Status report WP1: User needs and possibilities

SAMBA - Smarter Assets Management with Big Data

Statnett

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The Challenges

- Statnett has an ageing and increasing* asset base
  - Many assets at the end of their expected theoretical lifecycle are believed to still have a long remaining life if well-maintained.

- Statnett needs to optimize the maintenance plans and the timing of reinvestment projects.
  - Need to better monitor and model the assets' condition in order to exploit their whole technical lifetime.

- Statnett has a lot of data of its assets, but we can better utilize them.
  - The challenge is to find the best way to use existing data and expertise to tune condition models applicable to specific components.
  - In the future we need to know what data we need for better condition modelling and how to efficiently collect it and make it available for asset management purposes.

*The asset base of Statnett is increasing due to the European Union's Third Energy Package and corresponding changes in the Energy Act - making Statnett the sole owner of the transmission network. Statnett is also expanding and upgrading the system at a large scale.

Introduction to SAMBA

SAMBA is a three year (2016- 2018) research and development project lead by Statnett and involving the following project partners: SINTEF Energy Research, ABB, IBM and GE. The project is partially funded by The Norwegian Research Council.

With the pilot project SAMBA, Statnett sets out to build competence and to develop solutions aimed at the core questions in our asset management:

- What is the condition of our transmission system assets right now and how will it change during its remaining lifetime?
- What is an optimal maintenance strategy in order to be able to avoid failures and guarantee a reliable power supply while optimizing maintenance resources?
- When do we need to replace components?

The project aims at investigating available data - both structured and unstructured and expert knowledge - and possibilities to apply existing methods and models for different asset management purposes:

- Methods for condition monitoring and modeling to be able to improve the maintenance analysis. (RCM) and planning.
- Methods to estimate remaining lifetime and optimally time the replacement.
- Methods and analyses to support asset management strategies.

The project will look into possibilities for the development of a new ICT platform and system integration, as well as the development of effective decision-support solutions to process and compile large amounts of data.

About WP1: User needs and possibilities

The goal of work package 1 was to describe the state-of-the-art and user needs regarding asset management utilizing big data.

In this work package Statnett arranged workshops with its project partners. The scope was to provide an initial arena for discussions regarding:

- The status and main challenges for asset management in Statnett in the future.
- The partners' solutions and their advances within analysis platforms for asset management
- Recommendations for further work, including use case ideas to be investigated further in the SAMBA-project.

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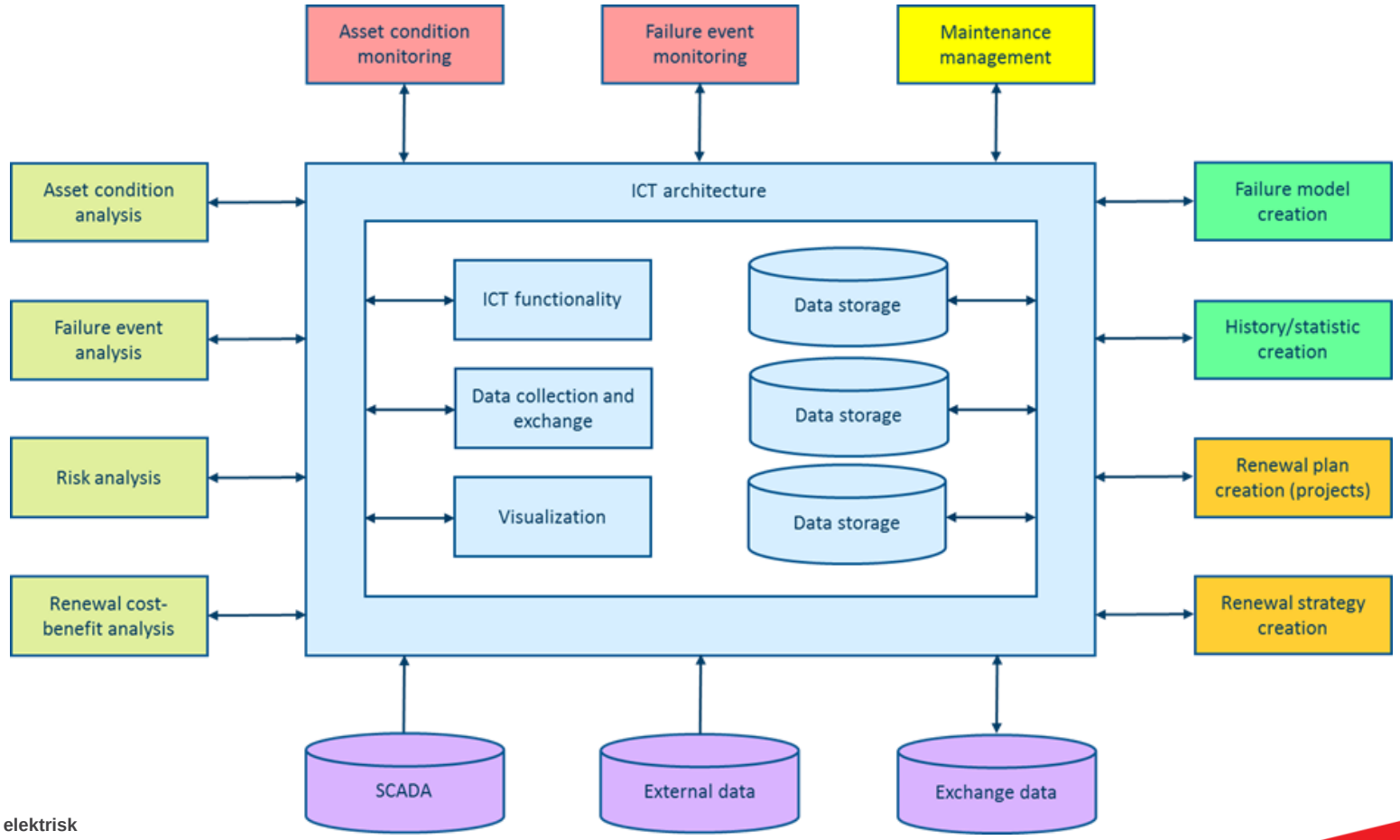
Future needs concerning asset management in Statnett

