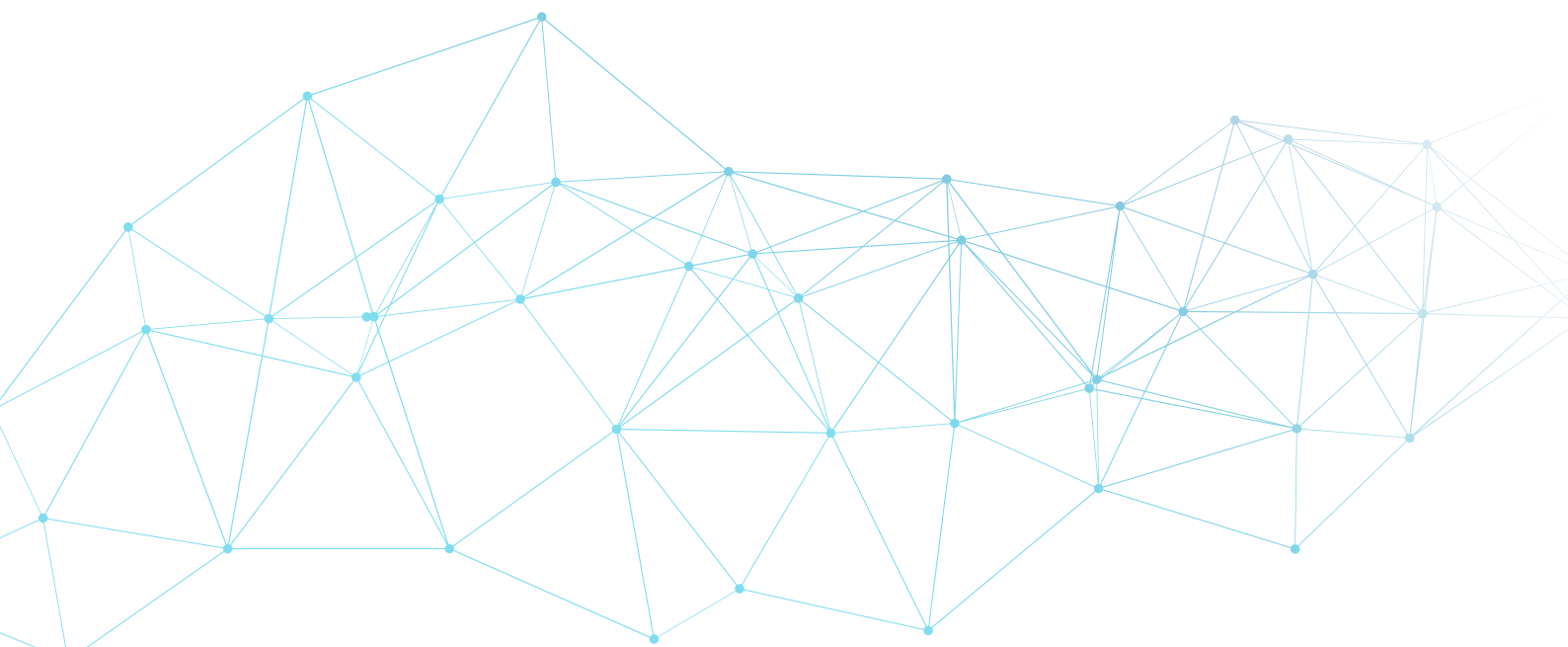# eSIM Solutions

Accelerating digital transformation
for Mobile Network Operators

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Overview: **A new digital dynamic in the consumer device connectivity market**

For Mobile Network Operators (MNOs), the eSIM represents much more than a technical evolution in device connectivity. Supporting remote subscription activation, anytime and anywhere, it creates a platform for a fully digital, frictionless customer experience. Further enabled by the latest online ID verification solutions, as well as 5G networks, the emerging eSIM ecosystem also aligns perfectly with MNOs' wider ambitions for digital transformation.

