



## Proactive Cloud Resources Management at the Edge for efficient Real-time Big Data Processing

**Dirk Mayer**  
**Director Research**



# Challenge

Dynamic orchestration of distributed processing nodes that manages sudden changes in the „3Vs“ of Big Data - **variability, volume, velocity.**

**Change is regarded as an ever-emerging concept in Big Data.**

Changes can happen:

- in the incoming data streams,
- in the Quality of Service,
- in the speed of changes in data streams / changes of the processing node status.

The project vision:

A dynamic, distributed **architecture** for proactive cloud resources management, reaching the extreme edge of the network **for efficient real-time big data processing.**

We target:

**Big Data solution providers** who utilise cloud & edge resources

- for their client solutions and seek to **optimize resource utilisation** and
- seek for personalized innovative services, an improved **Quality of Service**

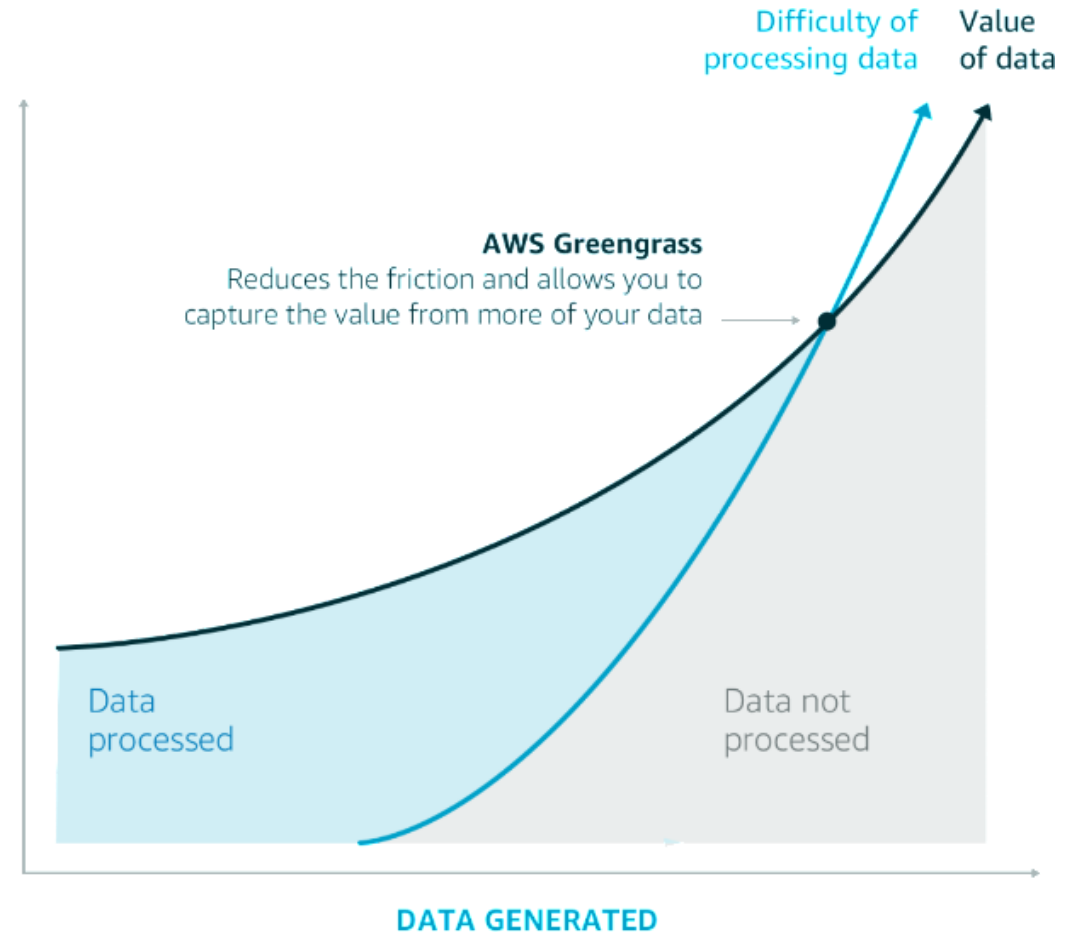




# Motivation: Cloud

## Data Processing and Cloud

- Cloud Computing allows the execution of computational processing without caring about the resource location or limits.
- However transferring and processing the data to cloud is not always a viable solution
  - *“Most machine-generated data never reaches the cloud” Julien SIMON, AWS*



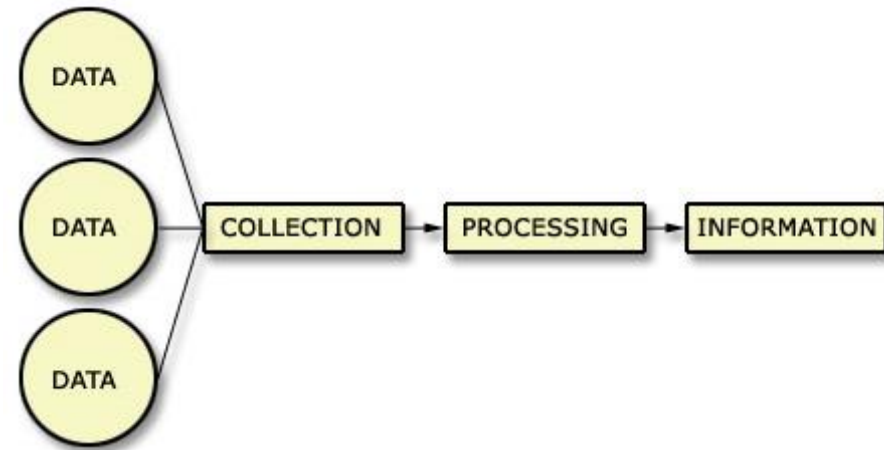
# Motivation: Edge

## Data Processing and Edge

- Modern IT systems in a wide field of applications produce massive amounts of data
- There is a need for efficient processing of the generated data and especially streaming data
- However, the abilities of data processing on the extreme edge are limited by the hardware capabilities of the devices.



