Programming Tools for Rapid NFV-Based Media Application Development in 5G Networks

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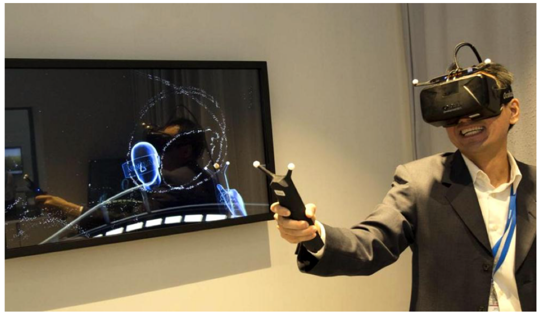
Outline

- Introduction & Motivation
- 5GMEDIA SDK Tools
- Example Workflow & Demo Video
- Future Works & Conclusions

5G

3D/UHD Video Telepresence

UHD Video Streaming



Virtual Reality

5G - MEDIA

The H2020 5GPPP Phase 2 project 5G-MEDIA* aims at innovating media-related applications by investigating how these applications and the underlying 5G network should be coupled and interwork to the benefit of both .

*www.5gmedia.eu

5G – MEDIA SDK Contributions

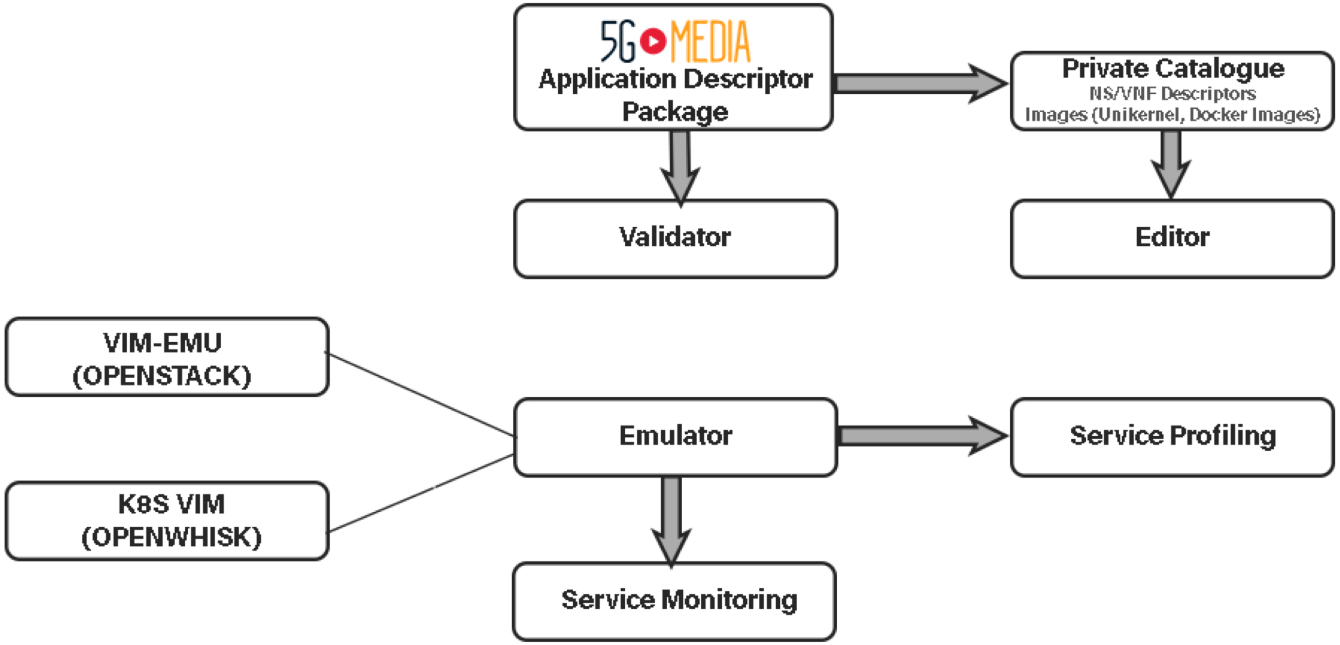
- 5G-MEDIA SDK includes an all-in-one UI which enables developers access all SDK tools in a single interface, therefore it improves user-time efficiency and provides smooth user experience.

