TRANSFORMA INSIGHTS

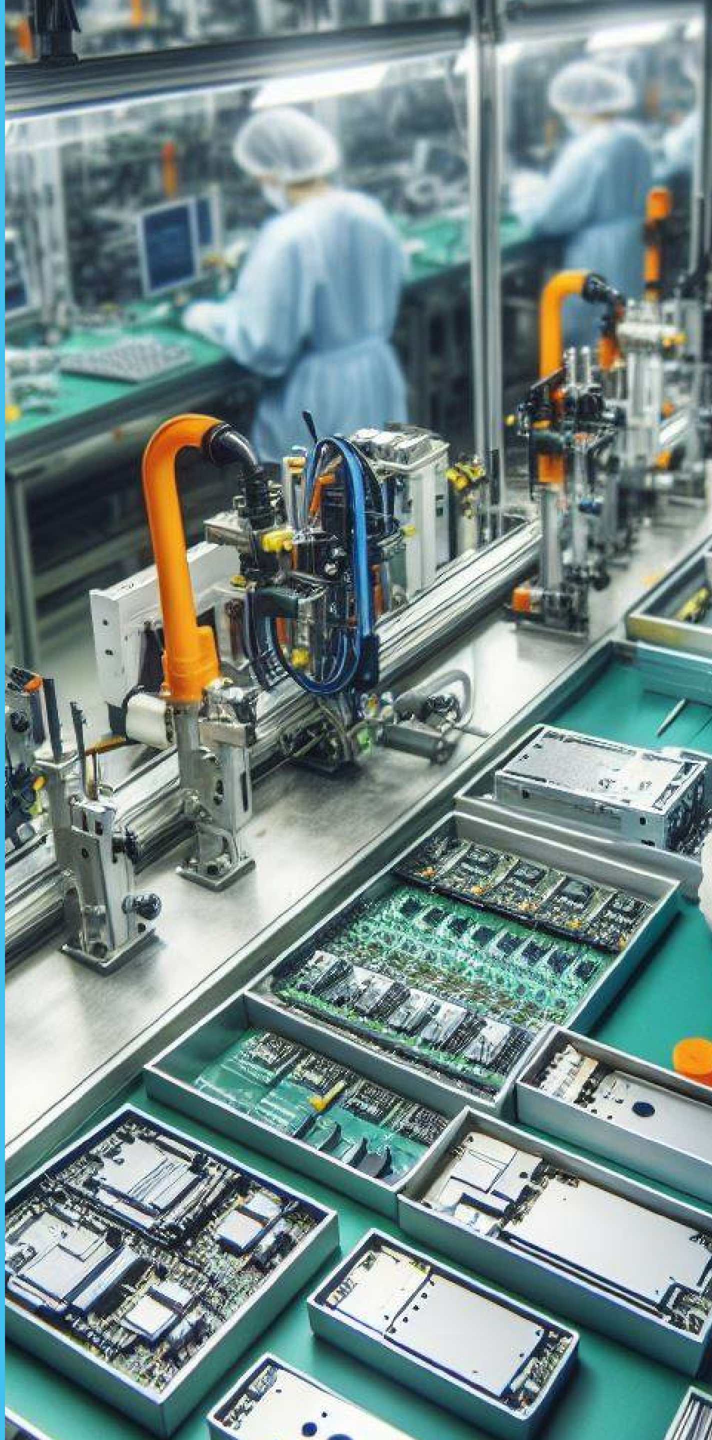
In-Factory Profile Provisioning (IFPP): new eSIM approach drives profitability and improves product performance in connected electronics manufacturing

IoT Transition Topic

Position Paper

Sponsored by:

Kigen



About this report

This report examines the concept of In-Factory Profile Provisioning as an emerging technology being used to streamline the process of embedding cellular SIM profiles into Internet of Things and other connected devices, reducing operational costs and improving performance.

In-Factory Profile Provisioning (IFPP) is a mechanism for the secure loading of mobile network SIM profiles during the manufacturing and/or order fulfilment process based on characteristics such as the device capabilities or the geographic location into which it is expected to be deployed. The use of IFPP removes the need to manually fit plastic SIM cards into each device and offers an alternative to in-field provisioning which may not be appropriate for many forms of device.

The benefits of IFPP can be categorised in terms of improving the in-bound and out-bound logistics associated with SIMs (including removing the need to maintain and manage a large inventory of plastic SIM cards), streamlining the process of applying the SIM profile (by removing the manual step of inserting a card), and reducing the power consumption associated with in-field provisioning.

In this report we explore the motivations for making use of IFPP to streamline supply chains for volume electronics manufacturers that are increasingly making use of cellular connectivity in their products. We then consider the wider concept of eSIM and remote SIM provisioning, of which IFPP is one variety, as well as considering the new GSMA standard for IFPP, SGP.41/42. The report goes on to consider the benefits of using IFPP, including reducing logistics and manufacturing complexity and power saving, as well as delving into four key IoT/connectivity verticals - smart metering, automotive, fixed-wireless access, and consumer electronics, to look at the ways in which IFPP will be valuable.

