Moonshot Catalysts

Monetizing federated connectivity for automotive OEMs

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Overview

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Catalyst summary
Introduction

Overview

Enhancement of **Automotive** use cases through the adoption of **5G technology** and **Edge Computing** capabilities, aiming to provide tools for **Network Abstraction** and **Service Monetization** focused on both **Application Providers** (Customers) and **Service Providers**

- Monetization: collecting service events from the abstracted Edge network infrastructure
- Federation: “Any Connect Any Edge” for vehicles including 5G SA Roaming services
- Connectivity: Edge network to drive the vehicle for getting the best-fit connectivity

Project members:

TOYOTA

AECC

vodafone

NTT DATA

xacria

Netcracker
An NEC Company

Technologies:

GSMA

tmforum

CAMARA
THE TELCO GLOBAL API ALLIANCE

2023 - 2025
ML SysOps
Funded by the Horizon Framework Programme European Union

3GPP
A GLOBAL INITIATIVE

Participants
Sponsorship and Contribution

Proposal & System Integration: NTT DATA

Sponsorship (Champions):

TOYOTA AECC	vodafone	vodafone	TOYOTA AECC
Application Provider	Service Provider	Infrastructure Provider	End-User Devices
Automotive OEM (use case)	Monetization Manager; Service & Order Manager; Edge Middleware	5G; Edge Node	Telematics Control Unit(s)

Contribution (Participants): Netcracker An NEC Company; xacria; NTT DATA

“Monetizing federated connectivity for automotive OEMs”
Roles

Application Provider	**Automotive OEM** (Use Case)	**Application Design and Execute** for Automotive use cases with the idea to leverage on Network Capabilities for Edge and Proximity services
Service Provider	**Monetization Manager**	**Service Provider function**, capable to **monetize, expose and bill the Customers** (Application Providers) based on real traffic and resource usage
	Service & Order Manager	**Service Provider function**, capable to **expose primitives**, decompose and execute **network creation and service delivery work orders**
	Edge Middleware	**Abstraction Layer** capable to **interoperate with mobile devices** and to **expose a unified multi-technology data model** to get information for **resource usage** and **near-real time events**
Infrastructure Provider	**Network Operator**	**Network Infrastructure and Service Management role**, capable to create resources based on Customer work orders and **allocate connectivity resources on-demand**
End-User Devices	**Telematics Control Unit(s)**	**Automotive Telematics Control Unit (TCUs) installed into vehicles** engaged in Application Provider’s use cases **driven by the Edge Middleware for best-fit connectivity** execution

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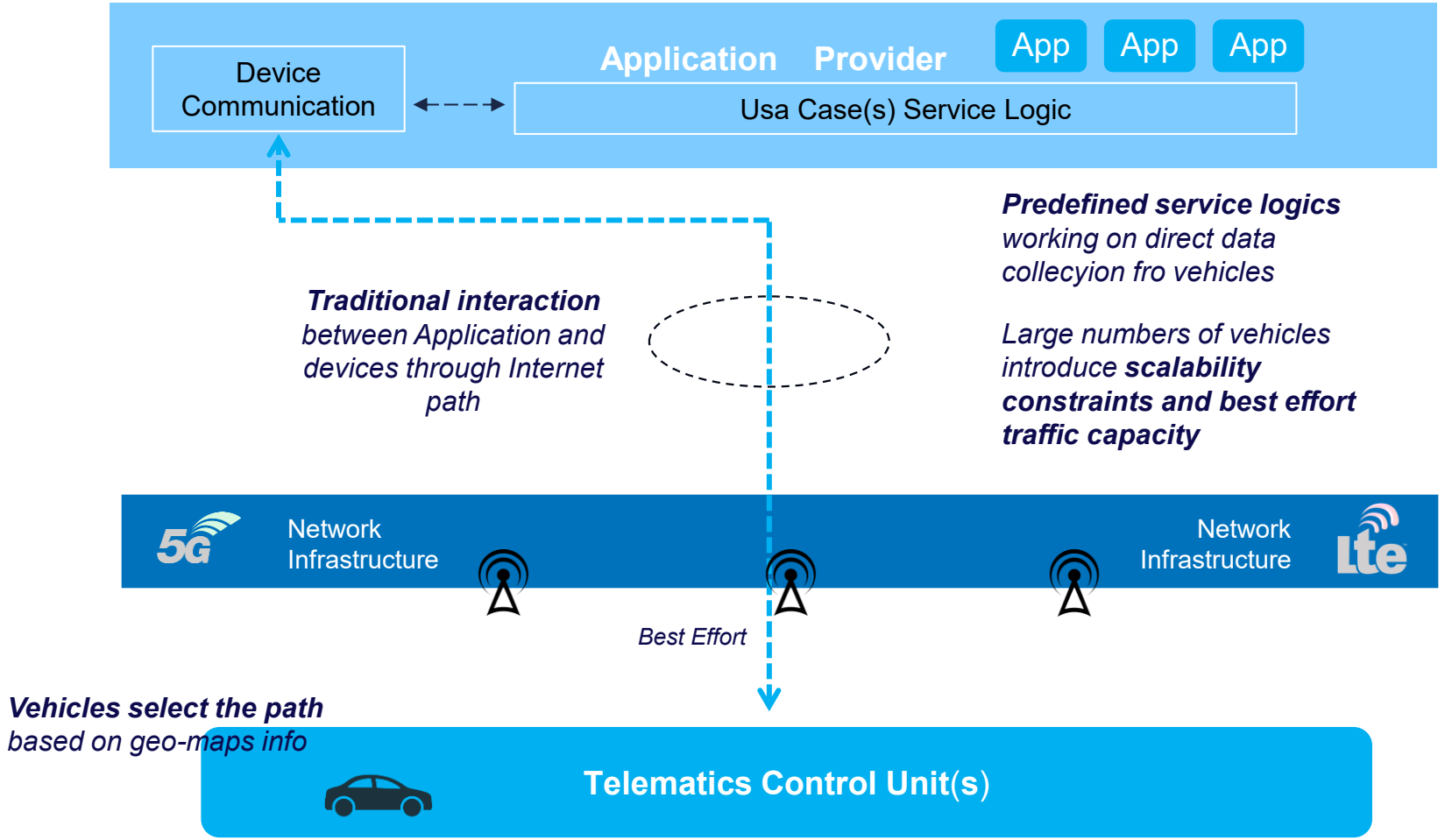
Legacy View



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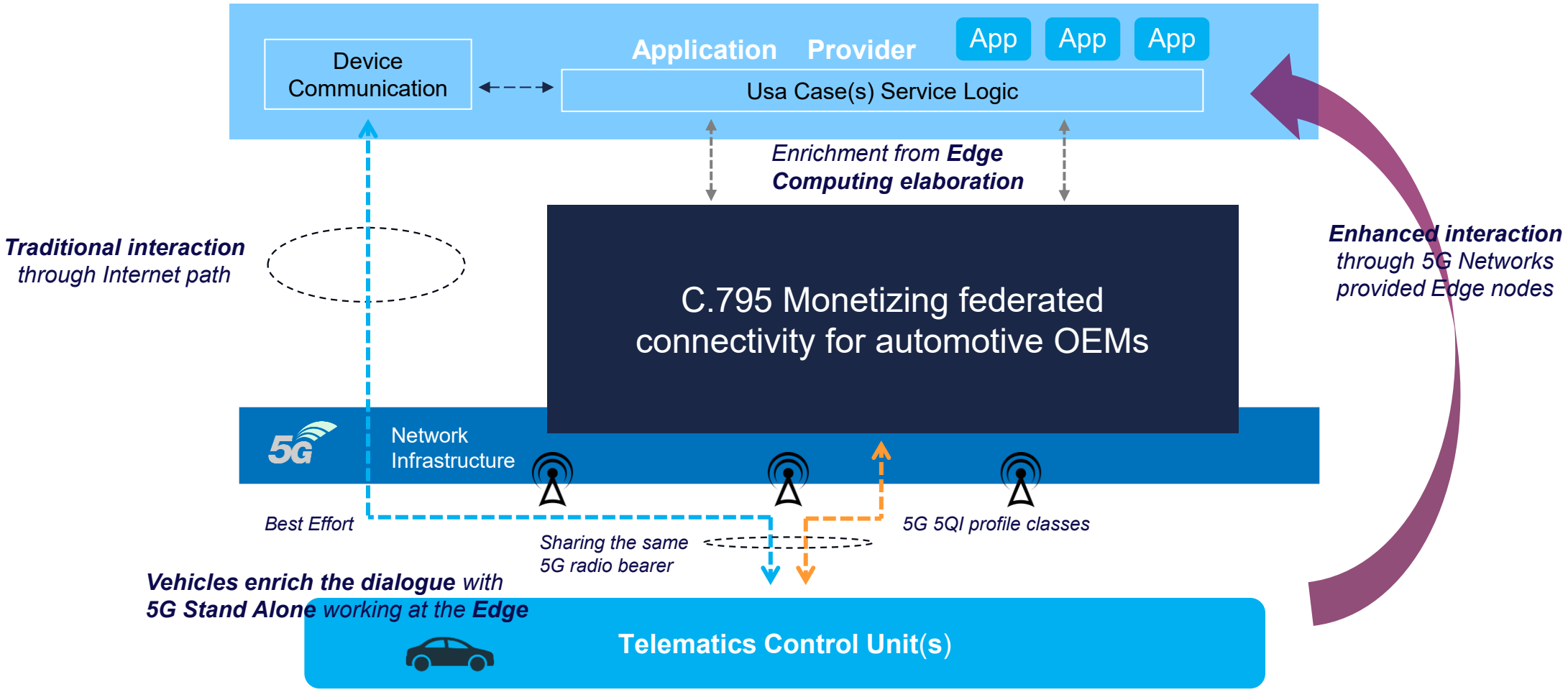
Innovation: Edge Support



