

New Era of Cardless e-SIM

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Abstract

In this paper, we offer a brief introduction to e-SIM, covering how it works and the things it can do, as well as how and why it is advantageous in the AI and IOT-driven world we live in today. Many IOT devices are everlasting, transforming ICT. Accordingly, e-SIM can be considered a breakthrough in IOT allowing wireless communication between devices. Our Study analyzes the main uses of e-SIM as related to IOT. As well as exploring potential possibilities for e-SIM technology.

Keyword-: e-SIM, Artificial Intelligence (AI), Internet of things (IOT).

INTRODUCTION

e-SIM, also known as UICC or embedded SIM, is an electronic SIM card that can be reprogrammed over the air (OTA) instead of being a traditional SIM card. With e-SIM and eUICC together, a device is securely downloaded in the device and permanently installed, proving the facility to change the network operator without physically removing the card. It is embedded directly in the mobile device and no swapping of SIM cards is necessary to switch operators. User can switch between operator's remotely on one device and can have more than one network operator. With more and more compatible devices entering the market, e-SIM can be used for both consumers and M2M solutions. It provides remote provisioning capabilities to any IOT framework. Next-Generations telecommunications technology allowing remotely deploying network details and connectivity to phones containing embedded SIMs.

e-SIM ARCHITECTURE

GSMA e-SIM Specifications include elements such as eUICC (embedded universal integrated circuit card) and subscription management platform.

SM-DP (Subscription Manager-Data Preparation) and SM-SR (Subscription Manager –Secure Routing) are the two main components of the subscriptions.

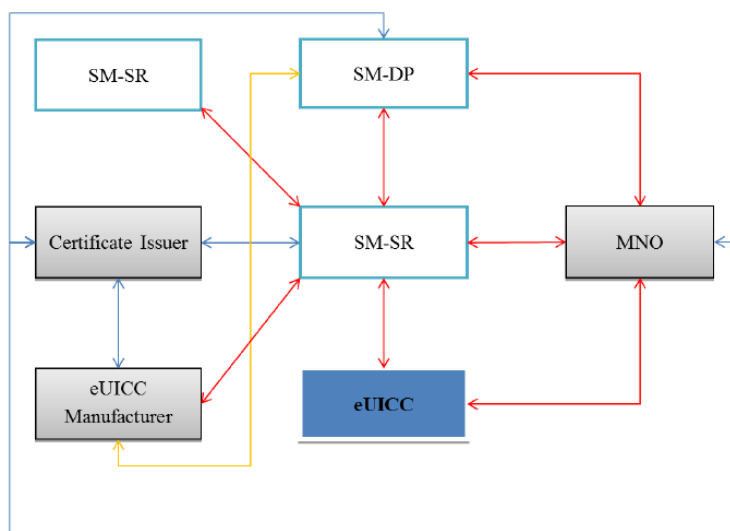
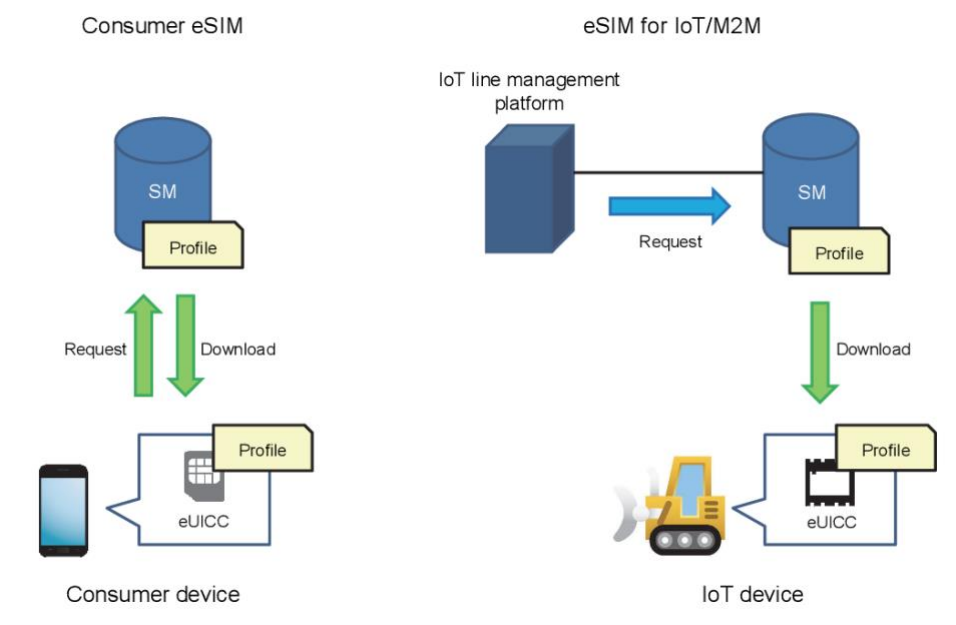


Figure1: e-SIM Architecture

- eUICC:-A subscription profile is eUICC's main component, it is secure element that enables the user to change subscriptions. This cannot be changed or replaced easily.it has all functionalities of removable SIM card.
- SM-DP-; It is primarily responsible for securely stores operator profile and credentials within eUICC.it is provisioned to facilitate over-the-air installation of profiles.
- SM-SR-: It is responsible for managing the SIM profile and operator credentials once the credential has been securely installed. It mainly removes, enables and disables credentials whenever necessary. Operator profiles are shared between SM-DP and eUICC.
- EUM(eUICC Manufactures)-: EUM is certificate for a single eUICC.
- CI (Certificate Issuer).