About the sponsor, Kigen

Kigen is the forerunner in eSIM and iSIM security-enabled IoT solutions built for scale. An Arm-founded company, Kigen flexibly empowers OEMs with security on leading IoT chipsets and modules and with the world's leading IoT and LPWAN connectivity providers in up to 200 countries. Our industry-leading SIM OS products enable over 2.5 billion SIMs and complement our GSMA-accredited Remote SIM provisioning secure service capabilities.

Find out more at kigen.com or join our #FutureofSIM conversation on LinkedIn.

IoT 'Transition Topics'

Transforma Insights has identified a series of aspects of the Internet of Things that are going through a period of fundamental transformation. These IoT '**Transition Topics**' are the subject of Position Paper reports and Virtual Briefings identifying the key aspects of change and how organisations should position themselves to be best placed to realise the opportunities generated.

Transition Topic: In-Factory Profile Provisioning for connected products

"Electronics device makers are increasingly adding cellular connectivity to their products, but the provisioning of appropriate SIM profiles continues to be a headache, either necessitating swapping of plastic SIM cards or the management of in-field provisioning. Into that environment, a new approach has surfaced: In-Factory Profile Provisioning (IFPP), a variant on eSIM and Remote SIM Provisioning (RSP).

For volume electronics manufacturers, the ability to more efficiently manage the connectivity of a huge estate of devices, being delivered to every corner of the world, has substantial implications for profitability. This is particularly magnified by the changing dynamics of the manufacturing sector. In this report we examine the use of eSIM/RSP by product manufacturers, particularly focusing on IFPP as a mechanism for increasing efficiency in the production process and improving the functionality of connected products."

Matt Hatton, Founding Partner, Transforma Insights

The changing face of volume manufacturing

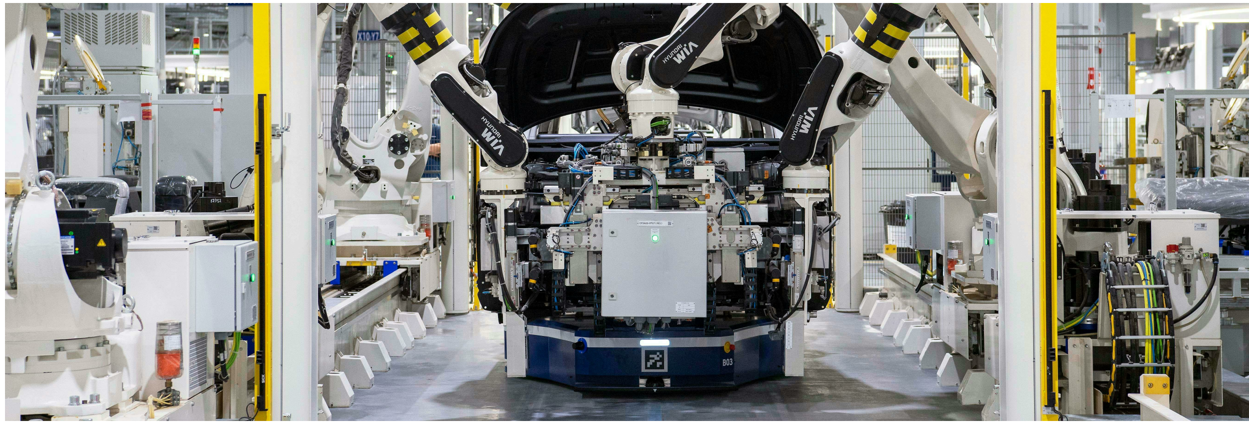
As part of its ongoing research, Transforma Insights tracks the changing dynamics of different vertical sectors and applications, as enabled by disruptive new technologies such as IoT and AI. Many of those emerging trends have significant implications for volume electronics manufacturing.

Firstly, the approach taken by manufacturers to how and where they run their production operations is changing. Post-COVID, there's a notable trend towards onshoring, driven by various factors. Supply chain disruptions during the pandemic highlighted vulnerabilities of offshoring, prompting companies to reconsider. Onshoring offers benefits like reduced shipping costs, faster delivery times, and increased quality control. Additionally, geopolitical tensions and trade uncertainties encourage businesses to localise production for stability. Governments incentivise onshoring through tax breaks and reshoring initiatives, aiming to boost domestic manufacturing and job creation. While cost considerations still play a role, the focus is shifting towards resilience and sustainability, onshoring is emerging as a strategic imperative in the post-pandemic landscape.

Manufacturing onshoring, as well as a general push for increasing efficiency, drives increased automation. Rising labour costs in developed countries incentivises companies to invest in automation technologies to remain competitive. Advances in robotics, artificial intelligence, and machine learning make automation more accessible and efficient. By leveraging automation, manufacturers can improve productivity by determining process effectiveness, predicting and preventing supply suspension, better handling inventory imbalance, reducing errors, and achieving greater flexibility in responding to changing market demands, for instance through more agile production processes. Across the production process, process efficiency continues to be the key metric, and smart manufacturing processes are being tailored towards optimisation of throughput.

