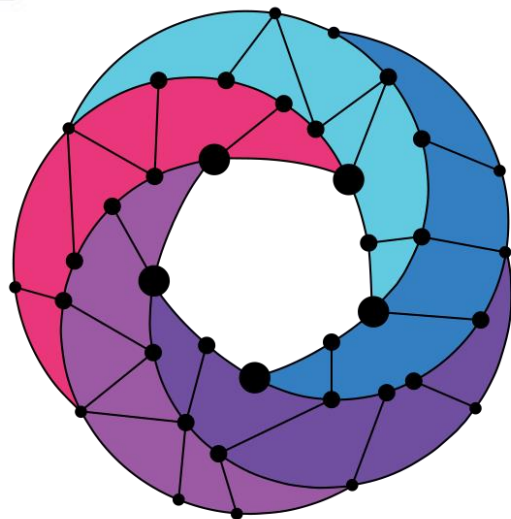




Open Source MANO

PaaS-driven Interoperation between OSM and Kubernetes-based Edge Platforms

Nikos Psaromanolakis, Staff Research Engineer
Vasileios Theodorou, Senior Research Engineer
Intracom Telecom

Overview

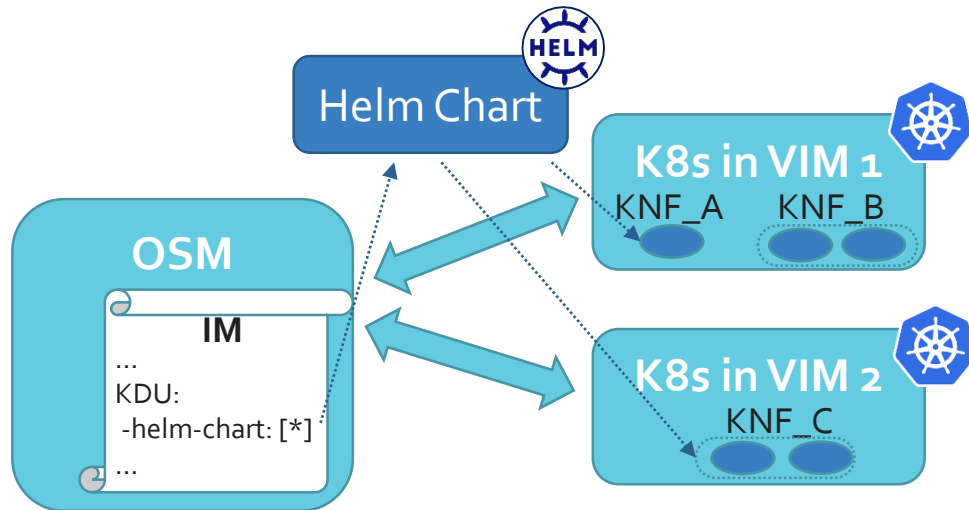
- Motivation
- Edge PaaS Approach
 - Edge Management Platform (EMP)
 - OSM Extensions & EMP
 - Updated OSM Information Model
 - Architecture & Implementation
- Demo

Motivation

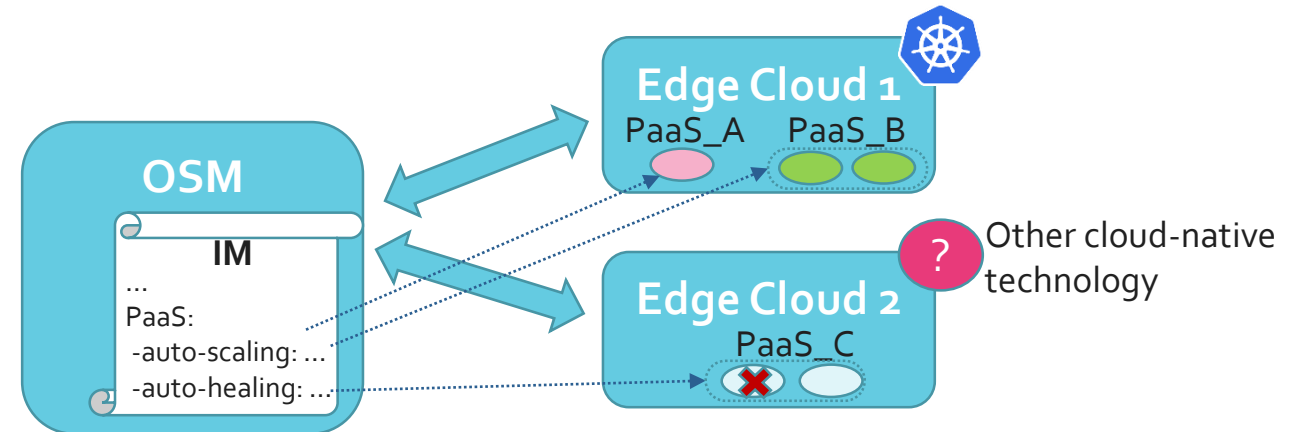
- Enhancement of NFV MANO towards incorporation of a Platform-as-a-Service (PaaS) delivery model for Edge services
 - Foster automation, interoperability & maintainability
 - Minimize management overhead
 - No need to continuously collect detailed state/raw data from all edges
 - Low level management decisions can take place locally → optimized on local infra
 - Minimize deployment speed and stimulate reusability of services
 - Abstraction of service modelling to a usable yet flexible level

