Global. Simple. Secure. Flexible.

IoT Connectivity Guide

Everything you need to know about IoT connectivity

Connecting your world.

Contents

The IoT makes things come to life

Machines notice when something is wrong and flag the need for maintenance. A connected cup documents the fluid consumption of dementia patients and if necessary issues a reminder to drink more. Water pipes sense leaks and waste containers notify you when they're ready to be emptied. All of this happens in the IoT. Connected products are transforming how manufacturers and customers interact with them and enabling entirely new use cases and business models. Whether it's tracking or monitoring, autonomous driving solutions or smart products – the IoT holds enormous potential for innovation.

For devices to be smart and communicate, the one thing they need most is the right communications technology. As Europe's leading telecommunications provider, we have the capability to provide ideal connectivity for any IoT project anywhere in the world. We have achieved this by focussing on mobile and satellite-based networks in addition to innovative technologies that support smart industries and efficient operations. With our expertise and end-to-end solutions, we help you reduce complexity and unlock the full potential of the Internet of Things.

What type of connectivity will you need to implement your IoT plans?

Every IoT project has different requirements in terms of security, latency, module costs, network coverage and data transmission. With this Connectivity Guide, we'd like to take you through the options available for IoT connectivity and the related topics. This includes the different IoT networks and their availability as well as SIM, hardware, connectivity management, security and tariff models.

Simple

Over 99% (LTE-M and NB-IoT) and 96% (5G) network coverage in Germany plus our own transatlantic network and agreements with over 600 selected roaming partners allow us to deliver excellent coverage and global connectivity. All using standardised SIMs, under a single contract, with centralised customer service.

Secure

Flawless network coverage and secure IP-VPN connections allow us to deliver reliable global connectivity. We support your project at every stage with ISO-certified hardware and regular audits.

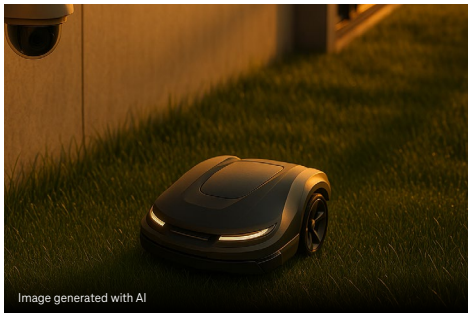
Flexible

You have access to the right network technology for the use case – whether it's NB-IoT, LTE-M, LTE, 5G or satellite. Our new embedded connectivity is the affordable way to ship connected devices that are ready to activate on demand.

Image generated with AI

Every product can be a smart product with global T IoT connectivity

Use cases



Smart lawnmower robots

Deployment across global markets and manufacturing at international production facilities

Smart water meters

Water meter / smart-meter solution for basement installation with global distribution

Highly specialised pharma tracking solution

Transparent supply-chain monitoring during the transport and storage of pharmaceuticals

The challenges

- User experience affected by boundary wire
- Launch new services and innovations without financial risk
- Ensure reliable connectivity for customers and manufacturing worldwide

- Water utilities must detect leaks in pipelines as quickly as possible – a process that has until now been costly and inefficient
- In addition, water meters need to measure consumption accurately for as long as possible to enable correct billing

- When transporting medicines, maintaining the cold chain is crucial – even tiny deviations can impact product quality
- If medicines must be disposed of, it means major financial losses for the pharmaceutical industry

Our solutions

IoT Embedded Connect & Precise Positioning

- Products are equipped in the factory with global IoT connectivity
- Wireless deployment accurate to within 2 cm
- A bundle consisting of a radio module, a SIM and connectivity makes developing IoT-enabled services simple
- No high upfront costs; data plan isn't activated until customer uses the service

More about factory-installed IoT

More about Precise Positioning

IoT Business LPWA

- Precise early detection of water losses in pipelines and extended meter life – at lower total cost
- NB-IoT technology advantages: Power-saving with strong building penetration
- Access to an excellent global NB-IoT roaming partner network

See customer success story

More about NB-IoT

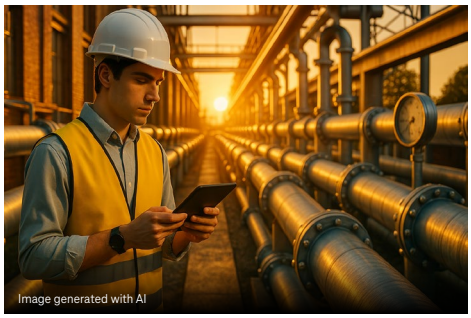
nuSIM

- Detailed location and temperature data along the entire route with space- and energy-saving nuSIM
- This IoT-optimised iSIM uses Deutsche Telekom's global, energy-efficient NB-IoT and LTE-M networks

See customer success story

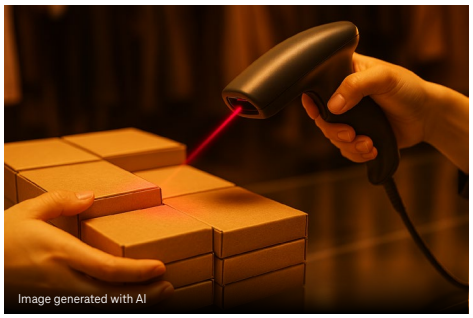
More about nuSIMs

Use cases



Fallback for water sensor data (critical infrastructure)

Monitoring critical pipeline systems in water supply infrastructure



Smart logistics

Simplification of global logistics processes using smart handheld scanners

Mobile surveillance

Targeted security solutions for construction sites, car parks, vehicle fleets and machinery

The challenges

- Extended coverage in rural areas as a backup for critical infrastructure

- New devices exclusively shipped with pre-installed eSIM (SGP.22)
- The global distribution and allocation of devices to logistics centres is complex

- Costs reflect irregular nature of usage
- High data throughput
- Transfer recordings in compliance with data protection regulations, clearly identify mobile surveillance towers

Our solutions

IoT Satellite Connect

- Reliable connection to the central monitoring system even in remote areas without mobile coverage
- Cellular broadband switches to satellite connectivity according to specified parameters

eSIM for IoT

- Custom digital eSIM profile provisioning as straightforward as with smartphones
- Managing handheld scanners is more flexible and efficient with eSIMs for IoT, optimising global logistics processes

IoT Business Data Best & Mobile IP VPN M2M

- Balance out fluctuations in usage across the year
- Reliable security for IoT connections, unique identification and active availability of video towers
- 5G gives surveillance cameras wireless connectivity and high bandwidth

More about satellite IoT

More about IoT SIMs

Use case example

More about 5G

Find out more about IoT security

1

Global availability

Image generated with AI

Always best connected

IoT demands a reliable network. And depending on the application, IoT also requires cross-border connectivity. How does global connectivity management work? How can you ensure compliance with local regulations? And is it even possible to have a reliable network everywhere?

The Bridge Alliance

The Bridge Alliance is a business consortium of 35 mobile network operators across Asia, Australia, Africa and the Middle East. Deutsche Telekom was the first European telecommunications company to join the Alliance.

The core mission of the Alliance is to provide members with access to connectivity and integrated value-added services. This collaboration offers both sides maximum flexibility to meet the unique requirements of customers who are active in international markets. Cooperation between Alliance partners makes it possible to offer local connectivity under global contracts.

bridge alliance

The IoT is mobile

Many IoT-enabled devices are portable and can cross national borders. For example, IoT tracking devices in logistics that record the locations of pallets or containers. Or IoT-enabled pacemakers that monitor and transmit vital signs. These implants accompany patients wherever they go. Even products used in fixed locations – such as washing machines – can be part of cross-border IoT applications, for instance when the point of use is in a different country from the place of manufacture. But what happens when IoT-enabled devices cross national boundaries?

Seamless coverage

With T IoT, your devices stay connected worldwide. Because we operate our own mobile networks in Germany and nine other European countries in addition to the United States. That makes us the only provider with our own networks on both sides of the Atlantic.

In addition, we have roaming agreements with more than 600 selected mobile network operators around the world. We offer global network coverage and worldwide access to data connections under a single agreement. This way, companies no longer need to juggle dozens of contracts with national operators in each country. If an IoT device ends up in a country where Deutsche Telekom does not operate its own network, the device automatically connects to the mobile network of an available roaming partner.