In the years ahead, across both the consumer and industrial domains, billions more products will employ the eSIM. As a result, the relationship between MNOs and their customers will be redefined. In this white paper, we focus on the compelling opportunities being created in the consumer market

to increase revenues and streamline business operations. The industrial market will be the subject of a separate publication. However, across both sectors, the key to success for MNOs lies in exploiting the wide range of eSIM subscription activation methods defined by GSMA specifications, and the rich array of innovative consumer use cases they enable. Crucially, these provide MNOs with the freedom to develop policies that are in line with both their go-to-market business strategies and customer preferences.

As critical mass is reached in the eSIM-enabled consumer device market, we outline the options available to MNOs, and the key role that associated technologies such as secure online customer onboarding and the 5G eSIM are set to play.

Business context: **Embracing the eSIM and digital transformation**

The eSIM market has come of age. Trusted Connectivity Alliance reports that eSIM profile transactions rose by 54% in 2021 and that 337 Mu eSIMs were shipped the same year. Going forwards, momentum is building fast and strong growth will be evident in both the consumer and industrial domains. In terms of volume, the former will lead the way; by 2027, ABI Research estimates there will be

677 million eSIM-enabled consumer devices. But while the industrial market is set to be smaller, it is far from insignificant. The same ABI Research survey indicates that, by the same year, another 275 million eSIM-enabled devices will be supporting IoT/M2M applications such as automotive, smart cities and track and trace.
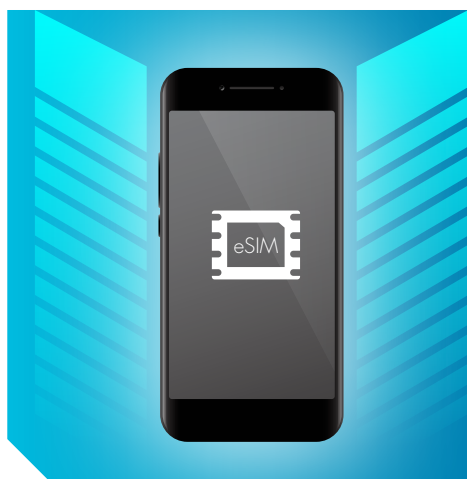
Smartphones are driving eSIM adoption

In this white paper, our focus is on the consumer market, where eSIM adoption is being driven by a fast-growing portfolio of OEM smartphones. Examples in the market includes Google Pixel 7, iPhone 14, Huawei P40, Samsung's flagship Galaxy S20 series, Motorola's eSIM-only RAZR and many others. More eSIM-enabled OEM smartphones are in the pipeline, as are enhancements to existing models. MNOs are also active, for example with Rakuten's eSIM-capable devices. According to our own market analysis, there were more than 75 types of eSIM smartphones models in 2021. Also, the number of eSIM consumer devices has more than doubled in the past 2 years. At the same time, the eSIM is becoming an increasingly familiar feature in tablets and PCs, as well as a new generation of smartwatches such as the recently introduced OPPO.

A new ecosystem emerges

As eSIM-enabled consumer devices reach critical mass, a new ecosystem is emerging. Alongside the inherent benefits of the eSIM, this is being built on the firm foundations of a mature and well proven set of GSMA specifications. For MNOs, the rapid development of this market is highly significant, as it provides an opportunity to fundamentally transform their business operations. Leveraging a range of eSIM solutions, MNOs are now able to digitize the consumer journey for a wide variety of consumer devices. This in turn will serve to boost connectivity revenues.

MNOs and subscribers welcome digitization

Many MNOs are already moving fast in this direction. According to the GSMA, as of June 2022 more than 260 mobile carriers in around 90 countries support eSIM services for consumer devices. Considering that the first eSIM-enabled iPhone was only launched in 2018, this clearly represents a significant shift.

Embracing the eSIM is very much part of a wider trend towards digitization. For example, according to a GSMA report released in June 2020 ("eSIM moving up the agenda: from industry work to customer adoption"), operators now sell just 36% of their smartphones in store. Of the remainder, 33% are purchased online and a further 31% through third parties.

Enthusiastic consumer adoption of eSIM-capable devices is good news for this digital transformation agenda. This is because the eSIM facilitates instant, over-the-air activation of mobile subscriptions, anytime and anywhere. The need for customers to go in-branch to activate their subscriptions is eliminated. And consumers are increasingly ready for change. According to a new survey from industry specialist Capgemini ("The connected telco consumer: how telecom operators can reconnect with customers and emerge stronger from the pandemic"), 46% of consumers are open to the idea of activating mobile services remotely via an eSIM.

