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Ongoing transformations in transport networks: how making all them work

Luis M. Contreras, Telefónica GCTIO Unit

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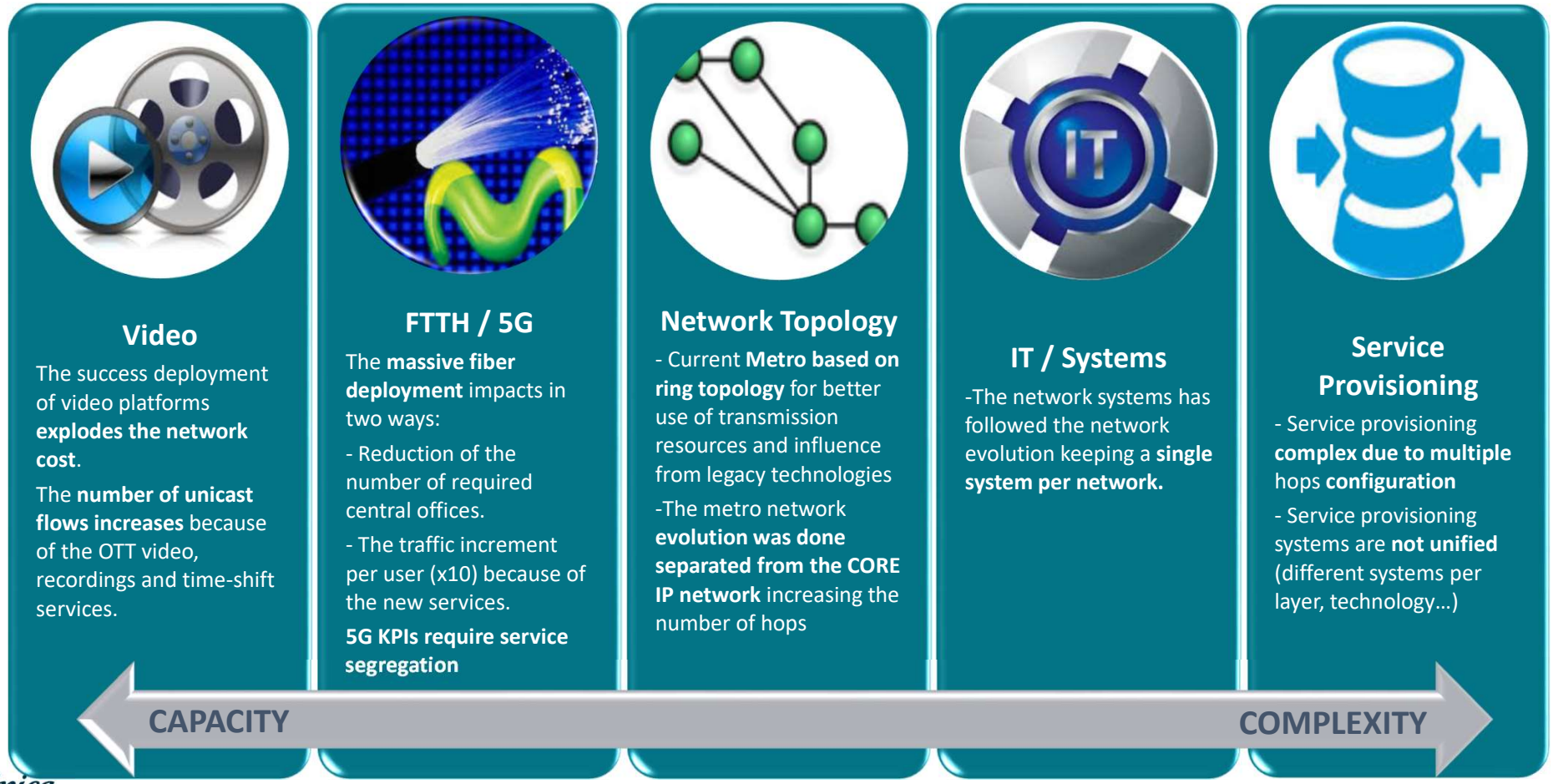
NOMS

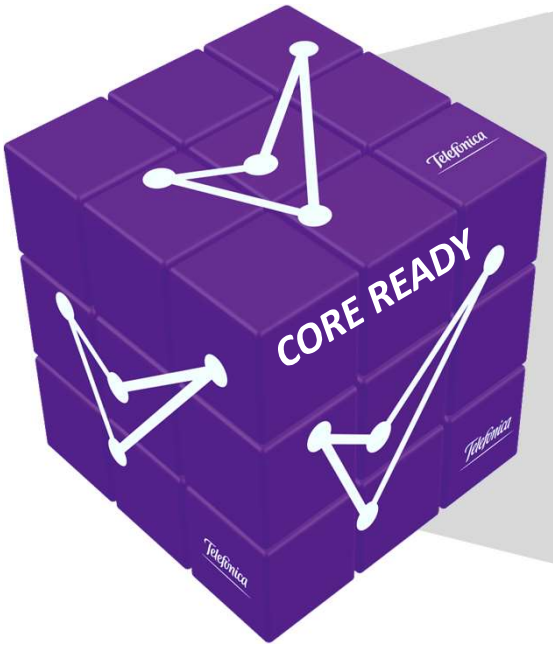
ifip IEEE

Drivers for IP & Transport Transformation

Facing the increase of capacity and complexity



Telefónica “Core Ready” Transformation Program



- UNICA TELCO CLOUD
- Legacy Evolution
- IP & Transport Transformation
- Business Intelligence & Analytics

A new Programmable and Virtualized Network designed to:

- **Re-allocate capacity in real time** wherever needed making **elastic and scalable networks** possible
- Provide **service agility** by automation
- Improve **Time-to-market**
- **Minimize integration** efforts
- Enable **operation at global scale** in a simplified and automated way
- **Enabling E2E lifecycle** management
- **Sharing infrastructure** in an efficient way

Network Programmability and Virtualization are key enablers for future 5G network architecture

Core Ready Program aims to enable Telefónica to support the new challenges and functionalities to be demanded by Telefónica’s customers during the coming years in the most efficient manner

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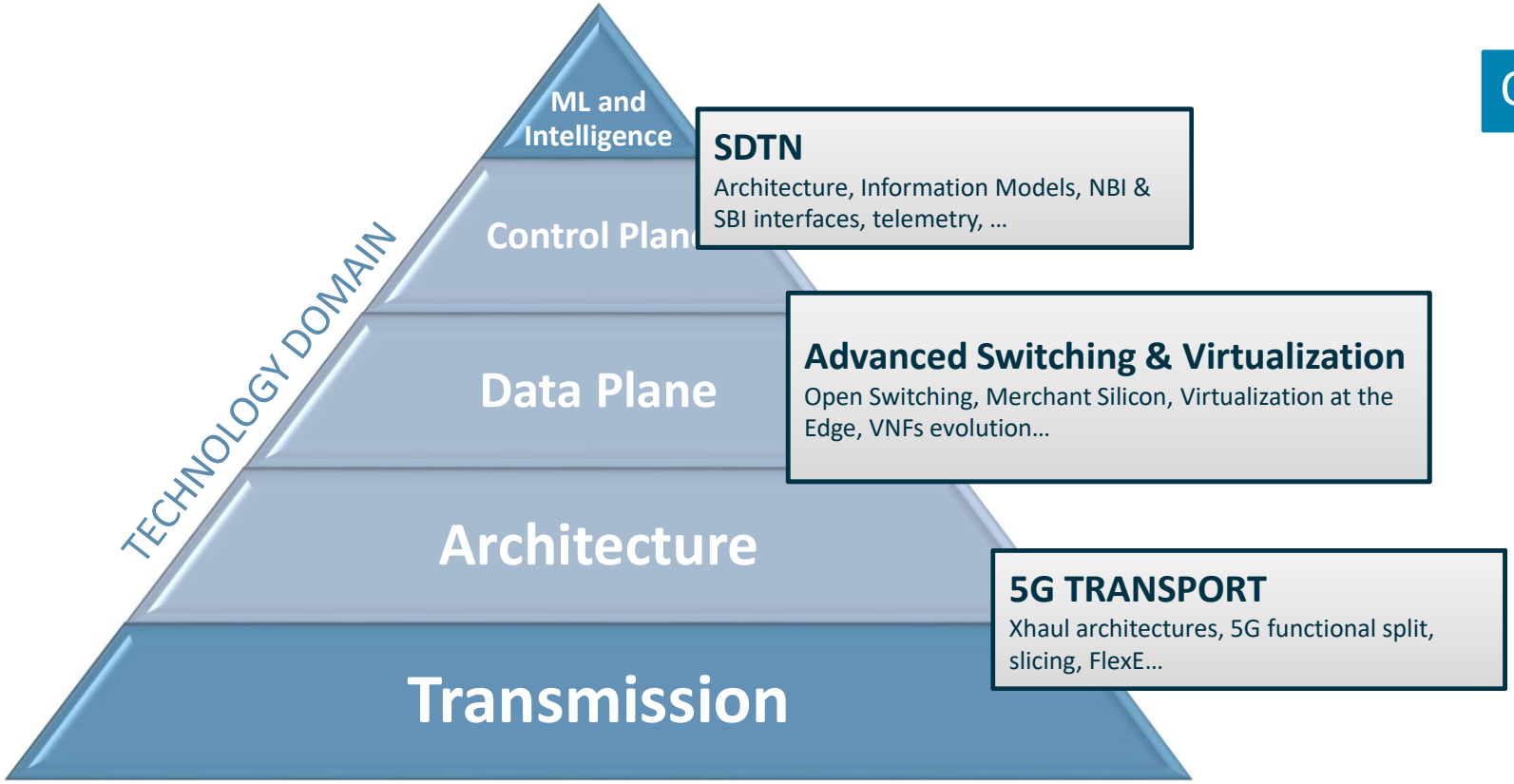
Telefonica's Transport Evolution

Ongoing transformations in Transport networks are key (and mandatory) to enable 5G



ONGOING DEPLOYMENTS

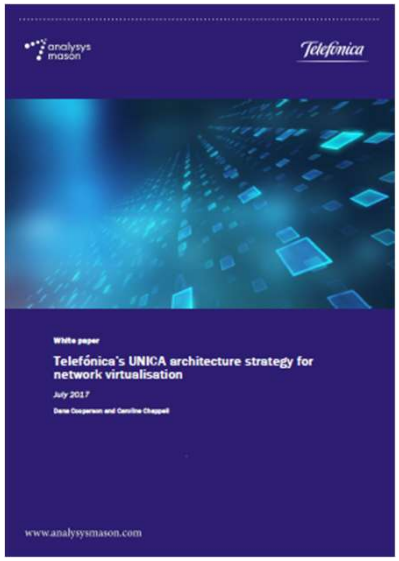
UNIC@ Telefónica

FUSION

UNICA: Telefonica Network Virtualization Program

Telefonica UNICA is **the foundation of our NFV strategy** and can be **described as a Telco Cloud** architecture allowing **hosting and deployment of network components in an automatized fashion**

- UNICA Architecture -



UNIC@ Telefónica

- **Open**: modular, multi-vendor, standard, evolvable
- **Cloud based**: Elastic, Multi site, Multi Vim, Multi Tenant
- **Telco Grade**: Secured, High availability, High performance
- **Efficient**: Automatized deployment and network connectivity through SDN

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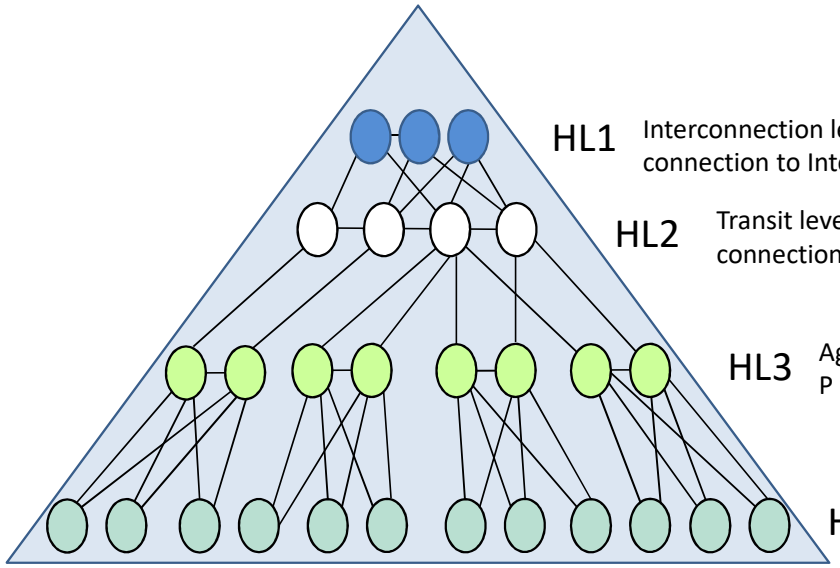
FUSION: Telefonica IP&Transport Transformed Network

Telefonica transformation towards 5G has already started:

- **E2E Flattened Multiservice Network**, arranged in a few hierarchical levels (typically 4, at most 5)
- **Seamless Transport** architecture and **SDN enabled** to simplify network provisioning and operation, for higher scalability and resiliency
- **Flexible**. Specific **functions** are assigned, but **not bounded, to predefined levels in the hierarchy** to increase homogeneity
- **Scalable**. **Not** required to **rearchitect** the network for new services.



