

EU**CloudEdgeIoT**.eu

# TAXONOMY FOR THE COMPUTING CONTINUUM

Lara López (EVIDEN / OpenContinuum)

# Homogenising European research



## Cloud Computing



## Next Generation IoT



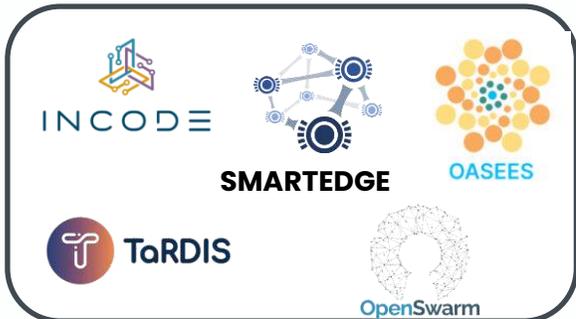
## META-Operating Systems



## Cognitive Cloud



## Swarm Intelligence



## Open Source for Cloud services



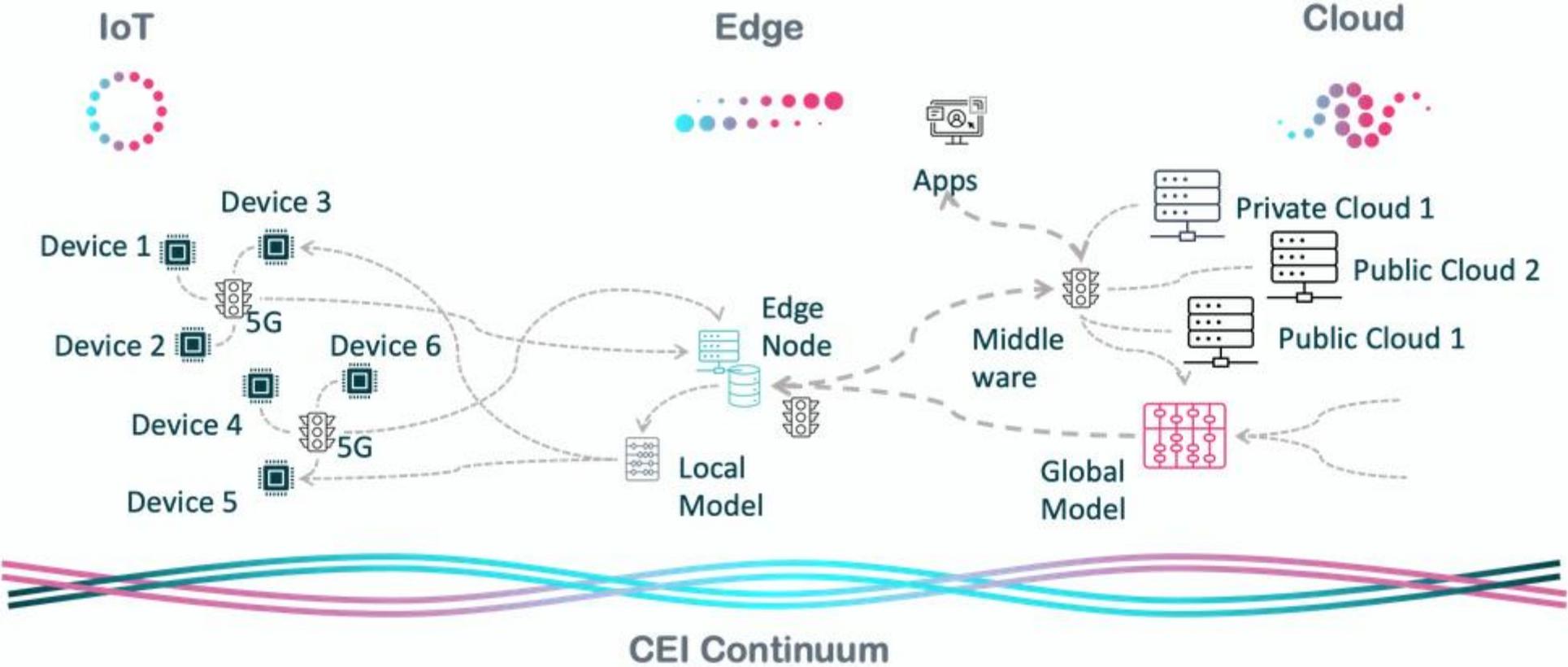
## Software Technologies



## & More



# Cloud-Edge-IoT overview





## ARCHITECTURE

January 2023- December 2024

**Lead: ATOS**

- Lara Lopez
- Francesco D'Andria
- Enric Pages

**Participants:**

- MARTEL
- TRIALOG
- EGI
- ECLIPSE

**Methods and Relationship:**

- Regular meetings
- Tech workshops

**Main topics:**

- Taxonomy definitions
- Sharing of components between RIAs
- Peer review and testing

