



STREAM TECHNOLOGIES

eUICC White Paper

Publication Date: 02/05/2017

Contents

eUICC: Transforming Cellular Connectivity.....	3
eSIM versus eUICC – What’s the Difference?	3
Differentiating eUICC from Global Roaming SIMs	3
The Evolution of eUICC	4
The Conventional SIM	4
eUICC.....	4
A Customer Focussed Solution	4
Standardisation, Specification and Lifecycle.....	5
The GSMA Specification: Defining a Standard	5
eUICC Form Factors.....	5
eUICC Lifecycle.....	6
Key Features.....	7
An Emerging Market	9
Opportunities for Enterprises	10
Supporting Connected Cars	10
Simplifying OEM Supply Chains	10
Supporting Long-Term Deployments.....	10
Opportunities for Operators	11
Additional Income Through Increased Connections.....	11
Reduced Costs and Inventory Complexity	11
Consider eUICC If	12

eUICC: Transforming Cellular Connectivity

The development of **eUICC** (embedded Universal Circuit Card) technology is poised to transform cellular connectivity for consumers, device manufacturers and enterprises alike. With conventional SIM cards, if a customer wants to change network operator, they need to swap the physical SIM inside their device. The development of eUICC enabled SIMs means that enterprises can remotely provision SIM profiles over the air, without having to change the physical SIM card. Device manufacturers can replace conventional SIMs with eUICC enabled SIMs, enabling them to embed a reprogrammable chip in their devices at the point of manufacture and drastically simplify their supply chain.

With the ability to operate globally, support multiple subscriptions and be reprogrammed remotely, eUICC enabled SIMs are hugely beneficial for **IoT** (Internet of Things) applications. eUICC opens the door to a range of use cases that cannot be supported by conventional SIMs and offer exciting opportunities to network operators, SIM manufacturers and enterprises. eUICC represents a radical change in cellular connectivity that has the potential to significantly impact the mobile value chain.

This paper describes what eUICC technology is, the key features of the technology and the use cases that eUICC will deliver benefit to.

eSIM versus eUICC – What's the Difference?

The terms **eSIM** (embedded SIM) and eUICC are often used interchangeably. The term eSIM simply refers to an embeddable SIM card, whereas an eUICC enabled SIM is a remotely reprogrammable SIM, which is available in a range of form factors.

Differentiating eUICC from Global Roaming SIMs

While both eUICC enabled SIMs and global roaming SIMs provide global cellular coverage from a single SIM card, a key difference between the two is that only eUICC allows users to remotely programme the SIM to use a different SIM profile. Remotely switching SIM profile provides a level of flexibility that is not available with global roaming SIMs. A crucial difference is that eUICC enabled SIMs can provide customers with global connectivity at local rates, whereas customers using roaming SIMs may incur a premium charge.

The Evolution of eUICC

The Conventional SIM

Historically, the conventional SIM card has provided the backbone of cellular communications. A SIM, or Subscriber Identity Module, is a plastic card that slots into a device. A SIM card contains unique information that identifies a subscriber to a specific mobile network and enables a connection to be established between the device and the operator.

Introduced to support the original digital cell phones in 1992, conventional SIM cards were not designed to match the requirements of IoT applications. For example, a conventional SIM is locked to the network operator who issued it. This means that a SIM card can only be used to access the services of the operator who issued the SIM. The permanent relationship between the network operator and the SIM card, means that if a subscriber wants to change network operator, they must also change the physical SIM in their device.

eUICC

The emergence of eUICC technology has radically disrupted the conventional model. eUICC enabled SIMs provide the same functionality as conventional SIMs, plus they allow the device user to change network operator remotely, over the air at any time. This represents a significant change in the way connectivity is managed, since the network a device is subscribed to can be changed without having physical access to the device.

Unlike conventional SIMs, eUICC enabled SIMs allow multiple network profiles on a single SIM. Network profiles provide different commercial and network agreements with different network operators. This feature is a crucial distinction between eUICC and conventional SIMs because it means that the user can switch to a different profile over the air, without having to switch the physical SIM inside the device.

With conventional SIMs, device manufacturers are obliged to maintain complex inventories of SIM cards and insert the right SIM into the right device, depending on the location it is being deployed to. In contrast, eUICC allows manufacturers to embed a single reprogrammable chip in their devices at the point of manufacture. Once the device arrives at its destination, eUICC technology allows the device to connect to a local network operator, provided the relevant tariff agreements are in place.

By decoupling the service a SIM provides from the physical hardware, eUICC delivers a much greater level of flexibility to network operators, SIM manufacturers, device manufacturers and enterprises.