- FaaS Emulation (Lean OW) and FaaS CLI Tools implemented in 5G-MEDIA SDK allows media application developers to quickly develop value added code while relieving them from the infrastructure management concerns.

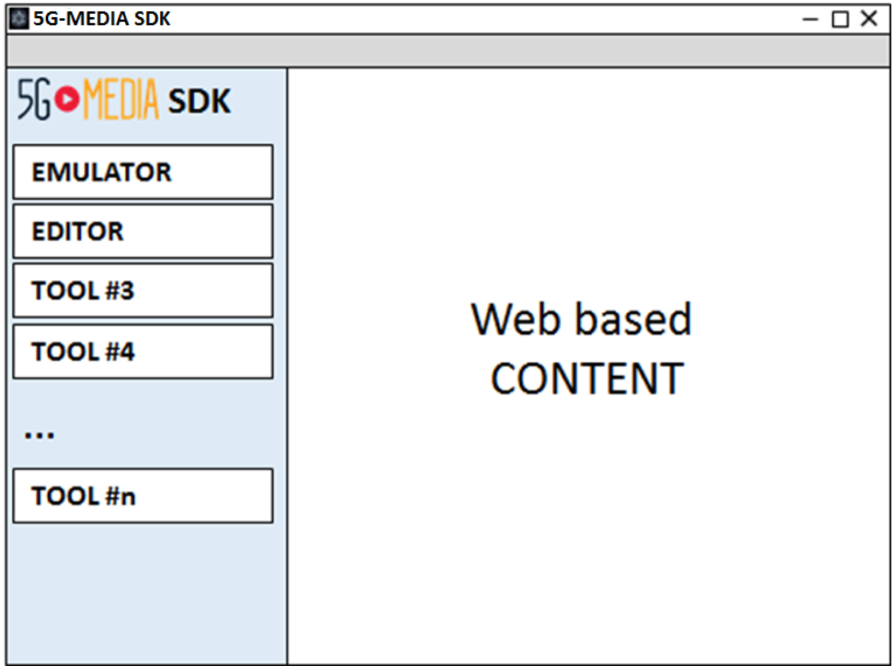
- VNF/NS Emulation toolkit including monitoring tools provides visualization of pre-defined performance metrics in the emulated multi-vim environment (i.e Openstack and Openwhisk) (emulator). This allows media application developers to test, verify their applications functionality and fine-tune their media application performance before deploying to a live environment.

5G-MEDIA SDK Tools

5G-MEDIA SDK Tools



All-in-one UI

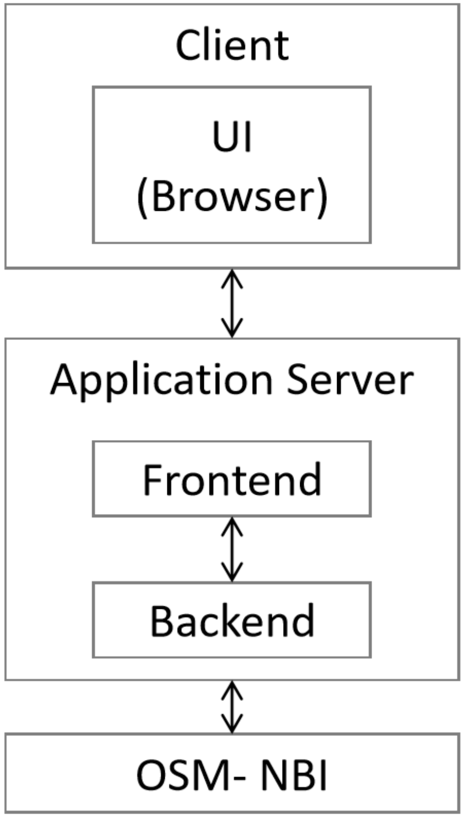


- The proposed interface is a web based GUI embedded into a desktop container (a.k.a desktop application) which can be used by the developers on their personal computers.

- The proposed interface is build using two platforms: Electron and React.

