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IoT NOW

HOW TO RUN AN IoT ENABLED BUSINESS

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[1/3]IOTPro Today, NTT Edge Advantage Report, Jun, 2023
[2]Forrester Research, Forrester Infrastructure Hardware Survey, 2023
*Gartner, Hyperscalers Stretching to the Digital Edge, 24 July 2023

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Richer relationships fuel the IoT partner ecosystem

Finding the right partner can be full of challenges. What initially looks attractive can quickly fade as previously unseen attributes reveal themselves and expected advantages fail to materialise. On the other hand, deeper relationships uncover concealed depths, shared attitudes and aims in common. For IoT organisations, building those relationships is essential but far more complex since this is a polyamorous relationship involving many partners

George Malim, managing editor

Complications are multiplied because typically, the multiple partners involved need to collaborate effectively and therefore the customer organisation is often in a role in which it has to ensure its suppliers play nicely together. The partners needed for a successful project won't necessarily get along, although achieving overall goals should be a compelling incentive to at least work professionally with each other.

For example, a lead systems integrator partner might find it easy to get along with a connectivity provider because their roles are well understood with minimal overlap. However, when an app developer and a partner with specialised understanding of a regulated industry enter the equation, disagreements can proliferate and pressure can mount on all the inter-relationships.

This goes straight to the heart of what a partner is and what it should be in IoT. In some cases, a partnership trumpeted in a press release is what I would simply call a deal. A customer has agreed to buy goods and services for a defined period of time from a vendor. Congratulations, but let's not pretend it goes any deeper than that.

In other cases, a vendor, such as a module provider or a device developer, might invest in a customer's business to help it get to the scale it is aiming for. This type of partner demonstrates willingness to share the risks and the rewards and is in the relationship for at least the mid-term.

Partnership in IoT is a spectrum between these extremes. Where you are on that spectrum depends on the needs of your deployment and the existing capabilities your business already has. Few deployments need just one partner so it's essential to choose carefully and look for partners that have demonstrated success in the capabilities you need. A hurried decision could result in higher costs and longer delays to product introduction.

Selecting partners and building the ecosystem to support your IoT offering can be the difference between success and failure. It's undesirable to make mistakes here because changing partners is disruptive and expensive but new innovations arrive, greater cost efficiency comes to market and process efficiencies are continuously introduced. Your partners need to move with you to accommodate these or be moved on. Successful IoT partnerships aren't a 50 year marriage, but they're more than a short-term affair.

Enjoy the magazine!
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SES to acquire Intelsat in deal aimed at creating a multi-orbit operator

SES and **Intelsat** have agreed that SES will acquire Intelsat by purchasing 100% of the equity of Intelsat Holdings for US$3.1 billion. The combination will create a multi-orbit operator with greater coverage, improved resiliency, an expanded suite of solutions and enhanced resources. The transaction, which is subject to relevant regulatory clearances, which are expected to be received during the second half of 2025, is fully supportive of SES's financial policy and is underpinned by expected total synergies equivalent to 85% of the total equity value of the transaction.

"This important, transformational agreement strengthens our business, enhances our ability to deliver world-class customer solutions, and generates significant value for our shareholders in a value accretive acquisition which is underpinned by sizeable and readily executable synergies," said Adel Al-Saleh, the CEO of SES. "In a fast-moving and competitive satellite communication industry, this transaction expands our multi-orbit space network, spectrum portfolio, ground infrastructure around the world, go-to-market capabilities, managed service solutions and financial profile."

David Wajsgras, Intelsat

David Wajsgras, the CEO of Intelsat, added: "We have reversed a ten-year negative trend to return to growth, established a new and game-changing technology roadmap, and focused on productivity and execution to deliver competitive capabilities. The team today is providing our customers with network performance at five nines and is more dedicated than ever to customer engagement and delivering on our commitments. This strategic pivot sets the foundation for Intelsat's next chapter."

News in Brief

Shield AI to acquire Sentient Vision Systems

Shield AI has announced an agreement to acquire **Sentient Vision Systems** subject to customary closing conditions and regulatory approval. The companies will merge AI expertise and operational understanding to deliver intelligence surveillance and reconnaissance (ISR) capabilities for the changing defence and security environment.

In August 2023, the companies announced joint development of a ViDAR-enabled wide area motion imagery (WAMI) solution called Sentient Observer, which Shield AI plans to fly this year.

"The combination of AI pilots, Sentient Observer and teams of affordable drones like the MQ-35 VBAT will provide the same land and maritime domain awareness that today's US$40m and US$180m Group 5 drones and crewed aircraft like the P-8 provide at a fraction of the price," said Brandon Tseng, the president and co-founder at Shield AI and a former Navy SEAL.

Palo Alto Networks and Google Cloud enhance partnership

Palo Alto Networks has extended and increased its commitment to **Google Cloud** with a ten-figure, multi-year commitment and named Google Cloud its AI and infrastructure provider of choice. Google Cloud has long considered Palo Alto Networks its preferred next-generation firewall (NGFW) provider and the expanded agreement solidifies that relationship. The alliance also underscores the critical importance of platformisation fuelled by AI to automate and consolidate multiple solutions and deliver near-real-time security resolutions.

The expanded partnership will create customer value as new and existing workloads are developed and managed with zero trust, world-class network security. Palo Alto Networks Network Security platform with VM Series is embedded into Google Cloud to enable a zero trust network posture and to strengthen defences against threats targeting applications, devices and users – and it will use cloud delivered security services (CDSS) offerings. The integrated solution provides protection and scalability across public cloud and Google Distributed Cloud (GDC) deployments, even in air-gapped network environments.

The partnerships will also encompass enhanced AI capabilities. Palo Alto Networks' Cortex XSIAM, AI-driven security operations platform for the modern security operations centre (SOC), is built on over a decade of expertise in machine learning models and the most comprehensive, rich and diverse data store in the industry. Backed by Google's cloud infrastructure and advanced AI services, including BigQuery and Gemini models, the combination delivers global scale and near real-time protection across all cybersecurity offerings.

"As the threat landscape intensifies, organisations are betting on AI-powered platformisation to protect their most valuable assets," said Nikesh Arora, the president and CEO of Palo Alto Networks. "The increased depth of Palo Alto Network's partnership with Google Cloud empowers customers to transform their digital futures without sacrificing security. We look forward to expanding our footprint using Google's capabilities to accelerate and deliver AI-driven cybersecurity advancements."

News in Brief

Workz debuts unrestricted IoT device management

Workz, a cloud-based eSIM vendor, has launched its new remote device management system. The platform is claimed to eliminate the restrictions associated with traditional technologies that limit the number of networks and include lengthy and costly deployments.

The new offering based on the **GSMA**'s upcoming eSIM standard for IoT, SGP.32, promises clients several advantages over traditional M2M technologies such as multi-IMSI and M2M eSIM. It allows greater market reach with the ability to manage previously unmanageable devices, such as those with limited power or no user interface.

"This is to IoT what the mobile phone was to the landline," said Edwin Haver, the CIO of Workz. "It enables businesses to have complete freedom to manage their devices at a fraction of the cost. Ultimately, this will unlock possibilities for providers and businesses of all sizes."

Quectel expands antenna portfolio for IoT devices with 5G and GNSS offerings

Quectel Wireless Solutions has made further additions to its range of antennas for IoT devices and deployments. The latest launches include the YEMN016AA and YEMN017AA 5G 5-in-1 combo antennas, the YECN001J1A and YECT000WBA external 5G antennas and the YEGB000Q1A and YEGN000Q1A active GNSS L1 and L5 antennas.

"We are thrilled to expand our product line with antennas that offer superior performance and meet the unique needs of our IoT customers," said Norbert Muhrer, the president and chief sales officer at Quectel Wireless Solutions. "Quectel consistently enhances its diverse portfolio to precisely address the unique requirements of our clients' deployments and applications, offering unparalleled performance and adaptability, and these antennas add to that portfolio."

The YEMN016AA is a 5G and global navigation satellite systems (GNSS) 5-in-1 combo antenna measuring 204.4mm x 86.7mm x 32mm. This ultra-wide-band 5G/4G antenna provides broad coverage from 600–6,000MHz whilst offering backward-compatibility to support 3G and 2G networks as well as LTE Cat-M and narrowband-IoT (NB-IoT).

The Quectel YEMN017AA is a 5G screw mount 5-in-1 combo antenna pack optimised for 5G and 4G networks. With a diameter of 103.5mm and height of 42.5mm, the combo antenna can integrate a variety of antennas, such as 5G, 4G, GNSS and Wi-Fi antennas.

Norbert Muhrer, Quectel

Quectel has also added the YECN001J1A and YECT000WBA external 5G antennas to its portfolio. Both antennas cover the 5G NR sub-6GHz frequency bands and are compatible with 4G, 3G, 2G and LPWA bands. For users prioritising GNSS, Quectel has introduced the YEGB000Q1A and YEGN000Q1A active GNSS L1 and L5 external antennas.

Semtech enhances global connectivity with NTN support in HL78 modules

Semtech has announced the integration of non-terrestrial network (NTN) support into its HL series LPWA modules, specifically the HL7810 and HL7812. Semtech's LPWA HL78 modules, now upgraded with NTN support via a straightforward software update, enable devices to maintain dependable global connectivity through satellite networks, supporting continuous connection even in the most isolated regions.

Semtech has partnered with **Skylo** to integrate NTN capabilities into its HL series modules. As a result of this collaboration, Semtech's upcoming software update, slated for commercial release in Q2 and pending testing and certification on Skylo's network, will provide access to Skylo's expansive network. This partnership is a testament to Semtech's commitment to enhancing global connectivity options, enabling devices equipped with HL78 modules to maintain reliable communication links, even in the most remote areas.

"By incorporating NTN support into our HL78 modules via a straightforward software update, we are enhancing the capabilities of our existing products, providing our customers with a substantial competitive edge," said Michael Buonassisi, the director product management LPWA modules at Semtech.

"We are thrilled to partner with Semtech to bring the power of non-terrestrial networks to the HL series modules," added Andrew Nuttal, the CTO and co-founder of Skylo. "This collaboration marks a significant milestone in our mission to bridge the connectivity gap, providing reliable, global communication solutions that meet the needs of today's digital world. Together with Semtech, we are setting a new standard for connectivity, ensuring that no device is left unconnected, no matter where it is located on the globe."

Carson City upgrades to Iteris' advanced Vantage Apex sensor

Iteris has announced that Carson City, Nevada, USA has chosen it to upgrade the city's intersection detection sensors to Iteris' Vantage Apex hybrid sensors. The Vantage Apex is a 1080p high-definition (HD) video and four-dimensional (4D) radar sensor with integrated AI algorithms. It delivers detection, tracking and classification accuracy of vehicles, pedestrians and cyclists, as well as HD video display for traffic management centre monitoring.

Intersections across Carson City will be upgraded with the new sensors, which are connected vehicle-ready and able to provide critical infrastructure data through vehicle-to-everything (V2X) communications to connected and automated vehicles (CAVs).

"We're thrilled to be providing Carson City with the equipment it needs to create smarter intersections," said Mark Nogaki, a senior vice president of sales at Iteris. "With Vantage Apex, the city will now have the unmatched detection and analytical capability that is necessary to improve safety, mobility and sustainability throughout the area."

Mark Nogaki, Iteris

The Vantage Apex AI-powered smart sensor is a key component of Iteris' ClearMobility Platform, the solution to continuously monitor, visualise and optimise mobility infrastructure. ClearMobility applies cloud computing, artificial intelligence, advanced sensors, advisory services and managed services to help ensure roads are safe, travel is efficient and communities thrive.

Itron improves Temetra platform for water utilities in Australia and New Zealand

Itron has expanded the capabilities of its Temetra platform in Australia and New Zealand to include NB-IoT communications, enabling digital transformation for water utilities. Temetra's comprehensive offering includes meter data processing, storage, operational analytics and validation.

Adding NB-IoT functionality provides water utilities with the flexibility they need to maximise business value and streamline operations on a single platform.

Currently available for the Australian and New Zealand markets, Itron's Temetra platform can seamlessly analyse water data from multi-vendor meters to highlight consumption patterns, identify irregularities and generate billing information in a way that more accurately reflects water usage.

With the expansion of Temetra to include NB-IoT, on top of existing support for multiple communication protocols, including LoRa and other water-advanced metering infrastructure network communications, alongside existing manual and automated meter reading systems, Temetra provides utilities with true interoperability at all stages of the transition to a digital future.

"Today, over 40 water utilities in Australia rely on Temetra for data collection, data management, and data analytics. Adding native support for NB-IoT enables our customers to seamlessly integrate this technology into their business without adding complexity to their architecture," says Paul Nelsen, vice president of sales, APAC at Itron. "By supporting different choices in communications protocols, and endpoint vendors we are helping to streamline our customers' digital transformation. We look forward to helping more utilities use digital technologies to create new efficiencies, connect communities and encourage conservation."

News in Brief

Rajant boosts Mirato's efficiency with Reios IoT solutions

Rajant has announced the adoption of its Reios suite of IoT solutions for an Italian manufacturer **Mirato**, a maker of personal hygiene products, such as haircare, make-up and fragrances. Looking to improve energy efficiency and safety, along with optimised vehicle utilisation within plant operations, Mirato chose Reios Smart Lighting industrial LED lamps for lower energy consumption and Reios sTrack to monitor vehicles and people for improved safety.

The Rajant Kinetic Mesh-enabled Reios IoT platform provides comprehensive automated operational intelligence anywhere, which is fast and easy to deploy. By deploying Rajant Reios both indoors and outdoors, Mirato has reaped significant benefits in terms of optimised energy efficiency, safety, security and future-proofed profitability controls.

"By analysing vehicle movements with (sTrack) sTags placed on our forklifts, sTrack is helping us enhance safety and efficiency. We get the real-time fleet position in the plant to enable monitoring and reduce downtime," said Giovanni Tedesco, the plant manager at Mirato. "In addition, the analysis of data we collect continuously allows us to identify ways to optimise paths and use of our resources."

Robert Schena, the CEO and co-founder of Rajant, added: "Rajant welcomed Reios into our family of products in November 2023. Our view is that the combination of Rajant and Reios is a great opportunity for our global channel to deepen its stronghold and offer customers solutions for IoT using Rajant Kinetic Mesh. What's been successfully done for Mirato in terms of efficiency, savings, safety and simplicity will be a win for customers worldwide."

Partnerships create the disaggregated ecosystem to support next generation digital transformation

The old saying is that it takes a village to raise a child. Well, it takes an ecosystem to enable a digitally transformed business. That is coming together now as hardware, software, apps, networking and vertical-specific skills create the businesses of the future. Sanjay Uppal, vice president and general manager of the software-defined edge business at VMware by Broadcom, tells IoT Now why one-size-doesn't-fit-all anymore.

With Gartner predicting that 50% of enterprise data will be created outside a data centre by next year, it's clear that next generation operations are happening at the edge and enabling the edge is now a priority for enterprises, he explains

Providing the ecosystem and infrastructure that scales are the two hallmarks of an effective partner

IoT Now: There are big changes happening across multiple industries as systems digitise and enterprises look to align their infrastructure with their new needs. How complex is this transformation and what should organisations be looking for in a partner?

