ETSI IoT Week 2022

Edge-native paradigm: ASSIST-IoT approach for the next NG-IoT decentralized architecture

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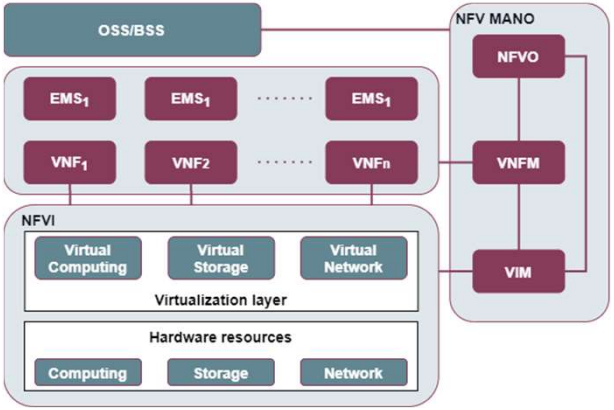
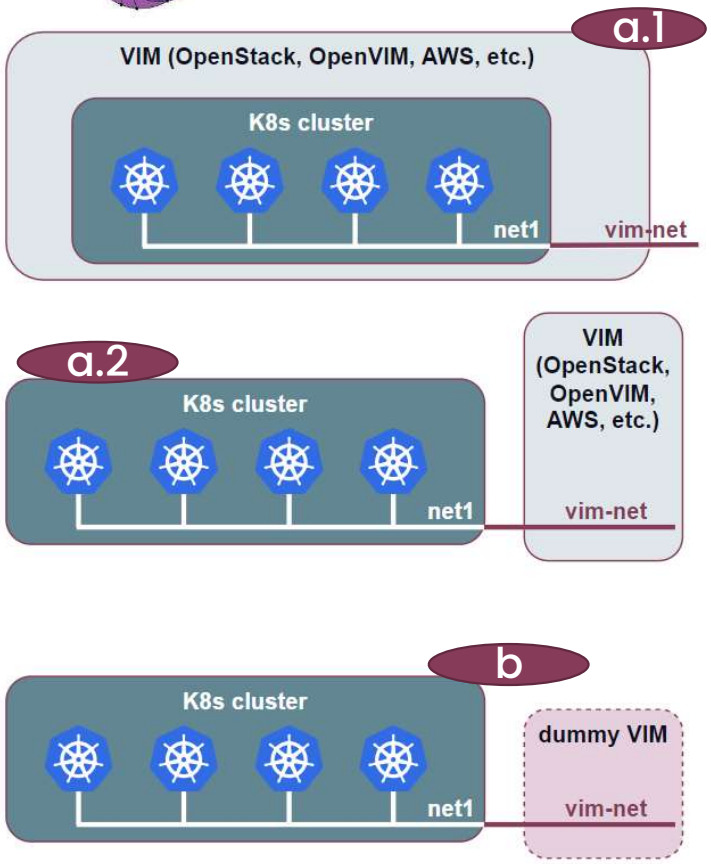
Global view of MANO and OSM

ETSI MANO architecture



- Centrally, MANO orchestrates the virtualised resources relying on three elements:
  - VIM for the infrastructure.
  - VNFM to define and configure the functions.
  - NFVO for orchestrating all the previous: specifically the NS (network services) composed of one or more VNFs

OSM deployments with Kubernetes support



- Implements MANO relying on NFV ISG information models.
- Three deployment types (a.1, a.2, b)
- NS (network services) are deployed with its VNFs
- Packaging is accepted (Charms & Charts)
- Service mesh not included
- Oriented to one centralised single location.

Changing the paradigm

Benefits of the Cloud-Native approach for CNFs

Reducing development and operational costs

Granular, small, interchangeable microservices

Improving the agility of a system

Faster deploying a container than a VM

Novel business paradigm

Renting vs. purchasing

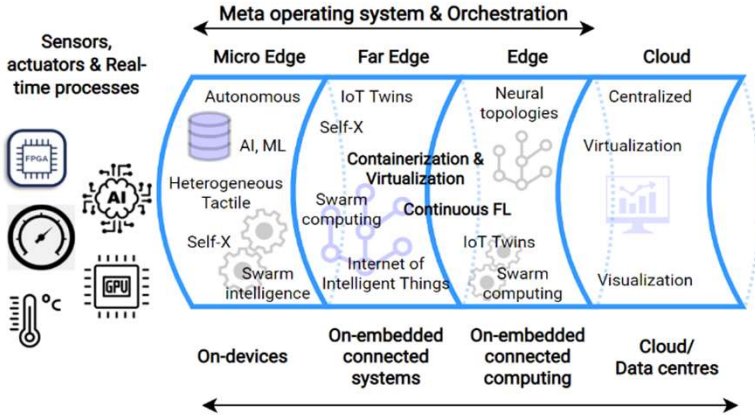
Edge Computing types

Types of Edge Computing:

MEC — Associated to Radio Access Network (RAN), performed in base stations BS

Cloudlets — Cloud replicas, cloud in a box over resource-rich equipment

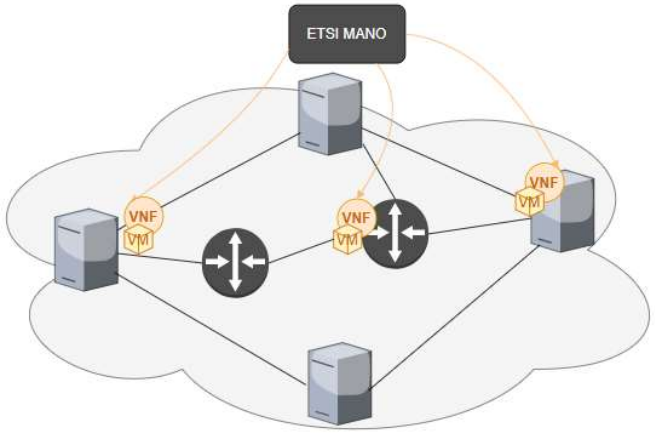
Fog — For low-resource equipment, related to IoT, conceived as many nodes.



Analysis of the desired evolution

Usual scope of OSM

Orchestrator

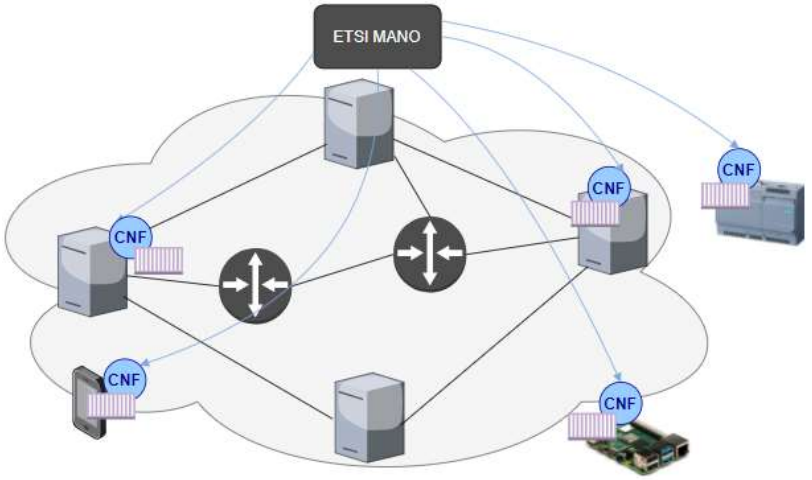


- Virtualised network functions (NFV)
- VNFs executed over VMs
- Focused on Cloud infrastructure

Challenges / misalignments towards the new paradigm

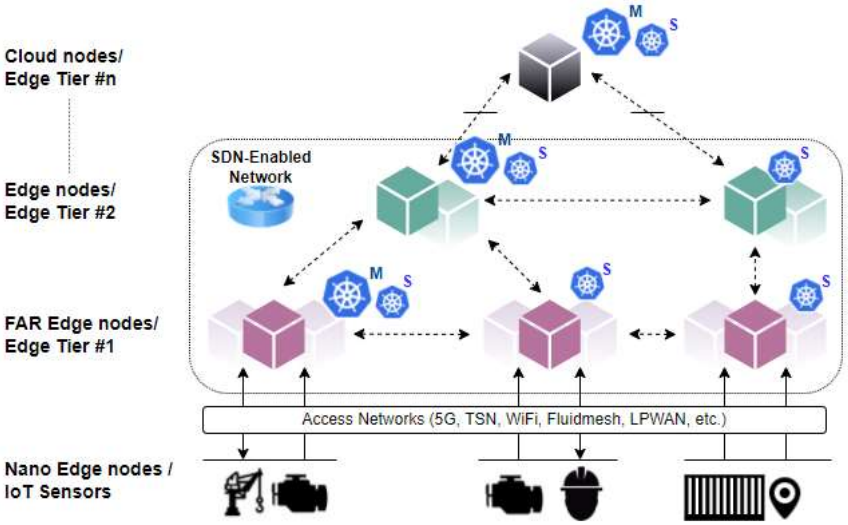
- OSM (and MANO orchestrators in general) are designed (and mostly used) for telco environments, with large computing capacity and not thought for NGIoT.
- Connection between services deployed by OSM require deep understanding and provisioning of (Neutron) OpenStack networks

