✳ Particle

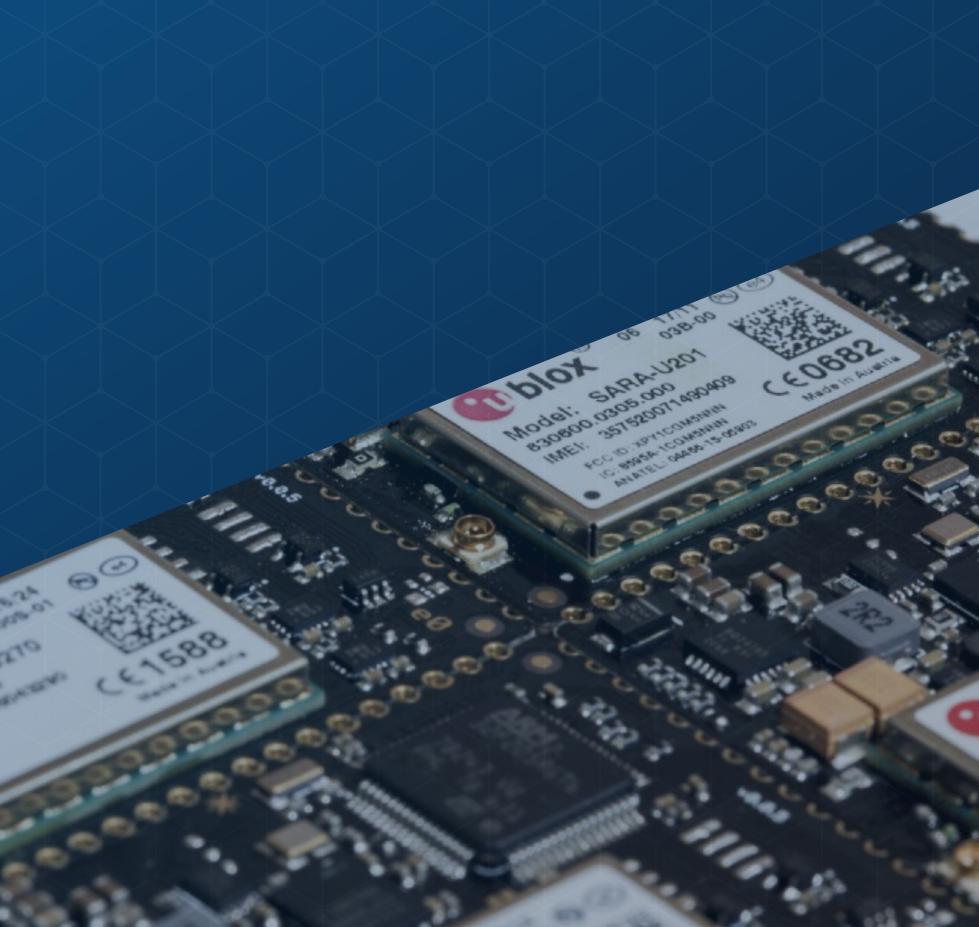# RELIABILITY, SCALABILITY, AND QUALITY AT PARTICLE

Bringing the physical world online, and making sure it stays there.

Imagine if the same people who assembled your car at the factory came along for every journey. It would probably be quite reassuring, knowing they were there. Well, when you build on Particle, you're bringing our site reliability engineering (SRE) team along for every ride.

The purpose of this document is to outline how the SRE Team at Particle proactively monitors our IoT platform on your behalf, to keep you, and your customers, connected at all times. Whether you've deployed one, or one hundred thousand devices, you can rest assured that the team is working with the same level of diligence to ensure the highest quality of service.

We'll also discuss how the Particle IoT platform is built to scale with your organization, thanks to a modern container-based infrastructure, which takes full advantage of the elasticity of Amazon Web Services (AWS).

Finally, we'll cover how having the SRE team is involved in quality assurance testing, from the factory to the field, and provides Particle customers with a significant advantage when it comes to ensuring the quality of their products.

