# Strategic Role of eSIM Infrastructure Ownership in Navigating SGP.32 Deployments

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Executive Summary

The Internet of Things (IoT) is shaping the future of connectivity, with billions of devices expected to connect to global networks in the coming years. As digital transformation accelerates worldwide, industries are being redefined by unprecedented levels of connectivity. According to Counterpoint Research, cellular IoT connections are projected to grow at a CAGR of **10%**, reaching **6.3 billion by 2030**.

Technology-wise Global Cellular IoT Connections, 2023 vs 2030 (In Billions)
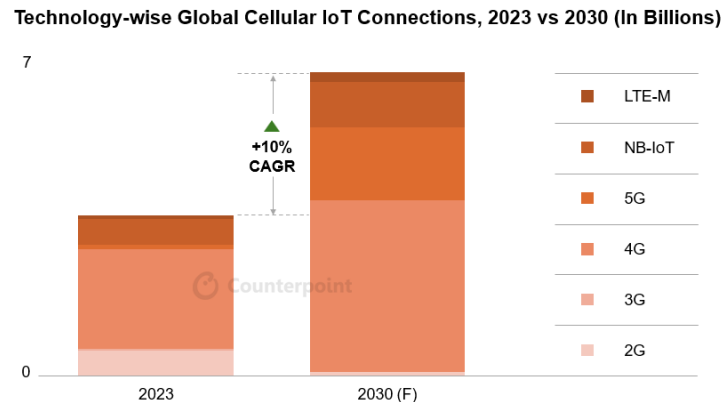
Source: Counterpoint's Global Cellular IoT Connections Tracker and Forecast, 2018-2030

The rapid growth of IoT, while offering significant opportunities for mobile network operators (MNOs), also poses challenges, particularly in addressing diverse demands for robust, scalable connectivity in remote and high-mobility environments. **Traditional SIM** cards often fall short in delivering flexibility and seamless global connectivity. **eSIM** technology fills this gap by embedding SIM functionality into devices to enable over-the-air network switching, enhanced security, reduced costs and sleeker designs. Despite the product-technology fit, eSIM's adoption remains limited, with fewer than **200 million** of the 3.3 billion IoT connections in 2023 using eSIM, partly due to restrictive **M2M specifications**. The new **SGP.32** standard addresses these limitations with cost-effective, scalable solutions, enabling MNOs to harness the full potential of cellular IoT. Adapting to this standard will require MNOs to navigate new business challenges, plan strategically and implement **robust infrastructure**.

Hosting eSIM provisioning and management software in-house can offer distinct benefits, such as enhanced control, greater customization and long-term cost efficiency, especially appealing to companies operating under unique constraints or with varied operational needs.

This white paper examines the new IoT standard and explores the **key differences** between outsourcing eSIM infrastructure and deploying it in-house, providing critical insights for service providers to strategically plan their IoT deployments.

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Advantages of SGP.32

Introduced in 2013, the first eSIM specification, SGP.02, was designed specifically for M2M devices. These relied on a **complex architecture** requiring predefined contracts and provisions and operated on a "push" mechanism using SMS-based communication for remote profile management.

The second eSIM specification, **SGP.22**, focussed on consumer devices with active user interfaces, like smartphones, smartwatches, tablets and notebooks.

GSMA's latest specification, **SGP.32**, addresses the requirements of modern, **constrained IoT devices** with significant improvements, benefiting MNOs, IoT device manufacturers, enterprises and end users.

Advantages of New SGP.32 Over Legacy SGP.02		
Feature	**SGP.02 (M2M)**	**SGP.32 (IoT)**
Target Use Case	Designed for low-complexity deployments like utility meters and kiosks.	Focused on dynamic deployments such as automotive, industrial, and remote sensors.
Architecture	Centralized architecture with complex integration requirements.	Modular and decentralized architecture with simplified integration, optimized for diverse IoT requirements.
Protocols	Mandatory support of SMS and HTTPS.	Support of lightweight protocols like CoAP and DTLS.
Deployment Flexibility	Suited for static and long-term deployments with minimal need for operational adjustments.	Highly adaptable, enabling remote provisioning and lifecycle management across dynamic IoT environments.
Scalability	Limited scalability due to centralized architecture and static provisioning.	Built for massive IoT deployments, with low operational overhead.
Cost Efficiency	Higher costs due to reliance on centralized systems and rigid infrastructure.	Optimized for cost efficiency with decentralized management and reduced operational complexity.

The SGP.32 specification creates two key functions for profile management – eSIM Remote IoT Manager (eIM) and IoT Profile Assistant (IPA) – while utilizing the widely adopted SM-DP+ infrastructure as defined by SGP.22.