In addition to the trends in the manufacturing process, many products are also changing in one major way. Electronics hardware manufacturers are increasingly looking to connect those products in order to add recurring revenue streams, find differentiators, or comply with regulations. For example, it is increasingly difficult to buy a TV that is not a 'smart TV', 89% of new cars roll off the production line with embedded connectivity, and almost every electricity meter that is replaced is swapped out for a smart meter (as well as hundreds of millions being installed proactively). As a result, the lion's share of electronics products today are connected products. Of course not all of those products make use of cellular connectivity, but a substantial proportion do. According to Transforma Insights, a total of 4.1 billion IoT connections were added globally in 2023, of which 10% were cellular connected. And, we should note, the availability of increasingly cost-effective Low Power Wide Area (LPWA) options for cellular connectivity, most notably NB-IoT and LTE-M have helped to drive down the cost of deployment and open up many new use cases. For many use cases, particularly those identified in the 'Key use cases' section, below, cellular will be the dominant option.

This combination of greater emphasis on manufacturing process efficiency, coupled with the increasing requirements for cellular connectivity within products, is creating a headache for product makers with regard to cellular connectivity. Specifically, how to provision the right SIM within the product to be appropriate for the country or countries into which the device will be deployed. Historically this was done by maintaining an inventory of SIM cards which were manually inserted into the devices based on where they would be used. This added a further step in the production process, required management of a SIM card inventory including multiple operator SIMs, and significantly increased the number of product SKUs. Fortunately the SIM technology has evolved with the arrival of embedded SIM (eSIM) and Remote SIM Provisioning (i.e. applying the SIM profile virtually) as discussed in the next section. That new approach streamlines the process, and new enhancements are being added regularly.



What is eSIM and remote SIM provisioning (RSP)?

For connected product manufacturers, the options for managing cellular connectivity have evolved quite dramatically in recent years, from swapping plastic SIM cards, through in-field remote SIM provisioning (RSP) to In-Factory Profile Provisioning (IFPP). Manufacturers of connected products need to understand how the technology has evolved and what this means for the management of connectivity profiles, as well as the production processes and the products that are being supported.

Until 2016, cellular connected devices were authenticated onto a network using a removable plastic SIM card. This was not particularly appropriate for many IoT use cases, which required a more ruggedised form factor. And the requirement to plug in a physical SIM card added an extra step in the manufacturing processes. In 2016, the Machine Form Factor (MFF, now MFF2) was launched, comprising a chip to be soldered onto the circuit board of the device. This further evolved with the advent of iSIM in 2018, which saw the SIM application moved onto another processor, within the same System-on-Chip (SoC), as an integrated secure element.

As a result of this change in the physical form factor, it was necessary to develop the capability to change the SIM profile through a mechanism other than physically swapping out SIM cards. That mechanism is Remote SIM Provisioning (RSP), i.e. over-the-air switching of profiles on the SIM card without needing to access it physically. This functionality is another additional benefit of embedded SIM, i.e. removing some of the logistics headache of managing connectivity on devices as they are deployed.

The handling of RSP will generally be dominated by the standards developed by the GSM Association (GSMA). The first two standards for eSIM architecture were developed as SGP.02 ("M2M") and SGP.22 ("Consumer"). SGP.02 was introduced in 2014 and SGP.22 in 2016, with a lag of a few years before widespread commercial deployments.

We should explain the terminology a little here. For each of these standards (SGP.02, SGP.22 and SGP.32), there was a pre-cursor which involved laying out the requirements for the standard. Prior to SGP.02, there was SGP.01 which performed that function. The same was true of SGP.21/22 and SGP.31/32, and will be true of SGP.41/42 as described below.

The SGP.02 M2M format is a 'push' model whereby changes of eSIM profiles are taken from the SM-DP (Subscription Manager - Data Preparation) and pushed to the SIM by the SM-SR (Subscription Manager - Secure Routing) element that controls it. To have full control over the SIM, the customer needs to run the SM-SR itself, although in almost all cases it is envisaged as being run by a third party such a Mobile Network Operator (MNO) and/or Subscription Management provider (typically a SIM vendor such as G+D, Kigen or Thales). The challenge with SGP.02 is that it requires cooperation between the subscription management infrastructure of the donor and the recipient networks in order to handle the hand-over. It is, effectively, controlled by the provider of the connectivity rather than by the user or the product vendor, such as a hardware OEM.

In contrast, the Consumer form uses a 'pull' approach with the profile pulled directly from the SM-DP, with the role of the SM-SR split between the SM-DP (or in this approach the 'SM-DP+') and the device itself, in the form of a Local Profile Assistant (LPA). In this scenario the ownership of the device is enough to manage the process, and it is thus controlled by the device user. This approach, however, requires the device to have a more sophisticated user interface (UI) and a camera (for instance to scan a QR code), as well as manual intervention to activate the process. This is fine for smartphones and some categories of consumer electronics, but most IoT devices lack some or all of those characteristics.

Technical specifications of a third variant, SGP.32 ("IoT"), were finalised by the GSMA Working Group 7 in May 2023, and await finalisation of the associated testing and certification standard (SGP.33), and compliance procedures, at the GSMA. This is expected to be completed by September 2024. Device vendors expect certification of SGP.32 compliant devices by Q4 2024, and production of devices in early 2025.

