The Project OASIS (Openly Accessible Services and Interacting Society)

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Openly Accessible Services and Interacting Society

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Abstract—**Public authorities have been designing and developing several initiatives for more than ten years in the attempt to guarantee an easy access and a wide offer of on-line services to citizens. Moreover, public authorities should guarantee a common heritage of data, accessible for any person at the same conditions. Despite of these initiatives, public bodies are still often dependent on software vendors. The European project OASIS aims to place the user at the center of a sustainable ecosystem where data, described by an open format, are shared among interoperable and reusable services. This approach allows public authorities to reduce costs, citizens to benefit of a wide range of high quality services and service providers to access to linked data for the development of new applications. Providers can also be part of the OASIS ecosystem, thus benefiting of an open a sustainable economic model. This manuscript describes in the details motivations behind the OASIS project and the portal Ozwillo, presents the platform architecture and discusses preliminary results.**

Keywords-breaking vertical data silos; opening and reusing services; deploying new architectures; implementing large scale demonstrators.

I. INTRODUCTION

Computer scientists usually divide the evolution of computing in three main periods (sometimes called eras). Sometimes these periods are categorized according to a "architectural" vision. The first period (1950s-1970s) is related to mainframes: "stupid" clients were connected to centralized computers. Applications were run on the mainframes and only data representations (usually textual information) were sent to clients. In this scenario, the end user is a passive actor that can only input data (e.g., by keyboard or punched cards) and receive displayed or printed outputs [1]. The personal computers (PCs) era (1970s-2010s) changed the paradigm: data and applications are directly managed by the end user and with the advent of high speed networks several different distributed and complex architectures, such as P2Ps and grids, raised [2]. Nowadays, we are living the Cloud Computing era: the network is on planetary scale, data and applications are "on the cloud" and users can select (and pay) only for resources they really need and use. The main advantages of the cloud computing are scalability and elasticity, which allow users to allocate resources on-demand in a self-service way [3]. Other times, these periods (called revolutions) are categorized according to the "financial value" vision: the first IT revolution is related to the PC and the IBM is the leader. the second revolution is related to the software and it is leaded by Microsoft, finally, the third revolution, related to data, is represented by Google, Facebook and others..

This paper describes the project OASIS (Openly Accessible Services and Interacting Society [4]), which aims to take advantage of the cloud computing paradigm in order to facilitate users to get access to information, public e-services and economic promotions by federating services and data by a unified portal (Ozwillo). Cloud computing architectures provide scalability, flexibility, fault tolerance, robustness and many other useful characteristics that will allow public authorities to make services more accessible, more efficient and less expensive for citizens.

OASIS has been founded by the EU under the Competitiveness and Innovation Framework Programme (CIP) 2007-2013, call 5; OASIS will have a duration of 36 months. Ten partners are involved in the project from six different countries and five pilot sites will be deployed during the last year (see Figure 1).

The four main goals of the projects are: breaking vertical data silos, opening and reusing services, deploying new architectures and implementing large scale demonstrators. These goals basically reflect in making services interoperable. A set of original services has been redesigned in order to allow an exchange of information through a datacore (see Section III). This datacore has a twofold purpose: from one hand it provides a shared repository where data are stored in a well defined and homogenized format, on the other hand it acts as a sort of "common good" that service providers can use, thus boosting software developers to supply new services/applications to be included in the OASIS catalogue. In this way, it will be easier to release public authorities from the so called "vendor lock-in" (the term lock-in has to be meant as the dependency of a customer on a vendor for products and/or services, thus making the customer unable to use another product/service without additional switching costs).

A lot of challenges have to be faced in order to tackle the above mentioned ambitious goals. First of all, OASIS defines a new unified and homogenized data model to be implemented in the datacore. Shared data have to be consistent and coherent with respect the original data sources, duplications should be avoided and services have to cope with the datacore in a safe and efficient way. The datacore will be in charge to store public data; on the other hand, confidential and protected data will be managed as specified by legislations in force. As one of the OASIS' goal is to entice also small and medium enterprises

to contribute the product catalogue, services will not be necessarily hosted in the OASIS platform.