After all, when you partner with Particle, you're getting more than just a hardware component or a piece of software. You're expanding your team to include the security, reliability, and engineering expertise of Particle. As you engage with us, you'll find yourself exposed to a group of people who are just as passionate about keeping your devices connected, and customers delighted, as you are.

The team

Like all Particle teams, the SRE team is composed of engineers with a diverse range of backgrounds and experiences, particularly in hardware engineering, networking, software development, and security operations. In addition to the three principal areas we're discussing in this whitepaper, the team also has responsibilities related to manufacturing support.

Communication

When it comes to SRE; no news is good news. If everything is working as it should, you won't hear from the team at all. That's how they know they're doing a good job! Of course, although the aim is silent perfection, there are times when things happen (either planned or unplanned), and when they do - transparent and open communication is key.

The SRE team is responsible for maintaining **status.particle.io**, which is where you can subscribe to real-time status updates about the health of the platform. Engineers include updating this page as the first step in any incident situation, so be sure to bookmark the page and subscribe to alerts.

Manufacturing

Being deeply embedded in Particle's manufacturing processes, the SRE team has a unique perspective on working with Particle hardware. The team is perfectly positioned to ensure that any changes made in the manufacturing processes are entirely compatible with the Device Cloud infrastructure. Being both the service provider, and a manufacturer, allows Particle to exercise complete ownership of device connectivity on your behalf.

Security and Privacy

The SRE team has a significant role to play in implementing technical security controls per our security and privacy policies, to make sure the data that passes through the Particle infrastructure is kept safe. You can read more about our security practices in our 'Security, Privacy, and Trust at Particle' whitepaper.

Reliability

The core responsibility of the team is making sure that the Particle Device Cloud maintains high levels of availability and reliability. As a critical infrastructure provider for our customers, this is something we take seriously and invest significant time and resources in ensuring we deliver day after day.

Monitoring

The key to keeping a service running reliably is the proactive monitoring of every component. The SRE team manages a suite of monitoring tools that operate at each layer of our infrastructure.

The Particle microservices that power the Device Cloud leverage common logging libraries, which feed log data into our log aggregation infrastructure, so we can be sure that our code is behaving as it should. Underneath the code, the compute infrastructure is also monitored for issues, to ensure that the right compute resources are being assigned to the microservices at all times.

The team also proactively monitors the network infrastructure that carries data from our devices to the Device Cloud, and back out across the Internet to our customers via their integrations.

Proactive alerting

Having visibility into the infrastructure that powers the Particle Device Cloud is, of course, a crucial first step, but it is just that - a first step. In order to truly get a return on the investments we've made in our monitoring tools, we need to be proactive when it comes to leveraging those tools to detect when things aren't working as they should be.

The SRE team is responsible for defining alerts that work by correlating data from various sources to detect potential problems that may impact the availability of the service for our customers. For each alert, a tested runbook allows the engineer responsible for leading the response to know exactly what to do.

Where an alert is indicative of an issue with a specific customer's fleet, Particle's support teams have been empowered by SRE proactive alerting work to reach out to that customer and address issues.

Alert tuning

Continuous learning and improvement is a theme at Particle. We take time to celebrate and recognize when we get things right, but we're naturally inclined to keep making things better, on behalf of all of our customers.

The SRE team meets weekly to review each alert that has been received over the preceding seven days. The purpose of the meeting is to make sure that the alerts that did trigger, and did so at the right time. We also look for the alerts that didn't trigger and make sure that if the same set of conditions emerges again, that they are caught promptly.

Partner relationships

The SRE team also maintains technical relationships with our cellular carrier partners around the world, to ensure that devices stay connected no matter where they are. Our monitoring extends beyond our infrastructure to include those partners, ensuring that end-to-end connectivity is as reliable as possible.

Beyond general health and reliability, the SRE team also works with our carriers and customers to activate and deactivate SIM cards to ensure efficient billing and identification of 'misbehaving' devices on behalf of our customers. This "carrier concierge" service is yet another example of the daily operational work offloaded to our team as a result of building on Particle.

