FINGRID

CASE STUDY

HOW ASSET INTELLECT UNLOCKED THE VALUE OF IOT SENSORS TO ENABLE THE MOVE TO CONDITION-BASED MAINTENANCE

INDUSTRY

Utilities Transmission System Operator

COMPONENTS

IoT devices, Azure, PI, Asset Intellect

THE COMPANY

As Finland's electricity transmission system operator (TSO), Fingrid is responsible for planning and monitoring the operation of the Finnish transmission system. In addition they maintain and develop the system.

The transmission system encompasses over 14,000 kilometers of 400kV, 220kV and 110kV transmission lines plus more than 100 substations. Major power plants, industrial plants and regional electricity distribution networks are connected to the grid. The Finnish power system is part of the inter-Nordic power system.

THE CHALLENGE

Fingrid's most critical assets and equipment required more data, better information management and analytics to provide decision support for Operations.

The IoT project is part of the continuous process in securing grid quality, improving grid availability and improving cost effectiveness, safety and sustainability.

As part of the project, Fingrid is rolling out IoT-devices to improve asset visibility to better understand the condition of the assets based on real-time data to enable transitioning into Condition Based Maintenance (CBM).

The project required a scalable enterprise solution for visualizing, reporting and dashboarding of operational and IoT data.

IOT SENSORS

IoT enables large-scale implementation of monitoring substation assets, primarily due to affordable sensor technology and wireless data solutions. Complexity of deploying new sensors is reduced, as IoT gateways are separated from SCADA and control network, reducing the complexity of change control and costs related to it.

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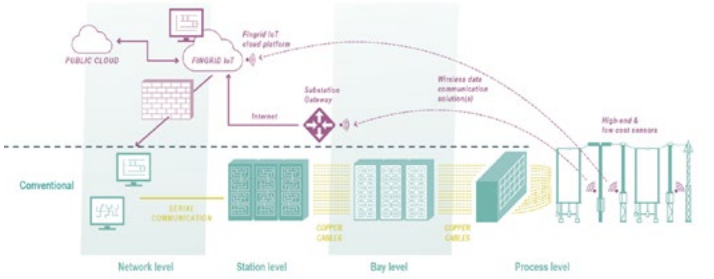
IOT IS FULLY SEPARATED FROM CONTROL AND PROTECTION SYSTEM



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Replacing time-based manual measurements with IoT sensors frequent and precise live monitoring, enhances visibility to substations asset condition and functional performance. Improved situational awareness has several benefits:

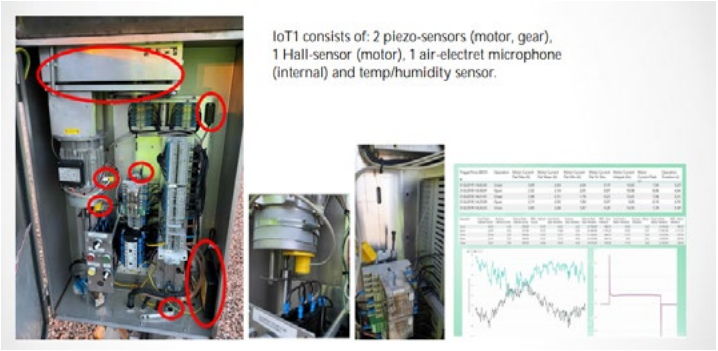
- Earlier detection of emerging defects and need for maintenance.
- Maintenance resource allocation decisions are based on accurate, up-to-date data.
- Improved reliability and cost-effectiveness from optimization of planned outages.

New sensor technology also allows Fingrid to extend into Radio Frequency Inferference (RFI) monitoring of high voltage equipment insulation and acoustic monitoring of gears, motors, dampers etc. with traditional current profile analysis of coils, motors and CT secondary circuits.

Sensors have been upgraded to withstand the high voltage environment experienced in substations.

Control building environments are monitored with sensors for temperature, humidity, air pressure and water leakages. Wireless temperature monitoring has been installed on primary parts of disconnectors and joints. Using acceleration sensors for busbar vibration monitoring is also under investigation.