The IoT variant is largely an adaptation of the Consumer SM-DP+ approach, but with four main relevant additional features:

- Remote UI - The role of the LPA is now partially on the device as the IoT Profile Assistant (IPA) and partially hosted by the network operator or third party, in the form of the eSIM IoT remote Manager (eIM), allowing for the remote control of the IPA without need for manual intervention.
- Support for lightweight protocols such as CoAP-based Lightweight M2M (LwM2M) to manage profile downloads and other operations - SGP.32 does not require support for TCP/IP, which is heavier than the UDP used in CoAP, and LwM2M that runs over it. This helps to overcome constraints on latency and bandwidth which are common with newer IoT connectivity technologies, particularly NB-IoT.
- No requirement for SMS - NB-IoT devices often don't support SMS, which was required for SGP.22.
- A small footprint - Because much of the functionality of the LPA has been moved into the eIM it reduces the memory and processing requirements on the device itself.

The main implications of the use of SGP.32/IoT are commercial and operational. Compared to SGP.02/M2M it removes some of the business inflexibility and lock-in. With the SM-SR/SM-DP

What is eSIM and remote SIM provisioning (RSP)

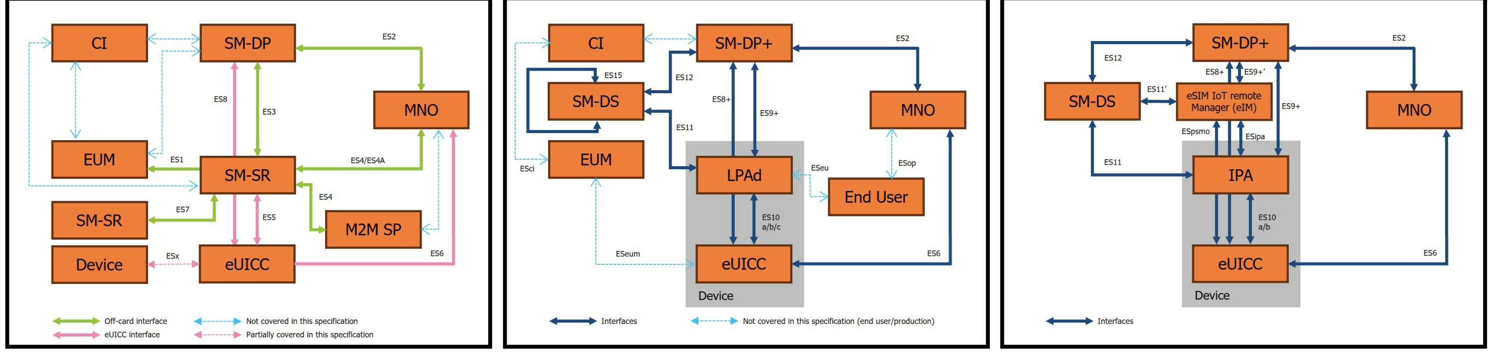
format it was necessary to integrate between subscription management platforms in order to move connections between operators. Moving between them was difficult. In contrast, with SGP.32 it is relatively easy to create a new eIM/eUICC association and send the new configuration. There is no need for integration between the two eIMs. This removes the need for integration between the operators, giving more flexibility and control for any company using it. It combines the user control of SGP.22/Consumer with the ability to manage the process across large fleets of devices remotely without user intervention which is the big advantage of SGP.02/M2M.

Before the availability of the SGP.02/M2M standard, there were a number of implementations of an equivalent capability that were developed as pre-standards by the SIM vendors, mostly to support the demands of automotive OEMs. These lacked interoperability between operators but were useful for initial localisation. In other cases, vendors have developed pre-standard versions of SGP.32/IoT ahead of the finalisation of that standard too; we should note that pre-standard versions of SGP.32/IoT are proportionately more standards-based than the equivalent in SGP.02, featuring as they use common standards-based elements such as the SMDP+ from SGP.22.

SGP.02, SGP.22 and SGP.32 standards for In-Field Remote SIM Provisioning

[Source: Transforma Insights, 2024]

M2M (SGP.02)	Consumer (SGP.22)	IoT (SGP.32)
Pushed profile download via service provider platform direct to the device.	Pull profile, could be activated with QR code or pre-provisioned on a device.	Allows users to order a profile from any operator, connecting to the relevant SM-DP.



SM-DP (Subscription Management Data Preparation) – stores eSIM profiles and prepares for download.
SM-SR (SM Secure Routing) – establishes secure channel to the eUICC to manage it
SM-DP+ (SM Data Preparation and Secure Routing) - both elements handled through a single platform
SM-DS (Discovery Service) – optional add on for Consumer, where SM-DP+ address is unknown to eUICC
LPA (Local Profile Assistant) – local profile to communicate with SM-DP+ located on SIM or device

What is In-Factory Profile Provisioning?

The approaches to RSP outlined in the section above are focused on managing the SIM of a device after it has been deployed into the field. However, there is another scenario in which SIM provisioning might be more effectively supported: to set the initial SIM profile(s) during the manufacturing process. This is In-Factory Profile Provisioning (IFPP).

