Ericsson Performance Optimizers

April 2022

Network optimization transformed with AI

AI-powered Ericsson Performance Optimizers analyze communications service providers' Radio Access Network (RAN) to resolve network issues efficiently and provide specific parameter change recommendations. Various advanced AI techniques enable fast and accurate optimization of the end-user performance.

Traditionally, network performance monitoring and optimization is handled by a team of engineers supported by rule-based systems, able to cope with limited areas of the network (typically areas with the worst-performing cells). However, with the rapid introduction of new technologies like 5G, mobile networks are growing and becoming more complex. With this speed of change, performance gains become more difficult to achieve, so optimization efforts must evolve into broader and more agile solutions that reach beyond human capabilities.

Introducing Ericsson Performance Optimizers
The first telco-industry, field-proven suite of AI-powered applications to use digital twin technology and deep reinforcement learning (RL), Ericsson Performance Optimizers provide mobile network optimization recommendations to proactively resolve performance issues. The solution also accounts for the invisible changes in the network caused by each addition to the environment, such as new applications, city growth, new sites or user behavior.

To ensure the coverage of automated optimization across mobile networks constantly increases, Ericsson will be periodically releasing new Performance Optimizers that target different issues.

Figure 1: Ericsson Performance Optimizers architecture
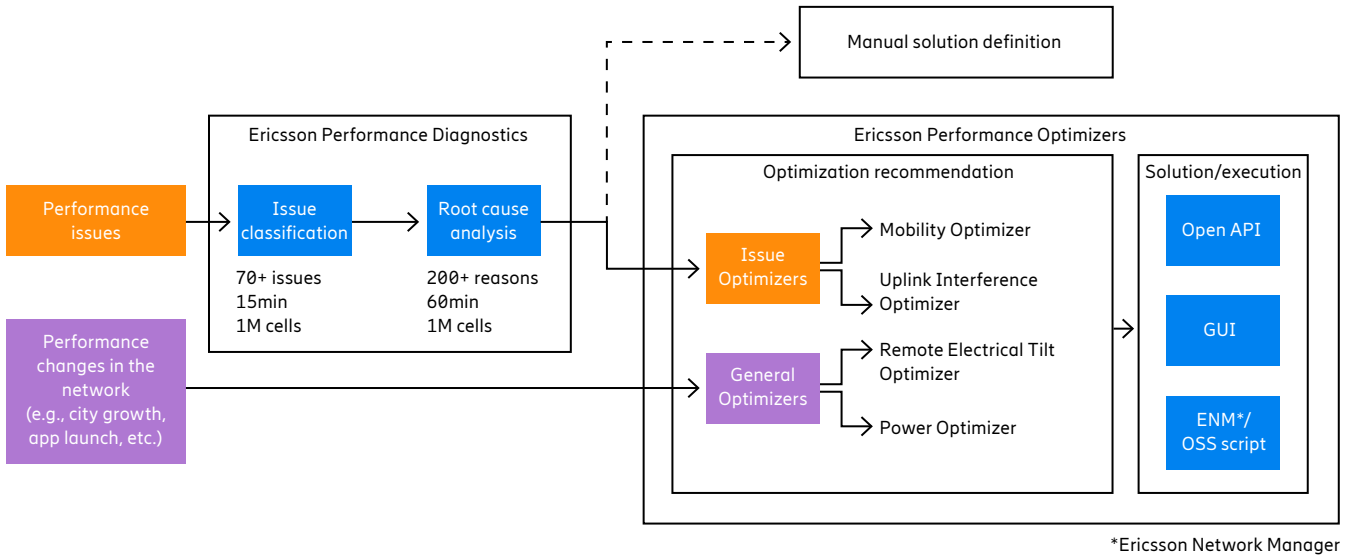