SWITCHING DEVICE MONITORING; DISCONNECTORS, EARTHING SWITCHES AND CIRCUIT BREAKERS



To successfully move to condition-based maintenance, Fingrid requires a large number of IoT sensors which will generate a vast amount of data on the operational characteristics of different asset types and asset models. Individual IoT solutions were selected to address each particular condition that needed monitoring.

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THE SOLUTION

Condition-based maintenance strategies require actionable, high quality data to be available to the end users for decision making.
On a high level, required data can be split into the following categories:

- Live instrumentation data, including alarms and events, collected through SCADA and stored in OSISoft PI.
- IoT data stored in Azure.
- Infrequently collected measurements from site visits, lab results etc., stored in an Enterprise Asset Management (EAM) application or other disparate database.
- Maintenance plans, KPI reports and asset related data which has impact on decision making and prioritization.

Fingrid compiled a set of requirements for an Asset Performance Management (APM) application capable of presenting all relevant asset condition data in the same context. The requirements for an APM application divide into two main categories: visualization of large amounts of time series data, and capability to implement reports, documents and dashboards from various sources.
The main requirements for the APM tool are as follows:

- Efficient time series data management.
- Versatile analysis by implement different types of charts and graphs.
- Effortless navigation between assets and dashboards
- Asset fleet analysis tools.
- Alarms configurable to detect deviations in the measurement data.
- Notifications to end users when alarms are triggered.
- Summary tools such as health index.
- Time series data is stored only once and not copied between systems.

Fingrid chose individual IoT solutions for each use case with Asset Intellect bringing the data together in a cohesive solution providing actionable information.

The PI System is Fingrid's preferred solution for collecting, analysing and presenting time series data.

IMPORTANCE OF ANALYTICS

Microsoft Azure was chosen as the cloud data platform for data analytics, storage, and to handle provisioning, communication, and software management of the IoT devices.

Even though the IoT project is implemented using Microsoft's Azure cloud solutions, it was essential to present IoT data in context with SCADA data in the PI System and as part of their enterprise Asset Framework.

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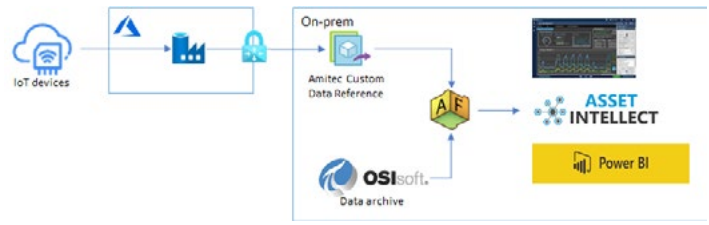
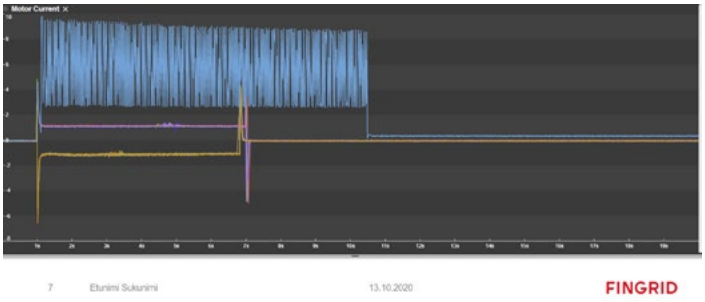
Dimension Software's Asset Intellect was chosen to visualize data from PI Asset Framework (PI AF), and IoT data from Azure into a single web-based platform. Key performance indicators are presented in the form of time series graphs and deviation notifications, efficiently providing wide availability of data across Fingrid.

Amitec was selected to implement seamless integration of Azure IoT data into PI Asset Framework. Amitec's Custom Data Reference component enables IoT time series data from Azure to be part of PI AF Asset tree structure and allows analysis, visualization and reporting of IoT data in context with other PI AF data while adhering to Fingrid's policy of storing data only once. Asset Intellect integrated all the individual components into a scalable enterprise solution for visualizing, reporting and dashboarding of data.

As PI AF is controlling the access to IoT data through Custom Data Reference, administrators can leverage full Asset Framework UAC and security features to control access to IoT data.



REAL LIFE EXAMPLE OF AN OUTLIER. FAILURE OF A DISCONNECTOR MOTOR, RECORDED BY AN IOT DEVICE



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