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1. Executive Summary

The technical integration architecture plan introduced in this document describes the EPIC platform as the interoperability foundation for smart connected city operations sharing data and services across organizational boundaries in a manner that is compliant with local, National and EU regulations and policies.

The EPIC core enterprise services ensure interoperability on the technical, semantic and procedural level while providing security and privacy in procedures and service consumption. Being built on-top of open standards, they also ensure technology transparency for any service provider being hosted on the platform, i.e. the pilot applications during the EPIC project and all further smart city services choosing to use the platform during a wider roll-out afterwards.

This document describes those services as well as the anticipated configuration and usage patterns of the platform for optimal pilot operations. Additionally chapter 4.9 has been added, which outlines how requirements of the traceability matrix referring to the platform are fullfilled by the platform, as requested by the reviewers of the second EPIC project review, held at La Gaude (France) on 31st May, 2012.

2. Introduction

This document describes the technical integration and architecture plan. It outlines the envisioned architecture for the EPIC platform and the activities that need to be undertaken to ensure successful integration of all the individual elements together.

The EPIC software interoperability foundation will be deployed on the open-standard-based virtualization, automation and security architecture of the IBM SmartCloud Enterprise. Therefore, the platform provides trusted scalability and flexibility as well as collaboration means, efficiency and effectiveness to it users: citizens, smart cities and service providers.

The platform provides trust and security in all its flavours: dependability (reliability, accessibility and security), credibility, confirmability and transferability.

Two important goals should be reachable by providing this EPIC platform: interoperability and best-of-breed architecture. The following chapters describe how the EPIC platform will achieve these requirements.

It is important to note, that the platform is designed and implemented in a manner that ensures service and application providers to choose any technology for implementing their products. This applies to the use of programming languages, internal interfaces and protocols as well as for data storage techniques. The platform is to be considered as a – potential - hosting environment for application services, supporting service level agreements, security and privacy for their respective user communities.

For the pilot application development and deployment, different application maturity levels have to be taking into account. Whereas those from the smart energy and urban planning pilots are very far advanced in their lifecycles, the web services supporting the relocation scenario still have to be developed. To deliver them, technologies inherent in the platform to implement and host those will be used. In particular, that means storing data provided by various data sources via web services, in a central geo-spatially enabled database, in our case DB2. By de-coupling the data owners from the final consumers, the relocation application (not the platform) further assures technology independence at the provider and consumer levels.

The structure of this document is as follows: in this introduction of chapter 2, we briefly introduce service-orientation as the major design principle for the platform. Chapter 3 describes the platform as the interoperability foundation for smart cities facilitating the ground for the principle platform requirements and design criteria: security assurance, semantic layer support, IoT integration support, business process management capabilities, a multimodal portal with mobile device support. Chapter 4 depicts how the functional and non-functional requirements identified in D2.3 ([25]) are addressed by the core platform and by application-specific extensions. Chapter 5 elaborates on the implementation plan on the time axis before in chapter 6, we conclude with a brief outlook.

3. The EPIC Platform as Interoperability Foundation

The EPIC platform as the interoperability foundation for the pilots integrates the partners and application on three different levels:

- **Technical interoperability**: web services are published into the central web service repository which manages the WSDL metadata to provision and orchestrate the usage of the services via the platform enterprise service bus. Access management services assist the front-end integration and customization of presentation for small-screen browsers on mobile devices.
- **Semantic interoperability**: service composition is supported via service metadata management in the repository (ontologies of web services). In addition, platform services for the maintenance of ontologies and related business rules are provided.
- **Procedural interoperability**: collaboration means are integrated as core enterprise services in the platform's portal. A business process and rules engine allow the regulatory compliant implementation of comprehensive business processes – and have them being exposed as a web-service.

The following sections describe the underpinning standards and installed components in more details.

3.1. Open Standards for Interoperability

Open standards play a key role in achieving interoperability, because they enable products to interact together and provide for future extensibility. This gives smart cities the choice among a variety of applications from a wide range of suppliers and leads to innovative technological developments. Furthermore, open standards ensure quality. The term "open standards" describes openness in both:

- the standards-setting process and
- the access to the specifications.

While not universally defined, according to [1] the following characteristics are the minimum characteristics for a standard to be open:

- "easy accessibility for all to read and use;
- being developed by a process that is open and relatively easy for anyone to participate in; and has no over-riding control or tie-in by any specific group or vendor."

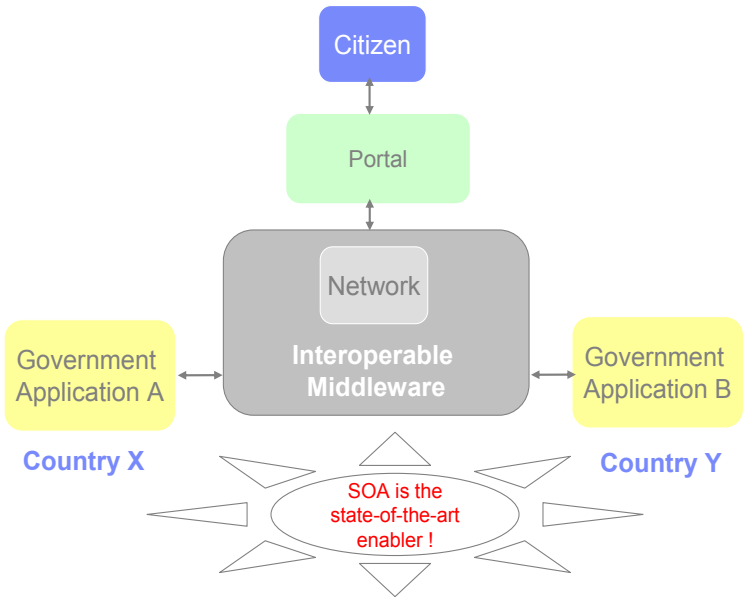


Figure 1: Interoperable Middleware *(Source: European Commission)*

Interoperable middleware has to be built on a core set / stack of open standards and technologies. In the following, the most important of these standards are listed. In addition, those definitions for these standards are provided which are agreed upon in EPIC. Naturally, those definitions have become common knowledge so that they can be cited from handbooks or Wikipedia web pages.

- **Internet Protocol (IP)** has become the de facto communication standard for IT systems. Technologies in the problem space of converging networks focus on how to bridge from telephone lines and wireless communication networks into the IP world for which Voice over IP (VoIP) is the enabling entry point.
- **eXtensible Markup Language (XML)** "is a simple, very flexible plaint-text format derived from SGML (ISO 8879).). XML is readable by humans and is readily parsed by computers. Although XML data files may be very large compared to binary-encoded data files, this is not a problem given the enhanced speeds of data communications and availability of low-cost storage. Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere" [2]. XML has been acknowledged as the technology of choice for information exchange in various areas in public sector, too: e.g. there are XML specifications for a variety of NATO standardization agreements (STANAG), for inter-agency citizen information exchange (e.g. xÖV in Germany), in healthcare and social services (e.g. integrated case management).
- A **Web Service** "is a method of communication between two electronic devices over a network" [3]. It is important not to confuse web-services with web-sites or web-pages. Web-services deal only with the transmission of data between provider and consumer, not with the display of the data. Web-services decouple business function

from its IT implementation by providing standardized means for universal description, discovery and invocation of application services and functions to a service broker (UDDI). The service description through Web Service Definition Language (WSDL) encapsulates the internal service implementation, but allows for sharing and semantic interoperability by defining "input needed – output expected" of the service in a meaningful manner (a WSDL description in that way becomes a mini ontology in itself). Once a contract is established, the service consumer and provider communicate via XML messages, based on SOAP (simple object access protocol). Deriving WSDLs from XML Schema is a first step to achieve interoperability.

- **Web Services Resource Framework (WSRF) –** The purpose of the OASIS WSRF Technical Committee was to define a generic and open framework for modelling and accessing state full resources using Web services. It has specified the standards for WS-ResourceProperties (WSRF-RP), WS-ResourceLife (WSRF-RL), WS-ServiceGroup (WSRF-SD) and WS-BaseFaults (WSRF-BF) [4]. The purpose of the OASIS **WSN** (Web Service Notification) Technical Committee was to advance a pattern-based approach to allow web services to disseminate information to on another. The committee has defined the standards for WS-BaseNotification (WSN-BN), WS-Topics (WSRF-T) and WS-BrokerNotification (WSRF-BN) [5]. All of these specifications are built on WSDL and XSD (XML Schema Definition).
- **Representational State Transfer (REST) "**is a style of software architecture for distributed hypermedia systems such as the World Wide Web" [24].Over the recent years, REST is becoming popular again as it is used by major web services on the internet, such as Twitter, Yahoo, Flickr and both eBay and Amazon have web services for REST. REST is an architectural style for the design of Web Services that is based entirely on the existence of sources of specific information, termed resources. Each resource that can be found across the network can be referred using a Uniform Resource Identifier (URI) and can be accessed via the standard methods of HTTP. The client uses these standard methods provided by HTTP (i.e. GET, POST, PUT, and DELETE) in a way that is consistent with the protocol definition, in order to manage the state of the resources. There is a one-to-one mapping between the HTTP methods and the Create, Read, Update, Delete (CRUD) operations on the resources. According to this mapping, the POST method is used to create a new resource on the server, GET is used to retrieve an existed resource, PUT is user to change the state of the resource[28]], while DELETE is used to delete the resource [28].
- **Java Platform, Enterprise Edition**: Java EE is the industry standard for implementing enterprise-class service-oriented architecture (SOA) and next-generation web applications. "The platform was known as *Java 2 Platform, Enterprise Edition* or *J2EE* until the name was changed to *Java EE* in version 5. The current version is called *Java EE 5*. The previous version is called *J2EE 1.4*"[6].

  "Java EE is considered informally to be a standard since providers must agree to certain conformance requirements in order to declare their products as *Java EE compliant*; albeit with no ISO or ECMA standard. Java EE includes several API

specifications, such as JDBC, RMI, e-mail, JMS, web services, XML, etc, and defines how to coordinate them. Java EE also features some specifications unique to Java EE for components. These include Enterprise JavaBeans, servlets, portlets (following the Java Portlet specificationJSR168), JavaServer Pages and several web service technologies. This allows developers to create enterprise applications that are portable and scalable, and that integrate with legacy technologies. A Java EE "application server" can handle the transactions, security, scalability, concurrency and management of the components that are deployed to it, meaning that the developers can concentrate more on the business logic of the components rather than on infrastructure and integration tasks" [6].

- **Open Document Format (ODF):** the **ODF (*ISO/IEC 26300***, full name: **OASIS Open Document Format for Office Applications**) "is an XML-based file format for electronic office documents, such as spreadsheets, charts, presentations and word processing documents" [7]. The standard was developed by the Open Office XML technical committee of the Organization for the Advancement of Structured Information Standards (OASIS) consortium and based on the XML format originally created and implemented by the OpenOffice.orgoffice suite (see [8]). As well as an OASIS Standard it is, in its version 1.0 manifestation, a published ISO/IEC International Standard, *ISO/IEC 26300:2006*. The OpenDocument standard meets the common definitions of an open standard, meaning the specification is freely available and implementable [7].
- The **Unstructured Information Management Architecture (UIMA)** "framework is an open, industrial-strength, scalable and extensible platform for building analytic applications or search solutions that process text or other unstructured information to find the latent meaning, relationships and relevant facts buried within. It enables developers to build analytic modules and to compose analytic applications from multiple analytic providers, encouraging collaboration and facilitating value extraction for unstructured information" [9]. The framework provides both a build time environment for creating UIMA-compliant analytic components (from scratch or by wrapping existing analytic modules) and for developing composite analytic modules and a runtime infrastructure for executing the composite analytic processes. UIMA is now being standardized.
- **Web Ontology Language (OWL)** "The OWL Web Ontology Language is designed for use by applications that need to process the content of information instead of just presenting information to humans. OWL facilitates greater machine interpretability of Web content than that supported by XML, RDF, and RDF Schema (RDF-S) by providing additional vocabulary along with a formal semantics. OWL has three increasingly-expressive sublanguages: OWL Lite, OWL DL, and OWL Full."[10].
- **Resource Descriptor Framework (RDF) "**is a family of World Wide Web Consortium (W3C) specifications originally designed as a metadata data model. It has come to be used as a general method for conceptual description or modelling of information that is implemented in web resources, using a variety of syntax formats" [11].

3.2. Frameworks for Interoperability

To move from an interoperability framework to an Enterprise Architecture (EA) is in concept similar to moving from a generic building perspective to a town plan stand point. Like a building code, an interoperability framework is a set of rules that specifies what standards are to be used to ensure interoperability, rather than a blue-print for creating the actual interoperable elements.. The EA/SOA is a "town plan" consisting of common resources and defined rules for their use and reuse.

3.2.1 Enterprise Application

EA, as defined and standardized by Open Group ([13]), provides a coherent model of a business, its capabilities built upon infrastructure components.



Figure 2: The Open Group Architecture Framework – TOGAF *(Source: TOGAF)*

The IBM EA discipline defines and maintains the architecture models, governance and transition initiatives needed to effectively coordinate semi-autonomous groups towards common business and/or are aligned as appropriate IT goals.

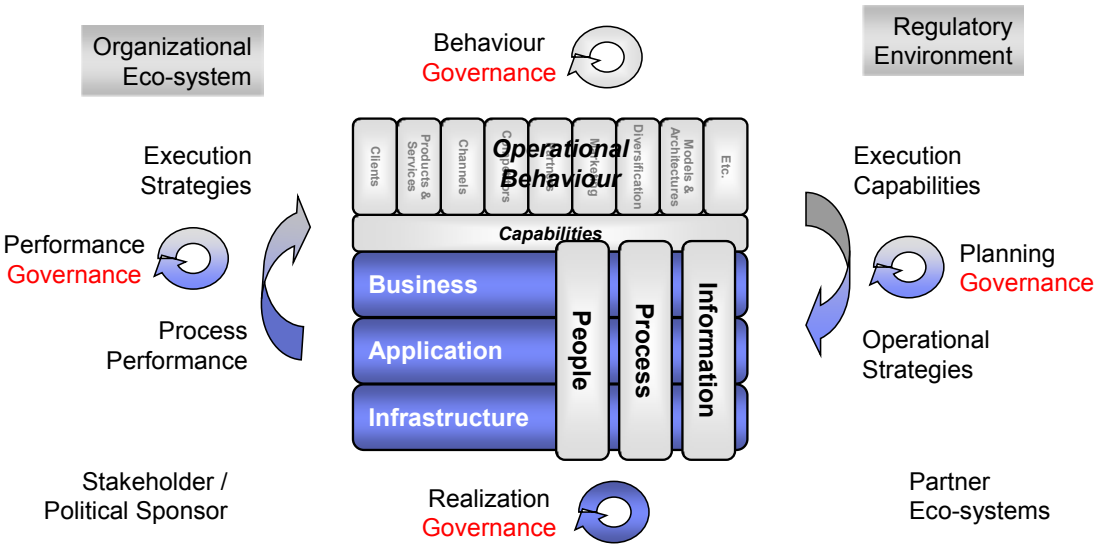


Figure 3: IBM Enterprise Architecture & Governance *(Source: IBM)*

As mentioned upfront, to achieve coherent and consistent operational behaviour, pan-governmental data and metadata models have to be established and standardized, in other words: scenarios and use cases to standardize smart city operation and application domains have to be modelled.

EA can be considered as a mean for 'capability lifecycle management', because administration strategy is enabled by the elements managed in EA. Over time evolving strategic imperatives require gap analysis regarding current and required capabilities of the virtual organization involved. Program management within the organization needs to identify, prioritize and initiate suitable transformation initiatives to transform and optimize the supporting enterprise architecture:

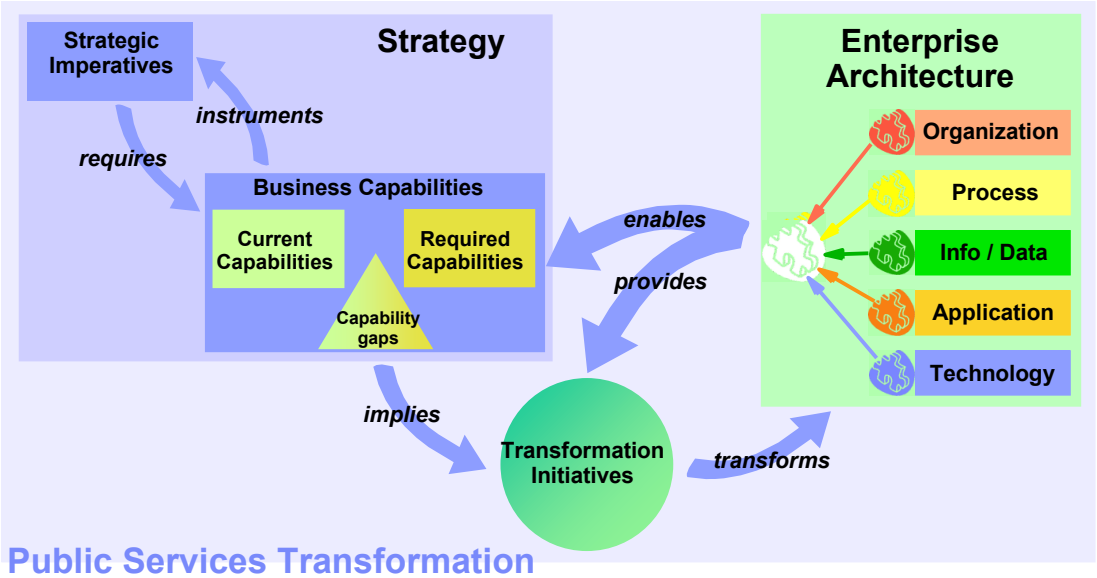


Figure 4: EA Role in Public Services transformation *(Source: IBM)*

3.2.2 The Importance of Models

Clearly, the described governance and lifecycle management processes are business- and thus model-driven. The same is true for the enterprise architecture transformation framework and strategy. The development of enterprise level solutions needs to define models and instantiate them during realization and launching in the following domains:

Organization and strategy: solution development is initiated by the strategic goal of an organization or ecosystem (virtual organization) to fulfil a mandate. This combination defines the high-level business objects (e.g. people, units/departments, products, forces, capabilities) and their relationships and therefore the underlying business ontology.