Sanjay Uppal: It depends on the industry you're in. Some are already transformed while others are just getting started. For example, the telecoms industry first started its digital transformation route by disaggregating the core and has moved on to the radio access network (RAN). The benefit is agility in rolling out new apps - but to get that disaggregation done you need platform partners with two key skills.

First, they must be a great ecosystem player that is able to bring together apps, hardware and services. Second, they must be able to provide digital infrastructure that scales. Providing the ecosystem and infrastructure that scales are the two hallmarks of an effective partner, but in industrial manufacturing, healthcare, logistics and many other verticals. ▶

IoT Now: To take one example of the transformation burden, how do you see organisations' efforts to right-size their infrastructure in the face of moves to software-defined edge and away from monolithic IT architectures? There are several different dynamics involved in this but each is interrelated, so how can holistic approaches that keep projects on-track be enabled?

SU: You start off with where the devices that are producing or consuming data are - and more than half will be outside the data centre. You'll find that most of these workloads outside the datacentre are highly specialised and constrained by hardware. After you locate your use cases, you then look at the functionalities you need to place close to those devices to enable them.

Why does being close matter? Because latency is the new currency whether for self-driving cars, robots on the factory floor or for customer loyalty in a retail shop.

You start off with a blueprint for digital transformation and then build the ecosystem you need to enable the use cases you've identified. For a retail store, you can chart a path from being inefficient to automatically replenishing shelves when stock goes down and reducing shrinkage by identifying live theft.

In grocery chains in the UK, for example, people can walk in and out without engaging with a sales representative or scanning goods. Through a combination of edge devices, the store recognises the items they've shopped for and charges them for it. That's a computer vision use case and to achieve that you need specific partners.

Regardless of the use case, the process begins in the same way - identifying what the sources and consumers of data are and then rolling-out the ecosystem based on those visions.

IoT Now: The nature of IoT means there is a 'things' part of the transformation so the work can't just be done in the internet or the data centre. What challenges does having to upgrade infrastructure on the factory floor involve? ▶

Sanjay Uppal
vice president and general manager
VMware by Broadcom

On a factory floor there are not enough IT staff to understand if a potential interference has been added to the floor, but a simple sensor can provide valuable insight to defend against operational challenges

SU: There are several challenges to consider. Location and proximity to similar workloads is one, latency is another and you can't have an intelligent conversation about the edge without talking about the network underneath. Today, there are industry sites that have devices numbering in the millions that require a level of scale that is very different from a data centre.

The first challenge is to right-size the infrastructure so it can run on very small hardware and we've been able to do that with the VMware Edge Compute Stack. It really is a case of 'Honey, I shrunk the stack'.

For example, with new machine learning workloads, it's possible to run models on hardware that has less than 256k of RAM. In this case you could have a tiny sensor on the side of a machine that measures a rise in temperature or vibration and can predict when the machine will fail. That's a very different scenario than a large language model (LLM) but still has a high impact since you can act on the insight very quickly and avert a catastrophe in the next few minutes.

On a factory floor there are not enough IT staff to understand if a potential interference has been added to the floor, but a simple sensor can provide valuable insight to defend against operational challenges. A sensor doesn't need more computing power or a high-capacity connection. It just needs to be able to react to performance data outside of a preset range and communicate that. Moreover, these kinds of workloads can be consolidated on edge devices to further shrink the stack. While we aren't talking about the thousands of workloads in the data centre, we do see consolidation of about 6-to-1.

One thing that is critically important from the edge standpoint is that all things behave as if they are independent. It's therefore essential to come up with a way to synchronise management of edge devices and intelligence. We've developed our VMware Edge Cloud Orchestrator to achieve this so when the edge device wakes up it can call home and get access to the platform software as needed.

Being able to shrink the footprint and ensure security are all hallmarks of being able to run efficiently in very diverse environments which bring new requirements. For example, in manufacturing, safety and compliance is very important. The machine should be shut off immediately if it is failing whereas in a retail site, there are no moving parts so there's no need for millisecond-level responses.

The technology that supports this is made up of the vertically-oriented ecosystem that provides specific software, hardware and services for that use case, such as app providers or computer vision specialists, and vendors like us who have the ability to put the entire ecosystem together on a vertical by vertical basis along with the telecoms operators, who are essential to edge performance.

IoT Now: How do you see the software-defined wide area network (SD-WAN) providing the connectivity tissue that complex operational environments, such as factories, need? How challenging is it to encapsulate the diverse connectivity needs of different equipment in a modern, fit for purpose infrastructure?

SU: SD-WAN started off being the solution for the connectivity for enterprise branch offices to the data centre. The solution we built excelled at that but now the effort is focused on how SD-WAN can be the fabric for the next generation workloads of digital transformation. That's comprised of low latency, orchestration and the best quality-of-service for the apps you want. These are the challenges that SD-WAN has to extend into.

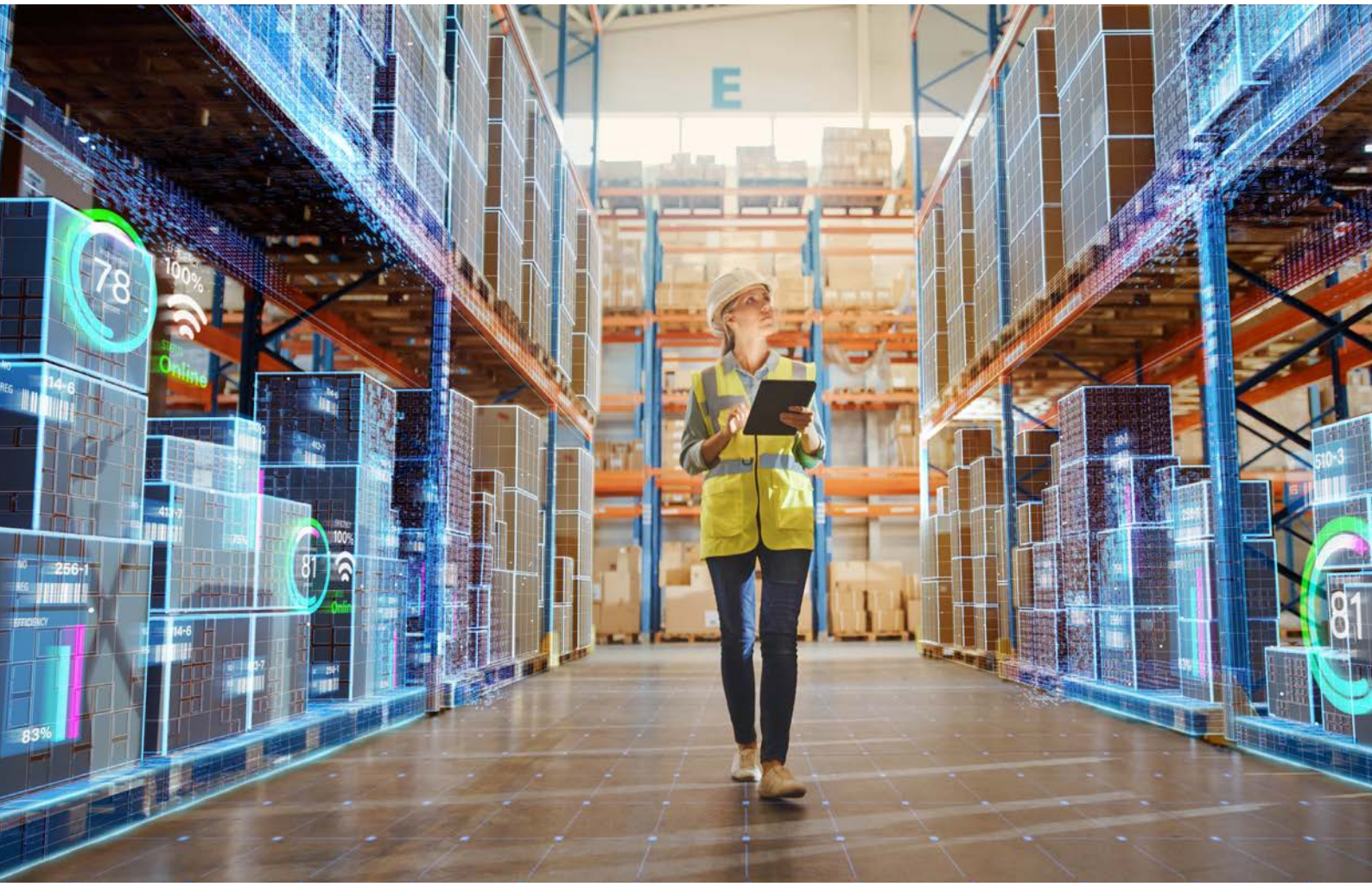
I view it as the next era of SD-WAN as it's all about programmability because the needs of office apps or Office365 are very different to factory or hospital use cases. These new apps see SD-WAN as the way to bring all the different requirements together. Systems don't have to tell if a device is a screwdriver on a factory floor, for example. The device is already recognised but the network has to be programmed to provide the right QoS for the use case.

This is the advantage for telecoms operators and providers of the underlying technology because they can add value. In addition, with technologies such as low earth orbit (LEO) satellites becoming available there is another link available to support all these new capabilities. Regardless of this, you need an intelligent layer so a device can say: 'I'm a respirator and I need a response within one second' or 'I'm a sensor uploading non-urgent shift-end data.'

I'm very excited about this next phase with SD-WAN.

IoT Now: There's understandable caution regarding investing in the next generation connectivity infrastructure to support IoT-enabled operations. How does Broadcom give customers confidence that they will not only achieve greater agility and flexibility today with their transformations but also be well-placed for these networks to support their future needs?

SU: The glib answer in computer science is to add another layer of abstraction. Here we have another layer of programmable software and also the edge compute stack. These layers allow innovation to happen much faster than if you deployed monolithic systems. There is a reason architectures are moving towards disaggregation and software- ▶



defined – to support unanticipated growth in the future while achieving agility and flexibility today. Broadcom's tagline is 'connect everything' and what we are doing at the software-defined edge fits in with that objective. Other divisions are working on next gen GPUs and producing encoders for next generation networks. We're connecting everything, and that's what is required to thrive in the future.

IoT Now: Insofar as it's possible to define specific attributes given the diversity of transformations, what's the right partner attitude here?

SU: Usually when a new set of technologies comes in you get companies trying to do everything from soup to nuts, but I don't think that works here, especially with AI and machine learning. There are a wide variety of use cases that showcase an enormous array of diversity. That diversity means there is not going to be a one-size-fits-all offering so an ecosystem approach is needed. You need a partner that is building the ecosystem with hardware partners, telcos, app providers, hyperscalers with next generation programmability, and specialists in small language models.

That sounds like a lot of partners, but consider the use cases and what drives selections of a particular blend of partners. For instance, a hardware provider that allows us to apply the software stack or a systems integrator that knows the business and can simplify use case projects. There will be many players at the edge, so finding partners who enable this ecosystem-approach is important to success.

IoT Now: What is Broadcom's strategy for helping customers transform and optimise their operations for a new era?

SU: At Broadcom, we understand where we can add value and that's not by providing vanilla offerings. We're a world class technology provider and that starts off by understanding what the customer's use case is trying to achieve.

Our approach to all of our engagements is to achieve simplification and disaggregation, and to abstract complexity away. This is how we run our business internally and for our customers. Our software-defined edge portfolio is a great example of this. You bring the capabilities to where you need them, when you need them, so your business can be more efficient and agile. We're doing this so customers can concentrate on their businesses rather than their technology.

At Broadcom, we understand where we can add value and that's not by providing vanilla offerings

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How to enable IoT agility at the software-defined edge

Not so long ago, the data centre was the engine that powered enterprise innovation. Today, the real action has shifted to the edge. Enterprises across a variety of industries are reimagining their operations, exploring solutions like real-time AI analysis and decision-making, automation and extended reality

The edge means many different things depending on the use cases that shape it. For example, we're seeing retail organisations deploy AI-enabled computer vision in warehouses and stores for loss prevention, manufacturers are using smart sensor data to improve machine uptime as much as 50% and healthcare providers are acquiring real-time visibility into the state of patients' health – and the devices that serve them – at the edge.

While the edge can take on many shapes, enabling these new and transforming use cases requires the same foundations – software-defined edge.

Why software-defined edge?

Data centres moved to software-defined architectures to enable the agility enterprises are now seeking at the edge.

Just like in the data centre, the software-defined edge disagreggates the hardware and software to empower operational flexibility. It is distributed digital infrastructure for connecting, securing and running workloads across dispersed locations, close to endpoints that produce or consume data. Different from the data centre, software-defined edge brings a layer of intelligence needed to meet the scale and performance requirements at the edge – it empowers edge applications with zero-touch orchestration to provide each distributed workload with the resources and connectivity it needs, and the programmable telco network to prioritise workloads in real-time and enable services based on their unique performance requirements. This while managing everything with a software-defined overlay.

Organisations can use software-defined edge to transform operations, while **VMware**'s network of telco partners – the experts in distributed infrastructure – can help simplify connectivity management.

With a software-defined edge approach, you will deliver the advanced technology and edge-powered experiences that your customers and users expect – and achieve it in a low-cost, efficient way. It enables the following:

- **Right-size infrastructure** provides the flexible, automated compute infrastructure for operational technologies at the edge. This edge-optimised runtime platform enables virtualisation of workloads for flexibility while prioritising hardware efficiency and performance to meet the unique needs of distributed applications and infrastructure.
- **Network programmability** exposes the compute, connectivity and RAN resources available to each edge location via APIs. Applications can then access the right resources in real-time.
- **Zero-touch orchestration** enables zero-touch provisioning and management of software-defined edge resources. It links distributed edge networks and edge infrastructure with the programmable telco network and orchestrates the right ▶

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connectivity for each workload, automatically, to meet real-time application requirements. Its pull-based architecture allows for simple remote management, when the application needs it – empowering the applications to administer themselves.

Life on the edge is complex and demanding

It's clear that all these innovative use cases have tremendous transformative potential – but they also demand more advanced intelligence and resources at the edge. As the sheer volume of distributed applications, devices and data at the edge soars, complexity and management challenges multiply.

An enterprise organisation may have hundreds or thousands of potential edges where workloads could be processed – connected to different networks, under different administrative control, with varying IT resources. The need to process all these diverse workloads close to endpoints makes application visibility and management difficult, especially as operational technologies evolve.

Choosing the right partners

As you roll out these transformative edge applications, the technology partners you choose are critical to achieving the outcomes you want. Complexity can grow quickly in distributed factories, branches, vehicles and other locations with limited onsite resources. Find partners that can help you simplify the management of this complexity, offering the software excellence to support IT and OT convergence.

Each use case will also require a different ecosystem to enable it. Work with partners who have an open mindset and aren't trying to force you into a one-size fits all, end-to-end solution. To provide the flexibility you'll need to deliver a diversified edge, your partners should offer the right tools to not only provide right-sized infrastructure, but also a holistic, unified approach to management.

Revolutionise your business with software-defined edge

No matter where you are in your edge transformation journey, VMware software-defined edge delivers a complete solution that positions you to improve the stability and performance of your next-gen applications, control costs, and focus better on your business operations.

