VIRTUALIZED HYBRID SATELLITE-TERRESTRIAL SYSTEMS FOR RESILIENT AND FLEXIBLE FUTURE NETWORKS
INFORMATION & COMMUNICATION TECHNOLOGIES (ICT)
Grant Agreement #644843 – VITAL – H2020-ICT-2014-1

Virtualized SatCom Networks and Multi-Domain Integration with 5G: Architectural Perspectives from VITAL Project

5GPPP - 1st 5G Architecture Workshop
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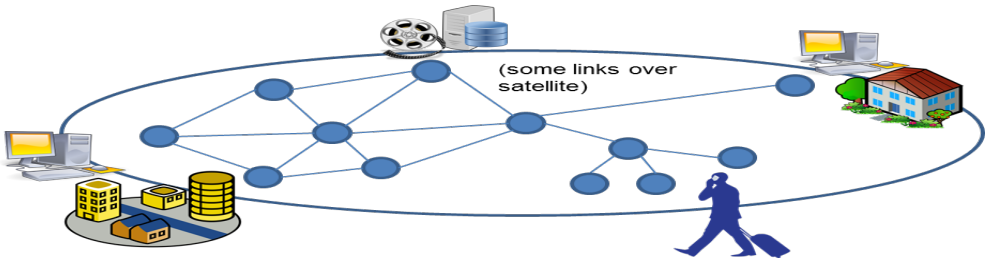
VITAL At a Glance

- H2020 RIA (Research and Innovation Action) Project – ICT 2014-1
- Duration: Feb 1, 2015 – July 31, 2017 (30 months)
- Budget: 2,9 MEuros
- Resource: 341 PM effort
- Project Coordinator: Tinku Rasheed, Create-Net
- Website: https://ict-vital.eu
- Twitter: VITAL Project @H2020_VITAL

Project Vision



Telecom services combining terrestrial and satellite elements

Provision of virtual networks (Virtual Network Slice–as-a-Service)

Federated SDN/NFV architectural framework (Resource virtualization and federated satellite + terrestrial resource management)

Infrastructure substrate

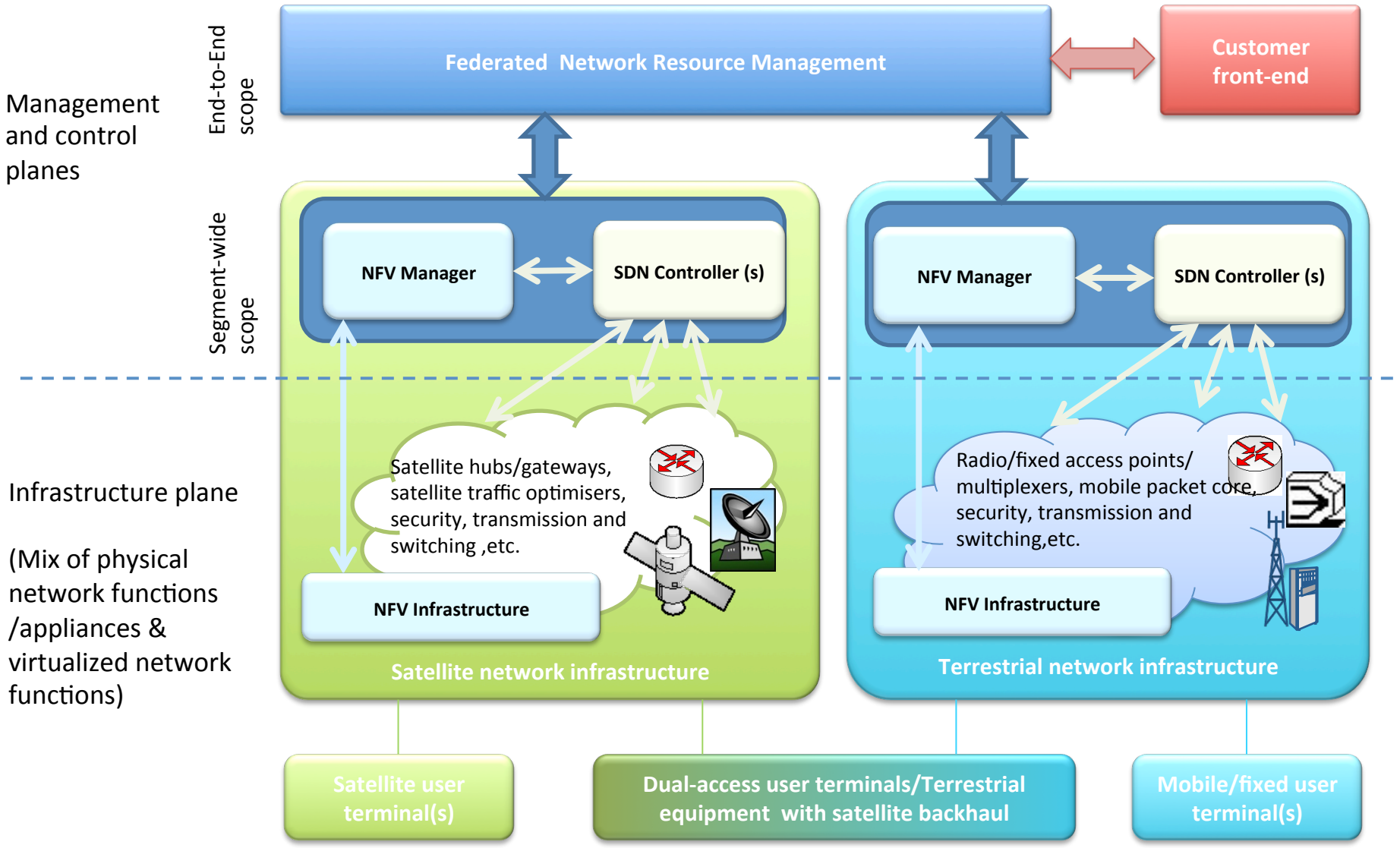
Satellite hubs/gateways, satellite traffic optimisers, security, transmission and switching ,etc.

