University of South-Eastern Norway

Faculty of Technology, Natural Sciences and Maritime Sciences, Campus Porsgrunn

FMH606 Master's Thesis

Title: A Digital Collaboration Architecture for Multi-Stakeholder Signal Management in Modern Power Grids

USN supervisor: Hans-Petter Halvorsen, Saba Mylvaganam

External partner: Elvia AS

Task background:
Elvia and the contractor responsible for the Protection Automation and Control System jointly prepare a signal list for the signals that are to be exchanged from the Protection Automation and Control System to Elvia's Network Operational Center and SCADA system.

Currently, collaboration with the contractor regarding these signal lists is challenging due to the lack of suitable collaboration tools and top-down engineering in a System Configuration Tool. At present, there is no dedicated solution for joint work other than Excel documentation, which is uploaded/downloaded by the parties via a shared platform used for dialog, process tracking, documentation and technical clarifications between Elvia and the contractor.

Today's setup can result in the parties working with different versions of the same documents, making it possible to lose track of changes. The objective is to maximize the use of standard templates, typicals, and definitions to streamline engineering and configuration. However, some changes and adaptations will occur during a specific project, and some of these adjustments are typically made continuously during signal testing of the control system, and since this phase is often subject to time pressure, it can be difficult to ensure proper and accurate documentation of all changes from both parties with today's setup.

Another challenge is that signal testing at Elvia can be carried out by multiple individuals within the same project. This can lead to variations in how tests are interpreted and documented in the signal list, especially regarding changes in the signal list.

Task description:
The purpose of this assignment is to develop a **prototype** for a shared digital collaboration framework that support efficient management of signal lists between Elvia and the engineering contractor. The prototype will not be developed within Elvia's systems but will serve as inspiration for further development. See details below:

- Both parties should have access to a common web-based workspace with appropriate user authentication and role-based access control.
- The system architecture should be evaluated to identify and propose a suitable architectural solution. A three-tier architecture may be considered, but other architectural models are also acceptable.
- The web application should interface with a shared database that stores the signal list and all signals within Elvia's scope. The signal list should be created by selecting signals from a common signal pool, or by using predefined signal list templates defined by Elvia. It should be simple for both parties to add or remove signals, while

only Elvia should be permitted to make major modifications to signal properties. The contractor should primarily select signals from the pool or templates and make limited adjustment such as name changes or addressing.

- Revision log should be implemented in the solution.
- The solution should include functionality that allows users to acknowledge and comment during the signal testing process for both parties.
- It should also be possible to export the signal list from the web interface to an Excel file, allowing it to be printed and used on-site during signal testing.
- Part of the assignment will involve defining the user roles and access permissions for the different parties. Another part of the assignment will be to define a more detailed technical specification that describes the requirements of the solution before development. Elvia resources will help to define these.
- Finally, the assignment should evaluate how the proposed solution can interface with the SCADA system enabling a more efficient import process for signal data.

Student category: ITA

Is the task suitable for online students (not present at the campus)? Yes

Practical arrangements:
It is a requirement that the assignment be carried out solely by the online student employed by the company (Elvia AS), as the project work potentially involves access to highly sensitive data. All types of highly sensitive data must be anonymized in the report and presentation.

Supervision:
Generally, the student is entitled to 15-20 hours of supervision. This includes necessary time for the supervisor to prepare for supervision meetings (reading material to be discussed, etc).

Signatures:
Supervisor:
Hans-Petter Halvorsen - 2026-02-06
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Student:
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