Giesecke+Devrient

A simple guide to SGP.32 and the future of IoT connectivity

Executive summary

IoT has quietly moved from experimentation to infrastructure. Connected devices now underpin everything from global logistics and transportation to energy, healthcare and smart cities. As deployments scale up into the millions and device lifecycles stretch over a decade or more, one issue has become impossible to ignore: connectivity was never designed with IoT's realities in mind. Giesecke+Devrient (G+D) provides a simple guide to the newly-released SGP.32 specification which introduces new, flexible potential for IoT connectivity.

For years, the industry has tried to adapt traditional SIM technology to fit IoT use cases. While this approach enabled early growth, it has also introduced hidden costs, operational rigidity and long-term risk. SGP.32, the latest eSIM standard from the **GSMA**, represents a fundamental rethink of how cellular connectivity should work for IoT. Rather than being a marginal technical upgrade, it signals a shift towards a more flexible, resilient and future-proof IoT ecosystem.

The connectivity problem hiding in plain sight

Connectivity problems are often overlooked in IoT. Devices connect to cellular networks, data flows to platforms and applications deliver insights. In practice, however, connectivity decisions made at deployment can constrain an IoT solution for its entire lifetime.

Traditional IoT SIM cards are typically provisioned with a single network profile before deployment. Once the device is installed — whether on a vehicle, container, utility meter or piece of industrial equipment — changing that connectivity can be expensive or even impossible. For globally deployed devices, this often leads to complex logistics, costly on-site maintenance visits or the need to over-engineer connectivity contracts upfront in anticipation of unknown future needs.

Vendor lock-in compounds the issue. When connectivity is tightly coupled to a single operator or provider, businesses lose negotiating power and flexibility. Coverage gaps, pricing changes, regulatory shifts or service degradation can all become strategic risks over long device lifecycles. As IoT deployments scale, these constraints directly impact total cost of ownership and operational resilience.

Traditional IoT SIM cards are typically provisioned with a single network profile before deployment

Why earlier eSIM standards fell short for IoT

Embedded SIM (eSIM) technology has been around for a while. The M2M eSIM standard, SGP.02, found early success in automotive use cases. It proved that remote SIM management could work with large device fleets, but the cost of integrating new mobile network operators and the reliance on SMS for provisioning and management made this a barrier to wider adoption.

On the other hand, consumer eSIM models assume the presence of a user interface, regular human interaction and relatively short device lifecycles. IoT devices, by contrast, often operate unattended, with limited processing power, constrained energy budgets and lifespans measured in years or even decades. Many are deployed in remote or inaccessible locations, where physical intervention is costly or impractical.

As a result, earlier eSIM implementations in IoT added complexity without fully solving the underlying problem. What the industry needed was a purpose-built standard, one that treated remote connectivity management as a core requirement rather than an adaptation. That's where SGP.32 comes in.

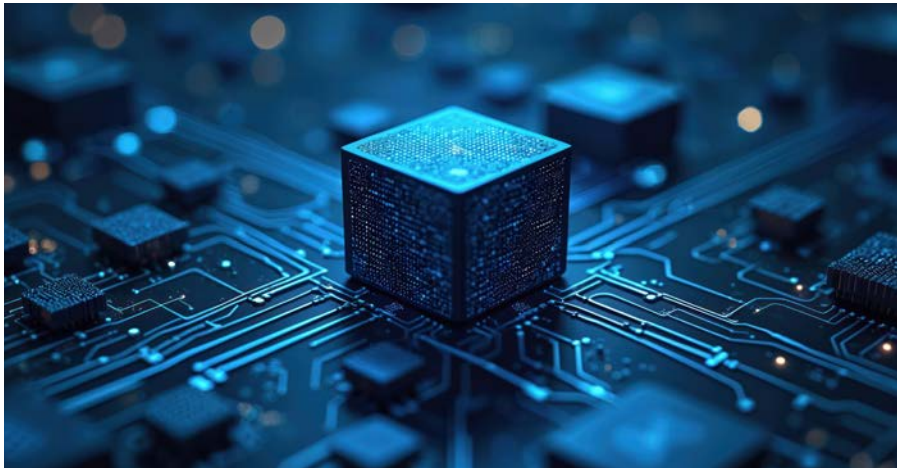
Embedded SIM (eSIM) technology has been around for a while. The M2M eSIM standard, SGP.02, found early success in automotive use cases

What is SGP.32, in simple terms?