A Customer Focussed Solution

Comparing eUICC enabled SIMs with conventional SIMs, it's clear to see that the eUICC is a customer focussed solution that puts the user in control of the subscriptions that their devices have access to.

Conventional SIM	eUICC
Owned by the network operator.	Owned by the customer.
Only supports a single subscription.	Supports multiple subscriptions.
Incompatible with subscriptions from other operators.	Compatible with any operator subscription.
Must be replaced to switch network operator.	The user can remotely provision the device's SIM profile.

Standardisation, Specification and Lifecycle

The GSMA Specification: Defining a Standard

To support the rapid adoption of eUICC connectivity, the telecommunications industry has defined an internationally applicable specification to support the technology. The **GSMA** (GSM Association), who represent approximately 800 mobile operators worldwide, have produced a specification for eUICC, with the most recent version, at the time of writing, being, "[Remote Provisioning Architecture for Embedded UICC v3.1](#)".

This document is a globally binding specification which addresses issues concerning the design and deployment of eUICC enabled SIMs. It provides a standardised definition of the processes involved in managing eUICC connectivity and ensures that all the parties involved in producing eUICC solutions use the same processes for downloading, enabling, disabling and deleting subscriptions. It is a significant milestone in the evolution of the technology, as it dictates standard practices to be used by the industry to ensure global levels of interoperability and compatibility between devices from all manufacturers. This provides enterprises with the greatest level of freedom when choosing the parties to work with when developing an eUICC solution, including SIM suppliers, cellular modem suppliers and network operators.

eUICC Form Factors

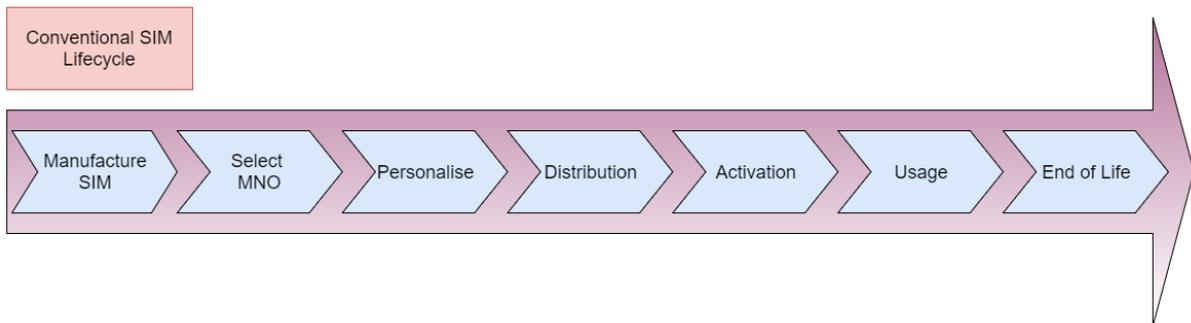
Hardware based eUICC enabled SIMs can be provided as removable SIMs or as embedded SIMs.

- **Removable SIM**
A removable eUICC enabled SIM is similar in appearance to a conventional SIM. It can be inserted into or removed from a device by an end user. They are available in a wide range of form factors including 2FF, 3FF and 4FF.
- **Embedded SIM**
This is a fully embedded SIM chip, that can be soldered into a device. Unlike removable SIMs, they cannot be easily accessed or removed from the device. Embedded eUICC enabled SIMs are significantly smaller than removable SIMs, which enables device manufacturers to reduce the overall size of their products. They are available in the MFF1 and MFF2 form factors.

eUICC Lifecycle

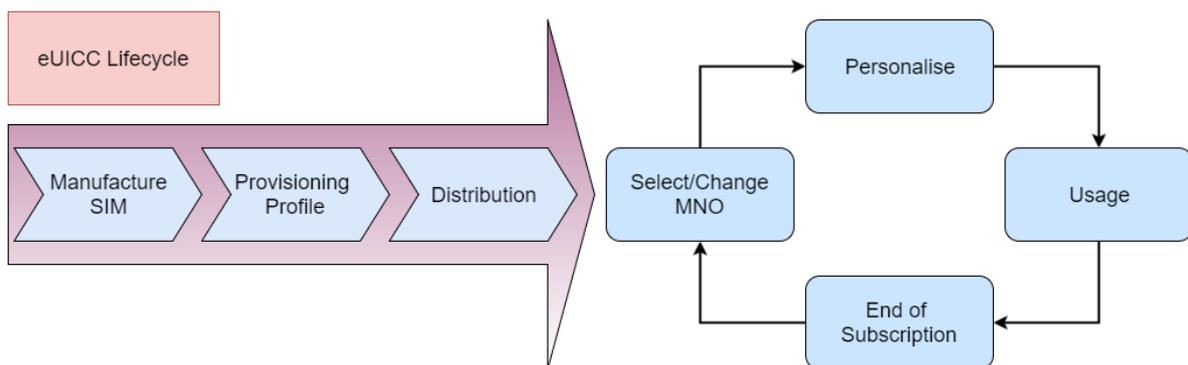
Conventional SIM cards have a linear product lifecycle. There are several steps involved in preparing the SIM card for usage by the customer and each step can involve a variety of organisations. If the device user decides that they want to change operator, they must discard the SIM, replace it with a new one and start the whole process again from the beginning. The cumulative logistical and administrative effort of every organisation involved in this process results in a massive overhead.

