5G-MEDIA

Programmable edge-to-cloud virtualization fabric for the 5G Media industry

Giacomo Bernini

NEXTWORKS
ENGINEERING FORWARD

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Technical challenges & Vision

- **Motivations:** Fast-growing Media & Entertainment vertical industry
  - 5G for high performance network services, high volumes, Any Device, Anytime, Anywhere, QoS
  - Telcos, manufacturers and media content providers are looking for solutions to design and deploy media functions for replication, distribution and adaptation of media contents
- **Our focus**: Consolidate/build an orchestration and DevOps platform for network media services and applications running on 5G networks

5G MEDIA

SDK and DevOps environment for Media Application

Hide the complexity of service development and deployment on the underlying 5G network and distributed cloud infrastructure

Service Virtualisation Platform

Orchestrate the deployment and scaling of media applications, interacting with the underlying network for dynamic control of resource by applying machine learning and cognitive optimisation

Use Cases: Tele Immersive Media

Goal

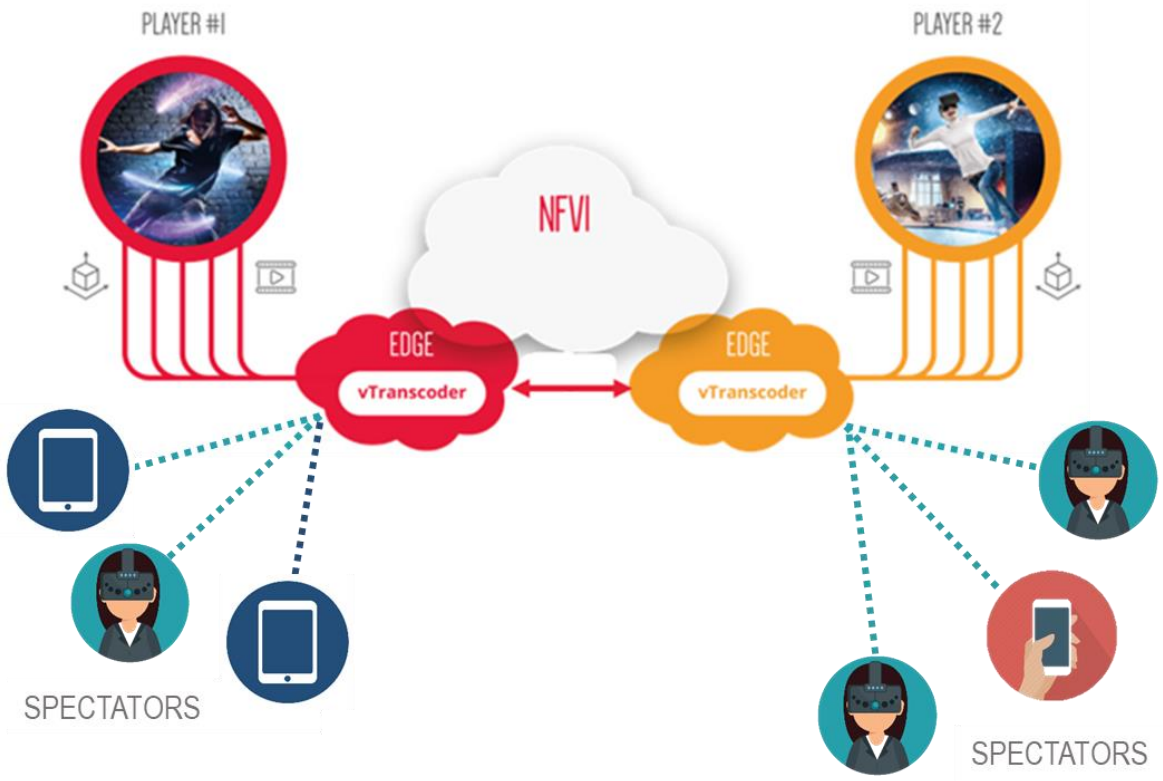
Ensure Quality of Experience for real-time multi-party applications, enabling HQ 3D virtual reconstructions of users

Main Expected Benefits

Improved QoE for players/spectators and support of real time Tele-Immersive applications

Packaged VNFs

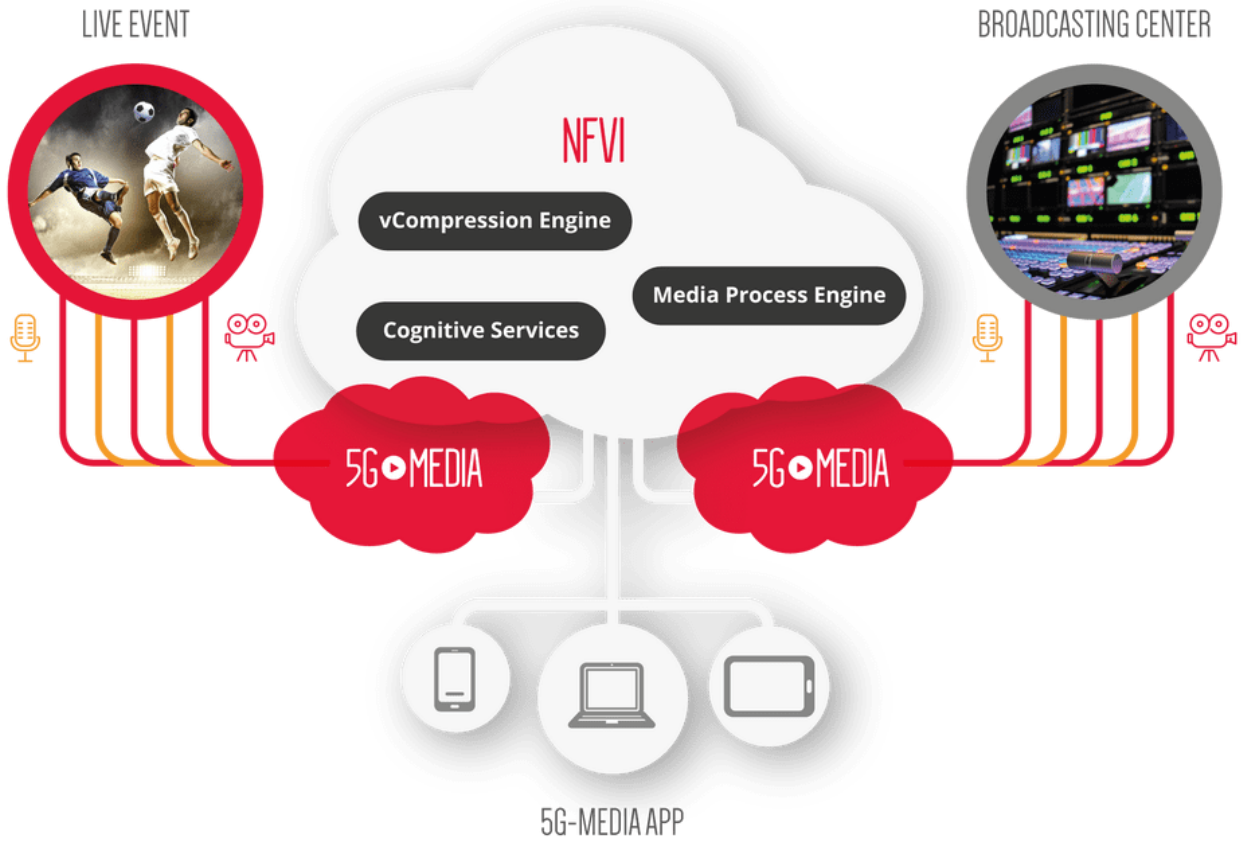
vTranscoder3D for 3D media (geometry & multi-view textures) on-the-fly transcoding



