SIMPLY CONNECTED

Issue 8
Through the IoT Looking Glass

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TELE2
INTERNET OF THINGS

10x10x10

While the concept of machines providing direct contact stretches all the way back to the mid-1800s when the telegraph – aka the first landline – was introduced, the Internet of Things wasn't officially named until 1999. More than a decade later, IoT came into its own, with 2013 deemed The Year of the Internet of Things. It's when companies began waking up to the opportunities IoT could bring and how it could enable and transform business.

2013 is also the year that Tele2 IoT was founded. Since then, we have grown from the 'little engine that could' to a top ten European player when it comes to global cellular connectivity. As we've grown, so too have our customers, who today have devices deployed in nearly every country on earth.

We like to say that no matter whether you're operating in five cities or on five continents, we've got you covered. We're ready to support you with world class global cellular connectivity, related services, and a dedicated IoT team so that you can successfully digitalize and manage your business, whether you are just starting your IoT journey or are taking it to the next level.

10+ years, 10k+ customers, 10+ million connections – around our offices we call it IoT love.

The Tele2 IoT Team

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Using Our Strength as a Swedish Company

At Tele2 IoT, we see being based in a country of ten million people as a strength and an advantage. After all, Sweden is known for punching well above its weight in a lot of areas, including design, sports, and even pop music. We're also known for our attention to detail, along with quality and easy user experience. Our strength as a Swedish company, with our Swedish values around transparency and logic, means that in just ten years we've gone from a small Nordic company to a top ten player in Europe when it comes to global cellular IoT connectivity.

The southern European market is the most mature IoT market in Europe, primarily because of the number of big groups operating there. They started their IoT journey a bit earlier, which allowed them to grab a big chunk of the market. Over the course of time, though, those operators haven't had time to update themselves – and they carry the heavy burden of legacy.

There is a complement between the Nordic cultures and southern European cultures, rather than a clash. We Swedes may not be flashy, but we are reliable – and we always deliver what you ask for. That said, our team is international, with employees operating in most regions of Europe, which means they understand the local business culture – and the local language. We like to say that we're small enough to care – and we're big enough to deliver.

If you would like to learn more about how we can help with your IoT solution, please feel free to get in touch.

> As we strengthen our ties to Europe, our relatively late entry into the market means we've not only leapfrogged over some of the early challenges of IoT, we are also not carrying that burden of legacy. Instead, we are able to address our customer's needs swiftly and aggressively – and we don't go into revenue protection mode when a longtime customer wants to leave.

Yvonne Strömberg
Head of Acquisition Sales Tele2 IoT

Without Connectivity There is No IoT

Without connectivity there is no IoT – it is the foundation upon which everything else is built. But connectivity has evolved and today there are a wide range of connectivity alternatives, which can make it challenging to understand which one is right for you.

Back in the early days of IoT, cellular connectivity technology was pretty simple: you popped a SIM card into your device and used 2G data or SMS. 2G was stable and offered a simple way to transport small amounts of data for the high value use cases that were first addressed.

Today, the number of devices has skyrocketed, and use cases are much more varied, so it makes sense that connectivity would evolve. This evolution drives complexity in IoT, both on the device side and the connectivity side. And as new technologies emerge, others are being retired. It is crucial that your connectivity provider is not just able to meet your needs today but is also preparing to meet them tomorrow.

Power consumption
Power consumption can play a critical role, depending on your business. Will your devices have a constant power source, or will they run on battery power? Will the batteries be rechargeable? Can they be easily replaced? LTE-M and NB-IoT are conservative on battery power and have battery saving possibilities such as PSM (Power Saving Mode) and eDRX (Extended Discontinuous Reception) which reduce power consumption by reducing the responsiveness of the device. By securing good coverage where the device is located and limiting the communication, battery power can be saved.

Coverage
Some IoT solutions need deep indoor coverage, while others are on the move. We are used with having cellular network coverage almost anywhere and the newer IoT technologies like LTE-M and NB-IoT allow for better and more coverage than what is provided today.

Bandwidth & latency
Different factors will affect your choice of technology. Does your IoT solution require high data output with low latency, or will you be transmitting small amounts at regular intervals? There is a vast difference between CCTV with its high usage and bandwidth requirements, charging stations that need to be instantly activated, and temperature sensors with regular sensor readings. LTE and 5G support low latency, high bandwidth, while LTE-M and NB-IoT support low cost and power consumption.

Cost
IoT solutions include multiple cost points, such as subscription and usage fees for connectivity, the device, the need to visit the device regularly, and, in some cases, even running your own last mile network. Make sure you are getting the connectivity you need at a total cost that fits your budget.

Most operators today offer a connectivity management platform (CMP) to manage your cellular connectivity. The right CMP can help you ensure that your connectivity costs are under control during the lifetime of the device.

Reliability & security
For almost any IoT solution, reliability and security are crucial, particularly when it comes to mission critical solutions. When selecting connectivity technology, make sure your provider can provide a reliable and secure network service.

Long-term Support
Most IoT solutions rely on devices that are functional for a long period of time, so choosing the right supplier can make all the difference. Cellular operators offer services on licensed frequencies that are backed by GSMA and 3GPP. While 2G and 3G networks are being retired, LTE and 5G will be around for many more years. LTE-M and NB-IoT are forward compatible in 5G and will have long-term support in the industry.

When looking at IoT connectivity technology you should consider a number of factors including bandwidth capacity, coverage, and power consumption, along with what you need in connectivity both today and tomorrow.

CASE STUDY

The World's First Autonomous Electric Passenger Ferry

Leveraging 5G & IoT to revolutionize urban transportation

For many city residents, ferries lie at the heart of everyday life, offering a quick and convenient way to get around the city while avoiding traffic-snarled streets. But while ferries are a part of many city transportation schemes, too often those ferries are still powered by highly polluting marine diesel. To put it into perspective, each year ferries transport nearly as many passengers as the airline industry and cutting carbon emissions across the board has become a priority, both because residents are demanding greener cities and regulations and laws are requiring it.

his is where Norwegian company Zeabuz, together with their partner Torghatten, has a solution. Their new ferry, the MF Estelle, was launched in Stockholm in the spring of 2023, and it is the world's first autonomous electric ferry, built with sustainability at its core – and powered by 5G and IoT.

"What makes Zeabuz different is that we are fully electric, so we have zero emissions," says Carl Petersson, Autonomy Engineer, Zeabuz. "We are trying to create a network of small electric ferries that are autonomous and that can travel short distances in cities, with very frequent departures. This will create a quick, convenient, and green mobility system to serve city residents."

The MF Estelle has the capacity to carry 24 passengers per trip. In Stockholm, that trip takes passengers from the island of Kungsholmen, where City Hall is located, across Lake Mälaren to Stockholm's biggest island, Södermalm, in just seven minutes. If you made that trip by public transport or car, it would take twenty minutes or more, depending on traffic. But twenty-four passengers aren't really a lot in a city of one million, so one way to counteract relatively low passenger spaces on the ferry is to increase the frequency of trips, as well as the number of ferries running.

"Running four or five smaller vessels along the same route means we can compensate for capacity needs, while also creating a better service by offering more frequent departures, similar to the way a subway system runs regularly – if you miss one ferry, another one will be along in a few minutes," says Carl Petersson.

Infrastructure

Zeabuz chose to deploy smaller ferries for a very practical reason: the technology available today makes it very difficult to electrify larger vessels in a viable way. A bigger vessel needs a bigger battery and the bigger the battery, the heavier the vessel. The only way to make larger vessels work today would be to fit them with smaller batteries and charge at each stop, something that would have a big impact on departure frequency. Basically, the infrastructure isn't there yet, so the company needs to work with what is available.

"Our design criteria were clear from the start: we needed to run the ferries throughout the day without needing a charge. Instead, they charge overnight when the ferry isn't in service, using the charging infrastructure already available. While there are advances being made around charging and battery size, it could be five or ten years before batteries are light enough for bigger boats. By making smaller, very energy efficient ferries, we can get the boats in the water and the mobility system in place, while also

> Our business objective is to enable widespread sustainable waterborne mobility through our autonomy solutions, combined with electrification and smart operational concepts.
>
> **Carl Petersson**
> Autonomy Engineer, Zeabuz

> We want to make it really convenient to travel by water in cities like Stockholm, which are built on or alongside waterways, making it an obvious way to get from one point to another.

preparing for what will eventually be possible."

Charging isn't the only area where Zeabuz is focusing on energy efficiency. The MF Estelle is a catamaran, which is very energy efficient by design – and it's also made from carbon fiber in order to further reduce weight and thus energy usage.

Autonomy & technology

What makes everything possible is autonomy. The largest cost for public ferries is manning them – a ferry captain's salary is nearly twice as much as a bus driver's and requires a longer education (five years in Sweden.) Additionally, a lot of captains in Sweden are nearing retirement, while at the same time fewer people are going into the industry.

"Even when they do go into this line of work, many are not that interested in driving smaller, short-distance ferries in the middle of the city, so the autonomy aspect solves a lot of challenges," says Carl Petersson. "But we can't take humans out of the loop entirely – that just isn't feasible in the long run."

"With one captain monitoring everything remotely, they can step in when needed and take over the vessel remotely, something that would not be possible without 5G capabilities," says Carl Petersson. "You need 5G because you can't have any lag – not even a second or two of delay. 5G allows you to have instant control and instant feedback – we would never be able to run an autonomous ferry without 5G – it is essential."

Currently, remote monitoring of MF Estelle is one way communication, from the ferry to the company. Eventually, two-way communication will be implemented and 5G will be vital to that enablement. And that is where Zeabuz is working with Tele2 to meet the demands of that next move.

"Tele2 is a leading player in the connectivity industry, and we need a company we could rely on and that can meet our needs," says Carl Petersson. "Of course, we com-

pared Tele2 to competitors, but in the end Tele2 has been more willing to act as a partner. We are creating something new and have very high standards on connectivity, particularly because of the remote controlling of the boat. This means Tele2 also has a stake in making this work and we believe that Tele2 is the partner that we can do this with together, instead of another company who might give us what they have but that is not willing to go those extra steps to ensure success. We know we have a real partner in Tele2 and the team we've been working with, particularly Linda Ekener Mägi, who is so passionate and intelligent about her work."

Data is stored in Zeabuz's offices in Trondheim, Norway and at the moment they use two different SIM cards for 5G. One sends small points of data around remote operations, such as current position. The other one is turned on when they want to remote in and grab data and do things like upgrades.

"Basically, we bag all data from a couple of crossings a day, which is a lot, and then we use that data to look into how the autonomy system is operating. Right now, we use it for development, but it could be used in the future for predictive maintenance or other things, but at the moment we're totally focused on autonomy."

Regulations & safety

Zeabuz has been running a research project since early 2023 and are now having a meeting with Transportstyrelsen (The Swedish Transport Agency), who are responsible for the final approval, which is needed since this is entirely new technology.

"They are very positive towards remotely operating and controlling the vessel, although of course passenger safety is the number one concern. Technically, the bar is very high, which is good," says Carl Petersson. "So, we're working with ensuring passenger safety remotely from shore and we will likely end up having a person onboard each vessel who is not educated to drive or handle the vessel, but who is educated in passenger safety, such as how to handle life vests and life rafts. In an emergency situation, everything will be handled remotely by the captain, so the person onboard is to act as assistance, similar to what we already have on the train system in Stockholm – a person who works with the passengers separate from the driver of the train. It's someone who can react quickly and calmly in case of emergency. What we have found is that people react very positively to autonomy, but not as well to unmanned, which are two different things."

