learning platform for auto-improving autocompletes suggestion. This will let the user input gradually improve the user experience.
- Spell correction and check.
- A statistical model for relationship graphs and clustering. Here the data from *e.g.*, job seekers, employers, job vacancies and user-provided information from social networks will be used to provide an automated relationship structure of the job market. This can provide novel functionalities for the users such as skills and industry dependent job recommendations similar to how the recommendations found in popular media services work.

- A simple query system for information retrieval and matching profiles to vacancies with stemming support.
- Design and creation of eProfiles (similar to profiles in social networks) for end users (employers and citizens).
- Skills and occupation/preferences input fields.
- API to import and export eProfiles with authorization.

The bottom-up approach will open possibilities for development of new innovative individual e-services for both, job-seekers and employers.

4.1. COLLECTING (e-account)

The process of creating client's e-account within these different partnering countries will implicate, in a first phase, the process of extensive collection of the data. E-accounts can be created using the public employment services national portal, which ensures the security of data collection process. In order to ensure a stable and reliable connection between the clients and the national User Profile Bank the latest 5G, 5th generation mobile networks (LTE), the standard will be used. This will enable the fast gathering of personal data in the Big Data storage. Within this process, it will be important to define a simple user interface to navigate the client to insert personal data.

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- Job search to be done automatically by search forms in which case clients receive an immediate match of their skills with those offered on the labour market. This will be offered also through a mobile app in order to better respond to the needs of youth.
- Qualifications of the applicant’s profile will be compared with the requirements of the job offers. In the results list the job offers that mostly matches the qualifications will be placed at the top.
- Narrowing of the search could be done by clients (job seekers and employers) to job offers from certain economic sectors.

4.2. PROCESSING (Skills Matching and Job Recommendation Algorithms)

The innovative action in this proposal is to create algorithms that can be applied on a large amount of collected data. First one is the skills matching algorithm. This algorithm considers matching of the job seekers skills and the work position knowledge requirements stated by the employer, besides the formal education. This approach will provide benefit to the job seeker to easy filter the open job positions on the labour market. On the other side, the employer will have an overview of skilled workers on the labour market. The second type of algorithms for job recommendation will be able to detect missing skills for the job seeker. If there are employers that require certain qualifications or skills in large quantity then it will be suitable to recommend to the job seekers to visit vocational canter.

The public employment services will use the processed data to run analysis, what kind of skills are really needed the labour market. The public employment services centres can have the leading role advising of recommending vocational training to job seekers. This will increase the efficiency of the measures needed to run requalification process in the public employment services centres.

4.3. STORAGE (Big Data storage User Profile Bank)

Big Data storage User Profile Bank will represent a central point of keeping and analysing gathered data. It will have reliable, secure and scalable storage system. By furnishing information in the e-Profiles and job vacancies about the real time evolutions in labour supply and demand public employment services through this bottom-up

collection of skills and storage in the Big Data User Profile Bank will help both employees and employers in identifying skill gaps and development perspectives.

The proposed architecture of MPeG-CSP integrated platform is given in Figure 1. The cloud computing services are hierarchically built from bottom to top in the order of Infrastructure, platform and software service [3]. The basis of the system architecture of MPeG-CSP platform is the Big Data storage and analysis layer, see Figure 1. This layer consists of Hadoop components: HDFS (Hadoop Distributed File System) and YARN (Yet another Resource Negotiator). HDFS is a scalable file system that can be easily scaled from a few nodes to a few thousand nodes, with existing clusters at Facebook scaling up to 100 PB in size. HDFS is the storage layer of Hadoop, and YARN/MapReduce is the parallel processing layer, see [4]. The main advantage of Map Reduce model is that allows systems to run on a set of homogeneous nodes including both computing and storage nodes, located in the infrastructure layer. YARN also supports modern in-memory data processing frameworks, such as Apache Spark and Apache Flink. Spark, in particular, enables integration of structured data, accessed using SparkSQL, with unstructured data using data-parallel machine learning libraries. On the foundations of this layer is build the second layer for operating system (OS) and hypervisor layer. Next is the platform layer, which holds MPeG-CSP where Skills matching and Job recommendation algorithms are executed. On top of the MPeG-CSP integrated platform is the cloud application layer, which delivers public services to the clients (job seekers and employers).

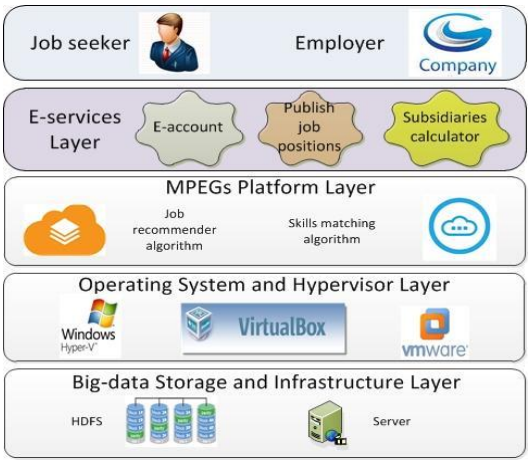

Figure 1. System Architecture of MPeG-CSP Integrated Platform

Another benefit of using cloud-based services for the development of MPeG-CSP integrated platform is the cross-platform support. Cross-platform mobile development refers to a technique of writing a single codebase for applications, which could be used on different operating systems. As a developer, especially developing mobile applications for the multiple platforms is an extreme challenge as they all have their own unique characteristics, capabilities and behaviour, making it difficult to create any uniform solution. The proposed platform will be developed to use a single development lifecycle in order to create application compatible for multiple devices.

