Title	Intelligent Self-describing Power Grids

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SUMMARY

The liberalisation increases the complexity of power grid operation and pushes companies to build cheaper electrical power generation and distribution systems. Automated network management systems based on massively distributed information help to maintain the expected quality performance, manageability and reliability.

Within the research project S-TEN, which is co-funded by the European Community, such automated network management systems are developed including one for the control of distributed resources in electrical power networks and another for distributed secondary control of MicroGrids. The paper will introduce the S-TEN technology and describe the mentioned applications.

The S-TEN decision support systems provide support for decision makers in a complex and continuously changing environment. This support is based upon the use of ontologies and semantic web technology to:

- represent the semantics associated to field measurements, acquired by the SCADA system or manually inserted by the operator.
- represent the semantics associated to equipment design information. This data together with the measurements associated to an equipment can be used by rule-based systems to detect any malfunctioning of the equipment and to trigger the corresponding alarms or any other kind of action to the operator.
- provide a plug and play capability to the equipments by representing knowledge associated to the devices, such that they can be self-describing.

The acquisition of distributed information and process control is assisted by self-describing devices, such as measurement sensors or intelligent sub-systems. These devices announce their existence, their position in a network and their (web) services. The ontologies for the definition of the required metadata are derived from international standards for engineering and will be enhanced as part of the S-TEN project.

The S-TEN approach is different to traditional network management systems because Semantic Web technology is used as a single platform, as follows:

- the Internet provides the communications infrastructure;
- the publishing of measurements on the Web using standard ontologies replaces traditional SCADA systems or enhances existing ones;
- the Semantic Web itself becomes the centralised data base;
- rule bases acting on the Web-published, semantically rich information will provide notification and operator support.

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 is required. Such requirements cannot be met by software running over the Internet and using non real-time operating systems. Nonetheless for other applications - e.g. for a wind farm operating with a very small staff and generating relatively small amounts of power and for which the expense incurred in the original system procurement, and in reconfiguring the system when the network changes, is very significant - it is the flexibility and low cost that makes a system practical.