Webinar on verticals onboarding, testing and monitoring in 5G-VINNI

5G-VINNI team, 12 March 2020, webinar

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 815279.

General instructions

- Please mute your microphone
- Q&A after the end of the presentation
- During the presentation send your questions via chat
- The session is being recorded

Agenda

- Introduction to 5G-VINNI facility and architecture
- NSaaS delivery model, 5G-VINNI Service Blueprint and Exposure Levels
- Onboarding
- Testing / Monitoring as a Service (TaaS/MaaS)
- Key Performance Indicators

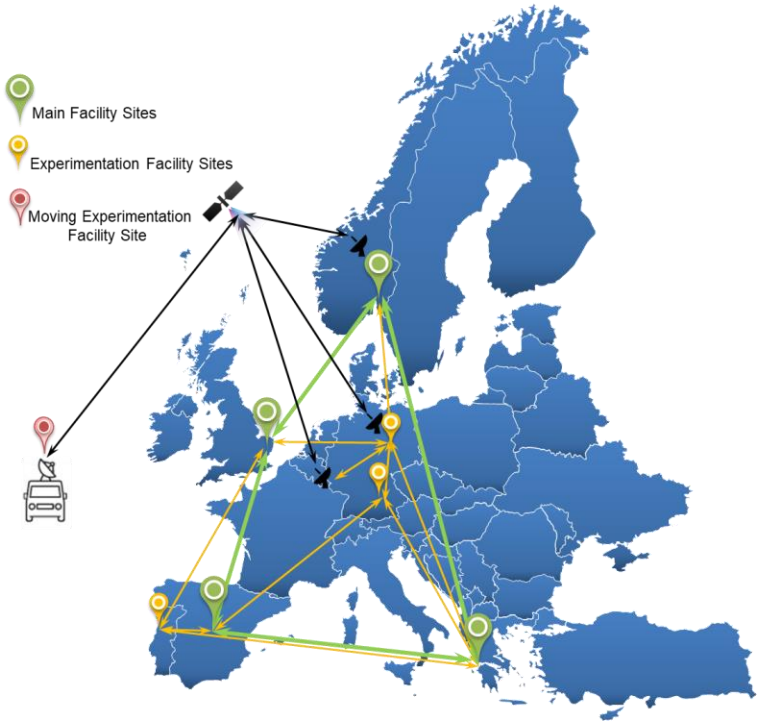
Pål Grønsund

Telenor ASA

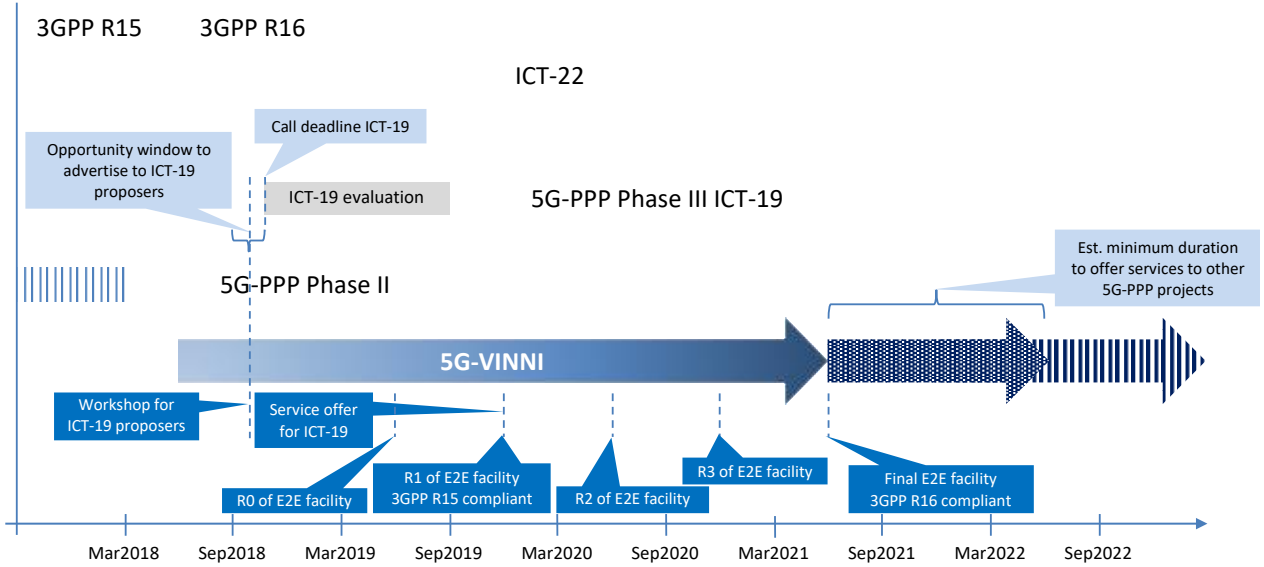
INTRODUCTION TO 5G-VINNI FACILITY AND ARCHITECTURE

5G-VINNI (**5G V**erticals **INN**ovation **I**nfrastructure)

- Build an open large scale 5G End-to-End facility that can
  - demonstrate that key 5G network KPIs can be met
  - be validated, accessed and used by vertical industries (e.g. ICT-19) to test use cases and validate 5G KPIs.
- Duration: 1.July 2018 – 1.July 2021
- Consortium: 23 partners (operators, vendors, academics, SMEs)
- External Stakeholder Board (vertical industries)

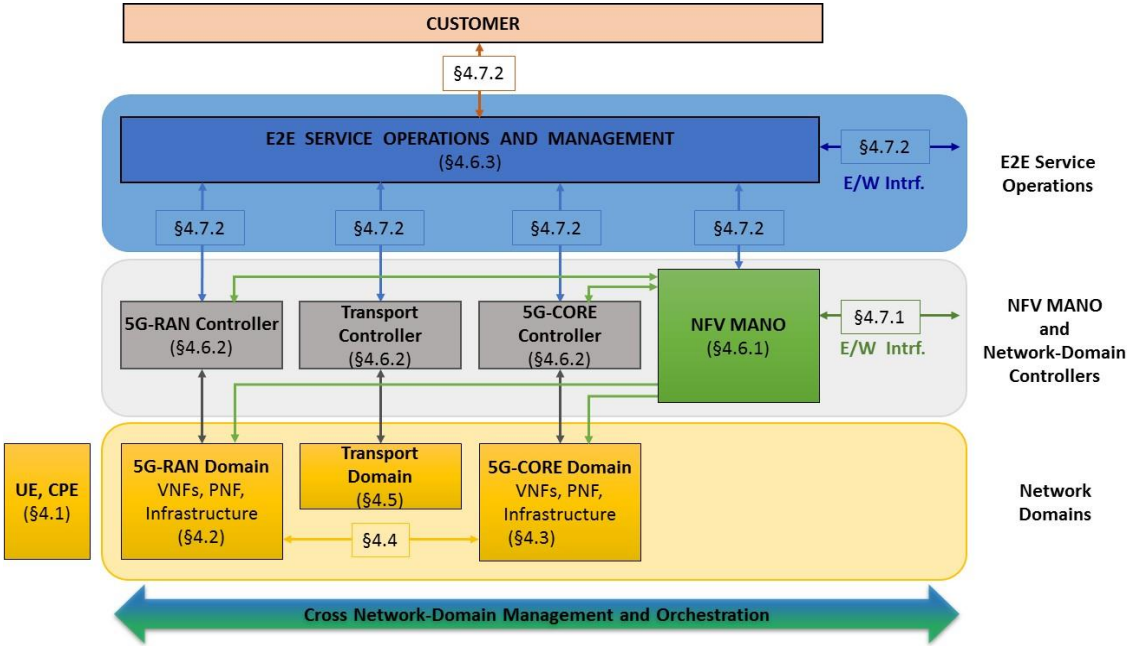


Global Timing and Releases (6 month release cycle)