In-Factory Profile Provisioning (IFPP) is aimed specifically at a particular type of use case: the secure loading of SIM profiles during the manufacturing and/or order fulfilment process based on characteristics such as the device capabilities or the geographic location into which it is expected to be deployed. This form of eSIM/RSP is rather different from others because the focus is predominantly on meeting throughput requirements of the plant. It is thus particularly relevant for the demands of volume manufacturing as outlined earlier.

In order to support IFPP, the GSM Association initiated a further evolution of its standards for eSIM: SGP.41/42. That standard is currently awaiting completion. The way in which the standard works is to allow the manufacturer to hold a digital inventory of Mobile Network Operator (MNO) eSIM profiles and integrate them by way of a profile loader in the manufacturing line, which will apply the next appropriate profile according to pre-established parameters. Typically it will be flashed to the device at the same time as firmware/software loading or when firmware is updated during personalization before the device ships.

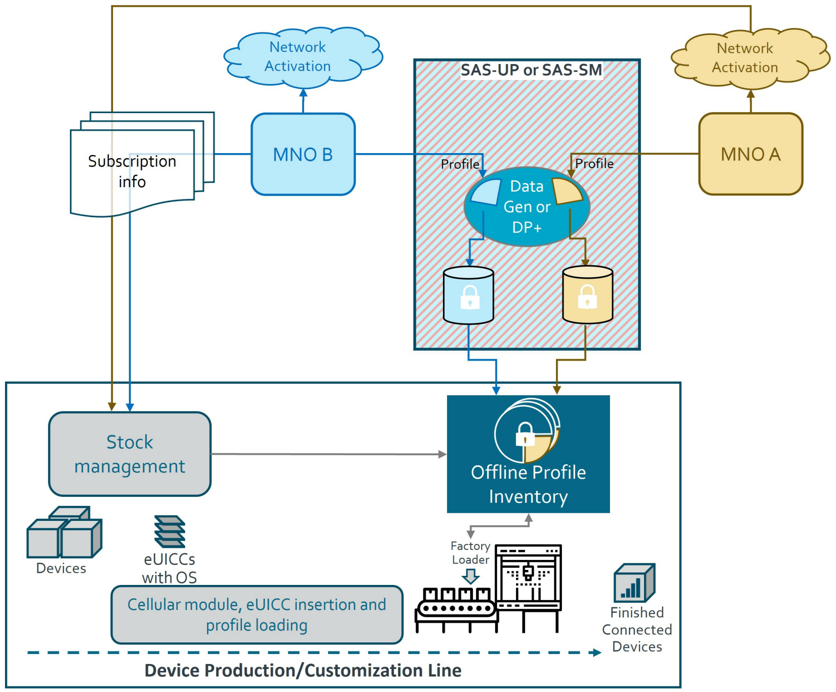
The SGP.42 standard can be expected to arrive in 12-24 months. Some see it as a possible alternative for in-field provisioning and wish to adapt the standard to support that.

It is important to note, however, that there is no overriding requirement to use a standard. As noted above, non-standard variants of SGP.02 and SGP.32 have been used to address the market before the equivalent standards were available. Car makers, for instance, made extensive use of pre-standard equivalents of SGP.02 for RSP in vehicles for many years. They were perfectly effective, although lacked interoperability between MNOs, RSP providers (i.e. the SIM vendors who operated the SM-SR/SM-DP) and car makers. In the case of IFPP the lack of interoperability is unlikely to cause any issues as it is being used for a one-off flashing of the profile, without a need for compatibility with other factories or processes. IFPP is being deployed in a closed environment of one manufacturer's plant. There also won't be any requirement for future-proofing since the process is a one-off affecting the devices only as they roll of the production line for the first time. Therefore any current system does not need to be compatible with any alternative system that the manufacturer might choose to switch to in future.

There may be some advantages to using a standard in terms of being able to mix and match vendors, and also to provide comfort to MNOs about the processes being used to manage their eSIM profile inventory. However, we do not see these as insurmountable obstacles. Manufacturers will want the most efficient approach possible, meaning they will accept some limitation on vendor selection, and they will probably be quite persuasive to MNOs that the multi-million device connectivity deal on offer is worth approving their non-standard approach. We should also note that many manufacturers will prefer to have their own customised variant of the process, acting as a 'special sauce' to make its manufacturing process more efficient than that of its competitors. For volume manufacturers focused on throughput, this could be a very strong reason for actually favouring a customised approach over the standard, or at least adding their own custom enhancements.

Coming SGP.41/42 standard for In-Factory Profile Provisioning

[Source: Kigen, 2024]



Why use IFPP?

There are seven key characteristics of IFPP that make it stand out as beneficial for manufacturers, as explored in the list below.

