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**EXCLUSIVE  
PREVIEW INSIDE**

BARCELONA  
26 - 29 FEBRUARY 2024



## COVER INTERVIEW

**Kigen's Vincent Korstanje explains why eSIM's secure element underpins data integrity for cellular growth**



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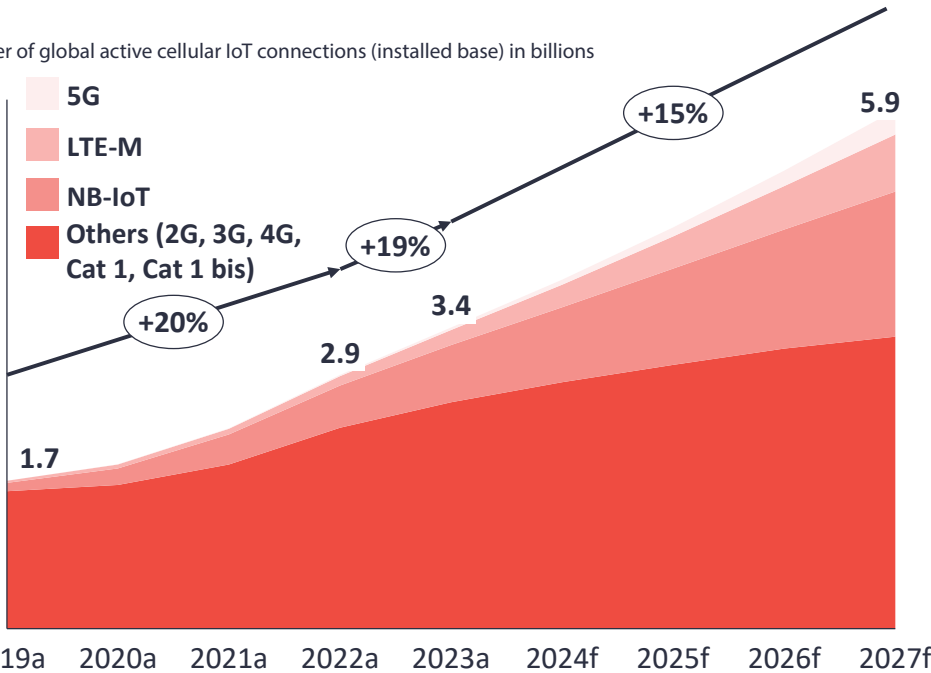


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# IoT market update: Global active cellular IoT connections grew by 19% to 3.4B in 2023

Number of global active cellular IoT connections (installed base) in billions



Source: IoT Analytics Research 2024. 5G Market Report 2024-2029. IoT Operator Pricing 2024-2029 Report.

## Analyst opinion



“Emerging technologies, such as 5G, 5G Redcap, LTE Cat Bis, and LPWA, are set to catalyze significant growth in the cellular IoT market in the forthcoming years. Despite facing macro uncertainties and experiencing layoffs, the cellular IoT market is expected to demonstrate resilience and to remain robust in 2024. However, geopolitical tensions, notably between the US and China, pose potential disruptions to the cellular market due to security concerns.”

-Satyajit Sinha, Principal Analyst at IoT Analytics

## IoT Analytics: Enabling informed IoT decisions through qualitative and quantitative market research

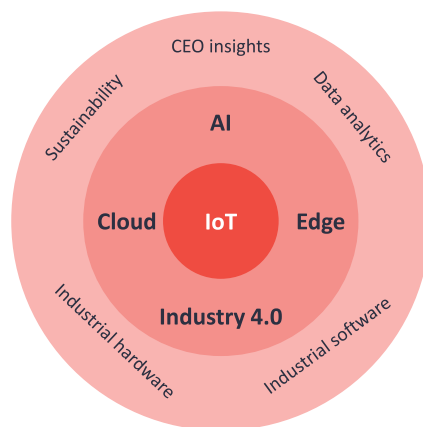


### Areas of research (selection)

- 5G IoT and private 5G
- LPWAN
- Operator pricing
- Generative AI
- Satellite IoT
- IoT Semiconductors
- Edge Computing
- Cellular IoT Module and Chipsets
- IoT Connectivity
- eSIM and iSIM

“Your content blows the other researchers out of the water. If I have a question based on a report, the answer is almost always within the report”.

- Product Manager, leading chipset manufacturer



### Customer example



### How clients leverage our market research

Client  
Multinational MNO

Purpose  
Staying attuned to industry trends and making more informed decisions, ensuring their solutions are aligned with market dynamics.

“IoT Analytics doesn’t just provide high-quality data. Their valuable insights enhance our understanding of the ever-changing market dynamics, leading to impactful actions.”  
- Marketing Manager

Reach out for more insights

✉ [info@iot-analytics.com](mailto:info@iot-analytics.com)

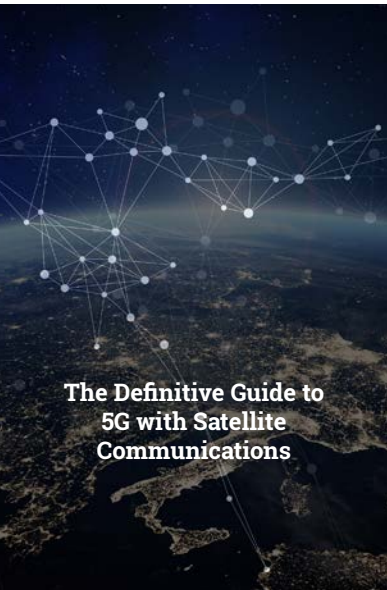
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📊 AVERAGE CUSTOMER SATISFACTION SCORE: 4.5/5

📊 ALL CUSTOMERS RATE US 3 OR ABOVE WITH 60% RATING US 5 OUT OF 5



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**Cover sponsor: Kigen** is the forerunner in eSIM and iSIM security-enabled IoT solutions built for scale. An Arm-founded company, Kigen flexibly empowers OEMs with security on leading IoT chipsets and modules and with the world's leading IoT and LPWAN connectivity providers in up to 200 countries. Our industry-leading SIM OS products enable over 2.5 billion SIMs and complement our GSMA-accredited Remote SIM provisioning secure service capabilities. Find out more at [kigen.com](https://kigen.com) or join our **#FutureofSIM** conversation on LinkedIn.

<https://kigen.com/contact/>



# Stick to the shadows, bring your own bocadillo

Regular visitors to MWC Barcelona may have been lulled into a false sense of ease by the pandemic-triggered lower than normal attendance levels at recent events, but visitor numbers this year are set to return to the near six figure levels of old. Therefore take steps to minimise discomfort



**George Malim,**  
managing editor

My early warning systems – budget airline costs to Barcelona from UK airports during the show week and occupation rates at hotels in the city – have revealed that a return to form will be witnessed at this year's event. That's unless a concurrent event such as Formula1 testing is skewing the picture and I doubt teams have suddenly seen the need to massively increase on-site personnel. In addition, there's

no significant football in the week of the show to distort these data so the loadings look to be MWC-related.

That can only be a good thing for IoT, telecoms and the growing number of businesses from adjacent industries that rely on the enabling technologies that MWC covers. Innovation needs a platform on which it can showcase developments, share knowledge and make sales. MWC Barcelona has provided that and is the focus of many companies' marketing budgets for this reason.

Having said that, the last few years have provided a break from the typical stresses and strains of MWC. With fewer people, everything has worked better. It has been easier to find accommodation, less crowded to travel to the Fira and less pressure on everything from catering to hygiene has contributed to a more pleasant experience.

This year then, everyone will be a little more frazzled, stressed by arriving late because of transport congestion, sorer of feet from not having enough access to chairs and shorter for time because of queuing for entry, coffee, lunch or latrines. The venue itself will be more of a battle to get around and the crowds will make it harder to spot old friends and new acquaintances. More is not always better, but it will certainly deliver a bigger buzz in the Fira's vast halls.

Of course, for veteran attendees, the old rules still apply: Avoid the central spine by stepping outside between the halls and bring your own bocadillo.

Enjoy the magazine – and MWC Barcelona 24!

George Malim

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## Quantinuum raises US\$300m in equity funding

**Honeywell** has announced the closing of a US\$300 million equity fundraise for **Quantinuum** at a pre-money valuation of US\$5bn. The round is anchored by Quantinuum’s partner **JPMorgan Chase**, with additional participation from **Mitsui**, **Amgen** and Honeywell, which remains the company’s majority shareholder. This investment brings the total capital raised by Quantinuum since inception to approximately US\$625m.

This capital raise represents Quantinuum’s first equity funding round since **Cambridge Quantum Computing** and Honeywell Quantum Solutions merged in November 2021. The funds will be used to accelerate the path towards achieving universal fault-tolerant quantum computers, while also extending Quantinuum’s software offering to enhance commercial applicability.

Rajeeb Hazra, the chief executive of Quantinuum, said: “The confidence in our business demonstrated through this investment by our longstanding strategic partners and industry leaders is a clear indication of the value we will continue to create with the world’s highest performing quantum computers, groundbreaking middleware to accelerate

the developer ecosystem and innovative application software to revolutionise fields like cryptography, computational chemistry and AI.”

Quantinuum’s technologies are used today by leading companies, including **Airbus**, **BMW Group**, **Honeywell**, **HSBC**, **JPMorgan Chase**, **Mitsui** and **Thales**. In collaboration, these organisations are exploring how to engineer and scale quantum capabilities to help solve some of world’s most challenging problems – from designing and manufacturing hydrogen cell batteries for transportation, to developing materials to sequester carbon safely from the atmosphere to support the world’s energy transition.

Quantinuum is also at the forefront of developing quantum natural language processing, which will help enable the next generation of AI to be scalable and fit for purpose. ■



**Rajeeb Hazra**  
Quantinuum

## News in Brief

### New UK smart things hub launches

The UK government, **Glasgow City Council** and the **Smart Things Accelerator Centre (STAC)** have formed a partnership, backed by substantial government investment, to establish Glasgow as a leading smart things and IoT innovation hub in Europe. The alliance will centre around a £2.5 million public and private sector investment into a 250-desk state-of-the-art facility named ‘thebeyond’ at SkyPark, Finnieston in Glasgow.

Projections are for Glasgow to have as many as 100 companies being up and running by the end of 2024. Through the partnership, Glasgow City Council and the city, the third largest city in the UK, will become a test bed for homegrown innovations via STAC, which was launched in 2021. The initiative is supported by industry executives with decades of experience from various organisations, including **Dyson**, **Plexus**, **Meta**, **Blackberry**, **Motorola** and **Volvo Cars**. ■

### Trigent launches Trigent AXLR8 Labs

**Trigent** has launched Trigent AXLR8 Labs for the transportation and logistics services – a tech enabler that combines Trigent’s domain and technical expertise to help transportation and logistics companies move freight faster and smarter.

Trigent AXLR8 Labs is a comprehensive suite of services designed to empower shippers, carriers, brokers and third-party logistics (3PL) providers to accelerate their digital transformation and stay market-relevant. Whether startups or established enterprises, the tech accelerator enables businesses to achieve remarkable outcomes in multimodal supply chain orchestration, elastic logistics and digital freight marketplace, thus paving the way to fast-forward their tech innovations. ■

## TEAL and Kigen partner for initial GSMA-certified eSIM platform in the US

**TEAL**, the first US-based eSIM platform to be certified by **GSMA**, is partnering with **Kigen** to make available a version of the Kigen eSIM operating system (OS) with features that are ready for the new embedded SIM (eSIM) for IoT specification, SGP.32. The OS will be preloaded with TEAL’s in-house SGP.32 cloud platforms (eIM, SM-DS) and the partnership aims to support original equipment manufacturers (OEMs) and machine-to-machine (M2M) customers that will soon transition to formulas that support SGP.32.

“The upcoming SGP.31/32 specification reduces the commercial complexity of switching between eSIM profiles and paves the path for LPWAN devices to utilise standardised remote SIM provisioning (RSP) at scale,” said John Canali, a principal analyst for IoT at **Omdia**. “We estimate this will boost global active cellular IoT connections by billions of new connections through 2028, aided by interoperability as

companies adopt more adaptable solutions.”

TEAL’s wholly owned and patented eSIM Platform technology connects any device to any data network worldwide, giving businesses everywhere the flexibility and control to switch between networks over the air remotely. With the GSMA’s consumer eSIM for IoT specification, SGP.32, becoming the go-to deployment model for eSIM, this partnership sets a new standard for the management of IoT at scale.

“We are thrilled to partner with Kigen to provide a comprehensive solution melding Kigen’s SGP.32 operating system and TEAL’s advanced eSIM Platform technology,” said TEAL chief executive, Robert Hamblet. “This partnership will enable us to provide our customers with the most forward-thinking eSIM technology available, ensuring the highest level of reliability and performance for any IoT deployment.” ■



## News in Brief

### Onomondo teams with Carlsberg for IoT connectivity in bars and restaurants

**Onomondo** has begun supporting the **Carlsberg** Group to influence the way bars and restaurants operate their draught installations through Carlsberg DraughtMaster. By harnessing Onomondo's global connectivity and software, users of Carlsberg's new DraughtMaster system will have the platform they need to gain real-time insights into sales patterns, early warning of technical issues, and the ability to digitise their operations.

"Onomondo's objective has always been to serve a global client base and provide a simplified and unified network that provides IoT solutions with optimal coverage," said Henrik Aagaard, the co-founder and CTO of Onomondo. "By collaborating with Carlsberg, we have built a solution that can function wherever their beer is consumed. This is particularly important given the phasing out of 2G and 3G standards worldwide, making it crucial for the network and devices to demonstrate adaptability and remain future-proof." ■

### CommScope and STMicroelectronics partner for IoT security

**CommScope** and **STMicroelectronics** have partnered to integrate CommScope's PKIWorks IoT security platform with ST's STM32WB microcontroller unit (MCU). This collaboration provides device manufacturers with a comprehensive answer for developing secure IoT devices that comply with the Connectivity Standards Alliance's Matter standard.

By simplifying the manufacturing process for secure Matter device credentials, development and provisioning, the integrated solution helps reduce costs and time for IoT device manufacturers. It also enables devices to be commissioned at the MCU level without the need for developer intervention. ■

### Airtel to power more than 20 million Adani smart meters

**Airtel Business**, the B2B arm of **Bharti Airtel**, has announced that it will power over 20 million smart meters for **Adani Energy Solutions Limited (AESL)**. Airtel, through its nationwide communications network, will deliver secure connectivity for all AESL's smart meter deployments. In addition, Airtel's smart metering solutions which are powered by NB-IoT, 4G and 2G, will help AESL to ensure real-time connectivity and uninterrupted transfer of critical data between smart meters and headend applications.

The solution will also come powered with Airtel's IoT platform Airtel IoT Hub, which enables smart meter tracking and monitoring with advanced analytics and diagnostic capabilities in addition to real-time insights and services that empower customers with enhanced control over their energy consumption. AESL has an order book of more than 20 million smart meters from the power utilities of Assam, Andhra Pradesh, Bihar,

Maharashtra and Uttarakhand.

"India's smart metering programme is one of the most significant policy reform measures undertaken by the government," said Ganesh Lakshminarayanan, the chief executive of Airtel Business India. "These meters are critical building blocks for smart grids and fundamental enablers for the digitalisation of the power sector. Airtel expects its NB-IoT technology to play a significant role in the utilities space to connect and manage smart meters at scale with enhanced coverage, high reliability and security."

Kandarp Patel, the chief executive of Adani Energy Solutions, added: "This combination will enable us to seamlessly deploy our current order book of over 20 million smart meters across India, empowering millions of consumers with real-time consumption data and control, while simultaneously driving down inefficiencies in the distribution network." ■

### Software AG and Tencent Cloud collaborate to boost IoT services in China

**Software AG** is collaborating with **Tencent Cloud** to help smart equipment manufacturers provide IoT services for their customers in China. Customers of Software AG's application, Cumulocity IoT, can set up their smart device offerings, available as a software-as-a-service (SaaS) offering, within Chinese borders. This means faster time to value and return on investment (ROI). Currently, organisations are required to set up their infrastructure within China and obtain the necessary licences before they can start operating. Software AG's new collaboration with Tencent Cloud will enable these manufacturers to start connecting devices in China to Cumulocity IoT in the same way as anywhere else in the world: with one simple transaction with Software AG.

"The business landscape in China is unique, and establishing operations in China could



**Bernd Gross, Software AG**

be challenging without a reliable partner," said Bernd Gross, the chief technology officer at Software AG. "This is why we're very pleased to join forces with Tencent Cloud who will help us to easily extend Cumulocity IoT's benefits into China for our international smart equipment manufacturing customers to continuing operating and growing anywhere around the world." ■



## Pairpoint, Deloitte and Nexxiot forge alliance for global cargo

**Pairpoint, Vodafone and Sumitomo Corporation's** Economy of Things business, and **Deloitte** and **Nexxiot** have joined forces to offer digital services that speed up the flow of goods worldwide. The new service will automatically verify the provenance of data on the movement and content of cargo, allowing companies to improve freight handling whilst complying with trade laws. This will lead to faster customs and port authority clearance and expedite the digital transformation of the logistics sector.

The partnership combines the Pairpoint digital asset broker (DAB) platform, which among other things can improve the provenance of data relating to the routes and contents of shipping containers, with KYX, a new service comprising Deloitte's Know Your Client and Know Your Cargo services, and Nexxiot's freight solutions, including smart connected sensors. The KYX solution is the result of a recent partnership by Deloitte and Nexxiot, which specialises in enabling the autonomous collection of asset data to optimise the costs in moving freight, including shipping containers and railcars.

"Through this collaboration, we aim to offer significant advantages to stakeholders in the logistics sector by promoting surety and provenance of data in the shipping industry," said Jorge



**Jorge Bento, Pairpoint**

Bento, the chief executive of Pairpoint. "Our goal is to enhance the efficiency of maritime logistics and streamline goods clearing customs and ports without introducing additional risk."

