

# Simplifying IoT SKU Management with Smarter eSIM Strategies

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**A Practical Blueprint from In-Factory  
Provisioning to Post-Production**



## Abstract

Global IoT manufacturers face a critical bottleneck: managing dozens of device SKUs tailored to different carriers and regions, driving up costs and delaying market entry. This white paper presents a practical solution using eSIM technology under the GSMA SGP.32 standard to dramatically simplify SKU management while enabling truly global connectivity – and maintaining it over time.

Learn how companies are transforming from region-specific SKUs to a single global model through In-Factory Profile Provisioning (IFPP) strategies, Local and Remote SIM Profile Management, using Sequans' Monarch 2 and Calliope 2 platforms with Kigen's eSIM solutions. Achieve single global SKU manufacturing with post-production carrier flexibility, immediate device activation, and streamlined logistics that scale globally.

Featuring Itron's unique utility industry insights, this blueprint provides actionable strategies for manufacturers ready to transform IoT production and accelerate market penetration.

Essential reading for IoT product managers, manufacturing executives, and connectivity strategists navigating scale deployments.

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## 1. Introduction

Managing device SKUs for global IoT deployments is a persistent challenge for manufacturers. Traditional SIM cards require region- or carrier-specific SKUs, complicating inventory, increasing costs, and delaying time-to-market. eSIM technology—particularly under the latest GSMA SGP.32 standard, offers a path to SKU reduction, streamlined production, and flexible global connectivity. This white paper outlines how manufacturers can use eSIMs, explaining as well how Sequans and Kigen tools and solutions can simplify SKU management from factory to field.

## 2. eSIM Technology and Standards: An Overview

eSIM (embedded SIM), unlike traditional SIMs, allows for remote provisioning and management of multiple carrier profiles, supporting seamless switching between networks without hardware changes.

The GSMA has defined several eSIM standards:

- + SGP.02: For M2M (machine-to-machine) devices, requiring bilateral integration and typically using SMS/HTTPS for profile downloads.
- + SGP.22: For consumer devices, enabling user-driven profile downloads via QR code or app, with a Local Profile Assistant (LPA).
- + SGP.32: Tailored for IoT, enabling remote, bulk profile management over lightweight protocols (e.g., UDP/CoAP), with an IoT Profile Assistant (IPA), and supporting minimal user interaction and constrained devices.
- + SGP.42 (upcoming): Specifically addresses In-Factory Profile Provisioning (IFPP), enabling secure and interoperable loading of operator profiles during manufacturing, without requiring factories to be GSMA-certified or internet-connected

Each standard ensures secure profile management and remote provisioning, with SGP.32 specifically addressing the needs of large-scale, distributed IoT deployments

## eSIM Standards Comparison

Standard	SGP.02 (M2M)	SGP.22 (Consumer)	SGP.32 (IoT)	SGP.42 (IFPP)
Use Case	Machine-to-machine devices	Consumer devices	IoT devices	In-Factory Profile Provisioning
Profile Download	SMS/HTTPS	QR code or app	Lightweight protocols (UDP/CoAP)	Secure, interoperable loading
User Interaction	None required	User-driven	None required	None required
Integration	Bilateral	LPA (Local Profile Assistant)	Remote, bulk management with IPA (IoT Profile Assistant) on eUICC (IPAE) or device (IPAD)	Secure and interoperable

## 3. SKU Management Challenges in IoT Manufacturing

Traditional SIM-based production creates several pain points:

- + Multiple SKUs per carrier or region: Each connectivity variant requires its own SKU, inflating inventory and complicating logistics.
- + Design complexity: Multiple SIM slots or soldered SIMs increase production cost and limit device form factors.
- + Regulatory hurdles: Some countries require local profiles, adding further SKU variants and provisioning steps.
- + Delayed deployments: Devices may need to be reconfigured or replaced if shipped with the wrong SIM, leading to customer dissatisfaction and higher costs.

These challenges underscore the need for a flexible, scalable connectivity solution that decouples hardware from carrier selection.