Global compliance

Anyone operating globally must understand the markets of many countries and their local regulations – and that applies to IoT connectivity as well. A growing number of countries prohibit permanent data roaming, for example. Others forbid location data from leaving the country. To enable global IoT connectivity even in these markets, you need a provider with global infrastructure who also understands local markets and is agile enough to adapt to them. Deutsche Telekom achieves this by cooperating with local partners. Local connectivity solutions allow for compliant global IoT connections even in these regions.

How the IoT is connecting the world

Interview with Benjamin Bastians, CCO Deutsche Telekom IoT

Over 25 billion IoT devices are in use worldwide – and that number is rising. But how can all of it stay connected – even at sea or in the desert? Benjamin Bastians, CCO at Deutsche Telekom IoT, explains how data delivers tangible value, why pacemakers should be online, and what dormant connectivity is all about.

Current estimates place the number of connected IoT devices worldwide at over 25 billion. How many of them are managed by Deutsche Telekom?

We connect around 55 million devices for customers each year, and that number is growing fast. The demand for IoT connectivity is enormous. At the same time, expectations regarding bandwidth, availability, data security, and operational flexibility are also rising. That's why we employ over 400 IoT specialists with a focus on automotive, transport and logistics and the wider industrial sector.

How do markets differ around the world?

Every continent – and sometimes every country – comes with its own set of challenges: Network technologies, regulations, economic factors. What they all have in common is the desire for simple solutions that can scale globally. That's why we rely on strong partnerships with mobile network providers around the world.

What do your customers say are their biggest challenges?

Deriving value from connected products is a key issue. The type of connectivity is also a critical factor: Wi-Fi ®, Bluetooth®, or mobile data? With cars, cellular is standard. But for home appliances, it's often a question of cost versus benefit.

In what specific ways does Deutsche Telekom support its customers?

We keep devices online around the world. We integrate with your production processes, enable automated control and ensure regulatory compliance. We reliably transport data to where it's needed.

Which real-world examples have impressed you most?

The automotive industry sets the pace for IoT – vehicles lose functionality the moment they go offline. Our medical technology clients are connecting pacemakers to greatly improve patients' lives.

What are you doing to lower entry barriers?

It doesn't have to be a product that's ready to launch or a large vehicle fleet right away. It's worth engaging with us from the initial concept. Our solutions are modular and can be tested early in the development process. Often, our capabilities progress alongside our customer's, resulting in strong partnerships.

What does 'dormant connectivity' mean?

If it's still unclear whether or when a device will be connected, cellular technology can be pre-installed and activated as needed. That saves electricity and reduces costs.

How do you ensure connectivity even in the middle of the ocean?

Even the best mobile networks have limits – for instance at sea or in remote areas. To solve this problem, we seamlessly integrate satellite communications into our solutions.

How do you ensure the continuous flow of data?

For many products, maintaining a connection to the digital world is of vital importance. That's why we design our IoT solutions with redundancy and maximum availability in mind.

What role does AI play in the IoT context?

Predictive maintenance lets us monitor machines remotely and automatically trigger alerts in the event of anomalies. These methods have been around for a while, but new AI technologies are making them even more effective – and the data more valuable than ever.

In cooperation with

HP's construction layout robot is revolutionising site layouts

An autonomous robot from HP is making construction site layouts faster and more accurate using Deutsche Telekom's global mobile network.

The challenge

Site layout in construction is a labour-intensive and time-consuming process. HP has developed an end-to-end robotic solution that automatically prints floorplans and markings onto the floor during construction. The system – consisting of an autonomous printing robot, total station and tablet – requires a cloud connection to download CAD plans and remotely monitor the robot's status. However, construction sites often lack Wi-Fi or fixed-line connectivity. HP also wants to offer its site layout robot around the world without having to negotiate with a different network operator in each country.

The solution

The HP layout robot transmits data via Deutsche Telekom's global LTE mobile network which is based on Telekom infrastructure in addition to roaming agreements with more than 600 partners worldwide. This ensures secure connectivity in every country. Deutsche Telekom is HP's single point of contact for connectivity.

The benefits

The layout robot has reliable connectivity anywhere in the world in Deutsche Telekom's mobile network. This enables deployment at any construction site regardless of local infrastructure. Project teams can edit CAD plans in real time and share updates with stakeholders via the cloud. This accelerates planning for complex projects and reduces costs. HP can now market the layout robot worldwide without negotiating separate contracts in every country.

Click here to learn more

2 IoT networks

Image generated with AI

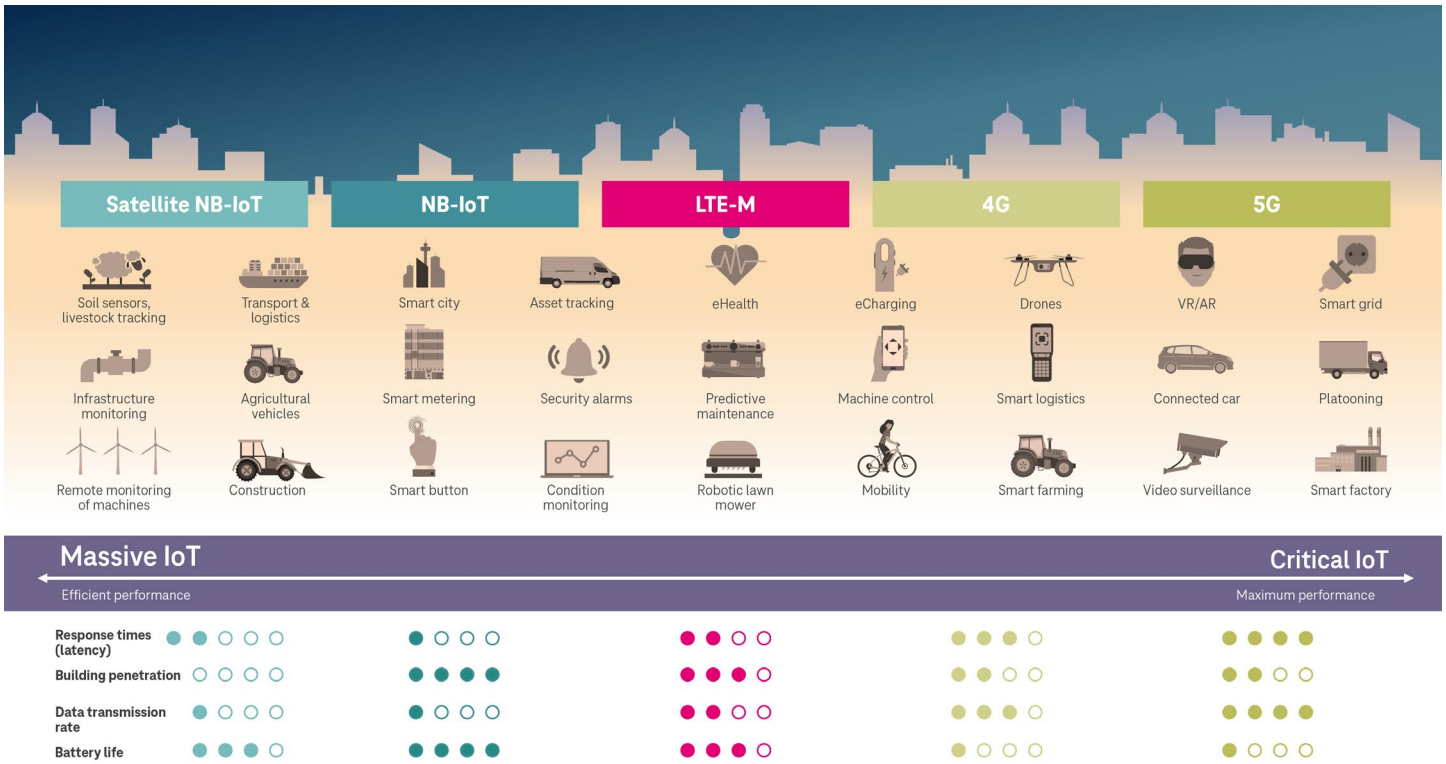
The best network for every IoT project

To connect devices securely and efficiently, the Internet of Things needs a reliable, high-performance connection. Different network technologies suit different applications – from energy-saving standards for small sensors to powerful solutions for real-time communication.

A wide range of wireless technologies is available for transmitting IoT data. The best IoT network for a specific use case depends on the data volume, transmission frequency, sensor battery life, where the data is collected and how sensitive it is.