CONSUMER ESIM VS. ESIM FOR IOT/M2M

It is basically designed to improve user experience. The consumer solution started from a consumer perspective, where in the end user can remotely provision multiple profiles over-the-air (OTA). User can connect to the network in that country or area by requesting and downloading the profile information for the network available in that country or area.



M2M(Machine-to-Machine) is the way for machines or devices to communicate without human intervention due to artificial intelligence algorithms and machine learning. This is possible due to several AI algorithms and Machine Learning. The data that is analyzed using the preexisting models. IOT devices generally operate through wireless communication, which is susceptible to the effects of any unforeseen circumstances such as unfavorable weather conditions or a downed network. e-SIM with M2M/IOT can help eliminates this issue. Since it will be pre-embedded, it will have no dependence on environmental.

INTRODUCTION TO IOT

IOT (Internet of things) is a network of connected devices which has gained mass attention across industries these days. The typical motive of IOT is to enhance the user experience in day-to-day life for common people, businesses and industries. Every IOT device function by creating a unique digital identity, reading and analyzing data from it and its surrounding. There are some key components that makes IOT work.

- ❑ **Sensors and actuators:** these are components responsible for gathering and analyzing information from an Environment. These are typically found in home appliance, wearable, smartphones, machines, environmental sensor, and so on.
- ❑ **Communication Chanel:** In order to connect communicational channel plays a crucial role in enabling device to share information with cloud-based services. This communication channels facilitates the continuous sharing of information between devices and cloud-based services.
- ❑ **Cloud Storage:** The information gathered from the devices is cleaned, combined, stored, transformed, and modeled with past data in order to yield results for the end user.
- ❑ **Information Delivery:** Delivering and consuming these generated results and making decision based on them is the last step in this IOT chain.

Here are the following characteristics that make IOT different from traditional technologies.

- ◆ Enormous Scale
- ◆ Platform Diversity
- ◆ Software/ Hardware Interconnection
- ◆ Connectivity
- ◆ Rate of Changes
- ◆ Security
- ◆ Privacy
- ◆ Analytics Challenges
- ◆ Regulation.

ESIM- A GATEWAY OF OPPORTUNITIES IN IOT DEVICES.

It is the origin of cellular technology with IOT in the form of e-SIM. After years of works on cellular IOT, e-SIM finally became available worldwide e-SIM technology was developed as means of scaling IOT solutions. Consumers and Machines can both use it serve “pull” and “push” request.

e-SIM created opportunities in IOT sector.

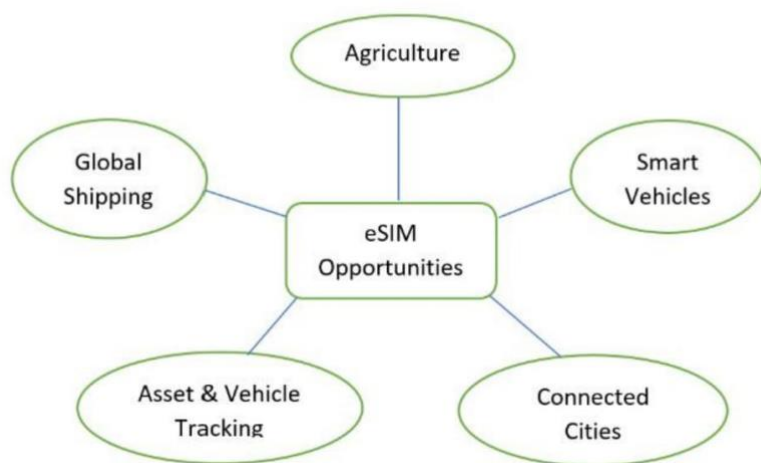


Figure3: Opportunities in e-SIM

- A. *Smart Agriculture:* Agriculture faces many challenges, including shortage of cultivable land, uncertainly in climate, water shortages, improver fertilizers use, and price and energy uncertainly. The IOT devices contains these sensors can be connected with e-SIM's works on the M2M model. Deere & Company, Trimble, Topcon Positioning System, and Raven Industries lead the way in Precision agriculture solutions.

