

Architecture for Scalable, Self-\*, human-centric,  
Intelligent, Secure, and Tactile next generation IoT

# assist-*iot*

***ASSIST-IoT*: Next-generation IoT  
insights**

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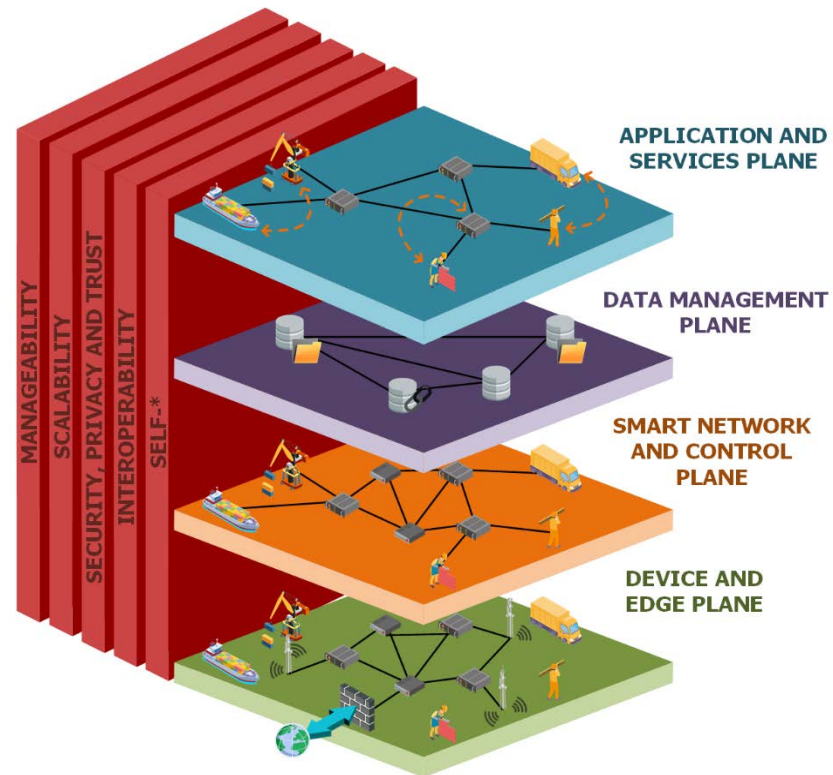
*Polytechnic University of Valencia (UPV)*



# ASSIST-IoT Partners



# ASSIST-IoT Reference architecture



## Multidimensional approach

### Design principles:

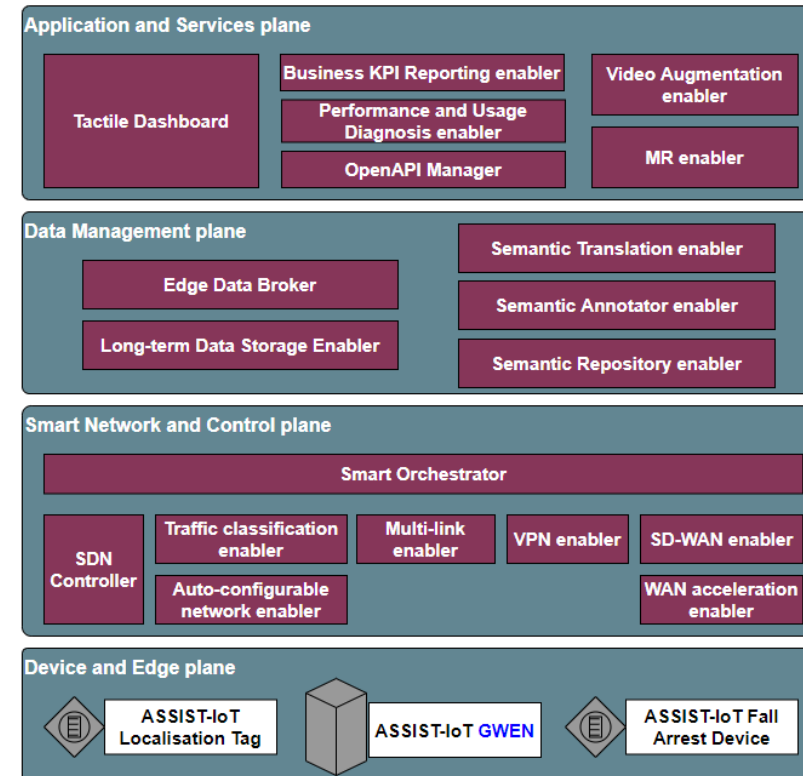
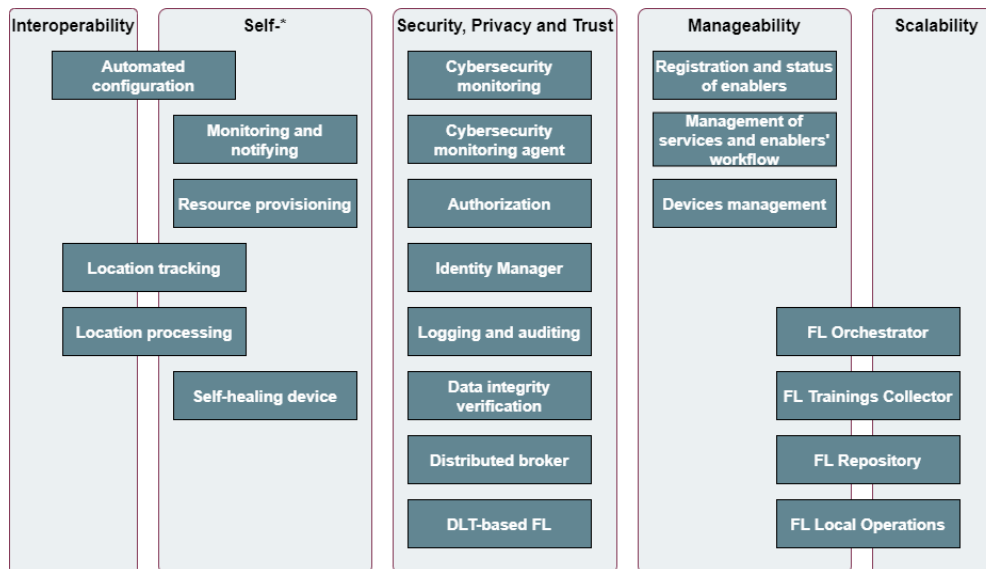
- Microservices
- Containerisation
- Enablers abstraction (+ encapsulation concept)
- Kubernetes-centric

