Ci4Rail

Computing Intelligence for Rail & Public Transport

EdgeFarm

The Cloud-based IoT platform for holistic fleet-wide management of edge devices, distributed applications and user data.

EdgeFarm

Key Features

- Hosted SaaS Service
- Management of Devices, Applications and User Data
- Fine grade User-Management with Multi-Tenancy support
- Command Line Interface (CLI) and Management APIs for fully automated setup
- Open-Source Software stack hosted on Azure Cloud
- Hosting in Europe

What is EdgeFarm?

EdgeFarm is a Ci4Rail product consisting of hosted cloud services and software components deployed on edge devices. EdgeFarm has been designed for typical use cases in public transportation applications such as preventive maintenance, condition-based monitoring, passenger information, fleet monitoring and many others.

EdgeFarm brings modern IT technology such as containers to edge devices, considering their limited resources, intermittent internet connections and their specific environment.

Because edge devices and cloud services are popular targets of cyber attacks, security was and is an important design aspect of EdgeFarm.

The modular products of EdgeFarm have been designed to work independently from each other in order to allow easy integration in existing systems.

EdgeFarm runs seamless on Ci4Rail EdgeDevices but is also open for other 3rd party edge device.

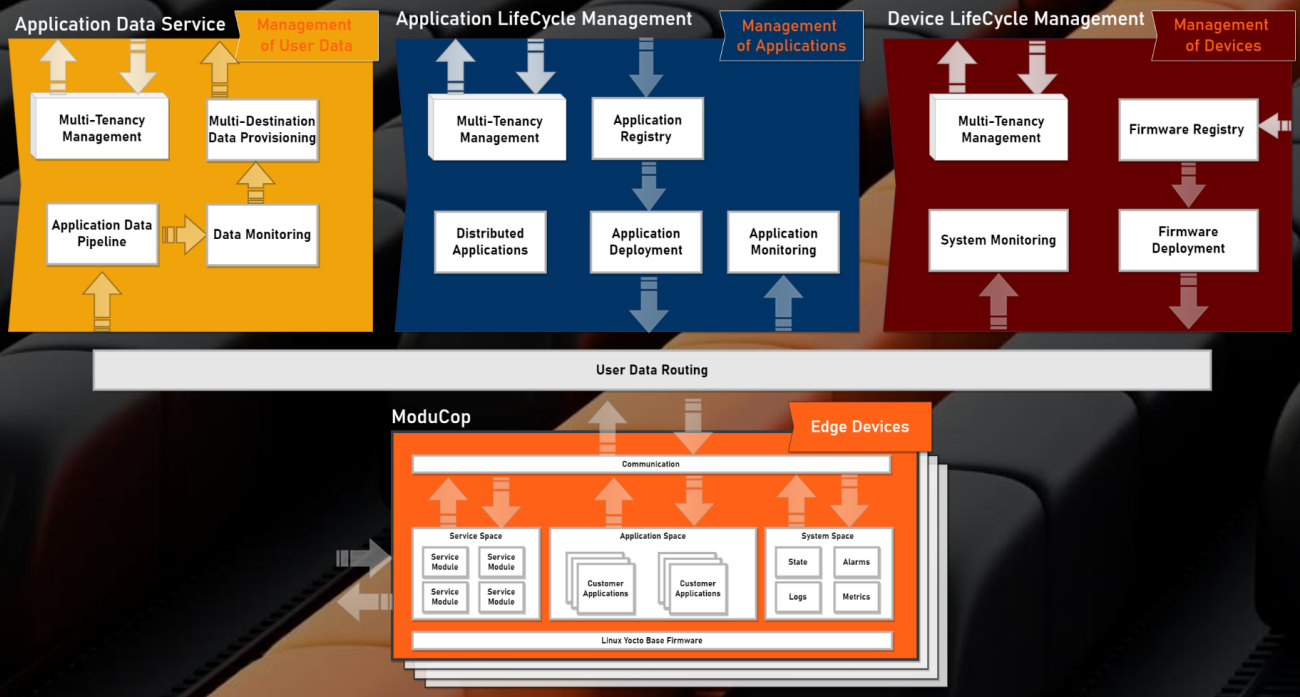
Multi-Tenancy and User Management

EdgeFarm supports multiple users and multiple tenants per Ci4Rail customer.

Via multiple tenants, a Ci4Rail customer may implement services for sub-customers or different fleets, separating the devices and users between tenants. This feature can also be used to implement separated environments (such as testing, staging production).