The 7 benefits of In-Factory Profile Provisioning (IFPP)

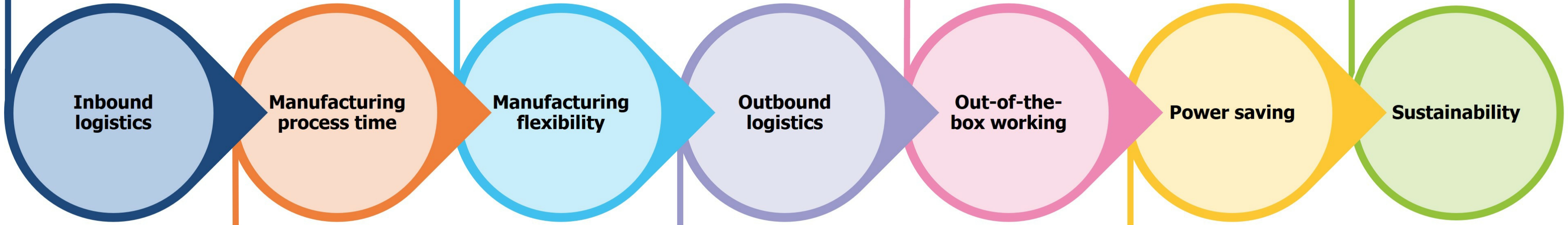
[Source: Transforma Insights, 2024]

Historically manufacturers needed to maintain an inventory of SIM cards, which may have a lead time stretching into months. Customer orders could not be fulfilled until SIM cards were delivered to the factory, leading to potential delays. In many cases the manufacturer would have to pay for the SIM cards before they arrived in the factory. With IFPP, SIM profiles are used only at the point at which they are required and they can be deployed instantly.

Production lines can be adapted automatically and instantaneously to different requirements for SIM profiles, simply by changing the parameters sent to the profile loader. In some cases, manufacturers opt to create generic stock to which a profile is downloaded once the order is received, typically alongside the buyer's firmware variant. IFPP gives the flexibility to use either approach.

Because the device has been pre-configured with the correct profile at time of manufacturing it will automatically attach to the right network rather than having to spin through a bootstrap profile and localising. This provides an improved service for the customer and reduces some of the overhead for MNOs/MVNOs because there is no longer a requirement to support records for short-term bootstrap profiles on the Home Subscriber Server (HSS).

The use of plastic SIM cards involves the production of quite large quantities of waste plastic. At the point of production card bodies are discarded in large numbers. Furthermore, if any network change might need to be initiated, the SIM related to the previous network would be discarded and replaced with a new physical SIM card. There is no such waste with eSIM.



Removing the need to manually handle and fit a plastic SIM card into the device eliminates a mechanical step from the manufacturing process, reducing labour cost and speeding up production, which is clearly critical in volume manufacturing.

The use of IFPP removes the need to support multiple SKUs, making distribution logistics more efficient. A manufacturer might easily have 2-3 profiles from major operators for a product in North America, but in Europe, this might be as high as 26-30 in order to support one operator per country. IFPP simplifies this as production runs can be managed to ensure the right connectivity is selected and meets all operator testing requirements within the process time. We should note that full flexibility is delivered through in-field provisioning, i.e. changing the SIM profile after deployment. IFPP can be deployed in conjunction with in-field provisioning.

The power saving benefits are particularly important for many use cases, specifically those devices that rely on lifetime battery power. The power requirement of SIM provisioning – in terms of the volume of data and authentication messages – can use up quite a significant portion of a battery; up to 15% in some cases. This can have a significant impact on the lifespan of devices that had been optimised to be ultra-efficient in their frequency and volume of data delivery. This is particularly relevant for applications using Low Power Wide Area (LPWA) technologies such as NB-IoT, which are typically highly power optimised, for instance in smart gas and water metering (see below).

Key use cases for IFPP

Internet of Things applications are hugely diverse. As a result there is no single 'best' approach to remote SIM provisioning; this will vary substantially depending on the type of use case. In this section we consider several of the biggest IoT applications involving large volume manufacturing and the ways in which they might most optimally handle RSP, considering the customer journey and the main sensitivities of each.

Smart metering

In the smart metering category we must distinguish between two main types, which have quite different deployment characteristics. Electricity smart meters have direct access to mains power, meaning that considerations of power saving are all but irrelevant. Additionally smart electricity meters are likely to report more frequently and in future are more likely to be stitched into energy load balancing processes, necessitating more reliable connectivity. In contrast, water and gas meters report relatively infrequently and generally have no access to power, making power-saving a key feature. In many cases these types of meters must work under extremely stringent requirements for battery life. What these two types of applications do have in common is that they are often located in similar types of locations, basements, which are not easily accessible for manually managing connectivity and also will frequently suffer from poor network coverage.

As a result of the use of batteries in gas and water smart meters, there is a stringent requirement to minimise the amount and frequency of communication to and from the meters. This includes both the message payload itself, and the management of the device and its connectivity, including things such as firmware updates and - most pertinently to this report - management of the SIM and the profiles upon it. Through the use of IFPP, the gas and water smart meters can be pre-provisioned with profiles in an efficient manner before they ever leave the factory, meaning that typically the management of connectivity on the device, such as initial network selection, will not represent a systematic battery drain for initial setup.

