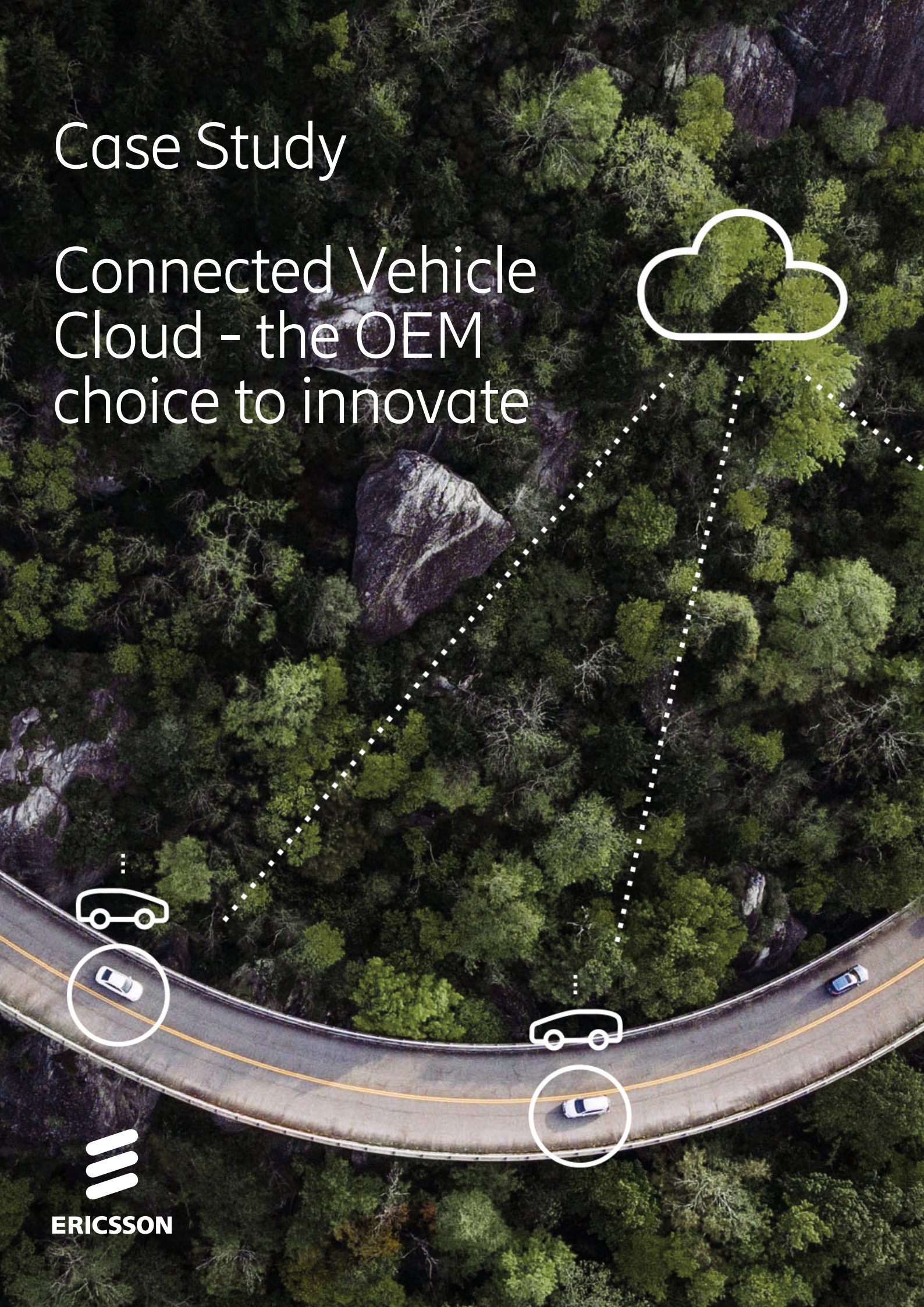
Case Study

Connected Vehicle Cloud - the OEM choice to innovate



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How a major automotive OEM used Ericsson Connected Vehicle Cloud to support their software development and digital transformation

After successfully running their telematics program with supporting connected car application for more than 10 years, the OEM wanted to take the next step with their connected vehicle program. The OEM had the aim to differentiate their brand, and be seen as the leader in digital and connected services. To achieve such a target required not only a major change in culture but also ways of working, tools to support the transformation and a connected vehicle solution that allowed the OEM to work according to the agile principles.

