

Multi-Layer Modular Business Models for 5G

Work in progress by
5G-VINNI (5G Verticals Innovation Infrastructure)

Work in progress!

TM Forum Action Week

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Key Points

- Telcos are lacking critical capabilities and offerings to allow and enable innovation in value added application services
- Value Added Connectivity on Demand (VAC) as a general service and “5G business model enablement layer” will allow innovation and growth across all verticals

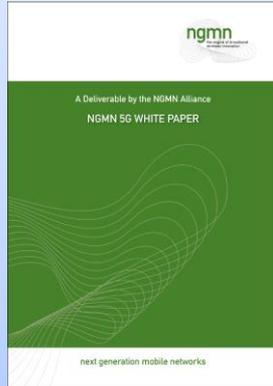
→ **Objective:**

Identify relevant concepts and scenarios to help drive the high-level requirement to enabling VAC and supporting business model enablers

Outline

- Telco industry shortcomings (briefly)
- Introduction to Value Added Connectivity on-Demand (VAC)
- About EU project 5G-VINNI
- Layered and Modular Business Models and Enablers
- Managed and Assured Service Quality Paths
- VAC API and supporting enablers

5G vision and numerous use cases



NGMN Alliance,
5G White Paper,
February 2015

**Broadband access
in dense areas**

**PERVASIVE
VIDEO**



**Broadband access
everywhere**

**50+ MBPS
EVERYWHERE**



**Higher user
mobility**

**HIGH SPEED
TRAIN**



**Massive Internet
of Things**

**SENSOR
NETWORKS**



**Extreme real-time
communications**

**TACTILE
INTERNET**



**Lifeline
communications**

**NATURAL
DISASTER**



**Ultra-reliable
communications**

**E-HEALTH
SERVICES**



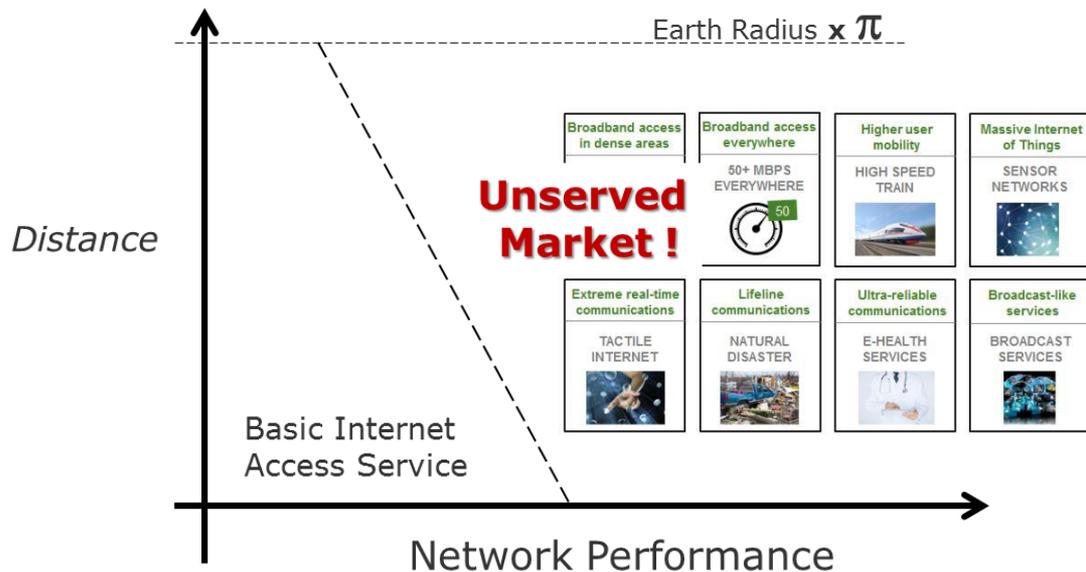
**Broadcast-like
services**

**BROADCAST
SERVICES**



However, we are facing multiple challenges

→ High level of uncertainty



Unserved Market !

Value Added Connectivity (VAC)

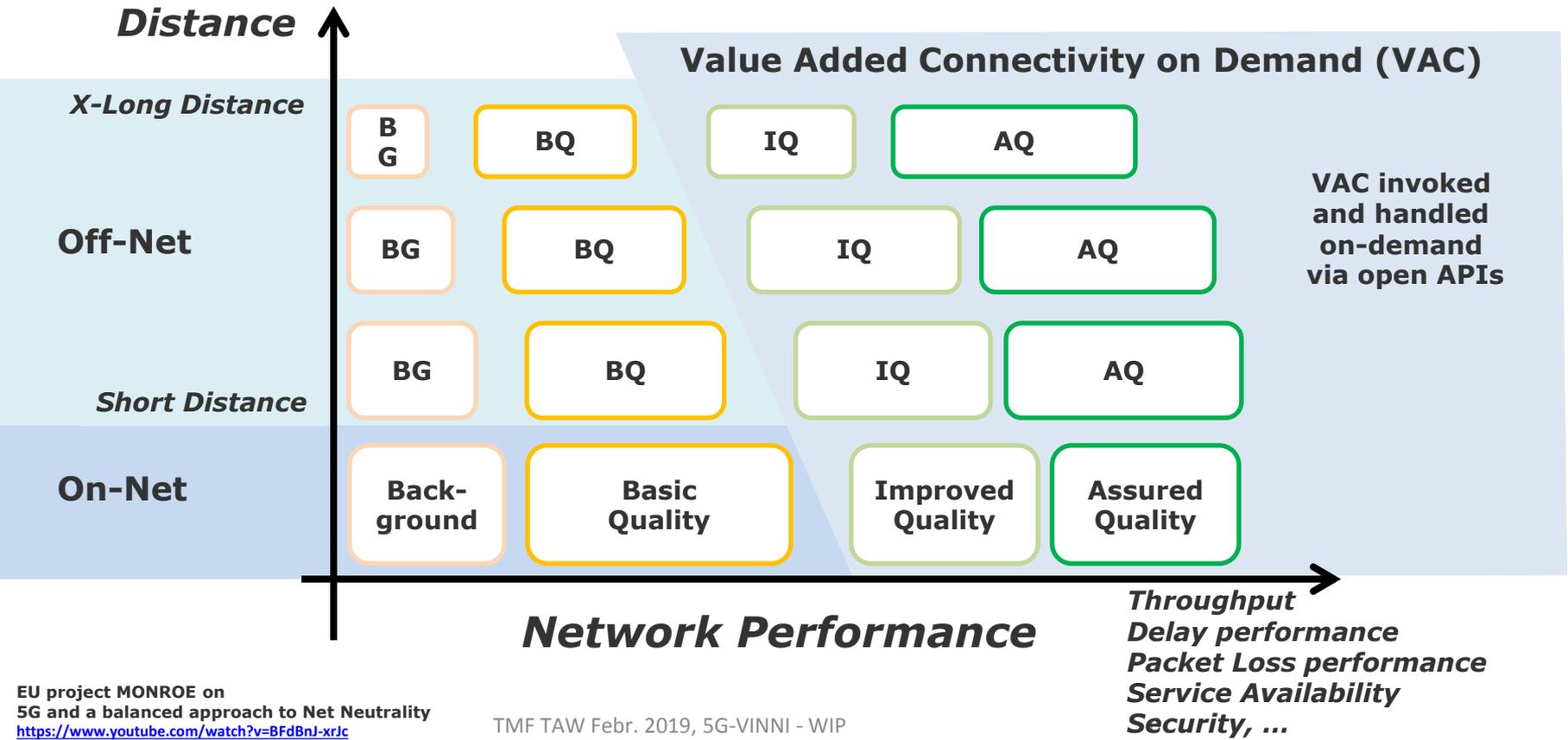
➤ Any-2-Any & On-demand

- ➔ Uncertain Demand!
- ➔ Uncertain Willingness to pay!
- ➔ Solution Uncertainty!
- ➔ Uncertainty around net neutrality!
- ➔ Opening up to disruptions?

NetWorld2020 pointing to a future direction

<https://ec.europa.eu/futurium/en/blog/principles-and-potentials-evolved-internet-ecosystem-0>

Value Added Connectivity on-Demand (VAC) will enable a plethora of “Specialized Application Services”



EU project MONROE on 5G and a balanced approach to Net Neutrality <https://www.youtube.com/watch?v=BFdBnJ-xrJc>

Today: Two (?) dominating value stacks

Actor Role			
Online Application SP (OAP)			
Communication SP (CSP)			
Network SP (NSP)			

Today: Two (?) dominating value stacks

Actor Role	Basic Quality (any-2-any) value stack		VPN (site-2-site) value stack
Online Application SP (OAP)			
Communication SP (CSP)			
Network SP (NSP)			

Today: Two (?) dominating value stacks

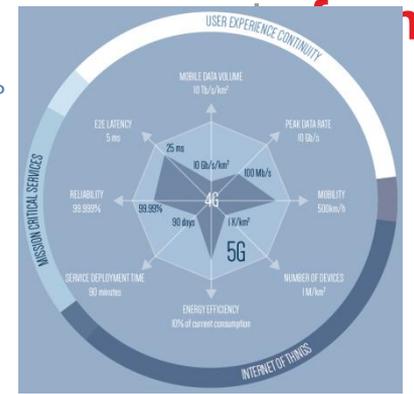
Actor Role	Basic Quality (any-2-any) value stack	What is missing?	VPN (site-2-site) value stack
Online Application SP (OAP)	Current Internet App Innovation Space		Point Solutions
Communication SP (CSP)	OTT Comm. Srv.		Point Solutions
Network SP (NSP)	Basic Internet Access Service		VPN (Access) Service

New Value Stack and Innovation space:

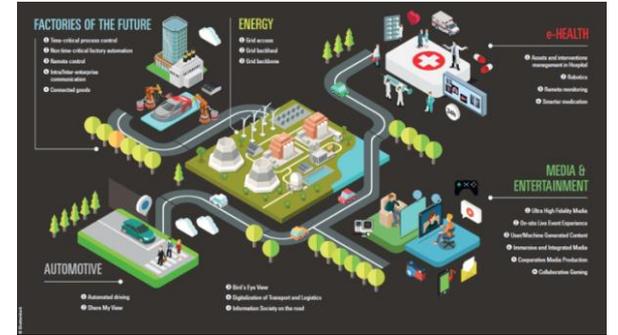
Value Added Connectivity & Value Added Application (VAA) Services

Actor Role	Basic Quality (any-2-any) value stack	VAC (any-2-any) value stack	VPN (site-2-site) value stack
Online Application SP (OAP)	Current Internet App Innovation Space	New VAA Innovation space	Point Solutions
Communication SP (CSP)	OTT Comm. Srv.	VAC on-Demand Services	Point Solutions
Network SP (NSP)	Basic Internet Access Service	VAC Access Service	VPN (Access) Service

5G-VINNI (5G Verticals INNOvation Infrastructure)