Use Cases: Smart and Remote Production

Goal

Provide broadcasters with ad-hoc, scalable, flexible and time-saving production mechanisms leveraging professional and user-generated remote media content



Main Expected Benefits

Reduction in costs, time and complexity for remote production, exploiting user-generated media content

Packaged VNFs

- **vCompression Engine** for audio/visual content based on FFmpeg
- **Media-Process Engine** for video signal switching based on Voctocore, FFmpeg and GStreamer
- **Speech-to-Text Engine** Conversion of audio signals into text based on the Google Speech API

Use Cases: UHD media distribution over vCDN

Goal

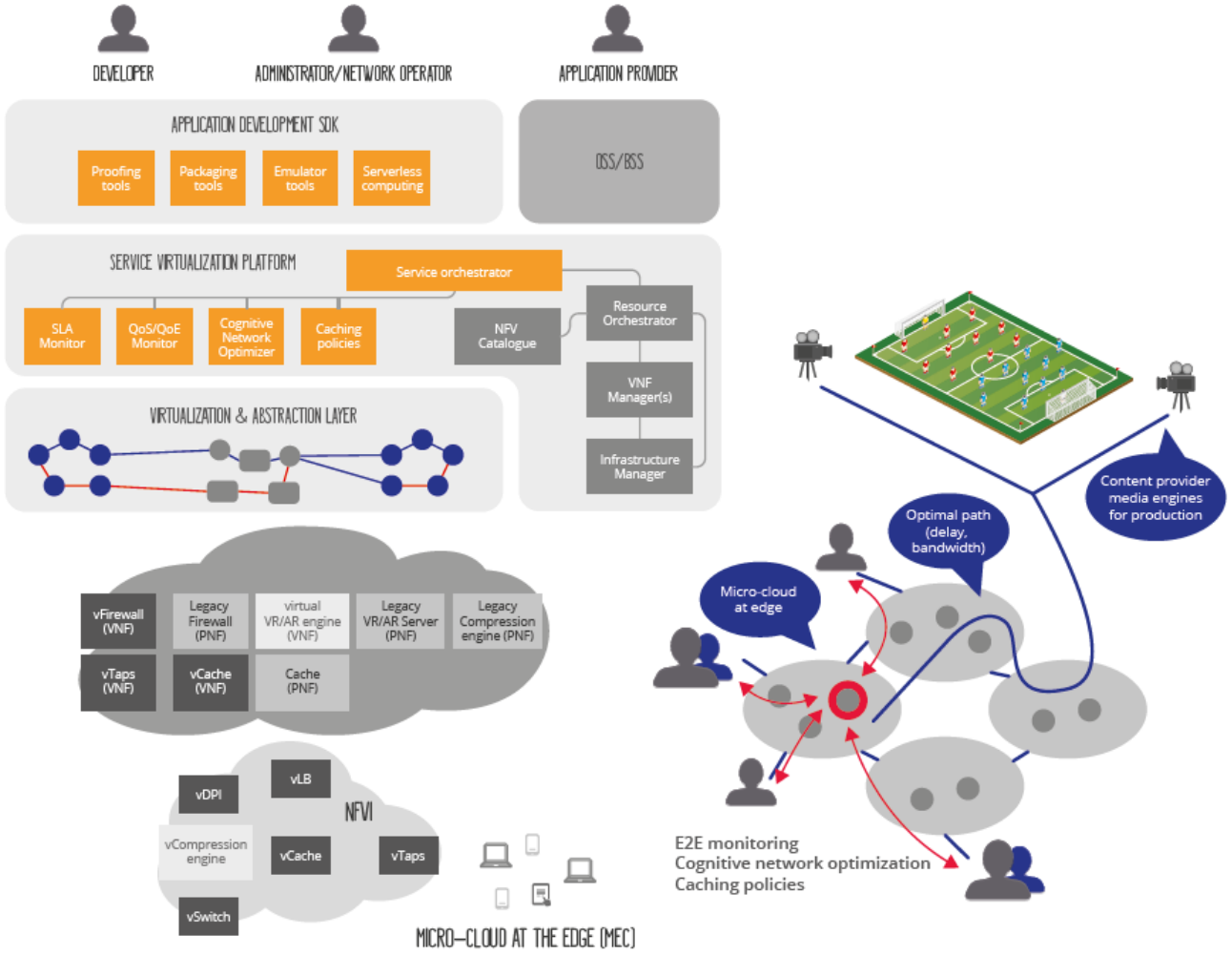
Deliver new capabilities to media service providers by distributing UHD content (4K and 8K) with an optimal consumption of resources