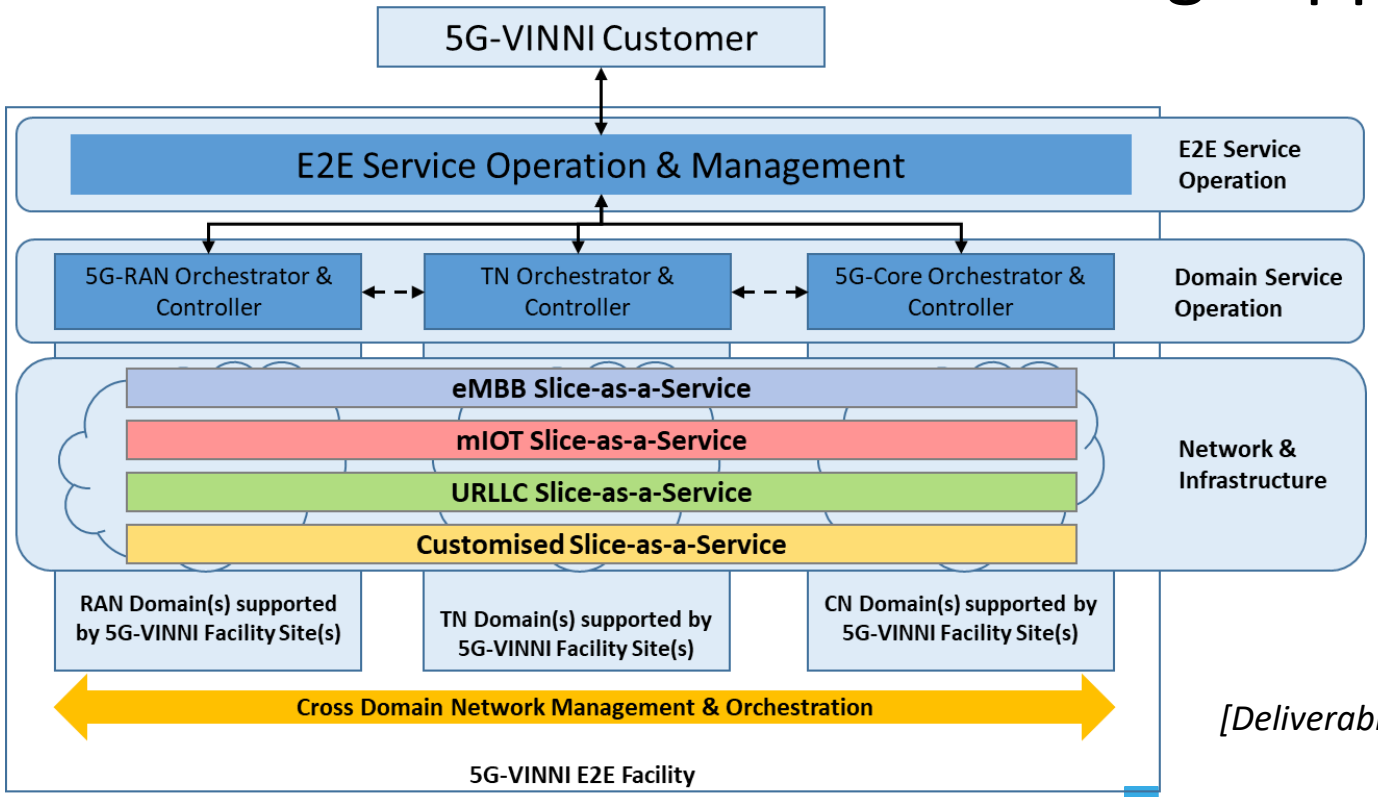
- 5G-VINNI Facility is ready for ICT-19 project experimentation.
- 5G-VINNI Facility will be available until 1st July 2022

The 5G-VINNI Architecture is common for all facility site implementations



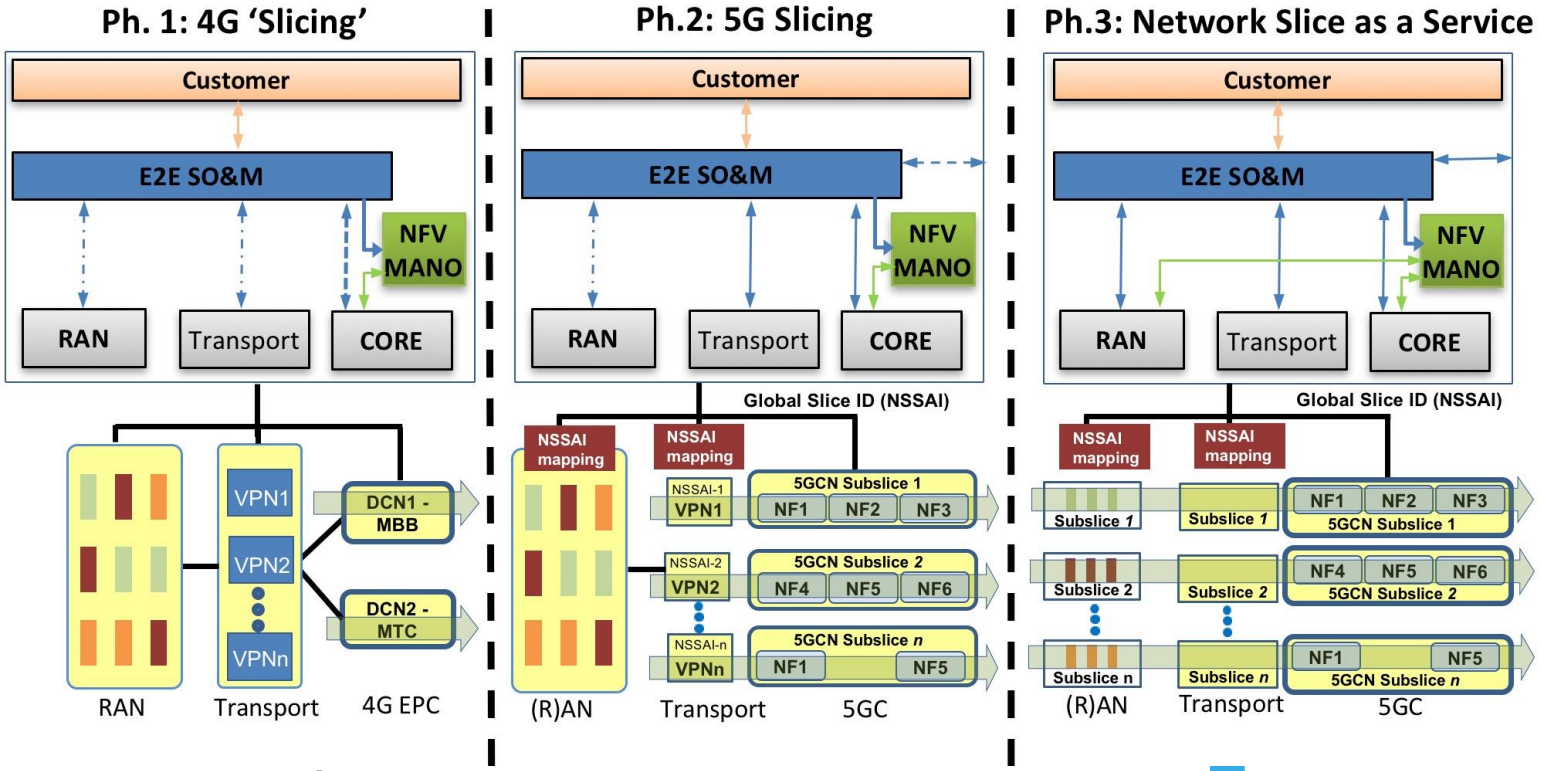
[Deliverable 1.1]

5G-VINNI E2E Architecture with Slicing support



[Deliverable 1.2]

Slice life cycle management and orchestration roadmap



[Deliverables 1.2 and 1.3]

5G-VINNI Facility Sites – Technical Summary

(see https://www.5g-vinni.eu/facility-site/, [Deliverable 2.1], [Deliverable 3.2])

Main Facility sites

Norway (Oslo, Kongsberg)

- Slicing (eMMB, URLLC, mMTC)
- E2E Service Orchestration (Nokia)
- NFVI (OpenStack) and MANO (Nokia)
- Edge Cloud (Nokia)
- Five 5G gNBs (Ericsson, Huawei)
  - 3.5GHz, 80MHz BW
  - 26GHz, 800MHz BW
- 5G Core (Ericsson)
- 3GPP compliance
  - Rel'15 in 2019, Rel'16 in 2021
  - NSA in 2019, SA in 2020
- Satellite backhaul option (GEO)

UK (Martlesham)

- Slicing (eMMB, URLLC, mMTC)
- Service Orchestration (Nokia)
- NFV MANO, NFVI and vEMS (Samsung)
- 5G RAN incl. 3.5 and 26GHz (Samsung)
- 5G Core (Samsung)
- 3GPP compliance
  - Rel'15 in 2019, Rel'16 in 2021
  - NSA in 2019, SA in 2020

Spain (Leganes)

- Slicing (eMMB, URLCC, mMTC)
- Service Orchestration (OSM NBI)
- MANO (OSM), NFVI (OpenStack), and SDN (ODL/ONOS)
- Support for micro-VNFs
- 5G RAN (Ericsson + SDR) 3.5 GHz, band C
- Model-based telemetry for monitoring and analytics
- Edge computing
- 5G Core (Ericsson + open-source)
- GEANT connectivity

Greece (Patras)

- Slicing (eMMB, URLLC, mMTC, via OSM)
- Service Orchestration (via OSM NBI services)
- NFV MANO (OSM) and NFVI (OpenStack)+DPDK
- 5G RAN open source radio (Lime, SRS)-700-800MHz, 3.5.-3.8GHz
- 5G Core (Open5GCore)
- NB-IoT, LTE-M (FhG NB-IOT core)
- mmWave backhaul (Intracom)
- GEANT connectivity