NB-IoT and LTE-M are the right choice whenever energy use, building penetration, battery life and cost matter most. Manufacturers use these LPWA (Low-Power-Wide-Area) networks in applications such as smart metering and health monitoring. In remote areas, satellite communication is often the best option. Satellite NB-IoT, for example, enables remote monitoring of offshore wind farms. Applications that require high-performance, low-latency connectivity such as autonomous driving work best on 4G and 5G networks, which deliver high availability and speed.

Choosing the right wireless technology



More about IoT networks

Long-distance energy efficiency with NB-IoT & IoT LTE-M

The wireless standards NB-IoT and LTE-M were developed specifically for the Internet of Things. Each has distinct advantages: NB-IoT offers extremely low power consumption for both the radio module and transmission, along with excellent building penetration. In direct comparison, LTE-M provides lower latency, greater bandwidth and also supports voice and SMS.

NB-IoT

The mobile communication standard NarrowBand IoT (NB-IoT) specialises in transmitting small quantities of data over long distances. NB-IoT modules, optimised for efficiency, consume so little power that they can run for years on a standard battery. Another advantage of NB-IoT is its good building penetration. NB-IoT performs reliably even through thick basement walls thanks to its narrow bandwidth. A third advantage: Manufacturers produce NB-IoT modules at low unit costs, making connectivity affordable.

LTE-M

Compared with NB-IoT, LTE-M offers sufficient bandwidth for moderate data volumes and lower latency, though it uses slightly more power. Like NB-IoT, LTE-M provides strong building penetration and cost-effective modules. Unlike NB-IoT, LTE-M supports SMS messaging – for instance, to send an alert.

i Currently **258 operators** in **68 countries** have rolled out NB-IoT or LTE-M networks. (Source: GSA)

i More about NB-IoT

Low energy consumption

Low cost

Future-proof industry standard

LTE-based

Simple installation

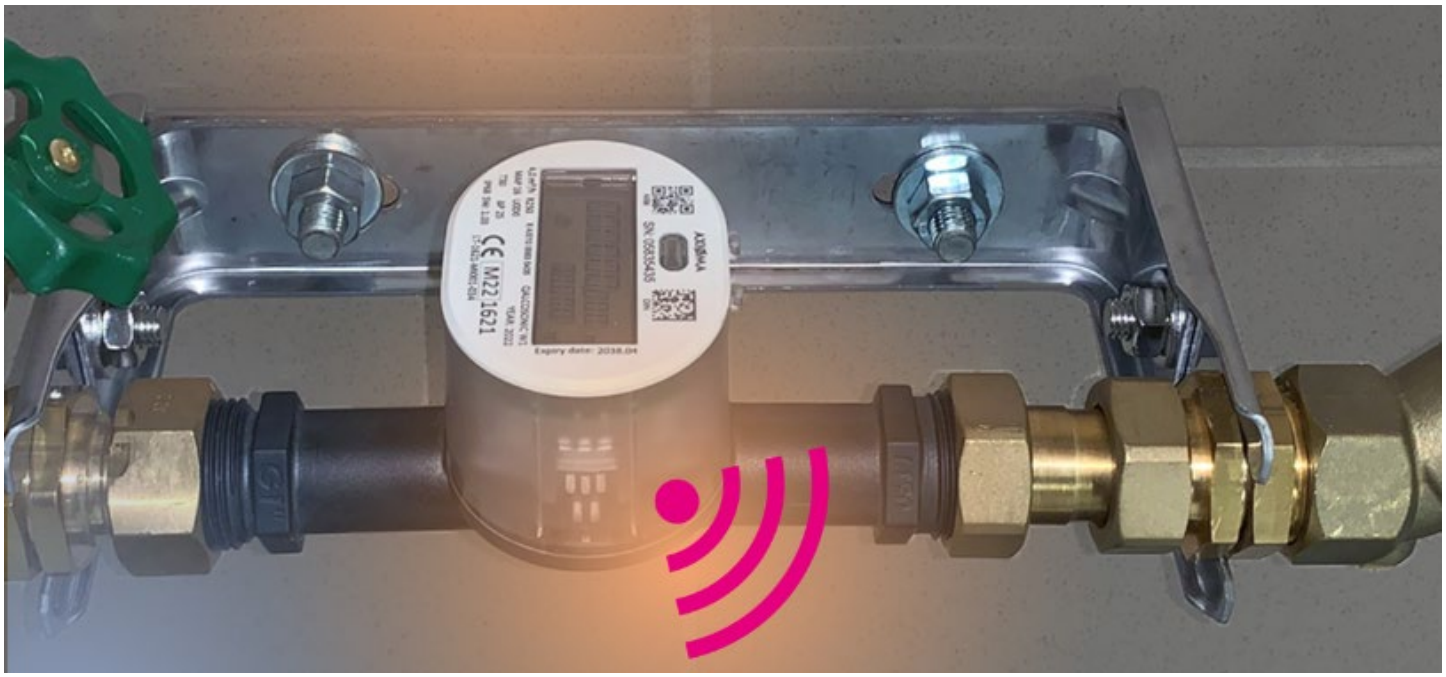
Secure technology

In cooperation with

HEITLAND

Heitland's smart water meter can detect leaks

Deutsche Telekom and Heitland are supplying water utilities with smart ultrasonic water meters that can detect pipeline leaks early and extend meter lifetimes while cutting total costs.



The challenge

Water utilities must detect leaking pipelines as soon as possible. Doing so is normally labour-intensive, costly and inefficient. Searching for leaks is often done at night. This leaves fewer staff available during the day, delaying other tasks. Water meters also need to measure accurately for as long as possible to ensure household water bills reflect actual consumption. Currently, water companies only read the meters once a year – which makes accurate billing difficult.

The solution

Heitland has developed a high-end ultrasonic water meter with a premium energy-efficient embedded SIM (eSIM). It automatically sends encrypted water-use readings every day via NarrowBand IoT (NB-IoT). This is a disruptive product, nothing comparable is available in Germany at the moment. The ultrasonic meter is currently made from composite material, with a brass version coming soon.

The benefits

Deutsche Telekom provides a mobile network that spans the globe with cross-border roaming agreements. Thanks to this global NB-IoT coverage, the water meters stay connected even in remote areas and without a power supply. This network infrastructure allows customers to get started immediately and rely on Deutsche Telekom for availability, maintenance and security.

Click here to learn more

The responsive 5G network

Deutsche Telekom's 5G network already reaches 98 % of the German population and it keeps expanding every quarter. No other mobile network operator in Germany offers such extensive 5G coverage.

With 5G, a new era of the Internet of Things has begun. 5G provides the foundation for advanced technologies such as autonomous driving. But it's also making virtual and augmented reality applications genuinely seamless. The enormous bandwidth of 5G enables smooth video conferencing on high-speed trains and high-definition streaming from surveillance cameras.

5G also accelerates applications powered by artificial intelligence and mobile edge computing. Latency and speed are crucial for many smart factory applications such as autonomous vehicles. And what's more, because 5G can support more than one million connected devices per square kilometre, large-event network outages are soon to be a thing of the past.

i By **2030**, global sales of 5G modules for IoT use are projected to reach **250 million units**.
(Source: McKinsey)

i More about 5G

More speed

More connections

Fewer delays

Networks that are more stable

In cooperation with

Cleverciti

Cleverciti improves parking by using IoT sensors

Cleverciti and Deutsche Telekom are creating connected parking spaces using AI-driven sensors and IoT technology. The intelligent solution reduces traffic congestion and improves parking management around the world.

The challenge

Studies show that around 30 percent of inner-city traffic results from drivers who are looking for parking. This congestion increases emissions and frustrates motorists. Cities need an efficient way to manage parking more effectively and guide drivers quickly to free spaces.

The solution

Cleverciti's monitoring and control system uses optical sensors mounted on existing infrastructure such as streetlights. A single sensor can cover up to 100 parking spaces and use AI to detect in real time whether they are occupied. It reliably transmits this vacancy information while maintaining full GDPR compliance to the cloud via Deutsche Telekom's 4G/5G network. The system includes digital signs that guide drivers to available spaces. A smartphone app provides navigation and payment options. City authorities gain detailed insights into parking utilisation, enabling better planning and management. Deutsche Telekom's global mobile coverage lets Cleverciti deploy its solution worldwide.

