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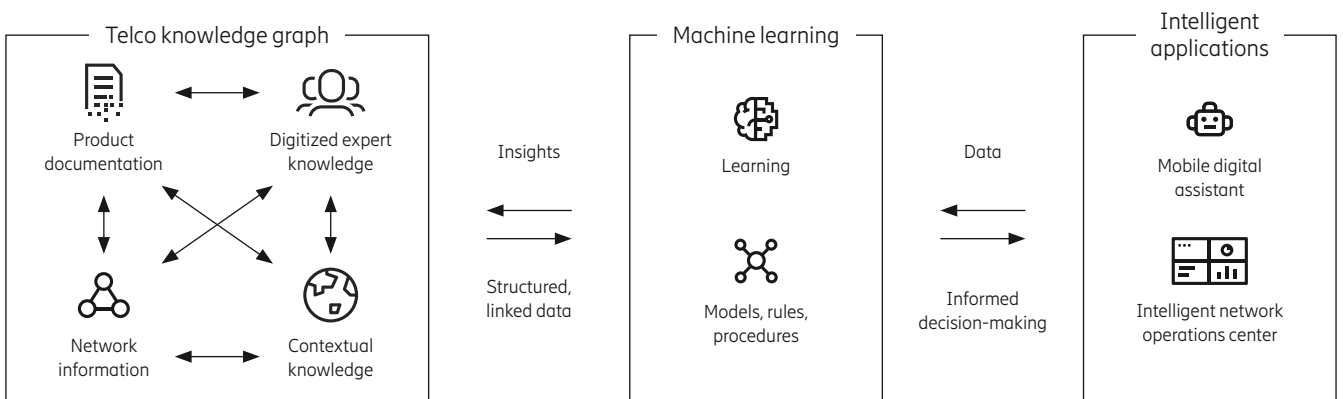
# How machine intelligence is helping to manage networks

Extract from the Ericsson Microwave Outlook Report

# How machine intelligence is helping to manage networks

Artificial intelligence (AI) has evolved from systems mimicking human behavior to systems leveraging human expertise. Tools and techniques are finding their way into all parts of society, with applications even helping to manage microwave networks.

**Figure 17: The role of structured knowledge in enabling machine intelligence and intelligent applications**



Source: Ericsson Mobility Report (2018)

Based on structured digitized data, such as product documentation, network information, expert knowledge and contextual knowledge, machine learning software can build models, rules and procedures (Figure 17). Adding AI techniques such as reasoning and planning to machine learning enables the creation of intelligent applications we refer to as machine intelligence (MI).

Currently, challenges in the microwave networks are met by domain experts at the network operations center (NOC). They are required to make fast and

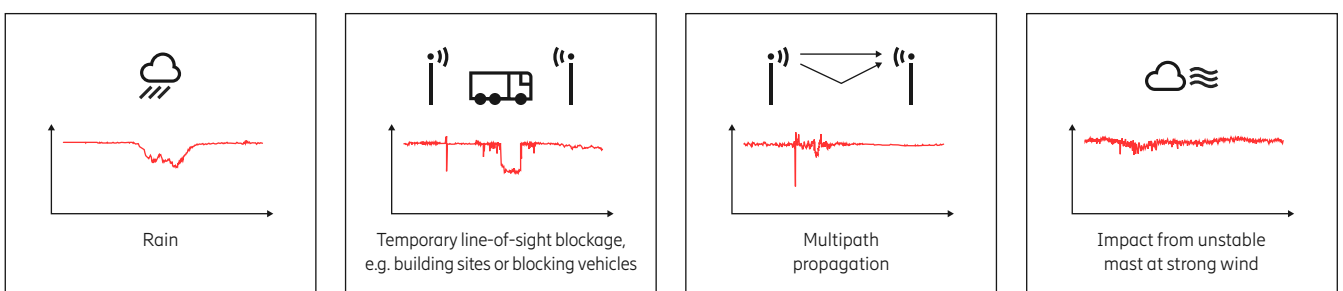
intelligent decisions based on alarm, configuration and performance data in networks that may cover thousands of sites over vast geographical areas.