fiber-optic  
transmission time: 150ms

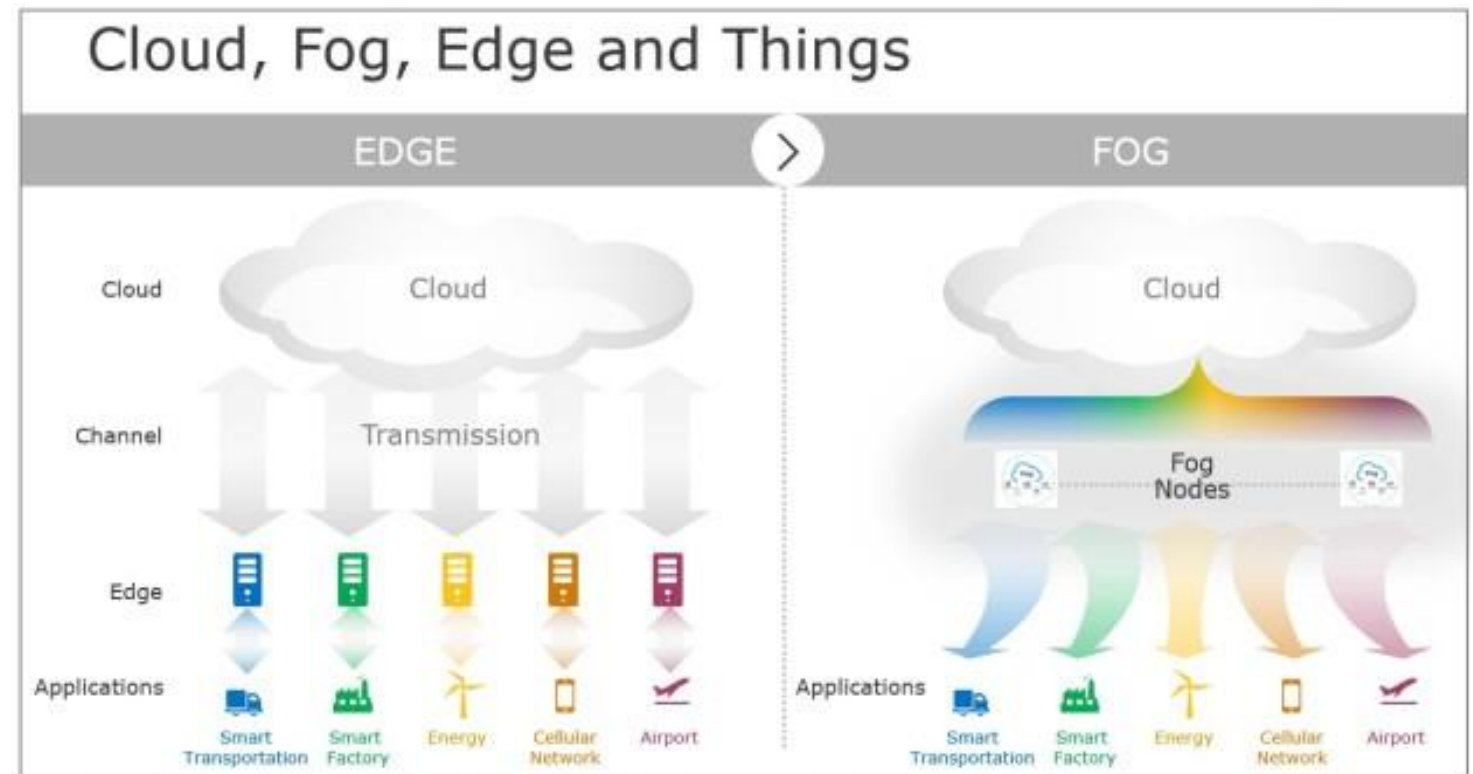




# Motivation: Fog

## Data Processing and Fog

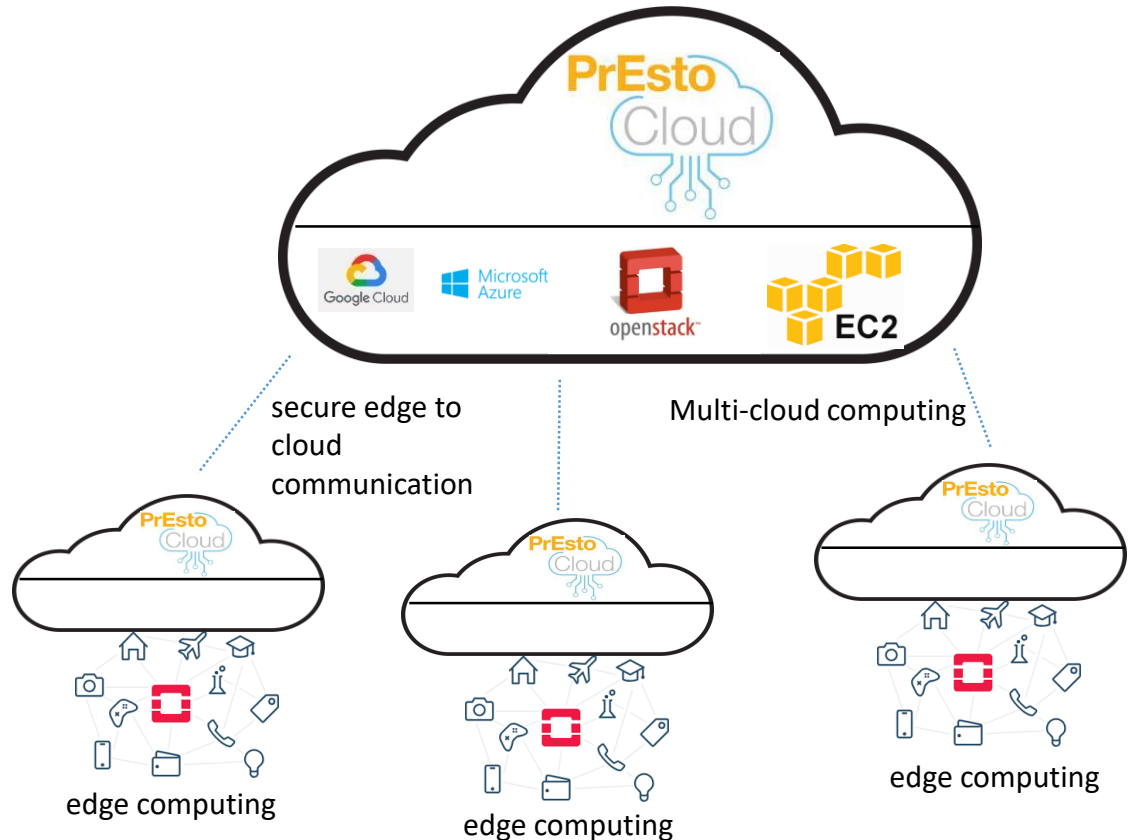
- PrEstoCloud allows the deployment of applications at a combination of cloud, edge and extreme edge resources and provide an *adaptive architecture, suitable for data intensive apps.*



Source: OpenFog Consortium

# PrEstoCloud Solution

- Multi-cloud / edge network overlay
- Multi-cloud / edge deployment
- Application fragmentation
- Optimized placement of application fragments
- Scalable Lambda functions
- Seamless scaling of deployed applications based on real-time workload and context information
- ***Multi-vendors***







**Media**



Israel



**Surveillance**



Cyprus



**Logistics**



Slovenia

# Media Use Case numbers



## Acquire

**5,000+**  
units globally

### Industry Leading Portfolio of Field Units

- **Aggregates** and utilizes all available networks
- **Dynamic routing** load-balancing of video provide optimized and best quality feed



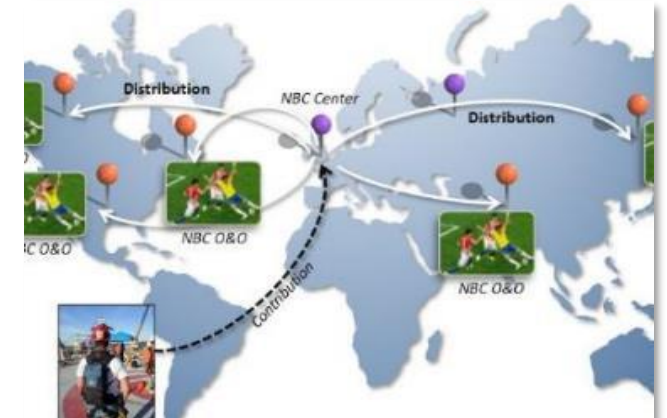
## Manage

**2,000**  
end customers

**2.4+ million**  
annual live sessions

### IP Cloud-Based LiveU Central Management Solutions

- Video Matrix and Remote Management
- Live preview
- Geolocation: tracks units on a map, monitor cell signals and performance
- File Manager for playback or export of recorded Store & Forward or FTP files



## Distribute

**111 TB**  
monthly live transmissions

### IP Distribution & Cross Entity Services

- Cloud-based solutions & infrastructure for content distribution
- Point to multi point distribution



To create a solution for any live event, the contribution part is global from any location in the world; planned and unplanned mass events.

- used by either professional broadcasters with LiveU dedicated devices,
- used by prosumers and consumers using their mobile phones.