HL1 Interconnection level (includes P functions, connection to Internet)

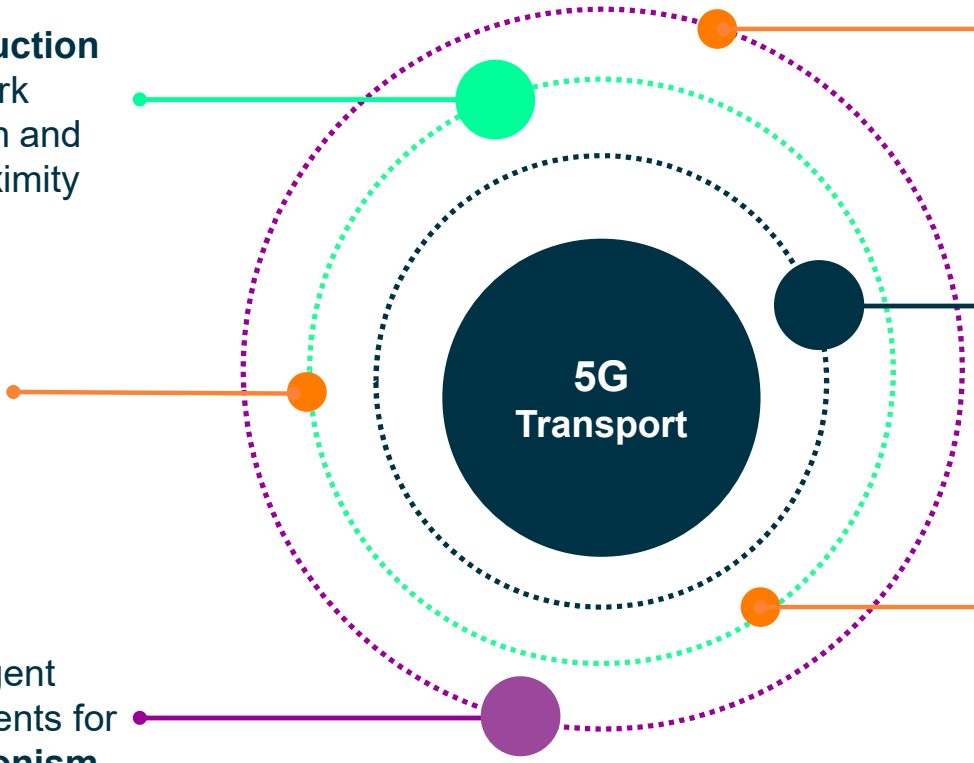
HL2 Transit level (includes P functions, connection to control platforms)

HL3 Aggregation level (includes L2 PE, P functions, connection to video platform)

HL4 Access level (includes BNG, L2 and L3 PE functions, and connection to the OLTs/DSLAMs and to voice platform)

The Path towards 5G

Challenges



Latency reduction by network simplification and content proximity

Unified Orchestration across the network including different technology domains and virtualization environments (UNICA)

Stringent requirements for **Synchronism**

High Bandwidth capacity up to the access

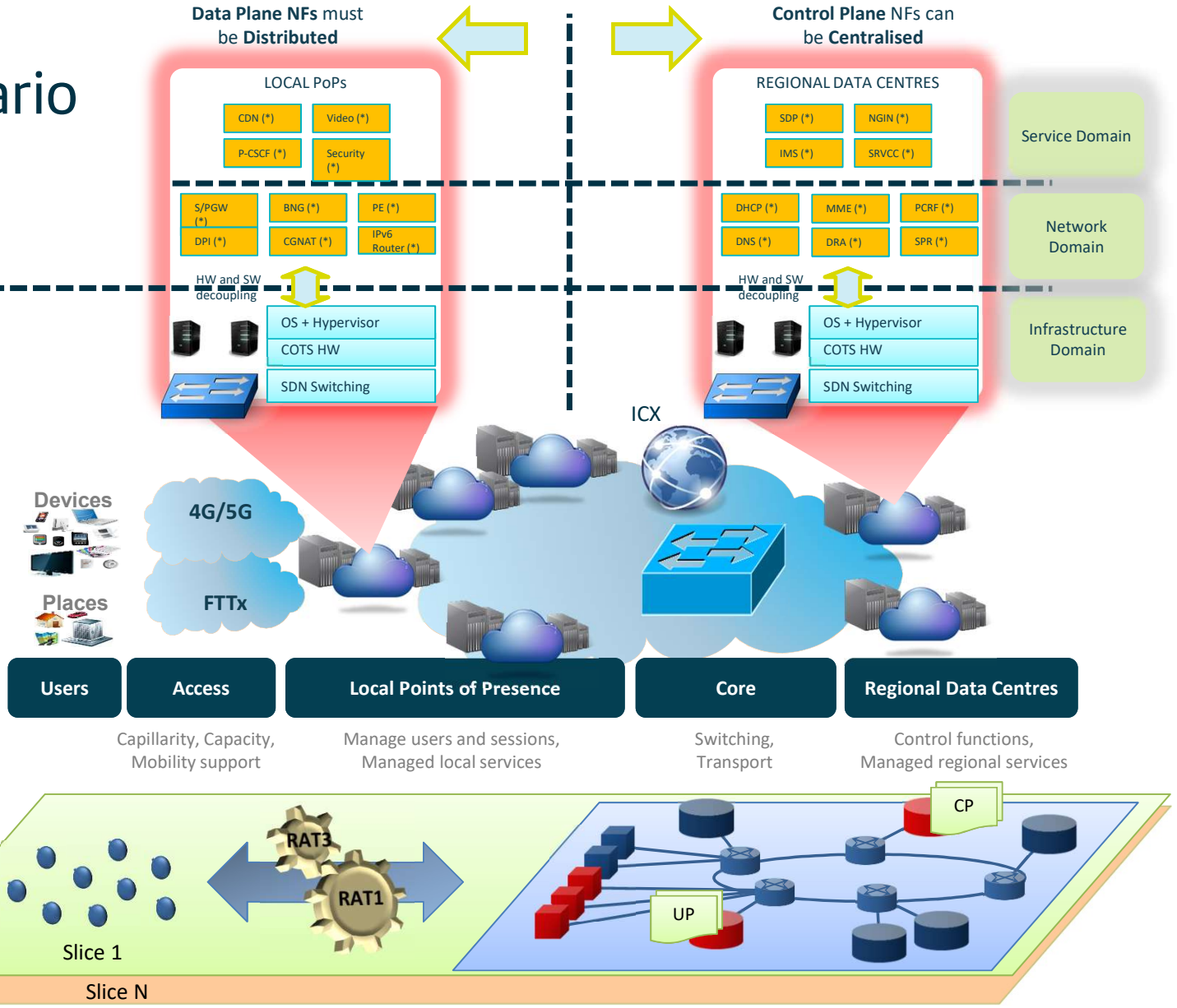
Service segregation for vertical customer through **Network Slicing**
/
Strict **SLAs**, associated to penalties for vertical customers

Flexible and Fast Reconfiguration of transport network for agile service deployment to accommodate all kind of 5G services

The future Telefónica scenario

FUNCTION
(software defined, NFV)

CAPACITY
(Homogeneous infrastructure)



(*) Illustrative, since final VNFs deployed will depend on a natural selection processes regarding traffic and digital world evolution and requirements.

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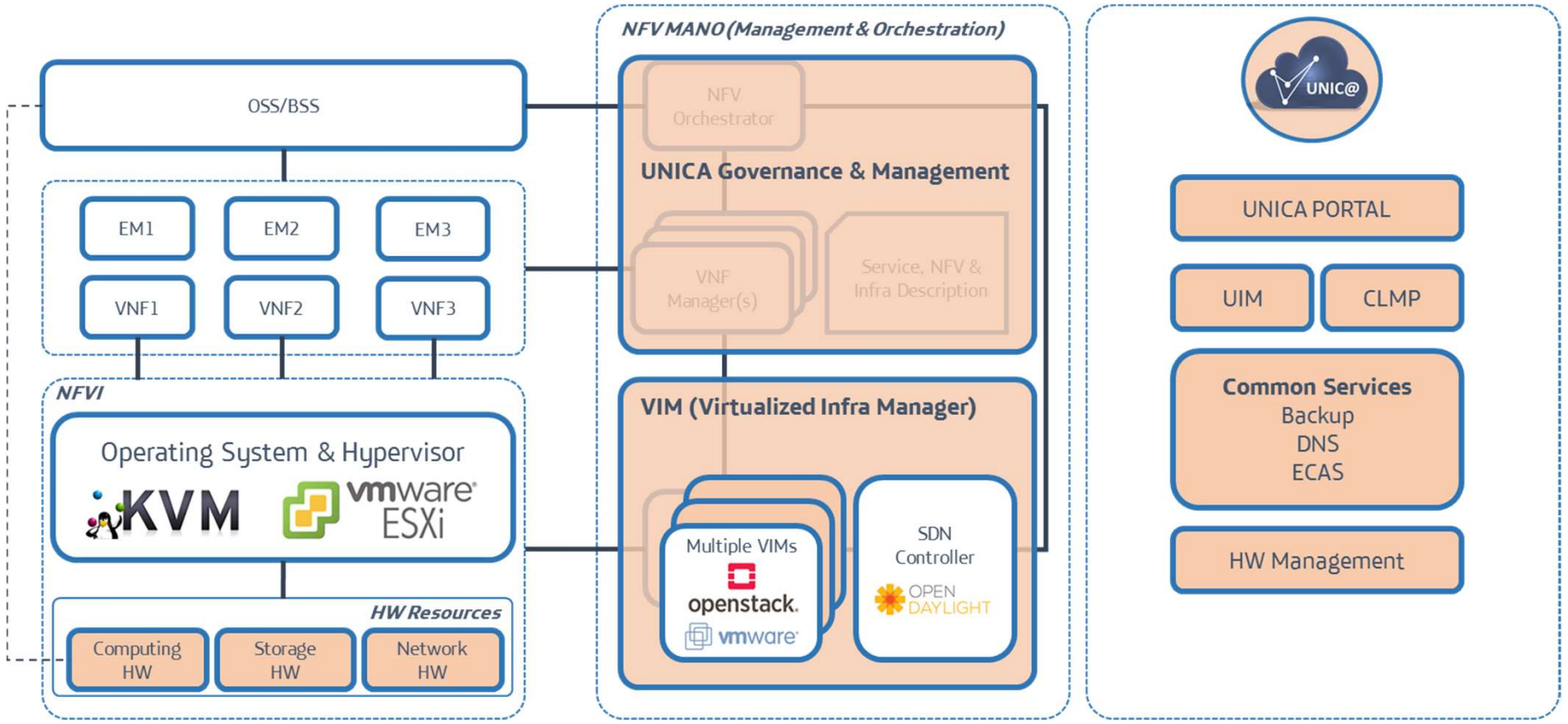
UNICA architecture augments ETSI NFV architecture



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UNICA will use OSM as the service orchestration layer

The goal: a new virtualized network designed to be agilely changed and operated in an automated fashion

- Wider and competitive vendor ecosystem
- Agile and open innovation
- Faster Time-to-market
- A way to differentiate

Virtual Network Functions

Orchestration

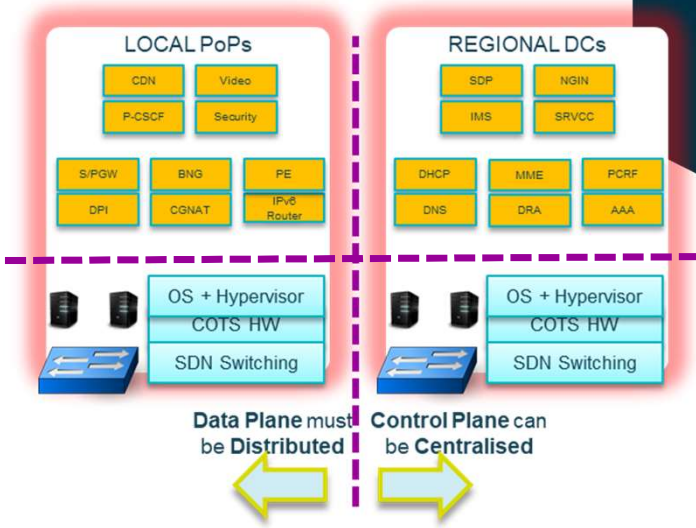
- Simplified & automated operation
- E2E lifecycle management
- Common information models
- Simple integration per VNF
- Lowering entry barriers
- Elastic and scalable networks

Open Source MANO

UNICA

SOFTWARE DEFINED

MOULDABLE HARDWARE



Infrastructure

- Homogeneous and versatile infrastructure
- Commoditized infrastructure
- Easier interoperability
- Flexible and easy capacity addition
- Common IT+Network infrastructure operation

