![RGS - Rancher Government Solutions logo]

eBook

The Rancher Government Guide to Edge Computing in a Cloud Native World

2023

Introduction – Let's define Edge

Although the topological concept of edge computing may be decades old, the limitations imposed by the centralized implementation of hyperscale cloud and the growing investment in IoT have thrust edge topology into the limelight. Edge computing places content, data and processing closer to the applications, things and users that consume and interact with them[1].

Edge computing is entering the mainstream as organizations look to extend cloud to on-premises and to take advantage of IoT and transformational digital business applications[1].
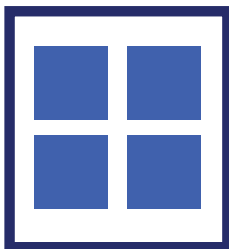
Depending upon where the edge infrastructure is located, we can segment the Edge landscape into three logical areas: Near, Far and Tiny.

Near Edge
Computing infrastructure that is between the data center and the far edge. For example, Cell tower-based compute, Telecom Central Offices, and Campus compute facilities.
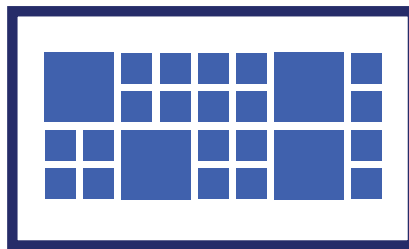
NEAR Edge

FAR Edge

Devices

Tiny Edge

10s to 100s devices

Closer to data center

100s to 1000s devices

On-site, Farthest from data center

> 1000s devices

1 Gartner - 2022 Strategic Roadmap for Edge Computing

Far Edge

Edge computing infrastructure which is deployed in a location furthest from the data center. This will be on-site and close to the end-point devices (from a network latency perspective). Examples of Far Edge include:

- Commercial sector: Retail (shop or mall), Hospitality (hotel), Banking (local branch office), Education (school), Healthcare (medical center)
- Industrial sector: Agriculture, Oil and Gas (drilling location), Manufacturing (factory floor), Transportation (airline, trains), Energy (wind turbines), Utilities (electricity, water facilities)
- Public Sector: Defense and Intelligence, Civilian agencies, State and Local

Tiny Edge

The end-point itself (e.g. microcontroller enabled sensors, actuators, fixed function devices, etc.). Often referred to as "edge devices" – the Internet of Things (IoT) fit here. The tiny edge is typically within the same network as a Far edge service.

Challenge: How to simplify lifecycle management of Edge devices

With edge devices, organizations achieve tremendous flexibility and modularity in designing the products/services that they can offer and do it at scale. On the flip side, the scale of deployment starts becoming a key element of design.

Organizations face some common pain points:

- Static builds of device firmware are no longer acceptable. Security patches and feature enhancements are routine and frequent.
- Device servicing/maintenance/updates must be delivered over the network as compared to onsite visit of a technician.
- Lifecycle management of these devices must be automated.

In order to address the pain points, the edge solution is expected to provide:

- Device registration and onboarding capabilities
- Leading security positioning
  - Security is critical as edge deployments lose the protection of the data center, introduce new attack vectors and lead to an increasing attack surface area.
- Deployment and management guidance

All the above needs to accommodate growth from 10s to 100s to 1000s and beyond. As the edge deployments scale, eliminating or reducing the operational overhead of managing edge at scale becomes key. The challenge becomes one of "Management at Scale". Combine that with the fact that market has yet to offer a fully-managed edge solution. So, to an administrator/architect, the question becomes - Can we really have "Full Lifecycle Management" for the Edge?

Our unique approach

The Rancher Government Solutions (RGS) approach is born in the cloud and meets the edge wherever it is – near, far or tiny.

RGS is creating an open source, cloud native solution for full stack edge infrastructure management. A true open-source solution for full stack Edge infrastructure management, with following 3 foundations:

RGS Edge

- Lightweight cloud-native edge stack, which is also Kubernetes-ready
- Reliable & secure edge infrastructure
- Aim for maintenance-free infrastructure

Lightweight Kubernetes at the Edge

Rancher Government Edge solution utilizes K3s - a CNCF sandbox project that delivers lightweight Kubernetes distribution fit for resource constrained and remote location or IoT devices.

K3s was built by the Rancher team and was donated to the CNCF in August 2020. K3s is production ready and packaged as a single binary optimized for ARM64 and ARMv7 support.

When used with Rancher, K3s provides users with an exceptionally reliable, comprehensive Kubernetes experience that confidently manages thousands of clusters across the Edge. Using Rancher's GitOps-powered Continuous Delivery features, K3s users can manage up to 1 million edge clusters built on x86 or ARM64-based hardware with maximum consistency and efficiency.