Helena Lisachuk, the global IoT lead at Deloitte, added: "We are dedicated to establishing green lanes to minimise disruptions for cargo in global transit. Achieving this requires close collaboration with port authorities and engagement with global and regional justice organisations. Applying Nexxiot's and Pairpoint's technology and knowledge to enable real-time monitoring and door-related event tracking, along with Deloitte's expertise—offers new mechanisms to monitor data integrity during cargo movements." ■

## Eurotech launches Everyware GreenEdge for IoT device management

**Eurotech** has introduced Everyware GreenEdge, a software formula designed to address typical challenges that occur during the onboarding and management of edge IoT devices at scale. These challenges include time-consuming errors, security vulnerabilities, inconsistent data, and ultimately, unmanageable IoT devices with insecure credentials. With Everyware GreenEdge, customers can enrol edge devices and establish a seamless connection to **Amazon Web Services (AWS)**. This enables them to leverage the complete range of AWS services, including AWS IoT Analytics.

"We are incredibly proud to make our integrated offering available in AWS Marketplace, combining our 30 years of

edge expertise with the extensive IoT portfolio and global reach that AWS provides," said Paul Chawla, the chief executive of Eurotech. "Everyware GreenEdge confirms Eurotech's commitment to unleash the power of the edge by staying true to our business principles of delivering simple, agnostic, and secure solutions. More than a product, Everyware GreenEdge empowers our customers to achieve their digital ambitions with confidence and speed."

Everyware GreenEdge merges the functionality of AWS IoT Greengrass and Eurotech's Everyware Software Framework (ESF). It also uses the capabilities of Eurotech's Everyware Cloud (EC) for remote device management. ■

## News in Brief

### Wearable device shipments reach record 148.4 million in Q3 2023

Worldwide shipments of wearable devices grew 2.6% year over year during the third quarter of 2023 (3Q23) and reached an all-time high for the third quarter of 148.4 million units, according to new data from the **International Data Corporation (IDC)** Worldwide Quarterly Wearable Device Tracker. Total volume even surpassed shipments in 3Q21 (142.1 million) and 3Q22 (144.6 million) when sales were driven by pandemic-related spending. The growth is largely attributed to the rise of smaller brands and emerging categories.

"It's been a decade since the wearables market got off the ground and while there has been some consolidation, the market still has plenty of diversity in terms of brands and form factors," said Jitesh Ubrani, a research manager, mobility and consumer device trackers at IDC. "Health and fitness tracking has come a long way since the original **Fitbits** and **Pebble** watches but the greatest driver of wearables has been the emergence of smaller and sleeker designs. Smart rings from newer brands such as **Oura**, **Noise**, **BoAT**, **Circular** and others are expected to jumpstart the new form factor in the coming quarters while also putting pressure on the incumbent brands to innovate on health tracking."

"Smartwatches and earwear still hold pride of place in the wearables market," added Ramon Llamas, a research director for mobile devices and AR/VR at IDC. "These still resonate with consumers and continue to find their way to first-time users, especially among the most wary and price sensitive. This is where we can still see emerging vendors ship volumes high enough to rank among the leading brands. Combined with strong refresh cycles – including those who purchased a wearable as recently as 2020 – the wearables market has set up a strong fly wheel to keep volumes growing." ■



# eSIM's secure element underpins data integrity for the mass-scale, AI-enabled next generation of cellular IoT

The mass-market success of cellular IoT has been delayed partly by the constraints of utilising cellular networks that were designed to support the communications of consumers rather than the connectivity needs of connected devices, sensors and vehicles. Now though, a new wave of cellular networks designed with IoT mind are coming to market addressing high energy-efficiency use cases with optimised cellular connectivity. This provides greater choice for organisations deploying cellular IoT devices but also keeps them and their data protected thanks to the continuation of carrier-grade security provision for new networks and for enabling technologies, such as embedded SIM.

With the security stakes rising as AI-enabled services start to emerge, even heavier reliance is being placed on assured device identity and data integrity Vincent Korstanje, the chief executive of Kigen, tells George Malim

**George Malim: 2024 looks to be the year that cellular IoT growth accelerates rapidly, beyond the dominance of the automotive industry and into a wide variety of industries. What do you see becoming mass-market in cellular IoT this year?**

**Vincent Korstanje:** Indeed, as we embark on 2024, the early indicators are very promising – something industry experts and analysts have been forecasting. At **Kigen**, we champion the original equipment manufacturers (OEM) and device makers, which gives us the pulse of the adoption of cellular IoT – and momentum, especially driven by eSIM, is tremendous. There are multiple mass-market industries already, but I think the change is that the cellular IoT sector is now ready to support an industry that can come in and add hundreds of millions of connections. All of that won't happen overnight but I can see NB-IoT and Cat-1 bis helping customers to break into mass markets quickly.

The move into connecting shipping labels and smart trackers is already underway and accelerating. This is due to the desire by shipping

giants to have real-time visibility or nationwide transformation programmes such as the AIS-140 regulation for passenger safety in India, all amounting to applications in logistics to be a mass growth area.

Also, devices like smart meters are moving to cellular connectivity in huge numbers. This type of deployment has become more attractive where cellular IoT is far more effective than other technologies such as when assets are remote and costly to access in large numbers, and IoT has quick payback.

We're also seeing use cases such as the monitoring of industrial or domestic solar power generation becoming increasingly popular. When you are considering connected assets that are integral to national infrastructure, securing connectivity is essential for the outcomes – in this case, optimised production. Across many connected campuses, airports and other sites, we see micromobility drive growth: particularly, think delivery robots! We share a case study later in this issue, on how private and public networks support a vast range of connected services in such environments. ►

SPONSORED INTERVIEW





**GM: How do you see Kigen's role in OEMs to achieve mass market success?**

**VK:** I think there's a fundamental shift happening because of embedded SIM (eSIM). eSIM is changing the IoT industry because the OEM can determine connectivity when the device is either constructed or shipped. This means that in contrast to changing the SIM at the point of deployment and adding connectivity later, the eSIM enables connectivity decisions to happen earlier. That can be good and bad, depending on the deployment type.

It's good because the eSIM enables a smaller form factor within the device, which allows greater design flexibility and, of course, a smaller overall size and weight. This is appealing for OEMs. If you consider a smart meter maker looking to create a product for the world, moving to soldered eSIM enables more straightforward sourcing: they don't have to negotiate separate connectivity from different operators, each with their own minimum order quantity and requirements. Plus, the embedded hardware and the connectivity ►





**Vincent  
Korstanje**  
Kigen



profile make a unique stock-keeping unit (SKU), which would need to be maintained for each. This can be cumbersome and not suited to production setups for scaled manufacturing.

A connectivity profile is often something that can be set at that last stage of manufacture. So, instead of having 20 or 30 versions, you can achieve just-in-time provisioning of the right connectivity profile on the manufacturing line itself, which enables the device to bind with a cellular network before the smart meter is shipped into the field.

Of course, the final deployment is not the only time a device needs to connect. For example, an eSIM might contain secure elements from a German manufacturer such as **Infineon**; in another scenario, it could be **Samsung** in South Korea. Their module is selected from **Murata** in Japan, so the secure elements must be shipped to Japan, and then the module is sent to the ODM or OEM in Taiwan. In these three stages, the product is tested – so once in Germany, Japan and Taiwan. It may then be sent back to Europe or the US, where it is deployed into a tracker on a car, which might move between borders.

There might be four, five or six times an eSIM needs to connect in different regions during the manufacturing to deployment process, and that's something that secure in-factory provisioning can help with to ensure connectivity works for the whole supply chain. At Kigen, we hear positive feedback from our OEM customers on our focus to bring this critical missing piece in eSIM adoption at the mega scale.

**GM: Power consumption is still a critical part of the cost vs lifespan vs form factor equation that every device has to go through. How can battery life be conserved and maximised from manufacturing onwards?**

**VK:** Power efficiency and optimisation have been a mainstay of innovation in IoT device design. This affects cost majorly across the overall lifespan – the total cost of ownership, and hence is a critical requirement. For

## ***A connectivity profile is often something that can be set at that last stage of manufacture***

example, in metering, the devices are designed for low data rates and with very low power NB-IoT connectivity but need to operate effectively for a minimum period of ten years on a single battery charge. So, simply downloading a new connectivity profile, which can reduce useable life when the device is in the field might not be in your best interest. This risk can be minimised by installing device profiles in the factory before it ships and can be enabled in the field. Enabling a profile is a much smaller operation that doesn't involve radio as much, so power consumption is much lower.

**GM: Cellular connectivity is not the only option for IoT deployments. Why do you expect volumes to grow substantially?**

**VK:** There are several dynamics to consider. Cellular technologies used to be confined to 2G, 3G, 4G and 5G – where available – but now, the range encompasses a wider variety of low power wide area network (LPWAN) options, developed with IoT use cases in mind. These are a much better fit for cost, power, and network performance with IoT use cases than adaptations of cellular network technologies initially developed for consumer communications.

Increasingly now, there is an appropriate cellular technology for each IoT deployment, and the choice extends from made-for-IoT technologies such as narrowband-IoT and 5G RedCap to IoT-appropriate offerings such as LTE Cat1 bis. Of course, there are also standard LTE, LTE-Advanced, 5G standalone, and non-standalone to consider as 2G and 3G networks sunset. These options mean there is less need to over-specify cellular performance, and cost can be controlled.

These in combination with the Kigen secure OS products for eSIM and iSIM, you start achieving energy-efficiency with the benefits of robust security in a similar ballpark as other connectivity options. With a radio chip now coming down to perhaps US\$7 or US\$8 the comparison to a Wi-Fi chip at US\$5 is narrowing. A washing machine company could install its own cellular chip to communicate data, assuming data protection compliance, without needing the customer's Wi-Fi connectivity. The business case for IoT is also now well established, so whether you are considering a connected product line of washing machines, one of the world's largest solar power generation plants, or a connected airport – cellular is far more in consideration than ever before due to the cost being on par.

Further, the cellular market has changed a lot, and it is no longer in isolation. It's likely that water ►



***eSIMs are a really good security asset that can be used for other things, such as verifying device identity, and to sign data coming off any IoT device. In the world of AI, security is a must***

meters that use NB-IoT, for example, will also link to non-terrestrial networks (NTNs) to gain satellite connectivity in areas where there is no coverage.

And with eSIM technology, it is getting much simpler for OEMs as we just talked about. This year we see the SGP.31/32 specifications formalise, which has created great excitement and demand from OEMs. Traditionally, cellular product development timelines were far longer, the time needed to invest in contracts and certification of your module or SoC. Kigen has taken this unique position in the market to bring semiconductor, module, and chipset vendors and connectivity partners to build a more agile, faster path to market. Now, OEMs can come to Kigen and request to access eSIM and iSIM with their chosen MNO profile such as **AT&T**, and then work directly with their major operator and transfer their subscriptions to their existing operator relationship. This ecosystem approach creates shared value (which we continue to build on from our origin in **Arm Holdings**), and also contributes to greater confidence from OEMs that are new to cellular, growing the overall sector.

So all of these put together bring new options to market with great flexibility and, in turn, help to drive the volume substantially.

**GM: How do you see the arrival of SGP.32-ready devices helping increase flexibility and broaden the appeal of cellular IoT?**

**VK:** What's important about SGP.32 is that it starts to bring the consumer specification's ease for IoT deployments. That's interesting because the old M2M specification has several challenges, one of which is the management of devices had to be done in a GSMA-certified location. This would typically be restricted to the site of a SIM supplier or by the mobile network operator. Secondly, although interoperability between the players was there in theory, it wasn't working in practice for OEMs. A lot of effort was required to make it work well. So, the new eSIM specifications have aimed to solve specific, real-world challenges.

SGP.32 has the potential to enhance interoperability – so more devices work on more cellular networks, and with more third-party technologies. It's about the ability to take control of your devices and make sure they have the right connectivity provider for your use case. That might be an e-scooter provider doing a new deal in Paris and choosing to move its scooters over to **Orange** connectivity or it could be that a device realises it's going into the desert and it needs to switch to satellite connectivity. With SGP.32, the

market will be able to manage fleets of connected vehicles in a more streamlined way to optimise their connectivity. We anticipate this would be a positive development to broaden the appeal and are focused on creating easy transitions for OEMs – with our first solution with SGP.32-ready features announced with **TEAL** in January 2024. We are always eager to learn from customers what we can do, for them to be future-ready.

**GM: Having management control and the secure element are two key steps to ensuring the performance of connected devices. That is essential to enable use cases that demand data is monitored and that are used to fuel artificial intelligence, machine learning and greater automation. How important is the ability to assure data integrity becoming?**

**VK:** The integrity of the data is indeed a foundation for the future. AI is garnering a lot of OEM attention because generative AI is shaking up the world. At some point, it will run out of data to take in because the English language – and other languages – are only so big. Fundamentally, that means at some point quite soon, AI will need to take in new data and data from new use cases becomes particularly interesting.

AI is currently summarising papers but at some point, it will be advising us then it will be assisting us. If you think about connected cars, it is already assisting us. Then, it will take decisions and for that, it really needs data that we can be sure nobody has tampered with. Where does that data come from? Initially, it comes from reading the internet, but soon it comes from those sensors such as smart meters out in the grid or vehicle sensors.

Those sensor networks and sensor data better be secure, which is why secure element enabled eSIMs and iSIMs are so important. eSIMs are a really good security asset that can be used for other things, such as verifying device identity, and to sign data coming off any IoT device. In the world of AI, security is a must. There is a lot of hype and concern around the fast evolving potential of AI and so it can be daunting to know where to start. To help companies, I have penned an approach which I hope will assist anyone looking at making most of greater automation, machine learning and AI.

With eSIM in cellular IoT, we are designing that security into use cases to ensure the device identity is trusted and also that the integrity of the data it communicates is assured. That's a compelling advantage for the use cases of the very near future – whether they are AI-enabled or not. ■

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# eSIM services on private networks redefine connected mobility

IoT Now highlights how 5G IoT technology is playing a role in creating new opportunities for connectivity providers, device manufacturers and enterprises in 2024. Kigen shares how security and trust unlock next-generation experiences and what's important to know now

Embedded SIMs (eSIMs) can support cost-savings with further advantages in managing device fleets across enterprise devices. By bringing the improved ease and experience of connectivity profile distribution of Consumer eSIM to IoT, the new specification in SGP.32 also supports other services that redefine secure connectivity. Take the example of connected aviation.

- 190 million passengers will travel internationally through Beijing's new Daxing International Airport, within the 40 day Lunar New Year Spring Festival<sup>1</sup>
- 500% predicted growth for the travel eSIM retail market between 2023 and 2028 as leisure and business travellers embrace eSIM travel plans<sup>2</sup>

## The challenge

Large airports serving regional flight hubs are small cities. For example, Charles De Gaulle airport in Paris employs more than 230,000 professionals, who may use connected services to improve the traveller experience, such as passenger hospitality or transit of cargo and people, while maintaining ambitious goals for the airport to be more sustainable and more innovative.

### Connected assets

Sensors, enabled by secure network connectivity, deployed on physical assets to collect and transmit usage and location data for real-time scheduling and dynamic coordination across authorities, tenants and passenger services.

### Connected operations

Replacing obsolete siloed technologies, airports are expanding the use of autonomous vehicles and robots in airports. These in turn depend heavily on the availability of secure, eSIM-secured low-latency networks.

### Maximising security

There is a need to separate operational and passenger usage and traffic among networks, essential for security, safety and privacy reasons.

### Planning for the future

Airport operators require complete visibility and control over their wireless infrastructure - from planning and deployment to operations and upgrades.

## The solution

Private networks with **Kigen's** extensive ecosystem of leading connectivity providers, with Kigen's Remote SIM Provisioning secure services and enablement suite, simplify digitalisation for an airport that never rests. Combining and augmenting an increasing number of innovative connected services and devices with added intelligence, all supported by security in multiple forms, 5G IoT is helping shape the future of aviation.

The connected airport is a far more familiar scenario than other connected functional arenas such as campuses, stadiums, oil and gas fields or mining sites, which also benefit from this solution. ■

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<sup>1</sup> Ministry of Transport and Tourism of China, Jan 2024  
<sup>2</sup> Kaleido Intelligence Research, Oct 2023



# Are AI ecosystems agents of disruption?

When ChatGPT directed global attention to the transformative potential of artificial intelligence (AI), it marked a pivotal moment in technology history: It moved AI from the minds of a few thousand scientists to 100 million people and 50 languages. That rate of growth and proliferation of technology is one we have never seen before. There is much speculation and debate on how it will impact the future of practically every industry. Navigating this hype with some pragmatic steps to win with AI is possible, writes Vincent Korstanje, the CEO of Kigen

- 97% of global executives agree AI foundation models will enable connections across data types, revolutionising where and how AI is used in their own organisations<sup>1</sup>
- 6x increase in the mentions of AI in earnings call transcripts since the release of ChatGPT in November 2022<sup>2</sup>

The large language models (LLMs) behind ChatGPT, Bard and others mark a significant turning point for machine intelligence with two key developments:

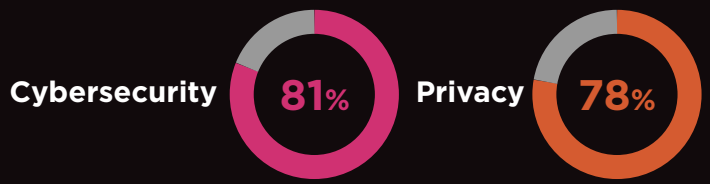
1. AI finally grasped the intent and language complexity that is fundamental to human communication – for the first time, machines can express answers, bring up context and can be independently generative.
2. Using the vast amount of training data in rich text, video, lyrics and image formats, AI can now adapt to wide range of tasks, and can be repurposed or reused in various forms.

The ability of these LLMs to follow instructions, perform high-level reasoning, and generate code, will overturn the enterprise data, analytics and app marketplace: This is a disruptive opportunity for device makers.

LLMs are built and trained on huge amounts of data – ChatGPT, for example, was trained on a massive corpus of text data, around 570GB of datasets<sup>3</sup>, including web pages, books and other sources. It will exhaust the available written text and articles at some point in the foreseeable future and will have to rely on verifiable real-life data. Sensor-driven data is essential for this and would be the most potent way to sense, verify and add to the integrity of the data that AI inferences are based on.