Experimentation Facility sites

Portugal (Aveiro)

- NG-PON2-based 5G front/backhaul (Alticelabs)
- MANO (SONATA)
- NFVI (OpenStack)
- SDN (ODL)
- 5G Core (Open5GCore)
- Cloud RAN
- Edge Computing
- Slicing (eMBB, uRLLC, mMTC)

Germany (Berlin)

- 5G RAN prototype(s)
- 5G Core (Open5GCore)
- Edge cloud/e2e Orchestration (OpenBaton, OSM)
- mmWave backhaul
- Interconnection with remote islands in Betzdorf and Tokyo
- Large scale events, Nomadic networks, Disaster Relief

Germany (Munich)

- 5G NR SA RAN (Huawei) 3.5 GHz
- 5G Core (Huawei)
- MANO and NFVI (Huawei)
- SDN (Floodlight)
- V2I, V2P
- MEC, Edge Computing
- URLLC targeting Rel16/17
- Sensor fusion enabled by 5G

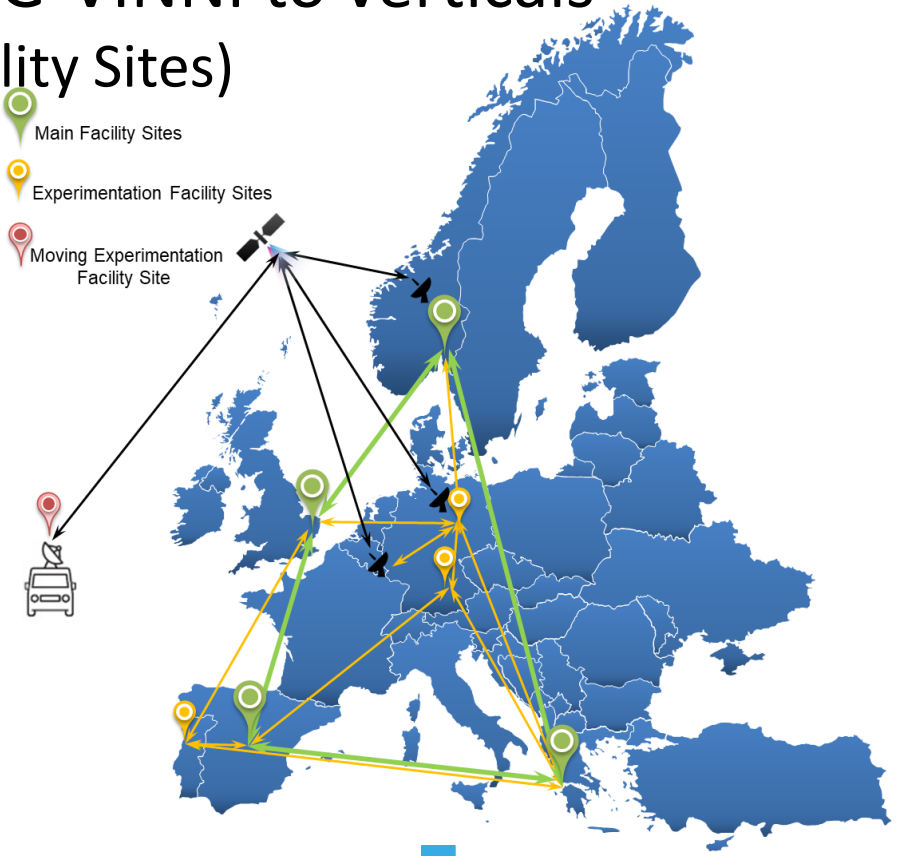
Luxembourg (Satellite Connected Vehicle)

- 5G Edge Node on-board satellite connected moving van
- GEO/MEO satellite backhauling
- 5G Core (Open5GCore)
- NFVI (OpenStack)
- MANO (OSM)
- Edge Computing
- Network Slicing (eMBB, mMTC)
- Interconnection w/ Berlin site

Services offered by 5G-VINNI to verticals
(Main Facility Sites)

Network Slice-as-a-Service (NSaaS)
eMBB network slice as a service
mIoT network slice as a service
uRLLC network slice as a service
Customised network slice

Value Added Services
Monitoring-as-a-Service
Testing-as-a-Service
Security-as-a-Service
3rd party VNF hosting
Distributed data fabric
Edge and Autonomous Edge
Flexible backhaul for redundancy (e.g. Satellite)
Interconnection with other 5G sites



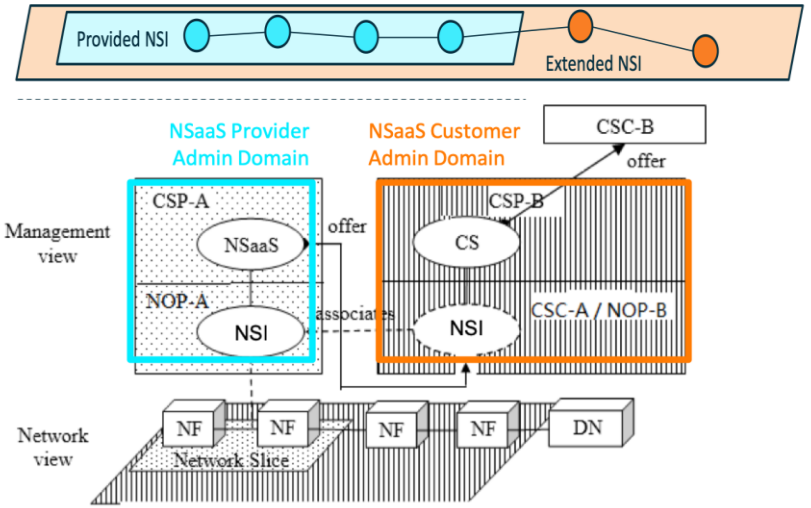
[Deliverable 3.1]

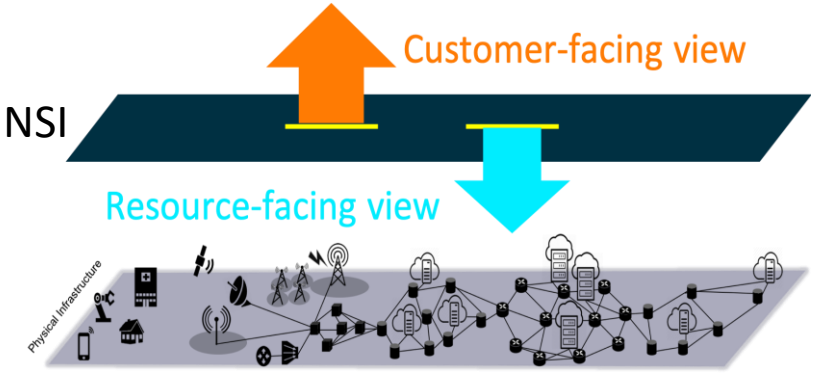
Jose Antonio Ordóñez Lucena
Telefónica Investigación y Desarrollo

NSAAS DELIVERY MODEL, 5G-VINNI SERVICE BLUEPRINT AND EXPOSURE LEVELS

Network Slice-as-a-Service (NSaaS) delivery model

- NSaaS is a future-proof service delivery model
  - Network Slice Instance (NSI) on demand, as a service
  - NSaaS provider and NSaaS customer roles