Each user is assigned to one or more tenants and can be assigned to different roles, in order to give each user only the permissions he needs (Role Based Access Control).

Architecture



User Interfaces

EdgeFarm offers command line interface (CLI) tool and REST APIs for all its cloud components, so it is easy to integrate in automated environments or existing systems.

Open Source

All components of EdgeFarm developed by Ci4Rail will be made available as open-source components under Apache 2.0 license, allowing to review, comment and contribute to the source code.

Note: EdgeFarm is using some closed source components under the hood. They are excluded from the open-source claim.

DLM – Device LifeCycle Management

Key Features

- Hosted SaaS Service
- Management of Edge Devices
- Device Monitoring incl. Performance Metrics
- Firmware Maintenance Service
- Secure Over-the-Air updates for Firmware
- Time scheduled and canary deployments
- Remote Device Access
- Access to System Logs

Description

DLM is part of the Ci4Rail EdgeFarm cloud services. It allows the management of edge devices from the cloud, to supply them with always up-to-date Linux firmware images and monitor the device' health status.

DLM supports edge device from Ci4Rail, but is open for 3rd party devices which run CI4Rail's EdgeFarm Linux images.

In order to keep edge devices secure over the entire life cycle, Ci4Rail provides regular updates of the Linux base firmware for the devices. The operator can then select when and to which devices the firmware shall be deployed.

Different deployment strategies allow flexible firmware rollouts, such as device selection by tags, deployment at specified times and phased rollouts.

For device monitoring, DLM provides access to important device parameters such as firmware version, online status, geo-position, etc.

To allow troubleshooting, DLM grants access to the device logs and offers a remote shell access to the devices.
All operations are secured by state-of-the-art technologies, such as mutual authentication, encryption and image signing.

... keep your device secure and up-to-date...

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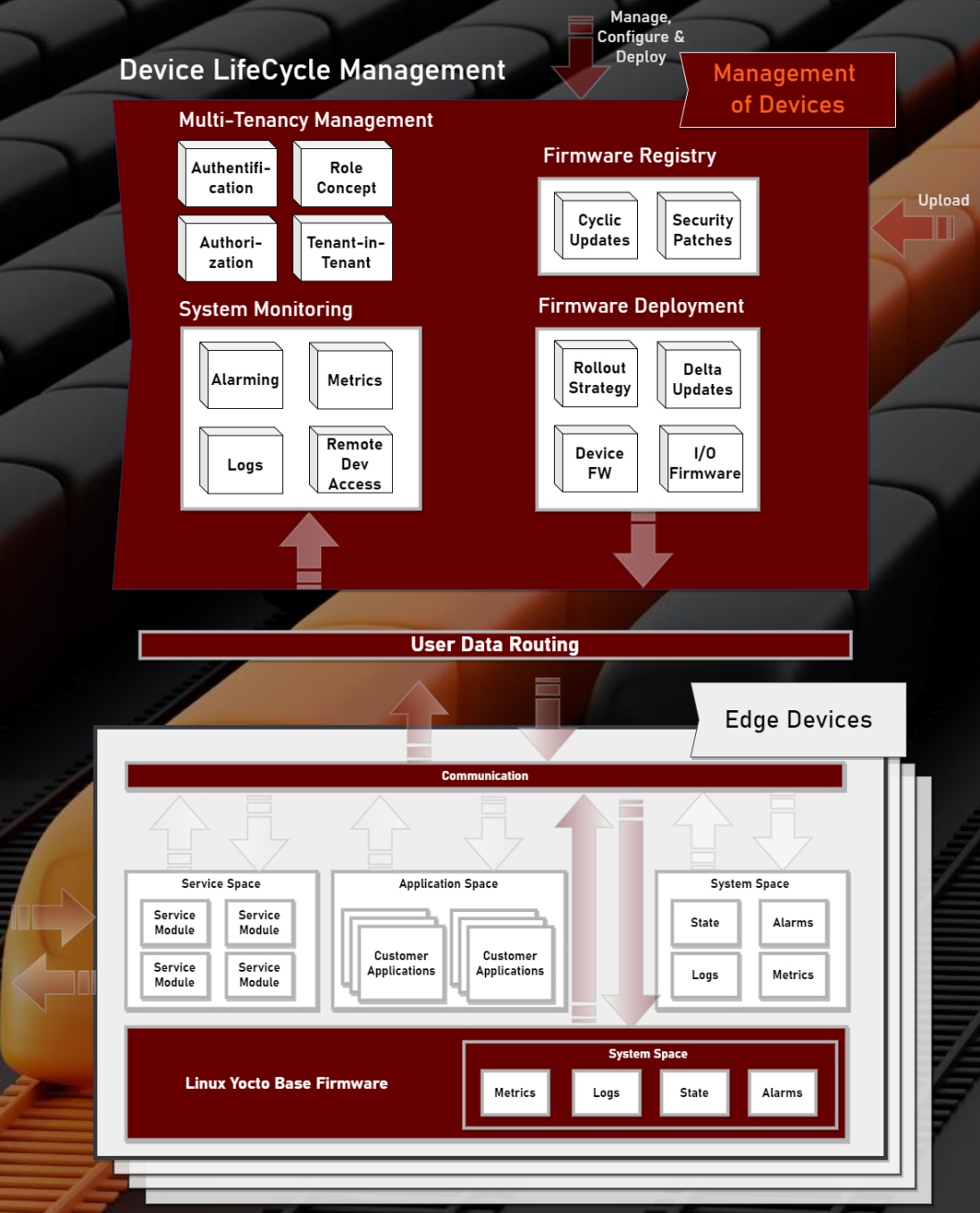
Architecture