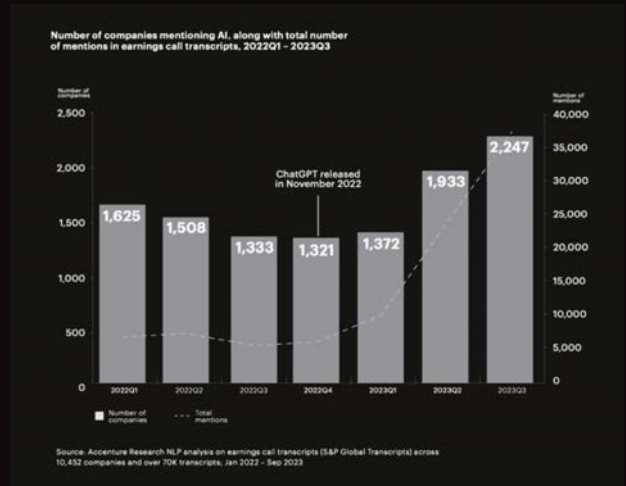
At **Kigen**, we have been talking about machine learning applications applications for several years<sup>4</sup>, and the fact that LLMs can now be run on readily available computing platforms

## Top-of-mind Gen AI concerns for IT leaders



### Can AI have your attention

The number of mentions of AI in earnings call transcripts has increased by 6x since the release of ChatGPT in November 2022.



such as Raspberry Pi is encouraging. As AI capabilities propel forward, we may see them co-exist and collaborate through ecosystems to offer personalised user experiences. In this interlinked context, where AI agents aid or take actions on behalf of users, it is paramount that the data exchanges are secure – all the way from on-device sensors, processors and cloud – wherever that may be appropriately used.

On-device AI is another fast-emerging development – Increased compute power, more efficient hardware, and robust software, as well as an explosion in sensor data from the Internet of Things – are enabling AI to process data on devices that have direct user contact rather than piping everything to the cloud, which can carry privacy and security risks. Such on-device AI capabilities open new ways to personalise experiences.

However, according to a **KPMG** survey<sup>5</sup>, cybersecurity and privacy remain top of mind concerns around AI for IT leaders. So, how do you move forward? The answer is start with what you can control: invest in secure-by-design sensors and IoT devices and integrate security end-to-end. One simple implementation of this that spans from the most constrained and simplest sensor to any edge device and cloud is Kigen's IoTSAFE based on GSMA standards.

The greatest risk associated with using GenAI is a loss of data confidentiality and integrity from inputting sensitive data into the AI system or using unverified outputs from it. For OEMs looking to be leaders in this space, integrating security into their sensors, devices and through the tech stack is a must.

In the age of AI, security is not just a feature, it is a necessity. ■

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<sup>1</sup> Accenture Technology Vision 2023

<sup>2</sup> Accenture research NLP analysis on earnings call transcript (S&P Global transcripts) across 10,452 companies and over 70k transcripts Jan 2022-Sep 2023

<sup>3</sup> Aparna Iyer, analyticsindiamag.com, 2022

<sup>4</sup> <https://kigen.com/resources/watch-now/isim-and-ml-iot-edge/>

<sup>5</sup> KPMG survey, 2023

## SPONSORED ARTICLE



# eSIM momentum gathers pace as connections pass one billion

Embedded SIMs (eSIMs) have been talked about for several years and, in the consumer devices market, are gaining significant traction. The emergence of new specifications from GSMA coupled with made-for-IoT connectivity offerings means that momentum is now spreading to IoT

Now the initial phase of innovation is complete and real deployments are happening at scale, it is clear to see that eSIM is bringing greater benefits to adopter organisations. In IoT, this means radical simplification of the traditional plastic SIM card model with enormous production, manufacturing, configuration and deployment savings to be made. The advantages to the cellular IoT market this delivers in terms of flexibility and choice are allowing creation of single devices for global markets that can be shipped with embedded connectivity.

Much of this has been streamlined by the introduction of the SGP.31/32 specifications from **GSMA** which play a critical role in preparing eSIM for mass adoption, especially on low power wide area network (LPWAN) devices that utilise newer cellular variants such as NB-IoT, Cat1 and Cat1 bis and, soon, 5G Reduced Capability (Red Cap). The specification reduces the complexity involved in switching between network profiles thereby making it easier for IoT organisations to manage devices, ensure optimal network coverage and access more attractive commercial offerings.

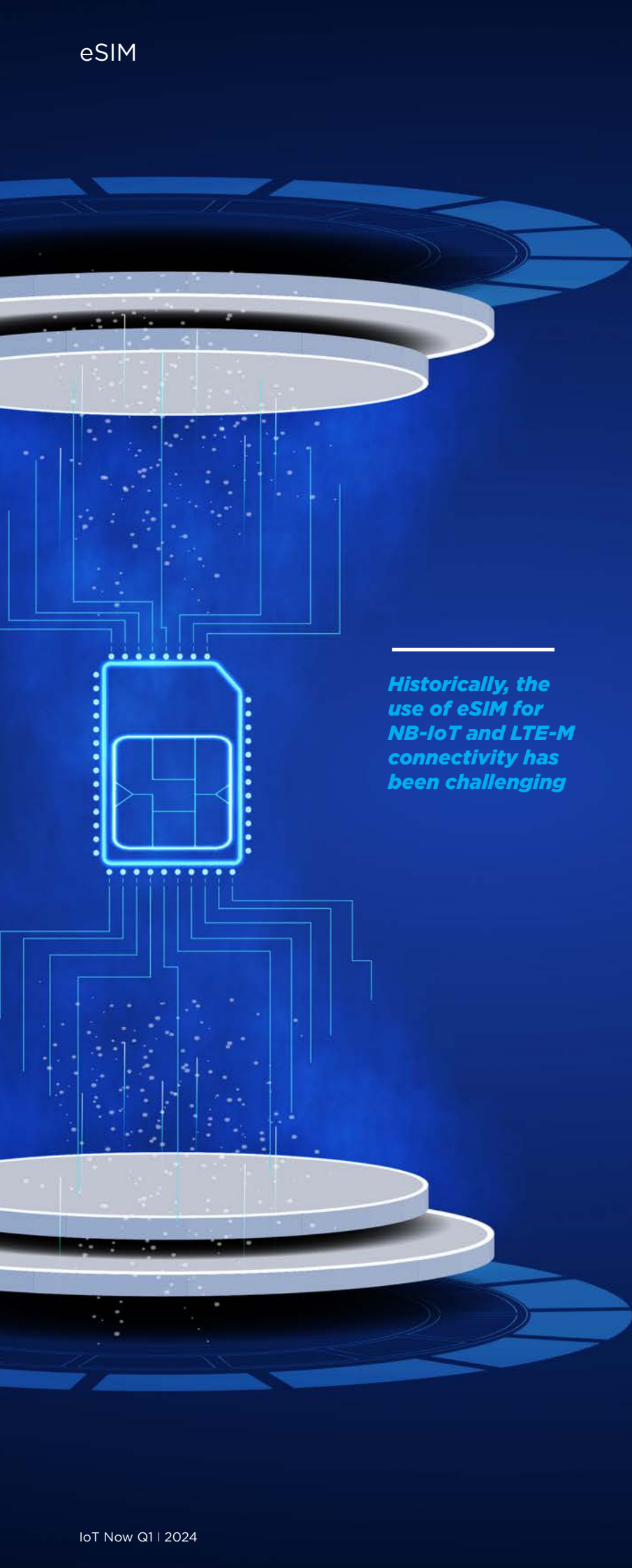
Although widely used in consumer cellular markets, having been driven by **Apple** and others, eSIM has faced a tougher path in IoT devices. Constraints on battery life, computing power and requirements for end user intervention have limited eSIM's appeal but these challenges are being addressed effectively to the extent that analysts expect eSIM to gain traction in IoT rapidly. Research firm **Omdia** believes that advances in eSIM technology will drive adoption in IoT from just over one billion in 2023 to more than

3.6 billion in 2030. "eSIM technology has long been seen as an important form factor for IoT devices, but now we are seeing the technology improve in ways that help enterprises provision over-the-air in resource-constrained IoT devices," explains John Canali, the IoT principal analyst at the firm. "This will create greater competition between communication service providers (CSPs), as IoT enterprises are less subjected to vendor lock-in by the CSPs and are better positioned to renegotiate connectivity tariffs."

Omdia's eSIM forecast is supported by primary data that it collected during a survey of over 700 global IoT enterprises in which nearly 90% of respondents planned to adopt eSIM or integrated SIM (iSIM) technology over the next two years. Aside from the increased security that these technologies offer, IoT enterprises also prioritised the benefits of eSIMs to create more complete and reliable networks, to help manage costs and to support improved ability to comply with local regulations.

"The new GSMA SGP.32 eSIM specification was much needed and has been specifically designed for IoT," adds Andrew Brown, the practice lead for IoT at Omdia. "It offers significant advantages in terms of cost, flexibility and longevity for hardware OEMs, finally beginning to bridge the gap between traditional consumer device provisioning and more traditional IoT devices. This will help to accelerate adoption in key industries, not only those that have long desired eSIM standardisation, such as automotive, but in a multitude of others also."

A similar, although more cautious, report has also been published by **Kaleido Intelligence**. ▶



**Historically, the use of eSIM for NB-IoT and LTE-M connectivity has been challenging**

which predicts that more than 1.4 billion eSIMs (including eUICC and iUICC form factors) will be shipped in 2028. That figure suggests adoption will grow at a CAGR of 21% between 2023 and 2028, with growth dominated by consumer uptake. The firm's report has highlighted the importance of a having a fully end-to-end digital onboarding process for consumer devices for achieving scale. The firm says many MNOs continue to rely on QR code mechanisms which do not offer an optimal end-user experience.

A critical factor behind the drive towards end-to-end digital onboarding will come from increased entitlement service uptake and digital BSS modernisation which are key to supporting and digitally enabling eSIM connectivity for disparate consumer devices. Market disruption, in the form of travel eSIMs in addition to widespread enablement of the ability to transfer an eSIM from one device to another, will effectively result in competitive differentiation, forcing the market to take new shape. As a result, mobile operators will be forced to embrace eSIM and Kaleido anticipates that smartphone eSIM activations will grow on average by 77% between 2023 and 2028.

The picture is different in the non-consumer market where the SCP.31/32 specifications are only now starting to see commercialisation. This will result in a reduced technical and investment burden for supporting IoT connectivity and, although many mobile operators may not have retail IoT connectivity strategies in place, the new specifications offer considerable opportunities for wholesale offerings. Kaleido expects well over half of active IoT eSIMs to use the new specification by 2028, and demand for connectivity profiles will be greater than ever before.

Historically, the use of eSIM for NB-IoT and LTE-M connectivity has been challenging, Kaleido explains. The M2M specification demanded support for SMS or TCP/IP, while eSIM profiles were considered large enough to be taxing on low-bandwidth, battery-powered devices. The IoT specification addresses LPWAN devices directly, by opening up constrained application protocol (CoAP) support for transport, while, critically, the Trusted Connectivity Alliance (TCA) has introduced a lightweight eSIM profile that reduces the power burden for over-the-air eSIM LPWAN campaigns.

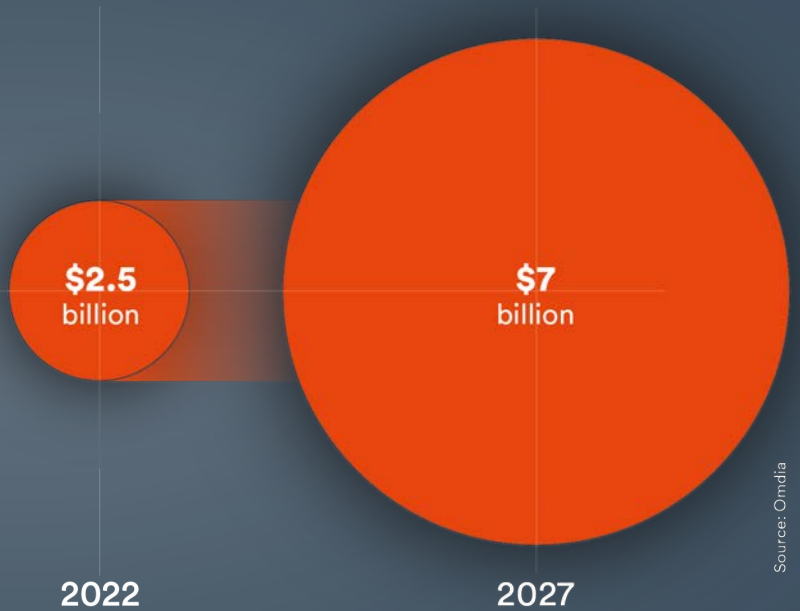
"The eSIM market has seen several developments recently that smooth the path to adoption, and address many lingering ecosystem challenges," says Steffen Sorrell, the chief of research at Kaleido. "The effect of this will mean eSIM or iSIM form factors will gradually become a de facto requirement by 2028 for most cellular devices." ■



# Wireless Private Networks for Business: Practical Steps Towards Deployment

Private networking is a huge step forward for IoT use in business operations, taking IoT evolution to another level. But is this just for large companies? What are the opportunities for smaller sites and smaller businesses? How should enterprises get started? How should they decide whether private networking is appropriate for their needs?

Projected Revenue Growth for 5G Private Networks



Source: Omdia



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# The Definitive Guide to 5G with Satellite Communications



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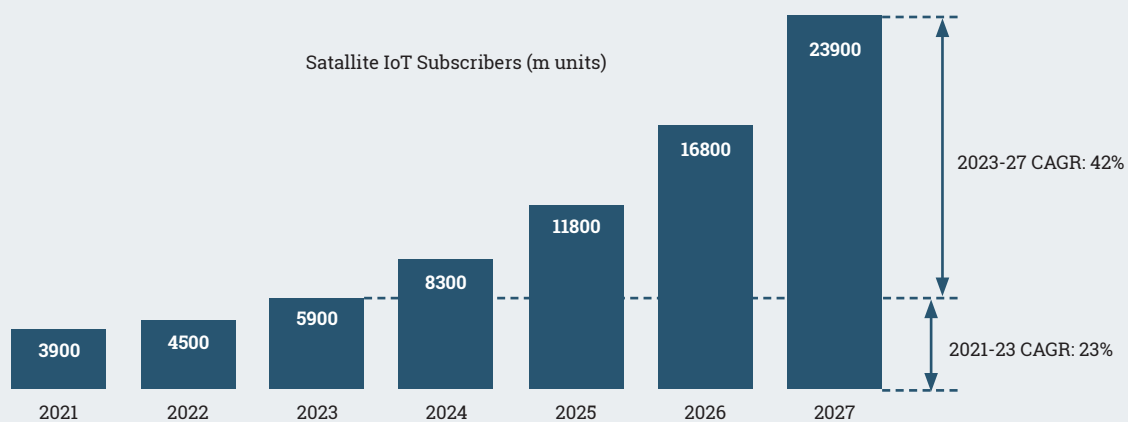
# Use of satellite for IoT set to grow quickly

According to the World Bank's World Development Report 2023, 95% of the world's population is concentrated on just 10% of the world's land mass. In the ITU's Facts and Figures published in November 2022, 95% of the world's population – not necessarily the same 95% but pretty close – has access to cellular. That leaves a lot of the Earth's surface – including land, sea and ice – not covered by cellular, and a lot of space where things are not connected, writes Robin Duke-Woolley, the chief executive of Beecham Research

Cellular networks are located where most people are, but not necessarily where things are that need to be connected. As IoT becomes increasingly central to operations for businesses and many other types of organisation, the other 80%+ of the Earth's surface is becoming increasingly important to connect to. Satellite looks to be the clear option, but the traditionally higher connectivity costs have impeded growth. This is because most satellite communication today is based on proprietary solutions – each constellation has its own set of protocols. As a result, IoT applications connected via satellite typically have to reach a higher bar of added value before they can justify being connected, which means they tend to be limited to mission critical activities. But that may soon change.

Low power wide area network (LPWAN) technologies are being introduced for satellite use, which increases the standardisation and the opportunity for lower costs. Some initiatives to combine long range wide area network (LoRaWAN) with satellite constellations have already commenced. Meanwhile, the 3rd Generation Partnership Project (3GPP) has been working to extend 5G standards to include satellite networks – referred to as non-terrestrial networks (NTNs) – in Release 17 and further in Release 18. As a result, **Figure 1** shows typical expectations for growth of satellite IoT connections over the next few years with LPWAN satellite connections becoming more evident from 2024 onwards. While CAGR to 2023 is 23% per annum, from 2023 through 2027 it is 42% per annum as these new technologies come to market. ►

**SPONSORED REPORT**



**Figure 1: Satellite IoT subscriber forecast**

(Source: Berg Insight)

## Introducing 5G to satellite

As the rate of adoption of mobile communication technology around the world continues to rise, the goal of using it to provide seamless global coverage to anyone, anywhere, at any time has become increasingly important. This has led to major advances in both terrestrial and non-terrestrial satellite networking technology.