Enabling digital transformation
with Thales eSIM solutions

The eSIM explained

The eSIM is often a misunderstood concept. The idea that initially springs to mind is usually one of dematerialization – the disappearance of the physical, removable SIM card. In fact, an eSIM is any reprogrammable SIM that enables an MNO or OEM to download a SIM profile over-the-air. This is regardless of the SIM's specific form factor. Having said that, the trend is undoubtedly towards smaller eSIMs, enabling more compact and straightforward design of consumer devices.
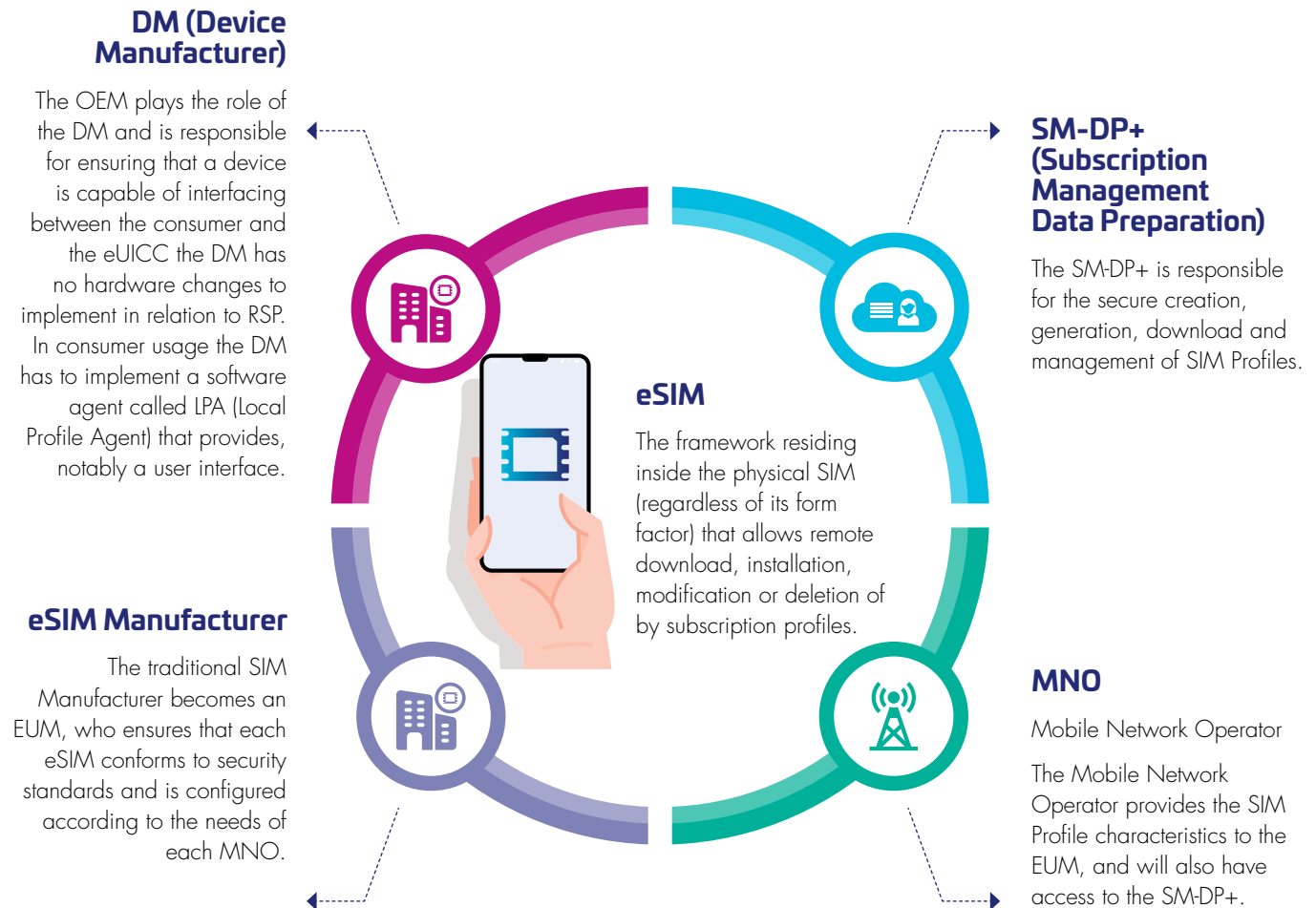
Thales eSIM solutions comprise the two required elements:

- the hardware: the eSIM (also known as the embedded SIM or eUICC), based on a hardware with security features that can be either dedicated or integrated in a larger chip.