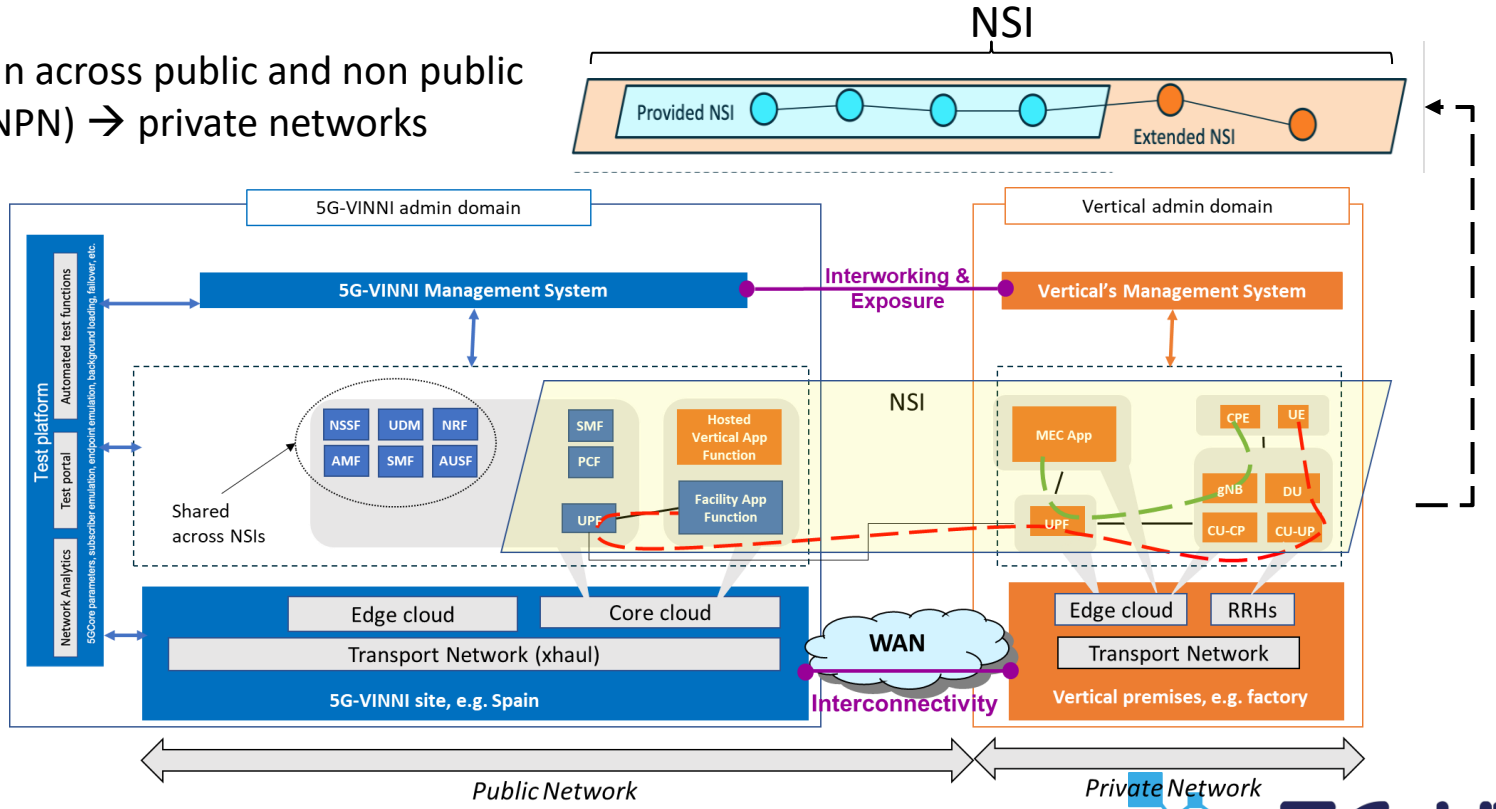




- Two complementary service views on an NSI:
  - **Resource-facing** (NSI deployment details) vs. **customer-facing** (NSI exposed capabilities)
  - **Abstraction** to preserve the required **demarcation point** between the provider and the customer

5G-VINNI & verticals integration based on NSaaS

The NSI span across public and non public networks (NPN) → private networks



NSaaS – Two main phases

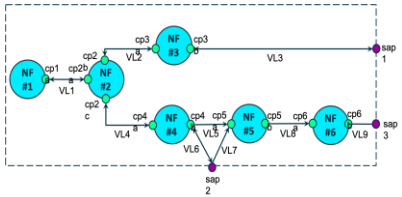
Network Slice (aaS) Request

The NSaaS customer issues a service order towards NSaaS provider, requesting the deployment of a tailored network slice

NSI is deployed and activated

Network Slice (aaS) Operation

The NSaaS customer monitors and takes (some) control over the network slice, deployed and made available by the NSaaS provider



Slice Topology

Slice Requirements

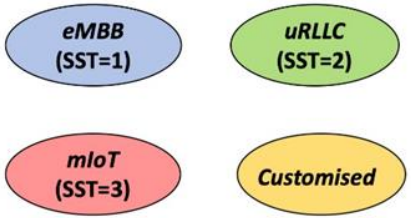
Slice performance assurance and fault supervision

Slice Management & Control

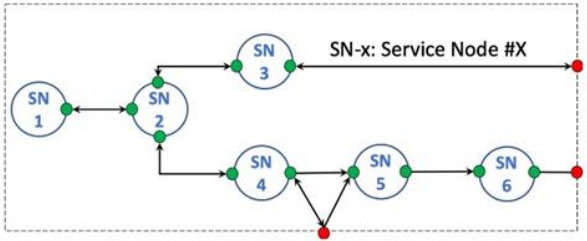
NSaaS Request - Ordering a VINNI-SB

VINNI-SB = 5G-VINNI Service Blueprint

Slice Service Type (SST)



Service Topology

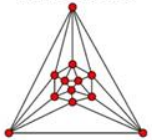


Service attributes

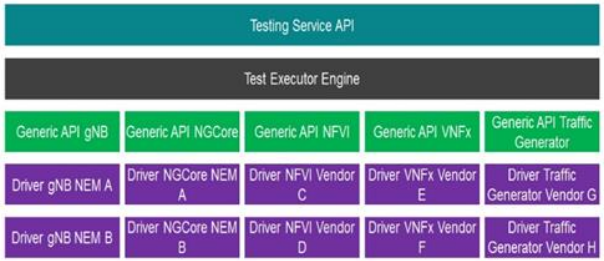
Performance attributes

Functionality attributes

Network optimization attributes

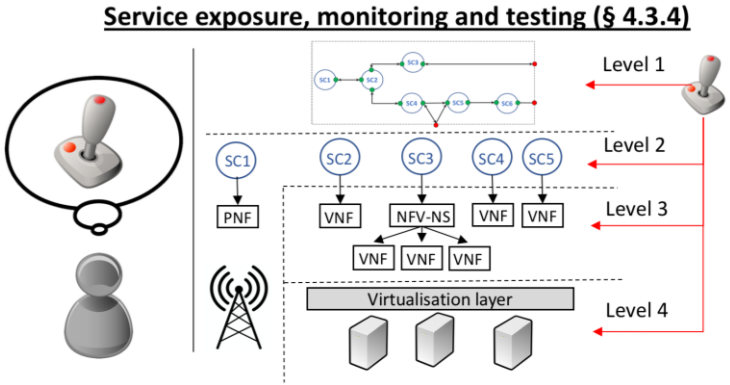


Service monitoring and testing



NSaaS Operation – Service Capability Exposure

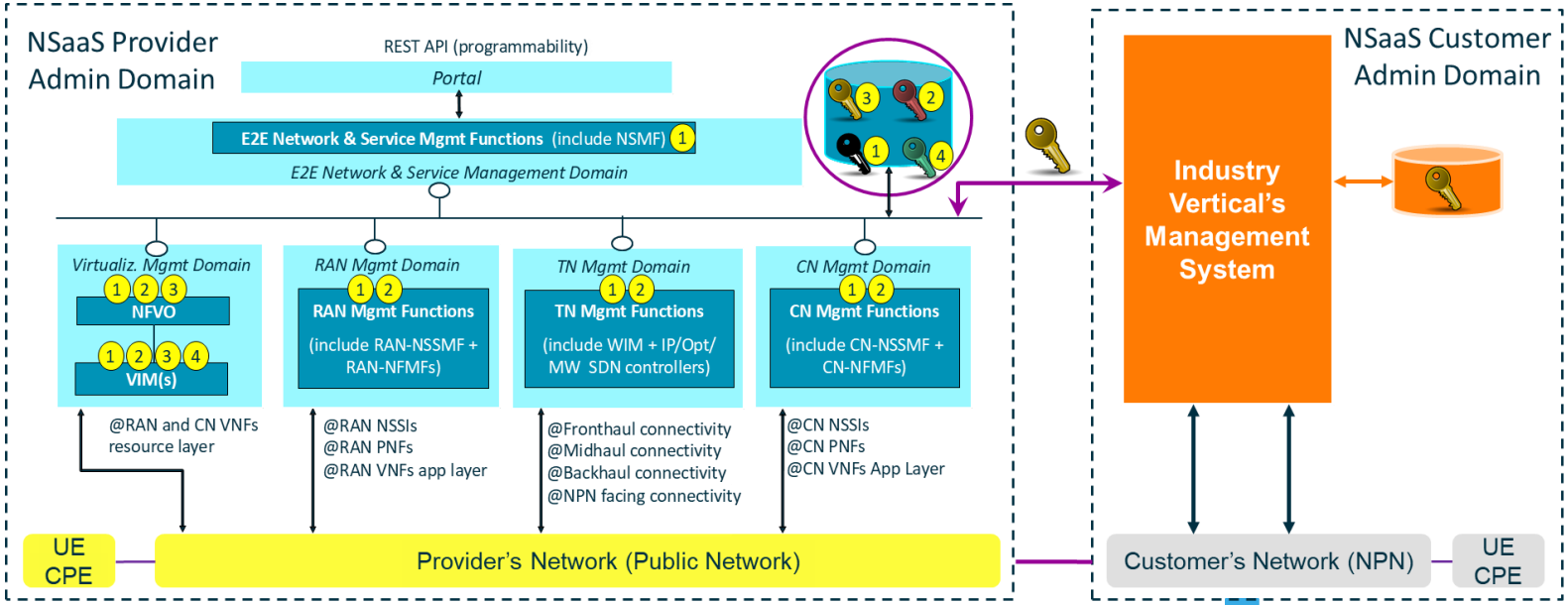
- In vertical-oriented experimentation scenarios, different verticals may want to take a more or less proactive role in the operation of their slices
- 5G-VINNI offers to vertical different “capability exposure levels” → levels of control a vertical can take over the provided slice