Data must be collected, exchanged, aggregated, presented, visualized and stored to fulfill different AM needs. A well-designed and well-functioning ICT-architecture (illustrated by the light blue boxes) should tie all the elements together and is a premise for the asset management platforms of the future.



The asset management plan (PFA)

Status

- The plan includes maintenance and reinvestment strategies for 10 years ahead and a macro analysis of reinvestment needs within a 40 years' time perspective.
- The plan is updated every second year.
- The process includes dialogs with the regional asset managers and maintenance teams and the final plan/strategy is more or less manually assembled.
- Available, relevant data is reviewed and the assets considered for renewal are analyzed with respect to risk.
- The replacements of the components are prioritized and postponements are considered.

Future needs

- The plan can be updated automatically, whenever new data is available.
- The optimal replacement time for each component is automatically updated based on new input data regarding condition, remaining lifetime and risk evaluations.
- A decision support system will be used to analyze both technical data, observed data and expert opinion.

Asset renewal

Status

- Renewal (reinvestment) is mostly time/age based, with corrections from experience and fault analysis.
- Component renewal projects are usually coordinated with other similar project as well as with capacity expansion projects.
- The process regarding reinvestments is well defined.

Future needs

- Renewals (reinvestments) will be optimized based on estimations of the remaining lifetime and the risk associated with system components.
- Technical condition will be estimated based on observed and measured data, expert opinion, local knowledge or external information e.g. international statistics and experiences.
- Systematical assessment of probability of failure of the main system components and functions.

Maintenance management

Status

- Reliability Centered Maintenance (RCM) is the basis for the maintenance plans. In RCM it is focus on finding the maintenance actions that would allow each asset to keep performing its designated function(s) in the system. We identify failure modes, mechanisms and causes and possible consequences of failure. Each asset is assessed individually, to account for local conditions.

- Based on this analysis we estimate the time to first failure, the mean time to failure, the time between the moment a fault is discovered until the equipment fails and the mean downtime.

Future needs

- A predictive and prescriptive approach to maintenance management where tasks are more or less automatically pushed to the maintenance personell.

- Analyse if maintenance is efficient and what changes are needed to improve RCM and update the maintenance programme.

- Estimate components' condition, probability of failure or remaining lifetime and associated risk.

- More sensors and measuring equipment are installed, if they bring added value, and actively used to monitor assets' condition.

Analysis and decision support in Asset Management

Status

- Mostly manual. Much time is spent on getting and preparing data for analysis.
- Because of the time required, these analyses are done when needed, either time-based or event-based.
- Results of analyses are not easily available to others.

Future needs

- Analysis is automated, initiated by triggering events or new data available.
- Automatic acquisition and processing of relevant data for analysis.
- Analysis results will be easily available and presented in the right form adjusted to different stakeholders.
- Tools to fill any need for presentation of analysis results, as for example real-time visualization.

Monitoring

Status

- Monitoring at load dispatching center.
- "Problematic" components are more closely monitored (online or offline), i.e. online gas monitoring of transformers with high levels of gas identified in routine oil tests.

Future needs

- Real-time condition monitoring for critical components, real-time risk monitoring based on a widespread use of forecasting and predicting techniques as decision support.
- Enable a risk monitoring and asset management platform/center.

