Project Results

NEMO&CODED
Improving energy efficiency in electrical distribution

Energy efficiency is the quickest, cheapest and cleanest way to extend global energy supplies. Simply understanding where and how energy is used can yield up to 10% savings without any capital investment, using only procedural and behavioural changes. While sustaining such an energy-management programme can cost around 1 to 2% of total energy expenditure, it can reduce overall consumption by 10 to 40%. However, energy efficiency needs a structured approach and an evolution in electrical distribution.

SERVICE ORIENTED ARCHITECTURE

The ITEA 2 NEMO&CODED project focused on the modelling, design, implementation and operation of networked hardware/software smart devices to improve energy efficiency in electrical distribution. The service-oriented, architecture ready smart systems enable them to cooperate with other devices and services to carry out distributed monitoring, diagnostics and control so that service suppliers can provide accurate forecasts of energy costs and potential savings. Furthermore, the results of the project will also contribute to global standardisation on energy efficiency and will ensure the proper implementation of Smart Grids.

Given the huge potential in the energy sector, service-oriented architecture (SOA) ready devices in the electrical distribution domain was considered the most suitable approach and resulted in:

■ A distributed infrastructure enabling dynamic energy efficiency services for low-voltage electrical distribution.
■ Global architecture and SOA models for dynamic control, monitoring and diagnostic of electrical distribution devices.
■ Development of an acquisition platform for collecting energy data in real time.
■ Extension of the classical SOA on a Extreme Transaction and Processing Platform (XTPP).

KEY PERFORMANCE INDICATORS

Energy monitoring and the evolution of consumption patterns is a key performance indicator for energy-management systems and requires the monitoring of energy consumption at device level, combined with a specific energy-management process. Real-time monitoring of energy consumption makes it possible to map energy consumption with respect to specific devices, activities and external conditions as well as use energy consumption as a key performance indicator and then optimise the utilisation based on this, making the best use of existing assets.
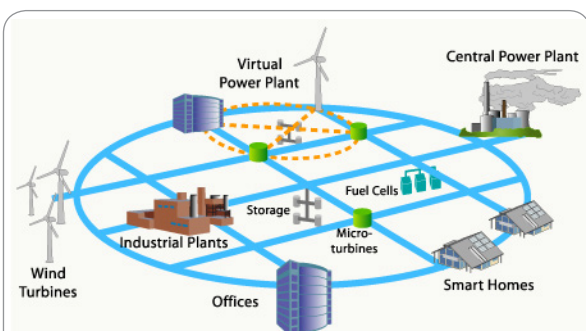
ECOSYSTEM OF SERVICES

NEMO&CODED focused on the low-voltage electrical distribution domain targeting mainly commercial buildings. The concepts developed in the project were validated for environments using a SOA approach and provided open interfaces that enable interoperability by realising an ecosystem of services running at device, network and enterprise level and through the seamless composition of more sophisticated services from generic ones. Field tests and prototypes helped demonstrate the practicality of the project goals, such as a field test in a home setting where the different sensors, electric analysers and concentrators were installed and the data acquired.

MORE AFFORDABLE APPROACH

Introducing a SOA solution to the low-voltage electrical distribution domain makes energy-management systems more affordable as well as cuts set-up time, simplifies data exploitation and reduces efforts to support the evolution for new uses that are essential to transform the energy-efficiency concept into reality for many professional consumers. Key benefits include:

■ The ability of facility managers to get the right solution to master their energy consumption.
■ The ability of performance-contracting companies to give their customers competitive systems.


Smart Grid Concept

Project Results

- Market share acquisition by electrical equipment and tool providers.
- The ability of utilities to provide new services, taking advantage of the information systems deployed.

The real winner, however, will be the environment: mastering energy consumption on a large scale will cut energy needs and lead to a drastic reduction in CO_2 emissions.

