

Advanced eGovernment Information Service Bus (eGov-Bus)

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The eGov-Bus project provides citizens and businesses with improved access to virtual public services, which are based on existing national eGovernment Web services and which support cross-border life events. Requirements and specific rules of these life events are considered, and personalization of user preferences is supported. eGov-Bus is based on adaptable process management technologies, allowing for virtual services which are dynamically combined from existing national eGovernment services. In this way, a comprehensive workflow process is set up, allowing for service-level agreements, an audit trail and explanation of the process to the end user. The eGov-Bus process engine operates on top of a virtual repository, providing a high-level semantic view of information retrieved from heterogeneous information sources, such as eGovernment Web services. Further, eGov-Bus relies on a security framework to ensure all high-level security requirements are met. The eGov-Bus architecture is business oriented, it focuses on Service Oriented Architecture (SOA) concepts, asynchronously combining Web services and providing a Service Bus.

Keywords: Frameworks and Guidelines, eGovernment Ontologies, Administrative Process Design, Life Events, Web Services, Service Bus Integration.

Introduction

The overall eGov-Bus project objective is to research, design and develop technology innovations which will create and support a software environment that provides user-friendly, advanced interfaces to support “life events” of citizens and businesses – administration interactions involving many different government organizations within the European Union.

Specific objectives:

- To create adaptable process management technologies by enabling virtual services to be combined dynamically from the available set of eGovernment functions.
- To improve effective usage of advanced Web service technologies by eGovernment functions by means of service-level agreements, an audit trail, semantic representations, better availability and better performance.
- To exploit and integrate current and ongoing research results in the area of natural language processing to provide user-friendly, customizable interfaces to the eGov-Bus.
- To organize currently available Web services according to the specific life-event requirements, creating a comprehensive work-

flow process that provides clear instructions for end users and allows them to personalize services as required.

- To research a secure, non-repudiable audit trail for combined Web services by promoting qualified electronic signature technology.
- To support a virtual repository of data sources required by life-event processes, including meta-data, declarative rules, and procedural knowledge about governing life-events categories.

Generally citizens and businesses will profit from more accessible public services.

The following concrete benefits will be achieved:

- Improved public services for citizens and businesses
- Easier access to cross-border services and therefore a closer European Union.
- Improved quality of life and quality of communication
- Reduced red tape and thus an increase in productivity

Work Packages

To accomplish these challenging objectives, eGov-Bus researches advances in business process and Web service technologies. Virtual repositories provide data abstraction, and

a security service framework ensures adequate levels of data protection and information security. Multi-channel interfaces allow citizens easy access using their preferred interface. Based on the eGov-Bus goals, research is being conducted in six main directions. These are organized into individual RTD work packages which further comprise project management, project dissemination and the implementation of a prototype

The main research axes embrace nine RTD work packages:

- Scenarios and Requirement Analysis (WP2)
- Architecture (WP3)
- Enhanced Web Services (WP4)
- Virtual Repository Management (WP5)
- Security Framework and Qualified Signature (WP6)
- Administrative Process Generator (WP7)
- Prototype Implementation (WP8)
- Dissemination (WP9)
- Project Management (WP1)

Scenarios and Requirement Analysis

The research track of this work package aims at analyzing existing state of the art and trends in eGovernment services in order to give directions and propose decisions as to where the project efforts should be focused. Existing standards in the problem domain are pointed out and propositions as to where to enhance these standards are given. Based on the requirements found, the project team may define the right abstraction levels for the various layers of eGov-Bus. The operational track aims at gathering the requirements for the demonstration perspective, i.e., for the prototype implementation. This way a sample life event can be defined and implemented. WP2 sets the requirements as well as the constraints for the research and development performed in the remaining work packages of the eGov-Bus project. In other words WP2 establishes a kind of legal, architecture and interoperability framework that the following work packages will need to fit into. The main objective of eGov-Bus project is to deliver a set of tools which both enable and facilitate the construction of an application

which integrates various IT systems built locally by public administration bodies at the pan-European level. The major constraints for this kind of solutions have been stated in the document on European Interoperability Framework (EIF) for pan-European eGovernment Services (PEGS). EIF emphasizes several principles, inter alia (1) accessibility, (2) multilingualism, (3) security, (4) privacy, etc. all of which need to be considered during development of any supranational eGovernment solution.