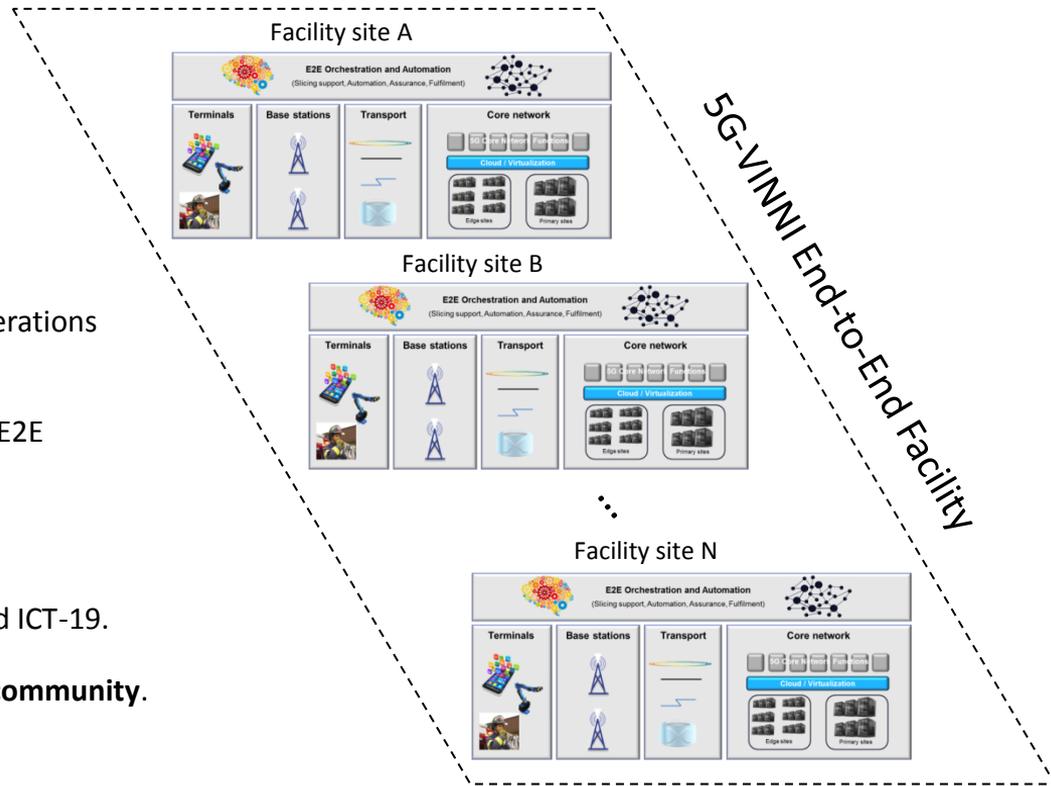


- Build an open large scale 5G End-to-End facility that can
 - demonstrate that key 5G network KPIs can be met
 - be validated, accessed and used by vertical industries (e.g. in ICT-19 projects) to test use cases and validate 5G KPIs.
- Duration: 1.July 2018 – 1.July 2021
- Consortium: 23 partners (operators,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



Key objectives of 5G-VINNI

1. Design an advanced and accessible 5G end to end facility for verticals and ICT-19.
2. Build several **interworking** sites of the 5G-VINNI end to end facility.
3. Provide user friendly **ze-torough orchestration**, operations and management systems for the 5G-VINNI facility.
4. **Validate the 5G KPIs** and support the execution of E2E trial of vertical use cases for ICT-19 projects.
5. Develop a viable **business and ecosystem model** to support the life of the 5G-VINNI facility during and beyond the span of the project for verticals and ICT-19.
6. **Demonstrate the value of 5G solutions to the 5G community.**



5G-VINNI Facility Sites

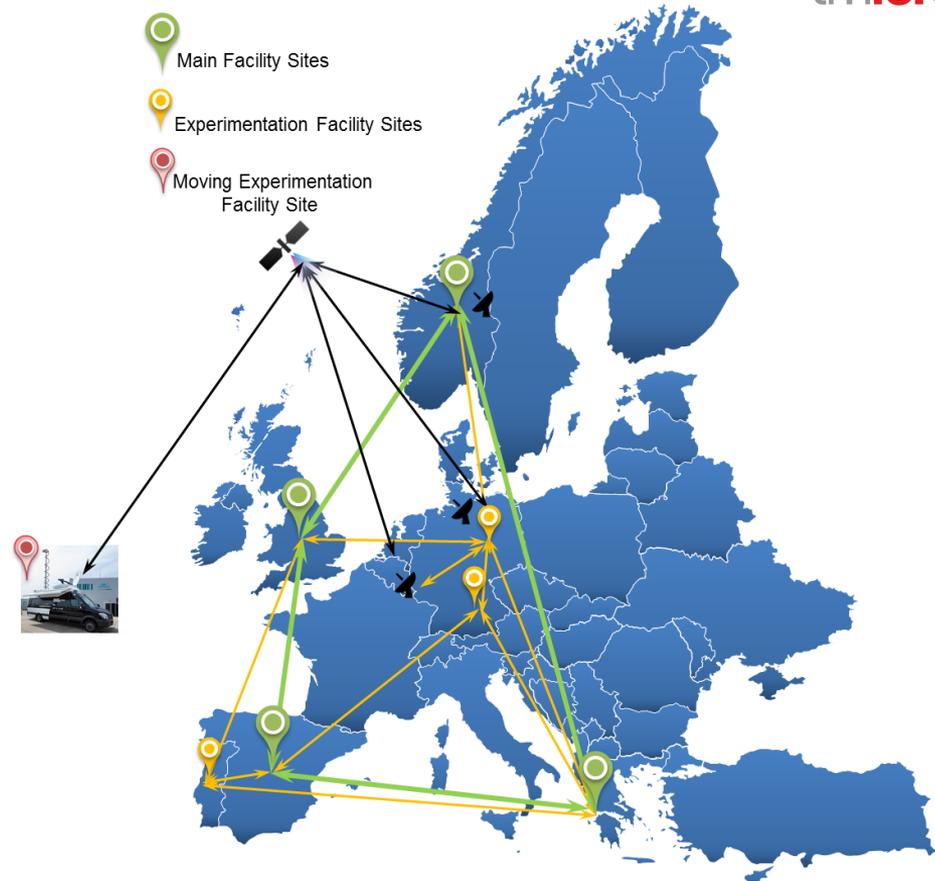
Main Facility sites: E2E 5G-VINNI facility that offers services to ICT-18-19-22 projects with well-defined Service Level Agreements.

- Norway (Oslo, Kongsberg)
- UK (Martlesham)
- Spain (Madrid)
- Greece (Patras)

Experimentation Facility sites: provide environments for advanced focused experimentation and testing possibilities on elements and combinations of elements of the E2E model.

- Portugal (Aveiro)
- Germany (Berlin)
- Germany (Munich)

Moving Experimentation Facility site: satellite connected vehicle.



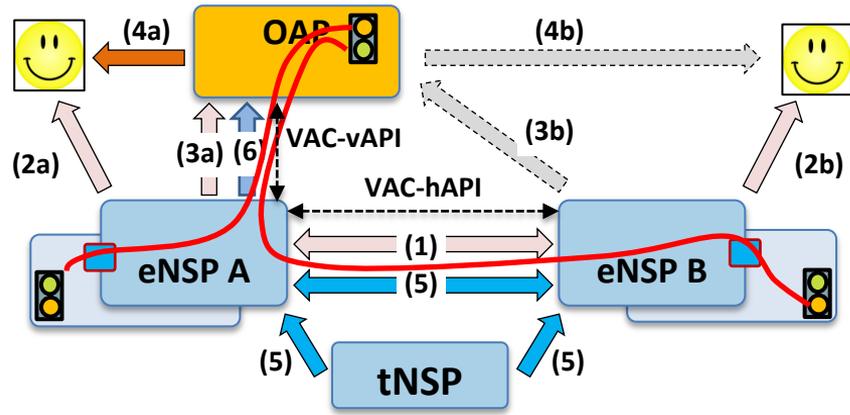
The target: Multi-layer Modular Business Model Innovation tmforum

➔ Incentive compatible; Open APIs; Decoupled Chargeable Events

 Connectivity End-Point (Source; Sink)

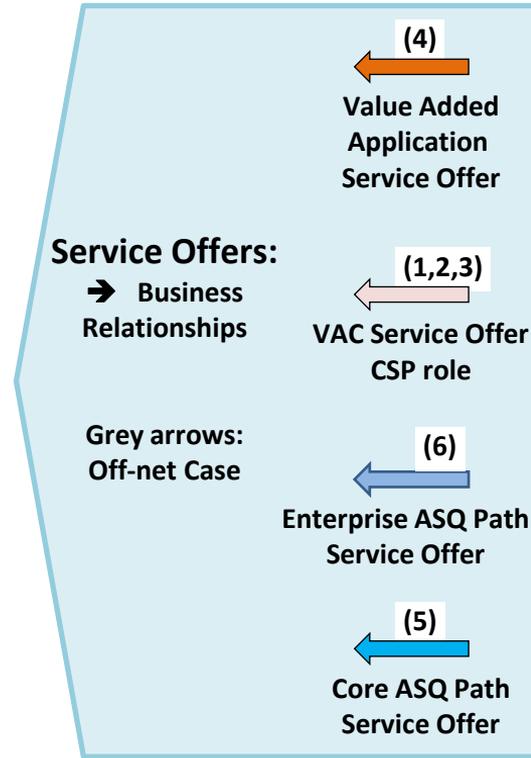
VAC-vAPI
Vertical API
➔ CSP-2-OAP

VAC-hAPI
Horizontal API
➔ CSP-2-CSP

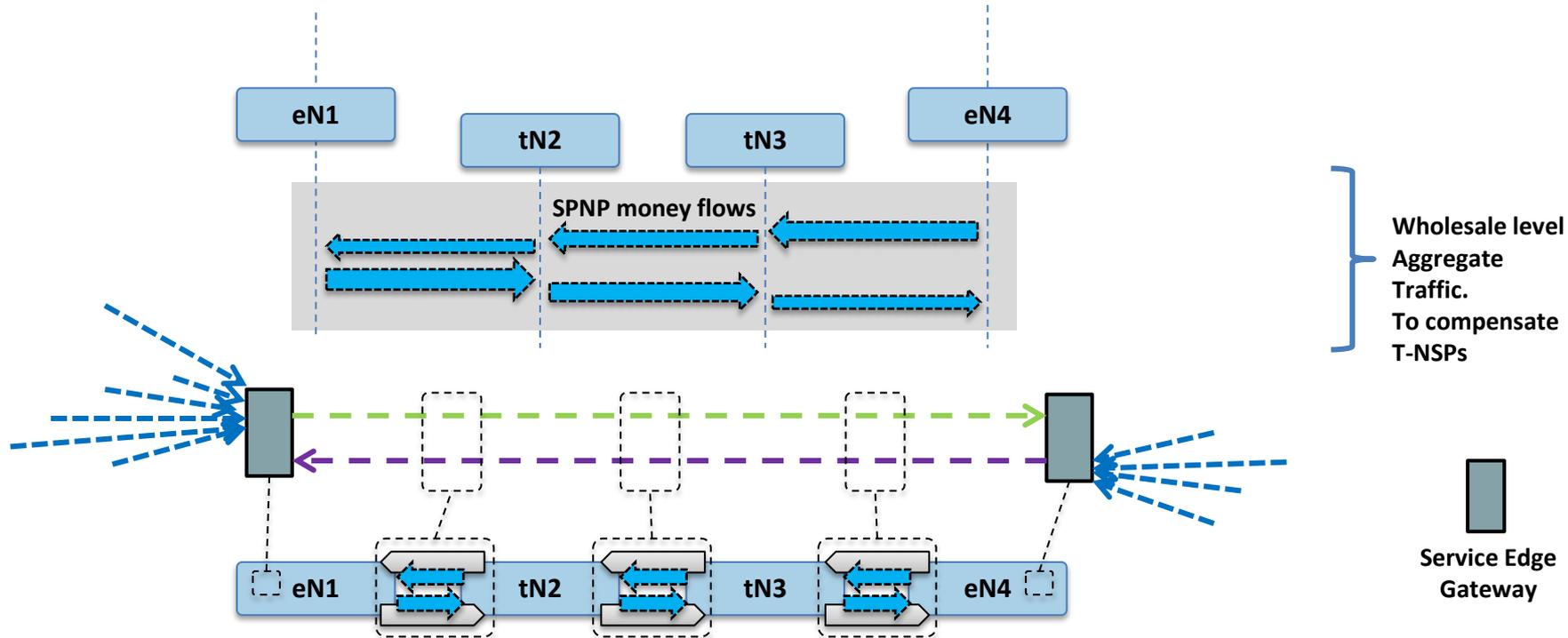


VAC end-2-end service ➔
 1) VAC edge segment (flow) steered on top of
 2) Managed Quality Path (MSQ) Infrastructure