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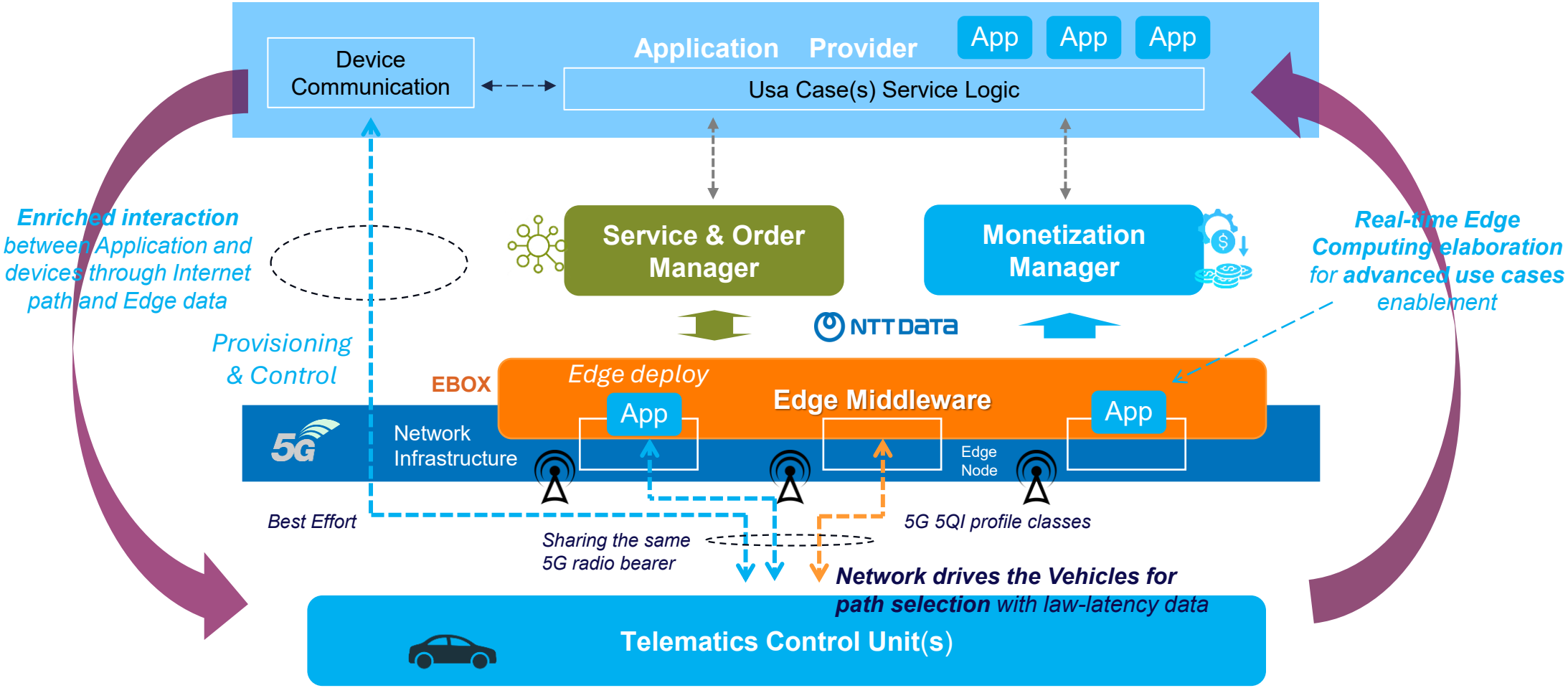
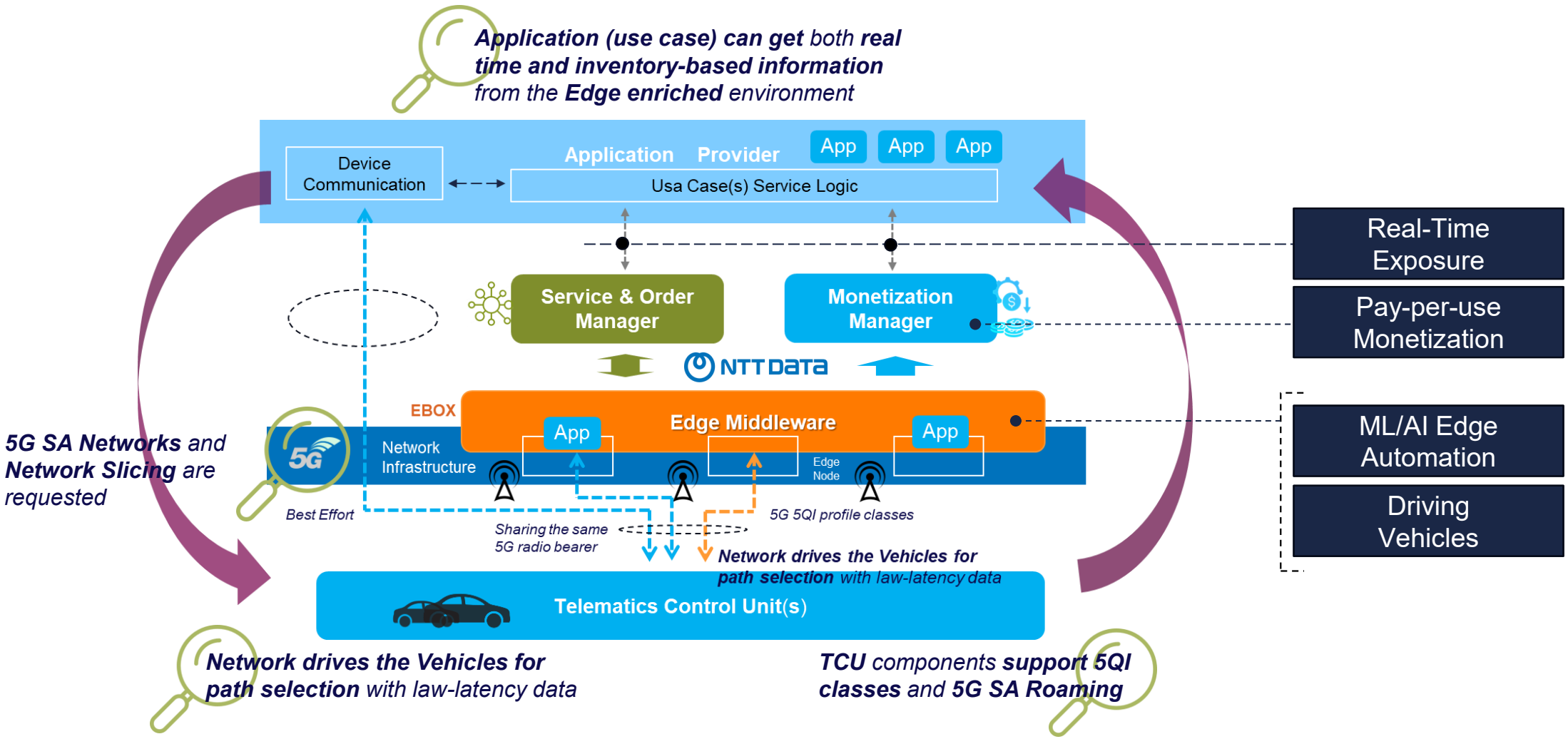
Proposed Solution



“Monetizing federated connectivity for automotive OEMs”
Innovative Features



“Monetizing federated connectivity for automotive OEMs”
Innovative Features

Real-Time Exposure	**Exposure of real-time parameters to Application Providers** about vehicles mobility by **abstracting the infrastructure** (CAMARA THE TELCO GLOBAL API ALLIANCE)
Driving Vehicles	**Best-Fit Connectivity for Telematics Control Units** (**TCU**) **driven by Edge Nodes** based 5QI quality parameters (5G service classes)
ML/AI Edge Automation	**ML/AI**-based **Network Creation for Edge Computing nodes** supporting on-demand location or area coverage served by Automotive use cases
Pay-per-use Monetization	**Monetization and pay-per-use model of Automotive services** in a multiple Mobile Operators environment

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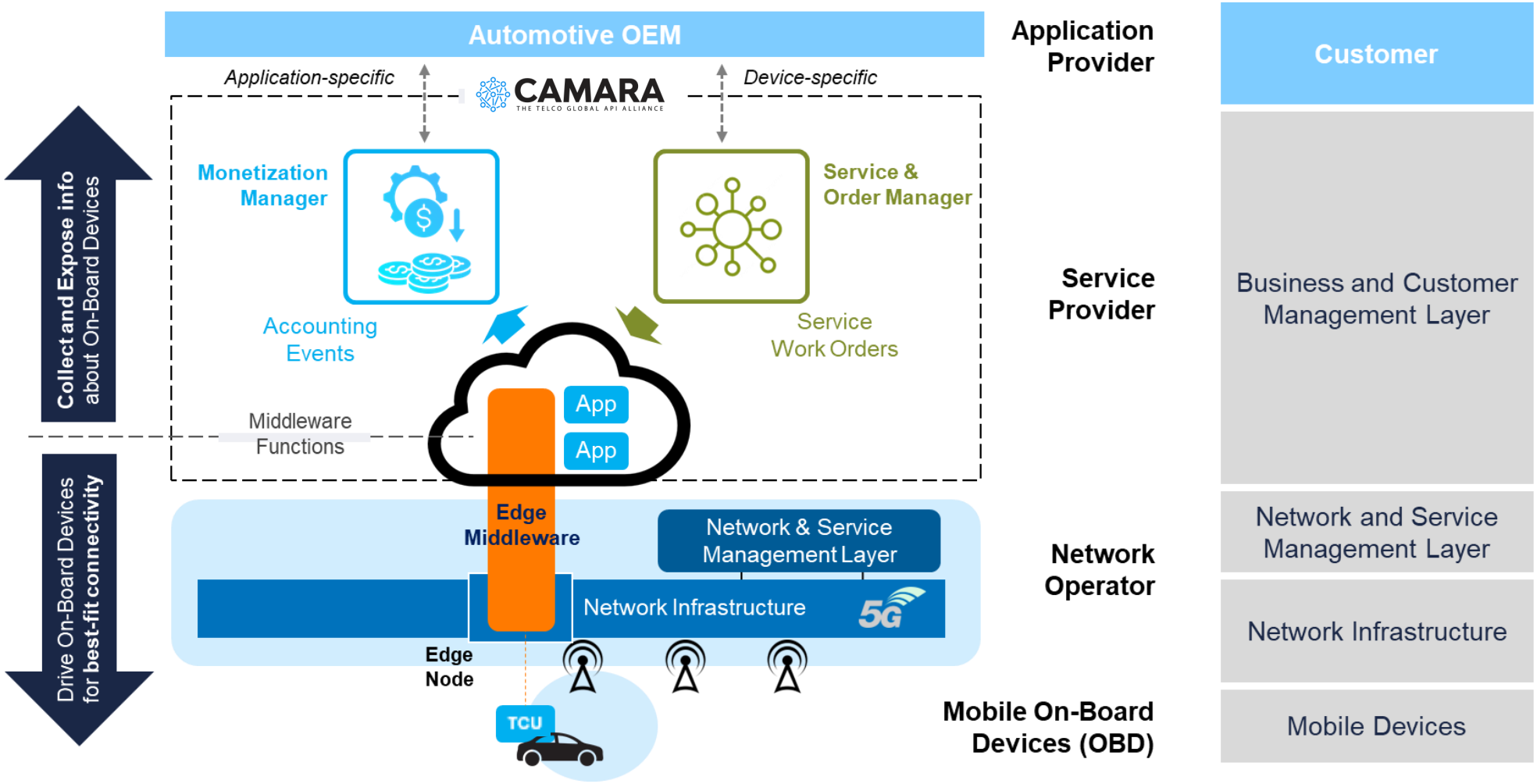
Taxonomy



Concept of the Catalyst
Ingredients

“Monetizing federated connectivity for automotive OEMs”

Monetization

- **Full Control** on the **target environment**
- **Capability to collect information and events** on **resource usage**

Federation

- **Agreement among Network Operators** and **Service Providers**
- **Secured Management Plane primitives** for resource sharing

Connectivity

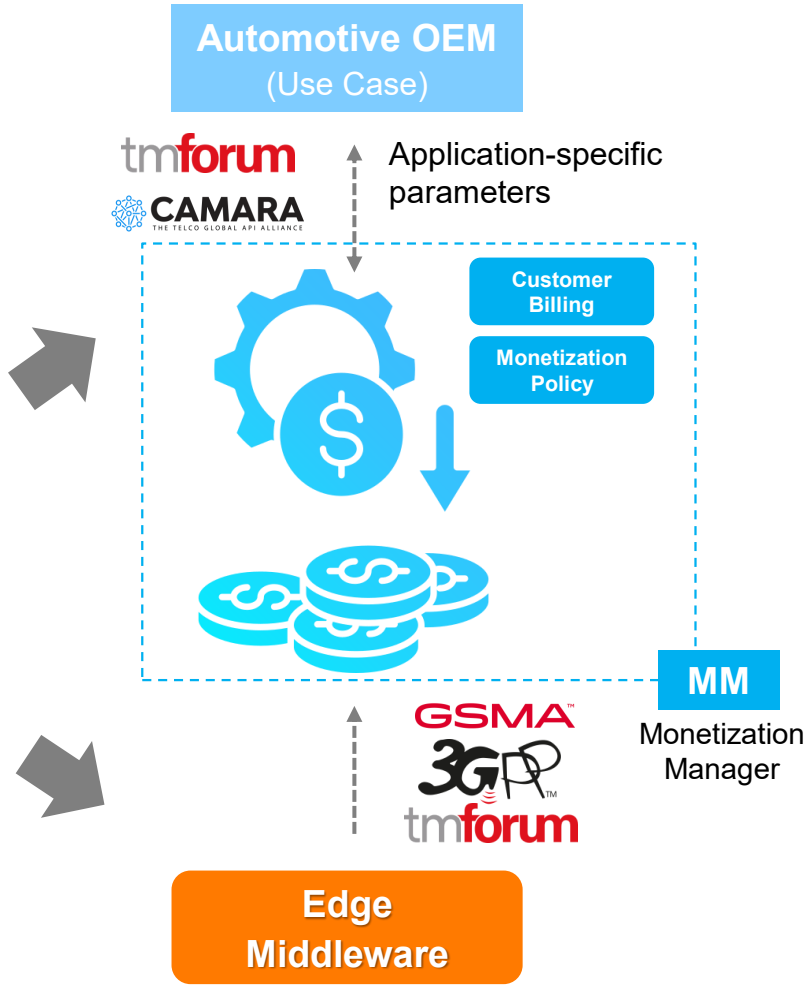
- **Capability to allocate dynamic resources** owned by **Network Operators**
- **Capability to create connectivity** based on a **5QI (5G) service profile**

