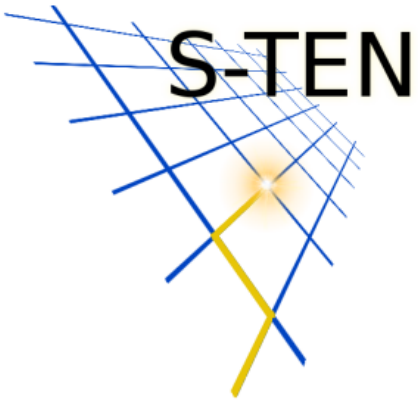
Executive summary



S-TEN

Intelligent Self-describing Technical and Environmental Networks

www.s-ten.eu

1.1 Abstract

W3C envisages the future of the Web to be a “Semantic Web”, which is an extended web of machine-understandable information and automated services that go far beyond current capabilities.

The objective of this project is to tap these new possibilities for applications in the technical domain, especially to provide support for decision makers in a complex and continuously changing environment. This support is based on applying rules and process knowledge on available data published to the web. The data comprises measurements, human observations and design information. Data acquisition and process control is assisted by self-describing devices installed in the considered technical systems. The technology will be demonstrated by applications in the field of electro-technical systems, decentralised energy systems and environmental measurement systems.

The key standardisation task is to move the current generation of standards for design, engineering and process monitoring data to OWL ontologies, and thus make the appropriate data models available for semantic web technologies.

Innovations provided by the project will comprise an ontology that enables a device to announce its existence, position in a network and the services it provides. Also, the capturing of human qualitative observations and their publication on the web with respect to a formal ontology, as well as the development of rules that can be applied to any kind of technical data available on the web are key innovations. Finally the project will link two worlds up to now apart: STEP and OWL.

1.2 Project objectives

S-TEN’s overall objective is to exploit “Semantic Web” for scientific and engineering applications, and to provide support for decision makers in a complex and continuously changing environment. This support is based upon the application of rules and process knowledge to measurements, human observations and design information published on the Web. Data acquisition and process control is assisted by self-describing devices, e.g. measurement sensors or intelligent sub-systems, installed in the considered technical systems.

The S-TEN project will contribute to international standards by defining standard ontologies for the publication of network information on the Web and defining a methodology for the extraction of ontologies from existing international standards, e.g. ISO 10303 (STEP) and ISO 15926 (Life cycle data for process plant, including oil and gas production). Innovative objectives provided by the project will comprise:

- an ontology which enables a device to announce its existence, position in a network, the function it performs and the services it provides;

- the capturing of human qualitative observations and their publication on the web with respect to a formal ontology;
- the development of rules which can be applied to any kind of technical data available on the web, e.g.
  a) process monitoring
  b) preventive maintenance
  c) best practise advice for control centre operators
- the linking of STEP and OWL allowing not only to publish network design knowledge created by existing CAD systems and represented using the STEP family of standards on the Web using OWL but also to collect information about self-describing networks published on the Web using OWL, and to represent it using STEP so that it can be visualised by existing CAD systems and STEP tools.

The overall approach towards the S-TEN technology is shown in Figure 1.

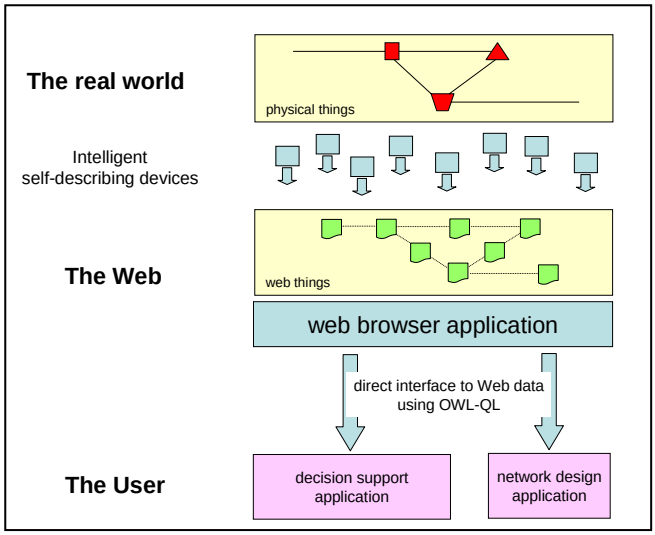


Figure 1: *Diagrammatic representation of the S-TEN approach*

1.3 Consortium

The consortium comprises eight partners, both academic and SMEs, from Germany, Lithuania, Spain, Switzerland and the UK:

- Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V. (FGH); Germany (Co-ordinator)
- CAESAR Systems Ltd. (CAESAR); UK
- Cygnus Engineering AG (CYGNUS); Switzerland
- Haute Ecole Valaisanne (HEVS); Switzerland
- Fundación LABEIN (LABEIN); Spain
- UAB LKSoft Baltic (LKBALTIC); Lithuania
- LKSoftWare GmbH (LKSOFT); Germany
- RACOS Technische Informationssysteme GmbH (RACOS); Germany

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1.4 Work performed and results achieved

Work within this first reporting period has focussed on the technology validation and selection of software tools to be integrated into the S-TEN architecture with respect to mapping languages, ontology management tools, standard web services and Semantic Web services, rule and inference engines, agent technology, and RFID. As to covering requirements for the S-TEN demonstrators a generic use case study based on different UML tools has been carried out. First work on the draft architecture specification has been started in September.

With respect to the ontologies and the methodology of self-describing devices and technical networks a set of measurement examples has been developed and implemented in different ontologies for evaluation. OWL-S seemed to be a promising technology to build a network of self-describing devices integrated into a web environment. However the network will be built using more classical technology with ad hoc semantic enhancements.

Further work is devoted to the linking with design and maintenance knowledge and here specifically to the translation from OWL to STEP and vice versa. Within this work a prototype syntactic translator from EXPRESS to OWL has been set up and the representation of principal classes in OWL has been completed.

S-TEN is tracking several ways to raise public interest of the project and ensuring its dissemination even in this early stage, e.g. by papers and poster presentations at international conferences, publications, direct contact to similar projects in the field of semantic web or the envisaged application domains and simply by printed or digital information materials as well as by a public website. Work on standardisation has started earlier than proposed due to currently running discussions in international standardisation bodies.

The project management has established several information and communication channels within the consortium. Funds have been distributed and communication with the EC on behalf of the consortium has been established. Project meetings have been performed twice and internal discussions on a joint dissemination and exploitation body have been moderated. Technical issues have been discussed and potentially resolved within the two meetings of the technical board, an additional workshop on semantic web technologies, within the two weekly telephone conferences and on a bilateral basis where applicable. A first draft of the plan for use and dissemination has been developed and is incorporated in this activity report.

1.5 Expected end results, their intended use und possible impact

The S-TEN approach is based upon off-the-shelf Semantic Web software, plus standard ontologies for publishing measurements on the Web, standard ontologies for publishing network design data on the Web and rule bases to provide notification and operator support. Furthermore various software packages will be developed to prototype level within the S-TEN project. Some of them will be put into public domain, others will be developed into commercial products after the end of the project.

The S-TEN demonstrators to be developed within the project are examples of applications for which a traditional system is not suitable:

- Environmental Monitoring: For environmental monitoring applications the flexibility of the S-TEN approach is important, because the nature of the sensors and their positions may be continually changing. Also there may be many different actors wishing to access the data.
- Control of Distributed Resources in Electrical Power Networks: For the control of distributed power generation, the control systems for conventional power generation

are theoretically suitable, but the problem is the expense. The S-TEN technology will offer a low-cost solution for monitoring distributed electrical resources in medium-voltage and low-voltage systems.