VAC = Value Added Connectivity
 OAP = Online Application service Provider
 NSP = Network Service Provider
 eNSP = edge NPS
 tNSP = transit (backbone) NSP
 ASQ = Assured Service Quality (Path)

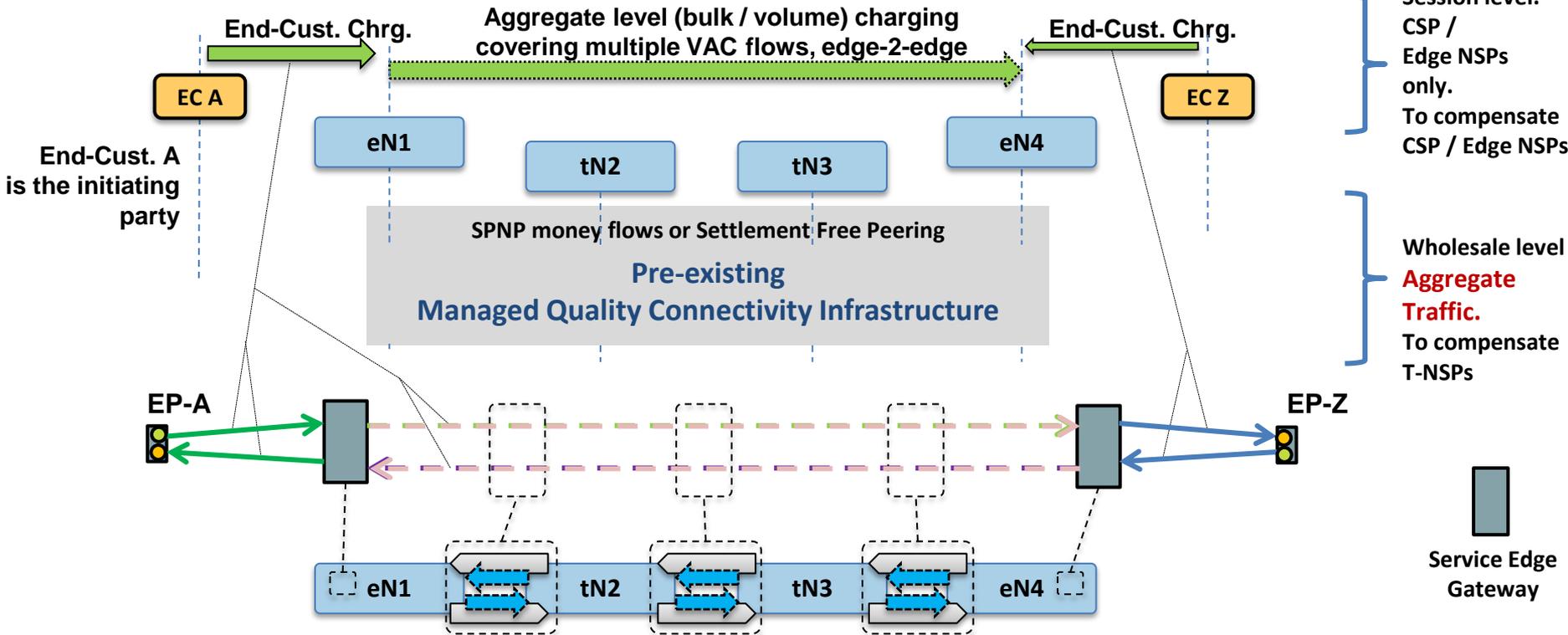


Send Party Network Pays (SPNP) charging principle



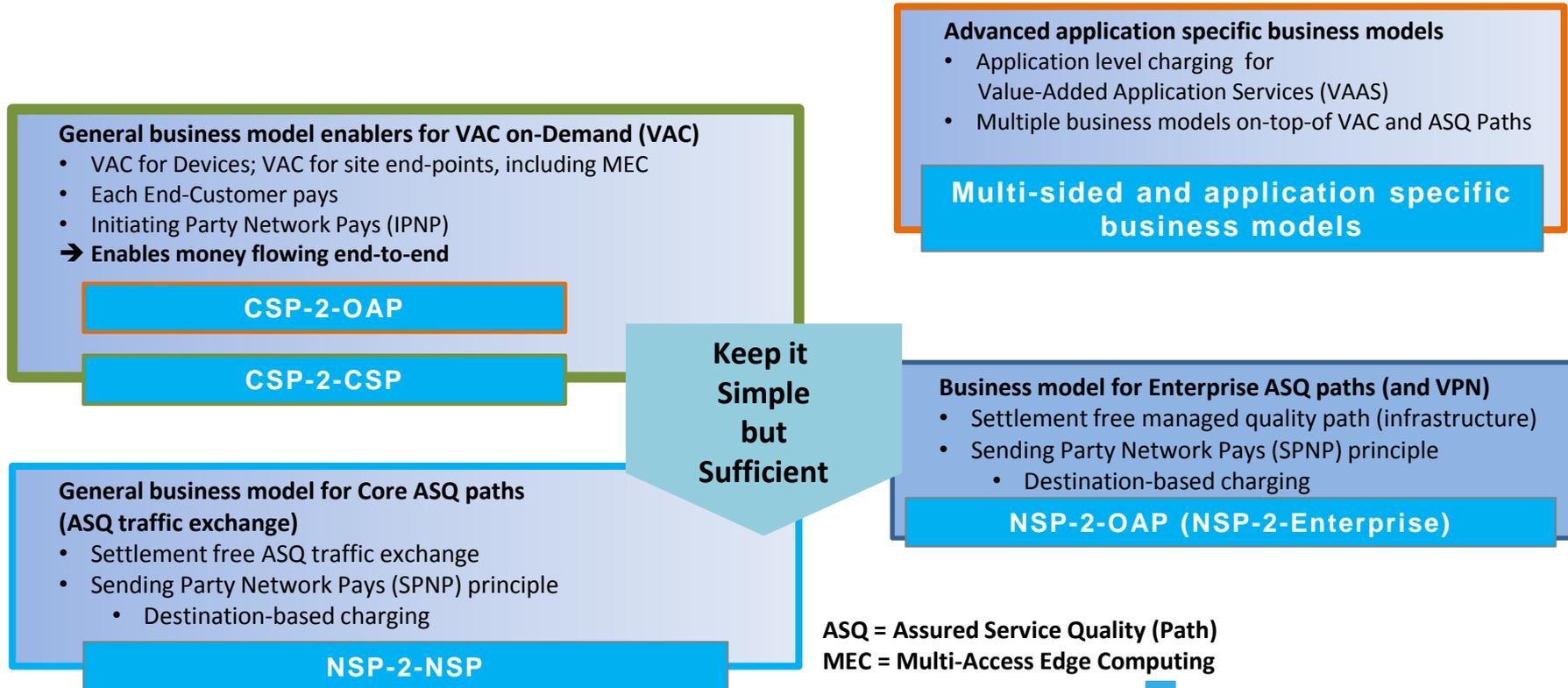
VAC Charging baseline example (NSP – NSP)

Initiating Party Network Pays (IPNP)

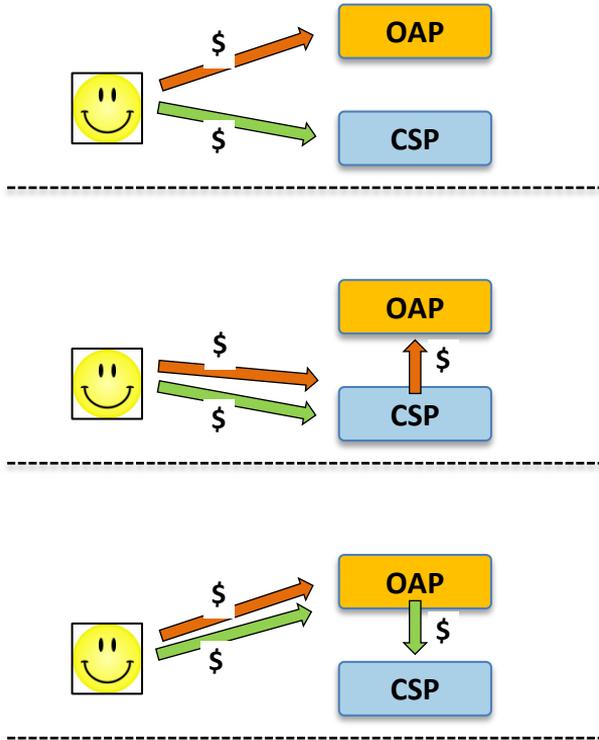


New loosely coupled Business Models (Enablers) are needed tmforum

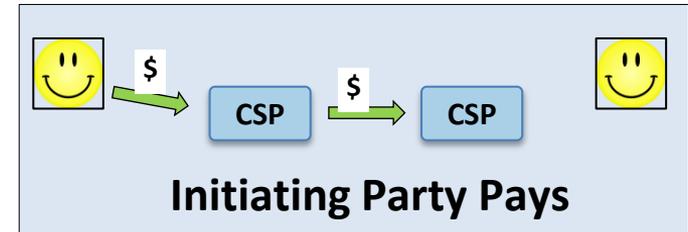
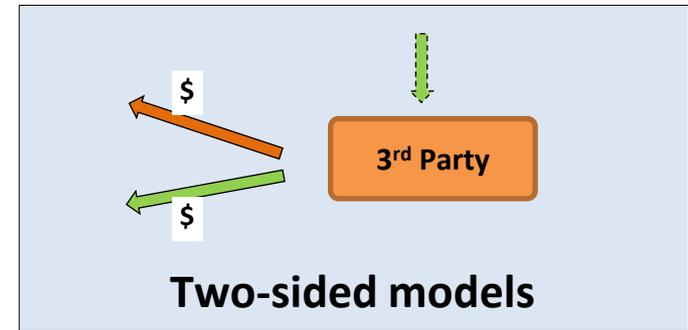
→ Some principles for a layered and modular approach



End-Customer is paying to



Consider also



Managed Quality Paths – Main options

- ❑ Pol-2-Region
 - ❖ Supported by probing and monitoring services
- ❑ Assured Service Quality Paths (AQP)
 - ❖ Aggregate traffic over Multi-Service and Assured Service Quality Internetworking
- ❑ Basic Quality Paths (BQP)
 - ❖ Aggregate traffic over current best-effort Internet