Business services: support the organizational capabilities, which typically are achieved by modelled and well-described business processes. There is a process model for each business service, in public sector e.g. for peace enforcement, professional licensing for a trader or granting social benefits to a citizen.

Meta information model: within each business service/process the information objects and pieces of required knowledge need to be identified; the process model in particular leads to a semantics-driven model for information exchange and discovery. Therefore, a business service specific ontology is needed prior to solution assembly.

Regulations and policies model: in order to ensure compliance and vitality of the solution as well as governed and communicated management of exceptions and appeals, external regulations (e.g. data privacy laws) and policies (e.g. establishment of one-stop public services to tax payers) need to be expressed in models digestible by IT infrastructure services.

Risk and threats model: there is no such thing as 100% security and safety in conducting business. Therefore, also each SOA solution needs to address the factor of residual and acceptable risk. Each node in the enterprise architecture – covering facilities, networks, hardware, operating systems, middleware, applications/ services, processes, data, people and regulations - needs to be assessed regarding its risk of being compromised and the imposed threat to the business if so. Such a conditional assessment then leads to a model for event-driven actions to prevent and mitigate damage.

Operational model: in order to manage an enterprise solution, key indicators for its performance need to be defined. The operational model includes for example: service level agreements and non-functional requirements like availability and security topics.

A middleware-based SOA solution foundation, which is capable of digesting a subset or even all of the above models, bears the potential of a **generic solution foundation accelerator**.

3.2.3. IBM EA Transformation Methodology

IBM provides methodologies, methods, techniques and tooling to support the transition process towards coherent enterprise architecture:

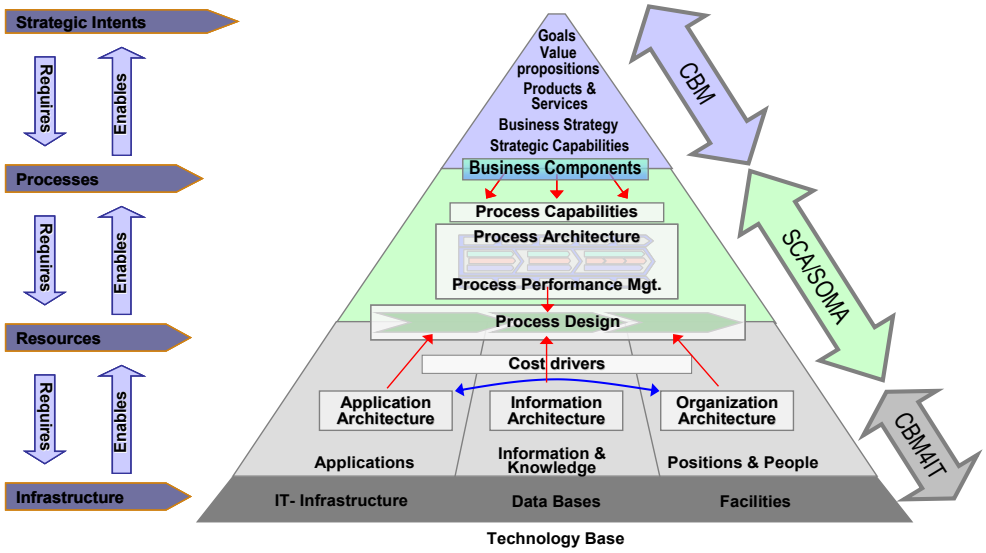


Figure 5: Transformational "observe – orient – decide – act" cycle for EA transition *(Source: IBM)*

The business goals and value needs, as well as the mandate of the organization, are used by the Component Business Modeling (CBM) method to assess organizational competencies. It models the enterprise as a set of components that are networked together. Whereas CBMs do vary by clients, there is some generality to them within and across industries.

From the CBM the business artifacts can be derived and mapped into business processes, defining the service component architecture. The approach of Service-Oriented Modeling and Architecture (SOMA) design allows for proper bridging between business and IT-infrastructure. The results are composite business services and atomic IT services in the SOA enabled infrastructure.

Finally, CBM for IT (CBM4IT) defines the procurement strategy and governance as well as the operations' model of IT as an evolving business in itself. In particular, there is a roadmap model for SOA transition included.

IBM	Environmental and Territory Affairs	Transportation and other Utilities	Healthcare	Census and Social Services	Education, Sport, Tourism	Economic Development	Public Safety	Legal Offices & Jurisdiction	Finance	Internal Administration
Direct	Environmental Planning Town Plan	Demographic Development	Health Plan	Social Services Planning	Education Budgeting Touristic Promotion Sport Event Planning	Economic Development Planning	Civil Emergency Planning	Central Government Liaison	Budget	HR Planning
Control	Environmental Control	Water & Power Management	Health Expense Management	Social Services Management	Education Expenses Control	Inspections	Civil Emergency Coordination	Inspections	Financial Performance	Performance Monitoring
Execute	Land Register Critical Infrastructure Protection Sanitation Department	Utilities Delivery Utilities Management Road Management Public Transportation Public Hospitals Road & Traffic Congestion	Patients Directory Reservation Center Emergency Management Social Workers Management Patient Record	Registry Office Public Records Electoral District Eligibility Determiniation Work Department Social Services Delivery	Schools Management Sport Event Organisation Museums, Libraries, Tourist Sites Sport Center Management	Licensing Subsidiaries of Agriculture Local Taxes Eligibility Determiniation	Local Police Fire Brigade Volunteers Coordination Inter-Agency Collaboration	Law Enforcement Civil Court Legal Office Prison Management	Treasury Operational Spending / Benefits	IT HR (e-) Procurement Public Tenders Facility Management

Figure 6: Generic smart city / local government CBM *(Source: IBM)*

Whereas the capability and competency CBMs will have to direct/control this high business level direction, control needs to be coherently conducted across the virtual enterprise of Government.

Each of the operational building blocks needs to be underpinned with such component model, up to the business service layer. The business components that are aggregating orchestrated business services are responsible for delivering one or more unique services to the enterprise. Each business component has a 'thumbnail' which describes its purpose in the enterprise:

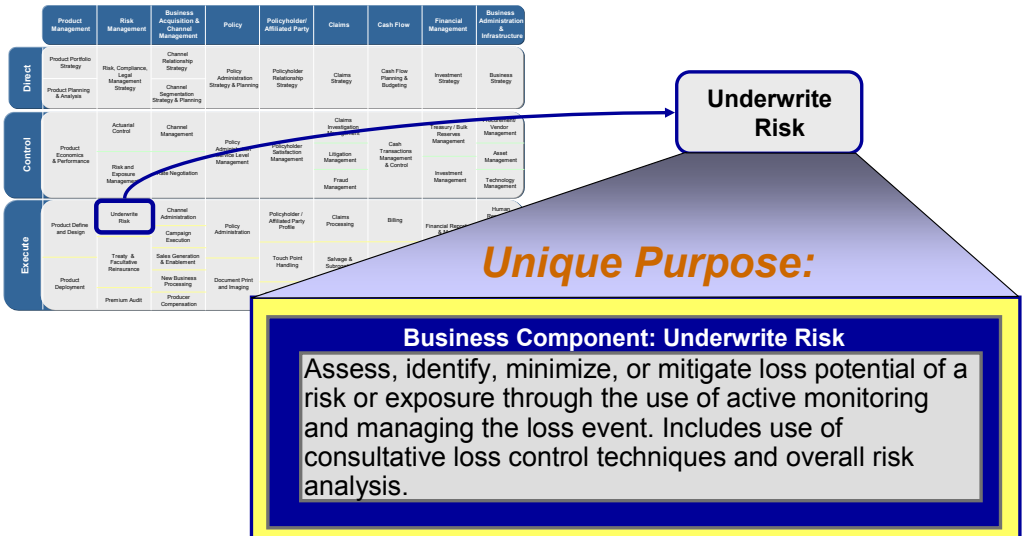


Figure 7: Example of a business component definition *(Source: IBM)*

The components are realized through investment as an SOA project.

CBM constrains the design of SOA services to maintain consistency of purpose and volatility to a single governing component, thus increasing services stability and reuse potential – in other words: ensures semantic interoperability among SOA services.

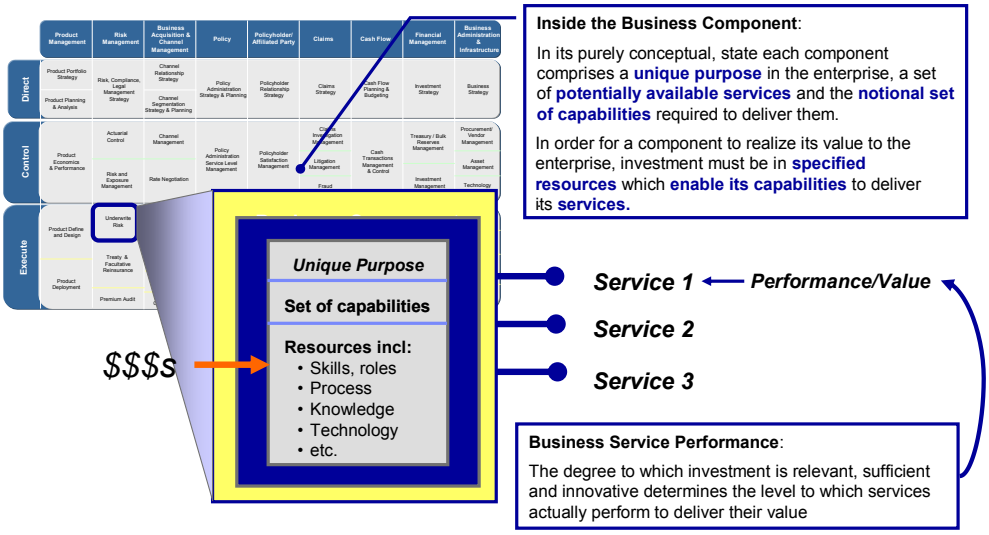


Figure 8: Dive-down into a business component and its realization *(Source: IBM)*

It is crucial to model semantically the governmental enterprise, i.e. creation of ontologies for each public service to be included in the SOA.

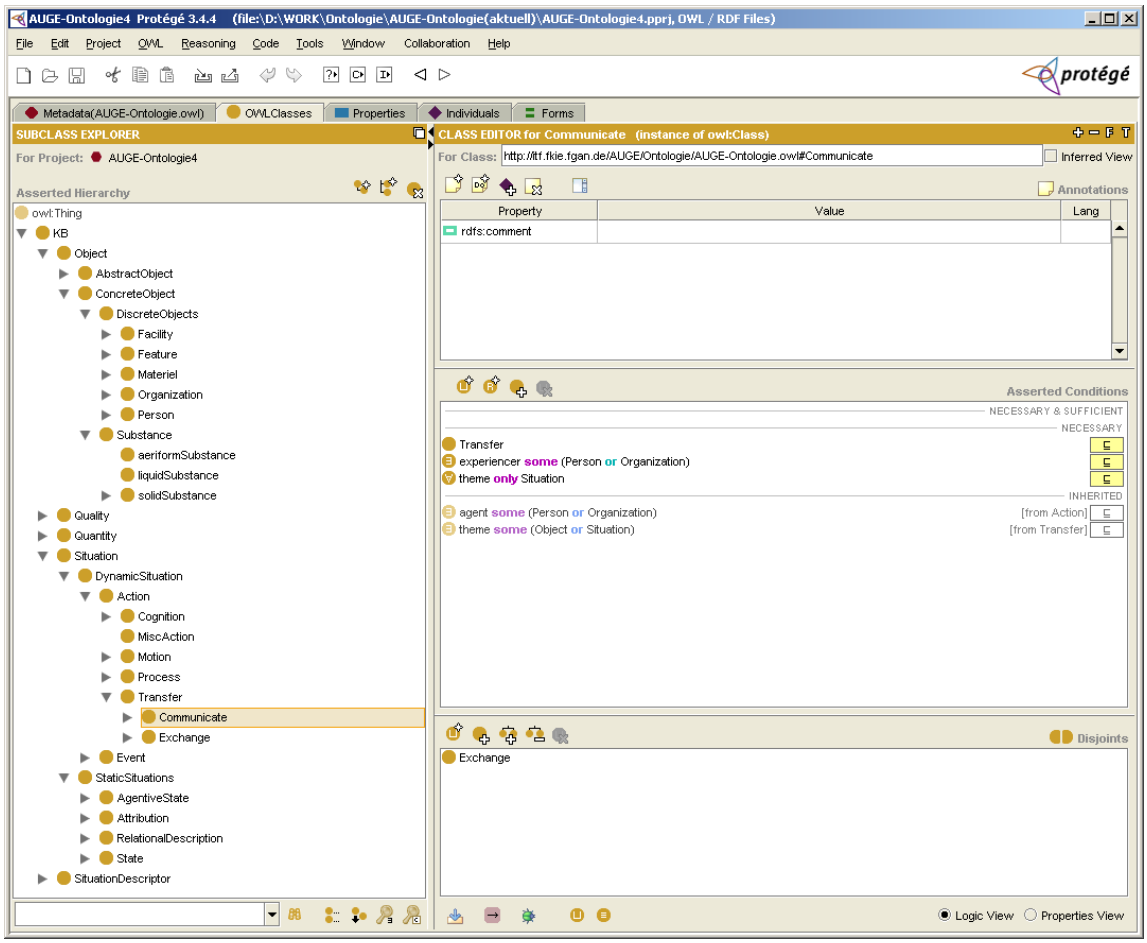


Figure 9: Snapshot of an upper ontology for EPIC

Figure 9 shows the upper ontology for EPIC which has to be augmented for the pilots to achieve sustainability.

3.3. Mobile Device Usage Classification

As the user requirements determined from the Stakeholder Workshops become clearer, those involved in development of the Relocation / City Planning / Energy Monitoring applications are planning their technical developments. It is therefore timely to reconsider what the EPIC project was about and to clarify exactly how these objectives will be achieved. A key element of this is the role of mobile devices through which end-users will consume the services delivered by the EPIC platform.

3.3.1 Service Consumption

The EPIC platform will host the smart city portal server, through which users will consume the three services that are being developed, as examples of citizen-focused "smart city

services". The focus of EPIC is on the development of the underlying web-services, which are wrapped as "portlets" and delivered to the user's browser via the portal server. The browser on the user's device renders the interfaces to the end user, accessing the required web-services via the portal server and displaying the results to the user.

The primary focus of EPIC is the underlying web-services not the development of web or device applications. The logic is that creating and hosting the underlying smart city web services creates an opportunity for software developers to create commercial web and devices applications which consume the web-services. The use of these applications will generate revenues for the developers and the platform hosts, creating on-going revue streams that will ensure commercial sustainability.

The primary focus of the project must therefore be on web-service creation, not the creation of web-applications or device-specific applications or "apps". However, creating a web-service alone does not make it accessible, until it is appropriately "wrapped" and "consumed". It will therefore be necessary to create a limited number of web-applications that demonstrate how developers could consume the smart-city web-services delivered via the EPIC platform.

3.3.2 The role of "Mobile" Devices

Mobile devices, including mobile phones, smart-phones, internet tablets, etc. complicate the user landscape. Increasingly such devices have significant local computing power, high resolution touch screens, large memories and support a range of network technologies including Wi-Fi WLAN, Bluetooth PAN and wired LAN connections. Cellular data networks and mobile broadband are supported by GSM, GPRS, EDGE WiMaxand 3G cellular connections providing WAN connectivity.

Increasingly there is convergence between the capabilities of these mobile devices. Smartphones with high resolution touch screens have computing power akin to that of a netbook or laptop computer. Tablets and netbooks with a 3G SIM slot can access cellular data in the same way as a smartphone. Indeed the operating systems for the devices are in some cases common, particularly Google Android which powers many tablets and phones and Apples' iOS which powers iPad tablets and iPhone smartphones.

It therefore makes more sense to categorize not by device type but by use and interaction method with EPIC. Within this project there are multiple use-cases for each application and these often segment into two parts:

3.3.3 Proposed Usage Characterisation

It is envisaged that for many Smart-City applications users may consume these in several different modes:

"Remote Exploration" – passive users: probably desk-based, often as a pre-cursor to a physical visit to the smart-city, to discover information about the city and the services it can provide. The user accesses the EPIC Smart City Platform from a "fixed" computer with a

large, high-resolution display and a wired or wireless LAN connection of relative high bandwidth. The user is primarily using EPIC.

"Local Immersion" – active users: where the user accesses the EPIC Smart City Platform using a mobile device whilst they are physically exploring the Smart City. This can involve "user pull", where the user requests information from EPIC to help them "find out" more and potentially "transact" with the Smart City. Alternatively, "EPIC push" can deliver relevant supporting information to the mobile device user, based on their needs and current context of use, potentially supported by position or location services running either on the mobile device or on the EPIC platform. Connectivity could be via 3G cellular or by Wi-Fi and increasingly WiMax, where supported by the device and where appropriate hot-spots are accessible within the Smart-City, which may be free to use or paid for.