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Picking an ideal IoT partner isn't a speed date

It's obvious that IoT use cases need the expertise of multiple partners in order to provide optimal performance. These include hardware vendors, network providers, app providers, vertical industry specialists and others. However, companies looking to deliver IoT offerings often don't have the resources to manage partners, the time needed to understand technical complexities or the will to add skills outside of their core business. In these scenarios they need rapid access to an ecosystem of partners who can bring them everything they need to make their deployments a reality, writes George Malim

Solution components must be carefully chosen and orchestrated to work together to address a business objective

That ecosystem is seldom a network of equals and there is a clear need for there to be a lead partner to manage the others. Manage is a loose term here and encompasses partner selection as well as ensuring partners deliver their portions of the project to specification. Industry insiders advocate choosing a lead partner with proven experience who can assemble a tailored ecosystem of approved partners with a clear chain of command.

"IoT implementations can be extremely complex," says Devin Yaung, the senior vice president for Group Enterprise IoT Product and Services at **NTT Data**. "Solution components must be carefully chosen and orchestrated to work together to address a business objective. Businesses should consider a few factors when choosing a lead partner. Firstly, experience. A proven track record of managing complex projects and integrating various technologies is crucial. A consulting-led approach is also key to really understand the business objective and if the solution makes sense from an ROI perspective."

"A lead partner should not just push products but assess the individual needs of an organisation, designing a bespoke solution, and guiding them through the entire process, taking a big picture view for a more unified ecosystem," he adds. "System integrators are uniquely suited to this role as one main point of contact to simplify communication and streamline project management, ensuring your IoT project functions as a cohesive whole."

Experience in IoT and in developing a robust ecosystem are core attributes for a lead partner and the other partners should also be able to demonstrate ability to partner effectively. "The lead partner for an IoT project should have a dedicated practice and/or expertise in successfully deploying IoT products or other connected environments such as OT or connected factory," says Darron Antill, the chief executive of **Device Authority**. "Successful IoT deployments depend on an ecosystem of partners and providers. Solution providers need to have a track record of working with partners across the various solution areas required for IoT. There are some examples of these ecosystems being created by individual solution providers or the likes of **Microsoft** or **Carahsoft** which show the success of this approach."

Glyn Dodd, the director of Channel Development at **IMS Evolve**, emphasises the need for proven experience and the ability to deliver sustained ROI. "When selecting partners, IoT organisations should strive to establish an ecosystem of approved providers and solutions," he explains. "These partners should be capable of providing qualified recommendations, offering proven solutions or services, and accelerating and enhancing use cases and return on investment."

In the past, this hasn't necessarily been the case, with fragmented amalgamations of providers supplying a mish-mash of services, hardware, software and technologies with an inevitable counter-productive lack of cohesion. True ▶

Devin Yaung
NTT Data

Darron Antill
Device Authority

streamlining of and optimisation of an IoT offering can only be achieved with properly aligned partners who understand not only the needs of the adjacent system or technology but also recognise their offering's part in the overall service picture.

"There is absolutely a strong need for a better integrated partner ecosystem in IoT," confirms Yaung. "While many providers understand their specific niche, they often lack the full picture of an IoT project. This can lead to fragmented solutions that struggle to communicate and work together seamlessly. A comprehensive IoT strategy should not only consider the technology, but also consider the people and processes that will be using the technology, the security, and regulatory environment, and the financial implications - particularly the operations impact for the total cost of ownership."

Getting this right delivers substantial benefits to a deployment from accelerated time-to-market, to simplified architectures and better optimisation to fuel profitability. "A successful and diverse network of specialist partners can add significant value, such as expanding reach both geographically and across industries, or enhancing the speed and scale of implementation," says Dodd. "However, the IoT organisation's focus must remain on the value of outcomes to the end client. They should seek only best-in-class partners and applications to support and extend the technology to ensure real value and outcomes are delivered 100% of the time."

It's also case of horses for courses so choosing which type of organisation to partner with or select as your lead partner merits careful consideration. "There are many different IoT technologies, protocols, standards and proprietary ecosystems," says Yaung. "Systems integrators are specialists that excel at bringing diverse technologies together. By taking a holistic view, they easily integrate with existing systems, ensuring everything works in harmony and solutions are designed with all project aspects in mind, guaranteeing a complete vision. By partnering with a systems integrator, you gain a single point of contact and bridge the communication gap between vendors. Ultimately, this streamlines communication, eliminates fragmentation, and delivers a cohesive IoT project, rather than a mess of parts."

The yardstick for any IoT deployment is the ROI it provides and this feeds down to the ROI that each partner involved in the delivery contributes. Sometimes that might even involve a partner saying 'no' because they can't see the sense of the implementation or how a return can be generated.

"Success in IoT hinges on selecting a partner that understands specific business problems and works with you to solve them," adds Yaung. "Don't get caught in the trap of just buying technology without a strategy – prioritise partners that work with you to tailor solutions to your organisation's needs. Seek a partner that takes a holistic view, offering control over the entire IoT stack."

"This ensures a single point of accountability if things go wrong, saving you time and frustration in the long run," he explains. "But partnership goes beyond troubleshooting; choose a partner who's invested in co-innovation. They should be your sounding board, collaborating with you to push boundaries and develop cutting-edge solutions that drive real business value."

It's a two-way street. Enterprises should also be embracing the partner network, committing to it and following through on that co-innovation activity. "Nurturing and optimising the partner network from day one is critical," Dodd adds. "This ensures IoT organisations can consistently deliver on their promises, provide the best possible service to customers, and stay ahead in an increasingly competitive market."

With the long-promised mass-market volumes of connected IoT devices now being rolled-out, the pressure is on the IoT sector to make good on its promises. This means partnering and the ecosystem needs to continue to mature and remain as open as possible in order to foster innovation.

For Antill at Device Authority, "a rich partner-ecosystem is a must. [Enterprises] need to embrace strategic partnerships and actively work toward building successful relationships with complementary solution providers."

Yaung concludes that openness and collaboration are essential ingredients for successful partnering. "Vendor communities must embrace open standards rather than closed ecosystems," he explains. "The road to cohesive IoT services is paved with collaboration, not competition. While standardisation efforts are underway, ironing out the wrinkles will require active participation from all vendors. This collaborative approach, with a focus on both standardisation and navigating the regulatory landscape, is key to delivering seamless IoT experiences for customers."

There is absolutely a strong need for a better integrated partner ecosystem in IoT

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ANALYST REPORT

How will IoT achieve sustainability in manufacturing?

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From compliance to leadership: The future of sustainability in manufacturing

Discussions about sustainability and related topics appeared in 29% of manufacturers' earnings calls in Q1 2024, according to IoT Analytics' quarterly coverage of keywords in corporate earnings calls. The attention that CEOs of industrial companies are giving to the topic has risen considerably in the last five years. For comparison, in Q1 2019 only 9% of CEOs at the same companies discussed sustainability in their earnings calls.

This is just one of several statistics that show climate change is transforming 'sustainability' from a corporate buzzword to an imperative for manufacturers worldwide. ►

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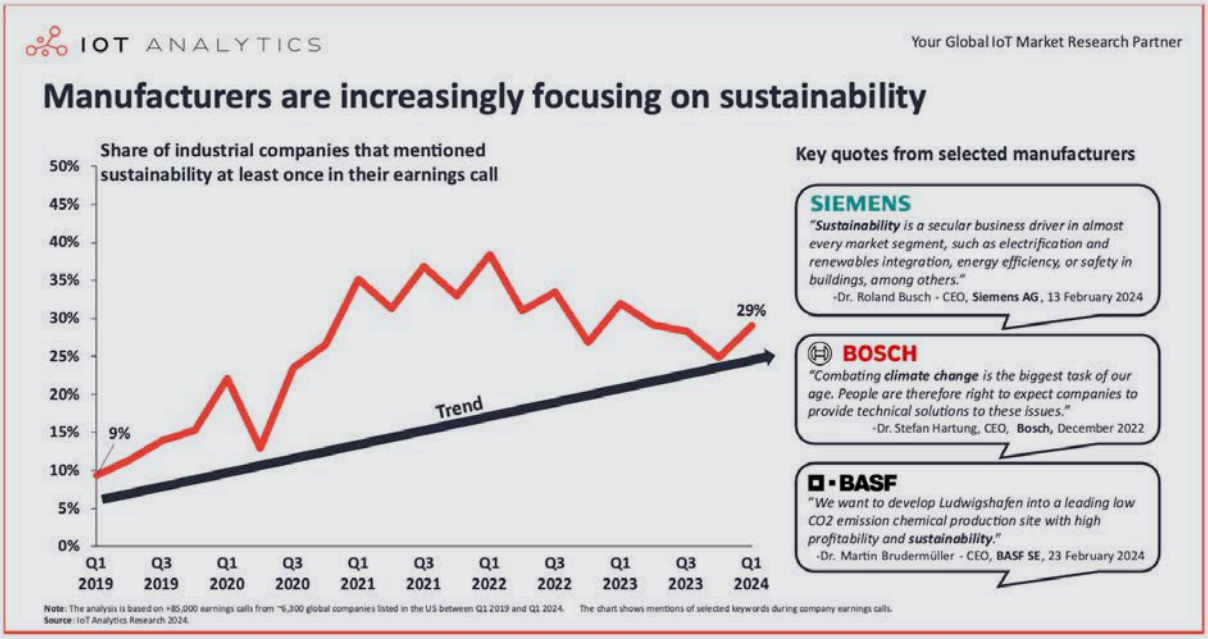

Figure 1. Tracking mentions of sustainability in earnings calls of manufacturers since Q1 2019.
(Source: IoT Analytics)

This report, authored by **IoT Analytics**, focuses on sustainability in manufacturing, including what is driving manufacturers' sustainability initiatives, how the initiatives are currently tracking environmental impacts, and what manufacturers need to prepare for upcoming reporting and transparency requirements. But first, we will review why sustainability matters.

Why sustainability matters

Since the pre-industrial era (1850–1900), the average land surface air temperature has increased more than 1° C,[1] and the earth keeps getting warmer: February 2024 was the hottest February on record and marked the ninth straight month of record-high monthly temperatures.[2]

In short, the climate is changing, and for decades, researchers have attributed this change to pollution and emissions, primarily of greenhouse gases (GHGs), such as CO_2.

These temperature increases may not sound like much, but their impacts are real. In 2022, the World Wide Fund for Nature's (WWF) Living Planet Report found a 69% decrease in monitored wildlife populations since 1970, attributing this loss of biodiversity to climate change and the unsustainable use of resources.[3]

If the loss of wildlife populations is not tangible enough, climate change's impact on the weather certainly is. Data from the Université catholique de Louvain's Emergency Events Database (EM-DAT) shows that the average number of natural disasters per year between 1980 and 1999 jumped 79% between 2000 and 2022, from 217 to 388, respectively.[4] While these numbers include non-climate-related disasters like earthquakes and volcanic activities, climate-related issues such as flooding and extreme weather events witnessed the steepest climbs since 1980 and outpaced other natural disasters. Everyone, including corporations, is impacted by climate change, and most are realising more and more that the way we produce and consume is not sustainable.

Drivers of manufacturers' sustainability initiatives

According to Our World in Data, using the World Resources Institute's Climate Watch data, industrial manufacturing made up nearly one-quarter (24.2%) of energy-related emissions in 2020. Meanwhile, 5.2% of non-energy-related emissions come from manufacturing cement, chemicals and petrochemicals.[5]

Manufacturers appear to be aware of these emission levels. Sustainability is a more common topic in industrial companies' earnings calls than for most other groups (29% of manufacturing earnings calls discussed it in Q1 2024 compared to 22% of overall earnings calls), with many executives discussing individual projects and corporate targets. ▶

[1] "Climate Change: Global Temperature," NOAA, 2024, **https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature**
[2] "How Streak: Why February 2024 Was The 9th Consecutive Hottest Month On Record," Forbes, 7 March 2024, **https://www.forbes.com/sites/davidrvetter/2024/03/07/hot-streak-why-february-2024-was-the-9th-consecutive-hottest-month-on-record/**
[3] "Living Planet Report," World Wide Fund for Nature, 2022, **https://livingplanet.panda.org/en-US/**
[4] "Number of recorded natural disaster events," Our World in Data (from EM-DAT data), 2023, **https://ourworldindata.org/grapher/number-of-natural-disaster-events**
[5] "Sector by sector: where do global greenhouse gas emissions come from?" Our World in Data, 2020, **https://ourworldindata.org/ghg-emissions-by-sector**

> ***"Sustainability is a secular business driver in almost every market segment, such as electrification and renewables integration, energy efficiency or safety in buildings, among others."***
>
> ***Roland Busch*** *– CEO, Siemens AG, 13 February 2024*

Four aspects identified in our research drive these projects: cost savings, social pressure, corporate values, and, most of all, regulations.

1. Cost savings

Often the low-hanging fruit for manufacturer sustainability initiatives in recent years, immediate cost and resource savings have been a motivating factor for many manufacturers. An example of such initiatives is reducing and reusing waste material, which can cut disposal resource costs and let companies use more of the materials they already purchased.

2. Social pressure

This driver includes environmentally conscientious consumers and investors, who are more and more considering the environmental impacts of their spending decisions (often referred to as responsible investing or responsible consumption). Many consumers consider the environmental impact of the production or disposal processes when deciding to purchase a product. Meanwhile, many investors are looking at sustainability portfolios, which include companies that have sustainability initiatives, be it emission reduction or impact offset initiatives.

> ***"The absolute emission reduction KPI was requested by many shareholders to be included in our short-term incentive scheme. That's why we, in the first place, also put it in. It also perfectly fits our carbon emission reduction targets."***
>
> ***Markus Steilemann*** *– CEO, Covestro AG, 27 October 2023*

3. Corporate values

Research has indicated that companies are internalising sustainability as a corporate value, helping to drive initiatives with full support from executives and other corporate leaders. In 2010, **McKinsey** shared that 'Maintaining or improving corporate reputation' was the top reason for addressing sustainability issues.[6] However, in 2021, respondents to that year's sustainability survey from McKinsey marked 'Align with our goals, mission, and values' as the top reason, highlighting a shift in why corporations address sustainability.[7]

> ***"Combating climate change is the biggest task of our age. People are, therefore, right to expect companies to provide technical solutions to these issues."***
>
> ***Dr. Stefan Hartung*** *– CEO, Bosch, 21 December 2022*

4. Regulations

Our research has found regulations to be the biggest driver of sustainability initiatives at scale. To help cut GHGs and other pollution, many governments worldwide have adopted regulations and limitation mechanisms intended to encourage companies to adopt sustainability measures. Such actions force a large number to comply with the guidelines, helping to advance entire sectors rather than individual companies.

Examples of key sustainability regulations that manufacturers have had to follow in the recent past include the following:

- **EU Emissions Trading System (ETS)**, which caps emissions by sectors and allows companies within them to trade emission allowances
- **EU Carbon Border Adjustment Mechanism**, which is a carbon tax on carbon-intensive goods imported into the EU and aims to prevent the relocation of carbon emissions from the EU to non-EU countries
- **US Clean Air Act**, which has served as the basis for the US Environmental Protection Agency's regulation of pollutants, including greenhouse gas emissions.

