District Heating Network Monitoring, Control and Optimization with CyberVille® IoE Application Platform

EXECUTIVE SUMMARY

The Fortum district heating network in Espoo (Finland) was operated with an existing SCADA and several proprietary network management software solutions. These solutions received data from several sources and were not integrated into a single system. The CyberVille® Industrial Internet of Things platform from CyberLightning enabled integration of all data sources into a single big data processing engine. The data integration enables faster analysis of the network status and potential problems within the network. "See at a glance" visualization also enables much more efficient problem management and energy production management in power plant's control room.

> "*Fortum's purpose is to create energy that improves life for present and future generations. We have always been keen to adopt new technologies and we see the Industrial Internet as the next wave in improving our operational efficiency and customer satisfaction. CyberLightning with energy sector optimized offering, has potential to fulfill our concrete needs by providing us a cutting edge technology platform, CyberVille®, which enables us to strengthen our competitiveness for the future and also creates a base on top of which other solution providers can build new next generation applications.*"
>
> - Heli Antila, CTO of Fortum Plc.

THE CHALLENGE

Fortum Plc. wanted to bring a fully integrated highly visual "see at a glance" monitoring and management solution to the district heating network operators and managers at Fortum's power plant. The target of this approach was to enable higher automation and lower possibility for manual errors, such as non-optimal water pumping. Requiring full integration of SCADA and several other sensor data and external data source integrations, Fortum challenged CyberLightning to meet their integrated network monitoring and control demands.

Fortum Plc. owns the second largest district heating network in Finland. It is located on the coast of the Baltic Sea in Espoo. The network consists of over 800 km of underground piping and has a

volume of over 60,000 m3. Suomenoja combined heat and power (CHP) plant's four main units and ten smaller heating plants in the area supply the heat. In addition, there are 12 pumping stations in the network to distribute the heat to thousands of end customers. Altogether, the plant and 10 heat-only boiler stations have a total heating capacity of about 1,300 MW.

The network was operated with an existing SCADA and several proprietary network management solutions. Management of the network included several manual steps and data from different sensors within the district heating network was not integrated into one database and one system. The data also was not integrated with other business systems such as maintenance and required manual handovers and controls.
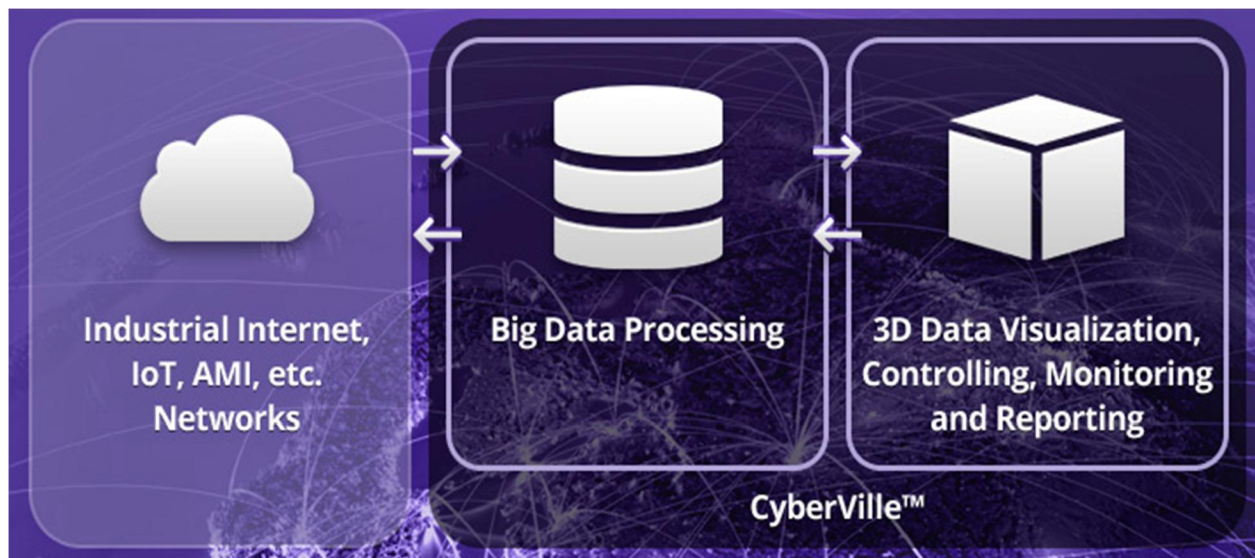

THE SOLUTION

Each sensor data source was integrated into the CyberLightning CyberVille big data processing engine. This data included all production and network flow and temperature data, operational data and business process data (e.g. maintenance teams' location and status and access control to the production and pump sites). In addition to real-time network monitoring and control, predictive analytics with weather forecast integration was a key demand from Fortum. The interface also integrates external data sources (e.g. relevant weather data) for predictive analytics.