Figure 1: Conventional SIM Lifecycle



In contrast, the eUICC lifecycle is closer to a closed-loop model. This is because an eUICC enabled SIM is a reusable module, that does not need to be discarded or replaced when the user changes network operator. The eUICC enabled SIM is provided with a provisioning profile at the point of manufacture. This allows the SIM to obtain network connectivity when the device is first turned on and download the appropriate network profiles, as specified by the customer. The network operator for the eUICC is chosen much later in the module's lifecycle and it can be changed with ease. After the initial operator selection has been made, the user can change it without the necessity to replace the card. New profiles can be created or deleted on demand. An eUICC enabled SIM can hold multiple profiles, however, only one profile can be designated as the active profile at any point in time.

Figure 2: eUICC Lifecycle



Key Features

- **Ease of remotely provisioning profiles**

eUICC makes it possible to remotely provision SIM profiles over the air. The ability to provision profiles remotely means the customer does not need to have physical access to the device to change the SIM profile. There is no need to change the SIM card, it can all be done with the click of a button. This can drive substantial savings, particularly for large-scale deployments, as changing the SIM profile does not incur the cost of a site visit.

By enabling subscribers to provision SIM profiles over the air, eUICC technology prevents enterprises from being locked in to long-term tariff agreements with a single provider. This allows enterprises to future-proof their connectivity and quickly react to changing market conditions, ensuring that their connectivity costs remain as economical as possible.

This feature also provides enterprises with enhanced levels of connectivity redundancy and protects the customer from being negatively impacted by mobile network operator issues, such as an outage or loss of service. If the service operator that your organisation is using experiences an outage, eUICC enabled SIMs allow you to switch to another profile and minimise any downtime.

- **Build once, deploy globally**

eUICC enabled SIMs allow **OEMs** (Original Equipment Manufacturer) to support “build once, deploy globally” distribution models. This model enables OEMs to manufacture products in their existing factories, wherever these might be in the world, and ship them to customers through their usual distribution channels. From here, the customer simply buys the product, switches it on and connects it. For cellular connectivity, this model relies on the device being able to obtain a connection regardless of the country it is deployed to. eUICC enabled SIMs provide the ideal solution to this challenge as, provided the necessary network agreements are in place, they enable devices to obtain connectivity regardless of geographic location.

When a device using an eUICC enabled SIM is first turned on, the SIM wakes up and connects to the network using its provisioning profile. The provisioning profile allows the SIM to obtain the most appropriate operator profile for the device, depending on its geographic location. This process can be configured to occur automatically, meaning that no customer intervention is required.

- **Choose profiles based on cost and QoS (Quality of Service)**

Once the device is up and running, the customer can change SIM profile at the click of a button. This delivers unprecedented levels of flexibility to cellular customers. If, for example, the device moves geographic location, then the customer can change the SIM profile to a local operator in the new location. This can be configured to occur automatically when the device crosses an international border. This also enables customers to respond to changing market conditions. For example, if a network operator starts offering connectivity rates that are more competitive than your current provider, eUICC enabled SIM allow you to change quickly to a cheaper option.

- **Simplified supply chains**

The ability to embed eUICC enabled SIMs into devices at the point of manufacture streamlines the manufacturing process for mass volume deployments. This also drives lower production and distribution costs, as devices can be provisioned once they are in the field.

- **Choice of form factors**

eUICC enabled SIMs can be provided as either removable cards or as embeddable chips. They are available in the full range of form factors, including 2FF, 3FF, 4FF, MFF1 and MFF2. In the case where the SIM is fully embedded in a device they offer increased levels of robustness and a longer lifespan.

- **Cost efficiency**

As well as having a longer lifecycle than conventional SIMs, eUICC enabled SIMs can provide global connectivity at local rates. The ability to remotely provision SIM profiles also simplifies the supply chain cuts down on inventory costs.