**Key objectives:**

- Enable architecture definitions and cooperative settlements between projects
- Identify key resource areas, standards and building blocks towards common architecture approach
- Understand the contribution of each project towards the standardisation of the architecture components
- Harmonise different approaches to a shared architecture within the CEI ecosystem

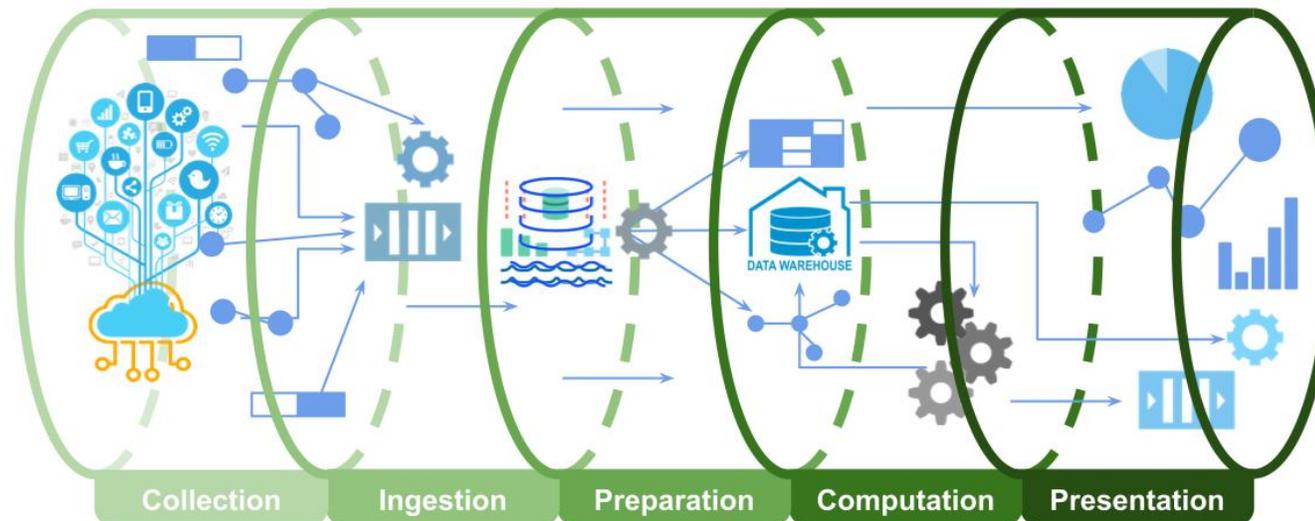
**Main outputs:**

- Agreed methodology for a shared architecture approach
- Whitepaper on CEI architecture

# Why do we need a common language?



- Plenty of taxonomies
  - Cloud – Edge - IoT
- A proposed one for the Continuum
  - Data pipeline
- Horizon Europe projects and others before them
  - Focusing on the compute pipeline



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# First results – Ontology + Glossary



## Cloud terms

Public and private clouds + hybrid cloud  
Multi-cloud management  
Orchestration of resources  
Cluster management  
Balancing  
Scalability  
Migration  
Networking (c+e+f)  
Network slicing management  
Software-defined networking (SDN)  
Tunneling, Virtual Private Networks (VPN)  
Compliance assessment  
Service Level Agreements (SLA) management  
Monitoring and observability  
Security  
Trust  
Workloads deployment (c + e)  
Federation (c + e)  
Lifecycle management (c + e)  
Data storage (c + e)  
Data preservation  
Virtualization

