

- Secrets of IoT success: Designing devices that always connect.

Why an onboarding and deployment plan can
make the difference between success and failure.



– **Introduction:** Why IoT companies need to take device design seriously

Visionary companies with physical products or assets are considering how to IoT-enable these devices. The opportunity to connect the physical world – adding functionality, communication, data insight, and revenue opportunities – is too good to miss. And doing so is becoming more feasible as the cost of cellular connectivity comes down. But cheap does not mean easy. And the technical act of ensuring a single device connects is not the same as successfully deploying millions of cellular-connected devices into the field.

Many see connectivity as simply about integrating or installing a SIM card. This can work up to a point – and is usually enough to pass basic connectivity tests on a lab bench. But this relative ease of connecting an individual device in a controlled environment masks the complexity of ensuring thousands of such devices connect reliably around the world.

“80% of **IoT projects fail** due to an issue at the device level.”

Think of a consumer smartphone. Ostensibly, these reliably connect once you insert a SIM. But this is only because a huge amount of technical R&D, testing and certification has been done by the major manufacturers over sometimes several years to ensure the mobile phone electronics reliably interact with the SIM.

And even then, it's often necessary for consumers to move around to get a signal or wait for the phone to reconnect – which your IoT device may not be able to do.

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- Don't let connectivity problems stand in the way of your IoT vision

The SIM is of course critically important. But there is more to think about when designing your device. In our experience, these issues are often overlooked until the device is in the field and it is too late to do anything about it.

Once the device is deployed, its connectivity solution will inevitably come up against issues. A problem affecting just 1% of devices in a global deployment means a lot of complaints and lost revenue. But if all of these small issues and rare events are considered and planned for at the design stage, the device will be ready to deal with them.

“A problem affecting just 1% of devices in a global deployment means a lot of complaints and lost revenue.”

This is true for everyone, whether designing devices from the ground up, or converting long-established products (from vending machines to lawnmowers) into IoT devices. Both may – quite sensibly – look for off-the-shelf solutions to handle connectivity. This is fine, but they need to be aware of the pitfalls around implementing that solution, and how to overcome them.

In this whitepaper, we will discuss common cellular connectivity challenges and how to overcome them. We will look first at the initial device onboarding process (ensuring the device is able to connect in all circumstances), then once the device goes into full deployment (ensuring connectivity is managed through the product’s lifecycle.)



– Part 1: Device onboarding

Onboarding means ensuring the device is connecting properly in any conceivable place it might end up. This means putting the device through tests to simulate what might go wrong post-deployment.

What are the pitfalls?

Problems can come from the device itself, connectivity infrastructure, or the networks on which it relies. Network behaviour can be one of the biggest challenges, as they are out of your control. Networks are hugely complicated, and things do go wrong. Usually, this means losing connectivity briefly, for example when a device moves.

However, outages can be serious if not planned for; an Eseye client with connected devices delivering services across Africa recently suffered a network outage of several days in one of the regions where it operates. When networks fail, devices need to be able to fail and recover quickly and gracefully. Fortunately our client worked with us to design devices that would spot the network was down and connect to another one. Those without alternative networks in range had backup systems to keep delivering water until the network was back online, whilst the central IT system spotted the lost connection and alerted the right people.