The other benefits of IFPP identified in the previous section are also relevant to all meters. The manufacture of smart meters is a volume market and is quite commoditised. For smart meter manufacturers, shaving a few cents off the cost through a more efficient production line and supply chain will be significant.

Car manufacturers

With the majority of new vehicles having cellular connectivity, car makers have been in the front-line of considerations of how to manage the application of appropriate SIM profiles. Initially this was generally done through a pre-standard variant of SGP.02, then migrating to the standard. The use of IFPP is increasingly under consideration to personalise to a national operator during order fulfilment. A further driver has been the requirement to support mandated emergency call (eCall) services.

Regarding remote SIM provisioning, there are a number of factors to be considered. First that the connected device has access to power, meaning that considerations of power-saving are minimal, not least because they will rely on more power-hungry 4G and 5G technologies. Second that car makers are less likely to know where a particular vehicle will be activated than the makers of most other types of device. As a result, the use of a bootstrap IMSI and in-field Remote SIM Provisioning is highly appropriate.

However, large scale manufacturing of the type engaged in by car makers will certainly benefit from the streamlined provisioning in the factory or distribution channels of SIM profiles provided by IFPP.

Key use cases for IFPP

Fixed Wireless Access/CPE/Routers

The use of cellular connectivity as an alternative to - or back-up for - fixed line broadband is an emerging trend, particularly in the United States. These offerings might take the form of enterprise Fixed Wireless Access (FWA), branch connectivity, site connectivity or cellular failover, but effectively they amount to a similar thing: using cellular networks to connect a router which supports multiple devices and would historically have been connected to a fixed connection. This has seen an increased uptick in appeal in markets with readily available 5G connectivity and plenty of spare capacity, of which the US and India are the prime examples.

In the case of FWA, it is typical that the manufacturer knows which connectivity provider's profile or profiles should be added before shipping. IFPP therefore streamlines the process of out-of-the-box working. The same may not be true of more generic router products.

Consumer electronics

According to Transforma Insights' IoT Forecast Database, of the top 5 market segments for cellular-based IoT connectivity, several involve applications that involve consumer electronics products. The top two are Connected Vehicles and Smart Grid (including smart metering), which are considered above. The next three, Asset Tracking & Monitoring, Building Safety & Security and Consumer Internet & Media Devices, all include consumer electronics products, and these dominate in the case of the latter. While they might individually lack the absolutely scale of smart meters and connected vehicle production, they collectively represent hundreds of millions of shipments worldwide.

These categories of applications are quite diverse. In some cases they will be optimally designed for the use of SGP.22/Consumer remote SIM provisioning with the user themself manually handling profile selection, for instance for smart watches. In others the connectivity will be opaque for the user and would be managed by the manufacturer as part of a bundled offering. In the latter case, the device maker will probably benefit from IFPP for simplicity of supply chain and streamlining of the manufacturing process.

Additionally, some of these use cases, such as pet trackers, will make use of battery power and will thus benefit from IFPP.

Furthermore, consumer device OEMs may wish to implement a process whereby the customers eSIM can be installed without the need for a Wi-Fi connection, for instance using different bootstrap operators in different regions and personalising the devices at the last minute according to where stock is being shipped.

Conclusions and recommendations

Transforma Insights makes the following recommendations relating to the adoption and support of IFPP:

1. **In-Factory Profile Provisioning (IFPP) offers volume electronics manufacturers multiple mechanisms for improving profitability and competitiveness, and making a better end product.** The cost savings in production/fulfilment of IFPP's reduction in loading time will have a notable impact on cost of operations, with a flow-through impact on profitability and/or competitiveness. The reduction in setup-related power consumption might make the difference between a product that meets deployment requirements and one that doesn't.

2. **Volume manufacturers of cellular connected electronics devices will almost certainly benefit from the use of IFPP.** Migrating away from plastic SIMs to soldered SIM is inevitable for any hardware maker. The question remains, however, of how the provisioning process happens: in factory or in field. As illustrated in the previous section there are many examples where in-factory provisioning makes the most sense.

3. **Connectivity providers need to adapt to the needs of manufacturers.** The use of IFPP is in large part driven by a requirement to make the SIM profile provisioning process more appropriate for volume manufacture. Until now it has relied on a process ostensibly developed for mobile phones and latterly adapted somewhat for IoT devices. However, until IFPP it has never been optimised for connected device makers. The trend in IoT over the past 10 years has been to replace technologies optimised for telecoms with those that are specifically designed for IoT. The arrival of IFPP continues that trend.

4. **IFPP is particularly relevant for deployments that are power-constrained.** Any cellular-enabled IoT device that runs on batteries will be, by definition, power-constrained and will benefit from eliminating the need for power-hungry in-field provisioning. Smart metering is a good example here, but numerous others such as track & trace will also have such a need. There is a strong overlap with applications using NB-IoT, the use of which is growing rapidly.

5. **You don't really need a standard to benefit from IFPP.** In the same way that pre-standard versions of SGP.02 and SGP.32 have pre-empted the arrival of the standard with very effective technology, in the case of IFPP a non-standard approach is also valid. In fact, it is even more valid because the deployment is in a closed and highly managed environment. Furthermore, manufacturers will be actively looking for their own 'special sauce' customised approaches to give them a competitive advantage.

eSIM LIKE NEVER BEFORE

Security for scale.

