New eSIM for IoT – SGP.32 specification explained

Here's Kigen's quick guide to everything you need to know about the new eSIM for IoT GSMA Specification.

With the release of the new GSMA eSIM IoT specification (SGP.32) standards, IoT manufacturing and management are becoming more accessible. Saïd Gharout, Head of Standards at Kigen, who also supports as the chair of the GSMA eSIM Working Group 2, takes on some of your frequently asked questions on the new eSIM standards. We spotlight what you need to take advantage of the latest specifications and benefit from eSIM growth.

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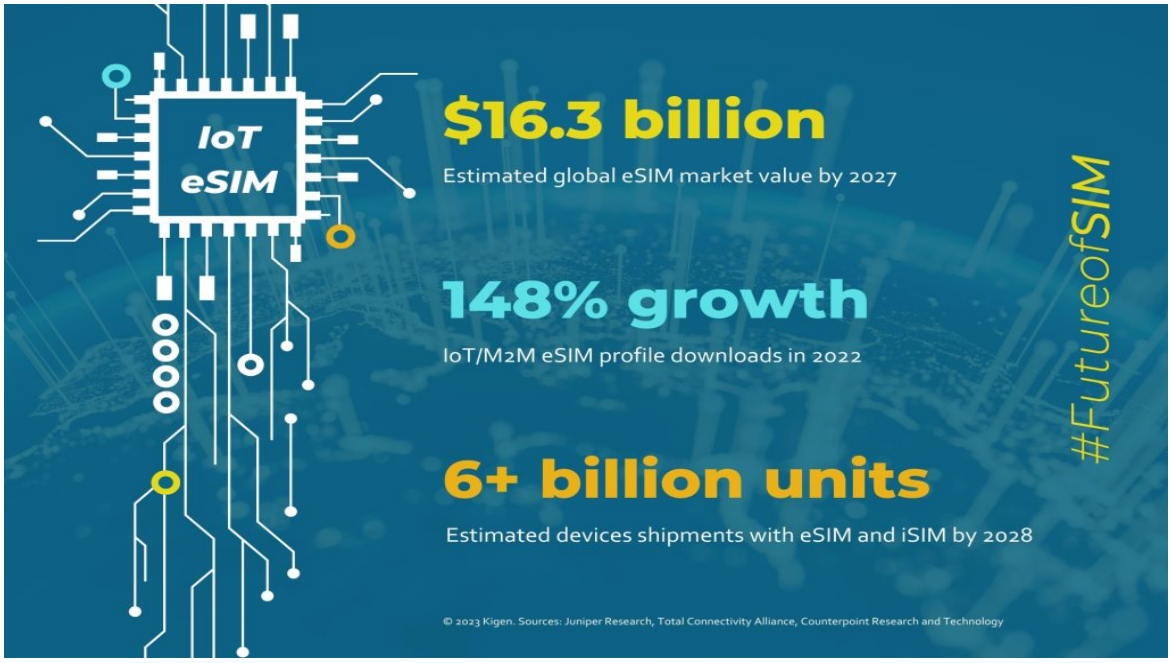
The role of eSIM standards in 5G IoT

The introduction of eSIM has significantly changed cellular logistics. It's been the most significant factor for device personalization count identification for decades and customer access with benefits for device makers and connectivity network operators alike. Now, the momentum of eSIM adoption with 5G IoT is accelerating:

- At least **175 mobile service providers** already offer commercial eSIM services for smartphones spanning more than 69 countries. (GSMA Intelligence, 2021)
- Juniper Research forecasts the value of the global e-SIM market will increase from $4.7 billion in 2023 to **$16.3 billion by 2027**. Further, **IoT connections will outpace smartphone eSIM growth** by 2026. (March, 2023)
- Although device shipments and projections are sound indicators, eSIM profile downloads show actual activity – encouraging estimates from Trusted Connectivity Alliance show that IoT/M2M eSIM downloads increased by **148% in 2022**. (April, 2023)
- Counterpoint Technology and Research projects that **more than 6 billion xSIM (eSIM + iSIM)** devices will be shipped in its eSIM Devices Market Outlook over the next five years. 70% of all cellular devices shipped in 2030 will sport an eSIM. Further, **iSIM (iUICC) will grow fastest** as it becomes the preferred SIM form factor by 2030 for all cellular categories. (June 2023)



In summary, eSIM technology is set for hyper-growth and is crossing a critical inflection point, as many respected analysts in the industry observe. Another vital factor bringing eSIM to the fore is that the latest Release 17 of the 3GPP standards that define the 5G technologies has also incorporated full support for NB-IoT and CAT-1 Low Power Wide Area Networks (LPWAN) as "New Radio" or NR.