Concept of the Catalyst
Monetization

Monetization

Customer Facing Services (CFS)

- **Accounting Model** for the proposed Automotive Services
- **Exposure** of Monetization process to Customers
- **Network Abstraction** Layer
- **Service and Resource usage** indicators



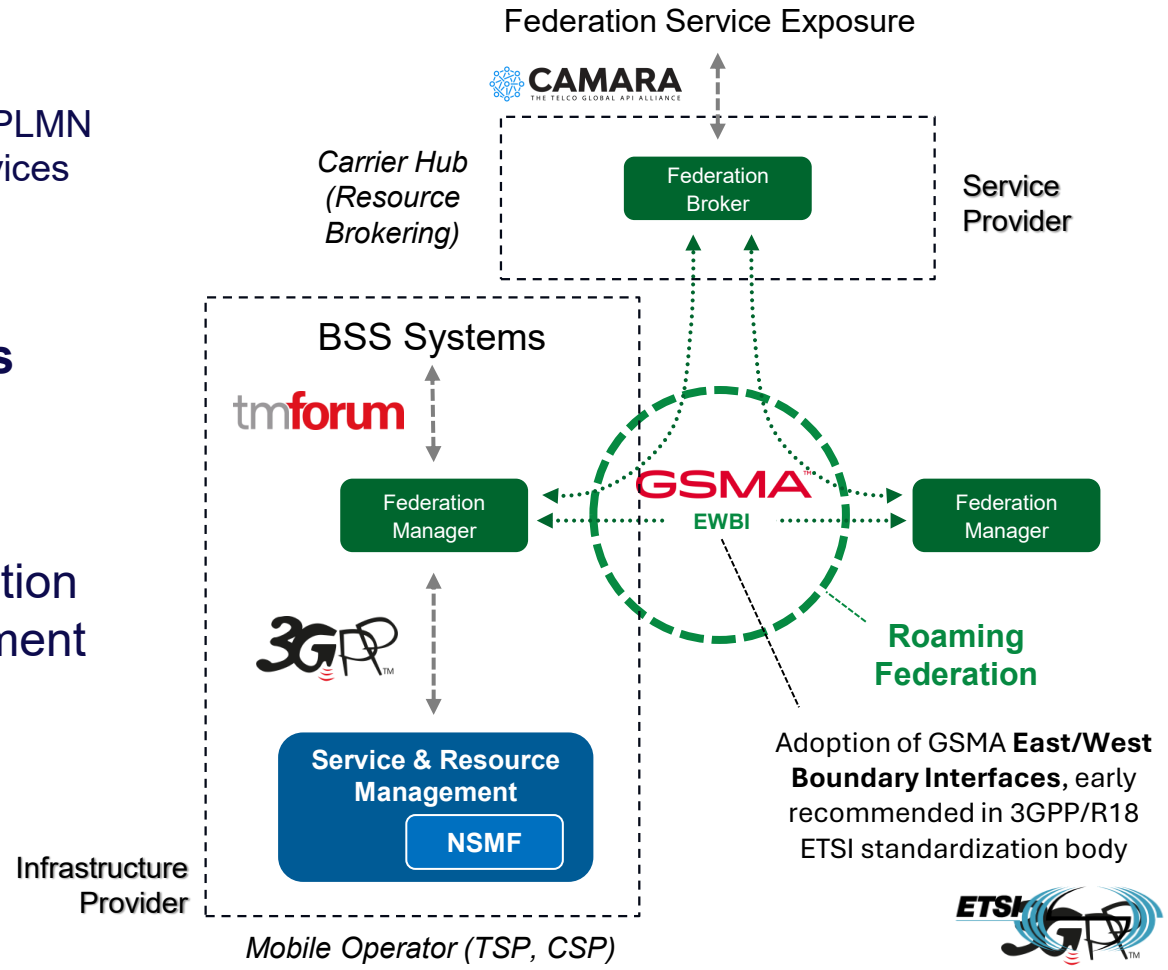
Concept of the Catalyst
Federation

Federation

Inter PLMN Services

- Federation Service **work orders**
- Federation Service **catalogue**

- **Resource Modeling** for Federation
- **Neutral Host Service** management



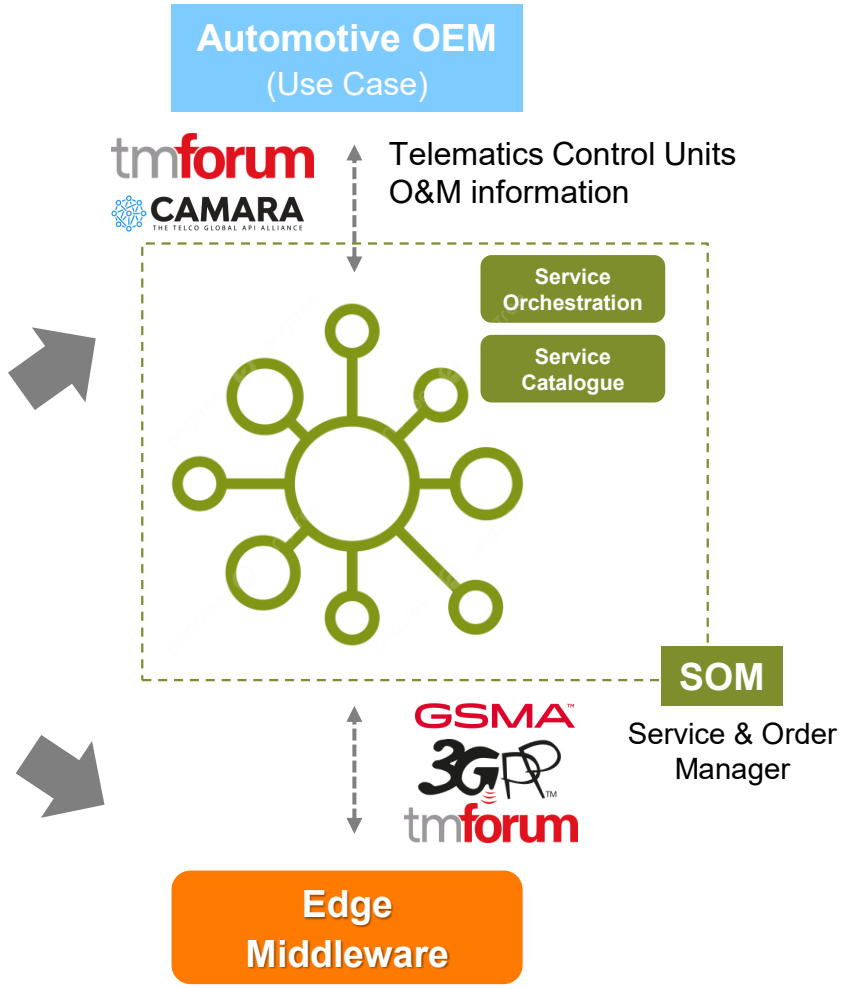
Concept of the Catalyst
Connectivity

Connectivity

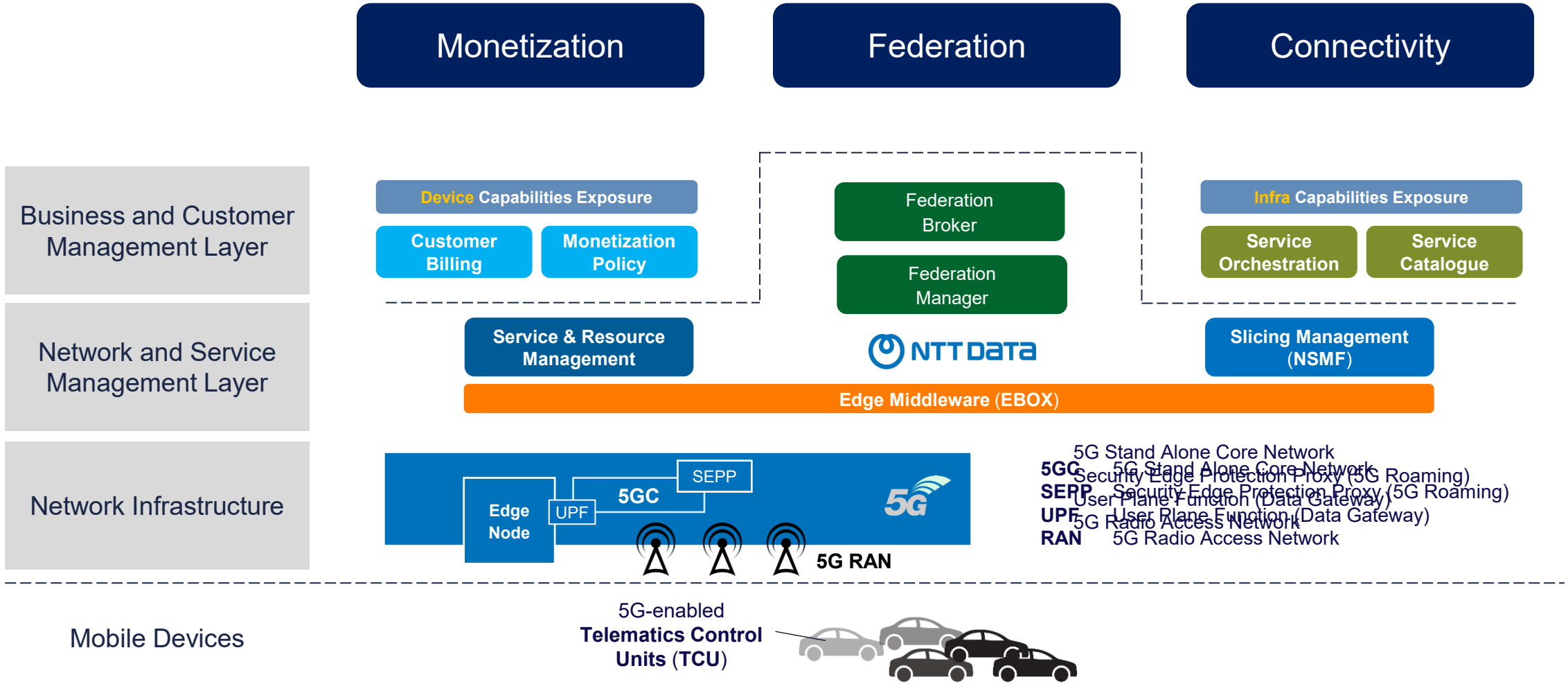
Resource Facing Services (RFS)

- Connectivity Service **work orders**
- Connectivity Service **orchestration**

- **Network Slicing** over 5G Stand Alone network
- **Dynamic Resource Allocation** flows