**Reference NGLoT architecture (D3.7):** Design principles, Views (functional, node, development, deployment, data), Verticals  
Additional considerations: Common endpoints (/metrics, /api, /version), monitoring and logging, encapsulation exceptions  
Considered: ISO/IEC/IEEE 42010, LSP programme architecture, the OpenFog consortium RA, and AIOTI HLA

# ASSIST-IoT planes & verticals

## 41 enablers implemented (D4.3, D5.5)

- Following the design concepts and the guidelines of the Reference Architecture (only 3 exceptions)
- Covering several technological domains (AR, AI – FL, Virtualization – MANO, SDN, DLT, Cybersecurity, access control, Self-\* mechanisms, etc.)
- Different levels of design and development effort
- Many already public, others will be soon



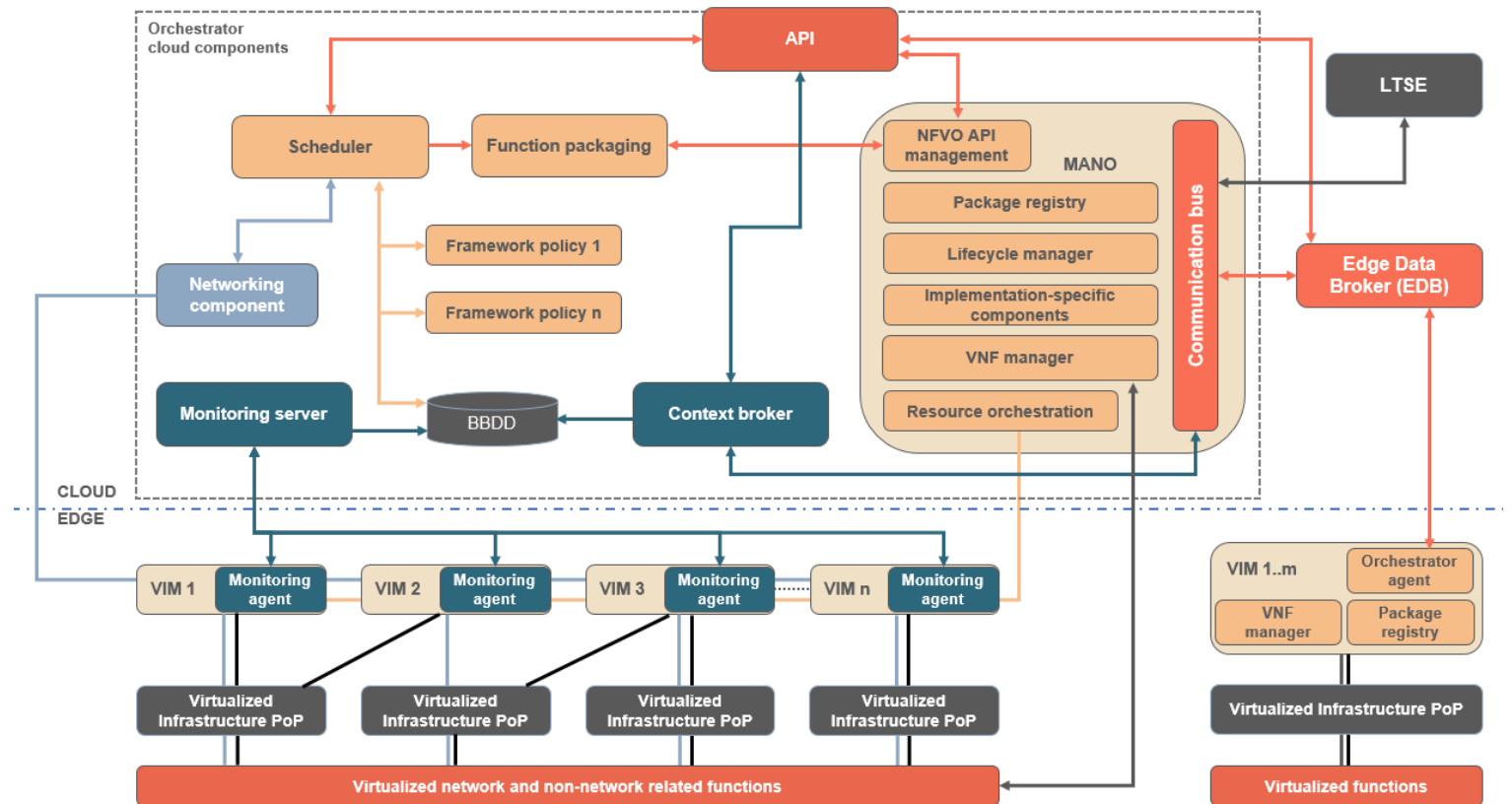
# ASSIST-IoT Orchestration

## Key outcome: Smart orchestrator

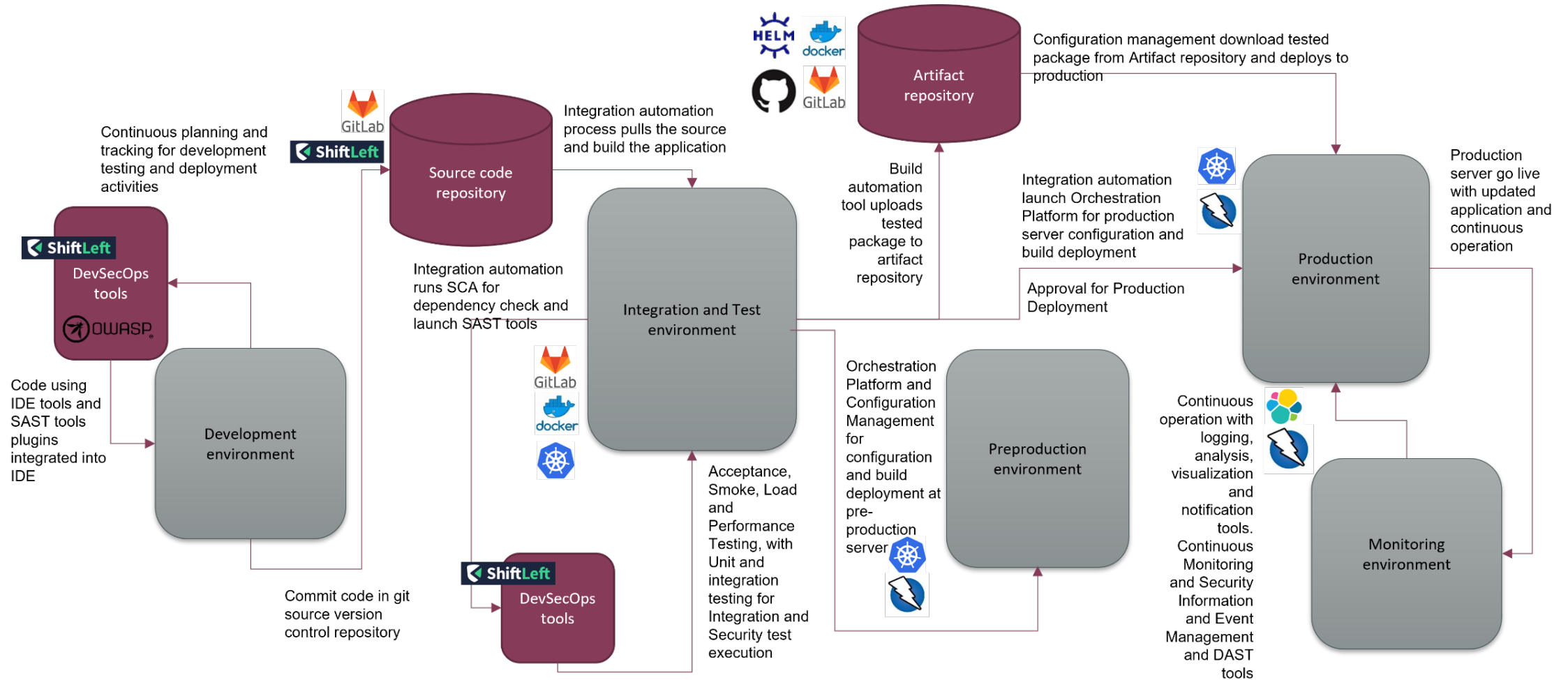
- For IoT-Edge-Fog-Cloud ecosystems
- Compatible with K8s-based (v4, v3) and Openstack-based (v3) ecosystems
- Facilitates the lifecycle management of workloads, extended to environments with private and dynamic IP addresses
- Automated networking, policy rules and telemetry
- Policies for automating deployments

## Insights:

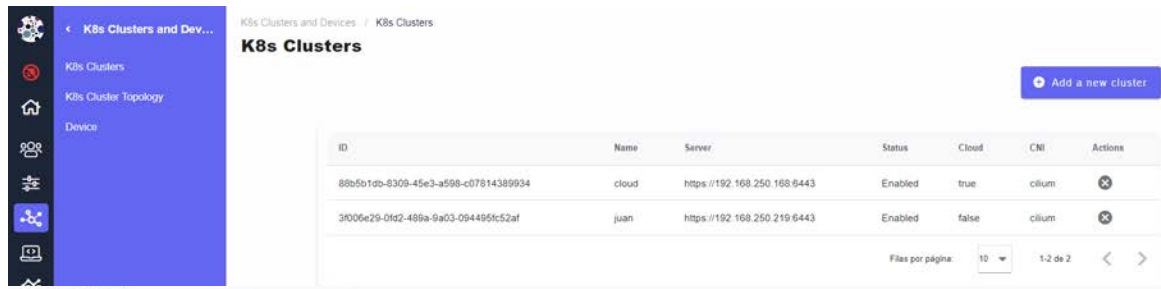
- Valid for many realistic NGIoT use cases, pending features for large, multi-domain ecosystems



# ASSIST-IoT Enablers



# ASSIST-IoT Enablers



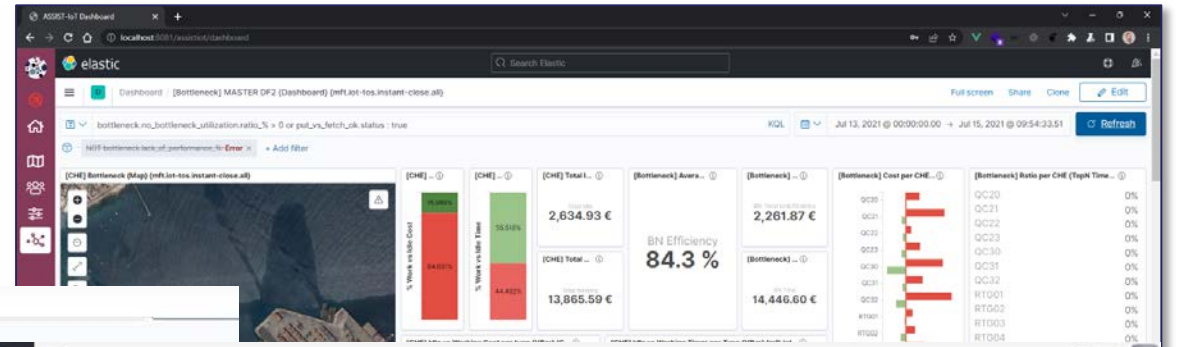
K8s Clusters and Devices / K8s Clusters

### K8s Clusters

[Add a new cluster](#)