> Zeabuz is working towards creating a 'mobility network', with several vessels serving the same route, and that will be overseen by one captain who performs all remote operations.

Zeabuz have launched the world's first automated ferry service in Stockholm

Sustainability

"Boatplan Stockholm" is a program to convert all Stockholm ferry traffic to and from the city's archipelago to 100 percent emission-free operations, with electricity or hydrogen as fuel. While this is an ongoing initiative, Zeabuz is something of a gamechanger in the city's evolution to an environmentally sound and green city.

"There's no reason not to and the tools are there to make it possible, so it was never even a question for us. Sustainability is the way forward, because it's just where we are as a society," says Carl Peterson.

The future

Since the launch of the MF Estelle in the spring, Zeabuz has garnered a lot of attention from around the world. The launch in Stockholm unleashed articles across the globe, from the Nordics all the way to Australia.

"We are really showing people that is possible now and you need to think about this when doing city planning going forward because it's going to make life easier for your residents," says Carl Petersson. "Many cities already have inner-city ferry systems, but many are out of date or using old technology

> For us, if you're going to create a new mode of transportation these days – or create anything, for that matter – you are of course going to do it in an environmentally friendly way.

which is often highly pollutant. Our ambition is to expand to the entire world.

"Our main challenge is getting down the cost of the vessels – we need to get the economics of scale into this picture – so we're in the middle of negotiations with one of the world's largest ferry building companies and they are very eager to get this going. They can see that this is the future, and we all know that the way to get the price of production down is to mass-produce them, just like you would do with buses or any other kind of transport."

Zeabuz is also in discussions with a number of cities around the world who have seen what they're doing in Stockholm and are interested in how this could become part of their city's transport scheme.

"There are a lot of requirements in play around meeting sustainability goals and those regulations will only get stricter, so our solution fits perfectly into what a city needs to do to meet those requirements and regulations around sustainability, as well as meeting the demands of citizens. This is also a very cost-effective way to do this. It's not like you have to build a new road or bridge – the water is already there, so it's relatively small money. A number of municipalities have already reached out to us and we're already in deep discussions with them."

As Zeabuz goes global, 5G will be necessary for the autonomy of the ferries. With Tele2 expanding its 5G roaming footprint, those requirements around autonomy will be met.

AI & IoT: How These Technologies Work Together

In today's business world, IoT (Internet of Things) has moved from 'nice to have' to 'must have' due to the tremendous amount of data being captured from multiple sources, leading to a host of benefits, including improved processes, cost savings, streamlined operations, and increased customer satisfaction.

According to the International Data Corporation, the total data generated by 2025 is expected to be around 175 ZB, with roughly 80 ZB attributable just to IoT devices. This presents two challenges: 1) Not all data is created equal, meaning a fair amount of data collected isn't useful, and 2) processing that data efficiently isn't easy.

This is where AI (Artificial Intelligence) comes into the picture. AI, machine learning, generative AI – they all fall under the same umbrella of artificial intelligence. And by combining AI's data analysis capabilities with IoT's extensive data collection, organizations can make data-driven decisions, optimize operations, and improve efficiency across their business much more quickly and efficiently.

To put it simply: IoT collects and transmits the data, while AI has the power to unlock that data much faster than a human can. The combination of these two disruptive technologies creates and enables extremely powerful end results that have the potential to revolutionize industries, businesses, and economies:

Operational efficiency
AI takes the constant stream that IoT devices extracts and detects patterns and anomalies that devices are not capable of doing. Machine learning coupled with AI can predict operation conditions and detect parameters to be modified to ensure ideal outcomes. AI-enabled IoT offers insights into which processes are redundant and time-consuming, and which tasks can be fine-tuned to enhance efficiency. AI processes large volumes of data received by connected devices and identifies similarities in patterns faster and more accurately than humans. This means you can maximize time, resources, and effort.

Data preparation
While IoT devices collect and transfer data with no eye towards what is relevant and what is not, AI can sift through and select useful data, presenting relevant and insightful information, while leaving aside what isn't useful. AI can also assist in optimizing data labeling – adding tags, labels, or names to raw data, which allows a machine learning program to better understand and utilize information.

Faster analytics
Bringing AI and IoT together means data has less distance to travel before it's usable. This is because many large data centers are often situated in a different region than your business, which means your information has to cover a lot of ground between origin, processing, and application, which in turn gives you latency issues.

Better risk management
AI-enabled IoT helps businesses to both understand and predict a broad range of risks and automate a prompt response. The classic example of this involves employee safety. Equipping workers wearable smart devices connected to a database allows those devices to collect data on things like location, temperature, worker vital signs, etc. That data is then transmitted to a central point for processing and analysis. If a worker's vital signs are reaching a dangerous level, AI-enabled virtual assistants can send an alert to the worker or management and avoid a potentially dangerous outcome.

Improved customer satisfaction
Prioritizing customers' needs and keeping customers happy is at the heart of every business. Unfortunately, any number of factors can contribute to customer dissatisfaction. Today, though, more and more businesses are recognizing the value of AI

> IoT deals with devices interacting using the internet. AI allows those devices to learn from their data and ‘experience’.

by implementing chatbots to not just interact with customers and address their needs, but to also utilize enormous amounts of data offer a far more personalized experience based. There are two kinds of chatbots: the first is based on AI and thus is more complicated, with the ability to evolve, while the second is based on a fixed set of rules that mean limitations and the inability to grow on their own.

Conclusion

The scalability and adaptability of AI and IoT complement one another. Combining the two technologies offers immense potential for driving innovation and transformation in a variety of industries. The number of connected devices will continue to grow and with it the amount of data.

IoT provides the infrastructure and connectivity to collect and transmit data, while AI algorithms are ideal for handling the increased complexity and volume of data, extracting meaningful insights and making sense of it at scale. By leveraging the unique capabilities of AI and IoT and letting them work in harmony, organizations can unlock new levels of automation, efficiency, and decision-making. And as both AI and IoT evolve, both individually and in conjunction with one another, the impact will help shape future intelligent systems.

AI & IoT Functional View

CASE STUDY

Curosense: Combatting the Caregiver Shortage

Connected healthcare for better outcomes

All over the world, the healthcare industry is facing a sizable caregiver shortage, one that is only expected to worsen in the coming years. According to the Global Coalition on Ageing, across OECD countries, the number of elder care workers will need to increase by 60% by 2040 to maintain the current ratio of caregivers to patients – which means that roughly 13.5 million new care workers will be required in addition to those already working in the field.

The shortage of care workers means additional solutions will be required – and they're already being implemented. Curosense is a Sweden-based connected care company whose customers are relatives to anyone who is getting older or is vulnerable in some way, who lives by themselves or in a couple where your partner or other loved ones are concerned about care.

"It's important to understand the scope of the problem and why our solution is crucial to addressing challenges both today and, in the future," says Pär Sydow, Co-founder and CEO, Curosense. "In Sweden alone, roughly 1 out of 5 people over the age of 18 years (1.3 million out of 10 million Swedes) have the primary responsibility for caring for parents who still live in their homes, something that puts a lot of pressure on everyone – because when I say 1.3 million, I mean they have taken on the responsibility of taking care of their elderly relatives, something that is really the responsibility of the municipalities – but the municipalities don't have enough resources to take on everyone."

The solution

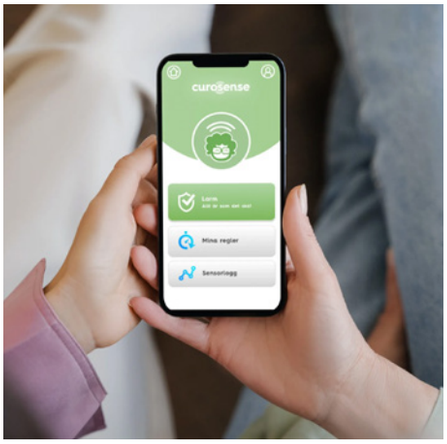
The Curosense solution is based on motion sensors and an innovative system with, among other things, 'passive alarms.' The idea is that whoever has Curosense sensors in their home will trigger a proactive alarm when their activity pattern changes over time or, whenever it deviates from individually set parameters.

The device is also suitable for caretaking facilities and can be used in all resident's rooms. So, you have the alarm for the resident, but also an alarm for the caretaker where you put in alarm details where you can say something like 'let me know if mother is awake and out of bed by 9am'. If she is you get a green light, if she isn't you get a red light. Basically, you set the different types of alarms for throughout the day, so if dad is going out to dinner and is expected home at 9pm, you can set a one-time alarm that will ping you when he gets home, which can be crucial.

"It is both a proactive alarm and an active alarm, depending on what is needed at any given time. This is something needed by caretaking companies and home support provided by municipalities," says Pär Sydow. "In many regions people live in remote areas and it's a challenge to reach everyone physically and it's a big burden on the care workers to go from home to home to check on people – but it's an inefficient system. In the morning they need, for example, 50 people to check on the elderly, but only ten in the afternoon. With Curosense they can check the app and see who needs attention first because maybe 40 have a green light and ten have a red light – you can check the indicating red light first."

Curosense is also introducing statistics to the app, so subscribers will get bi-weekly

> The care recipient gets a bracelet with an alarm button and can select themselves who gets the alarm on the Curosense phone app – this could be a care worker, a relative, a friend – and you can have a broad set of alarms that go to one or multiple persons.



or monthly reports that tell them that, for example, they have the alarm set between 8 and 9am but their mother is always up before 8, so Curosense can suggest they narrow or change the window for a better view.

"You can't ask for specific stats, but you can check yourself things like if your father has a visit to the bathroom every night," says Pär Sydow. "He might look tired but tell you that he sleeps well – the app can tell you that he gets up to use the bathroom 6 times a night, which could not just tell you his nighttime habits but also alert you to a bigger problem – this information could also act as an indicator of other, perhaps bigger health challenges. This is where the potential to look at trends emerges. If Agneta is no longer getting up at 8am and instead has gotten up at 9 or 10 am for a few weeks, is this because she's out late or is there an underlying problem?"

Why IoT and cellular connectivity?
There are reasons Curosense moved from an ethernet broadband supply to IoT and the cellular network. Historically, people think it's more secure to have a wire in the wall but having used mobile networks and WiFi it's clear to Curosense that it's better to have a SIM in the devices.

"It's very rare that a phone doesn't work or doesn't have coverage or if it doesn't work there is something wrong with your phone, not the network," says Pär Sydow.

The truth is that more people than you'd think are very adverse to technology and don't want to hassle with WiFi. SIMs and cellular connectivity – it's how we're moving forward as a society. Just look around you and you will understand that IoT and SIMs are everywhere.

> Our solution is financially viable, meaning the cost is not prohibitive for most. It is a clean solution, so we're not canabalizing anything and our products are very scalable.

"Another reason we moved to IoT and cellular connectivity is that while we had an expectation that the cost of SIMs would be high, it turns out the price was much lower than expected, so it became a completely different commercial game for us. And thirdly, when looking at our product roadmap we're going to go for bracelets and other types of sensors soon and if we were to rely on ethernet and ports, etc. we would not have a successful future – you can't wear a bracelet that's connected to ethernet. And it's good to have a company like Tele2 IoT to partner with because of the global footprint, something that will be very important as we expand into other countries. Tele2 IoT also has a good entrepreneurial mindset and that is important to us as we move forward."

