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Network Softwerization Impact

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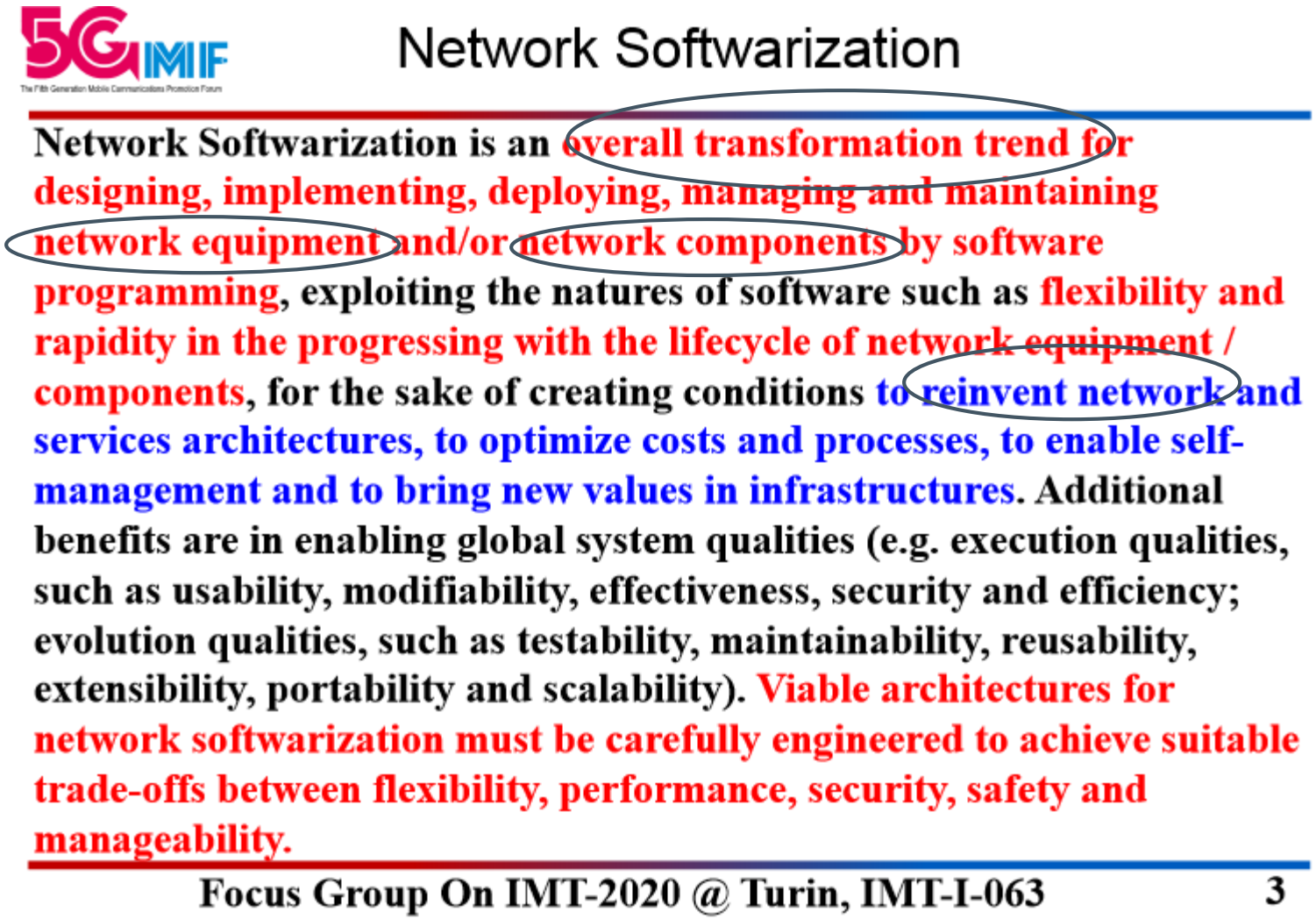
Network Softwerization



Network + Software

Overall
=> It touches any part of the network

Transformation trend
⇒ Not a revolution, but an evolution (implies hybrid with legacy & new architecture = STEPs)

Network Equipment
⇒ Box to SW

Network Component
⇒ A part may remain HW, a part becomes SW

Reinvent network & services Architectures
=> new, different

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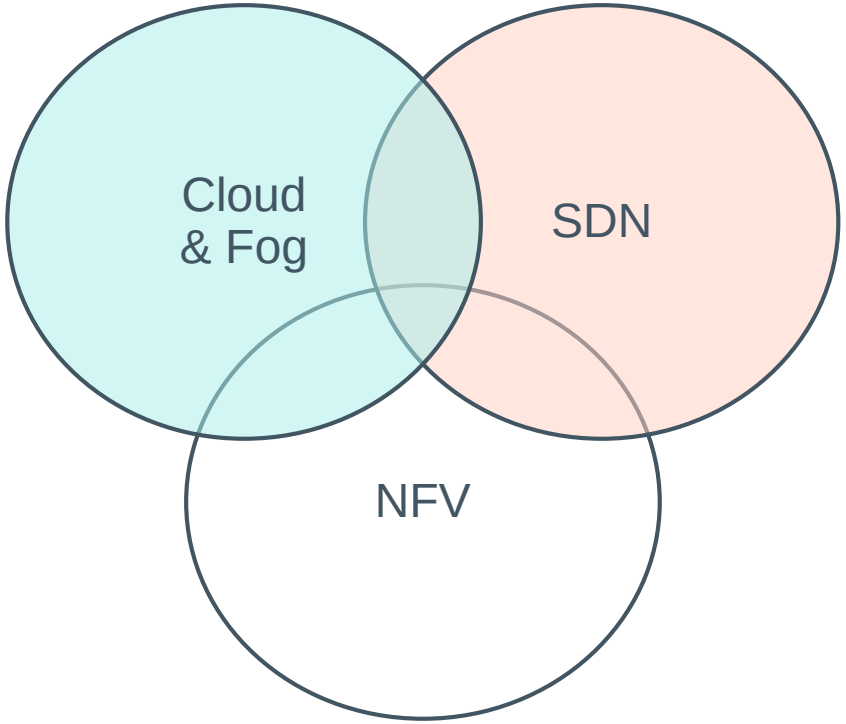
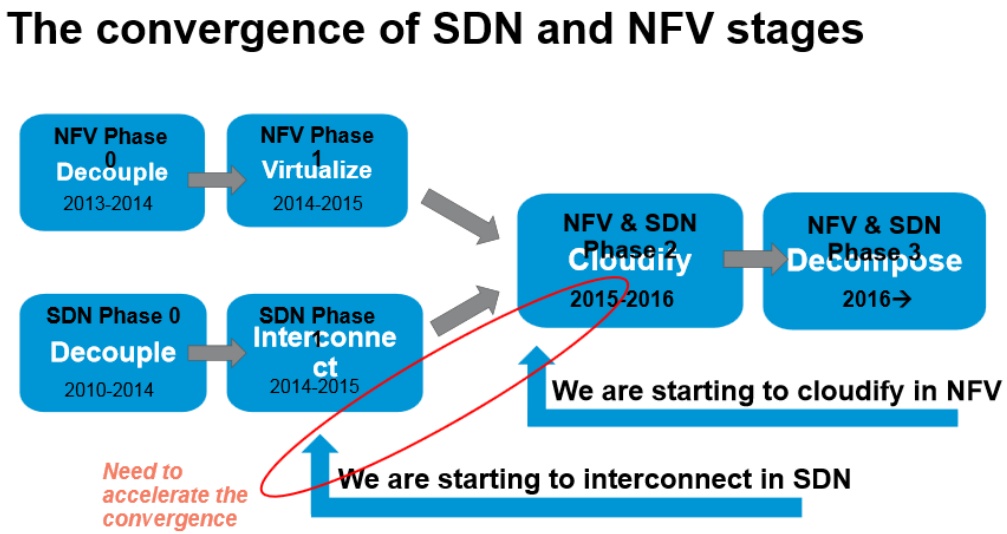
Network Softwerization: NFV, SDN, Cloud-Fog





A phased approach to combine NFV + SDN with Cloud & Fog deployment architecture

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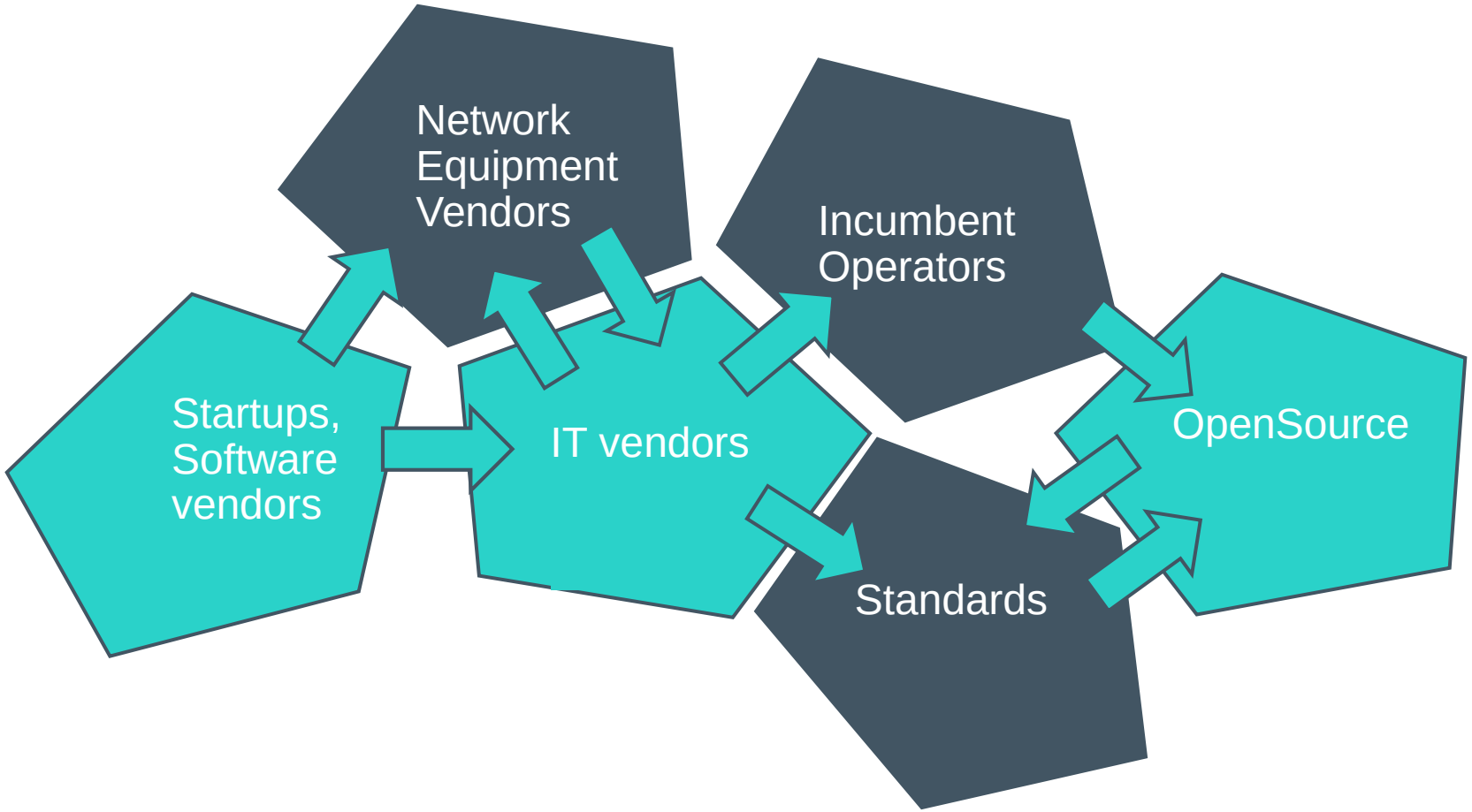
The Driving Forces towards Softwerization



New entrants challenge the incumbents

IMPACT on EC
(beyond regulation)