Edge-Native Approach

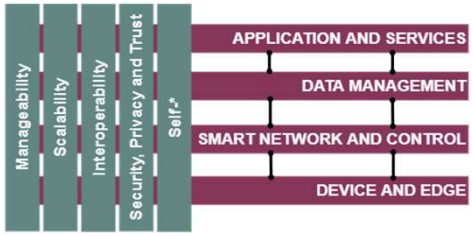


- Network and non-network functions
- Microservices executed as CNFs materialised as containers
- Opens up orchestration to low-resources equipment -> edge computing.

The basis of ASSIST-IoT



- **Multi-plane** reference architecture approach:
  - **Horizontal planes** → Provide different capabilities
  - **Vertical planes** → Support required cross-plane technologies



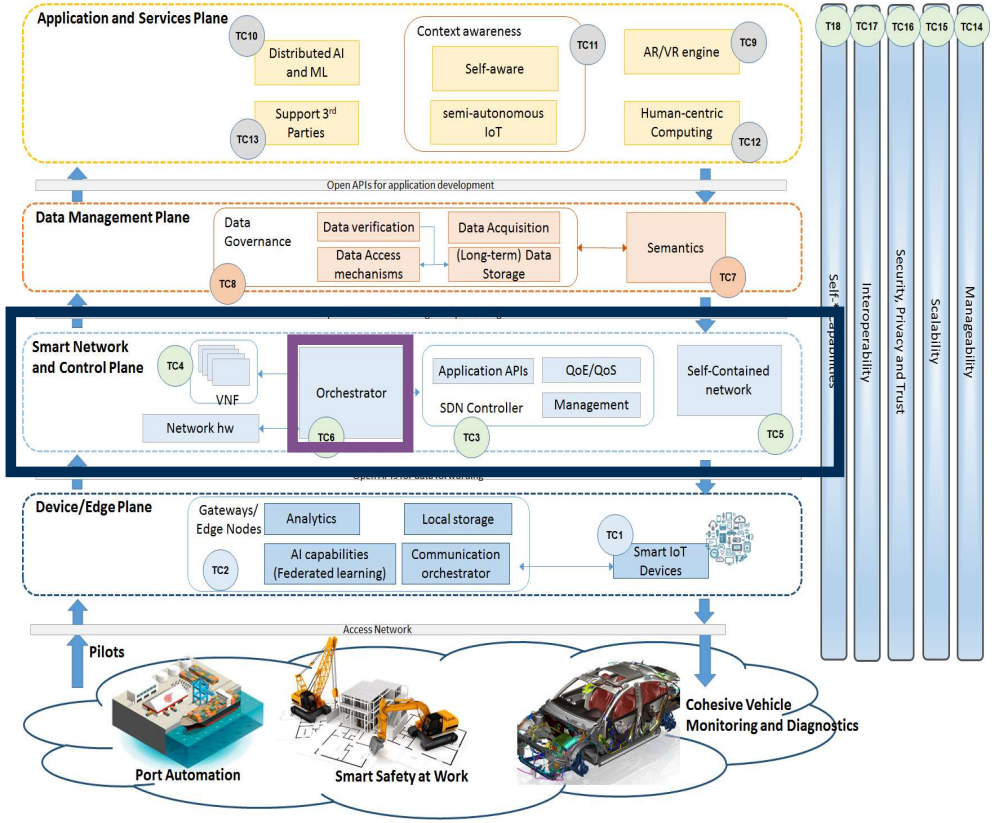
Flow of encapsulated enablers: *services of NGIoT*

- *Composable* into different, concrete, *modular* deployments
- Flexible and *decentralized*
- Very technologically *flexible* (k8s,k3s, microk8s)
  - Ready for edge & constrained devices
  - Built on open standards

Essential and complementary *enablers*

- Separated from physical layers
- Resilient
- Easily *adaptable* to changes
- Packaged in Helm Charts

Smart network and control plane



The envisioned **objectives** include:

- To implement an Orchestrator and a complete virtual networking architecture, both adapted to the requirements of Next-Generation IoT systems,
- To improve the decisions of SDN Controllers, leveraging AI engines and methods,
- To develop containerised easy-to-deploy intelligent VNFs focused on IoT deployments and human-centric support,
- To facilitate the realisation of Self-contained networks, based on SD-WAN and VPN technologies.