In order to make really good e-services, both in design and functionality, we proposed to be used HTML5 together with CSS and JavaScript. Cascading Style Sheets (CSS) is a style-sheet language that can be used alongside HTML5, see [5]. The latest standard for CSS is CSS3 and is still under development. CSS3 allows the m-app designer to focus more on the presentation side of the website, leaving HTML5 for general structure and content. JavaScript is a lightweight, interpreted, object-oriented language, most known as the scripting language for web pages. We can think about JavaScript as an extension of

WEB RTC (Real-Time Communications) or as the behavioural real-time communication language of the web. It can be used for interacting with the end-user in order to have a functional user interface.

Finally, we will use Big Data technology to drive a strategy of data-driven decision making. Hadoop, as a platform, enables the integration of structured data and unstructured data in a single system. This enables the development of more user-tailored and intelligent services that integrate information from many different sources (user forms, interview transcripts, user behaviour in MPeG-CSP, social network history, *etc.*,) in a single system. Hadoop enables the efficient storage and processing of massive amounts of data on commodity hardware, resulting in a cost-efficient platform. Hadoop, and Hops-Hadoop is open-source software and has no licensing costs.

This innovative action will solve the problem of mismatched demand and need to work in the labour market, by using modern collaborative ICT paradigms. The MPeG-CSP first contribution is to engage and motivate inactive unemployed citizens from certain societal groups, such as the low-skilled youngsters, people aged 55 and older, occupationally disabled persons and long-term unemployed to have public profiles on the labour market. The second challenge that is addressed with the research is to promote public employment services as transparent and modern Governmental institutions. The proposed Big-data storage User Profile Bank for skills matching will enable storage of real-time end user generated job skills for training needs; it will contribute to increased skill transparency and matching supply and demand side of the labour market.

The platform will offer a great modularity by implementing this Platform as a service cloud computing approach. The platform for data collection from clients (job seekers and employers) will be set as a cloud-based Platform a service application, and as a middleware between the Big Data storage and the services offered by the system. This approach of developing Platform as a service application will allow creating scalable system, independent of the underlying architecture, ease-of-use and ease-of-deployment system. The Platform will also offer in terms of service methodology a centralized collection of data, then again mobility of services independent of its hardware. This approach of building cloud-based applications will enable fast and widespread deployment of this application. The system as a whole will improve the process of finding jobs and mobility of job seekers. The widespread use of smartphones and the application developed by this research for several mobile platforms will allow faster, and better matching of the job seekers skills with work position knowledge requirements. This will result also in happier and many satisfied employees and improved productivity.

5. Measures to Maximise Impact

A real –time analysis on the needs on the labour market will further influence the training offered by private and public providers and will enable flexibility of the training system and with that a more realistic and relevant career development of those who are looking for new challenges/jobs. The platform should allow governmental institutions various e-services to link up and operate in harmony. The e-services will remain a responsibility of each institution, meaning their development and operationalization will be owned by the respective institution.

The opening of the system to the private sector enterprises and chambers of commerce will enable their plug-in and active participation in the information system offered by the government. This will also enable them to use offered services in their own electronic environment and propose training services, which would bridge some of the existing gaps on the labour market regarding the qualification and skills requirements. Merging the services of public and private institutions in one system will save resources, time and funds. In this way, companies will use this innovative approach to working towards the nurturing and development of skills that are relevant for their growth by providing direct

input into the analysis of the labour market deficient skills, while at the same time offering relevant training that will lead to job placement.

6. Discussion

The proposed public e-Government cloud services platform will contribute towards increased transparency of qualifications and skills throughout Europe through the creation of an advanced Big Data User Profile Bank digital accreditation system that is bottom-up designed (populated by people themselves). It will ease the employment process by collecting the achievements, career transitions and acquired skills in digital personal profiles generated by the job-seekers. The proposal will be based on an e-Portfolio system for all job seekers, job changers and employers, which take into account both experience and competencies/skills offered and sought.

This paper offers a revolutionary personalized (user centred) e-Government platform for career development and job search through the usage of a novel Big Data User Profile Bank concept and a personalized interface. Europe 2020 Strategy within its flagship initiatives is setting a priority theme as "An agenda for new skills and jobs" in order to modernize labour markets and empower people by developing their skills throughout the lifecycle with a view to increasing labour participation and better match labour supply and demand, including through labour mobility. Increased labour participation and a better match between labour supply and demand are some of the priorities of the Europe 2020 Strategy within the "Agenda for new skills and jobs" flagship initiative.

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