The future
Curosense is currently working through three channels: the public sector and care giving companies, partners and resellers and, direct to consumers.. They had originally started off looking at a straightforward business plan, kicking off in Sweden and then moving into other markets as they learned from their experiences in Sweden.

"We learned quickly that it's a good idea to scale in Sweden and then move into other markets, such as the UK, where the requirements are similar to Sweden, with the difference that there has traditionally been a lack of support from the local councils for a long time," says Pär Sydow. "And in the UK, it's one out of two who have the responsibility for elderly or care recipients, unlike one out of five here in Sweden, so they have big challenges. We're also looking to potentially expand in other countries in Europe."

While competition might be greater in other markets, there are surprisingly few who deliver this kind of solution to the consumer market. Those other solutions can be significantly higher in cost and many of competitors offer technology products that Pär Sydow says are not fit for purpose. Curosense is a solution that is easy to use and doesn't require any tech knowledge.

Curosense has several new products on the horizon. One is a bracelet that will have only two buttons, one with an alarm and the other giving you the ability to speak to your preassigned person.

"We are also adding a camera in order to enhance things. If mom falls and you can't reach her, a camera will help you get an immediate picture of what is happening in her home, and it can also help identify trends. We see ourselves as becoming the go-to point for home health solutions because we are quite unique in our solution – it's a solution that is robust, proactive, and carried by the mobile network, and it is adapted to address elderly care."

As IoT Technologies Evolve, Security Remains Crucial

At the moment, there is a lot going on in the IoT landscape, including mobile operators shutting down old technology environments like 2G and 3G to create new space for the latest technologies, including 5G, LTE-M, and NB-IoT.

This is being done in order to create a more connected world where providing information is seamlessly integrated with our daily lives. From temperature readers and dishwashers to parcel delivery and EV charging status, it all starts with connecting these devices and providing information in a secure way. But is it really secure? Security both for today and for the future should be near or at the top of the list when you're deploying, yet far too often, we see it being treated as an add-on.

Some things to consider in order to enable a future proof, secure, and manageable deployment:

Evaluate your current deployment

- Is your communication secure?
- Are you using a legitimate device?
- Are you getting future firmware updates regularly?
- How robust is the SIM environment (is it easy to remove the SIM from the device, particularly if it's remote or otherwise out in the field)?

Start or continue building your IoT/M2M solution based on your evaluation

Once you've completed your evaluation and gotten insights, this is where you start your deployment on a small scale, testing, and then rolling out. That might work if this is a new deployment, but what about one that has already been rolled out? If it's all legacy hardware the best way forward may be to aggregate it from the newest deployment. Another option: if firmware is not available after X number of years, you might want to consider switching out hardware.

Make sure your IoT solution is future-proof

Roll out small, test, don't forget about 'can I upgrade firmware remotely'. Ask yourself: Do I have challenges doing this and how can I solve that before I mass deploy my devices?

Let's look at the devices you are using

Are they future proof, built with the latest firmware, and able to connect with the latest technologies like e.g., 5G, LTE-M and possibly NB-IoT?

What about the data transmitted from the device to your platform or vendor? Is it connected using the internet and do you want to review your connectivity? Reach out to us for other – possibly smarter – ways to connect your deployment to your datacenter or Cloud.

You should also look at the way you control your connectivity in you Connectivity Management Platform (CMP). Is it secured by 2FA (two-factor authentication)? Ask yourself is users are administrated in a good way. Your account manager can explain the benefits of 2FA.

When you first deploy, security is often the last point on the roadmap. It might be better to consider making it the first point on the roadmap, so that you ensure that your solution is safe and secure. We are always happy to guide you in the right direction, such as where you can start to roll-out quickly, and how you can test and add the security features along the way to make your deployment future-proof even before you start your project.

Why eUICC Matters for Global IoT Connectivity

Since the start of cellular IoT, when it was still referred to as M2M, IoT devices relying on cellular networks for connectivity have used traditional "UICC" SIM Cards (Universal Integrated Circuit Card). UICC SIMs are "static", meaning that after manufacturing there is no way to replace the operator on the SIM. In the recent years however, technology advances have brought us the next generation of SIM Cards, namely the eUICC SIM (Embedded Universal Integrated Circuit Card).

With eUICC, it's no longer 'put the SIM card in the device, and what it is at deployment is what you get for the rest of the device's lifetime' – eUICC SIMs take things to the next level: you can download profiles, change operator, or even have multiple operators on the same SIM, something that isn't possible with traditional UICC SIMs.

eUICC is a functional concept for remotely managing SIM profiles, bringing benefits to both the IoT device and the entire deployment. At its very core, eUICC is a software component running on a specific type of SIM hardware that allows you to store multiple operator profiles and switch between them remotely. The physical SIM contains a profile for initial connectivity and is placed in the devices before deployment. Additional profiles can then be downloaded and managed remotely throughout the device's life cycle. This means that you can change your operator or service provider without having to physically change out your SIM cards, something that can be both costly and logistically challenging, particularly for enterprises who have large-scale, global IoT deployments, as well as those who have deployed hard-to-reach devices. Additionally, eUICC SIMs are available in all standard form factors, meaning that switching to eUICC-enabled SIM cards is possible without the need to completely change your device.

A single SIM for multiple global deployments

Previously, when deploying IoT with traditional UICC SIMs, you needed to understand where your devices would end up in the world so you could install SIM cards with the carrier profile needed to operate in those regions. This could cause complications in your supply chain because managing different SIM with different operators add significant complexity to your manufacturing and logistic process. With eUICC, once your devices are out in the field, remote provisioning allows you to set them up with the carrier profiles best suited to serve your connectivity needs. So, instead of having multiple different SIM cards in the same device in order to, for example, facilitate optimal roaming in different markets, eUICC means you need just one SIM that enables you to activate the optimal profile for the country you're in even after deployment.

The main benefits of eUICC SIMs include:

Simplicity: you only need one SKU to manage global deployments

Flexibility: through the ability to change the active operator throughout your device's lifecycle.

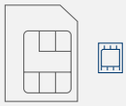
Resilience: against changes in roaming regulations, such as the introduction permanent roaming

Future proofing: through access to both existing and future Tele2 eUICC based services

Hardware characteristics

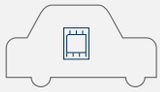
Commercial UICC SIM

Originally introduced in 1991, the Commercial SIM is a removable hardware used in consumer devices. It stores one profile, enabling identification and authentication with selected mobile networks



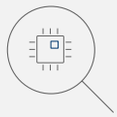
Premium Industrial SIM

Early 2010's the Premium Industrial SIM was developed. UICC represents a significant evolution in SIM card technology, primarily driven by the growing demands of industrial sectors. Traditionally, SIM cards were developed for consumer mobile devices, but as industries increasingly adopted IoT, the need for specialized SIM solutions emerged. At Tele2 IoT, this SIM has been phased out to make room for eUICC.



Automotive SIM

Specialized SIM for vehicles, enabling connectivity for navigation, infotainment, diagnostics and telematics. Ensuring a more secure communication with great security and reliability by taking various security measures, including authentication, encryption, access control and more secure protocols. Tele2 IoT's automotive SIM has the eUICC functionality. The SIM has data retention time of up to 17 years and is AEC-Q100 certified.



iSIM (integrated SIM)

iSIM uses the current UICC functionality (iUICC-integrated UICC) in a new formfactor that is integrated in the module. So iSIM is more of a new formfactor then new functionality. This innovation simplifies device design and when the eUICC functionality (ieUICC – integrated embedded UICC) is launched for this formfactor, remote provisioning capabilities for modern connected devices will be enabled.

Deep Dive Into an eUICC Premium Industrial SIM

To the naked eye, there isn't much difference between consumer and IoT/M2M SIMs. The SIM in your mobile phone looks pretty much like the SIM in an IoT device, but there are critical differences. Your phone SIM is a commercial UICC plug-in, while an IoT device is enabled to remotely manage subscriptions and has space for a removeable SIM is using an eUICC plug-in SIM. So, while they may look the same, the capabilities of eUICC SIMs are revolutionary for the IoT market - and the most secure eUICC formfactor on the IoT market today is the embedded SIM.

Let's look at the different layers of an eUICC SIM and how those layers need to match in order for the SIM to work.

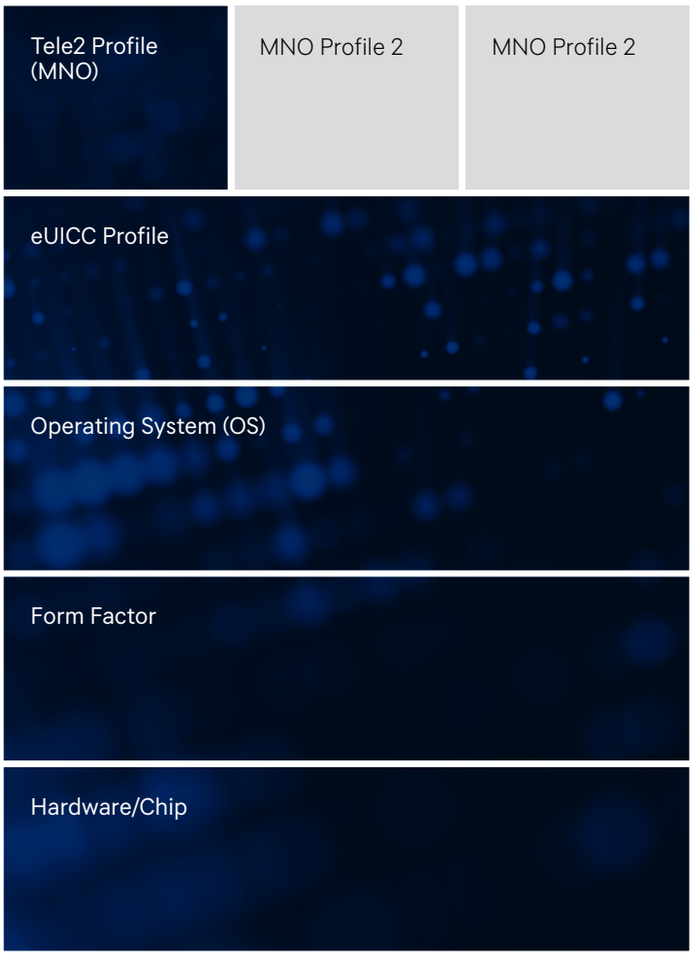
How are the layers linked together?
The hardware Operating System (OS) and electrical profile work like a minicomputer, with the different layers needing to be compatible for the SIM to function correctly. Not just any OS with work with any hardware, though, and it's the hardware and OS compatability that decides if a SIM can support eUICC functionality.

eUICC functionality allows the SIM to remotely download, switch, and enable a different profile. This means there is no need to physically change the SIM – you can switch between different profiles in the same MNO, or from one MNO profile to a different MNO profile.

The Operating System
In addition to matchnig with the hardware, the OS supports important features on the SIM. If there is a PIN active on the SIM, the PIN handling is in the OS, as are authentication, access, and management of files and data, along with loading and deleting applications. Encryption/decryption and tamper proof functions are also handled in the OS.

One eUICC profile, many MNO profiles
An eUICC SIM has one eUICC profile but can store multiple MNO profiles, although only one MNO profile will be enabled at a time. So, what are these profiles?