## 4. eSIM Benefits for Device Makers

eSIM technology, especially with SGP.32, directly addresses these challenges:

- + SKU reduction: One hardware SKU can support multiple carriers and regions, as profiles are managed digitally and can be updated over time without physical access.
- + Flexible provisioning: Kigen's pre-SGP.42 solution for IFPP and future SGP.42 standard enable profiles to be loaded securely in-factory, so devices are connectivity-enabled immediately upon leaving the production line. Profiles can also be loaded during distribution or in the field, supporting both local and remote workflows.
- + Streamlined logistics: Inventory management is simplified, as devices are not tied to a single carrier at production, enabling global scaling with minimal overhead.
- + Enhanced device design: Smaller eSIM form factors free up space for other components or enable more compact devices.
- + Sustainability: Eliminating redundant SIM cards reduces environmental impact.

\* See Glossary on page 8

- + Future-proofing and operational continuity: SGP.32 is designed with long-life IoT devices in mind. It allows secure remote profile updates and seamless switching between public and private networks — even years after deployment — ensuring support for future operators, technology tuning, or regional compliance changes. This is especially critical for use cases requiring 10+ years of service, where network landscapes may shift, new connectivity providers may emerge, and legacy networks may sunset or become less attractive.
- + Service resilience: With remote SIM management built into the device, operators or OEMs can dynamically respond to commercial, regulatory, or technical changes without physical recalls, extending the useful life and value of deployed assets.

By leveraging IFPP and adopting the SGP.32 framework, manufacturers gain not only efficient production and provisioning but also the long-term agility to evolve with the network ecosystem, enabling scalable, sustainable, and service-resilient IoT solutions.

## 5. Sequans and Kigen: Enabling End-to-End eSIM Management

Sequans' Monarch 2 and Calliope 2 platforms, in partnership with Kigen, deliver robust eSIM support for OEMs and system integrators. And here is how!

### 5.1 Local Profile Management and In-Factory Provisioning

Monarch 2 and Calliope 2 support local switching and downloading of eSIM profiles via host MCU or handheld tools, ideal for final provisioning at the end of production or for field updates.

Sequans and Kigen enable secure in-factory profile loading (Kigen's SM-DP\* implementation, the factory SM-DP with GSMA accredited SAS-UP, for IFPP), allowing manufacturers to provision devices with operator profiles before shipment, in line with and ahead of emerging SGP.42 standard. Part of the profiles that can be loaded is a generic test profile (corresponding to TS.48 GSMA specifications) to be used with test equipment in the manufacturing line.

Management is handled through simple AT commands (AT+CSIM), requiring only lightweight logic on the host device—no heavy Local Profile Assistant needed. The local profile management logic can incorporate cellular context—such as signal strength or preferred carrier—to optimize profile selection for both cost and power efficiency. This approach is efficient for manufacturing lines and post-deployment service, ensuring devices are ready for immediate use.

## 5.2 Remote Profile Management (RSP-Compliant/OTA) through SGP.32

Monarch 2 and Calliope 2 are validated for Remote SIM Provisioning (RSP) with Kigen’s IP Ae-enabled SIMs.

Over-the-air profile management is supported via cloud-based SM-DP+ and SM-SR platforms, enabling secure remote download, activation, and switching of operator profiles.

Sequans offers a lightweight IP Ad (IoT Profile Assistant on Device) implementation for flexible OTA provisioning, optimized for low-power IoT devices. While IP Ae provides an off-the-shelf, simplified route for remote profile management, OEMs may opt for IP Ad to retain full control and tailor the integration to their specific application.

To streamline large-scale deployments, customers can leverage Kigen’s eSIM IoT Manager (eIM), which orchestrates profile provisioning and lifecycle management across fleets of devices, providing monitoring, automation, and remote policy enforcement.

Sequans supports this integration with reference code and guidance, ensuring seamless connectivity onboarding for a wide range of use cases. Sequans modules are certified across multiple carriers and use a single, cross-certified firmware image—enabling seamless switching from one carrier to another without requiring a firmware upgrade or module reboot.

## 5.3 Key Takeaway

By combining eSIM with IFPP and SGP.32, Sequans Monarch 2 and Calliope 2, and Kigen eSIM, manufacturers can confidently deploy a single device SKU globally, manage connectivity flexibly, and streamline both production and post-deployment operations.