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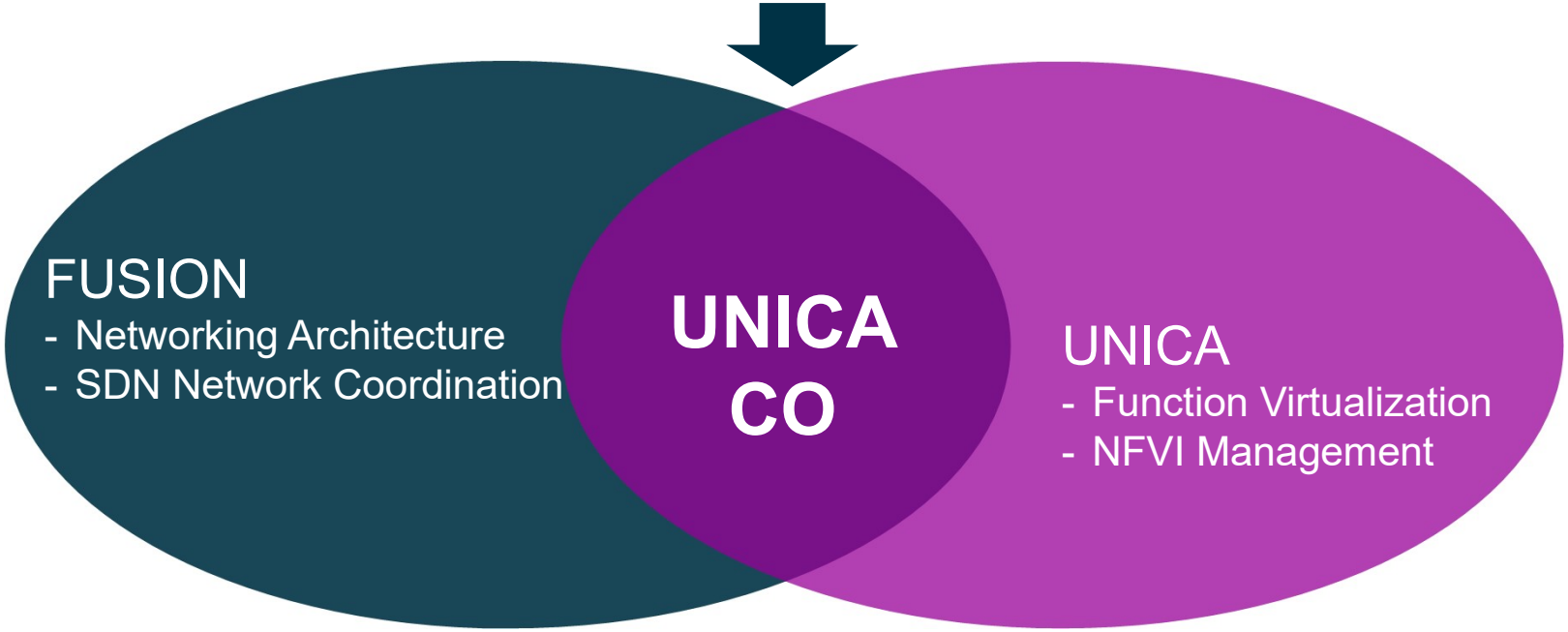
UNICA Central Office

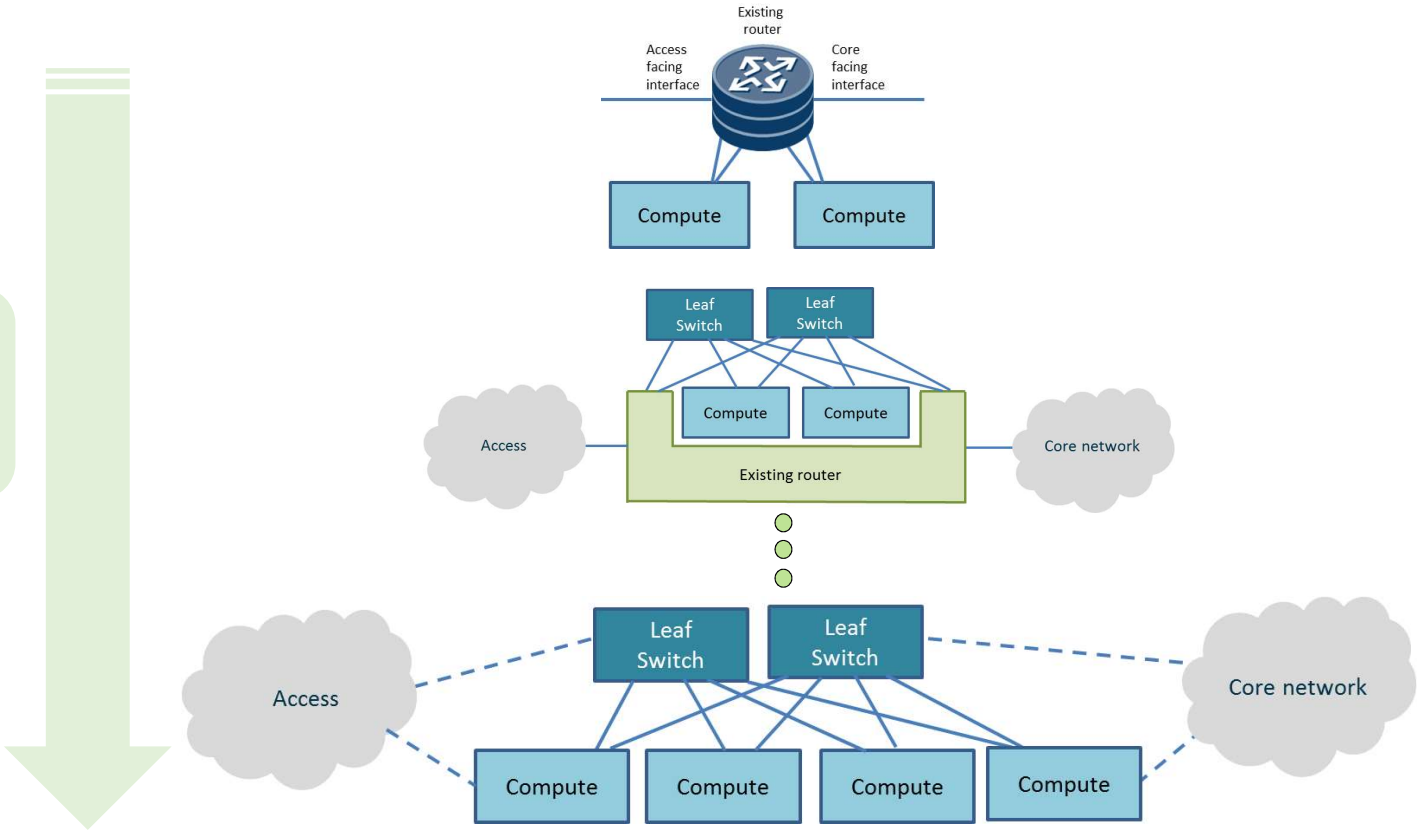
- Core Ready Program
- Ongoing Transformation & Optimization Processes



UNICA Central Office

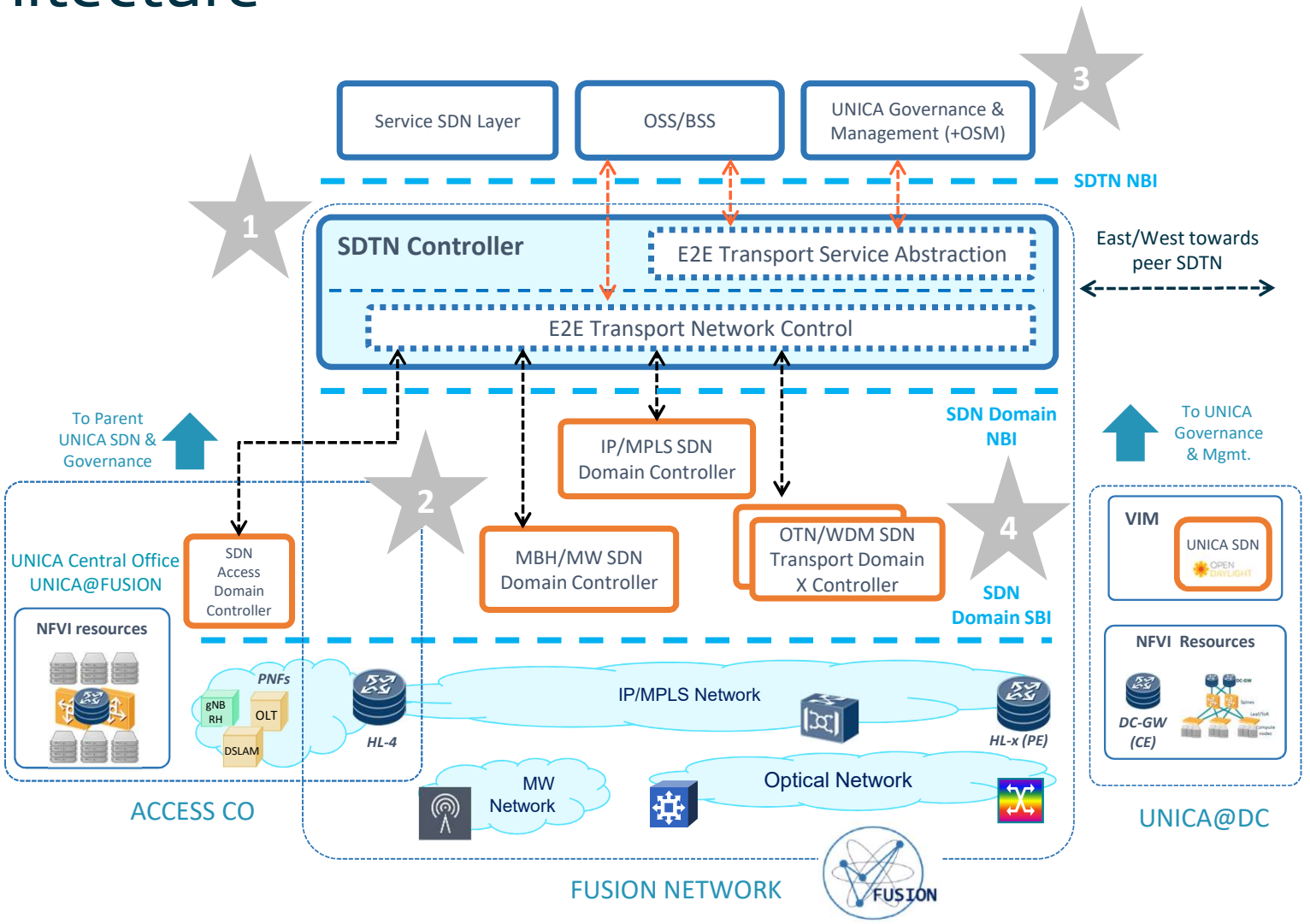
A phased, evolutionary approach, to account for the different needs of TEF OBs overtime, with high performance for dataplane applications

Towards the virtualization of the IP infrastructure

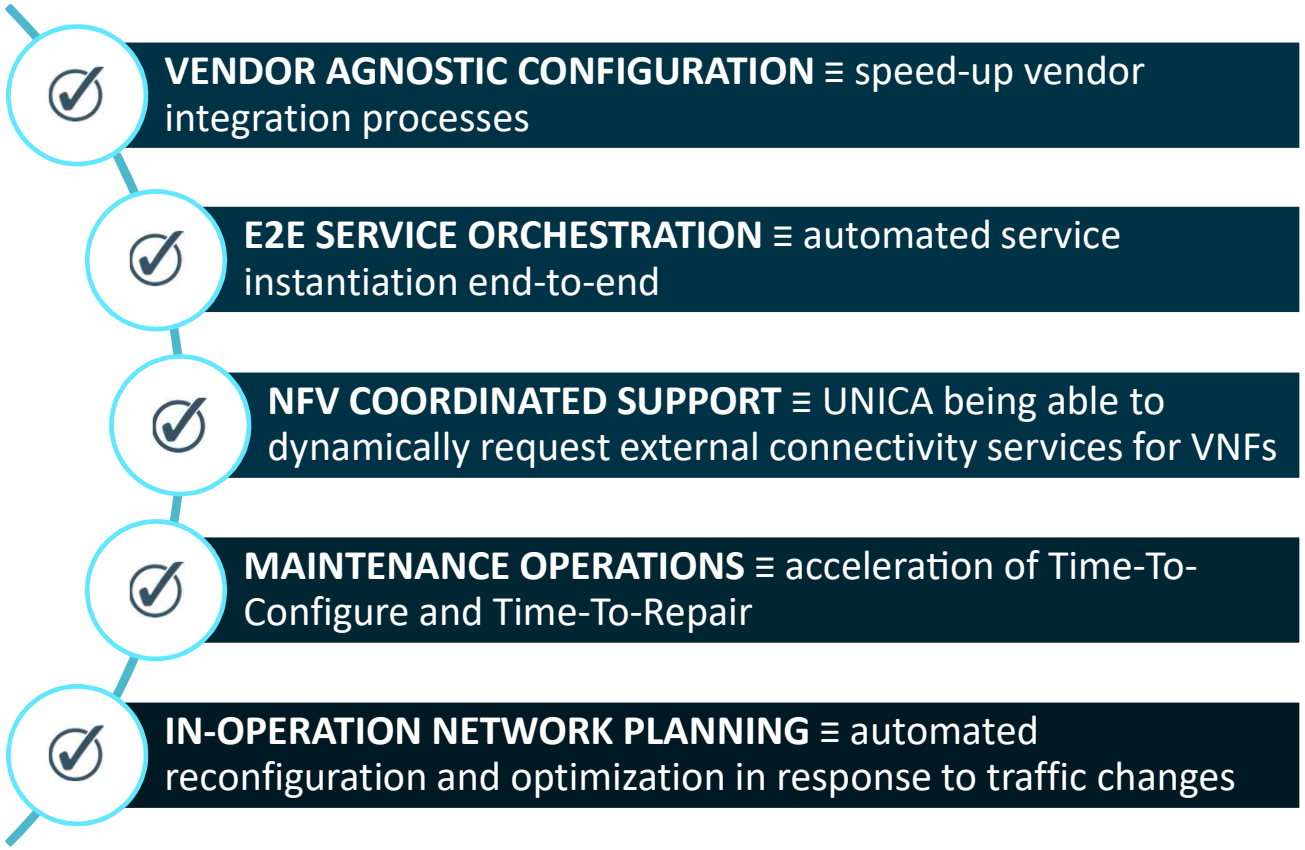


Target SDTN Architecture

1. Hierarchical approach with unique SDTN Controller, offering **service level abstraction**
2. Per network domain SDN controller, offering **network level abstraction** and implementing devices configuration
3. SDTN Controller may also **offer services to UNICA**, in combination with the UNICA SDN Domain Controller
4. **Common** SDN **Domain NBI and/or SBI**, for multivendor SDN interoperability