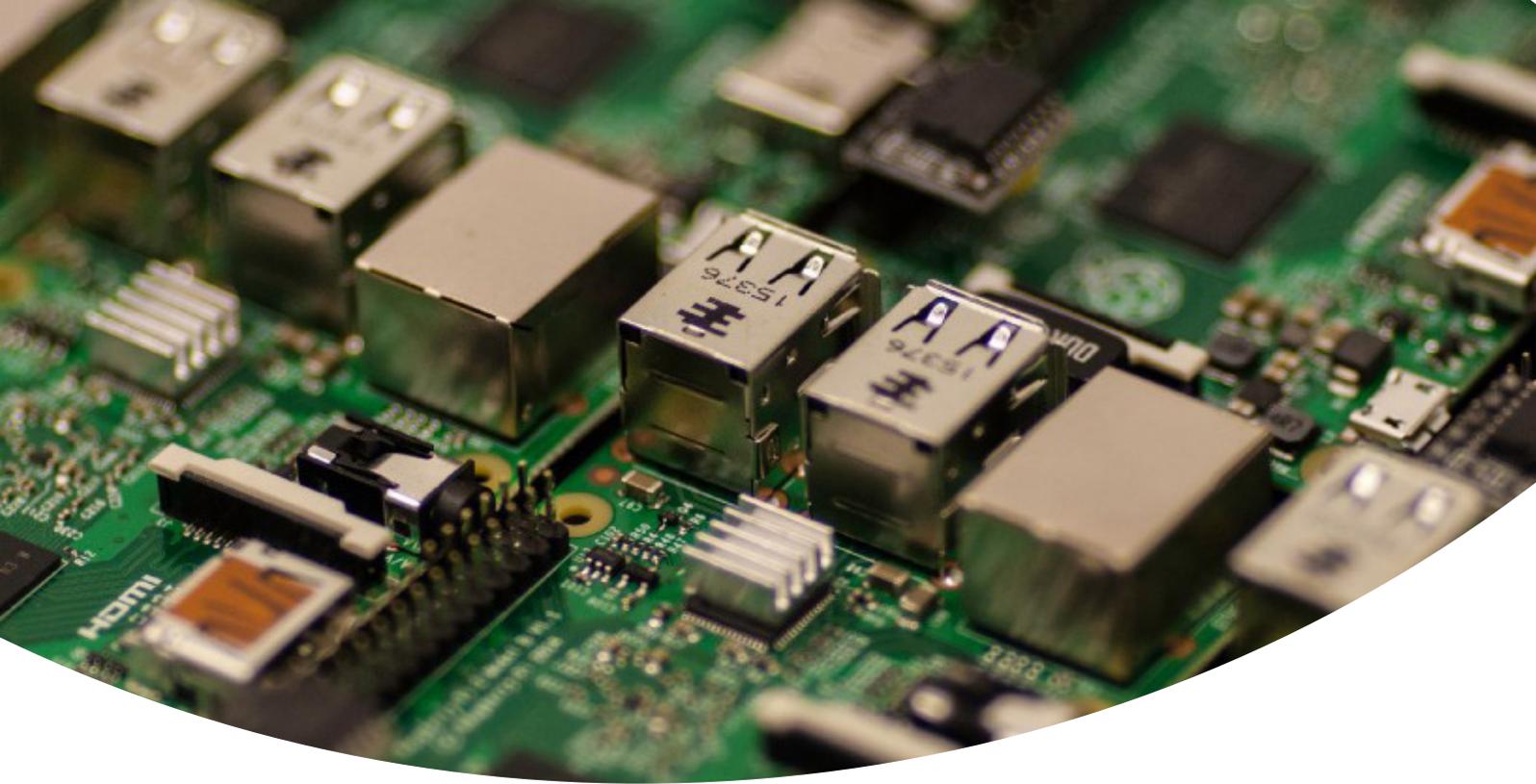
“...need to be able to fail and **recover quickly** and gracefully.”

You also need your own device management infrastructure to deal with unexpected events. For example, if your own server is managing data from 1,000s of your IoT devices, and needs to reboot, what will happen? Will the device know how to reconnect when it's up again? Will the server allow it to?

Tests to check that individual devices reconnect are fairly standard, but some overlook what happens when a million devices try to reconnect, and the server thinks it's being hit by a Denial of Service (DoS) attack. If the number of devices connecting to that server exceeds its capacity, software needs to be implemented to manage this, such as staggering the reconnections.

¹Senior Analyst, Gartner Research 2019, <https://cio.economicstimes.indiatimes.com/news/internet-of-things/8-out-of-10-iot-projects-fail-even-before-they-are-launched/52448887>





Then there's the device itself. Is it behaving correctly? Are the software and hardware properly configured and working in tandem with the SIM and modem? This is not just about asking 'does it work', but is it the best it can be? For example, we found a customer device that used a piece of off-the-shelf software that was constantly checking the time, despite having an internal clock. By removing this unnecessary feature we saved 70% of their data bill.