WP2 summarizes the pertinent state of the art in terms of:

- interoperability constraints;
- requirements – potential areas of interest for PEGS (with regard to requested functionality) based on various published survey reports;
- existing technology;
- legal issues – personal data protection, handling of sensitive data.

WP2 also sketches the plan for further research and development that is to be conducted during the subsequent work packages of eGov-Bus project.

Architecture

Unlike the RTD work packages that are dedicated to research on one specific domain, the WP3 is a transverse work package. The work in WP3 is done by following three main directions:

- meeting the requirements, both functional and technical, as defined by WP2 and the project description
- integrating the modules resulting from the academic research done by each of the RTD work package
- carrying out specific research on an audit trail and quality of service management

Because we are defining an application at the European level, the main technical requirements are scalability and modularity (as the European community can grow, any new European country may be able to join the bus without changing the bus architecture), non-intrusive access to data, as national confidential data can only be changed by the national government that owns them. Furthermore,

the use of existing or slightly modified standards is another requirement. The functional requirement is to allow any European citizen to access the public services no matter his/her localization or language. Public services being either informational or a set of core actions to be carried out. Since the bus will potentially be processing European private data, an implied requirement is that the whole process must be entirely secure. To prove that the requirements are met, the WP3 will detail:

- how new national Web service will join the bus
- life-event execution from a European citizen's point of view

The integration part is mainly to find how the above requirements can be met by using the outcome of the academic research done by the four RTD work packages. During this step we have to take several points into consideration:

- that the functional requirements are all met
- that the issued program meets the technical requirements
- that there is no security gap between the modules

Integration involves not only putting the resulting programs together but also clarifying the specific role of each program, making sure that all the requirements are covered and potentially making a request for additional work in another work package. The research on the audit trail will result not only in a definition of the set of data that will be audited but also details on how to integrate these data into the overall architecture, in other words where the audit data will be stored, how they will be gathered and how they will be managed. Regarding the Quality of Service, the WP3 will define the levels of Quality of Service, the associated metrics and how to get the values.

Enhanced Web Services

The Enhanced Web Services work package focuses on the Web service needs for the eGov-Bus as well as the handling of a Web services registry to improve services presen-

tation and transparency. Business Process Management (BPM) support, Service Level Agreement (SLA) enforcement, and asynchronous behavior of the Web services are provided by combining various Web services additional standards. The implementation of a SOA ensures business orientation according to a distributed computing paradigm.

There are four possible scenarios for accessing services based on existing e-Government services:

- Direct service access for services which don't need to be enhanced
- Direct service access via enhancements for existing Web services which are eGov-Bus compliant
- Access to services via Web services relay that encapsulate existing Web services which aren't eGov-Bus compliant
- Access to services via a service abstraction layer which exposes legacy application functionality as eGov-Bus compliant Web services

The Enhanced Web Services Framework has the following core components:

- **UDDI Registry:** The existing e-Government Web services register in the UDDI registry by publishing their model and WSDL endpoint. The registry is enhanced with custom categories of services store in an UDDI Repository.
- **UDDI Repository:** Each registered Web service in the UDDI Registry belongs to a category. Each category is qualified by a set of metadata which is stored in the UDDI Repository. Each category can have one or more service instance. Each service instance has its own state managed by the auditing and monitoring engine.
- **Auditing and Monitoring Engine:** It monitors and updates service instance states in the UDDI Repository, reporting service availability or failure along with hints. This is the main component used by the virtualization engine to reflect Web services state when selecting the best instance for a given category of service.
- **Management Engine:** This component defines and controls auditing and monitoring

rules, Virtual Engine, UDDI Registry and Application Server execution.

- **Virtualization Engine:** Selects the best instance from the category of service of a given call received from the eGov-Bus main portal. It's responsible for location transparency and load balancing. The engine can call the service directly if this is fully compliant with the eGov-Bus demands, or it can use the Relay Proxy to achieve compliancy. Legacy applications functionality is exposed as a Web service through a Service Integration Layer.
- **Service Integration Layer:** This is an accessibility layer which exposes legacy applications functionality as Web services. It uses both synchronous and asynchronous communication between the integrated applications and the caller.
- **Relay Proxy:** Extends SOAP interoperability for WS-Security, WS-Addressing and WS-ReliableMessaging.
- **Application Server:** This is an enhanced Web server with application containers and interceptors, which handles requests in two different ways: as a service client for the eGov-Bus Portal front-end and as a service provider exposing existing e-government services from the back-end.

