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The Energy Savings Imperative for Mobile Networks

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Telecom operators are some of the biggest energy users in the world, responsible for up to three percent of global energy demand. Unsurprisingly, telecom energy usage—and the carbon footprint it leaves behind—is predicted to grow along with the rise in 5G technology and its expected increased traffic.

Power savings in mobile networks is becoming a clear priority for most operators for several obvious reasons: energy prices are soaring, good corporate citizenship requires green initiatives, and there is significant room for improvement in optimizing the existing power savings features usage.

The technological building blocks are there: extensive power savings features provided by original equipment manufacturers (OEMs), AI-based agile decision-making machinery, and a way to measure and mitigate customer impact. Putting all these technologies together, however, and easily applying operator-specific strategies 24/7 in a multi-vendor and multi-technology environment is a challenge.

The current situation

In the last couple of years, we have seen increased news from operators on green initiatives, including more power-efficient products being sourced from OEMs. Between 2015 and 2021, the focus has been on modernization of base stations, which according to GSMA are known to be the main culprit of high-power consumption.

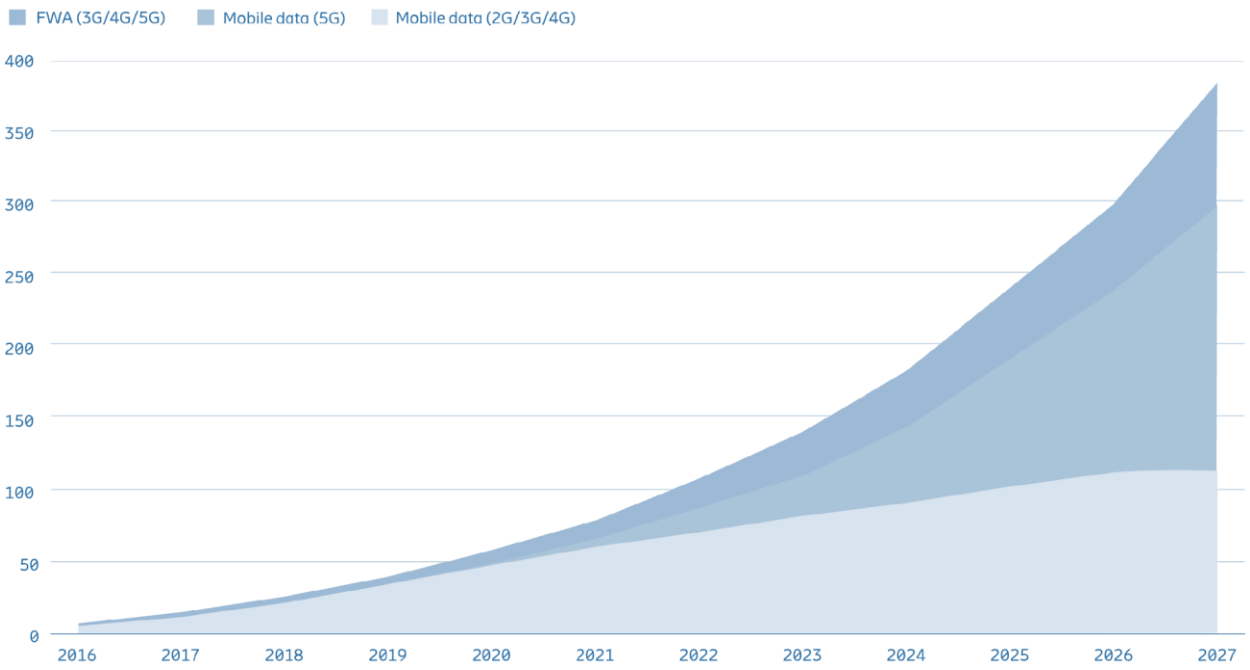

Figure 1: Global Mobile Network Data Traffic (EB per month)

According to this same resource, energy costs are between 20 to 40 percent of all network OPEX, accounting for estimated $3 billion per year in the US and $7 billion in Europe (estimation based on Tupl's experience and report by Cable.co.uk).

In addition, the GSMA study cited above, based on data from seven operators, says the radio access network (RAN) consumes 73 percent of the energy used, while 13 percent is consumed for core, 9 percent for data centers, and 5 percent for the remainder. While there is a significant effort in optimizing data centers and core network power usage, the RAN matters the most.

Costs are not the only concern, however. Telecom operators already account for two to three percent of total global energy demand, often making them some of the most energy-intensive companies in their geographic markets. According to McKinsey, as operators' energy consumption expands, so will their carbon footprint, hurting not just the environment but also their reputation, particularly among the expanding class of socially responsible investors.