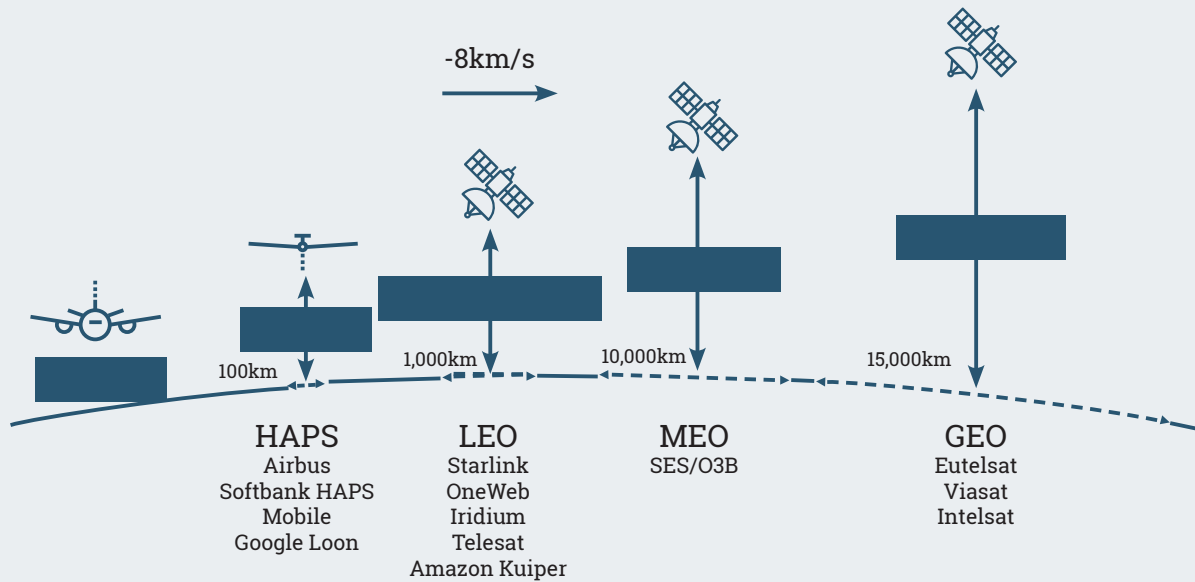
Smooth interworking and integration of terrestrial network (TN) – such as cellular networks – and NTN components is the next logical step on the coverage journey to provide enhanced mobile broadband (eMBB) to consumer smartphones (direct-to-smartphone) and Internet of Things (IoT) use cases.

Integration with satellite networking technologies that can provide coverage in areas that TNs cannot reach will help to deliver resilient services to people and businesses currently unserved in both developed and undeveloped parts of the world, bringing potentially significant social and economic benefits. Beyond the benefits NTN will

deliver to smartphones, they will also have the capability to support both industrial and governmental IoT devices for verticals such as:

- Agriculture/forestry
- Automotive
- Healthcare
- Logistics/track and trace
- Maritime transport
- National security/public safety
- Railways
- Utilities
- Weather/environmental monitoring

Different satellite systems have been used for years to provide services such as TV broadcasting, navigation, communications, surveillance, weather forecasting and emergency systems. **Figure 2** illustrates the orbits of the three main satellite types – geostationary (GEO), medium-Earth orbit (MEO) and low-Earth orbit (LEO) – in comparison to a commercial aircraft and high-altitude platform system (HAPS) providing local service coverage. ►



**Figure 2: Typical altitudes and footprints of existing satellite systems**

GEO satellite systems are operated at a high altitude of about 35,000km, which introduces long latencies (>500ms) and limited data rates. GEOs appear stationary to the device and provide a large field of view for a portion of the Earth's surface, such as Europe or North America but not both together. This makes them well suited for satellite television, business-to-business data services (such as trunking/backhauling and enterprise networking) and governmental services (such as military satellite communication systems).

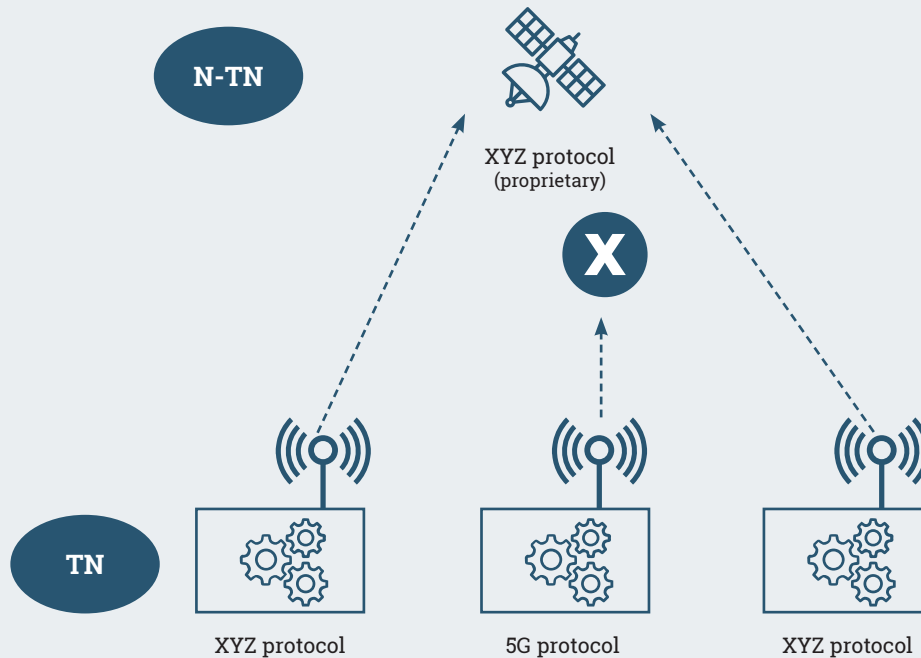
MEO satellite systems such as Galileo, global positioning system (GPS) and GLONASS are mainly used for navigation and are typically deployed at an altitude of about 20,000km in a semi-synchronous orbit that is predictable and reliable with an orbital period of 12 hours. There are constellations in MEO that are also used for communications services deployed at a height of about 8,000km. This leads to a latency that is five times lower compared with GEO, providing higher data rates.

LEO satellite systems are used for services such as **Starlink, OneWeb, Iridium** and **Globalstar**. These satellites operate at altitudes of 400km to 1,500km, where a higher speed of about 8km/s is required to stay in orbit. The time to orbit the Earth is then 90-120 minutes. LEO satellites provide the lowest latency and tens of megabits per second of capacity, making them suitable for MBB and IoT applications. As the footprint is notably smaller compared

with MEO and GEO – with typical footprint diameter of just 1000km – larger constellations are needed.

3GPP Release 17 has specified the use of GEO and LEO satellites for IoT connectivity via NTN in a track known as IoT NTN. To a large extent this follows on from the Release 17 work done for direct-to-satellite smartphone use, termed NR (meaning 5G New Radio) NTN. This work has resolved a wide range of key technical issues. For example, it includes reducing the number of fast handovers between cells required for devices connected to LEO networks, by using beam steering to create Earth-fixed beams. Also, inserting pre-compensation delays for dealing with Doppler shift issues caused by round-trip delays and frequency shifts that would otherwise impact receiving stations.

IoT NTN includes adaptations to NB-IoT and LTE-M that will enable them to support NTN. This 3GPP track is known as IoT NTN. Discontinuous coverage is a topic that is specific to IoT NTN. Unlike smartphone use via satellite, many IoT NTN use cases do not need continuous coverage. They may only need to transmit their data once every few hours. These types of use cases make it feasible to deploy constellations with fewer satellites. To support such operations, information needs to be signalled to enable user equipment to predict the times when it will have coverage. Release 18 will then extend these capabilities further. ►



**Figure 3: GEO with proprietary protocols vs 5G protocol**

**What are the benefits of integrating 5G with satellite for IoT?**

Essentially, integrating 5G with satellite, as envisaged in 3GPP Release 17, puts a stationary cell tower in the sky when considering GEO, or a fast-moving network of cell towers when considering LEO. It means a single SIM will be able to connect to both TN and NTN-compliant satellite networks.

Taking the case of GEO, incumbent satellite connectivity providers work with proprietary devices and communication protocols. These are relatively expensive due to relying on dedicated devices and high cost of infrastructure. As a result, customers have to invest in equipment that can only be used with one constellation and are therefore locked in. This is justified for critical applications but it limits the range of applications that can be cost effectively served.

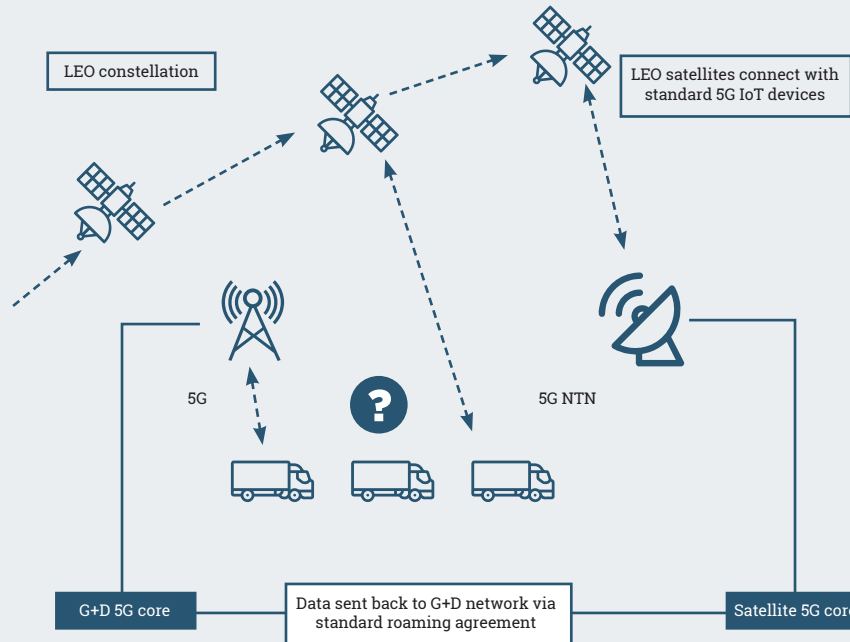
In comparison, use of 5G introduces the opportunity to use standardised hardware made by many different suppliers for both TN and NTN use. This will significantly increase the addressable market.

A LEO NTN equipped with 5G is exactly the opposite scenario to a 5G TN. For NTN, the ‘cell towers’ are moving

very quickly in relation to the connected devices, whereas for TN the devices move around static cell towers. Each LEO satellite is typically travelling at 8km/s, or nearly 17,900 mph. That is equivalent to Mach 23 – 23 times the speed of sound. However, they are much further away from the devices than in a terrestrial network and the line-of-sight range of the devices is much greater. The opportunity is to use a TN when you can, and NTN automatically when you cannot. This minimises the cost of universal coverage anywhere on the Earth’s surface.

Taken further, the utility of satellite communications is more limited within cities and in city-to-city communications because these are areas where fibre and Wi-Fi already dominate and the lines of sight necessary for satellites are significantly reduced. Nevertheless, integrating satellite and terrestrial systems will be necessary to meet the full spectrum of future demands likely to be placed on 5G networks. These include:

1. with the proliferation of IoT devices, increasing traffic and number of connections outside of dense city centres in more rural and remote areas.
2. providing coverage for devices on the move (such as a ship at sea or a car driving cross country where there is variable coverage, such as across the US. ►



**Figure 4: Combination of TN and NTN using LEO**

- 3. processing and data caching pushing progressively closer to the network edge as a result of edge computing, and further away from areas of dense fibre availability.

Take, for example, the connectivity needs of mobility. If you disconnect a mobile asset – a car, truck, plane, drone or ship – from the fibre network, it is possible to stay connected using Wi-Fi and terrestrial 5G infrastructure so long as it is either in or in close proximity to cities. Moving to more rural and remote areas, satellite communication has the potential to provide reliable coverage and sufficient data density. As the number, uses, and requirements of connectivity continue to evolve, so does the importance of extending the promise of 5G networks beyond the urban and densely networked communities.

To meet these demands, satellites will need to serve a diversity of purposes ranging from the last mile problem to connections on the move, redundancy for critical emergency services, edge networking, and IoT dense traffic areas outside of the already highly networked cities.

As a result, satellites as part of 5G are likely to play an increasingly significant role in the future.

**Use cases for TN + NTN IoT**

5G together with satellite has potential for a wide range of IoT applications. Here are some of the more compelling use cases for early deployment.

**Utilities**

The effects of climate change have brought utility networks covering electricity, gas and water to particular attention. Cellular networks are increasingly being used for smart metering and for utility network monitoring of supply and leakages. As a low power alternative, NB-IoT is a front runner for the connectivity and extending this direct to satellite offers opportunities for substantially increased visibility in remote locations.

**Maritime**

There is little network infrastructure available on the ocean – the majority of the Earth’s surface. The further from the coastline, the less accessible connectivity solutions become. For telematics applications where there is a need, for example, to track shipping containers and their contents, to recover lost or stolen assets including vehicles, or warn vessels of emergency situations, satellite IoT will increasingly have a significant part to play. Emissions control and remote monitoring for preventive maintenance are also of increasing interest. Telematics devices are often designed to be low power and do not require a constant network connection, which further makes satellite IoT a strong option. ►

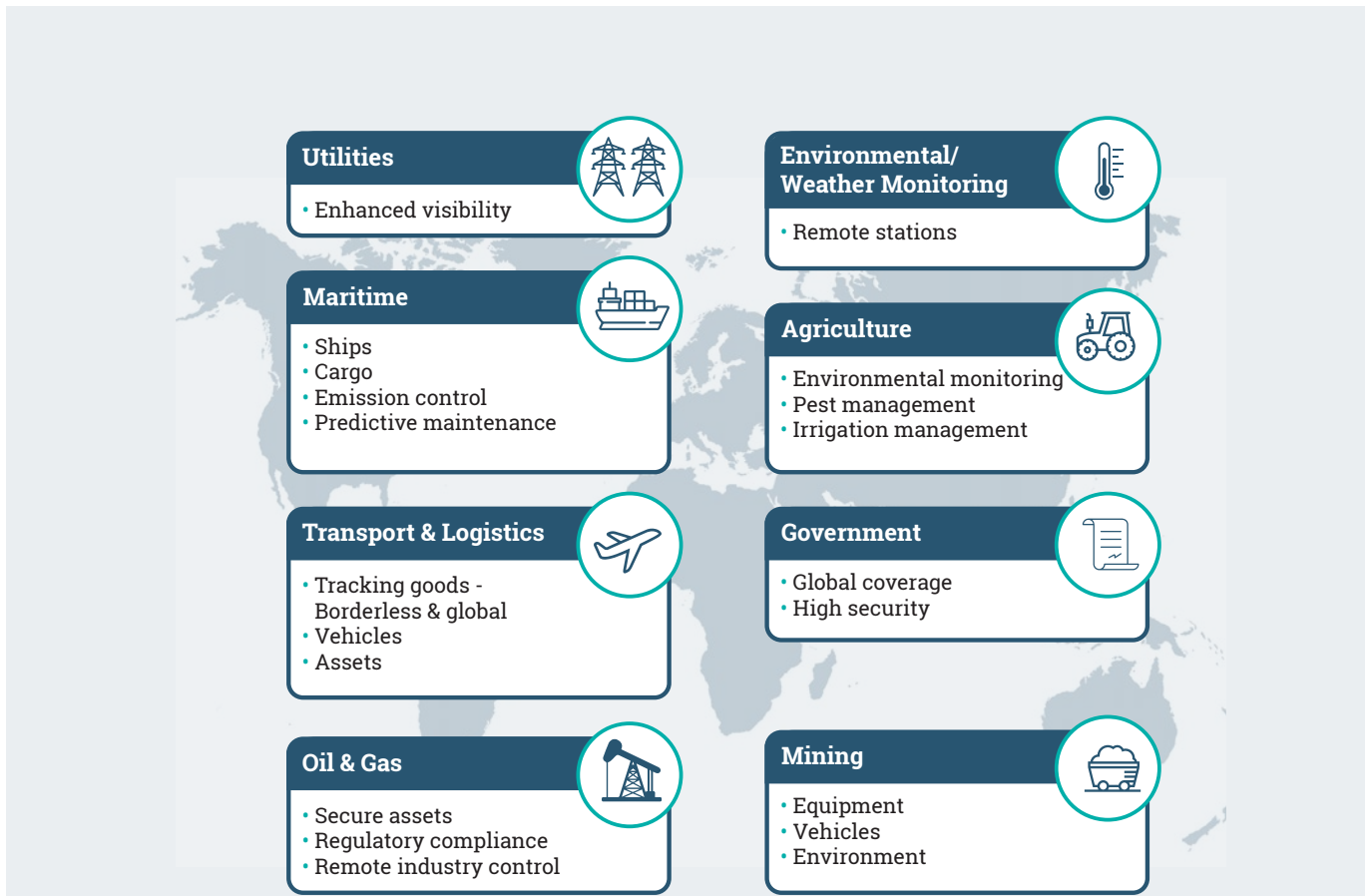


Figure 5: Typical near-term TN + NTN IoT use cases

**Transportation and logistics**

Cellular network coverage on roads and highways outside residential areas can be patchy or non-existent yet the need is increasing. For telematics applications that track vehicles, containers, or report the condition of goods across shipping routes, satellite IoT connectivity provides a missing link for low-powered telematics devices. This is particularly useful for cross border monitoring.

**Oil and gas**

Oil rigs need to operate wherever the oil is—and that is most often not where network infrastructure is. Some oil operations need to set up on the ocean, too far from cellular towers and other traditional connectivity solutions. Securing remote assets is an issue, as is the increasing need for ensuring and proving regulatory compliance.

**Environmental/Weather**

Climate change has also brought the need for higher visibility of the local environment and local weather conditions, from all points of the Earth’s surface. Remote stations may be on drifting buoys at sea, monitoring forestry or desert locations on land and many others. Satellite is often the only viable connectivity method and improving the efficiency and economics of this will likely significantly raise the visibility, particularly in remote locations.

**Agriculture**

Agriculture increasingly relies on IoT to automate routine processes and make more data-informed decisions. But remote rural environments can also create challenges for traditional connectivity solutions. In environments where cellular coverage is unavailable or spotty, satellite IoT can close coverage gaps for tech-enabled farming operations.

**Government**

Governments need access to data in remote locations for security and other operational needs. These applications are already substantial users of satellite connectivity. Improvements in efficiency and economics open opportunities for further developments.

**Mining**

In remote mining areas, there is either no public cellular network coverage, or only intermittent coverage available due to geographical conditions. This is where a NTN connectivity solution via satellite is needed. When cellular land reception drops or is not available, the IoT device uses the satellite network connection. Heavy equipment used in mining locations can stay connected for tracking location, predictive maintenance or remote condition monitoring, and emergency alerts. ▶



## Recent related G+D announcements

### 1. G+D and Sateliot announce first iSIM with cellular and satellite connectivity

22/06/2023

**Giesecke+Devrient (G+D)** has agreed to cooperate with **Sateliot**, a satellite communications network operator headquartered in Barcelona, Spain. This will enable G+D to offer users of its IoT services true global coverage. Whenever a terrestrial cellular connection is unavailable, roaming to a satellite network is automatic.

