Deutsche Telekom IoT

Embedded vs. Retrofitting

Easily connect your products to the IoT

T Connecting your world.

Contents

Smart connected products offer new opportunities

Every manufacturer knows the feeling: the product you've put so much effort into is hitting the market. Will it perform well? Will customers appreciate it? What will they use it for? What could be improved? How soon will maintenance be required?

Proactive service
The IoT gives you a unique opportunity to stay in touch with your products in the field. You get advance notification if there are problems, for instance. This way, you can offer customers proactive service before they experience downtime.

Better customer relationships
Smart, connected products also keep you in closer contact with customers. The data you collect reveals how people are using the product and the needs they have. These insights allow you to develop new, innovative offerings to delight both current and future customers.

Servitization
Servitization is how smart, connected products become the foundation for new business models. Develop digital services that set you apart and generate a steady stream of revenue. See pages 7 and 8 for examples of how our customers have implemented servitization.

74%
of medium-sized German companies are investing in smart products and services.

Source: Resellienzmeister study, 2022

25 billion
products will be connected in Europe alone by 2025.

Source: Omdia Research

Before you start...
It has never been easier to connect products to the IoT. But before you deploy a connected device, there is the question of implementation. What's the best way to give my product connectivity? What options are available, and what should I consider? This white paper provides guidance on developing smart, connected products.

The key questions to ask before any IoT project

Every IoT project has the same starting point: the use case. How, where, when, and why will the product be used? Many additional questions then follow. Which wireless technology should I use to enable connectivity? How secure must the network be? Which rate plan is right for me? How do I keep an eye on the costs, and how do I ensure global availability? Here are the key questions companies ask about networks, availability, SIM cards, hardware, connectivity management, security, and rate plans.

IoT networks

- Which network technology is the right one for my use case?
- Are battery life, energy-saving mode, or building penetration important?
- How high is the connection's data rate?

Global availability

- Do I need a solution for Germany, for Europe, or for global operation?
- How do I ensure cross-border reception for my devices?
- What should I do about country-specific regulatory requirements?

SIM cards & hardware

- Which devices and wireless modules do I need?
- Which SIM technology is right for me?
- How might my requirements change in the future?

Connectivity management

- How do I retain control over my global connections?
- How do I monitor communication behavior, usage, and costs?
- How do I incorporate connectivity management into my IT systems?

Security

- Which security requirements must my project meet?
- How do I protect data transmissions against hackers and data breaches?
- Which security laws and regulations must I comply with?

Plans

- Which offering is the best match for my complex project?
- How flexible are rates, data use, payment options, and contract duration?
- Do I need country-specific options?

Every IoT project has special requirements

In order to answer the wide range of questions before the start of an IoT project, the circumstances must first be clear. Below are a few examples.

Location

Will the product that I want to connect to be located somewhere mobile reception is weak or non-existent? For example, a smart meter in a basement, a smoke alarm in a warehouse, or a machine in a factory? For cases like these, the industry has developed the **Narrowband IoT (NB-IoT)** standard, which enables strong building penetration.

Is my product exposed to difficult environmental conditions, such a furnace operating at very high temperatures, a sensor in ice or under water, or a hammer drill that must withstand dirt, humidity, and shock on a construction site? For every environment, there is a **SIM card** to match — robust, industry-grade SIMs, for example, are the best choice for industrial environments.

Must my products be able to connect anywhere in the world? Refrigeration and cooling systems, **snow groomers,** or pacemakers destined for global markets all need to work properly no matter where they are. And that will only work out if the network operator can offer a **global footprint** with networks and roaming partners in every corner of the globe.

Power supply

Will my product be able to access a fixed power supply? If it is connected to a machine, electricity meter, or **street light**, for example, a power source will be available to the wireless module. In this case, the size and frequency of data transmissions will play a secondary role.

