



Newsletter 2020-12-11

### InfraSweden 2030 DMrail project Updates

**DMrail is a project that looks at improving existing state-of-practice maintenance systems in order to increase the operational uptime of rail infrastructure.** DMrail is investigating innovative methods for continuous health monitoring, data driven decision making, visualization for better user experiences and efficient allocation of maintenance resources will be utilized to this aim. DMrail addresses the digitalization dimension of the InfraSweden 2030 and brings us one step closer to a connected transportation vision.

The Corona crisis has impacted on the partners (their way to work remotely). However, despite the Corona situation, DMrail project has finalized the Conceptual Design of the Data Connectivity Architecture consisting of four main areas: (i) how users interact, (ii) how devices connect to the system, (iii) how data is collected and stored, and (iii) how data is processed and analysed. The potential KPIs have also been identified.

As showed in the figure below (Figure 1), DMrail Data Connectivity Architecture is composed of: (i) Edge Machine Learning Algorithms, (ii) Cloud Machine Learning Algorithms, and (iii) a module for Visualization of maintenance results.

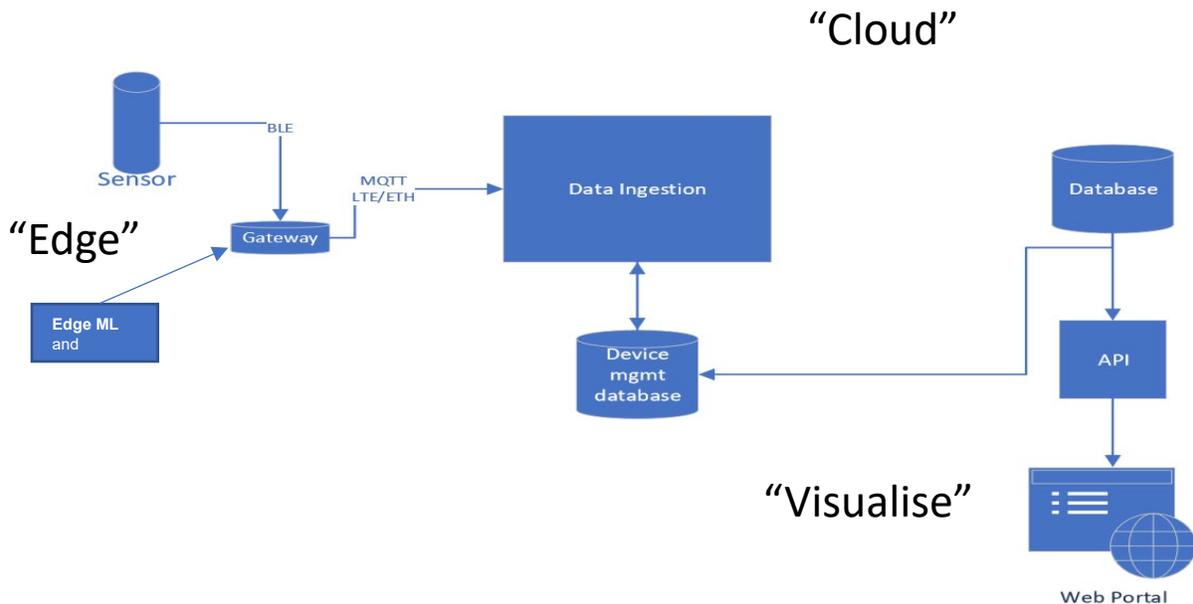


Figure 1: DMrail Data Connectivity Architecture

The figure above identifies the system in terms of computer engineering, database structure, components and data flow. The figure below (Figure 2) shows the system in a functional view in terms of the process

it applies in order to detect failures and issue a warning. It is important to note that while the current prediction system is applied on point machines, in reality this could be generalized for other types of signal system objects as well.