Main Expected Benefits

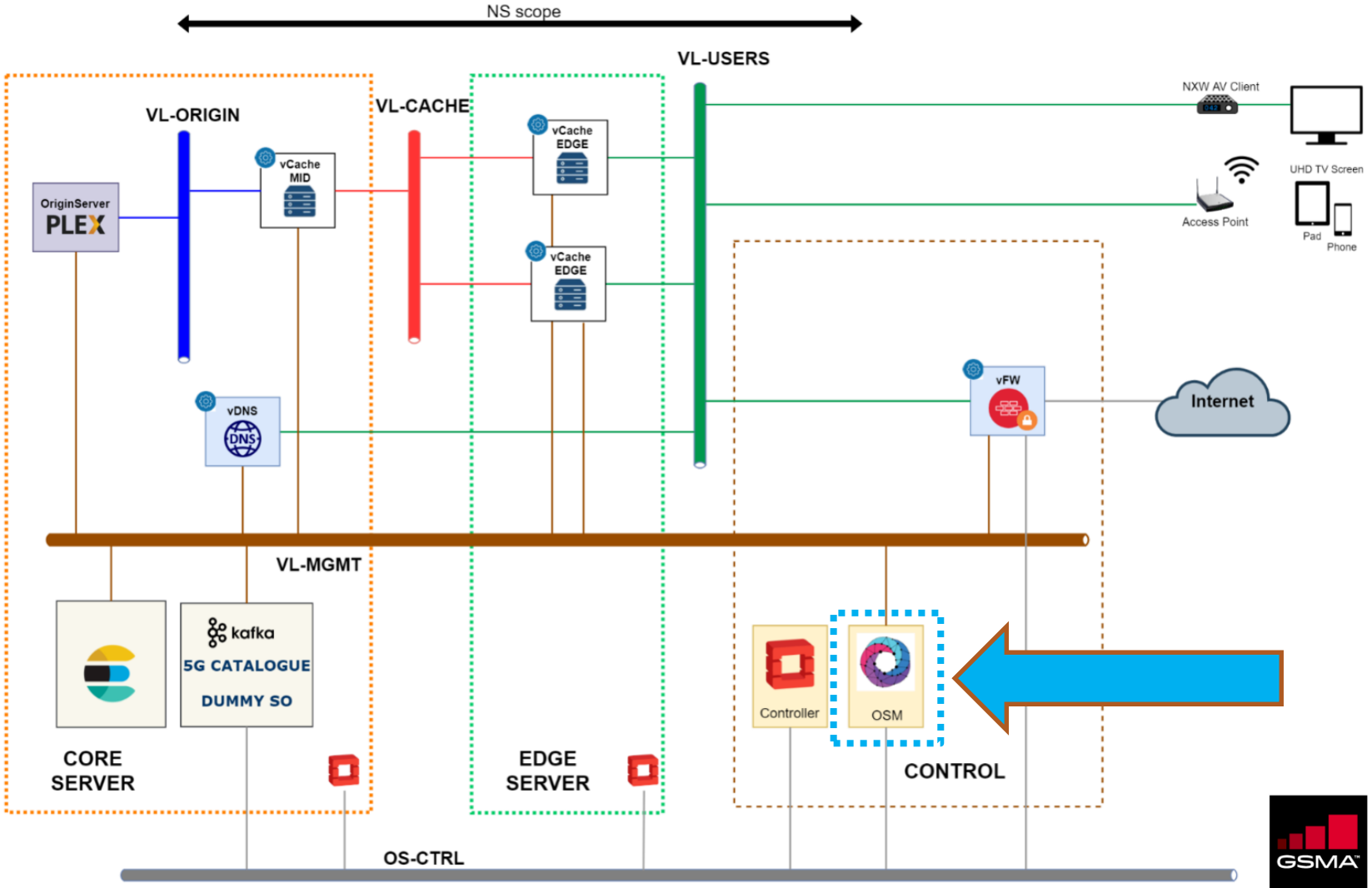
Better experience for end users and new market opportunities in content delivery

Packaged VNFs

- **vCaches** based on Apache Traffic Sever
- **vFW** Security Front/Back End VNF to protect users and service providers based on VyOS suite
- **vDNS** for CDN name resolution and HTTP URL redirect based on BIND and HAProxy



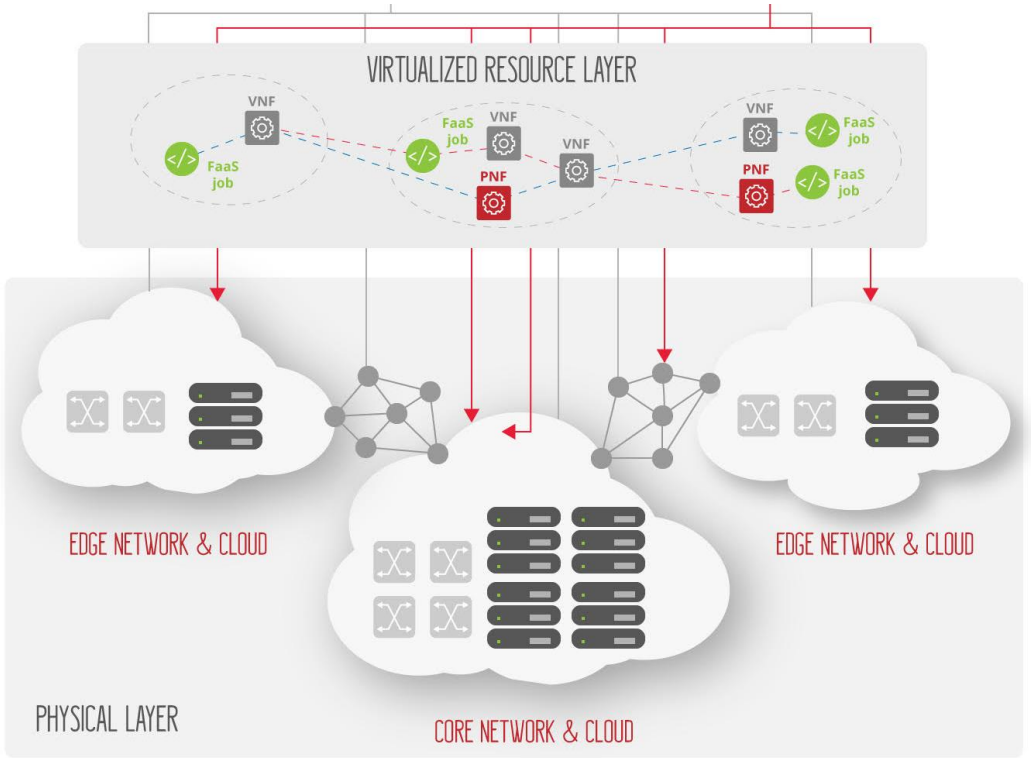
A practical media service NS example: the UHD vCDN case