Succeeding with digital transformation necessitated the acquisition of additional competence beyond the traditional OEM base, to include software and service delivery.

To make this shift possible the OEM had a long list of requirements to be met, and a few of the major ones are described below.

- To be able to continually update and enhance existing services and add new services during the vehicle life cycle: In the new world of the software defined vehicle, car drivers have **increased expectations;** they expect the same experience to that of using their smart phone regardless of the application area – in-vehicle entertainment, navigation or remote vehicle control.
- Secure that the money invested in service development maximize the perceived value by the customers and internal users. **Avoid spending much of the development effort on develop and maintain the generic solution** functionalities but rather **focus on the innovative new services** that will make the brand stand out amongst competition.
- To easily accommodate 3rd party service providers in addition to in-house software development and make them part of the service experience for the end user: How do they pick a solution that is flexible and futureproof? The OEM acknowledged that what constitutes "state of the art" now has a limited shelf life and there must be openness, flexibility and the fundamental basis within the connected vehicle solution to embrace hitherto unthought of services. This would ensure they remain true to their brand ambition of digital leadership.
- To have a **global operations back-up** to ensure high-quality delivery of services in all markets: Regardless of how innovative the services are, if availability and quality didn't meet end-user expectations, then there would be an adverse impact on brand image.

To succeed the OEM knew that they needed a new development strategy and the right global partner to support them on their journey.

To enable service development and reduce the complexity of connecting with the vehicle: The OEM wanted a partner that could provide a comprehensive **automotive-specific API abstraction of the vehicle**.

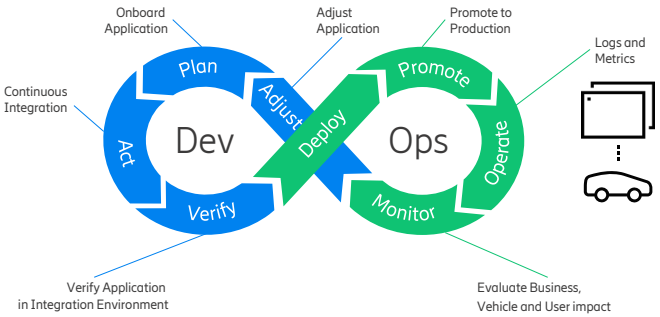
To pre-launch and test services in a flexible manner was a pre-requisite to improve the overall success of the connected services program.

By allowing new services to be introduced to a selection of users, for instance; drivers of a certain make and model of vehicle, in a particular region or of a certain demographic, the OEM could refine and perfect services based on the collected data prior to mass rollout. By testing services to limited user-base, they could streamline research and development efforts and increase the success of the eventual launch. Application developers should be able to use the same deployment and DevOps processes independent of region and cloud provider.

At the start of the journey, the OEM knew they needed a solution designed for change - with a car having a lifetime of 15-20 years, it was a given that there would be significant changes in services and their delivery over time.

Ericsson Connected Vehicle Cloud was selected to reduce the complexity for the OEM and allowed them to focus on what mattered most: The ability to innovate. To able to do that, the OEM decided to have a partner take responsibility for the technical and operational foundation required to rapidly develop, launch, and operate new connected vehicle services

Developing services to meet the demands of today's consumers requires developing, launching, evaluating, and improving services using continuous feedback loops. This process is typically described using the DevOps cycle.