For clarity and for the avoidance on confusion, it is proposed that we use three generic usage names when considering the devices through which users will consume EPIC services:

Large Screen Browser: Large screen displays accessing the Internet access using a fixed LAN or unmetered WLAN connection. Devices support a full-function browser including Microsoft IE7/8/9/ Mozilla Firefox 3.x, 4.x, Apple Safari, Google Chrome, Opera, etc. Screen sizes 25cm diagonal or greater with resolution 1024 x 600 or greater. This category includes fixed PCs, public information kiosks, laptops, netbooks and larger-screen tablets. Operating systems typically include Microsoft Windows XP, Microsoft Windows 7, Apple IoS and OSX, Google Android, etc. This maps primarily to the *Remote Exploration* phase above, although large-screen tablets could be used whilst mobile.

Small Screen Browser: Commonly smartphone type devices, typically using a 3G data connection to the Internet. These devices will run a standard, sometimes restricted functionality browser application inside a phone oriented operating system, including Symbian (now sunsetted), Android (Gingerbread, Honeycomb), Microsoft Windows Smartphone, Microsoft Windows Phone 7, Blackberry OS, etc. Device screen sizes up to 11 cm diagonal, resolutions typically up to 960 x 540 but more commonly 800 x 480. The EPIC platform may be required to re-render content to suit to reduced screen-sizes, resolutions and ambient lighting for mobile device users and to take account of data payload to reduce usage cost. These maps primarily to the Immersion phase above, where users explore the Smart City and are supported and guided by the EPIC platform services.

Device Apps: Applications or "Apps" are small software programs which are generally OS and / or hardware specific software applications. Apps are downloaded to, installed on and executed on the mobile device. Apps are used primarily either as small stand-alone programs that run on the mobile device without requiring access to the Internet, or where access to device specific hardware such as GPS, camera, accelerometer, etc. is not possible from standard code executed inside a standard web-browser (HTML4 etc). Apps are not necessarily restricted to small-screen devices due to the commonality of OS and Apps are available for iOS (iPad and iPhone), Android (smartphones, tablets and netbooks) and increasingly for Microsoft Windows Phone 7.

Small screen devices typically download Apps directly via 3G or Wi-Fi from an "App Store", such as Apple App Store via iTunes, Android Market or Microsoft Windows Phone

Marketplace Hub. This is an extremely important consideration for EPIC, as it is generally not possible to download and install apps by methods other than though the approved, and in some cases Vendor controlled, distribution channels. It will not normally be possible to download from the EPIC Platform, apps designed to run as "helpers" for EPIC Smart City services.

Larger screen devices without a 3G connection will download via Wi-Fi or fixed LAN.

From an EPIC perspective, Apps should restricted ONLY to support greater interaction with the EPIC platform NOT as stand-alone software that runs on the mobile device disconnected from the EPIC platform. This would normally be to support hardware aspects of the mobile device that could not be accessed through a standard browser. For example, the Relocation and City Planning applications could deliver an enhanced user experience when GPS on the mobile device provides the user position back to the EPIC platform and 3D visualization may require additional "helper" Apps to be installed.

The development of Apps should be minimized and efforts should be focused on delivering maximum user functionality through a standard browser, to remove platform and operating system dependencies. The ability to develop a small number apps that demonstrate how the EPIC smart city services can be consumed by mobile devices users and augmented with location and context specific data will provide a show how paths to future sustainability could in part be achieved, through the developments by commercial organisations of apps that leverage the EPIC platform functionality and which are commercially saleable.

3.4. Front End Integration

The portal server will be the platform for the EPIC front end integration. The following pictures show the initial interface mock-ups to be detailed and implemented during the pilots' development.

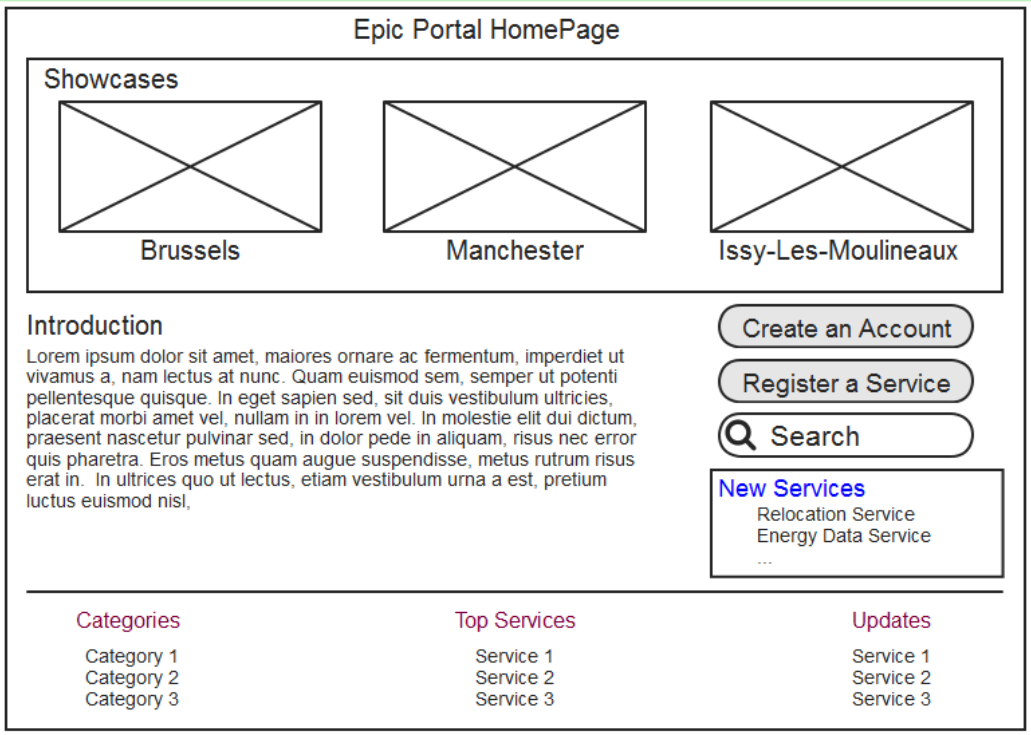


Figure 10: EPIC Portal Home Page

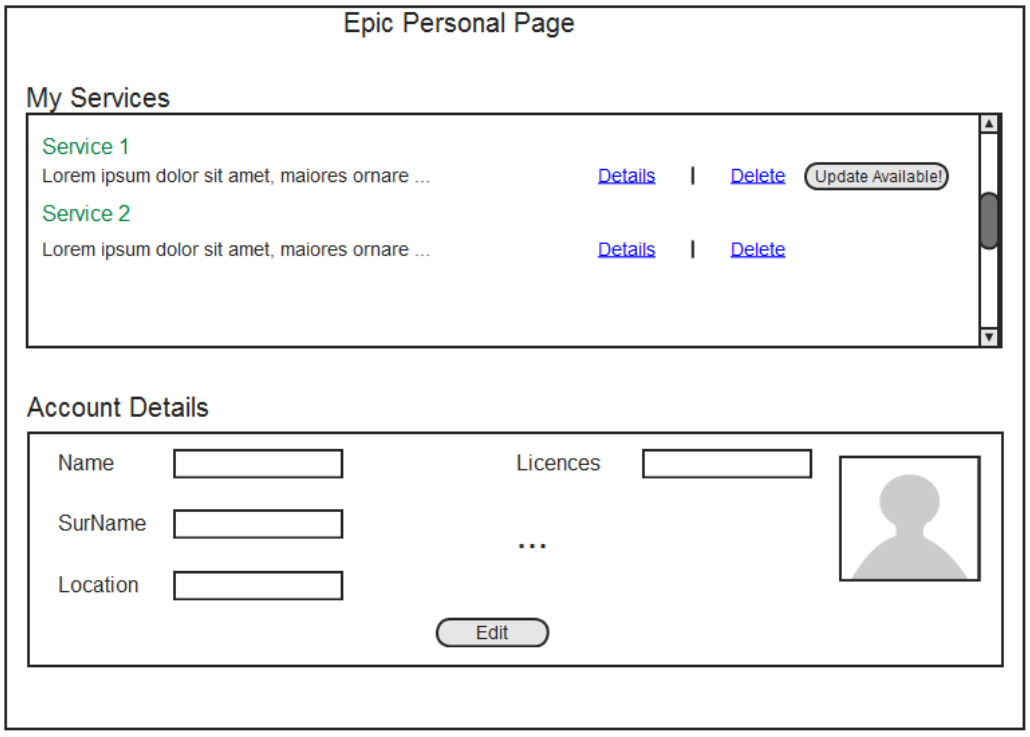


Figure 11: EPIC Portal Personalization

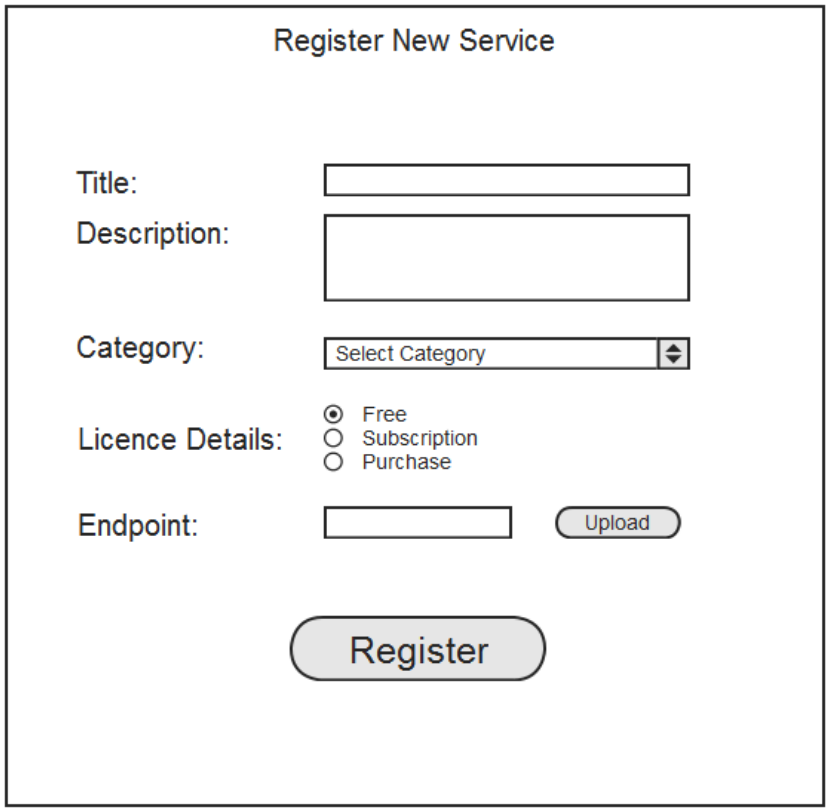


Figure 12: EPIC Register new Web Service

4. EPIC Platform based on Service Oriented Architecture

This chapter describes the relevant components of the EPIC Platform. It describes the topology of installed software. In addition it includes the relevant credentials and login information of administration and controlling of this platform. It describes the usage of portlets (incl. deployment), the using of processes, ILOG, web services and web standards. The description of the IBM components below is based on material given by IBM.

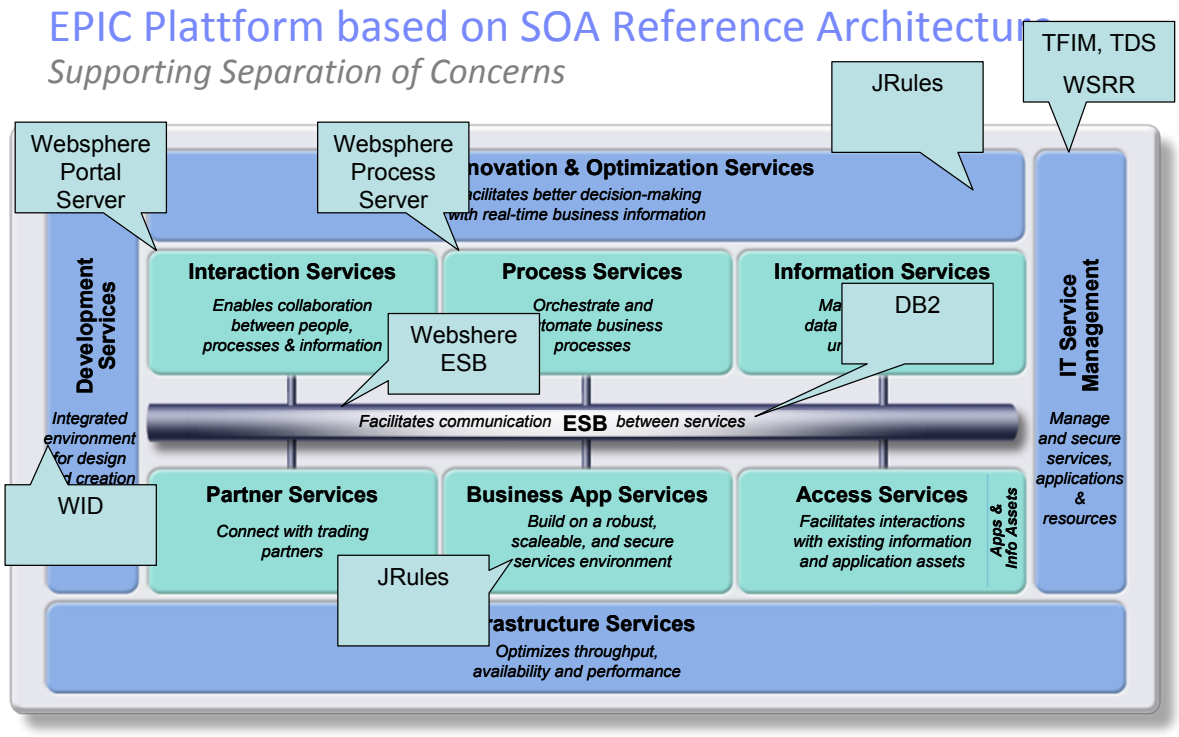


Figure 13: EPIC Platform based on SOA reference architecture

For managing and controlling relevant requirements the following components are part of EPIC platform:

- portlets and web sites, mobile devices enablement →WebSphere Portal Server
- forms (i.e. provided by the cities of Brussels, Issy and Manchester) → Lotus Notes Forms
- business processes that are designed by service providers →WebSphere Process Server
- rules that are designed by stakeholders → ILOG Rules (JRules)

- Integration of services, integration of external and internal interfaces →WebSphere ESB
- web services →WebSphere Service Registry & Repository
- authorization, authentication and identification of platform users with their roles and groups → TFIM based on Directory server
- development environment → WID
- data stores → DB2

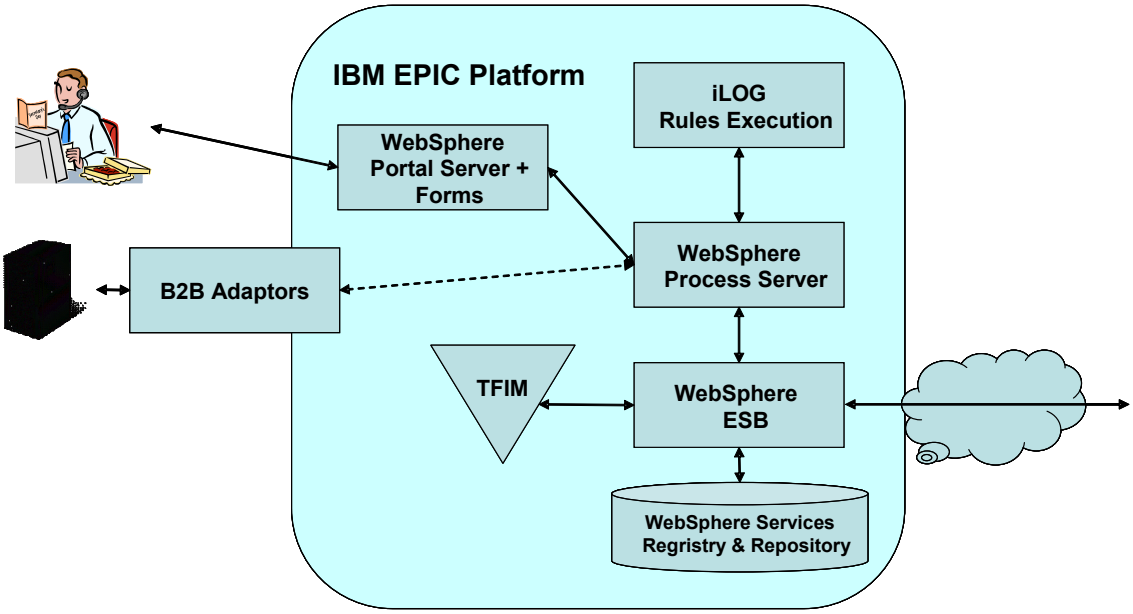


Figure 14: IBM EPIC Platform - Component Overview

The components and their purpose in EPIC are described in detail in the following subsections. A description on how the platform fulfills the requirements as identified in D2.3. is given in the last subsection.

4.1. Portal and Forms Server

WebSphere Portal Server enables organizations to quickly implement new business designs that are engaging, flexible and of high performance. It enables:

- **Web experiences** – take advantage of new social capabilities and enhanced analytics integration to help competitively address new market opportunities;

- **Extend your business assets** – create and deploy custom-branded, market-driven solutions that integrate components developed using a range of supported tools and frameworks;
- **Run your business efficiently** –built on enterprise-class WebSphere software, with added administrative and scalability features that further enhance an already proven, reliable, scalable and high-performance foundation;
- **Grow as you go** – add business-specific capabilities that speed time to value and allow you to pursue new market opportunities all while reducing the cost of deploying portals.

