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Outage Coordination Map

This report demonstrates the use of real time power outage data generated by Trimble DMS and passed on to a scalable interactive map platform.

Map can be used in case of wide network outages to get good situational picture of most problematic areas and coordinate resource management. Solution can be easily extended to show more operational figures, real time resource tracking via GPS, weather data etc.

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1 General

Handling widespread outage situations – often caused by storms – efficiently is critical to electricity distribution companies. Visualizing the situation would give all related parties better view of the severity of problems and helps to focus resources to the most badly hit areas of the network.

All this data is usually available, but it is difficult to obtain by most involved parties, since it is scattered around multiple systems and sometimes available only on database level. Seeing the overall picture is impossible. Also different roles have different requirements to handle their own work in the most efficient way.

During the project with Elenia, relevant key figures were identified and a single API was created to extract the data from various different databases and aggregate the data to a new single page app. Based on the users' role, most interesting data is highlighted, but all data is accessible to provide transparency to the whole situation.

Map gives a lot of possibilities to share information inside the company and also to external partners. It can be shown on digital signage solution around the offices to share overall situation with everyone, display who's on shift in Control Center, visualize situation in nearby areas to the field workers etc.

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2 Use cases

2.1 Overall picture

Basic view of the tool is large map showing all operational areas of Elenia (picture 1) with key figures listed on the left side of the screen. Key figures at the time of go-live are number of Medium ja Low Voltage faults and workgroup needs plus number of fault reports received from customers related to Low Voltage faults.
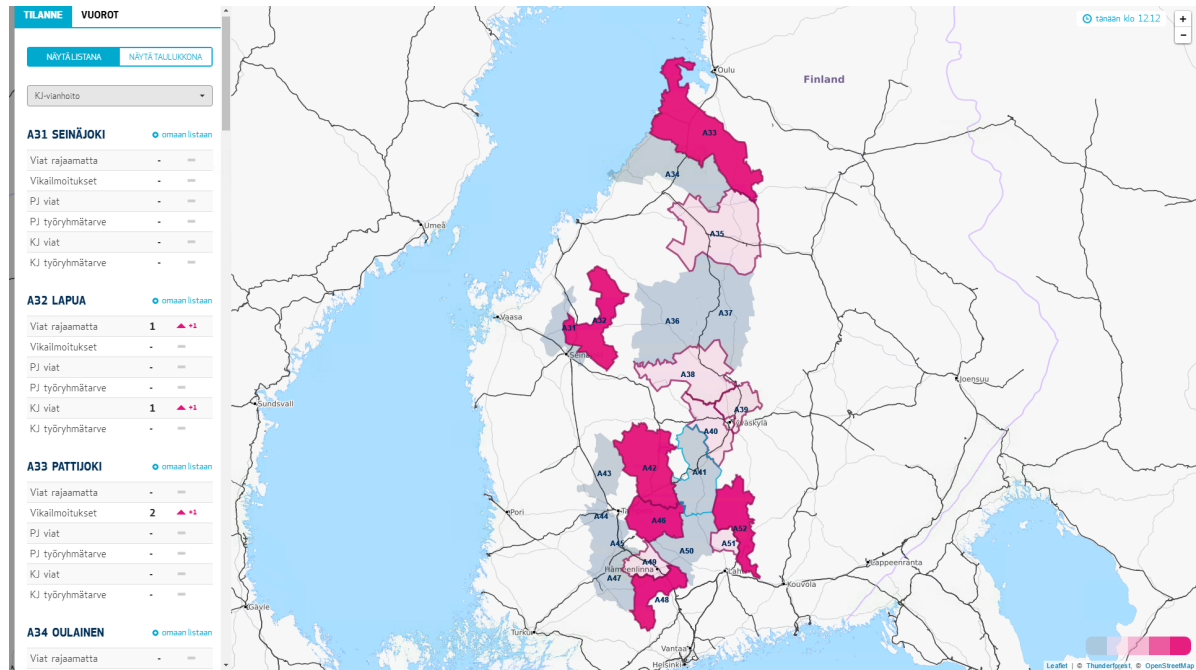
Picture 1: Overall view of network area

User can select which kind of information is the most interesting to him/her by selecting the desired role from a dropdown menu. Map automatically calculates situation criticality level per operation area in relation to all other areas, making the map highlight most problematic areas in all kinds of outage cases. So no matter if there's one fault or 100 faults going on at the same time, map will adjust its colors etc. automatically.