DevOps Practices Enabled by Service Innovation Value Package

The OEM realized that implementing a new strategy for connected services without changing, both, the existing organization and processes could lead to slower development and/or failure to compete with competitors and meet the perceived needs of their customers.

The need for change triggered the OEM to organize themselves around services and implement the DevOps process. Teams were tasked to continuously develop, operate, and improve services end-to-end. An architecture that supported this transformation throughout the entire DevOps cycle was required.

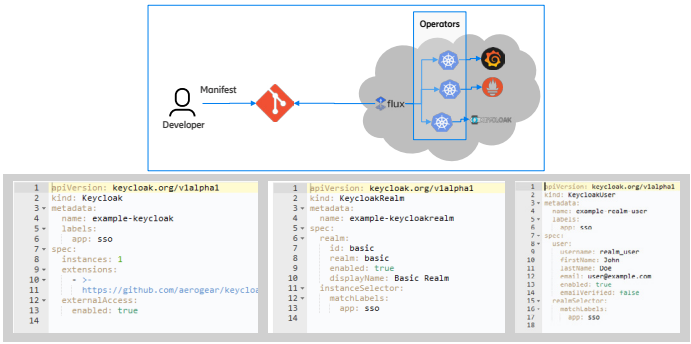
Each development cycle starts with planning and action of the next service release, based on feedback from production systems and wanted features from product management

The connected vehicle program of the OEM has, over the years, grown to include more than 100 different services or services components. These services are developed by many different development teams, in different organizations, which need to be able to work independently.

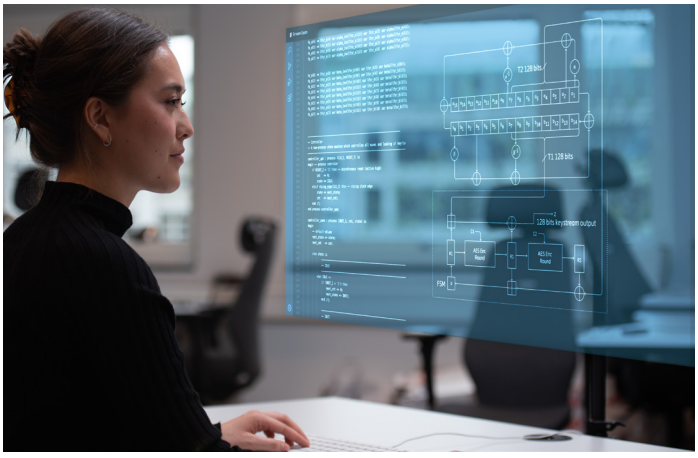
Each team controls the planning and design of their services, together with the product management, and has direct access to request the resources and services they need from Ericsson Connected Vehicle Cloud. An access policy control engine limits who can change what and get access to which resources. The access policies also limit different applications from interfering with each other, this is critical in order to enable the development organization to grow and work in an agile manner.