As a provider of cellular IoT connectivity, G+D already connects numerous devices across the planet. However, there are areas where there is no or only limited coverage with mobile networks, for example, at sea or in remote or rural areas. G+D is now closing this coverage gap by cooperating with service provider Sateliot, which provides 5G satellite connectivity for IoT.

Sateliot is the first provider to operate a LEO network that uses identical technologies for satellite and cellular connectivity. Unlike other solution approaches, this makes satellite connectivity available at a low cost by extending the coverage footprint of MNOs and MVNOS through standard roaming integration.

The LEO network will consist of a number of nanosatellites with 5G coverage for NB-IoT in NTN. The first of five nanosatellites this year was sent into space on a SpaceX Falcon 9 rocket on 15 April 2023. Sateliot is planning calls for an expansion to 64 nanosatellites in 2024 and 250 in 2025.

Global coverage in G+D's IoT service offering will be ensured in the future by Sateliot's satellite-based IoT connectivity and G+D's cellular mobile network for IoT devices. The IoT devices automatically switch from cellular to satellite communication when needed, without the user noticing.

The devices are equipped with G+D's SIM-technology. In principle, classic pluggable SIM cards, embedded or integrated SIMs (eSIM or iSIM) can be used here. The iSIM solutions offer users the greatest benefits. They are characterized by low space requirements, optimised energy consumption, and low costs. In addition, iSIMs score highly in terms of sustainability, which is ensured by the absence of any requirement for SIM slots, additional housings or use of plastic. iSIMs are therefore increasingly the first choice for secure IoT connectivity in NB-IoT applications.

Users can conveniently manage the SIMs and control all IoT activities via their IoT Suite. They can use it, for example, to analyse data, identify efficiency potential or read off costs.

The potential range of applications for G+D's new solution and service offering, which will be commercially available from the beginning of 2024, is far-reaching: conceivable applications include asset tracking, metering, smart farming and massive IoT applications in general. ■

### 2. G+D strengthens position in IoT market with acquisition of MECOMO

17/05/2023

G+D acquired **MECOMO**, a specialist in tracking and tracing solutions, in May 2023. MECOMO, based in Munich/Unterschleissheim, Germany, is a software systems house that provides end-to-end (E2E) telematics solutions for industrial and logistics enterprises. Founded in 2000, the company is the market leader in German-speaking Europe for the digitalisation of fleet-based logistics processes. In addition, its connected solutions promote climate-friendly operations in supply chains where goods are shipped via different modes of transport.

MECOMO is the leading provider in German-speaking Europe for maintenance-free tracking solutions of all kinds of logistics objects without own power supply. This ranges from pallets and refrigerated containers to load carriers, freight cars and sea containers. Eight of the ten largest Central European logistics companies are already using MECOMO's fleet telematics. Growing customer groups include railroad companies, airports, and defense and industrial companies.

The company offers its customers a holistic IoT solution that enables them to optimally control and manage their goods and fleets, including solar-powered IoT devices and sensors which are being attached to the logistics objects. They can be used not only to track location via GPS but also the condition of goods, for example, by measuring temperature or humidity. The recorded data is collected, processed and analyzed in the company's own software platform. The features of the platform can be specifically tailored to the customer's needs, such as dynamic rule and reporting settings. Thus, all aspects of tracking logistics objects and their condition in real time - from the warehouse location, through the company premises,

to cross-border transport by rail, ship and road - are addressed. The direct transmission into various customer IT systems via a wide range of standardised data interfaces is a decisive factor for logistics companies.

Every day, more and more IoT devices and machines are being connected with each other via cellular networks. In addition to data authenticity and data security, reliable global connectivity and powerful E2E solutions are essential. With the acquisition of Pod Group in 2021, an Enterprise Network Operator (ENO) specializing in scalable, mobile-networked solutions for the Internet of Things, G+D had already expanded its range of solutions in this area. Through the acquisition of MECOMO, G+D becomes an IoT solution provider with a complete end-to-end portfolio for customers in the transportation and logistics sector.

G+D's offering includes market-leading eSIM technology. With eSIMs, the SIM chip becomes permanently embedded into the device during manufacturing. Through a highly flexible and dynamic eSIM management solution, the associated connectivity profiles can be downloaded over-the-air and exchanged later at any time if required. This offers enormous application and cost advantages, especially in the IoT area.

With the acquisition of MECOMO, G+D is now taking the next step in expanding its IoT product portfolio and offering solutions from a single source. In doing so, the technology group is making targeted investments into selected verticals, one example being the logistics industry as one of the largest and fastest growing segments within the IoT market. ■



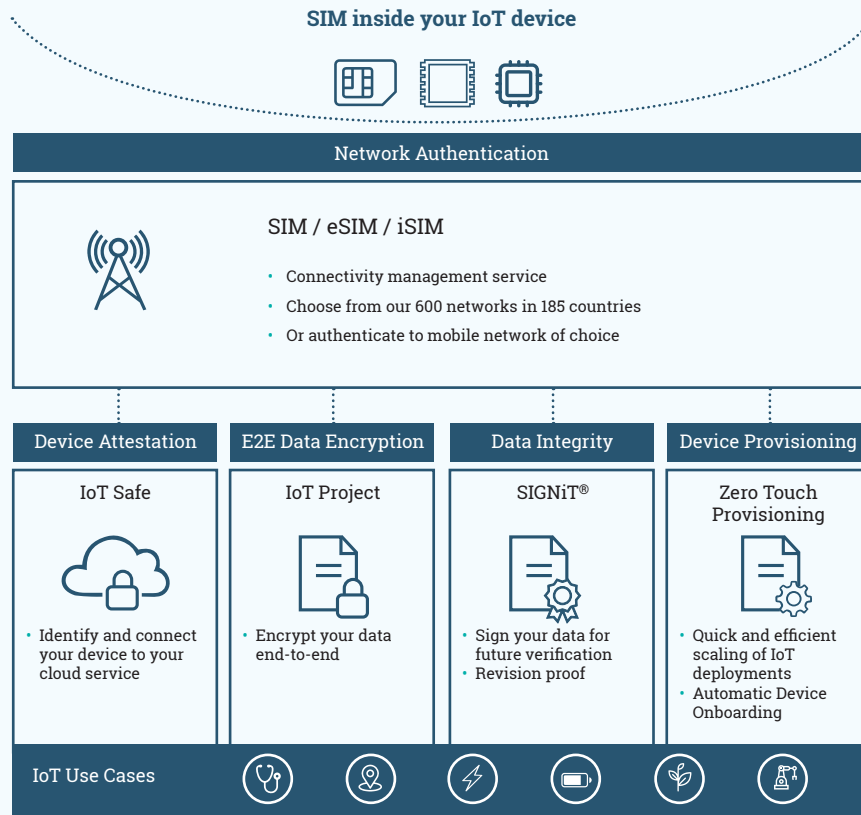


Figure 6: G+D's IoT security features

## G+D SIM and Connectivity Services

G+D's IoT security features protect data generated from IoT devices. They support cellular and non-cellular devices. Its core services are IoT Safe, IoT Protect, Zero-Touch Provisioning and SIGNiT. The platform covers both the backend and SIM software. It enables mobile operators to offer a consolidated toolbox to OEMs and enterprises. They, in turn, are able to manage SIMs and other devices over the entire lifecycle – from manufacturing and activation, to managing subscriptions and policies, all the way to deactivation.

### 1. IoT Safe

Companies build IoT solutions for the marketplace, and these devices connect to cloud platforms. The credentials, however, are mostly stored within the application processor memory. This makes them an easy target for attacks. IoT Safe protects against threats and provides cybersecurity by adding a secure element (a SIM card) to the IoT device. It is equipped with an applet that assists with the authentication to the cloud provider. In addition, the offering includes a credential manager that controls and replaces factory credentials. It also offers a device toolkit that provides documentation, which includes the sample code that is used to assist the IoT device developer in securing the communication between the IoT device app and the SIM applet.

### 2. IoT Protect

The overall functionality of IoT Protect is to provide an end-to-end encryption/decryption mechanism for IoT applications. Information is transmitted securely between the IoT device and the backend, independent of the communication channel (broadband, NB-IoT, Wi-Fi, etc.). Common applications for IoT Protect are those in which data transfer is low, which is typical for low-end and battery powered IoT devices.

### 3. SIGNiT

SIGNiT is the solution that provides data integrity for multi-party IoT ecosystems. It helps sign every packet of IoT data generated so that they can be verified in the future – starting directly at the source: the IoT sensor. Digital signatures for its data are provided by either the SIM or eSIM.

SIGNiT combines secure and proven SIM environments with blockchain technology. It allows to easily digitalise and secure processes in a decentralised ecosystem while providing IoT users with comprehensive and robust security for data generated by IoT devices. The solution has already been successfully implemented in commercial environments, and has potential in sectors like logistics, agriculture, energy and the automotive industry. ►

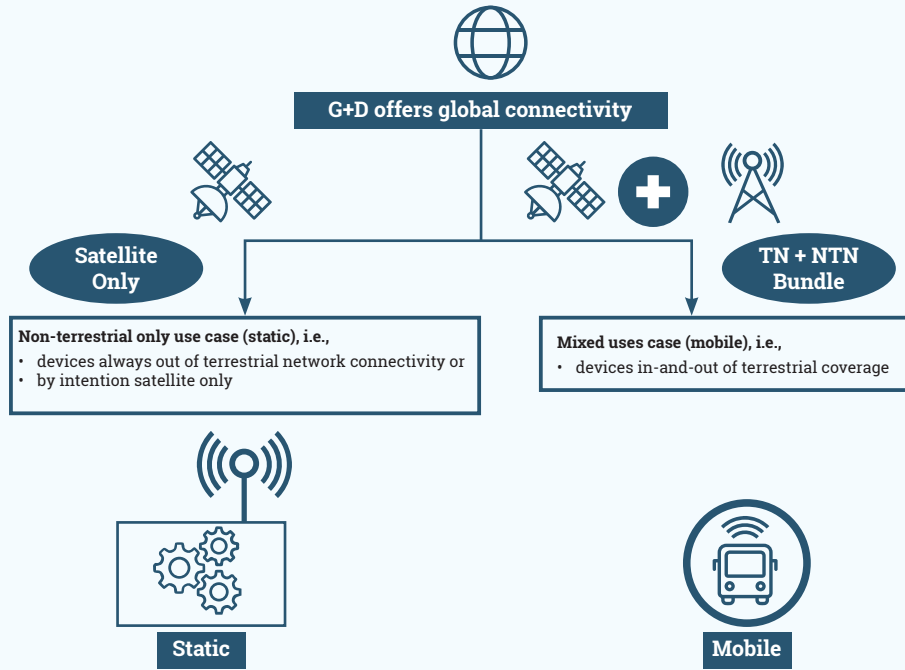


Figure 7: G+D satellite-related IoT connectivity offerings

**4. Zero-Touch Provisioning (ZTP)**

For businesses with large fleets of IoT devices in the field, getting these devices up and running can involve a lot of time, effort, and cost. Zero Touch Provisioning is a SIM-based application, for quick, simple device onboarding with no device or platform dependencies.

This innovative tool uses the SIM to negotiate a trusted connection with your application programme interface (API) upon first network registration. The ZTP application also requests the device to report its identification, while the location is obtained from the network registration info. This info can be used to provision device settings when the device is switched on.

This enables quick scaling of device deployments and reduces device manufacturing costs as security functions are shifted to the SIM. Large numbers of devices can therefore be deployed simultaneously, enabling organisations to scale their IoT deployments quickly and efficiently.

**5. Connectivity**

G+D also offers out-of-the-box global connectivity, optimised specifically for IoT applications. This covers over 600 mobile networks in 185 countries supplemented with 3GPP-based satellite network connectivity (NTN) for use in remote areas, meaning truly global coverage is achieved.

**6. Connectivity and Lifecycle Management with IoT Suite**

G+D's IoT Suite is an innovative connectivity management platform that offers a new level of IoT management. This platform seamlessly integrates with SGP.32, ensuring maximum compatibility for IoT devices. Devices and accounts can be visualised and monitored from a single dashboard, which effortlessly integrates with existing systems, thanks to its open API and agnostic technology. ▶



**Giesecke+Devrient**



## Conclusion

Satellite connectivity based on open 3GPP specifications offers the best opportunity to create a large NTN ecosystem, enabling connectivity between terrestrial systems and satellite systems on the same mobile platform. As satellite systems will not have the same capacity as terrestrial systems, they should be viewed as complementary rather than competing systems. We expect to see more cooperation between satellite operators and terrestrial communication service providers (CSPs) in the years ahead to achieve mutual benefits in this area.

Thanks to their collaborations with satellite partners, G+D is poised to transform the landscape of IoT connectivity by seamlessly integrating satellite communication into its services. This strategic move addresses current challenges in network coverage, particularly in remote and rural areas, enabling users to experience uninterrupted global connectivity. This integration eliminates barriers, allowing any NB-IoT device to effortlessly switch between satellite and cellular networks, setting a new standard for flexible and efficient IoT connectivity.

As G+D moves towards the commercial availability of this integrated solution in mid-2024, the potential applications span a wide range, from asset tracking to smart farming, marking a significant leap forward in the evolution of IoT connectivity. This collaboration represents a pivotal moment where the future of connected devices is characterised by seamless, resilient, and truly global networks. ■

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# Remote patient monitoring has a major impact in driving sustainability in healthcare

In a recent report, ‘[Digital Transformation in the Healthcare Sector](#)’, technology analyst firm Transforma Insights identified and highlighted eight key areas where disruptive technologies such as artificial intelligence, blockchain and the Internet of Things were contributing to the digital transformation of the healthcare sector. One of those eight areas was remote patient monitoring (RPM). In this article, Matt Hatton, the founding partner of Transforma Insights, provides an overview of remote patient monitoring, including how implementing RPM solutions can help the healthcare sector in achieving greater efficiency as well as becoming more sustainable

**RPM reduces visits to physicians, decreases hospital admission and readmission rates, and has the potential to save billions of dollars**

RPM solutions support the collection and sharing of patients’ vital health information with doctors and healthcare providers for continuous monitoring. Using them, patients can be accurately monitored without admitting them to hospitals or clinics. They are becoming increasingly critical in those countries which are dealing with a large number of patients with chronic diseases and/or with a shortage of medical personnel.

## How do RPM solutions drive efficiency and cost savings?

RPM reduces visits to physicians, decreases hospital admission and readmission rates, and has the potential to save billions of dollars. For instance, according to a study by the **University of Pittsburgh Medical Centre**, using RPM devices can decrease patient visits to physicians by 47% and reduce hospital admissions of elderly patients by 40%. Besides, according to some estimates, the resulting reduced demand for hospital resources from RPM solutions can save around US\$6 billion annually in the US alone.

There are many examples of healthcare providers deploying RPM solutions. An NHS Trust Hospital in Kent used **Current Health’s** AI-based wearable device to monitor discharged patients and achieved a 22% decrease in subsequent home visits. **Banner Health** collaborated with **Philips** and carried out a telehealth pilot of remote home monitoring for patients with over five chronic conditions. The trial showed a 27% reduction in the cost of care, a 45% reduction in hospitalisations, and a 32% reduction in acute and long-term care costs. **Trinity Health** partnered with **Vivify Home** which provided a care kit comprising connected monitoring devices and a 4G cellular-connected tablet computer. Within 30 days, this decreased

the hospital readmissions rate from 16% to 8% and enhanced patient experience.

## RPM and sustainability impact

As well as the efficiency savings outline above, there are significant sustainability benefits. In an earlier report, ‘[Sustainability Enabled by Digital Transformation](#)’, **Transforma Insights** found that the average annual nights spent in hospital for all causes of hospitalisation is 7.5 days across EU countries and carbon emissions generated by inpatient stay in hospital per patient range between 450kg CO2e to 700kg CO2e contributed by electricity, water, waste, medical gases, consumables, equipment and food.

Using remote patient monitoring to its full potential improves healthcare outcomes while paving the road for a sustainable future. In this section, let’s look at how these digital solutions can help us achieve sustainable objectives and conserve critical resources.

## Electricity

Hospitals consume more electricity than a home or other commercial buildings, since they operate 24/7, use medical equipment which has high electricity consumption, have sophisticated HVAC systems, and employ thousands of people. For instance, in the US, the average electricity consumption of a hospital is 31 kWh, which is higher than other building types except food service and food sales. Besides, they also have to carry out other energy-intensive activities, such as lab equipment use, refrigeration, sterilisation and food services.

Transforma Insights estimates that healthcare remote monitoring reduces the number of hospital admissions by 45-50%, reducing electricity ►



consumption by 20-30%. Monitoring chronic patients at home also reduces the length of stay in hospitals by around 30%, and electricity usage by the same proportion. Besides, these solutions also reduce the incidences of emergency admissions, which are more resource intensive (including electricity and other resources).

**Hydrocarbon fuels**

Since RPM solutions enable chronic or high-risk patients to be remotely monitored, they decrease the miles travelled and the fuel used in transportation. This is even more beneficial in developing countries or in remote regions where patients have to travel farther to access healthcare services. These solutions also reduce urgent trips to hospitals, which tend to require larger numbers of staff and therefore greater staff travel, further reducing fuel consumption.

As a case in point, the Vital Virtual Care program of Chicago-based **CommonSpirit Health** observed significant sustainability benefits during Covid (in terms of reduced travel time to and from hospitals). It recorded 1.5 million virtual visits between March 2020 to April 2021 across 1,143 locations in 21 states, equating to 37,440,731 miles not travelled and 1,678,956 gallons of fuel saved, for a monetary savings of US\$3.509 million (secured by patients).

**CO2**

Healthcare contributes around 4.5% of the world's carbon footprint, mostly contributed by building energy, travel (by patients, hospital staff and visitors), medical equipment and gases. Since RPM reduces travel and fuel consumption to hospitals or clinics by patients, the amount of CO2 emission is also lower. Besides, reducing travel implies less

traffic congestion, which again results in lower emissions. To cite an instance, in the same aforementioned study, CommonSpirit Health also finds that the miles not travelled by patients during Covid reduced greenhouse gas emissions (including CO2) by over 15,000 metric tonnes.