OSM KNF vs Edge PaaS Approach

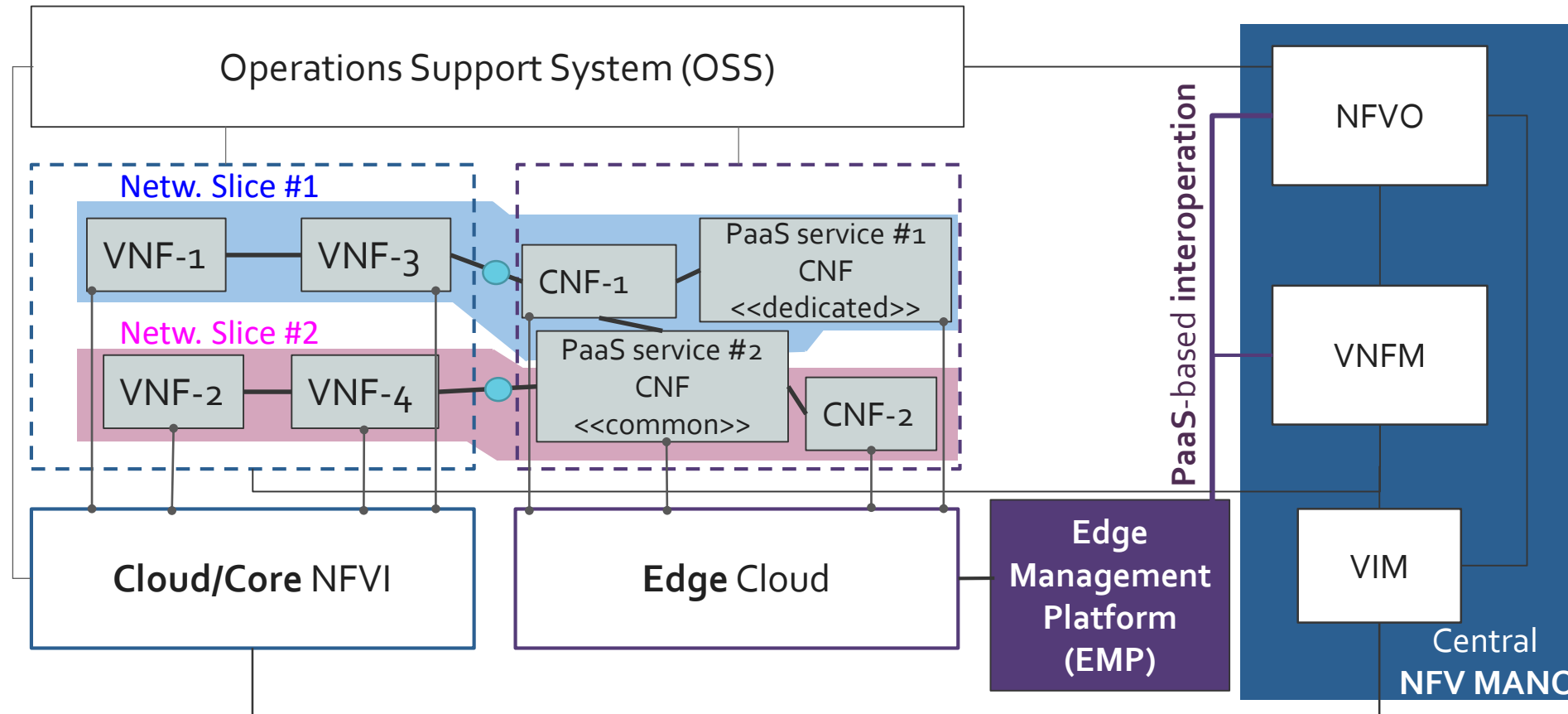
- OSM KNF steps:
 - Build helm chart (outside of OSM)
 - Reference helm charm inside of KNF
 - Package KNF
 - Upload KNF (inside VNFD) which contains helm chart to OSM