CyberLightning's solution needed to be reliable, real-time and highly visualized, enabling operators to see and understand all relevant data within the 800 km network at a glance and at the same time provide drill-in for detailed sub-network or individual customer building level views for problem solving.
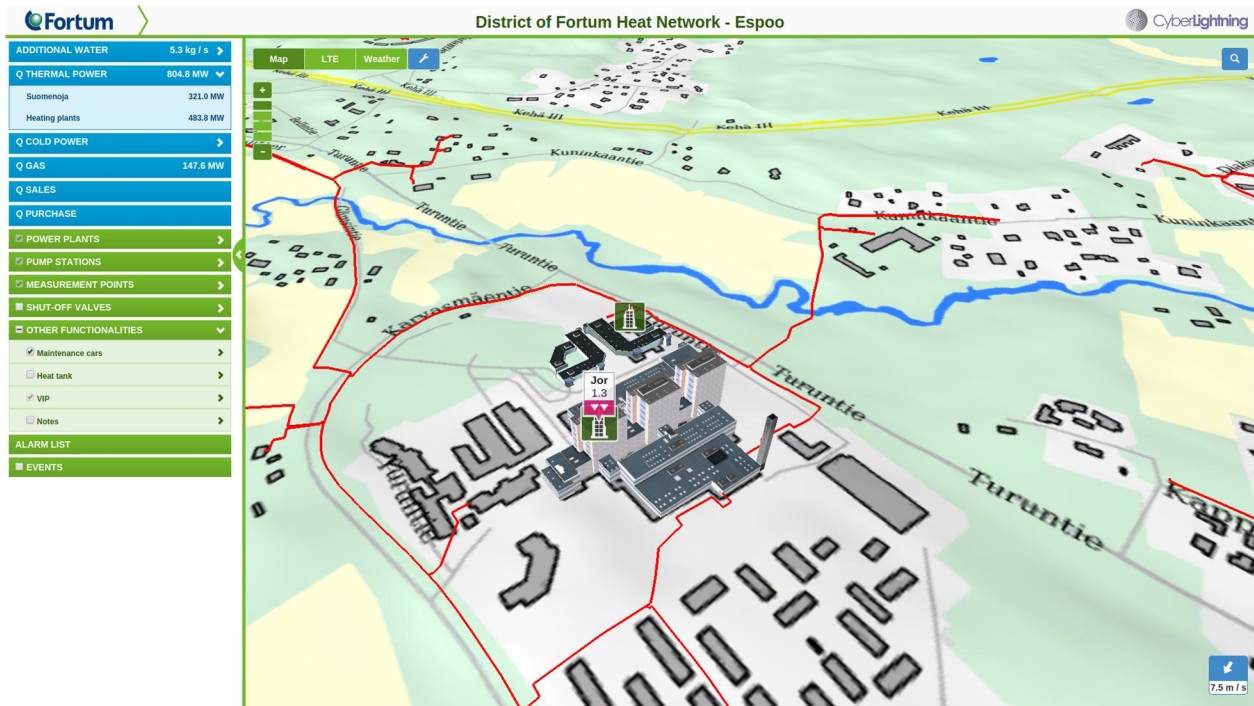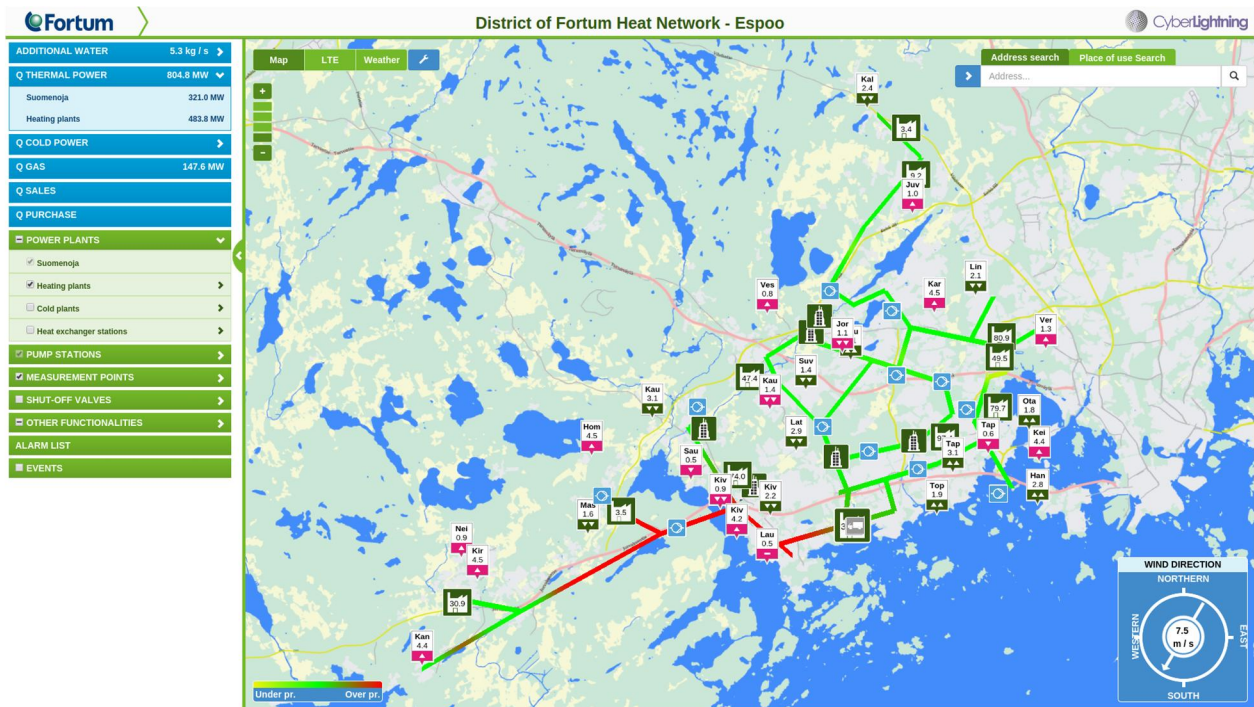
The customized user interface for Fortum was built using CyberVille SDK UI tools on top of CyberVille's data visualization, monitoring, control, and reporting module. The user interface utilizes standard web technologies and runs in a modern browser without any proprietary plugins. It provides a full view of the network on top of a map view with drill-in capability to individual district heating customer level, together with fast access to different production units

