The EBBITS Project: An Interoperability platform for a Real-world populated Internet of Things domain

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Abstract. The paper describes the FP7 ICT project EBBITS, which is targeting the Internet of Things and Services domain. The project is aiming at development of architecture, technologies and processes allowing businesses to semantically integrate various external devices, services and human actors into mainstream enterprise systems. The solution should support interoperable real-world, on-line end-to-end business applications. After a short introduction of project's basic facts, the vision and conceptual approach of EBBITS are described together with a preliminary design of the platform architecture.

Keywords: Internet of Things and Services, interoperability, semantic composition of services, communication infrastructure for sensors and devices.

1 Introduction

The EU R&D project EBBITS (Enabling Business-Based Internet of Things and Services) is aimed at semantic decision and resolution support for service-based applications in the emerging area of Internet of Things and Services [2]. It is envisioned that the EBBITS platform will semantically interconnect back-end enterprise applications, people, services, and the physical world, using a context-aware information generated by actuators, sensors, and other external devices, semantically combining the inputs and performing actions on the real-world environment.

EBBITS is an Integrated European project, co-funded by the European Commission within the 7th Framework Program, ICT-2009.1.3 Internet of Things and Enterprise environments. The project consortium consists of nine partners from five European countries (Germany, Sweden, Italy, Slovakia, and Denmark), and is co-ordinated by the Fraunhofer Institute for Applied Information Technology, Germany. The project started in September 2010 and is planned to run for four years.

In the next sections, the basic vision of EBBITS and a description of proposed functionality are presented. A preliminary design of high-level modular architecture, which is based on the principles of Service oriented Architecture (SoA) that implies semantic composition of services, is briefly discussed and directions towards the future work are outlined.

2 Vision and conceptual approach

The vision of the EBBITS project is to develop and deploy a software platform based on the concept of Internet of Things and Services, which should enable:

− an integration of physical devices, systems and components directly into their optimising systems (i.e. managing workflows, people, processes, assets, data, information and knowledge) and turn them into useful, value-added business services or service components;
− the interoperability between various subsystems in manufacturing environments across departments, lines or plants, regardless of geographical location with the aim to support production and energy optimisation;
− to meet increasing demands and regulatory requirements for authentication and traceability of a product line by providing a support through ubiquitous services integrated in wireless communication networks and smart home infrastructures;
− an easy and cost-effective networking of components, devices and systems towards the product line in a mainstream enterprise system, which will be provided by the interoperable solution in an open architecture.
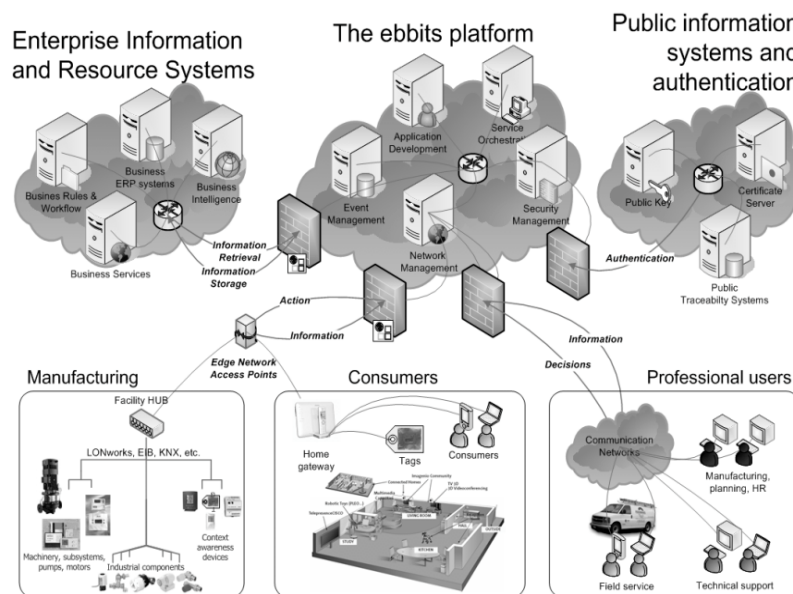
**Fig. 1** The concept of the EBBITS platform

The EBBITS platform, as depicted in Fig. 1, should provide a bridge between enterprise and public information systems, as well as between human users and "things" in the physical world. The platform will create a communication infrastructure that automatically and dynamically connects to sensors and devices in the physical world - for example, in manufacturing facilities or in private smart homes. These devices will be connected to mainstream back-end information systems, public authentication

systems, and regulatory information sources by means of semantic web services. Finally, this infrastructure will mutually connect human users in dispersed geographical locations such as professional users in a technical support, field service or other business environments as well as ordinary consumers in shops or at home.