Managed Quality Paths (MQP)	Singe Domain / Direct peering	Multi-Domain / Transit
AQP		
BQP		

Provider	Customer	Pol type
NSP	Enterprise	PoEI
NSP	OAP	PoDI
NSP	NSP	PoCI

NSP = Edge NSP or Transit NSP

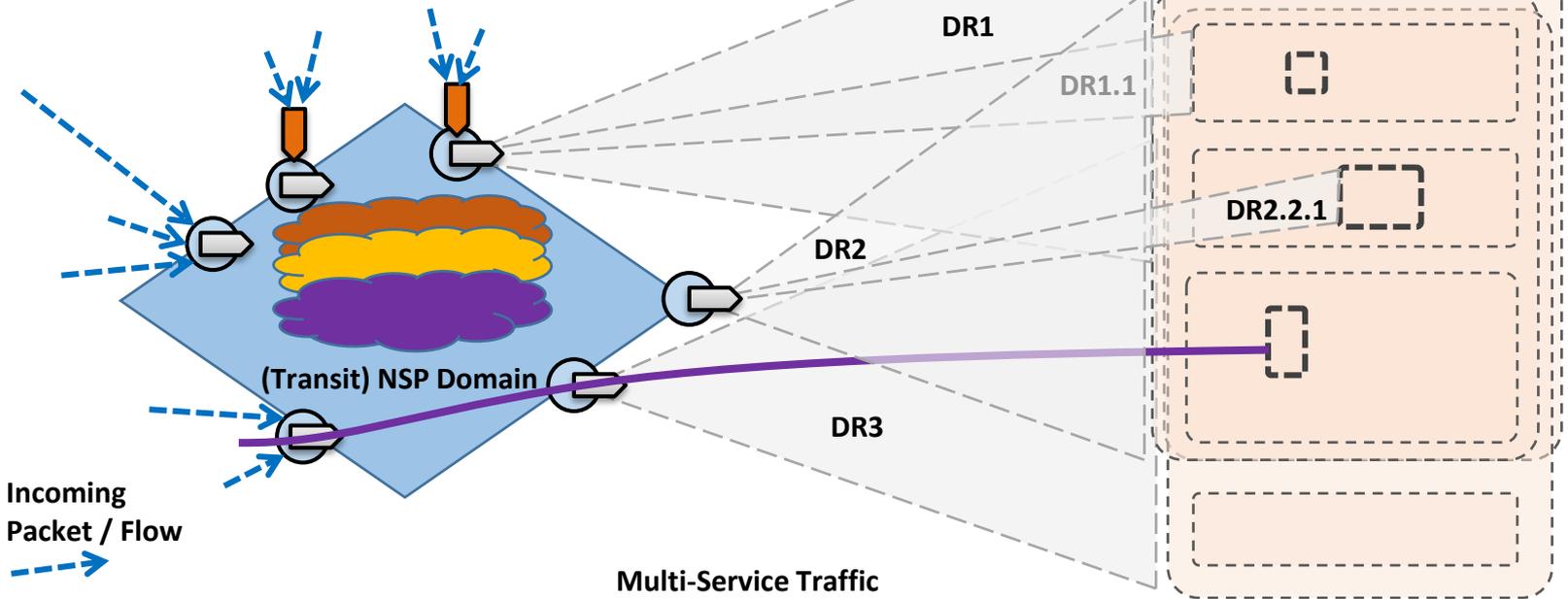
Pol = Point of Interconnect

PoEI = Point of Enterprise Interconnect at CPE or CE (Customer Edge node)

PoDI = Point of Data Centre (DC) Interconnect

PoCI = Point of Carrier Interconnect

Pol-2-Region: Many flavours of regions



Incoming Packet / Flow

ASQ VPN Tunnel (MD Stitching)

Domain internal virtual networks

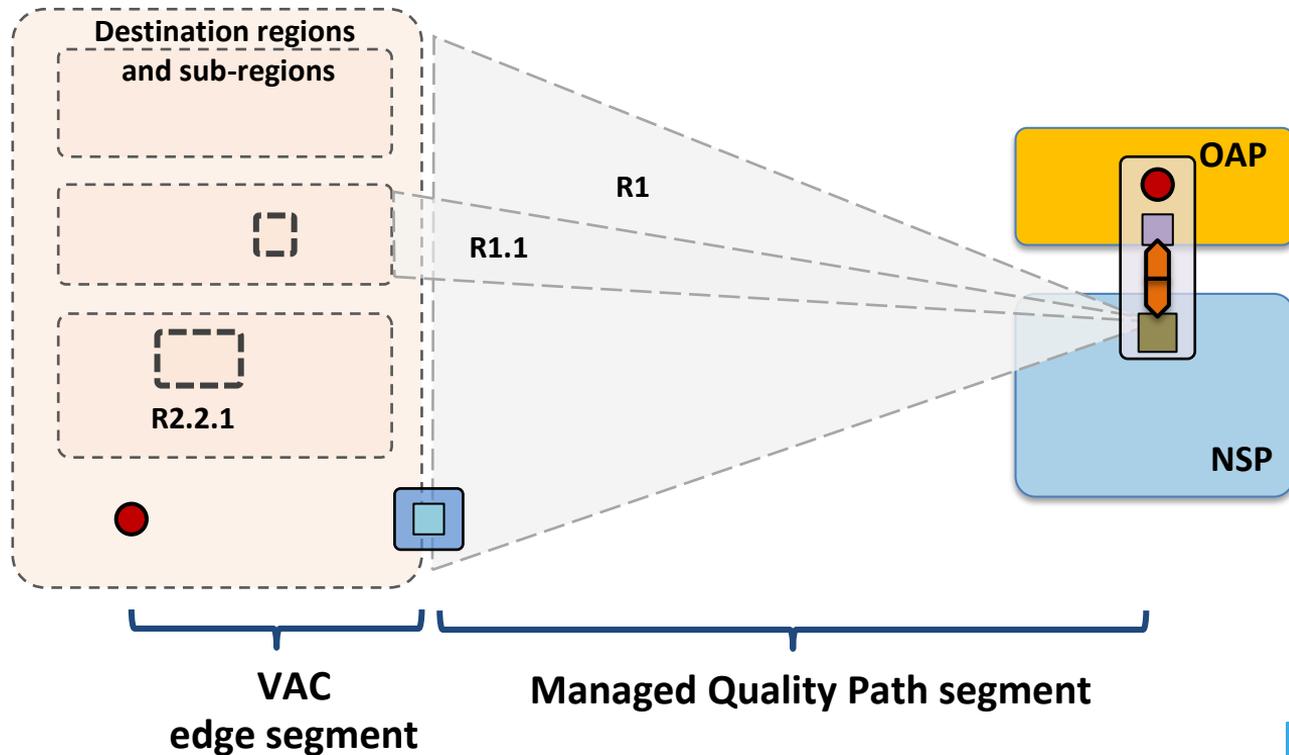
Multi-Service Traffic Exchange (MSX)

- e.g. VLANs
- ASQ path
- BE path
- VPN path

DC Region

End-to-End VAC SLA =

SLA of VAC edge segment + SLA of MQP segment



● VAC End-Point

■ DC GW

□ Backbone PoP

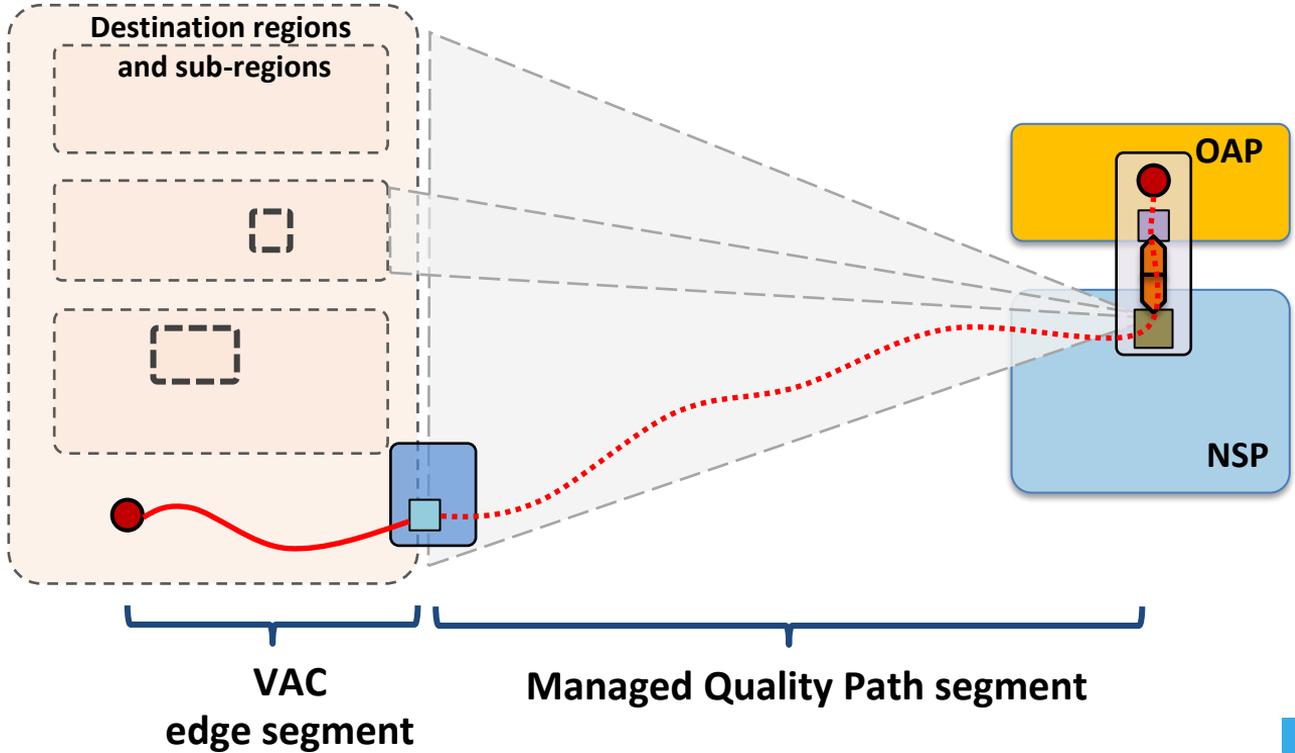
■ Backbone PE GW

■ Service Edge PoP

■ Service Edge GW (SEG)