B. Smart vehicles: Traditional e-SIMs are already installed in some vehicles, specifically cars, but they have limitations due to variety of factors such as high and low temperature, exposure to different weather conditions, corrosion issues, and friction from the engine and road. One more Limitation is that it can only connect to one network at a time. e-SIMs are now being used in AIS-140(Automotive Industry Standard) for commercial vehicles. This standard enables real-time vehicles tracking, camera surveillance, emergency notification between, and auto-notifications. Currently MG Hector and Hyundai Venue are equipped with e-SIM.

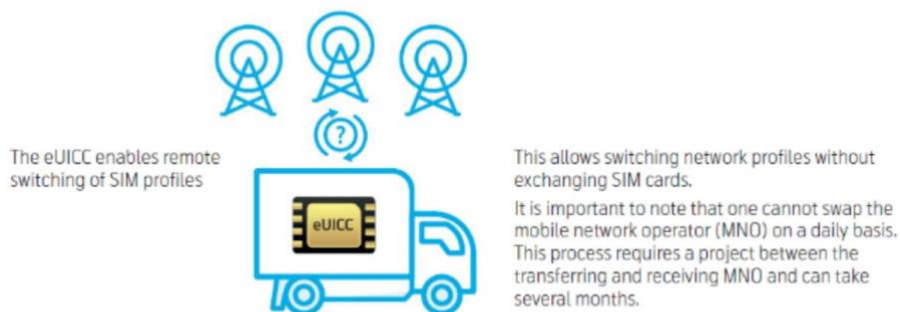


Image Courtesy: Telenor

e-SIM are now used as primarily in connected cars, originally for emergency communication. Now used for applications such as temperature control in the car, fuel, alerts, alternative routes, and many more.

C. Asset tracking and tracing:

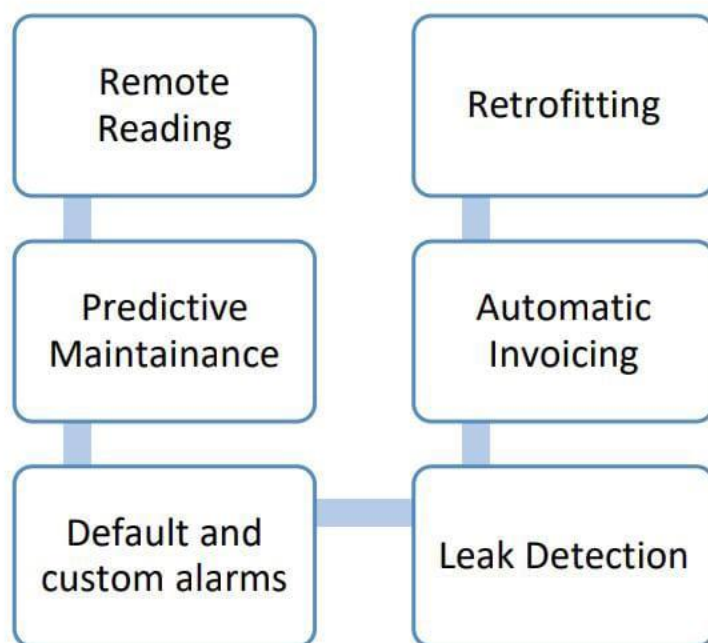
- Unknown Asset Destination
- Complex Logistical Processes
- Regulatory Compliance

Through e-SIM solutions, manufactures can offer a single module to all connected devices while not taking into account where they will be deployed. Once the device reaches its destination, it can be configured according to the carrier profile of that locations.

e-SIM provides some benefits such as

- optimized Network Connectivity
- Streamlined Operations
- Enhanced Control

IOT e-SIM cards make connections to the cloud more continuous and robust than cell phone SIM cards. If card is damaged in transit, e-SIM can be reissued. No matter how poor the coverage is, the e-SIM can still alert a logistics manager of the situation, with data integrity maintained even when assets are below ground.



- Remote Reading: Consumption data can be sent directly to the cloud without manual intervention.
- Predictive maintenance: Historical data can be used to make prediction.
- Default and custom alarms: There are several alerts that can be generated like over consumption of energy, voltage fluctuations, pressure management etc.
- Leak Detection: Crosschecking the amount of energy released and energy consumed, the device can detect leaks and other infrastructure issue.
- Automatic Invoicing: Smart meter can generate bills based on energy consumption without any human efforts and it is secure.
- Retrofitting: A smart meter can be installed on any preinstalled systems.

An e-SIM technology can be directly connected to cloud technologies, there will be no networking requirements for these smart meters working on LTE Cat M1 and Narrowband IOT.

CONCLUSION

A major inclination today is towards IOT devices, as connectivity in IOT devices is dictated by network connected to it, be it wireless or wired. We propose that if e-SIM technology is embedded in every IOT device, the major dependence on networks will be eliminated. For Example, a smart assistance can eliminate the need of a Wi-Fi connection, smart vehicle can perform diagnosed and self-monitor without needing manual intervention, and battery powered IOT devices required continuous power. The benefits of e-SIM technology on IOT devices includes connectivity, monitoring, security, traceability, agriculture, smart meters and much more.

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