Concept of the Catalyst
Functional Components



Components

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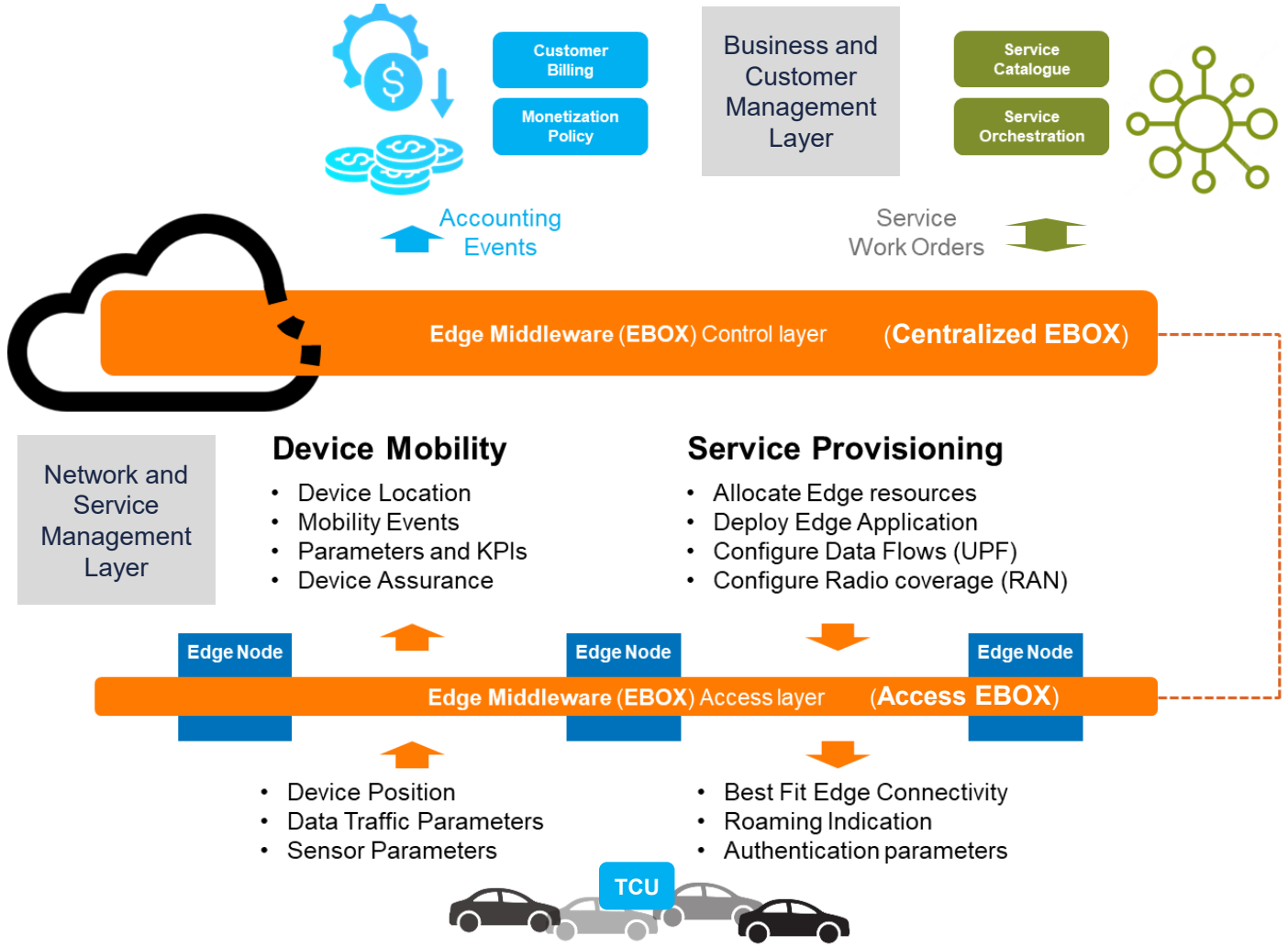
Edge Middleware
Edge Boundary over Technologies (EBOX)

EBOX modules are:

- organized in **Control (Centralized)** layer and **Access (Edge)** layer
- capable to **drive the vehicles** aiming **to get the best-fit connectivity**
- capable to calculate the next-hop Edge Node for the **Edge handover** procedure
- indicating the **need for Roaming** whenever the next Edge Node belongs to a **different Mobile Operator** (**"Any Connect Any Edge "** approach)
- **collecting and elaborating** locally all the information and parameters gathered from the on-board devices (**TCU**) for their exposure to **Business and Customer Management Layer applications**



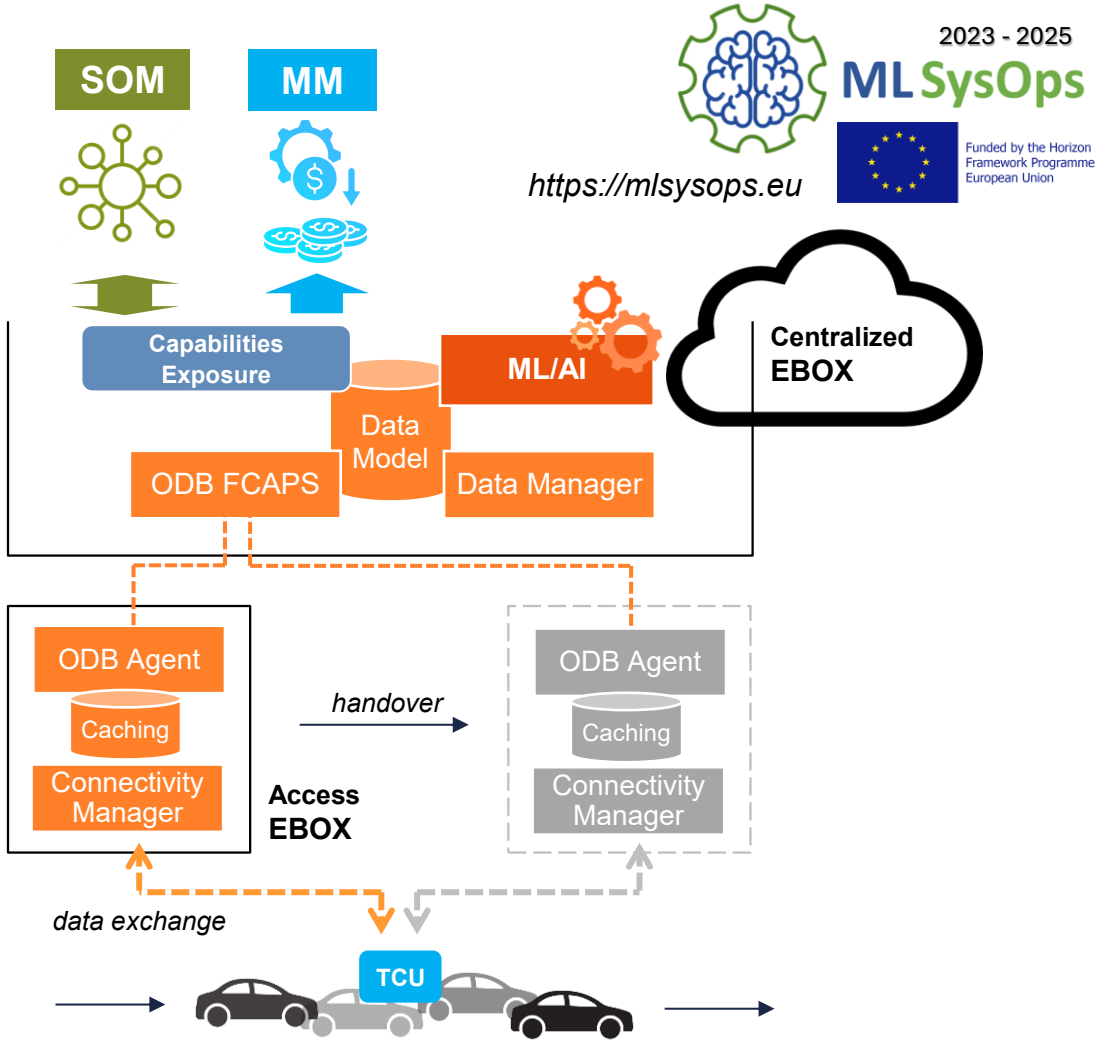
Edge Middleware
Edge Boundary over Technologies (EBOX)

EBOX modules work as a distributed management environment

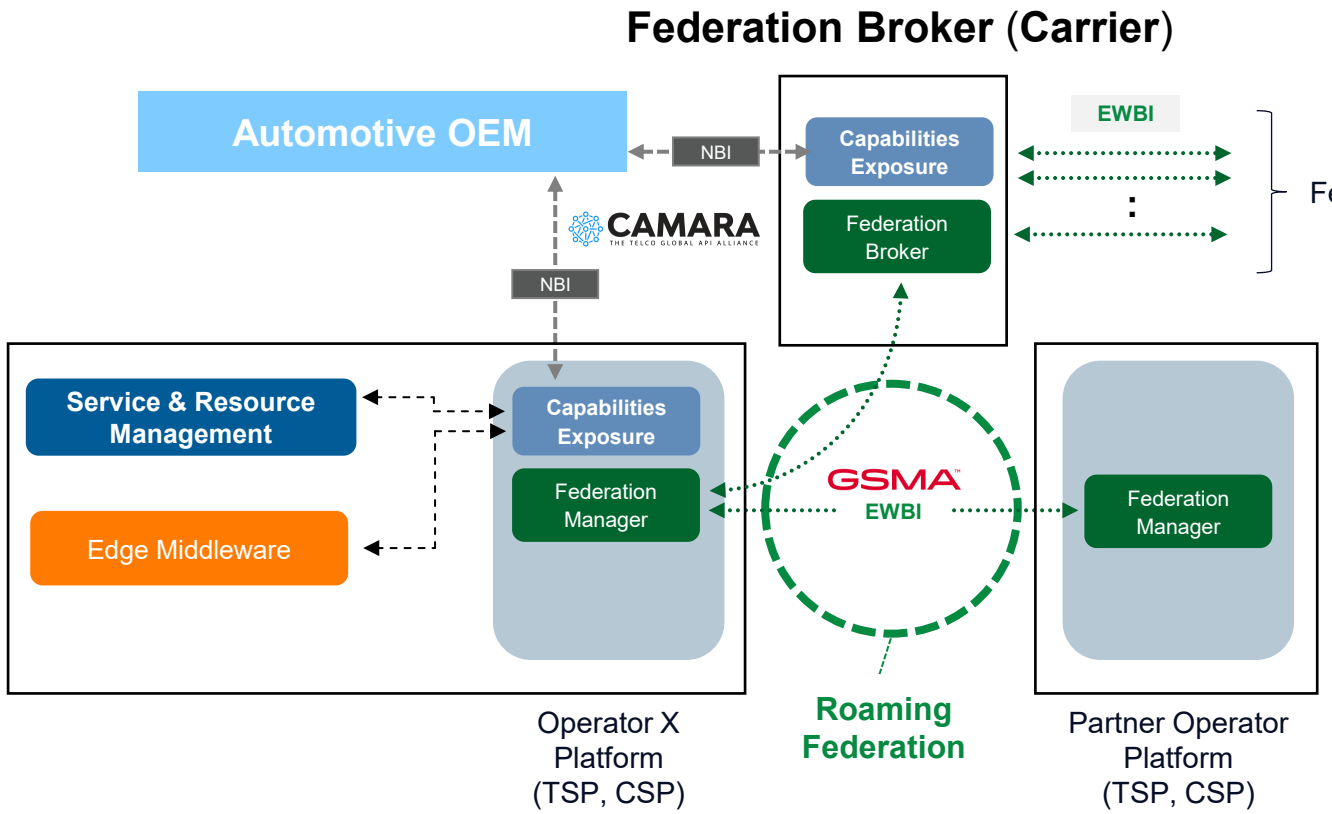
- **FCAPS module** for **TCU assurance and provisioning**
- **Data Manager** for elaborating **traffic performance** and **resource usage KPIs**
- **ODB Agent** working at “access” stage to **manage real time information** and share the data with the “centralized” part
- **Connectivity Manager** to **face with TCU devices** (registration, attach, authentication) and **exchange position, telemetry and sensor-based data**

EBOX is also provided with a **Machine Learning module** (exploiting the results of **MLSysOps Horizon Europe** project) **specialized in executing service logics** for Automotive Use Cases, as:

- **Digital Twin**
- **Alternative Traffic Path**
- **Edge Connected Map**



Roaming Federation
Scenario



NBI	NorthBound Interface
EWBI	East/West Boundary Interface
CSP	Communication Service Provider
TSP	Transport Service Provider

CAMARA API and E/WBI are part of GSMA Open Gateway umbrella

Federated Roaming Partners and Broker role

GSMA defines a **federation** between two operators (OPs) as an agreement allowing the mutual exposure of Edge Cloud resources (Edge Nodes) and related MEC capabilities.