The Tele2 (MNO) profile and eUICC profile are personalizations



SIM technical sheet

Description of environmental property	Environmental property letter
Operational and storage temp.	T
Moisture/Reflow conditions	M
Humidity	H
Corrosion	C
Vibration	V
Shock	S
Data Retention time	R
Minimum Updates	U

of the SIM. They contain network keys and subscription identifiers (IMSI, ICCID, authentication keys.) The Tele2 profile can either be personalized when the SIM is produced in the factory, or it can be downloaded later through SM-DP (Data Preparation)/SM-SR (Secure Routing).

Profiles can also contain applets, which are small programs on the SIM dedicated to fulfilling a particular task. This could be implementing the business logic to change a connectivity profile based on rules, such as when one network is not available and you want the next best available one.

If the SIM has a local applet, this is stored in the Tele2/MNO profile. If it's a global profile it will be in the eUICC profile. To provide interoperability applets are typically developed in JAVA. Today, Tele2 IoT has an applet that clears forbidden networks, and in 2024 local management and management of 5G standalone on eUICC will be launched.

What is unique in an eUICC SIM?
Every eUICC SIM has an EID (eUICC identifier) which is the administrational key in the hardware layer. If there is an MNO profile change the SIM will have a different ICCID and IMSI, but once the eUICC SIM is produced its EID is never changed.
The EID contains 32 digits compared to the ICCID's 20. There is a shortened version of the EID printed on both the embedded and plug in eUICC chip.

The EID is provisioned in the SM-SR, which is also responsible for managing the status of profiles on the eUICC.

Hardware and form factors
When using a SIM that has eUICC capabilities it is important that the hardware is robust and long lasting. ETSI has a classification of the different environmental properties in which the SIM is graded.

On a SIM technical sheet (see above), the environmental performance can be represented in a string, together with which version of ETSI specification was used. The string of letters can then be looked up to understand what the SIM can withstand.

For example, the environmental property temperature has the grades TS, TA, TB, and TC. The Premium Industrial SIM is graded as TB in its ETSI string while a commercial SIM is graded TS. The eUICC Premium Industrial SIM can be stored and operational in the temperature range of -40 °C to + 105 °C ,while the UICC commercial SIM can only be used in the temperature range of -25 °C to + 85 °C

As mentioned before there are two types of SIM cards: plug-in form factors (2FF, 3FF, 4FF) that are removable, and embedded form factors that are soldered into the device. The most popular embedded SIM on the IoT market is the MFF2 (M2M Form Factor).

As the abbreviation applies the MFF2 SIM is designed for M2M/IoT use cases and is delivered on what looks like an old film reel. It is one of the most secure chips due to being soldered into the device and the device can be designed in a way that makes it more robust in general. An embedded SIM is also a greener alternative to plug-in SIMs, with less plastic and metal per SIM.

We Are Trying to Tackle Climate Change Over Here – Can all Other Sustainability Problems Please Wait?

In Sweden we are famously good at queuing: we queue to get onboard the bus and at the check-out in the supermarket. One thing at a time, patiently waiting in line seems to suit us. Can this also be applied to some of the big, existential challenges that face us? When it comes to fighting climate change, do other sustainability problems have to get in line and wait their turn?

On the day this piece was published, in just 6 years and 56 days we have to reach net zero emissions if we are going to achieve the target of the Paris Agreement to limit global warming to 1.5 degrees Celsius. Add to that record high concentrations of CO2 in the atmosphere, sea levels rising by 26 centimeters since 1880, and 30% of the polar ice caps having disappeared since 1970. As there is overwhelming evidence that we must act quickly, there is increasing support from both businesses and governments to decrease the negative climate impact that we have as societies, companies, and individuals.

Currently 70 countries have committed to reducing emissions to net zero by 2050, covering 76% of global greenhouse gas emissions. More than 3000 companies are also engaging with the Science-Based Targets initiative to set ambitious climate targets in line with the latest climate science, including Tele2, which has committed to net zero emissions by 2035. At the same time, we run the risk of creating new sustainability problems in our attempts to reduce our negative impact on the climate. This could both be negative environmental impact, for instance increased use of various resources, such as raw materials or energy, or negative social impact, for instance on working conditions somewhere along our global value chains, such as occupational health and safety for workers or the use of child labor.

As the need for data centers continues to grow, so will the energy consumption. For instance, the International Energy Association estimates that in Denmark the energy consumption for data centers will increase six times by 2030 and will by then account for almost 15% of the country's total energy consumption.

This presents us with a problem that is becoming increasingly common as sustainability and sustainable business practices are gaining momentum: goal conflicts. This is not new to sustainability, and it is not unique to sustainability. Societies, companies, and individuals face goal conflicts every day. Should society invest more in healthcare or schooling? Should companies invest more in R&D or in upskilling employees? How do we weigh and value different aspects of these conflicting goals? And what kind and what level of negative impact can we tolerate?

This brings us to an axiom for sustainable business: "increase positive environmental impact, decrease negative social impact while growing the business". When that is applied to our industry, we have to ensure that data centers are run and managed in a way that decreases their negative impact on people and the planet, so that we can harness the effect for sustainable transition that they can provide.

Let me be clear, data centers are not sustainable, and will not be sustainable for many years to come. However, the output that we can get from data centers is so valuable in enabling a transition for businesses and societies to become more sustainable through for instance smart cities, smart energy, smart working, smart transport, smart agriculture, and smart manufacturing, that the trade-off will be worth it. Having said that, it does not mean that we have carte blanche to do business-as-usual in data centers. We must

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For businesses, data centers are essential to powering smart IoT solutions that enable the shift to more sustainable business practices, such as video conferencing or smart energy systems. At the same time, data centers around the world currently cause emissions of greenhouse gases that equal the emissions from the global aviation industry, mainly caused by energy use.

Erik Wottrich
Head of Sustainability Tele2 IoT

do everything we can to make sure that we run data centers that are more sustainable than those of the past (and present). We do that by using 100% renewable energy, employing efforts to increase energy efficiency, aggregating hardware to reap rewards of large scale operations, using free-cooling instead of cooling systems using refrigerants, using excess heat on-site or provide it to district heating systems, and at the end of the useful life of hardware ensure that it is re-used, refurbished, reconditioned or, if none of that is possible, broken down into components and recycled to decrease the extraction of new raw materials in nature.

Innovative technology based on connectivity will be one of the greatest enablers in ensuring that we can tackle climate change. We just have to make sure to minimize the underlying negative impacts on people and planet that this technology may have. That way we can manage one of the great goal conflicts that faces our industry today, so that we can tackle climate change without having to ask other sustainability problems to wait in line.

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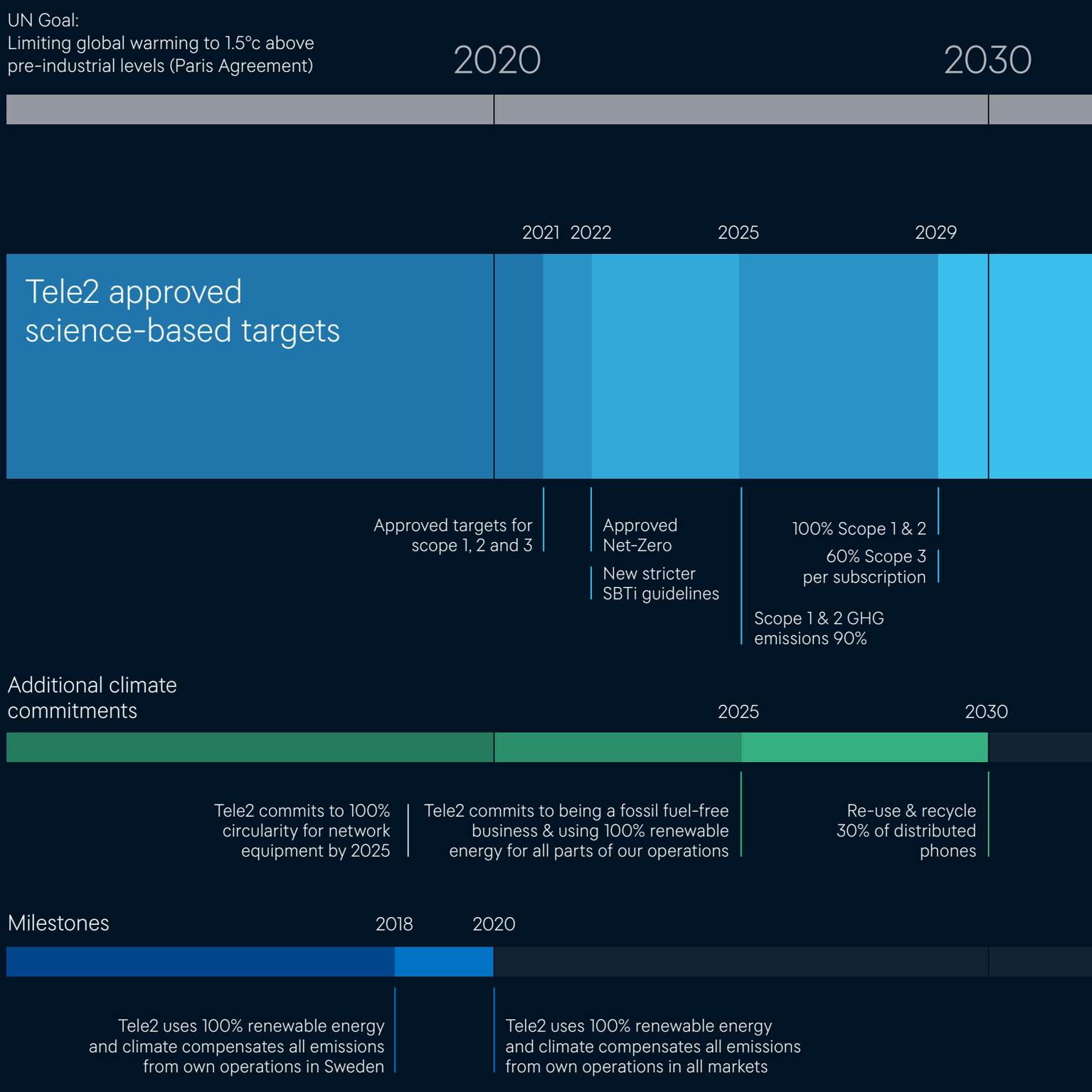
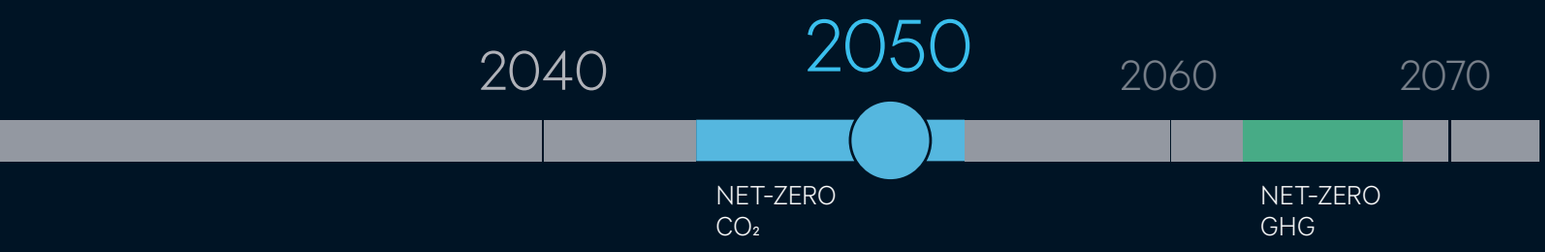
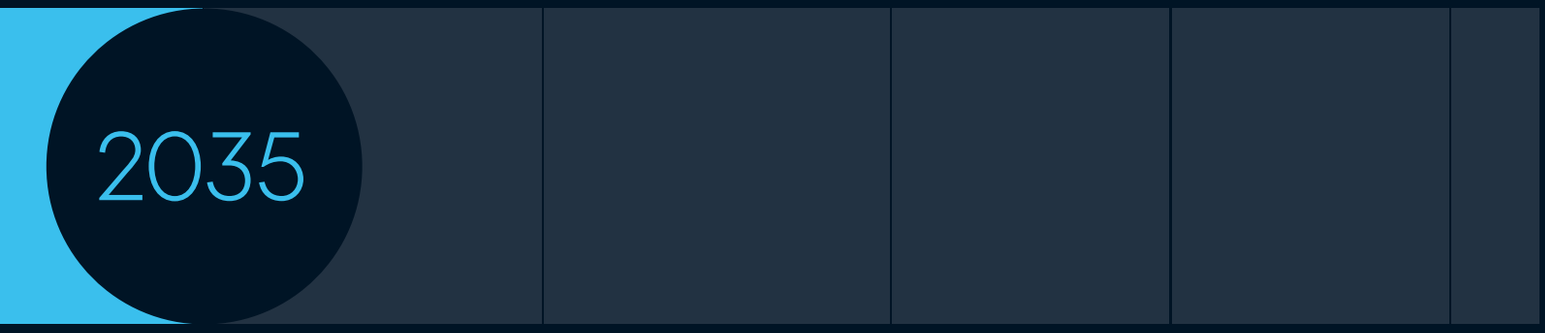
TELE2'S PATH TO NET-ZERO