Longhorn, also a CNCF project, is used to deliver a powerful, distributed, softwaredefined storage platform for Kubernetes that can run anywhere. When combined with Rancher, Longhorn makes the deployment of highly available persistent block storage for your edge-based Kubernetes clusters easy, fast, and reliable.
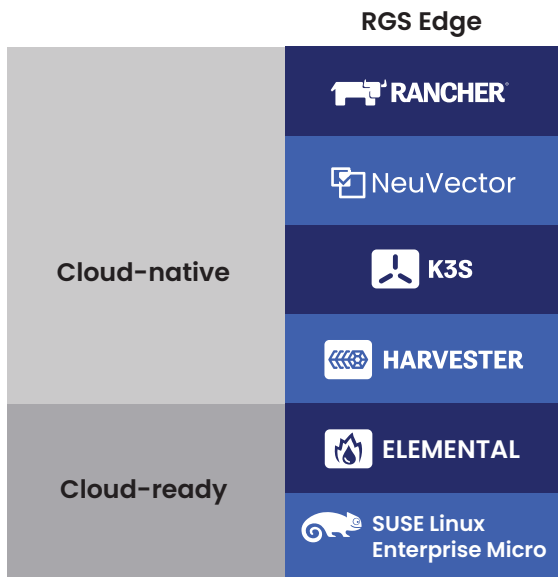
By supporting both x86 and ARM64 architectures, Longhorn is the first Kubernetes-native storage solution designed to help teams store data reliably within even the most remote, low-powered environments at the edge.

Operating System Built for Edge

100% open source and built using open standards, SLE Micro provides a reliable and secure OS Platform for the Edge. SLE Micro is built from ground up to support containers and microservices. SLE Micro leverages the enterprise-hardened technology components of SUSE Linux Enterprise and merges that with what developers want from a modern, immutable OS platform to provide an ultra-reliable infrastructure platform that is also simple to use.

SLE common code base provides FIPS 140-2, DISA SRG/STIG, integration with CIS and Common DISA STIG Criteria certified configurations. Fully supported security framework (SELinux) with policies is included.

Both Arm and x86 architectures are supported so you have architectural flexibility in deploying a broad range of edge applications.

Near Zero Maintenance

Our goal is zero maintenance - all routine maintenance functions like patches, updates, config changes are performed seamless. When things go wrong, security signed and verified transactional updates are easy to rollback.

Rancher's Continuous Delivery utilizes a 'GitOps' approach to help users manage and deploy thousands of Kubernetes clusters easily. Driven by project 'Fleet', Rancher Continuous Delivery gives users the ability to manage Kubernetes at the Edge across any infrastructure environment.

In summary, the Rancher Government Edge solution addresses a broad set of use cases ranging from organizations that are cloudready to organizations ready for cloudnative. The solution is modular. So, when combined with RGS Manager you can use it for edge use cases that are not fully containerized. For edge use cases that are fully containerized and cloud-native, Rancher can enable managing the lifecycle of largescale edge setups down to the OS level[2].

2 Check with RGS team for availability of OS level management with Rancher.

Success Story

Hypergiant

Hypergiant creates emerging AI-driven technologies for Fortune 500 and government clients in space science and exploration, satellite communications, aviation, defense, healthcare, transportation, and more.

Rancher Government Solutions is partnering with Hypergiant and DOD PlatformONE to do the impossible – putting Kubernetes on satellites for the first time. Together, the team will demonstrate the benefits of DevSecOps, Kubernetes, and AI/ML apps in remote and often disconnected environments. Working with K3s, the Hypergiant team is developing and integrating their software pipeline with the EdgeONE and SatelliteONE missions, including the launch of a K3s-embedded satellite planned in 2022.

The satellite industry faces several significant challenges. Firstly, software development and delivery on space-rated hard-

> "K3s is helping us build confidence in modern systems. We need to demonstrate the ability to update mission-critical applications and components, recover from failure, rollback, and roll forward. We need to prove reliability and survivability in space and on the ground – this is the key to making Kubernetes successful at the edge."
>
> Bren Briggs, Director of DevOps and Cybersecurity, Hypergiant

ware are costly, slow, and cold. Very cold. On average, temperatures in space are 2.7 Kelvin (-455 Fahrenheit or -270 Celsius). Consequently, in-orbit satellite software updates are often not possible or incredibly time-consuming and expensive. As a result, AI/ML capabilities are far behind those currently available on earth. Secondly, satellite connectivity and bandwidth are poor, which makes downloading large images and other data difficult.

The SatelliteONE mission was designed to solve these challenges. The project will demonstrate DevSecOps in space by leveraging PlatformONE's CI/CD pipeline alongside K3s provisioning and deployment.

Importantly, it will evaluate the use of lower-cost hardware on satellite payloads, show how the rapid delivery of software updates in space can be done, and demonstrate the use of AI/ML software in orbit.