Satellite network infrastructure

Radio/fixed access points/ multiplexers, mobile packet core, security, transmission and switching,etc.

Terrestrial network infrastructure

Main Concepts & Objectives



Main Concepts & Objectives

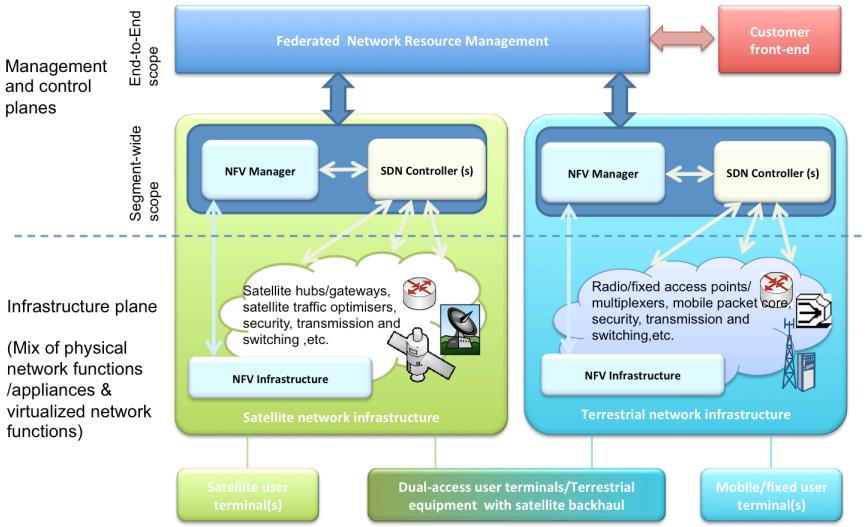
Design and proof-of-concept development of virtualized SatCom ground segment, or **Sat-Cloud-RAN**.

Design and validation of the **NFV Manager**, a management and orchestration entity specialized for SatCom service providers

Design and validation of the **multi-domain network service orchestrator**, for federated resource management over hybrid NFV/SDN-based Satellite-Terrestrial Networks

Validation and demonstration of the concepts and features through a combination of **real test-beds** and **software emulators**

To contribute to relevant standardization (ETSI NFV, ETSI SCN) and open-source initiatives (ETSI OSM, ON.LAB)



Application Scenarios

Scenario 1 - Virtualization and sharing of satellite communication platforms

Improvement area: SDN/NFV-enhanced satellite ground segment communication platforms

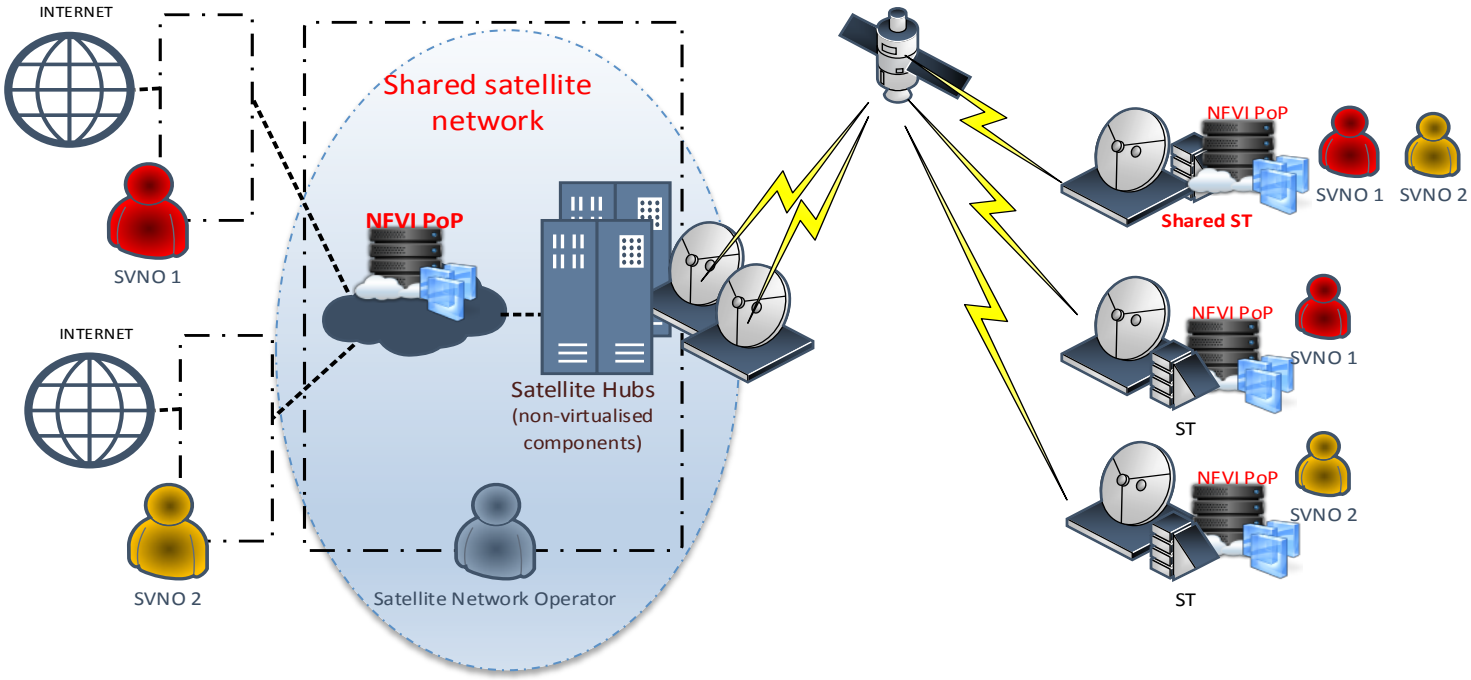
Scenario 2 - 4G/5G Satellite Backhauling Services