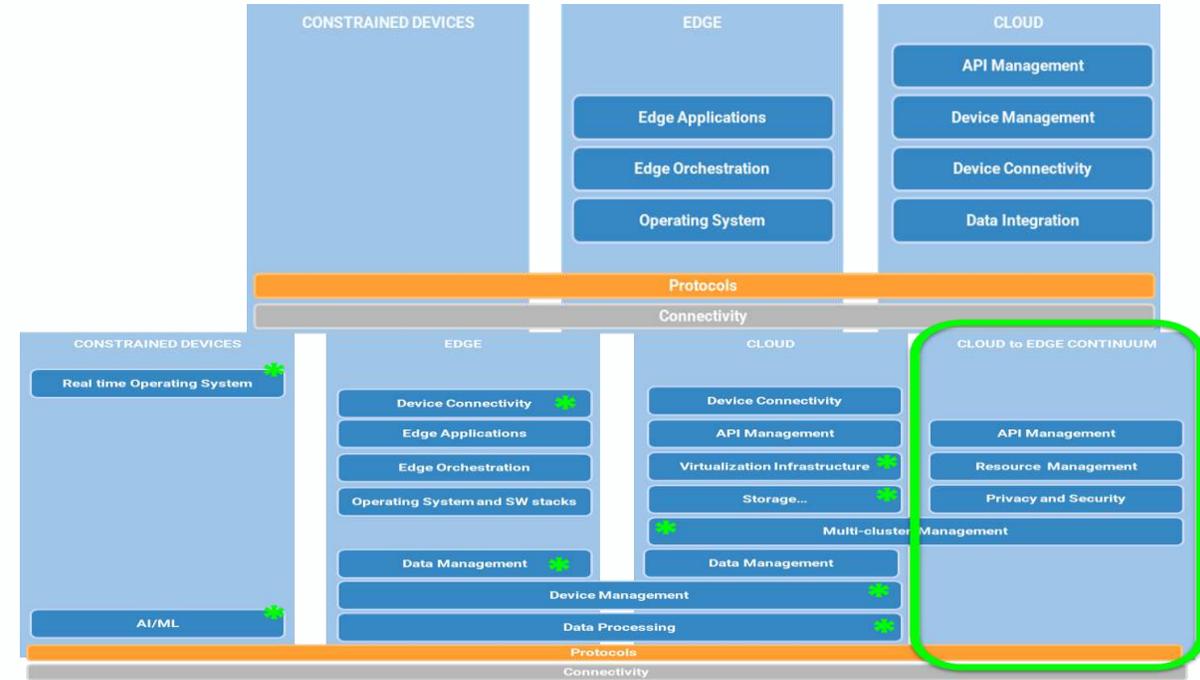
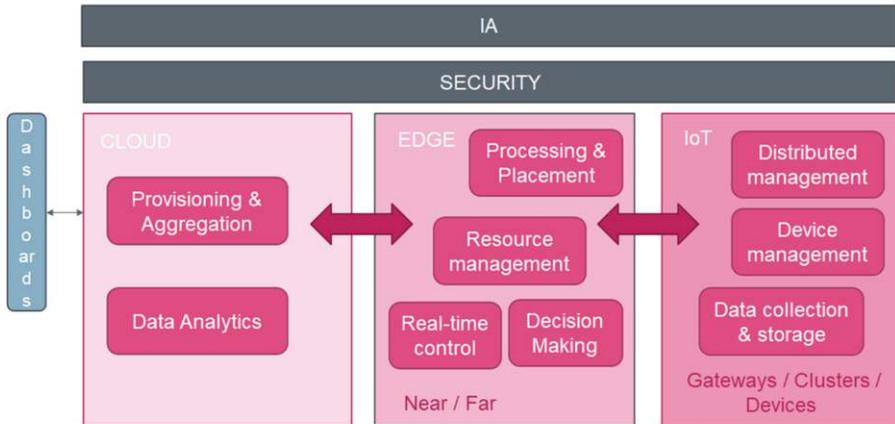
## Edge terms

Far edge  
Data processing  
Data privacy  
Data curation/interoperability  
Semantic annotation  
Data thinning/reduction  
Data patterns definition / discovery  
Data consistency and availability  
Federated Learning  
Data center edge  
Telco edge  
MEC  
Fog computing  
CPU architectures variability (ARM, AMD, Intel...)  
Computational offloading  
Green computing (smart allocation(only for c+e) and smart switching)  
Discovery and mobility of edge devices  
5G and 6G  
IoT devices discovery  
Decentralization  
Decision Support Systems (in management of control of equipment)  
Time Sensitive Networking (TSN)  
Frugal AI  
Automated monitoring system health  
Service brokerage