So, to support OEMs who wish to take advantage of eSIM's growth potential, a standardized approach to eSIM management and services needs to be adopted.

This is the remit of the collaboration of the eSIM Working Group at GSMA. This group looks after the eUICC definition in consumer and IoT, eSIM discovery service, eUICC identity scheme, and eUICC security accreditation. Kigen has been deeply invested in helping build all the eSIM specifications at GSMA, with many of our technical experts contributing to multiple working groups.

Your questions on SGP.32 answered.

April 2022 marked a key milestone with GSMA releasing the first new eSIM for IoT Requirements Specification (SGP.31 v1.0). This was the trigger to start the drafting of the technical specification. The first release of the eSIM for IoT Technical Specification (SGP.32) was published in July 2023. This version allowed stakeholders to start implementation and provide feedback. On the 27th of June 2024, GSMA published SGP.32v1.2, the stable version of the eSIM for IoT Technical Specification. The first products will be based on this version.

Kigen's Saïd Gharout leads the **GSMA eSIM Working Group,** which defines the SGP.32 GSMA eUICC Specifications for IoT Remote SIM Provisioning (RSP), and all the other eSIM Technical Specifications (e.g., SGP.22). He was also chairing the eSIM Working Group 7 who provided the first versions of both SGP.31 and SGP.32. We sit down with Saïd to learn about all you need to know about eSIM RSP for IoT and what's coming ahead that you should prepare for.

1. How did the eSIM come to exist?

Innovations leading to cellularly connected machines with the rise of IoT saw a need for SIMs to reduce the size further, increase spoilage resistance, and offer greater electrical and memory endurance.

ETSI (via TS 102 671, first published in 2010) noticed this and standardized a new class of SIM with more robust physical and logical characteristics to ease their adoption and ensure quality assurance. This included a move from discrete, physical SIM cards to "soldered down" M2M form factors, which delivered on the resiliency requirements but posed an issue around choosing or switching networks.

To address this, the GSMA (the Carriers' Industry Trade Association) agreed to establish a solution through an industry-backed set of specifications via a specialized SIM group. GSMA released the first version, defining eSIM as suitable for Remote SIM Provisioning to target the M2M market in 2013. Since then, the world of IoT has evolved beyond the point-to-point connectivity that the terminology of M2M applied to and is moving more towards hyper-connected cloud and data. For this, the eSIM group has been exploring how to simplify RSP for the variety of use cases IoT serves.

2. What specifications are most relevant today?

Specification relevance will depend on the role and or activity you perform. For anyone looking to build a GSMA-compliant IoT RSP component or deployment, SGP.31 and SGP.32 (requirements and architecture specifications) explain why and how to implement the standards.

Beyond the two core documents, the testing (SGP.33) and conformance (SGP.24 with IoT RSP extensions) documents ensure that your offering is interoperable and has been accepted in the market.

Where appropriate, it must be referenced with the consumer specifications SGP.21 v2.4 & SGP.22 v2.5, which set out requirements, architecture, and description of eSIM across the board.

Lastly, only some people must be experts in these documents to take advantage of these specifications. At Kigen, we have helped connectivity providers, device makers/OEMs, and ODMs speed up their deployment with GSMA-compliant RSP services. Please contact us with any eSIM IoT-related questions.

3. Why is a new IoT eSIM specification needed?

IoT is seen as an emerging market with its origins in M2M. However, as new technologies diversify cloud connectivity and widen data usage, IoT use cases blur the boundary between consumer and M2M.