About Rancher Government Solutions

Rancher Government Solutions is specifically designed to address the unique security and operational needs of the U.S. Government and military as it relates to application modernization, containers, and Kubernetes. Rancher supports a complete open source software stack for teams adopting containers. It addresses the operational and security challenges of managing multiple Kubernetes clusters at scale, while providing DevOps teams with integrated tools for running containerized workloads. RGS supports all Rancher products with U.S. based American citizens who are currently supporting programs across the Department of Defense, Intelligence Community, and civilian agencies. RGS is a U.S. based subsidiary of SUSE, the largest pure play open source company in the world. Established in 1992, SUSE has a proven track record to contributing to the open source community and delivering secure enterprise products and services.

To learn more about RGS's products and solutions visit www.ranchergovernment.com/contact/
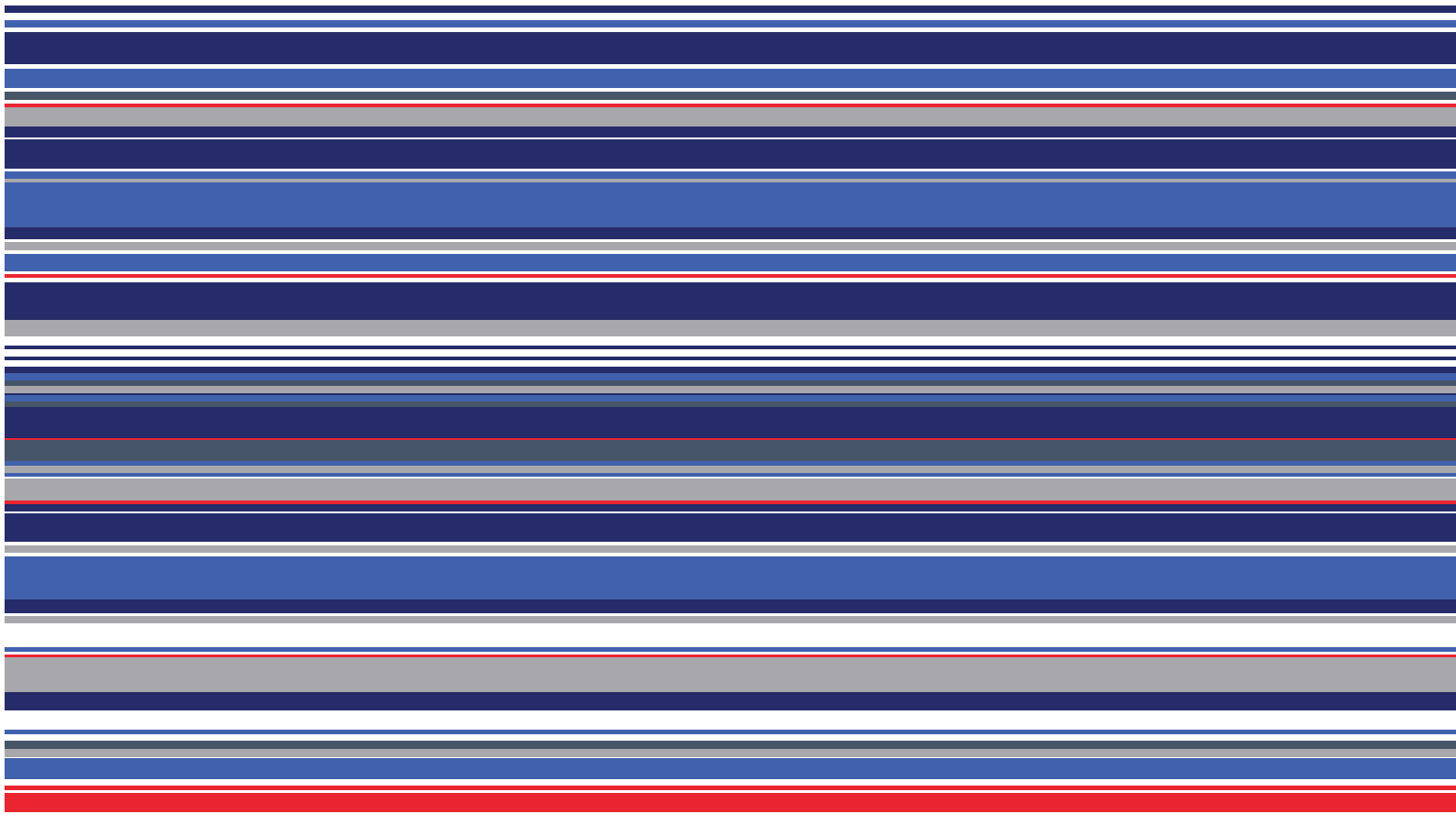
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