These are just a few of the issues that need to be considered when onboarding your device. Understanding the nature of cellular networks is the key to knowing what questions to ask about how your device will operate in different conditions.

How to plan device onboarding

Road-test the device, modem, module, and SIM in the lab to make sure it performs as expected. Think through how it will operate in situ and simulate normal and challenging conditions to investigate how it performs. Try to break it. Record what the device is doing - how it is connecting, how much data it uses, how often it transmits, how it recovers and reconnects in the face of problems. Test its interaction with your connectivity management platform. Move beyond box-ticking, and think critically about why it is doing these things and what role they play in its correct functioning.

Start with an individual device, then scale up to see if anything changes when multiple devices are connected. Problems that affect one in ten devices could end up as big costs. Beyond certain numbers, live testing becomes unrealistic, but think through how issues you identified might manifest when you have a fully deployed fleet of devices. Some of this will spot flaws that need fixing. Others will start conversations about how things can be done better.

– Part 2: Deployment and lifecycle management

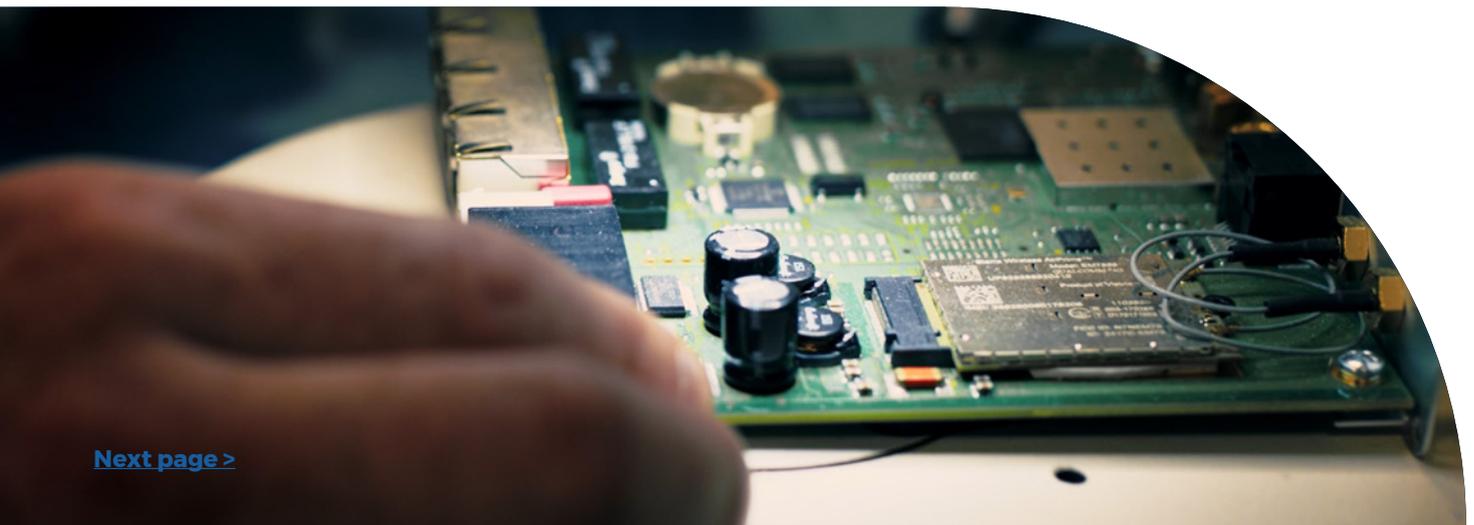
The second part of connectivity planning once the device has been fully tested and onboarded, is to consider the logistics of manufacture and process of deploying the devices' in the field.

What are the pitfalls?

Planning this phase is critical. Failing to do so could result in devices not working in the field, and require expensive remediation. **Managing your SIM logistics correctly is key to getting deployment right.** Each unique SIM needs to be associated with a unique device for that device to function and that needs to be reflected in manufacturing and record-keeping processes. Without the correct SIM to device information, it will be hard to perform analytics or manage problems.