But this does not have to be the case. All mobile operators have considerable scope to cut energy costs and consumption. In current mobile networks, for example, transferring data only consumes around 15 percent of energy. Some 85 percent is wasted because of heat loss in power amplifiers, equipment kept idling when there is no data transmission, and inefficiency in systems such as rectifiers, cooling systems, and battery units.

Currently, it is estimated that only about 16 percent of networks have any activation of OEMs' Power Savings Features (PSFs). These are defined as a piece of software in one or more types of RAN elements that provides specific functionality to reduce the energy consumption compared to the default performance of the equipment.

So why are mobile network operators (MNOs) not using PSFs to their full extent? We can mention three main reasons why mobile operators might not be using PSFs:

Traditional focus on RAN performance

Mobile network operators have traditionally put all their effort on RAN performance, competing to be the top performers in their respective markets' benchmarks. This focus pushed the already developed OEM's Radio PSFs into the background. Most MNOs have been reluctant to activate radio PSFs at all, as almost all engineering departments are measured only by network KPIs. In case of PSFs, there is always a lingering doubt about whether there is an impact on the performance.

Transition from legacy technologies

Another issue is the transition between technologies, which discourages the investment of energy-saving efforts in technologies that will soon be disconnected (3G before 2G), as well as in new technology (5G), in which the current focus is on deployment and market adoption.

Lack of optimization of PSF capabilities

Finally, there is PSF optimization. It is possible to have PSFs active at every RAN site but, like any other radio feature, most of them can be optimized. PSFs can get activated with default settings. This one-size-fits-all approach may be conservative enough to create confidence that no single site or cluster is degraded across the entire network, but it falls short in most sites in the energy savings target.

Despite these reasons, there is a huge potential for energy savings to be realized by ensuring that all possible actions are implemented and optimized. There are currently up to four technology generations consuming energy: even if some of them are going to be switched off soon, it is possible to cut down consumption starting today.

An ideal solution to control energy consumption

There are some recommendations that are worth discussing to maximize the use of PSFs. These recommendations are based on three essential concepts.

AI is the way

As stated in an NGNM report, "Here, Artificial Intelligence (AI) could play an important role. By predicting and learning the traffic behavior, AI algorithms define the activation/deactivation of sleep mode functionality and site energy management without impacting the overall performance, including Quality of Experience (QoE). AI is still in an early phase, and more development and research are needed to reach its full potential. AI-based energy saving solutions can greatly increase the energy performance of cellular networks."

Low latency

The on-demand resource allocation requires minimum latency between the data collection that characterizes the current state of the system, the execution of the decision-making process, and the implementation of the corresponding action in the network.

Low latency in this observation-reaction cycle leads to a responsive network adaptation to traffic changes that ensures a minimum power consumption without impacting the user experience. For instance, when user traffic starts to increase significantly, then additional radio resources are seamlessly enabled.

Dynamic and multi-vendor orchestration

Another advantage of this ideal approach is the continuous orchestration of the different possible actions to take. The selection, sequence, and timing of actions are essential to maintaining the goal of optimally reduced energy consumption with no impact on the customer network quality.