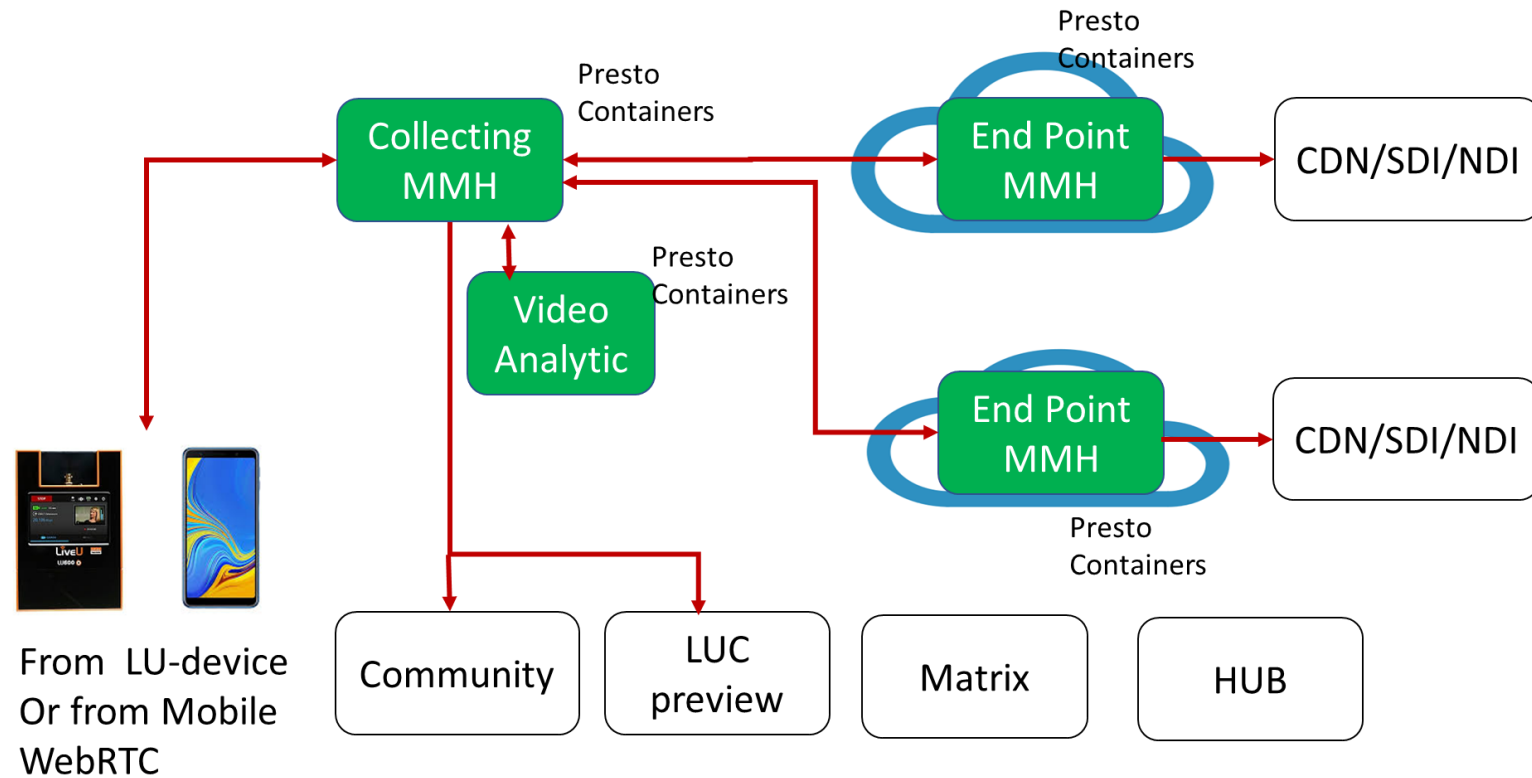




# Media Use Case

## *PrEstoCloud-enabled prototype:*

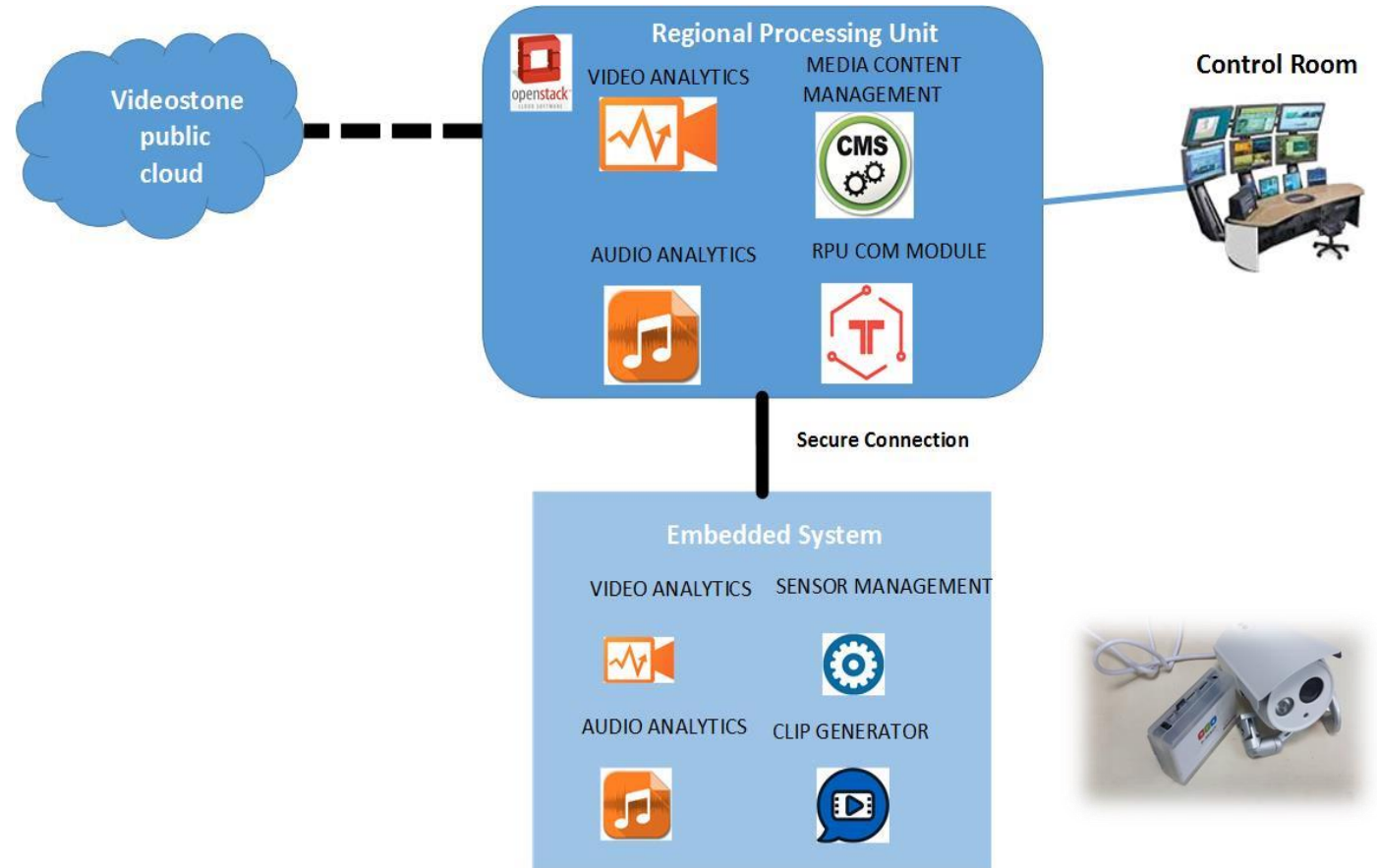
- Containerized Multimedia Hub (MMH)
- Integrating Video Analytic as Micro Services
- Contributions from Consumers using WebRTC, directly from browsers
- Using security enforcements, and network virtualization of PrEstoCloud platform services.



# Surveillance Use Case

In the context of smart surveillance systems, **constant availability of services, system integrity** and **real-time detection** of illicit activity are critical factors.

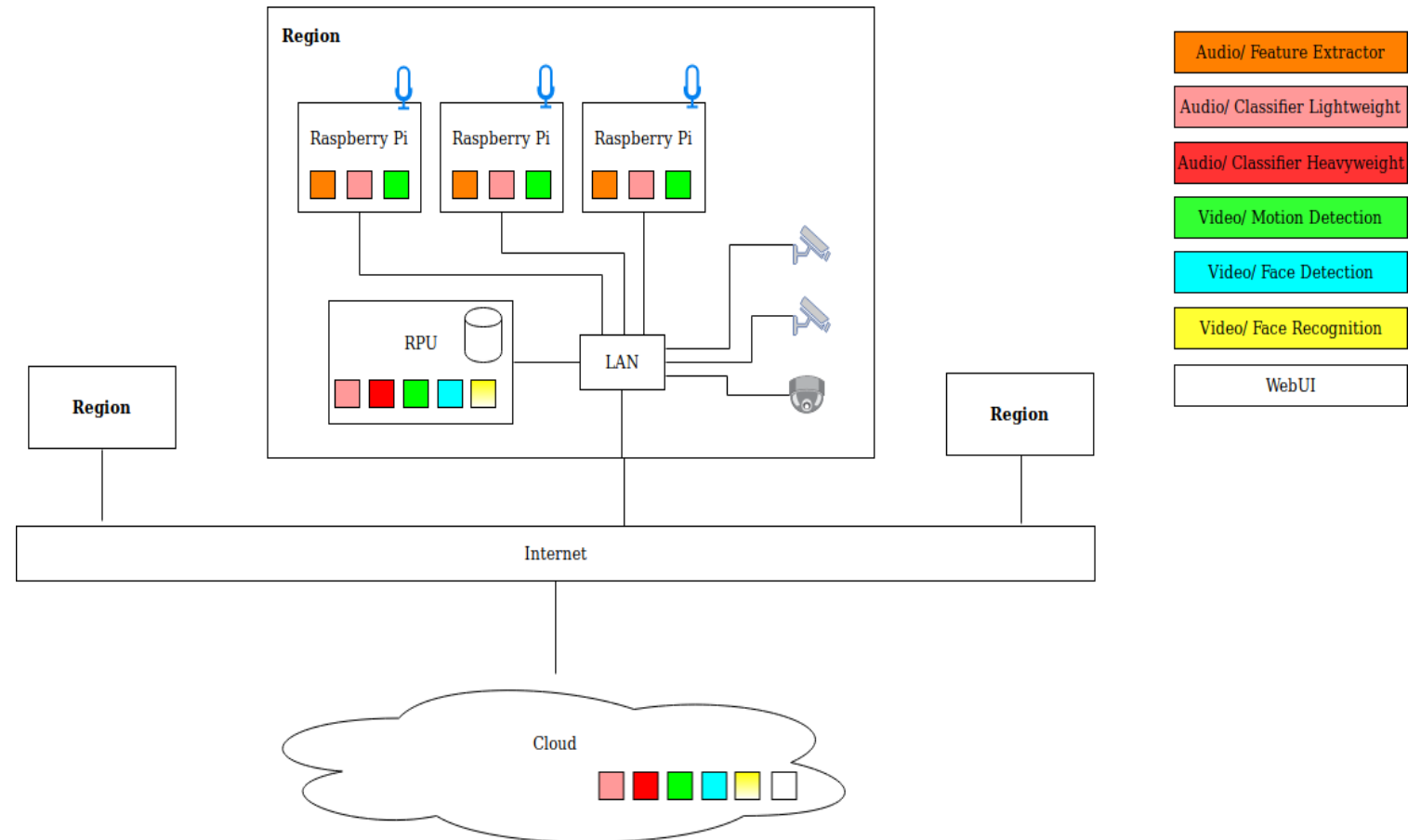
PrEstoCloud aims to ensure the above concepts by exploiting the available infrastructure resources in a way that minimizes cloud and maintenance fees.



# Surveillance Use Case

- Event generated by microphone systems, triggering camera activations
- Operator through UI requests a face detection/recognition mission, activating nearby camera

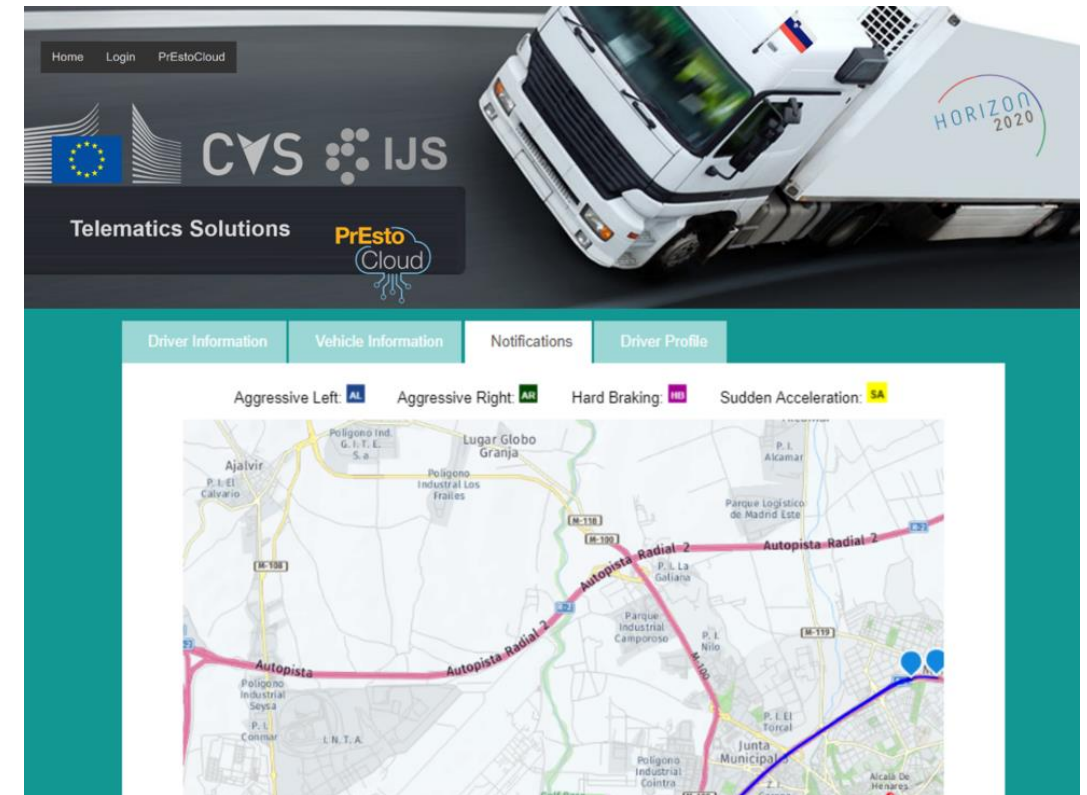
*Despite the increased number of streams, system availability will be ensured. Optimization functions will be used to exploit infrastructure resources in a way that minimises cloud fees*