NEMO&CODED SOA Architecture
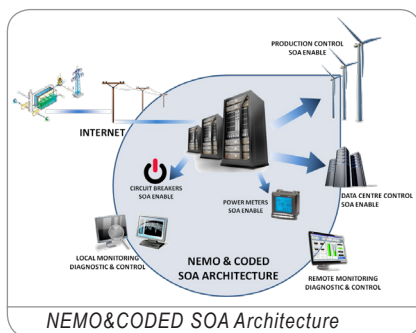
ENABLING DYNAMIC ENERGY-EFFICIENCY SERVICES

The major result of this project is a distributed infrastructure that enables dynamic energy-efficiency services for low-voltage electrical distribution. This is fundamental to the support and implementation of the new energy paradigms being researched throughout Europe in response to global energy and environmental challenges. NEMO&CODED has elaborated a global architecture model and a SOA model for dynamic control, monitoring and diagnosis of electrical distribution devices as well as method specifications at device and aggregation levels.

INNOVATION FOR REAL MARKET IMPACT

Among the major innovations of the NEMO&CODED project are enhancement of current Web Service technologies, the independence of equipment and extensive use of several communication technologies, a communication paradigm – publish/subscribe SOA – and a novel implementation of semantic SOA. Furthermore, by transforming the closed vertical business layers into a horizontal layer through the global architecture, establishing a real-time platform by means of a highly performant DDS middleware and developing algorithms to more accurately predict energy consumption, not only innovative but also highly practical solutions have been made ready for market application as evident in, for instance, the Eco Hub – energy efficiency data concentrators – that Indra already supplies along with the considerable interest being shown around the world, from South America to Southeast Asia. Furthermore, a technology pilot is in place and includes a web portal for a thousand ENDESA users. This will start operating at the beginning of 2014 while there are also plans for a more ambitious solution, offering energy efficiency services to four million customers.

NEMO&CODED is a project that has taken on a key aspect within the energy domain and transformed it into a major advance in the pursuit of a more sustainable global energy supply and, by so doing, has shown itself capable of seizing the high ground.

Major project outcomes

DISSEMINATION
- 5 Journals
- 2 Capstone Projects
- 11 Conferences and Presentations
- 1 Book Chapter
- 1 Magazine Article
- 2 Master Thesis
- 2 PhD Thesis

EXPLOITATION
- Energy Efficiency Concentrator with DDS Middleware embedded
- Interoperability (CIM, 61850, DDS native raw)
- Bundle Management (Massive deployment and update of Real-Time Node Software)
- Real-Time Monitoring (Device Real-Time Monitoring, Real-Time Sensor Data)
- Advance Adquisition Platform for Smart Metering
- Forecasting Energy Consumption Algorithms
- Energy Efficiency Web Portal
- Android Energy Efficiency Application

STANDARDISATION
- Participation in standardisation committees and working groups in the following fields:
    - Communications (IEC IEEE TC BACM)
    - SOA (SoaML)
    - Smart Grids (WG in Smart Grids, CEN-CENELEC, IEC Smart Grid Strategy Group, CNE Smart Grid WG- Spain)
    - Smart Metering (CNE Smart Metering Interoperability WG- Spain)

■ ITEA 2 – Information Technology for European Advancement – is Europe's premier co-operative R&D programme driving pre-competitive research on embedded and distributed software-intensive systems and services. As a EUREKA strategic Cluster, we support co-ordinated national funding submissions and provide the link between those who provide finance, technology and software engineering. Our aim is to mobilise a total of 20,000 person-years over the full eight-year period of our programme from 2006 to 2013.

■ ITEA 2-labelled projects are industry-driven initiatives building vital middleware and preparing standards to lay the foundations for the next generation of products, systems, appliances and services. Our programme results in real product innovation that boosts European competitiveness in a wide range of industries. Specifically, we play a key role in crucial application domains where software dominates, such as aerospace, automotive, consumer electronics, healthcare/medical systems and telecommunications.

■ ITEA 2 projects involve complementary R&D from at least two companies in two countries. We issue annual Calls for Projects, evaluate projects and help bring research partners together. Our projects are open to partners from large industrial companies and small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

NEMO&CODED
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