Patching

Software patching is a never-ending process. All software has bugs, and some bugs are more serious than others. The Particle SRE team has responsibility for applying routine and unplanned patches to all layers of the Particle Device Cloud infrastructure. The team monitors announcements from our vendors to prioritize patching needs, with particular attention being paid to patches that address security issues.

Disaster Recovery

The SRE team maintains and tests our disaster recovery (DR) strategy. The team would be the first responders in the event of any DR situation, and having intimate knowledge of the key components of the Device Cloud, would be on hand to recover the service to an acceptable level of performance as quickly as possible.

Scalability

Every component in the Particle platform has been designed to scale with your business, and the SRE team is on top of making sure that happens seamlessly. Using industry-leading practices, Particle's infrastructure is designed to scale horizontally, meaning there are always sufficient resources for every customer.

Infrastructure as code

All Particle Device Cloud infrastructure is managed through code, which means that changes to the infrastructure are subject to the same rigorous peer-reviewed commit processes as our software. Access to infrastructure repositories is stringently controlled so that only those with a need to make changes can do so. Changes are also automatically announced broadly through internal messaging.

Kubernetes

Particle's infrastructure is orchestrated by the open-source Kubernetes platform. Kubernetes integrates with our continuous integration / continuous deployment (CI/CD) pipelines allowing engineers to have ownership over their code as it makes its way into production. Crucially, the highly-available Kubernetes infrastructure automatically detects and corrects services that are not running properly through container recycling. All production services at Particle reside on Kubernetes infrastructure, without exception. This means there are no single points of failure. Getting to this point was a significant undertaking by the SRE team.

Amazon Web Services

Particle is hosted exclusively on Amazon Web Services (AWS), the leading Infrastructure-as-a-Service (IaaS) platform. AWS has invested significant resources towards obtaining multiple industry certifications that cover security, availability, and operations that have a direct benefit to us, and therefore our customers.

AWS also has a number of native access, auditing and monitoring capabilities that SRE leverages to further our visibility into the Particle infrastructure.

Quality

Maintaining the highest quality of service regardless of a device's physical location is a key consideration for Particle. We understand that connectivity and environmental conditions may not always be optimal. The SRE team has responsibility for Particle's Quality Assurance (QA) program and runs tests that accurately simulate real-world conditions to ensure that our devices and platform perform acceptably at all times.

Capture Test Fleets

Having a globally distributed engineering team has many advantages. One of them is that our engineers frequently have many Particle devices on their desks all over the world, and those devices are part of what we refer to as the 'capture test fleet'. The fleet of devices connects to Particle in 'real world' conditions, and the fleet is monitored to help us detect any localized connectivity issues that ultimately may impact our customers in those geographies.

Staging environment

Particle maintains a dedicated Device Cloud staging environment that mirrors the production environment, to review and test changes before they are pushed to production. The staging environment allows the SRE team to test patches and infrastructure updates in a controlled setting.

Our SRE team, is your SRE team

When you invite Particle into your product, and onto your customers networks, you're placing a significant amount of trust in us to deliver to the highest standards of reliability and quality. We hope that this document has given you an overview of the level of work that goes into ensuring the service stays up and running smoothly.

A trusted partner, from day one and beyond

Particle serves a variety of users in a variety of different industries. Whether you're just starting with your prototype, or leveraging Particle to deploy your one-thousandth unit, you can rest assured that you're being backed by the people, processes, and technologies you need to do so reliably.

Further reading

Particle maintains a wide variety of documentation and other materials relevant to our engineering program that are available by request, and where applicable, under a non-disclosure agreement (NDA). If you would like to review any of the following, please reach out to your account executive:

- Architecture diagrams
- Various security policies and procedures
- Latest penetration test report

We also welcome any further questions on our engineering practices, please reach out via your account executive, who will route your question appropriately.