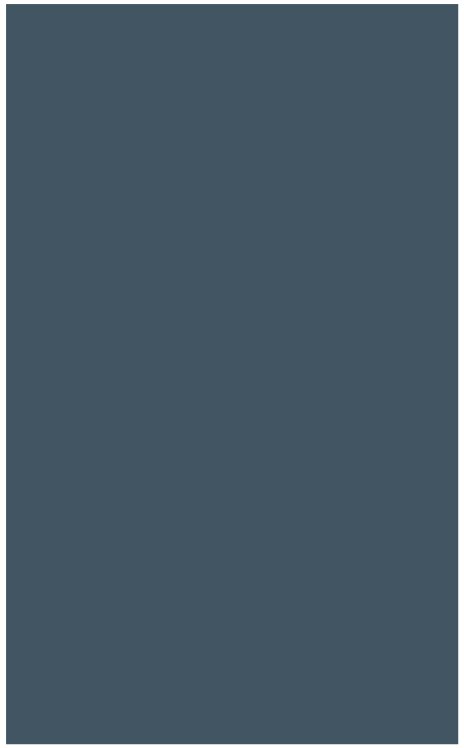
Example:

EC sends Mandate to SDO

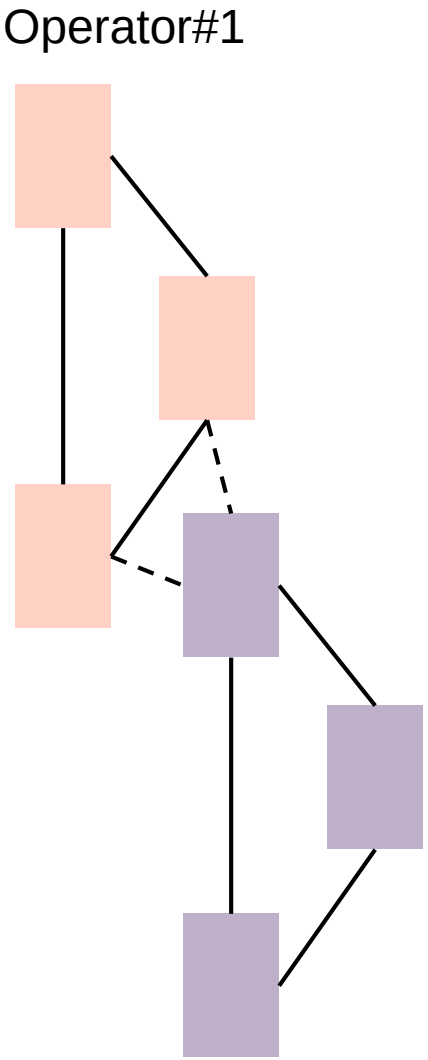
Not to OpenSource Project ??

SDO have no control on OpenSource Project

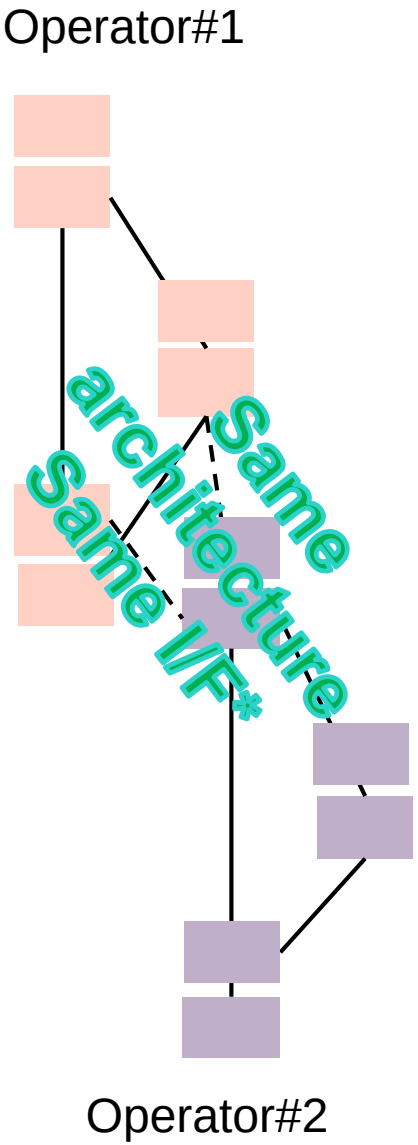
Evolution: #1 - Virtualization



Incumbent NEP
1 box
Standard I/F



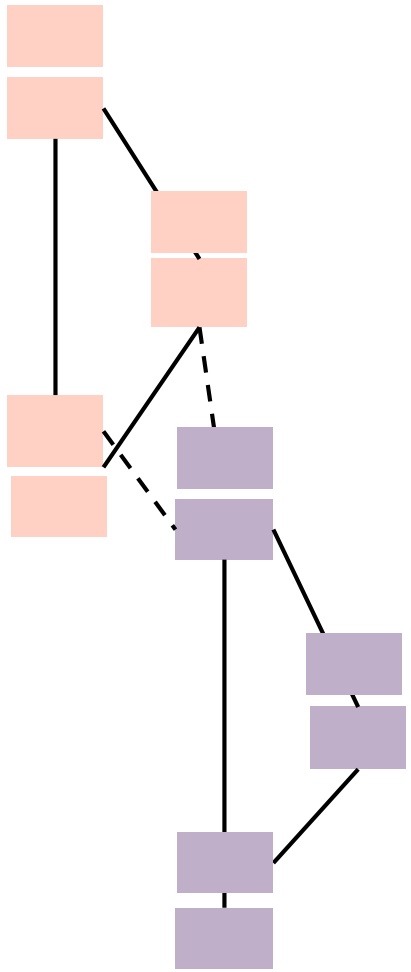
Step #1:
Virtualization inside
The box

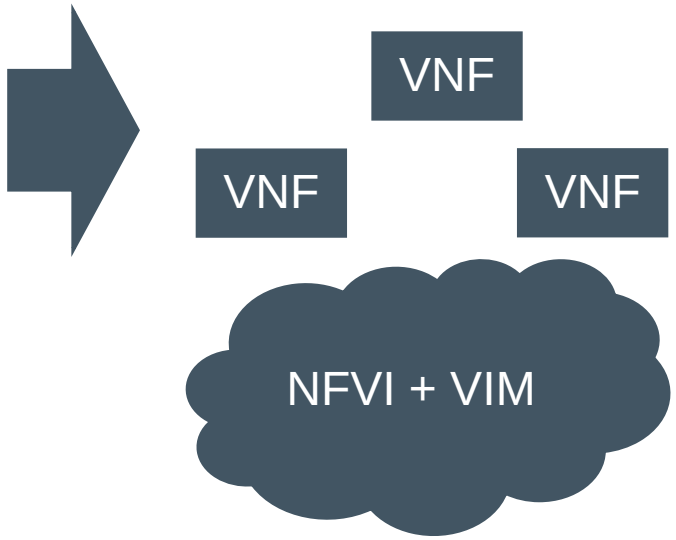


* Meaning same standard I/F - compliance

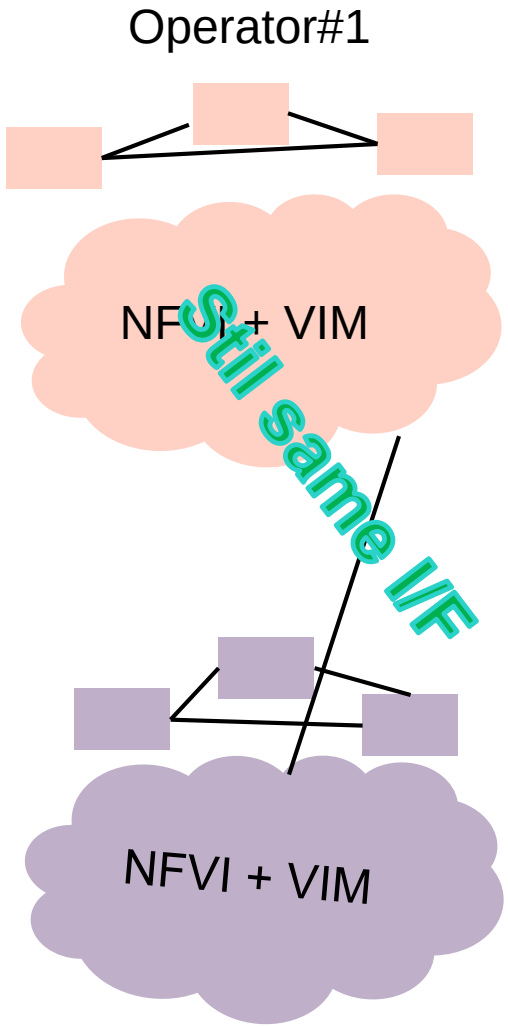
Evolution: #2 - Cloudification

Step #1:
Virtualization inside
The box





Step #2:
Cloudification
(NFVI+VIM)



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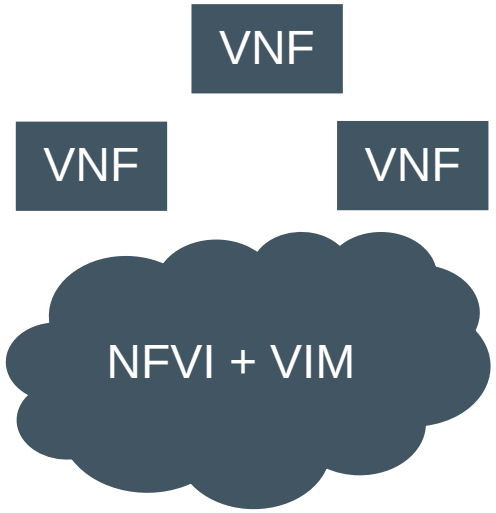
Cloudification Impact use case



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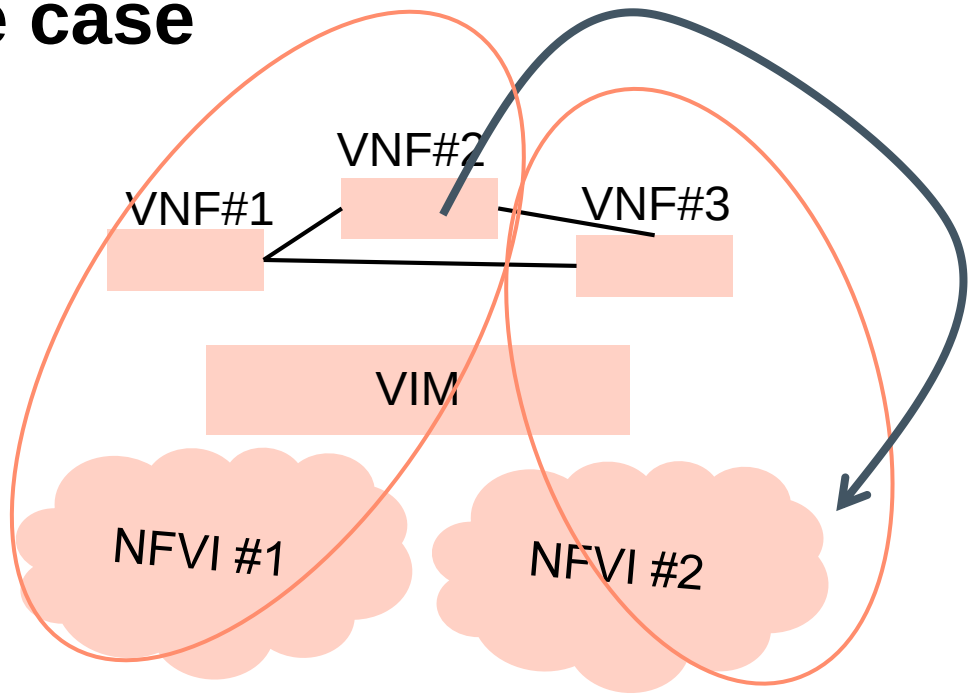