The eIM serves as a standardized management tool, simplifying the deployment and management of large IoT device fleets by allowing profile updates and other interactions to occur remotely.

This feature eliminates the need for direct user engagement, making it particularly suitable for IoT applications where devices lack user interfaces. Configuration options allow the eIM to be set up during manufacturing or later in the field, offering unprecedented flexibility for IoT deployments.

SGP.32 Architecture

The IPA acts as an intermediary, handling local profile management tasks and ensuring that devices can seamlessly switch between network profiles. Available in two variants – IPAd (device-based) and IPAe (embedded within eUICC), the IPA enables SGP.32 in devices to connect to the most appropriate network provider.

Self-hosted eSIM software – even more relevant for SGP.32

The provision of eSIM management platforms for M2M/SGP.02 and Consumer/SPG.22 has been done through an "as-a-service" model from established SIM manufacturers. However, the digital nature of eSIM has allowed an increasing number of service providers to enter the market, integrating self-hosted eSIM software into their stack with off-the-shelf products from remote eSIM provisioning (RSP) software vendors.

With the introduction of SGP.32, self-hosting of the eIM component instead of consuming it as a service will become an attractive, strategic option for organizations in the IoT ecosystem that, for example:

- operate in regions with stringent security and localization regulations.
- deliver specialized IoT solutions for verticals like healthcare, automotive, energy and agriculture.
- manage large-scale IoT deployments, handling massive IoT device fleets with complex scalability and control needs.

By managing infrastructure in-house, these organizations can address several challenges associated with the "as-a-service" model, such as avoiding vendor lock-in and the need to have more control over data and service.

Negating risks of eUICC-vendor-specific silos

eUICC-vendor-specific silos are established where parts of eSIM solutions are designed to work only with **specific manufacturers**, creating a **vendor lock-in**. The first GSMA standard, SGP.02 for M2M, though open in theory, caused these silos as an unintended consequence of its complex integration requirements. Even though this has been addressed in SGP.32, eUICC vendors nonetheless have incentives to build in proprietary features only available within their ecosystem of eUICC hardware and backend management solutions, while being interoperable with a subset of standardized features.

Vendor silos make it **harder** for organizations to adopt new, innovative technologies or implement changes rapidly, limiting the options for migration away from the vendor ecosystem. This can have an impact on the cost structure of the IoT operation in the future. As IoT technologies evolve, organizations locked into hardware-specific solutions may miss out on new capabilities or face challenges in integrating modern connectivity options.

A fully interoperable eIM (eSIM IoT Manager) solution that operates **independently** of any specific eUICC hardware and operating system can address these challenges. By providing a universal eSIM management framework, it is forward-compatible with evolving standards and new eUICC hardware releases. It allows organizations to choose eUICC hardware from **multiple vendors** and enables easy vendor switching or multi-vendor strategies. Organizations can also **leverage competitive pricing**, **regional expertise,** and **emerging technologies** as they arise. This approach maximizes operational efficiency, minimizes risk and enables IoT ecosystems to evolve with technological advancements.

Maximum control over data, implementation and service level

When software is hosted on-premises or in a private cloud, an organization has direct oversight of security protocols, data access and compliance, allowing it to customize protection measures to meet specific regulatory standards.

This allows for more extensive customization to optimally align with the organization's unique business needs. The flexibility enables the organization to adjust features, integrate additional services or apply modifications without depending on a third-party provider's roadmap or approval.

Last but not least, relying on an external service provider introduces potential downtime if the provider faces issues, whereas in-house hosting enables the organization to implement its own failover and redundancy measures, keeping operations stable and minimizing disruption.

Counterpoint's OWNERS framework

Both approaches to eSIM infrastructure have their advantages and challenges. Given the rapidly evolving IoT landscape and the growth ahead, Counterpoint recommends the **OWNERS** framework. This structured approach helps organizations effectively establish and manage their IoT deployments for long-term success. By breaking down the process into clear, actionable steps — Outline Objectives, Weigh Options, Navigate Deployment, Enable Skillset, Run Pilots, Scale and Sustain, this framework guides operators to align their strategies with business goals, optimize decision-making and ensure seamless implementation. It helps operators navigate the complexities of deployment, address skill gaps and establish scalable, sustainable operations, enabling them to meet evolving market demands and gain a competitive edge in the dynamic IoT ecosystem.

