

# Turning things on

The road to innovative IoT through eSIM and  
On-Demand Connectivity



## Turning things on

With everything from smart homes to autonomous cars, the integration of connected technology in everyday life has become a reality. The Internet of Things can enhance our way of living. But before drawing benefit from these “things”, we need to turn them on first!

Turning things on is Gemalto’s view on how the embedded SIM is paving the way for connecting these array of smart things, and bringing them to life.



## Connectivity - the fabric of the Internet of Things

The technology world has been taken by a storm; the storm of connected devices; the storm of the Internet of Things! For anyone who might see IoT as just another buzzword, there are already countless examples of connected things that are making our lives more convenient every day.

Smartwatches, connected cars, connected toys, smart thermostats – the list keeps going on. The promise of billions of connected objects is already an undeniable reality, and it is paving the way for new applications of big data, cloud computing, edge computing,

machine learning, and artificial intelligence. But little attention is drawn to the technology whose ubiquity today is enabling us to achieve these big strides – the connectivity technology.

Connectivity, or perhaps the omnipresent access to connectivity, is the fabric of the mobility revolution. Now it is paving the way for the Internet of Things. All the promises of IoT, whether improving customer intimacy, streamlining operations or developing new business models for new revenue streams; they all hinge on a reliable connectivity backbone.

In this e-book, we pay tribute to the unsung hero of the connectivity world – the SIM (Subscriber Identity Module). SIM cards have been an integral part of mobile connectivity. From the early brick-sized mobile phones to the most sophisticated flagship smartphones today, SIMs have made it possible for subscribers to make calls, exchange text messages, check emails, browse app stores, and stream HD media – all on-the-go. But as the world transitions from mobility to connected “things”, the SIM reaches a tipping point in its evolution – the Embedded SIM.

# What is a SIM?

A unique identifier and a mini-computer that handles passwords, codes, and security for all your calls and mobile connections – that is the essence of a SIM card.

The **SIM** (Subscriber Identity Module) has been around since the 1990s. As the name suggests a SIM is used to identify a subscriber on a cellular network.



7.3 billion SIM cards in use around the world by 2016 (excluding M2M).

Source: GSMA Intelligence

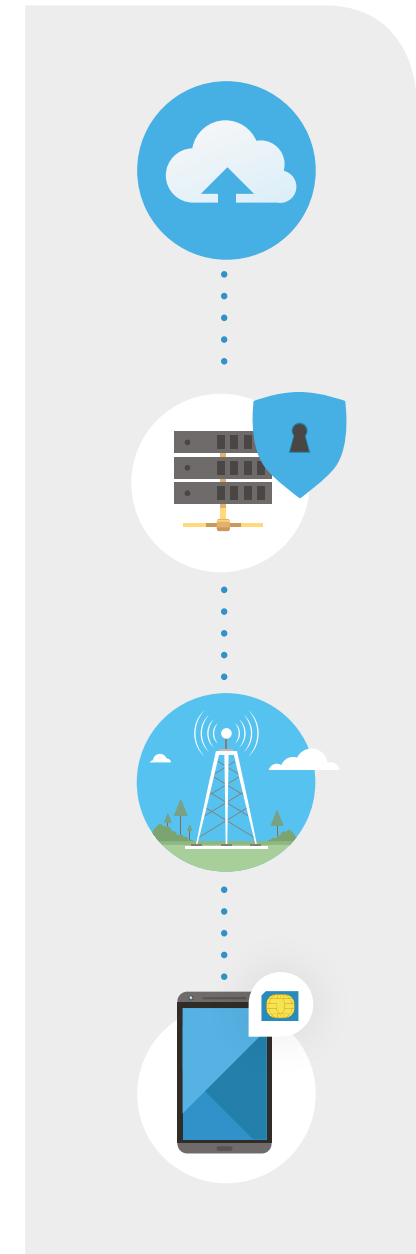
In everyday life when we want to communicate with one another, we either dial each other's phone number or look up the name of our contact from the address book. The mobile network infrastructure, whether 2G, 3G or 4G, doesn't really understand these names but instead uses an intricate identification number called **IMSI**. Every SIM holds an IMSI number, making the SIM card the de facto identity of the caller and the receiver on these networks.

Now imagine if every time you make or receive a call, your phone would ask you for a password to authenticate that it's really you. That would be a

nightmare. Luckily, the SIM card does this on your behalf. So it manages all such passwords or codes to ensure that you are able to securely log on to your mobile network.