Improvement area: Combination of SDN/NFV-enhanced satellite ground segment communication platforms for satellite backhauling in terrestrial networks

Scenario 3 - Satellite Terrestrial Hybrid Access Services

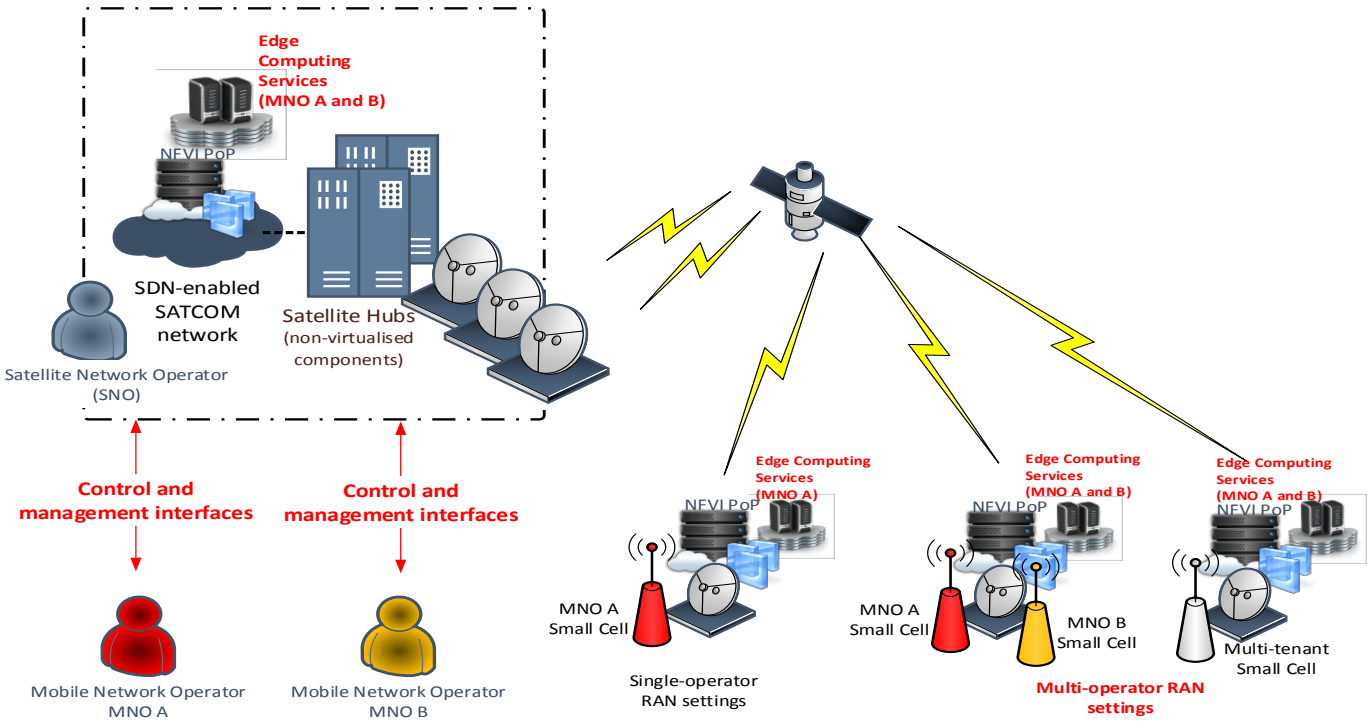
Improvement area: Combination of SDN/NFV-enhanced satellite ground segment communication platforms and terrestrial networks for hybrid access services