Main SDTN Use Cases



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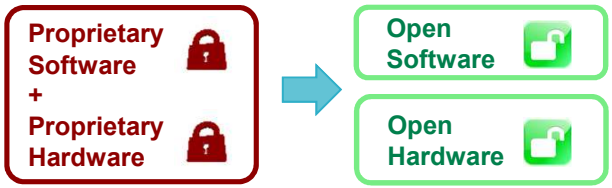
Advanced switching

New Players

Players from datacenter ecosystem **positioning for telco use cases** (improved L3 features and operator-like performance)

New Architectures

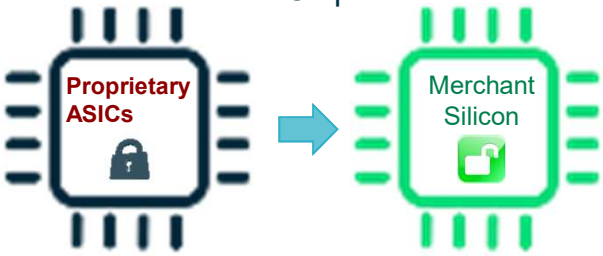


Concepts of **white-box** and **open switching**, defending decoupled hardware and software (e.g. TIP and OCP project)

TELECOM INFRA PROJECT

OPEN Compute Project

New Chipsets



Chipset vendors quickly evolving in the **merchant** and **programmable silicon** industry (driven by operators)

BROADCOM

BAREFOOT NETWORKS

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Deployment Drivers

- Reduced **cost per bit**
- **Homogeneous** commoditized **hardware**, decoupled from software
- **Simplified operation** and systems integration based on a unique software
- **Avoidance** of vendor **lock-in**
- **Faster** Time To Market

Path towards a convergent 5G Transport

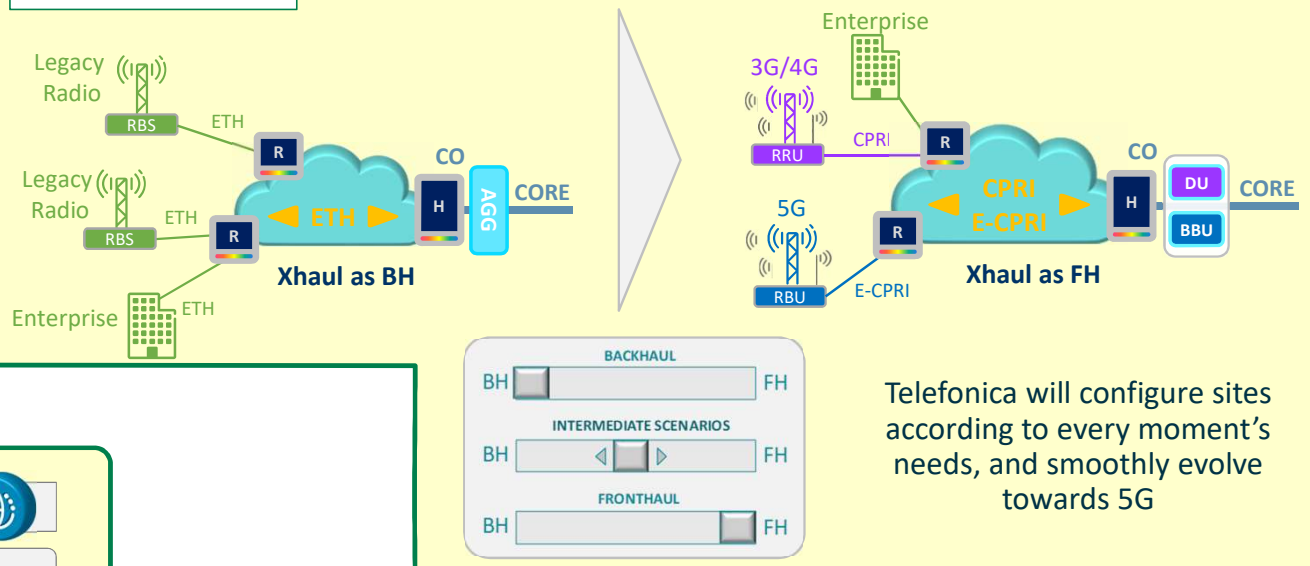
Evolution of the transport infrastructure

High Performance
Latency Reduction & Scalable Arch.

High Bandwidth
FO to radio sites, 100G in Aggregation

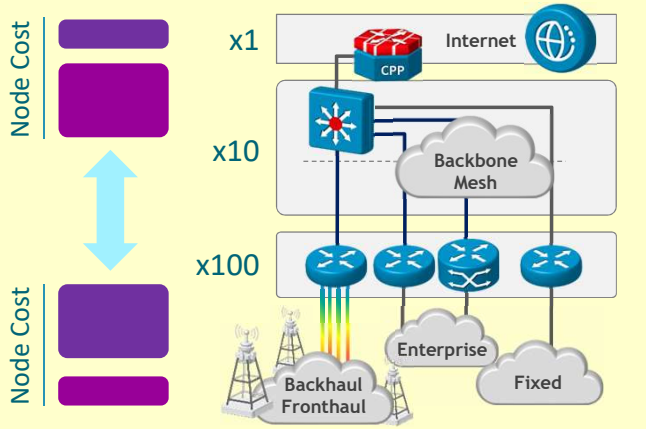
High Robustness
Resilient Architecture

Tunable networks



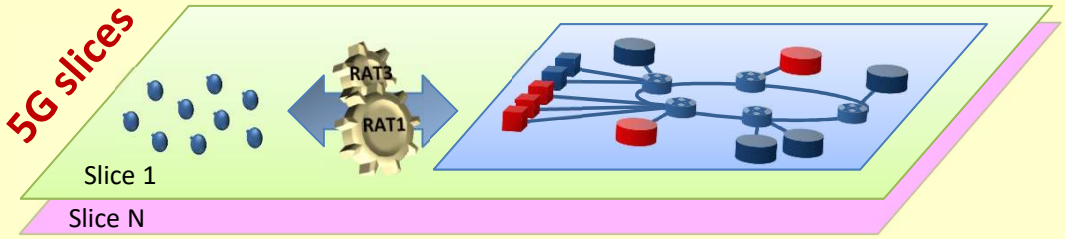
Telefonica will configure sites according to every moment's needs, and smoothly evolve towards 5G

Long-live network built



Installation/commissioning costs
HW/SW costs

Per service structure and unified orchestration



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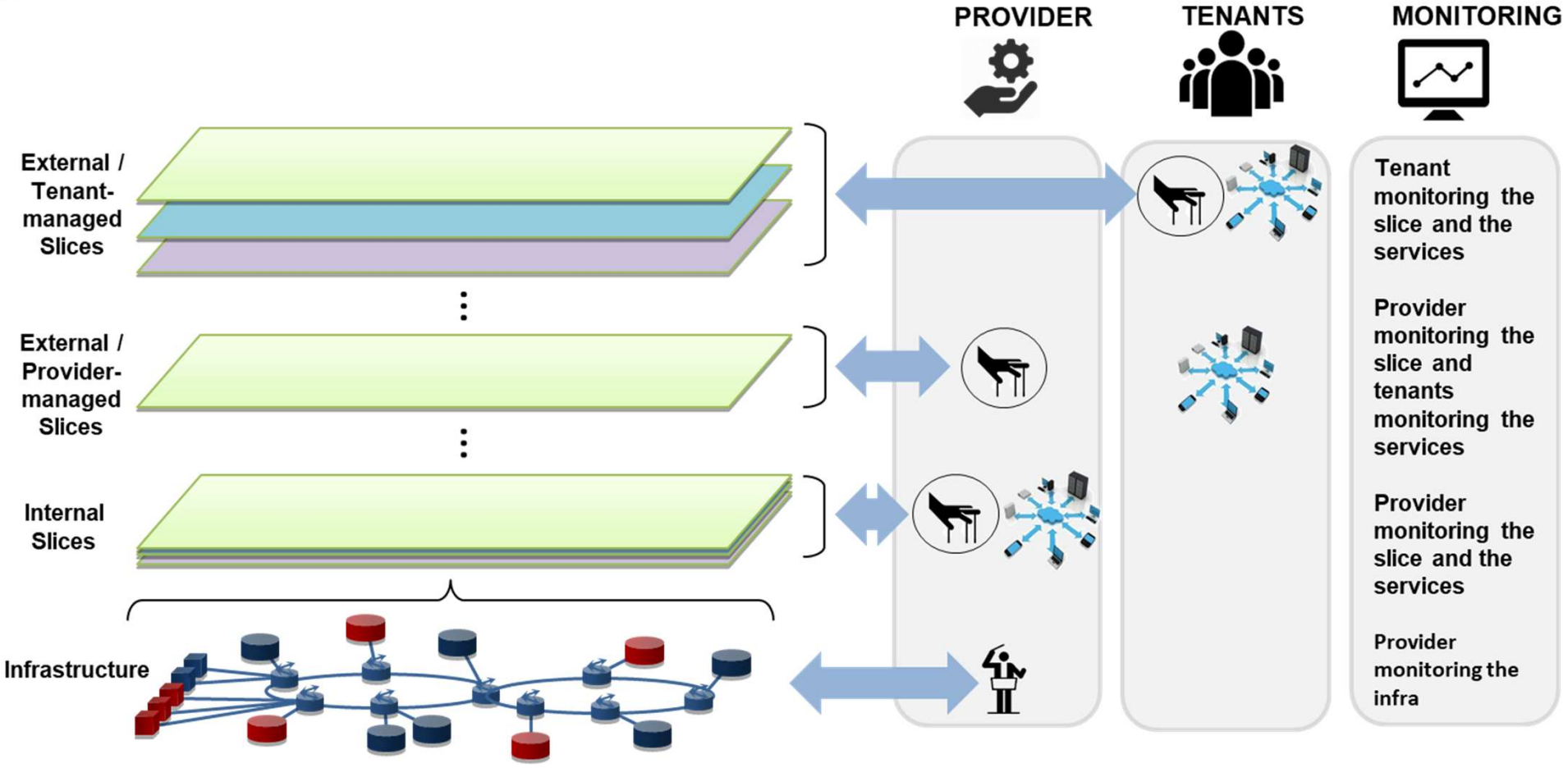
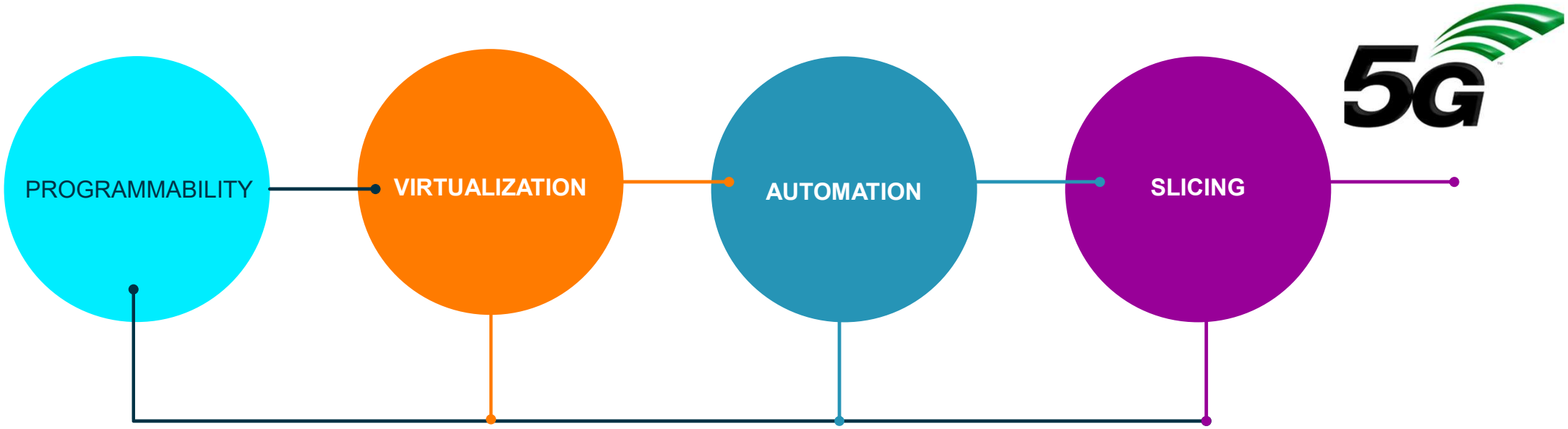
Types of slices and control responsibilities