The benefits

Cleverciti's system halves the average time drivers spend looking for a parking space. Emissions and noise decline, improving life for residents and visitors alike. Retailers benefit from greater foot traffic since drivers have more time for shopping or dining. Cities can use data-driven decisions to better manage parking. Improved utilisation of spaces results in higher parking revenues.

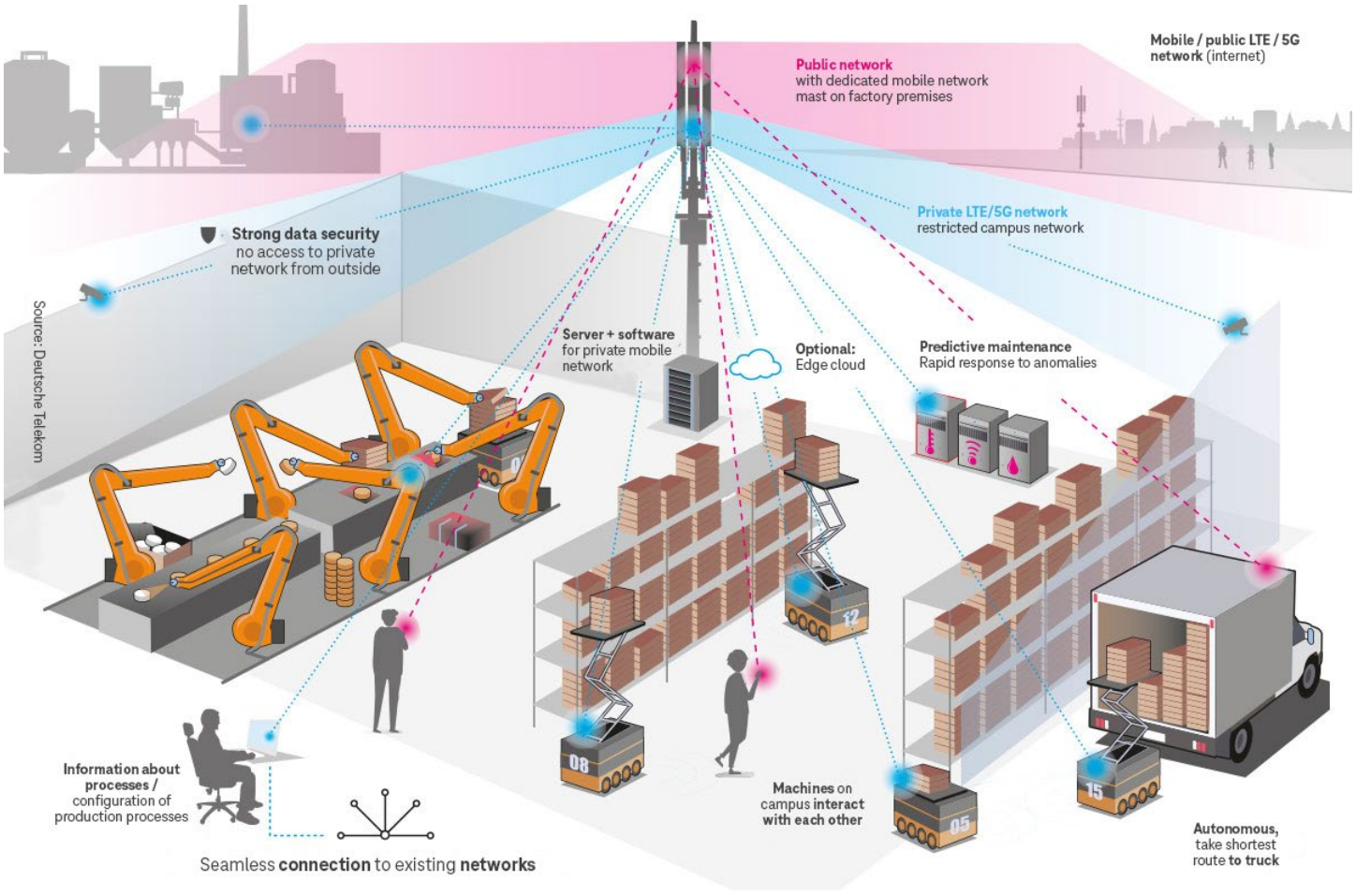
Click here to learn more

5G campus networks

5G campus networks provide secure, high-performance coverage across your premises, ensuring mobility, fast data transfers with ultra-low latency and guaranteed high-bandwidth availability for large numbers of mobile devices.

Campus networks are private mobile networks for defined local areas such as industrial sites, business parks or university campuses. They employ dedicated antennas to create a tailored mobile network. Depending on your requirements, the network can operate as a public (magenta), hybrid or private (blue) 5G network. Then we simply connect these networks to a local data centre or cloud application using Deutsche Telekom's cloud platform.

The advantage is that a 5G campus network establishes a separate, private mobile infrastructure, ensuring sufficient capacity for IoT applications is always available on-site. The network also has the ability to scale as needed and provides a secure technical foundation for future innovations.



More about 5G campus networks

How Kärcher is making cleaning connected

Interview with Marco Cardinale, CTO, Kärcher

Kärcher has made a name for itself around the world with its pressure washers, floor cleaning machines, and innovative cleaning solutions for both commercial and private applications. But the German manufacturer is increasingly evolving into a provider of smart, connected services.

Marco Cardinale, CTO and board member since 2024, discusses customer proximity as a driver of innovation, the autonomous cleaning robot KIRA B 50 and the role of artificial intelligence in tomorrow's cleaning market.

How does Kärcher identify new opportunities for smart services?

Our innovation journey always starts with the customer. And for our B2B business, that means around twelve different target groups ranging from facility management providers to farmers. Our teams around the world observe and interview users in everyday situations, analyse processes and pain points, and derive from these insights so-called demand spaces. Based on those spaces, we generate product concepts and then test and refine them until we have actual solutions – either physical or digital. One thing that's important here: it's not just what the customer says that counts, but also what we observe.

The KIRA B 50 cleaning robot is a smart product that Kärcher has successfully scaled. What were the critical factors here?

Two things coincided here: First, the shortage of skilled labour was driving demand for automated solutions. Second, technological developments such as falling prices for LiDAR sensors had made a feasible business case for customers possible. Our partnership with Deutsche Telekom was key to scaling, specifically because of the robust SIM cards we could use anywhere in the world. This was complemented by AWS cloud infrastructure and the transformation of our sales processes. We offer our cleaning robot with a service contract and digital reporting, which have clear benefits for our customers. The key was always being open to partnerships and the ability to complement our engineering expertise with digital services.

How does Kärcher envision the future of the cleaning industry, and what role will AI play in it?

We call it Connected Cleaning. It's a vision of needs-based cleaning that makes inflexible schedules a thing of the past. Sensor technology, automation and data analysis will play a central role. Robots should only clean when it's really necessary, which is more efficient and sustainable. AI helps us achieve this in two ways. On the one hand, it optimises cleaning processes for our customers. On the other, the usage data helps us develop the next generation of our products. This requires expertise in data science – people who can structure and analyse data to drive innovation. That doesn't mean Kärcher is now a software company. What we are is a provider of intelligent end-to-end solutions that combine mechanics, electronics and digitalisation.

Reliable at any location: Satellite connectivity

To achieve full network coverage and maximum reliability for IoT connections, operators can add satellite-based connectivity to complement terrestrial mobile networks. Depending on requirements, the integration can be convergent or redundant.

Converged satellite NB-IoT

The international 3GPP standard enables a combination of NB-IoT mobile communication and satellite connectivity. IoT devices that support 3GPP Release 17 can communicate via both traditional mobile base stations and satellites using the same SIM card.

Data rates stay very manageable (a few kilobytes per second) to maintain efficient communication and long battery life even over satellite. Deutsche Telekom leads the field, offering the world's first converged satellite NB-IoT service since early 2024, seamlessly integrated with existing IoT solutions. This combination is especially suited to applications that must work in remote areas or at sea.

LTE and satellite

When higher bandwidth and maximum availability are essential, hybrid solutions deliver the best results. They combine IoT mobile networks with satellite links to achieve redundancy. If the terrestrial connection fails, the intelligent system automatically switches to the satellite link.

This fail-safe hybrid connectivity is a good fit for environmental monitoring anywhere there are coverage gaps as well as critical-infrastructure use cases that demand exceptional resilience. With IoT Satellite Connect, Deutsche Telekom provides robust, high-bandwidth connectivity that keeps communications reliable even in remote areas.