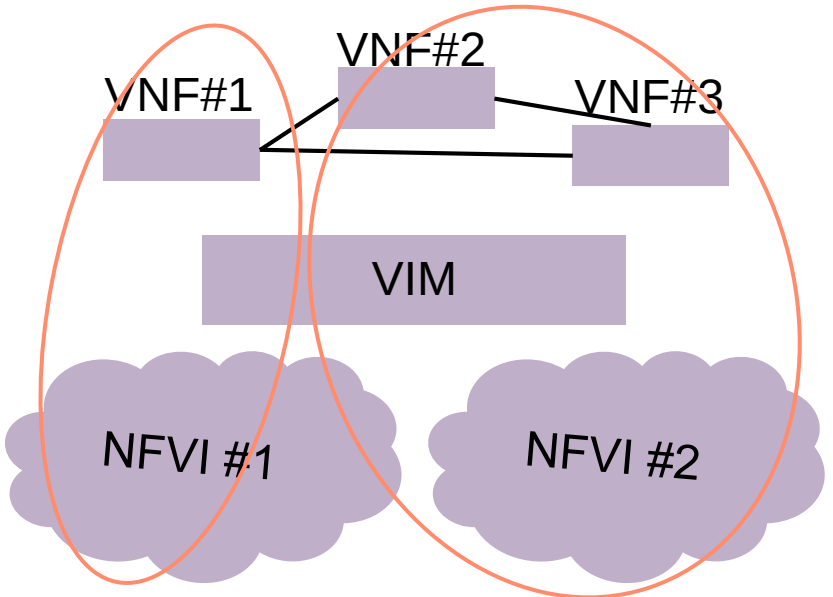

If the operator
Moves a VNF from
One location to another

VNF#2 moves from:

NFVI#1 to NFVI#2

Impact on EC:
The function is executed
in a different location
(ex Data Retention)

Ex: different country etc

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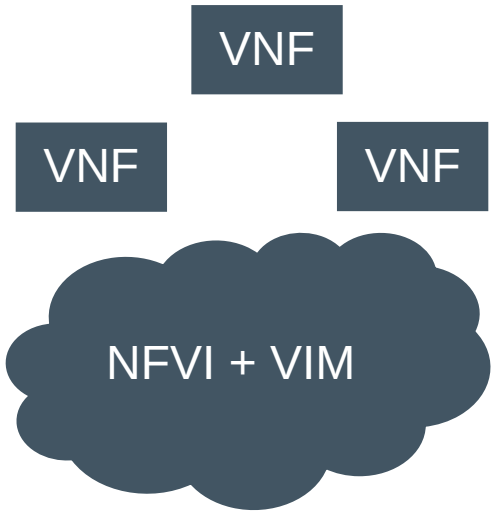
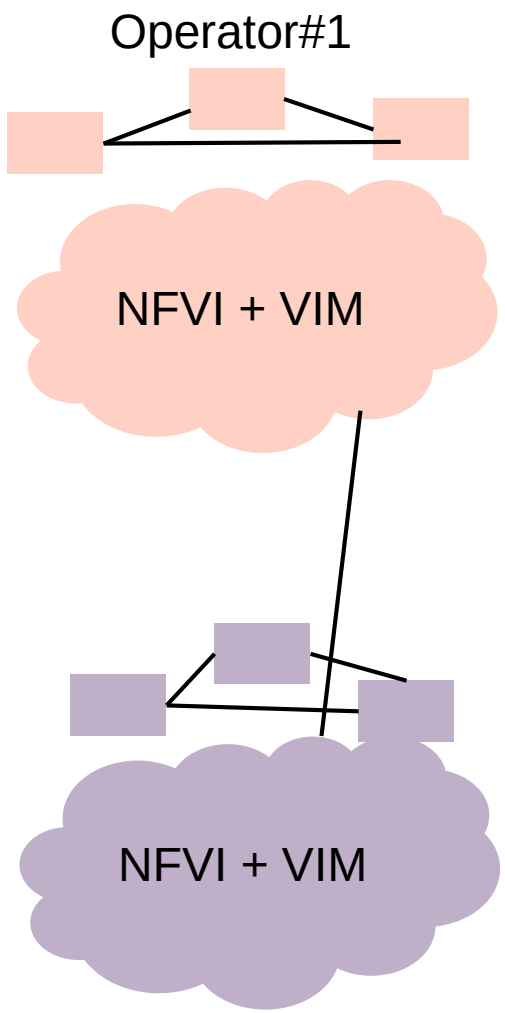
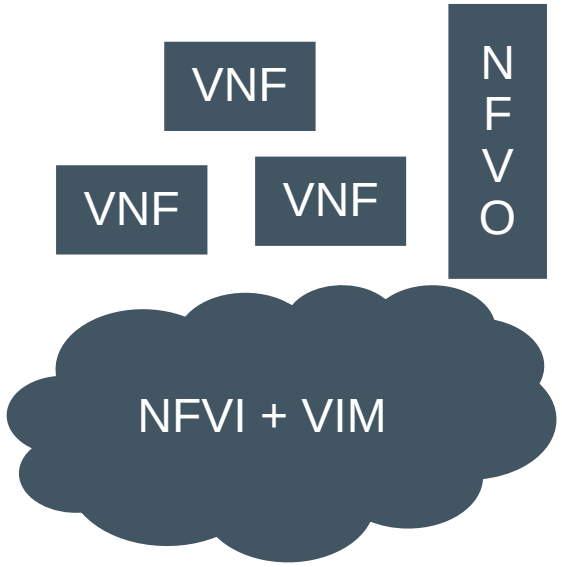
Evolution: #3 – NFV Orchestration



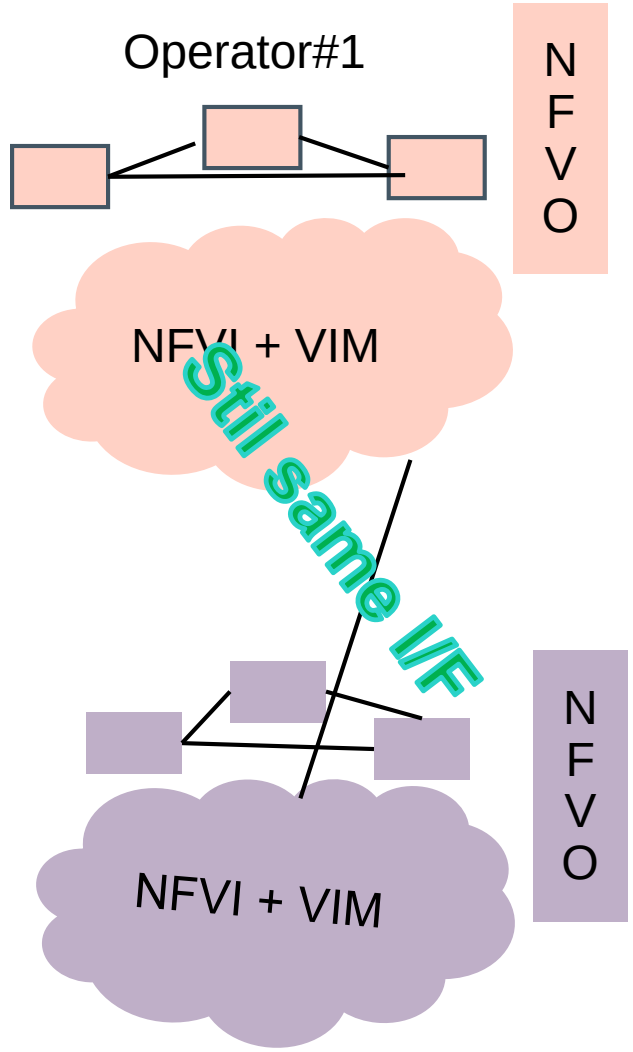
Step #2:
Cloudification
(NFVI+VIM)



Operator#2



Step #3:
Orchestration
(NFVI+VIM + NFVO)



Operator#2

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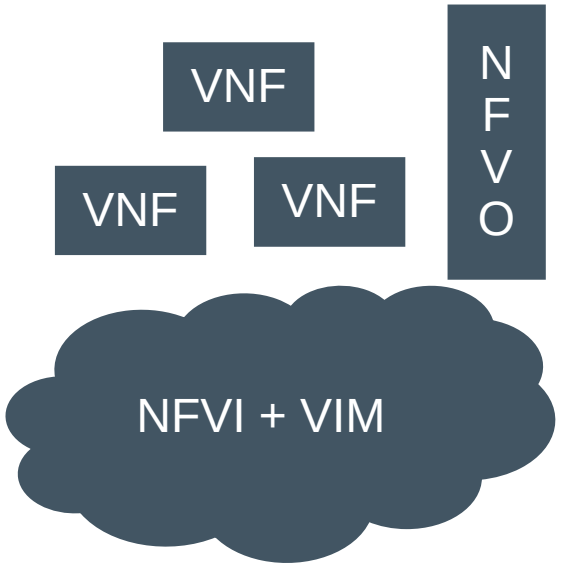
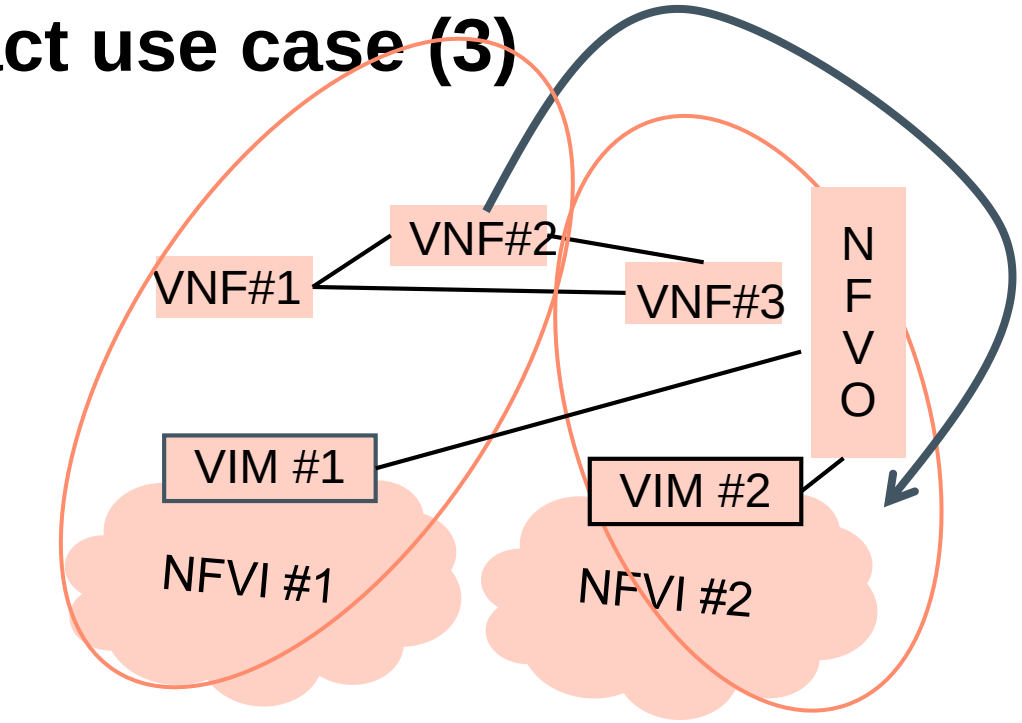
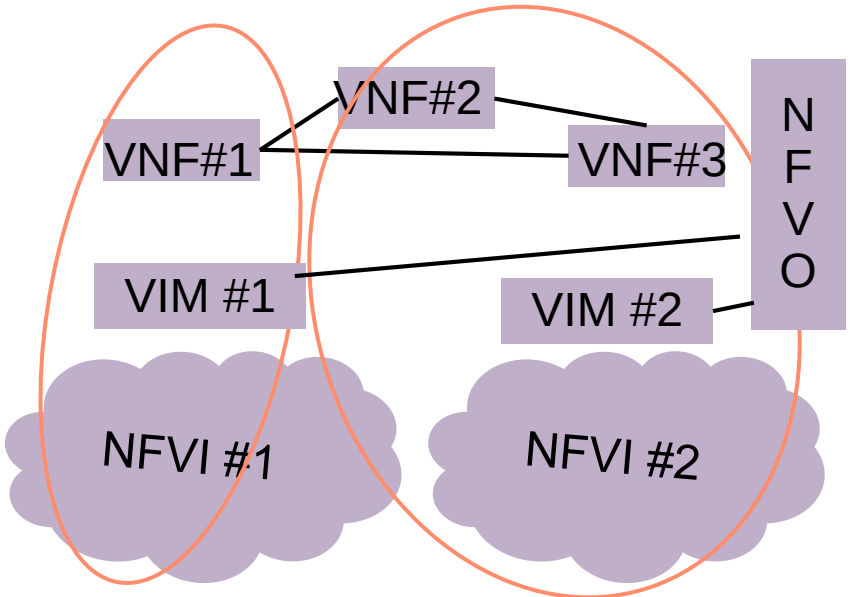
NFV Orchestration Impact use case (3)