An Emerging Market

With a binding specification in place, a growing ecosystem of partners and an ever-increasing level of market appetite, eUICC technology is ready to revolutionise connectivity. The uptake of eUICC technology will result in a radical change in the way customers select network operator and provision cellular connectivity, whether this is based on criteria such as geography, data usage or other business factors. Although eUICC technology is still in its infancy, early adopters can expect to maximise their return on investment, provided the solution is implemented with due consideration.

This section details some of the emerging opportunities for enterprises and operators.

Opportunities for Enterprises

Some emerging use cases for enterprises include:

- Supporting connected cars.
- Simplifying OEM supply chains.
- Supporting long-term deployments.

Supporting Connected Cars

With analysts predicting that 80% of new vehicles will be connected by 2020, car manufacturers need a connectivity solution to support the needs of the automobile industry. eUICC enabled SIMs are an ideal solution for this industry because they optimise connectivity costs for devices, such as connected cars, that have a high-level of data usage and frequently move between countries. For example, intercity coaches that offer public Wi-Fi to passengers, or cars that act as Wi-Fi hotspots for passengers can severely reduce their connectivity costs using eUICC technology.

Conventional roaming SIMs can be configured to switch service provider when moving between geographies, or crossing international borders. However, depending on the tariff arrangement, the costs associated with roaming connectivity can be expensive. In contrast, eUICC enabled SIMs allow the customer to manage their subscriptions in real time, while paying local rates. This means that customers can choose the most cost effective option for their location and switch SIM profile straight away. This process can be automated, provided the backend services that support the solution are configured correctly. For example, if it is detected that the device has crossed an international border, an eUICC enabled SIM can be programmed to switch SIM profile, to take advantage of local rates.

Simplifying OEM Supply Chains

eUICC enabled SIMs allow device manufacturers to simplify supply chains, reduce inventory complexity and support build once deploy anywhere distribution models. The SIM's provisioning profile allows the device to obtain network connectivity when it is first turned on and download the appropriate SIM profiles for the location it is deployed to. This means that, no matter which location the device is deployed to an eUICC enabled SIM can obtain a local operator profile and deliver local connectivity rates. This means that device manufacturers do not need to maintain a complex inventory of SIMs for different geographies, instead they can embed an eUICC enabled SIM into a device at the point of manufacture, without worrying which location it will be deployed to.

Supporting Long-Term Deployments

eUICC enabled SIMs can make it easier to manage the connectivity costs associated with devices that stay in the field for a long time, such as smart metering or CCTV systems. If these devices are connected using a conventional SIM, the customer may end up being locked in to a tariff with a single operator for the life span of the device. If a device is deployed to a remote location, the cost of a site visit may negate the cost saving in changing the operator. For large scale deployments, the cost of changing the SIM for every device may prove to be extremely expensive. This can result in customers being locked in to a network operator that fails to deliver the best value for money.

eUICC enabled SIMs provide device owners with a means of switching between network operators, without having to conduct a site visit. This prevents the subscriber from being locked in to a single network operator and allows them to optimise their connectivity costs across their entire device estate. Although any operator changeover will still require consideration, performing the switch over the air is significantly easier and cheaper than arranging and resourcing multiple site visits.

Opportunities for Operators

MNOs (Mobile Network Operator) that enable eUICC traffic to traverse their network experience the following benefits:

- Additional income through increased high-**ARPU** (Average Revenue Per User) connections.
- Reduced SIM costs and inventory complexity.

Additional Income Through Increased Connections

As the appetite amongst global enterprise clients to deploy higher data usage IoT solutions, into a variety of countries and markets, continues to grow rapidly, their data requirements are also rising. This is because clients are increasingly using IoT solutions to deliver value add services, rather than solutions that operate over a fixed line connection.

By enabling eUICC enabled SIMs to operate on their network, MNOs gain a greater share in the revenue that this rise in traffic offers, by increasing the number of high-ARPU IoT connections that are trafficked through their network.

Reduced Costs and Inventory Complexity

By enabling eUICC enabled SIMs to operate on the network, MNOs benefit from reduced SIM costs. Enterprise clients can acquire SIMs from a single source in the form factor they require. SIMs can be updated over the air to use the local MNO's network. This means that devices can be easily enabled in country on the MNO's network, without the requirement to provide a physical SIM.

Consequently, enterprises are required to administer fewer SIMs from fewer network providers. This greatly reduces the complexity associated with inventory management and global deployments.

Consider eUICC If ...

You or your organisation may benefit from eUICC connectivity if:

- You want to future-proof your connectivity.
- You want to avoid being locked-in to a single network operator.
- You have a requirement to simplify your supply chain or device provisioning process.
- You frequently change your connectivity provider.