5G-VINNI is able to consume operations related to….	Level 1	Level 2	Level 3	Level 4
E2E network slice application layer config & management	✓	✓	✓	✓
Network slice subnet / network function application layer config & management	×	✓	✓	✓
Network slice subnet / network function virtualized resource layer config & management -> ETSI NFV Network Service (and VNF) orchestration	×	×	✓	✓
Infrastructure resource control & management -> NFVI with optional enhanced platform awareness capabilities and infrastructural SDN control.	×	×	×	✓

NSaaS Operation – Service Capability Exposure

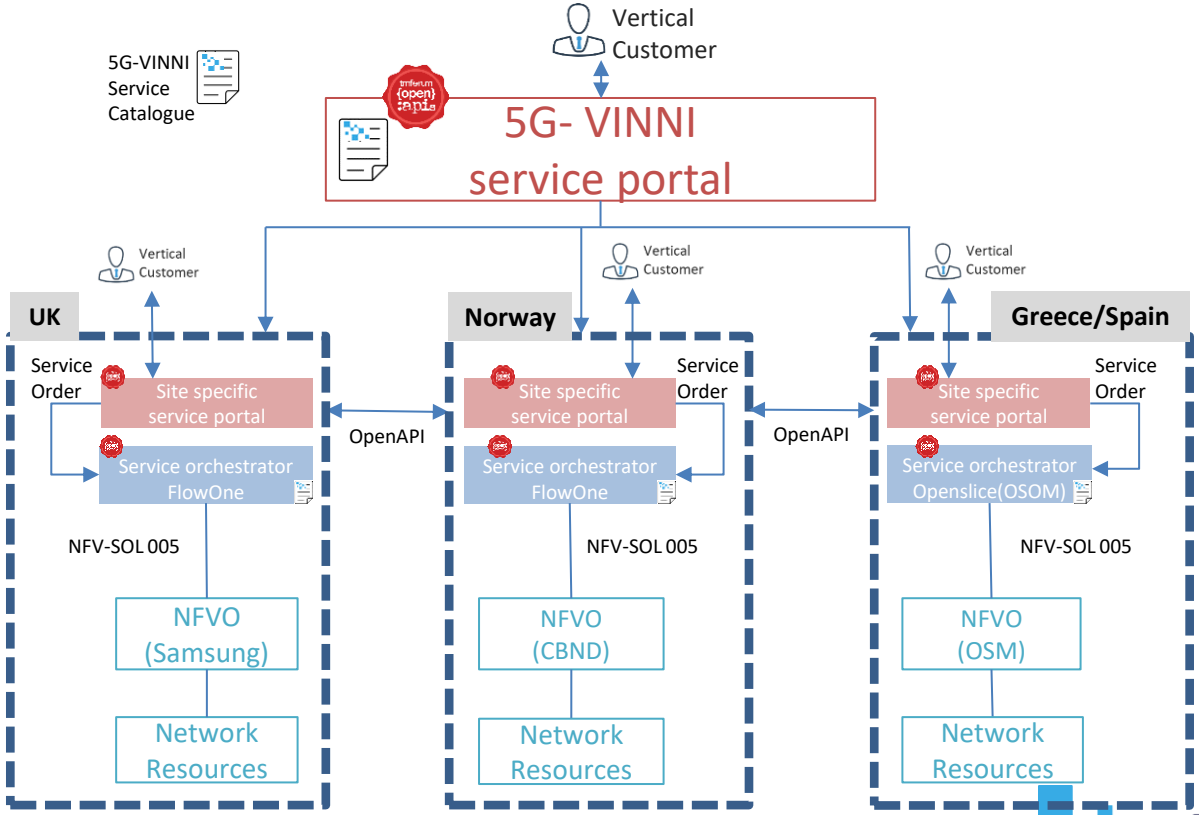
- Depending on the selected ”capability exposure level”, a vertical can consume more or less management services within 5G-VINNI admin domain
- Token-based authentication