Key figures are assigned with different weights and based on these the map categorizes severity class with a range from 0 (no issues) to 4 (critical). The weights of each key figure are different depending which role user has selected. Most critical areas are shown on the map. Backend handles the weight calculation and different multipliers can be put in place if there's identified need for different type of calculations.

Besides weight calculation, backend also keeps records of the changes in different key figures. Overall view displays arrows (up/down/line) and numbers showing the changes in each key figure compared to the situation 60 minutes earlier. This gives more visual way to identify if things are getting better or worse in some area. A line chart is also being planned to visualize the changes during a longer period of time.

Users can also select which areas are most interesting to them by marking the areas as "favorites". This raises the favorite areas on top of the left hand view for quicker access.

Each area is also assigned to one or multiple coordinators who are responsible of the area. This shift planning is explained in more detail in chapter 2.5. Users can see which coordinator is responsible of the different areas, so in case there's a need for someone to ask details regarding some area, users can address the correct person immediately.

In addition to the map view, tool provides a more numerical approach to get on overview of the situation. A generic table view was created to show all key figures for all areas in one place. Table can be sorted based on different figures and it also calculates totals of all areas. This view is a feature which can be used for all kinds of things, from management reporting to customer service, where it is good to know how things are developing.

2.2 Medium voltage coordinators

Medium voltage coordinators are interested in fewer details related to their job. Coordinator can select which areas he or she is working on and map highlights those specific areas more clearly. Key figures related to medium voltage are the ones changing most often and the coordinator role is one of the most critical to handle major disturbances effectively.

2.3 Low voltage coordinators

Low voltage coordinators are like mediums voltage coordinators, but are interested in different key figures. One special case is the amount of fault reports which customers have sent.

2.4 Resource management coordinators

Resource management is responsible to direct work groups in the field to the areas where repairs are needed. They need to know which areas have most need for the groups and also have clear picture where resources are available (or will be available in near future). Seeing all the affected areas on a map gives these users better picture on how the needs and available teams are located geographically and can make better decisions if workgroups need to be moved from one operational area to another one.

2.5 Shift planning

Coordinators also plan the work being done in the Control Center and around the office related to outage handling. Tool provides means to plan and follow up the shifts each named person is responsible of. Shifts are also displayed at the Control Center so everyone knows who is currently on duty.

Backend gathers a database of all the shifts so it can be later used to track down who was working and when. This information could also be shown publicly so the people coming in the next shift can see who has been working on their designated areas before them.

3 Technical details

3.1 Used technologies

Map backend runs on Node.js, front uses React and Leaflet, map tiles are provided by Open Street Map (can be switched to Google, Here etc. if needed, but licensing fees should be considered). Backend utilizes PostgreSQL to log all activities for configurable amount of time for reporting purposes. Ubuntu Server 14.04 LTS is used as the system core.

3.2 Integration to DMS

Trimble DMS does not provide ready API for the data used on the map. Integration is handled by Microsoft Biztalk server which performs Oracle database queries (picture 2) and publishes a REST API for the map which aggregates several database queries into a single JSON response.

To save server resources of DMS, map backend maintains its own cache of incident data and refreshes it every 60 seconds through the REST API. Individual map users will never generate a call to the database, but use the cached data of map backend.

JSON — MS Biztalk — SQL Queries

WWW — Map server (Node.js) — DMS Oracle
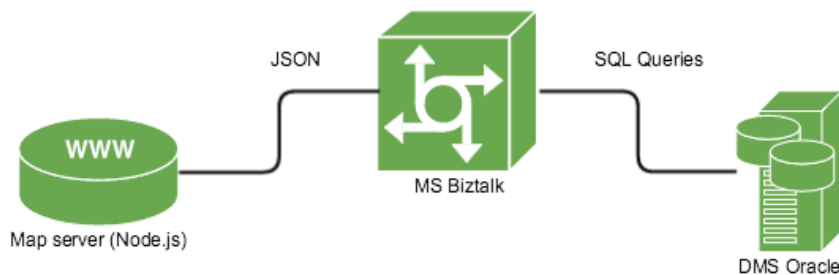
Picture 2: Integration to critical data is done using MS Biztalk provided API