Low data volume
For IoT applications that require high energy efficiency and low device cost

Medium to high data volume
For IoT applications that need guaranteed data rates with high availability

Image generated with AI

More about Satellite IoT

Down-to-the-centimetre positioning with Precise Positioning

For applications such as autonomous vehicle control or precise surveying in construction and land planning, conventional satellite systems like GPS lack the necessary accuracy. With Precise Positioning, Deutsche Telekom delivers precision down to the centimetre as a cloud-based IoT service.

Uncorrected GNSS (Global Navigation Satellite System) typically provides location accuracy of between three and ten metres. Errors arise from factors such as satellite orbit deviation, clock drift and atmospheric interference. Because that isn't precise enough for many applications, Deutsche Telekom and Swift Navigation operate a global network of GNSS reference stations. These stations collect data from major navigation satellites and compare it with the stations' known positions. Based on these measurements, the system calculates highly accurate correction data and transmits it in real time over mobile networks – for instance, to robotic lawnmowers that can then mow precisely without boundary wires.

Use cases for precise positioning

- Accurate navigation of vehicles in urban canyons, tunnels, multi-lane roads or mountainous terrain
- Precise control of autonomous vehicles
- Exact location tracking for outdoor wearables
- Accurate surveying and mapping in construction and land planning
- Reliable drone tracking

More about Precise Positioning

3 IoT SIM cards

Image generated with AI

The right SIM card for every scenario

SIMs are the heart of mobile communication. They let smart IoT devices on construction sites, in factories and in transport or logistics send data to cloud platforms.

Standard SIMs

A standard SIM comes in three sizes. This SIM card suits simple IoT applications that don't encounter extreme climates, dirt or vibration.

Chip SIMs (MFF)

For projects that demand extra robustness, we offer chip SIMs (MFF2). This is a soldered-in SIM that works just like a standard SIM card. During device production, customers can solder it directly onto the PCB. You can also seal it to protect it against corrosion. That makes the chip SIM the ideal option for devices that operate outdoors, are in constant motion or are designed for a long service life. It also provides enhanced security – because it's permanently built in, thieves can't remove it, and the device can continue to report its location.

iSIMs

Unlike a chip SIM, an iSIM (integrated SIM) embeds the SIM functions directly into the communications chipset. This reduces both production time and costs. Because there's no separate SIM card to operate and the SIM functionality is pared down to include only what IoT applications need, devices with iSIMs consume less power. iSIMs are therefore well suited to devices or applications intended to run for several years on a single battery.

The many requirements of IoT SIM cards

Robustness
Must operate reliably in a wide range of conditions

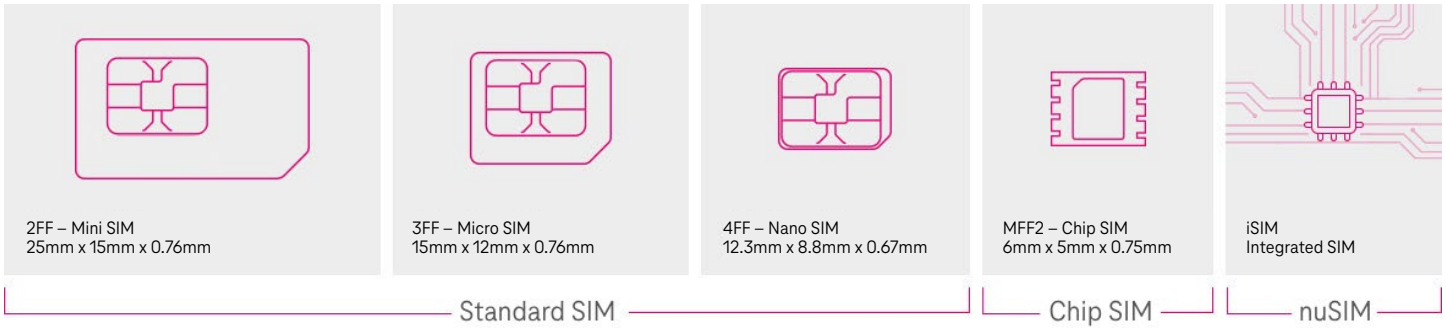
Flexibility
Must support multiple network technologies

Durability
Must operate as long as possible without malfunctioning

Form factor
Must save as much space as possible

Handling
Must be easy to activate

More about SIMs



eSIMs for IoT

It’s as simple as on a smartphone. You can just download and activate your eSIM profiles. Digital provisioning enhances flexibility and saves time and costs.

With eSIM technology, the Subscriber Identification Module (SIM) is embedded inside a secure component called the eUICC (Embedded Universal Integrated Circuit Card). In most cases, the eUICC is a pre-installed MFF2 SIM chip. It can also be implemented as a removable SIM card. The key advantage of eUICCs compared to traditional SIMs is that connectivity provider profiles can be provisioned remotely without swapping a physical card.

This greatly simplifies handling and device logistics. Because physical SIM cards no longer need to be shipped out or manually inserted. A Deutsche Telekom server simply sends the eSIM profile to the respective device. This works for devices with GSMA SGP.22 compliant eSIMs using an activation code we provide. Then you decide when to activate.

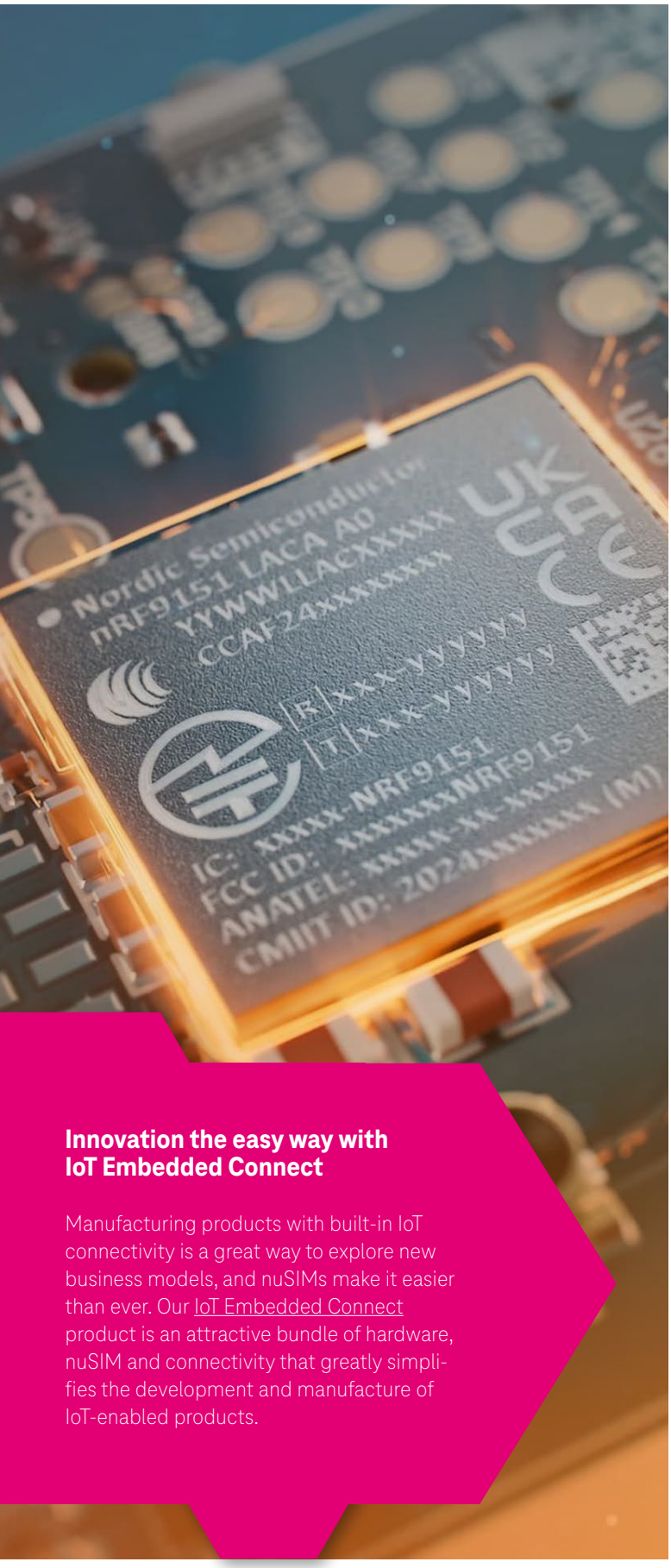
Digital provisioning
No physical SIM card shipments or manual SIM installation required

Saves time and money
Digital processes consume fewer resources

Digital customisation
You decide how, when, and where devices are customised

Flexibility
A technology- and vendor-agnostic solution adaptable to future technologies

nuSIM – the integrated SIM for the Internet of Things



Innovation the easy way with IoT Embedded Connect

Manufacturing products with built-in IoT connectivity is a great way to explore new business models, and nuSIMs make it easier than ever. Our IoT Embedded Connect product is an attractive bundle of hardware, nuSIM and connectivity that greatly simplifies the development and manufacture of IoT-enabled products.