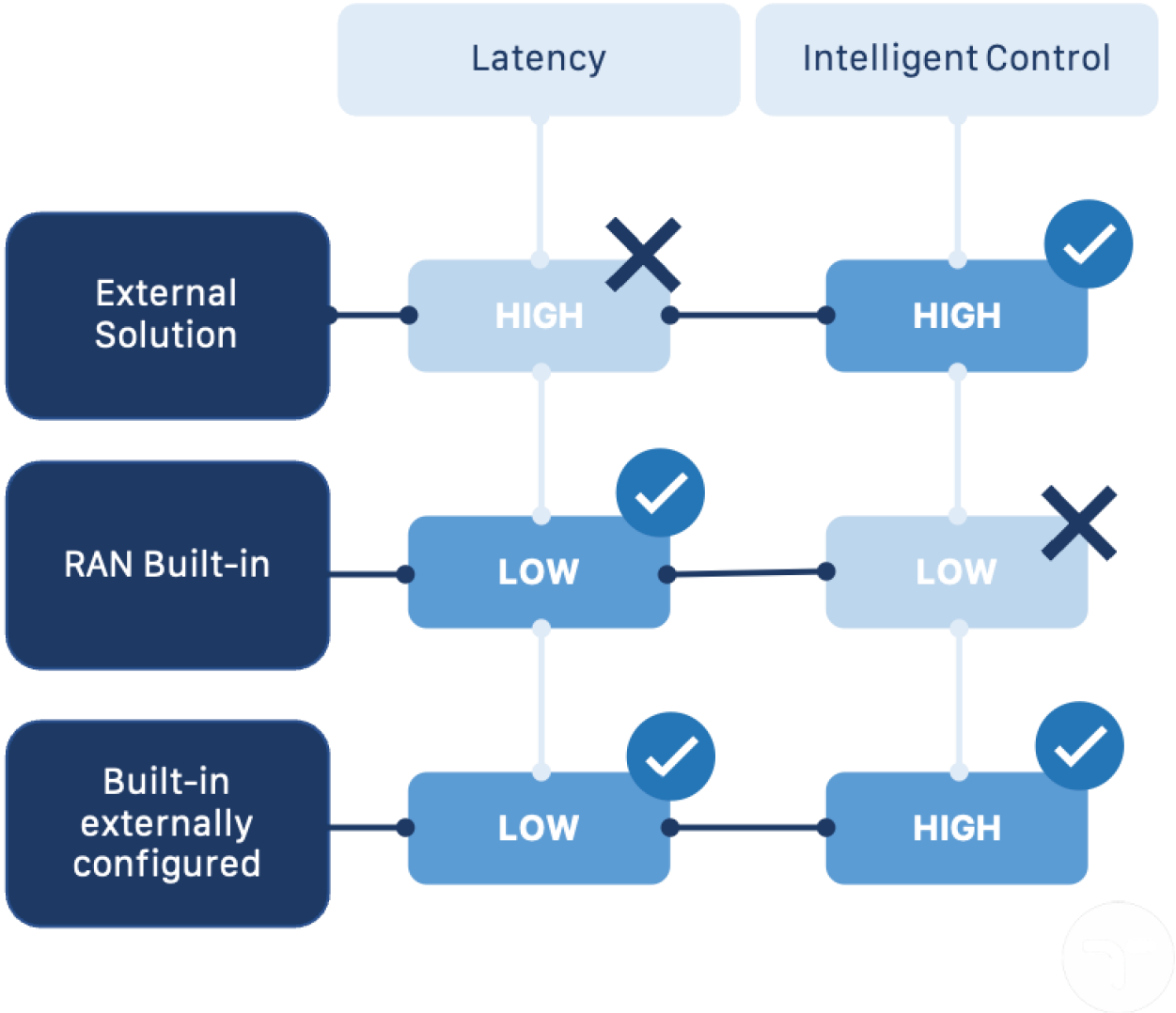

Figure 2: Outer loop control

Furthermore, an open orchestrator approach allows any MNO to implement their own power saving strategy, such as different levels of aggressiveness between technology and frequency layers.

to continuously measure the performance of the OEMs. In fact, the multivendor approach has already proved to improve OEMs' proprietary software for power saving features. We can affirm that low latency (the assessment of the time it takes for each approach to react to traffic pattern changes by activating or deactivating RAN resources) and intelligent control (the ability to adapt the energy-saving decisions to the characteristics of each network element to maximize the overall energy reduction) are the two key pillars for an ideal energy-saving automation solution.

The strategy to achieve more energy savings and better network performance and customer experience should balance performance of these two elements. Out of the several approaches one could take to energy savings in network operations, we affirm that the best strategy is a RAN built-in configured by a non-real time external solution. In this solution there are two main sub-processes involved: OEMs' power saving features and an external system that continuously configures them in a cyclic, non-real-time manner.

On the one hand, the PSFs ensure rapid execution of the observation-reaction cycle. This would be an inner-loop control.

On the other hand, the non-real time external system configures those radio features in such a way that the power savings are maximized in each network element, maintaining the user experience. This would be an outer-loop control.

There are examples of operators that are already implementing this approach, such as Kyivstar in Ukraine. Kyivstar was looking for a power-saving solution that could guarantee no impact on the customer experience, but also provide a transparent system in which engineers could verify the AI-based decisions—a system to provide anomaly detection on any deviations on KPIs and customer experience, and automatic actuation scripts for activation and deactivation of the power-saving features. Last, but not least, the solution needed to be able to operate in their multi-vendor and multi-technology environment. After applying AI to automate PSFs, the hourly shape of the energy consumption decreased by more than 15 percent compared to the baseline for Kyivstar.

Clearly, the telecommunications industry is starting to consider energy efficiency more seriously and is taking steps to reduce the impact of high energy consumption, such as using renewable energy sources. Undoubtedly, artificial intelligence is and will be the key technology enabling power savings. The AI-driven software approach will be the catalyst of the fundamental change in this domain, ensuring control and reduction of energy consumption. All this needs to happen without impacting the customer experience.

It is already possible today to achieve this with proven technology: AI-based solutions are available on the market for immediate implementation. Every month that passes is a lost opportunity to serve the planet and serve the shareholders of the MNOs.