Altogether, the SIM card is like a mini-computer. It has many components, like an operating system, applications, data, and files. While we know the SIM card as the plastic card body with a chip (the shape of which is called its **form factor**) that we insert in our mobile phones to turn on our connection, all the components we mentioned are together called a **SIM Profile** – an extremely important part to understand the evolution of SIM technology.

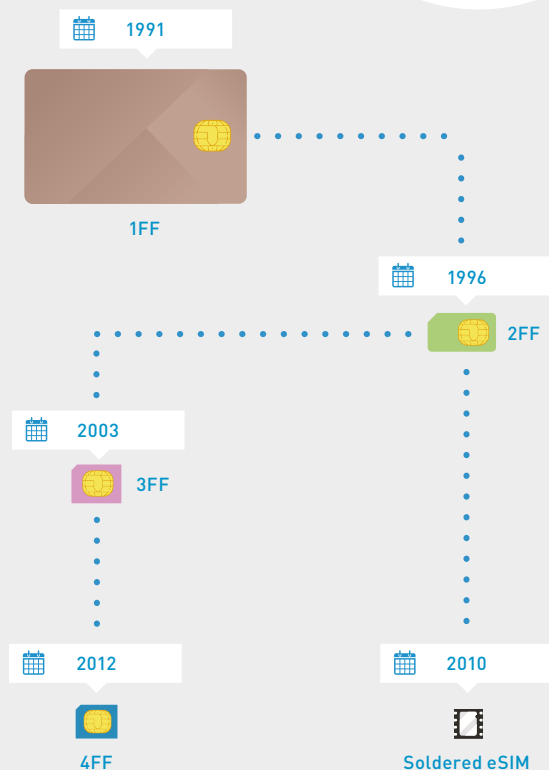
The SIM card in a mobile phone communicates with the mobile network's base station, which in turn opens the door to the entire Internet.



### Turning smartwatches on

A SIM embedded inside a smartwatch, like the Samsung Gear S2 and S3, enables new functionality.

[Learn more](#)



Over the years, the form factors for SIMs have evolved to meet different product needs.

## Form factor – the body

SIMs today come in different shapes and sizes, all adapted to the varied need of different products and situations – from a connected car on a rough desert road to a miniaturized waterproof wearable device.

Body and soul go hand-in-hand, and the life of a SIM is no different. The body of the SIM is something that we're all familiar with. We've seen the SIM's body (more appropriately called form factor) change its shape over the decades. Naming these form factors wasn't even important, until subscribers had to start choosing between Micro SIM or Nano SIM in the world of smartphones.

So, it's no surprise that a vast majority of consumers is not familiar with some other form factors of SIMs – the ones used for harsh environments. The need for such form factors arose when enterprises started using SIMs inside machines other than mobile phones or tablets. The conventional form factors were not sturdy enough to withstand extreme temperature or shocks. For a connected car, for instance, where the vehicle could be driving in extreme heat or on bumpy roads, a conventional SIM card could possibly stop functioning,

hence requiring automotive-grade modules.

Form factors have evolved in different ways, depending on the needs of the industry. We just mentioned the more industrial or [ruggedized form factors](#) tailored for enterprise usage, but the consumer side of the industry was also evolving. With smartphones, tablets and wearables housing new features, the conventional SIM card form factor was not enough. End users have been demanding smaller, slimmer and more water resistant smart gadgets.

Today, we see innovations like the Samsung Gear S3 or Gear S2 Classic – a watch in which the consumer does not have to insert a SIM card. Instead, the SIM card comes embedded inside the watch. The consumer no longer needs to worry about the form factor.

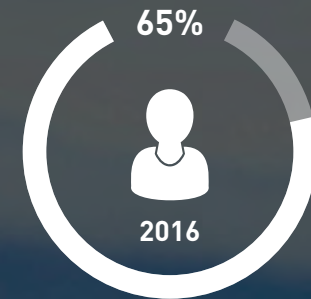
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# Profile – the soul of the SIM

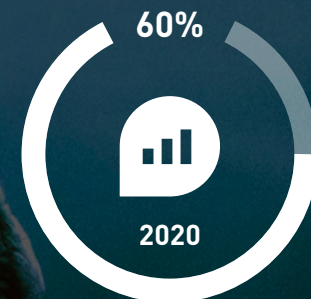
From form factor, we move to the soul of the SIM – the SIM Profile. A SIM Profile is a combination of different components, just like a computer: including an operating system, some software applications, some files, and a lot of data – most of which is highly sensitive. Let's simplify how the SIM Profile comes into existence:

1. The SIM Manufacturer, entrusted with this critical component, develops the operating system and an array of software applications, while conforming to very strict industry standards and recommendations.
2. The SIM Manufacturer then coordinates with Mobile Network Operators (e.g. Verizon, Orange, MTN, STC, Airtel or China Mobile), to develop a unique set of configurations for each one's network requirements. Should it be 2G, 3G or 4G; how many contacts should be possible to store; what sort of security should be employed, and so on. At this stage, the MNO and SIM Manufacturer have developed what you can call the **MNO Profile**.
3. Once the MNO Profile is tested and ready, it needs to be installed on millions or tens of millions of SIM Cards. In order to do this, the MNO needs to provide the SIM Manufacturer with the data (called **input data**) for these millions of SIM cards.
4. The input data is used by the SIM Manufacturer to generate separate data for each and every SIM card. The result of this data preparation is a large volume of highly sensitive **output data** that contains each individual physical SIM card's data.
5. This individual or personalized SIM data eventually gets installed on each individual SIM card, whatever its form factor, where it constitutes a personalized SIM Profile.



65% of the global population or 4.7 billion people had a unique mobile subscription in 2016.

Source: GSMA Intelligence



60 % of the global population will have mobile internet access by 2020.

Source: GSMA Intelligence

Explore Gemalto's IoT offers for [Consumer Electronics](#) and [Machine-to-Machine](#).

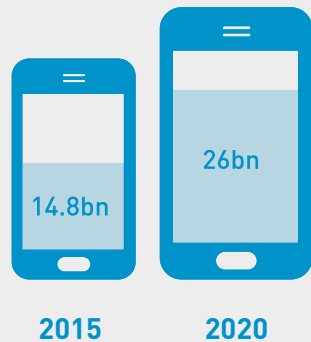


The Internet of Things can enable more convenient services for consumers - like keeping track of connected devices straight from your smartphone.

Explore Gemalto's IoT offers for [Consumer Electronics](#) and [Machine-to-Machine](#).



Total connected devices:



Source: GSMA Connected Living

[Discover what different RSP stakeholders have to say about IoT](#)

[Discover how Gemalto helps its customers Connect, Secure, and Monetize their IoT assets.](#)

# SIMs entering the world of Internet of Things

More and more connected devices of many different types are entering the market all around the globe. Both new shapes and uses for connected devices and the global marketplace create new demands for managing SIMs.

New form factors are a necessity in an industry that is transitioning from mobile phones to the Internet of Things. Connected devices come in all shapes and sizes, from smartwatches to trailer trucks. Connected device manufacturers (also called **OEM** – Original Equipment Manufacturers) want to make their devices more secure, more temperature resistant, more water resistant or smaller in size, and so on.

This requires that they embed the SIM card inside their device and seal it. So far, so good. The challenge arises when an OEM, let's say

a smartwatch maker in Asia or North America, prefers to manufacture in Asia but wants to launch their watch in Europe in partnership with a local Mobile Network Operator.

- Should the MNO order the physical SIM cards that have to be soldered in the smartwatch?
- Should the OEM rely on the MNO for delivery of these SIM cards, before it starts manufacturing the smartwatches?
- How does the OEM ensure that each watch will have the right MNO Profile?

- How does the MNO ensure that the right SIM Profile is installed in each smartwatch, when it's sold to an end consumer?

All these questions led to the launch of the initiative for **Remote SIM Provisioning** (RSP). Led by the GSMA and backed up by top Mobile Network Operators, SIM Manufacturers and leading OEMs, the RSP initiative was launched to tackle the emerging needs of connectivity for mobile and Internet of Things.



# eSIM and Remote SIM Provisioning

Improved services, new possibilities for product development and simplified logistics are all enabled by the same initiative: a new SIM architecture and infrastructure for the age of the Internet of Things.

The [Embedded SIM](#) (eSIM) and [Remote SIM Provisioning \(RSP\)](#) are two sides of the same coin. Having one without the other is nearly pointless. The Embedded SIM is often a misunderstood concept. The

first idea that comes to mind is a concept of dematerialization – the disappearance of the physical SIM card. While the evolution of form factors is critical, it fails to progress without addressing the issues we highlighted in the previous section.