SIMs need to be activated at some point. Once you activate, you are paying for the service, so from a cost perspective you want it to be 'just in time'. But that has to be early enough that devices can go through manufacturing test processes, or the products will not make it into the field. The last thing you need is a production line stopped as SIMs have not been activated and fail final testing.

You also need a well-defined SIM lifecycle management process, to ensure any SIM no longer needed is terminated. Knowing when to trigger the termination process based on a product's life cycle is critical. You don't want to terminate active devices, nor to have inactive ones racking up bills. Building this into your cost management processes all needs due consideration.



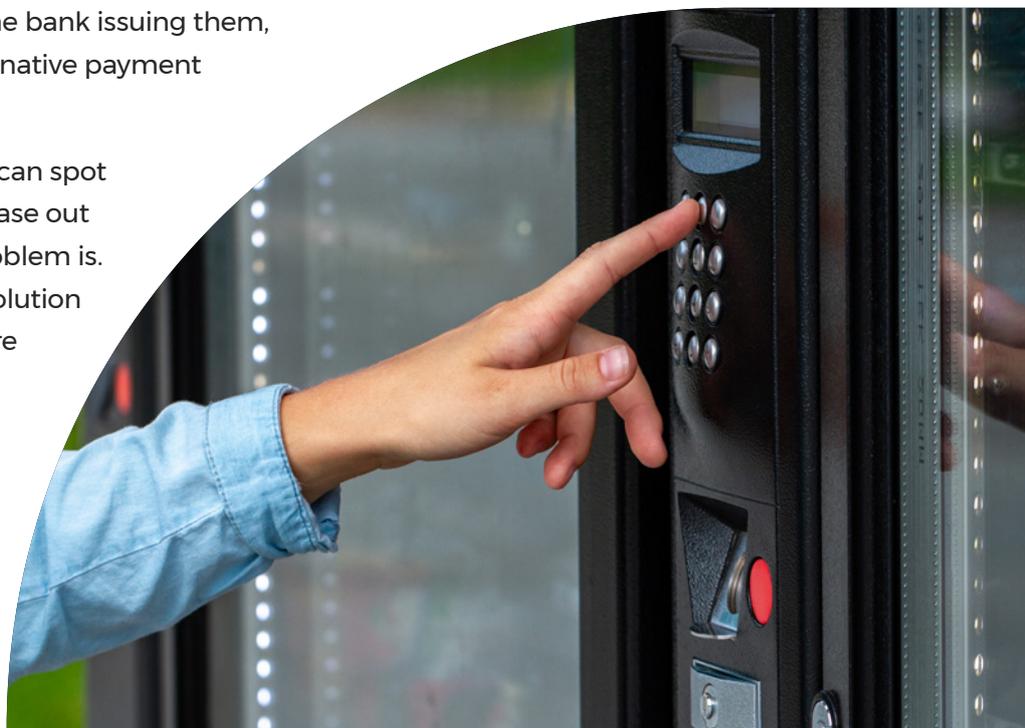
Once devices have been deployed and are connected, how do you ensure that connectivity is managed, how do you optimise that connectivity based on localization or perhaps legislation? How do you monitor for connectivity? And more importantly, what do you do when there is a reduction or outage in data from your devices? What remedial steps do you take, what should you communicate to your customers about the impact of outage of a reduction in service?

This deployment management and monitoring is an important part of a successful lifetime deployment. Devices get broken, never turned on, or abandoned. Analysis of timestamps, logs, and mobile network signals (if the onboarding phase identified the value of these and set up network tools to capture them) offer insights into network or user behaviour and help find solutions. These are complicated things to look at, but expert eyes can interpret data and derive insight.

“...**what do you do** when there is a reduction or outage in data from your devices?”

Insight into **why** a device isn't being used – not just **that** it isn't – is valuable, since users often misattribute problems. For example, it's amazing how often Point of Sale devices are assumed to have connectivity problems and thrown in the back of a drawer, when they are just not charged. These devices generate money for the bank issuing them, so any time a merchant uses an alternative payment means, the bank loses revenue.