End-to-End VAC SLA =

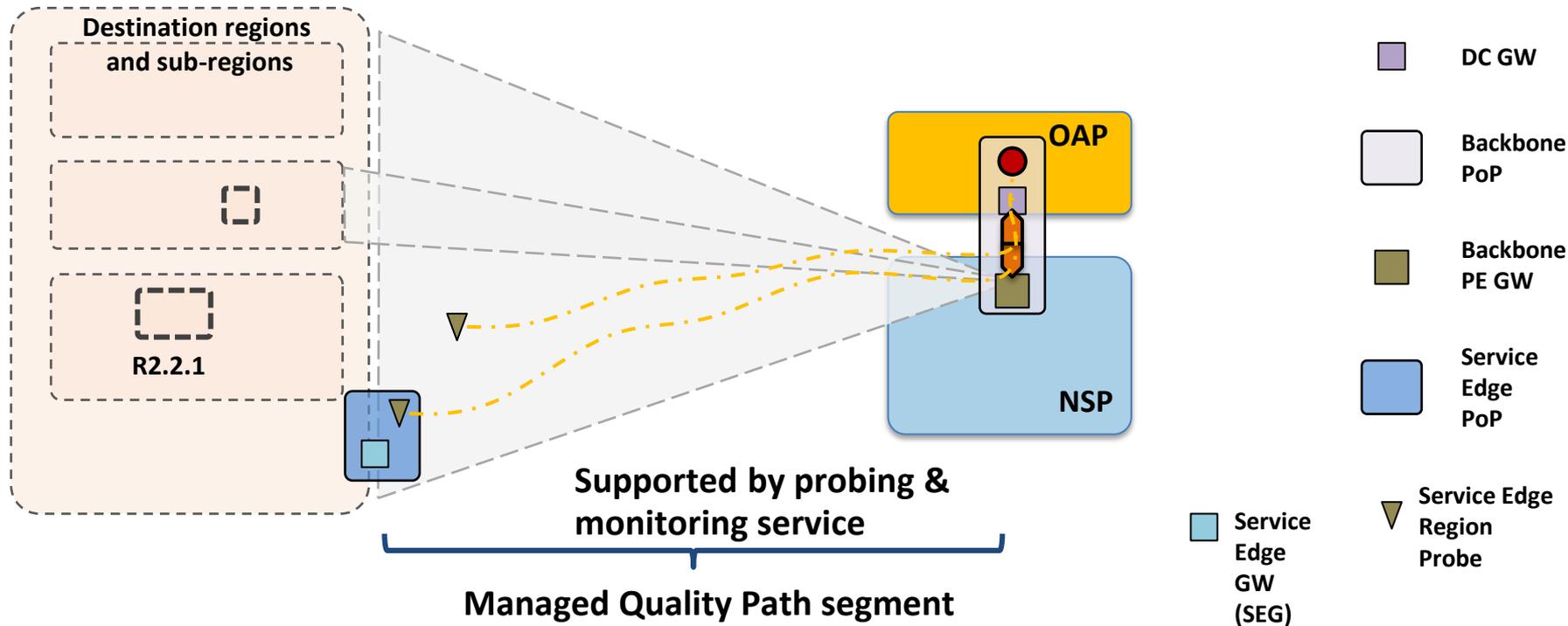
SLA of VAC edge segment + SLA of MQP segment



- VAC End-Point
- DC GW
- Backbone PoP
- Backbone PE GW
- Service Edge PoP
- Service Edge GW (SEG)
- ▽ Service Edge Region Probe

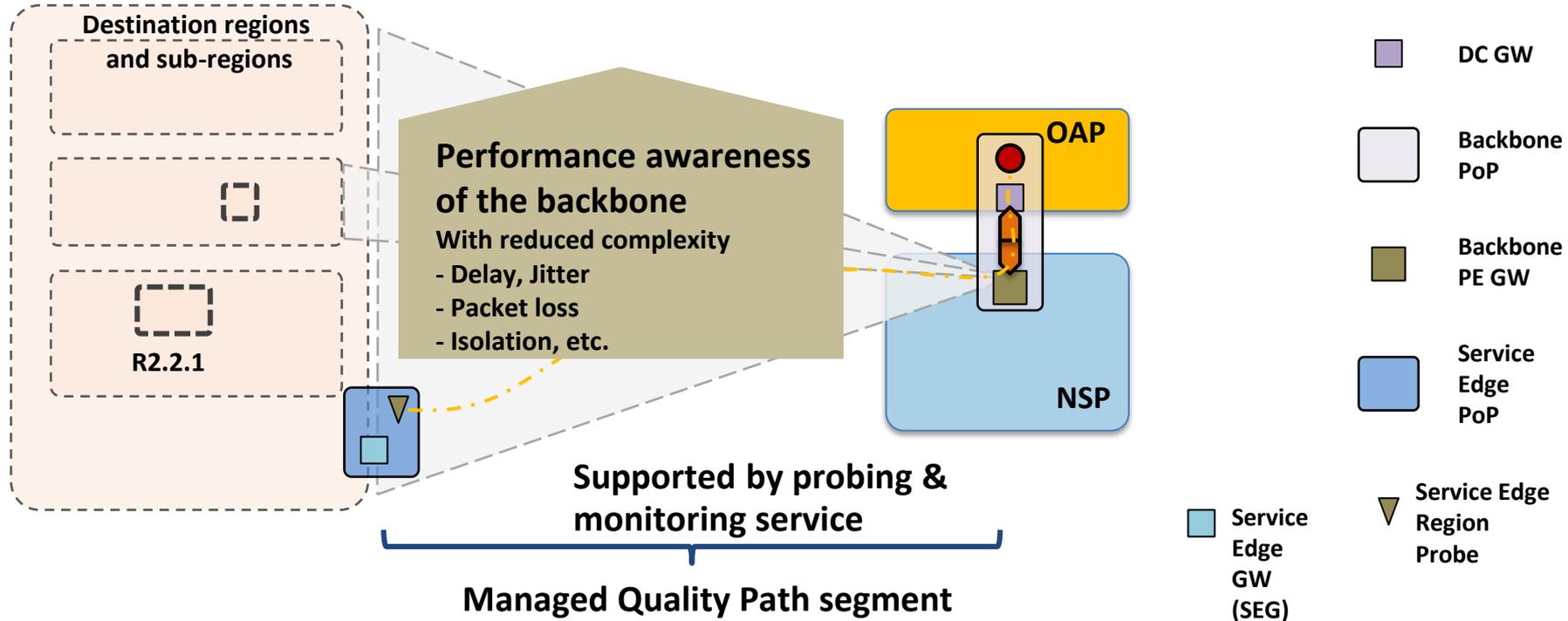
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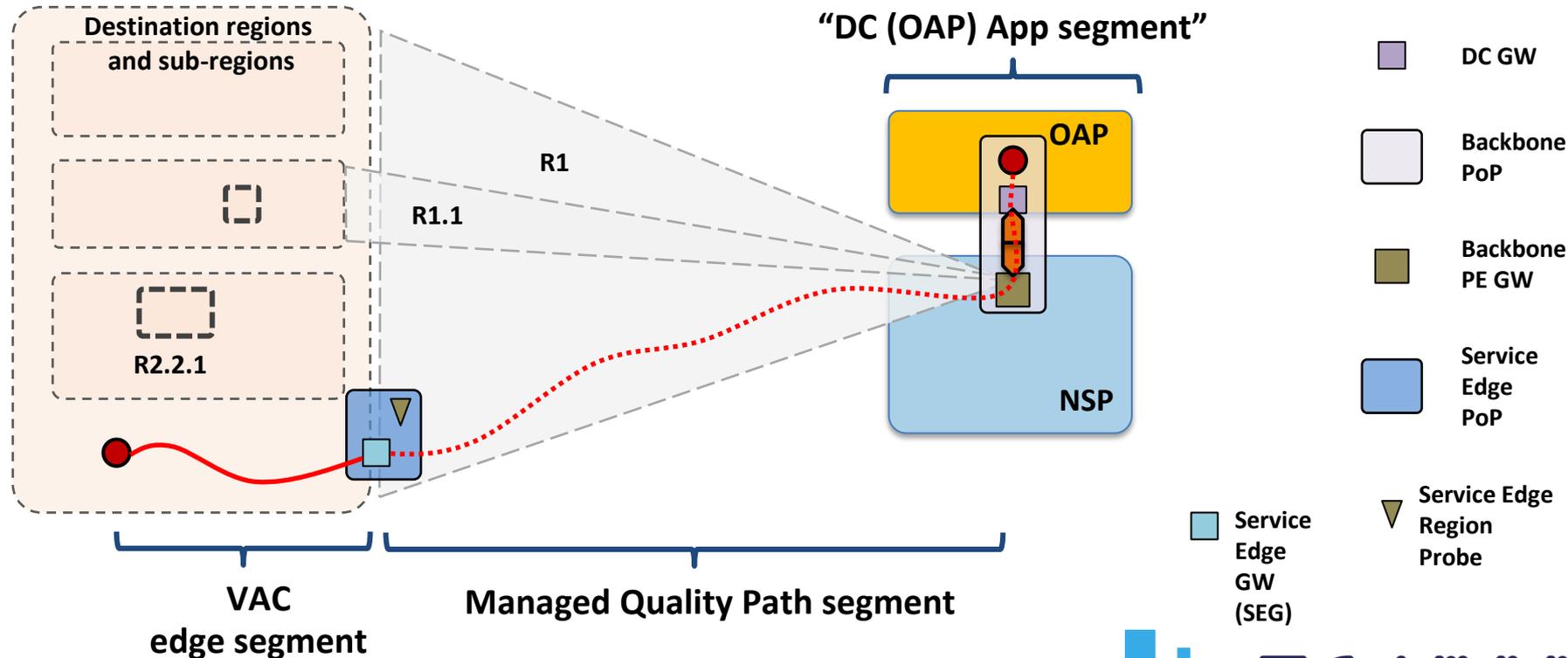
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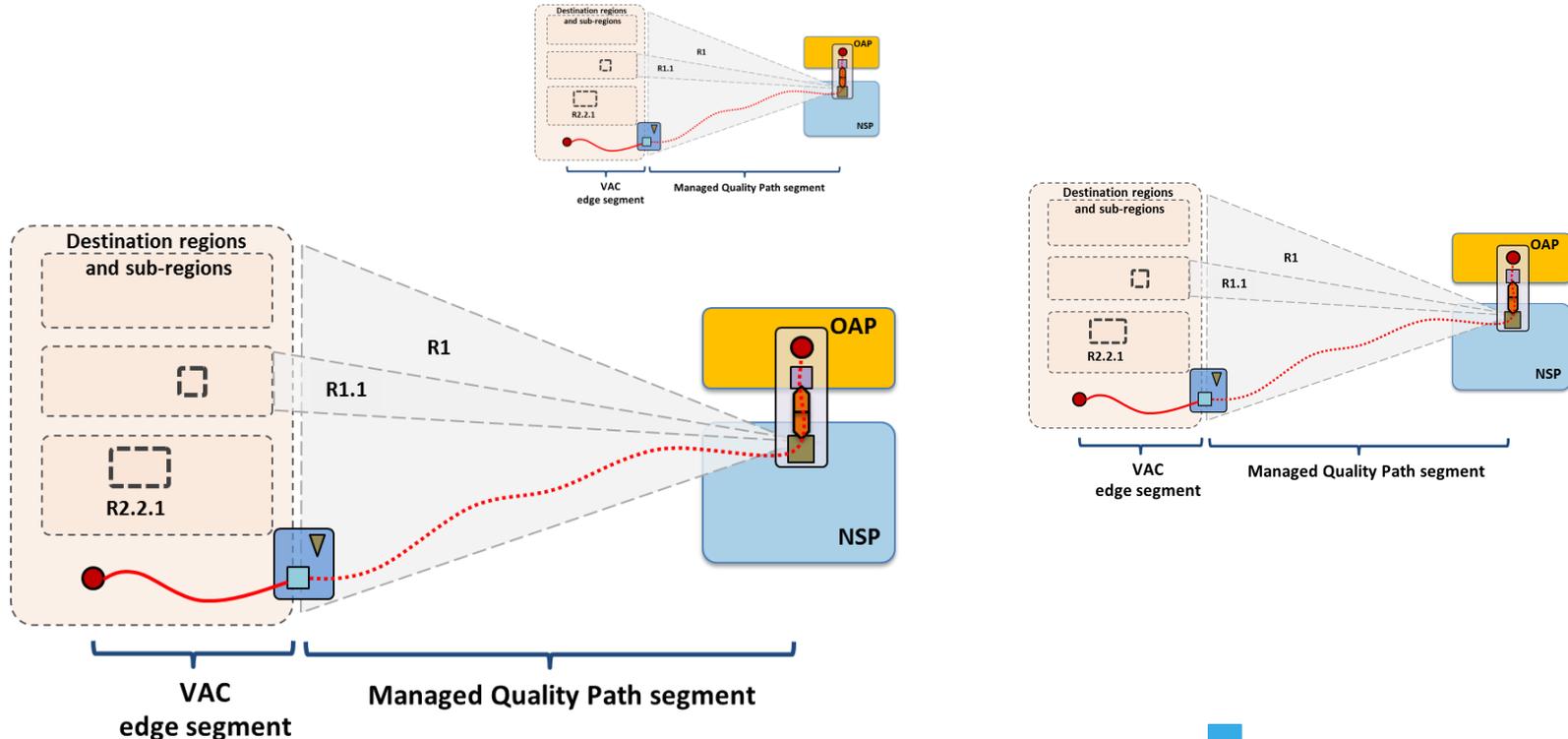