A telematics system for processing sensor data from vehicles, allowing to establish driver profiling and real-time anomaly detection

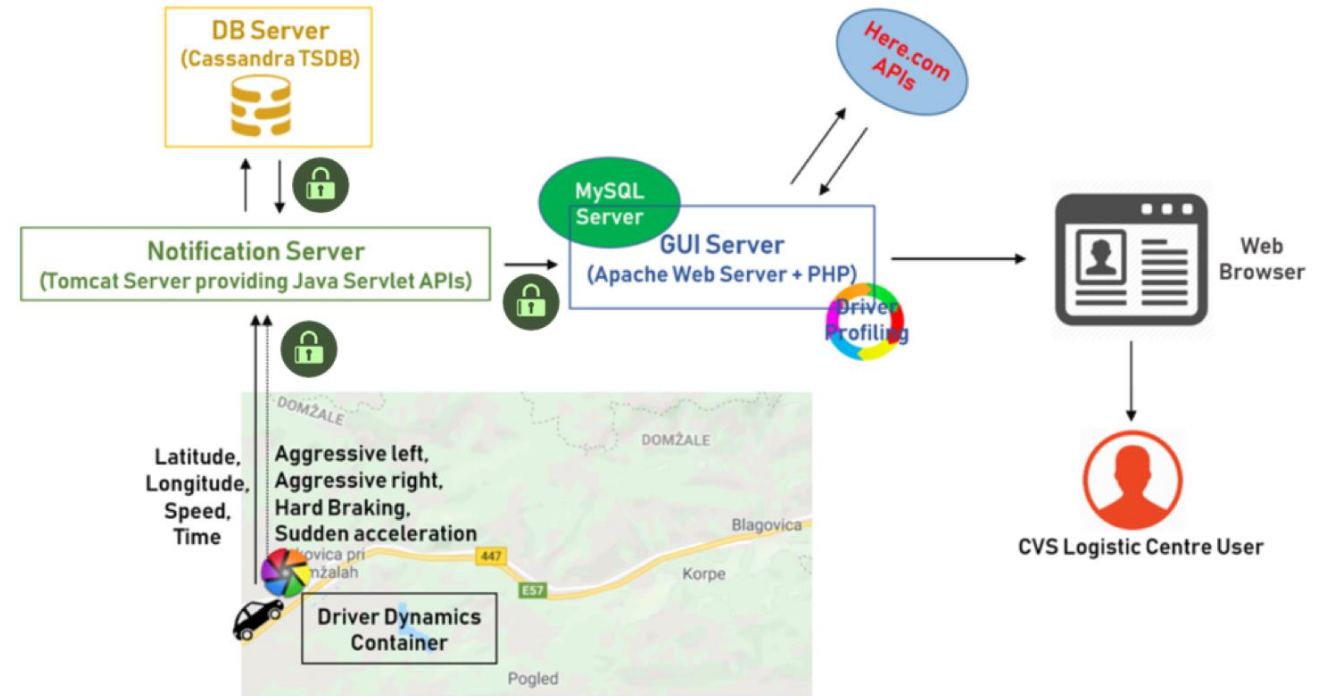
Such a system can provide feedback to different stakeholders such as driver and logistic center. Moreover, driver profiling scenario can also be used to generate whether a training system or an award system which may motivate drivers to keep trying to attain high standards of driving excellence.



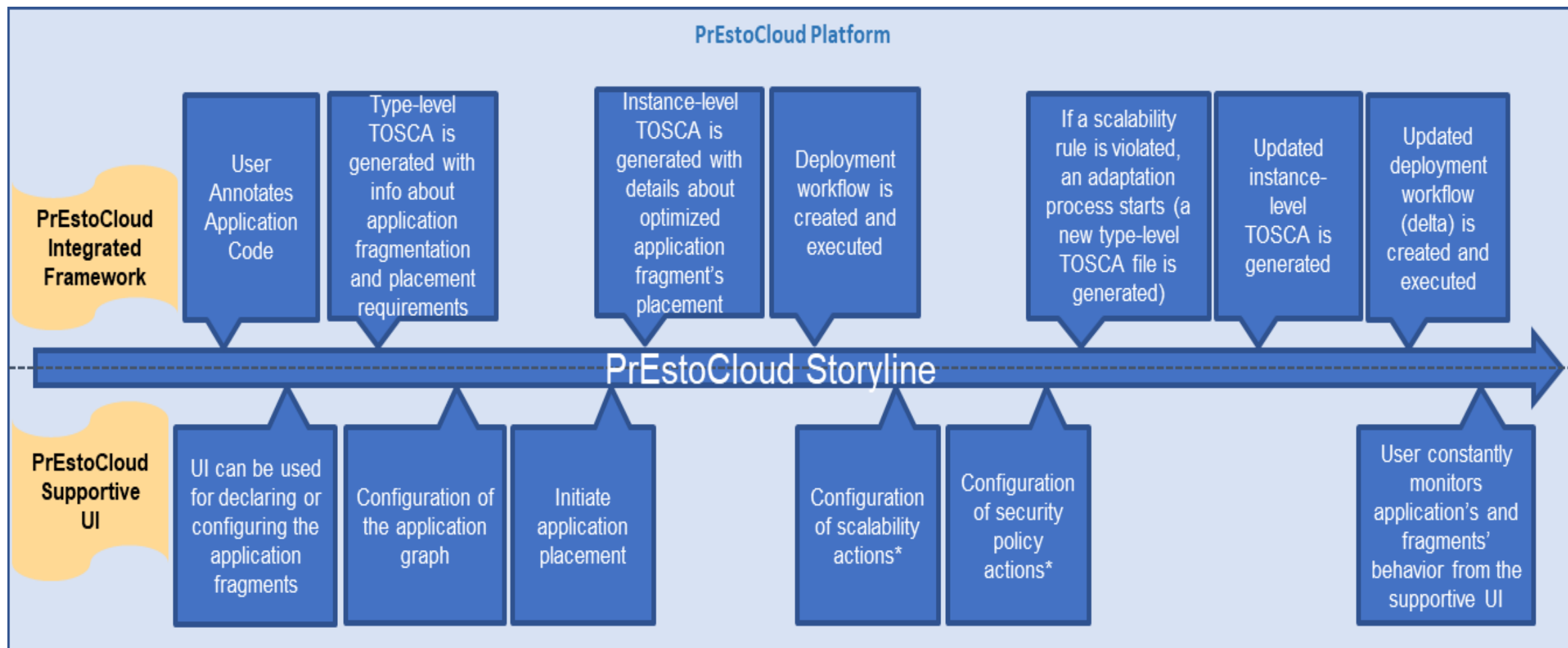
# Logistic Use Case

The CVS logistics pilot in the PrEstoCloud project provides a dynamic, distributed, self-adaptive and proactively configurable telematics system for processing.

The Driver Dynamics Container running on the edge side receives data from sensors and recognizes different types of unexpected driving dynamics.