- Edge PaaS Approach:
 - Describe the PaaS service natively inside OSM Information Model (VNF Descriptor)
 - Model expressiveness (auto scaling/healing policies, QoS, exposed application ports...)
 - Management translation and overhead is transferred to EMP (Kubernetes + Interfacing layer)
 - Updates on the deployed PaaS services can be made dynamically (without the involvement of OSM)



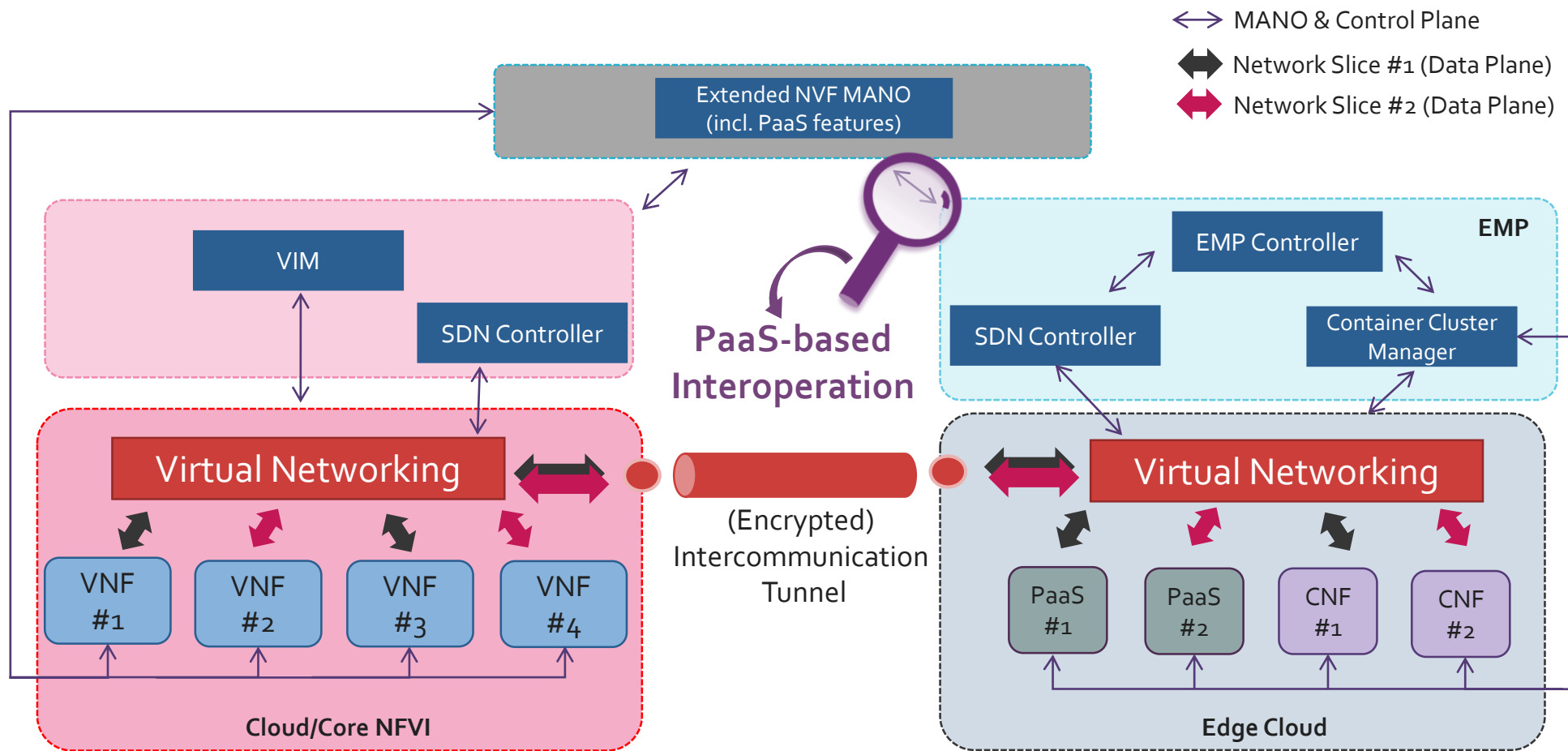
The “Edge Management Platform”