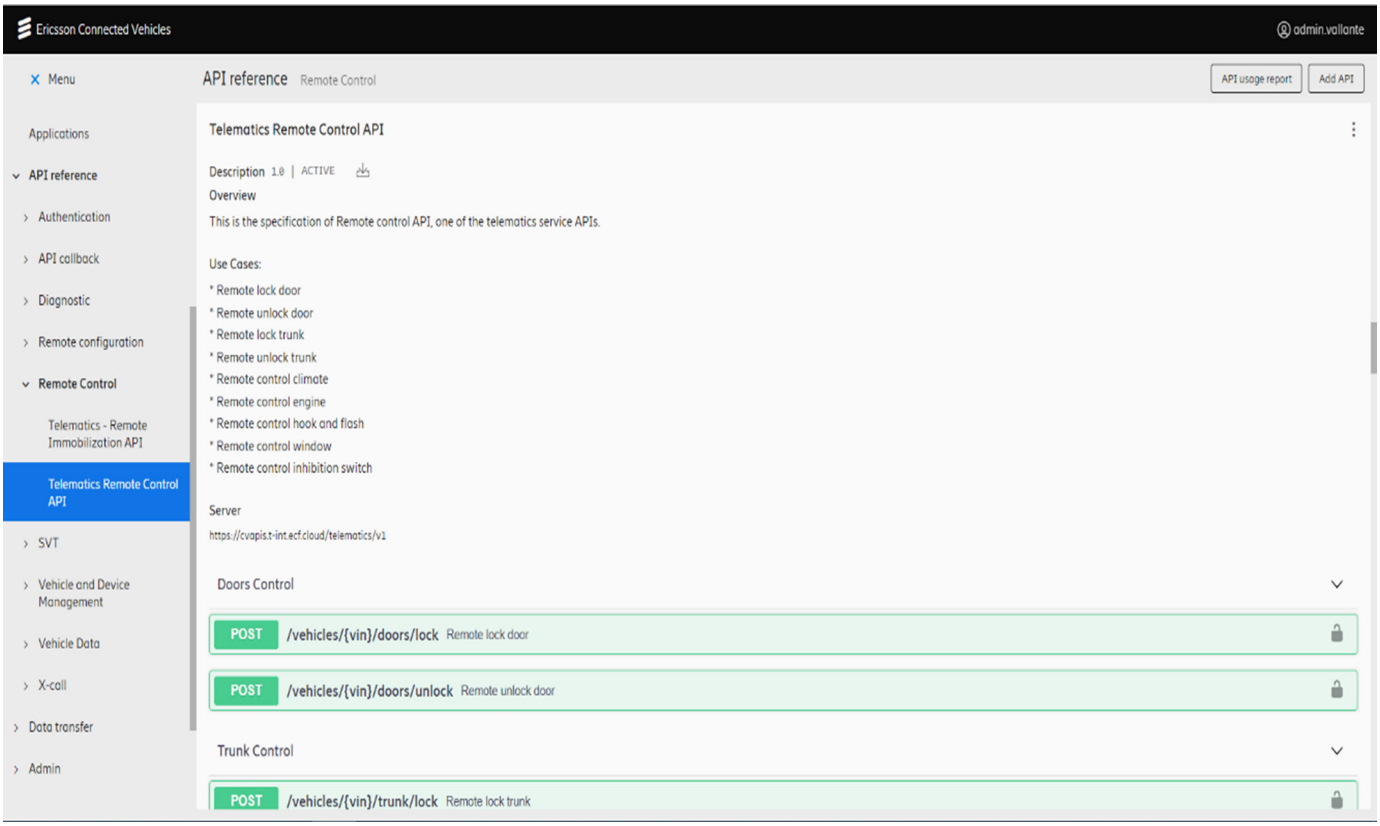
The ability to design for change and avoid lock-in to proprietary solutions was always been one of the main concerns of the OEM in selecting technology partners for their connected vehicle program. Because of this, the use of standardized technologies and open APIs as a foundation for all services in CVC is a highly valued facet. The use of leading open source technology ecosystems, such as Kubernetes, Docker Containers, and Git allows the teams to share development environments with other projects, and facilitates re-use of technology and competences within the IT or R&D organization. This also makes it **easier to change or switch out parts of the solution as requirements and technologies evolve over time**.

Resources and services are managed using APIs in Ericsson Connected Vehicle Cloud. Those APIs can be accessed using the CV Portal, REST APIs or by declarative APIs supporting a GitOps way of working. This allows developers to use their existing development environments and enables different continuous integration pipelines to be directly integrated with CVC in order to create a distributed continuous deployment flow.