Source: A Network Service Provider Perspective on Network Slicing. Luis M. Contreras and Diego R. López. IEEE Softwarization, January 2018

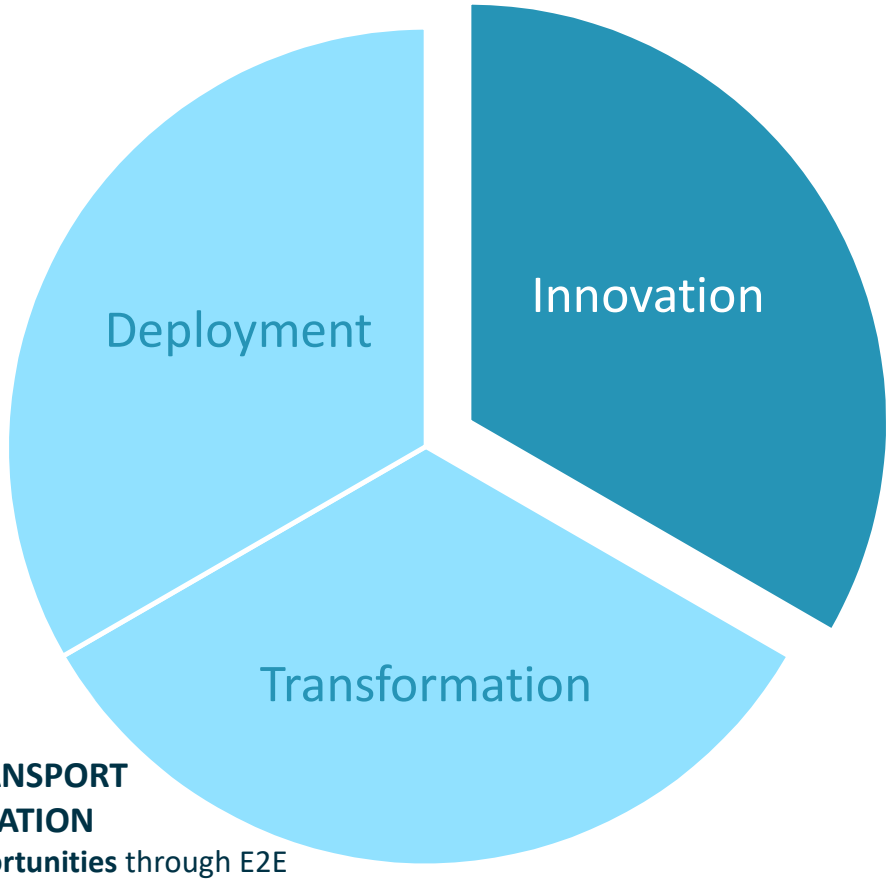
The Journey



Telefonica GCTIO – IP & Transport Networks

FOSTERING THE INTRODUCTION OF HOMOGENEOUS ARCHITECTURES, TECHNOLOGIES AND PROCESSES IN TELEFONICA FOOTPRINT

- Extending best practices and defining **technical guidelines**
- Ensuring **homogeneity** within Telefonica footprint
- **Defining** technical **requirements** for new global services
- Driving **PoC and FOA** for new technologies



ADVANCING NETWORK TECHNOLOGIES MATURITY THROUGH INNOVATION & RESEARCH

- Defining **new architectures and transport services**
- Participating in internal (with Telefonica OBs) and **collaborative (via EU funded programs, or with selected vendors) research**
- Contributing to the community with participation in **standards**, communication of Telefonica's strategy or requirements, and dissemination of results
- **Transferring the research results** to Telefonica OBs

ACCELERATING IP & TRANSPORT NETWORK TRANSFORMATION

- Bringing **efficiency opportunities** through E2E planning
- Establishing **global catalogs**
- Issuing and driving **global RFx processes**
- Leveraging **new architectures and technologies**

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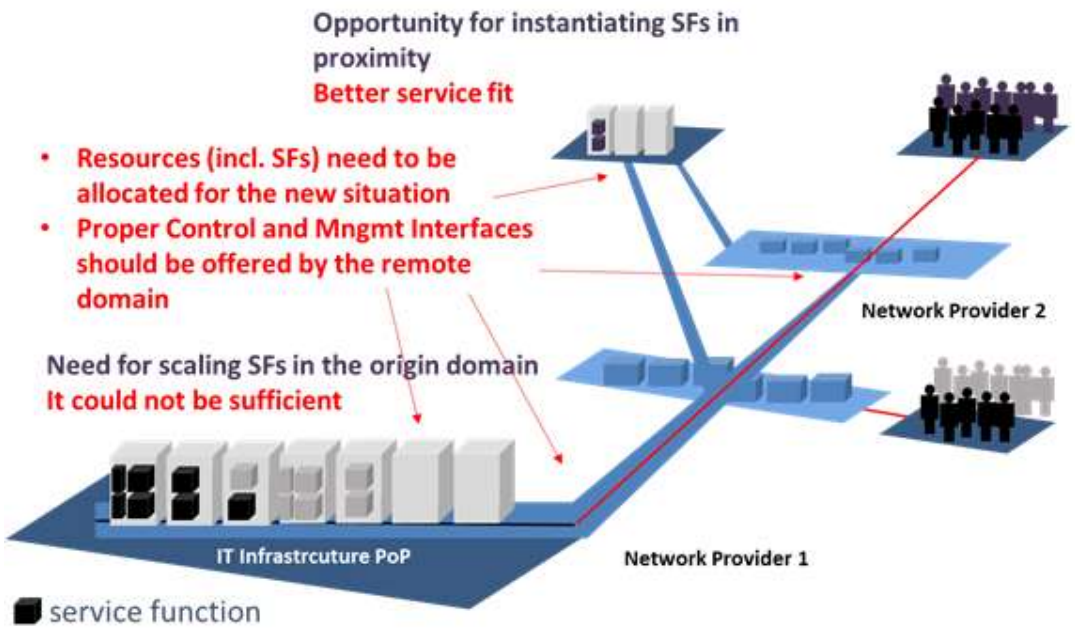
Next great challenge – Multi-domain slicing

- Vertical customers can request **services** that lay **outside the footprint** of their **primary provider**
  - How to resolve this?
- **Dynamic and automated** interaction with other providers are needed but …
  - How we can **charge** and bill for that service?
  - How we can **ensure SLAs** among providers?
  - How we can **know about the capabilities** of other providers for a comprehensive e2e service provision?
- **Current** wholesale and interconnection **services and mechanisms** are **not enough** in the era of virtualization and programmability
- In the case of Telefónica multi-domain refers to either interconnections with other providers as well as interconnections among affiliates (**up to 17 Networks in Telefónica group!**)



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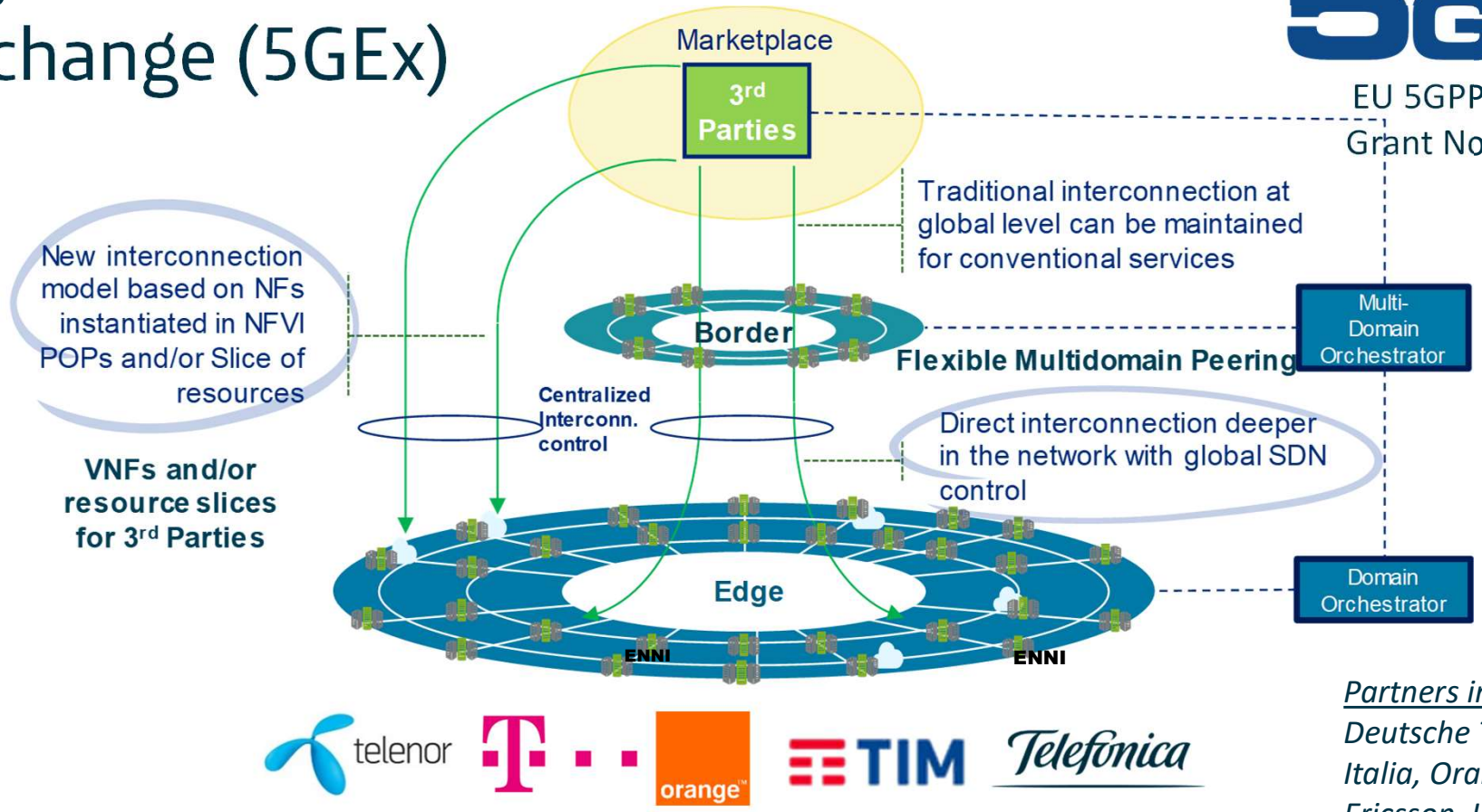
Taking action
5G-Exchange (5GEx)

http://www.5gex.eu/

EU 5GPPP H2020
Grant No. 671636



Partners include: Telenor, Deutsche Telekom, Telecom Italia, Orange, Telefónica, Ericsson, Huawei, HPE, ATOS, BISDN, RedZinc, UCL, UC3M, AUEB, BME, KTH , MNS

Objective:

From dedicated **physical networks with dedicated control and dedicated services and resources** for different applications…

…to a "network factory" where **resources and network functions are traded and provisioned:** new infrastructures and services are "manufactured by SW"