## Sequans and Kigen eSIM Management

Solutions	Monarch 2 & Calliope 2	Kigen eSIM
Local Profile Management	Supports switching and downloading profiles via MCU or tools (AT Command based)	Enables secure in-factory profile loading (SM-DP+) and profile listing and switching
Remote Profile Management	Validated for RSP with IP Ae-enabled SIMs and IP Ad implementation	Offers portal for remote management
Best Practices Integration	Guidance and IP Ad example code	Tool for secure profile loading, server for SIM profile management

## 6. Best Practices for eSIM Integration in Manufacturing

To maximize eSIM benefits for an IoT device maker, it is highly recommended to:

- + Integrate profile management tools into production lines for automated provisioning and testing: a proven solution is offered for device manufacturers to use
- + Adopt IFPP solutions like Kigen's SM-DPf to securely load operator and generic test profiles during manufacturing, ensuring devices are ready and can be immediately activated in the field.
- + Use secure systems for handling eSIM profiles and activation codes.
- + Train staff on eSIM processes and maintain clear documentation, notably for installers or distributors.
- + Update inventory management systems to track eSIM-enabled devices and profile status (using dedicated platforms delivering such services).
- + Establish clear roles among distributors, OEMs, contract manufacturers, and SIM providers for secure profile transfer and activation.

Sequans and Kigen can provide resources and guidance for each of these recommendations, based on a proven implementation.

## 7. Industry Applications

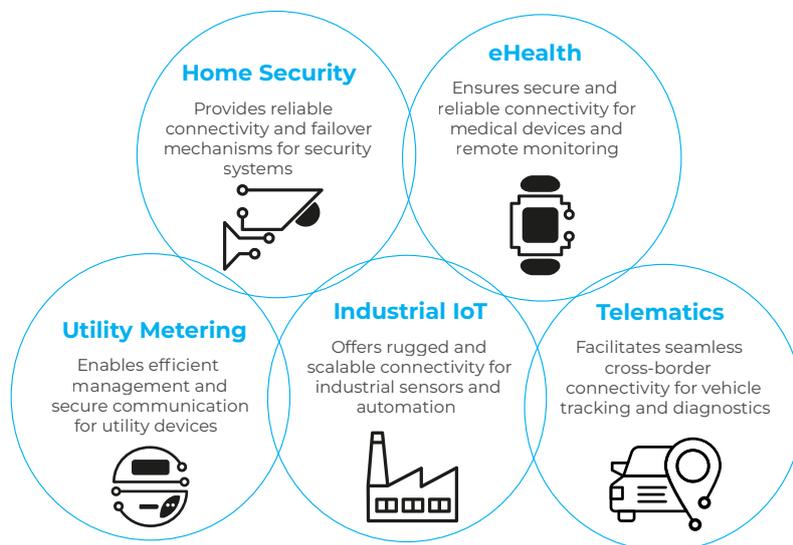
eSIM solutions are adaptable across sectors:

- + Utility metering: Batch activation and remote profile management for long-term deployments, including with private deployment (using dedicated profile).
- + Home security: Reliable connectivity with easy provider switching and failover.
- + Telematics: Global vehicle tracking and diagnostics with seamless cross-border connectivity.
- + eHealth: Secure, reliable medical device connectivity with privacy management.
- + Industrial IoT: Rugged, scalable solutions for sensors and automation in harsh environments.

### Bringing a customer perspective – Itron

At Itron, we serve utilities that demand high availability and long product lifecycles. By adopting eSIM technology aligned with the GSMA SGP.32 standard, we're working on streamlining device manufacturing through in-factory carrier provisioning - reducing the need for multiple regional SKUs and simplifying supply chain operations. More importantly, eSIM enables resilient, multi-carrier connectivity, allowing our devices to dynamically switch between networks based on coverage or performance - without requiring a truck roll or hardware swap. This flexibility not only lowers total cost of ownership but ensures reliable, secure connectivity throughout a device's 10 – 20 year lifespan, even as carrier landscapes evolve.

## eSIM Technology Applications



## 8. Future Outlook

eSIM adoption is accelerating, with nearly all mobile operators expected to support it by 2025, reaching up to 98% coverage.

Support for IoT through SGP.32 is beginning to scale in 2025 and is projected to achieve broad adoption by 2027.

From a GSMA standards perspective, the upcoming SGP.42 specification will further streamline in-factory profile loading, enhancing SKU management efficiency.