If no electrical supply is available — as is the case with rental bikes, waste bins, and fitness wristbands — the wireless module must be powered by batteries. Conserving energy will then be important to ensure the device functions for as long as possible. The NB-IoT and LTE-M standards are specially designed for power-saving transmission of small to medium amounts of data. This means the wireless module can run for years without needing a battery replacement.

Transmission frequency and data volume

Does my product transmit large amounts of data, for instance from the live feed of a surveillance camera? Or am I operating many cameras, maybe at a railroad station or a sports stadium? In such cases, the **5G cellular network** is the best choice because of the bandwidth, latency, and reliability it offers. Or do I just need to send a reading once a month, like a **smart meter** does? In this case, an energy-saving NB-IoT implementation is the right choice.

Costs

The total cost of an IoT integration project can also be estimated and influenced in advance. If I want to connect a large number of units such as **municipal waste containers** or smoke alarms to the IoT, the price per individual wireless module must be kept as low as possible. If I need to keep maintenance costs in check, the module should have a long service life and be energy-efficient. And if I only need to transmit tiny data packets, I will opt for a low-cost **IoT rate plan**.

Deutsche Telekom IoT experts are ready to advise corporate customers on all these issues and also assist with implementation. That includes the fundamental decision on whether to integrate connectivity into the product during development or retrofit it subsequently. Read more on this subject in the next chapter, **Embedded solution vs. retrofitting.**

Embedded solution vs. retrofitting

Embedded solutions and retrofitting are two ways to implement product connectivity. What do these terms mean in practice, and when does it make sense to use **dormant connectivity**?

Retrofitting

Have an existing product you now want to add connectivity to? In this case, you'll need to retrofit it. Adding sensors and wireless communications technology is a relatively fast, cost-efficient, and simple way to make a product IoT-ready. For example, you can simply bolt on a tracker with a SIM card and cellular module to a shipping container to provide better service to shipping customers. Not all products, however, can achieve ideal performance for the respective application this way. In those cases, the answer is an embedded solution.

Embedded

An embedded solution incorporates connectivity in the product design phase. The communications electronics including the SIM are built right into the device. **Different options are available to accommodate every situation**. A **chip SIM**, for instance, can be soldered onto the circuit board and sealed if necessary to protect it from corrosion.

A **nuSIM**, which is specially designed for IoT applications, goes one step further. The SIM functions are integrated right into the chip. No additional component needs to be attached to the circuit board. This reduces production time and lowers costs. SIM functionality in this case is limited to IoT operation for mobile scenarios using NB-IoT and LTE-M. As a result, a nuSIM is significantly more energy-efficient than a chip SIM, further extending the battery life of IoT devices.

Dormant connectivity

Planning to use the IoT in the future? Then it makes sense to start making your products IoT-ready now. Dormant connectivity is a cost-efficient, flexible option that lets you set off on your IoT journey right away. With dormant connectivity, you ensure your products are future-proof from a very early phase of the product life cycle.

The big advantage of this option is that your products come from the factory with connectivity built-in. Consequently, end-of-line testing is possible and a basic level of connectivity is available during production and warehousing. The rest of the time, the connectivity remains inactive. As soon as your business model requires it, you simply activate the connectivity. This way, you can open the door to future use cases now without incurring financial risk.