Scenario 1: Virtualization and sharing of satellite communication platforms



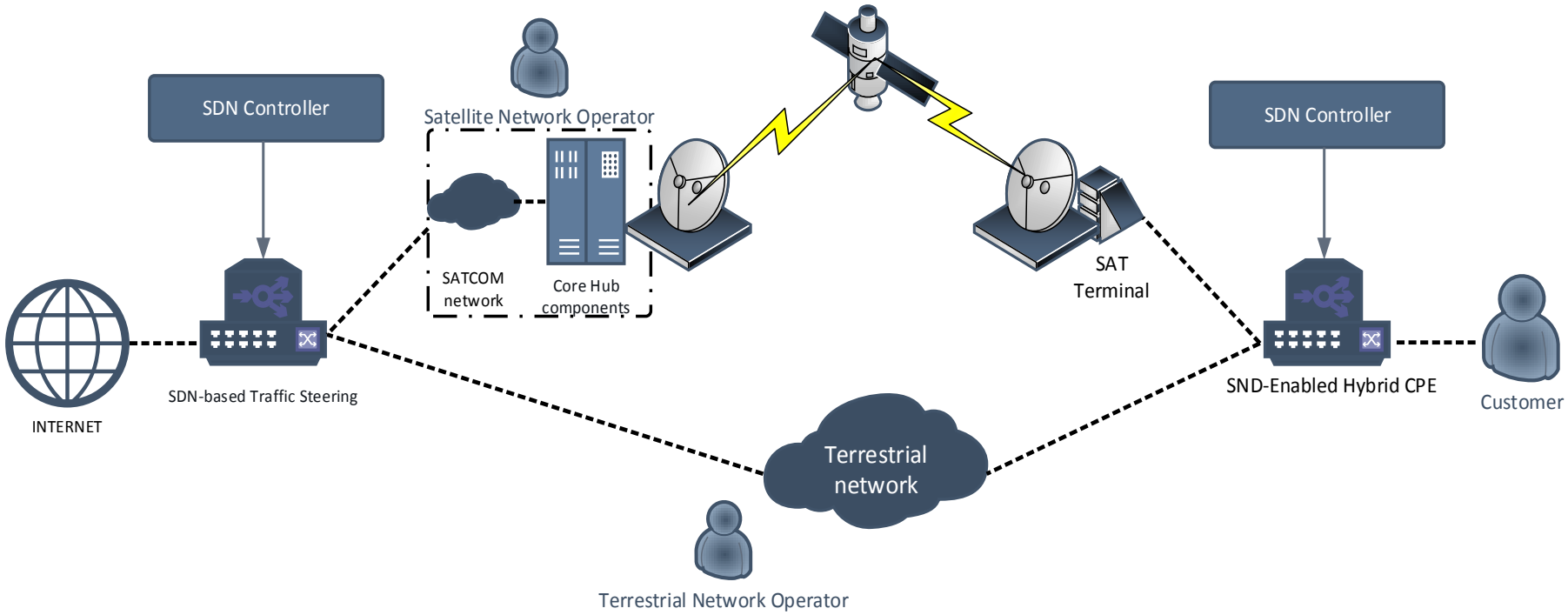
Scenario	Use Case	Main Focus
Scenario 1 - Virtualization and sharing of satellite communications platforms	**UC1.1:** SDN-based flexible satellite bandwidth on demand	Flexibility and customisation of the provided satellite network services
	UC1.2: Satellite Virtual Network Operator	Support of slicing and multi-tenancy in the satellite ground segment
	UC1.3: Satellite Network as a Service (SatNaaS)	Cloudification of the satellite ground segment

Scenario 2: 4G/5G Satellite Backhauling Services



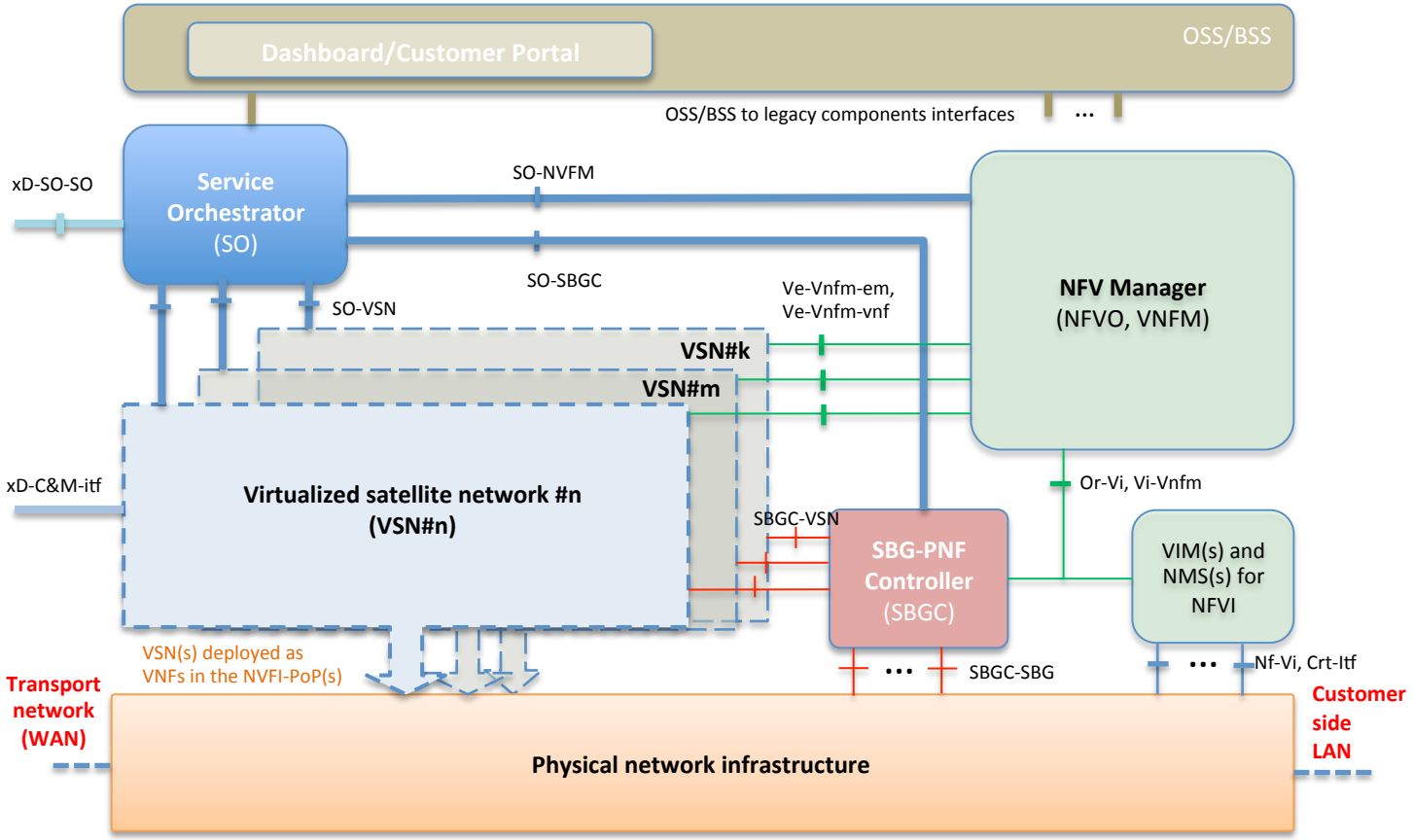
Scenario	Use Case	Main Focus
Scenario 2 4G/5G satellite backhauling services	**UC2.1:** Enhanced control and management of satellite backhauling capacity	Improved integration and management of satellite backhauling services
	UC2.2: Extending satellite backhauling with edge computing services and multi-operator sharing	Extension and coupling of the backhauling service with virtualization capabilities at the satellite terminal that allow for the delivery of mobile edge computing services.