- the eSIM Management platform , also called the Remote SIM Provisioning (RSP) platform: it enables the secure download of a new SIM profile onto the eSIM.

In practice, the eSIM and RSP are two sides of the same coin: both need to follow the GSMA specifications which are now mature but also evolve over time. Reflecting this, Thales solutions are fully compliant with the latest specifications, and ensuring that our platform enables the secure download and management of telecom operator subscriptions (profile packages) in all devices equipped with an eSIM.

The RSP process

RSP involves processing of input data, data preparation and personalization: all the steps required for developing a SIM Profile must be carried out. The infographic below highlights the key components and actors within the RSP architecture.

DM (Device Manufacturer)

The OEM plays the role of the DM and is responsible for ensuring that a device is capable of interfacing between the consumer and the eUICC the DM has no hardware changes to implement in relation to RSP. In consumer usage the DM has to implement a software agent called LPA (Local Profile Agent) that provides, notably a user interface.

SM-DP+ (Subscription Management Data Preparation)

The SM-DP+ is responsible for the secure creation, generation, download and management of SIM Profiles.

eSIM

The framework residing inside the physical SIM (regardless of its form factor) that allows remote download, installation, modification or deletion of by subscription profiles.

eSIM Manufacturer

The traditional SIM Manufacturer becomes an EUM, who ensures that each eSIM conforms to security standards and is configured according to the needs of each MNO.

MNO

Mobile Network Operator

The Mobile Network Operator provides the SIM Profile characteristics to the EUM, and will also have access to the SM-DP+.

How Thales addresses
the digital customer experience

In today's mobile communications market, the consumer is firmly in charge. Operators need to provide an outstanding end user journey, tailored to individual requirements.

Thales offers MNOs a full range of methods for downloading and activating their mobile subscriptions to any eSIM-capable device. Common to all is a seamless and secure digital connectivity experience - one that gives the end user a comprehensive choice of mobile subscriptions, across all channels, in-store and online.

The preferred method of downloading and activating mobile subscriptions will be driven by the MNO's strategy for maximizing adoption in the eSIM market and thereby optimizing the reach and activation of both branded and non-branded eSIM-capable consumer devices. In addition to this, the ability to provide portability of mobile subscriptions between non-eSIM and eSIM-capable devices is critical. Again, Thales addresses this challenge seamlessly, via our eSIM Management platform.

When focusing on the eSIM market, it is also important that MNOs do not overlook the critical first phase that is customer onboarding. Here too, Thales offers unrivalled capabilities that facilitate effortless eSIM activation via a fully secure and highly intuitive digital end user experience as explained below.

Freedom of choice: Introducing the four methods of eSIM subscription activation

Every stage of the eSIM lifecycle is defined within the GSMA specifications. This encompasses eSIM specifications, profile downloads and subscription activation. It also includes the interaction between the user and their device to activate the subscription.

The GSMA specifications recognize four main methods of activation. All of them enable instant activation of mobile subscriptions, anytime and anywhere. Those methods require the use of Wi-fi type of connectivity to initiate the activation processes.

1. QR code activation

With this solution, the end user initiates the process by simply scanning a QR code provided by the MNO. The code can either be physically printed (for example, on a leaflet or magazine advertisement) or displayed digitally on a screen.

This QR code already contains the information necessary for the download of a mobile subscription:

▌ The address of the SM-DP+ to target

▌ The activation code or matching ID, identifying the profile provisioned in DP+, to be downloaded for the end user

The profile download request is submitted by the end user and that profile is activated with the end user's consent.