Partner di OASIS		
1.	PÔLE NUMERIQUE	FRANCE*
2.	POLITECNICO DI TORINO	ITALY
3.	ATREAL	FRANCE
4.	CITTA' METROPOLITANA DI TORINO	ITALY*
5.	DAVID HOLDING	BULGARIA*
6.	EAST MARMARA DEVELOPMENT AGENCY	TURKEY*
7.	BRUNEL UNIVERSITY	UK
8.	BLAU ADVISOR	SPAIN*
9.	ATOL	FRANCE
10.	OPENWIDE	FRANCE

Figure 1. OASIS' partners (pilot sites denoted by '*').

New kinds of partnerships migrating towards the PPPP (public–private partnership procurement) model will guarantee soon end-users (citizens and companies) for long-term and sustainable local developments. New hybrid forms of organization will emerge on the territory, thus contributing and fostering to the development of services and job opportunity. OASIS puts the user at the center of an ecosystem (Figure 2 shows main actors and their relationships in OASIS) basically providing a mediation between users and public authorities, enterprises, service providers, and so on. Moreover, the governance of OASIS has to be shared among public authorities, organizations & associations of citizen and companies. On the other hand, in order to prevent any form of monopoly and possible conflicts of interest, companies involved in the OASIS' governance cannot be, at the same time, service providers.

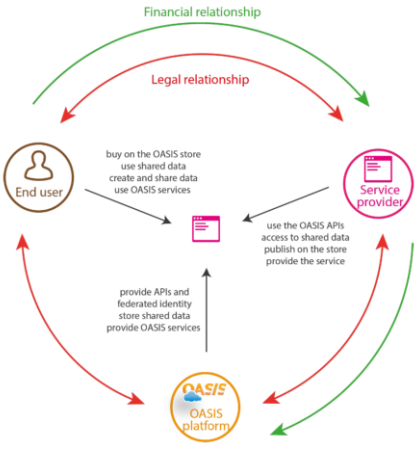

Figure 2. Actors and relationships in OASIS.

The rest of the paper is organized as follows: Section II presents motivation and background behind the OASIS project. Section III describes the architecture of the proposed platform and Section IV discusses advantages and drawbacks of the current work also analyzing preliminary results.

II. Motivation and Background

An analysis of the current scenario is important to better clarify the OASIS' philosophy and motivation. For instance, let us consider the reservation of the School canteen: three actors are involved. The first one is a family that has to reserve the school canteen for its children, the second actor is the school and the third participant to this process is a municipality. Usually, the family has to interact, through two different services, with two different "data providers": the archive of the municipality and the archive of the school. Relationships and data exchanges can be manifold and the system could be potentially not consistent, that is, the information stored in an archive might be different from the one stored in the other archive. Moreover, the family has to interface with two different entities, thus wasting time and facing unnecessary bureaucracy.

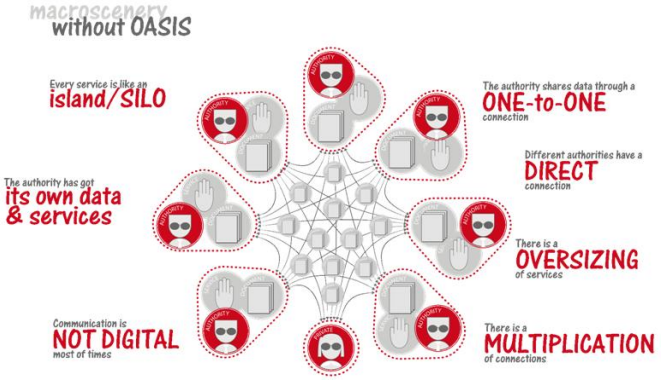

Figure 3. Scenary without OASIS.

OASIS completely changes the scenario: the datacore "easily" allows the two Institutions to share coherent and consistent information. Moreover, users (in this case the family) can take advantage of a unified interface (the OASIS portal) that allows them to directly and transparently contact the municipality and the school. This systemic approach can be extended to different service categories, which can be of interest both for citizens and enterprises that need to interface with public bodies. Figure 3 and 4 summarizes drawbacks (without OASIS) and advantages (with OASIS).

A. Analysis of the Current European Scenario

This Section presents a synthesis of a study, performed by the project coordinator Pôle Numérique [5], related to various areas of Northern or Southern Europe on the advances of the services and the uses of digital technologies and, more particularly, in the e-administration (on-line public services).