Failure to follow these regulations has resulted in sizeable fines or the loss of a business's ability to operate in the country. For instance, in March 2022, **Chevron Phillips Chemical Company** agreed to take measures to ensure CAA compliance after it allegedly failed to properly operate and monitor its industrial flares, resulting in excess emissions. The measures were estimated to cost ▶

[6]"How companies manage sustainability", McKinsey & Company, 2010, **https://www.mckinsey.com/capabilities/sustainability/our-insights/how-companies-manage-sustainability-mckinsey-global-survey-results**

[7]"How companies capture the value of sustainability: Survey findings", McKinsey & Company, 2021, **https://www.mckinsey.com/capabilities/sustainability/our-insights/how-companies-capture-the-value-of-sustainability-survey-findings**

[8]"Chevron Phillips Chemical Company Agrees to Reduce Harmful Air Pollution at Three U.S. Chemical Plants," US Department of Justice Office of Public Affairs, 2022, **https://www.justice.gov/opa/pr/chevron-phillips-chemical-company-agrees-reduce-harmful-air-pollution-three-us-chemical**

US$118 million, and the company settled on an additional US$3.4m civil penalty as well.[8]

While the aforementioned regulations have largely focused on limiting emissions and pollutants, there are recently enacted regulations that add more focus on precision in sustainability-related data and transparency. These will force many corporations, particularly manufacturers, to thoroughly collect relevant sustainability and emissions data and produce annual reports on environmental impacts, among other matters.

These regulations aim to enable investors and consumers to make knowledgeable, conscientious decisions in line with their sustainability priorities. Failure to follow these can result in hefty fines and bad press.

Sustainability data collection and management

Whether the new reporting directives will place onerous additional requirements on companies depends on how well the companies are prepared to acquire and manage data and convert the data into the desired reporting formats in an understandable and automated fashion.

> ***" ... sustainability pressures, driven by new regulations and consumer preferences, are driving unprecedented shifts in the market."***
>
> ***Emile Chammas*** *– Interim co-president, co-CEO, and COO, Sealed Air Corporation, 27 February 2024*

The struggle: Establishing the sustainability data foundation

Addressing sustainability begins with setting a data baseline: Tracking and estimating emissions, energy usage (such as electricity and fuel), and the overall carbon footprint. Specific methodologies and guidelines exist, such as the GHG Protocol, but these can vary between industries or even within an industry.

The two most notable regulations are:

1. The EU Corporate Sustainability Reporting Directive (CSRD)

2. The US Securities and Exchange Commission (SEC) Climate-related disclosures

	EU Corporate Sustainability Reporting Directive (CSRD)	**US Securities and Exchange Commission (SEC) climate-related disclosures**
What it is	EU regulation for corporate sustainability reporting.	US regulation for corporate sustainability reporting.
Current status	Enforceable since 5 January 2023	Approved in March 2024, will be enforced starting in 2025.
What it covers	All dimensions of sustainability, including metrics and targets with both environmental and social impact.	Climate-related financial data and insights into GHG emissions.
Who it covers	Around 50,000 companies including all large companies and listed SMEs (approximately 75% of the EU's total company turnover)	Around 12,000 companies incl. every US publicly traded company, including foreign SEC registrants (approximately 1,150 companies)
The approach	Stakeholder approach. Requiring reporting on the needs of a wide range of stakeholders. Companies need to disclose both the impact on sustainability matters and sustainability issues' impacts on the company's financials.	Investor-focused approach Requiring only disclosure of information that would influence investors' decisions.
Reporting standards used	Uses its own industry-specific reporting standard. Companies must report according to the European Sustainability Reporting Standards (ESRs), a set of multiple sector-specific standards with granular metrics and targets.	Re-uses existing standards to create a set of industry-agnostic, climate-related metrics. The approach appears largely based on existing frameworks by the Task Force on Climate-Related Financial Disclosures (TCFD) and the GHG Protocols.
First expected reports	2025	2026

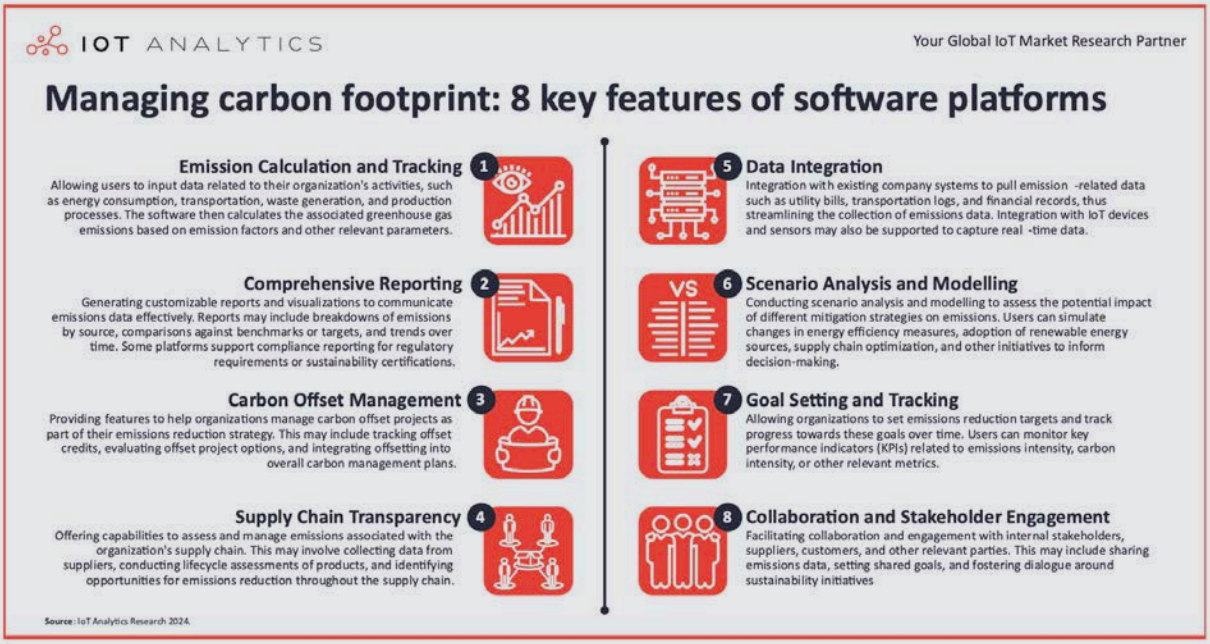

Figure 2. Eight key features of sustainability management platforms
(Source: IoT Analytics)

Many companies, especially small-to-medium enterprises (SMEs), struggle with collecting sustainability-related data. This often stems from a lack of the right collection tools, bad data quality, or companies not knowing what data they need to collect or even how to collect the data. Faced with this lack of operational or IoT sensor data, many companies turn to estimating their GHG emissions using activity and financial data (such as utility bills or transportation logs) and multiplying by emission factors specific to the source, industry or sub-sector. Worst yet, data are often tracked in spreadsheets, which lack robust data management and interpretation tools.

Considerations for impending reporting requirements

To prepare for upcoming regulations such as the EU CSRD, companies need to adopt tools that can address their industry-specific needs in terms of data collection – whether from IoT sensors or existing company financial or environmental health and safety reporting systems – data management and analysis, and automated reporting. This need is giving rise to a new category of software: carbon footprint management platforms.

These platforms specialise in data collection, management and reporting, including industry-specific calculation models – thereby addressing the requirements set by these new regulations.

Above are eight key features that an ideal carbon footprint management platform would offer.

At the core of the platform are data collection integration capabilities which are important for contextualisation and analysis, providing a clear picture of a company's carbon footprint and impacts from climate and resource management issues.

These platforms should also be able to interpret the data and assess different scenarios before offering optimisation and emission mitigation strategies. With data, reporting and mitigation strategies in place, companies can meet regulation requirements and better engage with stakeholders to foster dialogue around meaningful sustainability initiatives.

Seizing the future: A call to action for sustainable manufacturing

We are past discussing whether climate change exists. The discussion is now about what can be done to mitigate and, hopefully, reduce its effects. Weather is becoming more extreme, and biodiversity is decreasing – governments, interest groups and individuals alike are calling on manufacturers to address the causes and effects of climate change – and rightly so: Manufacturers are responsible for a significant share of carbon emissions.

With governments introducing new regulations (such as the EU CSRD), the majority of companies will have to get started with the mere basics: Setting a transparent baseline of their carbon footprint. New sustainability management and carbon footprint tracking platforms are emerging to help them achieve that.

Now is the time for any manufacturer to start looking at available solutions that help them collect and contextualise large amounts of differing data, interpret the data for optimisation and emission mitigation strategies, and automate reporting. ■

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Nine key digital solutions in smart cities

Transforma Insights' recent report titled 'Digital Transformation in Smart Cities' identified nine key domains of change that are enabled by disruptive technologies such as the Internet of Things and artificial intelligence. In this article, Paras Sharma, the lead analyst, and Joydeep Bhattacharyya, a content editor at Transforma Insights, examine each of these domains of change and the impact that they can have in real-world deployments

Smart traffic management solutions employ digitally transformative technologies to monitor and control traffic flow in urban centres. They alleviate congestion, reduce fuel wastage and lower CO2 emissions. For instance, implementing well-timed traffic management signals in Chicago and New York could potentially reduce annual CO2 emissions by 655,000 and 14 million tonnes, respectively. Some of the key aspects of smart traffic management are:

- **Smart traffic monitoring**. Previous research by Transforma Insights has found that road traffic monitoring can cut fuel consumption during traffic signal idling by 40%. AI-enabled traffic management systems are increasingly deployed to decrease accidents and congestion.
- **Smart parking and toll management**. Over 25% of vehicles spend 35% of their commute time searching for parking, resulting in 30% of urban traffic congestion and emitting 28 million tonnes of CO2 annually. Smart parking solutions use sensors or AI-enabled CCTV to locate the nearest available parking space.
- **Digital twins for traffic management**. Digital twins can also be used to reduce traffic congestion and greenhouse gas emissions by collecting data from multiple sources to streamline and provide near-time traffic information and forecasts. For instance, Chattanooga (USA) partnered with **Oak Ridge** and the **National Renewable Energy Laboratory** to develop a digital twin model and improved traffic flow by 30%.

Smart streetlights

Smart streetlights enable intelligent lighting in public places using a combination of sensors network connectivity and control systems. These systems can save financial resources and reduce greenhouse gas emissions. For instance, the Indian Ministry of Power deployed around 10 million smart streetlights ▶

Over 25% of vehicles spend 35% of their commute time searching for parking

Environment monitoring solutions include using environmental monitoring sensors to monitor temperature, humidity, various particulate matters and other pollutants

in 2019 and as a result decreased associated carbon emissions by 4.8 million tonnes.

In addition to helping to prevent crimes, smart streetlights can support remote monitoring and maintenance and so reduce manual maintenance and repair work. For instance, San Diego (USA) is saving US$250,000 annually by remotely monitoring the city's 3,000 connected streetlights.

Public safety

Public safety solutions utilise digitally transformative technologies for enhanced security in public areas, driven by rising crime rates and police shortages in urban areas. These kinds of solution can reduce crime response times and improve policing, indirectly cutting insurance claims and property damage.

Police departments often employ predictive techniques when planning policing for high-crime areas, as seen with the Vancouver Police Department achieving 80% accuracy in prediction of, and a 27% decrease in, property crime. Drones can assist in navigating challenging terrain, capturing aerial footage, monitoring crowds, and streaming live events, with the **Swedish Police Authority** for example utilising drones for crime scene documentation, mountain rescues, and crowd control. Robots, such as the **New York Police Department**'s Digidog, can also offer solutions to avoid direct engagement with gun violence.

Waste management

Waste management involves using sensor-equipped smart waste bins to assess fill levels and communicate data to waste management authorities, enhancing collection efficiency and reducing trips. For example, a US university's facility management team cut waste collection vehicle driving time by almost 50% by deploying smart trash cans. In addition, technology-driven waste segregation minimises health hazards by avoiding workers' exposure to hazardous materials. Two key aspects of digitally transformed waste management are:

- **Connected waste bins**. Smart bins with sensors provide real-time waste data, helping to optimise collection processes, reduce overflow issues and minimise collection frequency.
- **Waste processing**. Digital solutions can ensure accurate waste sorting, streamlining and accelerating the process.

Environment monitoring

Environment monitoring solutions include using environmental monitoring sensors to monitor temperature, humidity, various particulate matters and other pollutants. This group of solutions also includes the installation of audio-based monitoring tools to detect noise pollution and events (like gunshots) and share near real-time data with the relevant authorities.

These solutions ensure regulatory compliance with various pollutions directives, exemplified by **Chevron Phillips Chemical Company**'s US$118 million penalty after violating the US Clean Air Act. These kinds of solution offer real-time pollution monitoring allowing for the optimisation of construction progress by managing pollution levels, and can also assist first responders with timely information during emergencies.

Some key aspects of environmental monitoring are:

- **Pollution monitoring in cities and urban areas**. According to the **World Health Organisation**, outdoor air pollution causes 4.2 million premature deaths per year, which underlines the criticality of deploying solutions such as smart traffic systems to reduce pollution levels.
- **Aggression and gunshot detection**. Using sensor-equipped analytical tools can reduce assaults and gunshot detection devices are often employed to prevent gun violence and mass shootings. For instance, **SoundThinking** reports a 36% year-on-year reduction in homicide cases in Pittsburgh following deployment of its solutions.
- **Manmade disaster monitoring**. In California in 2018, approximately 8,500 wildfires incurred a US$148 billion economic loss. IoT-enabled wireless sensors can be used to predict, detect and respond proactively to fire incidents, facilitating timely evacuations of vulnerable residents.
- **Natural disaster monitoring**. In 2022, weather-related disasters caused a global economic loss of US$313 billion and around 31,300 deaths. Companies are implementing machine learning-enabled early warning systems for natural disasters and to quickly identify future seismic activities.

Smart mobility

Smart Mobility includes bike and scooter sharing, micromobility, self-driving vehicles and demand-based routing solutions which are encouraging commuters to shift away from personal vehicles, thereby combatting traffic congestion and the shortage of parking spaces across major cities around the world.

Some of the key aspects of smart mobility are:

- **Bike and scooter sharing**. The US Department of Transportation estimates that bike sharing can cut traffic congestion by nearly 4%, offering a cost-effective, time-efficient solution for cities aiming to ease congestion and public transport burdens. The emergence of low power wide area (LPWA) networks supports the longevity of bikes through maintenance tracking and location updates.
- **Micromobility**. This category includes compact and lightweight vehicles, often operating below 25kmh and with onboard connectivity. The key features of such devices encompass embedded displays, automatic emergency calls, integrated navigation, social media connections, anti-theft systems, performance logging, health monitoring and remote diagnostics.
- **Self-driving vehicles**. Autonomous vehicles can reduce car accidents (according to the National Highway Travel Safety Administration in the USA, 94-96% of accidents happen due to human error) and offer more suitable options for the elderly. They can also reduce carbon footprints since they typically use less harsh braking and acceleration, increase fuel efficiency and can allow platooning.
- **Demand-based routing**. These kinds of solution combine users' travel patterns and public/private transportation data to create dynamic, demand-driven routes, reducing waiting times and traffic congestion. For example, **Go-Coach** in the UK increased vehicle utilisation by 77%, decreased driving hours by 62%, and reduced waiting time from one hour to 11 minutes.