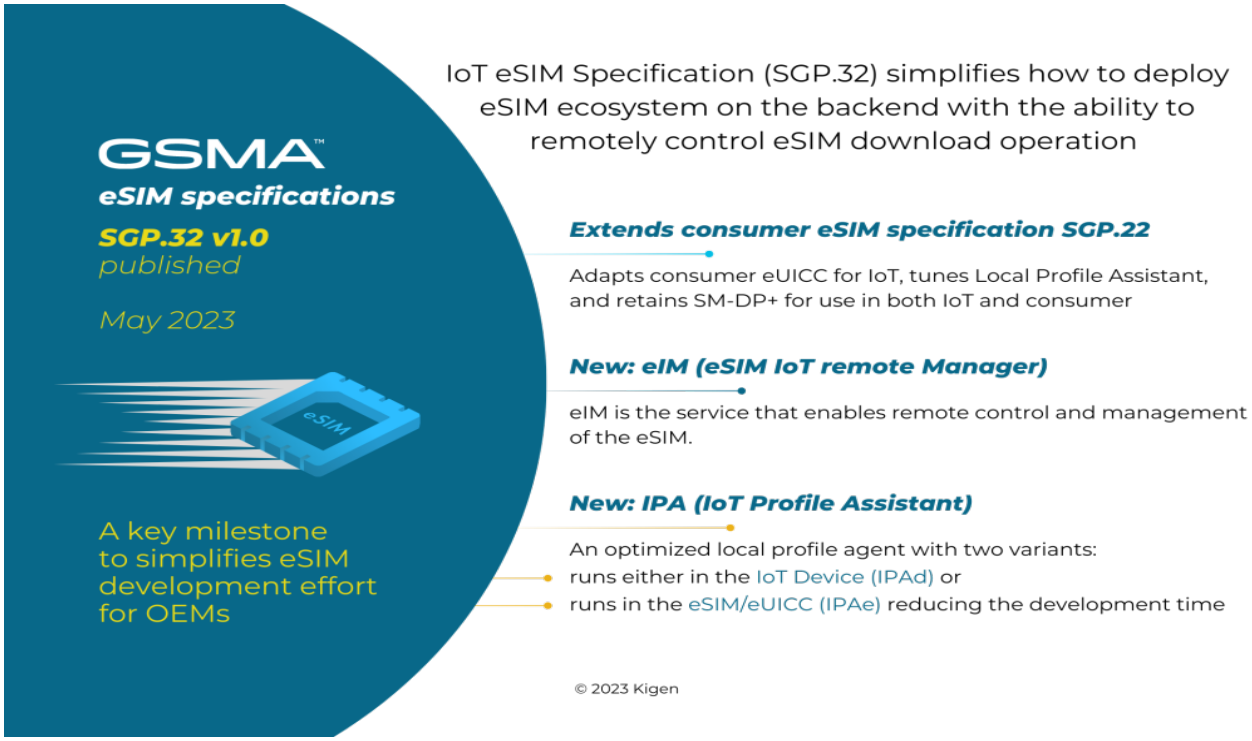
As ideas for new connected things and their deployment options emerge, the original business cases and requirements that initially scoped the M2M and consumer RSP architectures fell short of fulfilling what is now expected for IoT.

Learning from customer feedback on how pragmatic specifications are easily interoperable and scalable IoT has been a core of Kigen's collaboration at the GSMA. Since the initial RSP architecture was defined, the partnership's focus has been to ensure maximum security for all stakeholders and coverage of evolving needs. With the new specification published, MNOs and providers like Kigen are ready to support OEMs because they offer support for the broadest use cases.

4. Can you explain the main changes from M2M to IoT eSIM RSP specifications?

There are three main drawbacks to the M2M specifications:

1. Mandating SMS or HTTPS to deliver the Profile from the SM-DP to the eUICC is challenging for memory-restricted LPWAN devices.
2. Complex integration between SM-SR and SM-DP.
3. SM-SR needs to be configured at eUICC manufacturing. We don't know which SM-SR will be used at deployment in some scenarios. This makes it harder to support global deployments in countries that may require a swap to comply with regulations.



It comes down to the "eIM" (eSIM IoT Manager).

New in SGP.32:

- **eIM** is a standardized eSIM provisioning tool allowing large-scale deployment and management of eSIM-enabled IoT devices. eIM is defined in GSMA SGP.31 and standardizes the process for the mass deployment of eSIM-enabled IoT devices.

The IoT specifications give interoperable resolutions for all the points described above:

1. A more comprehensive list of protocols has been specified to cover many categories of devices. CoAP/UDP/DTLS has been specified for LPWAN Devices. HTTP/TCP/TLS is also possible for broadband devices. The specification also defines mechanisms for the eIM to verify compatibility with the IoT Device.
2. The eIM can communicate with any IoT Device and any SM-DP+. The IoT Device can communicate with any SM-DP+ or any eIM. There is no need for pre-negotiation between actors.
3. eIM can now be configured flexibly at eUICC Manufacturing, IoT Device Manufacturing, or in the field, whichever suits the manufacturing flow better. Adding, deleting, or changing an eIM is fully standardized.

OEMs may use the older M2M specification in certain situations; however, with a more capable way to manage large-scale eSIM-based deployments, momentum is shifting to the new RSP IoT Specifications.

5. How does the transition from the old eSIM M2M specification to the new eSIM IoT Specification (SGP.3x) work?

In many IoT use cases and industries, a device has a much longer lifecycle (10-20 years), and contracts in those industries are significantly longer than in consumer use cases.

