



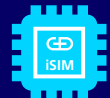
The one-stop shop for successful IoT connectivity implementation

The GSMA, the world's leading umbrella association for the telecommunications industry, maintains that in 2026 more than 3,500 new devices will be connected to the internet – every minute. The same year, the number of connected devices is expected to exceed 26 billion. There are several ways to connect mobile and IoT devices wirelessly, e.g. via Wi-Fi or Bluetooth. But the real boom and the future lies in IoT connectivity via cellular communications. This approach has undisputed benefits. It is highly secure, flexible, location independent, and agile, and of course it has a greater range and covers wide areas.

With the advent of 5G, a new era has started that will lead to unprecedented speeds and data rates. This is especially true of the IoT. 5G technology will further push development in cellular communications. The IoT supports digital transformation and the growth of new business models. By using cellular networks, IoT use cases facilitate new revenue-generating use cases. The market for the IoT is diversifying and expanding; promising technologies are evolving. Cellular connectivity can address the massive IoT market as well as the needs for specific requirements such as security, reliability, bandwidth, and latency to support unique and challenging IoT projects. Regardless of this, the topic of sustainability is of global importance, which also affects the IoT. Existing and new emerging requirements must be met. For the IoT, this opens up opportunities in three dimensions: the optimization of the devices themselves, the use of IoT data to improve existing systems, and the creation of completely new solutions, e.g. with the aim of reducing overall CO₂ consumption.

The key IoT challenges are in the spotlight: flexible connectivity, trusted device identification, secure data transmission, and optimized sustainability.

G+D's leading IoT connectivity solutions ensure flexible and global application-specific cellular network connectivity that accounts for customers' needs and requirements.



G+D addresses key IoT challenges by providing:



Flexible connectivity



Scalable security



Trusted identification



Improved sustainability



Digital processing

Various applications and advantages for the IoT



Remote provisioning



Cost savings



Customer satisfaction



New revenue streams



End-to-end security



Future proof



Reduce logistics



Scalability



Sustainability



| | Low | High | Medium |
|-----------------------|--------|--------|--------|
| Remote provisioning | Low | High | Medium |
| Cost savings | Low | Medium | High |
| Customer satisfaction | Medium | High | High |
| New revenue streams | Medium | High | High |
| End-to-end security | High | High | High |
| Future proof | Medium | High | High |
| Reduce logistics | Low | Medium | High |
| Scalability | Low | High | Medium |
| Sustainability | Low | Medium | High |

Master current and future IoT connectivity challenges

In theory, any IoT device can be equipped with mobile connectivity. In addition to a cellular modem, a SIM is needed to enable connectivity. However, pluggable SIMs are not ideal for all use cases since they have to be adapted to the size or design of the device. In some cases, the SIM card may even be stolen, e.g. if the devices are in public areas. In addition, with traditional SIM cards, environmental conditions such as temperature, vibration, and humidity must be considered. For this reason, soldered SIMs – typically in a chip or SMD form factor – have become the norm for IoT / M2M use cases. However, these embedded SIMs (eSIMs) are not easily replaceable. The same applies for the new integrated SIM (iSIM / iUICC). Once the hardware configuration issues are resolved, other operational issues arise:

- Which network operator should be selected?
- How can the requirements regarding sustainability be met or optimized?
- How can logistics be managed for IoT devices sold worldwide?
- Do different SIMs need to be in stock for different local M(V)NOs?
- How can flexibility and future proofing for connectivity be ensured during the lifetime of the device?

- Can the M(V)NO be changed during the lifetime of the device when offers become cheaper or services improve, or if the current provider goes out of business?
- How can the low power requirements of low-power wide-area networks (LPWANs) such as narrowband IoT (NB-IoT) or LTE-M mobile networks be ensured to enable the longest possible device lifetime?

G+D has the right answers to all these questions and challenges. This approach enables a flexible and dynamic user journey and ensures that the customer's existing business infrastructure and processes can still be used or even optimized.

G+D's portfolio offers state-of-the-art solutions that are future proof and flexible – even for requirements and possibilities that may not even be on the radar today. The eSIM solution, for instance, includes remote eSIM management services, eUICC hardware, eSIM profiles, the required mobile device software, and the right partners. This provides flexibility and enables remote management of the device's IoT connectivity while it is in use, without the need to swap SIM cards. For customers who attach particular importance to sustainability, G+D offers "green" SIM, eSIM, and iSIM solutions, for example. The data centers are operated with sustainable energy, depending on the region and availability.

Global and instant connectivity for IoT devices

G+D's solutions empower fully digital connectivity enablement and lifecycle management for cellular IoT devices.