- Because of the security level, web-based frameworks like React cannot to open the external application from local; for this reason, Electron is used in combination with React to overcome this problem.

Editor



- The editor runs on developer’s local OSM environment so that the developer can manage emulation environments such as vim-emu or lean-OW.

- It is the main UI for adding new data centres/virtualized infrastructure managers (VIM), designing, validating and onboarding media applications, instantiating or shutting down a NS deployed in emulated data centres.

- UI also visualizes the topological dependencies or interconnection of involved VNFs of VNF-FG and descriptions of individual VNFs.

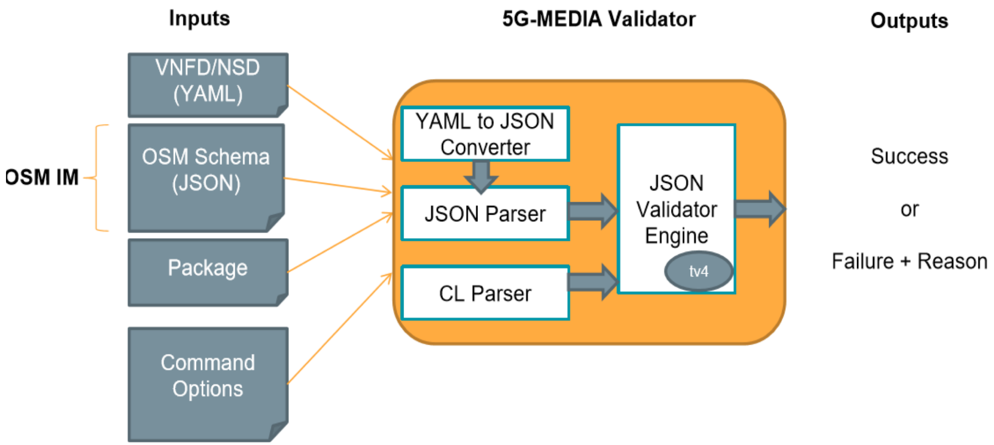
Editor – FaaS

- A FaaS button is placed in the composer of the OSM UI. Therefore the developer can list the FaaS VNFs pressing this button and can edit them using the editor.

- The FaaS VNFs are uploaded on the OW using the OW API.

- The UI also includes a button for FaaS accounts under the account sections like SDN or VIM accounts. Hence, the developers are enabled to store access credentials of OW through this menu. These access credentials are used for authorization in any OW API calls related to FaaS specific configurations.

Validator



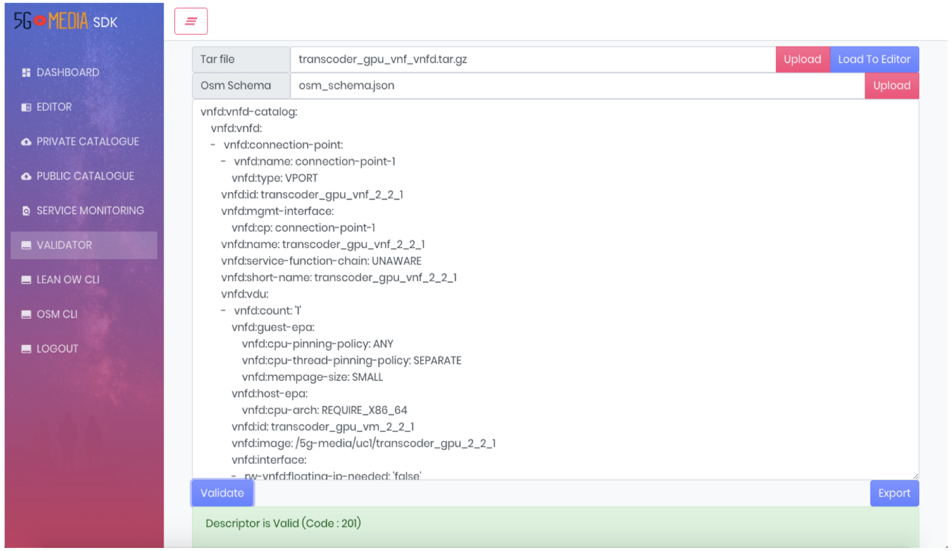
The inputs of the validator are specified as follows

•NSD/VNFD yaml files: NSD files can be validated with a path where referred VNFD files are located.