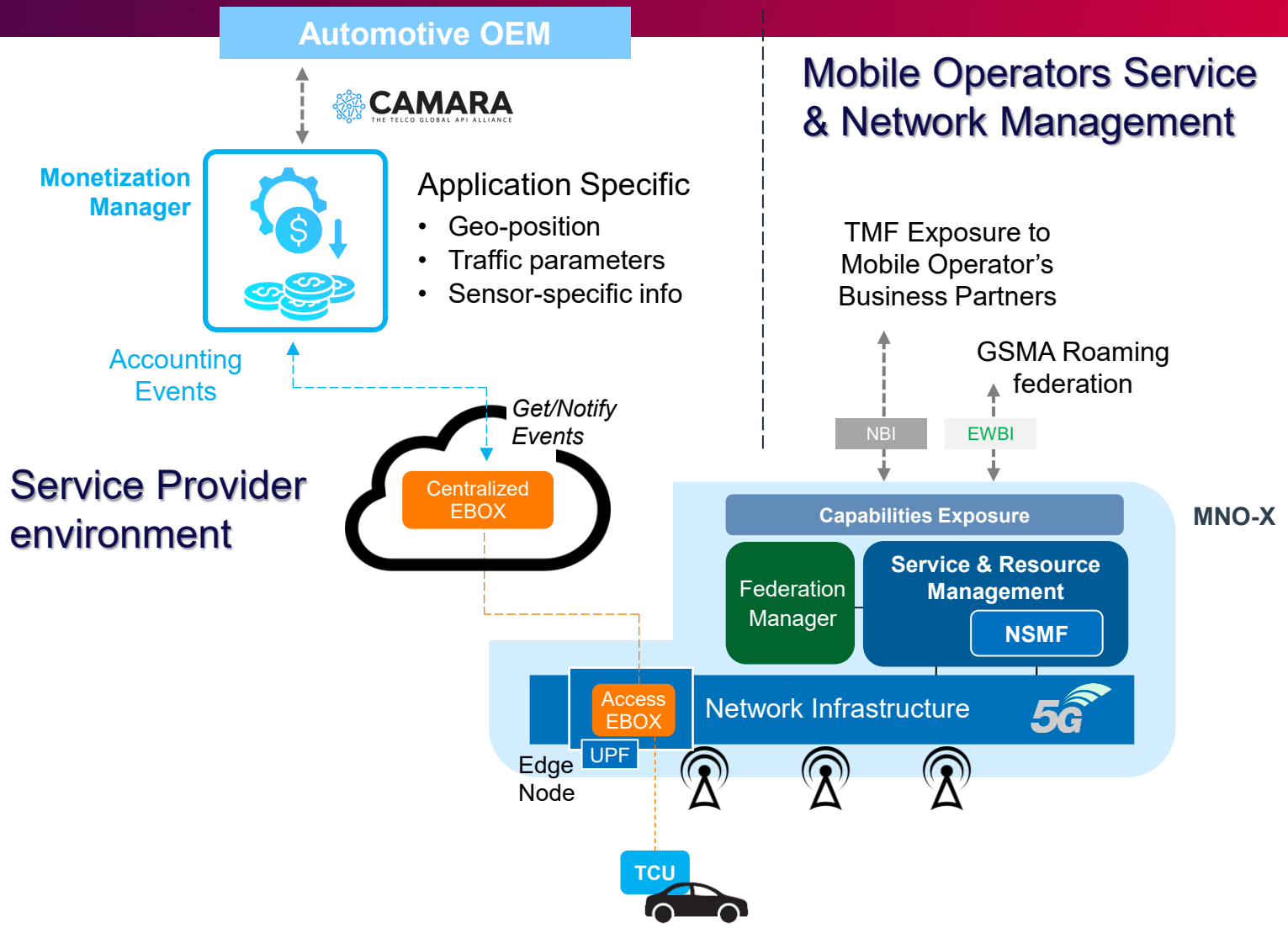
This is facilitated through the **GSMA Open Gateway East/West Boundary Interface (E/WBI) APIs**.

CAMARA APIs enable developers to **easily integrate advanced telco functionalities** into their applications without dealing with the technical complexities of network infrastructure.

Monetization Manager
Scope

Monetization Manager is capable to **collect network events** (connections, roaming) and **traffic volumes by devices** for **B2B/B2B2C billing purposes**

Exposure (markedly through CAMARA API) to provide application-specific data in either near real-time or inventory mode

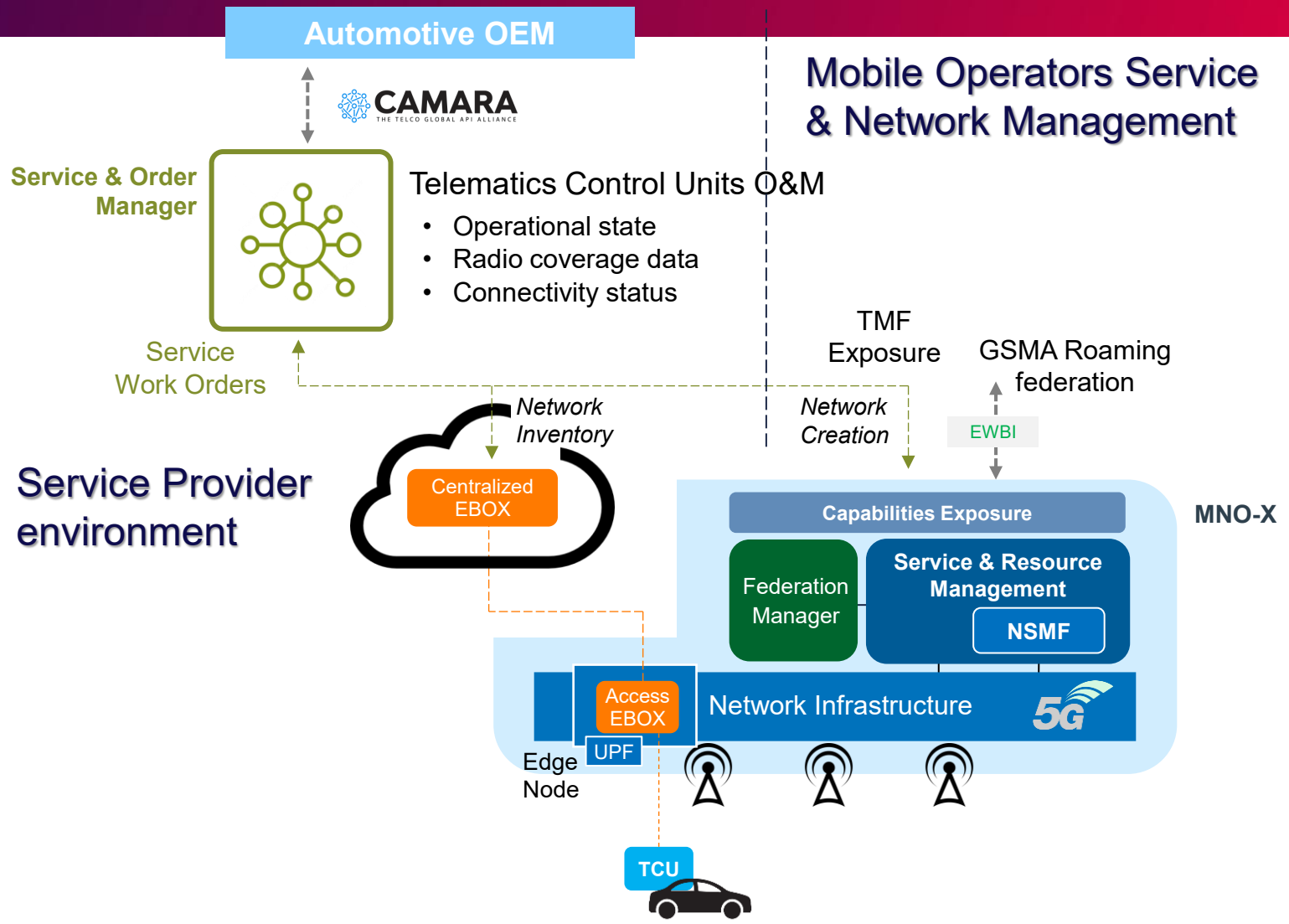


Service & Order Manager
Scope

Service & Order Manager is capable:

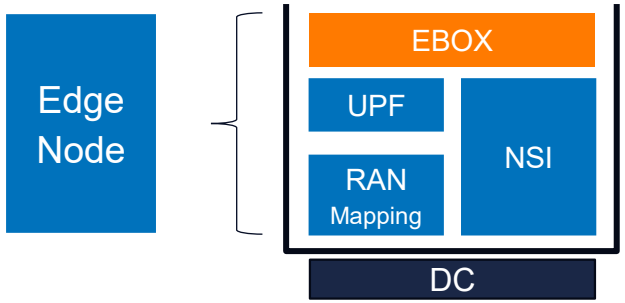
- to expose both **service catalogue** and **resource inventory** information,
- to **drive the network creation** work orders towards **federated Operators**
- to **drive the automotive service delivery** work orders towards the EBOX

Exposure (markedly through CAMARA API) to provide service and resource related information in inventory mode



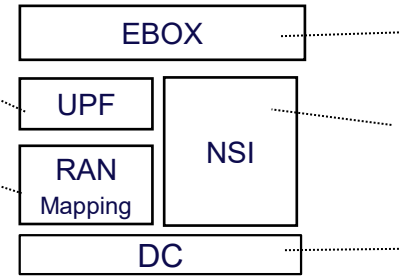
MEC Node Modeling
Managed Object Description

Edge Node is modeled with a set of logical and physical components



Core Network (User Plane) Function

Combination of RAN configuration and software (Open) RAN Network Functions based on how they are provided by the Mobile Operator

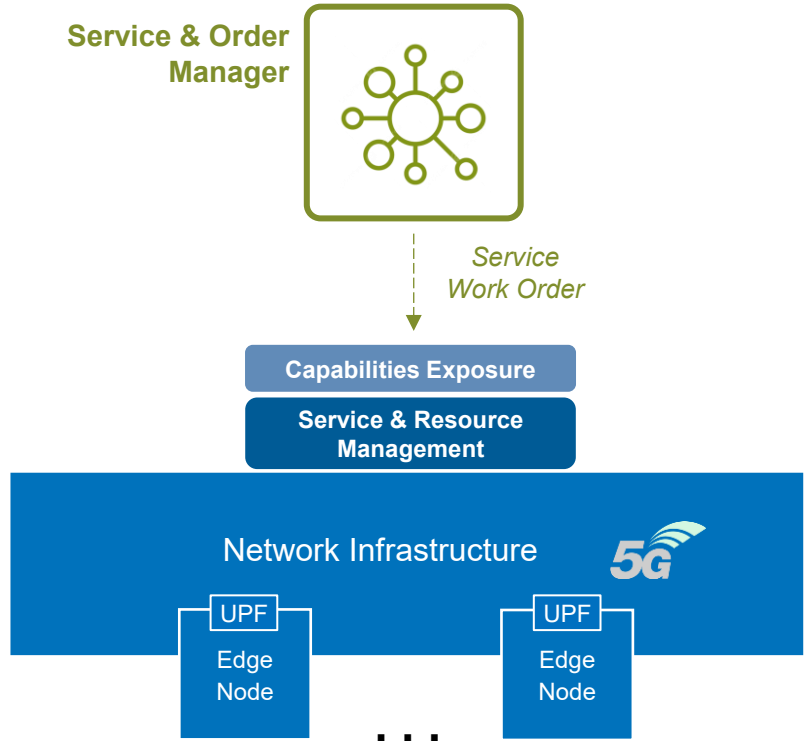


Access Edge Middleware

Dynamic connectivity profile for network slicing creation all over RAN and Core Network domains