- Global connectivity from a single platform with region-optimized subscriptions covering 600+ networks in 185 countries.
- In-factory profile provisioning to enable out-of-the-factory connectivity. It allows device and region-specific M(V)NO profile downloads during the production process.
- In-field profile provisioning to empower out-of-the-box connectivity via highly efficient global bootstrap service, that supports mobile network based profile downloads – wherever a device is turned on for the first time.
- eSIM IoT Manager to allow IP-based and SMS-less, in-field connectivity management via one portal (GSMA SGP.02 / SGP.32). E.g. supporting single SIM/eSIM SKU and adaptable device fleet management.

Enabling flexible connectivity for secure IoT deployments

A key element to the success of 5G-driven IoT is the concept of remote SIM provisioning (RSP). This technology goes above and beyond the evolution of SIM cards from pluggable to embedded; it is one of the developments that will have a major impact on IoT deployment, propelling its acceptance significantly. Due to its fully digital concept, it enables optimization of IoT device production processes, logistics, sustainability goals, lifecycle management, etc.

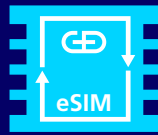
G+D's efficient eSIM management solution enables the IoT service provider or IoT device vendor to flexibly load the appropriate MNO subscription remotely at any time. This can already be done in the factory, or in the field later on when the IoT device is deployed.

The latest SIM evolution, the iSIM, is optimized, e.g. for NB-IoT and LTE-M use cases. With the iSIM, the SIM function is integrated into a device's baseband processor to significantly save space and reduce power consumption. In this case, the SIM operating system (SIM-OS) runs in a tamper-resistant element (TRE) within the system on a chip. The iSIM provides the same level of security as traditional SIM solutions.

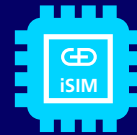
Depending on the type of IoT device being used or manufactured, the right concept is crucial. G+D offers a variety of solutions, including customer-specific ones: the classic SIM, the eSIM, the iSIM, and remote connectivity management. All these solutions comply with the relevant GSMA, ETSI, 3GPP, and other industry-specific standards.



1ST SIM
Delivered in 1991



1ST eSIM
Delivered in 2012



1ST iSIM
Delivered in 2021

Future-proof offerings to enable and manage your IoT connectivity

- The AirOn360® RSP solution makes it possible to load the required SIM credentials digitally over the air (OTA). It supports provisioning, modification, and deletion of MNO-specific SIM access data.
- The IoT connectivity and security solutions are based on highly secure hardware incl. G+D's SIM-OS that enables reliable access to cellular networks and enhanced security for the IoT across the complete device lifecycle.
- G+D provides the required SIM cards, eSIMs, modules in various form factors, and the iSIM, e.g. as a SIM-OS licence.
- The eSIMs come in three primary hardware quality grades to satisfy a range of device and use case requirements: Consumer grade, enterprise / industrial grade and automotive grade.
- A full range of IoT SIMs / eSIMs, both conventional and enhanced, can be offered, which offer a longer lifetime and better data retention as well as higher environmental resistance, for example.
- The SIM / eSIM / iSIM solutions are available according to common cellular IoT network standards from NB-IoT and LTE-M through LTE to 5G and private networks, etc.
- Especially for battery-powered IoT devices with long lifespans, G+D provides the iSIM.
- G+D offers "green" SIMs / eSIMs / iSIMs with improved sustainability, e.g. by using less or recycled plastics, which reduces the CO₂ footprint.
- Global and region-optimized connectivity solutions with multicarrier coverage with a single SIM / eSIM / iSIM are available.
- eSIMs with preinstalled ultralight bootstrap (ULB) connectivity, enabling RSP based on cellular networks with global coverage, are available.
- G+D's SIM- / eSIM- / iSIM-based applications enable secure end-to-end communication, encrypt, verify, or sign IoT data, e.g. using blockchain technology, securely identify IoT-devices as well as associated servers or cloud infrastructures, and much more.



**We connect the IoT
and provide security
for data and devices**

About Giesecke+Devrient

Giesecke+Devrient (G+D) is a global security technology group headquartered in Munich. As a trusted partner to customers with the highest demands, G+D secures the essential values of the world with its solutions. The company develops technology with passion and precision in four major playing fields: payment, connectivity, identities and digital infrastructures.

G+D was founded in 1852. In the fiscal year 2022, the company generated a turnover of 2.53 billion euros with more than 12,600 employees. G+D is represented by 103 subsidiaries and joint ventures in 33 countries.

Further information: www.gi-de.com



Giesecke+Devrient

Giesecke+Devrient Mobile Security Germany GmbH
Prinzregentenstrasse 161
81677 Munich
Germany

www.gi-de.com
connectivity@gi-de.com

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