SIM OR ESIM

WHICH TO CHOOSE FOR YOUR IOT DEPLOYMENT

SIM V ESIM, SGP.02 V SGP.32

The accelerating growth of IoT is driving transformation across industries, of which device connectivity is critical. The key to successful deployment is robust, reliable, and scalable connectivity to ensure your devices are 'always on' as required by each different use case.

Traditional SIM cards and embedded SIMs (eSIMs) each offer distinct advantages and limitations and come with a wide range of challenges both through deployment and in life.. This white paper explores the comparative value of SIM and eSIM technology in IoT, emphasizing the evolution of eSIM from SGP.02 (M2M eSIM) to the next-gen SGP.32 standard (IoT eSIM).

In our connected world, devices need to be connected in the most flexible way, which obviously points towards eSIM as the ideal technology. But what most will not tell you is even in this hyper connected industry, flexibly updating and modifying your connectivity provider once the device is in the field, still is not an exact science.

Consider in the traditional SIM scenario, there is the ability to utilise a Multi-IMSI solution to enable flexibility and a first level of resiliancy with the additional options to add, modify and select different connection options remotely to keep the SIM up to date with the frequent changes in roaming agreements. What is not common knowledge is that this remote management is carried out using an Over The Air (OTA) platform service, which one can be costly but also in a typical use case will only ever reach a maximum of 85% of devices depending on their deployment. This means a large percentage of your device estate will not be updated and will remain on the historic, potentially costly configuration, not to mention the risk of losing those devices completely.

Whilst the eSIM solution provides a greater flexibility and is designed to enable full remote connectivity management, the profile download (remote updates) are still prone to the same success rates as above, with an even greater risk of losing devices if profiles are not updated and configured in the correct manner. Add to this, in the SGP.02 scenario, the deployment and Mobile Operator (MNO) integration process to really enable this solution at scale is completely cost and time prohibitive.

Even with the arrival of the long awaited eSIM IoT SGP.32 solution, these challenges will remain. Yes, with SGP.32 the platform and MNO integrated process is more streamlined and flexible, but we now need add an LPAe or LPAd as well as an EIM to the mix, adding complexity to the initial deployment.

With all of this in mind, below we present benefits, implementation challenges, and associated risks to help stakeholders make informed connectivity decisions.

SIM V ESIM

IoT deployments initially adopted traditional SIMs due to simplicity and widespread infrastructure. However, as IoT scaled globally, challenges in remote management and provisioning led to the development of embedded SIM (eSIM) solutions, so what are the differences:

- **SIM or UICC (Universal Integrated Circuit Card):** Removable chips that authenticate a device on a mobile network, traditionally single mobile operator support, enhanced with Multi-IMSI options. Available in removable plastic form as well as embedded (soldered) form in both commercial or industrial grades.

- **eSIM (Embedded SIM) or EUICC (Embedded Universal Integrated Circuit Card):** A reprogrammable SIM, supporting multiple Mobile Operator profiles with the ability to download and switch connectivity options remotely. Available in removable plastic and embedded form, also in commercial or industrial/rugged grades. Based on GSMA standards, SGP.02 which was introduced in 2014 and more recently launched solution SGP.32

The eSIM model enhances lifecycle flexibility and is better suited to remote, global, or mass-deployed IoT environments.

SGP.02 M2M ESIM

SGP.32 IOT ESIM

- Designed for machine-to-machine (M2M) use cases.
- Requires a Subscription Manager Secure Routing (SM-SR) and Subscription Manager Data Preparation (SM-DP).
- Operator profile management is typically initiated by the enterprise or OEM.
- Best suited for static or minor networking switching such as smart meters, logistics, and industrial devices.
- Whilst designed for increased flexibility in mobile network selection, it is often costly and complex to enable multi operator capability via remote provisioning.
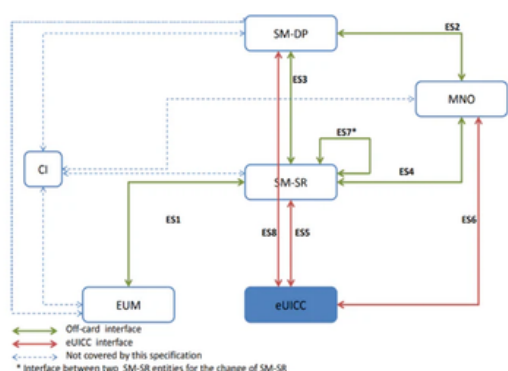
- Introduced as a more scalable, interoperable, and simplified architecture for IoT.
- Improves upon SM-SR and SM-DP: SM-DP+, similar to the SGP.22 consumer solution.
- Supports IoT Remote SIM Provisioning (RSP) using more lightweight protocols.
- EIM, LPAd/e additional requirements to manage the device and connectivity capability,
- Designed to eliminate complex integrations and operator lock-in.
- Enables direct device-initiated profile downloads.
- A more flexible and cost effective solution for IoT connectivity switching, the scalable reality is yet to be seen.