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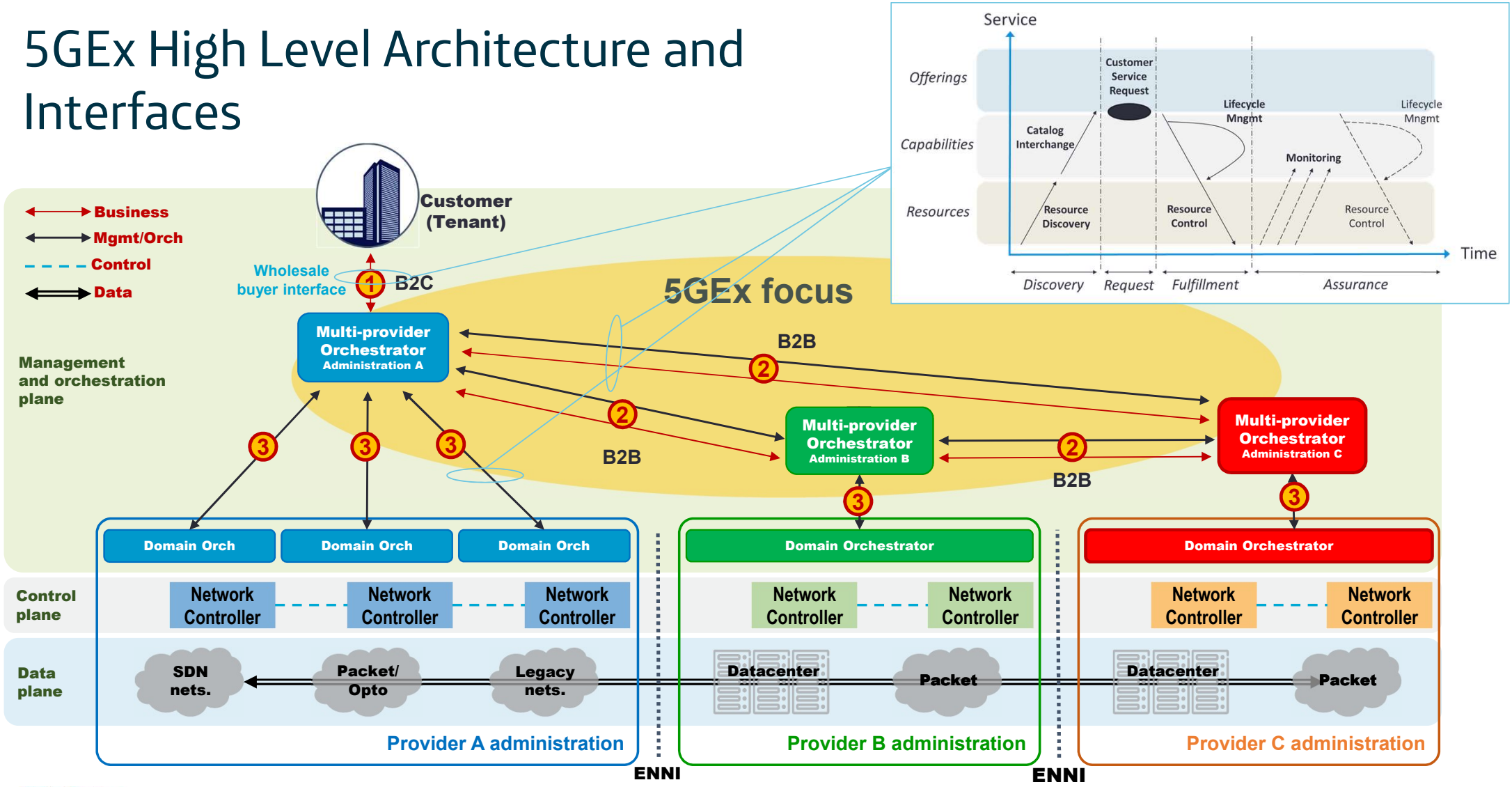
5GEx High Level Architecture and Interfaces



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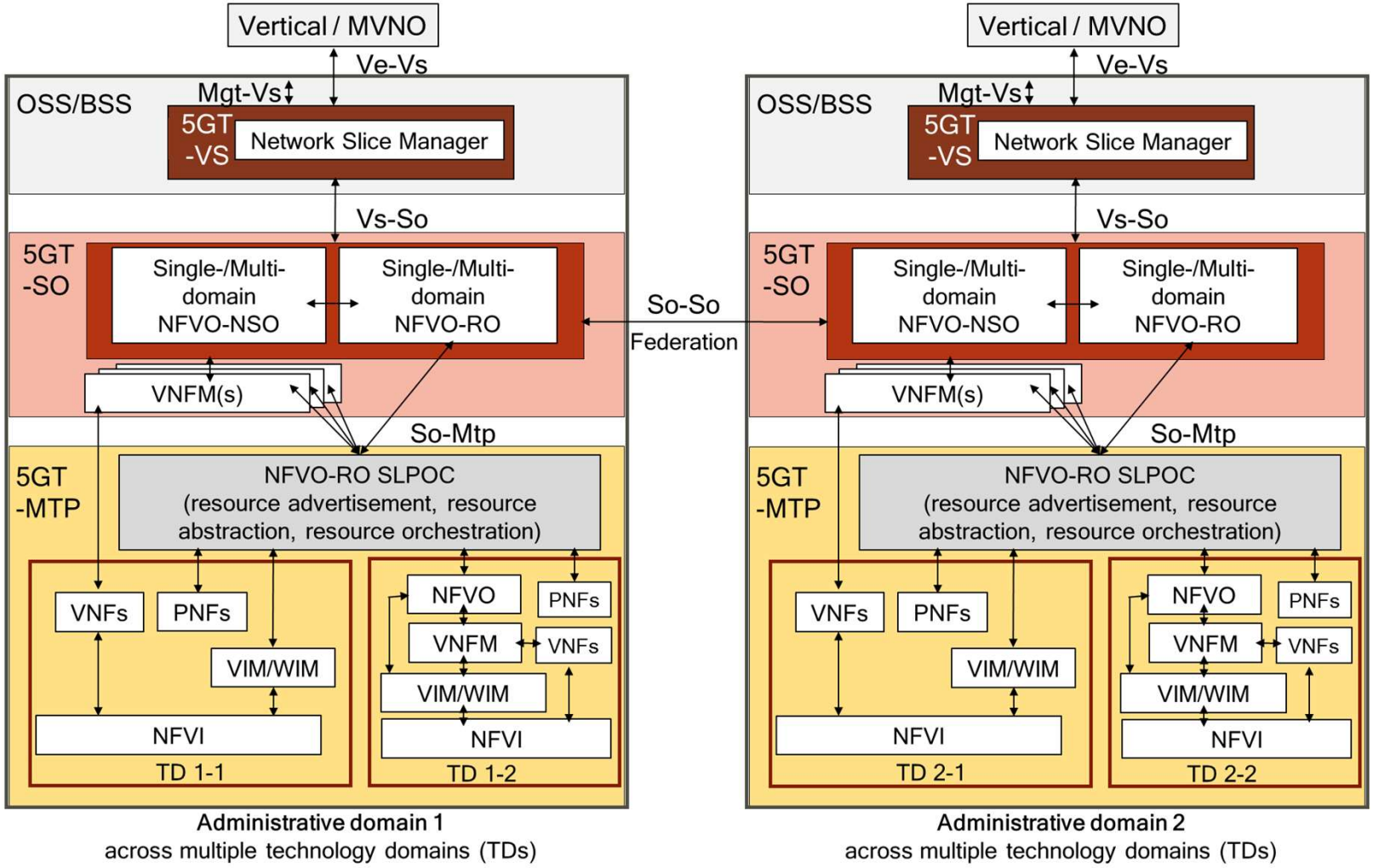
Taking action – 5G-TRANSFORMER



http://5g-transformer.eu/

EU 5GPPP H2020
Grant No. 761536

Automotive

eHealth

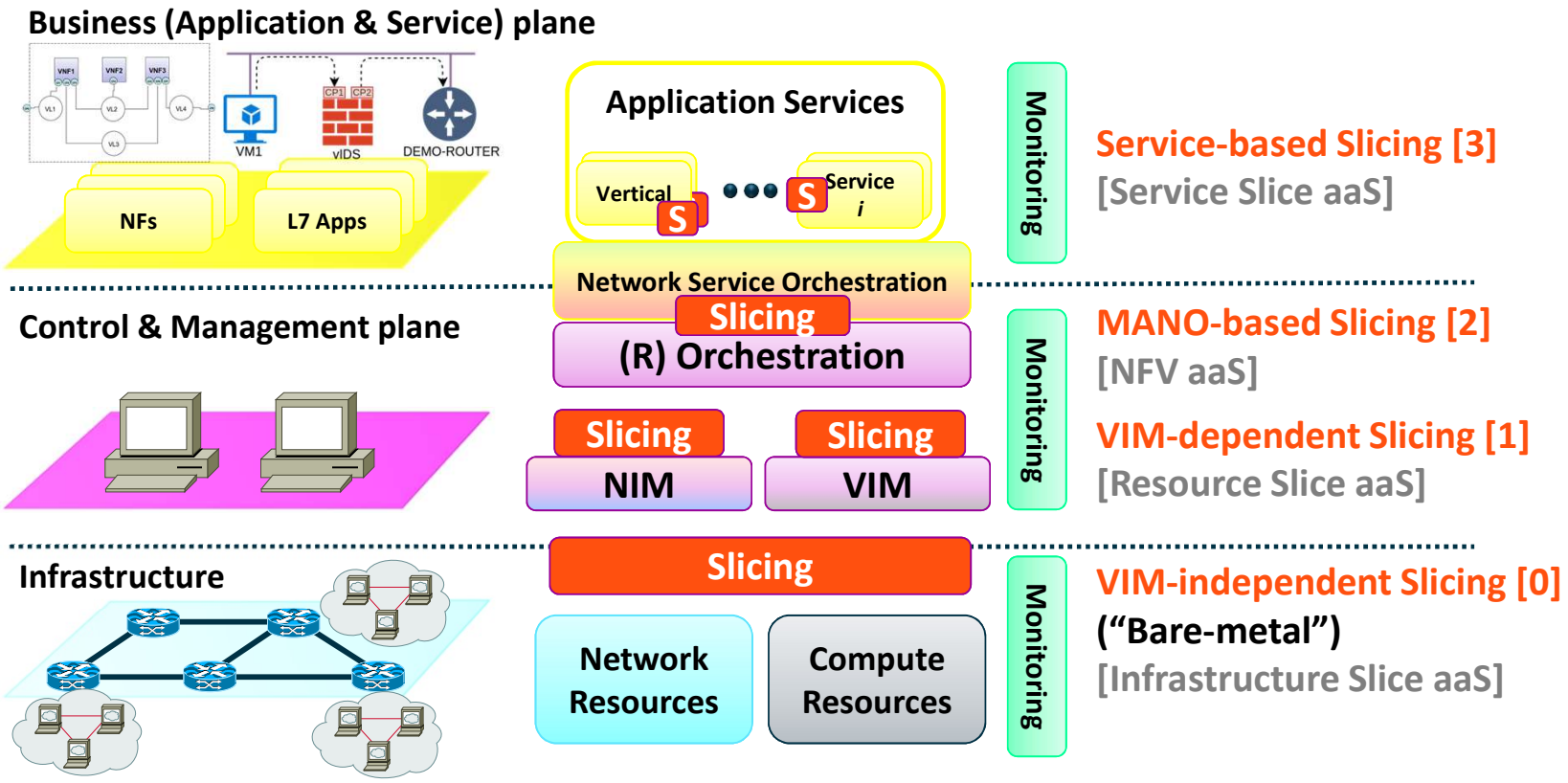
Media

M(V)NO

Taking action – NECOS

http://www.h2020-necos.eu/
H2020-EUB-2017
Grant No. 777067

Slicing Models & Approaches



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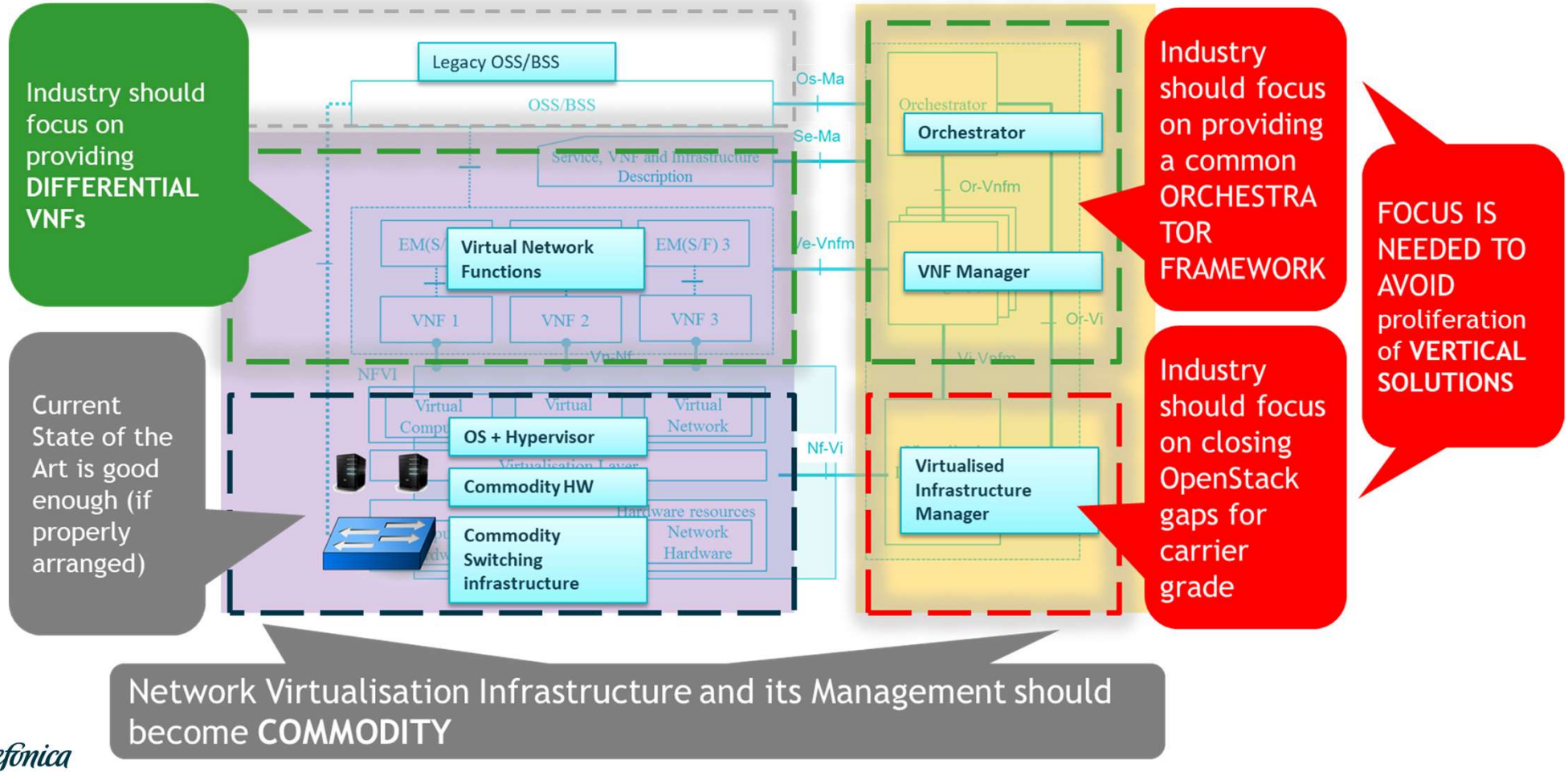
This prsentation reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