MI applications need to support the technicians in this decision-making process. They can be used as stand-alone applications or as enhancements of SDN solutions, as discussed in the 2017 Ericsson Microwave Outlook Report. We examined an MI tool that identifies signal fading events in real-time. The process can distinguish between

MI is used to leverage the skills of microwave planners and engineers.

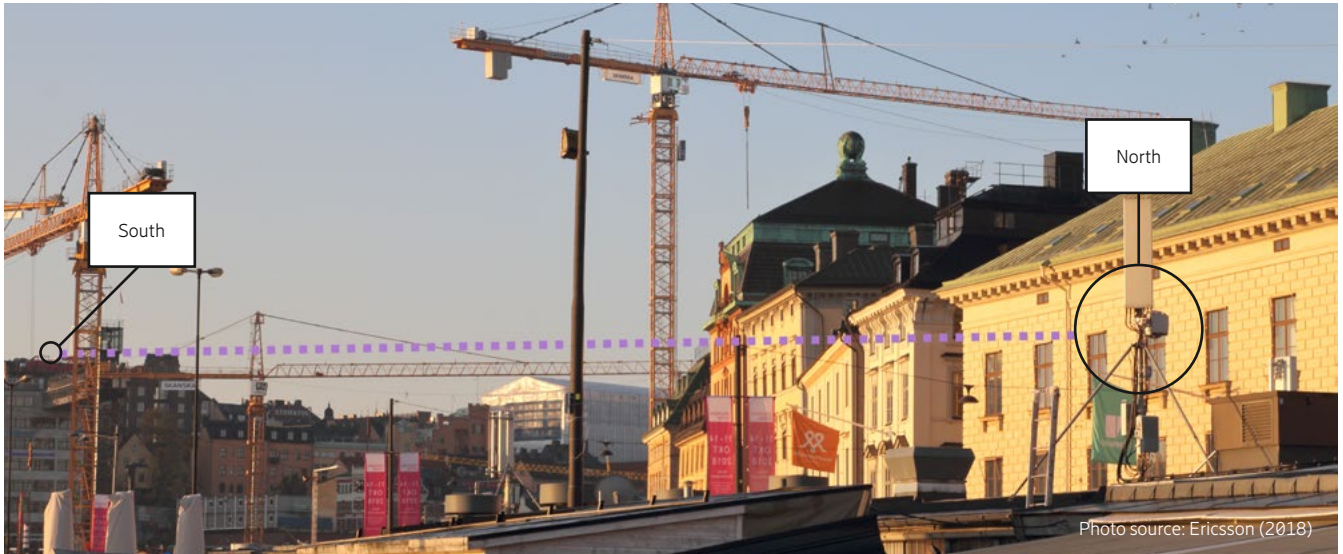
normal events caused by rain and multi-path propagation, and abnormal events caused by a line-of-sight blockage or unstable antennas. The input dataset is signal strength versus time, as illustrated in Figure 18, and the machine learning software is based on a convolutional neural network architecture.

**Figure 18: Signal fade events in microwave networks**



Source: Ericsson (2018)

Figure 19: Microwave link in construction site in Stockholm, Sweden



An intelligent NOC supports engineers with MI for root cause analysis, datamining, interpretation of patterns in large datasets and proposed network optimizations.

over three days, and identified events during the first 19 hours of August 28. The hours marked in purple indicate hours in which the signal faded due to the use of construction cranes at the site. The offset in received signal strength between the two directions is due to different output power signal settings.