The goal is to orchestrate microservices as CNFs (network and non-network) across the continuum -> decentralized deployment.

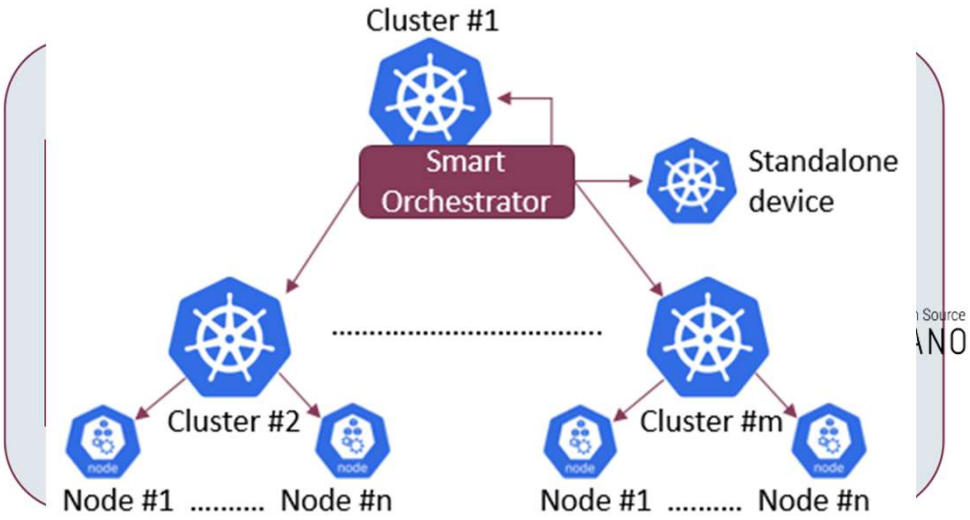
Building upon OSM

- The smart orchestrator is a key element of ASSIST-IoT, based on OSM, in charge of deploying enablers within a managed decentralised system.

We have developed custom software over OSM to:

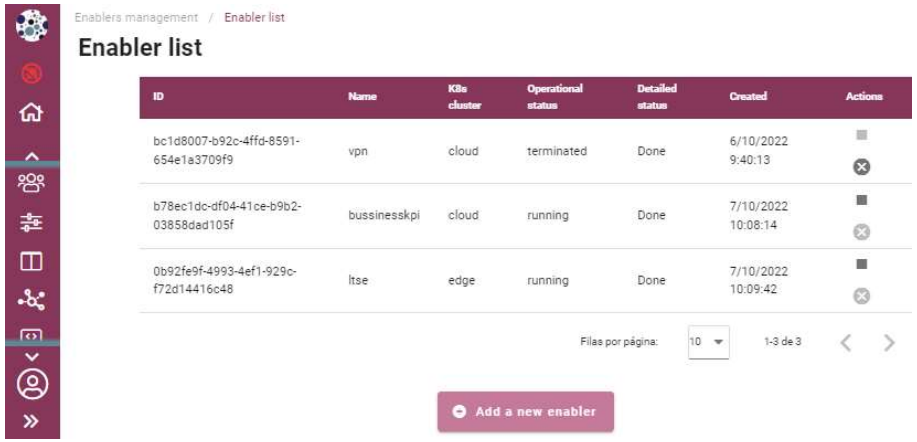
1) Add a custom layer of abstraction that allows the deployment of NGIoT services (MR, AI, persistence, DLT…) for non-expert users.

2) Prepare (automatically) the CNIs of the underlying k8s (or K3s, microk8s) clusters to communicate among them by their name (avoiding the need of IPs) independently of their location (where they are installed).



- Its goal is to realise the mentioned edge-native paradigm, deploying services over the edge-cloud continuum