Integrated transport systems

Integrated transport systems support multiple modes of transportation from a unified platform by combining mass transit, car sharing, bike sharing and taxi services using a single interface. This approach can reduce congestion, unnecessary fuel consumption and greenhouse gas emissions.

The three main aspects of integrated transport systems are: ▶

In 2022, weather-related disasters caused a global economic loss of US$313 billion and around 31,300 deaths

Wearable cameras for personal protection involve using body-worn cameras to reduce the potential for violent clashes

- **Consolidating existing transportation networks**. Cities are consolidating public and private transportation into effectively a single platform, enabling users to conveniently book optimised journeys. For instance, Singapore's Land Transport Authority reduced passengers' waiting time by three minutes through use of an integrated transport system.

- **Real-time information on public transport services**. Integrated transport systems provide real-time service information to commuters, so increasing the utility of services and promoting usage. For example, Transport for Wales introduced real-time passenger data, offering live train locations and estimated arrival and departure times.

- **Smart ticketing**. Digitally transformative technologies support migrating towards cashless transactions, which can eliminate waiting times to purchase tickets at ticketing terminals or vending machines and reduces unnecessary paper wastage.

Smart data management

Smart data management involves the use of data portals to consolidate information from various sources to create a unified data source which promotes better data sharing among government departments, local authorities, businesses, and citizens. For instance, the Italian government is utilising Pronto Soccorso Lazio Ospedalis, a mobile application which estimates emergency ward waiting time, identifies less busy hospitals and reduces waiting time. The application can help to guide patients to hospitals that are relatively less busy at any particular time.

The adoption of smart data management ensures quicker information access and reduced data duplication resulting in economic gains. Smart city data portals can also foster innovation, create jobs, boost GDP and promote service consumption.

Wearable cameras for personal protection

Wearable cameras for personal protection involve using body-worn cameras to reduce the potential for violent clashes. They can also serve as evidence in court, reducing reliance on potentially biased eyewitnesses. It has been shown that the use of such devices can decrease the use of force by police and also complaints against officers. For instance, a study revealed that after adopting bodycams, police's use of force decreased by about 10% and complaints against the police fell by 17%.

Bodycams are also being adopted by firefighters (for training purposes and gathering evidence during rescue operations) and emergency medical service agencies. For instance, France wants its firefighters to be equipped with bodycams and the **Cypress Creek EMS** (USA), **London Ambulance Service** (UK), and Australian **South Wales Ambulance** (Australia) have all adopted bodycams.

Smart cities offer a significant opportunity for digitally transformative solutions

Many city authorities have sought to modernise their city infrastructure with the aim of improving the quality of life for their residents. With rising urbanisation, increasing traffic congestion, air quality challenges, and security concerns authorities often feel obliged to introduce technological solutions and so contribute to the evolution of cities into smart cities. Currently, the majority of the world's population resides in cities and most of the world's GDP is generated by urban centres, which puts pressure on generally limited city resources.

To be successful the smart city ecosystem requires a cohesive collaboration between residents, businesses, and the relevant authorities to transform a city into a smart, environment friendly, and secure place to live and work. The adoption of new emerging digitally transformative technologies is a key element of the development of many of today's fastest growing metropolises.

ANALYST REPORT

How intelligence at the edge powers endless optimisation for IoT use cases

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Intelligence at the edge powers endless optimisation for IoT use cases

In the first half of 2024, the pendulum has swung away from cloud obsession to increased reliance on edge intelligence that allows IoT organisations to gather the insights and information that use cases need to operate effectively. That doesn't mean it's time to dump your Amazon, Google or Microsoft stock but it does mean that IoT organisations are more carefully assessing when to utilise cloud. They are looking closely and adopting alternatives to centralised cloud, taking advantage of improved economies of scale, advances in processing capability and the ability to apply artificial intelligence and other processing within their IoT devices ▶

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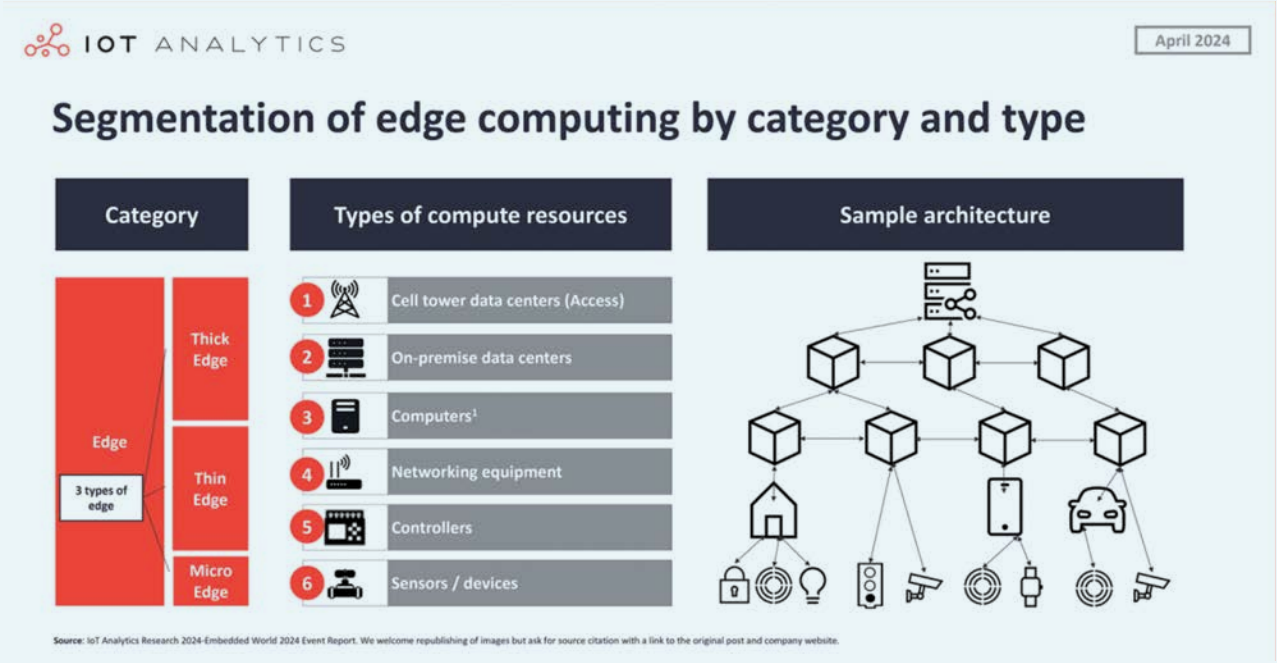


Figure 1: Intelligence has many edges
Source: IoT Analytics, 2024

The right answer isn't always to roll-out massive volumes of dumb devices at the lowest unit cost possible, relying on resilient wireless connectivity and vast public cloud resources to deliver the desired outcome. Instead, today, with increasing regularity, the correct decision is to use the increased processing at the edge and add intelligence either in the devices themselves or in nearby hardware such as smart home hubs or resources at the network edge that can aggregate information and process it to derive valuable insights and outcomes. Not everything has to go to a centralised cloud computing resource for analysis to determine what action to take and then be communicated back to the device. Increasingly decisions can be made on the device or closer to it, reducing latency of roundtrip transmissions.

Edge intelligence reduces network and cloud payloads

Increased analytics outside of cloud data centres is in line with Gartner analyst, Santhosh Rao's 2016 prediction that 'by 2025, 75% of enterprise-generated data will be created outside the traditional data centre or cloud.' It's now clearer that the 'outside' of Rao's vision is composed of intelligent edge devices and vast volumes of data will be created – and acted upon – by these devices.

Had the established practice of sending everything to the cloud continued uninterrupted, IoT development would have been slowed because the network would not be able to keep up with the vast amount of data needing to be communicated in the massive IoT era. On top of this, organisations would face crippling cloud computing costs in the form of network charges as well as unacceptable latency for some use cases. In addition, don't forget that, while cloud itself has offered greater flexibility than monolithic IT infrastructure, it has never been free and power and cooling costs continue to rise.

Devices need to be network aware

The trend away from cloud puts pressure back on IoT device designers who need to add processing capabilities into their devices to power edge intelligence. These devices still need the capability to communicate autonomously, often with both low power, local communications technology and long range, high-bandwidth cellular technology. Alongside that they need processing power and the ability to perform functions via actuators, sensors and application-specific systems.

IoT now starts and ends with the device so designers and developers are looking to boost device functionality with ▶

The trend away from cloud puts pressure back on IoT device designers who need to add processing capabilities into their devices to power edge intelligence

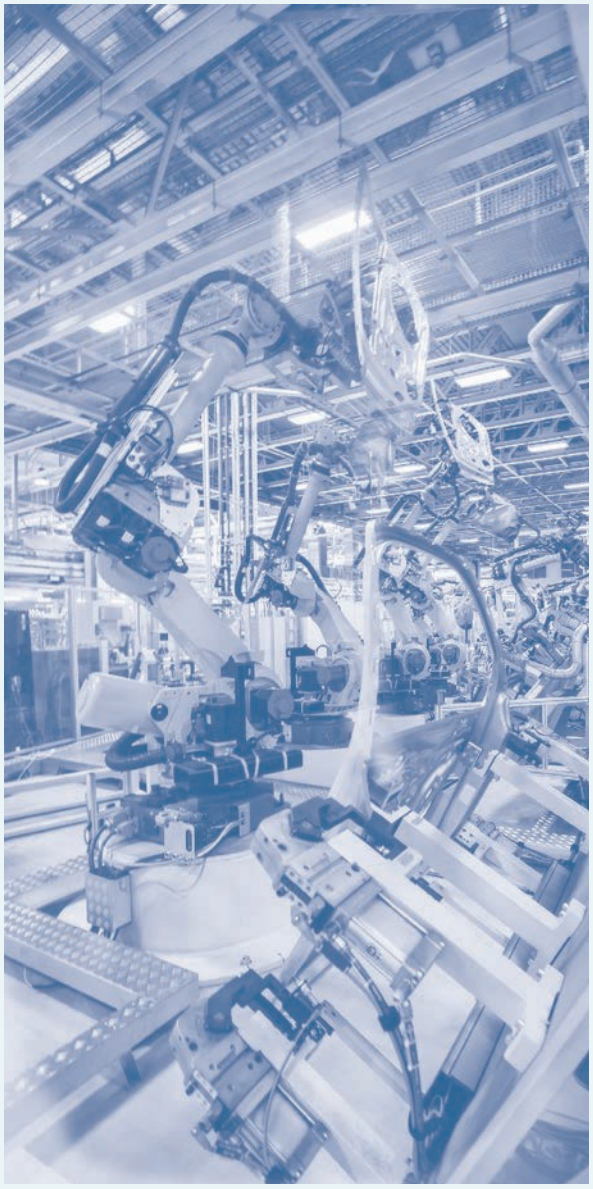
smart modules, multiple connectivity – or radio access technology (RAT) – capabilities, the early application of AI and machine learning and utilisation of more granular sensors that can collect and analyse inputs across multiple data points. These are all essential to create, augment, support and contribute to the overall performance of an IoT offering. A key aspect of this is ensuring that distributed data are able to move around the network as required.

The challenge facing IoT organisations as they adopt intelligence at the edge is also an opportunity. If you think of a connected water sensor, it's counter-productive for data to be sent to the cloud for processing which results in action being taken to sound an alarm. Instead, a more intelligent device can sound an immediate alarm to warn residents of a leak and therefore the sensor needs to have the capability to take the sensor data and trigger an alarm all on one device with minimised latency and cost.

More complex, less urgent tasks optimised

This isn't where the value of the product ends, though. There are other analyses the sensor can perform and non-urgent data that it collects, such as information on monthly consumption or temperature data, can contribute to the overall service value. The optimal blend is to utilise device intelligence at the edge to deal with straightforward, mission critical, time-specific requirements alongside connection to the cloud for processing of additional, potentially more complex but less urgent data that can be combined with other data sets. Depending on the use case, these data may be more complex and require greater compute power or involve processing of larger data sets to derive insights and value.

There's a clear divergence of computing needs between the local, time-sensitive use cases that have a limited processing burden and the distributed, non-urgent value propositions that require in-depth analysis and, potentially, inputs from multiple devices. On-device, edge intelligence, powered by advances such as machine learning, enables that very fast, lighter weight processing to be completed at a cost that is increasingly acceptable to IoT business cases. On the other hand, cloud computing enabled by robust, secure, compliant and trusted connectivity, delivers the foundation for analysing terabits of data from hundreds of thousands of devices and sensors. In most instances, edge and cloud computing can be combined to address deliver different parts of a solution. For example, the water sensor would notify the person in the house with an audible alarm while the cloud would be used to send a text message and provide more



comprehensive analytics on increasing humidity levels that may be an early indicator.

There is, of course, a middle ground in which intelligent edge devices operate to gather and explore data from a network of local devices. Not all of these data go all the way to the cloud, some is processed on these devices, allowing for very cost-effective connected sensors that communicate to the local device, potentially using ▶

Cloud data must be accessible to devices, device data must be accessible to edge computing resources, edge resources must be able to access cloud data and the IoT devices themselves

efficient low power wide area (LPWA) connectivity. As network technologies proliferate, with the addition of non-terrestrial networks (NTNs) to the mix, IoT services can take advantage of different networks in different situations. In a fleet tracking scenario, for example, the vehicle may use an NTN when it is out of cellular coverage, cellular coverage while in a city and Wi-Fi when back at base to upload routine data. IoT is becoming increasingly network-aware with devices and data needing to behave differently according to the network resources available at any given time.

Balance performance, latency, availability and cost

To help enable this intelligent switching between networks to use the most appropriate for a given task, **Eseye** has developed its SMARTconnect offering which includes a range of APIs designed to optimise edge intelligence with connectivity. The network aware API, in particular, provides an IoT application with information on the network state to help it prioritise and transmit data, switching between networks based on availability and signal strength, data volume and frequency, power consumption, compliance and security. While the SMARTconnect system can calculate some of these answers itself, it also needs to be told about information such as the network cost in order to make an optimised decision.

A system that isn't able to assess the full picture, can't hope to succeed. For example, a system could decide that utilising 5G is the best way to upload some video data from an application may break the business case because the – unknown – cost of 5G in that location is more than the fee charged for the service can support.

SMARTconnect has the intelligence to balance out a wide range of factors to arrive at the best network for the use case at that time in that location. It's the opposite of a one-size-fits all approach to IoT connectivity, fitting the best available network to the use case and switching when better options become available. This is simplified because SMARTconnect can work autonomously with no need for real-time instructions from an IoT network. ▶

Right size, not one-size

Effectively right-sizing connectivity for the job at hand and having the flexibility to switch to an alternative when the job or situation changes is integral to enabling edge intelligence. The knowledge that fuels smart connectivity is also applicable to supporting more business, life and mission critical applications across IoT. The same intelligence applied to connectivity can be repurposed to support end-to-end security, compliance and trust and this means complex applications, such as those in healthcare, can be enhanced (**see Case Study p33**).

By knowing how the device is reacting and seeking to ensure relevant data has transmitted to the edge devices or cloud resources that it needs to access, applications can be assured that the network is operating as expected, that the network hasn't been compromised and that regulations for financial services or data sovereignty have not been broken. One example use case is carbon trading. The high value of the sector means that a significant amount of fraud occurs and device authentication, authorisation and encryption are prerequisites.