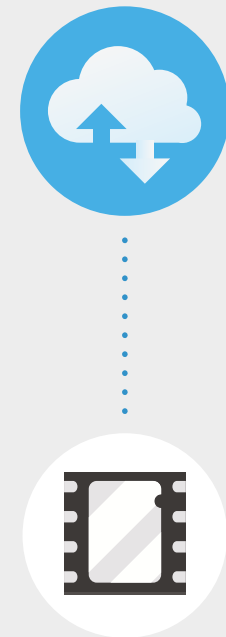
The eSIM is a SIM that allows the MNO or the OEM to download and install a SIM profile on the SIM, over-the-air, whatever its form factor. It is this process of being able to download a new SIM Profile on a SIM that is called Remote SIM Provisioning. Consider it the equivalent to downloading a new version of Android or

iOS on your smartphone. Since this process can now be done wirelessly outside the SIM Manufacturer's factory, it is called an **over-the-air** (OTA) operation or update.

The OEM gains enormous advantage of flexibility in the form factors they can adopt. It allows them to focus on product development and innovation. It also simplifies the supply chain, which is an obvious advantage for the MNOs as well. The MNOs do not need to worry about physical inventory of SIM cards, since they can now come pre-soldered in the devices.



February 2016 – GSMA release of the Remote Provisioning specifications to connect mobile consumer devices



Remote SIM Provisioning enables wirelessly downloading a new SIM Profile on the eSIM, whatever its location.

**Discover RSP for:**

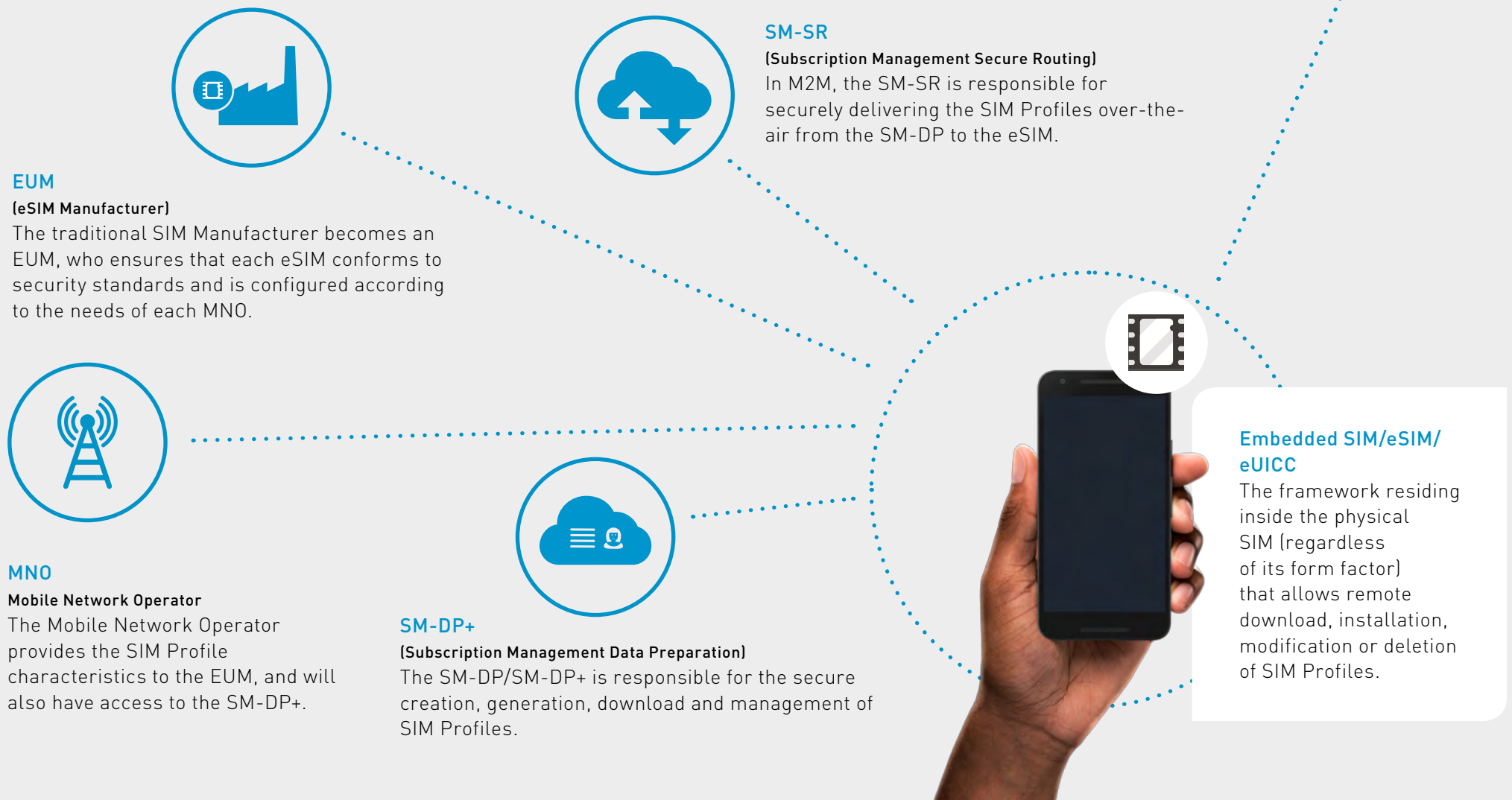
[Consumer Electronics](#)