## IoT terms

Sensor  
Actuator  
Gateway  
Real time / Right time  
Calibration  
Device registry  
Device management  
Communication protocols (BLE, Lora, WiFi...)  
MQTT (pub/sub)  
IoT platform  
Micro processing  
Virtual object  
Digital twin  
IoT cluster  
Service (transversal to other blocks)  
Swarm computing

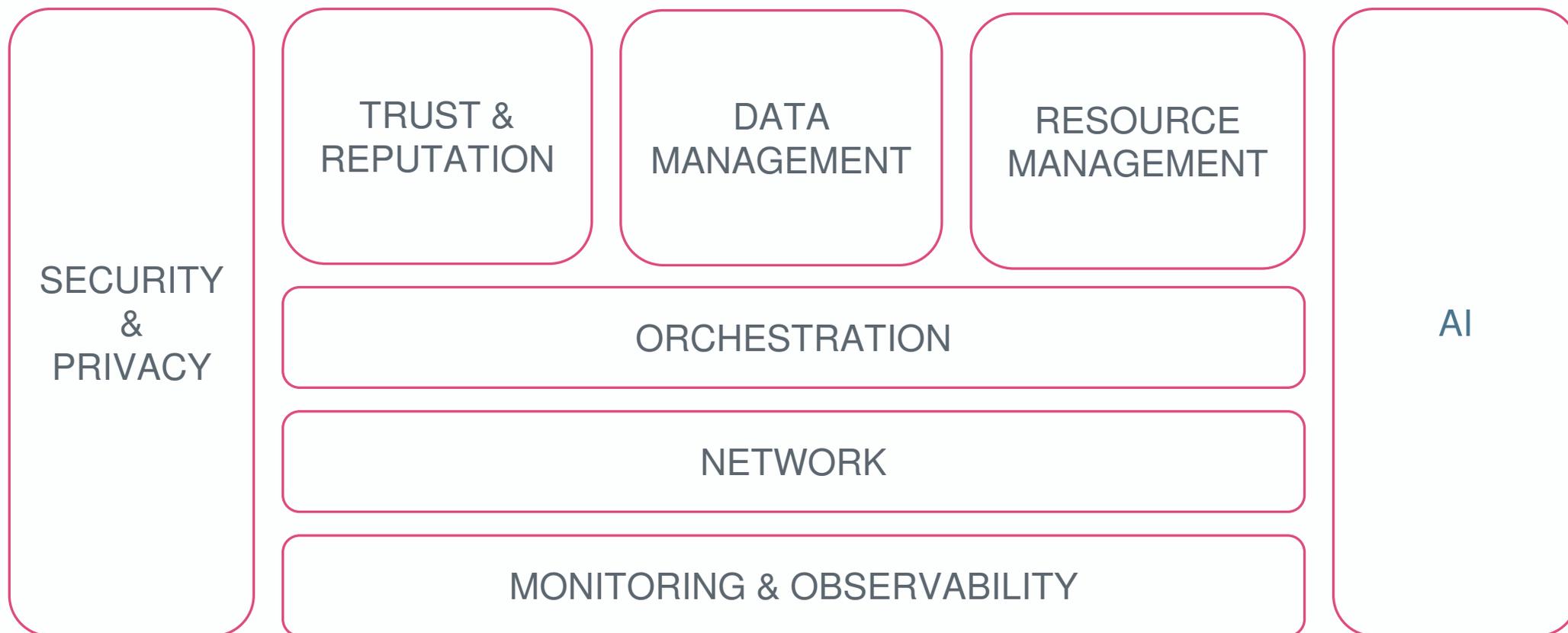
# But... only a common language?



| INTEGRATION   | BROKERING   | APPLICATION   |
|---|---|---|
| Virtual object specification<br>Virtual object interoperability software<br>Meta network cluster controller<br>Autonomous and secure reconfiguration support<br>Federated communications<br>Hierarchical structure - aggregation into super nodes | Semantic models for fog brokerage<br>MCDM cloud & fog service brokerage<br>Methods and tools for resource brokerage | DevZeroOps Platform as a Service<br>Distributed EMS with automatic anomaly detection<br>Federated frugal AI                                     |
| ORCHESTRATION   |   |   |
| Synergetic orchestration mechanisms in the compute continuum  |   | Meta-Orchestrator<br>Edge nodes federation  |
| TRUST AND PERFORMANCE   |   |   |
| Federated Identity Management<br>Traceability and accountability<br>Zero-trust approach<br>Distributed Ledger Technologies in Smart Contracts   |   | Trusted Platforms Models<br>Federated authorization<br>Detection of security issues and mitigation mechanisms<br>Secure overlay, access control |