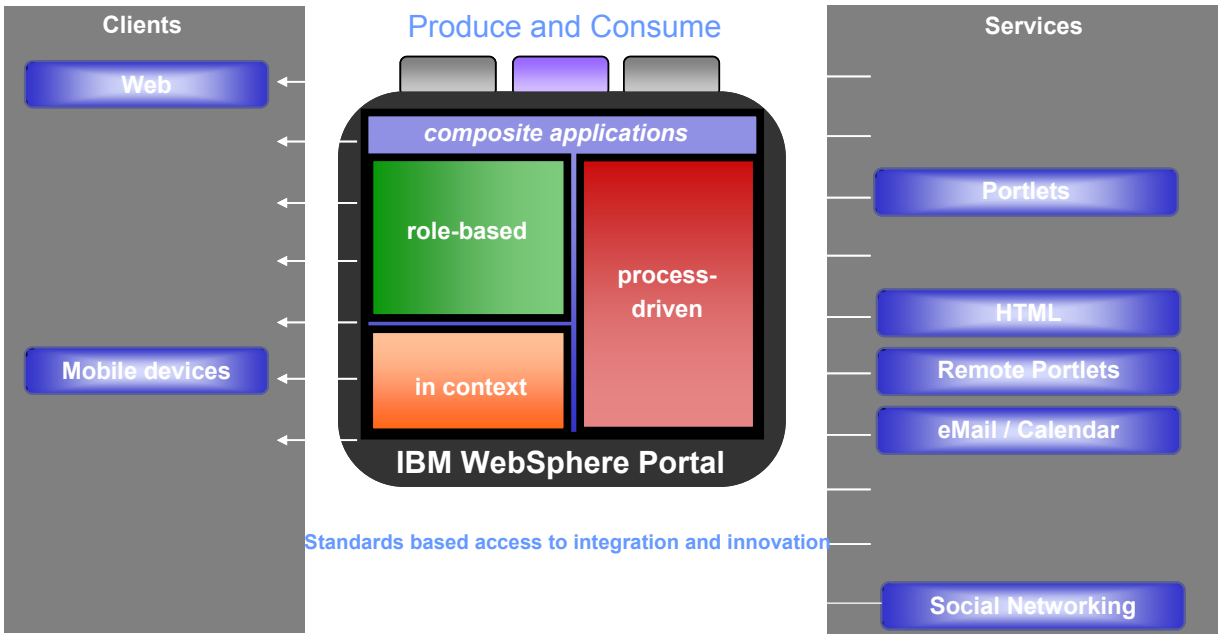


Figure 15: Portal server interaction

Within the EPIC project we are exploiting a few so-called portal accelerators briefly described subsequently.

IBM® accelerators for IBM WebSphere® Portal software are prepackaged offerings, comprised of various combinations of portlets, software, frameworks and templates to address specific business requirements

4.1.1 Business Process Accelerator

There is widespread and growing recognition that a service-oriented architecture (SOA) helps organizations become more agile, adapt to change more quickly and implement new services and solutions more easily to take advantage of competitive threats or marketplace opportunities. But an SOA is not a single technology or a single project or initiative but a

business strategy that must be implemented in phases and that requires certain levels of success at each step along the way. When implemented correctly, SOA helps streamline access to and use of applications and information, which means people can be more productive, efficient, collaborative and innovative. A front-end approach is often the easiest and fastest way to realize immediate benefits from an SOA. The front end represents a key integration point where users – citizens, civil servants, service consumers – all experience an SOA in a very practical way.

A portal is, by definition, a composite application, one that is assembled at the front end from many different application elements. It is an aggregation point for services, delivered through portlets, and it helps drive SOA-based business processes. IBM Lotus Forms software is well suited to an SOA, because it is based on open standards and contains within itself the process rules and data to drive and adapt to the services in an SOA. Lotus Forms and WebSphere Portal software are very user centric. End users – internal and external, technical and nontechnical, as well as business-line executives – are likely to touch and interact with the software every day. Together these software products provide users with a visual example – a first-person experience – of the benefits of SOA. In EPIC this accelerator is included to accommodate the pilot workflows.

4.1.2 Collaboration Accelerator

IBM Collaboration Accelerator provides the tools individuals (developers, architects, researchers, etc.) need to easily connect with one another and to more effectively share information based on job roles and expertise. Featuring capabilities from IBM Lotus® Connections software, this offering enables individuals to establish and build expertise and relationships across various teams, roles and geographies:. The collaboration accelerator:

- Provides directories to find individuals based on their self-selected areas of expertise or related interests, as well as tools that support the formation of online communities
- Delivers Web 2.0 tools such as blogs, wikis and bookmarks to promote efficient information sharing, research and idea promotion
- Facilitates the collective creation and sharing of content

IBM Collaboration Accelerator supports the need for quick contact with other individuals through presence awareness, instant messaging and Web conferencing capabilities. By leveraging IBM Lotus Sametimesoftware capabilities, the accelerator enables anytime access to people and information. It also enables individuals to easily determine which of their colleagues are available to collaborate or share information and facilitates real-time text message conversations with individuals or groups, as well as audio and video support. It supports web conferences where team members can share information on their desktops and use virtual whiteboards for brainstorm sessions.

Within the EPIC platform this functionality is provided to all portal users via inbuilt portlets.

4.1.3 Content Accelerator

Web sites are an organization's face to the world. If content is outdated, inaccurate or difficult to find there is the risk of frustrating site visitors and losing opportunity to communicate with them. The challenge is to keep content relevant and secure without over-stretching teams and budgets. IBM Content Accelerator enables organizations to increase the value of web sites by delivering real-time, personalized information, while reducing the cost of deploying and managing web sites:

- Enables to "snap in" powerful, flexible web content management tools that support the dynamic delivery of personalized web content, helping to extend the value of existing investments
- Facilitates rapid creation and easy management of robust websites, intranets, extranets and portals
- Reduces the time it takes to get content from producers to consumers, and speeds the web content update and approval cycle.
- Support security-rich, accurate content searches
- IBM Content Accelerator uses IBM OmniFind® Enterprise Edition software both to provide fast and accurate search results and to help protecting sensitive information.

The content accelerator with all these functionalities is available to be used in the pilot applications.

4.1.4 Mobile Device Accelerator

IBM Mobile Portal Accelerator software (formerly IBM WebSphere® Everyplace® Mobile Portal Enable) is the integrated, server-side, mobile front-end to IBM WebSphere Portal software. Mobile Portal Accelerator software helps enterprises provide mobile users access to portals via a highly navigable, personalized Web experience.

IBM WebSphere Portal software provides platform services that flexibly coordinate assembly of Web and IT assets into a unified, personalized display. IBM Mobile Portal Accelerator software extends access to personalized WebSphere Portal applications and services to mobile devices by providing the following capabilities [17].

4.1.4.1 Out-of-the-box mobile-enabled portlets

Mobile Portal Accelerator software includes XDIME-enabled portlets that can be used out-of-the-box or as samples for demonstration purposes:

- Mobile Portal RSS is an XDIME 2/XDIME mobile-enabled version of the IBM Syndicated Feeds Portlet and supports RSS2 and ATOM feeds;

- Mobile Portal Stock portlet is an XDIME2/XDIME mobile-enabled portlet that displays stock quote and performance data for selected companies, symbols and investments, with configuration and edit options for users to modify selected stocks and quote sources;
- Mobile Struts MailReaderportlet sample;
- Mobile Media Access Proxy (MAP) portlet sample for adaptation of images to mobile devices;
- Change of Address portlet sample for mobile devices;
- Calendar portlet sample, for managing appointments, meeting events and calendar;
- Mobile Login portlet;
- Mobile Portal Client Framework Sample Portlet is a mobile-enabled portlet and artefacts that showcase over 50 XDIME 2 sample widgets that can be used to deliver an enhanced, more interactive experience to client capable mobile devices. Examples of widgets include styling, transition, AJAX table, autocomplete, popup, ticker tape, and more.

4.1.4.2 "How to" documents and deployment best practices

Mobile Portal Accelerator V7.0 includes new documentation to help developers and administrators:

- How to documents: Create a Mobile Theme Layout; "XDIME" Enable an existing portlet; Integrate Web Services, JavaScript features, and Stream Video Content.
- Deployment Best Practices: Cluster Installation, Using Virtual Portals, Updated Troubleshooting Guide.

4.1.4.3 Multi-Channel Server content-adaptation capabilities

The intelligent Multi-Channel Server content-adaptation capabilities of IBM Mobile Portal Accelerator software enable fast and effective delivery and optimization of portal content according to the mobile device specific capabilities. Mobile Portal Accelerator software provides a repository of mobile-device policies, which define visual presentation elements (such as page layouts and style sheets) and device-attribute information, and device categorization for over 8200 mobile devices.

4.1.4.4 Media Access Proxy (MAP) for image conversion

In Version 7, IBM Mobile Portal Accelerator uses Media Access Proxy 5.3, a web application to dynamically resize images for display to various mobile device types according to their

display capabilities. This is particularly relevant to the "immersive" use cases explained earlier for mobile users.

4.1.4.5 Multi-Channel Server Framework Client services

The Multi-Channel Server framework client services enable delivery of XDIME/XDIME 2 applications leveraging widgets with rich client-side user interfaces.

4.1.4.6 Lotus Web Content Management integration

Integration with IBM Lotus Web Content Management enables content authors to render content to both server-based and mobile audiences. IBM Mobile Portal Accelerator Version 7.0 adds support for Lotus Web Content Management Version 7.0.

4.1.4.7 Mobile Portal Toolkit

To help developers create XDIME/XDIME 2-enabled mobile portlets, the Mobile Portal Accelerator software includes the Mobile Portal Toolkit, an Eclipse plug-in. The toolkit includes support for mobile application development: mark-up/layout editors, templates for rapid site development and enforcement of style guidelines, mobile portlet samples, APIs, and documentation.

The toolkit also includes these features:

- Portlet Creation Wizards. These wizards include support for creating Mobile XDIME Standard and Mobile Struts portlets that support standards-based JSR168/286 APIs. Developers can use the Portlet Creation Wizards to create configure-and-edit mode JavaServer™ Pages (JSP) for XML-based, XDIME (XHTML with Device Independent Markup Extensions) portlets.
- Device Repository of mobile-device policies, which define visual presentation elements (such as page layouts and style sheets) and device-attribute information, and device categorization.
- Policy editors. Rational-software-based policy editors are used to create policies which are referenced in the XDIME mark-up and used by the Multi-Channel Server runtime to make the best decision for emitting device-dependent mark-up to a target device.

4.1.4.8 Mobile Page Management

Mobile Portal Accelerator allows administrators to configure mobile pages from the WebSphere Portal Administration panels. The software:

- Allows portal administrators and marketing personnel to define how mobile users access and navigate portal services from mobile devices. The mobile pages navigation tree is stored in the navigation model of WebSphere Portal and consists of nodes that represent pages, URLs, labels or portlets. At runtime, the XDIME/XDIME 2 aggregator displays and allows users to navigate the tree created by Manage Mobile Pages.
- Supports the configuration of metadata for each navigation node and portlet on a page. Some metadata will be standard (device characteristics, icons) and understood by the XDIME aggregator. Configuration of custom meta-data is also supported, but a custom aggregator or other functionality is required to use this data.
- Includes support for metadata configuration to enable a higher quality user experience by fine-tuning content delivery based on device type and capabilities. For instance, it filters image and audio content when a device does not support those features, or filtering content based on device type or manufacturer. At runtime, the aggregator queries the metadata for a node to determine whether the corresponding page, URL, label, or portlet is to be included in the display output.
- Creates the navigation for wireless devices and PDAs, and support the configuration of meta-data as provided by the Extended Attributes Configuration Portlet.
- Preload Notices are typically informational pages that are optionally displayed after a link is selected and before it is displayed. They may be used to insert special promotional advertisements, notify users of billable charges associated with a selection, or deliver a warning regarding the content to be displayed. The preload notice works with the Manage Mobile Pages portlet to do the following:
- Allow configuration of where preload notices appear in the navigation.
- Allow selection of pre-defined rules for determining when a preload notice is displayed.
- Provide a mechanism for navigation to flow from the preload notice to the target link.

In EPIC this product is used to render GUIs according to the characteristics of the mobile devices used in the pilots.

4.2. Process Server and Business Rules

A city is a smarter place than it was ten years ago, with systems and processes that are more intelligent, instrumented and interconnected than ever before. The convergence of physical and digital infrastructures is changing what is possible in the worlds of work and leisure, allowing global collaboration; prediction of events and control of complex systems. The fast interconnected nature of the digital world is changing the way we live and do business in the physical world, presenting a myriad of opportunities with their attendant challenges.

Business networks are changing as relationships become more dynamic between citizens, administrations, service providers, consumers, partners and suppliers, all of whom are constantly shifting and being re-evaluated. The same technologies that are creating a smarter planet are driving the need for a more dynamic business network. Citizens and enterprises demand lightning-fast responsiveness and increasing levels of personalization of service. Regulations and compliance demands shape and reshape the way business is conducted. More agile, interconnected business processes are required to enable organizations to establish dynamic business networks and fully take advantage of a smarter planet.

Business processes must be explicit, documented, understood and agreed upon. They must also be visible, making process performance data available, measurable and actionable in real-time. Increased personalization of service delivery needs agility combined with process information contextualized by role and current usage paradigm of each stakeholder, with robust governance to ensure compliance with business rules and regulatory requirements relevant to the stakeholders' locations.

IBM WebSphere Process Server software is a process automation engine that deploys and executes processes within either an SOA or non-SOA infrastructure, automating the complex and inter-dependent processes that span people, processes and ecosystems. Business rules management systems automate process-based decisions and businesses can easily maintain and deploy new rules for improved response times. IBM WebSphere Process Server and ILOG JRules have been chosen to facilitate the regulatory compliant business process flows within the pilots in the EPIC platform.

4.3. Enterprise Service Bus and Service Registry

Smart cities and smart city networks are looking increasingly to service oriented architecture (SOA) for better align business processes and IT systems, to improve agility; maximise reuse of SOA assets and reduce maintenance costs. An enterprise service bus (ESB) and a service registry are essential components in any successful SOA, to connect to the right information at the right time and to reuse existing SOA assets.

The use of IBM® WebSphere® Enterprise Service Bus (WESB will allow fast and flexible integration of the demonstrator applications into the EPIC platform, with decoupling of integration logic from each application into a centralized set of business rules and user authentication processes.

The IBM WebSphere Service Registry and Repository (WSRR), complements the SOA by providing the service visibility and governance needed by City Administrations operating a smart city. With WSRR, smart cities can understand what services are running, track service usage and increase service reuse, resulting in greater efficiency.

WebSphere ESB provides fast and flexible application integration through an easy-to-use tool and a run-time perspective. Manoeuvring through services, defining connections and intelligent message routing are some of the capabilities that make the implementation process easier and much quicker. These capabilities are essential in the context of the EPIC project, where three existing applications are to be integrated into a single centrally

managed platform, with great potential for collaboration between demonstrator applications, e.g. combining elements of City Planning with Relocation, which would not be possible without the EPIC platform.

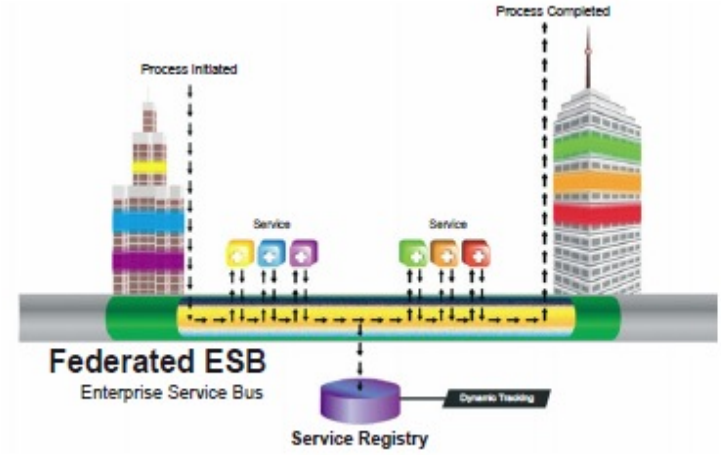


Figure 16: Service Visibility

Service governance in WESBRE is achieved through WSRR, which delivers the foundation for enabling service life-cycle governance. As clients adopt effective SOA solutions, the need to proactively govern the service life cycle through prescriptive capabilities offered by WSRR becomes important. WSSR helps clients to:

- Manage service interactions and dependencies by handling policies, versioning, classification and usage throughout the life cycle of the service to promote optimal interaction of services in the SOA
- Facilitate storing, accessing and managing service information (service metadata), enabling service consumers to easily select, invoke, govern and reuse services
- Deliver visibility and control of services in the SOA, and drive business flexibility by managing the services that align IT with business objectives. WESBRE uses these capabilities from Service Registry and Repository throughout the SOA life cycle—model, assemble, deploy and manage—to help govern access, monitor service vitality, manage policies for publishing and use and retire services.