•JSON Schema File: Schema file based on OSM informa- tion model is considered.

•CL Parser: Node.js opt [12] is considered

Validator – Web UI

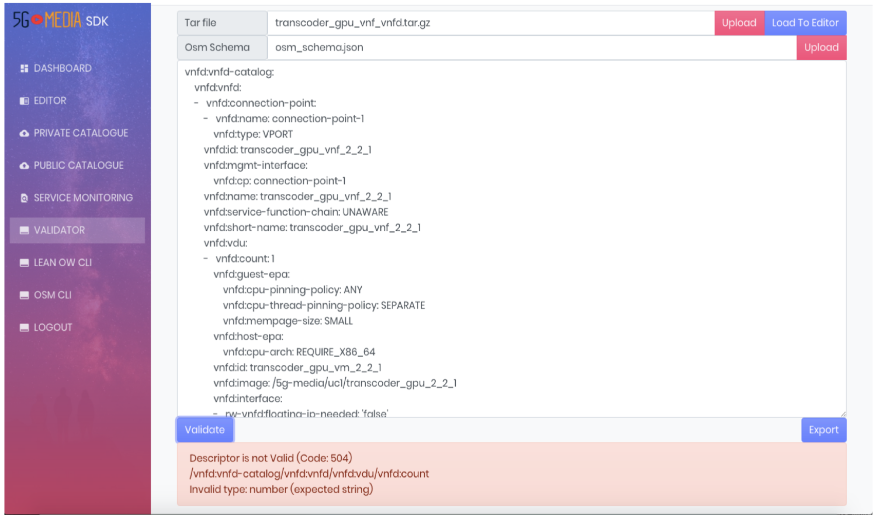


transcoder_gpu_vnf_vnfd.tar.gz

osm_schema.json

```
vnfd:vnfd-catalog:
  vnfd:vnfd:
  -  vnfd:connection-point:
    -  vnfd:name: connection-point-1
       vnfd:type: VPORT
    vnfd:id: transcoder_gpu_vnf_2_2_1
    vnfd:mgmt-interface:
       vnfd:cp: connection-point-1
    vnfd:name: transcoder_gpu_vnf_2_2_1
    vnfd:service-function-chain: UNAWARE
    vnfd:short-name: transcoder_gpu_vnf_2_2_1
    vnfd:vdu:
    -  vnfd:count: '1'
       vnfd:guest-epa:
          vnfd:cpu-pinning-policy: ANY
          vnfd:cpu-thread-pinning-policy: SEPARATE
          vnfd:mempage-size: SMALL
       vnfd:host-epa:
          vnfd:cpu-arch: REQUIRE_X86_64
       vnfd:id: transcoder_gpu_vm_2_2_1
       vnfd:image: /5g-media/ucl/transcoder_gpu_2_2_1
       vnfd:interface:
       -  rw-vnfd:floating-ip-needed: 'false'
```

Descriptor is Valid (Code : 201)