● Inter-domain Link

- **Edge Management Platform (EMP)** is managing Edge Cloud resources & services
- Enhanced VIM entity for edge clouds, which additionally:
 - Manages the lifecycle of **edge resources**
 - Exposes **PaaS capabilities** for the provisioning of Edge services

Cloud/Core to Edge Slicing Interoperation



K8s technologies for Virtual Networking

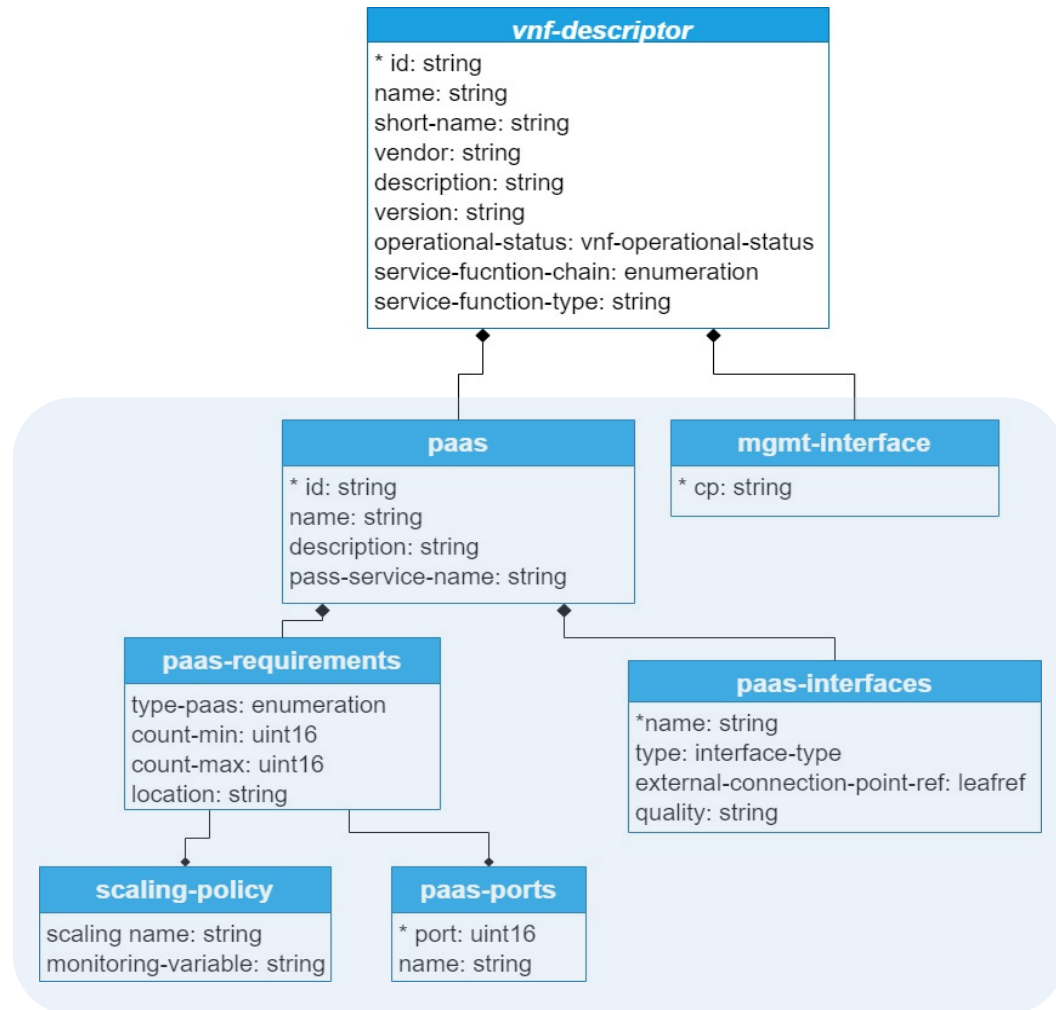
- Open vSwitch CNI plugin
 - <https://github.com/k8snetworkplumbingwg/ovs-cni>
- Antrea
 - <https://antrea.io/>
- Multus CNI
 - <https://github.com/k8snetworkplumbingwg/multus-cni>
- k-vswitch
 - <https://github.com/k-vswitch/k-vswitch>
- ...