Scenario 3: Satellite Terrestrial Hybrid Access Services

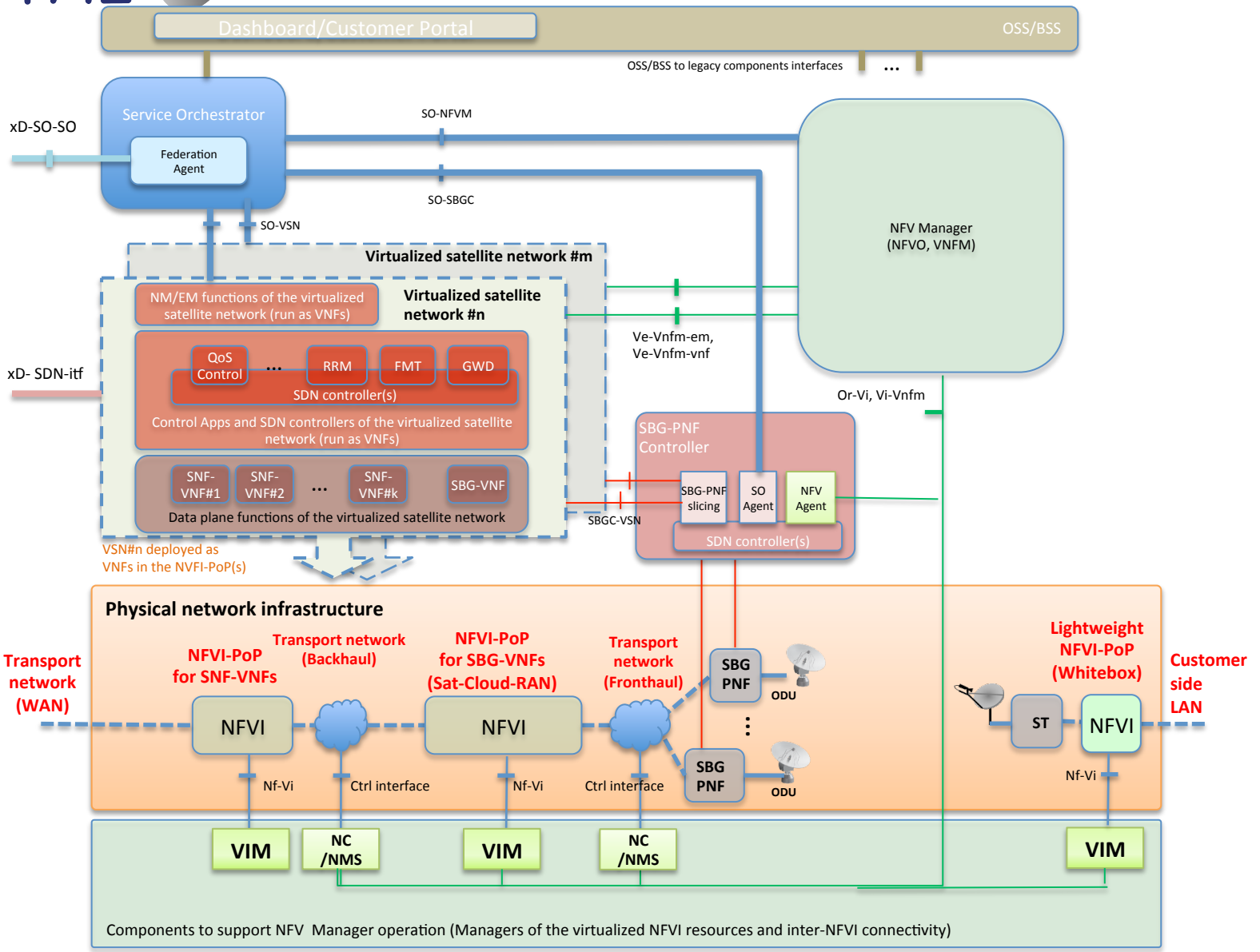


Scenario	Use Case	Main Focus
Scenario 3 –Satellite-terrestrial hybrid access services	**UC3.1**: SDN-based flexible federation of Satellite and terrestrial networks	SDN-based flexible traffic steering between satellite and terrestrial access network
	UC3.2: Media distribution over Federated SDN/NFV-enabled terrestrial and satellite network	Federation of SDN and NFV-enabled satellite and terrestrial domains for content distribution
	UC3.3: Customer functions virtualisation over Federated Terrestrial and Satellite network	VNF-as-a-Service (VNFaaS)