Where OSM fits into the 5G-MEDIA big picture:

5G-MEDIA High Level Architecture

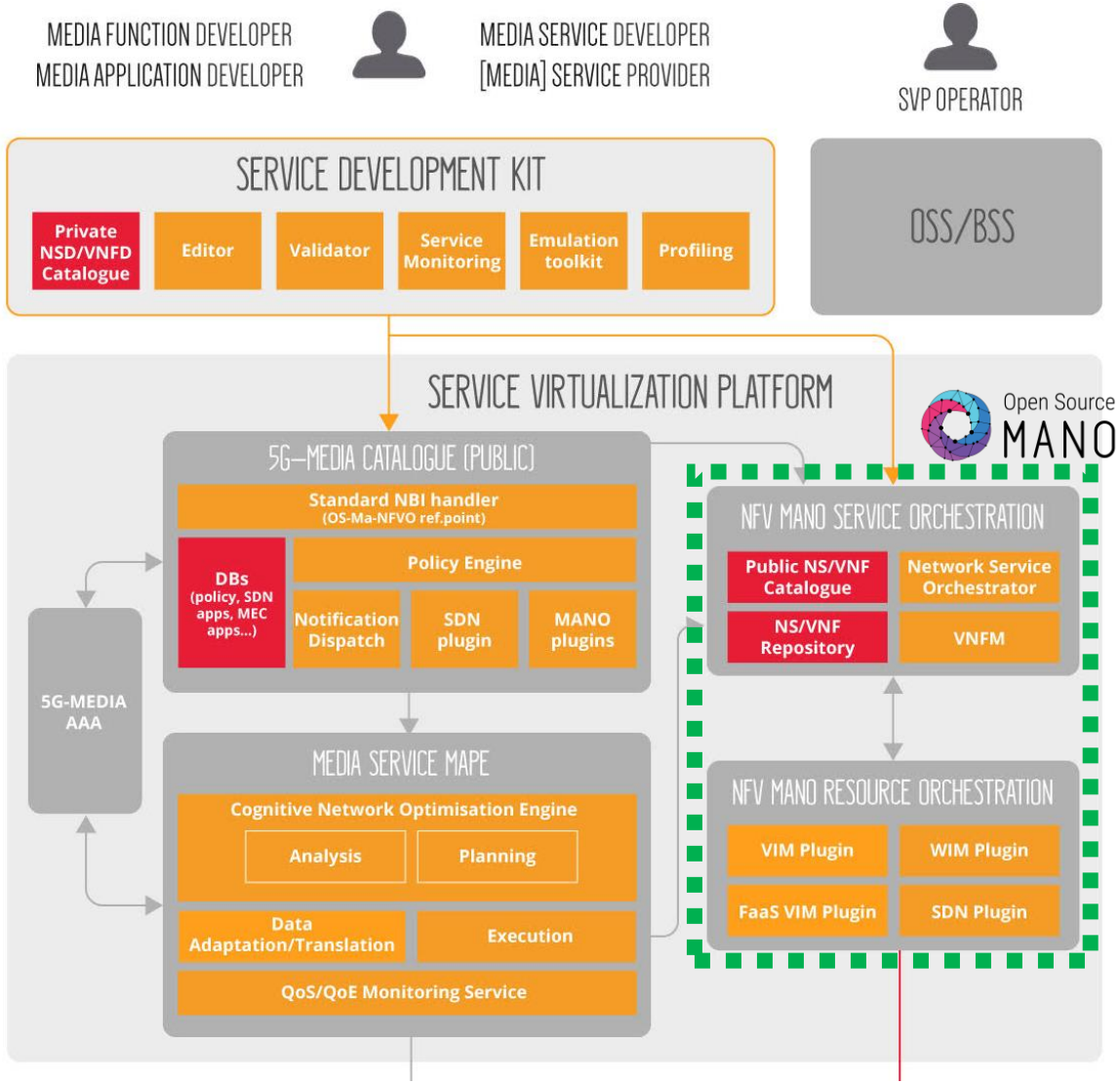
- **Network Function Virtualization Infrastructures** (NFVIs)
  - To run the virtualization and abstraction layer on resources
  - VIM/NFVIs integration (OpenStack, OpenNebula, FaaS/OpenWhisk)
- **Core Network & Cloud**
  - For the deployment of legacy components and services esp. those instantiated on physical/specialized hardware
- **Micro/edge cloud**
  - To instantiate network and media functions closer to the consumer/user