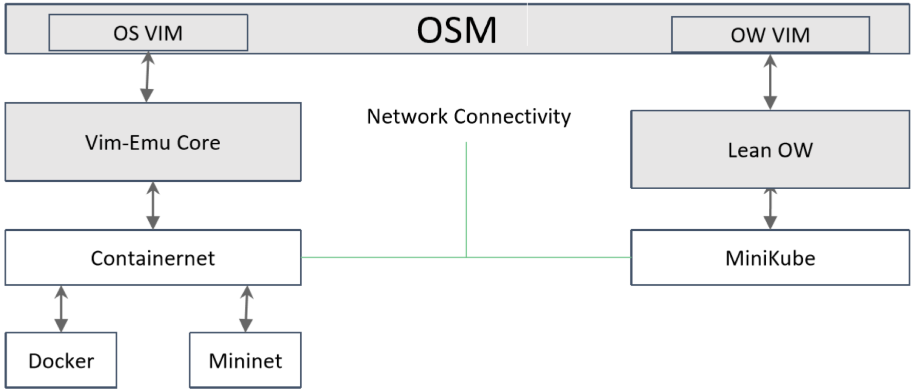
transcoder_gpu_vnf_vnfd.tar.gz

osm_schema.json

```
vnfd:vnfd-catalog:
  vnfd:vnfd:
  -  vnfd:connection-point:
    -  vnfd:name: connection-point-1
       vnfd:type: VPORT
    vnfd:id: transcoder_gpu_vnf_2_2_1
    vnfd:mgmt-interface:
       vnfd:cp: connection-point-1
    vnfd:name: transcoder_gpu_vnf_2_2_1
    vnfd:service-function-chain: UNAWARE
    vnfd:short-name: transcoder_gpu_vnf_2_2_1
    vnfd:vdu:
    -  vnfd:count: 1
       vnfd:guest-epa:
          vnfd:cpu-pinning-policy: ANY
          vnfd:cpu-thread-pinning-policy: SEPARATE
          vnfd:mempage-size: SMALL
       vnfd:host-epa:
          vnfd:cpu-arch: REQUIRE_X86_64
       vnfd:id: transcoder_gpu_vm_2_2_1
       vnfd:image: /5g-media/ucl/transcoder_gpu_2_2_1
       vnfd:interface:
       -  rw-vnfd:floating-ip-needed: 'false'
```

Descriptor is not Valid (Code: 504)
/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vdu/vnfd:count
Invalid type: number (expected string)

Emulator



- It represents a low footprint of SVP with OSM being the entry point for the emulator and OpenStack and FaaS VIMs managing all-in-one development distros of OpenStack and Apache OpenWhisk.

- The emulation platform not only offers OpenStack-like APIs for each emulated PoP but also provides OpenWhisk APIs via Lean OW*, which can therefore be installed to developers personal computer.

-5G-MEDIA Emulator leverages vim emulator (a.k.a vim-emu/son-emu) and Lean OW to provide an emulated network in the developers environment.

* https://medium.com/openwhisk/lean-openwhisk-open-source-faas-for-edge-computing-fb823c6bbb9b

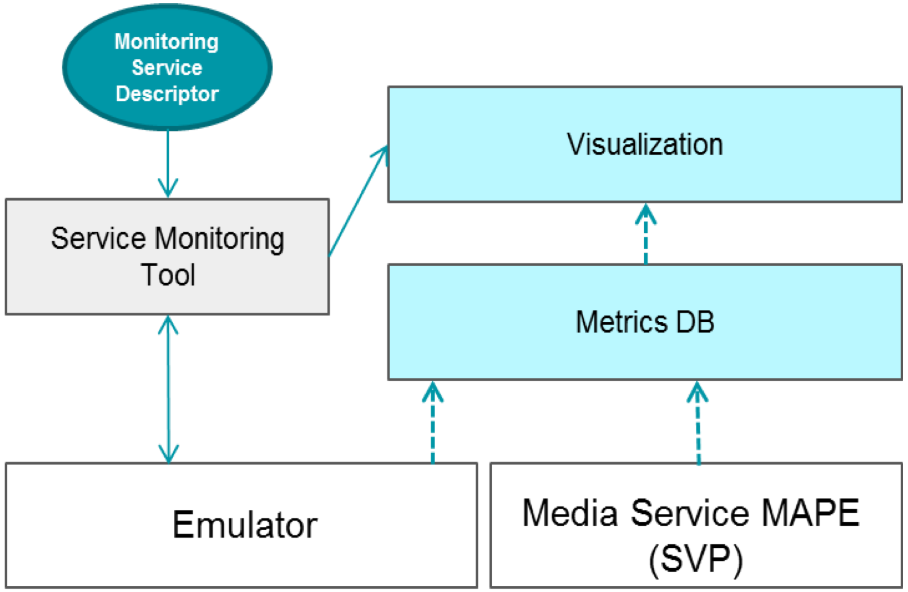
Emulator - FaaS

- The FaaS emulator which compromises Lean OW and Minikube is not fundamentally different from the SVP, which uses a full clustered installation of Apache OpenWhisk and of a K8s cluster.