- Secondary Control of Electrical Power Systems: Secondary control involves manual intervention to deal with fault situations and other operating problems. Many different types of query and notification are required, for which the configurable rule-based approach of S-TEN is especially suitable.
- Initial Operation and Preventive Maintenance in Electrical Systems: SMEs often do not have the money or expertise to acquire or develop bespoke systems that add additional functionality to industrial automation systems. The S-TEN technology will provide a simple way of interfacing with the industrial automation system, querying historic data, visualising the current status of a production network and defining the rules for scheduling preventive maintenance activities.

In a long run possible impact is seen in advanced process monitoring and alarm systems to be applied to continually changing technical and environmental networks, without the need to maintain a network data warehouse. The S-TEN approach will make the network self describing, that is. each component of the network will publish autonomously information about what it is, where it is, and what it does on the Web. This approach will make network monitoring and control practical, in new applications as exemplified in the demonstrators and beyond, like in active supply chain management.

1.6 Plan for using and disseminating (Publishable results)

The consortium partners initiate measures in parallel with the research activities in order to turn project results into commercial success. These measures include the identification of market segments, gathering requirements from these markets, defining products and finally marketing these products. The S-TEN exploitation activities may provide a marketing platform to the individual partners witch help to initiate the marketing process and lead to commercial success.

Major industrial enterprises concerned with network management already have systems with similar functionality offered by the S-TEN technology, although they do not support new features like the capability of the devices to publish their data on the Web, using STEP in OWL and viceversa and so on. Initially the S-TEN technology will not address such traditional systems, but of course in a further step S-TEN will also have an impact on them.

Moreover the S-TEN technology is not appropriate for safety critical applications where a guaranteed short response time and a high level of whole system reliability are required.

Nonetheless for other applications, it is the flexibility and low cost that makes a system based on S-TEN technology practical. Therefore the first take up of the S-TEN technology will be for new applications where a traditional system is not suitable, because of expense, complexity and inflexibility. The S-TEN demonstrators are examples of applications for which a traditional system is not suitable:

- Environmental Monitoring
- Control of Distributed Resources in Electrical Power Networks
- Secondary Control of Electrical Power Systems
- Initial Operation and Preventive Maintenance in Electrical Systems

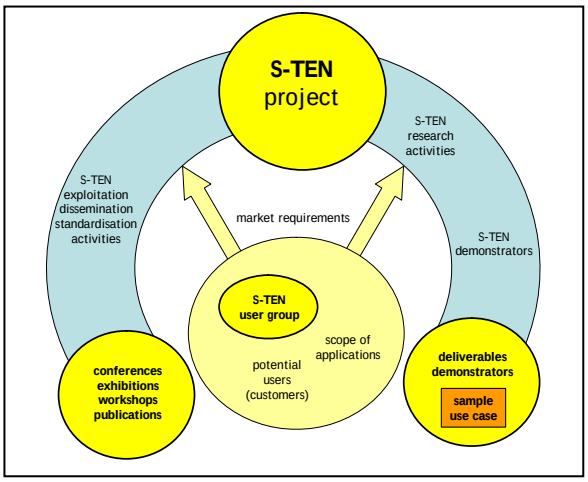

Figure 2: *S-TEN exploitation strategy overview*

Figure 2 illustrates the S-TEN exploitation strategy. The exploitation, dissemination and standardisation activities of the S-TEN project on one hand and the S-TEN research activities with the subsequent development of the demonstrators on the other hand limit the scope of applications and potential future customers. As a consequence of the exploitation, dissemination and standardisation activities S-TEN will be present at conferences, exhibitions and workshops attracting potential users. A sample use case plays the role of the demonstrators at an early stage and helps to bridge the time gap until the demonstrators are available. The user group is considered as a key issue in order to get feedback for the research activities, refine the specification of the demonstrators and retrieve market requirements. Therefore it plays a key role within the exploitation strategy. It is intended to gain members for the user group wherever S-TEN is present. As soon as appropriate results are available user group meetings are organised which help to sell the project results and retrieve feedback from potential users.

Initial contacts to industrial partners for further product developments have been established. S-TEN has been present in several standardisation workshops and attendance at several international conferences is planned.