We anticipate that OEMs will take advantage of the more straightforward eSIM IoT functionality and flexibility for most new deployments. Leading smart metering and energy, logistics, and transportation businesses are actively preparing to use the latest IoT specifications.

New in SGP.32:

- The new eSIM IoT Specification introduces a simplified IoT profile assistant (IPA) and the eIM. This tuned local profile agent is available in two variants running directly on the eUICC (LPAe) or **the IoT device (LPAd).** Both operate the same way as far as the eIM and SM-DP+ are concerned. Customers can activate local profile switching in more convenient and user-friendly forms.

Lastly, a common challenge for OEMs is that when an MNO issues profile subscriptions for eUICC, the end deployment model or geography is still being determined. With the combination of eIM and Kigen's Just-in-Time provisioning, OEMs can now support every kind of eUICC with profile customization at the time of profile binding to maximize manufacturing throughput.

6. What should companies do today to prepare for this transition?

OEMs and MNOs should consider end-to-end testing for eUICC devices using their eSIM IoT solutions. There will be variances depending on whether the IPA runs in the eUICC or the device module and how these connect to the SM-DP+ and eIM.

Kigen has been working with Connectivity Service Providers and leading Connectivity Management Platforms to ensure that integration is simplified now that specifications have been published. Our ecosystem's scale means that we can support OEMs and smaller MNOs that may typically not have as much financial pull as more established players. **This means anyone starting today can take advantage of eSIM hyper-growth.**

7. Does the new eSIM for IoT technology require new design implementation, or can it be added to existing devices as a retrofit?

It is possible to choose an eSIM that retains the device's physical footprint to avoid re-designing the device and re-using the printed circuit board (PCB). The key is to select an eSIM that supports IPAe (IoT Profile Assistant built within the eUICC) so the device software doesn't need any major updates. For instance, at Kigen, we have adopted an approach for our IPAe that ensures the device will work with any industry standard SM-DP+ for profile downloads.

8. Is this new eSIM for IoT specification suitable for all applications? How about drone deployments?

Many existing and new applications will benefit from the SGP.32 IoT eSIM RSP specification. Applications where access to SIM would have been a limiting factor (eg. smart city, smart lighting, agricultural monitoring) or where changing connectivity would have been complex (eg. asset tracking, smart metering), are bound to benefit from the optimizations the new standard brings.

However, specific requirements may exist, and compliance needs to be considered. For drone deployment, soldered eSIMs would be more suitable than removable ones. Additionally, applications such as drones would need industrial or automotive-grade eSIM compliance to meet the temperature, environmental, and vibration tolerance scenarios in ruggedized packaging.

9. How can OEMs ensure eSIM interoperability across different IoT devices?

This area needs careful attention. Adopting the standards approach does not guarantee interoperability. However, adopting an eSIM lifecycle management approach that is RSP-standard agnostic is helpful.

The eSIM owner can download their preferred MNO or MVNO connectivity to their device through a single pane of glass orchestration platform, irrespective of the eSIM in the device. The eSIM service provider's platform would need to intelligently support all RSP standards and handle how the appropriate profile is downloaded to the right eSIM.

The standards simplify supporting such requests for your chosen MNO or MVNO. Using an RSP-agnostic eSIM lifecycle management platform with advanced data generation capabilities, the MNO can provide the connectivity that works on both M2M eSIM and IoT eSIM.

10. What are the security measures for provisioning this new eSIM for IoT standards?

The new standard carries forward the same security measures as with Consumer eSIMs today. The new SGP.32 standard additionally introduces the eIM, which can be SAS certified. There is end-to-end security between eIM and eUICC. Only authorized eIMs can interact with the eUICC.

11. Is there a specific model of IoT equipment that supports eSIM?

The Cellular Module used in an IoT device requires specific capabilities to support eSIM. The eSIM is agnostic of the radio technology so that it can work with 2/3/4/5G, CAT-M, NB-IoT, CAT-1/2/3/4, etc.) but requires support for BIP (Bearer Independent Protocol) to be able to Open Channel to the server for data communication. The CAT functions are listed. This is explained in SGP.32 Annex A.2

12. Could eSIM flexibly switch between NB-IoT & LTE-M?

The eSIM is agnostic of the cellular radio and will work with both or either. The device will decide which radio network to use. However, once the device switches, it can trigger a profile switch on the eSIM to match the MNO profile best suited for NB vs. LTE.

Contact Kigen

Whether starting the eSIM journey or looking to enhance IoT devices in your digital transformation, our team of experts can support your decisions at all stages.

Expand your customer base by capitalizing on eSIM interoperability with a broader OEM base to deliver trustworthy IoT information to third parties. For more information, please contact our expert team.