Where OSM fits into the 5G-MEDIA big picture

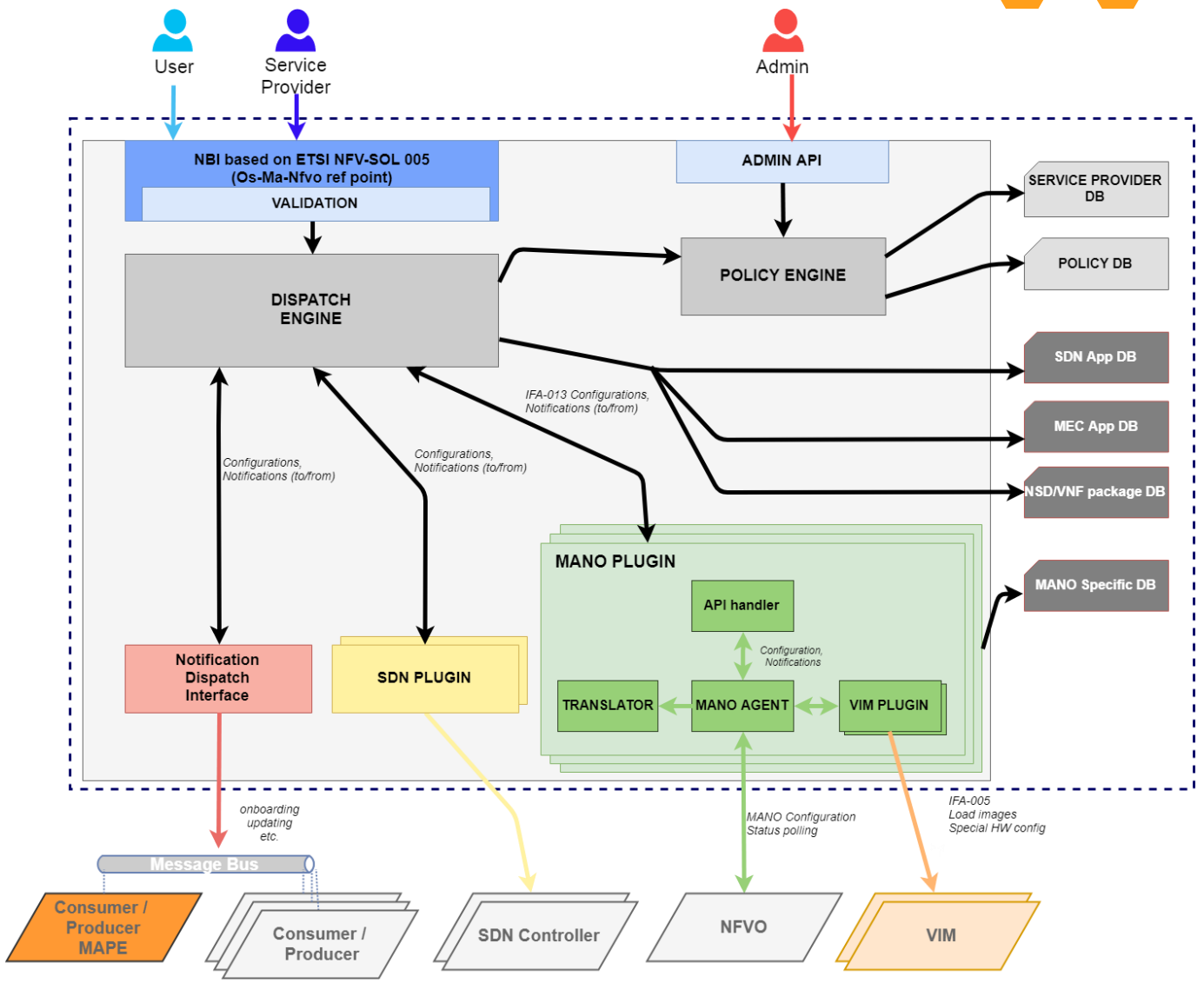
contd.

- **Service Virtualization Platform**
  - **MANO (Service + Resource Orchestrator) based on ETSI OSM**
  - **Media Service MAPE**
    - QoS/QoE monitoring used by Service/NFV orchestrator and VNFM
    - Cognitive Network Optimizer to dynamically change VNFFGs
  - **VNF/NetApp Repository & Catalogue** with V[N]F to be used across many M&E and network applications
- **Application Development SDK**
  - Tools for media applications DevOps (**proof**, **package**, **emulate**)
  - **Serverless computing** to focus on functions to code/execute instead of resource lifecycle mgmt (FaaS)
  - Packaging of **unikernels** for lightweight atomic function VNFs



Focus #1: 5G App & Service catalogue

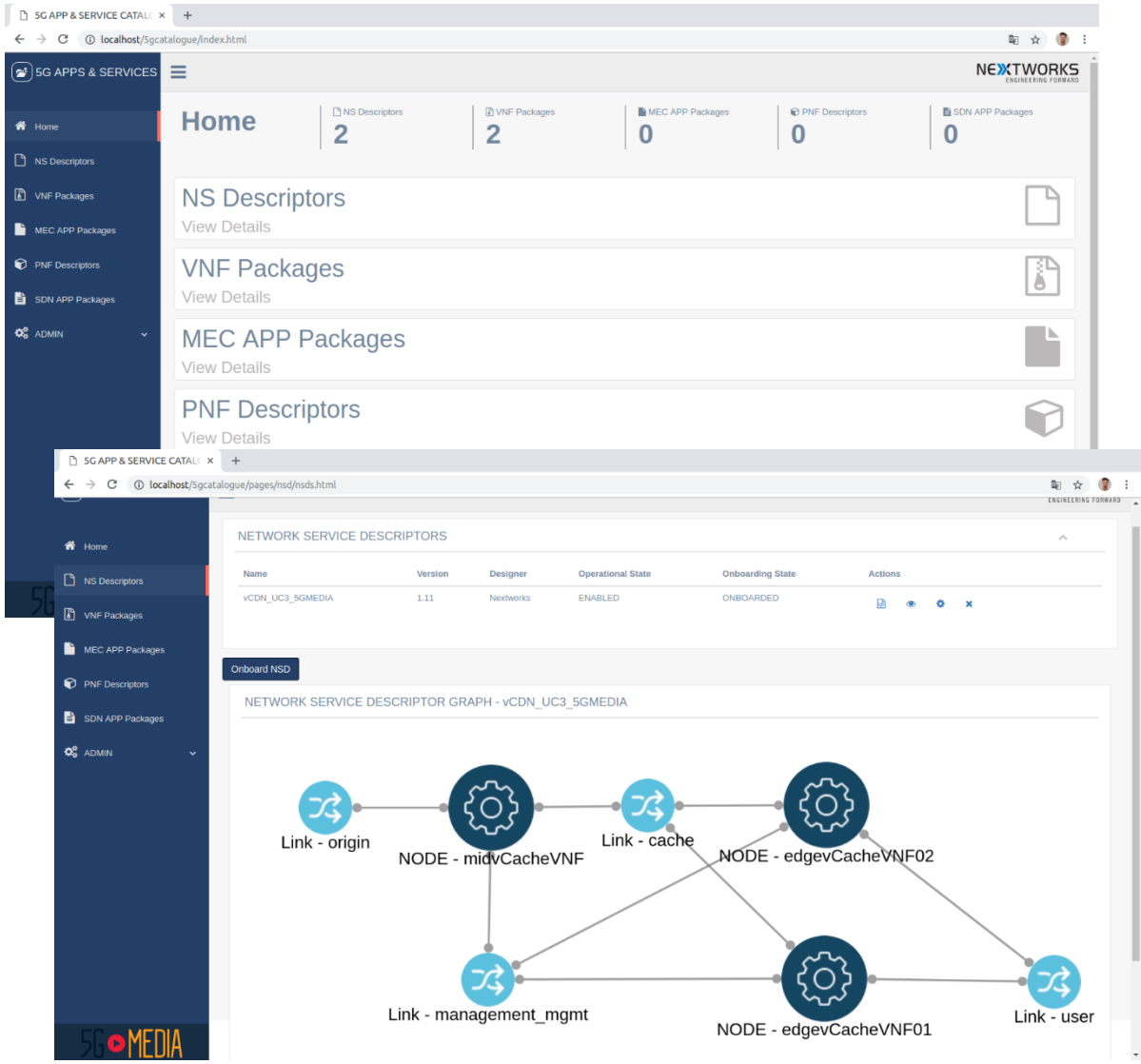
- **A new more generalized 5G App & Service catalogue**
  - Allow service customers to bring their own VNFs and NSs into the Service Provider's MANO
    - **5G DevOps**: from the private catalogue in the SDK to the public catalogue in SVP
  - Use a generalized (ETSI NFV) standard format and contents for descriptors
  - Additional VNF/NS characteristics not strictly related to (NFV) LCM (e.g. monitoring, D1/D2 conf)



