Business Services in an IP enabled SmartGrid

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Today's grid features a typical centralized approach where few powerful central stations broadcast energy to the different consumers. However in order to tackle the ever rising need for energy and comply with social and economic demands of our times, we need to move towards increasing the usage of alternative energy resources. This leads to a very dynamic and decentralized future energy network, where electricity will be produced in a distributed way; where customers will be not only consumers but also producers (hence called prosumers); and where bidirectional interaction between producers, consumers and other entities will be possible.

A revolution in energy domain is underway, namely the smart grid. Its basic building blocks are the existing efforts of the Internet of Things and Internet of Services, that come together with cooperation as the key enabler. In smart grid era, networked embedded devices are making the electricity grid itself, our homes, factories, cities etc. smarter, enabling and increasing the collaboration among and within them. In the future it is expected that all devices will offer directly or via gateways their functionalities as IP-enabled services (e.g. over IPv6/6lowpan) that other entities can (dynamically) discover and use.

The smart grid is a system of systems i.e. a complex ecosystem of heterogeneous cooperating entities that interact in order to provide the envisioned functionality. Advanced business services are envisaged that will take advantage of the near real-time information flows among all participants. These real-world energy services will go way beyond the existing ones and enable us not only to become more energy aware, but also to optimally manage it. In order to realize the promise of smart grid, a key element would be to have timely monitoring and control; a task that will heavily depend on ubiquitous networked embedded devices and ecosystems of them. For instance smart meters are the key for monitoring energy consumption. However in parallel the bidirectional interaction is pursued i.e. that there is an adaptation on the behaviour of the prosumer device based on the information that it receives e.g. electricity price.

The bidirectional information exchange will put the basis for cooperation among the different entities, as they will be able to access and correlate information that up to now either was only available in a limited fashion (and thus unusable in large scale) or extremely costly to integrate. The Internet of Things however, bears the hope that networked embedded devices that lie in heart of the smart grid will not only be connected but will be able to exchange info over the Internet in an open way. Today we already have several examples of tiny devices depicting their basic functionality (e.g. status reporting, control functions etc.) in a service oriented way, which brings us one step closer to realize the vision of the Internet of Energy.

From the business side new, highly distributed business processes will need to be established to accommodate these market evolutions. The traditional static customer processes will increasingly be superseded by a very dynamic, decentralised and market-oriented process where a growing number of providers and consumers interact. Such an infrastructure is expected to be pervasive, ubiquitous and service-oriented. A new generation of affordable information and communication technologies has to be developed to support these changed, complex business processes and enable the efficient functioning of the energy market for the benefit of citizens and businesses.

The architecture of such distributed system landscapes has to be designed, standards must be created and widely supported, and comprehensive and reliable IT applications will need to be implemented. Service architectures, platforms, methods and tools focusing on a network-centred approach will need to be developed to support the networked enterprise. Understanding and managing the complexity of a critical infrastructure such as the energy sector is crucial and implies systemic risk analysis, resilient distributed information and process control frameworks.

Today, we are at the exciting dawn of an era that we would describe as the "Internet of Energy". Existing efforts in the energy domain can be compared to the Internet and mobile communication early stages in the 1980s and 1990s. Once a highly distributed and service-based energy infrastructure is in place, we will see cost-effective new innovative concepts and technologies flourishing that will empower us with new capabilities and tools.

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Stamatis Karnouskos joined SAP in 2005, to investigate the added value of integrating networked embedded devices in enterprise systems. Prior to that and since 1997, he has been working as a project manager and research engineer at Fraunhofer Institute FOKUS in Berlin, Germany. The last 13 years Stamatis leads efforts in several European Commission and industrial funded projects related to smart grids, Internet-based services and architectures, software agents, mobile commerce, security and mobility. Stamatis is actively involved in several consultations at European Commission dealing with System of Systems, Internet of Things, energy efficiency, the SmartGrids European Technology Platform, and various projects at European level, as well as similar activities targeting energy efficiency at national (German) level with the German Ministry of Technology and Economics (BMWi). He has authored more than 80 technical papers, acted as guest editor in IEEE T-SMC and Elseviers ECRA journals, and participates as a program member committee in several international conferences and workshops.