ID	Name	Server	Status	Cloud	CNI	Actions
88b5b1d5-8309-45e3-a598-c07814389934	cloud	https://192.168.250.168:6443	Enabled	true	cilium	
3f006e29-0f92-489a-9a03-094495fc52af	juan	https://192.168.250.219:6443	Enabled	false	cilium	

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elastic Dashboard [Bottleneck] MASTER DF2 (Dashboard) (left: list-tes.instant-close.all)

Search Elastic

Jul 13, 2021 @ 00:00:00.00 → Jul 15, 2021 @ 09:54:33.51

Refresh

Search: `bottleneck_no_bottleneck_utilization_ratio_% > 0 or put_logs_fetch_ok_status: true`

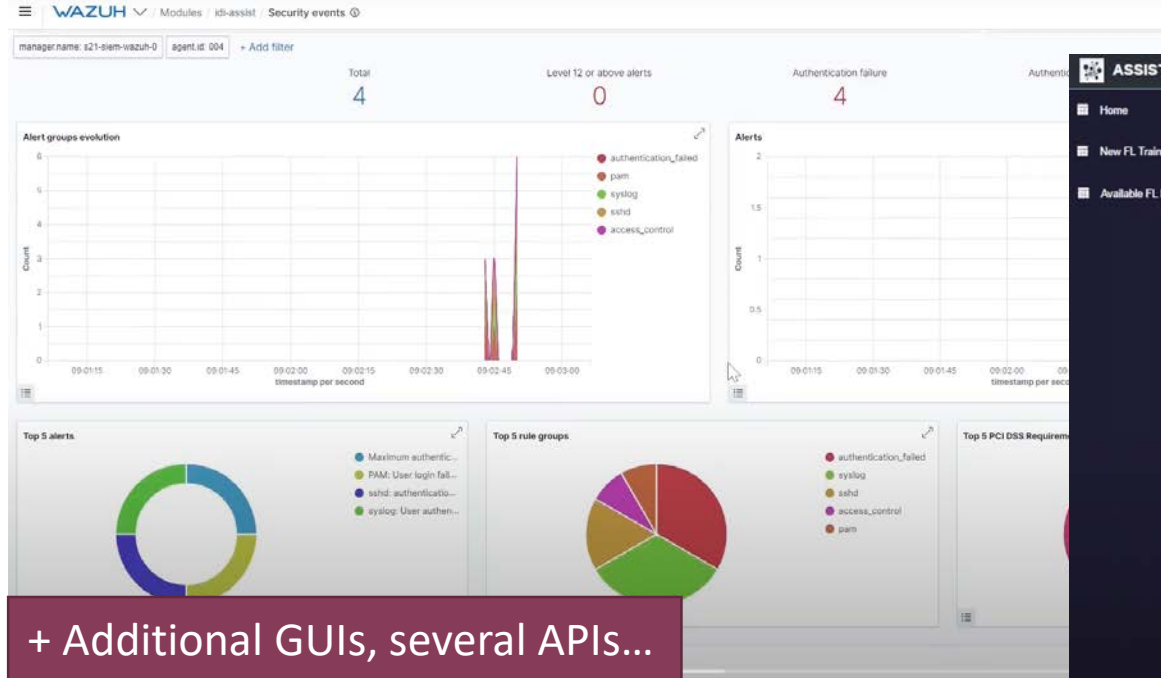
Filters: `!NOT bottleneck_usage_of_performance:Error`

Metrics:

- [CHE] Total L: 2,634.93 €
- [CHE] Total: 13,865.59 €
- BN Efficiency: 84.3%
- [Bottleneck] Avera: 2,261.87 €
- [Bottleneck] Cost per CHE: 14,446.60 €

Bar charts showing % Work in the Queue (94.00%), % Work in the Error (41.40%), and % Work in the Queue (75.00%).

Horizontal bar chart showing [Bottleneck] Ratio per CHE (Tight Time) for various categories like OC20, OC21, etc.



WAZUH Modules: kb-assist, Security events

manager name: s21-siem-wazuh-0 agent id: 004

Total: 4 Level 12 or above alerts: 0 Authentication failure: 4

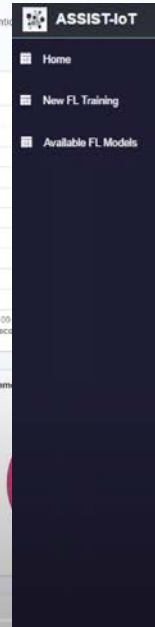
Alert groups evolution: Line chart showing counts over time for authentication\_failed, pam, syslog, sshd, access\_control.

Alerts: Line chart showing counts over time.

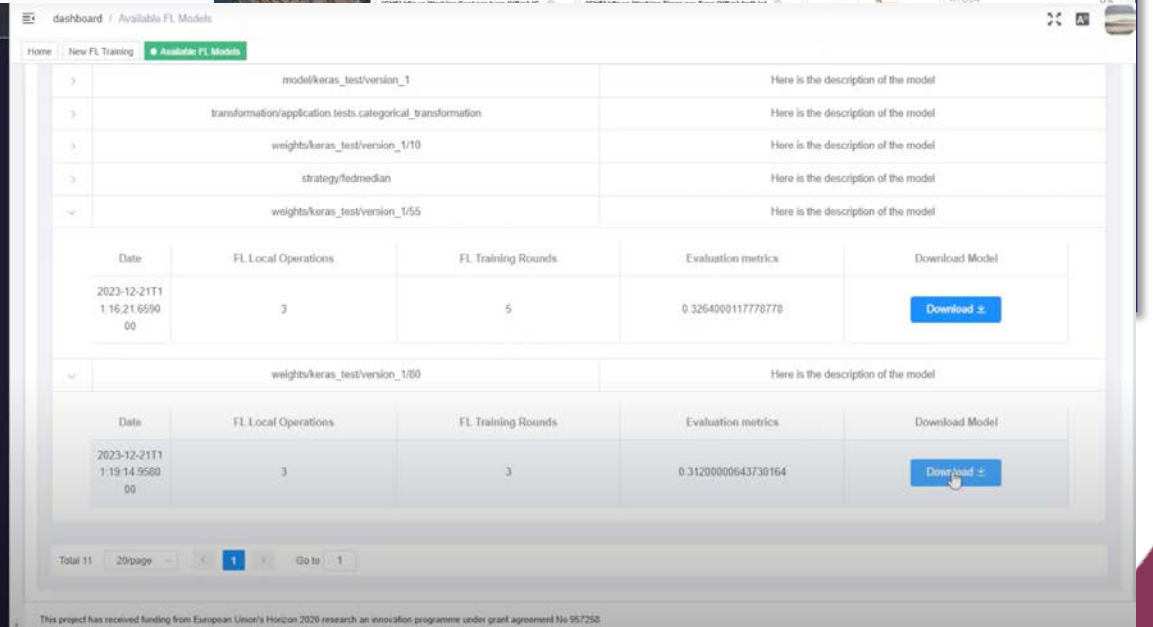
Top 5 alerts: Donut chart showing distribution of alert types.