The Scandinavian approach is essentially based on important public investments, which sometimes even create

positions of public monopoly on the broadband networks infrastructure. From the 2000s, the Swedish local authorities invest in collection networks in urban and peri-urban zones, thus allowing both a large number of citizens to access high connections and suppliers to imagine an provide new high quality services.

Observations of Scandinavia and Switzerland allowed of analyzing the first technical-economic effects of the "Open Access" model, which consists in the implementation of a virtuous competition on the services based on a unique investment for the realization of infrastructures. The term "service", in this case, ranges from the simple Internet access up to the most complex software application. This "Open Access" model is often presented as the Swedish model of the open networks: that is a network infrastructure, accessible under the same conditions to several operators and service suppliers.

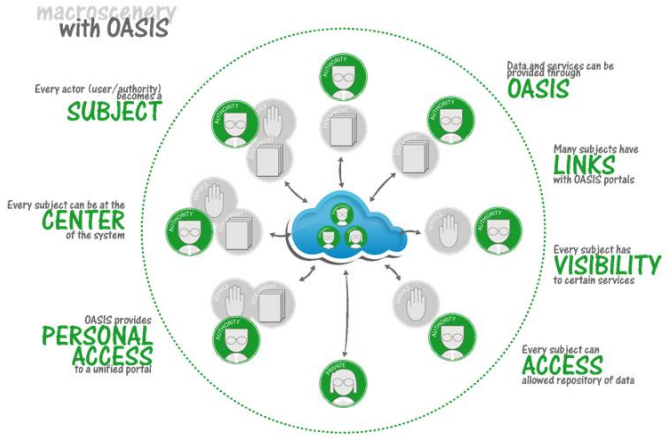

Figure 4. Scenary with OASIS.

This model has generated a competition among service providers: users can choose in a catalogue rich of services but they receive as many invoices as the number of different providers selected. Open access networks are straightaway activated up to the house and they allows the end user to choose and to change access provider without additional costs and/or service interruption. Furthermore, this model allows local companies to supply various types of services and the experienced feedback shows that the return on investment in most of the open networks models is very quick as the broad range of services is usually available at very competitive costs.

This advance on infrastructures also quickly allowed to improve the qualitative level of the offered services, thanks to the implementation of a direct competition among operators. This political strategy also offered important levers of local economic development to the Scandinavian public authorities, which set it up from the beginning of the 2000s with the creation or the expansion on their territory of companies working in the digital field, of operators and Start-ups.

The deployment of these open networks also saw initiatives of mutualization of some software applications among several entities, thus providing public authorities a quick return on the investment:

- a significant cut of the management and maintenance fees of the network infrastructures;
- a remuneration when a citizen subscribes to a service that is supported by the infrastructure: Internet access, on-line service, third application, etc;
- the possibility of sharing e-administration IT services of communities and other public bodies, leading to a strong cost reduction of licenses for a territory and the possibility of "ordering" specific developments to share among several public entities of the same territory.

This model, initially set up by Scandinavian countries, Sweden first, is now on worldwide known under the name of Open Networks with major initiatives in Australia (AVICCA Symposium 2010), New Zealand, some states of the USA and some cantons of the Swiss Confederation.

In the South of Europe, the competition was mainly led on the "price" aspect in a vertical model; numerous public initiatives allowed, at the same time, to supply a broadband access to a majority of citizens by limiting the broadband-less areas and, at the same time, to make the network much more reliable and independent from a private deployment strategy often based on a short-term economic model. Most of these new infrastructures, as the Networks of Public Initiatives, thus allowed an improvement of the quality of services. Up to now the regulation made by the telecommunications regulations authorities does not allow to offer, on the public initiative networks, services on the basis of a "Market place" model (e.g., in France). End users remain often captive of an operator and undergo an access cut when they wish to change service provider.

The distinction made on infrastructures between the "integrated vertical model", which we mainly know in Europe, and the "open model" can be also declined on the software and data levels. First research works were made in this sense Figure 7. .

The change of postulate that is underlying at every networks level is based on the positioning of the user. In the first case "vertical integrated", the model is operator-oriented, in the second one "open", the model is user-oriented.