and pump station relevant sensor data. The UI also has a built-in feature to control heat network equipment just by tapping/clicking objects on the screen.

Finally, the interface integrates relevant weather data for predictive analytics. Further planned extensions include the spot production cost and market price of the energy sources used for generating the heating energy.

RESULTS

All relevant and essential district heating network monitoring and control data are now centralized into one big data database, including business process data such as access control of the gates to production sites and the location and current status of maintenance crews. Also the relevant external data such as weather prediction data has been integrated into the system. It is also possible to drill in to a customer building level to check the real-time energy consumption of the customer site.

The data integration enables faster analysis of the network status and problem solving within the network. "See at glance" also enables much more efficient problem management. For example, the idle and useless running of pumps can be totally eliminated with this solution, thus generating significant savings to Fortum. The weather data integration enables Fortum to manage the network heating performance to customers more accurately and thus generates higher end-customer satisfaction.

Additionally, Fortum is seeking direct savings by avoiding the use of heat-only boilers whenever it is possible. Operators at the CHP power plant can achieve this goal only if they have an excellent understanding of the changing operating conditions, thus enabling predictive decision making.

ABOUT CYBERLIGHTNING

CyberLightning provides an intelligent, end-to-end Internet of Everything (IoE) Application Platform for operational and business use in Smart City environments. The company was founded in 2010 by a core team at the Center for Internet Excellence at University of Oulu, Finland.

Introduced in May 2014, CyberLightning's CyberVille® software platform integrates heterogeneous data and inputs from multiple control systems to create a unified view and control panel for complex networks that can be accessed on any client device, from smart phones and tablets to traditional desktops. Based on open-source, standards based Internet technology, it provides a multilayered 3D view of complex networks based on a combination of geographic information system (GIS) data sets and 3D models, along with all of the real time data feeds associated with the various objects that make up the network or networks under management. More information is available at www.cyberlightning.com.

ABOUT THE INDUSTRIAL INTERNET CONSORTIUM

CyberLightning Ltd. has been a member of the Industrial Internet Consortium since December 2014. The Industrial Internet Consortium is a global public-private organization of over 140 members, formed to accelerate the development, adoption and wide-spread use of interconnected machines and devices, intelligent analytics, and people at work. Founded by AT&T, Cisco, General Electric, IBM and Intel in March 2014, the Industrial Internet Consortium catalyzes and coordinates the priorities and enabling technologies of the Industrial Internet. Visit www.iiconsortium.org.

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