Image: Midjourney
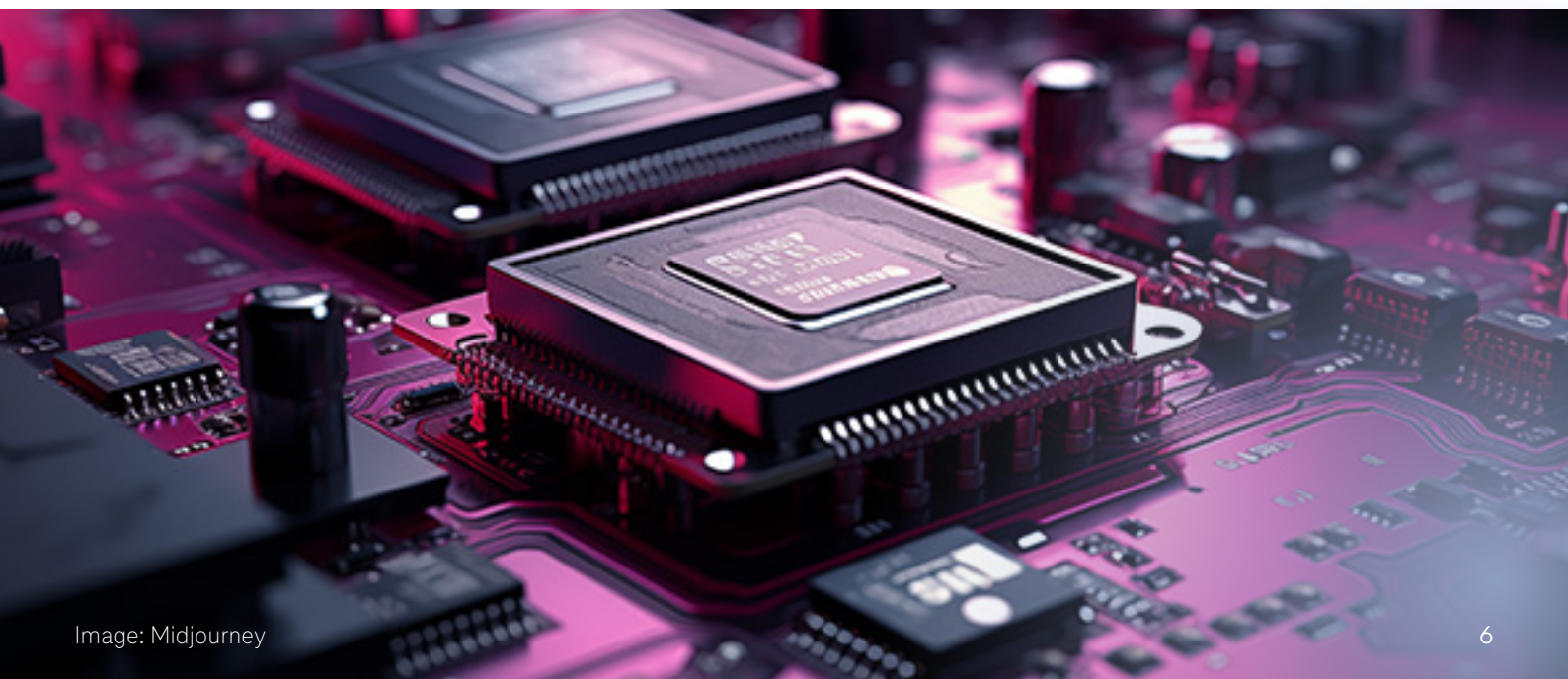
How our customers are implementing product connectivity

Should you embed connectivity now, or retrofit later? These methods each have their advantages depending on the use case. Our customers have had success with both. Here are a few examples.

Retrofit
The waste disposal service provider **Remondis** has retrofitted its glass recycling containers with a **laser level sensor** developed jointly with Deutsche Telekom and the Fraunhofer Institute. A wireless module transmits a collection notice before the container reaches maximum capacity.

Rhenus, a sister company of Remondis, is now using the same technology to ensure that its confidential waste containers are collected at the appropriate time. This is a simple, inexpensive solution that makes it possible to connect existing products that are already on the market in large numbers to the internet of things.

RUD Ketten Rieger & Dietz specializes in industrial conveyor systems. Its robust system components such as high-performance chains, rollers, and wheels are often exposed to extreme conditions, necessitating regular inspections and maintenance. RUD Ketten has equipped its products with an **IoT box from Deutsche Telekom**, a device that collects sensor data such as temperature or chain elongation and sends it to the **Cloud of Things** platform (Deutsche Telekom's IoT cloud) for evaluation. Conveyor system operators are notified automatically any time a value exceeds thresholds. This way, RUD can schedule service and maintenance in response to actual component wear and tear. Retrofitting was the best solution here too, enabling connectivity without a product redesign.

