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

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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

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

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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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