Step #3:
Orchestration
(NFVI+VIM + NFVO)





If the operator moves a VNF from one location to another

VNF#2 moves from:

NFVI#1 to NFVI#2

Impact on EC:
The function may be executed
in a different location,
Incl different country
(ex Data Retention)

Similar to Case 2
Without NFVO

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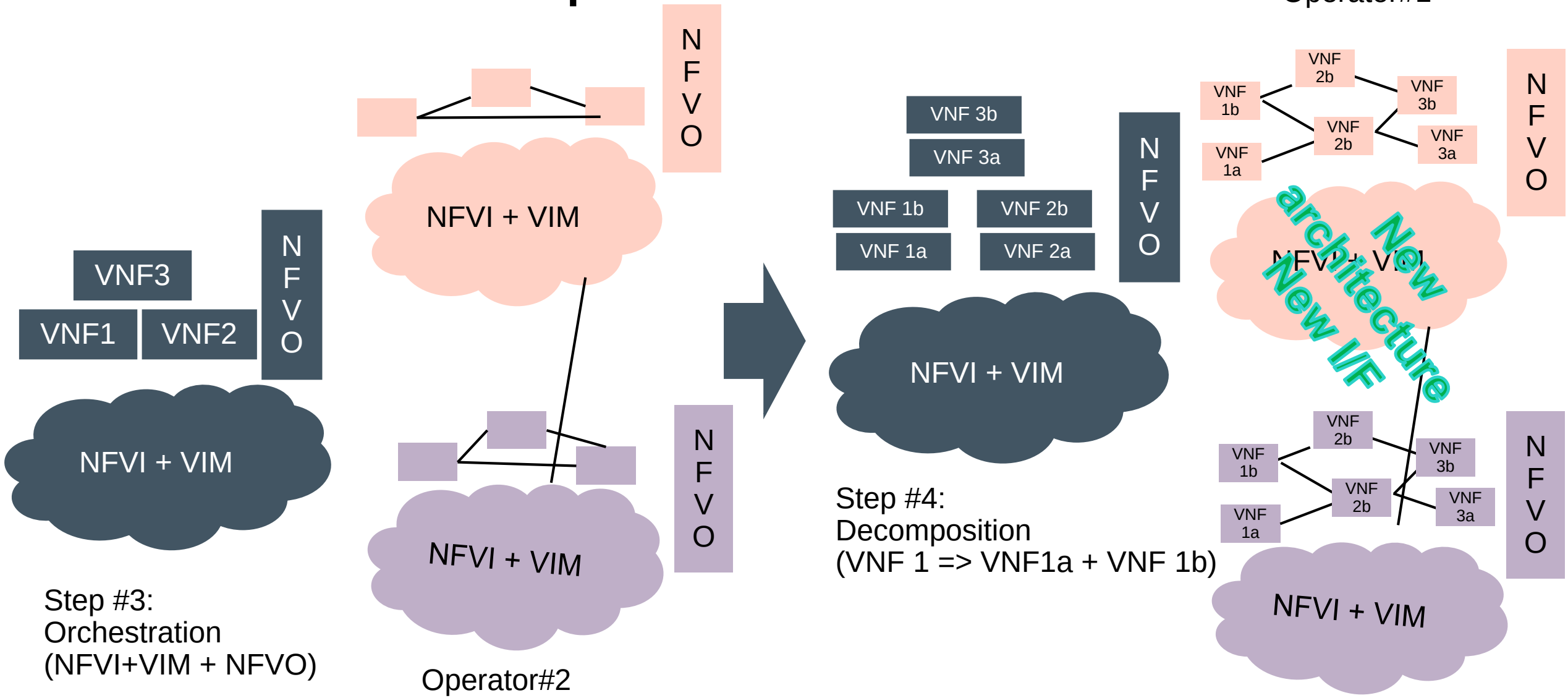
Evolution: #3 – Decomposition



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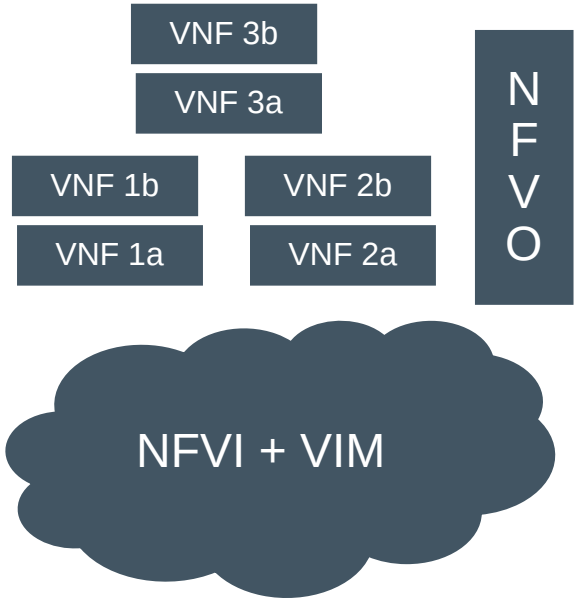
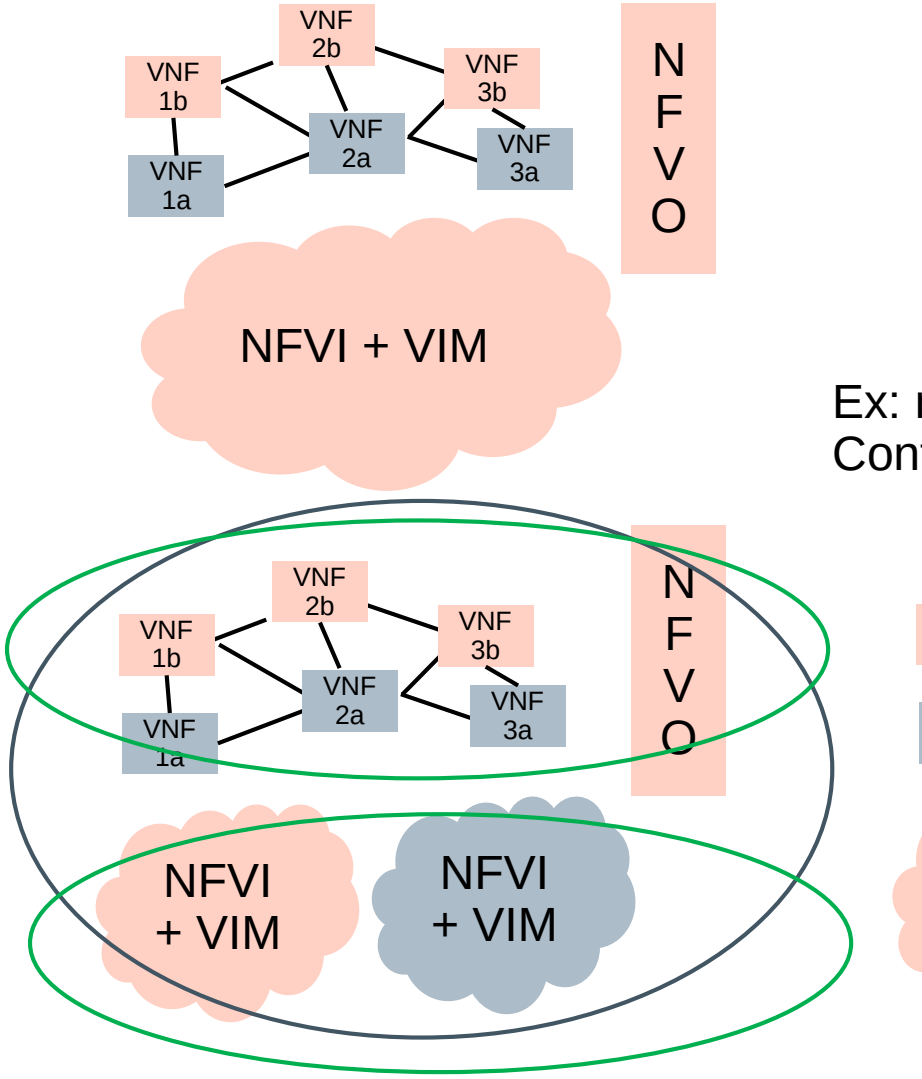
Decomposition Impact use case (4a)



Step #4:
Decomposition
(VNF 1 => VNF1a + VNF 1b)

Operator#1

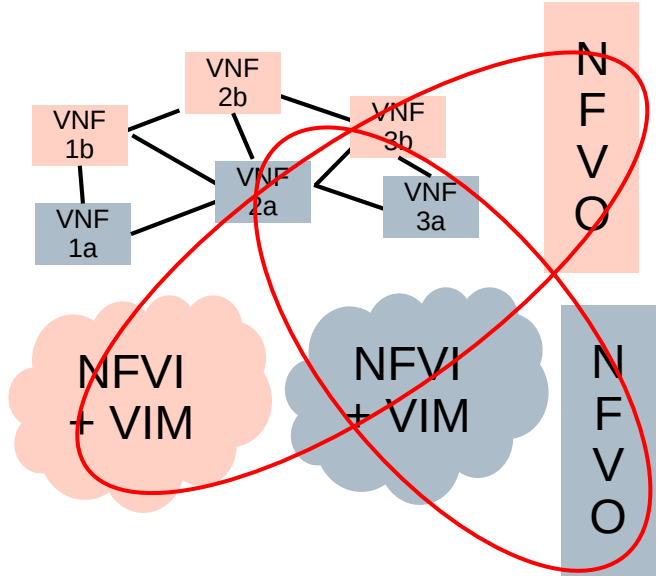


Impact :
I/F between VNF1a (Vendor a) and VNF1b (vendor b) is new, not standardized