SGP.32 is an eSIM standard defined by the GSMA specifically for IoT deployments. At its most basic level, it allows IoT devices to securely download, activate and switch cellular connectivity profiles over the air, without requiring costly physical SIM changes or user interaction.

The key difference lies in how SGP.32 is designed around IoT realities. It supports devices with no screens, no keyboards, minimal power availability and long operational lifetimes. Connectivity can be managed remotely at scale, across fleets of devices, using lightweight and efficient processes.

In practical terms, SGP.32 separates the device hardware from a fixed connectivity decision. Devices can be manufactured, deployed and operated without being permanently tied to a single network or operator. Connectivity becomes a flexible resource that can evolve alongside the business and its operational needs.



How SGP.32 works behind the scenes

Once a profile is active, the device behaves like any other cellular-connected endpoint

SGP.32-enabled SIMs can store and manage multiple connectivity profiles. Using a centralised remote SIM management system, operators can download new profiles to devices over the air. These profiles can then be activated, deactivated or replaced as needed, without physical access to the device. The process is designed to be efficient and secure, even for devices operating on low bandwidth or intermittent connections.

Once a profile is active, the device behaves like any other cellular-connected endpoint. The difference is that if coverage, pricing, regulatory requirements or business priorities change, connectivity can be updated remotely. This decoupling of hardware and connectivity is what makes SGP.32 such a powerful enabler for long-term IoT scalability.

However, to fully understand why SGP.32 matters, it is important to introduce other concepts that are often overlooked: the eIM and the IPA.

eIM: The invisible engine behind SGP.32

The eIM, or eSIM IoT Manager, is the operational layer that makes SGP.32 usable at scale. While SGP.32 defines how eSIM profiles can be securely provisioned and managed for IoT devices, the eIM defines who manages them and how those processes are orchestrated across large device fleets. In simple terms, if SGP.32 is the standard, the eIM is the system that brings that standard to life.

The eIM operates entirely in the background, acting as the central control plane for IoT connectivity. It manages the lifecycle of eSIM profiles on devices, handling tasks such as initial bootstrap connectivity, profile downloads, activations, deactivations and switching between operators. Crucially, it is designed for IoT-scale operations, where thousands or millions of devices may need to be managed with minimal human intervention. This makes the eIM essential for unattended, low-power and long-lived IoT deployments.

With SGP.32 and the eIM working together, connectivity becomes a software-controlled resource. Decisions about which network to use, when to switch or how to optimise coverage can be made throughout the device lifecycle, not just at the moment of deployment.

IPA: The hands-on assistant on your device

The IoT profile assistant (IPA) is a small software programme that helps IoT devices manage the SIM securely. It acts as a middleman, making sure the device can safely communicate with the eIM and carry out tasks like downloading new IoT profiles.

There are two ways the IPA can be set up, according to SGP.32:

1. IPAd – IPA on the device

- Runs directly on the device's operating system.
- Gives device manufacturers more control over how the IPA works.
- Requires the device manufacturer to handle testing and certification, which can take more effort.

2. IPAe – IPA inside the SIM

- Integrated with the SIM operating system.
- Often comes pre-certified, reducing the manufacturer's work.
- Can speed up product development and time-to-market.

The key difference between the IPA and the eIM is where they operate and what they control. The IPA runs on the device or SIM and acts as a local assistant, executing commands and managing profiles directly on the device.

In contrast, the eIM lives in the cloud or network and serves as the central manager, sending commands and controlling the lifecycle of embedded universal integrated circuit cards (eUICCs). Essentially, the eIM is the 'boss' giving instructions, while the IPA is the 'assistant' carrying them out on the device. Both elements are the core enablers of SGP.32.

Benefits of SGP.32 for your business

SGP.32 is often described as a technical standard, but its real impact is felt at a business level. By changing how connectivity is managed over the lifetime of an IoT deployment, it delivers clearer control, lower risk and greater flexibility.

1. Connectivity that adapts as your business grows

With SGP.32, connectivity can evolve alongside the business. Devices operating across different regions can use the most appropriate local network without requiring new hardware variants or complex SIM logistics. When fleets expand into new countries or markets, existing devices can be adapted remotely rather than replaced.

This makes global growth simpler and faster, while avoiding the operational overhead traditionally associated with multi-country IoT deployments.