Net-Zero emissions

SBTi

Science Based Targets Initiative (SBTi) is a collaboration between CDP, United Nations Global Compact, World Resources Institute (WRI) and World Wide Fund for Nature (WWF), driving ambitious climate action in the private sector by enabling organizations to set science-based emissions reduction targets.

Science-based targets show organizations how much and how quickly they need to reduce their greenhouse gas (GHG) emissions to prevent the worst effects of climate change.

Scope 1, 2 & 3

According to the leading GHG Protocol corporate standard, a company's greenhouse gas emissions are classified into three scopes.

Scope 1 and 2 are mandatory to report, whereas scope 3 is voluntary and the hardest to monitor. However, companies succeeding in reporting all three scopes gain a sustainable competitive advantage.

CSRD

The Corporate Sustainability Reporting Directive (CSRD) is the new EU legislation requiring all large companies and listed SMEs, to publish regular reports on their environmental and social impact activities.

It extends the scope and reporting requirements of the already existing Non-Financial Reporting Directive - a regulatory framework that mandates sizeable public interest entities to report on their sustainability performance since 2018.

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Sunsetting 2G & 3G

What This Means for IoT Connectivity & Your IoT Solution

2G and 3G networks have been around for decades and billions of IoT devices have relied on them for their connectivity. Both generations have enabled an affordable way to keep devices connected almost anywhere in the world, whether those devices are static or on the go. But now it is time for modernization and upgrades, and with only so much bandwidth to go, with 4G already established, the rollout of 5G underway, and IoT-specific technologies such as LTE-M now available, 2G and 3G will be retired and replaced.

Tele2 Sweden already began phasing out 3G during 2021 and initially it will only be in places with good 2G and 4G coverage. Over time the phasing out will increase in speed and completely retire in 2025.

Decommissioning of 2G and 3G has already been initiated and/or completed in some parts of the world, including in Canada and Australia, with the US to be next. Other countries and regions have a wide range of sunsetting dates, with most of Europe looking at the end of 2025, although that is not a unilateral date for all countries. Switzerland will likely be the first European country to completely close 2G, which is estimated to happen at the end of 2023. The bottom line is that 2G and 3G will eventually be retired everywhere, so this is an issue that cannot be avoided.

The 2G closure is similar for all large operators in Sweden since the license for the 2G frequency ends in December 2025. Tele2 will use this opportunity to futureproof the network for all of our customers.

Tele2 IoT is here to assist you in not just understanding when and where decommissioning will happen, but also to understand how these changes will impact your deployment and what steps you need to take to deal with the coming changes – because the last thing you want is to still be using 2G and 3G networks when a carrier you rely on shuts that network down and your deployment is not ready for the next generations.

It is important to be proactive, not reactive, and most of all, to be prepared. It is essential to take inventory of every device deployed and assess which deployments and customers will need to make a transition. Tele2 IoT has the tools to help you identify where changes need to be made and our team is ready to assist you in assessing which technology you should move to, as well as address other challenges, such as if your hardware will be compatible.

The Tele2 IoT Team is committed to supporting and guiding our customers as we go through this technological shift. We are able to provide you with information on sunsetting dates for specific regions and countries as it is available so that your solution is not interrupted or otherwise impacted. There are plenty of excellent options available to replace 2G and 3G and we are happy to help you decide which best suits your particular needs.

LTE-M vs NB-IoT: An Overview

Ever since IoT first hit the scene, everyone has been trying to predict the future: How many billions of devices will we have, when will we all be connected, and what sort of technology will we need? The short answer is that we will eventually have billions and billions of devices connecting pretty much everything, but when it comes to business, many will need technology designed specifically for IoT – in other words, businesses are going to need low power wide area (LPWA) technology. But what are the choices when it comes to LPWA – and what are the differences between them?

It's no secret, of course, that IoT security needs to be a prime Low Power Wide Area (LPWA) technology is not a technology standard, but rather a class of wireless technologies particularly suited to the specific needs of IoT. The majority of IoT devices, such as those in smart city and industrial sectors, don't require the same bandwidth and speed as consumer cellular devices.

LPWA Network (LPWAN) technologies offer cost and power-efficient options that leverage existing networks while also having strong built-in security and a global reach, enabling low power consumption and long-range wireless connectivity. LPWAN technologies also support data transfer of small intermittent data packets ranging from 10 to 1000 bytes. And because they operate with better power and bandwidth efficiency over a larger area, less infrastructure and hardware are required, leading to greater cost efficiency.

LPWAN technologies also allow IoT devices to reliably operate for up to 10 years on a single battery charge, which is ideal for remote solutions that lack a reliable power source. These include:

Smart city applications

Track & trace	Smart buildings
Smart agriculture	Smart meters

While both LTE-M and NB-IoT are good connectivity options for industries in need of LPWA technology, and there are many similarities between the two, there are also some key differences.

LTE-M

LTE-M (also called eMTC and Cat-M1) leverages existing LTE networks to allow for highly efficient connectivity with extended coverage indoors and underground. It consumes less battery power and allows for cheaper modem costs thanks to design simplification. It supports downlink and uplink speeds of up to 1 Mbps with a latency of 50-100 ms, which makes it very flexible and ideal for real-time communication.

- Efficient battery usage
- Real-time communication
- High data transfer rates
- Full mobility: Ideal for both fixed & mobile applications
- Supports VoLTE (Voice over Long-term Evolution)

NB-IoT

Narrow band IoT features up to 10 years of battery life and the widest possible network coverage and can support a large number of new connections using only a portion of the available spectrum. While it also offers potentially less expensive modules, this comes at a price: latency is 1.5 to 10 seconds – it does not allow real-time or voice communication.

- 10+ years battery life
- High latency
- Low data transfer rates
- Ideal for stationary/static devices (no connected mobility)
- Does not support VoLTE

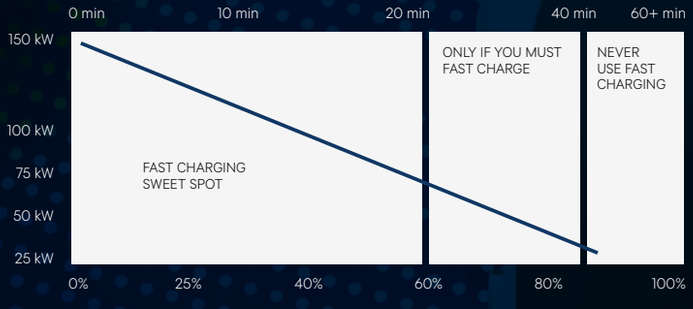
Ultimately, the technology you choose will depend on your use case and the challenges you want to address. For asset tracking, data throughput is small, but mobility is needed as objects move. When it comes to smart meters, on the other hand, use-cases typically require data transfer once or twice a day. Understanding the specific requirements and nuances of your use case will help you understand which connectivity option is best for you.

How to Become an EV Charging Pro

Anyone who owns an electric vehicle (EV) will at some point find themselves asking why are there waiting times at DC (Direct Current) charging points from time to time? Shouldn't we be enjoying fast charging for our EVs by now?

Well, there is something to learn about how to use fast charging or DC charging. This technology is fast, but it also depends on how you use the service. All EVs have protection in their batteries, and this steers how fast you can charge or how much energy you can load into a battery. Fast charging stations are also something of a social experiment in stress management for drivers. Luckily there is a very easy way to cut the waiting time if you treat your batteries as the manufacturer would like you to.

The example below uses a Polestar 2 with fast charging (DC) protection for batteries. The numbers are not exact, but they do illustrate the huge difference in speed when using a Level 3 Fast Charging station. The rule is to never charge more than 60%, and instead charge more often. Doing this means waiting times reduce dramatically since the efficiency and speed per charged kw/h is higher.



Charging an electric vehicle involves refilling its battery with electricity. There are different types of EV charging methods, each with varying charging speeds and suitable use cases.

Level 1 Charging:
Level 1 charging is the slowest method and involves using a standard household electrical outlet, typically rated at 240 volts AC. This method often utilizes a portable charging cord that comes with the vehicle. Level 1 charging provides a charging rate of around 5-10 km of range per hour of charging. It is best suited for overnight charging at home, especially for vehicles with smaller battery capacities or when a faster charging option is not available.

Level 2 Charging:
Level 2 charging is faster than Level 1 and requires a dedicated charging station that operates at 380 volts AC on 3 phases. These charging stations can be installed in homes, workplaces, or public locations. Level 2 charging typically provides a charging rate of around 15-30 km of range per hour of charging, depending on the vehicle and the specific charging station. This method is suitable for daily charging needs, offering faster charging times and convenience for most EV owners.

Level 3 Charging:
DC Fast Charging, also known as Level 3 charging or quick charging, is the fastest charging method available for EVs. It utilizes high-powered charging stations that supply direct current (DC) electricity to the vehicle's battery, bypassing the need for onboard AC-DC conversion. DC Fast Chargers can provide charging rates ranging from 150-500 km of range per hour, depending on the charger's power output and the vehicle's capabilities. This method is primarily used for long-distance travel or situations where drivers need to quickly recharge their vehicles in a short amount of time. DC Fast Chargers are commonly found along highways, at rest stops, and in certain public charging stations.

In summary:

- Level 1 charging is suitable for overnight charging at home or when faster options are not available.
- Level 2 charging is ideal for daily charging needs at home, workplaces, or public charging stations.
- Level 3 DC Fast Charging is designed for quick charging during long-distance travel or situations that require rapid recharging.

The overall conclusion is that when using DC fast charging, charge more often to shorten waiting times. Always stop the fast charge when you reach 60%. Your car will be happier and the people waiting will be thrilled.