Benefits

- System transparency
- Geo-localization
- Full control of rollouts
- Adoptable to any edge computer
- Maintained and up-to-date firmware over complete system lifecycle

ALM – Application LifeCycle Management

Key Features

- Application orchestration for containerized applications distributed on edge and cloud
- OCI (docker) container technology
- Multiple application on same edge device
- Sophisticated roll-out strategies
- Powerful communication network for fault-tolerant inter-module messaging
- Well defined service APIs to abstract data from hardware interfaces
- Application monitoring and alarming

Description

EdgeFarm application lifecycle management cares about the user applications. User applications consists of one or more application modules that may run either in the cloud or on the edge.
Application modules within an application can communicate through the powerful open-source messaging system NATS, providing multiple communication patterns such as pub/sub, request/reply and includes data buffering in case connection between nodes is interrupted.

Specific HW interfaces on the Edge are addressed by service modules that translate the raw data into a unified data representation in Apache AVRO format. Edge and cloud application modules can subscribe on those data, so they receive only the data they need.

Thanks to the container technology, applications can be developed in many popular languages, such as python, go, C++ or using graphical programming environments, such as Node-RED. Because each container uses its own environment, applications are highly separated from each other.

Since each application is defined using a single "manifest", consistency between cloud and edge modules is guaranteed and communication channels between the application modules are defined. It is possible to run multiple, independent applications in parallel - even on the same edge device. Powerful filters select the device groups to which a specific application module shall be deployed.

What is the benefit of distributed applications?

Consider an application that shall predict the lifetime of a specific asset in a vehicle. In a classical IoT architecture, the devices would send all available data into the cloud, and a cloud application module would later use the data to perform the predication. This approach comes to its limit when huge amounts of data are needed for prediction. In this case, the amount of data is usually too large to be transported via a cellular network. ...

... process the data where they happen...