Embedded

Kässbohrer Geländefahrzeug AG has equipped its tracked snow making and grooming vehicles with **SIM cards from Deutsche Telekom**. The vehicles communicate independently over the IoT with one another and with the data center, sharing information on snow depth, dangerous spots, and grooming progress. A live map in the cockpit relays this information, allowing drivers to navigate better and avoid unnecessary trips. The technology makes grooming safer and more efficient while conserving resources. What's more, it can reduce slope grooming costs by 25%.

Biotronik is a world-leading medical technology company. It has equipped its implants—devices such as pacemakers or defibrillators—**with a wireless module** that sends sensor data to an IoT device called CardioMessenger. At night, the Telekom SIM card in the device relays data from the implant to Biotronik's home monitoring platform. Medical specialists can access the data at any time to check on the patient's health and confirm the CardioMessenger is operating normally.

DB Call a Bike also relies on Deutsche Telekom IoT technology. After a comprehensive feasibility workshop with Deutsche Telekom, Deutsche Bahn's bike sharing subsidiary is equipping its approximately **20,000 rental bikes** with LTE-M SIM cards. Now you can rent a bike very quickly by simply scanning a QR code on your smartphone. In addition, LTE-M is more energy-efficient than the previous communications technology. This and other upgrades such as the new solar panels on the bikes mean DB Call a Bike doesn't need to collect and recharge its bikes as often. These

longer charging intervals increase revenues and decrease operating costs. Deutsche Telekom has also recommended the **IoT Solution Optimizer** for future projects. This will allow Call a Bike to test new features and upgrades to the bikes on a digital twin, an electronic replica of the actual product.

The tool specialist **Hilti** is also looking to expand its business model using integrated connectivity. The company's semi-autonomous drilling robot Jaibot can take care of overhead drilling on large construction sites, a job that's particularly grueling for human workers. The robot receives drilling plans wirelessly from its remote control unit. During the drilling and marking work, the robot is synchronized via mobile data and the user can follow the installation progress in real time. For a pilot project, Hilti is also developing a wireless module with Deutsche Telekom for a new generation of battery charging stations. During charging, the IoT device reads sensor data such as device use, rev count, battery status, vibration, operating time, and location and sends it to the cloud. Hilti customers can then, for example, document excessive stress and strain on users and tools, locate all tools, and consequently improve their device management.
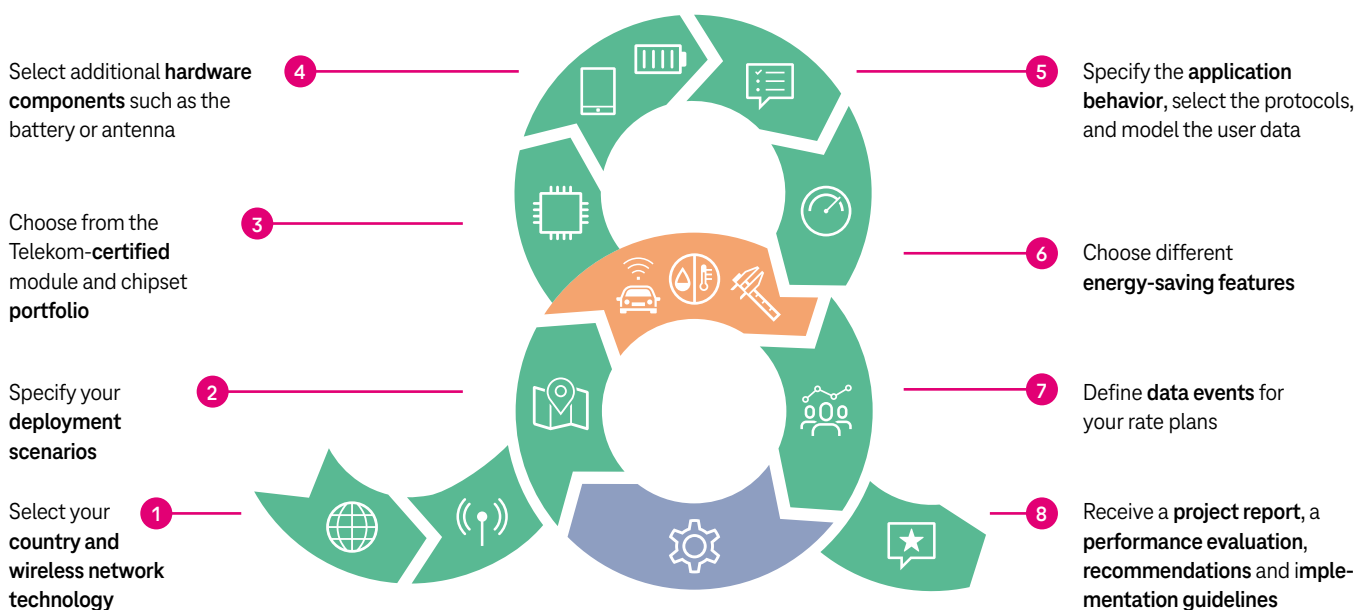
Evaluate interoperability