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How IoT Enables the EV Ecosystem

Before we get to how IoT enables the EV ecosystem, let's take a quick look at the background: all across the world, the electrification of road vehicles is growing quickly. In fact, for the first time ever, more than half of car buyers say their next purchase will be an electric or hybrid model. This shift is driven by a number of things, including environmental concerns and low maintenance and operation costs, along with government subsidies and regulatory support. What this means is that there will be an estimated 140 million electric vehicles (EVs) in use by 2030. The European Union (EU) alone has more than 330 thousand publicly accessible charging point and that number is growing, but deployment is uneven.

So, how are we going to charge all those cars? EV owners want and need the same autonomy, range, and ease of refueling as they have gotten with traditional fuel-injected cars, which means we must do more than just install more charging points. What we need to do is develop a robust EV charging infrastructure.

Connectivity is a crucial component to the evolving EV ecosystem and IoT offers huge benefits to all stakeholders across the value chain, including EV drivers, Charge Point Operators (CPOs), and network operators. In order to connect, maintain, and manage the different parts of the EV ecosystem (charge points, payment systems, locators, maintenance, etc.) there is a strong need for resilient and secure two-way connectivity and not just in locations where wired infrastructure isn't always readily or easily available.

But there are challenges in developing the EV ecosystem, including infrastructure management, addressing customer experience, profitability, maintenance, monitoring, energy management, and ultimately, how to create a universal ecosystem that works for everyone. IoT will play a crucial role in bringing it all together.

Managing charging stations

Charging stations are geographically dispersed, making it challenging and expensive to manage 'onsite'. IoT enables CPOs to remotely monitor and manage operations and quickly resolve issues by presenting real-time insights into usage and device performance, including charger availability, fault monitoring, and troubleshooting – all of which help enormously when it comes to predictive maintenance and reducing downtime. Additionally, as charging station buildouts increase, data on existing deployments will help operators more accurately plan locations for new stations. Data can also be used to optimize charger utilization, identify areas for improvement, and track trends over time.

> By connecting the entire EV ecosystem, finding charging stations will become easy, payment systems will be simplified, and a variety of value-added services will become available.

Charger availability
EV charging apps can search for nearby stations, check availability, and reserve a slot at the time required, based on battery capacity. Apps can also indicate charging rates or advise on off-peak hours for lower-cost charging.

Smart charging
Even at the best of times, energy rates vary throughout the year. Additionally, as EVs become increasingly prevalent, it's crucial to be able to track charging stations in order to decrease grid load, because if a lot of people are charging their EV at the same time, this can put strain on the grid. By tracking and monitoring charging stations with IoT, you gain insights into how they are being used and how much power is being drawn, information which can be used to regulate the flow of power, so the grid isn't overloaded. Overall, IoT allows us to manage the increasing demand for EVs while also keeping the grid stable.

Reducing downtime
Without reliable connectivity, sensors at charging points will not be able to communicate with the network, which means EV drivers will be left frustrated and the CPO's credibility will be damaged. Basically, for IoT devices to function, there needs to be network availability and a stable, always-on connection. Cellular technology is the preferred choice, due to its presence in places where EV charging points would likely be installed, such as schools, parking lots, hospitals, office parking garages, etc. Downtime or poor connectivity can cost brands both revenue and reputation.

Security
IoT-enabled EV stations must do more than facilitate smooth energy exchange between EVs and the grid, or even information between customers and the charging point. Security must also be considered, because as the number of EVs grow and the EV ecosystem expands, the attack surface is also growing. Look at it this way: if a hacker is able to disable all EV chargers connected to the same network, it would be the equivalent to a gas shortage. Security is also crucial for the privacy of customers, such as their banking details. The advantage of cellular IoT connectivity is its built-in security measures that protect data and sensitive information, offering reliable and secure coverage, no matter the location.

IoT allows us to manage the increasing demand for EVs while also keeping the grid stable

Breaking Down Silos to Open Up Smart Cities

Un-silo your smart city solution

Cities across the globe have already implemented any number of smart city solutions, leveraging IoT technology to connect everything from public transport to healthcare to waste management. But unlocking the full potential of a smart city remains a challenge. To be truly successful and to fully reap the benefits of IoT, smart cities cannot simply adopt digital technologies in silos – they need to leverage and combine the strengths and diverse capabilities of their different departments across the entire smart city ecosystem.

To avoid the myriad challenges silos bring, it's important that cities create transparency between various city services. Too many teams still operate in solos as they manage various needs such as traffic, utilities, power, water, and parking. Each of these departments generate massive amounts of data – and IoT technology can enable each area to increase productivity, improve processes, and leverage that data to allow for better decision making and cross-departmental collaboration.

The good news is that many cities are working to remove barriers to a truly connected smart city. The result is a collaborative approach that leverages IoT to mitigate risk and optimize assets, resulting in improved systems and enhanced quality of life.

Here's what breaking down the silos could mean in practice: imagine a driver on his or her daily commute. They are stuck in traffic and wondering why. Suddenly, they are alerted by the city of an accident 20 km down the road. They are also given information on alternative routes, which allows them to quickly adjust their plans and make it to work on time.

Now let's add some more to that picture. By leveraging IoT and related technology, the driver isn't the only person alerted to that accident. First responders and people working with public safety and public works are also notified, oassengers using public transport are alerted and nearby police officers are quickly re-routed and re-assigned.

Suddenly, through IoT, you have all interested parties mobilized and aware and a potentially difficult situation is brought under control much more quickly. Additionally, data from the incident can be utilized to understand if the place of the accident is one where accidents happen regularly. Data can also be used to measure response times and how systems are working.

Another scenario could involve a big event in your city, such as a sporting event or a concert. By connecting your various systems and departments and sharing information, traffic lights and public transport can be coordinated with event timings to help manage and disperse crowds in a safe and efficient manner. Connected parking spaces can help people easily identify where to park through an app, while an integrated cashless payment system can ease proceses.

> Chaotic, siloed planning and development, outdated policies, strategies, and infrastructure – all of these contribute to wasted time, money, resources and energy.

So, how do you develop a truly cohesive smart city that is responsive and integrated? While the best advice is to integrate your solutions right from the start, that might not be possible, given that many cities already have smart city solutions up and running. No matter what stage your smart city is at, collaboration between the various players across the smart city is pivotal in developing the right suite of smart solutions to meet the unique needs of your city.

Linking legacy systems, including IT systems, with IoT sensors and data architectures is crucial. It's also important to not see implementing IoT purely in terms of just technology. Implementing IoT is also an operational transformation that will impact a wide range of stakeholders, even if they are not directly involved. And don't forget about data: know how you're going extract, analyze, and store data. You may not be using all of the data right away for things like AI, but you may want to in the future, so have a plan.

Ask yourself the following questions:

- What does ‘smart’ look like/mean for your regions?
- Which smart solutions will solve which challenges – and how can they work in harmony?
- Which technologies, policies, & strategies will be needed?
- How will you finance your projects?
- How will you address security?
- How will intelligent systems work together across departments & even with other regions?
- How will you measure outcomes for different stakeholders?

At the end of the day, employees will come and go, so developing an interconnected, interoperable smart system that is built to last will benefit both the city and any future employees in the long run. Historical data will be crucial to future city planning, as well as key to continued optimization and improved efficiency across the smart city ecosystem.

> Interoperability is a key factor in successfully removing Smart City silos.

CASE STUDY

Drifter World: Revolutionizing Parking, Payments & EV Charging

According to the European Parking Association, there are more than 47 million regulated parking spaces, with just over 30 million off-street, and nearly 17 million on-street. That might sound like a lot of parking spaces, but while 68% of land in cities is devoted to parking spaces, drivers still spend an average of seventeen hours every year looking for a place to park their car. And with the huge growth in electric vehicle (EV) ownership, people are spending more time in parking spaces as they wait for their vehicle to charge.

Drifter World is a Swedish technology company that is using its passion for bringing practical solutions to not just parking and EV charging, but to the larger smart city ecosystem. At its core, the Drifter World solution optimizes the usage of parking spaces, while also reducing administrative tasks for property owners. It also works with electric vehicle (EV) charging spaces, ensuring that you can charge your car while it is parked – and it deploys sensors that can measure things like air quality, sound levels and even traffic flow.

At the heart of Drifter's solution is the Drifter Box, an AI driven IoT box that automates the parking experience by 'reading' the whole parking space and removing the need for manual controls. In practice, this means it 'reads' license plates and starts a session as soon as you park your car, then ends the session when you leave, so you no longer have to start a session on a parking app, put coins in a meter, or take a ticket on your way in and pay on your way out. Instead, you have several payment options: use the Drifter World app, scan a QR code and pay via your phone, or an invoice will be sent automatically

"Additionally, if you park in a restricted spot, we can note that, so if someone parks a fossil fuel car in a space that is reserved for EV charging or maybe someone who shouldn't parks in a handicap space, we will know. We don't give tickets, though, we raise the price – or in the case of a caravan parking across 9 spots, we charge for 9 spots."

Drifter World works with a number of different players, including office parking, parking garage,s and parking lots. A lot of office buildings have reserved parking for employees and outside of office hours those parking spaces often sit empty.

"We can optimize those parking spaces and charging stations for companies," says Fredrik Durling. "So, they're assigned to employees during working hours, but then we open them up for others outside of those times. This is vital for cities all over the world because we know that every city in the world has parking problems."

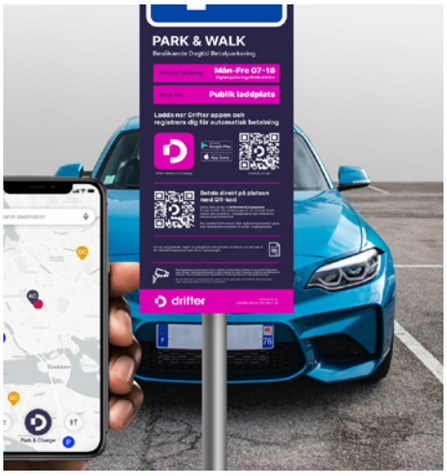
While other players working with parking have already tried to optimize spaces, automating through the use of AI and IoT allows integration in a way we haven't seen before. If we look at, for example, municipal parking, there are other challenges.

"Municipalities are very siloed in terms of departments and how they work," says Fredrik Durling. "We're trying to bring together parking and EV charging, but that

> The big difference between Drifter and other systems is that other systems only read entries and exits, while Drifter reads parking space by parking space. This removes the need to have someone walking around putting tickets on cars if they overstay or if they haven't paid. Everything is automated.

Fredrik Durling
CEO & Founder, Drifter World

often involves two or more different departments, so getting them all in the room and agreeing on how to best optimize parking and EV charging can be challenging. They want to see it working first and at this stage they prefer to handle parking challenges themselves. The problem is that they aren't handling it, and they aren't seeing the possibilities that technology brings."



The Drifter World app tells drivers where to find available parking spaces, but it also benefits EV drivers looking for parking spaces with available EV charging stations. In practice, this could mean that at one parking lot there are, just say, five cars waiting to charge, while at another parking lot close by, there are available EV charging spaces. The EV driver can check availability on the Drifter app and save themselves a lot of hassle.

Drifter World does not own the EV charging stations – the charging stations have been sold to the property owner, which presents its own challenge.

"Often, the EV charging companies think if they lose the app, they lose the customer, but we see it differently," says Fredrik Durling. "If we work together, we can keep the customer together, doing different parts of the solution. The data we collect can be shared by both of us – we just use it for different purposes."