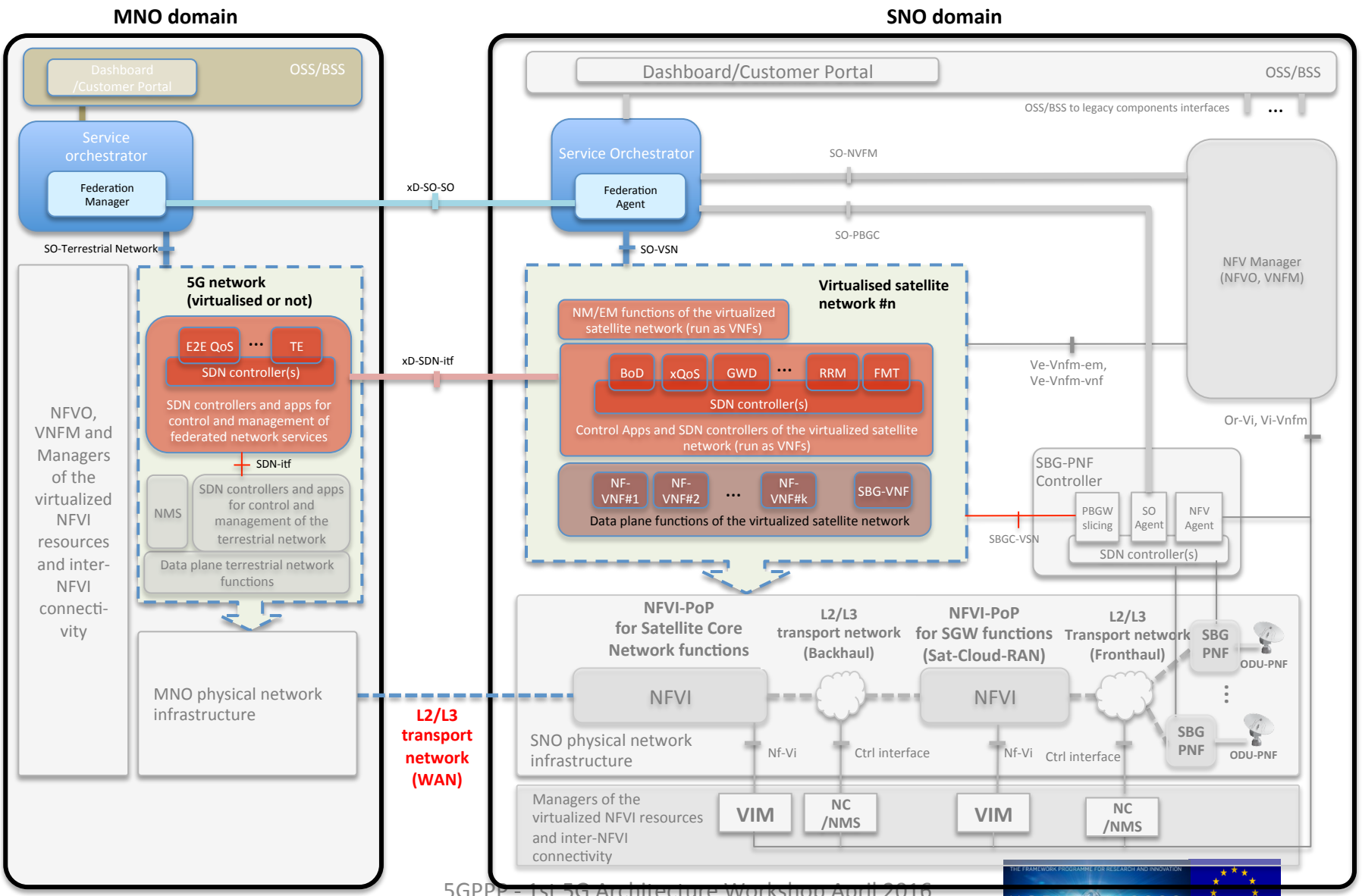
System Architecture – High level view



System Architecture – More detailed view

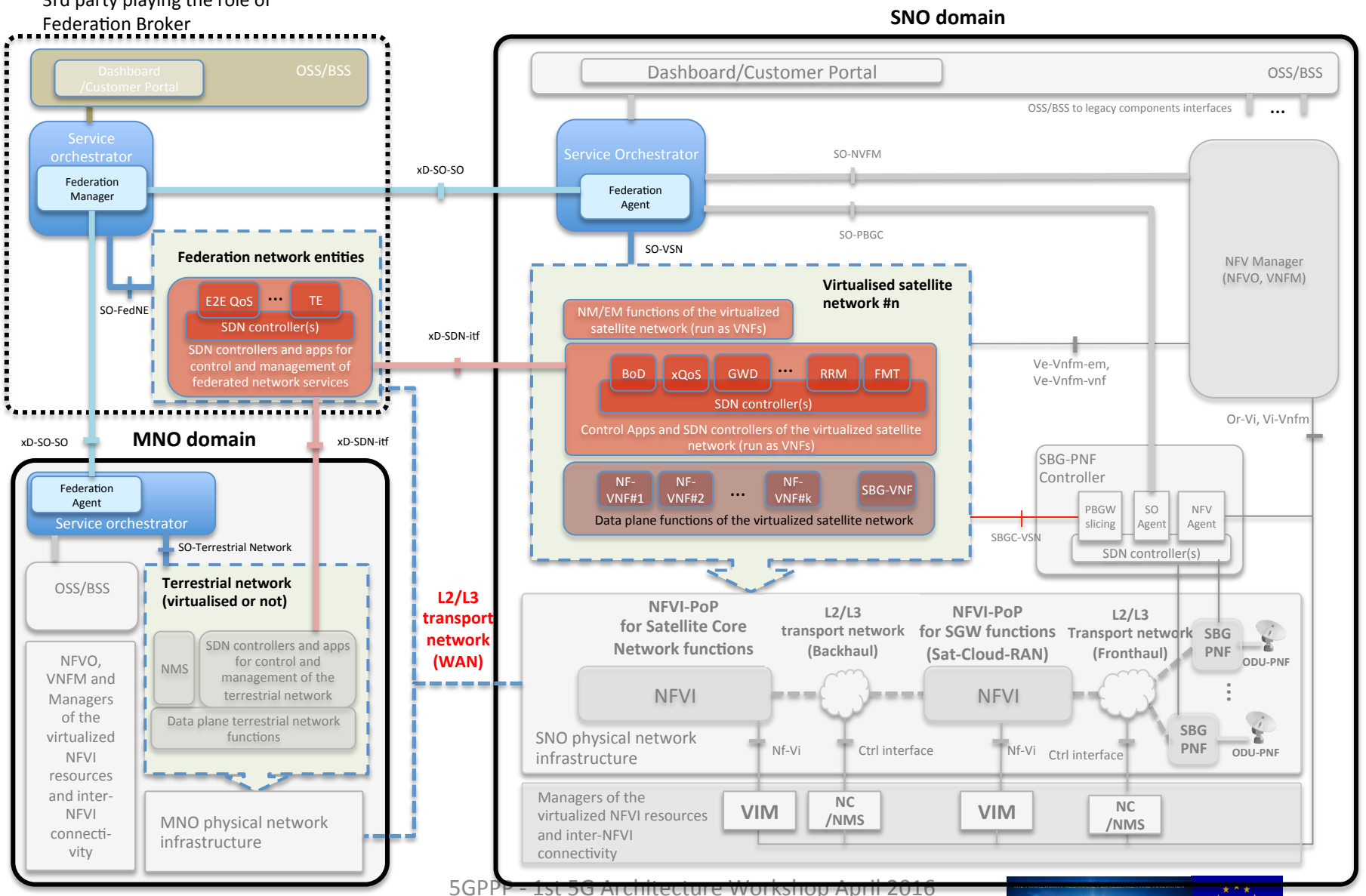


Multi-Domain Integration model



Multi-Domain Integration model

3rd party playing the role of Federation Broker



Conclusions

- Unified/Federated network service orchestration and management capabilities will allow the service providers and operators to augment 5G service capabilities, offer hybrid end-to-end services and identify new business models
- Adoption of SDN/NFV technologies into the satellite domain is a key facilitator to make SatCom industry well integrated within the anticipated multi-layer/heterogeneous 5G network architecture
- VITAL project research and develops solutions that will enable 'seamless' 'hybrid' end-to-end services and applications over SatCom & 5G technologies
  - Mobile Edge Computing services
  - Seamless Emergency services
  - Seamless mobile network management
  - High Speed Trains
  - Broadband 5G European Aviation Networks
  - Integrated Energy Sector Communications

