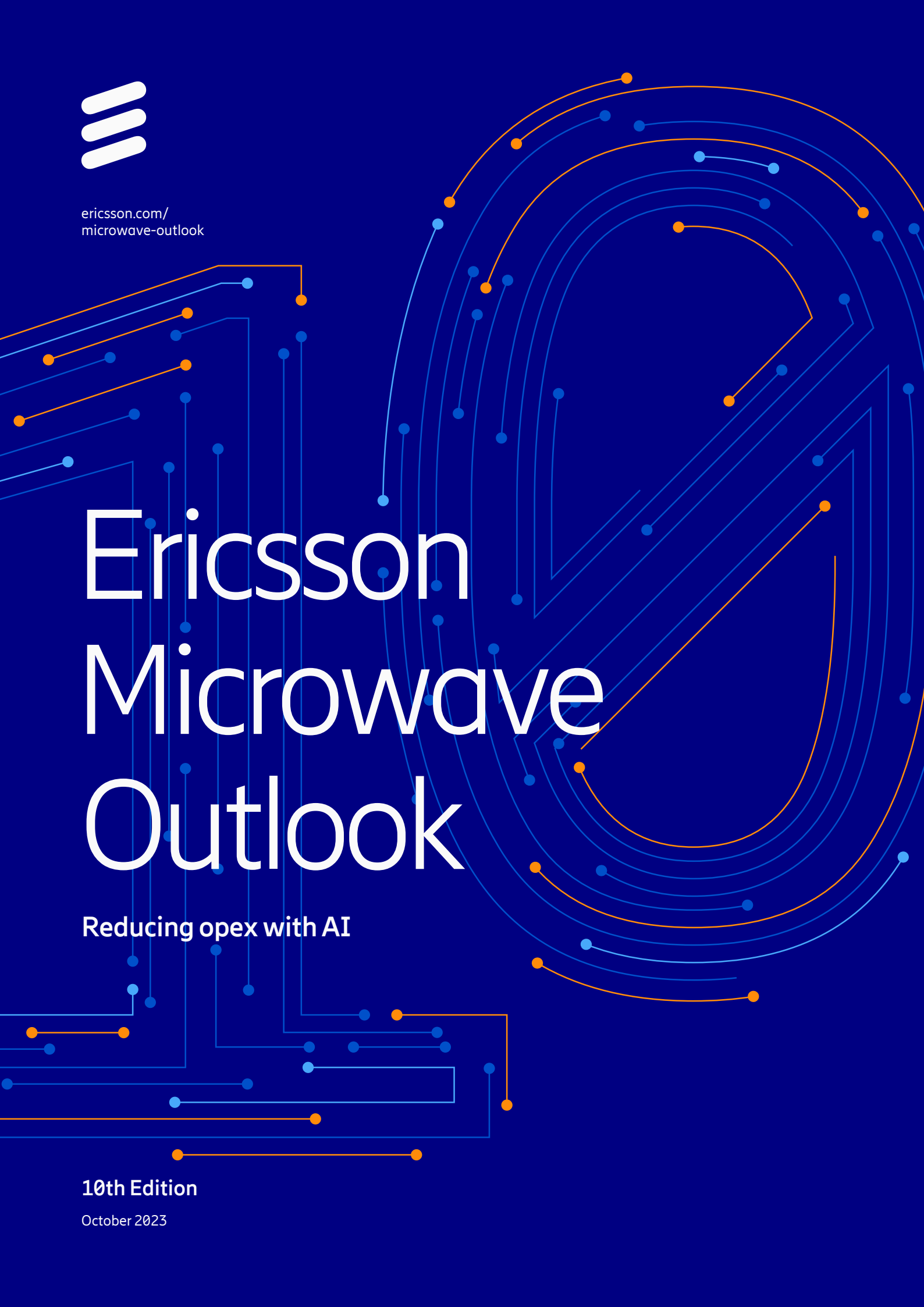

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Ericsson Microwave Outlook

Reducing opex with AI

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Reducing opex with AI

AI-based network automation can reduce operational expenses in many different areas of microwave networks. An interesting example is the Spanish service provider Lineox, which has reduced site visits by 40 percent by using automatic scripts.

With the rapid evolution of artificial intelligence (AI), network automation in combination with AI can, with a relatively small outlay, decrease the operational expenses (opex) of a microwave network. Resource-intensive areas such as power consumption, troubleshooting, site visits, and even spectrum costs can all be reduced. Examples of this can be seen in the use cases shown in Figure 11. Power consumption may be reduced with the help of automatic radio deep sleep scheduling. Network problems such as tower sway, antenna misalignment and signal propagation degradation can be identified and quickly addressed thanks to precise root cause analysis. In addition, preventive maintenance such as hardware degradation alerts, high-temperature early warnings and network traffic growth forecasts can mitigate costly firefighting events. Another benefit is improved network availability as a result of fewer outages, leading to increased and maintained revenues.