WESBRE helps achieve business agility by:

- Enabling fast and flexible application integration with reduced cost, and bridging to next-generation interconnectivity
- Decoupling complex integration logic from each application with a central, integration solution eliminating point-to-point connectivity programming
- Providing a central repository of services deployed in the ESB, facilitating ease of discovery and reuse

- Completing SOA potential by connecting the business and not compromising on service governance and security
- Exposing existing applications and data as new business service opportunities, without impacting the current IT environment

WESBRE helps drive cost optimization by:

- Reducing expensive redeployment of ESB mediations and flows through externalizing and governing service endpoints, metadata and policies
- Taking advantage of existing connectivity infrastructure for universal service delivery, and extending easily to federated ESB and service-federation models
- Reducing ongoing maintenance costs by decoupling connectivity and integration logic from each application
- Increasing interoperability and service reuse by using service federation to bridge SOA domains
- Serving as an operational control point so the life cycle of critical services can be governed in a business-aligned and cost-effective manner

WESBRE helps provide service governance by:

- Increasing visibility of services and interfaces promoting reuse
- Providing governance throughout the life cycle of the service to ensure that the right services are being developed and heritage systems can be decommissioned
- Enabling discovery of the services running in your environments, in order to accurately provision resources
- Supplying a repository and interface for defining business policies so that decision making within services can be modified without developing new code
- Tracking service usage and risk control among service consumers.

For all that reasons, WESBRE is in the heart of the EPIC platform.

4.4. Directory Server – Roles, Groups, Users

The main focus of Tivoli Directory Server is identity management. It supports role-based and fine-grained access control, plus allows for delegated ownership of entries. The server supports a high-performance Lightweight Directory Access Protocol (LDAP) identity infrastructure, which is used for the EPIC platform since it helps to enable rapid development and deployment. The advanced security capabilities of Tivoli Directory Server can be used within the EPIC platform to:

- Implement self-service and delegated administration by controlling data access down to the individual attribute level;

- Limit access to attributes within an entry, so that users can update a specific number of attributes but only read the rest;
- Securely encrypt the values stored within the directory using the latest encryption algorithms;
- Offer secure access to directory data;
- Provide the capability to define global, group and individual password policies;
- Allow delegation of authority to multiple directory administrators with granular administrative roles;
- Set and enforce password policies for logins used by directory server administrators;
- Protect directory data against denial-of-service attacks by using user- and group-specific search limits and identity assertions.

Additional advantages for EPIC by the usage of Tivoli Directory Services are:

- Provision of the performance, reliability and scalability needed for an on demand enterprise directory by including front-end proxy server;
- High availability of directory information;
- Robust application options;
- Great flexibility in configuration;
- Low administration costs;
- Fewer inconsistencies that accompany manual synchronization of different directories.

To support EPIC, too, which uses a variety of IBM software, Tivoli Directory Server seamlessly integrates with IBM middleware, identity management and security products. It functions as the default directory for IBM WebSphere® Application Server, IBM WebSphere Portal, IBM Tivoli Identity Manager, IBM Tivoli Access Manager and the IBM AIX® operating system.

4.5. Federated Identity Manager: Personalisation and Single-Sign-On

IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 provides an entry level solution that enables organizations to establish federated identity management with small-to-midsize business partners and offers access management for Cloud and SaaS environments with Security Assertion Markup Language (SAML)-only protocol support. It can be seamlessly upgraded to Tivoli Federated Identity Manager for an enterprise-level deployment.

IBM® Tivoli® Access family of products helps enterprises:

- Manage and enforce policy-based access control to your enterprise-wide applications with enhanced performance and scalability to support tens of millions of users;
- Provide seamless single sign-on (SSO) and user session management in Web 2.0 and Web services environments through enhanced integration with WebSphere® DataPower® SOA appliances as well as with .NET environment;
- Provide seamless SSO from desktop apps, mainframe, TTY, and JavaTM to Web applications;
- Enhance business-to-business (B2B) and business-to-consumer (B2C) collaborations and access management across the business ecosystem through B2C self-care capabilities;
- Provide standards-based federated access control for on-premise and off-premise applications, software as a service (SaaS), and Cloud-based services through updated support for SAML2.0 and OpenID;
- Centrally manage application roles, entitlements, and data-level access to new and existing resources including in-house and custom applications;
- Easily administer and enforce fine-grained data entitlements consistently from portals, for example, WebSphere Portal and SharePoint to databases, such as IBM DB2®;
- Deploy highly scalable, application-specific policy enforcements with incremental run-time security services deployments in a remote or local mode.

Using these features, the EPIC platform will provide coherent user and identity management including all mandated single sign-ons to the back office applications.

4.6. REST Web Services Support

REST is a very mature technology which has become popular again during the recent years due to the popularity with the software developers. RESTful Web Services are lightweight, small, resource efficient and requires less bandwidth than alternatives. REST does not require parsing of the XML response to a SOAP request to extract the desired data, so is well suited to small, low-power devices such as wireless sensors, which spend most of their time in a low-power state, “waking-up” only to send data or in response to an external request for data

The majority of the EPIC platform’s core web services are built following the SOAP approach. The Pilot applications may use either SOAP or REST web services and can be configured via common WSDL, while at the same time they can consume web services offered by other pilot applications. Moreover, web services will be used to pull/push data feeds from/to external data storages (i.e. points of interest in a city stored externally by the city administrators). According to the user requirements document of the EPIC project [25]

and the outcomes of the discussions between the relevant stakeholders, addressed at the D2.2 [24], the EPIC platform should ensure interoperability between all different components and facilitate the use of mobile devices. For the aforementioned reasons we consider at the EPIC platform level a distinct layer that will serve as a bridge between REST requests and SOAP calls. This potentially new component is introduced at the following figure:

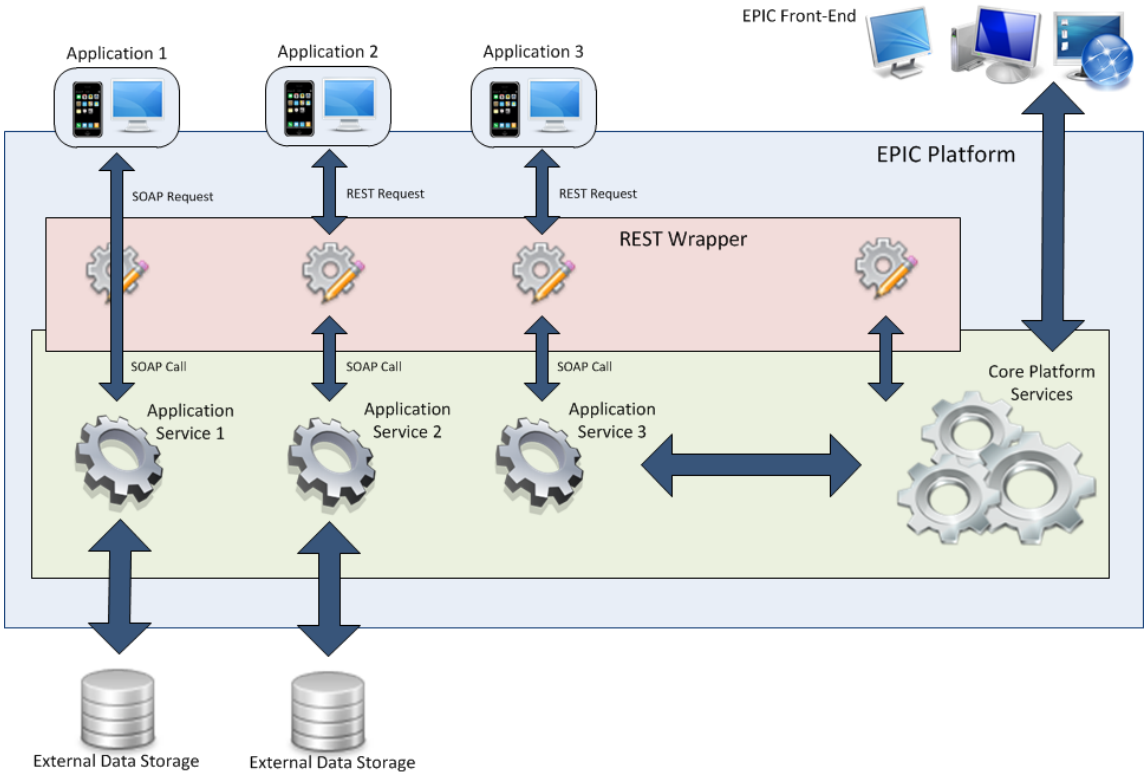


Figure 17: REST Wrapper

As depicted in the above figure, the REST Wrapper component will be located above of the existing SOAP web services. Applications that need to consume REST web services will make REST calls to the desired service of the wrapper, and the latter will translate this call to a SOAP request, will parse the XML response and return back to the caller the relevant answer via the standard HTTP methods. Whichever element wants to access a service, can do so either directly using SOAP calls or via the REST wrapper (in case of REST calls). The RESTful web services will be implemented in Java with the JAX-RS implementation Jersey (version 1.8 [27]) and in the majority of cases will make use of the JSON format [26] in order to exchange data feeds.

There might be two major benefits introducing the REST wrapper component to our solution which will be evaluated further as the pilots proceed:

a) New pilot applications could be easily plugged-and-played to the EPIC platform (as also described in [29]), without additional effort to modify their interfaces in order to meet the SOAP standards, thus increasing the interoperability of the platform and allowing new applications to be now smoothly integrated with the rest of the platform components, and

b) Mobile applications might also benefit by this approach as they are designed to consume continuously a significant amount of data, and therefore any additional overhead should be as minimal as possible. JSON objects are a lot simpler than XML schemas and web browsers can consume large amount of JSON much more efficiently than they can consume large amount of XML and the gap is widening because the latest versions of the browsers are now providing native, safe support for encoding and decoding JSON. We will compare such a self-coded component with the out-of-the-box platform capability as described in D3.2 [29]).

4.7. Development Support

4.7.1 alphaWorks

alphaWorks[16]was founded in August 1996 by IBM. The alphaWorks program has launched early release technology implementations in nascent technology communities of software developers, in areas like Java technology, XML and web services. alphaWorks is a key aspect of the developerWorks resource for developers.

4.7.2 developerWorks

Since 1999, IBM developerWorks[17] has been the IT industry's most comprehensive source of technical content, downloadable code, and community forums focusing on IBM software products, as well as on open-standards technologies such as Java, Linux, XML, Web development, and more. It provides an extensive, easy-to-search technical library where information for developers is stored:

- How-to articles;
- Tutorials and skill kits;
- Trial code;
- Demos;
- Podcasts.

DeveloperWorks makes it easy to form meaningful connections to build a professional network that can help in solving problems.

4.7.3 Eclipse

Eclipse [18] is an open source community, whose projects are focused on building an open development platform comprised of extensible frameworks, tools and runtimes for building, deploying and managing software across the lifecycle. The Eclipse Foundation is a not-for-profit, member supported corporation that hosts the Eclipse projects and helps cultivate both an open source community and an ecosystem of complementary products and services.

The Eclipse Project was originally created by IBM in November 2001 and supported by a consortium of software vendors. The Eclipse Foundation was created in January 2004 as an independent not-for-profit corporation to act as the steward of the Eclipse community. The independent not-for-profit corporation was created to allow a vendor neutral and open, transparent community to be established around Eclipse. Today, the Eclipse community consists of individuals and organizations from a cross section of the software industry.

On the web site, a comprehensive software development kit is downloadable – most state-of-the-art software development tools plug into this platform.

4.7.4 Front-End Development (Portlets)

The primary method of EPIC service consumption should be via a web browser, either the large-screen or small-screen forms as identified above. Applications must be accessed via portlets hosted on the EPIC portal server.

“Portlets are Web-based components managed by portlet containers that supply dynamic content. Portals employ portlets as pluggable user-interface components – a presentation layer – for information systems. The Java Portlet Specification (JSR168) achieves interoperability among portlets and portals by defining the APIs for portlets and by standardizing the rules for preferences, user data, portlet requests and responses, deployment, packaging, and security” [19].

For EPIC, the portlets wrap the required functionality to consume the relevant smart-city web-services and deliver the outputs to the user.

4.7.5 WebSphere Integration Developer ([20])

IBM Integration Designer V7.5 (previously known as WebSphere Integration Developer (WID)), is an Eclipse-based developer tool that simplifies integration with supplied visual editors and built-in test support.

WebSphere Adapters v7.5 as part of the WID accelerate business integration projects with a comprehensive set of capabilities (e.g. service-enabling of assets, including packaged, custom, and legacy applications, technology protocols, and databases) Additionally the WebSphere Adapter Toolkit enables the development of custom adapters to meet unique business requirements. Following are the most important adapter capabilities (also provided to WebSphere ESB clients as part of its Integration Designer V7.5 tooling.):

- Browse for process applications that have or need Application Integration Services to be implemented;
- Associate service modules with Process Applications or Toolkits;
- Support for WebSphereDataPower appliances;
- Support creating and testing XML schemas and XML maps that can be deployed to a WebSphereDataPower system;
- Validation of DataPower XML maps that use DataPower XSL extensions;
- Supports direct connection to a DataPower appliance for exchange of XML schemas and maps with DataPower appliances;
- XML mapper enhancements;
- Enhanced capabilities for import/exporting Mediations flows in a human readable file format to enable several uses;
- Enables the use of third party compare/merge tools for teaming situations;
- Enables clients to create Mediation flow patterns templates;
- Integrated Test Environment enhancements.

For the EPIC project, WID will be made available to all interested internal developers.

4.7.6 JRules Studio

JRules Rule Studio [21] runs on the Eclipse integrated development environment (IDE), providing a single platform for modelling, coding, debugging and deploying rule-based applications. Developers and architects can easily apply their corporate development standards, best practices and processes for building and maintaining applications. Rule Studio fully equips IT teams to:

- Manage application code and rules in a single interface;
- Develop iteratively through integrated testing, debugging and refactoring;
- Control application development through integration with source-code control systems;
- Extend rule maintenance and management to business users through synchronization with Rule Team Server;
- Quickly learn rule-based application development with project guidance dashboards, out-of-the-box project tem-plates and wizards that assist in creating business object models, simulation and testing scenarios and deploying rule services.

JRules Rule Execution Server provides a complete management system for the deployment, execution and monitoring of business rules in the production environment. It gives IT operations everything they need to ensure the performance, scalability and reliability of

rule-based applications. Rule Execution Server ensures the integrity of deployed applications by:

- Using a robust, J2SE™/J2EE™-compliant architecture: IBM ILOG's industry-leading rule engine can be run on a variety of application servers and operating systems, offering unmatched scalability and performance for mission-critical systems;
- Offering comprehensive rule execution options: the JRules rule engine supports synchronous, asynchronous and web services-based invocation, with the ability to use either inference or sequential-based rule execution;
- Enabling hot deployment and roll-back of rule-based applications: Rule Execution Server prevents downtime and disruptions in the production environment;
- Providing monitoring services: Java™ Management Extensions (JMX™) and a web-based administration console provide diagnosis and monitoring of rule execution, as well as management of versioning and reporting for deployed applications. Monitoring services can also be easily integrated into other JMX-based tools.

For EPIC, we will plug-in the Studio into WID.

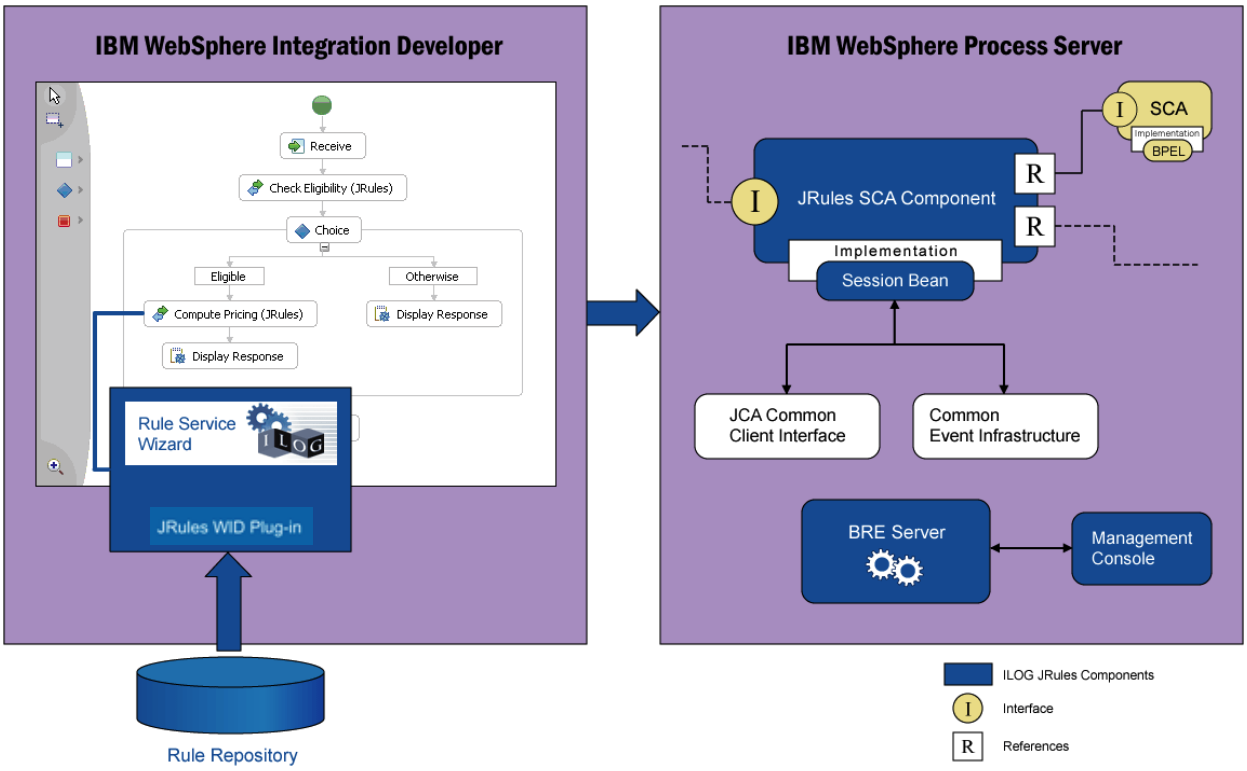


Figure 18: Integration of WID and Process server ***(Source: IBM)***

Furthermore, examples and best practices of process/service deployment and of portlet development will be provided through EPIC specific user guides.