Top 5 rule groups: Donut chart showing distribution of rule groups.

Top 5 PCI DSS Requirements: Donut chart showing distribution of requirements.



- Home
- New FL Training
- Available FL Models



dashboard / Available FL Models

Home | New FL Training | Available FL Models

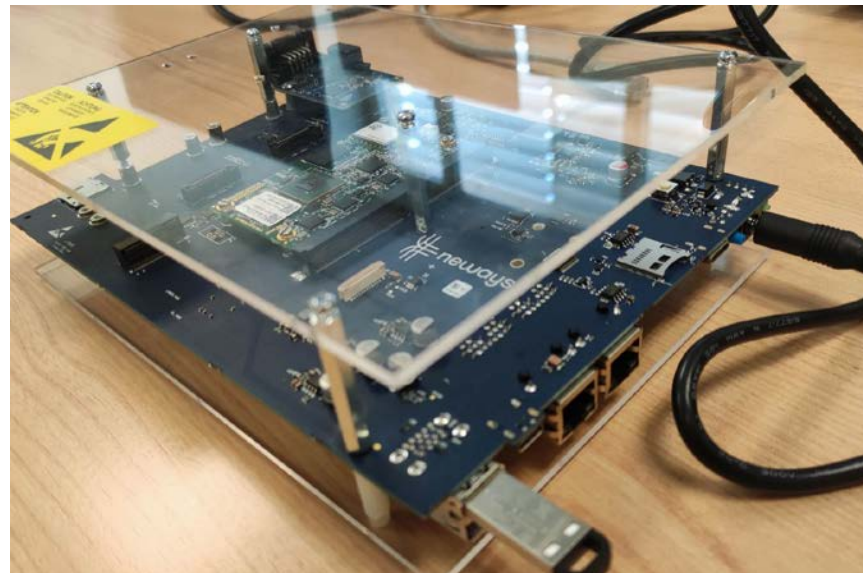
Date	FL Local Operations	FL Training Rounds	Evaluation metrics	Download Model
2023-12-21T11:16:21.659000	3	5	0.3264000117778778	<a href="#">Download</a>
2023-12-21T11:19:14.958000	3	3	0.31200000643730164	<a href="#">Download</a>

Total 11 20page 1 Go to 1

+ Additional GUIs, several APIs...

# ASSIST-IoT GWEN

- The ASSIST-IoT's Edge Node (**GWEN**) is the main hardware designed and manufactured by ASSIST-IoT:
  - It is a **multipurpose** gateway that can be adapted to several use cases, as it considers the most **typical interfaces** used in the industry (cellular – 5G, serial, WiFi, BLE, Ethernet, UWB)
  - It is based on **open software**, and jointly with the **expansion modules**, it can be **fine-tuned** to support any need at the edge (including AI and real-time capabilities)





# ASSIST-IoT pilots

Enablers tested in highly **heterogeneous environments** to ensure minimization of the risk, involving **leading industries (D7.X)**



## Port automation



Improve operational efficiency, safety and profitability of port processes

**BS:** Management of assets; automated cooperation; remote control of cranes with AR



## Smart Safety of workers



Make provisions for predicting potentially dangerous situations in construction

**BS:** Occupational safety (workers' health, geofencing, site control); fall arrest detection; safe navigation and healthy inspection with MR support