Backup Slides

In order to get the **industry focused on providing real value…**



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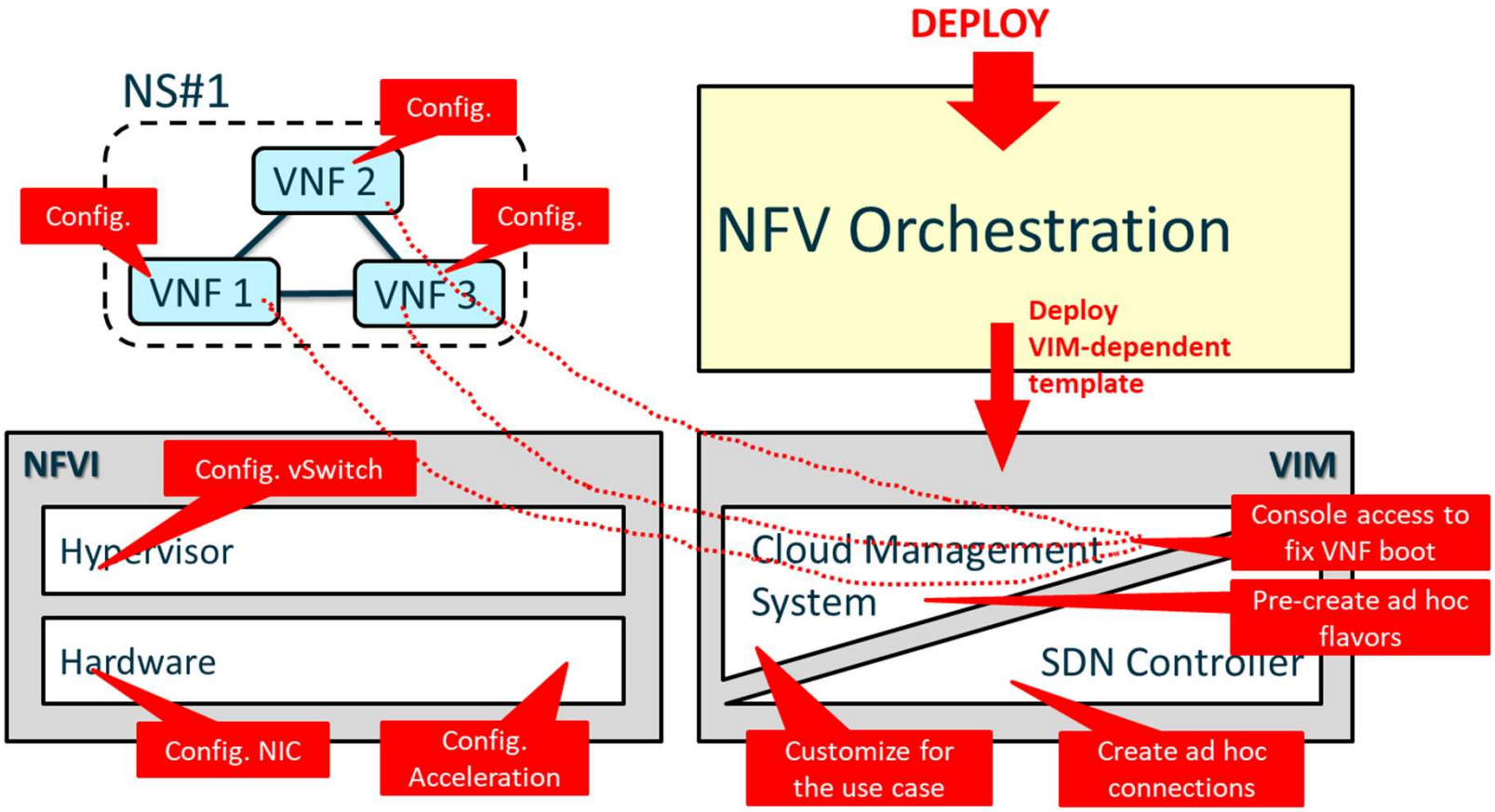
Automating the deployment and operation of Network services is a challenge!



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End-to-end Telco Cloud network

DESIGN PRINCIPLES

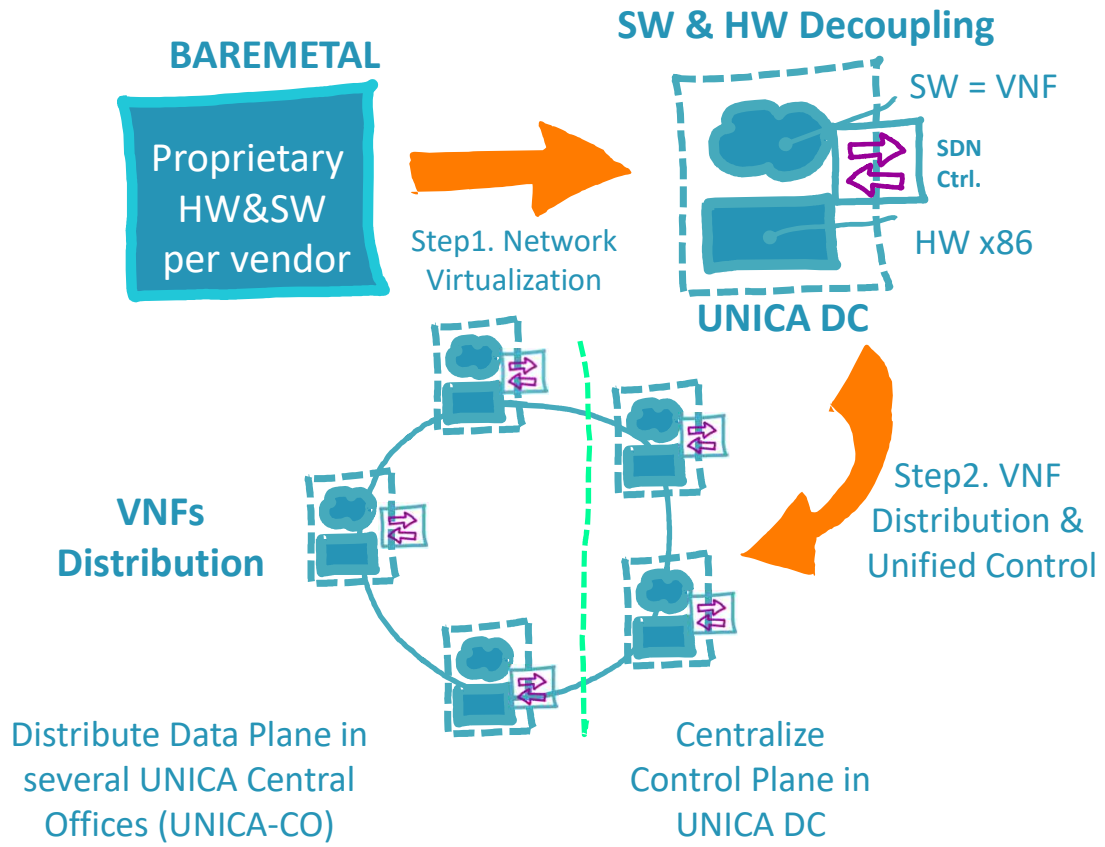
Enhanced user-centric connectivity experience

Homogeneous infrastructure

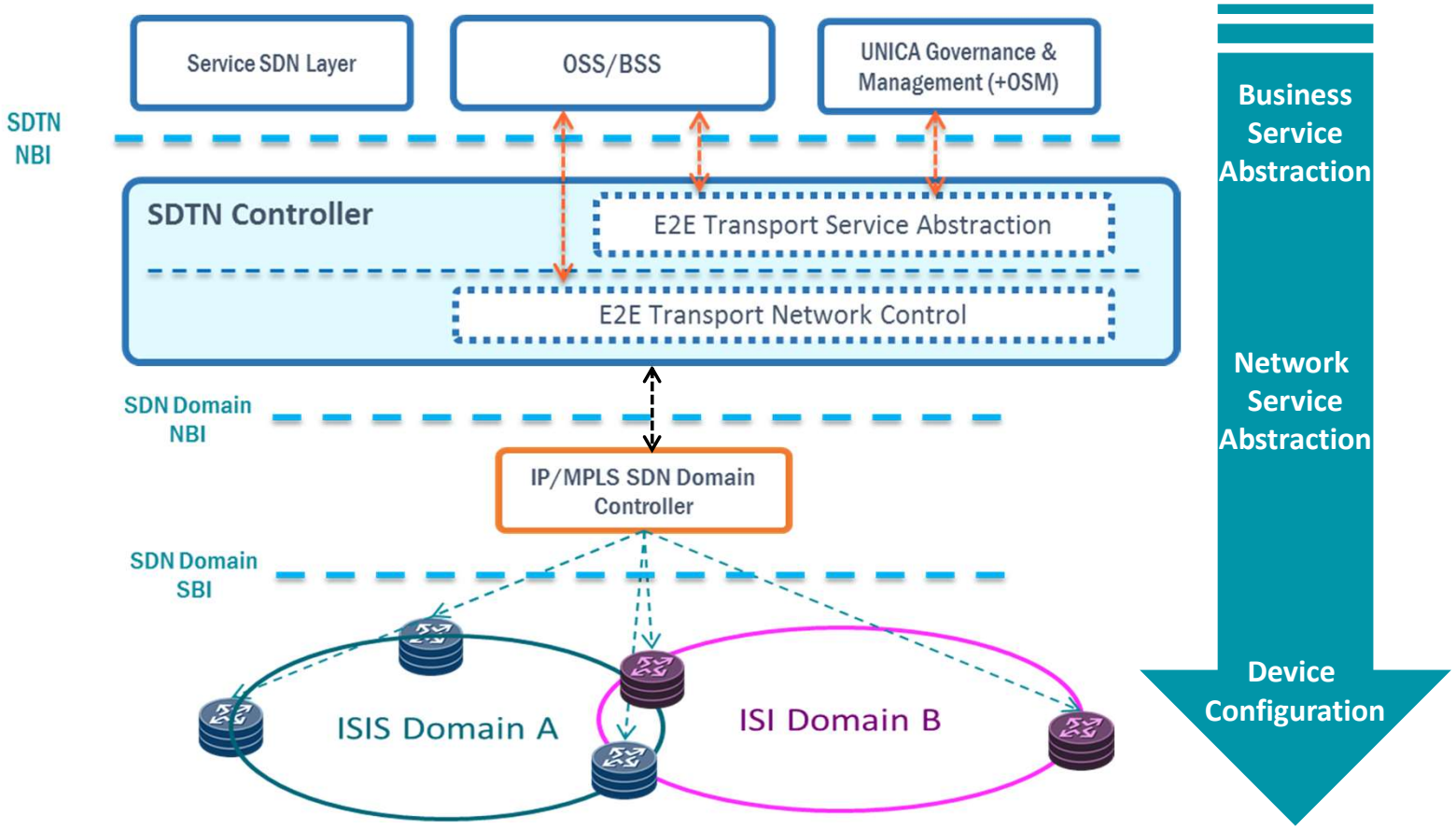
Simplified and automated operations (SDN)

Mouldable software-defined functionality

Agile and open to innovation



Automated service deployment



- ***Service level abstraction:*** Service definition at the business level toward transport network customers.
- ***Network level abstraction:*** Network connectivity services generation, network topology compilation for route calculation and visualization.
- ***Device configuration level:*** Actual configuration of the network devices involved in the connectivity service.