Thales offers multiple, flexible ways for MNOs to use QR codes for subscription activation:

▌ by batch (for both physical and digital QR codes), each QR code representing a single subscription

▌ generic - with a single QR code representing a pool of subscriptions

▌ on-the-fly, where a QR code is generated, only upon request, so no reservation of QR codes in advance

2. Mobile app activation

If it's not already on their handset, the end user downloads the MNO's app.

The profile download is then managed automatically by the app, providing the server with all the necessary device information to download the subscription to the eSIM.

The profile download request is submitted by the end user using the app; the profile is activated with the consent of the end user.

3. Default SM-DP+ based activation

The MNO provides the end user with a branded device. This contains all the information necessary to download the mobile subscription to the eSIM. In fact, the eSIM is personalized with the default SM-DP+ address in the factory.

The profile download request is submitted by the end user. If their consent is given when the confirmation, the profile is then downloaded upon end user's consent, in one click.

4. Discovery service-based activation

Using this method to download the eSIM profile, the end user (or sales person for an in-store activation) simply has to enter the eSIM identifier, also known as the EID (eUICC issuer Identifier).

Once the profile download request is submitted, it is followed by a subscription activation that is performed with the user's consent, in one click.
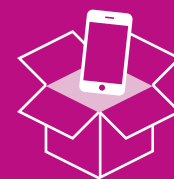
Adding an extra level of security

With all four methods, an optional confirmation code can be employed to provide an additional layer of security. This confirmation code, standardized by the GSMA, must be entered by the end user. It guarantees that the end user requesting the profile is the legitimate holder of the mobile device.

Matching eSIM subscription activation to MNO business strategies

These four activation methods offer MNOs a high degree of flexibility in terms of how they onboard customers. They also provide a platform for innovative use cases that deliver real added value for their subscribers. With a choice of frictionless onboarding techniques such as QR codes or one-click solutions, MNOs can tailor their approach in line with their customers' preferences - and their go-to-market business strategies. Crucially, by supporting full and seamless digital journeys that enable instant activation of a mobile subscription, consumer adoption of the eSIM is optimized, along with associated connectivity revenues.

Enabling new consumer offers

The potential for innovative use cases further magnifies these benefits. For example, eSIM subscription activation via a generic voucher with a single QR code enables multiple connected devices to be onboarded easily and instantly, with their own independent cellular connection. It therefore supports attractive consumer offers such as family bundles, where any number of eSIM-enabled devices within the same household are managed via a single, simple contract.

Equally compelling enterprise use cases can also be created, with personalized subscriptions for an organization's employees activated and managed seamlessly, simply by scanning a QR code at any time and place. Yet another opportunity comes in the form of eSIM-based prepaid inbound roaming offers. These propose consumer deals based on local tariffs. As a result, they give MNOs the ability to target and monetize the "silent roamers" who would otherwise switch off their data connection when abroad.

Looking **beyond the eSIM**

In progressing their digital transformation roadmaps, MNOs are also looking beyond the eSIM. In particular, online ID verification and 5G technologies represent other key assets.

Online ID verification (also referred to as eKYC) and enrollment systems are a critical enabler for both the digital customer journey and the wider digital transformation of MNOs. Offering consumers the freedom to confirm their identity remotely, via a mobile device and fully in line with local regulations, it quite simply represents the foundations of any genuinely 100% digital experience. In this respect, Thales Trusted Digital Identity services provide a fully integrated and proven solution for smooth, secure and compliant ID verification.

The current arrival of 5G similarly dovetails perfectly with the digital transformation agenda. Benefits such as low latency, high data rates, reduced energy use and cost savings are sparking new digital revolutions throughout the commercial domain. Also, with 5G,for mobile users in roaming situations, attachment to a local network is much faster than with previous technologies. Consequently, the seamless customer experience is further enhanced. What's more, 5G brings with it greater cyber resilience: the capability to dynamically update the security of a given profile (subscription) without changing the subscription itself. 5G also extends built-in privacy features to end users.

With eSIM technology, all these benefits are within easy reach. Migration from older technologies is straightforward, as eSIM management platforms enable frictionless transfer of subscriptions from a non-5G eSIM to a 5G eSIM.