Meanwhile, iSIM (integrated SIM) will enable even greater integration and flexibility, building on existing eSIM management infrastructure. In preparation for this transition, Sequans is developing SPOT (Sequans Provisioning Offline Tool)—a comprehensive suite of tools for testing and manufacturing. SPOT extends the current Sequans manufacturing toolkit, ensuring a consistent customer experience from modem to eSIM. Kigen's IFPP solution supports a consistent customer experience across eSIM and iSIM secure profile provisioning in the factory today.

## 9. Conclusion

eSIM technology, especially when implemented with Sequans and Kigen solutions, empowers manufacturers to reduce SKUs, streamline production, and support global deployments with maximum flexibility.

Based on a proven solution already deployed with existing customers, our two companies provide customers with tools, documentation and support, enabling them throughout the product lifetime. By adopting eSIM-centric workflows and leveraging the latest standards, OEMs can future-proof their devices and operations for the rapidly evolving IoT landscape.

**One notable example is Itron, a leader in utility metering, who has adopted eSIM and SGP.32 to enable scalable, long-lifecycle connectivity in their water, gas and electricity meters. Their implementation highlights the value of in-factory provisioning and network resilience.**

## Glossary

- + Subscription Manager Secure Routing (SM-SR): This entity securely delivers the encrypted operator credentials to the SIM and then, once the credentials are installed, remotely manages the SIM thereafter (enable, disable and delete the credentials as necessary during the product's lifetime).
- + Subscription Manager Data Preparation (SM-DP): This is the entity which operators use to securely encrypt their operator credentials ready for over the air installation within the SIM.
- + Subscription Manager Data Preparation functional (SM-DPf): The SM-DPf is responsible for the generation, protection and delivery of Profiles for IFPP functionality within late-stage manufacturing, optimized per SGP.41 standard requirements.

## About the Authors

**Sequans Communications S.A.** (NYSE: SQNS) is a leading fabless semiconductor company specializing in wireless 4G/5G cellular technology for the Internet of Things (IoT). Sequans' engineers design and develop innovative, secure, and scalable technologies that power the next generation of AI-connected applications – including secured payment, smart mobility and logistics, smart cities, industrial, e-health, and smart homes. Sequans offers a comprehensive portfolio of 4G/5G solutions, including LTE-M/NB-IoT, 4G LTE Cat 1bis, and 5G NR RedCap/eRedCap platforms, all purpose-built for IoT and delivering breakthroughs in wireless connectivity, power efficiency, security, and performance. The company also provides advanced design services and technology licensing. Founded in 2003, Sequans is headquartered in France and operates globally, with offices in the United States, United Kingdom, Switzerland, Israel, Finland, Taiwan, and China. Visit Sequans at [sequans.com](https://sequans.com) and follow us on [LinkedIn](#) and [X](#).

**Kigen** is the forerunner in eSIM and iSIM security-enabled solutions built for IoT at scale in the AI era. We make secure-by-design adoption straightforward for manufacturers by delivering eSIM solutions across all RSP standards for M2M, consumer, and the latest GSMA IoT eSIMs. Purpose-built for device makers, Kigen's solutions enable secure profile delivery on factory lines within minutes. Our eSIM and iSIM OS products empower leading chipsets and modules and are supported globally across 200+ terrestrial and NTN networks. Kigen's robustly tested solutions streamline every step of eSIM and iSIM adoption—from design to secure provisioning, volume production, and field deployment—reducing risk, time, and costly rework. Backed by technology powerhouses Arm, SoftBank Vision Fund 2, and SBI Group, Kigen was named Mobile IoT Startup of the Year 2024 and is the partner of choice for leading brands in energy, automotive, logistics, and industrial automation. Learn more at <https://kigen.com/> or join the Kigen #FutureofSIM conversations on LinkedIn.

**Itron** is transforming how the world manages energy, water and city services. Our trusted intelligent infrastructure solutions help utilities and cities improve efficiency, build resilience and deliver safe, reliable and affordable service. With edge intelligence, we connect people, data insights and devices so communities can better manage the essential resources they rely on to live and thrive. Join us as we create a more resourceful world: [www.itron.com](https://www.itron.com).

## References

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