Figure 1: eUICC Remote Provisioning System
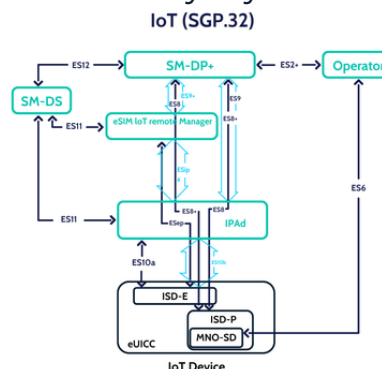
BENEFITS COMPARISON

Feature	Traditional SIM	eSIM (SGP.02)	eSIM (SGP.32)
Physical Swapping	Required	Not required	Not required
Remote Provisioning	No	Yes	Yes
Multi-Profile Support	Yes w/ Multi-IMSI	Yes	Advanced
Deployment Scalability	Low	Medium	High
Operator Lock-in	High	Medium	Low
Interoperability	High	Medium	High
Hardware Cost	Lower	Slightly higher	Slightly higher
Ideal Use Case	Static IoT	Industrial IoT	Scalable global IoT

RISKS AND MITIGATIONS

Risk	Impact	Mitigation
Profile Corruption	Loss of connectivity	Backup profiles and OTA rollback mechanisms
Lock-in with limited MNOs	Reduced flexibility	Adopt GSMA-compliant eSIM platforms with multi-MNO
Security Vulnerabilities	Unauthorized access	Implement certified secure elements and encrypted
Limited Vendor Support (SGP.32)	Deployment delays	Partner with early-adopter MNOs and platform providers

STRATEGIC RECOMMENDATIONS

- **Short-term**: For static or regional IoT deployments, traditional SIM or SGP.02 may still be viable, potentially embedding a Multi IMSI application and OTA capability.
- **Mid-term**: Enterprises should begin migrating to SGP.32 where possible to future-proof operations.
- **Long-term**: Align with ecosystem players (MNOs, MVNOs, platform vendors) who support SGP.32 and can scale globally.
- **Launch** a CMP (Connectivity Management Platform): Use a centralized platform to manage profile provisioning, monitoring, and switching across devices and geographies.
- **Identify**: Device and data security solutions embedded on the SIM/eSIM which is considered a secure root of trust to ensure device and data integrity.
- **Consider**: Secure device and connectivity monitoring solutions, embedded in the device or SIM/eSIM, to track and monitor device and network performance and early failure detection.

CONCLUSION

The transition from SIM to eSIM reflects the broader need for scalable, flexible, and global connectivity in IoT. SGP.32 represents a step-change in simplifying eSIM adoption and enhancing interoperability whilst still trying to combat the age old issues. While there are challenges that remain, early adoption of the right standards and ecosystem partnerships will empower IoT service providers to scale securely and efficiently.
Enterprises must assess their deployment landscape, operational needs, and security posture to choose the right SIM strategy today while building for the needs of tomorrow.

Implementation of a SGP.32 solution provides what SGP.02 could not for the IoT ecosystem as the costs were too high. With SGP.32 there a simplified local/custom profile download to adapt to each market and/or use case, while having a single SKU for manufacturing. Ensuring a seamless and integration-less profile download at any time, even if the initial setup needs greater attention. It's even more interesting now as we are seeing more and more restrictions on permanent roaming and huge performance gaps between native profiles and roaming ones. More and more businesses will need local profiles with dynamic deployments, and SGP.32 is the perfect fit.

ANAISON

www.anaison.com   info@anaison.com