It is very important for carbon trading participants to have an audit trail that demonstrates end-to-end support for ISO14064-2 and smart software is needed to provide complete auditability for linking devices together. Carbon trading is one of the better known use cases for blockchain and it relies on end-to-end security. In this example, SMARTconnect would have the secure credentials because it not only ensures secure connectivity is provided but also because it has insight into device CPU utilisation, supports IoT SAFE and combines intelligence on the device with local interconnected and breakout traffic to ensure the route taken from the device to the cloud is compliant.

Expanded intelligence at the edge

Recent innovation in the forms of AI, the return to more-than-Moore's Law processor advances and greater network technology choice have transformed the practicality of edge intelligence. This has happened at a time when cloud costs, environmental impacts and security are under heightened scrutiny. It's therefore no surprise that, with IoT set to cement itself as a hyperscale sector, participants are looking to optimise their operations.

Edge intelligence starts with cleverly designed IoT devices that balance cost with capability, form factor and power usage. These intelligent devices connect either to the cloud directly or to edge devices where pre-cloud processing can be performed and action taken locally. The connectivity type and network utilised can now be optimised for the data volume and frequency, the financial constraints and the power consumption of the device – and changed almost instantly to reflect the needs of new requirements. That flexibility and continuous ability to optimise across the networks alongside the entire ecosystem is at the heart of IoT's expanded intelligence at the edge.

Download the AnyNet SMARTconnect™ solution paper

Intelligent connectivity at the edge – a life and death use case

AmericanPharma Technologies monitors pharmaceutical and healthcare environments to make sure they're being operated in a safe and regulatory-compliant manner. Customers purchase its PharmaWatch offering as an IoT based System-as-a-Service software solution, which provides the sensor and communication hardware, data collection and storage. Eseye's market-leading connectivity solution enables the application to operate reliably over cellular networks, guaranteeing a high level of customer service, while unlocking the global data connectivity capabilities it needs to expand beyond the US

PharmaWatch monitors parameters such as temperature, humidity, CO2 concentration and differential pressure for materials such as human tissue, blood storage, organs, corneas and embryos for IVF. It notifies customers if conditions move outside defined limits, with alerting and reporting via an app. It also offers in-depth compliance reporting and business intelligence to prepare customers for regulatory audits, with guidance on how to improve operations.

Wi-Fi connectivity becomes unworkable

Initially, the PharmaWatch environmental monitoring devices were connected to the cloud with Wi-Fi and relied on the customer's own networks to send data. Customers' networks were often much less robust than expected and organisations in the healthcare industry were continuously ratcheting up the security of their networks – with each change there was a risk the PharmaWatch devices would no longer connect.

"We were spending increasing amounts of time fixing connection issues," says Casey Harris, **AmericanPharma Technologies**' chief technology officer. "If connectivity was interrupted, we would collect the data and send it when communication was restored, but that was not ideal."

To address the problem, AmericanPharma developed an early first-generation cellular system which fixed many of the issues it had experienced with Wi-Fi, but unfortunately this introduced other problems. A lack of roaming capability meant coverage was limited to the US, and the system could only operate within the Verizon network. It was also prone to long delays and outages.

"These issues were really putting a strain on our resources and limiting our success," continues Harris. "As our business grew, we need a scalable and less support-intensive solution with near 100% uptime that worked worldwide."

Following extensive research, AmericanPharma chose **Eseye** as its IoT connectivity partner, having found it the most responsive company among those it contacted. "We had many intrusive ▶

"We were spending increasing amounts of time fixing connection issues"

SPONSORED CASE STUDY

"Since working with Eseye, we've recorded an 87.5% improvement in connectivity performance compared to our previous cellular provider and we're working with Eseye daily to make even greater improvements. We have reached 99.6% connectivity which is better than we expected and it continues to get better every day. We now offer the best, most-reliable, world-class system available for our market"

Casey Harris**, CTO, **AmericanPharma.

questions, and put out many hurdles," admits Harris. "Eseye was able to easily pass each one in our quest for the ideal partner. It even put us in touch with one of its current customers so we could ask them directly about their experience with Eseye as a partner."

Unlocking global expansion

Installing Eseye's AnyNet+ SIMs into its devices enabled AmericanPharma to eliminate the barriers that had impeded reliable cellular connectivity, and cellular roaming.

Through its AnyNet Federation mobile network alliance, Eseye has agreements with every major mobile network operator in the world, giving it – and PharmaWatch – access to a choice of more than 700 cellular networks in over 190 countries. Each multi-IMSI SIM can be loaded with multiple network user profiles, allowing the team complete flexibility in the carriers it uses, based on geography, or to take advantage of better data rates, for example. New networks and operators can be easily introduced with a click as new markets are conquered.

Embedding Eseye's new AnyNet SMARTconnect intelligent connectivity software ensures the devices operate every time, and consistently, wherever they're deployed. The software monitors a variety of constraints on the device and selects and optimises the right networks and protocols to suit device performance requirements. If connectivity is interrupted, SMARTconnect keeps data flowing by switching the SIM seamlessly to another network.

The enabling infrastructure behind the AnyNet eSIM and SMARTconnect software is Eseye's Infinity IoT Platform, which provides centralised, detailed oversight of connection and device status across the entire estate. AmericanPharma can manage and optimise connectivity remotely for its PharmaWatch solution, on a device-by-device basis with the platform and make changes and updates to their units over-the-air.

Building connectivity in from the start

AmericanPharma took advantage of Eseye's expert IoT Advisory Services in the early days of the partnership – including device design, device validation and certification assistance – to optimise connectivity and resilience in its existing units, as well as the new ones it was building.

Its monitoring devices use an embedded system, comprising a base board and a communications daughter board. To upgrade its legacy units, the team needed to be able to create a new daughter board with the latest LTE Cat M1 low power wide area cellular technology. "This was a new engineering approach for Eseye, but it was game," remembers Harris. "We were able to licence the software from Eseye for the LTE module, taking advantage of Eseye's deep experience while still using much of our existing system."

AnyNet SMARTconnect provides real business value

Having signed the contract with Eseye in late 2021, AmericanPharma shipped its first PharmaWatch production units in the first week of August 2022. By the end of 2022, more than 1,200 devices were active on customer sites. "This was an exceptionally fast turnaround, in large part because of how good Eseye has been to work with," points out Harris.

In 2022, during the initial phase of commercial deployment, the network operator **Rogers Communications** suffered a massive network outage that affected Canadian customers. While wireless connectivity remained active, the end-to-end data path was down meaning most IoT devices were offline for 19 hours. This was not the case for PharmaWatch, however: all devices with Eseye's AnyNet SMARTconnect and AnyNet+ eSIM embedded recovered connectivity within 30 to 90 minutes, by redirecting traffic over the **TELUS** network. This meant minimum service downtime and disruption for customers.

Listen to the IoT Leaders Podcast episode 'Life and Death: How ± Degree Can Break the Cold Chain'

Download the AnyNet SMARTconnect™ solution paper

ANALYST REPORT

Why utilities select cellular for smart metering projects

The electricity sector is in a permanent state of gradual transformation. A feature of today's transformation has been the increased share of renewable (non-plannable) electricity in the energy mix. According to Enerdata, the share of renewables in the power mix worldwide has increased by 10% since 2010 to around 30% by 2023. Terms like micro-generation, electric vehicles and prosumers (individuals who produce and consume electricity) define a new reality where traditional utilities must update their strategies to meet the challenges of tomorrow. Smart meters, despite their two-decade tenure, remain pivotal for future smart grids.

The feature that puts the smart in smart meter is mainly connectivity. Notably, cellular connectivity has emerged as the go-to communications option for utilities, writes Mattias Carlsson, an IoT analyst at the IoT market research firm Berg Insight ►

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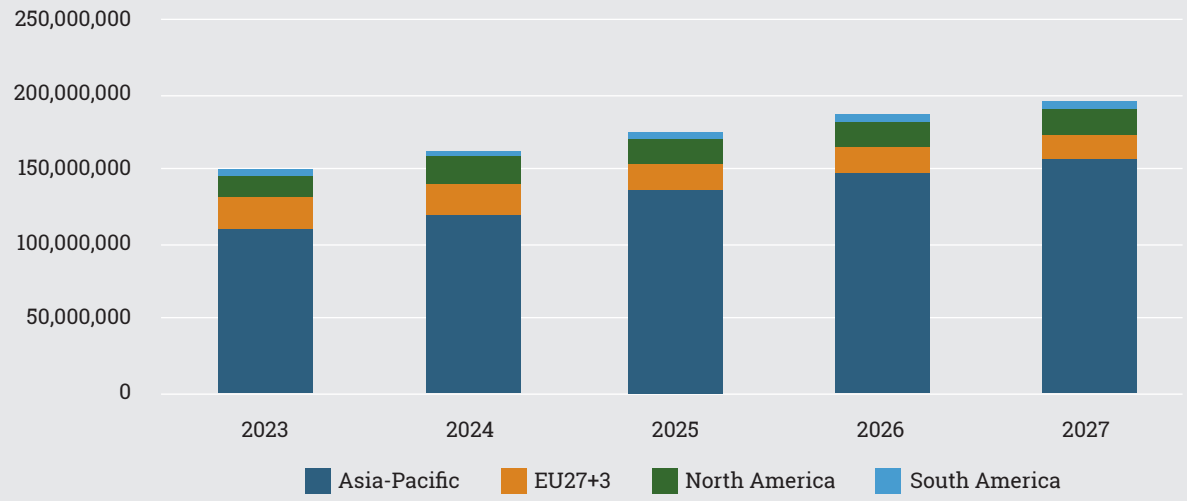

Figure 1: Yearly smart electricity shipment volumes (World 2023-2027)

Between 2019 and 2023, the penetration of smart electricity meters in Europe rose from 50% to 60%. The corresponding growth in Canada and the US was from 65% to close to 80%. By 2027, Berg Insight forecasts that the smart meter penetration rate will exceed 76% and 90% respectively in Europe and North America. In the Asia-Pacific region, East Asian countries are at the forefront of smart electricity metering adoption with China and Japan now having completed their nationwide roll-outs. Meanwhile, the Indian market is set for massive growth in the years ahead as the country ambitiously aims to replace 250 million conventional electricity meters with smart prepaid meters in the coming years.

The adoption of smart metering solutions in the gas and water segments is lagging in comparison to the electricity sector. Countries such as Italy, the UK and France have led the adoption of smart gas metering in Europe and combined boast an installed base of around 47 million smart gas meters, translating to a market share of 84%. Outside of Europe, the market for smart gas meters is growing particularly strong in countries such as China and Japan. The smart water metering market is in an even earlier phase of adoption but is poised for significant growth as utilities continue to upgrade existing infrastructure and implement smart water solutions as a tool to become more sustainable and reduce non-revenue-water.

The status of smart metering in Europe

In terms of market drivers for smart metering adoption, Europe stands out from a global perspective through its history of implementing top-down cross-border smart metering policies. Although EU regulations encourage the adoption of smart metering technology, deployment statuses for the European countries vary greatly as national governments ultimately decide whether to adopt the technology.

Countries such as Sweden and Italy had, for example, completed their smart meter roll-outs before the concept of cost-benefit analysis (CBA) was even adopted. By the end of the last decade, countries such as Finland, Estonia, Malta, Luxembourg, Norway and Spain had also completed nationwide rollouts.

Second-wave installations are now to a large extent either underway or completed in the first-mover markets as the deployed systems have reached their end-of-life. In Italy, **Enel** has paved the way and had by the end of 2022 installed more than 25 million second-generation meters. Among the Nordic countries, Sweden is leading the roll-out of second-generation meters and constituted one of the larger markets in terms of smart meter shipment volumes in 2023. ▶

Large-scale first-wave rollouts are furthermore currently ongoing in a number of other major European countries, including the UK, the Netherlands, Ireland, Belgium and Lithuania. A market that is expected to finally take-off after a multiple-year delay is Greece, which plans to roll-out more than 7 million smart meters out of which 3.1 million are aimed to be deployed by 2026.

Navigating the shift in the North American market

Whereas the European market boasts roughly 310 million electricity customers, the North American market comprises a total of around 180 million electricity customers. The region has been at the forefront of smart grid technology adoption and has more than 140 million smart electricity meters installed. While large-scale roll-outs had already started to emerge across North America in the mid-2000s, the market experienced a major boost during 2009–2013 through the American Recovery and Reinvestment Act.

Adoption has since then progressed at a slow but steady pace and is today mainly driven by legislation at the state or province-level, largely unaffected by competitive market forces. The investor-owned utilities (IOUs) that dominate the electricity sector are subordinate to state regulatory commissions authorised to veto any investment deemed too costly for end-customers. While some states have consistently criticised the benefits of large-scale smart meter roll-outs in proportion to the implementation cost, others have actively promoted smart meter deployments and adopted progressive policies for a green technology transition. As a result, there are significant differences in terms of smart meter adoption across various states.

East Asia's ambitious national roll-out strategies lead the way in Asia-Pacific

Asia-Pacific constitutes the world's largest and fastest growing meter market, having an estimated installed base of more than one billion electricity metering devices.

More than a decade ago, South Korea and China launched national policies for their government-owned national utilities to complete the construction of nationwide smart grids by the year 2020. The latter completed its unprecedented rollout in 2018 after having installed a total of more than 550 million smart meters. In addition, second-wave rollouts have already been initiated due to the roughly seven-year lifespan of Chinese metering equipment.

South Korea's 23 million smart meter deployment has on the other hand been subject to a series of delays caused by a myriad of technical concerns and tendering process issues. Japan, on the other hand, set a target to reach full deployment of smart meters for its 86 million electricity customers by 2025 and the electricity distributors in the country are on their way to complete the roll-outs according to schedule by the end of 2024. ▶

India's ambitious leap – 250 million smart meters on the horizon?

As the smart metering market in East Asia is maturing, attention is now shifting to India. The national government has identified smart grid technology to be a potential solution to fight operational losses. In 2018, the Ministry of Power stated the extraordinary target of reaching nationwide coverage of smart prepayment meters for all 250 million electricity customers by 2025.

Large deployments of smart meters have been ongoing in the last few years, following a lengthy period of pilot projects. The poor financial shape of the state-owned utilities which dominate the market has moreover led the government to go for a business model where a separate government-owned entity aggregates demand from a number of utilities and subsequently procures meters in bulk.

At the end of 2023, close to 100 million smart meters had been contracted but only eight million had been installed. Berg Insight believes that the 250 million milestone will be reached around the end of this decade.

Connecting the smart energy ecosystem

Today, three broad technology groups dominate the smart metering communications market – power-line communications (PLC), radio frequency (RF) and cellular technology. The technology choice varies broadly by region and country. In Europe, PLC technologies such as G3-PLC and PRIME today account for an estimated two thirds of all smart metering installations.

The vast majority of meters installed in North America are in contrast using proprietary sub-GHz mesh or point-to-point RF networking platforms. In countries such as Australia and New Zealand, cellular communications are instead favoured – mostly because of the market-driven roll-out mode characterising these two countries.

Smart metering is a complex enterprise

A smart metering roll-out consists of four distinct stages: i) system design and sourcing, ii) roll-out and integration, iii) implementation and operation and iv) customer education. A considerable part of the system design stage is dedicated to matching the best suited network technology to the project.