4.8. Deployment Support

4.8.1 User Administration

Using the URL http://129.35.209.110:10039/wps/portal, a connection to the "Manage Users and Groups" portlet is established. Via this portlet the viewing, creation and deletion of users and groups is enabled.

For doing these user/group administration activities you must login as administrator to the IBM WebSphere Portal, click **Administration** in the page header (or the collapsed quick link on the bottom bar) and then click **Users and Groups** in the side navigation. This will be shown on the following screen.

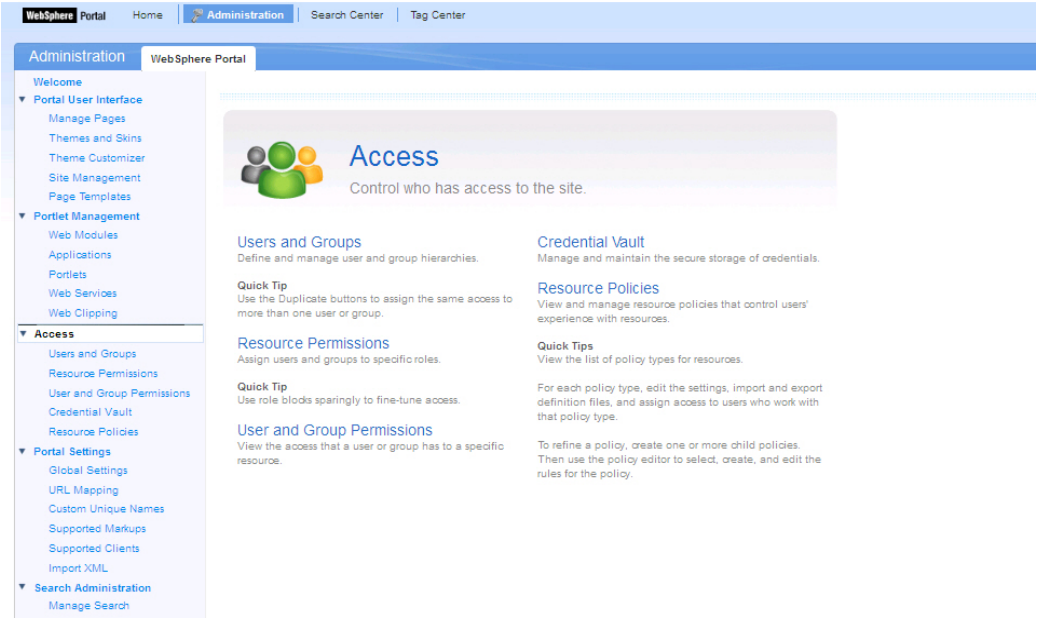


Figure 19: Screenshot – Managing Users and Groups

4.8.1.1 Adding Users and Groups

For adding users and groups follow the steps described here:

- Log in to your portal as an administrator → Click **Administration** → Click **Access** → **Users and Groups**
- Select the user group for the user.
- Click **New User** or **New Group** .
  If you are creating a new user group, enter a name for the user group. Do the following:

- Enter a User ID for the new user. The User ID must be 3 to 60 characters in length. It can contain alphanumeric characters, DBCS, and the hyphen "-", period ".", and underscore "_" characters. No other characters are permitted in this field.
- Enter and confirm a password for the new user. The password must be unique and 5 to 60 characters in length. Valid passwords may contain only the characters a-z, A-Z, period ".", dash "-", and underscore "_ ".
- Enter a first name for the new user.
- Enter a last name for the new user.
- **Optional:** Enter an e-mail address for the new user. This field is not required for successful creation of a new user.

- **Note:** If you use an LDAP server for your users and groups, your LDAP configuration might place additional restrictions on user and group names. For example, the LDAP configuration might require user names and passwords to be a minimum of 8 characters in length.
- Select **preferred language** from the drop down list. This field is not required for successful creation of a new user. If you do not select a preferred language or if the language is not supported by the portal, the default language is the default IBM® WebSphere® Portal language.
- Click **OK**.

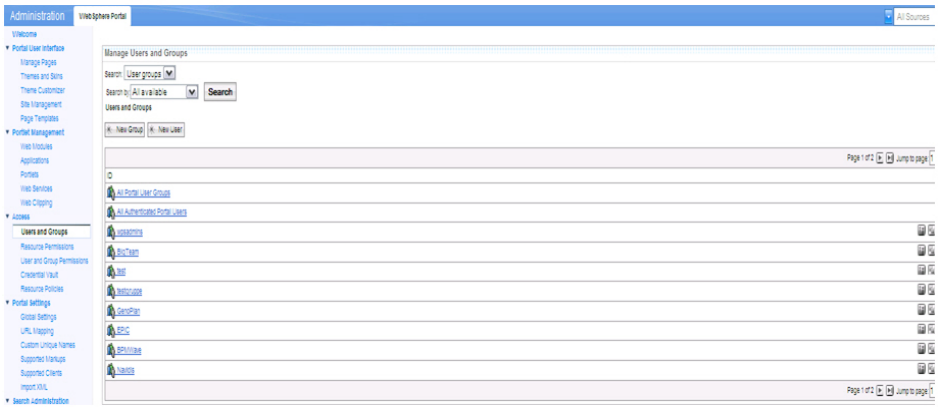


Figure 20: Screenshot - Adding new users

4.8.1.2 Viewing Members of a Group

Group members can be shown by the following actions:

- Search for the user group whose members you want to view.
- Click the required user group in the search results.

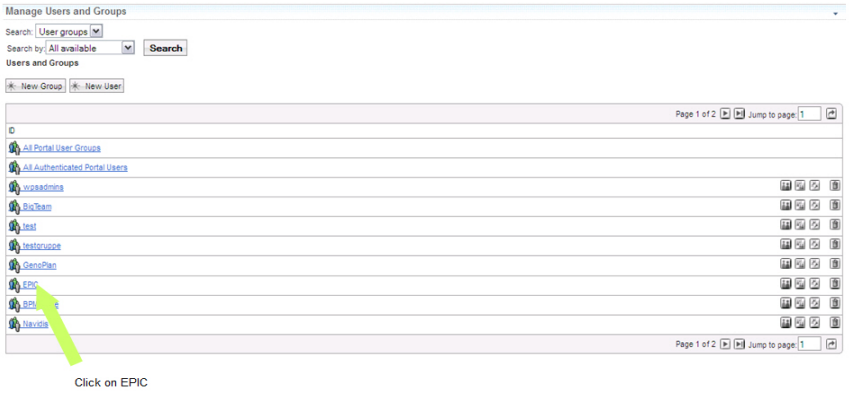


Figure 21: Screenshot - Viewing groups

- All members of the group are listed.

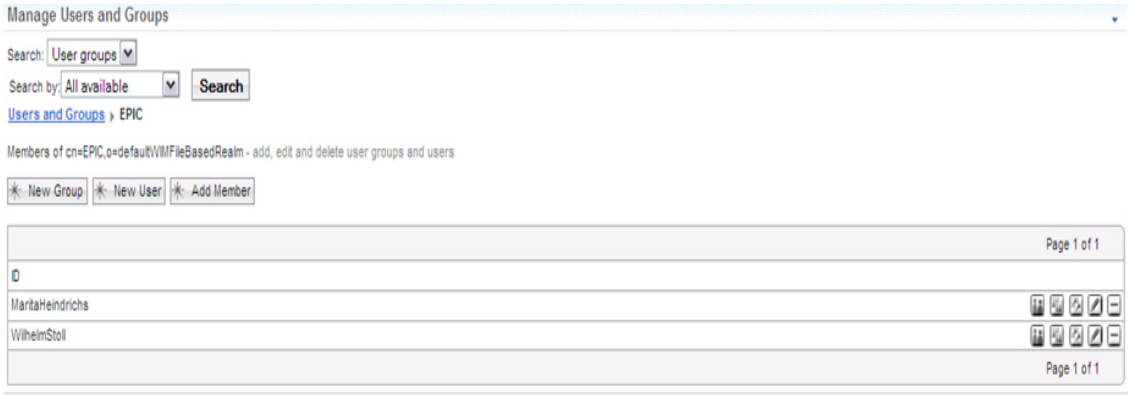


Figure 22: Screenshot - Viewing the members of group EPIC

4.8.1.3 Editing User Information

For editing user information such as password, User ID, first name, last name, e-mail address, or preferred language perform the following steps:

- Search for the required user or click the **All Authenticated Portal Users** link to get a list of users.
- Click the **Edit** icon for the required user.

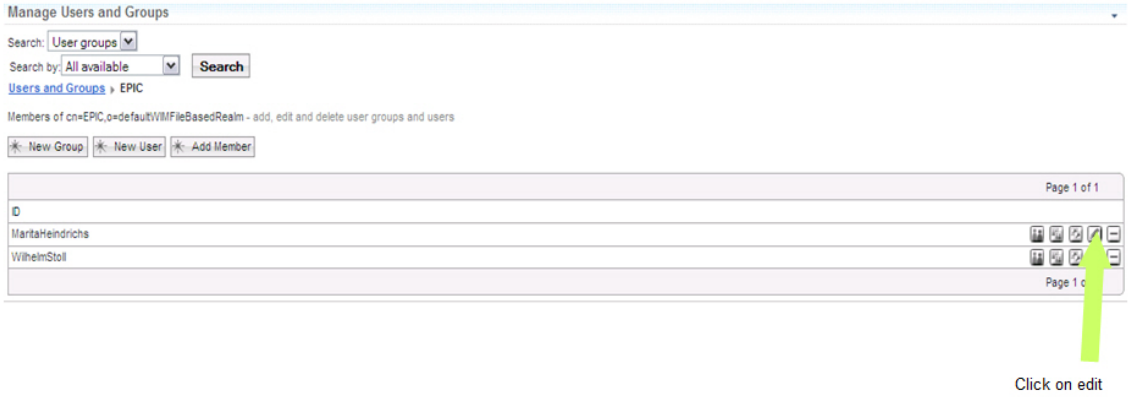


Figure 23: Screenshot - Editing user information (I)

- Make the necessary changes to the user information.
- Click **OK** to save your changes, or **Cancel** to exit without saving your changes.

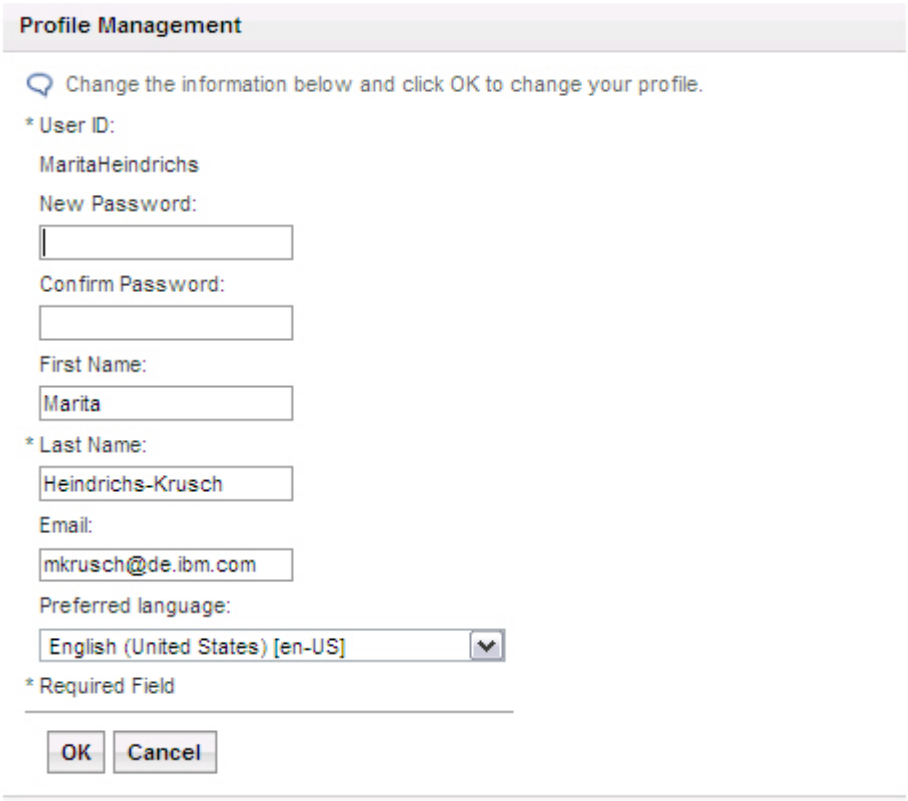


Figure 24: Screenshot – Editing user information (II)

4.8.1.4 Deleting users or groups

A user or a group can be deleted as follows.

- From the **Users and Groups** page, choose the link for deleting either a user or a user group:
  - To delete a user, click **All Authenticated Portal Users**.
  - To delete a user group, click **All Portal User Groups**.
- Select the user or user group that you want to delete.
- Click the Delete icon. A dialog box warns that the selected user or group information and all private data will be removed from the database.

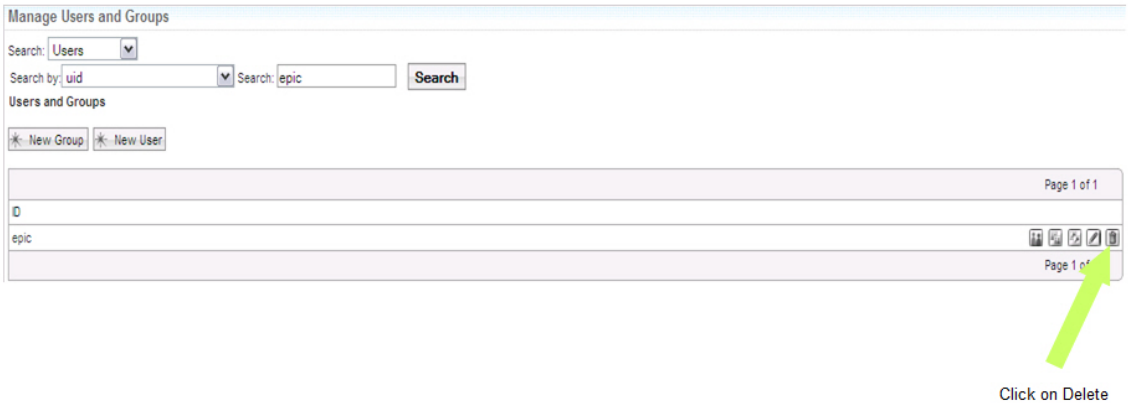


Figure 25: Screenshot - Deleting users and groups (I)

- Click **OK** to save your changes, or **Cancel** to exit without saving your changes.
- **Notes:**
  - Deleting a user from the **All Authenticated Portal Users** group is the only way to delete a user from WebSphere Portal.
  - Deleting a user group from the portal does not delete the members of the group.

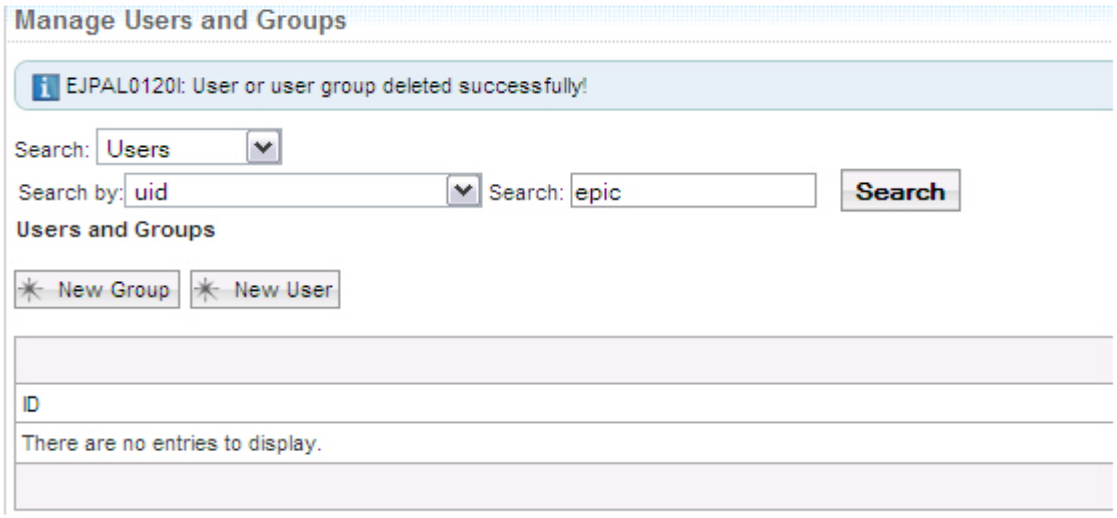


Figure 26: Deleting users and groups (II)

4.8.2 WID

The IBM Websphere Integration Developer (together with IBM WebSphere Process Server) provides a powerful platform for industrial strength applications utilizing a service oriented architecture. It is out of the context of this document to give a detailed description of the deployment. Instead a list of valuable links to information on the deployment is given below:

- Getting started with WID
  http://www.ibm.com/developerworks/websphere/techjournal/0512_peterson/0512_peterson.html
- Web Age Solutions WID Tutorial Part 1
  http://www.webagesolutions.com/knowledgebase/waskb/waskb019/index.html
- Web Age Solutions WID Tutorial Part 2
  http://www.webagesolutions.com/knowledgebase/waskb/waskb020/index.html
- Web Age Solutions WID Tutorial Part 3
  http://www.webagesolutions.com/knowledgebase/waskb/waskb021/index.html
- Web Age Solutions WID Tutorial Part 4
  http://www.webagesolutions.com/knowledgebase/waskb/waskb022/index.html
- A guided tour of WebSphere Integration Developer Part 1
  http://www.ibm.com/developerworks/websphere/techjournal/0602_gregory/0602_gregory.html
- A guided tour of WebSphere Integration Developer Part 2
  http://www.ibm.com/developerworks/websphere/techjournal/0603_gregory/0603_gregory.html

- A guided tour of WebSphere Integration Developer Part 3 http://www.ibm.com/developerworks/websphere/techjournal/0604_gregory/0604_gregory.html
- Building SOA solutions with the Service Component Architecture Part 1 http://www.ibm.com/developerworks/websphere/techjournal/0510_brent/0509_brent.html
- Building SOA solutions with the Service Component Architecture Part 2 http://www.ibm.com/developerworks/websphere/techjournal/0512_barcia/0512_barcia.html
- BuildingSOA solutions with the Service Component Architecture Part 3 http://www.ibm.com/developerworks/websphere/techjournal/0602_barcia/0602_barcia.html
- Building SOA solutions with the Service Component Architecture Part 4 http://www.ibm.com/developerworks/websphere/techjournal/0604_barcia/0604_barcia.html

4.8.3 Portlet development

It is out of the scope of this document to give a detailed description of portlet`s development. The interested reader is referred to the links/references given below.