Data and insights

Environmental data is collected from all parking spaces, meaning Drifter World know which model of car is using a parking spot, or why one parking spot is used more than another, as well as air quality and sound levels. The company also connects with energy companies and property owners. Property owners in particular have been able to see the benefits of the Drifter World solution, because through digitalizing their parking spaces they still get their income while no longer needing manual controls.

"Every parking spot has sensors measuring all of these things in real time and sends it to the property owner," says Fredrik Durling. "This is very attractive to private property companies – they make more money per parking spot annually because it's just one AI/IoT system that removes a lot of the middlemen."

Regulations, particularly within the EU, are going to continue to get tougher and this means cities will need to show environmental improvements over time. The Drifter World solution has the tools to provide data that validates improvements, both in real time and historically, when it comes to sustainability.

"If you don't have the tools to measure, you aren't going to make it," says Fredrik Durling. "You need to measure things in a proper way that is verifiable and parking spots are a great place to start. We can generate reports to validate improvements and where improvements are needed – basically we can give a report about nearly anything."

Data can be shared with cities and towns to understand things like traffic flows, while for parking companies this data can help them optimize the number of handicap spaces or EV charging spaces. The data will give them the insights they need to know exactly how to best serve their customers and it can lead to more unsiloing of the smart city ecosystem."

"We can also lead traffic in many parts of the city, so when you have your GPS on, we can tell you this parking lot is full, this one has available spaces. This helps ease traffic because you have less people driving around. It could also help governments understand how people are using their vehicles.

"Sensors can also be put in roundabouts and at tolls and other areas and learn what kinds of cars are coming in and out of the city and how much emissions are being released. We can build environmental zones that allow only certain types of cars can park in certain areas to reduce emissions – and while we can't punish someone that has a big gas-guzzling vehicle, you can be rewarded for choosing a more environmentally friendly one."

> There is a fear of integrating solutions, instead of taking the bold step to have a true smart city experience. We can connect the dots with other players and help create that real smart city ecosystem.

Every parking spot has sensors collecting data in real time

Security is always crucial when dealing with data. Customer credit card details are always stored in the app. All security is in the Drifter Box, so pictures and other information are only stored in there. The Drifter Box is updating regularly, and the company uses a VPN to transfer data. AI is handling everything on the spot and Drifter World doesn't 'see' cars unless there is a complaint – then they go in and extract the necessary information.

In the Drifter World solution, an AI motor is connected to a picture sensor, which never streams – it just captures images and reads the flow of the parking spot. It never takes a picture of an individual; instead, it reads how many people, how many cars, here comes a delivery truck, a garbage truck – it learns from the many different sessions that actually occur at any particular parking spot, and it learns something new every day.

Why Tele2 IoT?

"We chose Tele2 IoT because some vendors didn't look into us as a company and what we are trying to do – they didn't care, they just wanted the sale," says Fredrik Durling. "Then we started talking to Tele2 IoT and our salesman said, 'We can do this together and we can do so much for each other – and if you grow, we grow.' Also, Tele2 IoT is really into IoT and the possibilities it brings, so the company acts as a real partner. Tele2 IoT is the only one doing IoT for real. Other vendors have an IoT offering, but Tele2 IoT is driven and engaged in the IoT space."

The future

Drifter World has been live since October 2022 and currently operates in Sweden and Norway. With expansion into other countries in the roadmap, handling payments will mean adjusting to local conditions. In Sweden, transferring money digitally is usually done through the Swish app and in Norway it's Vipps, while in the US, Venmo is a big player.

"In general, when we enter a new market well have all the usual big payment solutions, like Paypal, Apple Pay, and Google Pay, and then we add the local ones that are most used," says Fredrik Durling. "When it comes to things like rental companies, we can run payments through them as well, so when you're traveling you don't need to worry about having the right app. Having a universal solution removes a lot of challenges.

"One of the biggest challenges we have is keeping up with demand, which is not a bad challenge to have, so in general we're happy with how things are ramping up and the future."

When it comes to expansion in general, the biggest challenge for Drifter World is that different countries have different ways of ticketing cars. In some countries it's police who give parking tickets, in others it's parking companies.

"When it's the police it's a bigger challenge to integrate, but once they realize that having the Drifter World solution frees up police resources to address more urgent and important matters, it becomes a very easy and obvious solution to embrace. I mean, do you want police checking that someone overstayed their time in a parking space or do you want them out catching criminals?

"Everyone today wants a seamless digital experience – Drifter World is a strong solution that can help bring that together across the smart city ecosystem.".

CASE STUDY

Secure IoT Connectivity and End-to-end Solutions

Making the world safer, smarter, and more sustainable

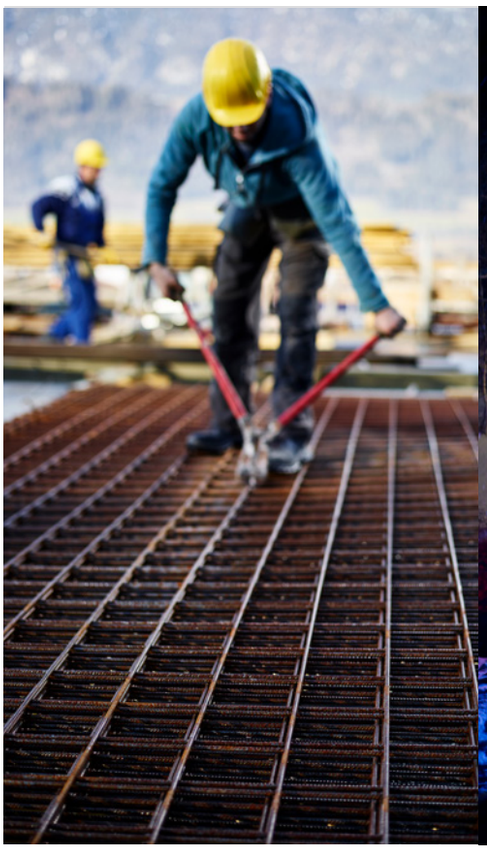
AddSecure is a leading European provider of IoT connectivity and end-to-end solutions. The company has a focus on secure critical communications and data, and sees it as their mission to help make the world safer, smarter and more sustainable. Through their secure IoT connectivity solutions, AddSecure help their customers save lives, protect property, secure vital societal functions, and drive business.

Securing critical communications since the 1970's

AddSecure firmly believes that digitalization is key to solving many of the challenges the world is facing. With a background in alarm transmission monitoring going all back to the 1970's, the company early on grasped the connected society's growing need for secure communications.

With their origin in the largest Nordic telecoms and security companies, the company has unique knowledge and competence within wireless alarm communications and security and has developed cloud-based solutions for critical communications since the millennium. AddSecure was actually the first company in Scandinavia to be approved by banks for alarm solutions based on mobile communications.

> Secure IoT connectivity solutions are vital for our customers' life- and business critical operations. They help save lives, protect property and vital public services, and drive business operations.



Today, AddSecure is no longer just securing communications for alarms, the company is also solving challenges in a wide variety of fields, such as public safety, rescue services, building security and automation, elderly care, transport and logistics, construction, utilities, smart cities, and more.

An increasingly connected world
The world is becoming increasingly connected. Organizations in a variety of industries are using the capabilities of IoT and data to operate more efficiently, reduce costs and emissions, improve decision-making, and increase the value of the business. This puts great demands on their IoT solutions and the need for data being safe and secure. Life, property, vital societal functions, and large values depend on it. This is where AddSecure makes a difference.

Secure IoT solutions tailored to meet customers' needs
AddSecure applies their expertise within IoT, secure critical communications and data through technology based on IoT connectivity platforms and software solutions. They use this technology to build differentiated end-to-end solutions tailored to meet customers' needs across different industries. The secure IoT solutions provide deep customer value by solving complex needs, provide quick responses to events and improve operational efficiency and productivity. The focus is on customers for whom secure signal transmission or safe data transfer is the key to operate successfully and profitably. For example, signals from fire or intruder alarms, communications from fleet management systems, and feeds from video surveillance are all transmitted through their IoT connectivity platforms, enabling data to be securely transmitted for the provision of services.

Long-standing partnership
AddSecure's IoT connectivity and end-to-end solutions are created by combining technology and hardware from third-party suppliers, based on long-standing partnerships, with their own software solutions. The IoT solutions are generally built on three different components: hardware (with integrated software), secure communications and data management, and software-enabled services. The data or signals from the connected devices are transferred through a secure connection either wirelessly or through a fixed line. Through deep integration with Tele2 IoT and other telecom providers, AddSecure is able to provide secure wireless pan-European connectivity between connected devices and the software transferred through their secure IoT connectivity platforms. This ensures that the signals or data arrives to the correct recipient without any data leakage or interception. In collaboration with Tele2 IoT, AddSecure can quickly adjust cellular subscriptions which create great benefits when their OEM solutions are rolled out globally.

Roaming is the key to connected services globally. Tele2 IoT continuously supports AddSecure and adapts their roaming to AddSecure's customers' needs. From the management system, with complete API integration to 2CONTROL (Cisco IoT Control Center), AddSecure can easily track their Tele2 IoT subscriptions and in real-time see and analyze data consumption, carrier service, and operators currently used.

Tele2 IoT provides seamless pan-European connectivity along with global coverage when needed, all with excellent service and availability. Together with Tele2 IoT's dedicated support and production staff, we can quickly and safely deliver our services across Europe thanks to good coverage with roaming partners and eSIMs – regardless if it's one 1MB SIM in Sweden or thousands of 10GB SIMs in southern parts of Europe.

The delivery of secure IoT end-to-end is the key common feature across all AddSecure's global offerings. In partnership with Tele2 IoT, AddSecure helps make the world safer, smarter and more sustainable.

> With our experience and expertise within IoT, secure critical communications and secure data, we make it safe and easy for connected devices to transfer data and to communicate with each other – in alarms, buildings, construction, power grids, trucks and much more.

Stefan Albertsson
CEO AddSecure

Transforming Building Automation with IoT

For a long time, many in the property industry were hesitant to use IoT for building automation – they thought it would introduce unwanted costs and unnecessary complexity. Times have changed, though, and today IoT is having a transformative effect on smart building automation and control, offering both cost savings and optimization opportunities, as well as increased sustainability.

The majority of Building Automation Systems (BMS) we see today serve the same purpose they did when first introduced in the late 1800s: simplified management of core building functions, particularly when it comes to HVAC (Heating, Ventilation, and Air Conditioning) equipment. While some things have evolved, such as the shift from pneumatic systems to computer-based control systems, most buildings remain energy inefficient and difficult to maintain, and often don't fully serve the needs of occupants.

By disrupting long-established BMS models with IoT and even AI/machine learning, there are significant opportunities to improve building efficiency in a variety of ways. The way buildings are being planned and constructed is also changing, with IoT technology being used from the start to reduce power consumption, increase energy savings, and create more sustainable buildings.

Here are five areas where building automation can have a big impact:

- Energy efficiency
- Water management
- Occupant comfort
- Security & safety
- Maintenance

Traditionally, these systems have often been disconnected from one another and from the central BMS. In a smart building, though, these systems feed into a central network and operate in sync with one another, leading to improved operational efficiencies.

Energy efficiency
Energy efficiency has long been at the core of BMS implementation, yet buildings still account for roughly 40% of global Greenhouse Gasses (GHG) – with 30% of building energy being wasted. Despite efforts to reduce their footprint, most buildings remain largely inefficient. HVAC equipment has traditionally been regulated in a uniform, predefined way, leading to overheating or underheating across the facility. IoT technology can identify key areas where energy is wasted and where energy costs can be minimized.