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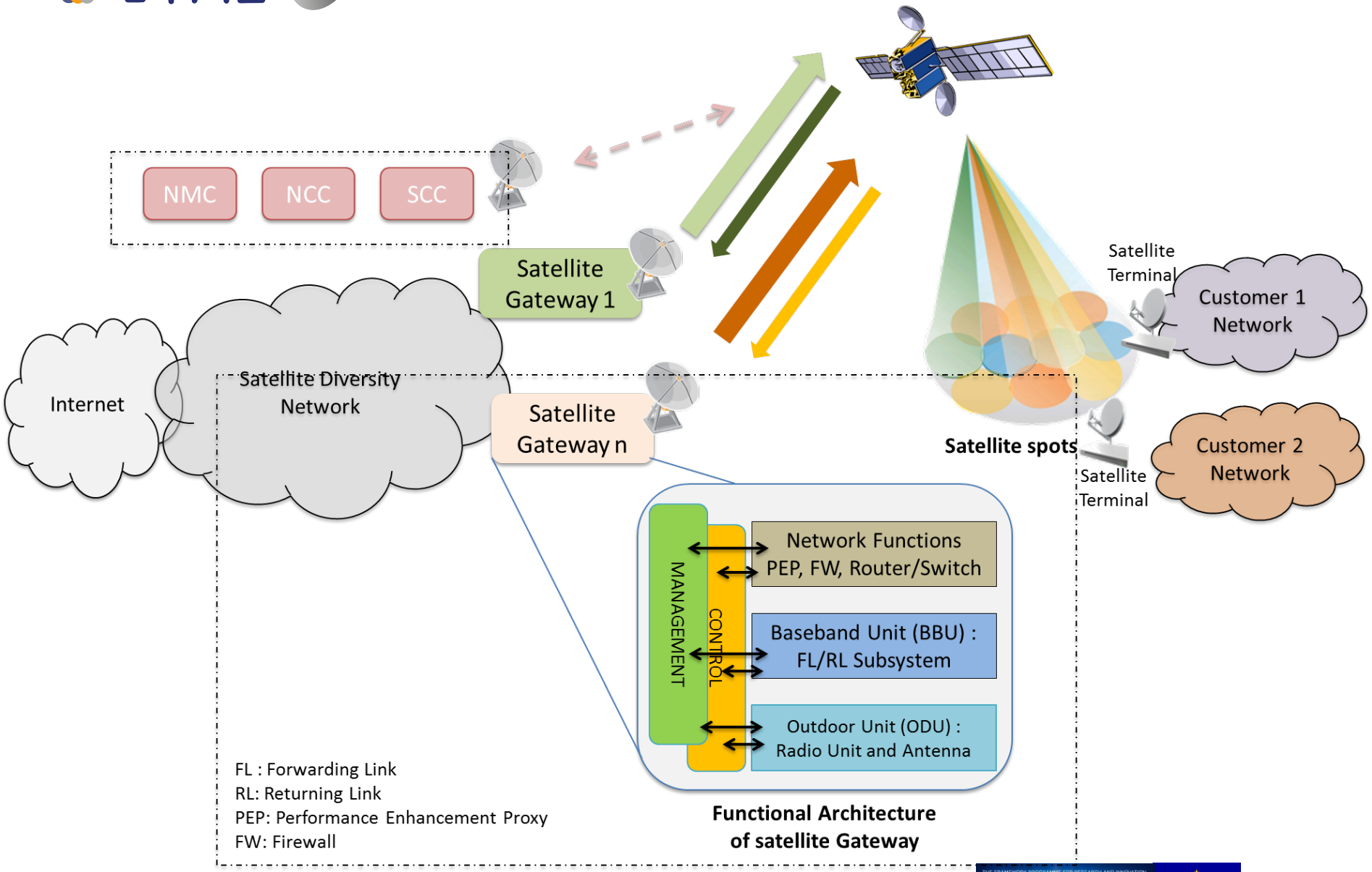
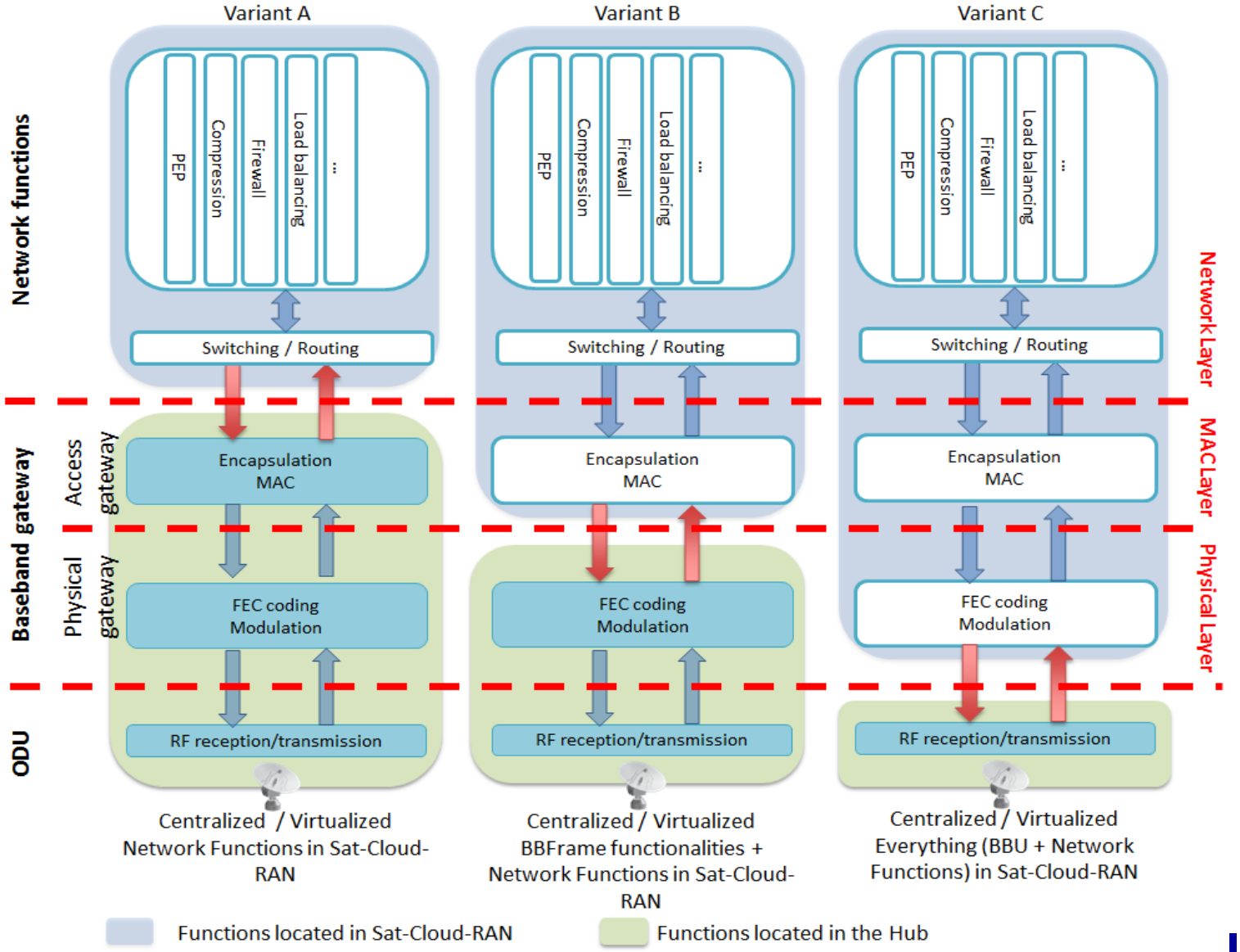
Backup Slides

Overall Satellite network architecture



Tradeoff analysis of satellite gateway functional split



SDN/NFV based Sat-Cloud-RAN architecture

- Satellite-domain SDN-based network control and management
- Different architectural options identified (single SDN controller, dedicated controller per tenant, hierarchical controller)
- Three control applications delineated:
  - **SDN-based bandwidth on demand**
  - **SDN-based QoS on demand**
  - **SDN-based satellite gateway diversity**