The natural fit **for 5G**

Supporting 5G is the natural evolution for both the eSIM and RSP. Standards for this are currently being finalized; the GSMA has released technical specifications for both consumer and M2M applications, and the Trusted Connectivity Alliance (formerly the SIMalliance) has published the specification for interoperable 5G profiles. Test specifications are also being finalized by the GSMA, with publication expected in the near future.

Why should 5G devices be equipped with a 5G eSIM?

Given the obvious digital synergy between 5G and the eSIM ecosystem, there is a compelling case for equipping new 5G consumer devices with a 5G eSIM:

Selecting a 5G-compatible eSIM product facilitates support for the latest network capabilities and interoperability with current and future network generations. Indeed, most MNOs deploy their 5G network in two stages. This ensures the network configuration can evolve over time, after compatible devices have been deployed.

Another major benefit of a 5G eSIM is user data anonymization, enabling privacy. By encrypting the IMSI into a concealed identifier on the 5G network, privacy is protected and abuses such as eavesdropping and tracking are prevented.

Other valuable benefits of the 5G eSIM include a seamless 5G roaming experience. This is due to 5G SIM-based over-the-air 5G steering of roaming capabilities, and cyber resilience that allows MNOs to securely and remotely swap, on demand, the authentication algorithm contained in the SIM. A trusted environment is therefore maintained.
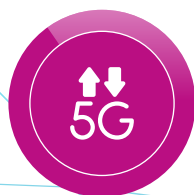
Because it provides off-the-shelf support for IMSI encryption and is certified for interoperability, the 5G eSIM is the simplest way to ensure that a 5G device will always successfully connect to a 5G network.

Conclusion: **The eSIM creates new synergies for digital transformation**

The advent of the eSIM represents a fundamental shift in how MNOs manage relationships with their customers. By offering subscribers the convenience of activating their subscriptions over-the-air, anytime and anywhere, the eSIM can eliminate the need to visit a store in person. As a result, MNOs must develop new approaches to acquiring and retaining customers. Fortunately, the eSIM provides significant freedom to implement tailor-made strategies, and launch compelling new consumer offers. Moreover, these can and should be pursued within the

wider context of digital transformation. Against a backdrop of increasingly dynamic and challenging market conditions, the ability to exploit the full potential of the eSIM to redesign business processes will be central to building connectivity revenues and realizing greater operating efficiencies. As discussed, this paper focuses on the eSIM opportunities within the consumer market, however there is a fantastic opportunity for eSIM in the field of industrial IoT. This will be the subject of further publications.

Working with **Thales**

Thales occupies a unique position in the field of eSIM solutions. We master all the necessary components, and benefit from a long-term trusted relationship with MNOs regarding the secure management of their network credentials.

Our award-winning solutions have been adopted by numerous MNOs, MVNOs and key industry players worldwide. Responsible for more than 360 projects, we are the world leader for Remote SIM Provisioning platforms, employed in both Consumer and M2M/IoT environments. We lead the creation of new specifications and collaborate closely with the GSMA and other relevant industries to enable streamlined deployment of Thales eSIM Subscription Management platforms.

Digital security is part of Thales' DNA, facilitating trust for all stakeholders in the eSIM ecosystem, including MNOs, MVNOs

and also OEMs, for which we provide eSIMs and wireless modules.

The 5G future connected world will open up a new chapter, more digital than ever, for Communications Service Providers and their customers (consumers, enterprises and governments). Extreme mobile broadband speed, massive critical IOT services and ultra-latency complemented by the network slicing will bring a shift from selling connectivity to analytics driven services and experiences. In parallel, new vulnerabilities, cyber-security, data privacy concerns and regulations, identity management for people and devices will increase in a more complex multi-stakeholder eco-system. Thales makes the 5G world a place we can all trust.

Useful links

Thales eSIM solutions

Thales Smart Profile Matcher video

Thales Smart Profile Matcher eBook

Thales On Demand Subscription Dashboard video

Thales On Demand Subscription Dashboard eBook

QR code eSIM activation with **Thales eSIM Generic Voucher**

Discovery service-based eSIM activation with **Thales SMDS Connect**

eSIM activation for OEMs with Thales Instant Connect

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