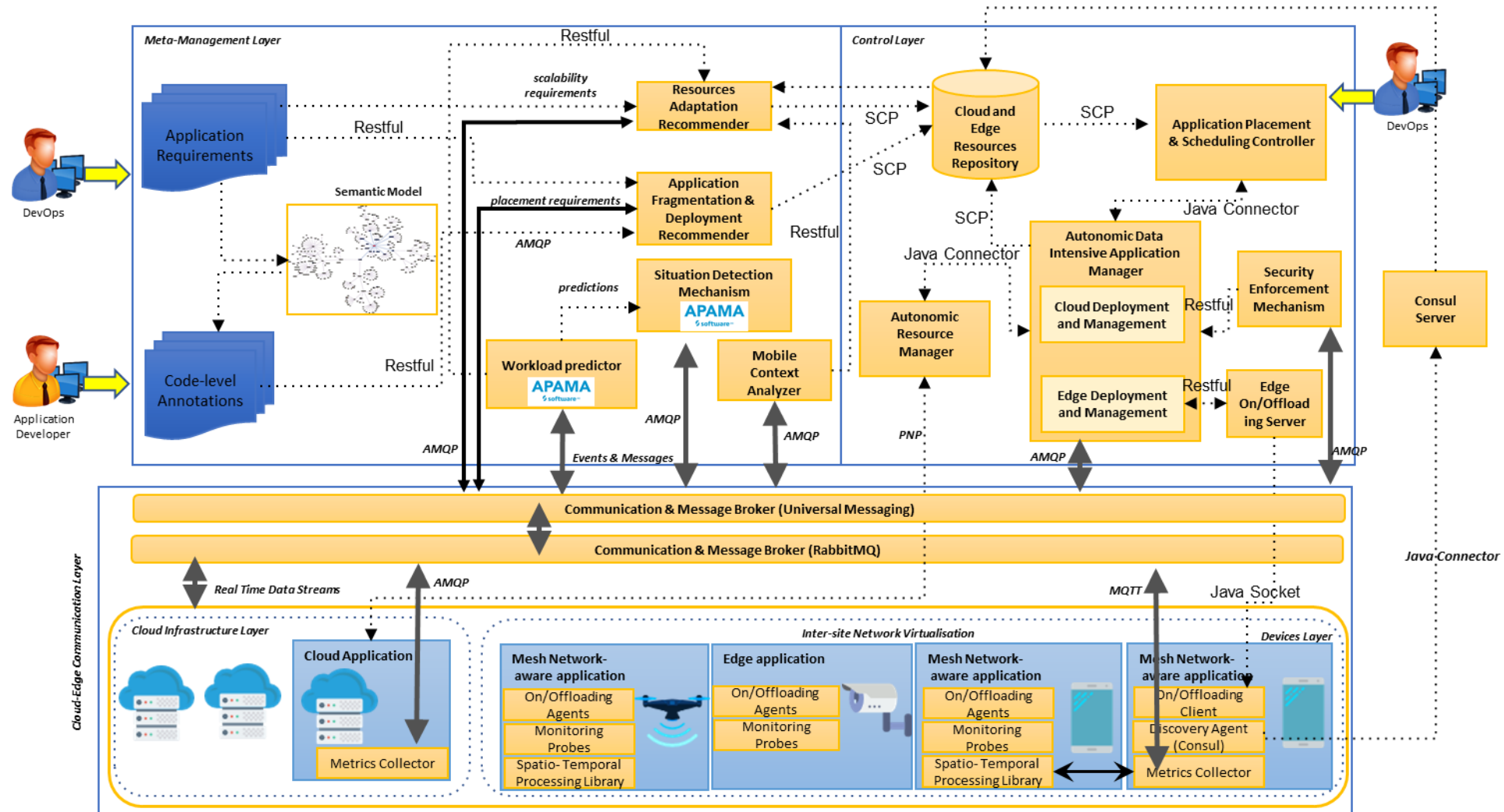
# PrEstoCloud Storyline



\* Configuration of scalability and security policy actions is also possible prior the deployment of the application

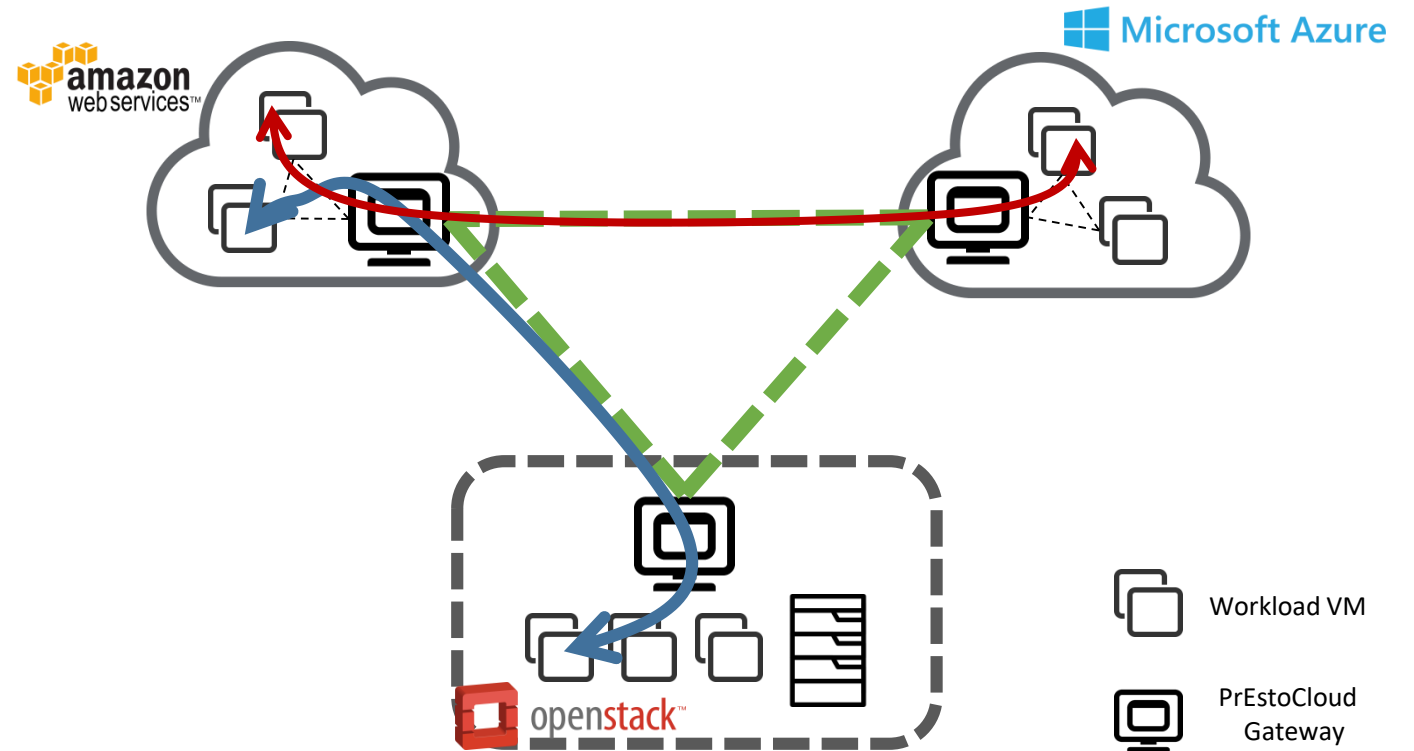


# Architecture overview



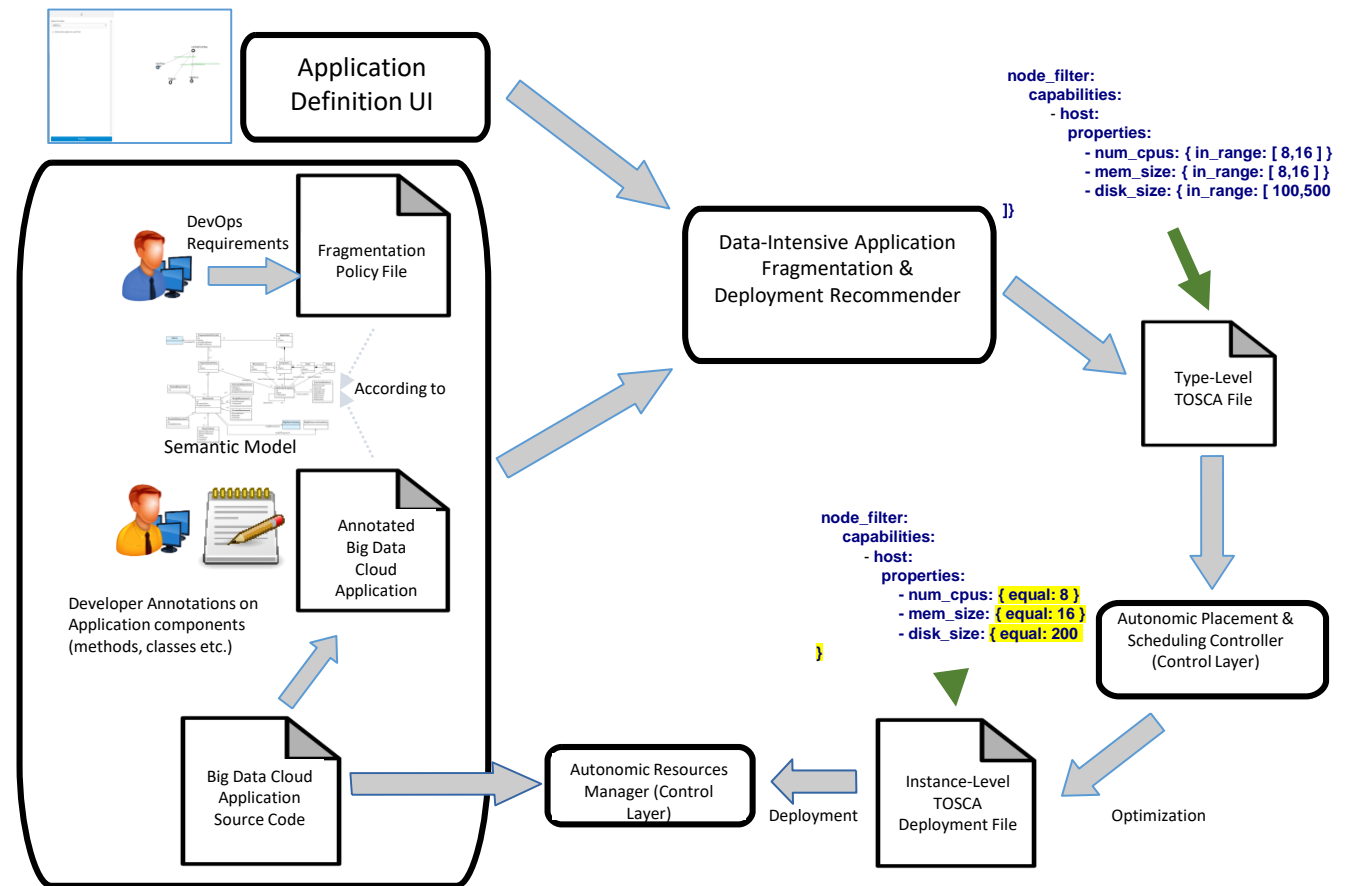
# Inter-Site Network Virtualization

- Connect cloud resources seamlessly independently of IaaS provider choice
- Secured front-end to Internet
- Reliable, least-cost traffic routing