ASSIST-IoT orchestration advantages



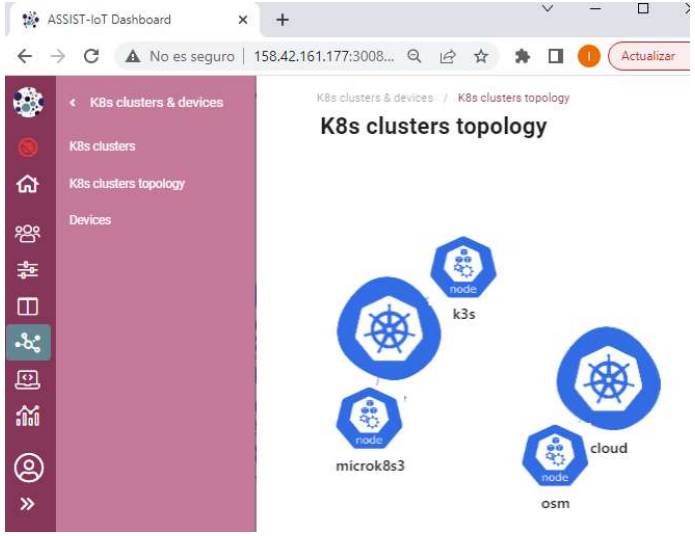
It focuses on **user friendliness** for non-experts

Smart deploying workloads (fully automatic, smart – AI-based, based on policies, or manual) – selection of best cluster and node.

Reduction of attack surface by applying **automatic networking rules**

Connect services by name abstracting IPs and port using K8s cloud-native resources

- Deployment of decentralized clusters (k8s-like) and connect their services without the need to provision heavy VIMs underneath (OpenStack).
- Addition of (edge-oriented) clusters, e.g.. with k3s on computers with 1GB RAM.
- Take advantage of NS concept to realize any containerized service, therefore deploying both network and non-network workloads.

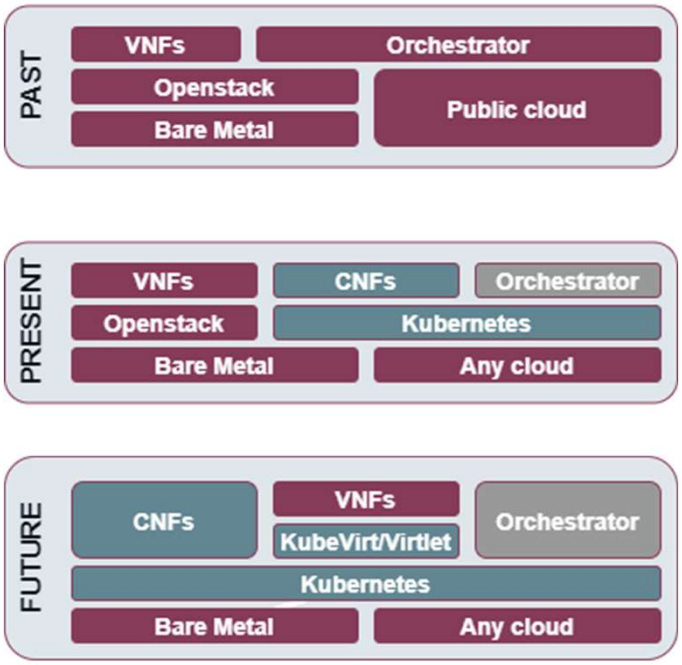


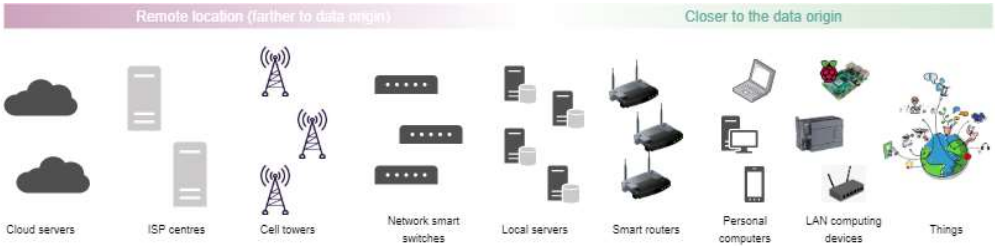
Discussion points and reflections

ETSI MANO not initially conceived for Edge-Native, but focused on cloud/large equipment as 5G core… and VNFs.

Some open-source initiatives (Anuket, Tacker…), mostly OSM, are delivering MANO-compliant orchestrators closer to cloud-native (in cloud & edge), but with certain misalignments towards NGIoT views.

For the future: Both VNFs and CNFs deployed over K8s and along the computation continuum.





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1) Takes advantage of OSM features.
2) Makes the most of cloud-native traits thanks to K8s-like deployments
3) It tests the global system in various relevant NGIoT scenarios (maritime port, construction site, automotive -car and inspection system).

Role of standardisation?

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THANK YOU!

Ignacio Lacalle - UPV

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EUROPEAN IOT-EDGE-CLOUD

Special thanks to:

DataPorts
Data Platform for the Connection of Cognitive Ports

https://assist-iot.eu/

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