- A FaaS VNF that is to be emulated, should be pre-onboarded into Lean OW in a regular way using a wskdeploy tool . This tool allows to define the OpenWhisk action that implements this VNF.

- Finally, the VNFD should be instantiated using OSM. The VNF instance and its status are shown in the OSM GUI. The instance can be terminated from OSM on the users discretion as if it was a regular VNF instance.

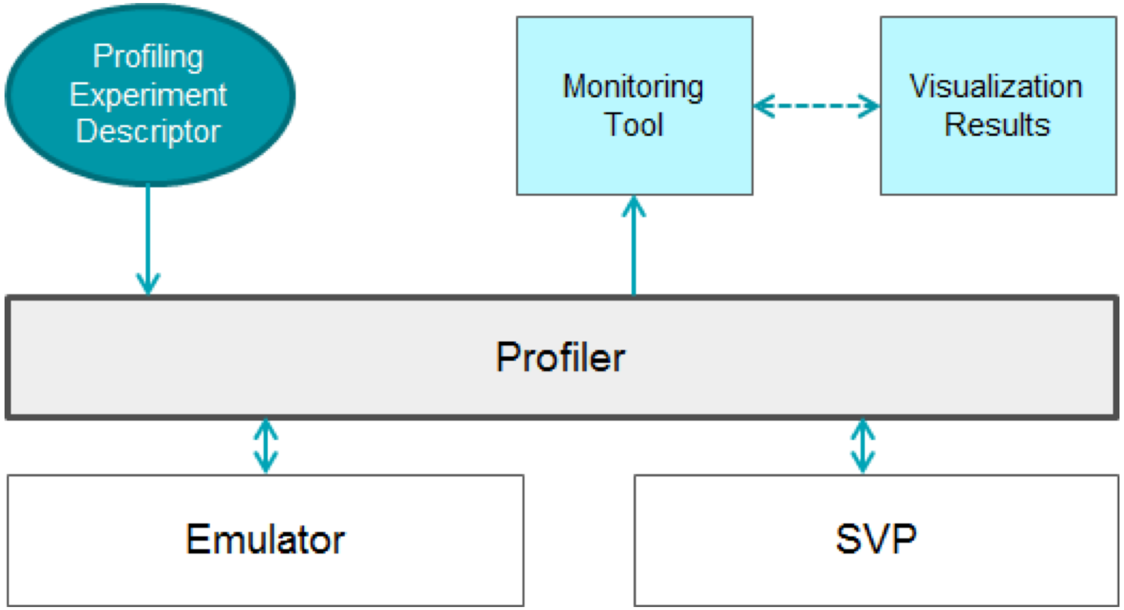
Service Monitoring



The emulator has a REST API to control the export of metrics to the Metrics Gateway. This can also be controlled from a Monitoring Service Descriptor (MSD) file that lists all needed metrics.

The gathered metrics can be visualized using the visualization tool which visualizes the inquired metrics from the Metrics Database using a web-based GUI. (i.e Grafana GUI)

Profiling


Profiling Experiment Descriptor
Monitoring Tool
Visualization Results
Profiler
Emulator
SVP

Example workflow

Video link: https://youtu.be/4LwZgmsbEIs

Conclusions

- The parts of 5G-MEDIA SDK have been presented discussing the open-source frameworks and libraries that are considered for the project.
- The architecture and usage of the 5G-MEDIA SDK tools such as all-in- one UI, validator, editor, emulator and service monitoring have been explained.
- Application of the serverless FaaS approach to NFV technology has been presented and the development of the appropriate programming tools to accommodate FaaS paradigm has been given.

thank you
danke
gracias
merci
obrigado
bedankt
dziękuję
go raibh maith agat
teşekkür ederim
ngiyabonga
спасибо
謝謝
рахмат
Баярлалаа
dank je
mochchakkeram
sukriya
kop khun krap
terima kasih
grazie
arigatô
dakujem
takk
tapadh leat
mauruuru
hvala
sagolun
감사합니다
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ありがとう
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barka
welalin
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dankie
dhanyavad
vinaka
спасибі
blagodaram
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matondo
paldies
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asante
manana
obrigada
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