| SECURITY  | INTEGRATION  | BROKERING  | APPLICATION  | DATA   |
|---|--|--|--|--|
| Security, Privacy, Mobility, Anomaly detection, Behavioral Analysis, Breach Response, Layered security, CASB, Impersonation, Token management.  | Virtual object<br>DApps<br>Federation<br>Lifecycle management, Virtualization, Patterns, Real time / Right time, Cluster, Communication Protocol, MQTT | Resource brokerage<br>Cloud & fog service brokerage  | Frugal AI, Tiny AI, Registry, Discovery, Calibration, Mobility | Storage, Preservation  |
|   | ORCHESTRATION  | ORCHESTRATION  |  | NETWORK  |
|   |  | Orchestration of resources, Cluster management, Balancing, Scalability, Migration, Computational offloading, Smart allocation, Smart switching |  | Network slicing, Software-defined networking, Tunneling, Virtual Private Network, 5G and 6G, Time Sensitive Networking |
| TRUST AND PERFORMANCE   |  |  |  |  |
| Federated Identity Management, Traceability and accountability, Zero-trust, Smart Contracts, Monitoring and observability, SLA management, Automated monitoring system health, Compliance |  |  |  |  |

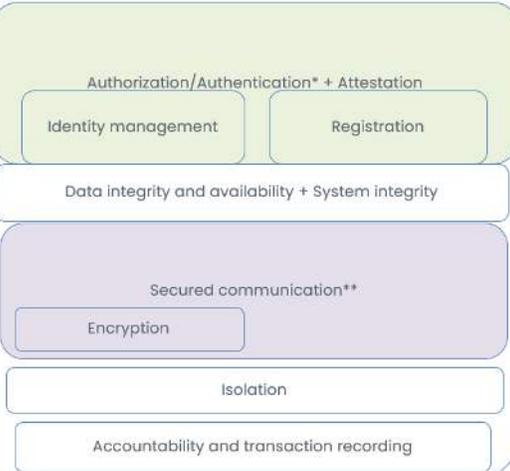
