

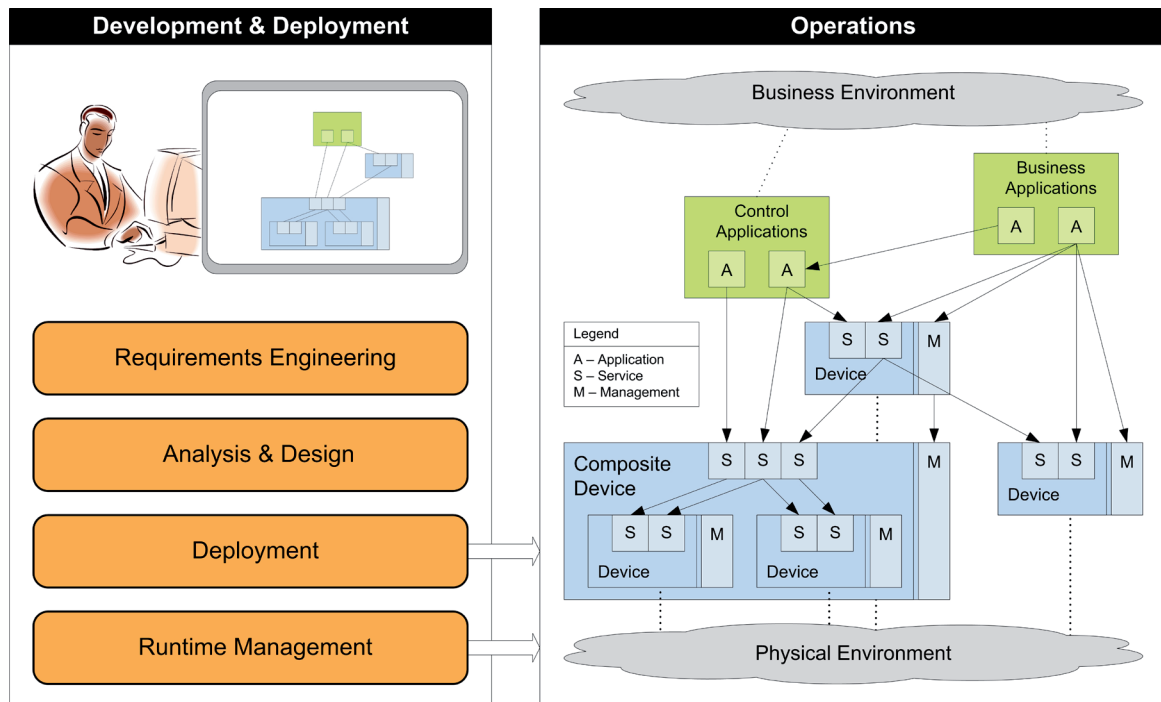
INNOVATION REPORT

Developing the ecosystem to manage embedded web services

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The SODA project has developed a comprehensive, scalable and easy-to-use ecosystem to manage interworking and high-level communications between intelligent devices in service-oriented architecture systems. This simplifies the development of systems using embedded web services in low-cost devices. The result is a world-leading implementation technology for the so-called 'web of objects'. The SODA approach was demonstrated in a range of domains from industrial and home automation to medical care. And the project provided major contributions to global standardisation activities in this field through OASIS Devices Profile for Web Services, adopted in 2009.



The SODA ecosystem

Service-oriented architecture (SOA) makes it possible to build systems from autonomous yet interoperable service components. A service provides self-contained functionality that is not tied to a particular use. Only the interface is visible – with the complexity of its implementation hidden. SOA is characterised by service interfaces, loose coupling between service providers and service consumers, and message-based, asynchronous communication. Leveraging open, vendor-neutral standards, in particular those of the web-services family, allows for implementing SOA in a platform-independent fashion.



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Availability of affordable, high-performance, low-power electronic components now allows embedding of an unprecedented amount of intelligence into very small components. The preceding ITEA SIRENA project played a pioneering role in this area by applying the SOA paradigm to communications and interworking between such components at the device level. Based on the proof of concept of embedding web services into particularly low-cost devices, SODA has now developed the overall ecosystem to manage such an SOA application, through out the full application life-cycle, in several application domains.