Data generated by sensors at the building level can be used to optimize and regulate HVAC equipment. For example, your building's HVAC system is set to operate until 8 PM, but your building rarely has anyone in it after, just say 6 pm. For example, connected systems can automate HVAC operations, turning off lights when someone leaves a room or controlling room temperatures based on occupancy. Additionally, wireless submeters deliver consumption data on individual assets or building areas, and these insights allow you to swiftly identify and locate where improvements can be made.

Building automations systems are already being widely introduced into new builds, but they can also be retrofitted to existing buildings, giving you the energy saving benefits of a smart building.

Security & safety
Access control is a fundamental aspect of security for every building and organization where restricted access is a necessary, including for schools, hospitals, offices, and even hotels. The primary driver of access control is to safeguard people and to protect physical and intellectual property. Most of us probably already use key cards, but with IoT another layer is added to the mix. With key cards and connected 'checkpoints', remote access control is possible, with doors that can be locked remotely, and the ability to track and program door access at any time. You can customize who has access to which room, and you can make changes as needed – and you can do it immediately.

Water management
The average person spends about 90% of their time indoors, and the average family uses around 300 liters of water each day, while at the office average worker uses up to 30 liters per day. At the same time, water resources are becoming increasingly scarce, so monitoring water consumption and taking appropriate measures to reduce it is imperative – but keeping track of it manually is pretty much impossible.

Embedding IoT-enabled sensors in water supply channels that go to toilets, bathrooms, kitchens, water tanks, etc. gives you the data you need to understand where excess consumption is happening. Sensors can also alert facility managers to other issues, such as water leakage or other problems with remote pipes. This can have a two-fold impact: water leakages can have knock-on effects, causing damage to a building's infrastructure or promoting the growth of mold. And a mere 3.2 mm crack in a pipe can cause up to 1000 liters of water leakage a day.

Understanding and being aware of problems before they spiral out of control saves money and limits disruption.

Maintenance
In the IoT world we talk a lot about maintenance – or more specifically, predictive maintenance. We understand that the longer a potential maintenance problem goes unchecked, the more likely it will become bigger and more challenging to fix.

In a smart building, IoT sensors monitor the state of your building and all the equipment in it, letting you know when maintenance needs to be performed before there is a problem- This does away with scheduled and often unnecessary maintenance rounds, which means better use of manpower, along with cost savings.

Additionally, unexpected issues are bound to arise, and they are often not visible to the naked eye. Sensors can detect potential problems long before anyone becomes aware and will send alerts and information to building managers so that they can act immediately, staving off what could be a costly breakdown of a system or piece of equipment. This also reduces tenant disruption and saves money in the long run.

Occupant comfort
And finally, the whole idea of keeping a building or facility running smoothly is to keep the people who work or live inside it comfortable. Facility owners and managers know and understand the importance of good tenant relationships, and smart buildings are designed to support that.

Many of the above areas contribute to occupant comfort, with indoor temperatures, air quality, lighting, and humidity all playing into occupants' well-being and productivity. IoT sensors monitor all of these and allow you to fine-tune as you go, helping you to maintain an optimal and healthy indoor environment. Data from sensors can also help you accurately assess traffic and usage in different parts of the building in order to prioritize things like cleaning activities, ensuring good sanitation and well-maintained amenities.

Ultimately, IoT can help you understand how your building or facility is operating on many different levels, while also ensuring safety, security, and comfort.

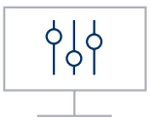
6 Reasons Why You Need IoT Control Center

Subscription Lifecycle Management

Intuitive and powerful lifecycle management with built-in automation.
Test, activate & retire subscriptions with automatic transitions.

Service & Pricing Provisioning

Enjoy full control over where you roam, which services are provisioned, and which price plan is best suited to your needs.



Data Tracking & Reporting

Get insights into device usage, deployment trends, and reports via the comprehensive analytics feature of the platform.

Advanced Troubleshooting & Diagnostics

Remote diagnostics quickly determine root cause for incidents, advanced troubleshooting finds solutions for complex problems.

Enterprise-grade Security

Grant or restrict access to employees or customers.

Block unauthorized devices by only allowing predefined devices or detecting when a SIM has been moved to a new device

Integrate APIs Into Existing Systems

Automate workflows and optimize productivity by integrating a comprehensive library of APIs into existing systems.

REST & Push API supported.

CASE STUDY

RevX: The Operations Glue Holding Your IoT Solution Together

As businesses attempt to scale their cellular IoT operations, their back office and customer experience become more challenging. These companies are navigating the challenges of delivering products 'as-a-service' at scale.

To address this challenge Tele2 IoT has partnered with RevX Systems, a California-based company, to provide clients with an industry leading solution for managing operations and subscription services. To succeed at scale, they must automate operations and provide a superior customer experience.

RevX Systems is dedicated to the task of ensuring your success with the industry's leading IoT Operations Platform (IOP), Cisco IoT Control Center. RevX addresses nearly every operational task around servicing revenue and connectivity, including providing a white-labeled end-user experience. Critical infrastructure for any company managing cellular data services, thousands of customers, and multiple carriers.

As an extension to Tele2 IoT's version of CISCO IoT Control Center, RevX enables businesses of any size to automate management of their revenue lifecycle, and take a more customer-focused approach to IoT operations. RevX provides a comprehensive revenue management and operational solution that goes beyond TeLe2 SIM management.

"RevX is the premier platform of its kind, solving problems that human capital cannot," says Anders Nilsson, Senior Sales Manager Tele2 IoT. "We're extremely excited to partner with RevX in helping companies automate operations and to enhance their end-user experience."

"RevX provides a personalized view of your connected devices world, with a self-care portal that simplifies the customer experience," says John D'Angelo. "our single pane of glass simplifies how a company manages multiple connectivity and legacy application systems in pursuant of their digitalization initiatives". If you got into the IoT game early and are faced with managing disparate legacy silo systems, or you're new to IoT and wants to keep things simple, our single platform approach significantly streamlines your front and back-office operations.

"Digitalization, particularly with legacy systems, isn't easy – we let you focus on your core business value creation while we manage all the IoT operations complexity and minutia."

We encourage you to learn more about operations systems that will ensure your IoT success.

> In a hyper-connected world, customers who experience activation and billing issues will immediately share their opinions over social media, harming your growth and tarnishing your brand, As companies scale it becomes apparent that to prosper, they need to focus on their end users experience and manage costs through automation.

John D'Angelo
CEO RevX Systems

How IoT Empowers Digital Signage

In a world where we are continually faced with floods of information coming at us from all directions, it's more important than ever to deliver messages that break through the noise and capture the attention of your audience. Gone are the days of the passive and static billboard on the highway or in a shopping mall – today, there is a fast-growing demand for digital displays that deliver high quality, high-resolution content everywhere from public spaces to restaurants to shops. The demand to be flexible in order to quickly pivot both your message and where that message is seen and heard mean cellular IoT connectivity is the right choice when it comes to connecting your digital signs.

Not all that long ago a digital sign was simply a digital replacement for a static sign. The signs weren't 'smart' and they didn't really do much more than passively display information. These days, digital displays are both interactive and dynamic, and they are connected to other resources or devices to provide near instant access to relevant and often personalized information. This leads to streamlined communication, differentiation from competitors, and often an improved bottom line.

But as digital signage evolves, new needs are emerging, calling for even more agile and dynamic solutions. This is where IoT brings real value. Businesses need simple, integrated solutions that offer the flexibility and freedom to customize their content and narrative without the need to constantly update their systems or lay out a lot of money.

So, when it comes to connecting your digital signs, it's simple: SIM-based cellular connectivity does away with the need for time consuming and complex on-site setups that you get with hardwired networks. By empowering digital displays with SIM cards, digital signs can be installed anywhere in the world where cellular networks exist – which means pretty much anywhere. You simply deploy your device, activate your SIM, and off you go, bringing your message to the audience you want, where you want.

Digital signage benefits
There are any number of benefits to connecting your digital signage, but these are the most critical due to broad applicability and relevance across most industries:

Enhanced engagement
Digital displays capture nearly 400% more views than traditional static displays. How does this impact your business? More views mean more opportunities, and more interest means more customers at your door, all of which can lead to more sales. Essentially, moving images attract eyes a lot faster than a static image.

Speed
We all know that time is money and the difference between traditional signs and digital signs is like night and day. Unlike with the old signs, digital displays don't need to be printed, posted, and lived with for days or weeks on end, only to go through the process all over again when you have some new content. With digital signage, you can change your content in the blink of an eye, tailoring your message where and and when needed.

Greater customer satisfaction
From helping customers find their way to improving information accessibility, digital signage enhances customer experience in myriad ways. In fact, according to Digital Signage Today, customers who interact with digital signage have 46% high satisfaction, with managing queues by displaying estimated wait times and alerts when it's a customer's turn reducing perceived wait times at checkout by as much as 35%. All of this leads to increased customer retention.

Increased revenue
When it comes to retail, you can take advantage of your digital real estate in high-traffic areas by selling advertising space to well-chose third-party companies. These could be brands you offer in-store or businesses with complementary products and services. Of course, over-using this tactic can have the opposite effect: a few, well placed ads can be a bonus – a deluge could degrade the experience.

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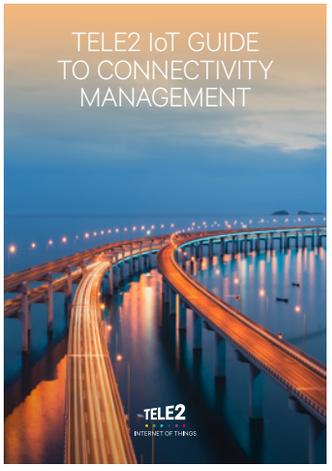

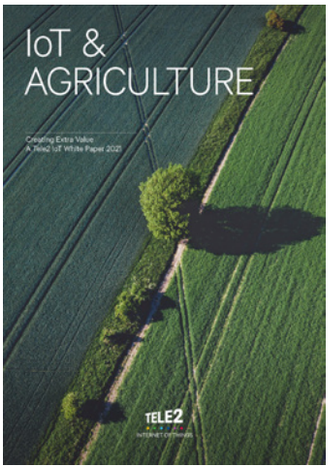

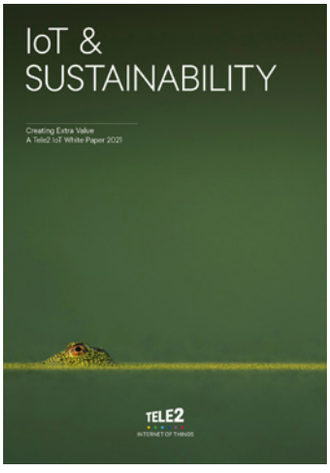

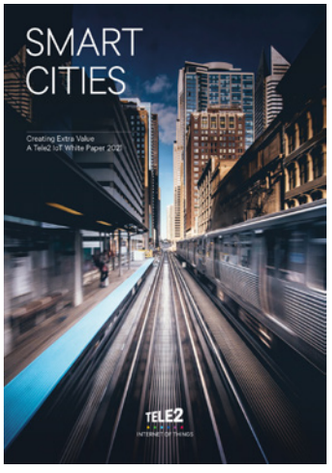

Tele2 IoT

www.tele2iot.com

TELE2

INTERNET OF THINGS