Data Center (Server) node

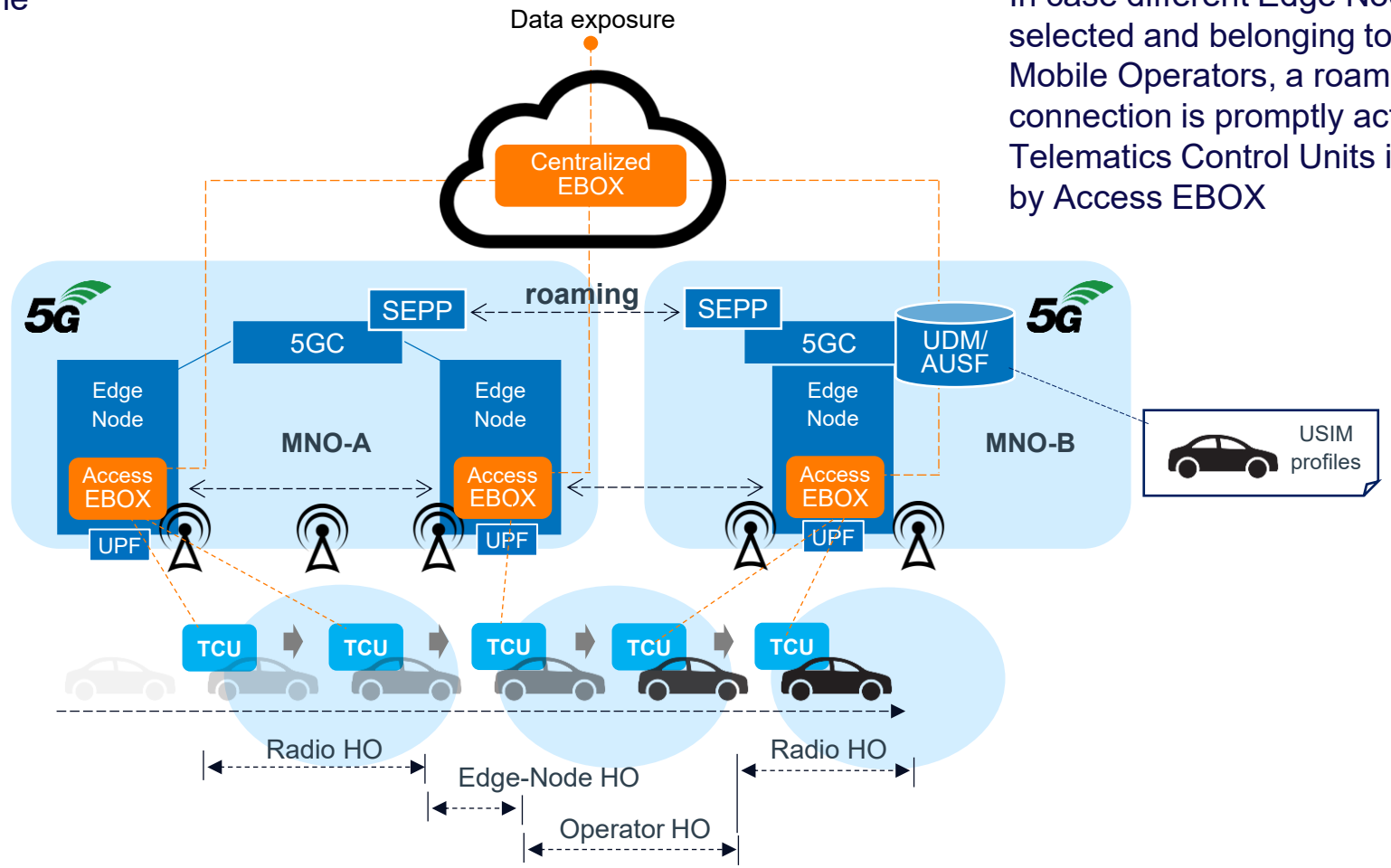
Mobile Operator is instructed by the Service & Order Manager **to create and configure all the components** belonging to Edge Node modeling



Any Connect Any Edge (Roaming)

Dynamic Connectivity

EBOX Middleware drives the vehicles to get the best fit connectivity based on the requested (network slice) connectivity profile



In case different Edge Nodes are selected and belonging to different Mobile Operators, a roaming connection is promptly activated by Telematics Control Units instructed by Access EBOX

Telematics Control Units
Redundancy and Service Continuity

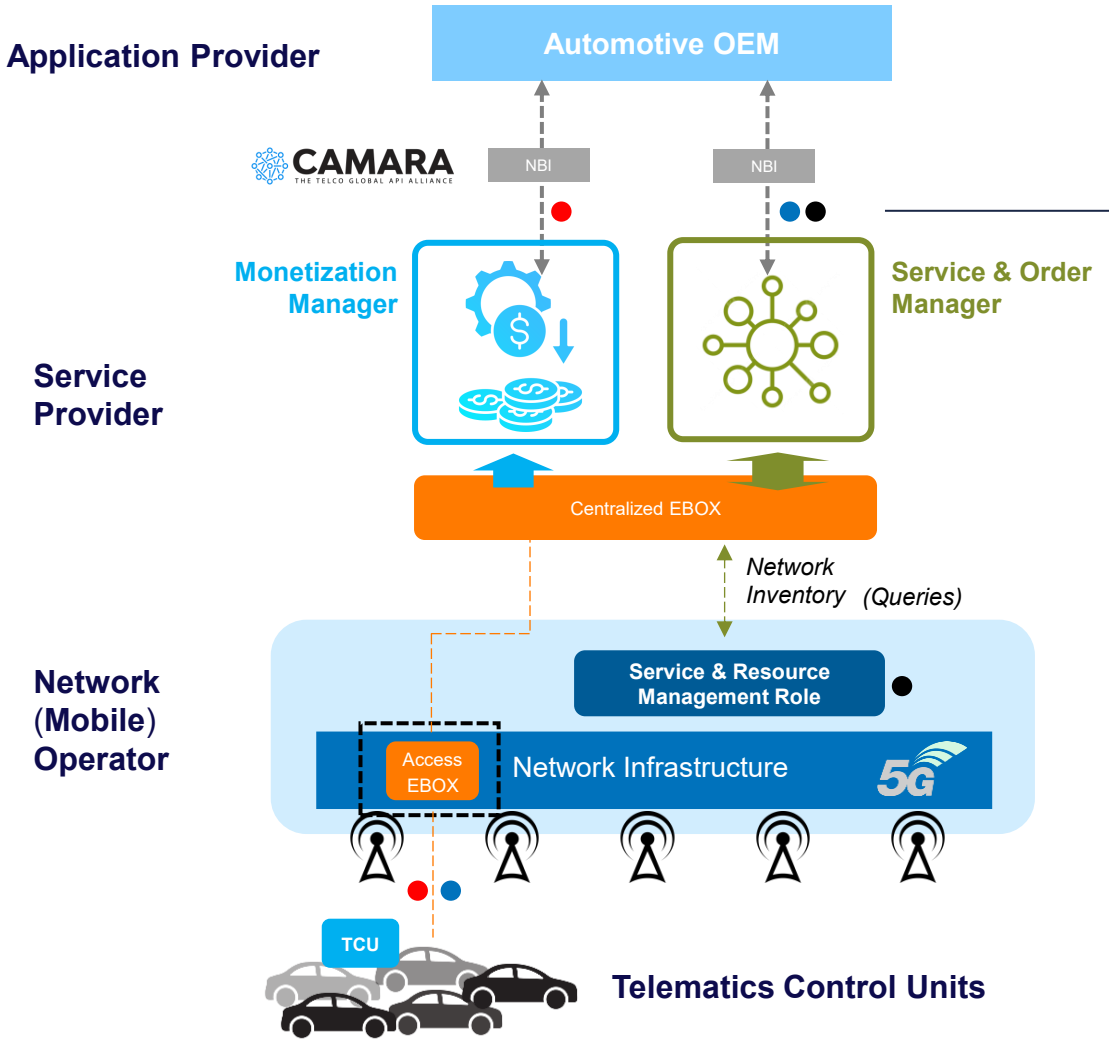
Dynamic Data Flows

Application-specific

- Geo-position
- Traffic parameters
- Sensor-specific info

Telematics Control Units O&M

- Operational state
- Radio coverage data
- Connectivity status



Service Exposure

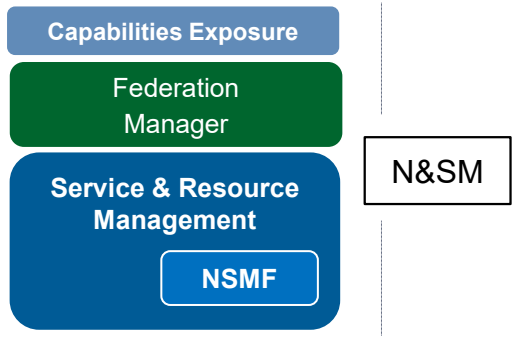
Service presentation could be kept separated between devices/resource inventory information and application-specific information, just like mobility, environmental, heath parameters

Infrastructure Inventory

- Edge distribution
- Radio Tracking Areas
- Geo-fence
- Edge neighbors
- E-SIM provisioning
- Data centers
- MEC node profiles

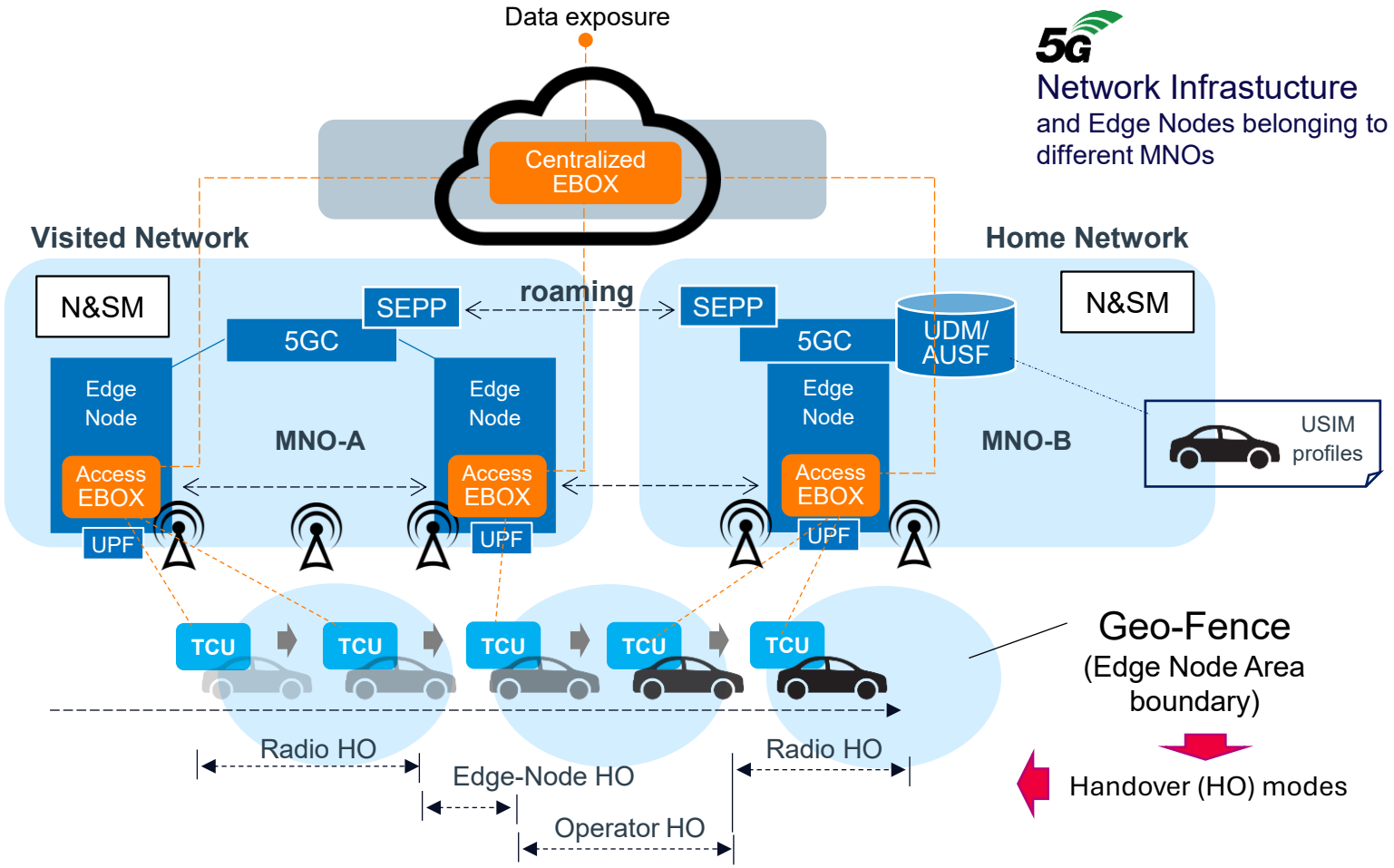
Network Infrastructure
Mobile Network Operators