VNF 1b Vendor b

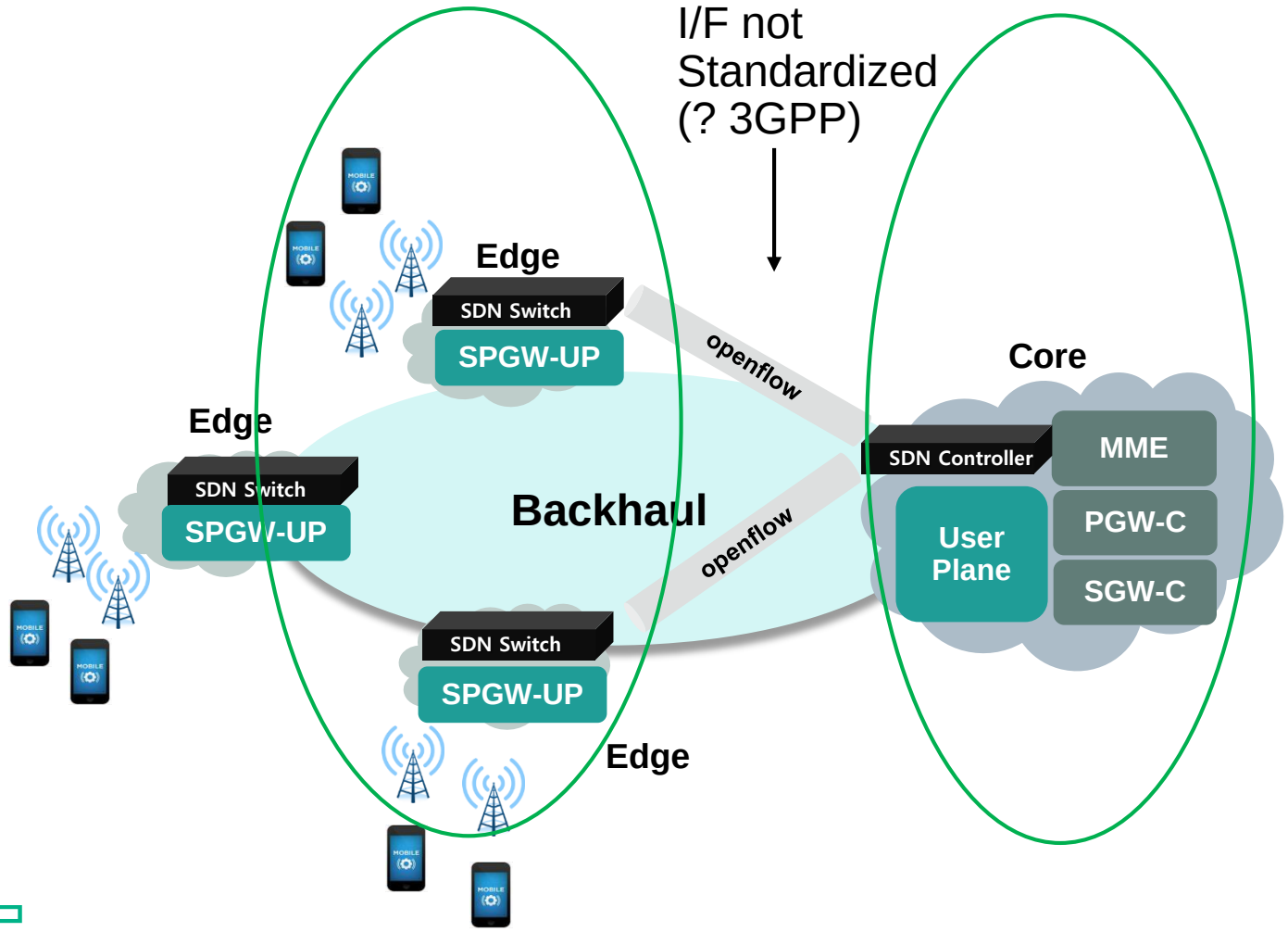
VNF 1a Vendor a

Ex: mobile core decoupling user plane Control plane



Different architecture … different business model

Decomposition Impact Use Case (4b)
Mobile Core: User plane and Control plane Separation + Fog/Edge



Same as 4a, but move
User plane to the edge

- If 1 operator, SDN controller
Can be shared between Core & Edge
I/F is then an RCI interface

- If 2 operators, 1 for the edge, and
1 for the core, an edge SDN controller
May be used, and I/F between edge
and core is an I/F between SDN controllers

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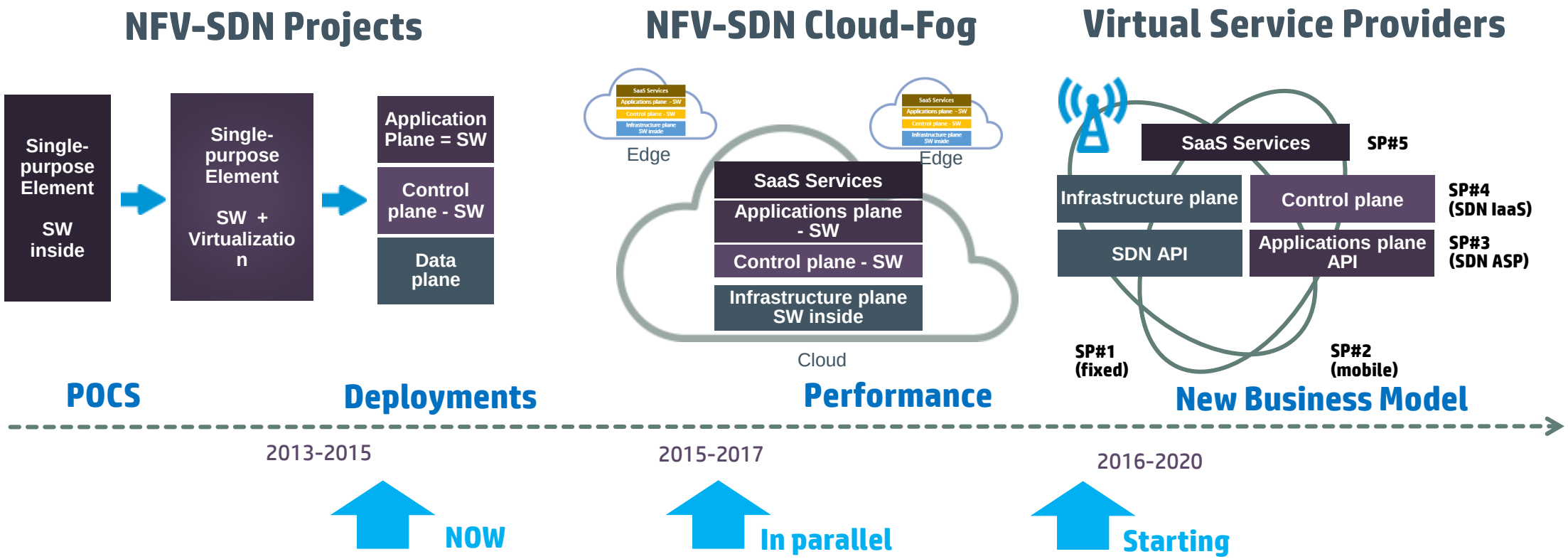
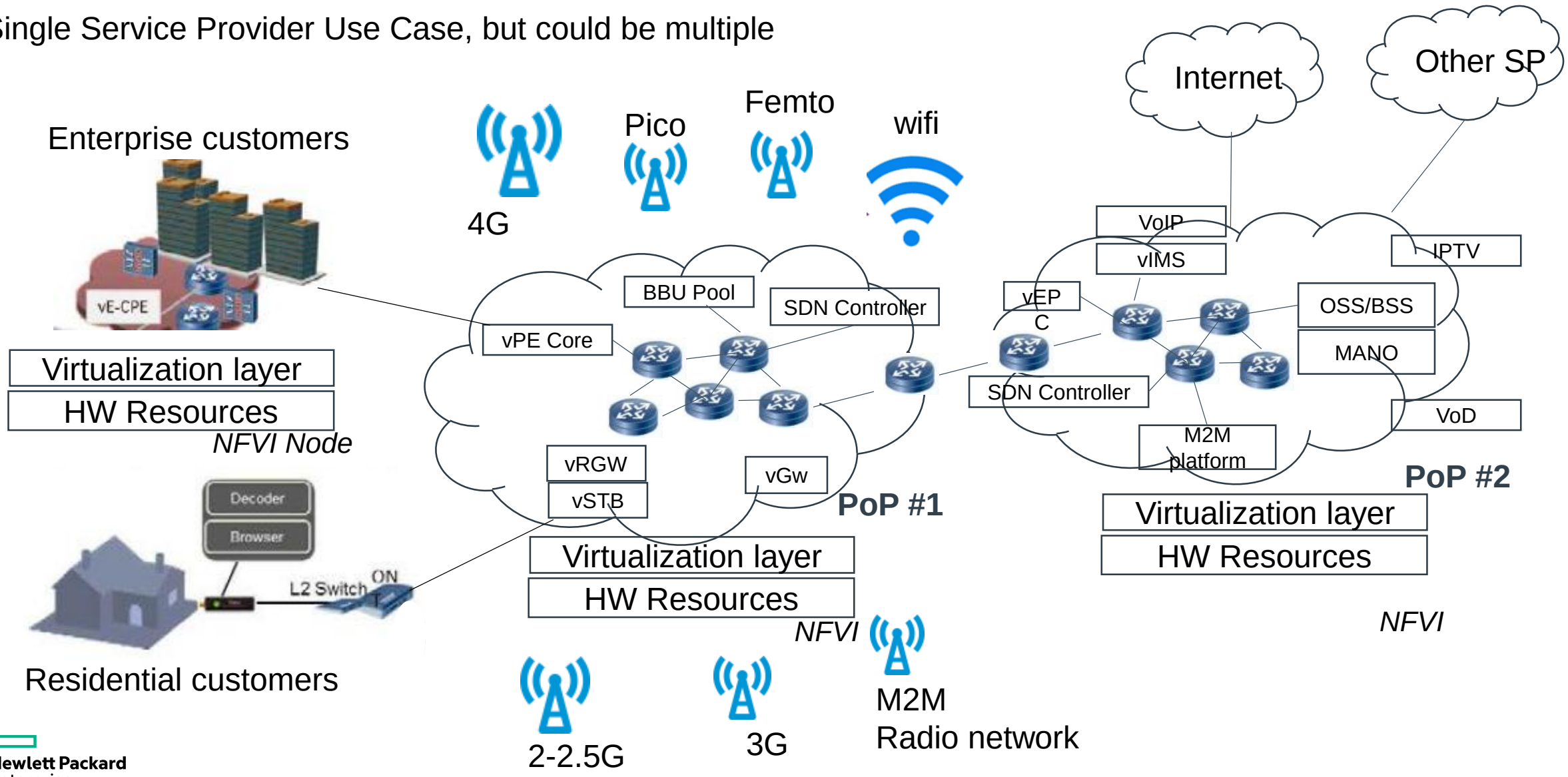
Network Softwerization: new opportunities



New business models: sharing resources, VNFaaS, Network sharing, NaaS, on demand services

Case #1: E2E with NFV & SDN

Single Service Provider Use Case, but could be multiple



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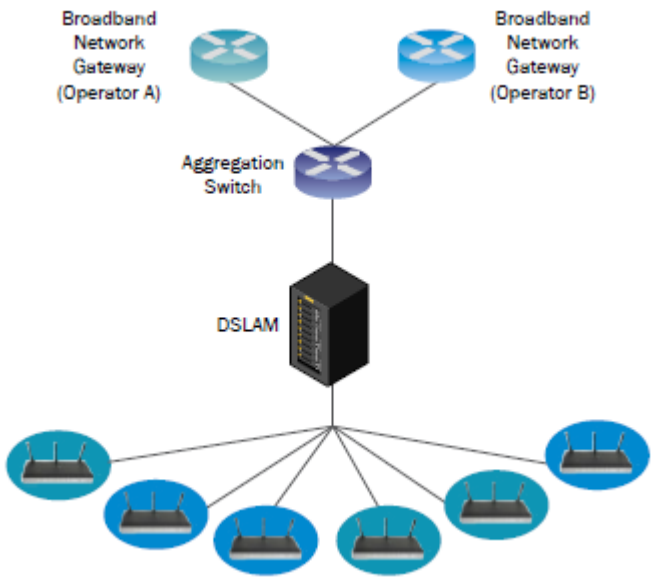
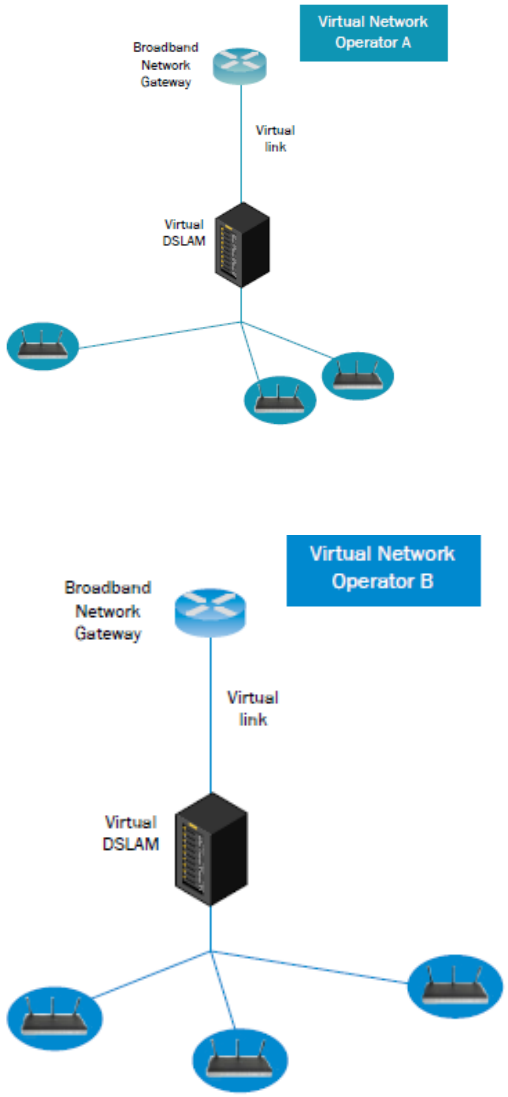
Case#2: Broadband use case (1)





(1a) is this possible in principle

>> Yes

(1) Do SDN and NFV enable fixed network access which gives alternative network operators more control over the network of the incumbent compared to current layer 2 wholesale access products (also known as Ethernet bitstream or virtual unbundled local access (VULA))?