Whether it is to optimize the performance of one of the world's most ambitious solar power stations, or to double the throughput of the world's largest smart metering manufacturing plant, or to disrupt the market with innovative new consumer services using NTN satellite – OEMs turn to Kigen as the forerunner in energy-efficient eSIM solutions built for scale.

Kigen invites you to discover what's possible together, with eSIM at kigen.com/esim

Kigen

Let's meet

Join the #FutureofSIM conversation on:

@Kigen

@Kigen_Ltd

Manufacturing for scale

- *Late-stage connectivity provisioning in the factory*
- *Built for mass roll outs worldwide*

Flexible management solutions

- *Elastic eSIM (M2M, Consumer and IoT) onboarding suite*
- *Chip-to-cloud security for trusted data service acceleration*

Industry-leading innovations

- *Future-proof with SGP.32-ready solutions*
- *Pioneering Integrated eSIM (iSIM) for novel IoT products*

Ecosystem committed to scale

- *World's leading IoT and connectivity modules*
- *Highest quality LPWAN and NTN connectivity ecosystem*

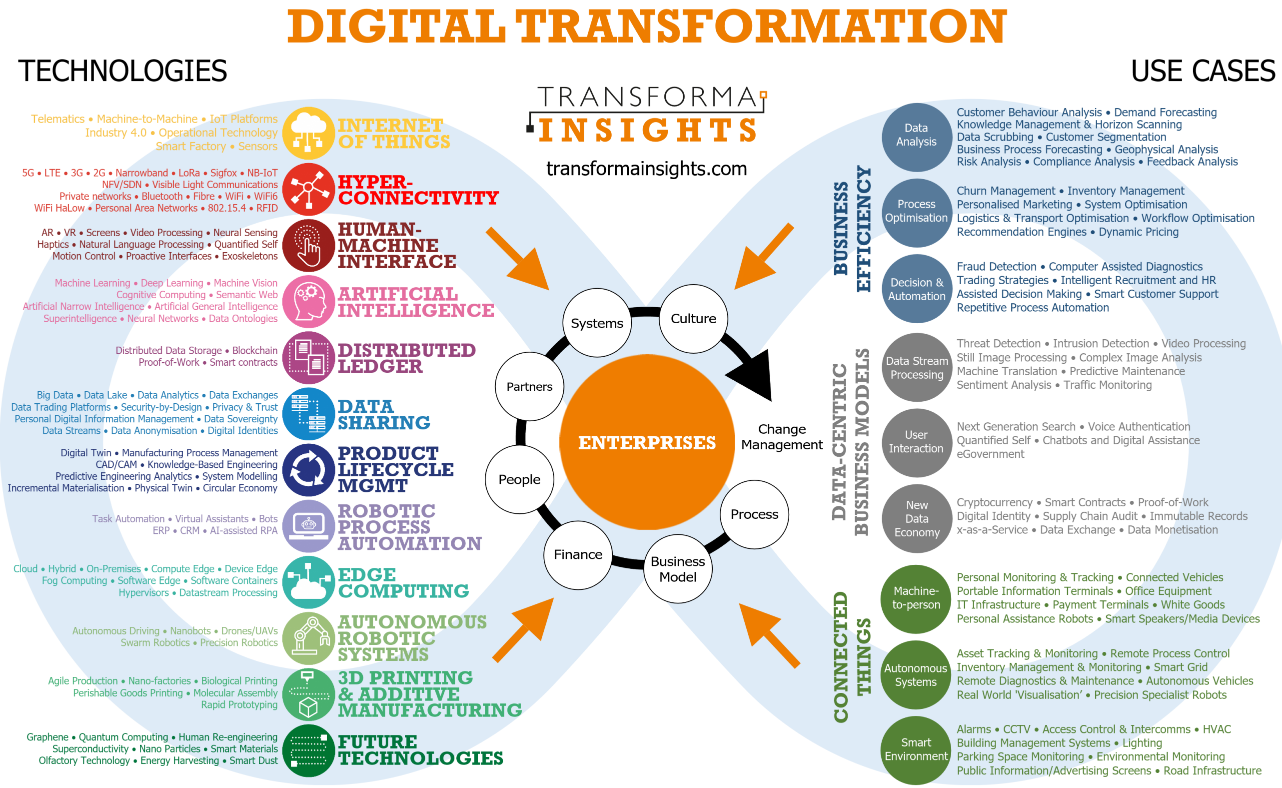
#Futureof**SIM**

About Transforma Insights

Transforma Insights is a technology industry analyst firm focused on the impact of emerging technologies and the associated technical and commercial best practice.

We help technology adopters understand the opportunities associated with new technologies, particularly the Internet of Things, but also in Artificial Intelligence, Distributed Ledger, Edge Computing and others under the umbrella of 'Digital Transformation'.

We help technology vendors understand the changing market dynamics and the associated market opportunity.



transformainsights.com

enquiries@transformainsights.com

@TransformaTweet