5G Stand Alone MNO Management Systems (N&SM)



- **Service and** (Network) **Resource Management**, including Network Slice Management Function (**NSMF**) for connectivity service
- *Capabilities Exposure* APIs
- *Federation Management* APIs

Edge (MEC) nodes follow the vehicles to get **connectivity** by **position** and related **Edge geo-fence** areas (Edge Node HO)

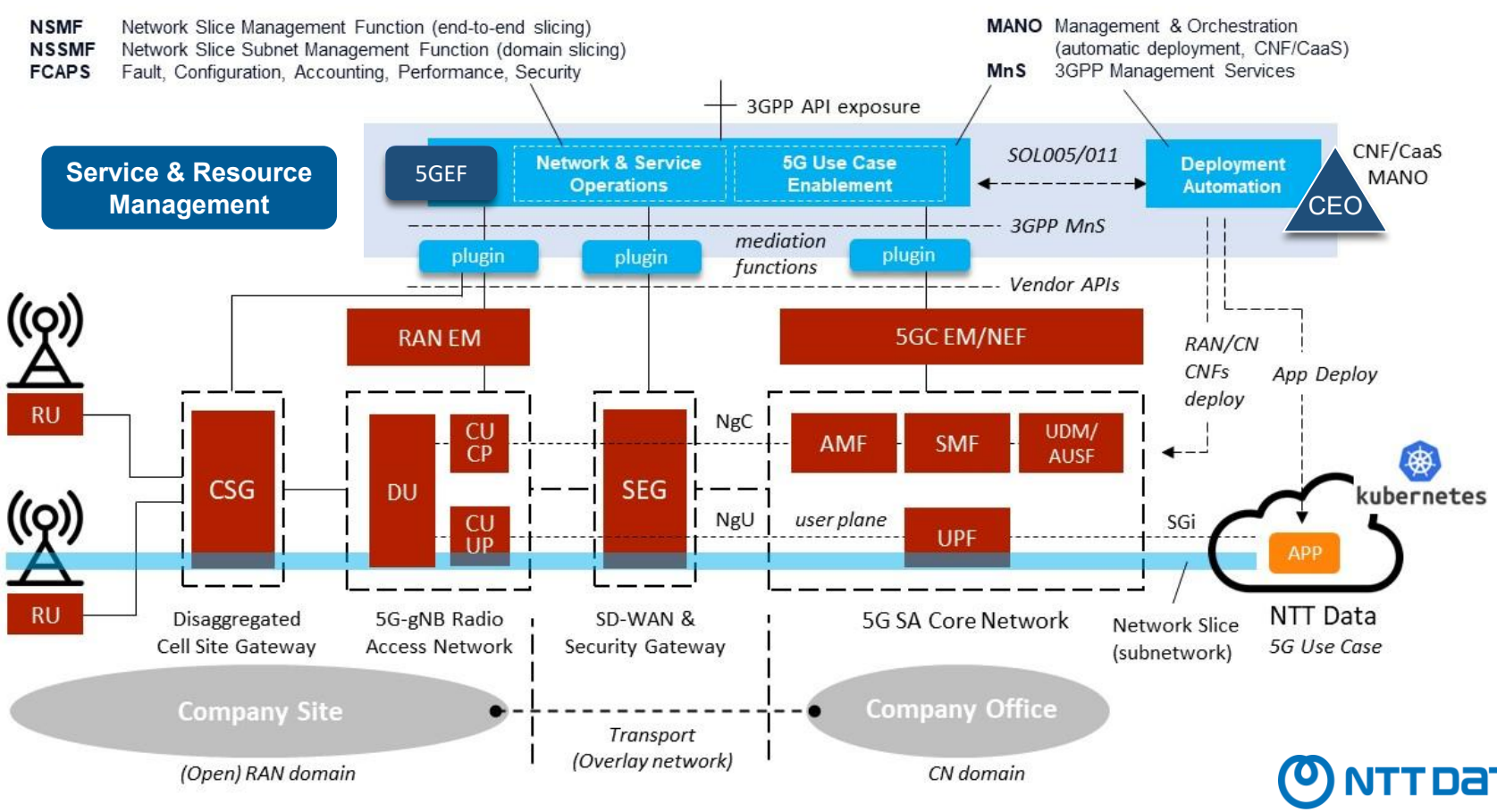


Service & Resource Management
NTT DATA Product Portfolio

NTT DATA **5G Enabling Fabric** (**5GEF®**) and **CreEdgeOn** (**CEO**) products manage the **delivery automation of 4G& 5G Stand Alone multi-vendor networks**

- Enhancement of Professional Services with product-based solutions
- Delivery automation
- Positioning of NTT DATA software products
- “Packaged” and bundled solution
- Certified Technologies

Experienced in multi/vendor 5G RAN and Core Network Technologies



Use Cases

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Use Cases Examples

“Catalyst M25.0.795’s federated MEC, open-API and event-driven billing architecture unlocks a wide range of automotive and monetization-centric edge applications

MNO Partner On-Boarding	Federated MNOs exchanging Edge Node (MEC) capabilities
Edge Computing Service Creation	Customer Service Delivery for Edge-enabled Applications
AECC Automotive Digital Twin	Digital Twin Service based on Automotive data gathering
Alternative Traffic Path	Dynamic Path Selection for Mission Critical scenarios
Edge Connected Maps	Path Selection provided with Edge-aware capabilities

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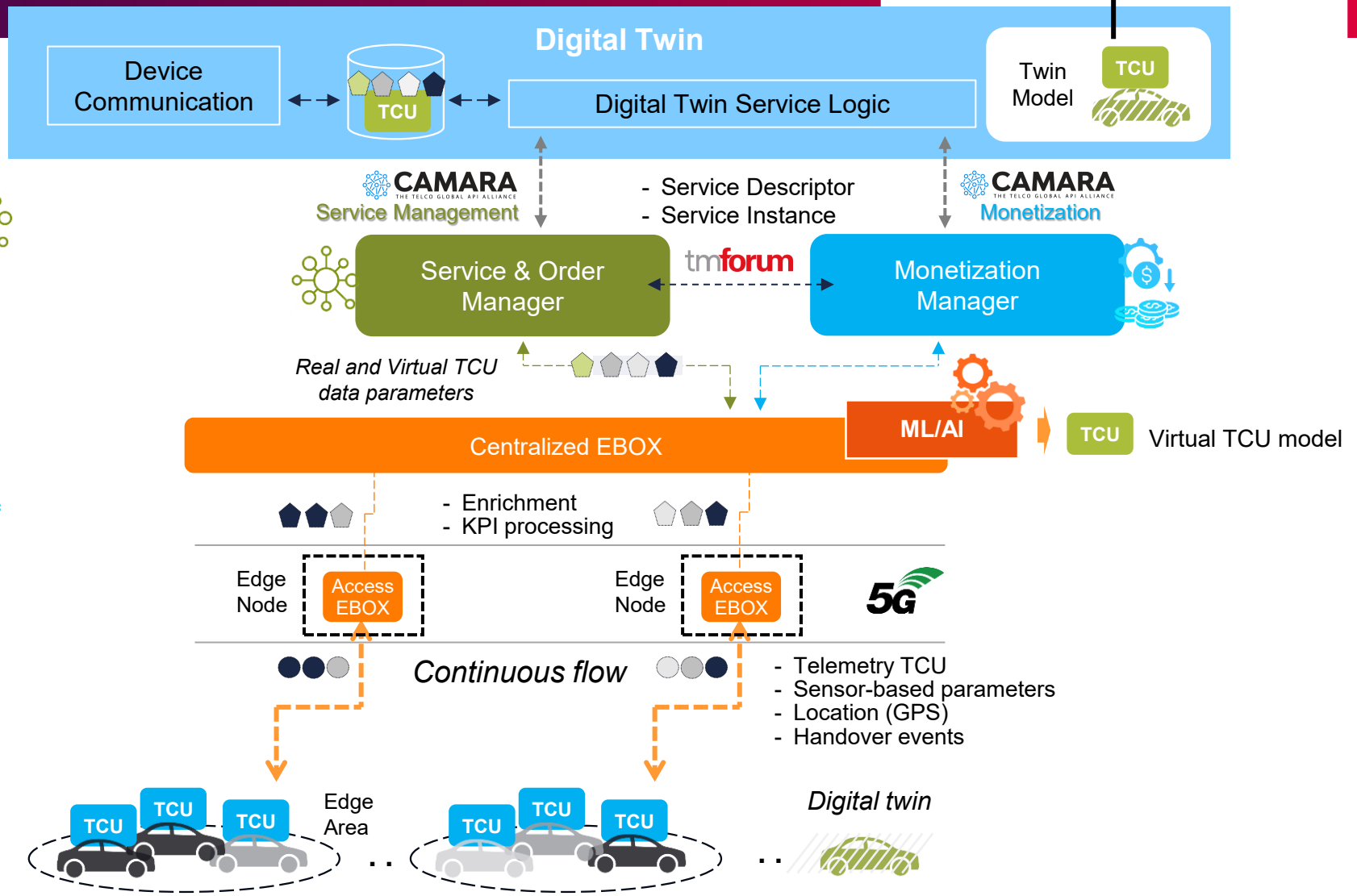
Automotive Digital Twin
Use Case (Architecture)

CAMARA

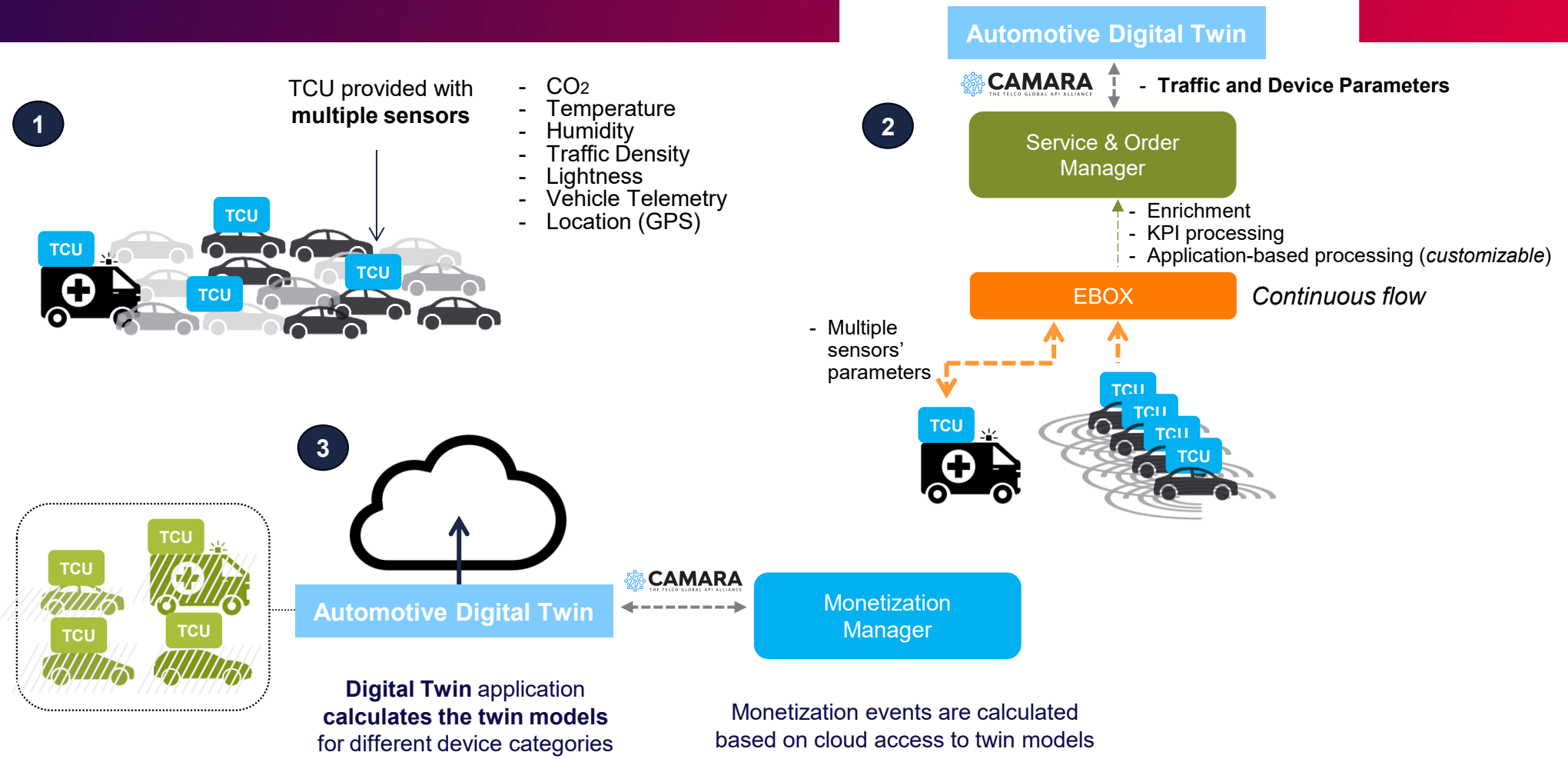
Service Management
CAMARA transactions:
- Traffic Forecast
- Traffic Alarms
- Predictive Telemetry
- Fleet Location discovery
- SIM enablement
- Virtual Maintenance