>> Yes

– vBRAS/BNG enable to share virtualized resources across 2 operators

- SDN and SDN/NFV integration enables to give network control access to multiple operators with proper north bound interfaces definitions with policies

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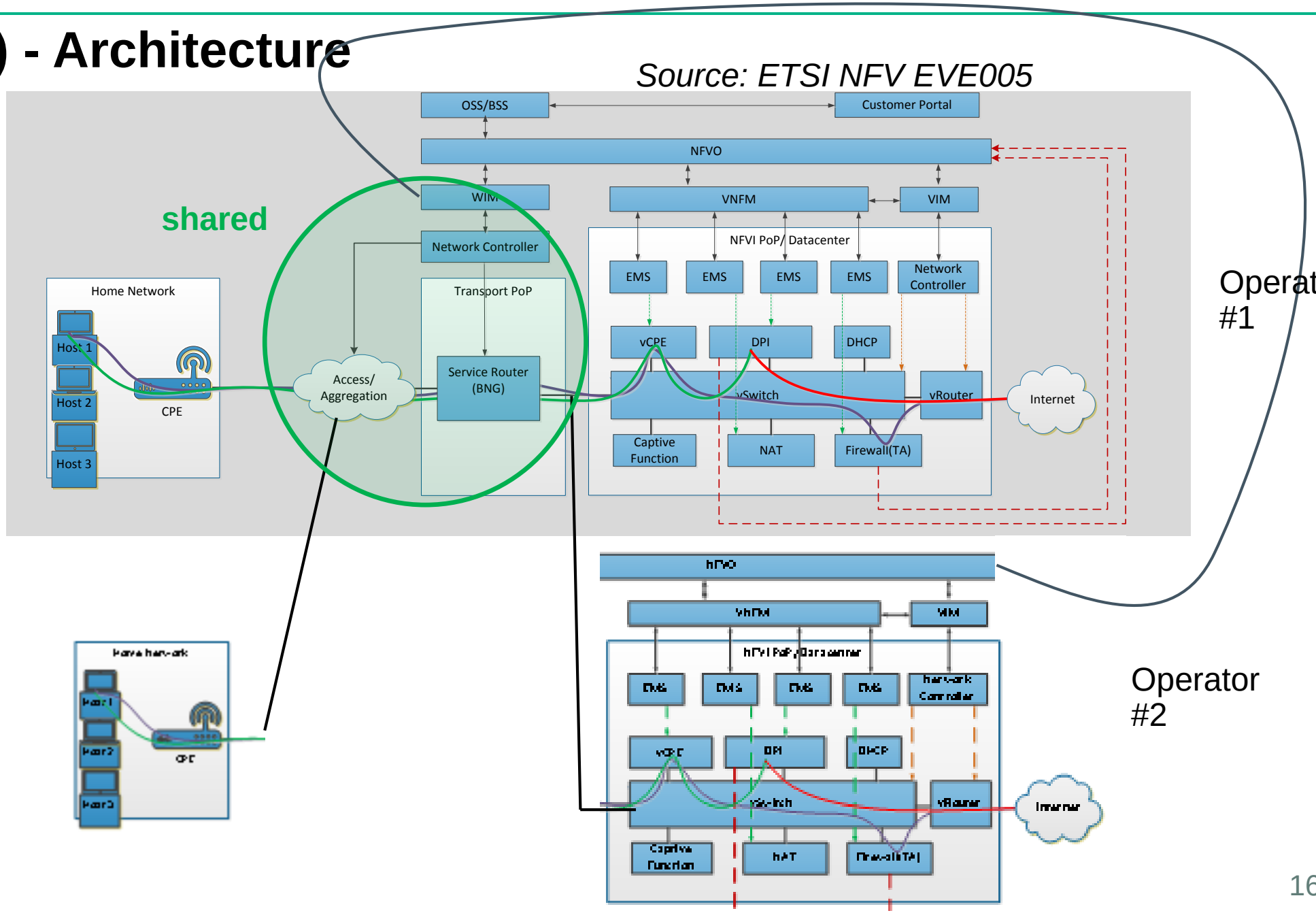
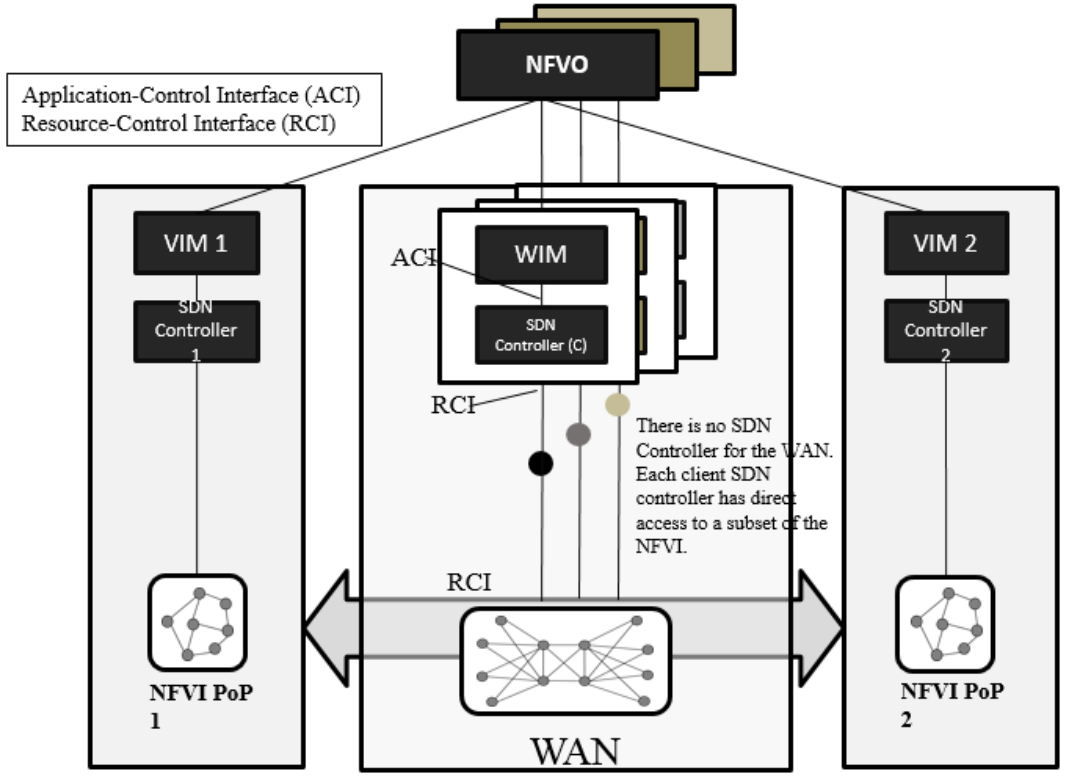
Case#2 (2) - Architecture

Source: ETSI NFV EVE005

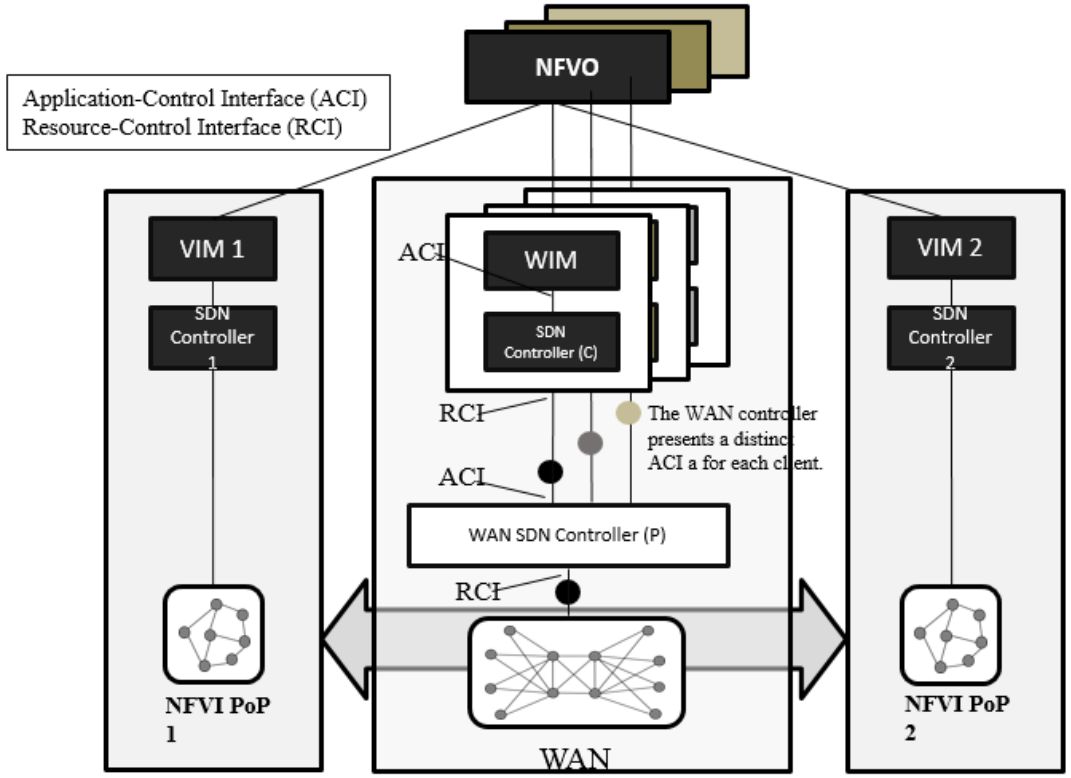


Case#2 (3) : WAN NFV-SDN options

Option 1- no SDN controller on WAN resources, each client SDN controller has direct access to a subset of NFVI
Option 2- there is a WAN SDN controller with multi-tenant, meaning different ACI interface for each client



Option 1- no WAN SDN controller



Option 2- multi-tenant WAN SDN controller

(1b) Will SDN and NFV also be standardized in a way (including multi-tenant support) which will make such forms of network access possible based on SDN/NFV?
(1c) Will SDN and NFV also be offered by vendors (and/or open source) which will make such forms of network access possible based on SDN/NFV?