2. Lower operational costs and simpler fleet management

One of the most immediate benefits of SGP.32 is the removal of physical SIM handling. There is no need for SIM swaps, on-site visits or device recalls simply to change connectivity. This significantly reduces operational costs, minimises downtime and simplifies the management of large device fleets. For devices deployed in remote or hard-to-access locations, this benefit alone can have a major impact on total cost of ownership.

In addition, SGP.32 profiles are designed to be more readily integrated across operators and platforms, without the need for significant custom integration effort. This lowers the commercial and technical barrier to onboarding new connectivity providers, further reducing costs and improving flexibility over the lifetime of a deployment.

3. Reduced vendor lock-in and stronger negotiating power

SGP.32 gives organisations greater independence from individual network operators or connectivity providers. Because profiles can be changed over the air, businesses are not locked into a single provider for the full lifetime of a device.

This flexibility allows organisations to renegotiate contracts, introduce redundancy or switch providers as coverage, pricing or service quality changes. Over long device lifecycles, this can translate into meaningful cost savings and improved resilience.

4. Future-proofing against regulatory and market change

Regulatory requirements around roaming, data residency and certification continue to evolve globally. SGP.32 provides a practical way to respond to these changes without disrupting deployed assets.

Instead of redesigning hardware or managing complex logistics, organisations can adapt connectivity remotely. This future-proofing is particularly valuable for IoT deployments expected to remain in service for many years.

Use cases where SGP.32 makes a tangible difference

The benefits of SGP.32 become most apparent in deployments where scale, mobility and longevity are critical. In automotive and telematics, vehicles routinely cross borders and operate in diverse network environments. SGP.32 enables seamless connectivity transitions without manual intervention, supporting applications such as real-time diagnostics, fleet optimisation and predictive maintenance.

Asset tracking and logistics provide another clear example. Containers, pallets and high-value equipment often move across regions and operators. With SGP.32, connectivity can follow the asset rather than being constrained by its original deployment location.

Industrial IoT and smart infrastructure deployments also stand to benefit. Devices monitoring utilities, environmental conditions or critical infrastructure may remain in place for decades. SGP.32 ensures that connectivity can evolve alongside technology roadmaps, business models and regulatory frameworks.

The benefits of SGP.32 become most apparent in deployments where scale, mobility and longevity are critical

A foundation, not a feature

It is tempting to view SGP.32 as a feature of connectivity platforms or devices. In reality, it functions more like a foundational infrastructure. Much like how cloud computing simplifies hardware design for developers, SGP.32 removes connectivity constraints from IoT solution design.

This shift allows organisations to focus on data, insights and outcomes rather than the mechanics of keeping devices online. It also encourages healthier ecosystems, where hardware manufacturers, connectivity providers and application developers can innovate without forcing long-term lock-in.

Looking ahead: SGP.32 and the future of IoT

The purpose-built approach of SGP.32 reflects a broader industry shift towards treating connectivity as a lifecycle capability rather than a one-time configuration choice. From the beginning of 2026, this shift becomes fully tangible. Until now, **Giesecke+Devrient**'s (G+D) SIM hardware and management platforms were SGP.32-ready. Now, so is G+D's connectivity service, meaning all layers of our IoT connectivity stack are now aligned to the same GSMA standard.

This means that eSIM hardware, platforms and connectivity are now all natively built around SGP.32. Rather than operating a mixed or transitional setup, device makers and solution providers can work with a fully SGP.32-native IoT connectivity stack from end-to-end. And what's more, we own every layer of that stack, rather than being assembled from multiple vendors. This end-to-end ownership creates a more reliable and predictable foundation for customers, with fewer integration challenges, more consistent behaviour across the stack and clear accountability throughout the entire connectivity lifecycle.

It also enables a more flexible engagement model. Device makers can work with a single provider across the stack, selecting only the elements they need, while benefiting from consistent architecture and interfaces. Support for both IPAd and IPAe further extends SGP.32 connectivity to a broader range of devices, including more constrained IoT use cases. In addition, the IPAe is capability aware, so if a device enabled with IPAd is used now, or upgraded in the future, the IPAe disables itself. The solution is future-proofed.

Taken together, this marks an important step in the evolution of IoT connectivity. By aligning hardware, platforms, and connectivity around SGP.32, the industry moves closer to a future where connectivity is simpler to manage, easier to scale and better suited to the realities of long-lived, globally deployed IoT solutions. It also reinforces G+D's position as a specialised IoT MVNO focused on next-generation eSIM connectivity, built around standards that are designed for what IoT has become and where it is heading next.

www.gi-de.com