O	Outline IoT connectivity objectives that align with the organization's long-term strategy and cater to the unique needs of service operators' clients.
W	Weigh options and assess the pros and cons of eSIM software deployment methods—'as-a-Service' versus 'in-house'—by prioritizing key factors such as enterprise IoT customer needs and compliance with regional data localization laws.
N	Navigate the SGP.32 deployment by planning a phased rollout that ensures seamless simultaneous operation with existing systems and facilitates a smooth, eventual transition from SGP.02 deployments to the latest standards.
E	Enabling the right skillset is crucial, whether eSIM infrastructure is outsourced or managed in-house. Outsourced models require expertise to coordinate with partners, while in-house strategies demand investment in internal capabilities for independent platform management.
R	Run pilots to gather insights on functionality, user experience, and integration challenges, ensuring the platform is refined and optimized before full-scale deployment.
S	Scale operations to support millions of IoT devices by continuously monitoring and upgrading systems for compliance and improvements. Build strong partnerships with hardware vendors and enterprises to enhance and expand platform capabilities.

The OWNERS framework serves as a guideline that can assist organizations in planning their upcoming SGP.32 related deployments, which in turn will play a very crucial role in boosting eSIM adoption in the Cellular IoT landscape.

Looking Forward

The IoT ecosystem will encounter several challenges in adopting SGP.32 standards for large-scale IoT deployments, including divergent industry perceptions of the standards, device readiness, and the complexity of managing multiple coexisting standards and infrastructures. However, we believe two fundamental factors will determine the **adoption rate of eSIM** in the Cellular IoT market – interoperability and infrastructure strategy.

Interoperability is essential for IoT deployments, and GSMA has established testing and conformance standards, such as SGP.33 (for IoT eSIM testing) and SGP.24 (for RSP conformance). Much of the success of SGP.32 will depend on how well the industry works towards full interoperability to enable a highly diverse mix of IoT devices to function seamlessly in multi-network and multi-region deployments.

Infrastructure strategy			
Unified	Medium	High	High
Aligned	Low	Medium	High
Fragmented	Low	Low	Medium
	Limited	Functional	Seamless

Ecosystem Interoperability

Various Scenarios for eSIM Adoption in Cellular IoT

Regarding **infrastructure strategy,** an important first step is to **enhance awareness** about SGP.32 among service providers, network operators and enterprises that extends beyond the technology and its benefits to include deployment models and effective management strategies, allowing them to choose an **efficient, unified approach** aligning their long-term goals and daily operations.

Opting for in-house eSIM management from hardware-agnostic software specialists such as *achelos* can offer substantial benefits, including greater flexibility, enhanced control over resources, improved security, and superior service quality for end customers. Alongside helping improve overall operations, this will also provide a **competitive edge** to service providers in an industry that is very competitive.

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About achelos

Our mission is to empower customers and partners by providing secure, flexible, and scalable eSIM management solutions that eliminate vendor-specific constraints, foster interoperability, and facilitate seamless deployments.

achelos stands at the forefront of innovation as a provider of hardware-agnostic Remote SIM Provisioning (RSP) software. Our solutions empower market players to independently establish their own eSIM services, whether for on-premises systems or public cloud-based deployments across diverse mobile networks, including Consumer, IoT, and Private Networks.

With a focus on interoperable eSIM management, achelos equips Mobile Network Operators, Telecom Service Providers, and IoT Enterprises with the tools to efficiently manage eSIM profiles—free from the limitations of specific hardware vendors.

achelos eIM	achelos DP+	achelos M2M	achelos OTA
GSMA SGP.32	GSMA SGP.22	GSMA SGP.02	3GPP TS 31.115

achelos eIM   Unlock the potential of your organization with our robust and fully interoperable eSIM IoT Manager (eIM) solution, designed to manage eSIM profiles effortlessly across diverse eUICC hardware. With a future-ready, component-based architecture, it ensures seamless integration and compatibility with GSMA-compliant eSIM components while adapting to emerging protocols with ease.

achelos DP+   Discover our cutting-edge eSIM RSP solution, offering advanced eSIM provisioning and secure profile management fully compliant with SGP.22 and SGP.32 standards. Designed for Network Operators and Telecom Service Providers, it empowers you with complete data control, cost efficiency, and operational independence.

achelos M2M   Experience a powerful integrated solution with SM-SR and SM-DP components, delivering seamless eSIM provisioning and efficient profile management for devices supporting the eSIM M2M standard (SGP.02).

achelos OTA   Leverage our 3GPP-compliant OTA engine for seamless profile updates with flexible campaign and runtime operations, optimised for efficiency and scalability. Use cases include critical Multi-IMSI updates essential for global IoT deployments ensuring reliable communication.

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