Low cost, long service life

Many IoT use cases involve deploying smart radio modules at scale – logistics tracking, for example. Every penny counts here. Deutsche Telekom worked with leading technology partners and developed the nuSIM especially for cost-sensitive IoT applications and the NB-IoT networks they run on. To establish nuSIM as a global standard for the Internet of Things, Deutsche Telekom has created an open ecosystem for mobile operators, chipset makers, module suppliers and providers of digital security solutions.

nuSIMs omit several features that are superfluous in typical IoT scenarios. A connected water or electricity meter, for instance, sends a tiny data packet once a day. It doesn't need voice, SMS or niche capabilities such as a SIM toolkit or Java Card support. This makes nuSIMs extremely lean and cost-effective. As an integrated SIM (iSIM), they also draw less power than conventional SIMs, extending device battery life. It's a natural fit for NB-IoT networks, where energy and cost efficiency are key. They also work well with the IoT cellular standard, LTE-M.

Robust and secure

The integrated nuSIM is also more resistant to vibration and large temperature swings than a SIM in a card slot, which is an advantage for deployments in industries such as manufacturing, logistics and agriculture. Eliminating the slot simplifies sealed device designs and helps protect against moisture and dust. This extends the IoT device's service life, and the nuSIM will last just as long.

It's also virtually impossible to tamper with a nuSIM because it sits deep inside the radio module's chip. TÜViT has independently certified the security level, which is equivalent to that of a removable SIM. The provider's encrypted on-chip credentials enable secure, private access to mobile networks and preserve billing integrity – crucial for roaming, for example when a lorry with a tracking module travels across Europe.

i More about nuSIM

In cooperation with Controlant

Controlant enables transparency in pharmaceutical supply chains

Controlant's smart IoT device with an integrated SIM card gives pharmaceutical manufacturers unprecedented visibility into their supply chains.

The challenge

The transport of pharmaceutical products is tightly regulated. It's essential to strictly maintain the cold chain. If a lapse results in medicine being discarded, it can mean considerable financial losses. If the supply chain is disrupted, shipments are delayed, and that has consequences for patients. Companies that lack supply-chain transparency are forced to keep large quantities of medicines in stock as a precaution, further increasing financial and environmental costs.

The solution

Working with Deutsche Telekom and several other partners, Controlant has developed a monitoring solution based on the Internet of Things (IoT). The Saga Card fits inside a carton or even a single pack of medicine. It can provide detailed location and temperature data across the entire supply route. It even records when someone opens the packaging. A software-defined Deutsche Telekom nuSIM powers this lean device. This IoT-ready iSIM uses Deutsche Telekom's global, energy-efficient NB-IoT and LTE-M networks to transmit data to Controlant's cloud platform.

The benefits

Controlant's new monitoring device can track medicine from production to patient, delivering end-to-end transparency in pharmaceutical supply chains. It also provides data and alerts on location and product condition in real-time, including the last mile. This way, pharmaceutical companies can immediately detect gaps in the cold chain and see when shipments are opened. The Saga Card dramatically reduces waste; it's no longer necessary to keep large stocks of medicine in reserve as a precaution.

Click here to learn more

eSIMs and iSIMs simplify connectivity

Interview with Uday Patil, expert for IoT SIMs and hardware, Deutsche Telekom IoT

The choice of connectivity determines the success of an IoT product. Uday Patil, Head of IoT Devices at Deutsche Telekom, explains why companies should move away from Wi-Fi and Bluetooth – and how cellular offers a more sustainable solution.

Why are Wi-Fi and Bluetooth often inadequate for IoT devices?

Many companies opt for Wi-Fi or Bluetooth because these technologies seem simple and cost-effective at first. But they come with significant drawbacks: The range is limited, they're prone to interference, and the connection can drop when the device moves. This results in severe limitations in applications such as logistics, smart cities and healthcare. Cellular connectivity offers a widespread, secure and scalable solution regardless of location or computer network infrastructure.

Wi-Fi and Bluetooth also come with high implementation and maintenance costs. Especially in industrial environments or distributed IoT networks, setting up and maintaining a stable Wi-Fi network can quickly become complex and expensive. Companies also need to keep the security of their networks in mind, since unsecured Wi-Fi connections pose a higher risk of cyberattacks. Cellular networks, on the other hand, offer built-in encryption standards and, via SIM management platforms, centralised management and protection for connected devices.

What challenges have people had implementing cellular solutions for IoT?

The three biggest hurdles have been cost, complex pricing, and a lack of expertise. Historically, cellular modules were more expensive than Wi-Fi alternatives, and many providers imposed inflexible contract terms. Additionally, many developers are familiar with software and apps, but less so with cellular technologies. To address this situation, Deutsche Telekom has developed IoT Embedded Connect. The idea was to use preconfigured modules, flexible tariffs, and low entry costs to make cellular as easy to use as Wi-Fi.

Beyond those challenges, network coverage also plays a critical role. Companies need a reliable solution that works globally – especially for logistics and smart city applications. Roaming costs and incompatibilities between network providers have been a frequent problem in the past. With IoT Embedded Connect, Deutsche Telekom offers global IoT connectivity that allows devices to connect seamlessly across regions without companies needing to worry about network handover or country-specific configurations. This significantly reduces not only costs but also administrative overhead.

What role will 5G, eSIM and iSIM play in the future of the IoT?

These technologies are completely changing the nature of the game. With 5G, large volumes of data can be transmitted in real time, a crucial capability for AI-powered applications like smart home devices or predictive maintenance. eSIMs and iSIMs simplify connectivity: Instead of swapping physical SIM cards, devices can now register on different networks around the world without manual configuration. Companies that adopt cellular IoT connectivity now are laying the foundation for smart, reliable IoT products that work all over the world.

5G standalone (5G SA) in particular is opening up new opportunities for industrial IoT applications by enabling ultra-low-latency connections and network slicing. This capability allows companies to reserve guaranteed bandwidth for critical use cases. The introduction of the iSIM (integrated SIM) will also be a game changer: The card is embedded right into the chip, reducing hardware costs and simplifying production. These technologies make IoT devices more efficient, cost-effective and sustainable over the long term, an essential step for any company investing in smart, connected products.

4 IoT security

Image generated with AI

Secure networks and connections

Network connections between IoT devices and in-house IT systems are a potential target for cyberattacks. Infiltration of a wireless link or network path can be the starting point for further espionage or sabotage. How can you secure these routes effectively?

Secure network deployment

For over 30 years, we've invested in building and expanding our mobile networks. We follow the most stringent security standards. That's why our network infrastructure provides a reliable foundation for your IoT applications and delivers outstanding performance.

Secure operations by experts

Our security specialists continuously monitor our networks. Our modern cyberdefence centre in Germany is where we ensure our networks are safe from attack and your data is protected.

Secure connectivity options with IP VPN

An IP VPN is one way to secure IoT connections. VPN stands for Virtual Private Network – it's an encrypted connection for a private user group that protects against unauthorised access. Fixed IP addresses ensure IoT devices remain actively reachable and uniquely identifiable at all times.

Benefits of IP VPN

Protection against unauthorised access:
Only authorised devices in your restricted user group can access your network.

Secure access:
With a private APN (Access Point Name), you get exclusive internet access that separates your data connections from public networks.

Unique identification:
Each device receives a fixed IP address, enabling continuous identification and easy management of your IoT equipment – even if a unit is inactive for long periods.

Reliable communication:
IP VPN keeps your IoT devices reachable and responsive – ideal for real-time applications and remote maintenance.