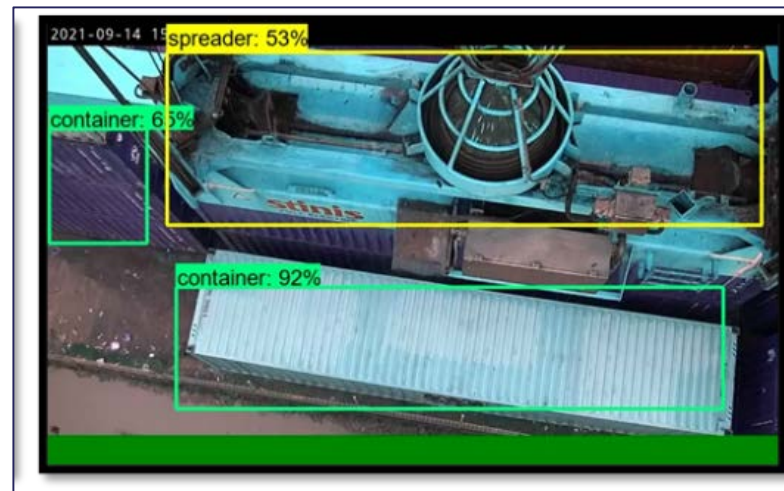
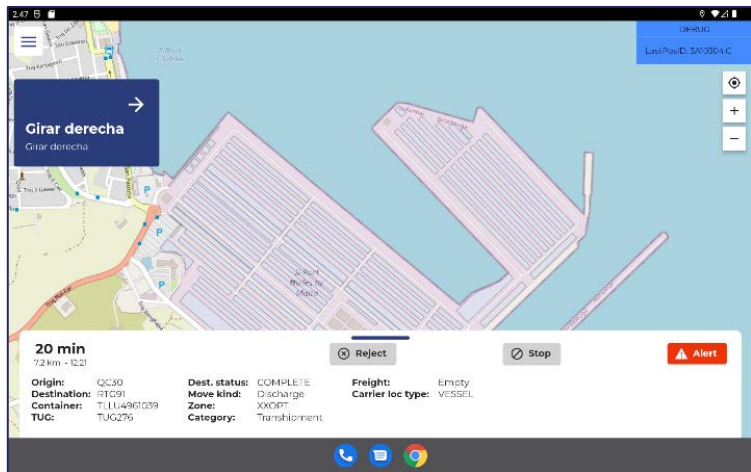
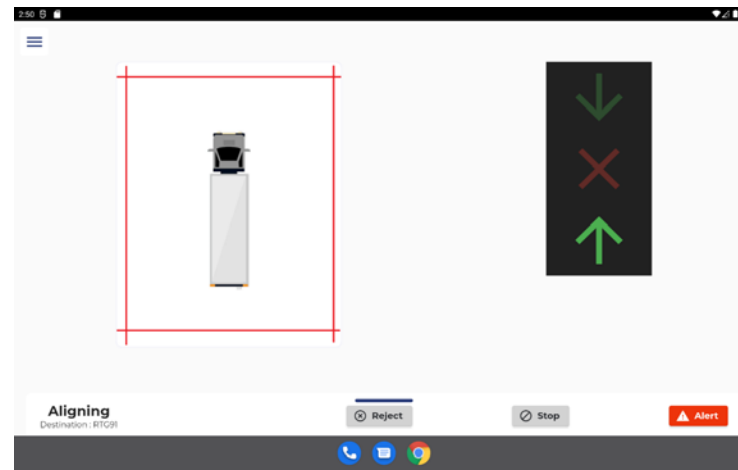
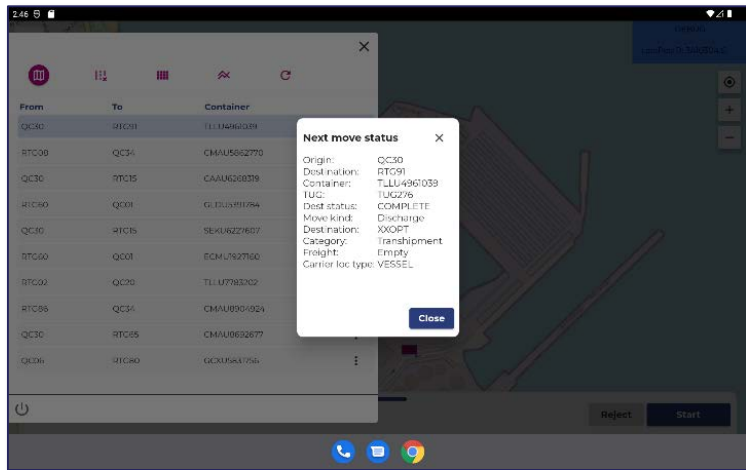
## Cohesive vehicle monitoring and diagnostics



Increase monitoring capabilities in individual cars and at a fleet scale

**BS:** Fleet in-service emissions verification and diagnostics; exterior condition AI-based inspection and documentation