https://github.com/nextworks-it/5g-catalogue

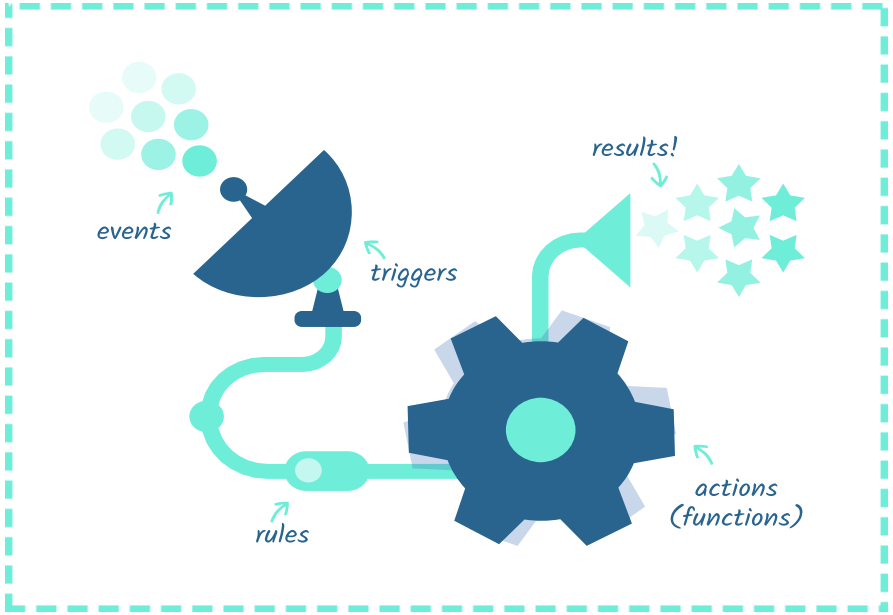
Focus #1: Catalogue key features

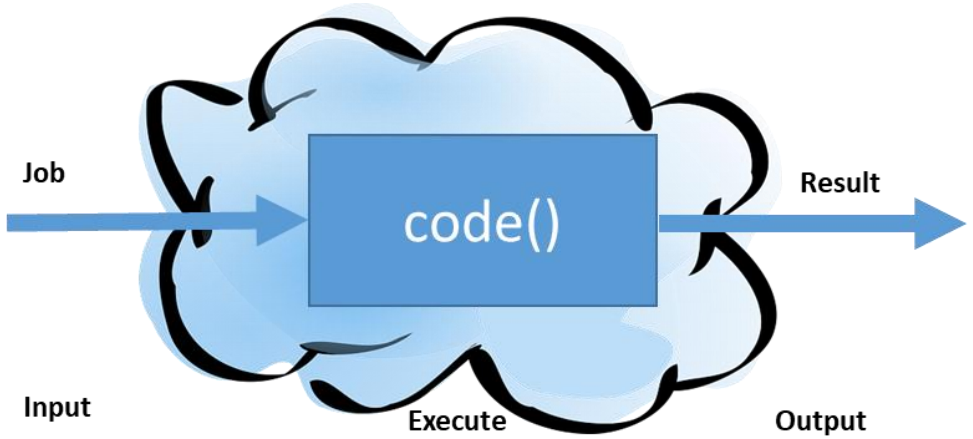
- **Unified and extendable format for descriptors**
  - NSDs [ETSI GS SOL 001]
  - VNF packages [ETSI GS SOL 001, ETSI GS SOL 004]
  - PNFDs [ETSI GS SOL 001]
  - MEC apps [ETSI GS MEC 010-2]
- **Package descriptors**
  - Common base + domain specific extensions for app config/monit, NFVI options, etc.
- **MANO domain-specific translation** from common to specific descriptors
  - **Support of OSM R3 and OSM R4/R5 catalogue APIs & IM**
- **Extended Interfaces to MANO** (NFVO, VIM)
  - Base LCM behaviors → basic NFV interfaces and descriptors
  - Additional behaviors (e.g. load images, configure hw acceleration, other tuning on NFVI, etc.) → additional interfaces and descriptors
- **Discovery, advertising, publishing, validation of descriptors** across catalogues from different providers
  - Policy-based management for level of descriptors' visibility