Find out more about IoT security

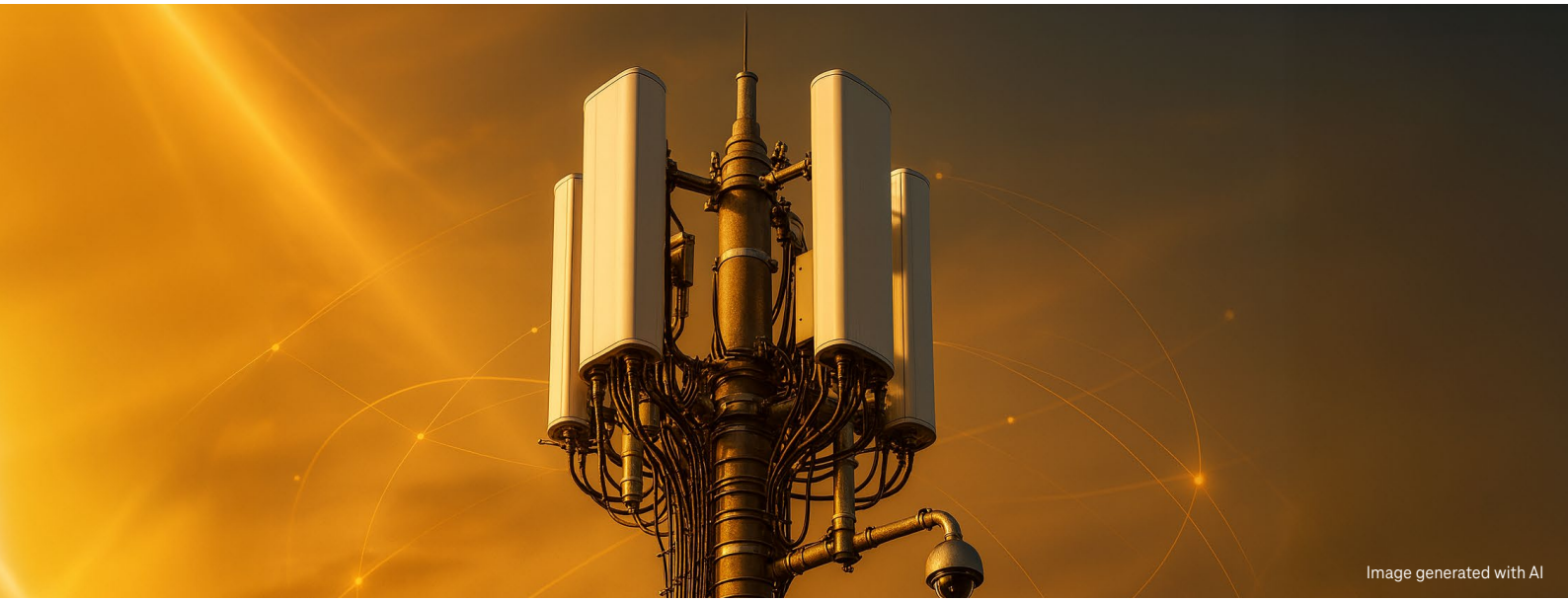


Image generated with AI

Reliable and secure data transmission for mobile video surveillance

A video surveillance company offers solutions for monitoring sites such as construction areas and car parks. An IP VPN ensures data transmission is secure.

The challenge

The video footage must comply with the GDPR. The mobile surveillance towers must also be clearly marked. Another challenge is accounting for the intermittent usage with a flexible cost model – especially across the global markets where the provider operates.

The solution

Our IP VPN gives providers secure, reliable connectivity so they can access their cameras at all times. Mobile IP VPN M2M provides an encrypted connection for a private user group to protect against unauthorised access. Fixed IP addresses ensure the devices are reachable at all times.

The benefits

With the **right IoT Business Data Best tariff**, the security provider can keep data costs in check despite the intermittent use of its surveillance towers, while deploying its surveillance systems with excellent 5G roaming coverage.

Image generated with AI

Securely manage IoT connections

IoT projects can include hundreds or thousands of devices around the world connected with cellular technology. Our M2M Service Portal 3.0 lets you keep a close watch over your secure IoT communications. You can monitor and manage the status, usage and costs of your IoT SIMs with ease. The portal also lets you see and manage costs and performance.

Keeping data secure is critical to the success of IoT projects. That's why the M2M Service Portal 3.0 offers encrypted IPsec tunnels for secure connections. It also provides extensive user access control features. Intelligent algorithms automatically detect abnormal usage patterns and notify you immediately.

SIM management

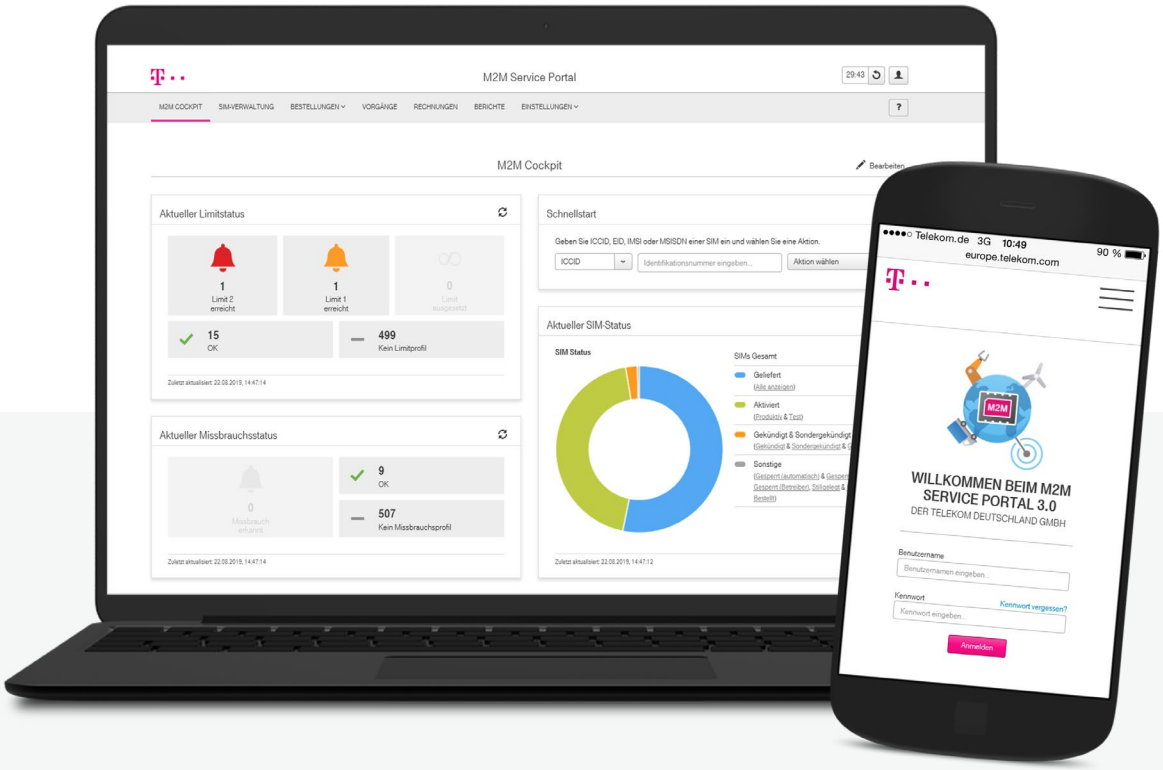
The portal provides visibility across all managed IoT SIMs. You can order SIMs, activate them and choose tariffs. You can see pool volumes and configure them. And beyond that, you can also equip your products with connectivity straight from the factory. Manage dormant connectivity using the IoT Portal and activate whenever required. And especially important for security, you can set up profiles for usage limits and fraud prevention.

Usage limit example

To keep costs under control, you can set a maximum data volume per SIM or per pool. If usage exceeds the limit, the system automatically sends a warning. If desired, the SIM can be immediately locked instead.

Fraud prevention example

A bike-sharing provider has equipped its bikes with IoT. The SIM profiles are configured to lock SIMs when they cross a defined geo-boundary. When the SIM lock triggers, the electronic bike lock engages as well. This prevents the rental bikes from leaving a specific country.



Performance monitoring

For an IoT project to run smoothly, you need to know that every single SIM is communicating as planned. The M2M Service Portal 3.0 provides comprehensive real-time insights into the performance of each individual connection. It also issues automated alerts if performance drops or unexpected communication patterns arise.