ICT - Status and future needs

Status

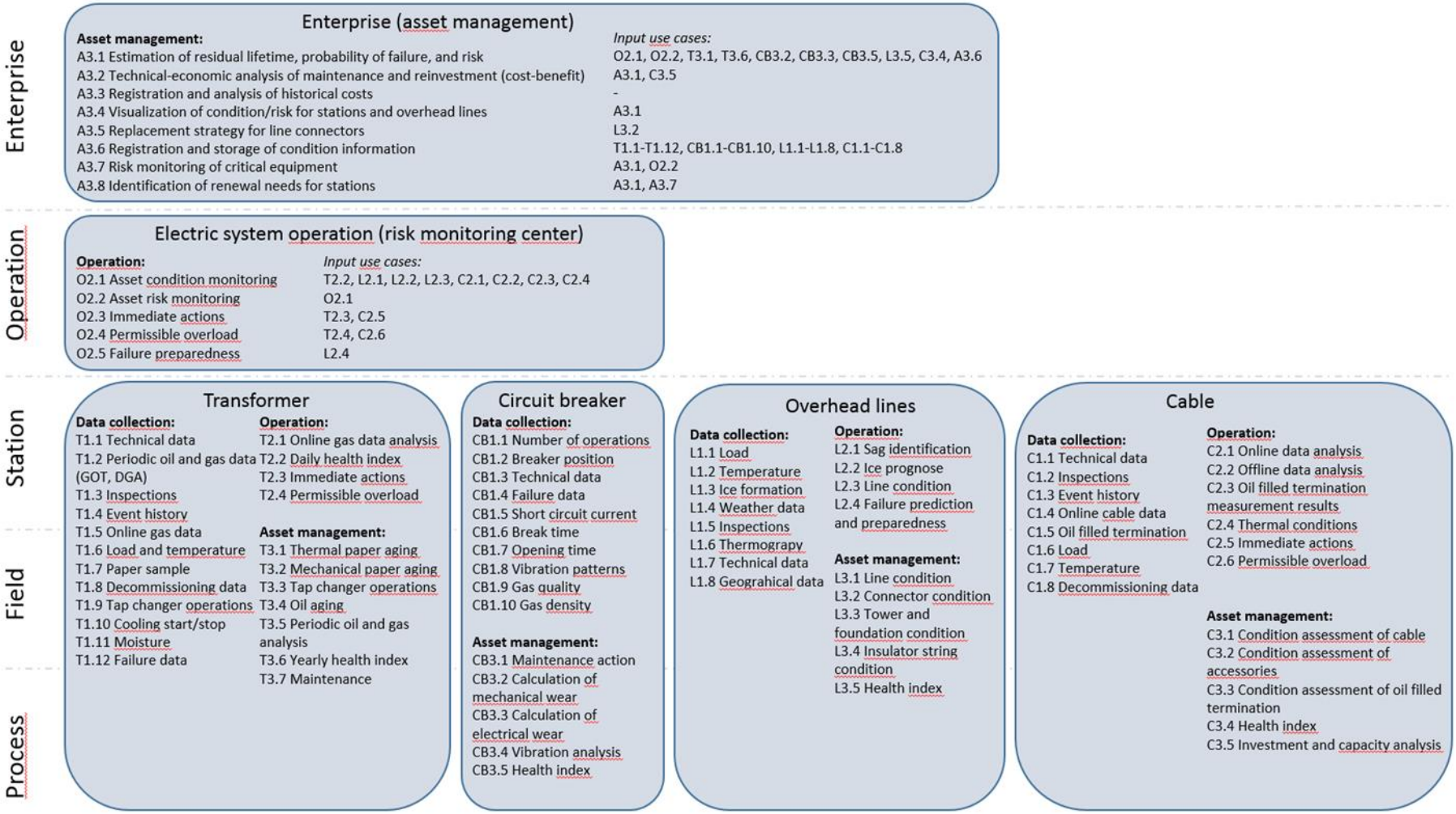
- Statnetts ICT-systems are often based on peer needs and are fragmented.
- Most of the analyses are done in a series of additional tools which combined solve most current user needs.
- The analyses are fragmented and mostly have different logic for data collecting and storage.
- The current architecture is not a good basis for expansion.

Future needs

- Data collection:
  - Common way to collect data from different sources to avoid performance issues on critical sources and unnecessary complexity.
  - Real-time data collection.
- Data storage:
  - A way of making data and analysis results available across ICT tools, business areas and physical data storage based on a technology that will not be a limitation in volume and velocity.
  - Based on a common information model.
- Functionality:
  - Functionality through traditional analysis tools combined with new tools to handle high volume and variety. Enable real-time analysis, predictive and prescriptive analysis for asset management.

Future work

Several use cases were proposed, covering most of the aspects discussed during workshops in WP1.



Future work

The use case ideas will be further developed and described in WP2 and tested in WP5. Through use cases the project aims at investigating available data and possibilities to apply existing methods and models for different asset management purposes. All project partners are encouraged to propose use cases they would be interested to test.

The project has an important ICT research facet which will be investigated in WP3 and WP4. WP6 will look at possibilities to integrate SAMBA's results within a 'risk monitoring center'. WP7 will summarize the work and main recommendations from the project.