Providing complete applications

The basic technology involved enables communications between any device, sensor or actuator. These devices can then communicate with information technology (IT) systems, personal computers (PCs) or even personal digital assistants (PDAs) to provide complete applications over Internet and intranets. And this approach can be used in nearly any domain to build advanced functionality into all types of embedded devices – resulting in new distributed applications based on interconnected, self-reliant smart devices in the web of objects.

The web of objects concept involves communication and interoperation between interconnected physical devices such as sensors and actuators and the IT world using IP and SOAP web protocols, with implementation based on SOAs. Major benefits include the ability to avoid proprietary solutions, no gateway requiring complex configurations, low cost and openness to the full IT world.

Such a concept enables direct communication from very high level IT applications such as an enterprise resource planning (ERP) server to any low-cost sensor or actuator – for example a temperature sensor – as well as interoperability between sensors and actuators, and plug-and-play connection of such devices.

While much of this was possible before, it is now very simple and easy to do. All devices, from a temperature sensor in the home to the PC or IT system will speak exactly the same language – the web-services language. Before, each intermediary would involve protocol conversions with data conversion and many different operations at each stage – really very complex. With web services, it is possible to interconnect devices with no intermediaries, protocol conversions or data manipulation.

Developing easy-to-deploy tool suite

SIRENA defined the service infrastructure for real-time embedded devices in a platform-, language- and network-neutral way, applicable to a wide variety of networked devices for diverse applications. SODA has developed the implementation of a comprehensive, scalable, easy-to-deploy SOA ecosystem – a complete tool suite – on top of this communications infrastructure, on industry-preferred platforms, supported by wired and wireless communications.

This involved the development of tools and methodologies to manage the complete life cycle of an application starting from an initial specification, implementation, deployment and maintenance – with different solutions and users at each stage, and different tools to enable these things. It included extensions and improvements of Devices Profile for Web Services (DPWS), such as increased performance and serviceability as well as integrated security support.

An important element was the preparation of seamless integration of device-provided services with higher-level business processes. Applications were demonstrated in several domains – such as industrial automation, telecommunications, home networking and automotive electronics – to validate use of SOA on a broad scale and to promote standardisation in vertical application domains.



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Heavy involvement in standardisation

Members of the SODA consortium were heavily involved with the Organization for the Advancement of Structured Information Standards (OASIS) in the development of the DPWS standard. This enables secure web service messaging, discovery, description and eventing in a similar manner to the Universal Plug and Play (UPnP) standard. However, DPWS is fully aligned with web-services technology and allows for seamless integration of device-provided services in enterprise-wide applications.

DPWS was defined to apply SOA in the device space. It provides the core web-services standards, such as SOAP, WS-Addressing, WSDL and XML Schema as well as WS-Discovery for plug-and-play device discovery and WS-Eventing for publish-subscribe asynchronous event notification. DPWS is complemented by WS-Management, a Distributed Management Task Force (DMTF) standard for identifying and communicating with manageable resources, which cuts across hardware, software and applications, and was designed to scale down to all types of resources.

DPWS was first published in 2004 and was submitted for standardisation in July 2008 to OASIS, as part of a set of three related standards: DPWS, WS-Discovery and SOAP-over-UDP – collectively referred to as WS-DD (Web Services Discovery and Web Services Devices Profile). These standards were accepted in mid 2009 and are offered for royalty-free implementation.

Real applications already

Real applications have already been developed making use of the SODA approach. Schneider Electric has made a strong move to SOA as an interoperability concept, simplifying integration of the different businesses it has acquired over the past ten years. Many different systems which could have been difficult to interconnect now all work together to achieve a common objective.

EADS is using the SOA approach in professional mobile radio (PMR) integration for emergency service communications systems for fire brigades, police, etc. This involves the deployment of the DPWS solution between base stations and remote devices.

Consortium members are also working in the SOCRADES EU Framework Programme project on next-generation industrial automation systems with other major competitors that all have internal projects for deployment of SOA using SODA results.

More information: <http://www.soda-itea.org/>