Once the connectivity, hardware, SIM type, and rate plan have been chosen, it is time to test the overall system. Are the chosen devices suitable for indoor use? How well does the application function on different networks? How does a reconfiguration affect energy consumption and the business model? Can I save on development costs? A protracted proof of concept and costly test cycles are no guarantee of success because numerous aspects of the design and deployment will influence results. A great help here is a provider who is aware of these issues and can give your company answers. Telekom has developed the **IoT Solution Optimizer** especially for cases like these.

IoT Solution Optimizer — the Swiss Army knife for IoT applications

The IoT Solution Optimizer consistently reduces development costs and shortens time to market. Digital twin modeling technology makes IoT project planning easier and delivers detailed results within minutes. Step by step, the IoT Solution Optimizer leads you through a customized performance analysis and indicates where there is potential for optimization. This saves time and money because expensive and protracted tests are no longer necessary. A comprehensive data portfolio helps you set up, review, and optimize suitable solutions. The efficiency of your use case can be calculated with a few clicks.

Just a few simple steps

4. Select additional **hardware components** such as the battery or antenna

3. Choose from the Telekom-**certified** module and chipset **portfolio**

2. Specify your **deployment scenarios**

1. Select your **country and wireless network technology**

5. Specify the **application behavior**, select the protocols, and model the user data

6. Choose different **energy-saving features**

7. Define **data events** for your rate plans

8. Receive a **project report**, a **performance evaluation**, **recommendations** and **implementation guidelines**

Design your products …

… or choose **ready-made products.**

Optimize projects to improve your business case!