Although South Europe countries did not follow the example of the Scandinavia in order to set up open networks at the infrastructural level, numerous initiatives using the Web technologies can be mentioned at the service level. These initiatives often arose from needs for computerization and maintenance caused by the dematerialization of the e-administration and the quality of services in Software as a Service (SaaS) model, which found echo in the "Cloud". Unfortunately, these initiatives are often constrained by a poor quality of our networks that cannot often guarantee the continuity of use of a remote service used over the Internet. Moreover, the vertical model above mentioned can also involve access problems using cloud platforms. Platforms created by telecoms operators provide users: Internet access, services and data hosting; this is very practical, but several

issues can arise when users wish to change services and/or operator.

The creation of e-administration service platforms looked for an interoperability of the services via the software and came up against the compatibility of IS in communities (e.g., Liberaccess in the Poitou-Charentes Region). The on-line public service platforms were created on the initiative of local authorities, for their members, in an eventually little operable model, which remains closed for legal reasons, procurement contracts, culture [7]However, these various initiatives allowed to make economies of scale and they contributed both to the creation of a reusable software bricks heritage and to harmonize the dematerialization procedures.

As a matter of example it is worthwhile to mention the Brittany region, which created the "Mégalis Syndicate" in 1999, to bring a high-speed Internet access to 2500 public authorities, then a regional e-administration platform in 2006 [8]. The implementation of this platform was based on an original organization in which all the associations of local authorities have a referent who favours the appropriation of the services of the "e-Mégalis platform". The services are supplied by external suppliers, and the access to the services is submitted to a tender, so as not to "break" the local market. Training centers support public authorities in managing the change of workflows and procedures.

Another example is the e-administration platform published on-line by the Province of Massa-Carrara [9] and made of several modules. "PA Flow" is an Electronic management system of documents, which allows the acquisition and the storage of documents in heterogeneous sizes. Paper documents are digitalized and classified. A Workflow module also allows to obtain a traceability and the automatic management of the assignment procedure of documents. Another module allows a better management of the contents of documents through a possible integration with Open Office. This platform allows a more effective documentary management within the public authority.

Two projects were developed in the Province of Naples. The first, the "SISDOC" project [10], which consists in a management system of the flows of documents also bringing an interaction between the government services and the companies or the citizens. The second one, the project "Progetto Museo Diffuso" [11] is a kind of interactive mapping of cultural and naturalistic resources of the Province of Naples. The project describes the multiple faces of the Province of Naples through its monuments, often hidden or forgotten to make them visible to all and accessible to those who want to know the region in general. A powerful search engine and the interactive browsing allow users an easy consultation of over 1200 historic and tourist information sheets as well as photos.

Very similar is the e-administration platforms of Malaga or Sevilla. With the peculiarity for Sevilla [12] to incorporate various public services (job search, teleassistance, telemedicine) into the package of the local Digital terrestrial television. The reliability of the distribution channels can involve problems in the exchanges among several services (interoperability) and the evolution towards new uses.

The final goal of a public authority should maximize the number and the quality of e-services offered and minimize costs. One possibility, as shown by the open network model, is share/mutualize costs with other actors (e.g., sharing the same software among different public authorities, thus dividing development and maintenance efforts). The mutualization is widened and the communities of users and developers favor its evolution capacities and its variety of uses. Unfortunately, there is still no platform of this type in the Arco Latino [13], the only one in project is OASIS, which joins in the ISA European initiative [14] and will participate in the definition of data repositories at the European level, towards the widest possible interoperability.

III. THE OASIS ARCHITECTURE

The step of architectural design has been preceded by a deep analysis of user requirements. Providers as well as citizens and public authority staffs have been interviewed to gather specifications and requests. The MoSCoW system [15] was adopted to collect user and functional requirements [16], which enabled the technical team of OASIS to design the platform. Figure 5 shows the OASIS architecture at a macro blocks level, whereas Figure 6 provides a detailed view.