Example of an exposed API using Kubernetes operators to manage realm and users in CVC Identity Access Management service





Screenshot of the Connected Vehicle Portal Application management

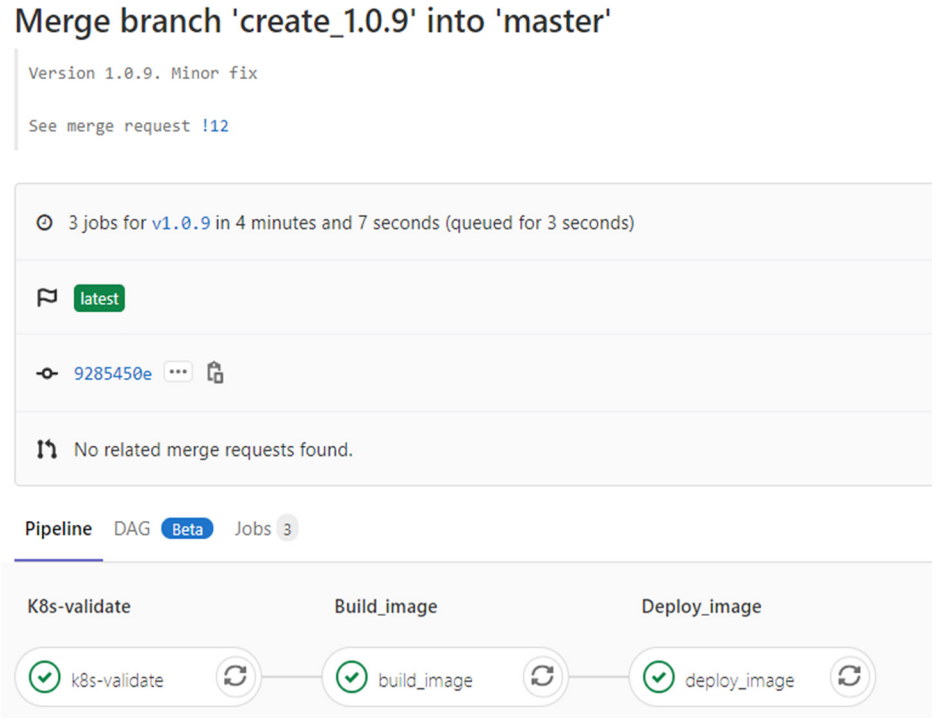
A highly automated verification, deployment, and promotion flow is the key to quickly and frequently launch new services, while meeting high stability and availability demands of the automotive industry

Connected services are following the micro service principles and are tested, deployed and promoted independently from other services. That implies that each service has its own Continuous Integration / Continuous Deployment (CI/CD) pipeline.

The CI/CD pipeline is integrated into the Ericsson Connected Vehicle Cloud, creating a distributed CI/CD pipeline where integration and verification of the service are done in the CVC integration and staging environment. This process is in most cases automated; exceptions occurs when the teams have a need for manual tests. For example, verify a service with real vehicles in the staging environment.

Large organizations with decoupled development using DevOps flows means that deployment and promotion approvals are delegated to each team. Each team is self-organized and have the mandate to define their own approval and CI/CD flows.

Deployment and promotion flows for services use GitOps based DevOps flows, where the wanted state of a service is declared in Git by the team and then CVC make sure that the declared state is deployed as declared. This gives the development teams a single source of truth of how and where their service is deployed.