With monitoring software, the bank can spot which ones aren't being used and tease out signals that reveal what the likely problem is. They can then decide whether the solution is replacement, deactivation, software upgrade, or customer education. This means minimised lost revenue, lower callout and replacement costs, and happier customers.





How to plan an IoT deployment

Deployment is about managing connectivity through the device lifecycle. It goes beyond individual device design, to thinking through how large-scale deployments will look.

Ensure you have the right number of SIMs delivered at the right time. Setup clear databases so you know which SIM is in which device, which integrates with your device management platform. Make plans for when to activate them, and define triggers for deactivation.

Ensure that the setup process is clear for customers. The device should always be designed to be as intuitive as possible, but users and support teams will still need adequate instructions and education on its setup and use.

Ensure you have clearly defined relationships with networks in all the regions you deploy to, and that they have adequate roaming agreements for your needs. This shouldn't be rushed, make sure you are crystal clear on what is provided.

Establish relationships with knowledgeable and available technical support teams who can guide customers to resolve any connectivity problems.

Set up monitoring software designed to spot and analyse likely problems and define processes to act on those problems, whether that's switching networks, or prompting the support team to contact the customer to get the device working again.

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– **Summary:** Don't let connectivity problems stand in the way of your IoT vision

Even for people skilled in hardware and software, designing compliant connected devices is a whole new challenge. But by carrying out sensible checks, and thinking critically, they can explore likely sticking points, and design solutions that overcome them.

This involves thinking through the journey of the device from the lab bench to in the field. Not all of this can be done through intuition, it also benefits from the insight of experts who have seen it all before. There is no single answer – each device's design depends on its intended use and operating environment.

The key is to check all aspects of connectivity work, including management tools, and understand the impact of cellular network failures. Develop standard responses to everyday situations, and tools to manage unpredictable ones.

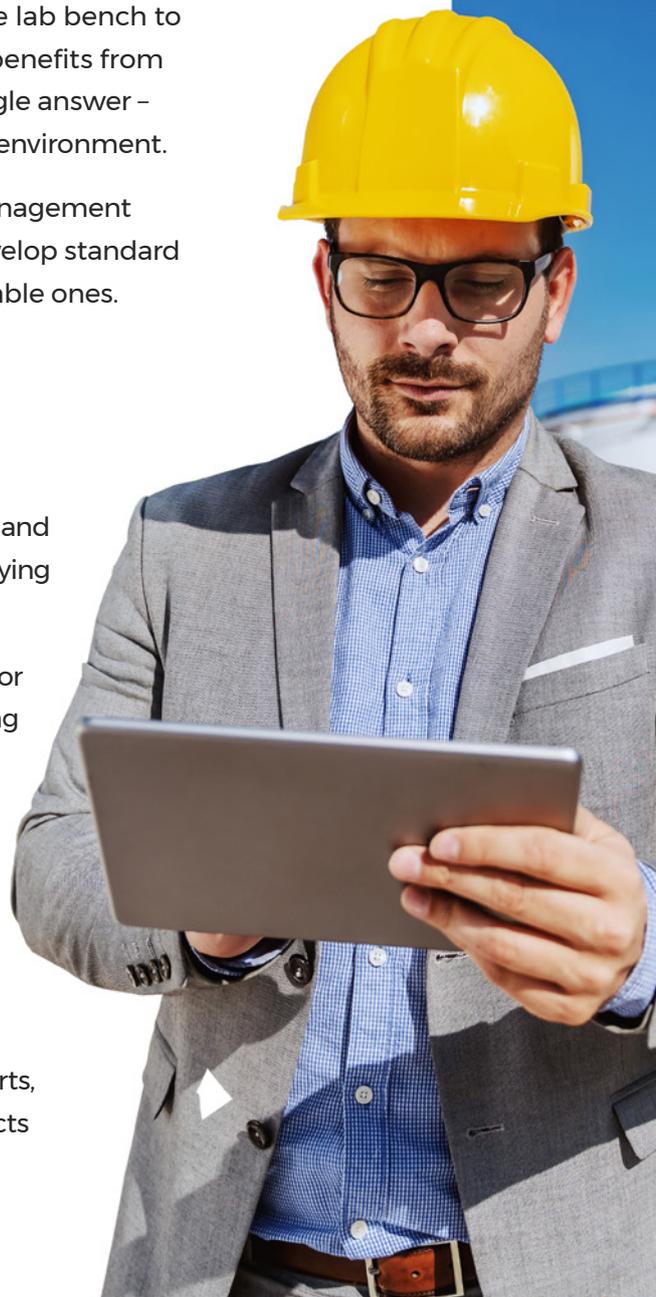
“...and **understand the impact of cellular network failures.**”