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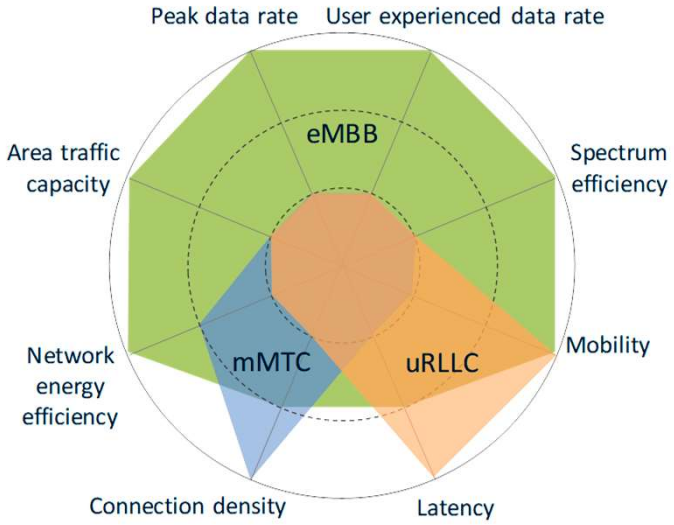
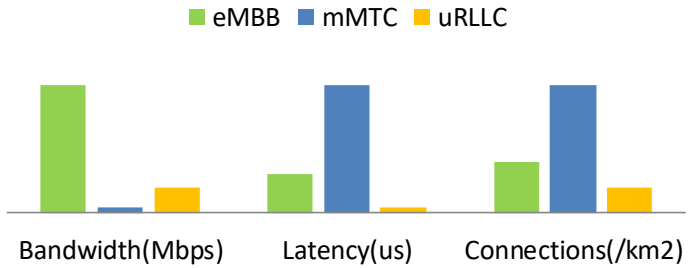
Categorization of 5G Services

Challenges



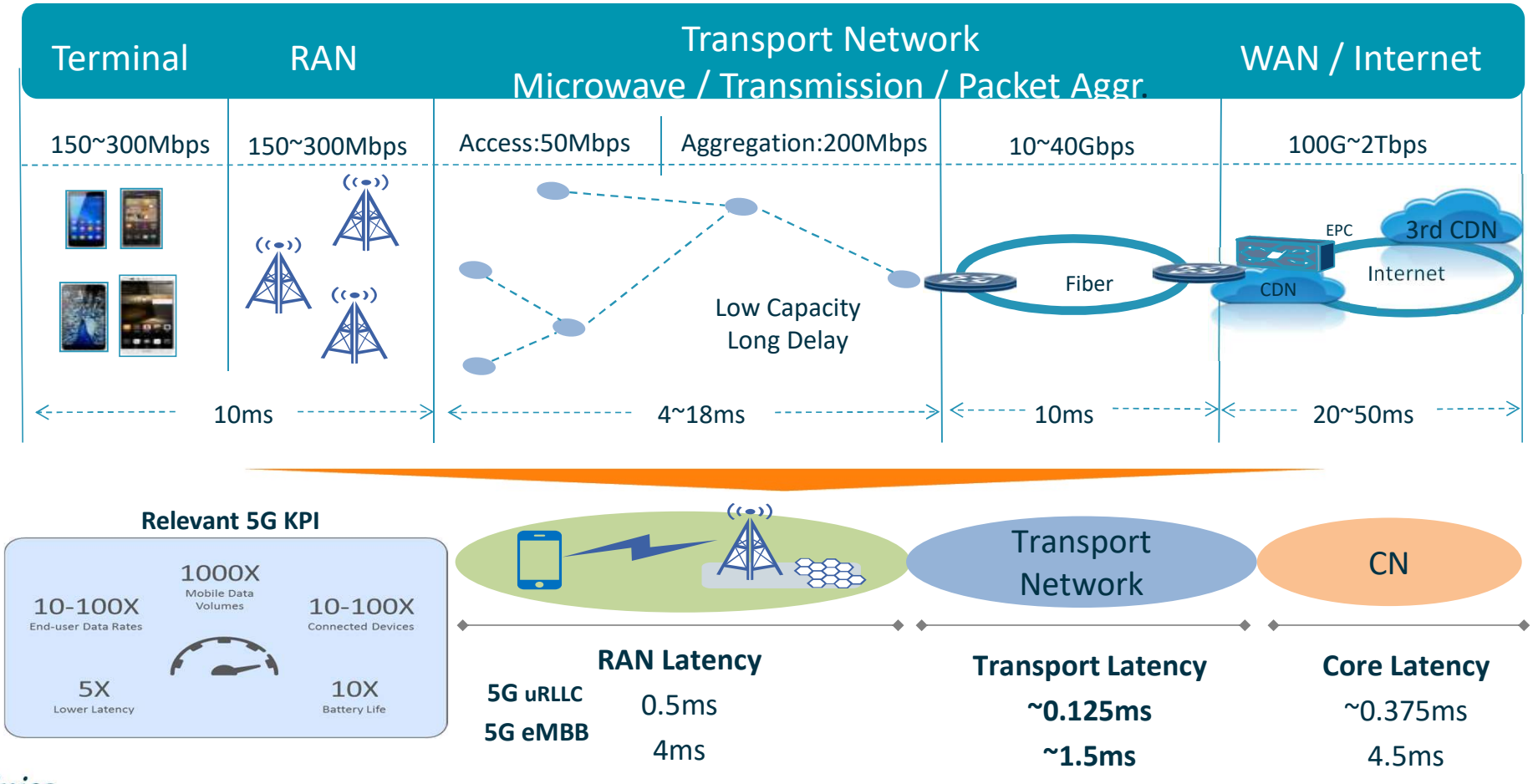


- The virtualization of 5G Core Network and RAN makes the network functions distributed, allowing to satisfy all use cases.
- Transport network is consisting of fronthaul, midhaul, backhaul and DC interconnection.

PERFORMANCE	FLEXIBILITY
1000x higher mobile data volumes 10x – 100x number of connected devices 10x – 100x typical end-user data rates 5x lower latency 10x longer battery life	Network programmability Agile service deployment Affordable and sustainable

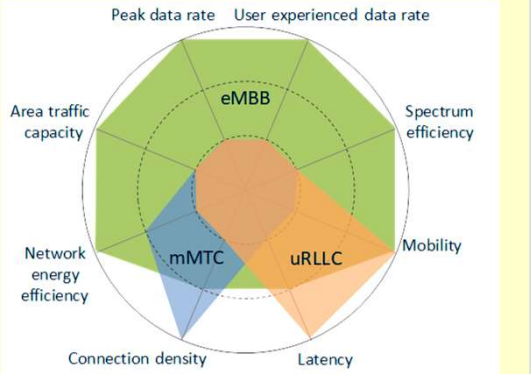
The evolution of the Transport Network is mandatory

5G requirements represents a substantial challenge for current MBH networks

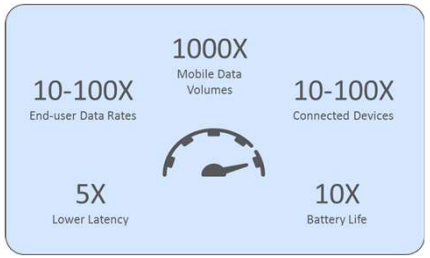


New considerations for 5G

5G mobile network services



Imposing



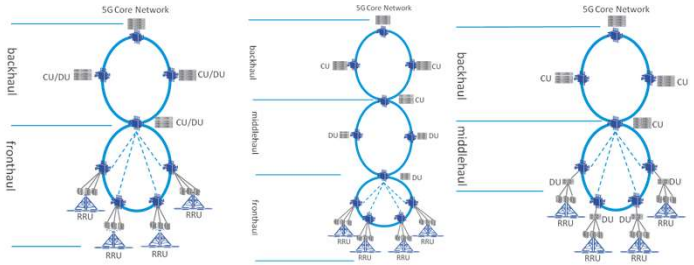
5G requirements

Defining

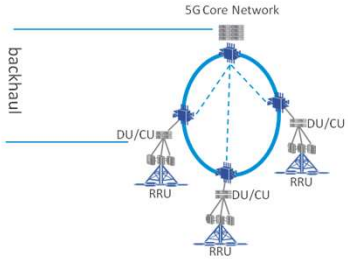
Combined with

RAN split scenarios

C-RAN



D-RAN



Requiring

Interface types

	Access	Aggregation	Metro Core
5G	Fronthaul: 25GE/50GE/100GE eCPRI Middlehaul/Backhaul: 10GE/25GE w/ SyncE and PTP	Middlehaul/Backhaul: 10GE/25GE/50GE w/ SyncE and PTP	10GE/25GE/50GE 100GE w/ SyncE and PTP

But this is not all!

Challenges in anticipation of Vertical's needs

- Strict SLAs
- High customization: automation & programmability
- Segregation/Slicing

Fast infrastructure layout

Agile service deployment

COST EFFECTIVENESS

Sites management and rented space

Energy efficiency, network simplicity and security

Operator requirements

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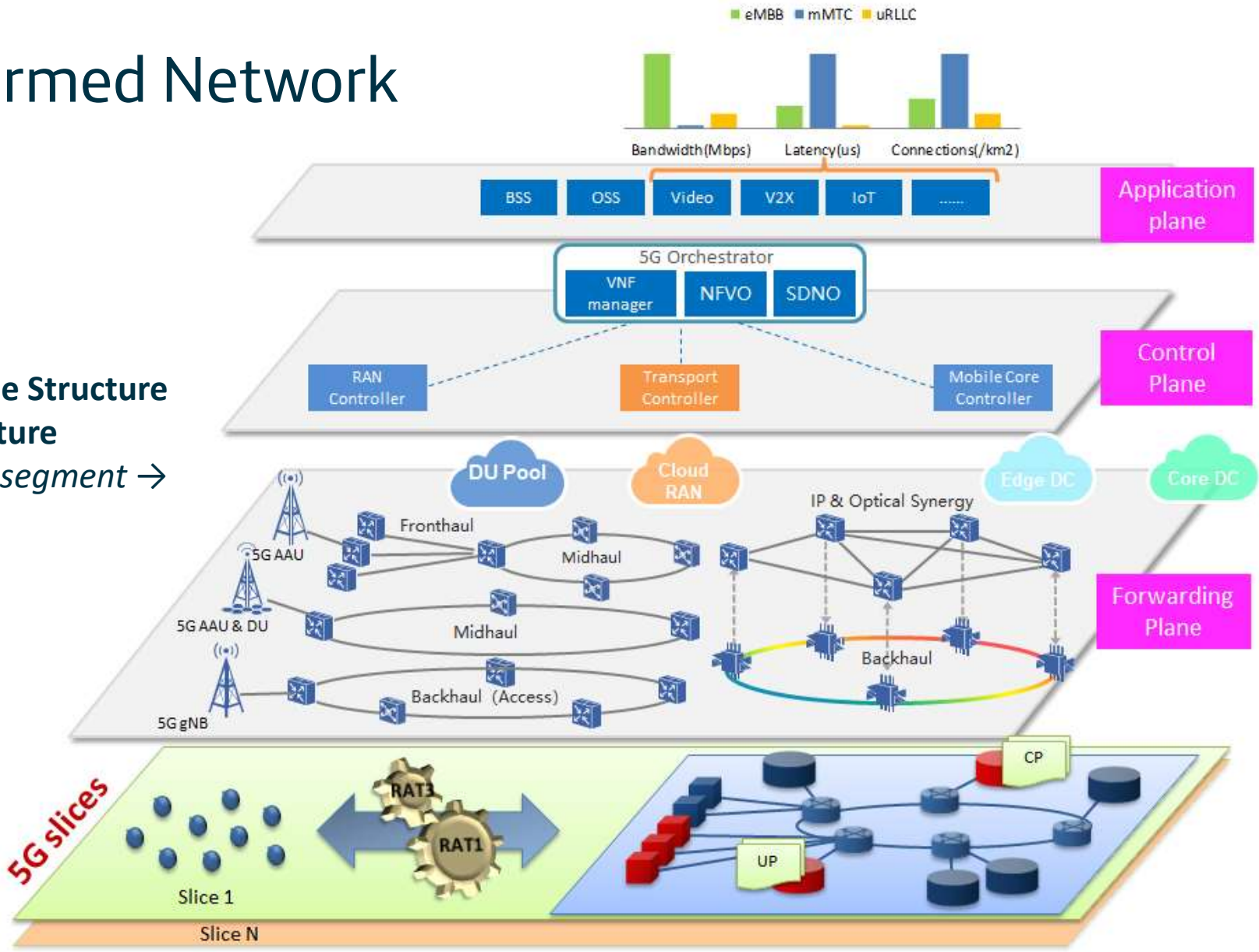
We choose it all

Target Transformed Network

From → **To**

- *Tree strucuture* → **Per-service Structure**
- *Static nature* → **Dynamic nature**
- *Separated management per segment* → **Unified orchestration**



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Functional Split of 5GEx interfaces

Service Management (Ix-S)

Used for requesting services by external customers or between MdOs of different administrative domains

Resource/Control (Ix-RC)

Used by the MdOs to reserve, provision, configure and manage resources through other MdOs

Catalogues (Ix-C)

For the interaction between catalogue subsystems to build multi-domain services

Lifecycle Management (Ix-F)

To communicate lifecycle mngt dependencies and workflows of NS parts or compound VNFs

Resource/Topology (Ix-RT)

Used by an MdO to exchange the network topology and resource information with other MdOs

Monitoring (Ix-Mon)

To collect measured data and managing the probing system that facilitates network service assurance

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Functional view of 5GEx Arch