# ASSIST-IoT pilot demonstrations



# ASSIST-IoT pilot demonstrations

```
:b0_11 rdf:type om:Measure ;
om:hasNumericalValue "255"^^xsd:integer ;
om:Unit aiot_p2:tagAccelerationUnit .

:b0_12 rdf:type om:Measure ;
om:hasNumericalValue "256"^^xsd:integer ;
om:Unit aiot_p2:tagAccelerationUnit .

:b0_13 rdf:type aiot_p2:AccelerationResult, sosa:Result ;
aiot_p2:hasXValue _:b0_7 ;
aiot_p2:hasYValue _:b0_9 ;
aiot_p2:hasZValue _:b0_11 ;
aiot_p2:accelerationWindow "1"^^xsd:positiveInteger .

:b0_14 rdf:type aiot_p2:AccelerationResult, sosa:Result ;
aiot_p2:hasXValue _:b0_8 ;
aiot_p2:hasYValue _:b0_10 ;
aiot_p2:hasZValue _:b0_12 ;
aiot_p2:accelerationWindow "2"^^xsd:positiveInteger .

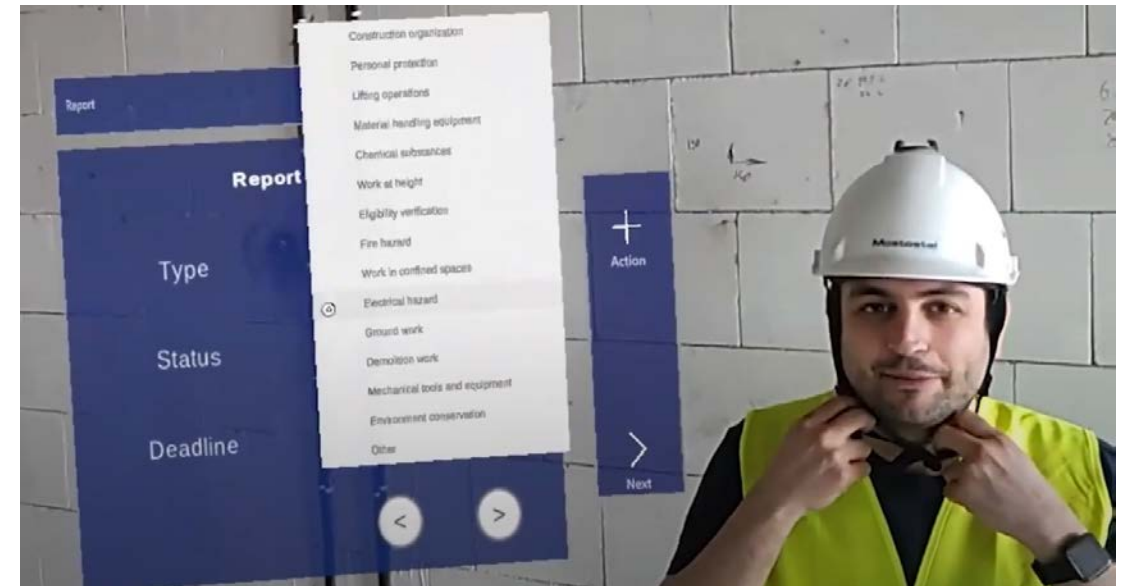
https://assist-iot.eu/pilot2_rdf/device/tag/36376> rdf:type sosa:
schema:identifier "tag-36376" ;
sosa:hosts <https://assist-iot.eu/pilot2_rdf/sensor/location/

:b0_15 rdf:type sosa:Observation ;
sosa:resultTime "2023-06-09T09:29:18.365239"^^xsd:dateTime ;
sosa:hasResult _:b0_1, _:b0_13, _:b0_14, _:b0_5, _:b0_6 .

https://assist-iot.eu/pilot2_rdf/sensor/location/36376> rdf:type
sosa:madeObservation _:b0_15 .

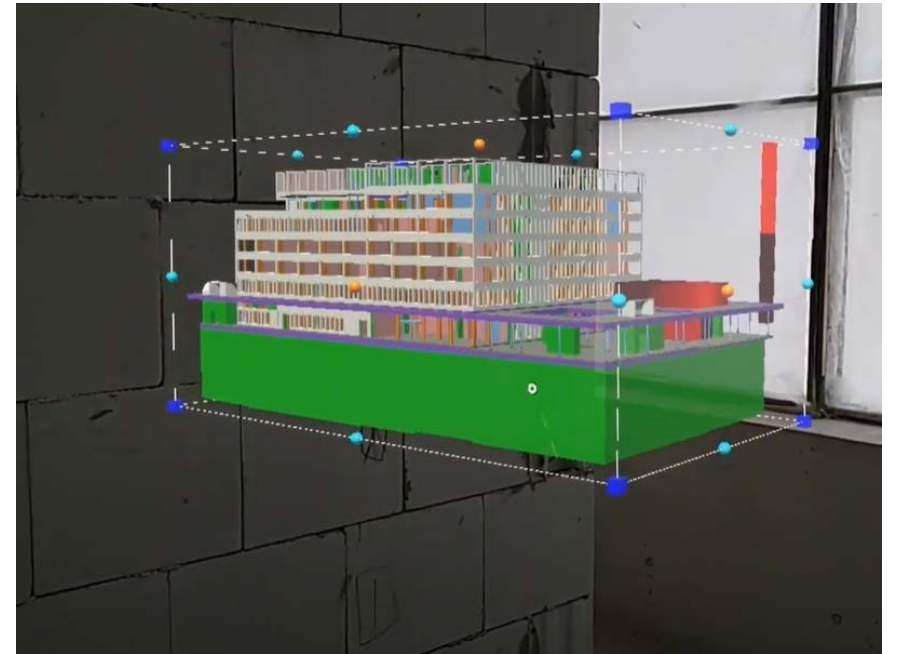
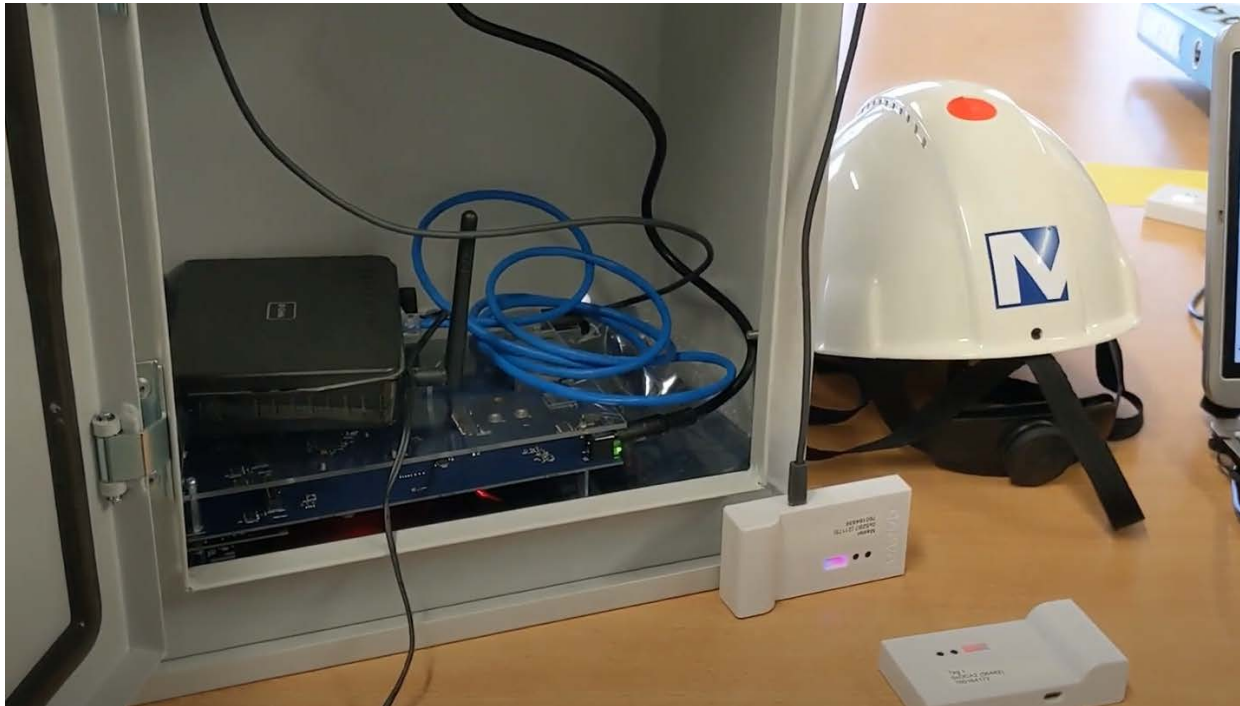
https://assist-iot.eu/pilot2_rdf/worker/2> rdf:type aiot:User ;
```