End-to-End SLA of Value Added Application Service =

$$\sum \text{VAC SLAs} + \sum \text{DC connectivity SLAs} + \sum \text{Application Function SLAs}$$



Regions and domains; their size and scope varies



MQ Paths – Potential roadmap phases

- ❑ Pol-2-Region
 - ❖ Supported by probing and monitoring services
- ❑ Assured Service Quality Paths (AQP)
 - ❖ Aggregate traffic over Multi-Service and Assured Service Quality Internetworking
- ❑ Basic Quality Paths (BQP)
 - ❖ Aggregate traffic over current best-effort Internet

Managed Quality Paths (MQP)	Singe Domain (on-net)	Multi-Domain (off-net)
AQP	Phase 1	Phase 3 (single transit) Phase 4 (multi-transit)
BQP	Phase 1	Phase 2

TMF TAW Febr. 2019, 5G-VINNI - WIP

Provider	Customer	Pol type
NSP	Enterprise	PoEI
NSP	OAP	PoDI
NSP	NSP	PoCI

NSP = Edge NSP or Transit NSP

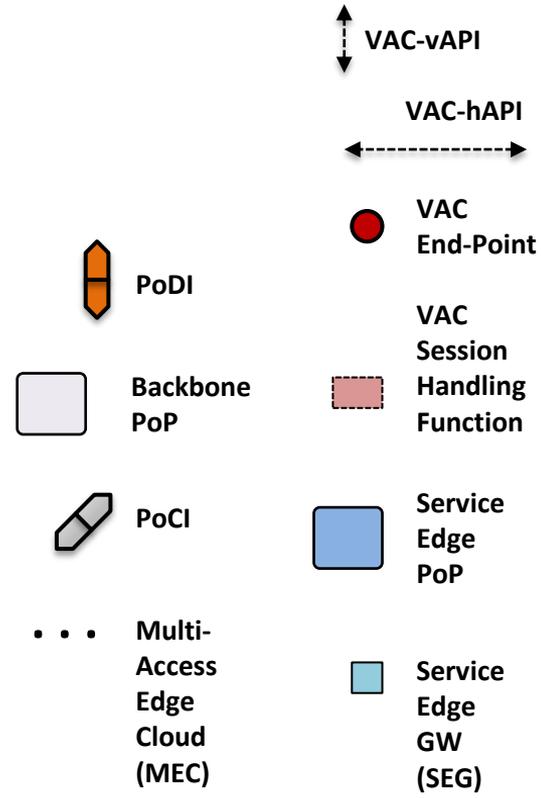
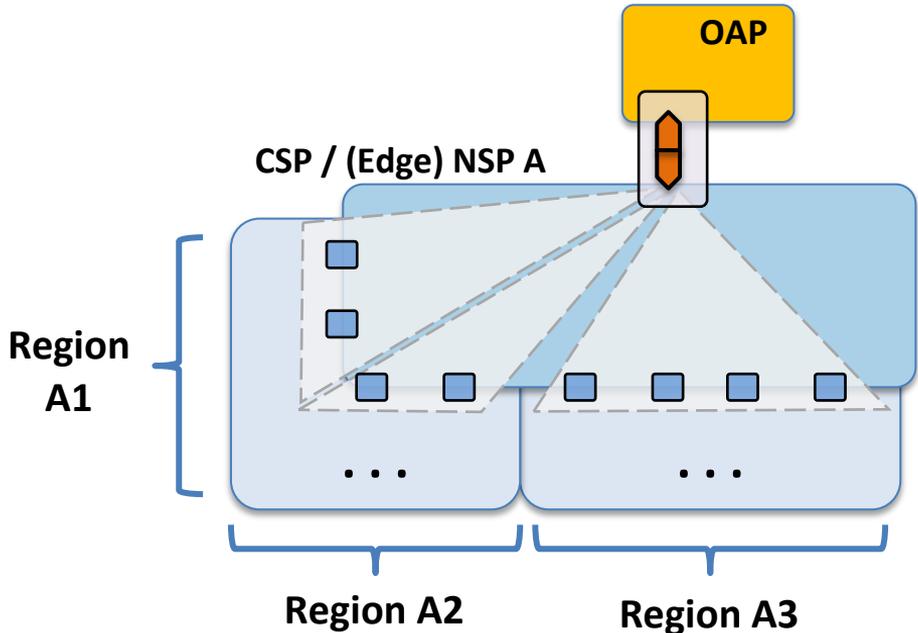
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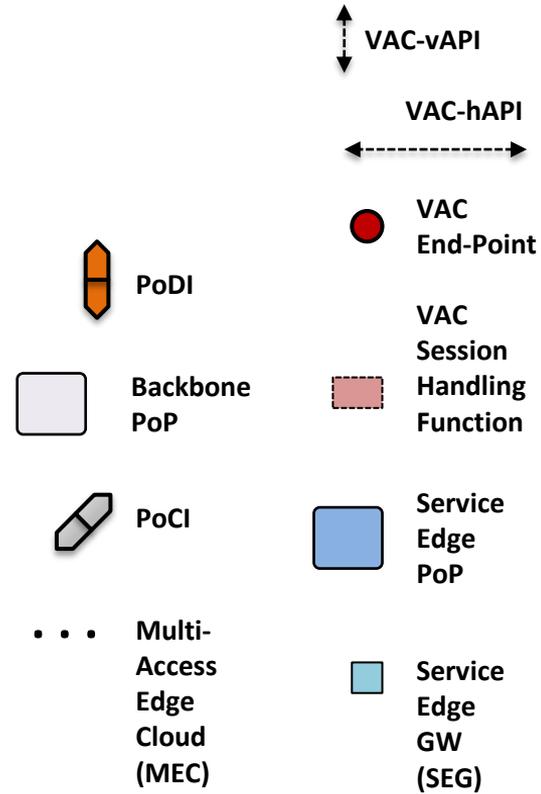
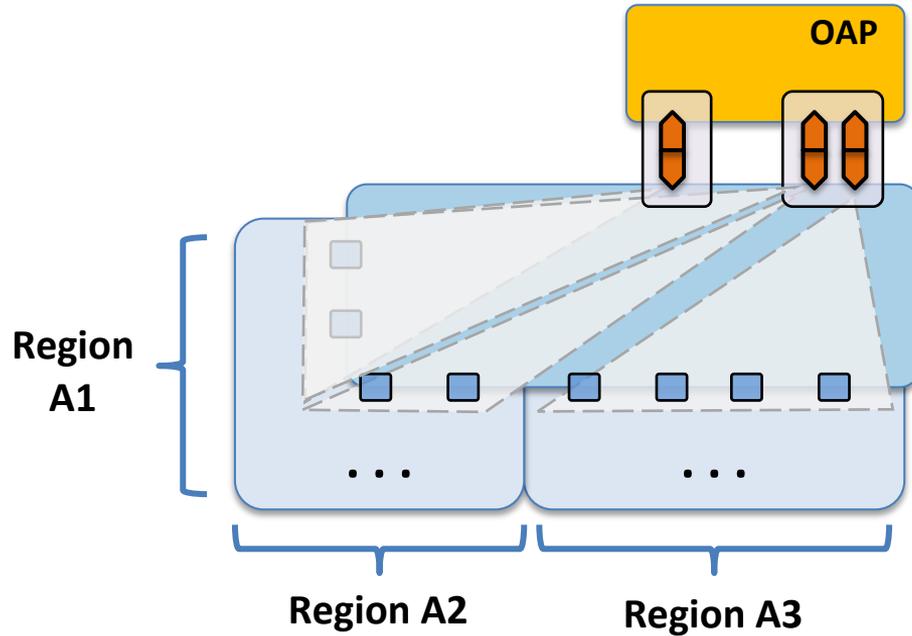
PoDI = Point of Data Centre (DC) Interconnect