- Introduction to portlet structure and programming http://www.ibm.com/developerworks/ibm/library/i-portal/
- Example for portlet development http://www.ibm.com/developerworks/websphere/tutorials/wes-helloport/index.html
- Deployment of portlets within the EPIC cloud environment, see [23]

4.8.4 Application and Process Deployment

The first application to be ported to the EPIC platform has be ICE 3 from Navidis. The implementation steps are described here as they are prototypical for all the pilot applications to follow:

The application's source code was fetched from a FTP link provided by Navidis. It was then packaged into a .war file (Navidis_Web.war) by using Eclipse to package the entire source code into war file (right click on the project ->**Export**).

The .war file was then installed on the Websphere Process Server which is hosted on 129.35.209.54 cloud instance. (For installing the .war, we need to login into the Process server, click on the Applications sub tab. Click on **Install** and follow the steps. It will ask to upload the .war file. Do so and wait until it installs. Make a note of the context root. In this case, the context root is /navidis).

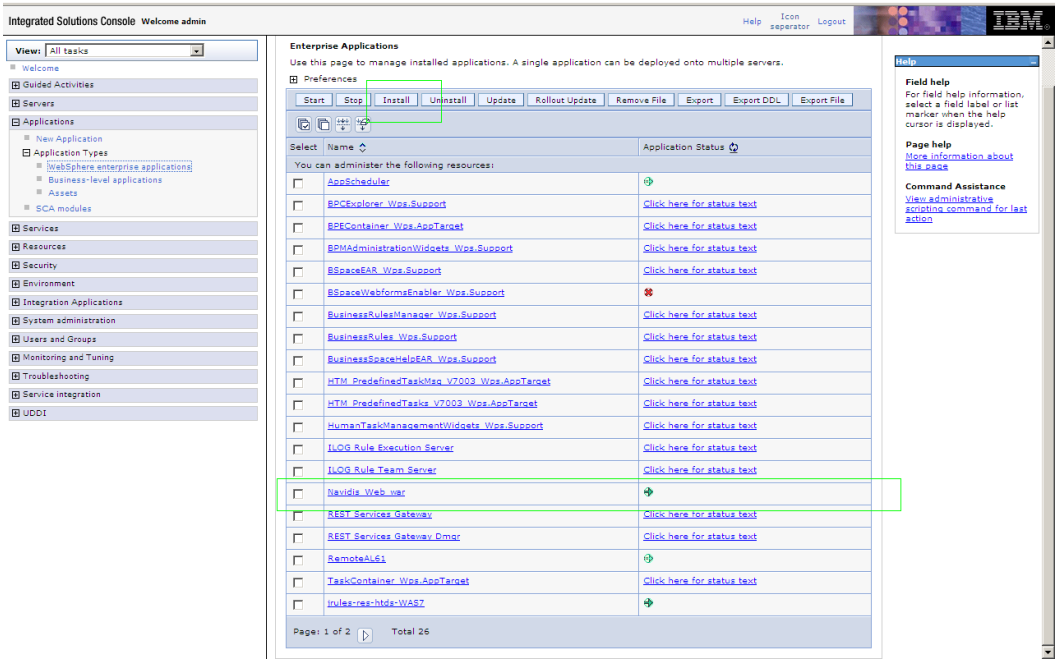


Figure 27: Screenshot – Application Deployment on Process Server

Once the installation is complete, the application was accessible using the link: http://129.35.209.54:9080/navidis/Navidis/

It was then ported on the Websphere Portal by creating an **iFrameportlet** and then referencing the WPS link provided. For creating an iFrameportlet, the following steps need to be completed after logging into the portal (as developer):

a. Goto Administration -> Portal User Interface -> Manage Pages

b. Create a new Page by clicking on “New Page”

c. Navigate to the page you created.

d. Click on “Actions” which appears on the top right corner of the page.

e. Choose a portlet you want to use.

f. Give the URL for the portlet as http://129.35.209.54:9080/navidis/Navidis/

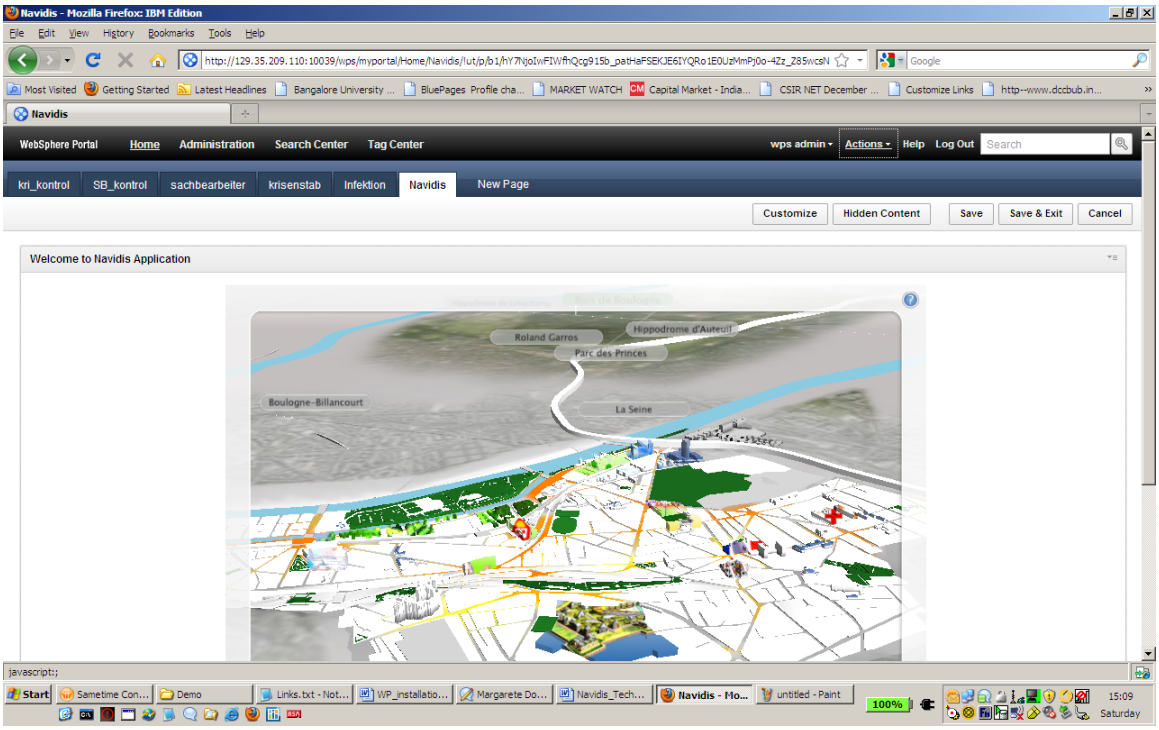


Figure 28: Screenshot – Linking to an application from a portlet

The above screenshot shows the "New Page" tab that is used to create a new page and add a portlet of your choice.

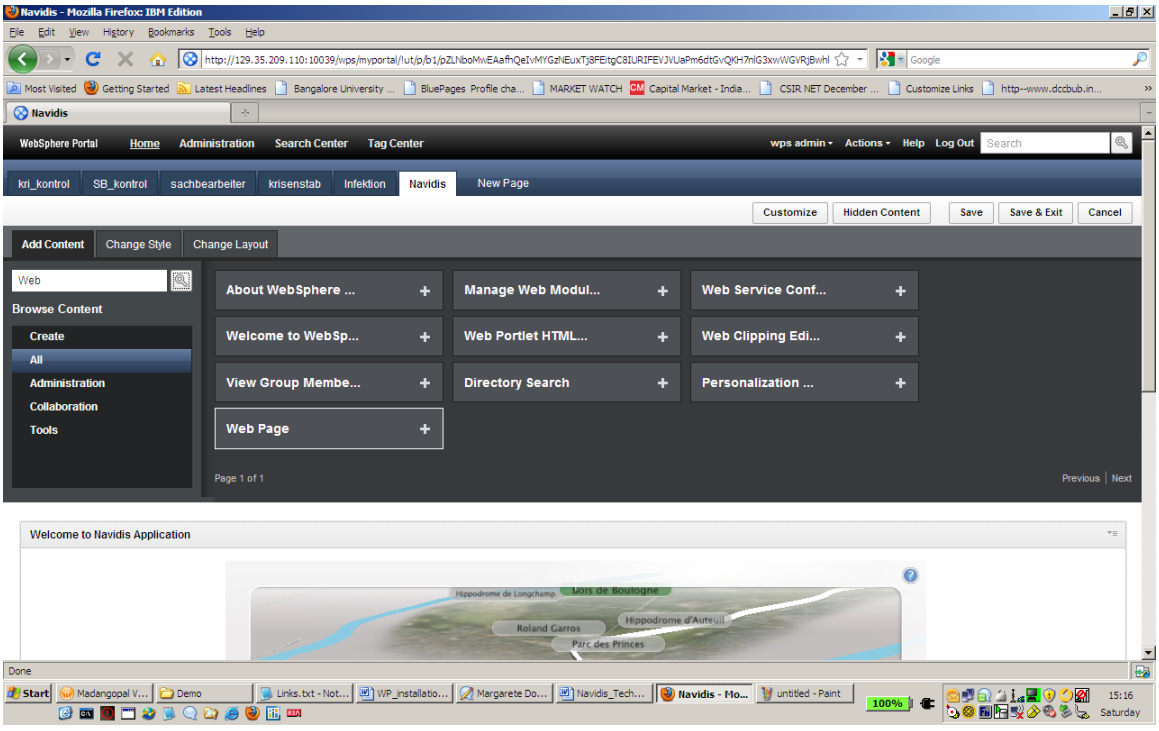


Figure 29: Screenshot – Choosing a Portlet

The above screenshot depicts the way of choosing a portlet. (A Web Page portlet was chosen this time).

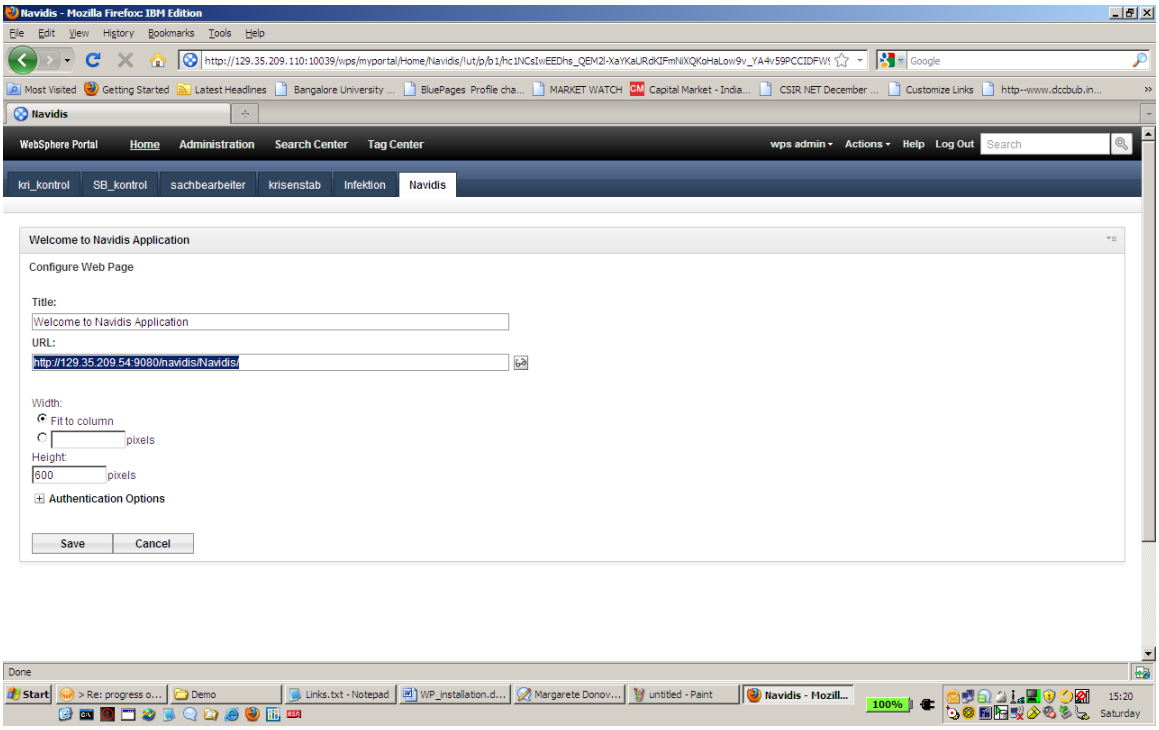


Figure 30: Screenshot – Referencing to the application

In the Portal settings, the Navidis' application is referenced as shown in the above screenshot.

Navidis is now integrated onto the Websphere Portal. The link to the portal is: http://129.35.209.110:10039/wps/myportal

Here is a screenshot of the Navidis after porting on the Websphere Portal:

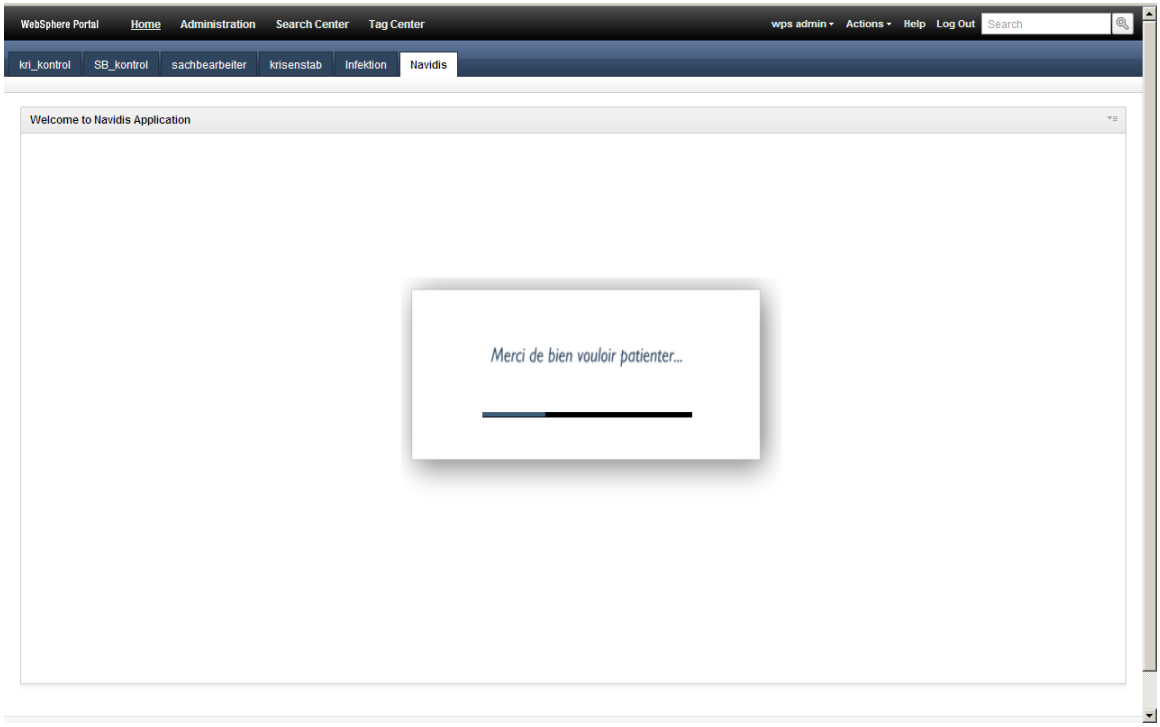


Figure 31: ICE 3 Screenshot

4.9. Fulfilment of Requirements

Fout! Verwijzingsbron niet gevonden. gives an overview of the mapping of functional and non-functional requirements as identified in D2.4 to the products chosen to implement the EPIC platform for pilot implementation and usage. The following requirements are not addressed by the platform as they are in the heart of the responsibility of the pilot applications and very specific to them: FR19, FR23, FR24, RRS4, RRS5, RRS6, RRS7, RUP4, RUP5, RSE2 and RSE4-9.