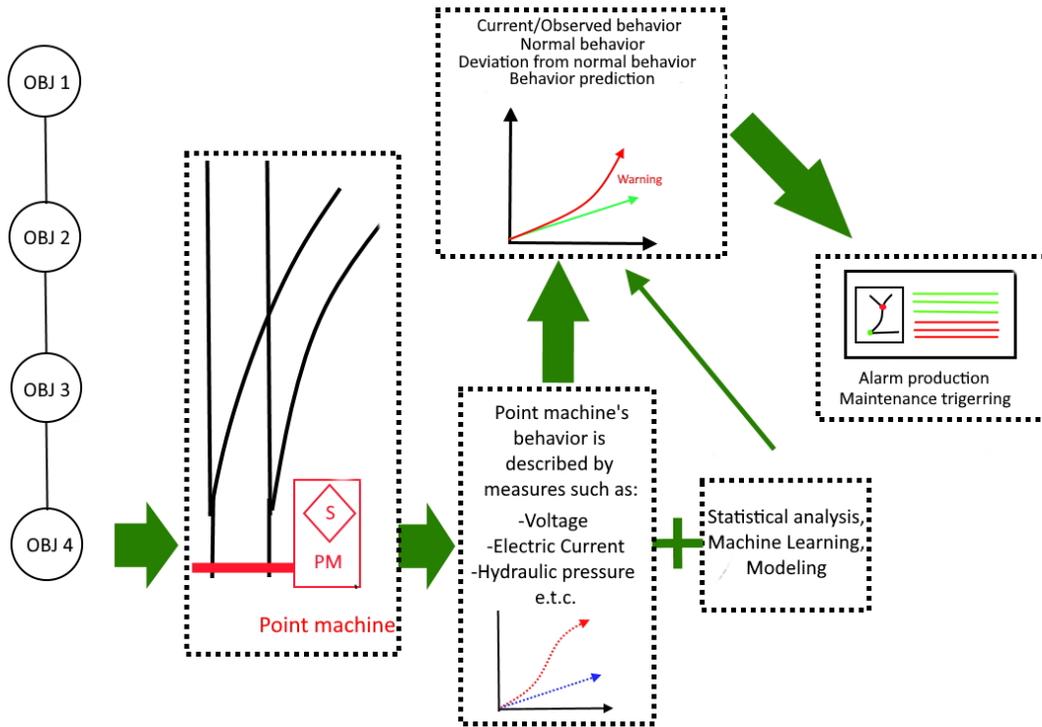


Figure 2: DMrail predictive maintenance – function in relation to railway infrastructure

In terms of how the DMrail predictive maintenance system is applied and works, everything can be traced back to the level of railway network. Part of the infrastructure is composed of structures: the track, the pylons, the platforms are structures. However, the rest of it are machines: devices that are serving a purpose on the railway network. They could be electrical, electromechanical etc. Such devices are called signaling objects. Examples are light signals, point machines in turnouts etc.

So, a railway network is comprised of signaling objects and a point machine constitutes part of them. The behavior of every point machine is described by data and measures collected by our system. Such measures could be the electric current, electric voltage, hydraulic pressure etc. The role of the system is to define what constitutes a normal behavior and what a non-normal behavior (a deviation from normal behavior). Furthermore, the aim of the system is to either detect anomalies or to predict them based on the variation of another measure. This is where machine learning, modelling and statistical analysis come into play. The final product is the issuing of an alarm and a report for a specific point machine (or signal object), should a deviation be detected or predicted.

### **Next steps, expected results and effects**

The next steps of the DMrail project are to implement and assess the potential innovation of Machine Learning (ML) algorithms (Edge ML and Cloud ML). The innovation potential will be built around creating simple innovative measuring methods, trouble-free installation, and rational data transfer - for an automated remote condition diagnostics/analysis. The DMrail impact will be measured in terms of increasing the technology readiness level of existing maintenance systems, adding value to the rail market, and improving the bottom line for rail operators.

**Webbinarium Järnvägsklustret:** On February/March 2021, DMrail project will organize a joint Webinarium Järnvägsklustret between DMrail projects and others InfraSweden 2030 projects.

**Project Duration:** June 2019 - May 2022

**Coordinator:** RISE Research Institutes of Sweden AB

**Partners:** Bombardier Transportation Sweden, Ekkono Solutions, Järnvägsklustret, RISE Research Institutes of Sweden, and KTH Royal Institute of Technology.

**Project Website:** <https://www.infrasweden2030.se/project/dmrail/>