Focus #2: support for Function-as-a-Service

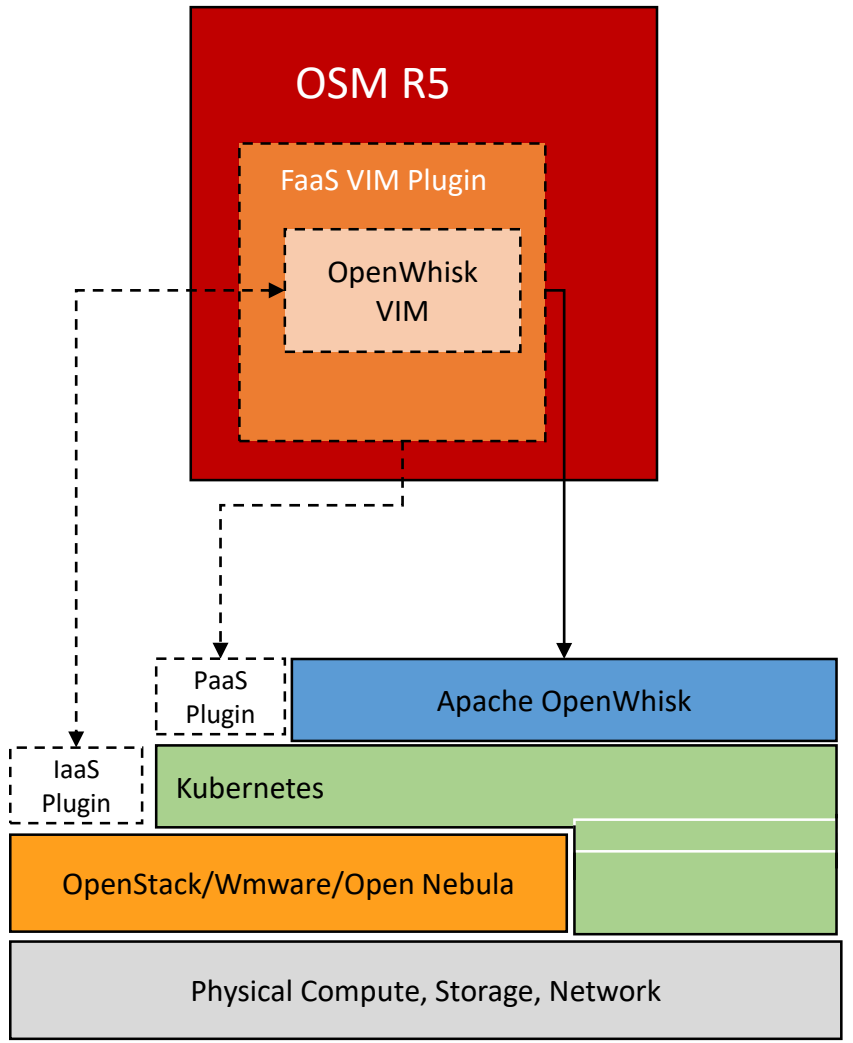
- **WHAT: A cloud-native** programming model
  - Geared for event-driven use cases
  - No administration & no provisioning
  - Built-in autoscaling
  - “Think only about your code”
  - Billing at 100ms resolution
- **HOW:** Making **a case for using it with VNFs**
  - **Cost reduction** for the customer
    - pay only for what you really consume
  - **Productivity** for VNF developers
    - focus on business logic and forget about the infrastructure
  - **Cost-efficiency** for platform providers
    - statistical multiplexing gain





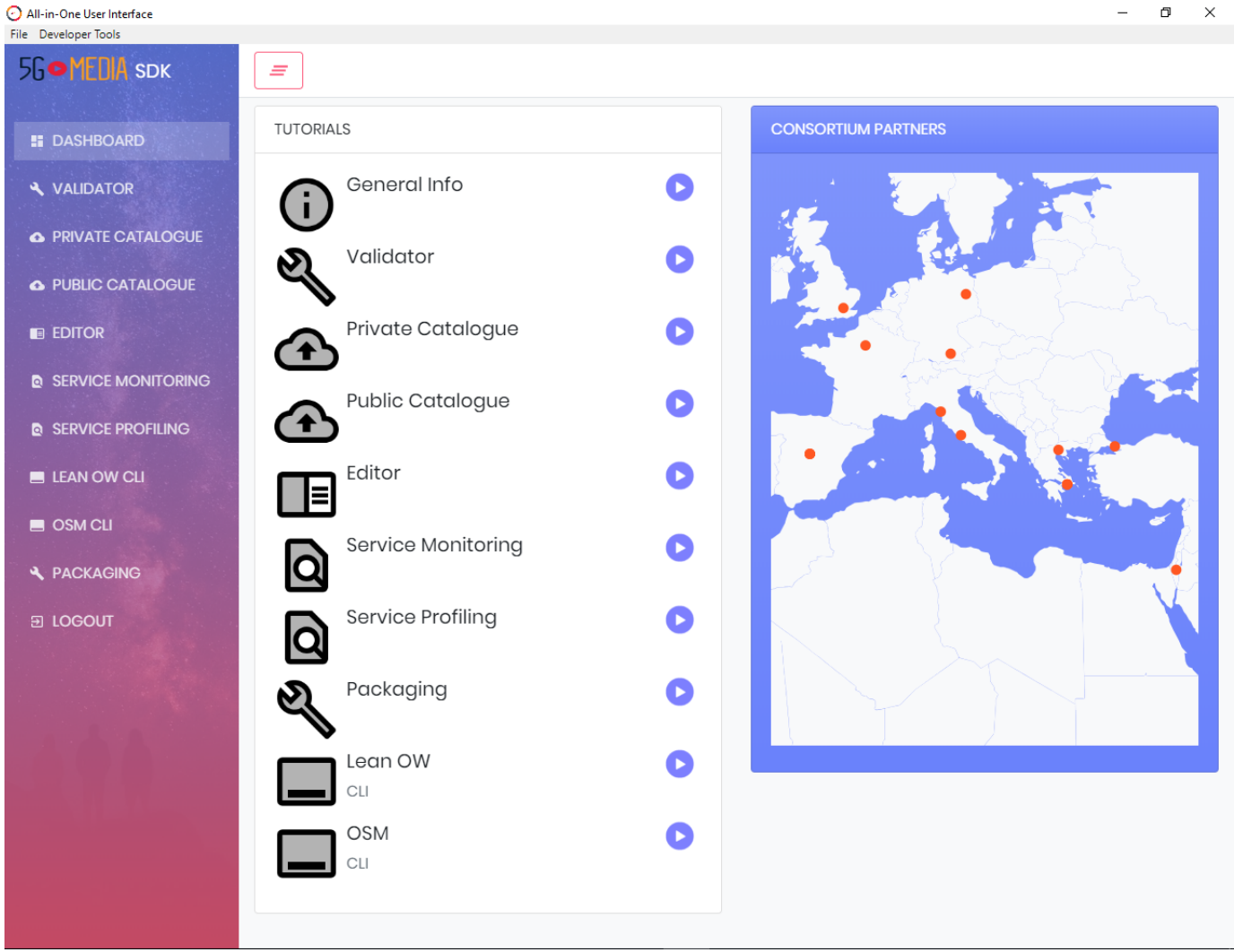
Focus #2: FaaS VIM Plugin

- FaaS takes away the burden of managing the underlying virtualized resources
  - FaaS shortens VNF development cycle
    - "*think only about your code*"
  - FaaS enables the instantiation of VNFs on-demand as processes (e.g., as containers)
- FaaS VIM can be integrated with an ETSI MANO stack
  - The 5G-MEDIA Reference Implementation uses OSM R3/R4
- At the southbound, FaaS VIM communicates with
  - a specific FaaS framework (e.g., Apache OpenWhisk)
  - a specific PaaS (e.g., Kubernetes)
  - a specific IaaS Cloud Orchestrator (e.g., OpenStack or OpenNebula)
- Seamlessly supports native K8s Knative serverless framework