OSM Information Model (IM) Extension

- Extended the OSM Information Model (OSM-IM SOL005) for handling PaaS aspects
 - PaaS deployment flavor
 - Auto-scaling/healing parameters
 - Inter-connection configurations
 - Exposed application ports
 - ...



Updated (Extended) OSM Information Model



```

1  vnf:vnfd-catalog:
2    vnfd:
3      - connection-point:
4        - name: eth0
5        description: MEC PaaS descriptor that includes a PaaS with scaling policy
6        id: demo_paas_vnfd
7        mgmt-interface:
8          cp: eth0
9        name: demo_paas_vnfd
10     paas:
11       - description: MEC Demo PaaS descriptor with scaling policy
12         id: Demo_PaaS
13         name: Demo_PaaS
14         paas-interfaces:
15           - external-connection-point-ref: eth0
16             name: ens0
17             quality: HIGH
18             type: EXTERNAL
19         paas-requirements:
20           count-max: '5'
21           count-min: '1'
22           location: Peania_19002_Athens
23           ports:
24             - name: port_1
25               port: '31510'
26             scaling-policy:
27               monitoring-variable: cpu
28               policy-name: minimize_cost
29               type-paas: CONTAINER
30             paas-service-name: demo-paas
31             short-name: demo_paas_vnfd
32             version: '1.0'

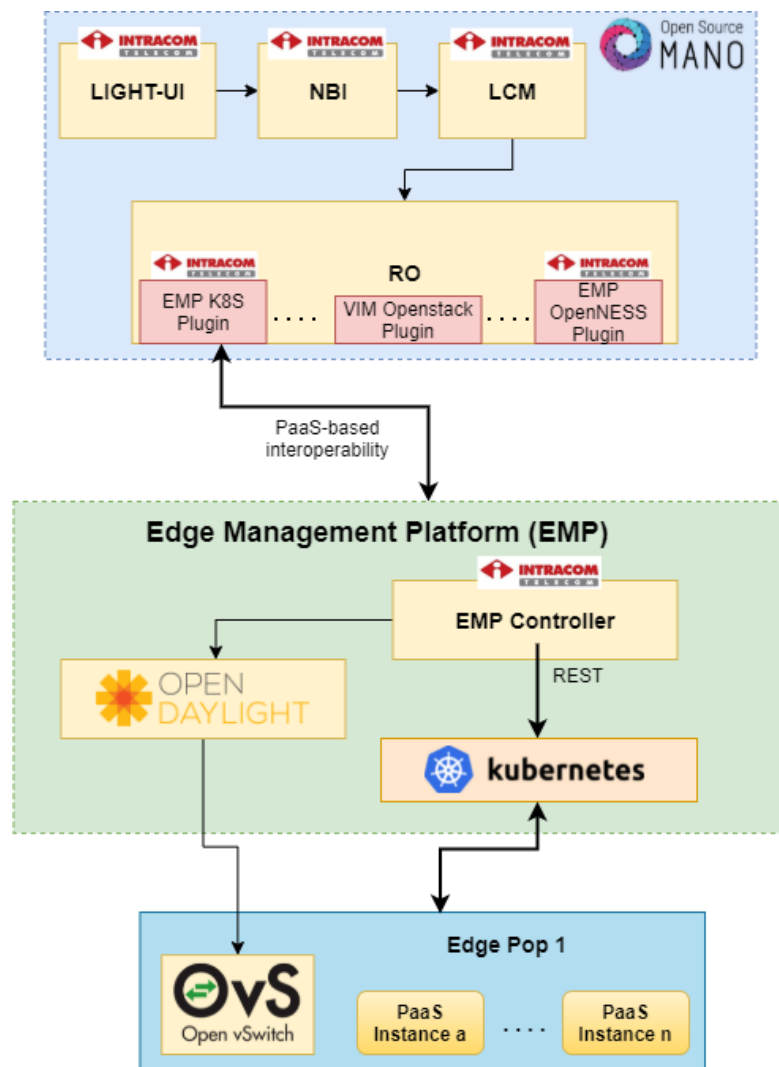
```