Besides, in terms of CO2 emissions, the carbon footprint of an average general physician appointment is 6kg CO2e whereas each elective in-patient stay is estimated at 708kg CO2e (not including visitors and staff travel). Additionally, reducing hospital stay durations by 30% also reduces carbon footprint per patient stay by 135kg CO2e to 210kg CO2e.

Constant patient monitoring can easily identify the need for pre-emptive care and avoid more critical cases in future. ICUs generate more solid waste (7.1 kg per day) and carbon emissions (138 kg CO2e per bed day) than a general acute care unit, and since RPM can better assess the requirement of ICU stays, these solutions can reduce carbon emissions significantly.

**Final thoughts: RPM will be a key part of sustainable healthcare**

Remote patient monitoring is a crucial technology-enabled solution, which is digitally transforming the healthcare sector. These solutions reduce visits to physicians, decrease admission and readmission rates in hospitals, and save significant amount while ensuring sustainable growth (by conserving critical resources such as electricity and hydrocarbon fuels and limiting emission of greenhouse gases). Therefore, embracing RPM solutions is a key step towards achieving a profitable and sustainable future in the healthcare sector. ■

**Since RPM solutions enable chronic or high-risk patients to be remotely monitored, they decrease the miles travelled and the fuel used in transportation**



# Why do industrial equipment manufacturers struggle with business transformation?

Industrial OEMs and enterprises are feeling the pressure to deliver smarter products and capabilities faster than ever. More and more, these capabilities are built on a foundation of intricate industrial applications empowering connected equipment as a service

## Challenges: Product Management | Executive Level

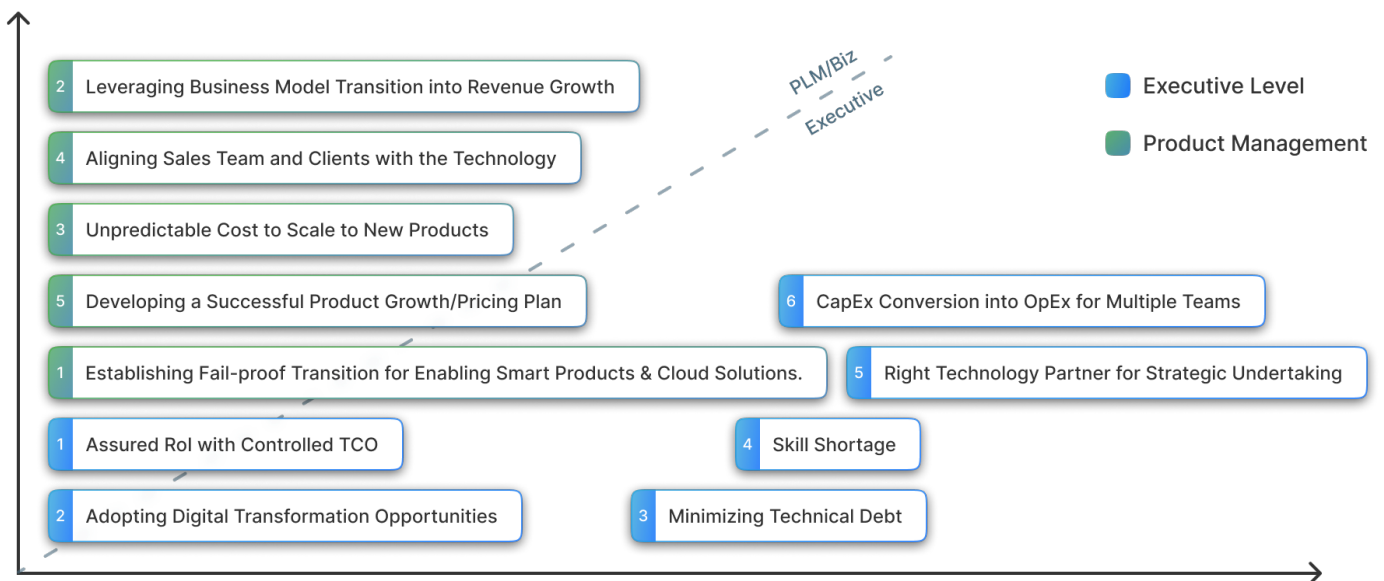


Figure 1: Industry pain points

The past decade for industrial OEMs has seen a dramatic rise in the need for business transformation in order to enable revenue preservation and growth in the long term. The SaaS model, at the OEM or distributor level (DSaaS), has become a prominent approach for organisations to sustain existing and acquire new untouched market share, either directly or indirectly. Many OEMs and enterprises of varying tier levels have realized this opportunity and have already started investing in this direction. Following this trend, **GE Digital** introduced GE Predix, **Hitachi** established Vantara, and **Siemens** developed Mindsphere, among others.

### But why do OEMs need an IoT strategy?

According to McKinsey, industrial OEMs are in a highly productive period using IoT in operational optimisation, integrated smart systems and asset performance management, all with a target market size of US\$3 trillion by 2030.

To survive and thrive in this new era of industrial revolution, OEMs must start delivering smarter products or equipment that integrates the Internet of Things (IoT) to become future-ready and protect market share, maximising the value of device data to better assist clients and incorporate new product innovations. With insights into how your equipment performs and how warranty costs occur, you can effectively control the opex. And that isn't all.

The value of smart equipment goes beyond cost control and asset management. For industrial OEMs, the core competencies are steadily shifting from hardware-centric to software-led services. With soaring global competition and increasing ROI expectations, new benchmarks are fading rapidly.

Industrial IoT and enterprise domain cloud open the door to offering newer revenue streams that bring greater recurring cashflow than a traditional single-time purchase model. These digital services may range from asset performance monitoring, asset remote monitoring and field ops to advanced business models such as equipment-as-a-service.

### OEMs' adoption challenge

In the McKinsey B2B IoT Survey, more than 90% of respondents revealed difficulty in incorporating all six components (connectivity, integration, cybersecurity, interoperability, confidentiality and device (AI/ML) intelligence) of seamless IoT adoption.

### CXO-level challenges

Developing a strategy for business model transition through IoT is complex, and executing it is even harder. Building bespoke applications on your own can backfire, leading many CXOs or decision makers at global OEMs to look for a trusted technology partner that can accelerate the development of scalable and reliable IoT services. ▶



Many OEMs and enterprises face significant challenges in making this happen. Even if they already have edge IoT data in hand, their goals of delivering applications such as remote monitoring, predictive maintenance, field service applications and smart products are blocked. Why? Because the underlying technology is complex and requires a lot of specialty skills, time, budget – and risk. The rise in level of complexity with each consecutive phase of application development yields a higher chance of failure at initiation.

If an OEM does not take action today, it's inevitable that their competitors will— and much faster. Both the risks of not taking action and the benefits of IoT adoption are too big to ignore.

**Buy or build an IoT platform, why just one isn't sufficient?**

Despite the benefits of conventional methods to develop an IoT platform (In-house development and IoT platforms), they eventually lead to a buyer's regret for OEMs. Pick any of the approaches, and you will get a partial resolve for core challenges in the technology adoption.

An IoT platform provides you with faster time to market and proves to be cost-effective. However, it locks you in a single environment with limited flexibility and misfitting customisation (a one-size-fits-all approach). Conversely, the in-house development approach gives you flexibility and customisation according to your business needs, but it eventually leads to a dead-end with gigantic capex, slower time-to-market, skill shortage and bleeding ROI.

**Solution: Why is it high time to consider an alternative methodology?**

Beyond Gartner's hype cycle for emerging trends in 2023, OEMs today are ready to implement IoT and AI/ML technologies and are on the verge of decision-making for the right methodology and technology partner.

The availability of an alternative that provides the best of buy and build is no longer a concept and has become a reality with an OEM enterprise domain cloud (OEDC). This approach allows OEMs to start on top of pre-built microservices at advanced progress (83%) and invest purely in the remaining development of core business logic (17%) to gain an 830% ROI.

**Multiple dimensions of new value and flexibility for OEMs**

- Unblocking the path to smart products and IoT differentiation: A cost and risk contained way to smart products and enterprise-grade IoT application systems.
- Enabling new revenue opportunities: Smart product services provide new value to the customers that you can charge for.
- Expanded support for multiple OEM paths to market: Scalability and multi-tenancy, SaaS capabilities, and portability support for all customer types.
- Dramatic improvements in operational costs:

Cutting service, repair and truck-rolls costs with predictive and preventative maintenance automations.

- Eliminating the skills gap needed to modernise OEM product lines: Developers only need to focus on customer value creation and not underlying Big Data technology.

An OEDC platform enables OEMs to build enterprise-grade applications such as APM, ARM, field ops, and more via an enterprise-fit ecosystem to deliver smarter products in a time and cost-contained workflow. It solves major challenges faced by different professional verticals (product, operations, engineering and business) at an OEM. It allows OEMs to focus on building new customer value and avoid spending valuable time on IoT stack technology.

**Outcomes that our global OEM clients achieved**

- Enterprise-grade security, reliability and scalability – proven to meet CIO audits for deployments.
- Customisation flexibility for multiple OEM products, customers and vertical market solutions.
- Application deployment flexibility to serve various OEM go-to-market alternatives.
- Three times faster time to market with 830% ROI (crossed break-even in less than a year).
- Zero technical debt and vendor dependency with 1/100th of lines of code (LoC)
- Complete IP ownership with industry-ready cybersecurity for risk-free adoption.

**How does IoT83 make a difference?**

IoT83 is a product technology company that caters to the OT and IoT market by recognising the vital need for business transformation for industrial OEMs. Our enterprise domain cloud platform, Flex83, enables OEMs to eliminate IoT adoption challenges such as significant capex investments and prolonged timelines in the in-house development, and customisation and flexibility limitations associated with existing IoT platforms — adhering to our 83/17 rule, an 83% head-start for industrial application development on pre-built microservices with only 17% work left for developing the core business logic.

Flex83 provides a rapid application development system, letting your teams focus directly on creating smart product differentiation without the overhead, delays and risks of the underlying technology. It also empowers OEMs to transform capex into flexible OPEX, providing a competitive edge with an accelerated time-to-market (TTM). Furthermore, it addresses security risks associated with handling critical data in the development and operation of industrial applications.

Headquartered in the United States and with an offshore development centre in India, we are a team of experts assisting our global clients in maximising the full potential of industrial IoT by enabling interconnected digital transformations to deliver smarter products. ■

**An IoT platform provides you with faster time to market and proves to be cost-effective**

<https://www.iot83.com/>



# Seamless mobility: exploring smart cities through integrated transport systems

The world's urban population is rapidly increasing, burdening transportation authorities with the challenge of traffic congestion. To address this issue, authorities can choose between investing billions in constructing additional road or public transport infrastructure, with no guarantee of reducing congestion, or opt for resilient digital technological solutions to effectively manage traffic congestion. In many cases, authorities place a premium on increasing efficiencies by aiming to better integrate existing infrastructure, write Paras Sharma, the lead analyst, and Jim Morrish, the founding partner, of Transforma Insights



Integrated transport systems support various modes of transportation within an urban area, including mass transit, car sharing, bike sharing and taxi services, under a unified platform with a single interface. Such solutions generally offer the added advantage of providing near real-time transport information to end-users, which enhances their overall travel experience. Additionally, smart ticketing solutions are frequently integrated into comprehensive transport system solutions.

## **Integrated transport systems encompass three main domains**

The deployment of integrated transport systems encompasses three main domains of change within urban areas, including the consolidation of existing transportation networks, the provision of real-time information on public transport services, and often smart ticketing. ►





## Consolidating existing transportation networks

Multiple cities are integrating public and private transportation networks (like mass transit, private taxi services and on-demand ride-sharing schemes) into a single platform, allowing users to conveniently plan and book their journeys according to their specific needs. They enable users to book tickets for optimised routes through multimodal transportation, eliminating the need to compare and book multiple tickets for different modes. The integration of disparate transport services typically leads to reduced waiting times, lower levels of traffic congestion, and lower greenhouse gas emissions. For instance, from 2012 to 2016, the Land Transport Authority in Singapore achieved a three-minute reduction in passenger waiting times by deploying an integrated transport system.

## Real-time information on public transport services

Integrated transport systems often provide real-time transport service information to commuters. A real-time passenger information system gathers data (like speed, time and location) from the transit network and delivers live alerts to passengers about estimated arrival and departure times of individual buses, trains and so on. In addition, passengers receive timely notifications about service delays, allowing them to consider alternative routes. Cumulatively, these features improve the passenger experience and it has been suggested that offering real-time information can lead to a 48% rise in riders' satisfaction.

Transport operators themselves are employing similar software solutions to eliminate operational bottlenecks and enhance the commuter experience. These solutions aid in optimising routes by integrating various information sources crucial for efficient transport services. They enable transport operators and authorities to better automate the scheduling of transport services based on passenger flows, so better facilitating the planning and design of transport network schedules.

## Smart ticketing

Many transit authorities are trying to shift away from paper-based tickets by using digital technologies. The migration from paper-based to cashless transactions facilitates an enriched customer experience by potentially eliminating waiting times to purchase tickets. In addition, it reduces paper wastage (and associated supply chain requirements) and dedicated plastic smart cards enable commuters to track the amount of money spent on their cards with time-stamped data.

More sophisticated transport authorities are replacing these plastic smart cards by allowing travellers to download a mobile app and purchase multi-modal e-tickets for different transport modes. Some of these apps also provide real-time

optimised route options for commuters. For instance, Genoa's public transport operators partnered with Hitachi Rail for smart ticketing. 7,000 Bluetooth sensors were deployed across buses, bus stops, metro lines, lifts, and two suburban routes to provide detailed real-time information relating to the status of bus and metro networks.

## Integrated transport systems unlock many benefits

By deploying integrated transport system solutions to help unify existing diverse transport infrastructures, city authorities can realise on the advantages of integrated transport networks and effectively reduce urban traffic. This decrease in city congestion not only benefits businesses and transport operators but also curbs unnecessary fuel consumption and enhances productivity by minimising time lost in traffic. It can also benefit city authorities by increasing the effective capacity of existing infrastructure, so reducing the need to invest in new infrastructure and increasing the volume of traffic that can be supported using existing infrastructure.

Integrated systems offer the added advantage of lowering greenhouse gas emissions by reducing individual solo trips and promoting the use of shared mobility platforms. These solutions aid cities and urban areas in accommodating growing populations, deal with higher population densities, and manage increased business activity, which increase the potential for higher revenues from taxes for the authorities.

Entities that have adopted integrated transport systems include **Transabus Mallorca**, which has collaborated with **GMV** to use its integrated transport solution for efficient optimisation and planning of its transport network, and **Dresdner Verkehrsbetriebe (DVB)**, Dresden, Germany, which has collaborated with **Trapeze** to modernise its operations control systems. Under this collaboration, Trapeze equipped buses and trams with on-board computers allowing DVB to gain insight into vehicle locations and traffic light pre-emption.

## Integrated transport systems pave the way for sustainable transportation in smart cities

Integrated transport systems represent a key tool to address the escalating challenges faced by urban transportation authorities. By consolidating diverse transportation networks, providing real-time information, and implementing smart ticketing, these systems enhance the overall commuting experience for users significantly. Apart from reducing congestion and lowering greenhouse gas emissions, these solutions also enable financial gains for city authorities through increased revenues from taxes. ■

**Integrated transport systems often provide real-time transport service information to commuters**



# Future first - Experience the power of connection at MWC Barcelona 2024

MWC Barcelona 2024 is once again shaping up to be the place to connect with the world's most influential leaders and thinkers, catch up on the latest digital trends, discover the game-changing power of mobile technology and access world-class content. Hosted by the GSMA at the Fira Gran Via in Barcelona from 26 - 29 February 2024, registration is open

You will not want to miss the event's diverse line-up of keynote speakers which includes industry giants, technology pioneers and thought leaders, so secure your pass to the world's largest and most influential connectivity event now.

Speakers include **Alef Aeronautics** CEO, Jim Dukhovny, who will share his experience designing and developing flying cars; **Dell Technologies** founder, chairman and CEO, Michael Dell, who will talk about the importance of Dell being a valued partner for telcos; **Ethiopia Telecom's** CEO Frehiwot Tamiru will share her technology vision for telcos across Africa; **Oxford Quantum Circuit's** CEO, Ilana Wisby who will discuss all things Quantum-as-a-Service; **Microsoft's** vice president and chairman, Brad Smith; **Xtend's** co-founder and CEO, Aviv Shapira, showcasing how 5G mobile technology is the catalyst for robotics.

All discussions at MWC Barcelona will be centred around the event theme, Future First, which speaks to the urgency of bringing industries, continents, technologies and communities

together to realise the future's potential. The agenda will be shaped by six sub-themes reflecting the latest trends and technologies. These themes will feature across the 17 different stages we have across the nine halls of MWC and 4YFN, providing a platform for over 1,100 speakers. The themes are 5G and Beyond, Connecting Everything, Humanising AI, Manufacturing DX, Game Changers, Our Digital DNA.

2024 is a special year as we will celebrate the tenth edition of 4YFN, the global digital and tech startup event which partners with MWC to showcase global tech entrepreneurs and the business leaders of the future. Over ten years, 4YFN has helped startups thrive, starting with exposure to investors and the business community at MWC and continuing throughout the year with the online 4YFN global community of founders and investors.

Taking place across Halls 8.0 and 8.1, 4YFN will welcome some of the hottest names in the global startup scene including Sir Martin Sorrell, founder and executive chairman at **S4 Capital** ▶





and Nigel Toon, CEO, chairman and co-founder at **Graphcore**. The 4YFN agenda will feature trailblazing talks and debates, with discussions centred around the 4YFN themes: the Age of AI, Growth, Startup Funding, Corporate Innovation, Art of Innovation and Decentralisation and Beyond.

**Unleash digital transformation across industry and society**

MWC Barcelona has long provided a forum to showcase how connected technologies are transforming the mobile industry, but the event’s reach now stretches far beyond, reflecting the impact of mobile on vertical business sectors. MWC celebrates the broader ecosystem of players across adjacent industries who are central to digital transformation. Over half of attendees to MWC are from businesses beyond the mobile industry, and every year the event is more vertically diverse. Building on this, the organisers are enhancing focused areas to convene the decision-makers and thought leaders who are accelerating the next wave of digital transformation across the entire connectivity ecosystem.