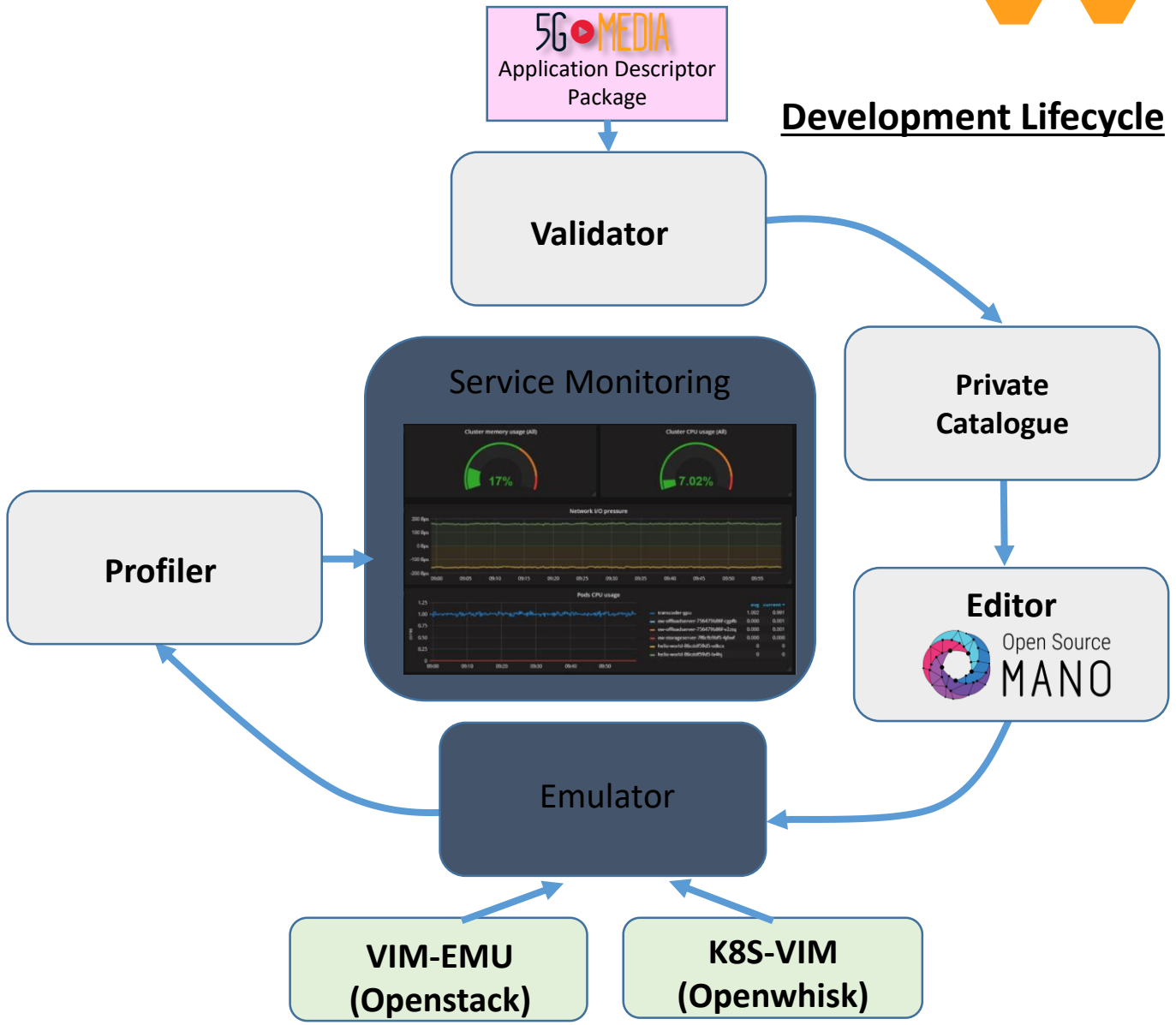
Focus #3: 5G-MEDIA SDK

- **Objective**
  - Help media application developers to easily implement and deploy new network applications to the SVP
- **Innovative Aspects**
  - All-in-one UI for developers to access the SDK tools through a single interface
  - FaaS emulation (Lean OW) and FaaS CLI Tools
  - VNF and NS emulation toolkit including monitoring tools
    - Support of Openstack and Openwhisk environments
  - CLI tools for unikernels



Focus #3: 5G-MEDIA SDK Programming Tools

- **Validator**
  - Validation of the projects, packages, services and functions
  - Available as CLI tools and web UI
- **Editor**
  - Assist creation and edit of NSs
- **Emulator**
  - Locally prototype and test complete NS chains
  - Environment for end-to-end multi-PoP and multi-VIM scenarios
- **Service Monitoring**
  - Visualization of pre-defined performance metrics in emulated multi-VIM environment
- **Service Profiling**
  - Test and verification of media applications functionality
  - Debug and fine-tuning before deploying to a production environment



Summary of touchpoints with OSM

- **What we have**
  - **5G Apps & Service Catalogue**
    - Unified catalogue approach with ETSI NFV standard formats for descriptors & packages
    - Translation to OSM R3 and R4 ready
  - **FaaS VIM plugin**
    - Enables event-driven VNF lifecycle
    - Support of native K8s K-native serverless framework
  - **5G-MEDIA SDK**
    - Full (OSM-compatible) SDK environment
      - from design to validation, emulation and profiling of VNFs and NSs (including FaaS)
- **Our wishlist** for future OSM releases ☺
  - VNF placement at instantiation time
  - Dynamic modification of VNFFG

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