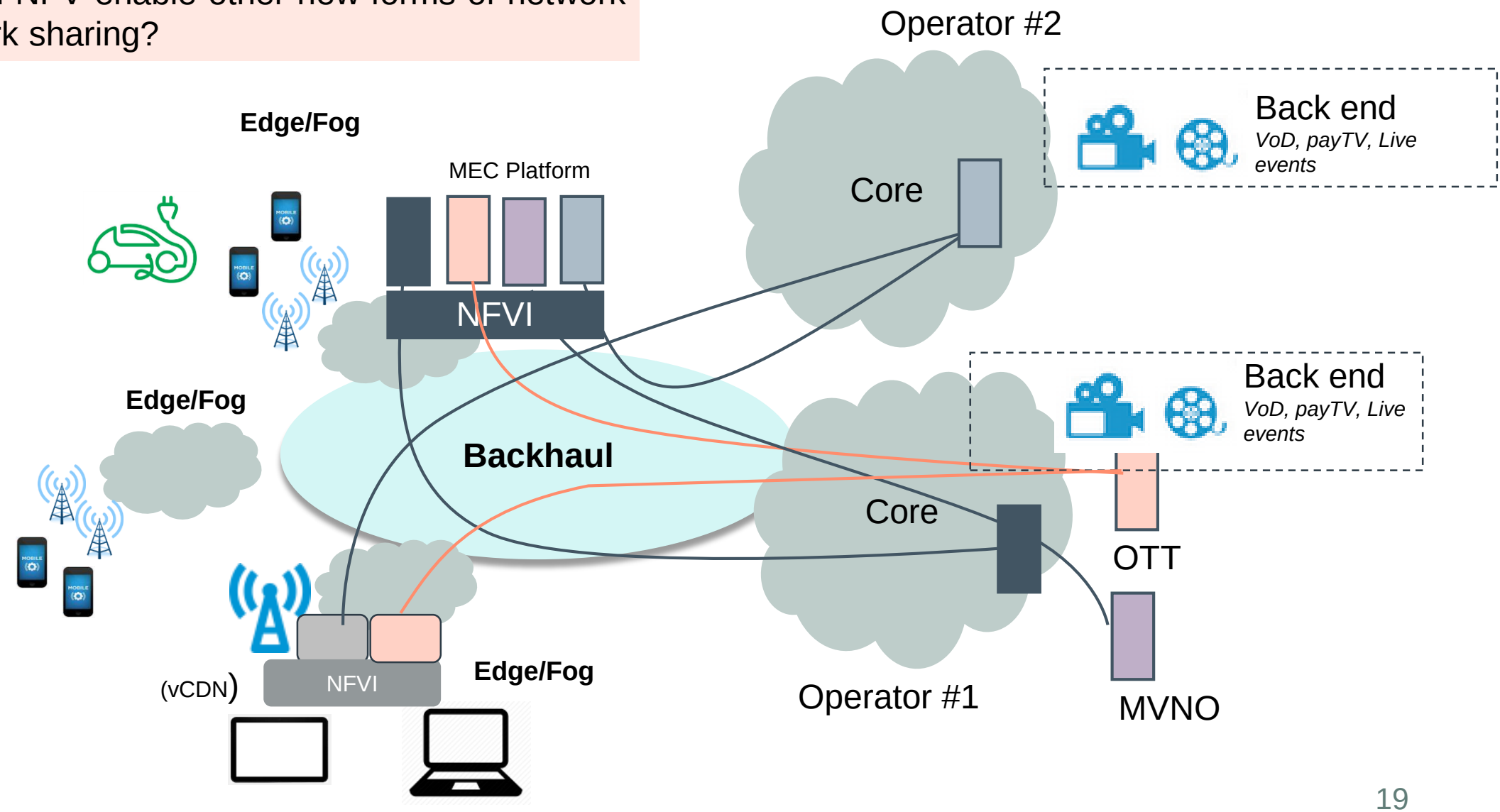
(1b)

ETSI NFV has defined these use cases in EVE005
⇒ The plan is to push this in IFA10 requirements in phase#2, to push an NFVO-WIM/SDN controller interface Specification
⇒ Knowing that in that case, WIM is really an SDN controller + some business parameters on the interface
⇒ TODAY the 2 aspects that drive this use case:
    ⇒ vBNG : not standardized
    ⇒ Interface NFVO-WIM/SDN controller with multi-tenancy : not standardized
    ⇒ Multi-tenancy support and different ACI I/F on SDN controller per client/tenant: not standardized
⇒ On SDN controller, some OpenSource support multi-tenancy… but many opensource project, TOO MANY !!! (this is not like a standard I/F, it does not guarantee interoperability)

(1c)
- vBNG: some vendor offering, no opensource to my knowledge
- Interface NFVO-WIM/SDN controller with multi-tenancy: some vendor will offer, no opensource to my knowledge (but this may come , ie OPNFV moving to MANO, T-Nova maybe …)
- SDN controller multi-tenancy: some vendor offering, some opensource offering

Case#3 – virtual edge

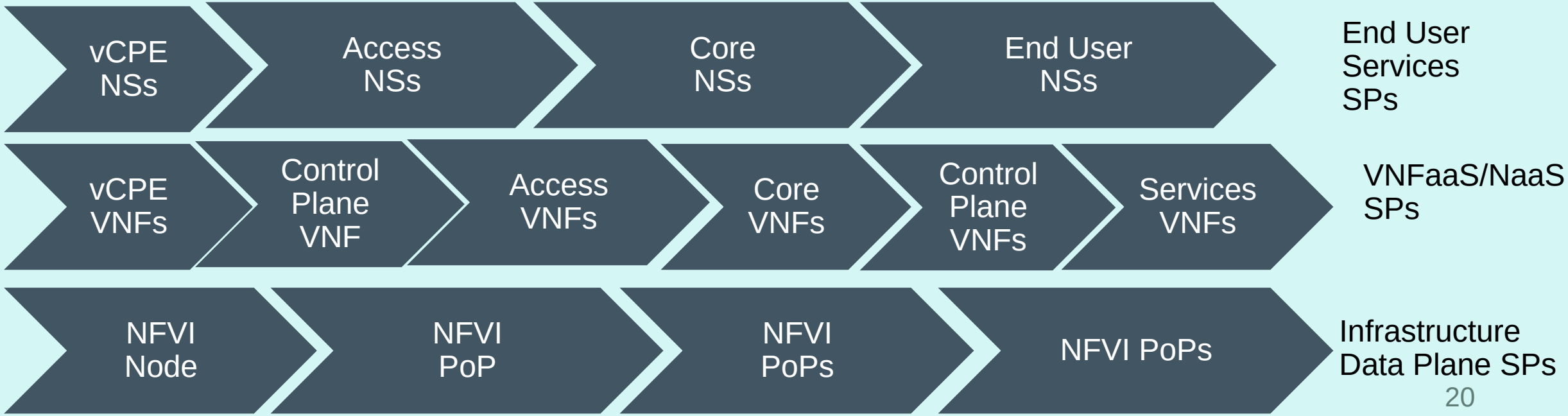
(2) Will SDN and NFV enable other new forms of network access or network sharing?



Impact of NFV – SDN on value chain

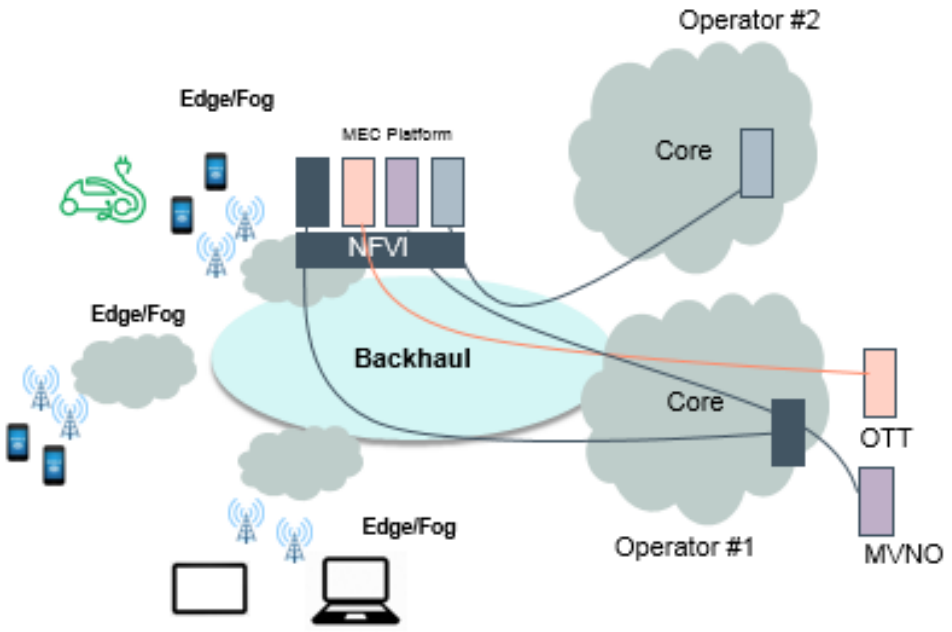
(3) Will SDN and NFV have an (further) impact on the current value chain? If this is the case, please present how SDN and NFV will alter the current value chain

More dynamic, more programmatic, each bloc more multivendor, more actors, more layers, more combinations



Impact of NFV-SDN on relationship with OTT

(4) Will SDN and NFV have an impact on the relation between OTT and telecommunications service providers? If this is the case, please present how SDN and NFV will alter the role and possibilities of OTT and telecommunications service providers.?



Service Providers will have more capabilities for OTT:

- Offer Virtual resources (NFVI)
- Offer VNFaaS – ex vDPI
- Offer autoscaling capacity
- Offer edge capacity on demand for low latency

Ex: if traffic grows in one location, more VM-OTT VNF Can be deployed automatically

- Offer virtual resource capacity on customer premises

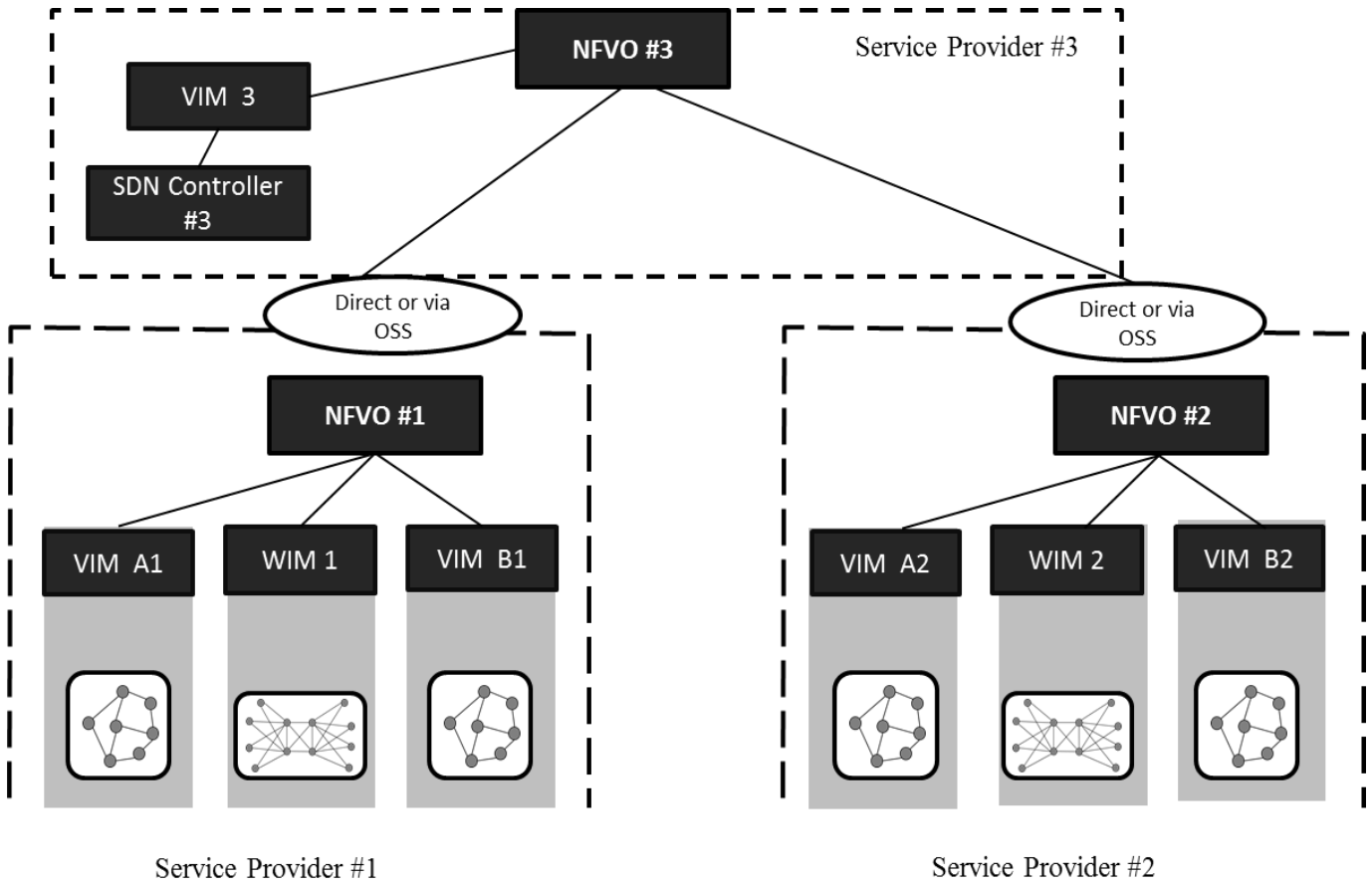
(5) Do SDN and NFV have other regulatory implications ??