[Automotive & M2M](#)

[Mobile Network Operators](#)

# Easier said than done

The process of Remote SIM Provisioning hides the complexities of the input data, the data preparation and personalization, but all the steps required for developing a SIM Profile must still be carried out. Following are the key components and actors in the Remote SIM Provisioning architecture:



# Customer Buying Journey

Consumer convenience is at the heart of the eSIM and Remote SIM Provisioning initiative. A seamless consumer journey aims at a near friction-less experience, and eSIM can enable that – with the flexibility for an In-store or an Online buying experience.





# A win-win formula

The combination of eSIM and RSP promises benefits for most of the actors involved, enabling a better user experience, streamlining logistics and opening new avenues for product innovation.

**\$ 1.1  
TRILLION**

Total addressable revenue  
opportunity for MNOs in 2020

[Learn more](#)



## Consumers enjoy a better user experience

Remote SIM Provisioning enables out-of-the-box connectivity. When buying their connected devices, whether wearables, tablets, or potentially even smartphones, consumers can activate connectivity right at the point of sale.



## Consumers enjoy more freedom

Consumers get twofold freedom of choice. First, they can get a better opportunity to freely select their favorite network provider. Second, RSP enables them to get on-demand connectivity exactly where and when they want it.



## MNO advance from Mobile to IoT

The eSIM opens up a whole new market for the MNO, ranging from the maturing connected car market to the nascent wearables market.



## MNO streamline logistics

Today, Mobile Network Operators have to deal with logistics of millions of SIM cards. With the availability of eSIM and RSP, MNOs can develop truly digital experiences for their subscribers, while reducing the burden on their supply chain and gaining customer loyalty.



## OEM focus on product innovations

The eSIM and RSP architecture is a catalyst for innovation in the OEM industry, allowing freedom to choose between different form factors, reducing barriers to entry in new markets, and giving more flexibility in managing SKUs.



### Turning things on, worldwide

On-Demand Connectivity can create new possibilities for smart services and new business models in all kinds of sectors.



## What's on the horizon?

One of the most crucial contributions of SIM cards has been improved security. If the cellular network is a door to the digital world of communication, entertainment, virtual & augmented reality, and many other services – then the SIM is the key to unlock this door. With that in mind, the ever-growing demand of IoT devices and the influx of cybersecurity breaches, this key holds a responsibility of great magnitude.

Numerous emerging security guidelines insist upon the need of a Trusted Computing Base (TCB), a system that preserves the integrity of the overall system. The SIM, and consequently the eSIM, forms the basis of this trusted computing base for cellular networks.

An eSIM may come in different form factors, but is still a physical, tamper-resistant hardware module. The acceptance of a particular form

factor will be governed by the market needs, and there are a number of market dynamics at play. The market is accustomed to the conventional form factors of SIM cards.

Using soldered eSIMs has now reached maturity in industrial usage, but for consumer devices there will be various factors that determine the adoption of eSIM. For example, consumer behaviour and readiness; adaptation of business processes for logistics,

supply chain, pre- and post-sales customer service; and adoption by the consumer OEM market.

Today there is a large ecosystem of device manufacturers, mobile network operators, and technology service providers. As long as there is a robust framework such as Remote SIM Provisioning in place for the ecosystem actors to leverage a secure communication mechanism, the eSIM will keep [turning things on!](#)

## ABOUT GEMALTO

Gemalto (Euronext NL0000400653 GTO) is the global leader in digital security, with 2015 annual revenues of €3.1 billion and customers in over 180 countries. We bring trust to an increasingly connected world.

Our technologies and services enable businesses and governments to authenticate identities and protect data so they stay safe and enable services in personal devices, connected objects, the cloud and in between.

Gemalto's solutions are at the heart of modern life, from payment to enterprise security and the Internet of Things. We authenticate people, transactions and objects, encrypt data and create value for software – enabling our clients to deliver secure digital services for billions of individuals and things.

Our 14,000+ employees operate out of 118 offices, 45 personalization and data centers, and 27 research and software development centers located in 49 countries.

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