Secure connections

Modern encryption strategies provide reliable security for your data. A secure IPsec tunnel protects your data on the internet. Using a private APN means that only authorised SIMs from your dedicated user group can connect.

Seamless integration into your processes

Our IoT portal adapts to your processes and structures: With rights management and sub-units, you can mirror internal structures such as product lines and cost centres. You can also use an API to conveniently integrate our services into your IT landscape.

Easy reporting

Alongside the standard web-portal reports, interactive and customisable reporting provides detailed insights into your IoT project status and costs. You can use these insights to optimise performance and expenditures. Are any IoT devices not communicating as expected? Are usage limits being exceeded? The reporting tool gives you instant answers.

Invoices and cost transparency

Our portal lets you break items down by country, cost centre or project for invoicing purposes. It also neatly lists items such as connection and volume prices, pool usage and provisioning fees.
A zoom-in feature displays supporting documents for the listed cost items to make it easy to drill down and get all the details.

More about M2M Service Portal 3.0

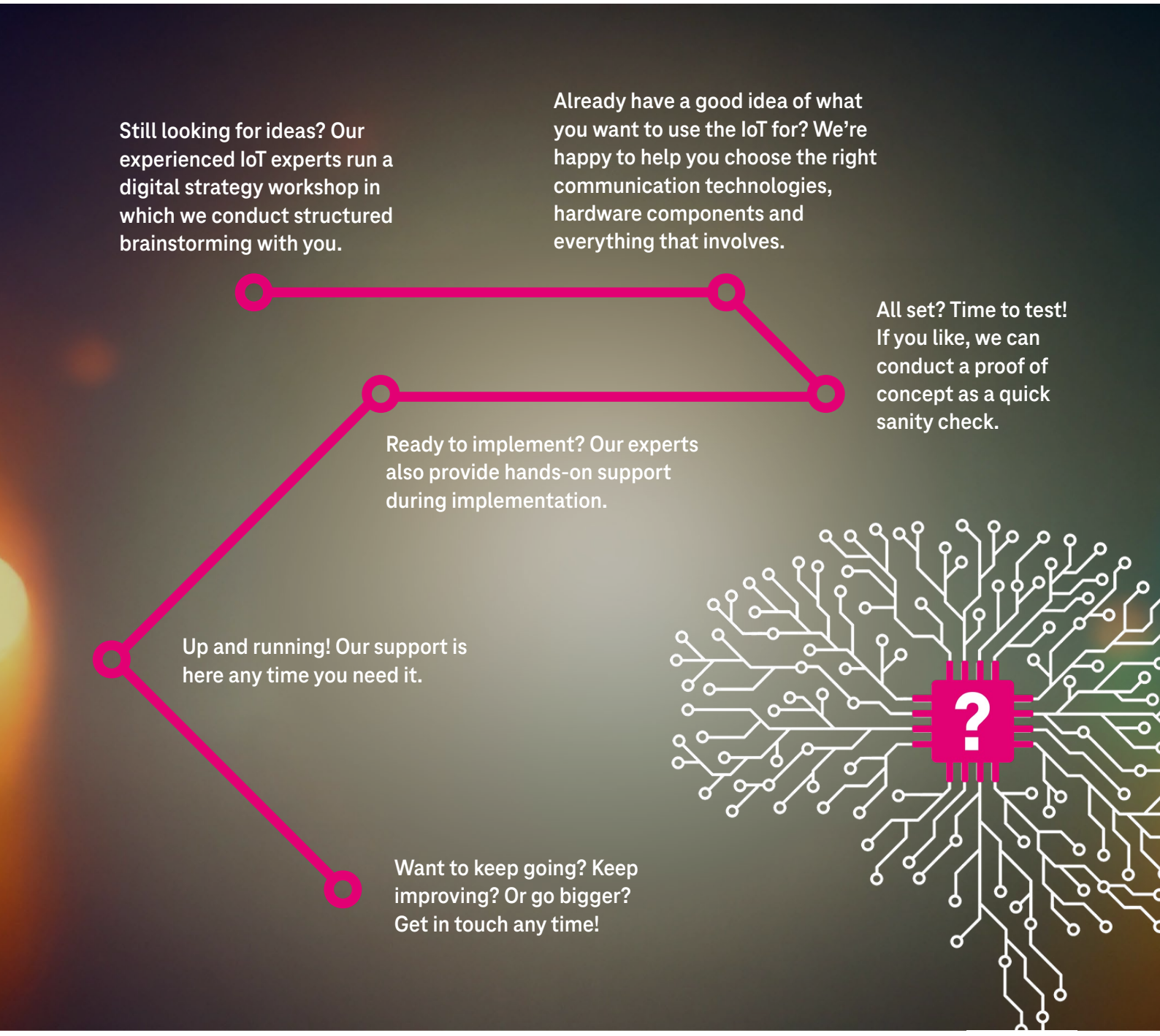
5

Getting started

Image generated with AI

How far along are you on your IoT journey?

Once you've selected connectivity, hardware, SIM type and tariff, it's time to test the overall system: Are the chosen devices suitable for indoor use? How does my application behave on different networks? What impact does a new configuration have on energy consumption and the business model? How can I improve efficiency or reduce development costs? Companies that want to deploy IoT solutions typically run lengthy proofs of concept and costly test cycles – just to find out whether their products deliver the required performance and battery life. There's no guarantee of success, because numerous design and deployment factors affect the outcome. A provider who is familiar with these issues and has the answers your business needs is a real help.



Finding the right tariff

Data volume, number of SIM cards, contract terms and country coverage – there's a lot to consider when choosing the right IoT tariff. Our IoT tariffs provide flexibility and transparency that fit your requirements exactly.

You want to connect devices using the IoT to establish smart processes. But using which technology? Of course it matters whether your IoT devices will need to send a small amount of data once per day or transmit high volumes in real time. And whether the sensors move across borders or just sit in a basement. Don't worry – we can cover all of these requirements and, thanks to international standards, deliver a future-proof solution.

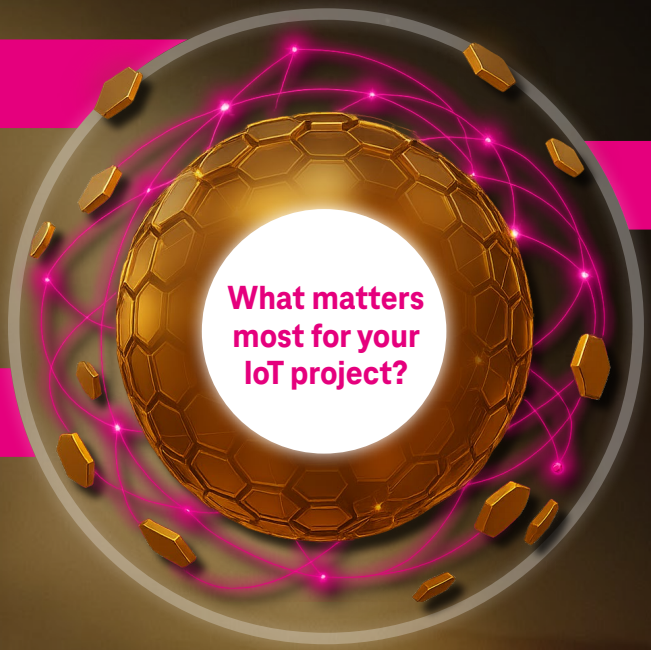
Which transmission technology and tariff scheme fit your IoT project depends on several parameters:

IoT network tech

- Fast connection and low response times
- Long autonomous device operation
- Energy efficiency
- High building penetration

Cost management

- Cost certainty
- Flexible data usage
- Simple connectivity management
- Dynamic tariff adjustment



Network coverage

- Reliable connectivity in Germany
- Cross-border connectivity
- Backup option for critical infrastructure
- Reliable connections even in remote areas

Click here to learn more

Join the Telekom IoT Community

Customers and partners from a wide range of industries come together in the Telekom IoT Community to share their experiences. Take this opportunity to gain fresh insights, connect with decision-makers from other companies and benefit from their knowledge.

What's it like to work with us?

Success stories from our customers and partners

Cooperation is the key to success in the Internet of Things. We develop solutions to the challenges our customers and collaborators face as a sparing partner with a wealth of practical experience. We're proud that you rely on our expertise. Explore our references to see how we successfully implement projects in numerous industries.

Learn more

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