PoCI = Point of Carrier Interconnect

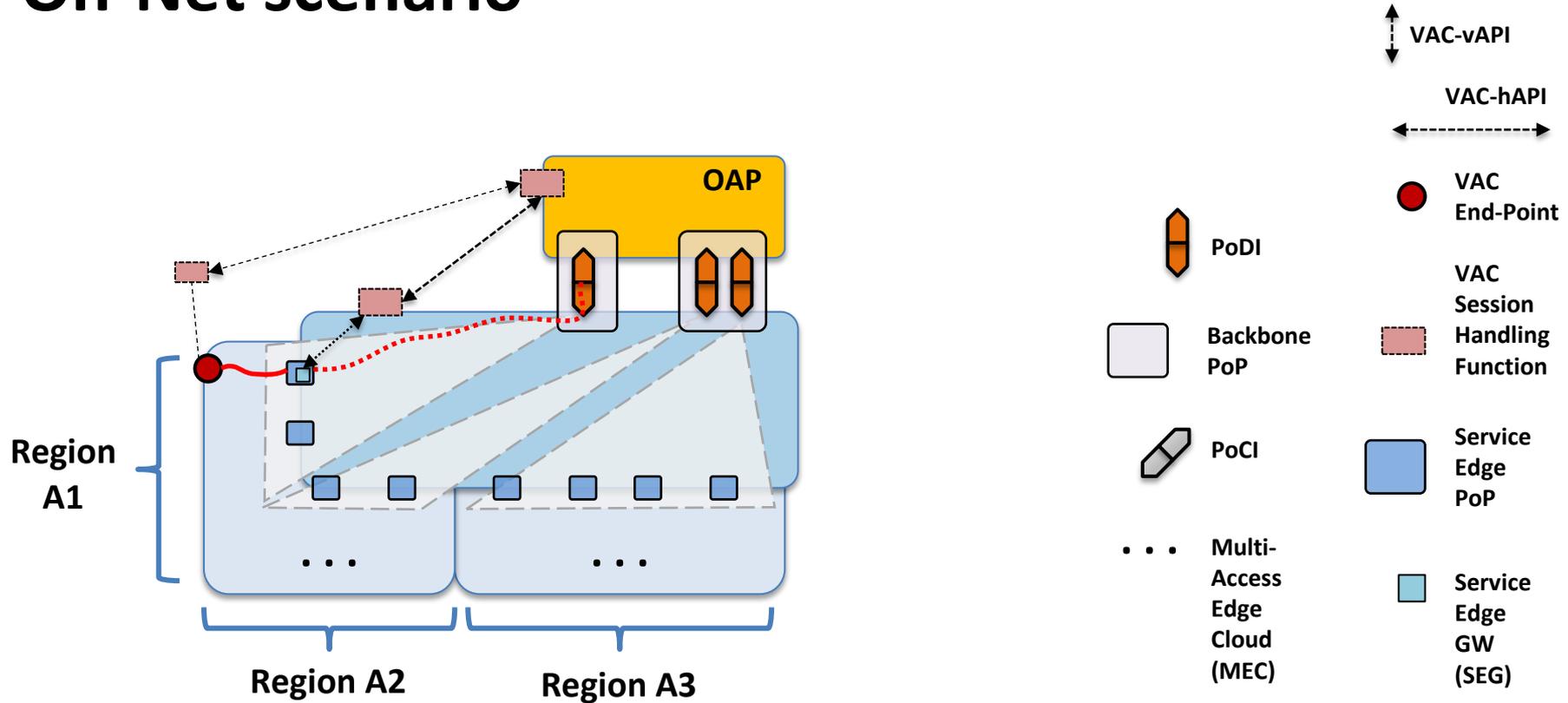
On-Net scenario



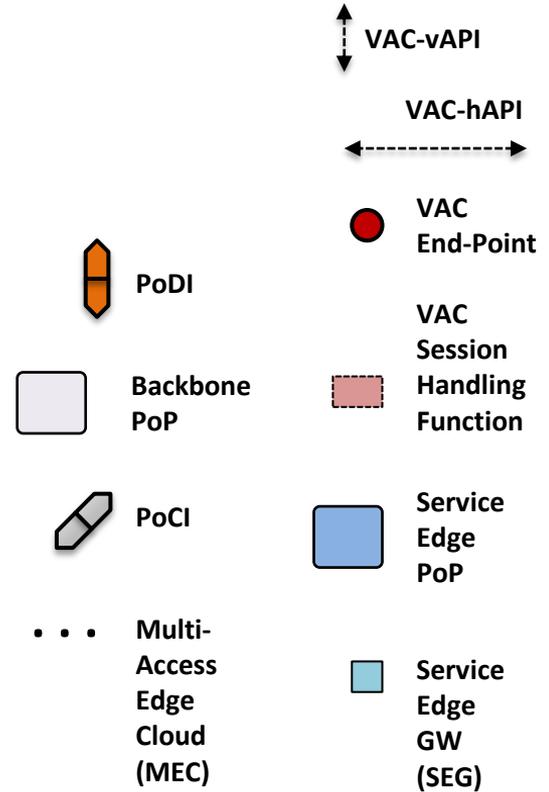
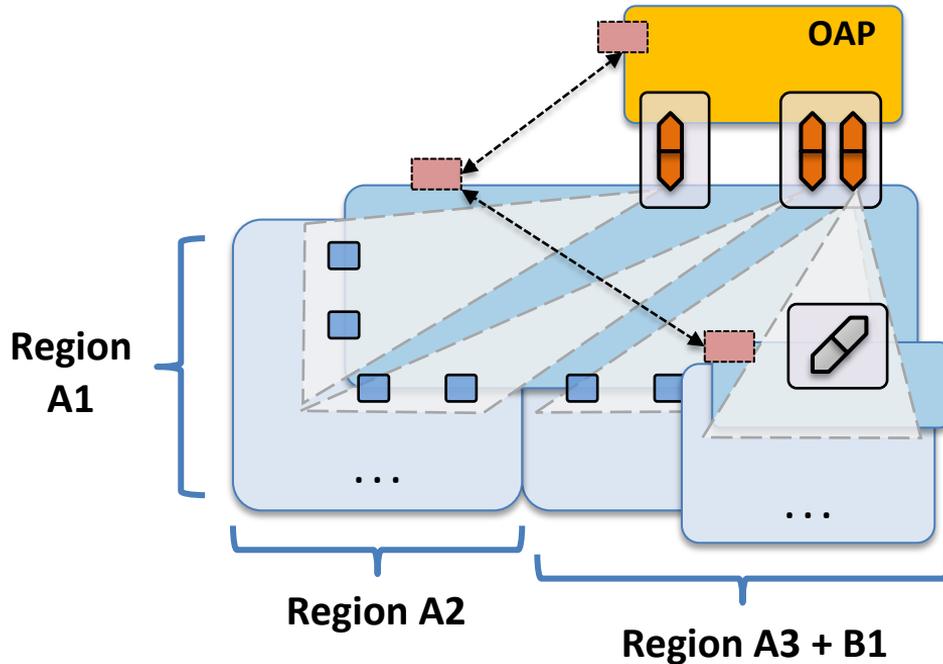
On-Net scenario



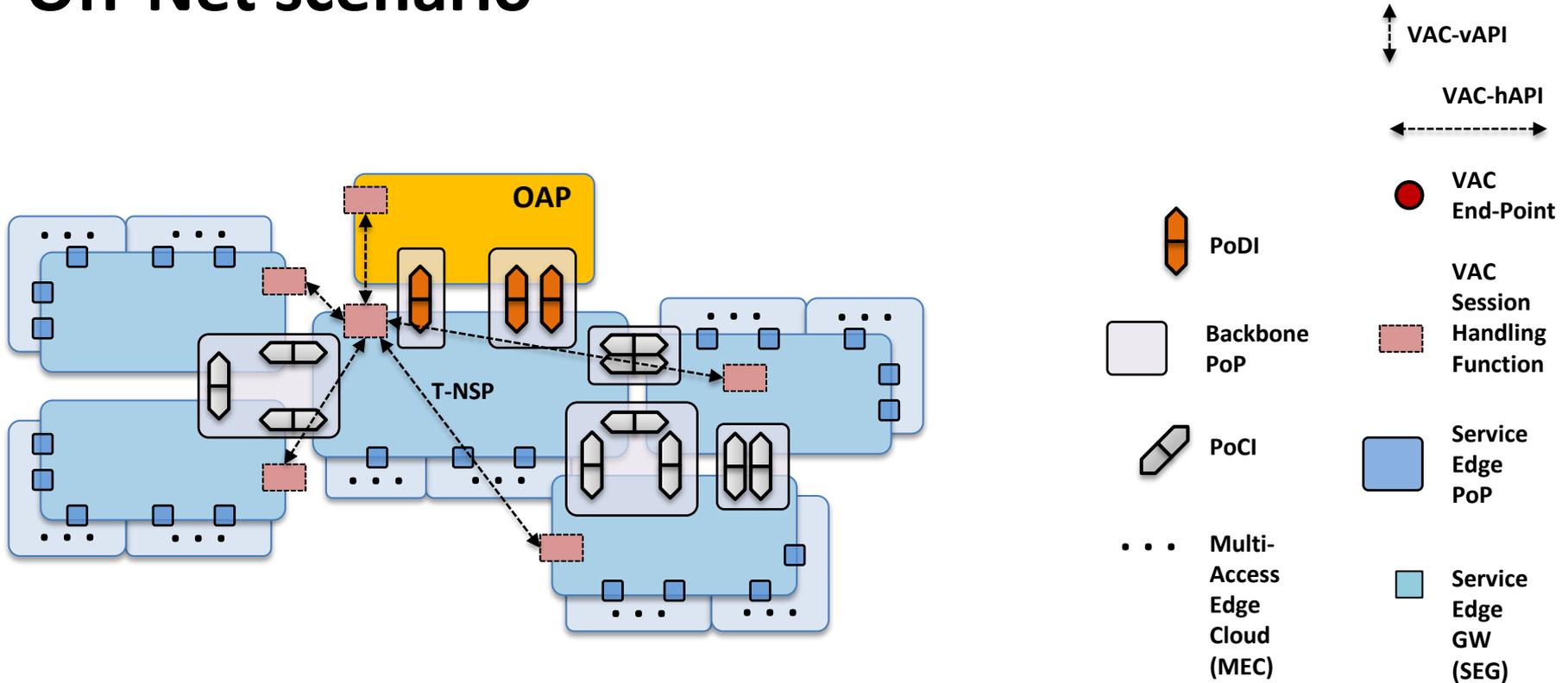
On-Net scenario



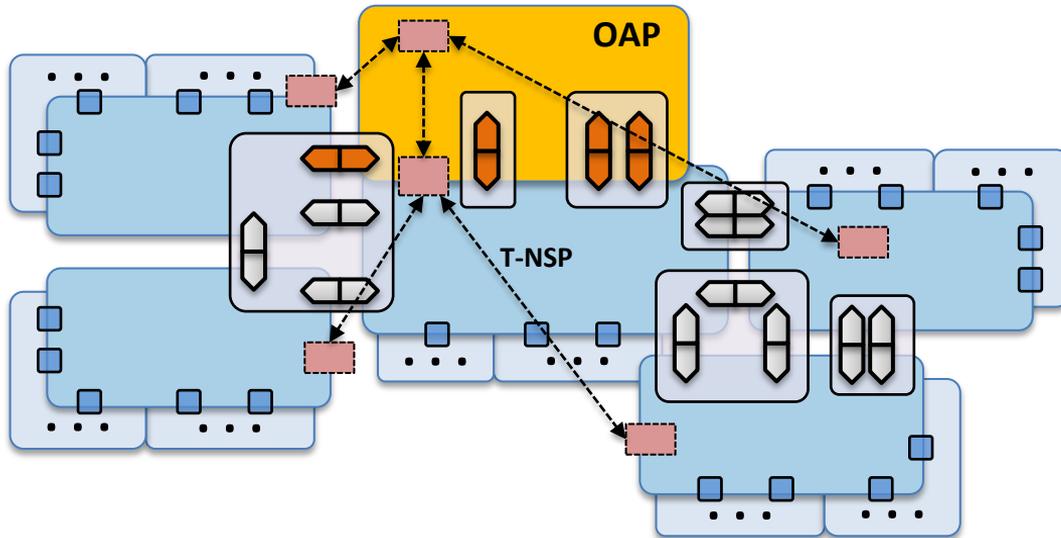
Hybrid (On/Off-Net) scenario



Off-Net scenario



Hybrid (On/Off-Net) scenario



VAC-vAPI

VAC-hAPI



VAC End-Point



VAC Session Handling Function



PoDI

Backbone PoP

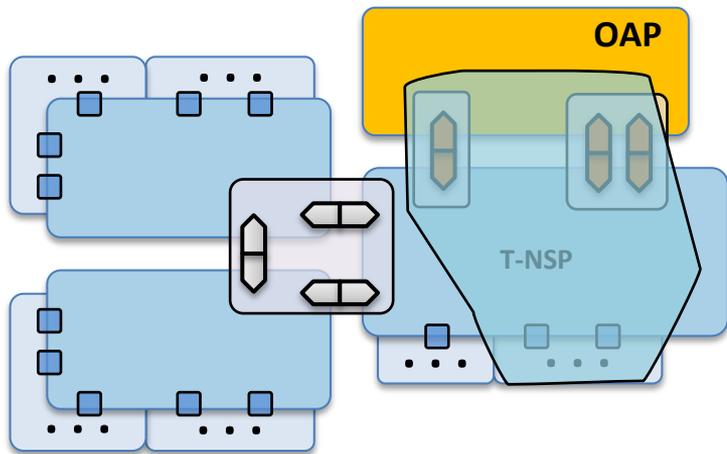
PoCI

Multi-Access Edge Cloud (MEC)