Access to relevant network data is the foundation of any automated solution. Network topology data is essential for automatic upgrades of network software, while frequent measurements of signal quality are needed for the classification of signal propagation events. Access to historical data is also important, as it provides insights that can help to identify areas for improvement, enable informed decisions, and create trend predictions. Although a modern microwave network may consist of more than 20,000 microwave links and data being collected every few seconds, the amount of data processing, storage, and transport capacity needed are still negligible compared to the media streaming and cloud services used in daily life.

The reliability and accuracy of predictions and event classifications depends on both access to relevant network data, and also on the amount of data and the algorithms applied. With AI-based training and close cooperation between equipment manufacturers and operators, it has been shown it is possible to reach over 99 percent accuracy.

Lineox is a neutral broadband operator in Spain with 100 percent radio link technology. To ensure connectivity throughout its entire territory, Lineox owns a network of more than 10,000 radio links, used mainly to transport telecom traffic. In recent years, Lineox has focused on improving network operation efficiency. Substantial operation costs are related to numerous closed work orders and site visits, where highly trained personnel could travel for hours to visit and inspect remote sites using specialized equipment.

Figure 12 shows the number of site visits per month due to microwave-related tickets over a period of 15 months. Before May 2022, 50 percent of all tickets raised resulted in a site visit. Site visits dropped by 40 percent after June 2022, when Lineox introduced automated alarm filtering on top of their network manager. Although the total number of tickets increased, as the tool was able to detect network issues that had previously been missed or neglected, the number of actual work orders issued was reduced as the tool helped the service provider to prioritize whether a work order needed to be opened or if the network impact was negligible so that no action was needed.

Figure 11: Benefits of applying AI in microwave links

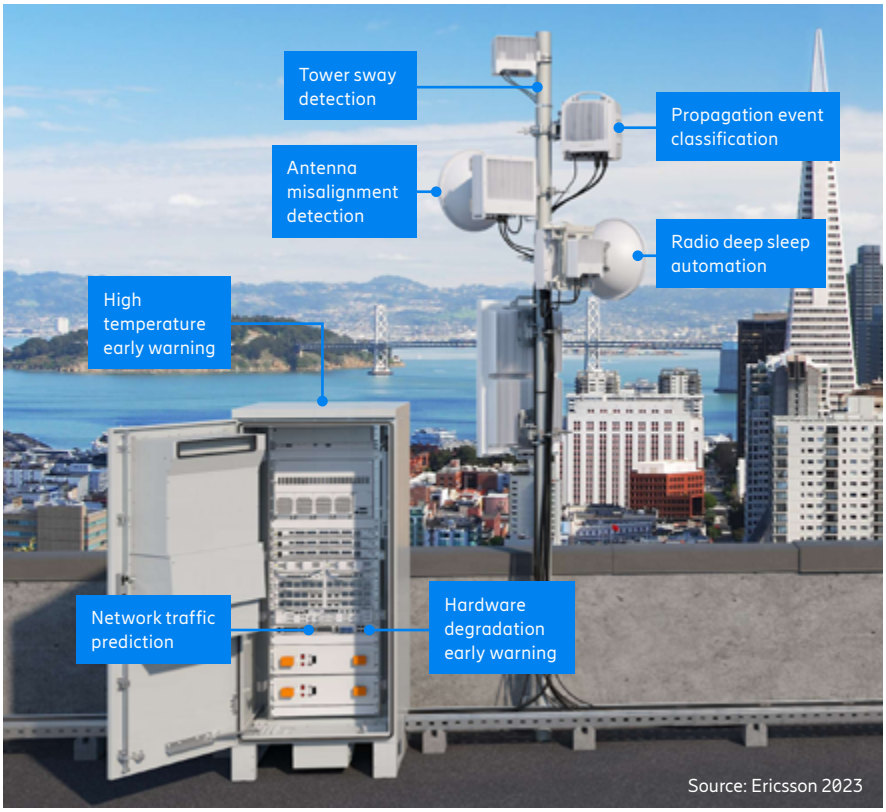
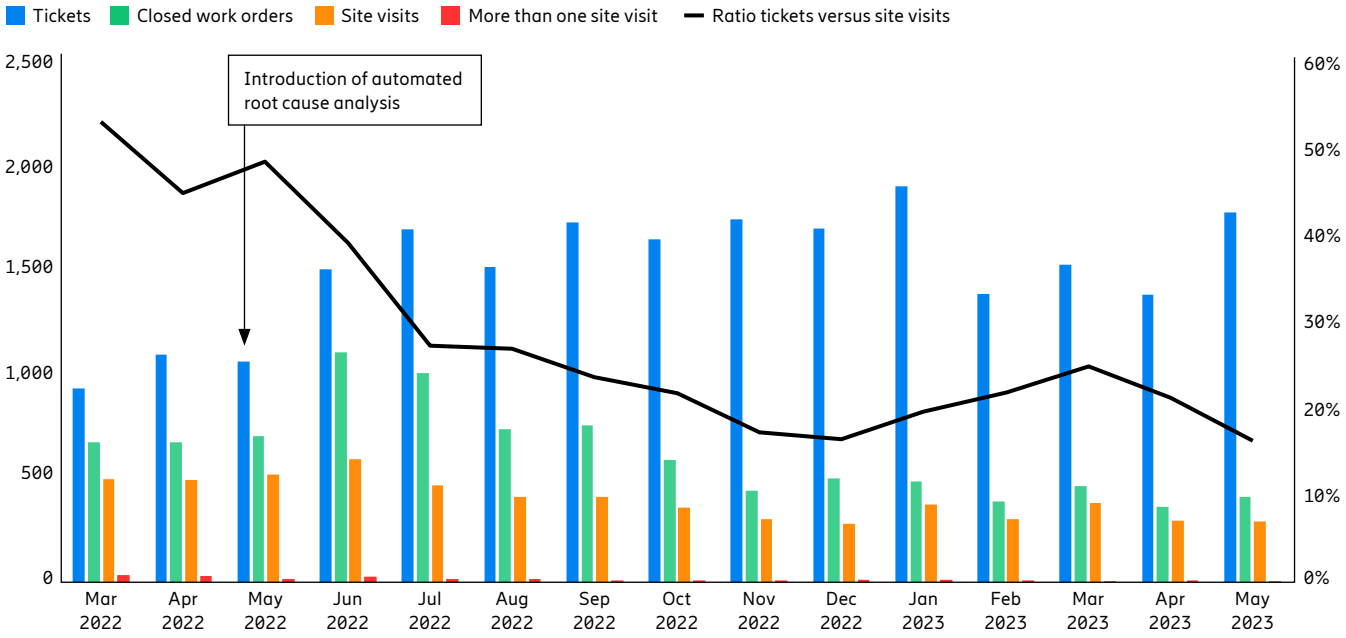