# Application Fragmentation

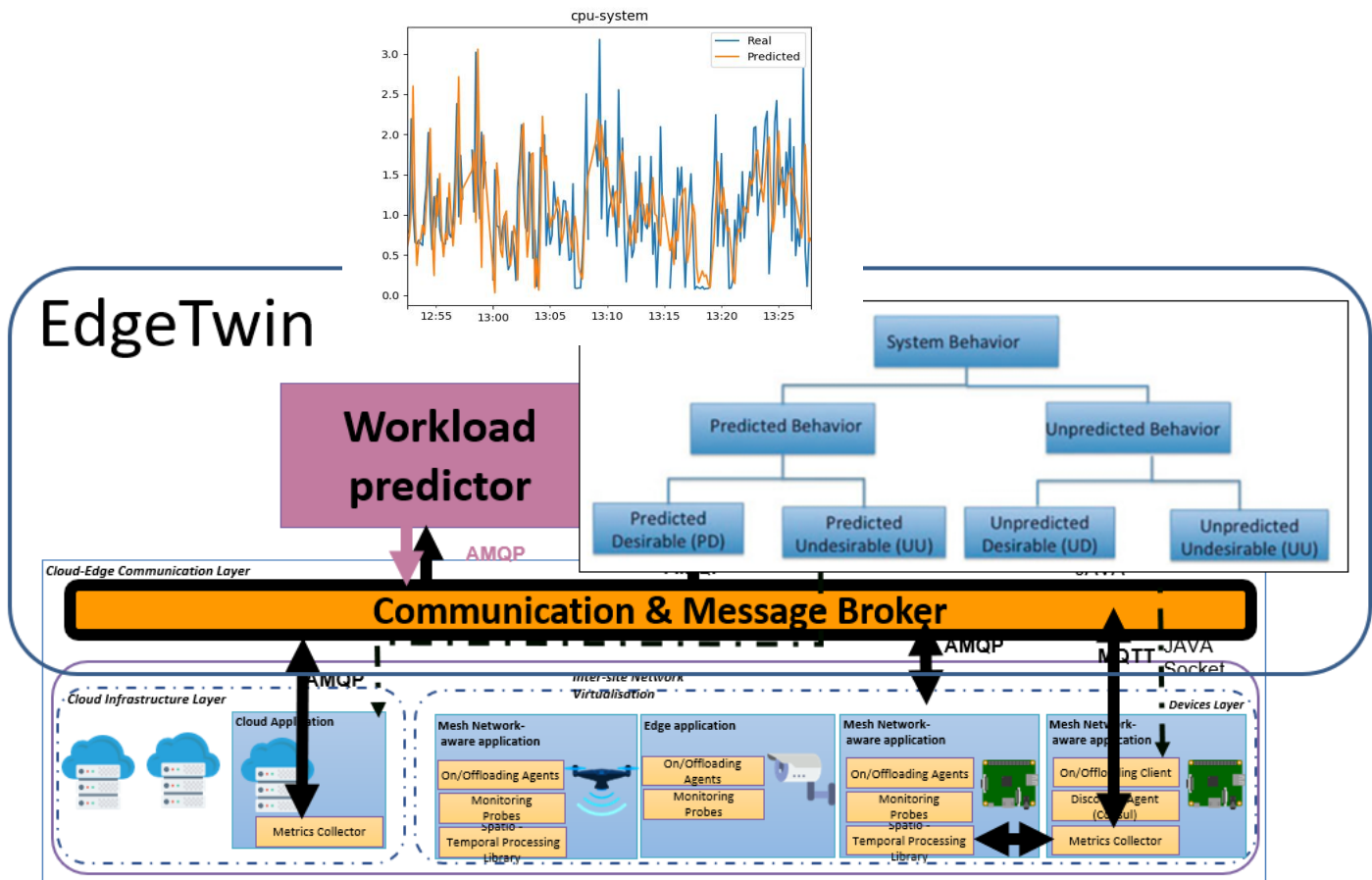
The *PrEstoCloud Application Fragmentation & Deployment Recommender* interprets the description of the requirements of fragments specified by the DevOps and the developer and creates a “type-level” TOSCA file describing an abstract deployment of the application





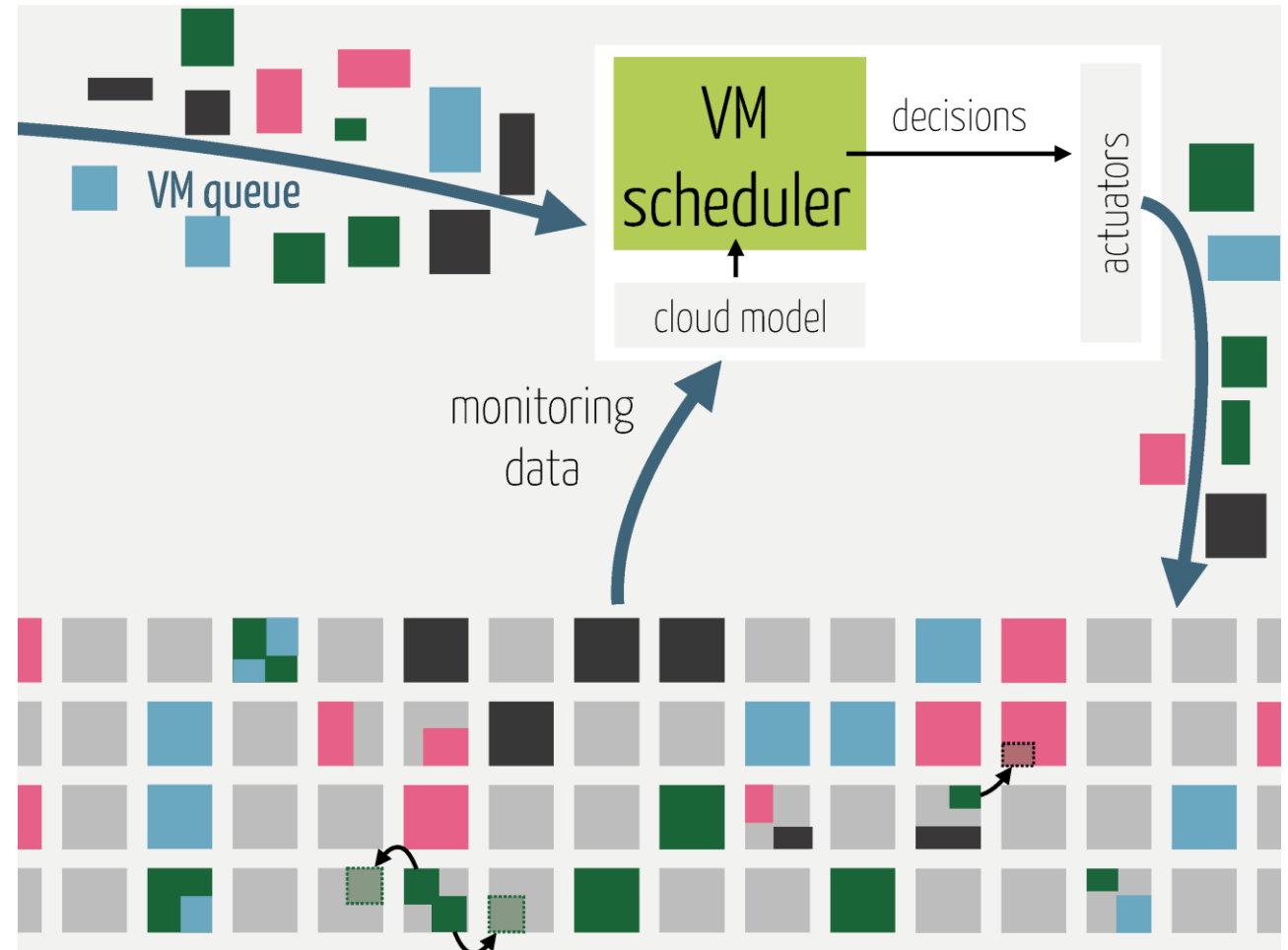
# Distributed Intelligent Communication Broker

- **Workload predictor** as an **analytic engine** for monitoring, understanding and **optimizing the communication** over the Broker in the complex extreme edge processing scenarios
- **EdgeTwin** is a **digital replica** of the communication on the edge, enabling to understand and improve the processing in the edge layer