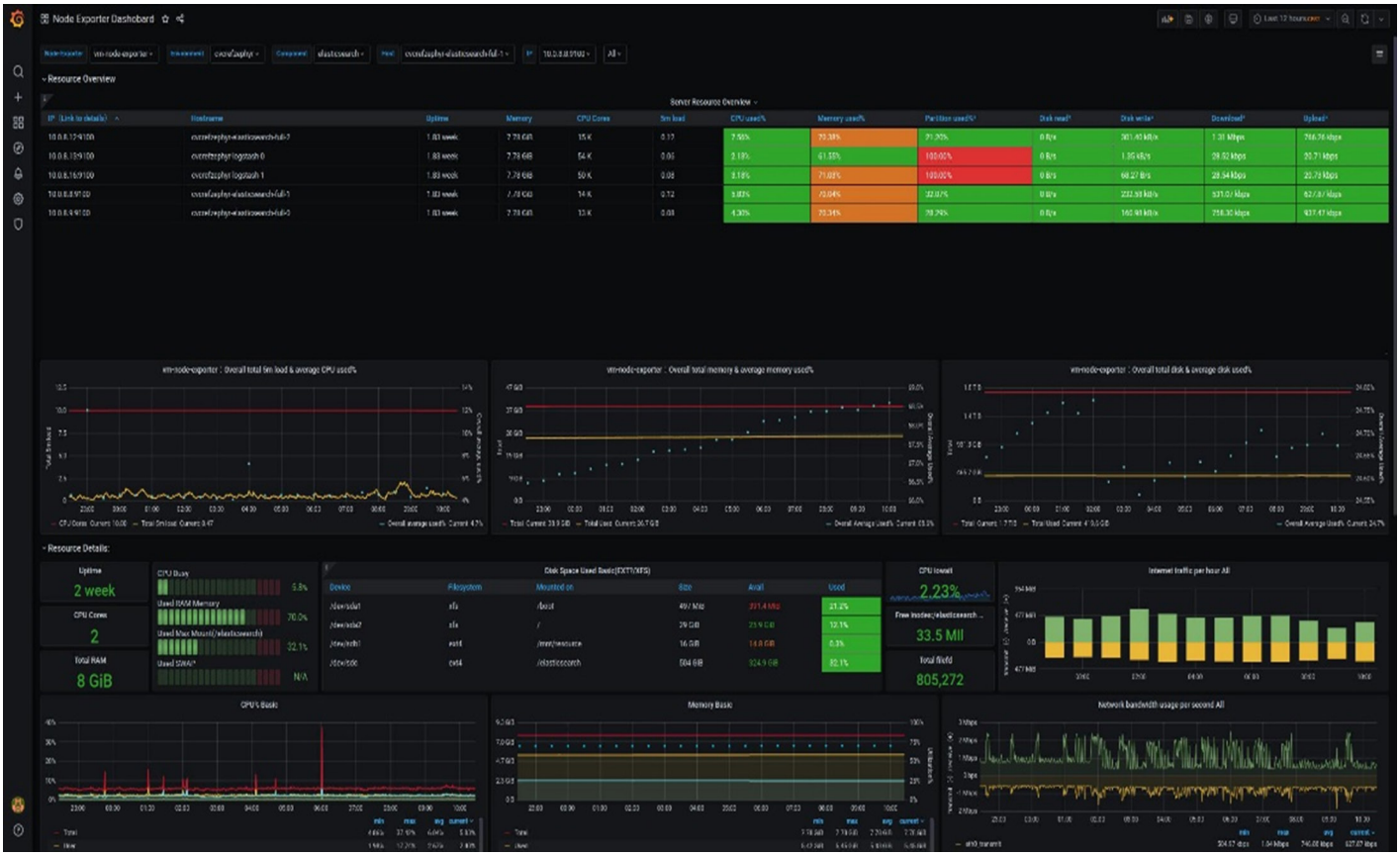
An example merge request CI pipeline for the OEM

Delivery of highly available and frequently changing global connected vehicle services requires the ability to decouple the operations of the infrastructure to reduce complexity and enable DevOps teams to monitor their own services

DevOps teams continuously monitor their service with the tools of their choice, integrated with CVC to receive service specific metrics and logs. Metrics related to service executions from CVC services are also available, enabling the development team to have a system view of their service.

Each developed service is different, some will handle a small amount of traffic, some will handle peak traffic during a couple of hours each day. Predicting the traffic at each given time takes time to learn, always with a huge uncertainty. To minimize the need of the team to always be available to act on changes in traffic volumes, horizontal (up and down) **auto scaling** is configured for each service using threshold value set by the team. The service must be built to support auto scaling, and if that is not the case auto scaling is disabled and it is then up to the team to manual scale the service.