The diagram is an RDF graph visualization. It features several nodes: 'wind speed' (blue circle), 'Result (external)' (blue circle), 'Tag metadata...' (blue circle), 'Acceleration result' (red circle), and 'boolean' (yellow rectangle). Relationships are shown with dashed lines: 'Subclass' from 'Result (external)' to 'wind speed' and 'Acceleration result'; 'Subclass' from 'Tag metadata...' to 'Result (external)'; and 'Has alarm' from 'Tag metadata...' to 'boolean'. There are also green labels: ':watch connected' between 'Tag metadata...' and 'Result (external)', and 'Acceleration wind' between 'Tag metadata...' and 'Acceleration result'. A 'Thing' node is shown in a dashed circle at the bottom right.

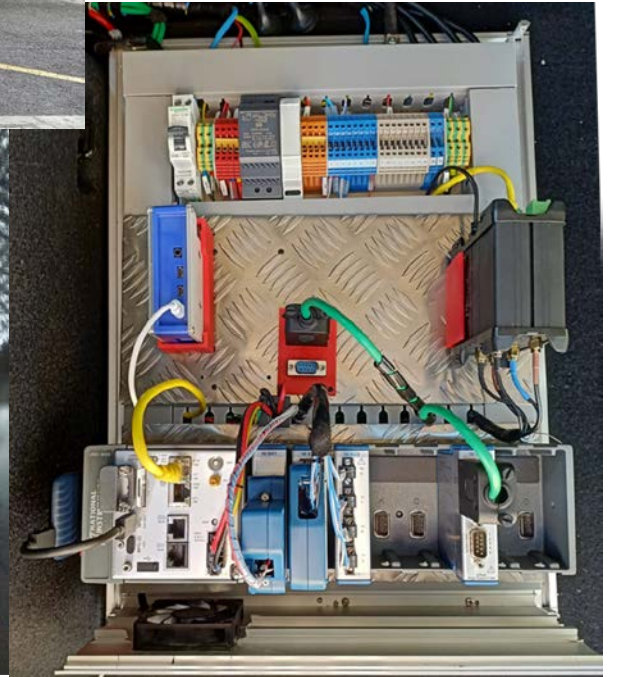


# ASSIST-IoT pilot demonstrations

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# ASSIST-IoT pilot demonstrations



# ASSIST-IoT pilot demonstrations



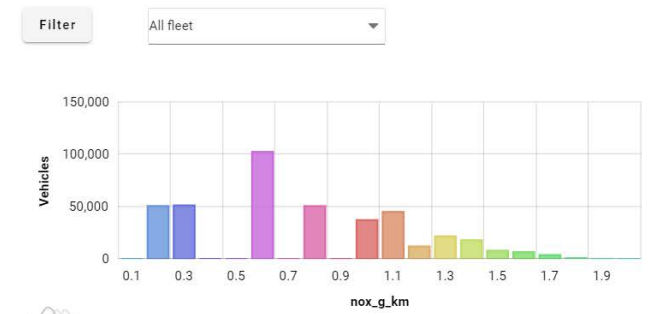
Monitored region

Entire fleet  
 Sub-fleet

Compliant Outliers

N %

Emissions histogram



**Analysis:**  
In this moment, the 97% of the fleet is estimated to be within the emissions limits mandated by the European regulation. A total of 325 are estimated to be outside those limits.

List of cars Upload calibration

DEVELOPER VIEW DRIVER VIEW

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Ford

assist-iot

Architecture for Scalable, Self-\*, human-centric, Intelligent, Secure, and Tactile next generation IoT

Upload calibration

Version\*

Cal file

Close Upload/replace



# ASSIST-IoT lessons learnt: now

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- The **design principles** used are pillars of recently-started related initiatives
- The **multi-cluster service mesh strategy** applied has proved very useful to:
  - Ease the communication of different types of services, and along distributed environments
  - Secure the communication by using uTLS, and by allowing only exposed interfaces to communicate
- The primary packaging technology selected (**Helm**) is very flexible also for distributed ecosystems, still:
  - The **values.yaml manifest**, that modifies configuration parameters at deployment at all Helm charts, should be powerful and well-documented so that solutions can be truly effective
  - For more powerful, live configuration updates, the use of custom **operators** are one good practice
  - Other technologies with similar approaches could have been used, towards **deployment flexibility**
- However, there are **exceptions** in which virtualization is not possible or desired
  - Cybersecurity tools should be installed at host level to monitor possible threats
  - Some 5G functions, like UPF, show lower performance if deployed as containers
  - Some devices, like tiny edge devices, AR glasses etc., are not powerful enough to enable virtualization

# ASSIST-IoT lessons learnt: next



- **Edge native** is still a field to further evolve. Basically, applications belonging to this category should *leverage cloud-native principles while taking into account the unique characteristics of the edge in areas such as resource constraints, security, latency and autonomy*
- The Cloud-Edge-IoT ecosystem is very heterogeneous and several implementations are available. Coordinated work is needed to work towards a common *taxonomy, glossary, and ontology of continuum orchestration*
- That heterogeneity prevents a one-solution-fits solution for the overall continuum. *Open platforms, marketplaces, reference implementations* for particular use cases are demanded
- Research, integrators, industry, EC... all the *actors of the innovation chain must be aligned* so the effort is actually transferred to the real world. Characterizing the real needs is key to translate the effort of the project outcomes into next actions, upscaling their TRL and influence standardization





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# Thank You Questions?

EUCloudEdgeIoT.eu  
RIA Showcase  
8<sup>th</sup> February 2024

Dr. Alejandro Fornés,  
Prof. Carlos E. Palau,  
Dr. Ignacio Lacalle  
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