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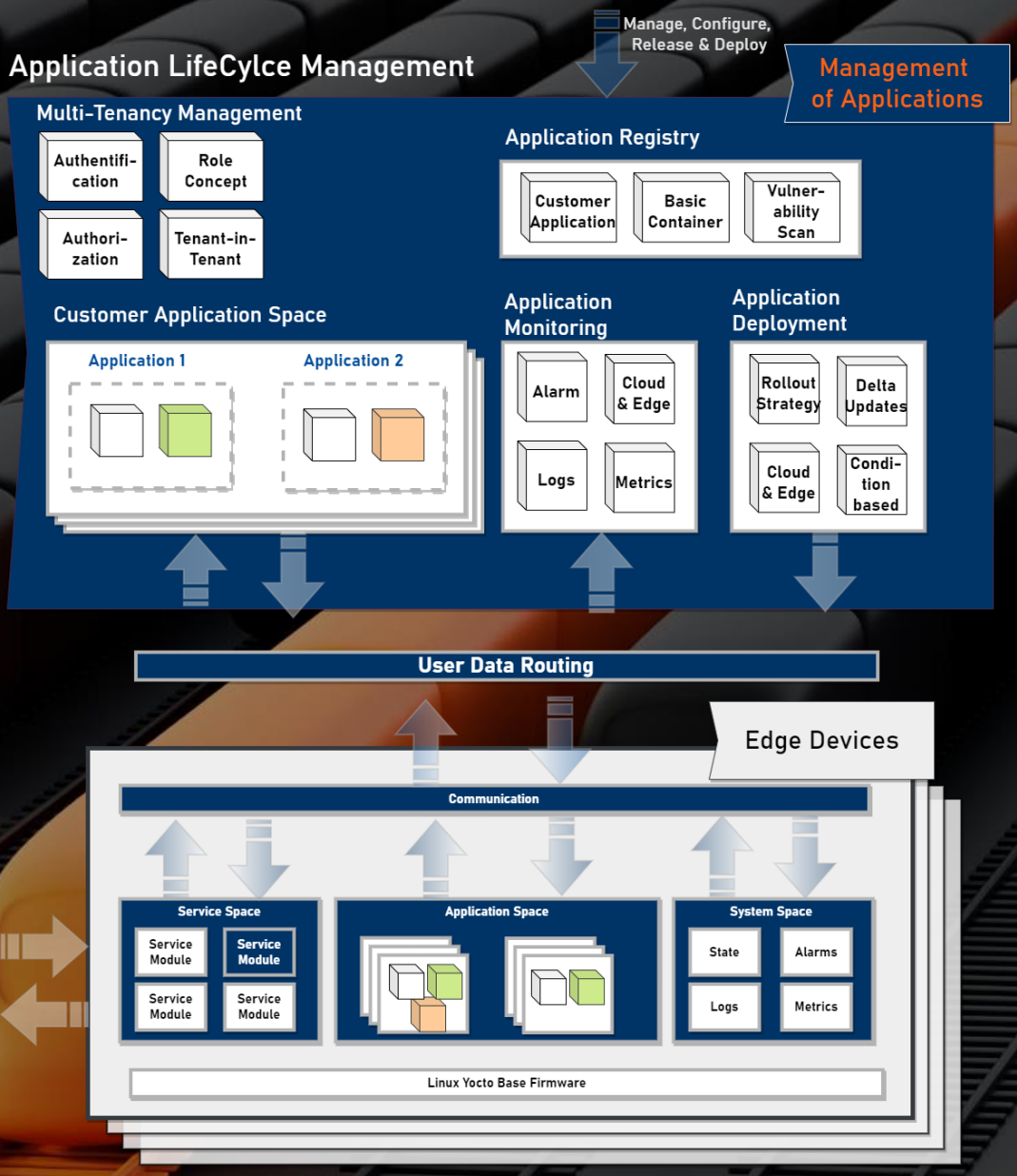
Architecture



... Furthermore, because the device does not know which data is required in the cloud, it may transmit data into the cloud which is never used. With Ci4Rail's distributed application approach, edge devices can pre-process and re-shape the data, and just transport the required data to the respective cloud application module in a suitable format.

Benefits

- Programming language independent application development
- Secure & controlled rollout and update of applications
- Extension of cloud applications to the edge – act as one application

ADS – Application Data Service

Key Features

- Data access by foreign systems through modern and secure APIs
- Configurable data routing from data sources to endpoints
- Temporary data buffering
- Data Monitoring for completeness and plausibility
- Zero data loss
- Data Filtering
- Technology independent

Description

ADS takes case about the management of the user data. It provides secure, efficient and zero loss of data transmission to the customers system. With ADS, EdgeFarm applications or 3rd party devices can publish their results to external systems for further processing.

ADS serves as a quality gate between the application and the foreign systems. As an example, consider the application "monitoring of a vehicle motor". This application may produce data targeted for the operator, while a subset of the data should be available only to the motor vendor. With ADS, the application needs to push data to ADS only, while ADS takes care of the data routing to the authorized tenants or into a database inside ADS. ADS will also buffer the data temporarily until it is consumed by external applications, providing temporal system decoupling.