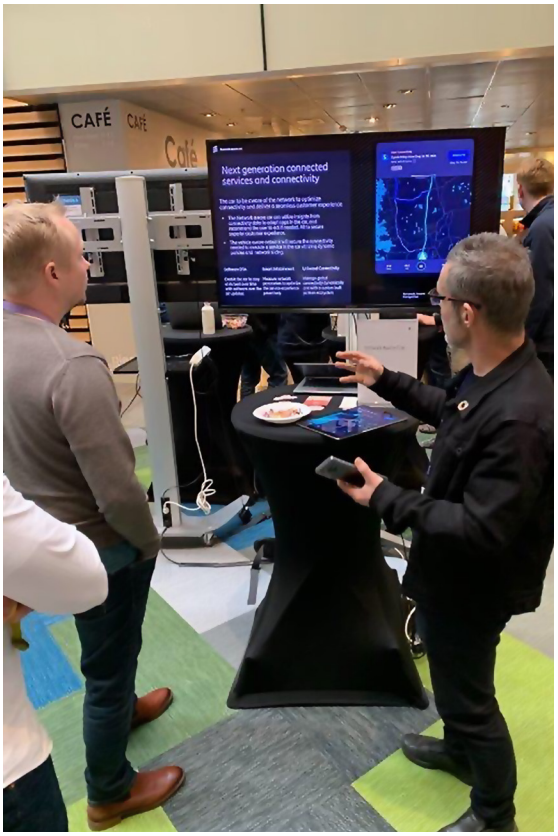
In addition, Ericsson CVC operation teams monitors all CV services and infrastructure 24/7 using CVC built in logging and metrics tools. Ericsson CVC operation team make sure that the infrastructure always has the capacity required by the OEM traffic and services.



Example metric dashboard of a connected vehicle service

New types of connected services require new features in Connected Vehicle Cloud. Ericsson is seen as a partner by the OEM with a tight collaboration to continuously evolve the platform to support the OEM's connected service needs

The CVC product roadmap is influenced by the OEM. 5 times a year, the appropriate OEM teams (including development) are invited to a roadmap and demonstration session. Ericsson presents the latest features in CVC, both those related to services used by the OEM and other areas of potential interest to the OEM. Certain features may be used to promote technology and thought leadership at industry events.



New Services in CVC demonstrated for the OEM

The Service Innovation Value Package in Ericsson Connected Vehicle Cloud is readily available to help any OEM launch a new connected vehicle program or accelerate development of an existing solution

Ericsson's Service Innovation capability allows OEMs to connect vehicles in a secure and scalable way, and to develop and operate applications that provide backend services for vehicles and users. It is built with the needs of the development and operations teams in focus. It provides a set of services, that can be freely selected based on the different and evolving needs of the OEM. All services are built to interwork with other services developed by the OEM, delivered by public cloud or other service providers.

The services that can be selected from Service Innovation include:

- Application Execution Environment – A Kubernetes based container orchestration platform with security policies, continuous deployment, and monitoring services to support a distributed GitOps based DevOps flow. Includes a self-service portal for creating, configuring, and managing all applications deployed on the platform.
- Vehicle Communication Services – A highly scalable vehicle connection endpoint and message broker that connects vehicles securely and scales globally. Including ready to use APIs to provision vehicles and communicate with vehicles.
- Application Support Services – Services available for hosted applications to utilize and allow developers and operations teams to focus on the differentiating services. Includes fully hosted, managed, and hardened databases (SQL/NoSQL), in-memory data storage, message brokers, metrics tools, and logging tools.
- API Management Tools – An easy to use self-service portal which the OEM development managers can use to manage which services should be available for different development teams and partners organizations to use for their development.

All services are provided globally with a 24/7 operations and support team, with guaranteed availability in accordance with the Service Level Agreement.

The Service Innovation services can be used together with other services in the Connected Vehicle Cloud i.e. Telematics and Fleet Management and with the OEM's own developed services created using Service Innovation.

For more information about Ericsson Connected Vehicle Cloud, visit: https://www.ericsson.com/en/internet-of-things/automotive/connected-vehicle-cloud

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.