MWC is where leaders gather to get deals done which is why it is a pivotal moment in business calendars, year after year. With this in mind, a hub in Hall 6 is being created that is dedicated to bringing leaders together across a range of collaborative networking areas, auditoriums and a VIP lounge. Combining networking and innovation, Hall 6 is shaping up to be a hot spot of inspiration and must-attend immersive experiences with the return of Journey to the Future, MWC’s high-tech feature area. It will showcase game-changing innovations with technology’s transformational impact on tomorrow’s industries, communities and citizens.

Elsewhere, Hall 4 will feature the Connected Industries space which invites attendees to

discover how mobile technologies are changing the face of four spotlight industries – manufacturing, smart mobility, fintech and mobile commerce and sports and entertainment. Global industry experts will take to the Connected Industries stage across each of the four days at MWC Barcelona, exploring topics such as the commercialisation of drones, the emergence of robots in smart factories, the future fraud landscape and the role of technology in creating world-class fan experiences.

MWC Barcelona will also once again be co-located with Sports Tomorrow Congress, presented by the Barça Innovation Hub (BIHUB). Sports Tomorrow Congress is a showcase of the decades of knowledge that FC Barcelona has accumulated on topics such as health, nutrition, high athletic performance, the digital sphere, and all topics related to sports and their impact on society.

Across Halls 5, 6 and 7, Pavilions from around the world offer delegates the chance to network with country trade bodies, policymakers and digital hubs. MWC Barcelona is the place to network, make new connections and catch up on the latest digital trends, with the largest gathering of policymakers who enable the digital economy, brought together by the GSMA Ministerial Programme. Ministers, heads of regulatory authorities and policymakers come to MWC every year to meet with mobile industry CEOs and senior representatives of international organisations, share knowledge, and evolve priority policy and regulatory issues. ■

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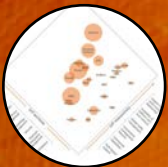
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A satellite view of Earth at night, showing the curvature of the planet and numerous glowing city lights across the continents. The background is the dark, starry space.

**ANALYST REPORT**

**LTE-M and NB-IoT:  
Technology and market  
landscape**

TRANSFORMA  
**INSIGHTS**

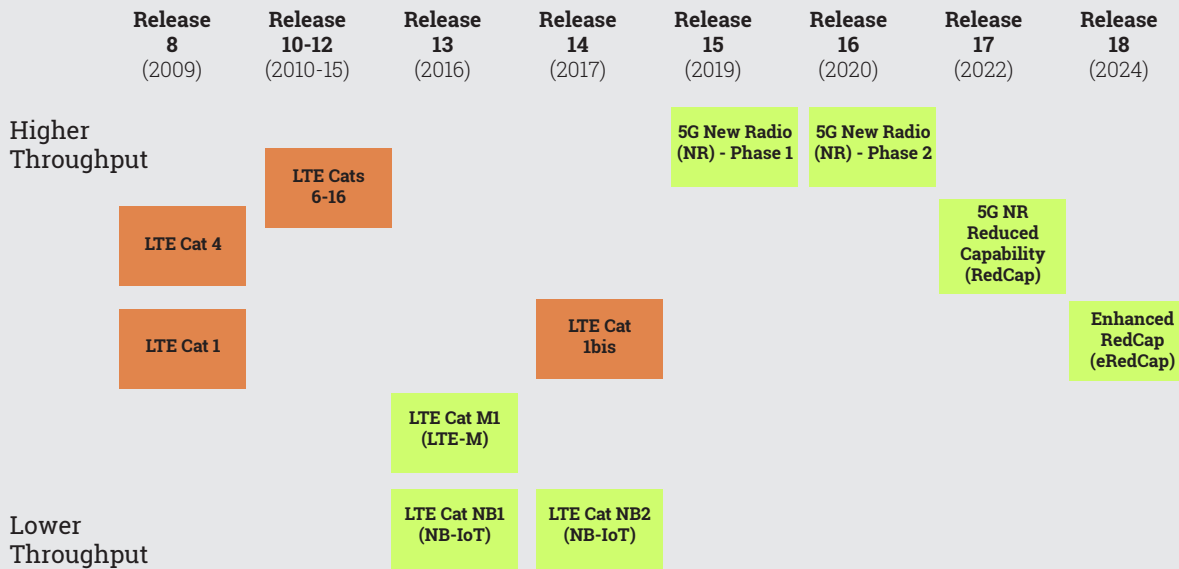


# How do LTE-M and NB-IoT compare in a world of wider cellular IoT choice?

Over the past 15 years, and particularly in the last seven, the mobile industry has developed cellular network technologies more appropriate for addressing the requirements of the Internet of Things, distinct from those technologies used for smartphones and other consumer connected devices. However, there is still a lot of uncertainty about the relative capabilities and merits of the different technologies, writes Matt Hatton, a founding partner of Transforma Insights

In this report we focus particularly on long term evolution for machines (LTE-M) and narrowband-IoT (NB-IoT) technologies that are increasingly widely deployed around the world. The report examines them in the context of the wider development of IoT-oriented technologies (including LTE Cat 1bis and 5G RedCap), considering the technology roadmap, the capabilities of

the technologies, network roll-outs, adoption, and key use cases. All of the technologies have been developed predominantly to address IoT devices. However, each has very different characteristics. The critical question for anyone considering whether to use LTE-M, NB-IoT or any of the other technologies is how it compares to other available technologies. ►



**Figure 1: 3GPP cellular technology releases**

[Source: Transforma Insights and 3GPP, 2023]

### The wide area cellular LPWA landscape

The GSM Association (GSMA) launched the Mobile IoT Initiative in June 2015 to accelerate the commercial availability of low power wide area (LPWA) solutions in licensed spectrum, aimed at addressing the growing demand for IoT devices for low cost, battery-powered devices. The mobile industry subsequently focused on two complementary licensed 3GPP standards: LTE-M and NB-IoT, both of which were initially introduced in 3GPP Release 13 in 2016, and refined in Release 14 in 2017.

The two technologies have been subsequently homologated into 5G networks as the two initial technologies constituting the massive machine type communications (mMTC) component of 5G standards. Subsequently, the 3GPP has focused on developing native 5G variants in the form of 5G Reduced Capability (RedCap), unveiled as part of Release 17, with an enhanced version (eRedCap) on the roadmap for Release 18 with a plan that it will be the ultimate replacement for LTE Cat-1 and Cat-4, with LTE-M and NB-IoT maintained for low power/cost/throughput use cases.

As well as these 5G technologies, there was also work to be done within 3GPP to develop variants of LTE that were somewhat optimised for IoT. LTE Cat 1 was designed as a relatively low bandwidth and cheaper variant of the 4G technology. In Release 14, LTE Cat 1bis was introduced with further reduced complexity and the need to support only a single antenna, giving lower cost but reduced coverage.

### Technology capabilities

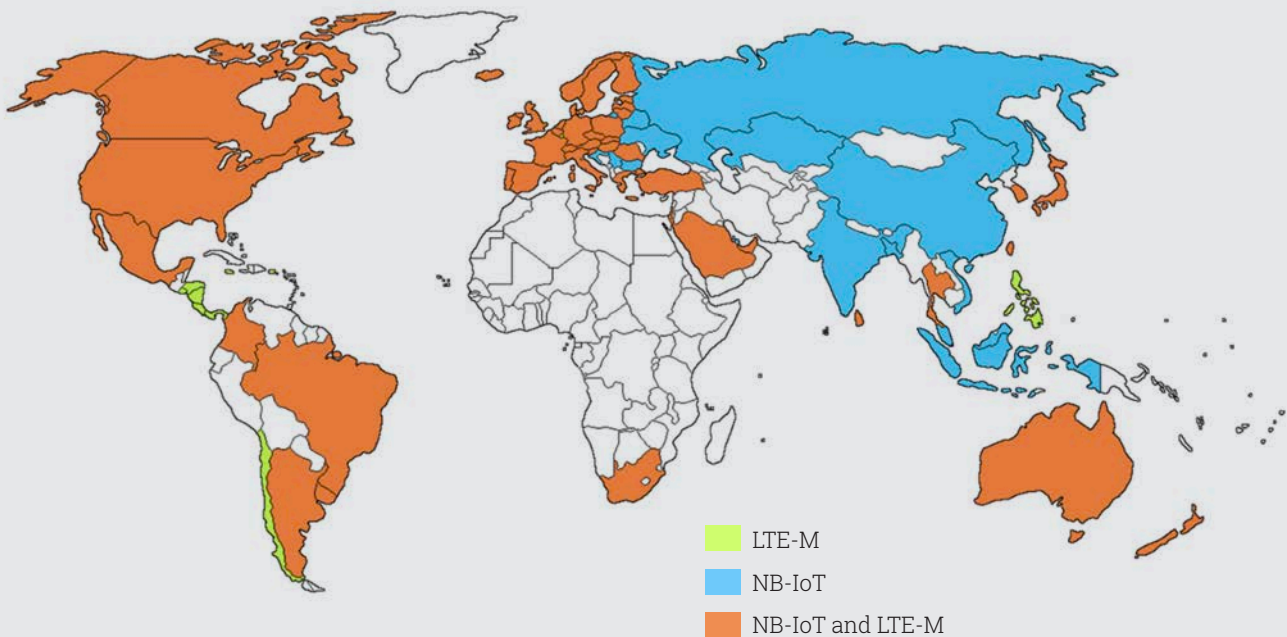
In this section, we assess the characteristics and capabilities of the main cellular network technologies that are available today to address IoT. These are summarised in the chart below.

	LTE Cat 1	LTE Cat 1bis	LTE-M	NB-IoT	5G RedCap
Future-proofing	🟡	🟡	🟢	🟢	🟢
Availability	🟢	🟢	🟡	🟡	🟡
Range/Coverage	🟡	🟡	🟢	🟢	🟡
Uplink/downlink speed	🟡	🟡	🟡	🟡	🟢
Latency	🟡	🟡	🟡	🟡	🟡
Power consumption	🟡	🟡	🟢	🟢	🟡
Unit price	🟡	🟡	🟡	🟢	🟡

**Figure 2: Capabilities of IoT-oriented cellular technologies**

[Source: Transforma Insights, 2023]

We should note that these are not the only considerations. For instance, some applications may require voice calling, which is not supported by all technologies. As illustrated in the chart, there is no single technology that will be appropriate and optimised for every use case. Every decision is a trade-off between the demands of the application, the capabilities, and cost. ▶



**Figure 3: Global LTE-M and NB-IoT deployments**

**Future-proofing**

An early consideration is that of future-proofing. Many users, whether they are municipalities deploying smart city projects or utilities investing in smart meters, want technologies that are supported for the next 10-15 years. The question they will ask is: will the technology continue to be available to use for the foreseeable future? This will depend on whether the technology is supported on LTE or 5G networks, in parallel with mobile network operator plans for spectrum refarming.

LTE-M and NB-IoT are included in the 5G standard, as 5G mMTC (along with 5G RedCap), with the ability to be supported on 5G core networks. As such, those technologies have an inherently extended operational life compared to 4G technologies such as LTE Cat 1 or Cat 1bis, which will not be so supported when LTE networks are eventually switched off. The importance of this depends on the likely roadmap for LTE switch-off.

Generally, there is little appetite for such refarming of LTE spectrum for use by 5G any time in the next 20 years. In Europe, for instance, MNOs are only just making inroads into switching off 3G, a technology that is ostensibly not required for either coverage or capacity and is rarely relied on for IoT. 2G switch-off is on the horizon, but for most major European countries support is likely to continue into the 2030s.

However, in the US, the major MNOs are showing increasing concern over pressure on spectrum and there is likely to be a move to refarm LTE spectrum for 5G within the next decade. As a result, Cat 1 and Cat 1bis will cease to be supported. We can anticipate that a few other countries may take a similar approach: Australia, Japan and South Korea have all been in the vanguard of 2G and 3G network refarming and may take a similar approach

to the US. Most of the rest of the world will probably be at least a decade behind them.

**Network availability**

The foremost consideration when selecting network technology will always be whether it has been deployed in the territories in which it is required.

Today LTE Cat 1 (and by extension Cat 1bis) has something of an advantage, being available in almost every territory around the world, wherever there is an LTE network. For a truly global deployment, this may prove to be a strong draw, notwithstanding issues of long-term longevity (see 'Future-proofing' section above) and limitations on range and battery life. However, for deployments in a single country, or even region, the characteristics of alternatives such as NB-IoT and LTE-M will likely be favoured.

LTE-M and NB-IoT network deployments been growing quite rapidly over the last few years. According to the GSM Association, in May 2023 there were 115 LTE-M networks deployed, almost comparable with the 137 NB-IoT networks active around the world. In recent years LTE-M has caught up noticeably. For instance, in October 2018 there were just 16 LTE-M networks, compared to 49 NB-IoT.

According to Transforma Insights forecasts, of the top 50 global IoT markets, 39 had both NB-IoT and LTE-M networks, 9 had just NB-IoT and two had neither.

**Range/coverage**

The existence of a network within a country, as noted in the previous section, does not necessarily guarantee availability for a particular device. Specifically, some ►





technologies have superior characteristics for supporting in-building coverage. This is highly relevant for some IoT applications, for instance smart meters located deep inside a building, or agriculture applications in rural areas with spotty cellular coverage. LTE-M and NB-IoT are particularly strong here, and LTE Cat 1bis particularly weak.

While LTE Cat 1 might benefit from dual antennas, this advantage is compensated by other coverage enhancement features of LTE-M and NB-IoT which provides significant coverage boost (up to 15db). This becomes pronounced at the cell edge or deep indoors.

### Uplink/downlink speed

The next consideration is whether the data link speeds are fast enough to support the application. Those applications demanding super-high data speeds will not opt for one of the IoT-oriented technologies considered here, but instead for 5G NR or a higher category LTE. However, for these technologies, there is a wide variation, from several hundred Mbit/s for RedCap, through to barely above 100Kbit/s for NB-IoT. LTE-M speeds are around 1Mbit/s. Sensitivity to capabilities here will depend entirely on the application being supported.

### Latency

In parallel with uplink/downlink speed is latency. Some applications will require data to be sent and received in real-time, while for others several seconds (or even days) delay will be acceptable. Smart metering, for instance, may cope perfectly with very high latency, making LTE-M and NB-IoT appropriate technologies, but for smart grid load balancing, where real-time control is needed, a technology with sub-100ms latency will be required.

## Overall when considering power consumption, NB-IoT and LTE-M perform very well

### Power consumption

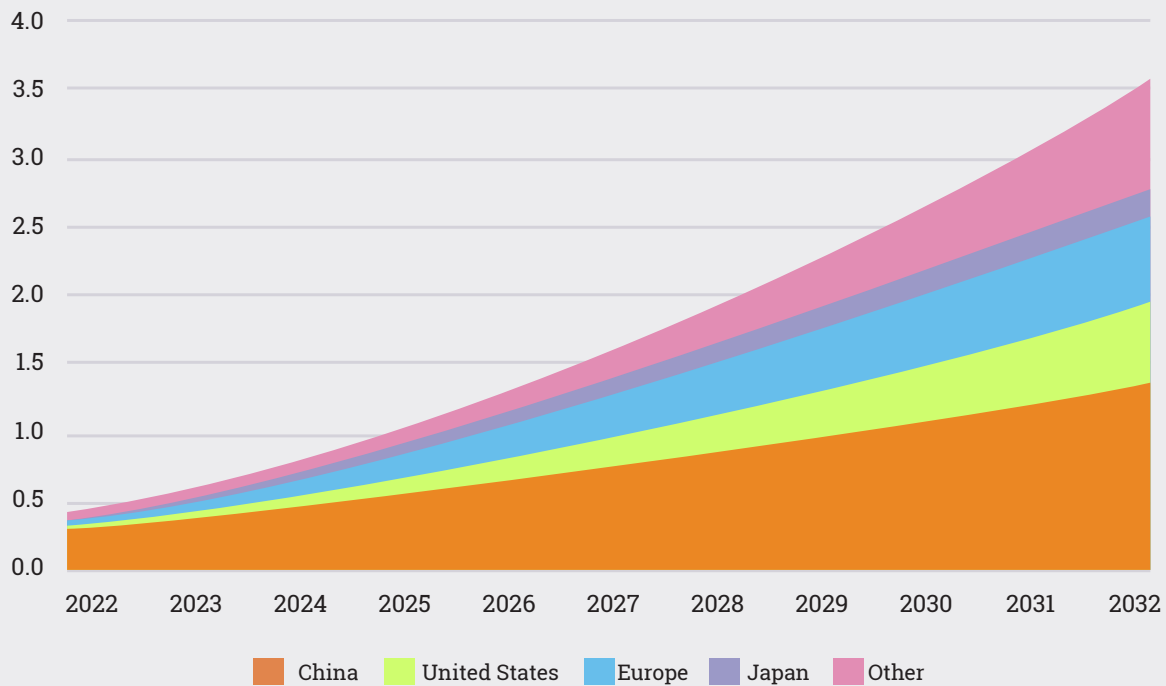
One of the key characteristics of these IoT-oriented technologies is the ability to be supported on a battery for multiple years. Both NB-IoT and LTE-M make use of power saving mode (PSM) or extended discontinuous reception (eDRX) functionality which are the features that allow for the long battery life. While these features can be implemented for LTE (including Cat 1bis) they are not typically optimised for them. Furthermore, both LTE-M and NB-IoT use smaller portions of spectrum compared to LTE, allowing for lower power consumption.

Overall when considering power consumption, NB-IoT and LTE-M perform very well. The specifics of relative merits of different technologies will vary depending on the application here, including how often the device needs to report, the payload being delivered, and the requirement for firmware updates.

### Unit price

Few IoT deployments are completely price insensitive. For various reasons, LTE-M and NB-IoT unit costs are lower. For instance, LTE-M uses half-duplex frequency division duplex (HD FDD) in contrast with LTE Cat 1's use of full-duplex FDD. In the case of the latter, where transmit and receive work simultaneously, additional components are required, in the form of duplexer and filters. This adds to the hardware cost. In addition, designers of Cat 1 devices need to know in advance which bands to support, requiring regional or operator-specific variants, meaning less flexibility in the design stage and less scale. The single antenna design of LTE-M and NB-IoT (and Cat 1bis) also help to reduce costs.