Portal Server including Forms and Mobile Accelerator	FR1, FR2, FR3[a], FR4[a], FR5, FR6, FR7[b], FR10, FR11, FR12, FR13[a], FR14, FR15, FR16[a], FR18[a], FR21, NF1, NF2, NF3, NF4, NF5[a], NF6[d], RRS1, RRS2[c], RRS3, RUP1[c], RUP2, RSE1, RSE3
WebSphere Portal Server	FR2, FR8, FR13
JRules	FR8, FR21[a]
ESB	FR8, FR10, FR20[c], NF7, RUP2
WSRR	FR2, FR5, FR6, FR16[a], FR17[a], FR22, RRS3, RUP2, RUP3
DB2	FR3[a], FR9, FR21,FR25,FR26
WID	DE1, DE3, DE4
	a: via application b: through additional web content management tools c: addressed by the Intelligent Operations Center ([29]) d: implemented in pilots

Table 1: Mapping of Products and Requirements from D2.4 (**[30]**)

Following, there is a more detailed description for each of the requirements referring to the platform

FR1 -Common role-based portal server

The realization of the required role-based functionality is both supported by the Websphere Portal Server and by LDAP which is integrated in the platform. Specific (additional) needs resulting from the pilot application will be covered by the EPIC user management component realized as web service within the project.

FR 2 - Registration of a service

Services will be registered within a Service Catalogue. WSRR, as part of the platform, supports the realization of a service catalogue including WSDL descriptions and other information on the service (e.g. prices). Alternatively, the platform supports the realization of a service catalogue via appropriated open-source software. WSRR contains a UDDI federation feature which enables interoperability with service catalogues not realized via WSRR but supporting UDDI.

FR3 -Registration of a stakeholder – providing credentials and trust evidences

This requirement is handled via ssl certification which guarantees trust on stakeholders. Credentials for usage of the pilot applications have to be checked by the pilots

FR4 - Subscription to a web service

Subscription to a web service will be realized via the Service Catalogue or/and via the EPIC user management component.

FR5 -Federated single sign on using various e-Identity means

Federated single sign-on is handled via the WebSphere Portal and the Epic user management

FR6 - Search for a web service

WSRR provides a sophisticated search facility, which will be made available as GUI via a portlet. Additionally an API based on WSRR can be provided for supporting search.

FR7 - Provide comfortable possibility to insert and edit contents of the EPIC web portal

WebSphere administration functions support the creation and management of pages.

Fr8 - Possibility to negotiate SLAs when needed

Information on SLA may be provided for each application and for each price of the application via the service catalogue as basis for SLA. Negotiation takes place on selecting an application on base of that information. Additional SLA has to be discussed in between service subscriber and service provider directly.

FR9 - DBMS capable for manipulating significant amount of data

For storing application data on the platform a DB2 server is integrated into the platform. DB2 is very high scalable with a limitation of 0,5 zettabyte. A restriction on the amount of data which can be handled therefore is less the DBMS but the HW infrastructure (storage etc.).

FR10 - Time zone and multicurrency support

Clouds are by its nature "global" oriented, i.e. means for supporting time zone and multicurrency are available in the cloud environment.

FR11 - Role-based user interface

The portal server of the platform is common role-based (see FR1 above). To each role a portlet with role specific functionalities can be assigned which is shown to the user after logging

FR12 - Administration interface

There is an administrator specific role which allows access to the administration interfaces provided by WebSphere Portal Server, and EPIC user management.

FR13 - Registration Page

Registration is handled by the pilots directly.

FR14 - Service registration screen

A service registration screen is available via WSRR. This screen can also be used for service catalogues/tools supporting UDDI protocols or WS-Discovery.

FR15 - Personal Space

Personal spaces can be realized via the underlying database of the EPIC user management by the pilots.

FR16 - Advanced search for services

Services are listed in the service catalogue which usually allows the search for services (e.g. WSRR). An application/web service may be realized providing the user with the available criteria for searching services and searching for the services via the Service Catalogue search interface. Additionally UDDI and WS-Disccovery can be supported via WSRR.

FR17 - Notification List

Information on service updates are available via the Service Catalogue. An application/web Service preparing a user specific update list based on the information in the Service Catalogue has to be realized.

FR18 - Promoted/Latest services area

Information on promoted/latest service are available via the Service Catalogue. An application/web Service preparing an appropriate area based on the information in the service catalogue has to be realized.

FR 19 - Easy integration into cloud services

An efficient development and deployment environment has been set-up supporting the easy integration into cloud services.

FR20 – Interoperability

The problem of interoperability has been solved within the IOC environment. The same IOC or similar components can used within the EPIC platform.

FR 21 - Multilanguage support

Websphere is realized for "global" usage, by this supporting multilanguage

FR22 - Semantic annotation for web services

Information on the meaning of a particular web service and the provided information/functionality is available via the WSDL description of the service in the service catalogue. Addition information (e.g. semantic information) can be provided via WSRR.

NF1 – Usability

Feedback on usability is expected during the living labs' test cycles. This feedback will be considered by adapting the platform to user needs. Additionally platform status information will be regularly analysed by the platform administrator in order to ensure general usability.

NF2 -Privacy Protection

Sophisticated mechanisms are involved in the WebSphere portal assuring privacy protection. Additional privacy protection mechanisms are realized within the EPIC user management.

NF3 - Security – rule-based authentication and authorization

The WebSphere Portal server supports the creation and management of rules for user authentication and authorization.

NF4 - Support for mobile devices

Support for mobile device is given by the Mobile Accelerator provided by the platform.

NF5 - No need for training

The realization of the platform is based on well-known portal functionalities. The GUI used is self-explanatory. Additionally, there is a detailed help facility provided by the portal server.

NF6 - Attractive design of EPIC web portal and pilot applications

The Portal Server provides a sophisticated tool for the design of screens, and portlets which is base for an attractive design. Customisation of themes and skins is supported by the WebSphere Portal functionality.

NF7 - High availability

IOC is an environment of high availability. The same IOC components or similar components are used within the platform.

RRS2 - GIS/Map for showing points of interest, real estate properties, etc.

The output of graphical information, digital pictures or video is supported by IOC. The same components or similar may be used by the platform since both are based on the same tools/infrastructure.

RRS3 - Reach as many smart phone platforms as possible and minimize software development effort

Support for a wide range of mobile devices is given by the Mobile Accelerator provided by the platform.

RUP1 – GIS

Please see RRS2 above.

RUP2 - Performance of architecture

The assignment of additional resources via cloud management infrastructure performance can be adapted to specific needs.

RSE1 - Domestic Energy Monitoring

The requirements to deliver the service by the platform via portlet has been discussed and can be fulfilled by the platform.

RSE3 – User Login

The specific requirements concerning user login for the smart environment service are fulfilled by the EPIC User Management.

Summary

The design of the platform considers all the requirements of the traceability matrix referring to the platform. It is subject of WP8 to evaluate the fulfilment of the requirements.

There are components of the platform without direct relationship to the requirements as for example the domino server. A domino server supports communication in the environment it is integrated. Thus, by the integration of a domino server in the platform communication between users and EPIC platform administration or between service provider and service subscriber (e.g. for negotiation of specific SLA) can easily be set-up if there will be a specific need for this functionality in the near future.

5. Implementation Plan

For the platform adaptation the following main tasks have been identified:

1. Preparation of platform
2. Extending IoT middleware
3. Integration of front-end
4. Adaptation of back-end
5. Technical testing review

According to the EPIC time schedule these tasks should be executed in the timeframe May – October 2011. The baseline time schedule for WP3 is given in the following Figure 32.

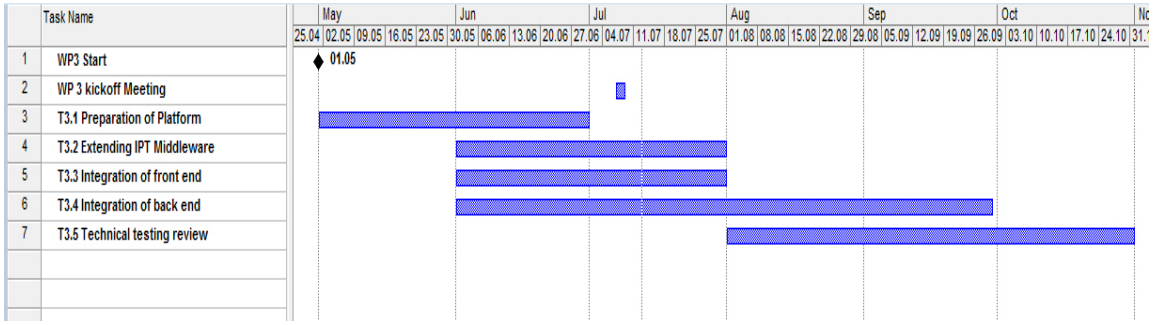


Figure 32: WP3 baseline time schedule

The activities within WP3 already started in April 2011 with some preliminary stages leading to preparation of cloud installation. Due to dependencies to activities of other Work Packages (e.g. completion of deliverable 2.3) some activities of task T3.1 have been delayed. Additionally, some new subtasks have been identified which have to be executed in close cooperation with other Work Packages causing an adaptation of the baseline time schedule. These all result in a new time schedule shown below.

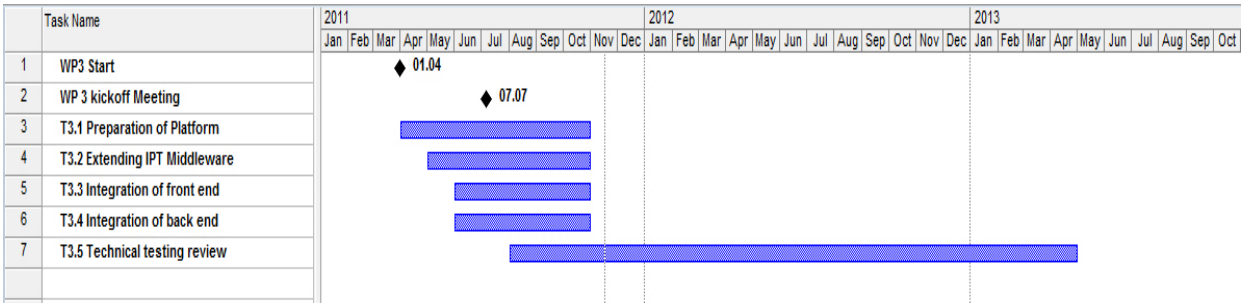


Figure 33: WP3 adapted time schedule

6. Conclusions

This document describes the overall architecture of the platform and its technical components. In particular, it explains the role of the central directory and ontology services to assist in service composition. Additionally it is shown how the functional and non-functional requirements listed in deliverable 2.3 with respect to the platform are fulfilled by the technical components.

In that respect, it sets the stage for the platform adaptation tasks:

- Interface to "upload" WSDL;
- Interface to deploy business processes and rules;
- Portal Customization/Personalization and Portlet Development;
- GUI rendering / repurposing capabilities for small-screen devices;
- Group Concept and User Definition/User classes, authentication, security, policies and rights assignment and management;
- Business Process Models/Ontologies;
- Data Models/Database Structures/Ontologies;
- web services to "pull" data from external sources into EPIC DB;
- web services to "push" data into EPIC applications.

These tasks will have to interlock with WP4's planning tasks and the WP5 scenario definition.

7. Abbreviations

AES	Advanced Encryption Standard
API	Application Programming Interface
App	Application
B2B	Business-to-Business
B2C	Business-to-Consumer
BRMS	Business Rules Management System
BSD	Berkley Software Distribution
CBM	Component Business Modelling
EA	Enterprise Architecture
EAL	Evaluation Assurance Level
ESB	Enterprise Service Bus
FIPS	Federal Information Processing Standards
GATE	General Architecture for Text Engineering
GPRS	General Radio Packet Service
GSM	Global System for Mobile communication
HTTP	Hypertext Transfer Protocol
ICS	Image Conversion Server
IDE	Integrated Development Environment
IOS	iPhone Operating System
IP	Internet Protocol
ISV	Independent Software Vendor
JAX-RS	Java API for RESTful Web Services
JCA	Java Connector Architecture
JMX	Java™ Management Extensions
JSON	Javascript Object Notation
LDAP	Lightweight Directory Access Protocol
MAP	Mobile Media Access Proxy
MCS	Multi-Channel Server
NLS	National Language Support
OASIS	Organization for the Advancing Open Standards for the Information Society
ODF	Open Document Format
OS	Operating System
OWL	Web Ontology Language
PDA	Personal Digital Assistant
PKCS	Public-Key Cryptography Standards
RDF	Resource Descriptor Framework
REST	Representational State Transfer
ROI	Return On Investment
RSS	RDF Site Summary
SaaS	Software as a Service

SAML	Security Assertion Markup Language
SHA	Salted Secure Hash Algorithm
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SOMA	Service-Oriented Modelling and Architecture
SSL	Secure Sockets Layer
SSO	Single Sign-On
STANAG	(NATO) Standardisation Agreement
TFIM	IBM Tivoli Federated Identity Manager
TOGAF	The Open Group Architecture Framework
UDDI	Universal Description Discovery and Integration
UIMA	Unstructured Information Management Architecture
URI	Universal Resource Identifier
URL	Uniform Resource Locator
VoIP	Voice over IP
WESB	IBM WebSphere Enterprise Service Bus
WESBRE	IBM WebSphere Enterprise Service Bus Registry Edition
WID	IBM WebSphere Integration Developer
WLAN	Wireless local Area Network
WSDL	Web Service Definition Language
WSN	Web Services Notification
WSRF	Web Services Resource Framework
WSRR	IBM WebSphere Service Registry and Repository
XDIME	xHTML Device Independent Mark-up Extensions
XML	eXtensible Mark-up Language
xÖV	XML in der öffentlichen Verwaltung (XML in public administration)
XSD	XML Schema Definition

Table 2: Abbreviations

8. References

[1] Hoe, Nah Soo (2006): Free/Open Source Software: Open Standards; New Delhi; Elsevier
www.iosn.net/open-standards/foss-open-standards-primer/foss-openstds-withcover.pdf

[2] Extensible Markup Language; W3C
www.w3.org/xml/

[3] Web Services; Wikipedia
http://en.wikipedia.org/wiki/Web_services

[4] The WS – resource Framework; Globus Online
http://www.globus.org/wsrf/

[5] OASIS Web Service Notification (WSN) TC ; OASIS
www.oasis-open.org/committees/wsn/

[6] Java Platform, Enterprise Edition; Academic Dictionaries and Encyclopedias
http://en.academic.ru/dic.nsf/enwiki/27354

[7] OpenDocument; Wikipedia
http://en.wikipedia.org/wiki/OpenDocument

[8] OpenOffice.org XML

[9] UIMA Java Framework; UIMA
http://uima-framework.sourceforge.net/

[10] W3C OWL Web Ontology Language Overview
http://www.w3.org/TR/owl-features/

[11] Resource Description Framework; Wikipedia
http://en.wikipedia.org/wiki/Resource_Description_Framework

[12] Welcome to TOGAF Version 9 "Enterprise Edition"; The Open Group
http://www.opengroup.org/togaf/

[13] The Open Group
www.opengroup.org

[14] EPIC D2.1 document, Project Vision

[15] Donovang-Kuhlisch, M. and Schade, U.: Smart e-Government Services by the Recognition of Common Intent, ICSOC Proceedings, 2010

[16] alphaWorks – Emerging technologies; IBM
www.alphaworks.ibm.com

[17] developerWorks; IBM
www.ibm.com/developerworks

[18] eclipse
www.eclipse.org

[19] Introducing Java Portlet Specifications: JSR 168 and JSR 268; Oracle
http://developers.sun.com/portalserver/reference/techart/jsr168/

[20] IBM Integration Designer; IBM
http://www-01.ibm.com/software/integration/integration-designer/

[21] WebSphere ILOG JRules; IBM
http://www-01.ibm.com/software/integration/business-rule-management/jrules/

[22] IBM Mobile Portal Accelerator V7.0 e extends web portals to mobile devices; IBM
http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS210-366&appname=USN

[23] EPIC WP3 document "Deployment of portlets within the EPIC cloud environment"

[24] Menychtas, A., Kranas, P., Coote, R. et al; (June 2011). D2.2 Stakeholder (User) Workshops' Results. Draft version: 1.0. European Platform for Intelligent Cities. No: 270895.

[25] Menychtas, A., Kranas, P., Donovang-Kuhlisch M. et al; (June 2011). D2.3 Online Service Delivery Baseline and Technical Requirements Report. Draft version: 1.0. European Platform for Intelligent Cities. No: 270895.

[26] JSON specification:
http://www.json.org/xml.html

[27] Jersey 1.8 User Guide
http://jersey.java.net/nonav/documentation/latest/user-guide.html

[28] Representational State Transfer (REST); Wikipedia
http://en.wikipedia.org/wiki/Representational_State_Transfer

[29] Donovang-Kuhlisch, M. et al.; (November 2011). D3.2 Smart City Information Architecture and Functional Platform. Draft version 1.0. European Platform for Intelligent Cities. No: 270895.

[30] Menychtas, A., Kranas, P., Donovang-Kuhlisch M. et al; (February 2012). D2.4 Report on Technical Requirements. Draft version: 1.0. European Platform for Intelligent Cities. No: 270895.