Figure 12: Microwave analytics improve operations



Source: Lineox 2023

Automated root cause analysis applied in Lineox microwave network

When investigating the reasons for site visits, it was concluded that common reasons were software problems, no-fault-found, misalignment of antennas due to strong winds and hardware failures. While the number of site visits to fix hardware failures and antenna misalignments remained the same, software-related and no-fault-found site visits declined significantly as a result of the implementation of automated root cause analysis. The cost savings from the reduced amount of site visits alone were enough to justify the investments in the automated root cause analysis tool.

It is worth noting that the automated root cause analysis tool used by Lineox was based on alarm filtering and performance management data, collected every 15 minutes. With more frequent data collection (for example, every 10 seconds) and by applying AI, it is possible to assess performance management data with greater precision to provide more in-depth root cause analysis. As a result, it will be possible to detect even smaller misalignments and schedule realignments before there is an outage. Thus, AI will enable service providers to create an effective preventive maintenance program to avoid expensive emergency site visits. Moreover, it will also make it possible for service providers to add new use cases such as propagation event classification, hardware degradation, radio deep sleep optimization, and network traffic prediction.

In the 2018 Microwave Outlook report, we discussed for the first time how AI can be used to automatically recognize propagation events impacting received signal quality. Figure 13 shows different propagation events that could cause signal degradation in a real microwave network including rain, temporary line-of-sight blockage and multipath and antenna movements due to wind or solar bending of a telecom tower (thermal sunflower effects). The final solar bending figure shows real measured data from a site in the Middle East in March 2022 and how the signal could have daily strength variations of more than 35 dB. The red (maximum) and blue (minimum) lines illustrate the signal strength measured over a 15-minute interval.

Automation reduces site visits by 40 percent, and AI will reduce it even further.

40%

Events impacting received signal quality are often time-consuming to detect manually and troubleshoot, and may result in unnecessary site visits if not properly identified. Being able to automatically identify and define propagation events is a strong value add.

Source: Ericsson 2023

Pre-emptive maintenance

In addition to the pre-emptive maintenance cases mentioned in the introduction of this article (early warnings of hardware degradation and high temperatures, and network traffic forecasting) there are several other more specialized pre-emptive maintenance use cases. One example is highlighted in the "Opportunities with antenna innovations" article in this Microwave Outlook report, which examines the benefits of using a water-repellent coating to reduce snow and ice on antennas. The coating effect slowly degrades over the years in UV-intense climate zones and AI can be used to monitor when it needs to be refreshed. This will help in planning site visits well in advance, preferably when a site must be maintained for other reasons, or if the customer is planning a service visit to a nearby site.