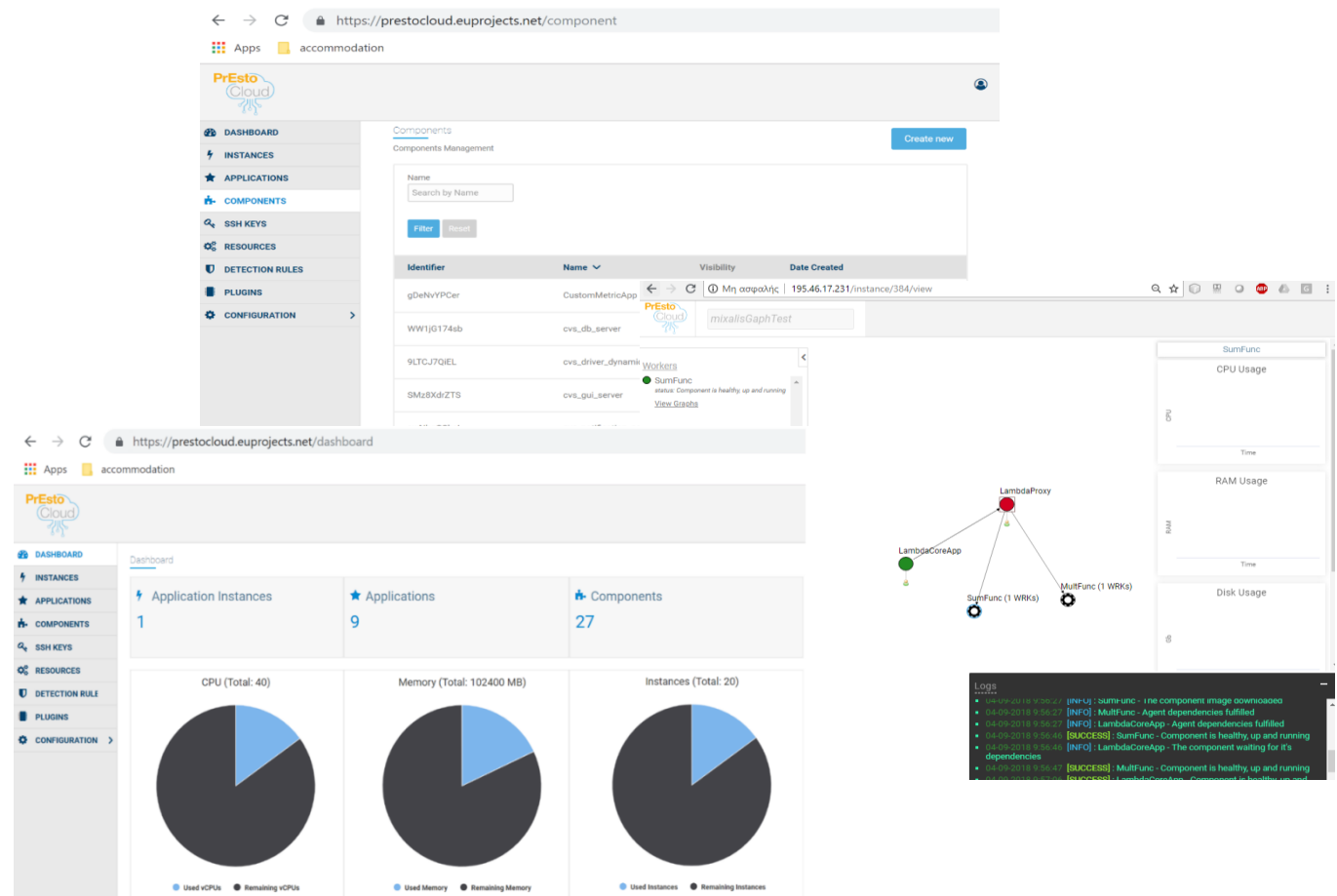
# Application Placement & Scheduling Controller

- Binds a task (fragment) to an execution environment (VM/edge device)
- Enforces execution-level constraints (e.g. software/hardware affinity, co-location of fragments)
- Allows administrative policies (e.g. preferred environment/location)
- Placement optimization based on infrastructure goals (e.g. SLOs, reduced hosting costs)



## *Enhance PrEstoCloud usability*

- Manages applications and components life-cycle
- Configures and monitor cloud and edge computing resources
- Designs application fragmentation
- Controls scalability and security





# Intelligent Telematics Solution

Marija Komatar  
Sebastjan Vagaja





**Telematics Solutions**

[www.cvs-mobile.com](http://www.cvs-mobile.com)

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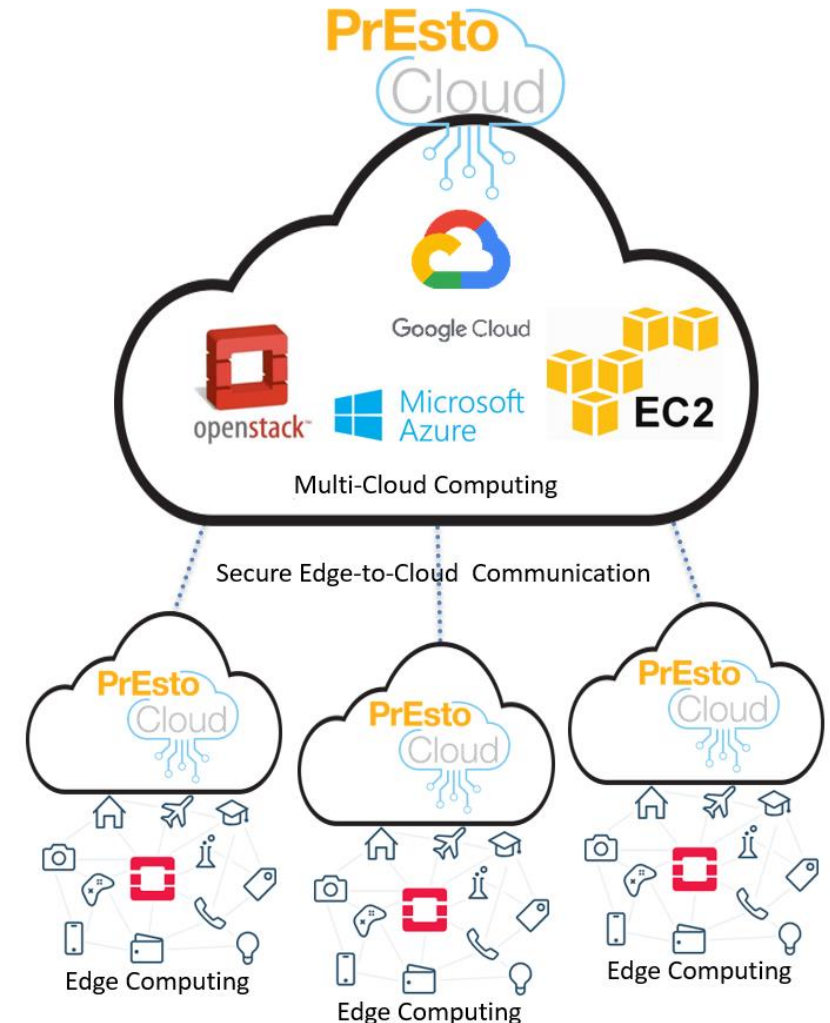
# PrEstoCloud Solution

- **Multi-cloud / edge network overlay**
- **Multi-cloud / edge deployment**
- **Application fragmentation**
- **Optimized placement of application components**
- **Seamless scaling of deployed applications**
- **Changing workload and context information**



# PrEstoCloud Solution

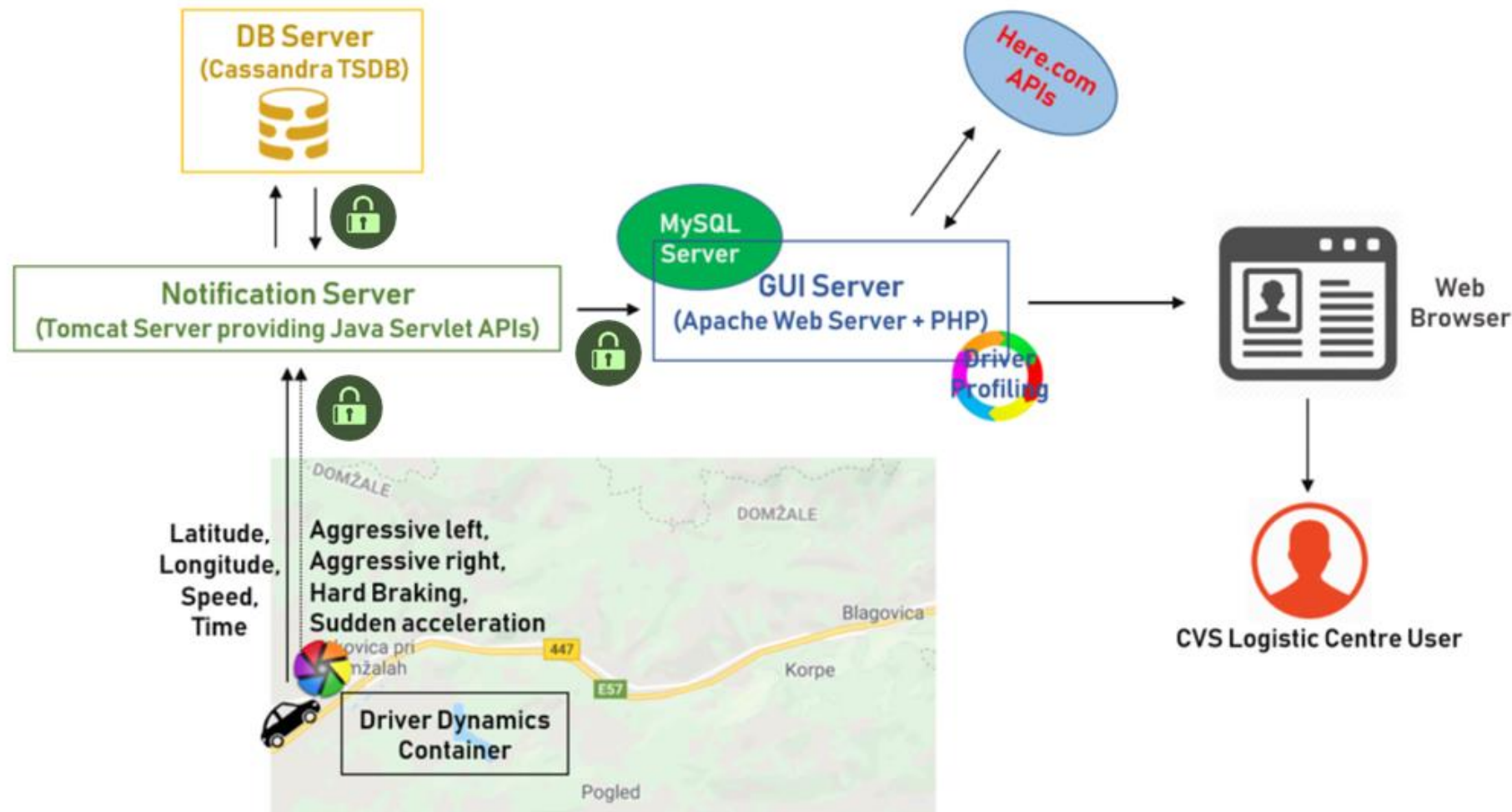
- PrEstoCloud is a dynamic platform for proactive cloud-based resources management, reaching the extreme edge of the network for efficient real-time big data processing.
- PrEstoCloud covers the self-adaptation to real-time changes in the execution environment, and cope with dynamics in velocity and variety.
- PrEstoCloud targets enterprises or SMEs utilizing cloud and edge resources for their data intensive applications.