# First results – 8 building blocks



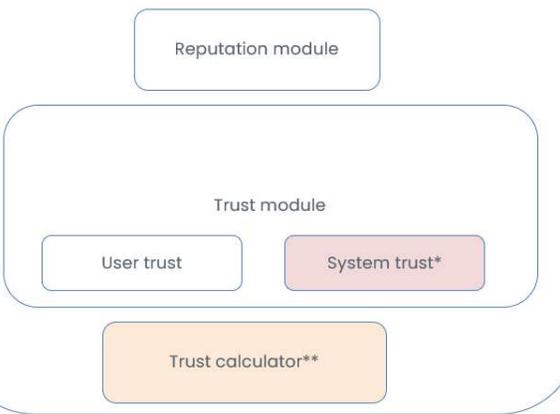
# Functional overview



## WG1: SECURITY & PRIVACY



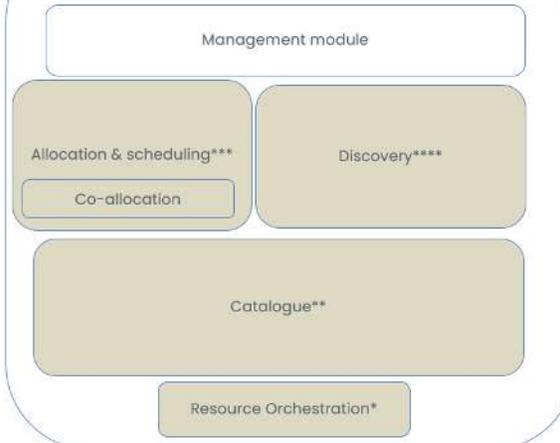
## WG2: TRUST & REPUTATION



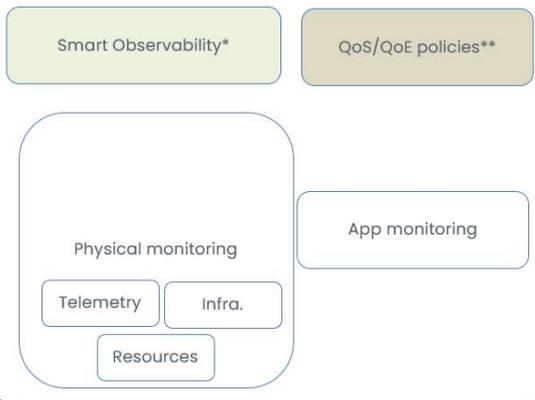
## WG3: DATA MANAGEMENT



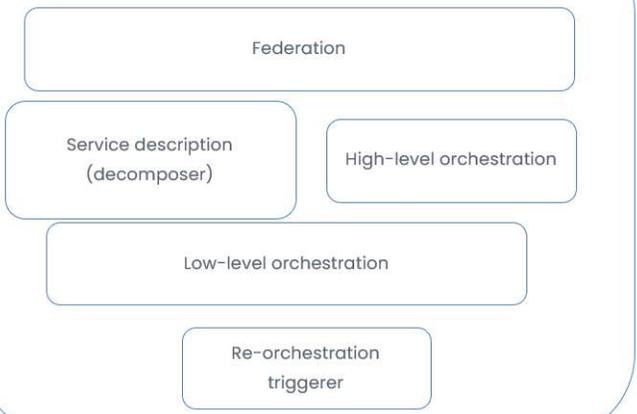
## WG4: RESOURCE MANAGEMENT



## WG7: MONITORING & OBSERVABILITY



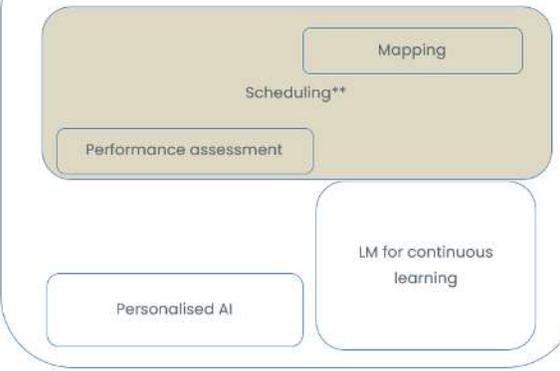
## WG5: ORCHESTRATION



## WG6: NETWORK

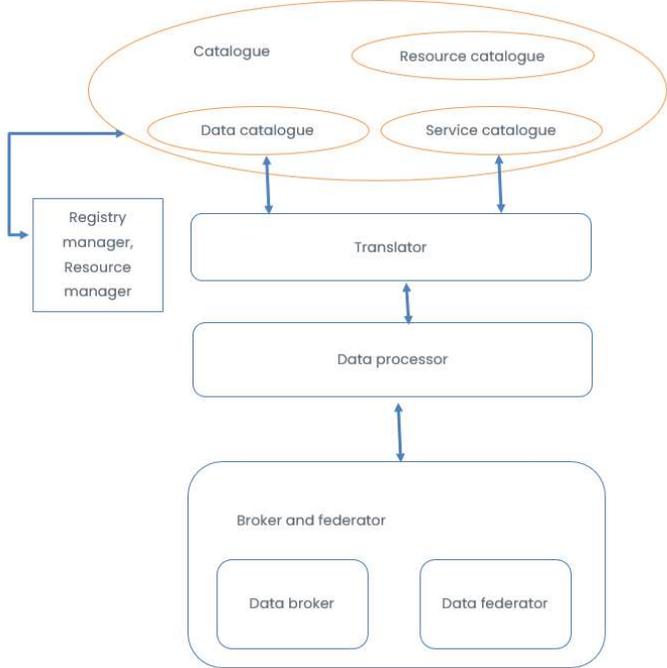
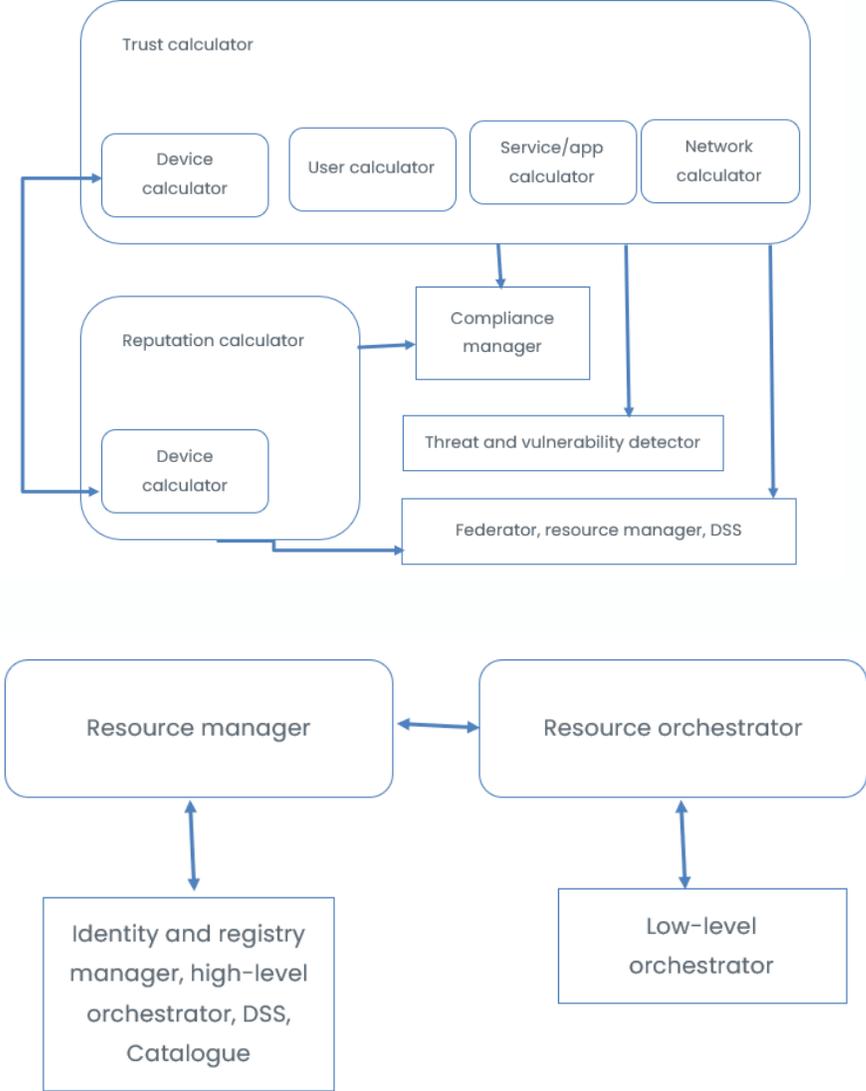
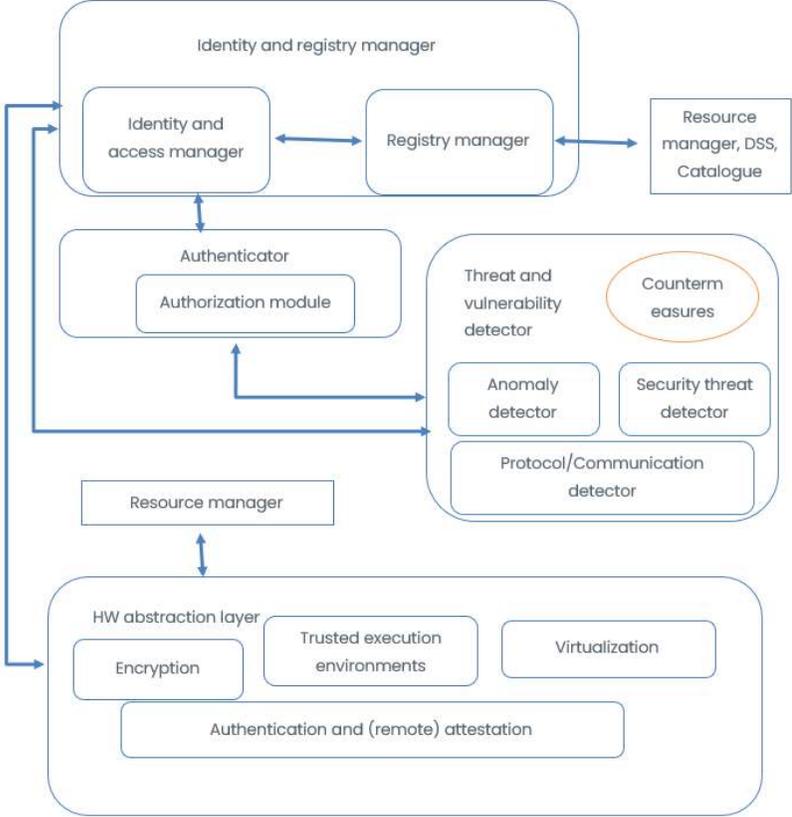