This whitepaper aims to provide an overview of what can go wrong, and an approach to thinking about the solutions to designing and deploying an IoT device for the first time. It is not intended to be exhaustive.

There is a long list of potential issues to be considered, from the minor to the serious, and what needs to be considered will differ depending on where the device will go and how it will be used. Our aim here is to help stimulate the right mindset for thinking about achieving successful device connectivity.

If this paper raises issues that concern you, or where you think you could do better but aren't sure where to start, Eseye is available to guide you through device design, onboarding, and deployment to ensure devices work out of the box and throughout their lifetime. Connectivity presents challenges, but they can all be solved by experts, leaving you to focus on your vision of getting your connected products to market.

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How Eseye can help with device design, onboarding, and deployment

We help organisations from every sector to overcome connectivity challenges and ready their IoT devices for a long and successful life in the field.

We guarantee a superior onboarding process that will future proof your device's connectivity

Here's how it works: Eseye's in-house hardware experience and knowledge help our customers to identify any issues early, so that they can be addressed before going into full production, resulting in fewer connectivity problems in the long-term. Our technical consultants run thorough lab testing by simulating a range of normal and challenging environments to make sure the device recovers quickly and gracefully.

"...fewer connectivity problems problems in the long term."

Our eUICC compliant [AnyNet+ SIM card](#) delivers near 100% global connectivity – translating into weeks of continuous connectivity without dropping. How do we do it? Eseye founded the [AnyNet Federation](#), a worldwide alliance of MNOs which helps to meet the needs of customers to deliver successful IoT projects globally with complete connectivity assurance.

What does this mean for Eseye customers? A flexible, global connectivity approach with access to over 700 mobile networks in more than 190 countries.

Traffic can be steered towards AnyNet Federation MNO partners depending on the geographic location of the deployed IoT devices. Regardless of which AnyNet Federation partner delivers the IoT connectivity service, the customer receives one contract, one management view of their entire global IoT estate, and one single point of support.

Eseye's relationships with global mobile networks, and understanding of local connectivity and data processing challenges, mean we can help businesses build connectivity into their devices rather than installing it locally. Devices with Eseye connectivity work out-of-the-box anywhere in the world and ongoing optimisation can be performed over-the-air, reducing the need to maintain large local setup teams.

Offering a high standard of technical support – no matter what!

Yoco, a financial technology company, recently approached Eseye to power its payment processing devices with rapid, reliable cellular connectivity. As part of the onboarding process, Eseye helped Yoco prepare the Neo ePOS device for deployment, putting the entire solution – including hardware, modem, module, and SIM – through rigorous lab testing to make sure everything performed as expected.

“...device with **Eseye connectivity**
work out-of-the-box anywhere..”

Based on how the device would be operating post-deployment, Eseye simulated a range of environments to check it was connecting properly, how much data it used, and how quickly it recovered in the face of problems such as a network failure. Here's what Yoco's Senior Technology Lead, said after the device went through Eseye's device onboarding process:

“The onboarding process was very thorough, which really impressed us. The guys ran through a very exhaustive list of technical checks. This highlighted some issues we were able to put right before deployment and gave us a lot of comfort and security going forward. No other supplier has given us the same degree of technical support as Eseye.”

Get in touch to discuss your IoT project

No Limits.



To talk to Eseye about the issues raised in this whitepaper or discuss the next generation of IoT solutions, please

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