*Ericsson Network Manager

Figure 1 illustrates the high-level architecture of the solution and introduces the two different approaches: Issue Optimizers and General Optimizers. Firstly, the data is collected from multi-vendor network management systems and translated into a normalized format as the AI algorithm is vendor-agonistic by design. After data ingestion, AI analyzes over 160 network key performance indicators (KPIs) per cell, across all cells in the network, processing millions of variables in minutes. AI identifies cells with anomalies and clusters those with similar issues, for example, coverage, handover,
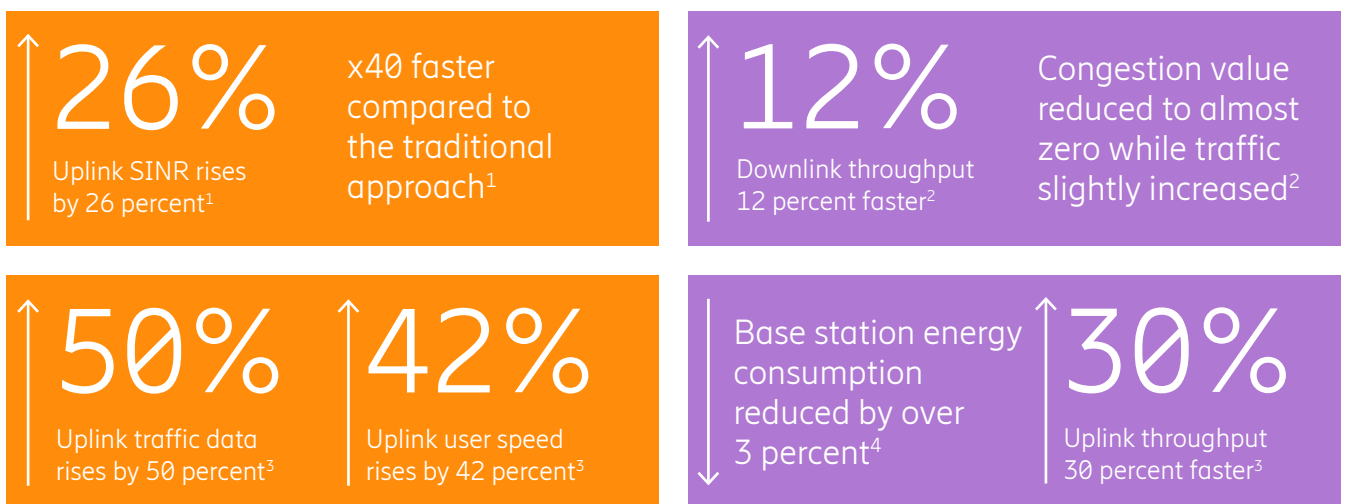
and external interference in over 70 different issue classes. Once issues are classified, analyzed and the root cause is identified by Ericsson Performance Diagnostics, Issue Optimizers then accurately predict network performance improvements and provide one-shot optimization recommendations for targeted cells.

As traffic patterns evolve with new applications, city development or user behavior, network performance may degrade. This is where General Optimizers step in, to proactively optimize network performance and keep up with these

changes. General Optimizers leverage deep RL and also use digital twin technology.

Ericsson Performance Optimizers benefit strongly from advanced AI techniques. The provided key values — automation, scalability, speed, accuracy and consistency in network optimization — enable service providers to maintain and improve their network performance at a higher level. Examples of tangible improvements introduced by Ericsson Performance Optimizers are shown in Figure 2 (all values are from live deployments and proof-of-concepts).

Figure 2: Ericsson Performance Optimizers' success examples

26%
Uplink SINR rises by 26 percent[1]

x40 faster compared to the traditional approach[1]

12%
Downlink throughput 12 percent faster[2]

Congestion value reduced to almost zero while traffic slightly increased[2]

50%
Uplink traffic data rises by 50 percent[3]

42%
Uplink user speed rises by 42 percent[3]

Base station energy consumption reduced by over 3 percent[4]

30%
Uplink throughput 30 percent faster[3]

Based on real customer outcome: [1] Asian service provider. [2] MASMOVIL. [3] Middle Eastern service provider. [4] European service provider.