It can be seen how the OASIS platform is basically composed by three macro blocks: the datacore, the kernel and the portal:

- the portal Ozwillo is the OASIS interface for users (e.g., citizens, professional users, services administrators and providers);
- the datacore is in charge to store and manage the access to shared data. The datacore provides some request language, and offers a homogenized access to external data. The datacore uses the authentication and rights management modules of the OASIS kernel to control the access to data;
- the kernel provides the functions of OASIS to portal and external services and it includes the catalog of all data sources and services.

If the portal represents the interface toward the end user, the datacore and the kernel are the two basic modules of the OASIS platform. The following Sections describe them in the details.

These blocks enable to provide users and providers all functionalities to publish and subscribe a service, to federate services, to create the common heritage of data, to federate external data sources and, from the end user point of view, all functionalities to search, retrieve and use services and data. Datacore, kernel and portal will be hosted on a cloud architecture, in order to take advantage of scalability, fault tolerance, elasticity and security provided by the cloud paradigm.

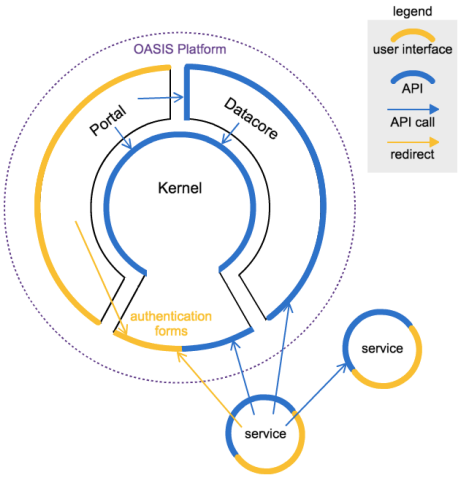

Figure 5. The three basic modules of the OASIS' Architecture.

OASIS runs on a cloud and a lot of instances will be run for each module; the platform's middleware manages these instances, and the server where they are running. On the other hand, services are not constrained to be hosted on the same cloud platform and they can, in general, be hosted externally.

Federation of data and services is directly accessible by a Web interface, thus making them accessible through PCs, smartphones, tablets, or by any other device.

A. *The Kernel*

The architecture of the OASIS' kernel includes 4 databases:

- Catalogs: there are catalogs to describe services federated by OASIS, data sources (both external and in the datacore), available repositories and vocabularies, rates and billing rules.
- Technical data: internal data that OASIS uses in all its internal processes, including subscription for services, status, temporary data, etc.
- Social Graph: people, organizations, and relations among those entities.
- Logs: all logs of the OASIS platform.

The OASIS kernel is composed by several modules:

- Social Graph Requester: this module provides APIs (web services) to request (read and update) social graphs. This module does not access directly to the social graph, it uses the right management module.
- Authentication module: this module provides unified authentication service for portal, datacore, and all external services and data sources.
- Broker: in the first version of OASIS, the broker is only a module that supplies services to access to catalogs and technical data and provides interfaces between OASIS kernel data, and portal and external services. It will be possibly improved during the experimental phase, when needs will be more obvious.
- Rights management: this module implements the algorithms to determine access rights on data in the datacore, or in the social graph. It is an internal module, and it does not make any form of authentication. On the other hand, rights on the data (right to read, create, modify or delete data) are managed by "providers": the datacore, the Social Graph, or other data providers.
- Logging: this module inserts events in the logs database, and provides APIs to request on this database.
- Notification and status flow: this module manages the notifications between services, the status of users' demands, and mediation request on data. It provides APIs to the service and portal to notify and search notifications and status. It manages automatic rules to determine which service must be notified, and can send direct notifications to the services which have implemented the input notification.
- Communication module: this module can send e-mails, SMSs, and other messages to notify users.

B. *The datacore*

The OASIS datacore; it stores several kind of data, in a scalable way:

- Data Resources: resources are personal data and data of applications. They are stored in Data containers, which are internal databases of OASIS. Each container has its own administrator, its own database software, and can be localized in a specific datacenter in the OASIS cloud.
- Data translations rules: these are the hardcoded or configured rules to convert data from one repository to another, or from one format to another.
- Data Models and types: these describe what data is available in the datacore, so that client applications know how to request and handle them. They are stored in their own repository. They can describe any kind of Linked Data Resources.