OSM extensions & EMP

- Extensions of all (end-to-end) involved OSM modules (v8) for realization of EMP features have been implemented:
 - **LIGHT-UI, NBI, LCM**
 - Databases (**MySQL** and **MongoDB**)
 - Resource Orchestration Module (**RO**)
 - Plugins that implement all methods (Instantiate, Update, Terminate & Delete etc.) to interact with:
 - EMP-K8S controller
 - OpenNESS (MEC software toolkit)
- Implemented an EMP controller that runs on top of Kubernetes:
 - Register, De-register, Deploy, Update and Delete Edge PaaS services
 - When a PaaS is instantiated, the EMP controller creates K8s objects:
 - Deployment, Services and Horizontal Pod Autoscaler (HPA)



OSM – EMP Architecture



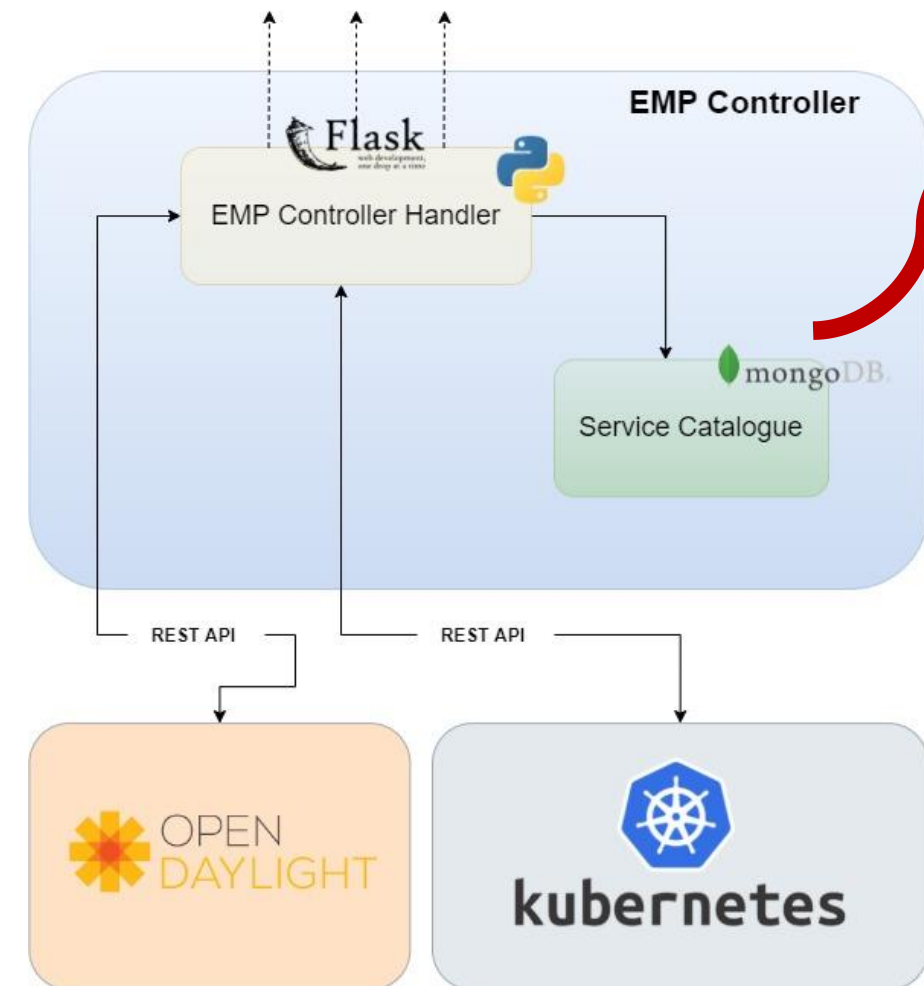
Extended OSM:

- EMP registration / de-registration
- PaaS interaction:
 - Instantiation/termination of PaaS edge services
 - Continuous (PaaS-level) status monitoring

EMP Controller:

- Translates OSM requests to K8S “language”
- Register, De-register, Deploy, Update & Delete PaaS services
- Communicates with an SDN controller to control (inter-)networking