Monetization
CAMARA transactions:
- Digital Twin queries
- Edge Node(s) usage
- Roaming events
- Edge Handover events



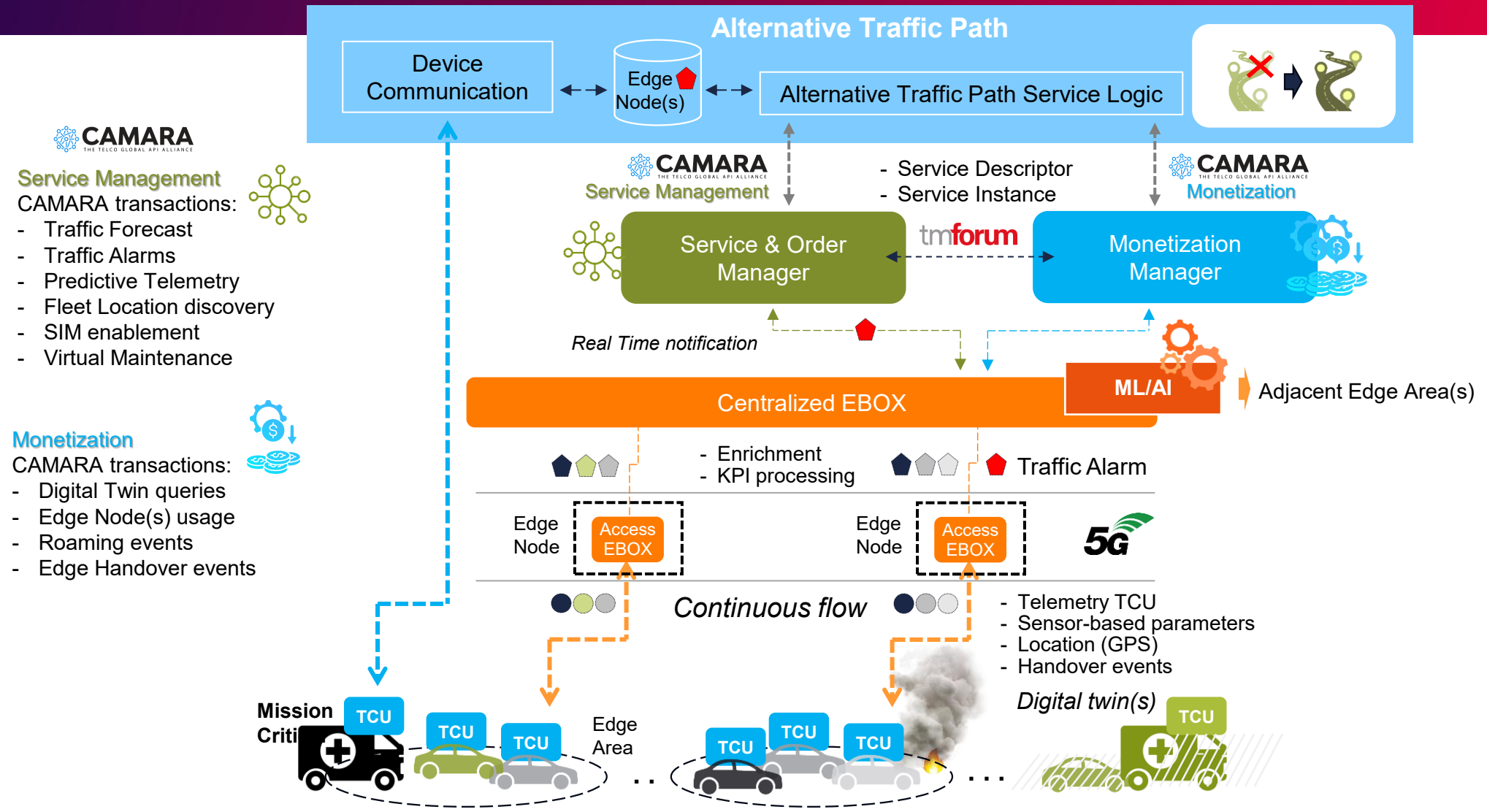
AECC tmforum CAMARA GSMA

Automotive Digital Twin
Use Case (Exemplary Sequence)

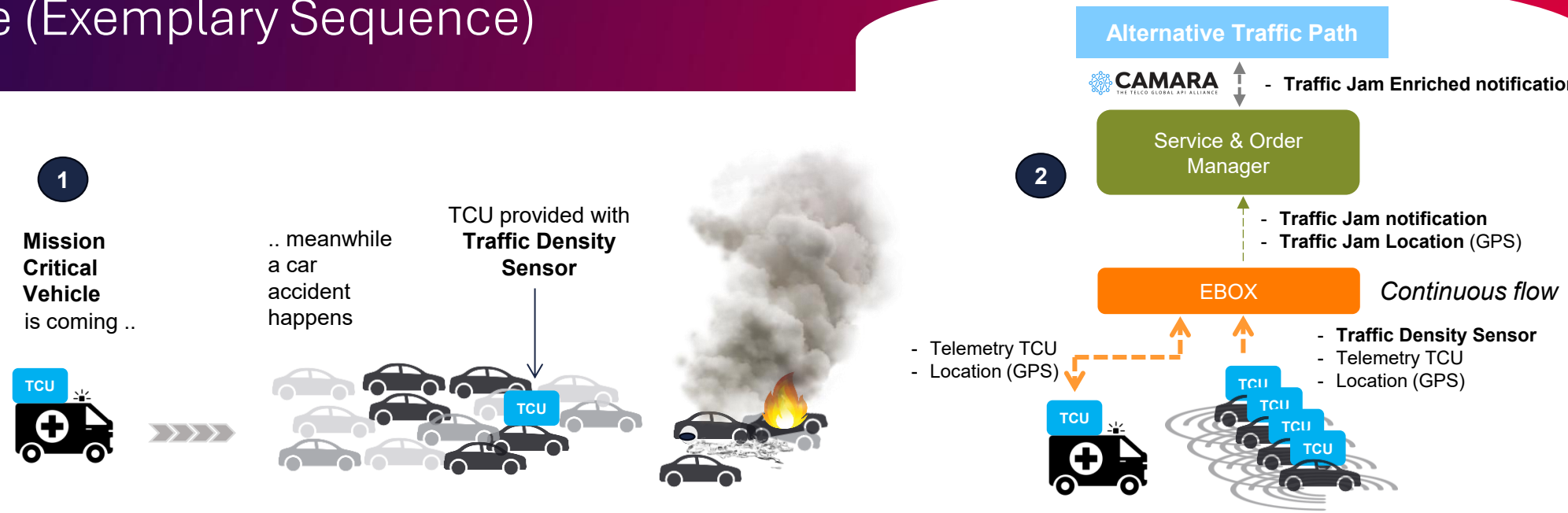


Alternative Traffic Path

Use Case (Architecture)

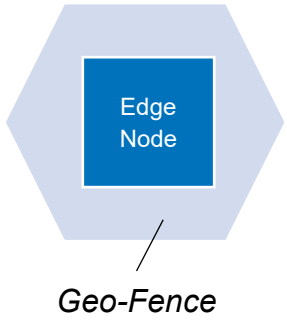


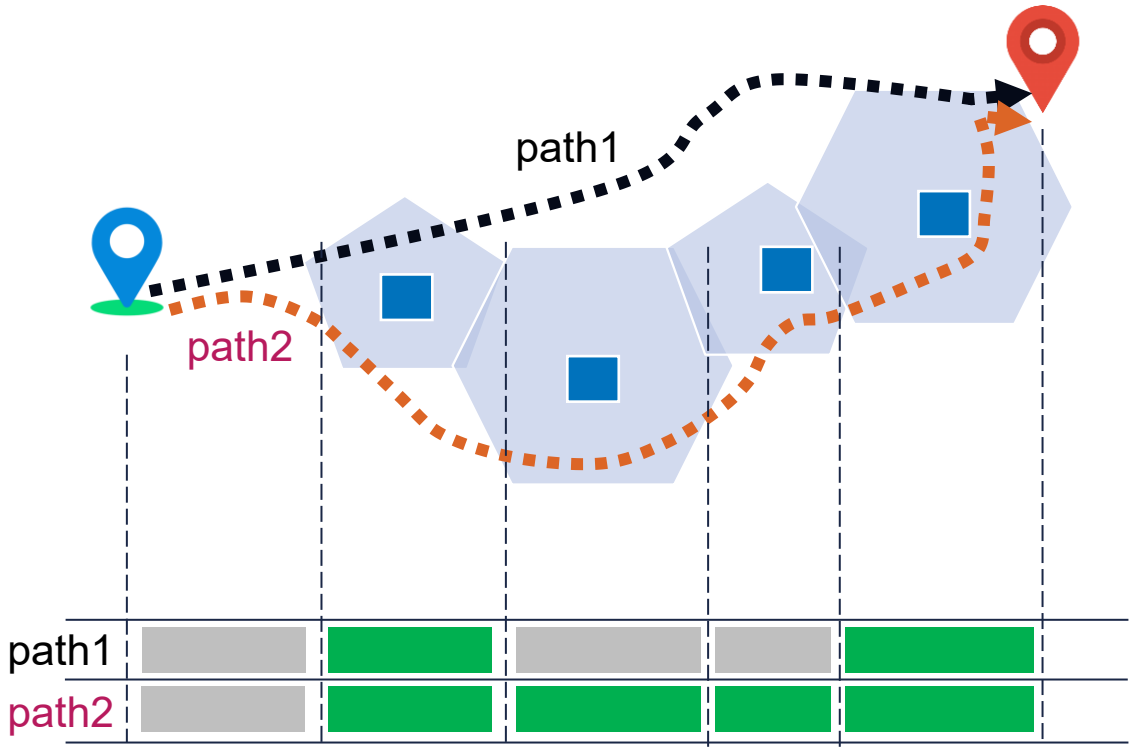
Alternative Traffic Path
Use Case (Exemplary Sequence)

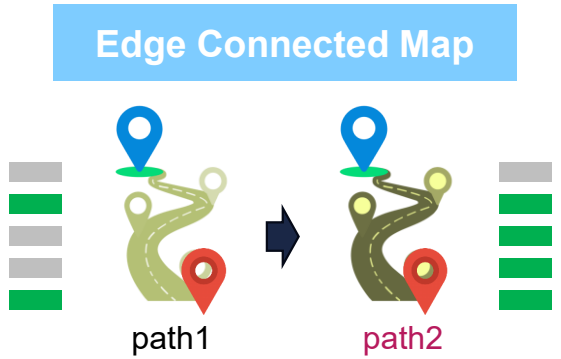


Edge Connected Maps

Use Case (Exemplary Sequence)







Edge Connected Map application can provide **maps** with the **higher level of coverage for Edge latency**, **bandwidth** and **increased connection performances**

Where cars are **not Edge Connected**, they are under **centralized control** (traditional connectivity)

Thank you!