Our solution

Ericsson's market-proven and AI-powered Performance Optimizers solution provides accurate parameter change recommendations for intelligent and automated network optimization.

Our solution has been used by different service providers globally since its first deployment in 2021.

Service providers benefit strongly from using two Issue Optimizers, Mobility Optimizer and the Uplink Interference Optimizer.

The Mobility Optimizer boosts the performance of cell-edge users with automatic optimization of A2, A3 and A5[1] event triggers for multiple frequency layers.

The Uplink Interference Optimizer improves throughput and phone battery life, while reducing interference through the optimization of uplink power control parameters (PzeroNominalPusch/ PzeroNominalPucch/alpha) in the cell area to maximize uplink signal to interference and noise ratio (SINR). Instead of targeting any specific predefined issue, General Optimizers, which include the Remote Electrical Tilt (RET) Optimizer and Power Optimizer, improve the network as a whole.

The RET Optimizer improves radio frequency quality and coverage while minimizing congestion, and the Power Optimizer lowers radiated power while improving performance and maintaining coverage. Both use cases leverage technologies like digital twins and deep RL.

Digital twin technology accurately mimics the network behavior upon parameter changes, ensuring an approach that minimizes risk and elevates the optimizer's quality to telco grade from day one.

RL is a machine-learning (ML) technique that learns from the network, where an agent (Performance Optimizer) interacts with the environment and takes actions towards a long-term goal, then adapts the optimization based on the characteristics of each cell and its influencing area.

Figure 3: Ericsson Performance Optimizers architecture with RL and a digital twin
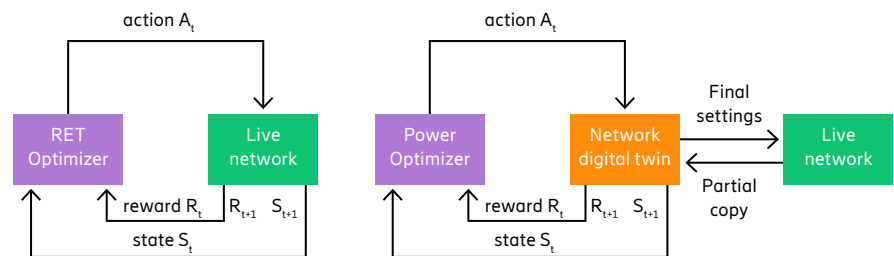
- RL[2] agent-based solution.
- Neural networks propose actions to maximise the long-term reward and receive feedback from the environment through the state, as input for the next action.

- Digital twin allows safe interaction with the network. Highly granular call trace in big data architecture enables offline optimization.

Key benefits

Automated optimization
Ericsson Performance Optimizers enable a systematic and fully automated parameter-optimization approach, boosting scalability and performance.

Ericsson domain expertise
Based on insights from daily challenges, our experts are experienced in developing leading AI technology that maximizes network performance and operational efficiency. Due to Ericsson's scale, we have access to vast amounts of highly granular live traffic data, which makes our software perform with exceptional precision.

High prediction accuracy
The field verifications show an issue classification accuracy of 98 percent, with the solution's prediction algorithms accurately identifying which cells to tweak for maximum performance impact.

Learnings from the live network
Digital twin technology and pre-training techniques enable a risk-free approach based on live traffic patterns. In a complete zero-touch approach, RL agents learn on their own after each change and determine the next change towards the long-term goal.

Leveraging AI capabilities
When a cell is affected by a combination of issues, it is hard for an engineer to identify them all upfront and resolve them at once. Leveraging from non-supervised ML algorithms, the system can detect and optimize both hidden and new issues.

Scalability and speed
With impressive scalability and speed, the solution scans the whole network every day, analyzes millions of cells in minutes, and provides recommended changes daily.

[1] Controls the trigger points for UE to move to a different LTE frequency for improved performance
[2] Read the Ericsson Mobility Report to learn more about reinforcement learning and digital twins:
  https://www.ericsson.com/en/reports-and-papers/mobility-report/articles/reinforcement-learning

About Ericsson

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