Virtual Repository Management

The Virtual Repository Management work package provides the development of a scalable and secure access mechanism for combining data and services supplied by different kinds of information sources through the eGov-Bus, including Web pages, XML files, Web services, relational databases, etc. The system will provide access to semantic Web (RDF) representation of the data, allowing the users efficient management of ontological data for future eGovernment applications. Technically, a virtual repository is a mechanism that supports transparent access to distributed, heterogeneous, fragmented and redundant resources. There are many forms of transparency, in particular location, concurrency, implementation, scaling, fragmentation, heterogeneity, replication, indexing, security, connecting/disconnecting and failure transparency. Due to transparency imple-

mented on the middleware level, some complex features of a distributed and heterogeneous data/service environment do not need to be included in the code of client applications. Moreover, a virtual repository supplies relevant data in the volume and shape tailored to the particular use. Thus a virtual repository much amplifies the application programmers' productivity and greatly supports flexibility, maintainability and security of software. A central part of the architecture consists of ODRA (Object Database for Rapid Application development), an object-oriented DBMS. Existing resources are extended by wrappers and contributory views (or importers/exporters) that convert data/services proprietary to particular existing applications into the format acceptable for ODRA. The application developers can install as many ODRA servers as necessary, addressing the same distributed sources. The integration view on an ODRA server allows for the virtual integration of data and services supplied by distributed sources, supporting many of the transparencies mentioned above. The virtual repository front-end will provide various APIs to access virtually integrated data, including workflow applications, Java applications, Web services applications, and others. A particular user works with his/her own client view that is a tailored part of the entire virtual repository schema. Among many other functions, the virtual repository will allow for transparent access to external information resources and for unlimited transformations of complex document structures. Implementation of a virtual repository provides, in particular, the development of the ODRA core functionality, an object-oriented query/programming language, object-oriented virtual updateable views, a communication bus, an integrated development environment, an XML importer/exporter, wrappers to relational databases, RDF-oriented scalable access to relational databases and an RDF wrapper to Topic Maps resources.

Security Framework

This work package covers the overall security framework and includes research on interoperability of electronic signatures and

electronic identity. The overall security framework is a horizontal component that defines the eGov-Bus security policy and provides a mapping of high-level security requirements to lower level security mechanisms while taking into account the different security systems involved. The work package elaborates on identification and authentication of users and services. Current state of the art security technologies are taken into account to provide eGov-Bus with adequate levels of security, data protection and non-repudiation. Electronic Identity (eID) and Identity Federation between eGovernment systems are part of the research in this work package. The objective is to develop solutions that are capable of seamlessly incorporating national and legacy identification and authentication solutions into the eGov-Bus. This includes national ID cards, qualified electronic signatures, or new approaches such as Microsoft CardSpace. To obtain secure message exchange in an SOA environment, eGov-Bus services rely on standard Web service security mechanisms. The OASIS standard specifications Web Service Security: SOAP Message Security (WS-Security) and the Security Assertion Markup Language (SAML) constitute the basis for the remaining standards used, as well as eGov-Bus security services. The security objectives are enforced by modular security services, implemented as SOAP/WSDL based Web services, which provide qualified signatures, encryption, authentication, secure timestamps, or secure auditing. For existing eGovernment Web services that do not yet feature new approaches such as WS-Security, a Relay Mode supports seamless migration in order to comply with eGov-Bus security requirements. Current efforts in the eID domain to enable federated identities and single sign-on are examined and respective standards are implemented and enhanced as needed for eGov-Bus.

Administrative Process Generator

The Administrative Process Generator work package provides the administrative process generator (APG) based on the domain ontology pertaining to a life event presented to the

system by a citizen, including graphic process model presentation and manipulation, and a sophisticated natural language voice/text human computer interface. The APG subsystem represents the top layer of the eGov-Bus system architecture.