# CVS Logistics pilot's deployment

**The CVS logistics pilot in the PrEstoCloud project aims to provide a dynamic, distributed, self-adaptive and proactively configurable telematics system for processing sensor data taken from vehicles. This use case presents a transport logistics solution with analytics on telematics data that is able to extract important information through real-time computation at the edge of the network.**

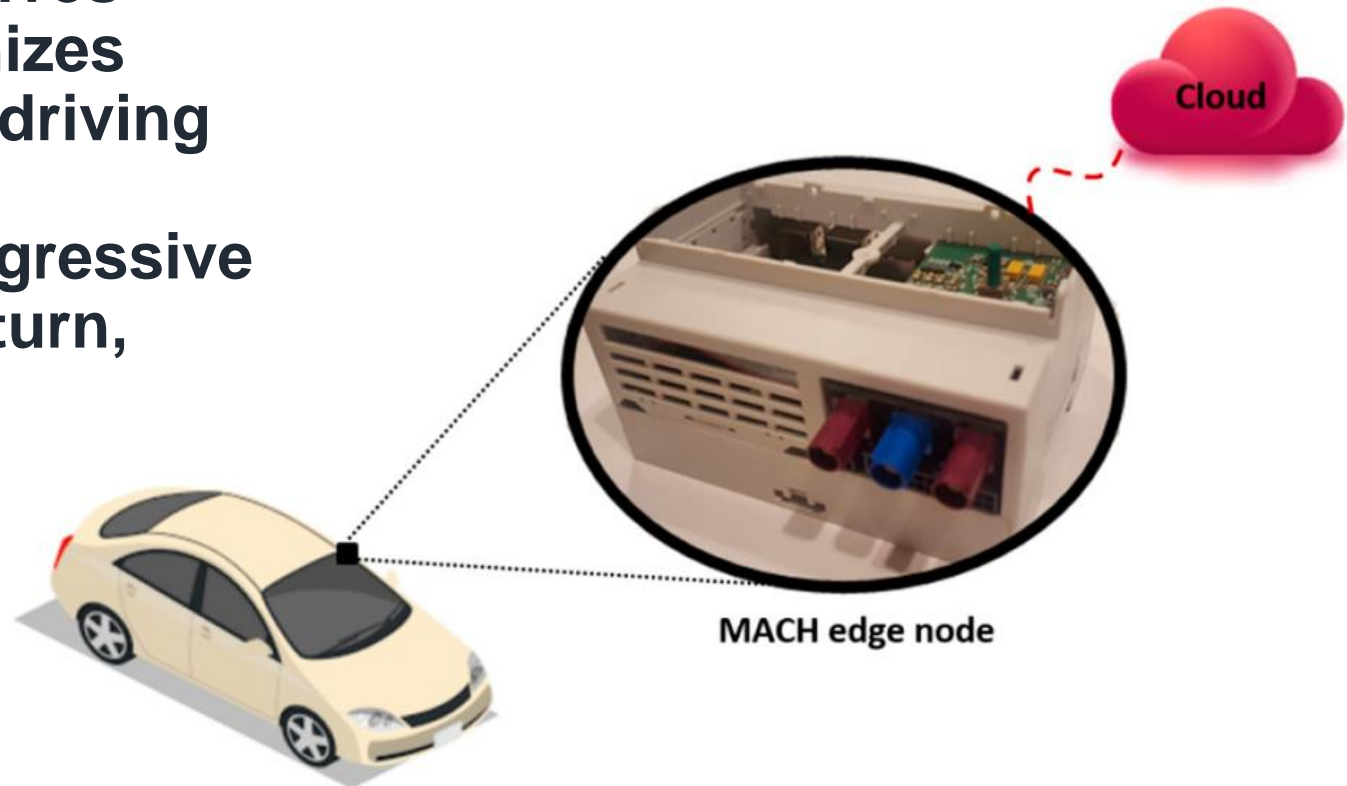
# CVS Logistics pilot's deployment





# CVS Logistics pilot's deployment

- The Driver Dynamics Container running on the edge side receives data from sensors and recognizes different types of unexpected driving dynamics (such as sudden acceleration, hard braking, aggressive right turn and aggressive left turn, improper lane change, etc.)



The screenshot displays the PrEstoCloud Telematics Solutions interface. At the top, there is a navigation bar with links for Home, Login, and PrEstoCloud. Below this, the CVS IJS logo is visible, along with the text 'Telematics Solutions' and the PrEstoCloud logo. The main content area features a map of Madrid, Spain, with several vehicle locations marked by blue dots. A red line indicates a specific route or boundary. The map includes labels for various locations such as Ajalvir, Lugar Globo Granja, Poligono Industrial Los Frailes, Poligono Ind. G. I. T. E. S. a, Poligono Industrial Seysa, P. I. Conimar, I. N. T. A., Poligono Industrial Cointra, Junta Municipal, Alcala De Henares, P. I. El Torral, P. I. El Nilo, P. I. La Galiana, Parque Industrial Camporoso, Parque Logístico de Madrid Este, P. I. Alcamar, and P. I. El Calvario. The map also shows major roads like M-118, M-100, M-119, and M-30. A legend at the top of the map area defines driving behavior data: Aggressive Left (AL), Aggressive Right (AR), Hard Braking (HB), and Sudden Acceleration (SA). The interface includes tabs for Driver Information, Vehicle Information, Notifications, and Driver Profile.

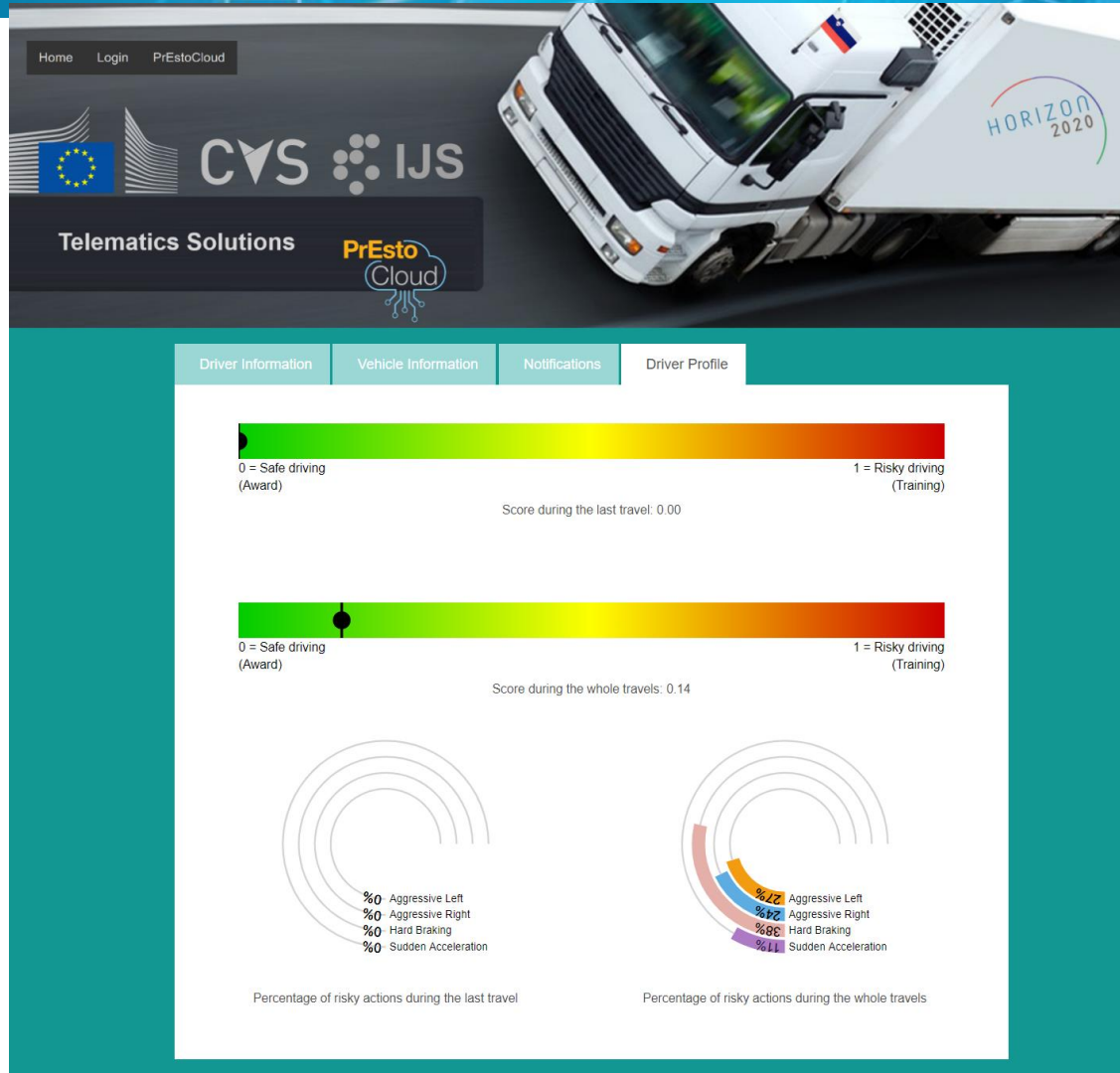


# Driver Profile

- All these features performed by the driver can be analyzed and allow us to form a profile which represents the driver's behavior. to show useful information on how safe their driving could be, how economic they drive in terms of fuel consumption, how much they care about vehicle maintenance, how efficient their driving is in terms of environmental impact, etc. Such a system can provide feedback to different stakeholders such as driver and logistic center. Moreover, driver profiling scenario can also be used to generate whether a training system or an award system which may motivate drivers to keep trying to attain high standards of driving excellence.



# Driver Profile



**For more, please get in  
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Thank you



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