OSM – EMP Architecture



• Edge PaaS Service Catalogue:

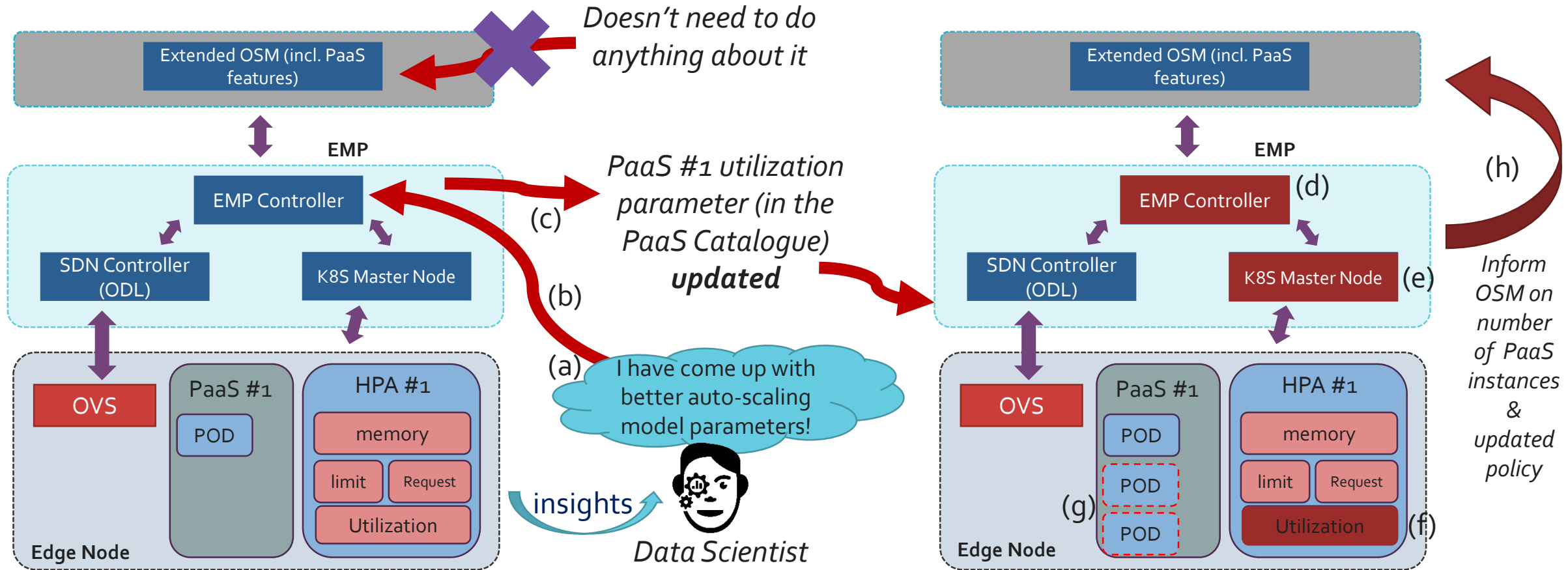
- Register PaaS services locally available (i.e., deploy-able)
- Maintain list of available auto-scaling policies
 - Extendable
 - Parameterizable
 - Configurable

```

{
  "_id": "6183e35ea1e1338f4c1f0697",
  "application_ports": [
    80
  ],
  "image": "k8s.gcr.io/hpa-example",
  "name": "demo-paas",
  "type": "Container",
  "autoscaling_policies": [
    {
      "policy": "minimize_cost",
      "monitoring_metrics": [
        {
          "limit": "1Gi",
          "metric_name": "memory",
          "request": "0.5Gi",
          "util_percent": 50.0,
          "is_default": true
        },
        {
          "limit": "500m",
          "metric_name": "cpu",
          "request": "200m",
          "util_percent": 60.0,
          "is_default": false
        }
      ]
    }
  ]
}

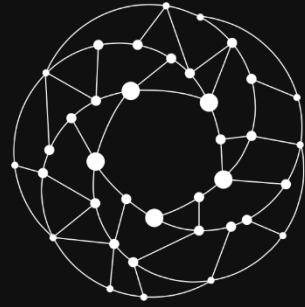
```

Edge PaaS Approach (Workflow example)



Control Plane

Time for the live Demo!



Open Source
MANO

THANK YOU!

<https://osm.etsi.org/>