The OASIS datacore is composed by several functional modules:

- Requester: this module provides APIs to services and portal to request data (read and write) in the JSON-LD format, which is W3C's standard for Linked Data. The requester controls authentication and transmits requests to the adapted query language interpreter. The requester also implements transversal behaviors such as business context logging or the request prioritization scheme.

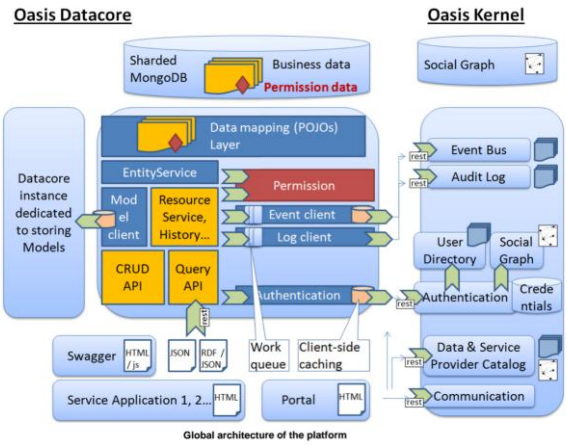

Figure 6. A detailed view of the OASIS' architecture.

- Query language interpreter: OASIS can support several query languages, such as W3C Linked Data Platform filters. For each query language, a specific interpreter is implemented to analyze the request.
- Data homogenizer: this module consists in the set of specific and generic rules governing conversion and mapping of data in the correct format. OASIS also uses it to request external data (data stored by a data provider), and it can help data providers to convert their database to OASIS data representation.
- External requester: this module builds the request adapted to the external database.
- Data access and qualification module: this module verifies access rights to data in reading or writing, and builds the correct request. This module also checks defined type constraints on data, manages further qualification, as well as historization and mediation of data.

IV. Preliminary Results and Conclusion

At this stage, OASIS' portal offer about 15 multi-language services and the development of basic functions related to: the datacore, the kernel and the authentication module is consolidated. For instance, two scenarios have been shown during an intermediate review meeting in order to prove that OASIS is able to tackle the call goals, thus providing a full reuse and interoperability of data and services:

- the first scenario involves a business process where citizen requests for being registered on the voter lists made online through a CRM service (Citizen Relationship Management) are processed by civil servants thanks to an internal business application OpenElec (OpenElec is part of the OpenMairie suite of free and open source software for the operation of political elections in local authorities [17]);
- the second scenario enables the reuse of data produced by the services Ushahidi (an open source project that allows users to crowdsource crisis information to be sent via mobile [18]) and Alternative Tourism (Alternative Tourism is based on the Joomla CMS [19] and aims to meet the goals and needs of: government organizations, travel agencies, companies and ordinary tourists) in order to feed a third service named Mapping of Territorial Activities. Mapping of Territorial Activities is a GIS application that involves the retrieval of records and information by end-users. It allows to: navigate through features on the map to see the economic and productive activities, identify a company using specific search criteria and identify the economic and productive activities in a given sector on the portion of the territory selected .

Mapping of Territorial Activities has been modified in order to read information from the datacore. In this way, Mapping of Territorial Activities can be reused to display, over a map, touristic information (which can be generated by: end-users, government organizations, travel agencies and companies). More in general, the service Mapping of Territorial Activities is now able to display "generic" georeferenced information, thus it can be now used by several public authorities to provide citizens an effective visualization tool. In fact, a new application (10 Things To See) able to tag PoI (Points of Interest) has been developed from scratch; its output is saved in the datacore and is displayable by the Mapping of Territorial Activities service. Therefore, the second scenario shows how data coming from different data sources can be harmonized and homogenized in the datacore, thus making several services interoperable.

From a general point of view, OASIS does not encapsulate any business logic neither defines workflow on data; specific processing rules have to be implemented only at the service level and OASIS aims to be able to federate services that can operate using the same knowledge base. Federated services have to be able to understand and manage data contained in the datacore, therefore a RDF model [20] of data allows to describe information as well as to support a progressive migration towards a semantic web. Moreover, federated services are connected to a bus that delivers the notification of events (event bus); in this way, any arbitrary workflow of operation on data contained in the datacore can be implemented at the service level.

Acknowledgment

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Figure 7. The portal Ozwillo and an overview of some currently available services.

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