Beyond …

New Interfaces, New Business Models

- More Network Sharing
- Data Retention
- Localization of the resources

SP#3 across 2 other virtualized SP



(Domain #1)

(Domain #2)

IMPACT

SP#3 can dynamically reroute traffic From domain#1 under SP#1 to domain #2 with SP#2

RISK: your traffic as a customer or as a SP that uses another SP network transits via certain location you did not want your traffic to transit through

Tenant SDN controller

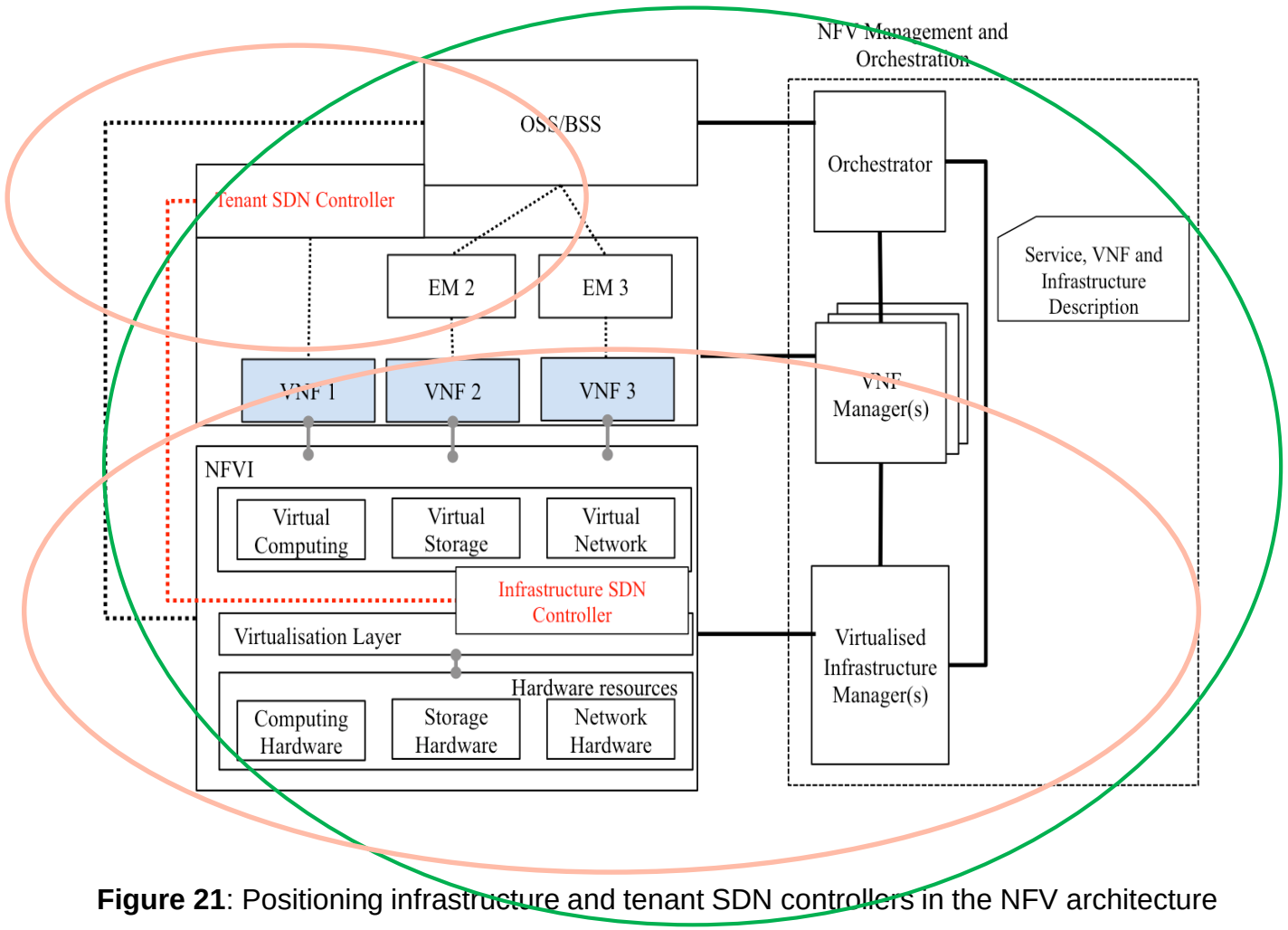


Figure 21: Positioning infrastructure and tenant SDN controllers in the NFV architecture

IMPACT:

Tenant SDN controller ask to change flow tables:

- Reroute traffic dynamically by interacting with infrastructure SDN controller
- Block some traffic
- Modify some traffic

Note: this interface is not standardized nor regulated

1 operator

2 operators, SP, MVNO or OTT

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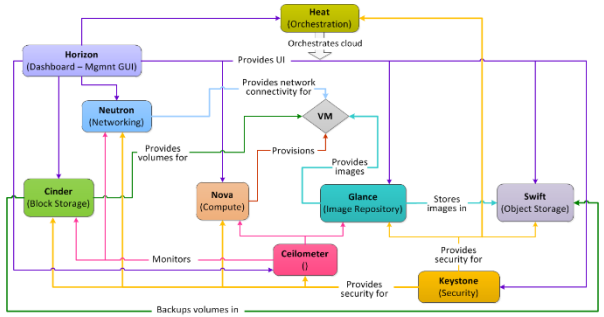
Big OpenSource NFV-SDN Project ?? Security ??

Over 1.7M lines of code

~ 6 meters or 20 feet

Security-specific?



Many blocks interact with Keystone

Keystone is not the only entity that deals with security

Keystone deals with security & policies, but NFV will need end to end security & policies across end to end network, at ?NFVO level : how to synchronize?

etc

? How can I ensure there is no security breach in 1.7M lines ?

? How does Openstack prevent back doors ?

? How does Openstack support secure boot, certified VM?

? How can I define security rules for an SDN application to change a flow table on an SDN switch that is provided by a IaaS Provider that may change along the life of the service ?

? How can I ensure that the memory I am sharing will not be accessed by somebody else ?

? Can I present the system admin to access my personal data

etc

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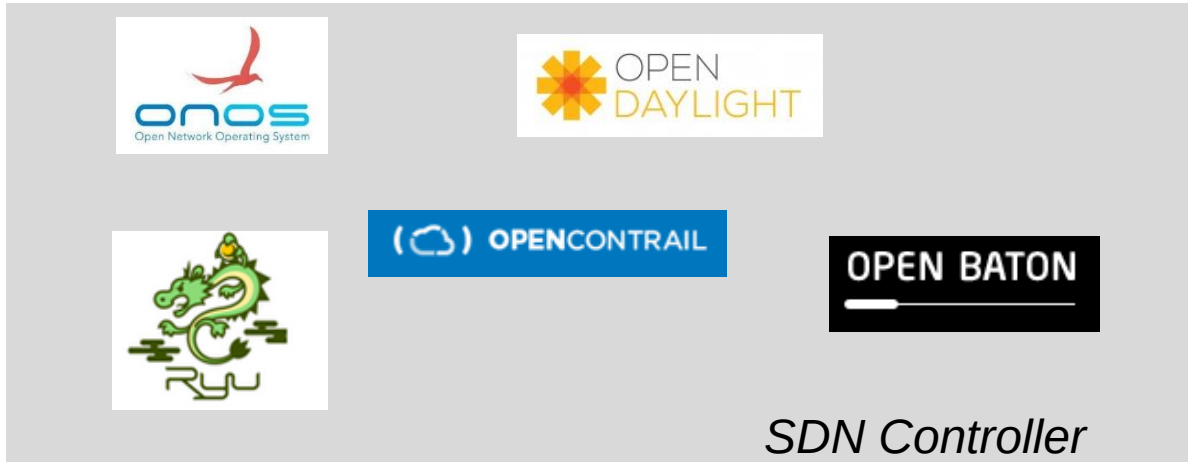
Source: ETSI NFV OpenStack Review in SEC WG – phase #1

Many Opensource projects on NFV-SDN … too many ??



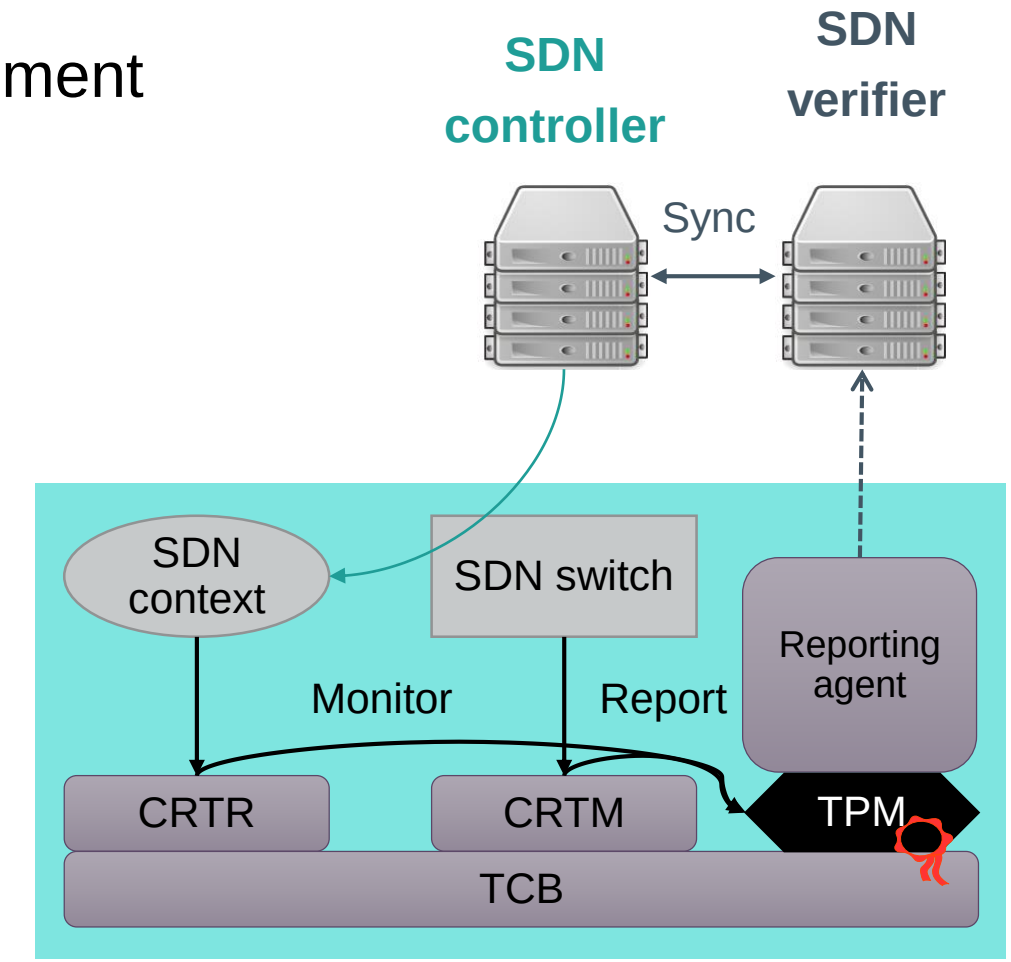
Non exhaustive list …

Monitoring SDN rules integrity

Monitoring the SDN rules inside a network element

1) SDN switch rules may be altered by unauthorized people
2) TPM “Trust Platform Module” holds information that can not be altered
3) SDN verifier checks SDN rule integrity by comparing configuration with expected data and TPM information

Solution: build a ‘secured/trusted Network’



HPE patents
European project

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CRTM: Core Root of Trust for Measurement = trusted process
CRTM: Core Root of Trust for Reporting = trusted process
TPM: Trust Platform Module = ‘security chip’ to store encrypted data, generate crypto key (implemented on most HW platform today – but illegal in china, Russia)
TCB: Trusted Compute Base = HW (motherboard)

NFV and SDN in Summary

New architecture
New interfaces
New services
New business models

Some opportunities,
Some uncertainties,
Some potential risks,
Some impacts on regulation

Some more work …