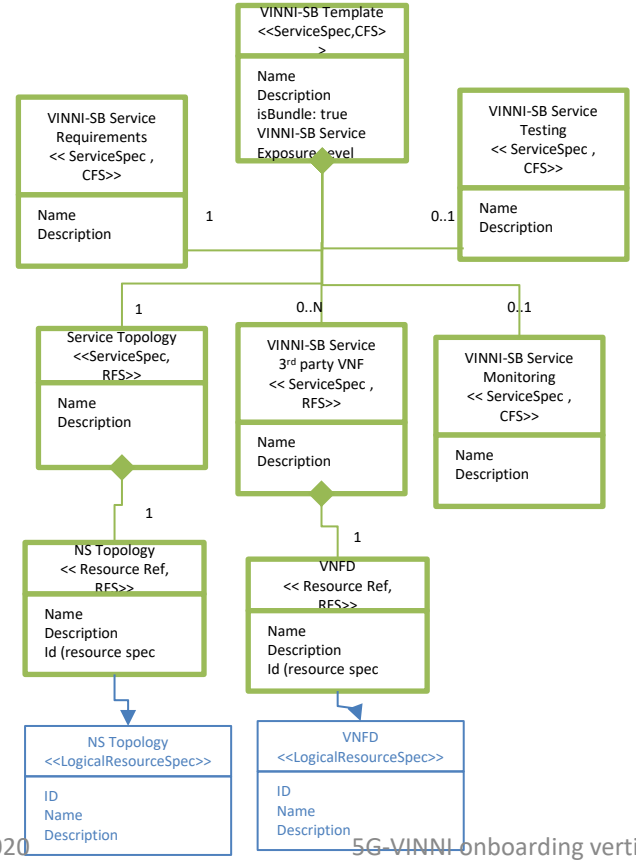
Christos Tranoris,
Univ. of Patras

ONBOARDING

Network Slice as a Service (NSaaS) delivery model



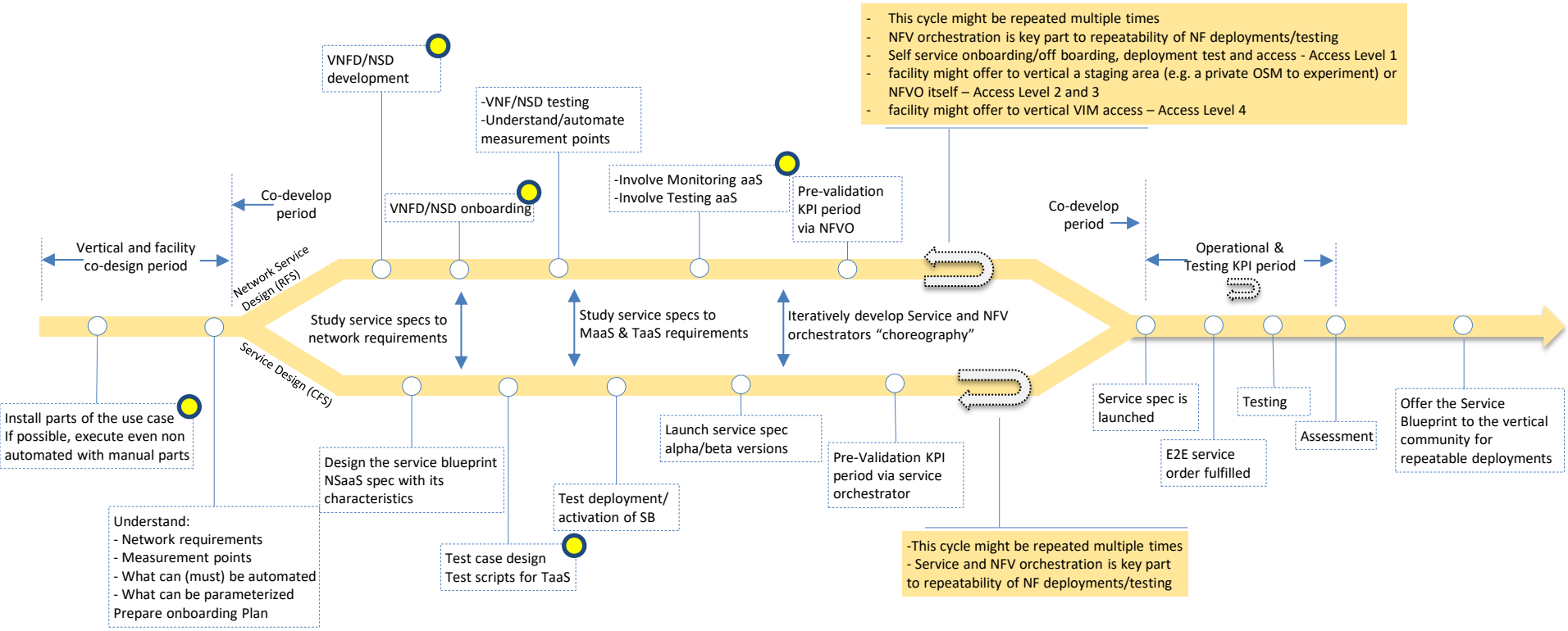
5G-VINNI-SB Template – Model diagram

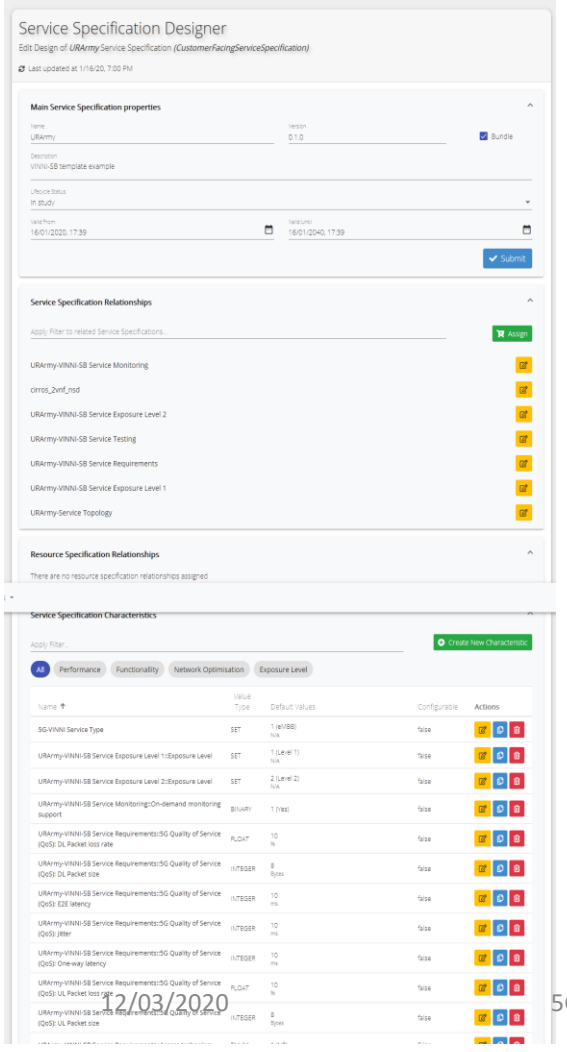


Parameters for service requirements specifications

Group	Parameter Name	Parameter ID
Performance	Peak data rate	P.PERF_1
	User data rate	P.PERF_2
	Area traffic density	P.PERF_3
	5G QoS	P.PERF_4
	Reliability	P.PERF_5
	Availability	P.PERF_6
	Service deployment time	P.PERF_7
Functionality	Deployment option	P.FUNC_1
	Access technology	P.FUNC_2
	Predominant device type	P.FUNC_3
	Radio spectrum	P.FUNC_4
	Isolation	P.FUNC_5
	Support for value-added functionality	P.FUNC_6
	3rd party VNF hosting	P.FUNC_7
	Positioning	P.FUNC_8
Network Optimisation	Number of devices	P.NO_1
	Device density	P.NO_2
	Coverage profile	P.NO_3
	Mobility profile	P.NO_4
	Service lifetime	P.NO_5

The onboarding and testing process





http://openslice.io

Openslice is a prototype open source, operations support system. It supports VNF/NSD onboarding to OpenSourceMANO (OSM) and NSD deployment management. It also supports TMFORUM OpenAPIs regarding Service Catalog Management, Ordering, Resource, etc.

Demo

- Openslice demo: http://portal.openslice.io/
- Openslice Service Catalogues and ordering: http://portal.openslice.io/services/

Video demo

- https://youtu.be/KU8JPDFFl9A

Supported APIs

For a quick access check our swagger links:

- TMF APIs: http://portal.openslice.io/tmf-api/swagger-ui.html
- API for VNF/NSD management: http://portal.openslice.io/osapi/swagger-ui.html

Andrea F. Cattoni

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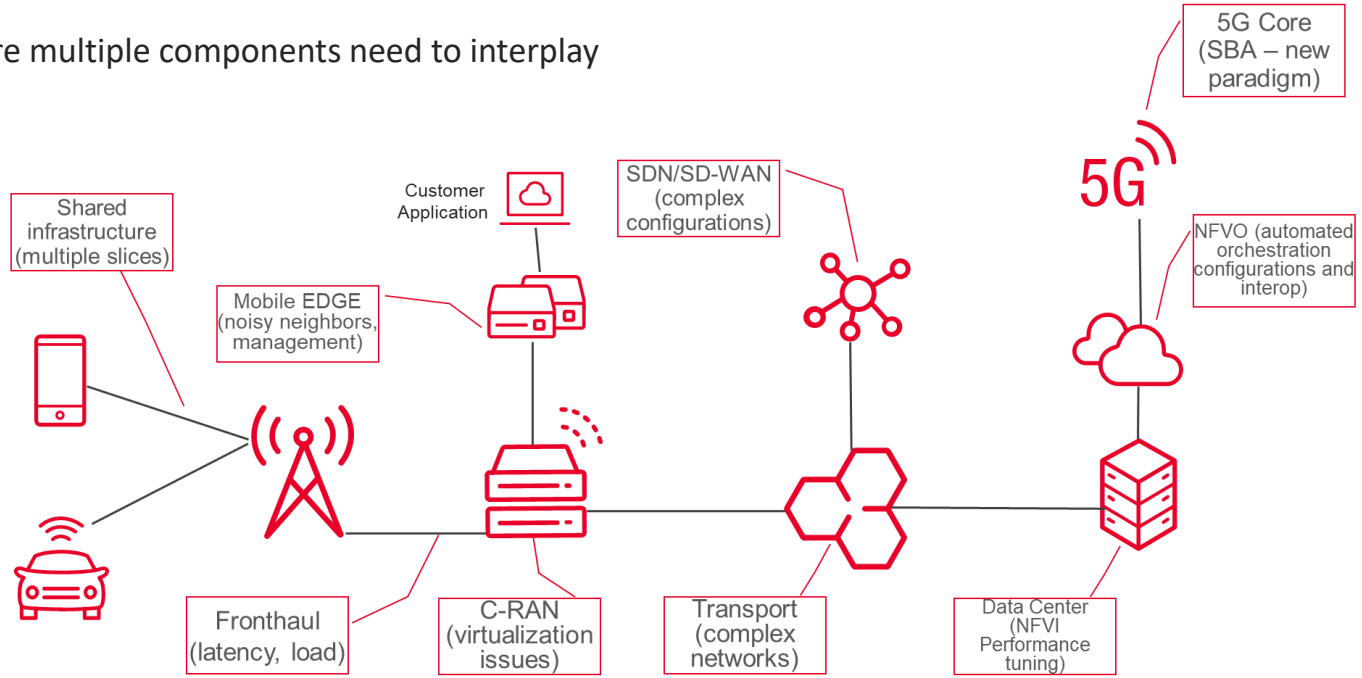
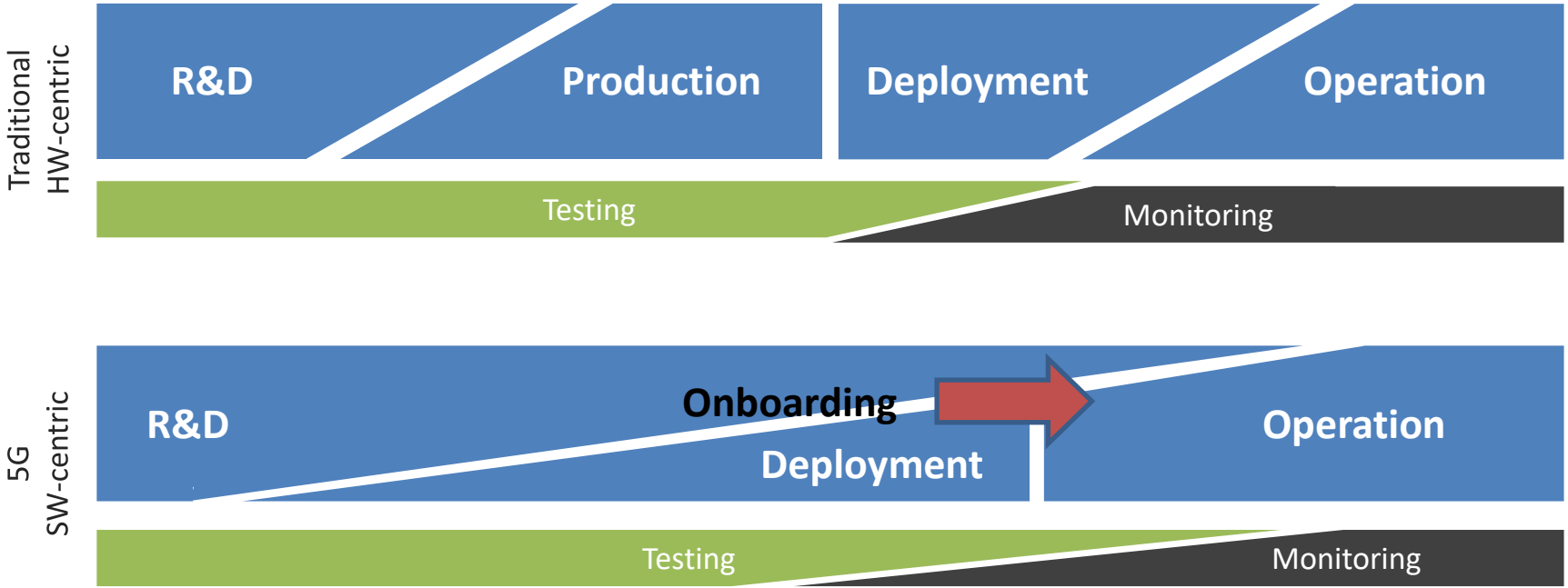
TESTING / MONITORING AS A SERVICE (TAAS/MAAS)