Another example is the degradation of radio cables. Water in a cable, or bending of a cable, will impact the signal quality of the receiver as well as internal signal levels and can be detected at an early stage with the help of AI. This avoids unnecessary troubleshooting at the site and eliminates the risk of swapping fully functional radio units ("no fault found").

Traffic prediction

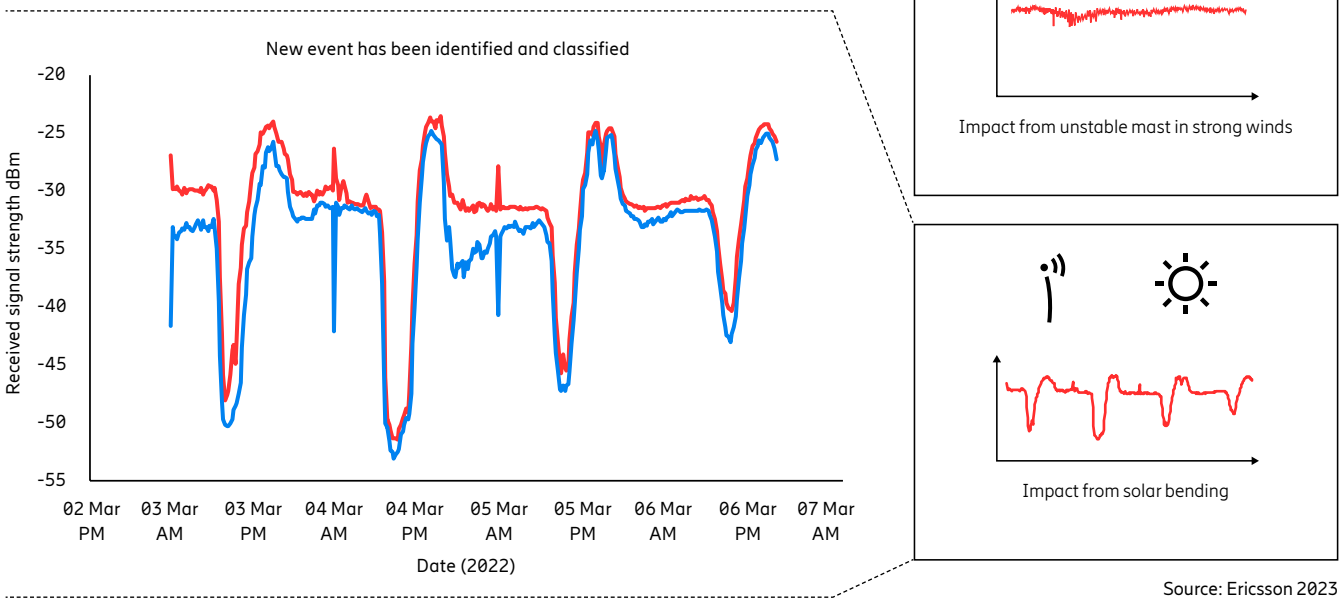
Today, the monitoring of network traffic is often goal-based (using key performance indicators) and focused on the current status, but AI can take this a step further and predict what will happen next by looking at network trends and simulating future network upgrades. For example, the pace of network traffic growth per link can be analyzed to make a projection that helps service providers plan network investments well ahead of time.

Energy consumption – radio deep sleep automation

An AI-enabled network orchestrator, such as a software-defined network (SDN) controller, is a useful tool for closed-loop optimization of a network. Radio deep sleep automation is one example of closed-loop optimization, used to reduce energy consumption and meet network targets on carbon footprint. By leveraging network traffic prediction, one or more carriers in a multi-carrier link are turned off during hours of low traffic load and AI is used to set and manage the windows for sleep hours. The sleep hours may vary depending on whether a site is rural or urban, as well as on the day of the week. Continuous machine learning is ongoing to set the windows correctly, and any solution must be ready to handle a sudden change in the traffic pattern due to local events, for example, a music festival. It is impossible for a human to manually set the correct windows for thousands of links on a daily basis, but an AI-enabled SDN controller can do this very effectively and the savings could be as high as over 20 percent of power consumption.[3]

To summarize, the data and findings from the Spanish operator Lineox show that introducing automated root cause analysis resulted in less time spent on troubleshooting and a reduction of site visits by 40 percent or more. Taking this a step further by applying AI, the operational costs of managing a microwave network can be significantly reduced – leading to better predictions of site visits, optimized microwave network performance, higher energy efficiency and superior end-user experience.

Figure 13: Using AI algorithms to identify events



Source: Ericsson 2023

[3] Ericsson Microwave Outlook Report 2022

About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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