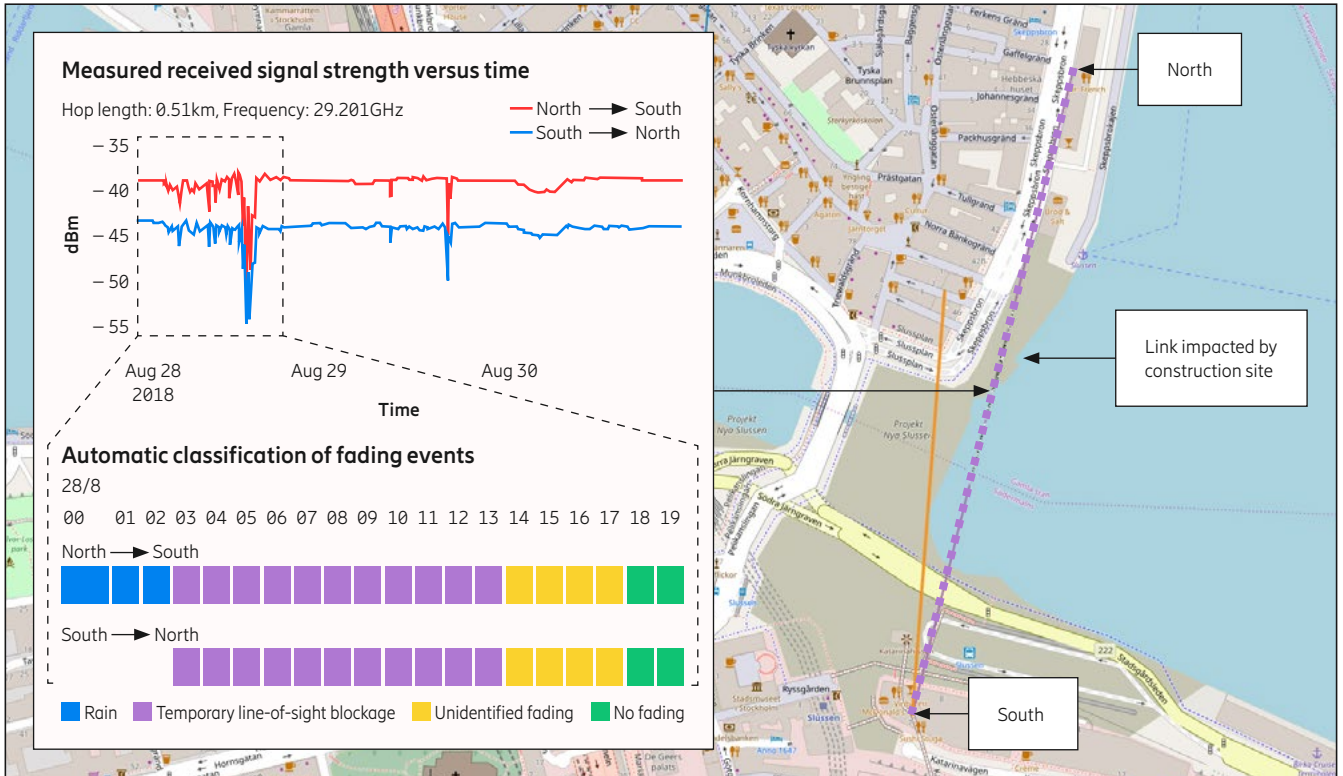
it to improve performance”) to the technicians in the NOC. MI has taken significant steps over the last decade. It offers techniques that leverage the expertise of microwave planners and engineers, allowing for management of larger, more complex and efficient microwave networks.

Figures 19 and 20 show a live example that demonstrates the technique. The microwave link is located in Stockholm, next to a large construction site, and is part of a nationwide network. The inset shows received signal strength in both directions

The tool can be used to reduce load at the NOC (e.g. by de-prioritizing alarms prompted by natural causes such as rain) and provide root cause insights (e.g. “This link has a lot of events indicating it is mounted on an unstable mast – consider stabilizing

MI is allowing systems to expand in size and complexity while improving productivity.

Figure 20: Automatic detection of temporary line-of-sight blocking from construction site



Source: Ericsson (2018)

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