What can possibly go wrong?

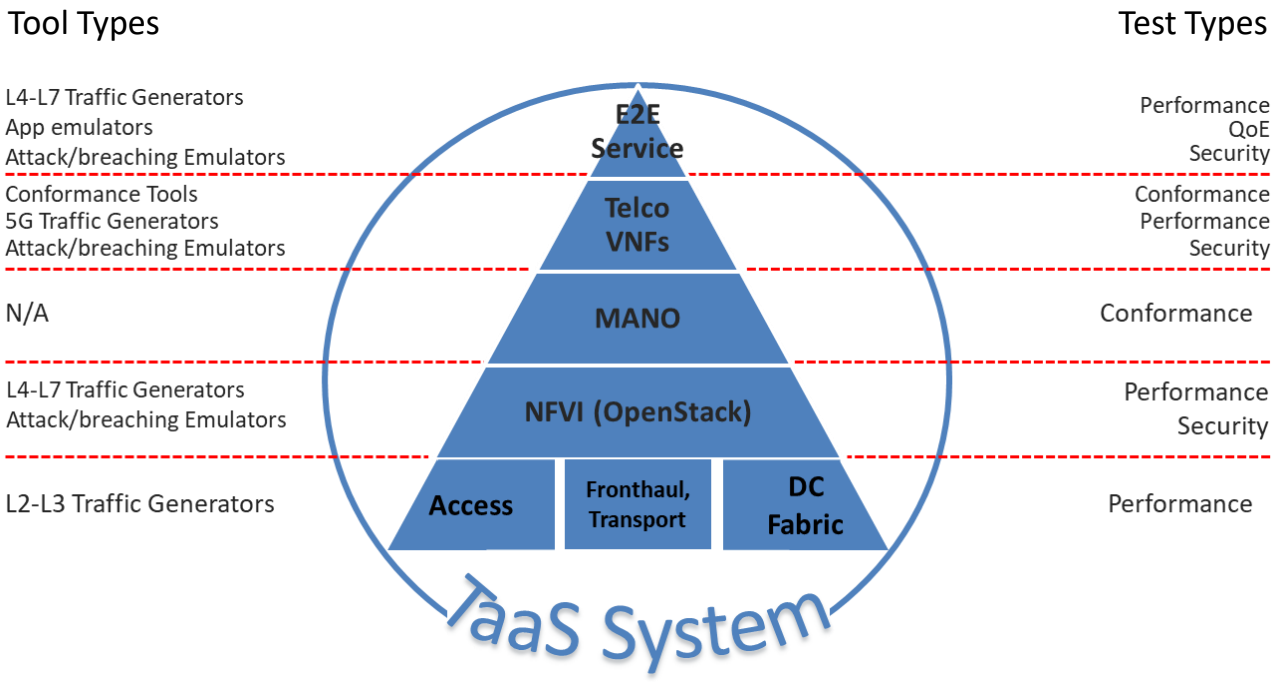
5G is a complex system where multiple components need to interplay