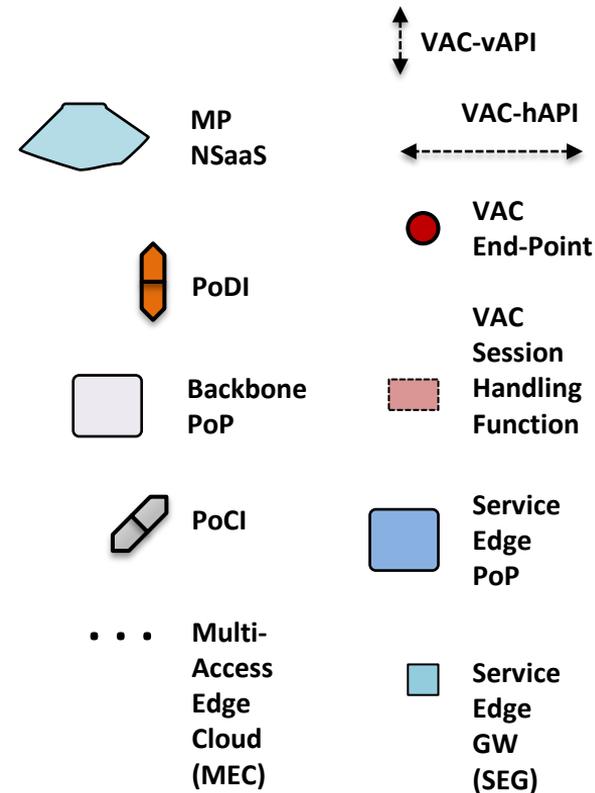
Service Edge PoP

Service Edge GW (SEG)

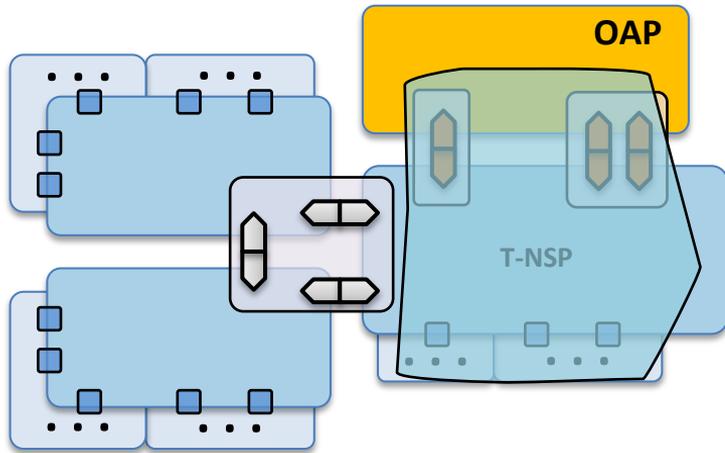
Dynamic Multi-Provider (MP) Network Slice as a Service (NSaaS)



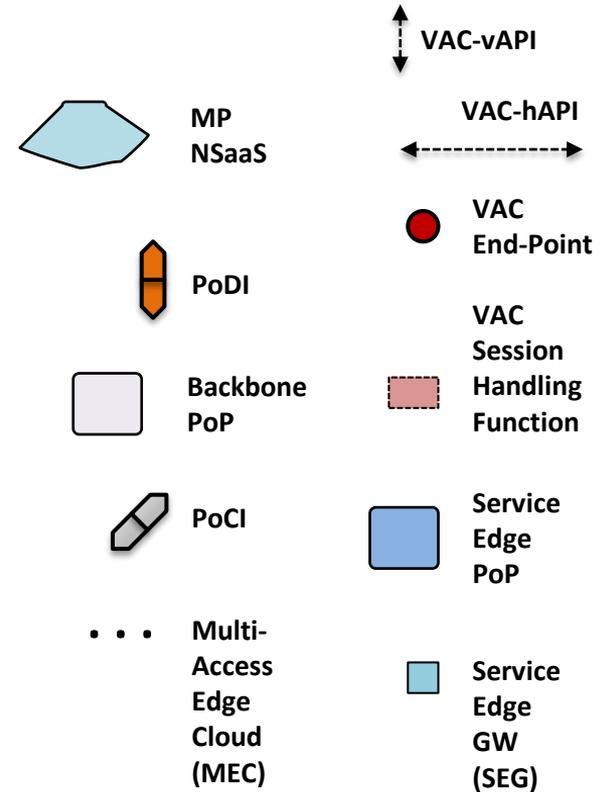
(MP → Federated)



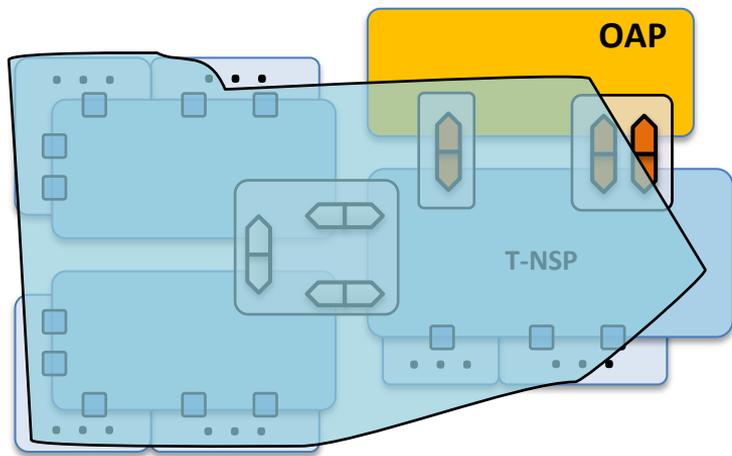
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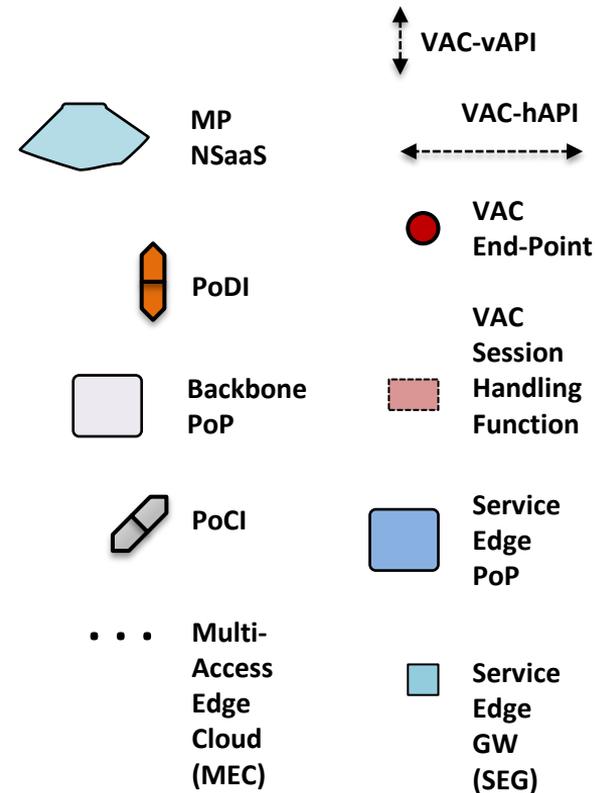
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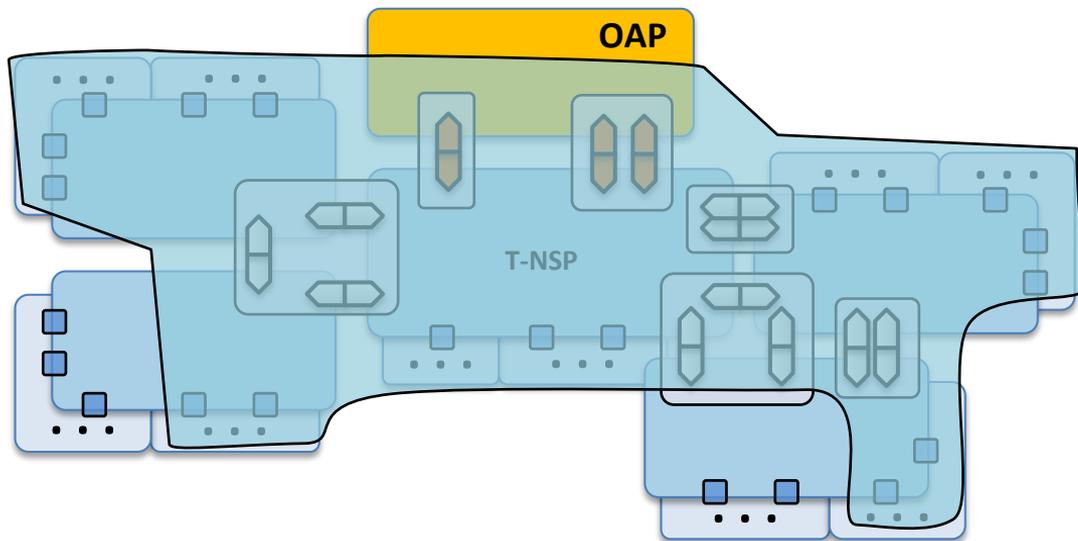
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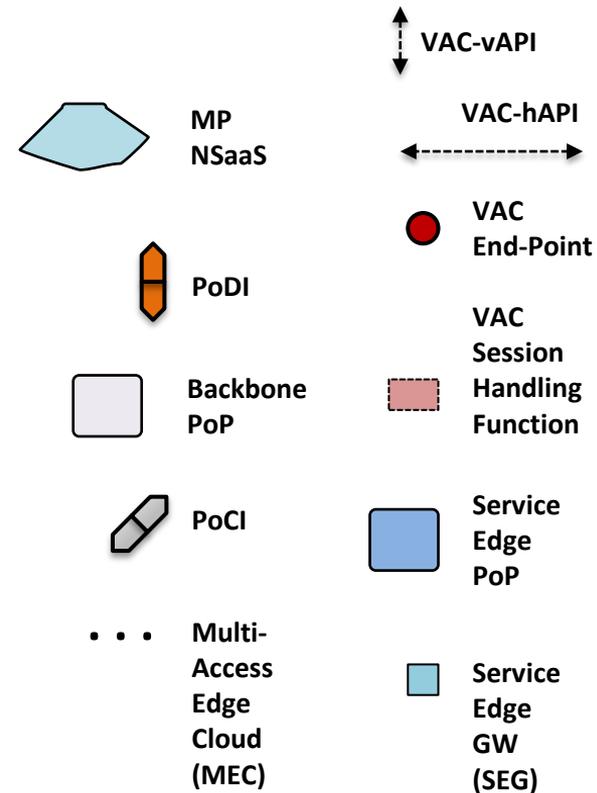
(MP → Federated)



Dynamic Multi-Provider (MP) Network Slice as a Service (NSaaS)



(MP → Federated)



Summary

Value Added Connectivity on Demand (VAC) as a general service and “5G business model enablement layer” will allow innovation and growth across all verticals

- VAC over MQ Path Infrastructure (PoI2Region)
- VAC API (Vertical & Horizontal)
- Loosely coupled business models enablers
- Towards Multi-Provider Network Slice as a Service

Thank you!

Questions



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