Smart metering is a cost sensitive, high-volume application that requires a small footprint networking technology. Gas and water meters in particular face stringent power consumption constraints as they rely on battery power. Network coverage is another critical aspect as many meters are situated in remote or hard-to-reach locations.

When it comes to cellular solutions, one of the first decisions is what standard to choose, for example NB-IoT, LTE-M or another 4G LTE variant. Further considerations have to be given to the selection of an IoT connectivity services provider, what type of SIM solution to use, and how the devices can be managed throughout their lifecycle. ▶

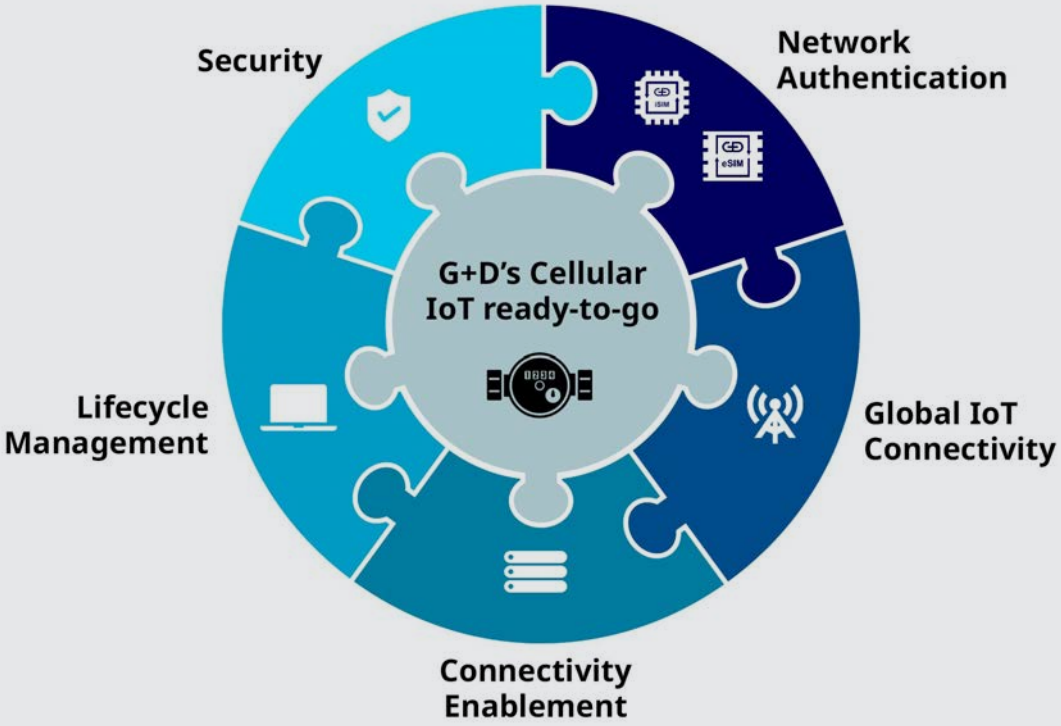

Figure 2: G+D's Cellular IoT ready-to-go for utilities

Remove complexity from smart metering with G+D's cellular IoT ready-to-go

Giesecke+Devrient (G+D), a leading company in eSIM development with a growing IoT connectivity business, aims to simplify connectivity for smart meter and utility customers in the electric, gas and water space. The main components of G+D's cellular IoT ready-to-go offering include network authentication, IoT connectivity, connectivity enablement, lifecycle management and security.

- **Network authentication:** G+D's SIM solutions are tailored to address the diverse needs of IoT applications, providing various form factors and SIM generations, including iSIM, eSIM and pSIM, along with hardware variations designed for specific applications, such as automotive, industrial and consumer use cases.
- **IoT connectivity:** G+D offers mobile connectivity as a service for a variety of IoT use cases, tailored for specific regions or used globally. The company covers 185 countries and cooperate with over 600 network operators. IoT data connectivity options encompass NB-IoT, LTE-M, LTE, 5G and satellite networks compliant with the 3GPP standards and provide coverage in remote areas. The connectivity can also serve as a backup or function as global bootstrap connectivity (GBC) when the device is initially activated to load the final subscription at the device's location.
- **Connectivity enablement:** G+D's AirOn360 RSP platform empowers the digital connectivity journey with iSIM and eSIM management, which allows you to download your purchased iSIM/eSIM to your device and activate it. It is best-in-class and ensures the highest levels of availability as well as geo-redundancy. The company also offers solutions for various device categories that comply with both the latest and legacy RSP standards, including SGP.02 (M2M), SGP.32 (IoT), SGP.22 (Consumer) and SGP.42 (In-Factory Profile Provisioning).
- **Lifecycle management (LCM):** G+D's AirOn360 IoT Suite facilitates diverse applications for the remote management of IoT devices throughout their connectivity lifecycle. This includes functions like OTA campaign management, as well as applet administration. With their hybrid, multi-tenant management platform, IoT devices can be administrated individually or collectively as entire device fleets.
- **Security:** G+D's IoT security features protect data generated from cellular and non-cellular IoT devices, ▶

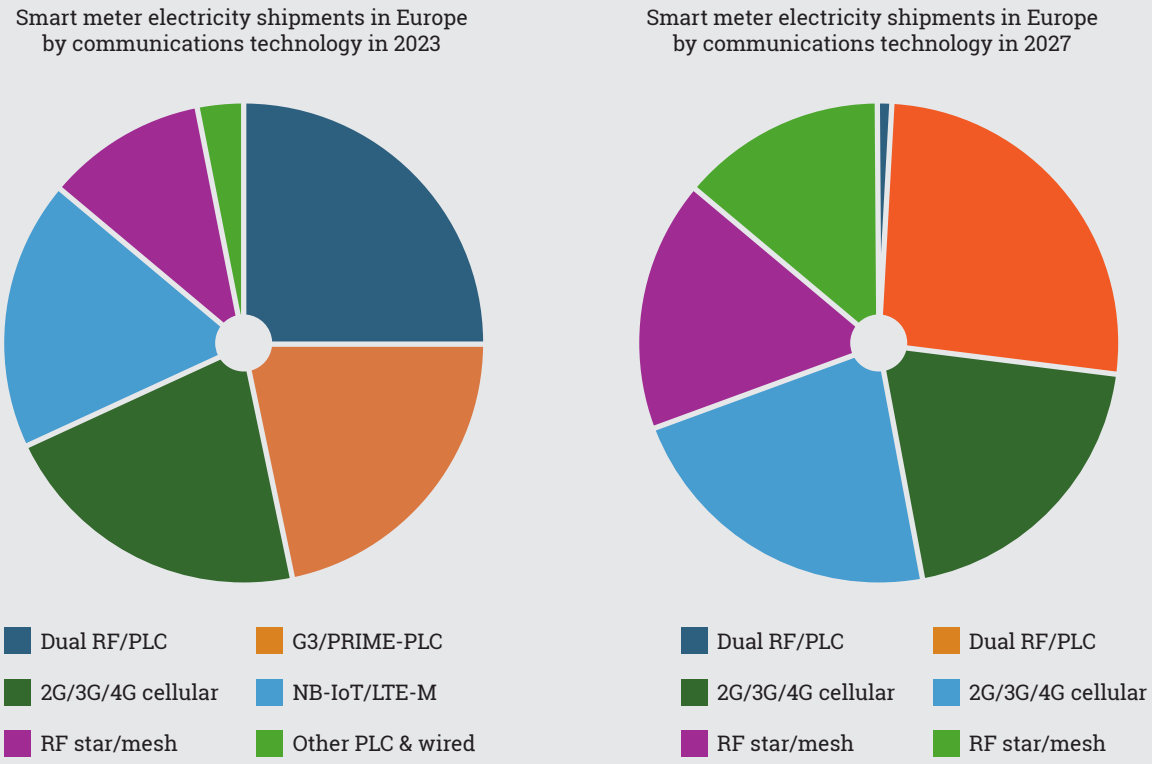

Figure 3: Smart electricity meter shipments in Europe by communications technology 2023 and 2027

with its platform covering both the backend and SIM software. This 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.

Smart meter communications in the mid-2020s and beyond

The rapid development of new technologies for the IoT space has a major impact on the smart metering market. Utilities planning for new smart grid projects and roll-outs in the mid-2020s have a wide range of increasingly sophisticated wireless technologies to choose from. 3GPP-based LPWA technologies such as NB-IoT and LTE-M are increasingly gaining traction in Europe, Asia-Pacific and the Americas. Optimised for cost-sensitive and mission-critical IoT applications, these technologies eliminate some of the main drawbacks which have held back wider adoption of cellular communications in the smart metering space.

In Europe, the major Dutch utility **Enexis** started using **KPN**'s LTE-M network in 2020 for the majority of the remaining installations in its smart meter rollout for 2.6 million customers. Similarly, **Fluvius** in Belgium is rolling out 2.9 million smart meters using NB-IoT connectivity. In Sweden, two thirds of the meters that will be deployed during the country's second-wave rollout are anticipated to be using NB-IoT/LTE-M connectivity.

Interest in 3GPP-based LPWA technologies is also visible in Asia. The adoption of NB-IoT across multiple verticals in China is spreading into the country's smart metering segment. A preference for NB-IoT communications has also appeared in the tenders issued by **EESL** in India. Government led deployments in the country are expected to favour the technology. In future, Berg Insight expects that adoption of 3GPP-based LPWA technologies will be strong particularly in the mid- and small-size utility segments, which to a greater extent can benefit from the increased deployment flexibility that point-to-point communications enable. ■

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IoT to hit 40 billion connections and (almost) US$1 trillion in 2033

Transforma Insights analysts have been forecasting the Internet of Things market opportunity for over a decade. Back in 2011 our analysts' expectation of 12 billion IoT devices by 2020 was close to the bottom of the league table of predictions but proved to be easily the most accurate. Today, as Transforma Insights, our team continues to provide the most extensive and deeply researched forecasts of the IoT, making ours the benchmark against which all predictions of IoT market growth should be compared. In this article article, Matt Hatton, the founding partner of the firm, presents the key findings of its latest annual analysis

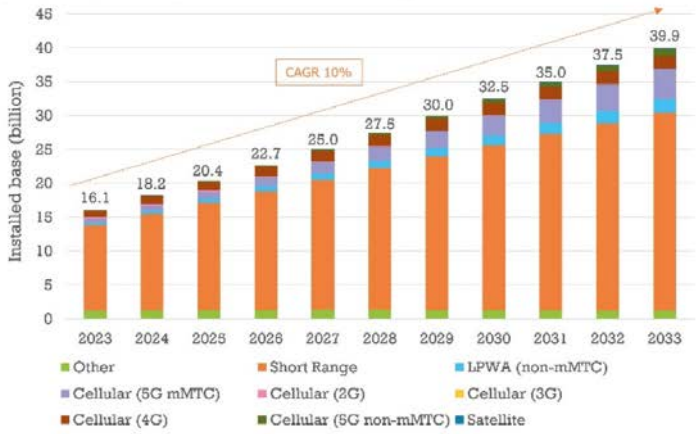
At the end of 2023 there were 16.1 billion active IoT devices, a figure which will grow to 39.9 billion in 2033, at a compound annual growth rate (CAGR) of 10%. In 2033 the consumer sector will account for 61% of all connections. Of the enterprise segment in 2033, 35% of devices will be accounted for by 'cross-vertical' use cases such as generic track-and-trace, office equipment and fleet vehicles, 24% by utilities, most prominently smart meters, 22% by retail/wholesale (predominantly payment processing devices and electronic shelf labels), 7% by government, 4% by transport and logistics, and 3% for agriculture. The single biggest use case is Consumer Internet & Media devices, accounting for 32% of all devices in 2033. The next largest is smart grid, including smart meters, representing 11% of connections. ▶

TRANSFORMA INSIGHTS Global advisors on the Internet of Things

Learn more: Join our annual global IoT market forecast update webinar on 13th May. https://transformainsights.com/events/iot-forecast-webinar-2024

Global IoT connections forecast, 2023-33

[Source: Transforma Insights IoT Forecast Database, 2024]



Technology	CAGR 2023-33	Leading applications
Satellite	25%	Track & Trace, Container Tracking, Drones, Military, Assisted Living People Tracking
5G non-mMTC	43%	Vehicle Head Unit, Smart Watches, CCTV, Road Fleet Management, E-Bikes
4G	7%	Vehicle Head Unit, Electricity Smart Meters, Road Fleet Management, Smart Watches, CCTV
2G/3G	-18%	Smart Meters, Emergency Call, Smart Grid, EV Charging, Track & Trace.
5G mMTC	22%	Track & Trace, Smart Meters, White Goods, Fire & Security Alarms. Stock Level Monitoring
LPWA (non-mMTC)	19%	Smart Meters, White Goods, Crop Management, Public Space Lighting, Track & Trace
Short Range	9%	Electronic Shelf Labels, Headphones, Building Lighting, Televisions, Building Automation
Other	0%	Smart Meters, Public Space Lighting, Crop Management, Connected Glasses, Fire Alarms

The Transforma Insights IoT Forecast is based on a comprehensive analysis of 243 applications spanning the entirety of the IoT market opportunity. Forecasts cover 196 countries, with metrics including connected devices, annual shipments, RGUs, technology split, public vs private network split, vertical sector, and revenue (hardware, connectivity and services) all accessible via the online Transforma Insights Forecast Database. All connections are counted based on their highest embedded technology. Cellular (5G mMTC) includes NB-IoT, LTE-M and subsequent future evolutions. LPWA (non-mMTC) includes LoRaWAN, Sigfox and other unlicensed technologies. Short Range includes Bluetooth, WiFi, Zigbee and other similar technologies.

The main thing to note is that there is no 'hockey stick'. There are sometimes a few fast growing markets, for instance the requirement for all cars in Spain to be equipped with a connected beacon will trigger very rapid adoption over a short period of time. But that is the exception rather than the rule, and the diversity of IoT means that such rapid growth markets are counterbalanced by those with longer time horizons. Furthermore, inertia in many markets and the dependency on user replacement rates (such as buying new cars) also act to maintain a steady linear growth.

Connectivity technologies in transition

Short range technologies will dominate connections, growing from 12.6 billion in 2023 (accounting for 79% of connections) to 29.3 billion (73%) in 2033. This reflects the fact that most IoT devices are consumer electronics and are deployed indoors, and thus typically have ready access to a private (usually Wi-Fi) network.

Cellular connections will grow from 1.9 billion at end 2023 to 7.5 billion at end 2033. A lot of Transforma Insights' focus is on wide area connectivity, and it is interesting to track the trajectory of the various generations of cellular technologies.

In total, 5G will grow from 650 million to 5.5 billion connections over the forecast period. The majority, 4.4 billion, will be using massive machine type communications (mMTC) technologies, predominantly comprising NB-IoT and LTE-M, both of which are nominally 5G technologies and are future-proofed to be supported on 5G core networks. Today China strongly dominates the 5G mMTC market due to extensive NB-IoT deployments. It accounted for 73% of the deployed base at the end of 2023, although by 2033 its global share will fall to 43%. The biggest use cases will be Track & Trace, smart meters and white goods. By 2033 there will be 1.1 billion 'full' 5G New Radio, or 'non-mMTC', devices up from 30 million today. The biggest 5G non-mMTC use case is vehicle head units, accounting for 41% of connections in 2033.