Module unit prices range from less than US\$5 for NB-IoT devices, to US\$8-12 for LTE-M and Cat 1bis, through ►



**Figure 4: 5G mMTC (including NB-IoT, LTE-M and evolutions) IoT connections 2022-32**

[Source: Transforma Insights, 2023]

to US\$15-20 for Cat 1, and perhaps US\$50 for RedCap (although the latter is not really available at scale today). There is some variation in pricing depending on specific requirements, but these figures illustrate the relative pricing levels.

In addition, considering an IoT deployment as a whole, the reduced power consumption of NB-IoT and LTE-M reduces the power cost, either through using smaller batteries or through reduced requirements to replace or recharge.

### Market growth and applications

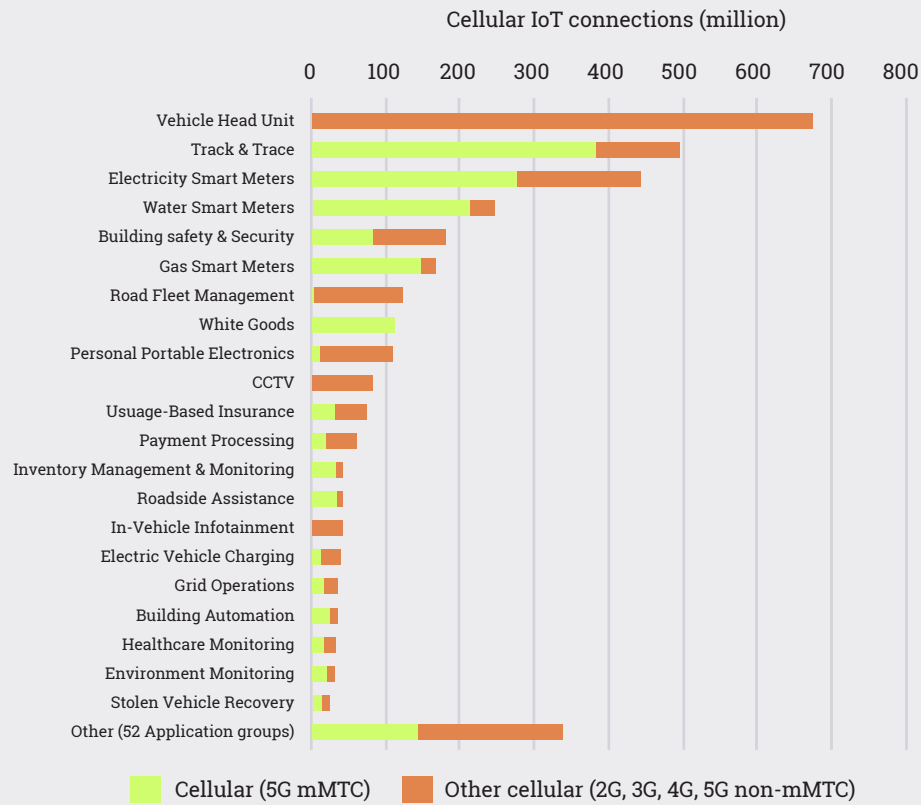
The use of 5G mMTC will be extensive and will be applicable for most cellular IoT use cases. Transforma Insights maintains highly granular forecasts of the IoT market opportunity, including breakdowns by hundreds of applications, every country and all of the main types of technology. In the chart below we present the number of 5G mMTC connections, including both NB-IoT and LTE-M as well as further evolutions, including 5G RedCap.

The total number of 5G mMTC connections will grow from 436 million at the end of 2022 to 3.6 billion at the end of 2032. Today, over two-thirds of connections are accounted for by China, and specifically the extensive NB-IoT deployments there. However, over the forecast period, other markets will catch up, using a combination of

NB-IoT and LTE-M. By 2032, China will account for 38% of connections, with 15% in the United States, 18% in Europe, 6% in Japan and 22% elsewhere in the world. Overall, 5G mMTC accounts for 28% of cellular connections, a figure which will grow to 58% by 2032. Outside of China the growth in market share is even more pronounced, from 16% to 54%.

The chart below illustrates the top application groups in which the 5G mMTC technologies will be most widely used. The use of other cellular technologies (e.g. LTE Cat 1 and above, 5G NR and residual 2G/3G) are presented alongside. As can be seen from the chart, there is a diverse range of use cases that will naturally favour the mMTC technologies, including track and trace, smart metering, and connectivity for white goods. Key use cases that will favour LTE-M include usage-based insurance (UBI) and assisted living. And, while NB-IoT might often be favoured for smart metering deployments, in many markets LTE-M will still be used for significant volumes of connections. Many use cases within the track and trace category will also use LTE-M. It is worth noting that NB-IoT will tend to be used for lower value tracking and monitoring.

Major 5G mMTC use cases within the 'Other' category include access control and intercoms, road transport, vehicle rental, leasing and sharing management, assisted living, and crop and aquaculture management. ►



**Figure 5 : Cellular IoT connections 2027, split between 5G mMTC (including NB-IoT, LTE-M and evolutions) and other cellular generations**

[Source: Transforma Insights, 2023]

## Conclusions

There is a wide range of technology options available for enterprises wishing to connect relatively low data IoT applications; and most IoT applications are low data. The much reduced power consumption capabilities of the likes of LTE-M and NB-IoT also opens up new use cases that may have been otherwise not possible. It can be tricky for enterprises to work out which of the technologies will be most appropriate for them, not least because new ones are being added almost annually, for instance with RedCap and eRedCap.

There are really three considerations when selecting a technology: Are there networks available to connect my devices? Will those networks be supported for the duration of my deployment? Do the capabilities match those I need for the application?

In most countries today LTE-M and NB-IoT networks are available, with more coming on stream every year. While LTE Cat 1 (and Cat 1bis) may have an advantage in terms of global coverage as part of 4G, the capabilities are generally inferior, other than for applications needing high bandwidth. Furthermore, typically LTE-M and certainly NB-IoT will represent a lower cost option. Add to this the long-term ongoing support for NB-IoT and LTE-M as part of 5G, which may become quite significant over the next decade, relative to other 4G options. ■



# From source to shelf: exploring ethical and sustainable supply chain transparency solutions

In a business era characterised by a heightened focus on ethical and sustainable practices, the importance of supply chain transparency is being increasingly recognised and organisations across diverse industries are acknowledging the need to reveal the intricacies of their supply chains. This shift towards openness in supply chains is reshaping industries, prompting companies to reassess their supplier relationships and present a transparent overview of their sourcing, manufacturing and distribution processes, write Suruchi Dhingra, the research director, and Jim Morrish, the founding partner, of Transforma Insights

This article discusses supply chain transparency, its importance, and how distributed ledger technologies (often referred to as blockchain) can enable supply chain transparency. Currently, sustainability and emerging legislation are the major drivers for end-users adopting supply chain transparency solutions, although there are significant associated business benefits that can be captured.

## Introducing supply chain transparency

Supply chain transparency refers to the close and detailed monitoring of supply chains, potentially using permanent, immutable records of goods that move through those supply chains. The concept of supply chain transparency focuses on providing more detailed information about goods in a supply chain (for instance, raw material sourcing and product quality) to downstream or external parties. The information provided could relate simply to quality parameters of goods, but it could extend to include the ethical practices adopted by any company participating in a supply chain, and, for instance, whether policies exist to avoid the use of child labour when mining for raw materials.

In the context of supply chains, transparency is often confused with visibility. In fact, the two concepts are similar with the main difference being that transparency focuses on providing more detailed information to external parties including end-users. Transparency in a supply chain is enabled through visibility in the supply chain (which is itself generally limited to monitoring the current status of any supply chain).

Distributed ledger, often referred to as blockchain, stands as one of the most important technologies for facilitating supply chain transparency. Utilising digital tokens, a distributed ledger can securely and immutably record supply chain data, thereby ensuring integrity and transparency. Meanwhile, information can be shared between multiple parties within a network and individual parties are able to contribute supply chain information relating to their own activities.

Companies spanning diverse industries (especially retail and FMCG) are making substantial investments in distributed ledger-enabled solutions to enhance product tracking and transparency. Notable adopters of distributed ledger solutions include **Walmart**, **Carrefour**, **Nestle**, **Unilever**, **Kroger** and **Tyson Foods**. For instance, **SAP** and **Unilever** launched GreenToken by SAP in 2022 to increase transparency in Unilever's global palm oil supply chain. The solution allows companies to know the percentage of palm oil shipments that

have been sourced from a sustainable origin. Similarly, in 2019, Ford launched a distributed ledger platform to ensure ethical sourcing of cobalt. The project documented how materials are sourced, produced, traded and processed.

## Sustainability concerns and emerging legislation are driving adoption

Companies are increasingly adopting supply chain transparency solutions to ensure ethical and sustainable supply chains, often actively aiming to reduce Scope 3 emissions (i.e. emissions that the company is indirectly responsible for, both up and down supply chains), which surpass direct emissions by 11.4 times.

In addition, a range of emerging legislation is also anticipated to drive a requirement for a supply chain transparency. For example, Germany's Supply Chain Act will force large organisations to provide visibility into their supply chains in a digital format. The advent of carbon-taxing regimes (like the EU's Carbon Border Adjustment Mechanism) will also drive the adoption of supply chain transparency solutions. Similarly, the EU Sustainable Batteries Regulation also includes a supply chain due diligence program for critical raw materials used in batteries (i.e., cobalt, natural graphite, lithium, nickel and their chemical compounds), and requires that associated supply chain transparency solutions address the most prevalent social and environmental risk categories.

## Business benefits of supply chain transparency abound

However, the desire (or need) to be a good corporate citizen is not the only driver of adoption for supply chain transparency solutions, and there are generally significant associated business benefits to be secured. Indeed, the business benefits of such solutions span a gamut between increasing revenues, reducing costs and reducing risks.

Increasing customer demand for transparency in sourcing, production, packaging, transportation and distribution practices has fuelled interest in supply chain transparency. A survey by the Food Industry and Association found that 65% of consumers are inclined to switch to a brand that demonstrates greater transparency regarding product origin and supply chain processes. By sharing information about their supply chain, brands foster trust and earn customer and brand loyalty, both reducing customer acquisition costs and increasing customer lifetime value. ►

## SUPPLY CHAIN

For example, a supermarket that can provide customers with full details about the provenance of ingredients in a prepared meal, including the geographies from which ingredients were sourced and associated quality parameters and working practices, together with full condition information (for instance storage temperatures) from the entire supply chain will likely have a competitive advantage compared to a supermarket that cannot provide equivalent information. By extension, support for supply chain transparency is at a premium across the entire supply chain and so is a competitive differentiator for all participants.

In addition, supply chain transparency can assist with the identification and assignment of liability to individual supply chain participants in case goods are damaged in the supply chain and enables transparency between different stakeholders in transactions. For example, Walmart developed a distributed ledger network DLT Freight to gather and share information related to transactions, after the solution had been adopted the rate of invoices that required reconciliation efforts decreased from 70% to 1%.

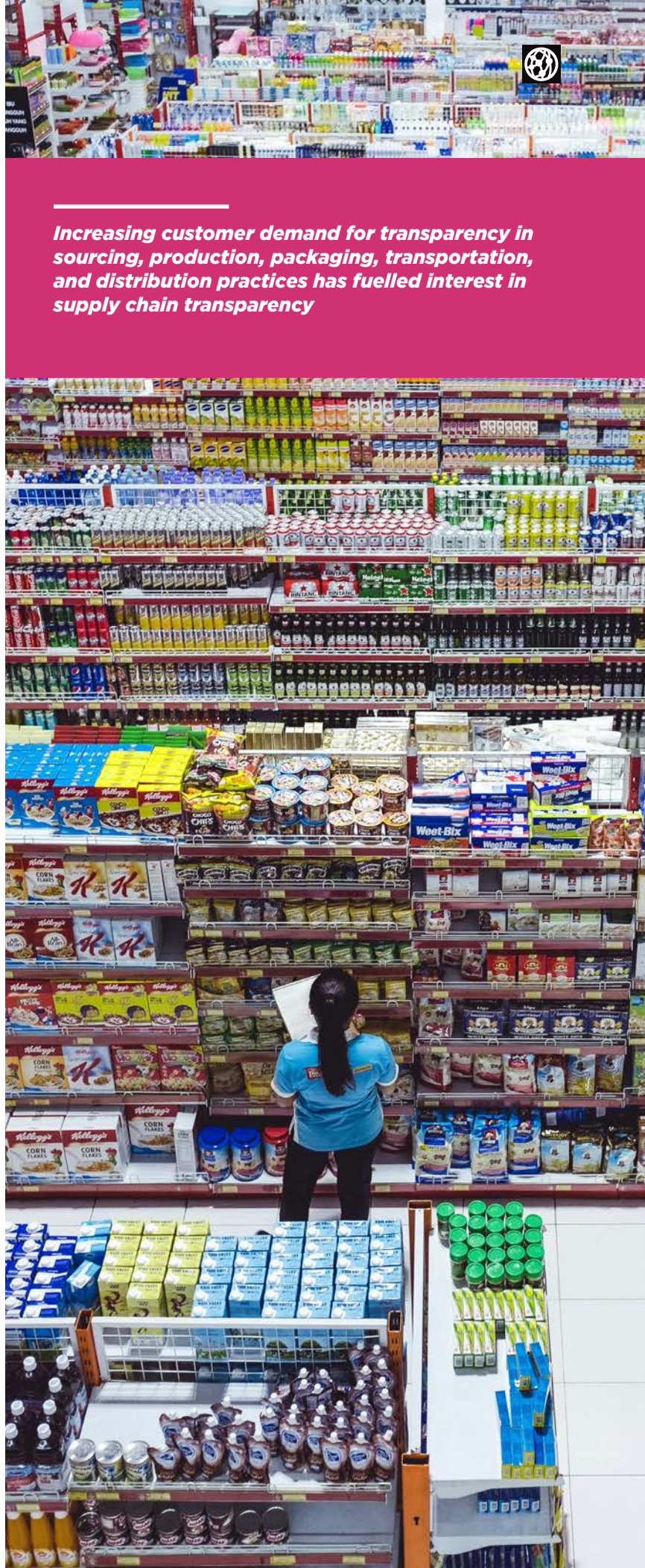
Accordingly, supply chain transparency solutions can play a crucial role in fostering enduring connections between individuals and brands, consequently increasing customer lifetime value and ultimately contributing to increased profitability. MIT research indicates that consumers express a willingness to pay a premium of 2-10% for products offered by companies that prioritise supply chain transparency and associated good practices. Deploying supply chain transparency solutions allows access to more information on how a product has been sourced and processed, which fosters informed consumer choices and builds trust in business practices.

Particularly for early-adopters, companies prioritising supply chain transparency can find that it is an effective way to differentiate their services from rivals, securing a competitive edge in the market. Actively revealing information about supply chain can serve as a distinctive factor, fostering consumer confidence, which also helps organisations attract new customers and retain existing ones who prioritise transparency and responsible sourcing.

Recording transactions in a decentralised and immutable fashion safeguards the integrity of transaction records, which drastically reduces the potential for fraud and errors. A streamlined approach can increase efficiency across an entire supply chain, minimising requirements for audits to verify product authenticity and consequently lowering operational costs. Furthermore, a more transparent system aids in pinpointing process inefficiencies, optimising inventory utilisation and delivery times, and often results in improved quality overall particularly in the case of perishable goods.

Lastly, of course, establishing a transparent supply chain enables businesses to adhere to regulatory mandates and mitigate risk of non-compliance. In turn this helps to safeguard companies against potential legal repercussions arising from infringements of labour laws or environmental regulations. Moreover, a comprehensive grasp of the supply chain facilitates companies in successfully navigating regulatory audits and inspections, thereby averting potentially significant fines. ■

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***Increasing customer demand for transparency in sourcing, production, packaging, transportation, and distribution practices has fuelled interest in supply chain transparency***



## Our pick of the IoT industry's upcoming events



**MWC Barcelona 24**  
26-29 February 2024  
Barcelona, Spain  
<https://www.iot-now.com/event/mwc-barcelona-2/>



**CDAO Canada 2024**  
26-27 March 2024  
Toronto, Canada  
<https://www.iot-now.com/event/cdao-canada-2024/>



**Smart City Asia**  
17-19 April 2024  
Ho Chi Minh City, Vietnam  
<https://www.iot-now.com/event/smart-city-asia/>



**London PropTech Show**  
27-28 February 2024  
London, UK  
<https://www.iot-now.com/event/london-proptech-show/>

**Smart Manufacturing World Summit**  
3-5 April 2024  
Stuttgart, Germany  
<https://www.iot-now.com/event/smart-manufacturing-world-summit/>

**Global Back Office & Operational Efficiency Conference**  
18-19 April 2024,  
Berlin, Germany  
<https://www.iot-now.com/event/global-back-office-operational-efficiency-conference/>



**Bosch Connected World 2024**  
28-29 February 2024  
Berlin, Germany  
<https://www.iot-now.com/event/bosch-connected-world-2024/>



**The embedded world Exhibition & Conference 2024**  
9-11 April 2024  
Nuremberg, Germany  
<https://www.iot-now.com/event/the-embedded-world-exhibitionconference-2024/>

**CDAO Spring 2024**  
18-19 April 2024  
San Francisco, California, USA  
<https://www.iot-now.com/event/cdao-spring-2024/>

**Global Digital Transformation & Customer Experience Summit**  
11-12 April 2024  
Amsterdam, The Netherlands  
<https://www.iot-now.com/event/global-digital-transformation-customer-experience-summit-2/>

**Global Smart Manufacturing Summit**  
15-17 May 2024  
Berlin, Germany  
<https://www.iot-now.com/event/global-smart-manufacturing-summit-2/>

**Global Supply Chain & Logistics Summit**  
16-17 May 2024  
Amsterdam, The Netherlands  
<https://www.iot-now.com/event/global-supply-chain-logistics-summit/>

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