The architecture comprises the following distinct functional layers:

- The Client Interface Layer (CIL) represents a standard J2EE, JSR 168 compliant portal interface comprising portlets supporting the user interface features orchestrated by the APG Dialog Engine (ADE).
- The Interaction Logic Layer (ILL) comprises the APG Service Broker (ASB) controlling the persistent interaction flow between user and the appropriate system services. The use of standard workflow management techniques allows easy experimentation and step-by-step refinements of the client-system interaction algorithms exploiting a fixed set of system services and dialog techniques.
- The APG Service Layer (ASL) comprises the functional APG engines supporting services required throughout the entire user interaction life-cycle. The APG services are supported by a repository comprising the process control information (process meta-model instances, process logs) as well as by the APG Ontology module enabling the process adaptability features.
- The APG Text Analysis Engine (ATAE) supports such NLP features as language-dependent flexion analysis (stemming), full text indexing, and ontology-based semantic analysis and information extraction. Depending on the flow of a specific interaction, the pre-processed text may also be processed by the Text Categorization Engine (TCE) to support the ontology-based life-event categorization.
- The APG Life-Event Generation Engine (ALGE) provides for selecting and transforming the process template pertaining to the identified life-event class, and it is responsible for populating the process template extensible meta-model with attribute values derived from life-event information collected

during the preceding interaction steps.

- The APG Life-Event Emulation Engine (ALEE) is responsible for collecting and verifying life-event information required for subsequent successful administrative process instance execution underlying the supported case.
- The Adaptive Administrative Process Execution Engine (AAPEE) provides an IT platform supporting the actual execution of the life-event presented by the system user and refined during the preceding steps of the user-system interaction.

The APG laboratory development environment is to be based on the OfficeObjects software products and will be extended with the required new custom features. The required functional modules will be developed with the use of an incremental spiral life-cycle model.

Prototype Implementation

The implementation and prototyping activities of all work packages is integrated in the implementation of a working prototype and tested in government environments. The prototype is an integral part of the development of the eGov-Bus, proving the feasibility of such an ambitious piece of communication technology. It will be included in the dissemination activities in WP9.

The prototype's functional range focuses on selected life events, which provide a functionally and technically representative view of the services offered by the eGov-Bus project. It includes comprehensive modular tests, which are used to assess the functional range of the prototype implementation. The analysis results obtained from these tests are used to refine the functional and technical specifications for the eGov-Bus project. The prototype will benefit directly from operational realizations carried out in work packages such as WP3 Architecture, WP4 Enhanced Web Services, WP5 Virtual Repository, WP6 Enhanced Qualified Signatures and WP7 Administrative Process Generator. However, the prototype will not be a simple juxtaposition of previous technical realizations. It will further, and above all, be a more

global development that integrates the set of technical and functional problem issues from previous work packages.

The following work activities will be carried out:

- Definition of the functional perimeter of the prototype through analysis of documents, in particular those supplied by the WP2 task.
- Definition of the technical scope of the prototype based on the analysis of documents, in particular those from tasks WP3 to WP7, and also verification by competent persons of the validity of projections for volume and workload previously indicated. A technical perimeter for realizing the prototype, hardware and software will have to be defined by researching a significant percentage of the target volume, 10% for example. Moreover, the technical architecture of the prototype must be predictive for the technical architecture of the target (ideally, proportionate to the determined percentage).
- Development of the demonstration platform based on developments already carried out during preceding tasks, in particular WP3, WP4, WP5 and WP6.
- Definition of platform test packs from the definition of technical and functional specifications. The test packs will be defined based on the development mode for the platform.
- Definition of platform metrics
- Execution of test packs and analysis of the results

Adaptation of the functional and technical specifications of the e-Gov-Bus project based on the experience gained through the project

References

- Advanced eGovernment Service Bus (eGov-Bus): <http://www.egov-bus.org>
- Axway Software – France: <http://www.axway.fr>
- Centre de Recherche en Informatique Appliquée – Université Paris Dauphine – France: <http://ceria.dauphine.fr>
- Department of Information Technology, Uppsala University – Sweden: <http://www.it.uu.se>
- Europäisches EMIC Innovations Center

GmbH – Germany:

<http://www.microsoft.com/emea/emic/default.aspx>

- Ministerstwo Spraw Wewnętrznych i Administracji RP – Poland:

<http://www.mswia.gov.pl>

- Polish-Japanese Institute for Information Technology – Poland:

<http://www.pjwstk.edu.pl>

- Rodan Systems SA – Poland:

<http://www.rodan.pl>

- Zentrum für Sichere Informationstechnologie – Austria:

<http://www.a-sit.at>