The right partner by your side

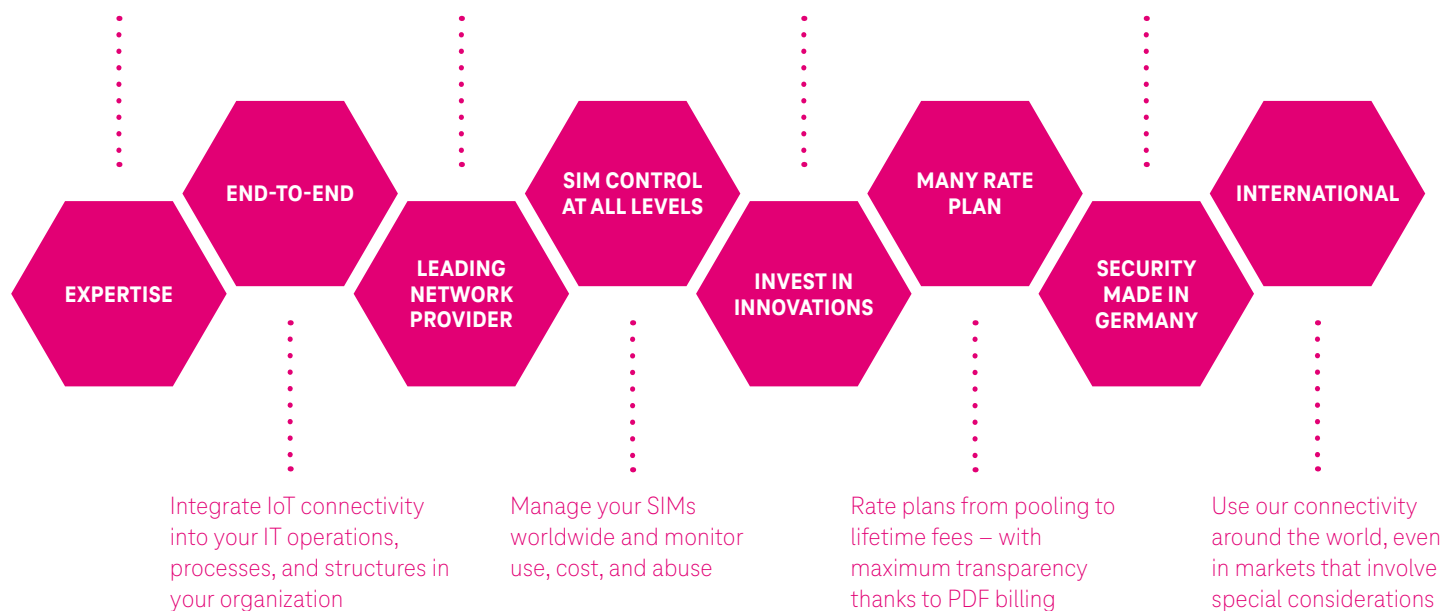**Why choose Deutsche Telekom IoT as your partner?**

As you can see, there are many facets to consider when deciding on an IoT connectivity solution. We are well aware of this complexity and know what matters. Choose Deutsche Telekom IoT and benefit from the following advantages.

A high level of expertise in both core services and tailored solutions for unique requirements

Benefit from our exceptional transatlantic network and global roaming partners

Continuous innovation in networks, the cloud, platforms, and SIMs

Secure hosting in Germany meets our high security standards

EXPERTISE

END-TO-END

LEADING NETWORK PROVIDER

SIM CONTROL AT ALL LEVELS

INVEST IN INNOVATIONS

MANY RATE PLAN

SECURITY MADE IN GERMANY

INTERNATIONAL

Integrate IoT connectivity into your IT operations, processes, and structures in your organization

Manage your SIMs worldwide and monitor use, cost, and abuse

Rate plans from pooling to lifetime fees – with maximum transparency thanks to PDF billing

Use our connectivity around the world, even in markets that involve special considerations

Contact us today.

Want to find out more about how your business can move into the fast lane with connectivity and the IoT?
Just get in touch. Our experts will find the best solution for your unique situation.

Feel free to contact us:
0800 33 090300 (within Germany)
00800 33 090300 (international)

Contact Form

The latest downloads—
our expertise for your business

IoT Connectivity Guide
More opportunities with seamless cross-border IoT connectivity
https://iot.telekom.com/en/downloads/iot-connectivity-guide

People in Logistics
How digital solutions ensure employee satisfaction and corporate success
https://iot.telekom.com/en/downloads/digitized-workplace

Success Stories from the Internet of Things
Eleven companies in different industries that benefit from digitization
https://iot.telekom.com/en/downloads/success-stories-from-the-internet-of-things

The Sustainability Impact of IoT
How the IoT can promote sustainability in its different facets
https://iot.telekom.com/en/the-sustainability-impact-of-iot

T Connecting
your world.