3 Composition of the EBBITS platform

The EBBITS platform is proposed as service-oriented, consisting of five loosely coupled core modules - production servers for data management, event management, security, application execution and communication. Each of the modules presented in Fig. 2 is responsible for the respective part of the overall functionality:

− The *Data Management* module is a central data provision background for all the high level applications and services deployed on the platform. It implements a model-driven architecture for application development and deployment, an open service oriented architecture for core service functionality, data manipulation, data fusion and event handling and also manages data transfer to and from nodes and stakeholders in the EBBITS environment.
− The *Service Orchestration* module will orchestrate different services available in a pre-described sequence for execution. This component introduces higher-level abstraction mechanisms and makes the application developer independent of a specific programming environment to orchestrate EBBITS applications. The service interoperability will be achieved by employing semantic structures based on RDF ontologies.
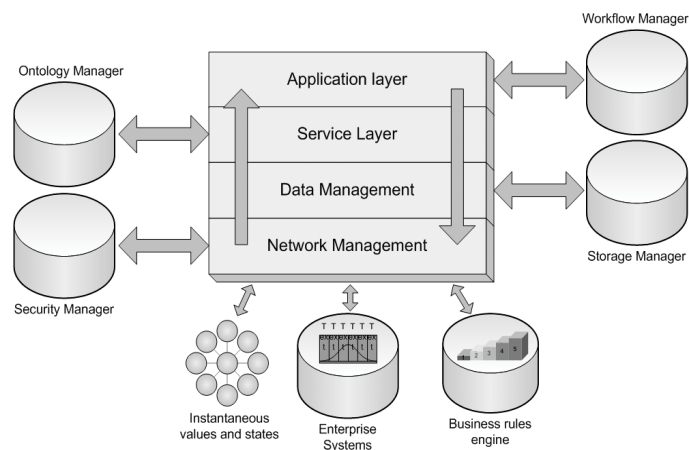
Fig. 2 EBBITS abstraction level

− The *Network Management* module is responsible for physical communication between devices, persons, and external repositories. Each node will have its own Network Manager and each Network Manager will have an external Web Service based interface where it can exchange data with remote Network Managers.

- The *Security Management* module will perform a mapping and brokering between security models, including user and device profiling management, mapping and usability between trust domains. It will provide semantic standards supporting customisation of generalisation ontologies for both users and devices.
- The *Application Development* module is proposed to be an open SDK toolkit for model-driven development of applications that can use the EBBITS platform.

The interoperability capabilities at the physical level will be built on the scalable, secure open middleware for devices, which was developed in the FP6 project Hydra, http://www.hydramiddleware.eu [1]. The SoA support for application design, simulation and monitoring of real-time distributed automation components from the control perspective in manufacturing environments will follow the approach elaborated in the Socrades project, http://www.socrades.eu [3].

4 Conclusions

The above-presented EBBITS project aims at enabling business-based Internet of Things and Services. Potential impact of EBBITS platform will be demonstrated in two areas: (1) manufacturing, where platform should help to manage production optimisation with special focus on energy consumption in the optimisation process, and (2) food producing industry, supporting the service and resource traceability at the consumption stage. Currently (October 2010), the project is in its initial phase - the user requirements are collected, relevant enterprise and management processes are identified and described. Based on this analysis, semantic decision models will be developed and the platform architecture will be designed in detail. First prototype of the EBBITS system should be available in autumn 2011. More information about the project can be found at http://www.ebbits-project.eu.

Acknowledgements

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