Product Lifecycles and Testing Stages in Networks



One Ring to Rule Them All…

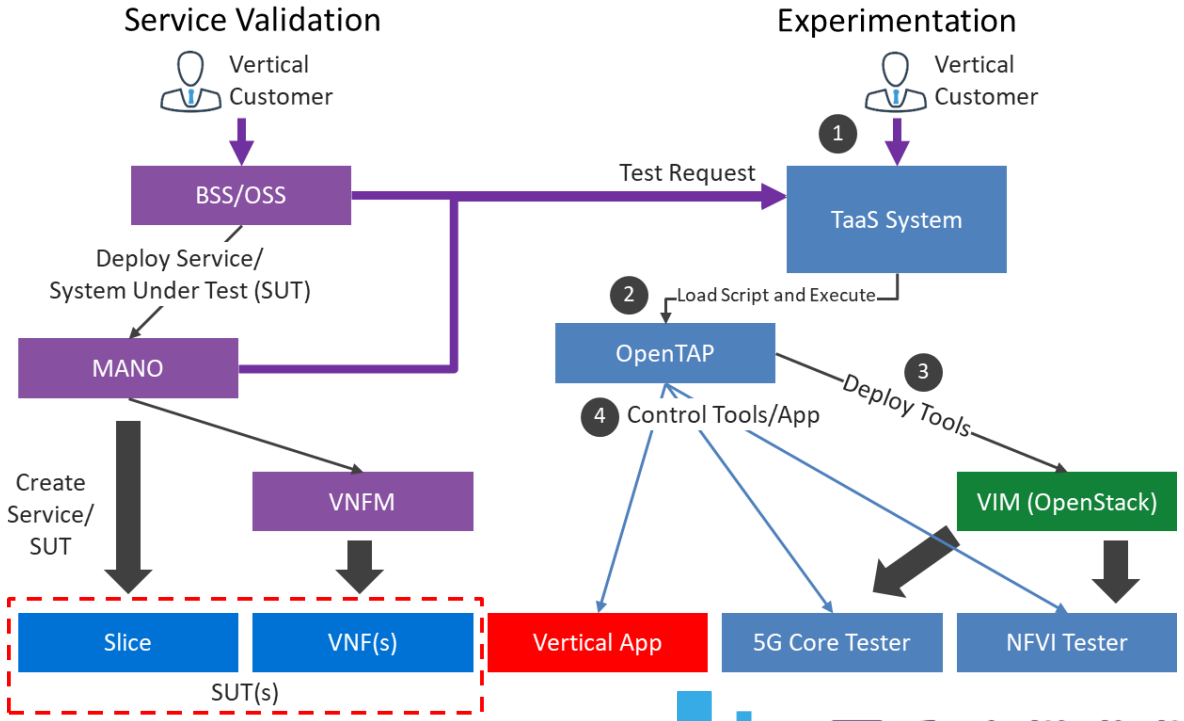


*from 5G PPP Test, Measurement, and KPIs Validation WG White Paper

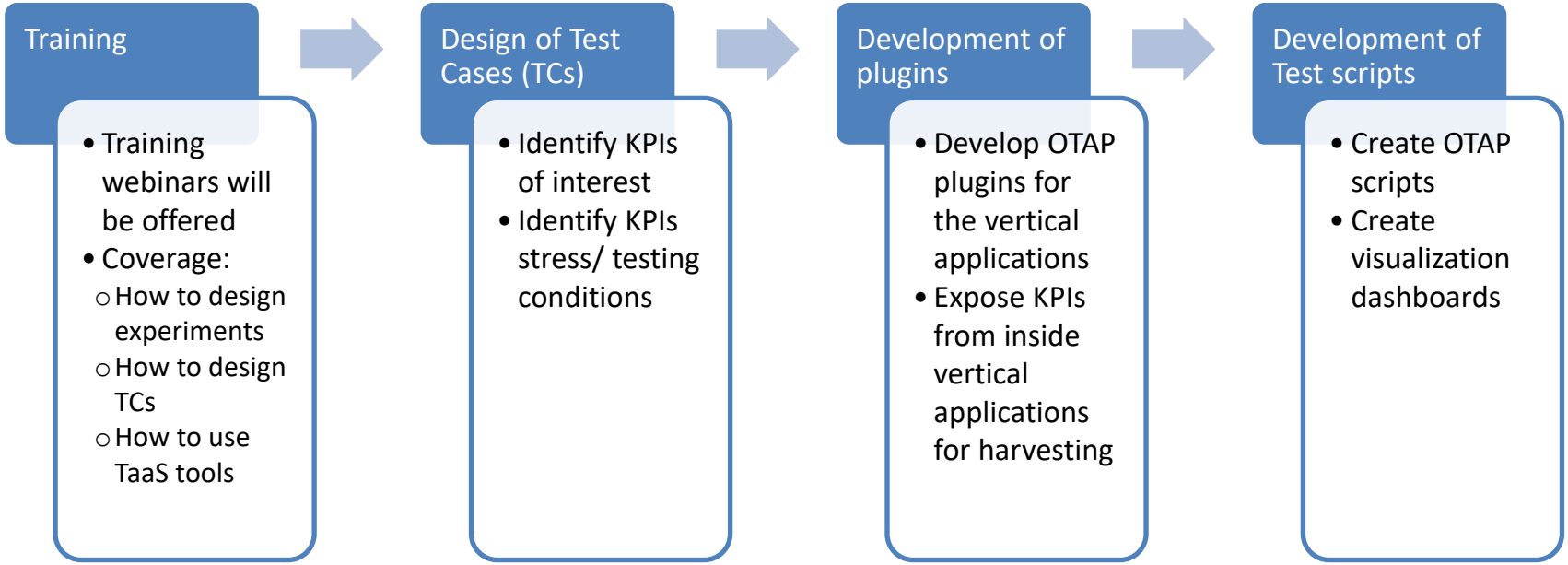
- Testing-as-a-Service (TaaS) is de-facto an implementation of the 5G TestOps
- TaaS is a way to unify the testing functionalities for 5G
- It provides a one-stop-shop for testing service for both CI/CD applications and users
- Test Automation is the keystone of TaaS

Example of TaaS Consumption

1. Tests are requested
2. Test scripts (TC) present in the TaaS repository are loaded and executed on OpenTAP
3. OpenTAP deploys tools e.g. in an OpenStack cloud
4. OpenTAP configures the tools to target the newly deployed service



TaaS Onboarding Process

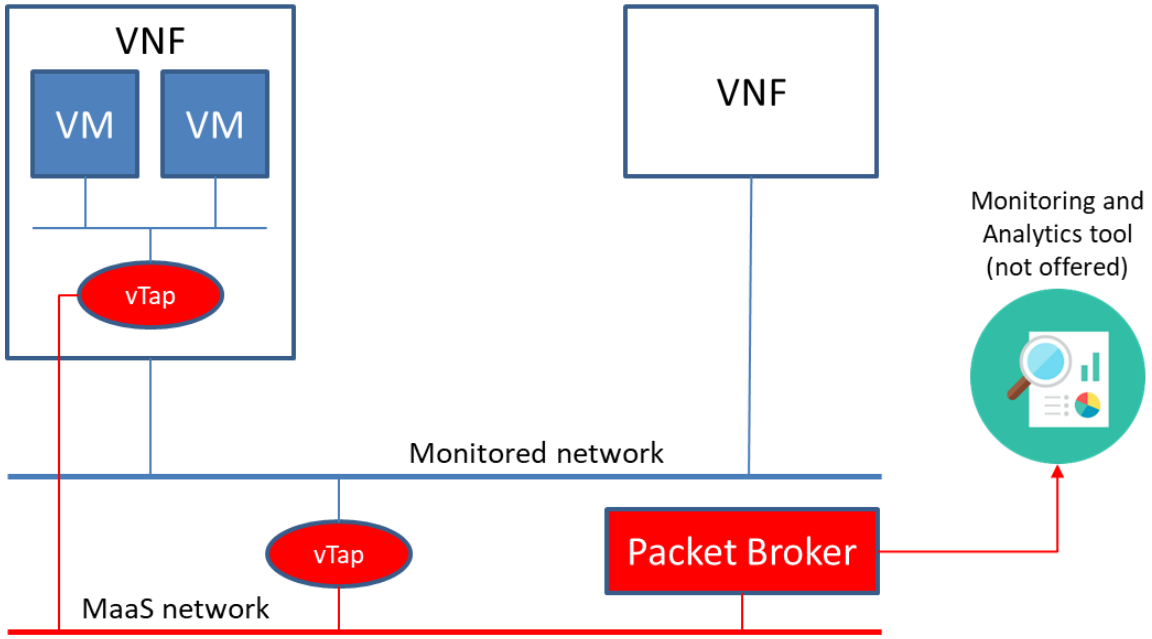


Monitoring as a Service (MaaS)

- MaaS is targeted at having a constant overview of the health and performance of the system
- It consists of two main categories of services: **Network Monitoring** and **Telemetry**
  - **a)** **Network Monitoring** (or visibility) is the traditional overview of the traffic flowing across the network, in particular emphasizing the visibility in specific critical points in the network
  - **b)** **Telemetry** is focused on providing the health and performance of the individual Network Service or VNFs/application components
- The two categories are very different despite being offered under the same umbrella of MaaS

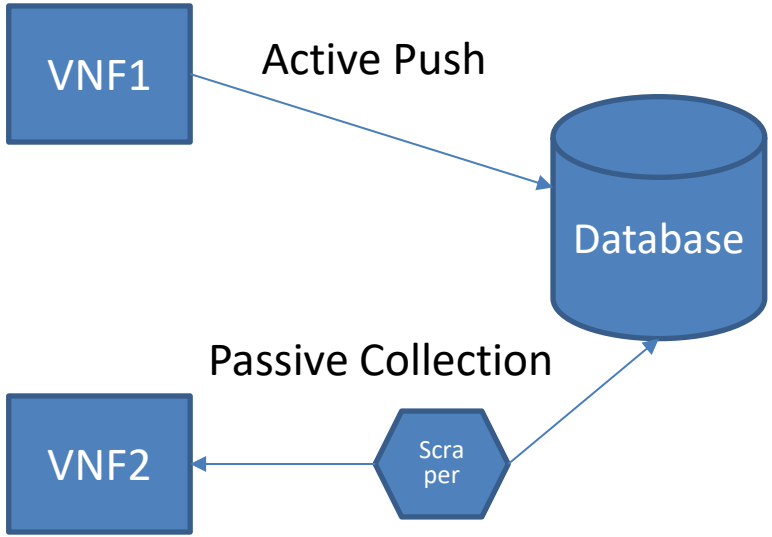
Network Monitoring/Visibility

- Virtual network taps can be deployed in specific points of the network, as described by the NSD
- The network taps are capable of sniffing (north-south and east-west) traffic, simple filtering, and re-routing the traffic to a specific destination.
- Destination can be an analysis tool (not provided by 5G-VINNI) or a packet broker.
- The packet broker is capable of more advanced filtering, aggregation, and re-routing options to either an analysis tool (not provided by 5G-VINNI) or a traffic recording server



Telemetry

- The typical example is a VNF that exposes metrics.
- Metrics can be either actively pushed, or passively collected, in order to be stored in a database, as e.g. a Prometheus time series one.
- This is common practice in modern virtualized solutions, and the 5G network is no exception.
- Telemetry can be effectively used for:
  - exposing health metrics
  - exposing performance metrics (e.g. network buffers status)
  - exposing directly measured KPIs



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KEY PERFORMANCE INDICATORS

Initial KPIs validation results

Category	KPIs	Achieved Values	Description
E2E Network Performance	UL Maximum Throughput (Mbit/s)	104.27 Mbit/s	mmWave, 27.3-27.5 GHz, 4T4R, 1 stream
	DL Maximum Throughput (Mbit/s)	883.69 Mbit/s	mmWave, 27.3-27.5 GHz, 4T4R, 40 streams.
	UL Latency (ms)	13.77 ms	3.6GHz, low foot-print traffic profile with 100Kbit/s bandwidth.
	DL Latency (ms)	9.15 ms	
	UL Jitter (ms)	1.01 ms	mmWave, 27.3-27.5 GHz, 4T4R, low foot-print traffic profile with 100Kbit/s bandwidth.
	DL Jitter (ms)	0 ms	
	UL Frame Loss (%)	0.01%	3.6GHz, low foot-print traffic profile with 100Kbit/s bandwidth.
	DL Frame Loss (%)	0%	
NFVI Network Performance	Maximum Throughput (0 Frame Loss)	4.573 Gbit/s	two compute nodes, DPDK was configured in the test environment.
	Latency between VMs	0.067 ms	
NFVI Compute Resource Performance	CPU Benchmarking Score	3,510	Yardstick CPU/Memory/Storage tests.
	Memory Read Latency	7.97 ns	
	Memory r/w Bandwidth	25.641 GB/s	
	Storage r/w IOPS	5.65 k / 4.21 k	
	Storage r/w Latency	188 / 621 ms	
	Storage r/w Bandwidth	1,018 / 425 MB/s	

5G-VINNI project and facility sites contacts

- Web page: http://www.5g-vinni.eu/
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