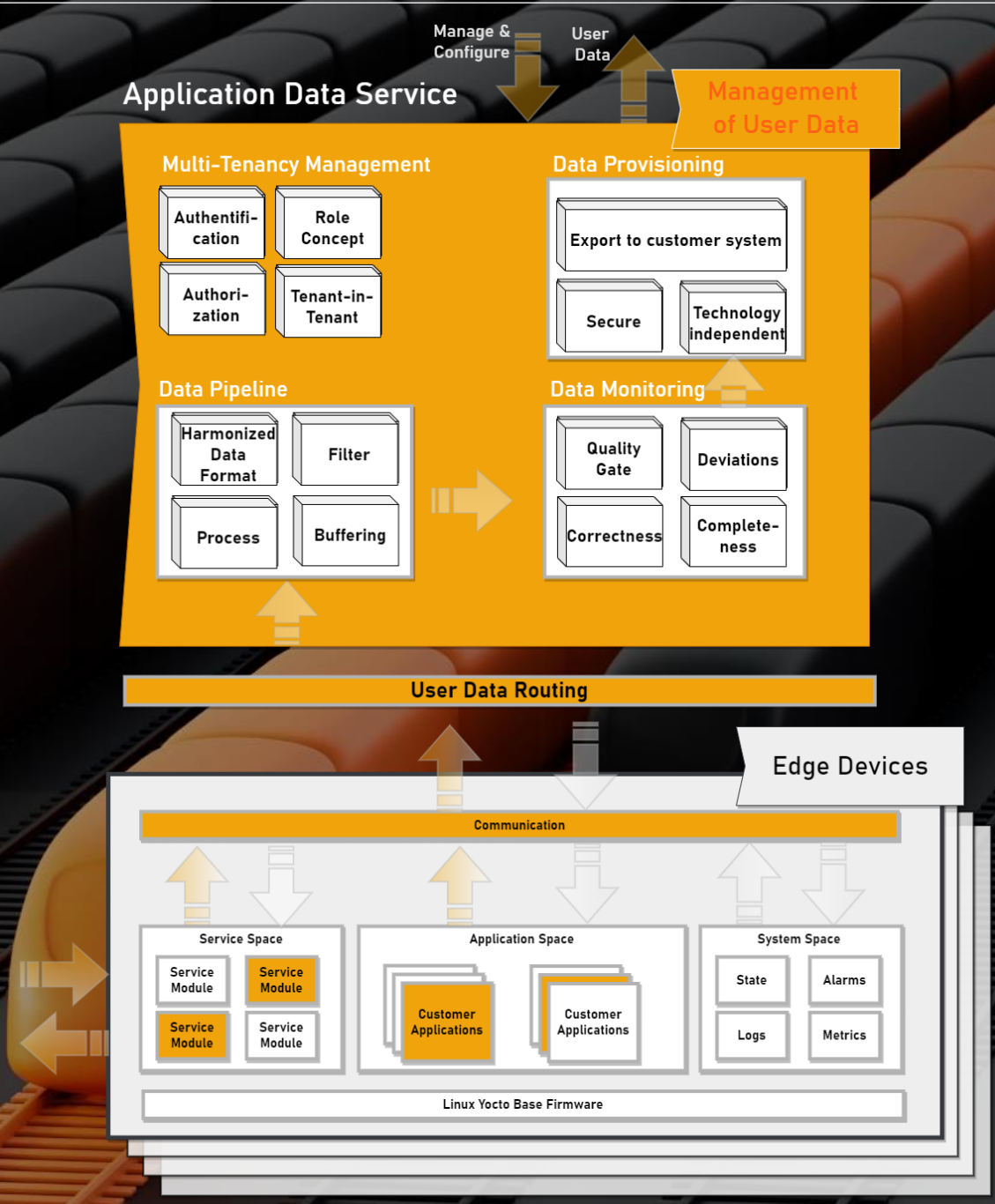
ADS offers an API to EdgeFarm applications and 3rd party devices to ingest data into ADS. ADS expects data in Apache AVRO format, with a few mandatory standard fields, therefore enforcing structured data in ADS.

Depending on the chosen commercial plan, ADS can be configured to include different kind of data bases, specialized for different use cases, such as time series data bases and data lakes. ADS can then route the application data into those data bases and the foreign systems use the APIs of those data bases to retrieve the stored data.

Using the endpoints provided by ADS, it is easy to attach external systems such as machine learning and data analytics frameworks.

... the quality gate for your application ...

Architecture



Benefits

- Configurable routes to independent tenants and create a Win-Win
- Zero loss of data
- Integration into customers cloud system
- Monitoring and Alarming

THE COMPANY

We increase the competitiveness of transport operators through computer-aided solutions using latest technologies such as machine learning and IT security for condition-based and predictive maintenance.

Ci4Rail offers computer and service solutions that support mobility operators, vehicle manufacturers and manufacturers of subsystems in their digital transformation.

Our Mission:

Driving the digitalization of rail and public transport with game changing technologies.

Our Vision:

A world in which everyone likes to use public transport because it is faster, cheaper and more environmentally friendly than other forms of transport.

Our focus is both on new equipment and retrofit for:

- Long distance passenger transport
- Freight rail transport
- Rail-bound local public transport
- Road-bound local public transport

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