The use of 4G will peak in 2032 at 1.9 billion connections, after which we expect it to decline. 2G and 3G will gradually be phased out over the forecast period too. By 2029 we anticipate no shipments of devices where 3G is the highest technology, and 2G shipments will be just over 100,000.

As well as cellular-based low power wide area (LPWA), i.e. the 5G mMTC described earlier, we also track unlicensed technologies such as LoRaWAN and Sigfox in our 'LPWA non-mMTC' category. These will grow from 361 million connections in 2023 to over two billion connections in 2033. The combination of the two categories of LPWA, both mMTC and non-mMTC, will amount to 6.5 billion devices in 2033, or 22% of all IoT devices, up from 8% today.

We should note that the generation splits as described above relate to the highest embedded technology.

Almost a trillion dollar market by 2033

In revenue terms, the total IoT market (defined as including connectivity modules, value added connectivity, and core associated applications) in 2023 was worth US$335 billion, a figure which will rise to US$934 billion in 2033. Value added connectivity will account for 10% of spend in 2033, with the connectivity modules accounting for a further 4%. The remainder is accounted for by what we term 'Service Wrap', i.e. the value of the IoT application that rides on top of the connection, such as fleet management or a security alarm service.

In financial terms, the biggest vertical sector is consumer, generating US$290 billion in revenue in 2033, or 31% of the total market value. Cross-vertical applications account for 22%. The remaining 47% is sector-specific applications across sectors such as energy, transport, retail and healthcare.

Geographically, China, North America and Europe dominate, accounting for 32%, 21% and 19% respectively of the total value of the IoT market in 2033. ■

Matt Hatton
Transforma Insights

Short range technologies will dominate connections, growing from 12.6 billion in 2023

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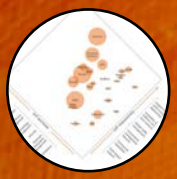

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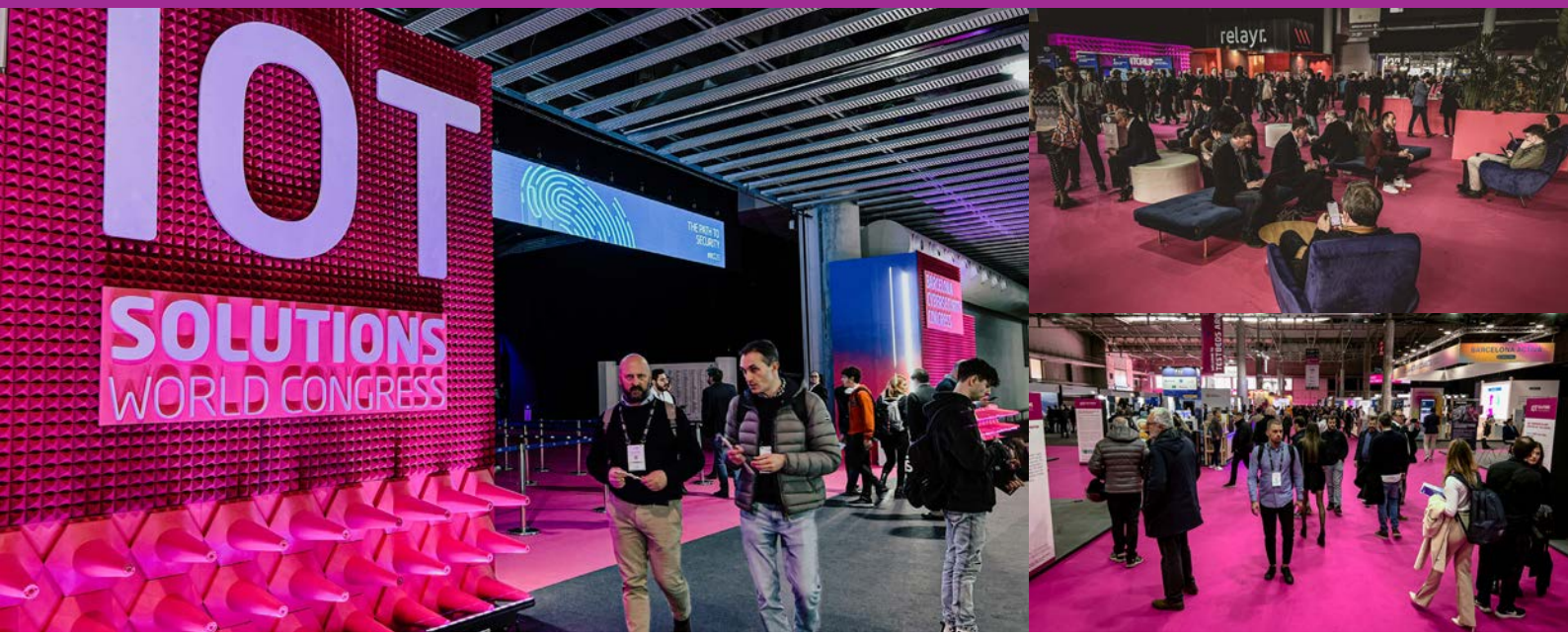
IoT Solutions World Congress Awards selects 18 finalist projects

A total of 18 projects from Germany, Saudi Arabia, Spain, the United States, Bulgaria, India, Italy, the Netherlands and Sweden have been shortlisted for the IoT Solutions World Congress Awards, which will be presented at the leading event on the transformation of industry through disruptive technologies. The jury of experts has judged the most outstanding initiatives in the modernisation of manufacturing production, energy, smart buildings, healthcare, mobility and cybersecurity



In the Best Smart Manufacturing Industry Solution category, which rewards companies that have transformed their processes by incorporating digital technologies, the nominees are Barcelona-based **Diprotech**, which has deployed IoT sensors throughout its facilities, integrating real-time operational data to optimise its processes; Germany's **Henkel-Loctite Pulse**, for a smart solution to monitor equipment and detect any incidents instantly; and India's **Tata Chemicals**, which has created an IoT-based, AI-driven digital twin to improve the sodium carbonate manufacturing process at its Mithapur plant in India.

The nominees for Best Energy and Utilities Solution are Madrid-based technology company **Barbara Tech**, which has developed a system for predictive modelling of chemical reactions in water using edge computing for 69 desalination plants worldwide; oil company **Saudi Aramco**, for two robots for hydrogen mining and exploration; and Spain's **Repsol**, for deploying an IoT system that reduces maintenance costs at its more than 3,200 oil stations.

As for the best solutions for smart buildings and cities, the finalists are the Bulgarian company **MClimate** for its radiator thermostat for any type of building that reduces the CO2 footprint; the Indian firm **GrydSense**, for its Omnos solution for the management of all types of buildings; and the Dutch company **Allorado**, for its Gateway project, a network for smart building management.

Healthcare, mobility and cybersecurity

In the field of healthcare, the finalists are the mobile application **SkinGuard**, which detects skin disease in its initial phase by the Spanish company **Topazium Smart Medicine**; the Catalan spinoff **Maxsens** for its musculoskeletal detection system to correct incorrect postures in sports; and the US company **CenTrak**, which has designed a real-time hospital management system.

Solving mobility problems is the objective of the connected transport and intelligent vehicles category, in which **Cafler**, a Barcelona start-up that has developed an online platform for managing vehicle-related procedures; **Helloauto**, a Catalan online insurance company that offers the insured an automatic accident detection system; and the Brazilian company **Effortech Technology**, which has designed satellite communication devices, have been nominated.

Finally, in the category of best cybersecurity solutions, the candidates are Sweden's **RIoT Secure**, with a wide range of tools and control solutions for IoT devices; Germany's **Infrafon**, for its smart card for secure user authentication; and Italy's **Muscope**, which has launched Risk, its cybersecurity rating platform for any company and supply chain.

The IoT Solutions World Congress Awards will be presented on 22 May in the Auditorium of the event, which, organised by Fira de Barcelona, will be held from 21-23 May at the Gran Via exhibition centre with the presence of more than 300 exhibitors and a line-up of 250 speakers and experts who will participate in 125 congress sessions.

Our pick of the IoT industry's upcoming events

IoT Solutions World Congress
21-23 May 2024
Barcelona, Spain
https://www.iot-now.com/event/iot-solutions-world-congress/

Enterprise Generative AI Summit
21-22 May 2024
Milpitas, California, USA
https://www.iot-now.com/event/enterprise-generative-ai-summit/

5th Edition Connected Africa
22 May
Johannesburg, South Africa
https://www.iot-now.com/event/5th-edition-connected-africa/

GITEX Africa
29-31 May
Marrakech, Morocco
https://www.iot-now.com/event/gitex-africa/

CDAO Canada Public Sector
4-5 June 2024
Toronto, Canada
https://www.iot-now.com/event/cdao-canada-public-sector-2024/

AI & Big Data Expo North America
5-6 June 2024
Santa Clara, California
https://www.iot-now.com/event/142249/

The Digital Transformation Week North American
5-6 June 2024
Santa Clara, California
https://www.iot-now.com/event/the-digital-transformation-week/

IoT Tech Expo North America
5-6 June 2024
Santa Clara, California
https://www.iot-now.com/event/iot-tech-expo-north-america-3/

GEO Business 2024
5-6 June 2024
London, UK
https://www.iot-now.com/event/geo-business-2024/

AI Hardware & Edge AI Summit Europe
18-19 June 2024
London, UK
https://www.iot-now.com/event/ai-hardware-edge-ai-summit-europe/

Viasat ELEVATE Global Partner Event
18-19 June 2024
Carlsbad, California, USA
https://www.iot-now.com/event/viasat-elevate-global-partner-event/

DTW24 – Ignite
18-20 June 2024
Copenhagen, Denmark
https://www.iot-now.com/event/dtw24-ignite/

MOVE
19-20 June 2024
London, UK
https://www.iot-now.com/event/move-2024/

Connected Manufacturing Forum
25-26 June 2024
Atlanta, Georgia, USA
https://www.iot-now.com/event/connected-manufacturing-forum-2/

Wireless Private Networks for Business:
Practical Steps Towards Deployment

5G Private Network projected revenue growth:

23%

per annum 2022-27.

PLUS

According to the GSA* customer deployments

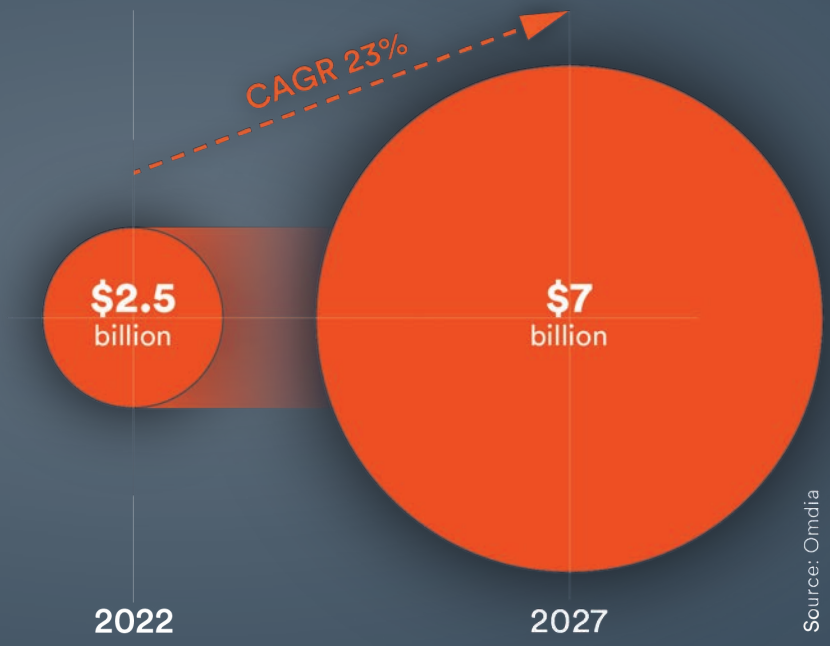
28%

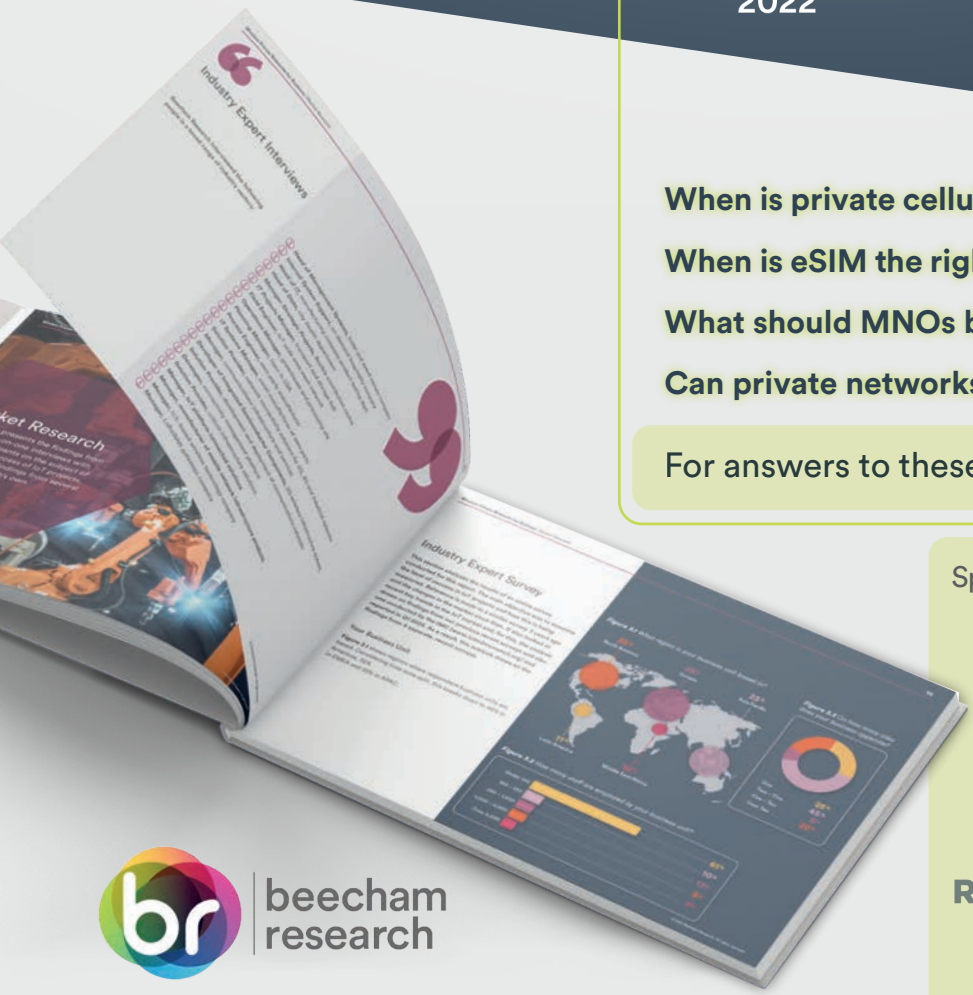
increase in 2023 alone.

Private networking is at last on the move.

*Global mobile Suppliers Association

Projected Revenue Growth for 5G Private Networks





When is private cellular cost effective for small sites?

When is eSIM the right solution for private networks?

What should MNOs be considering?

Can private networks address the Digital Divide?

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