## WG8: ARTIFICIAL INTELLIGENCE

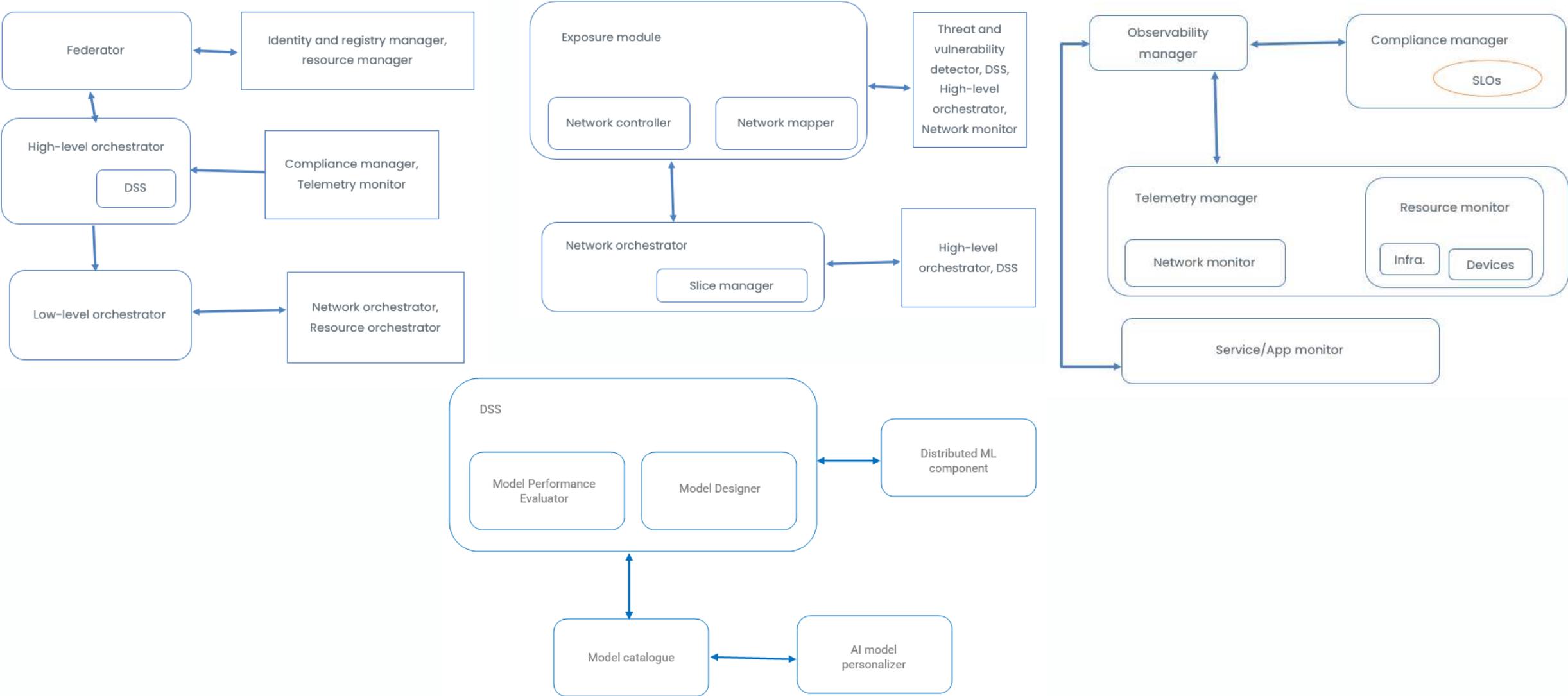


AI integrator\*

# Compositional overview (1/2)



# Compositional overview (2/2)





EU**CloudEdgeIoT**.eu

**Atos**

 **BluSpecs**

 **COMMpla**  
Communication Platforms  
and Online Solutions

 **ECLIPSE**<sup>®</sup>  
FOUNDATION

  
**EGI**

 **IDC**

 **Inside**  
Industry Association

  
**MARTEL**  
innovate

**Trialog** 

 **Trust-IT Services**  
*communicating to markets*

**VDI|VDE|IT**



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# Thanks for your attention!



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