



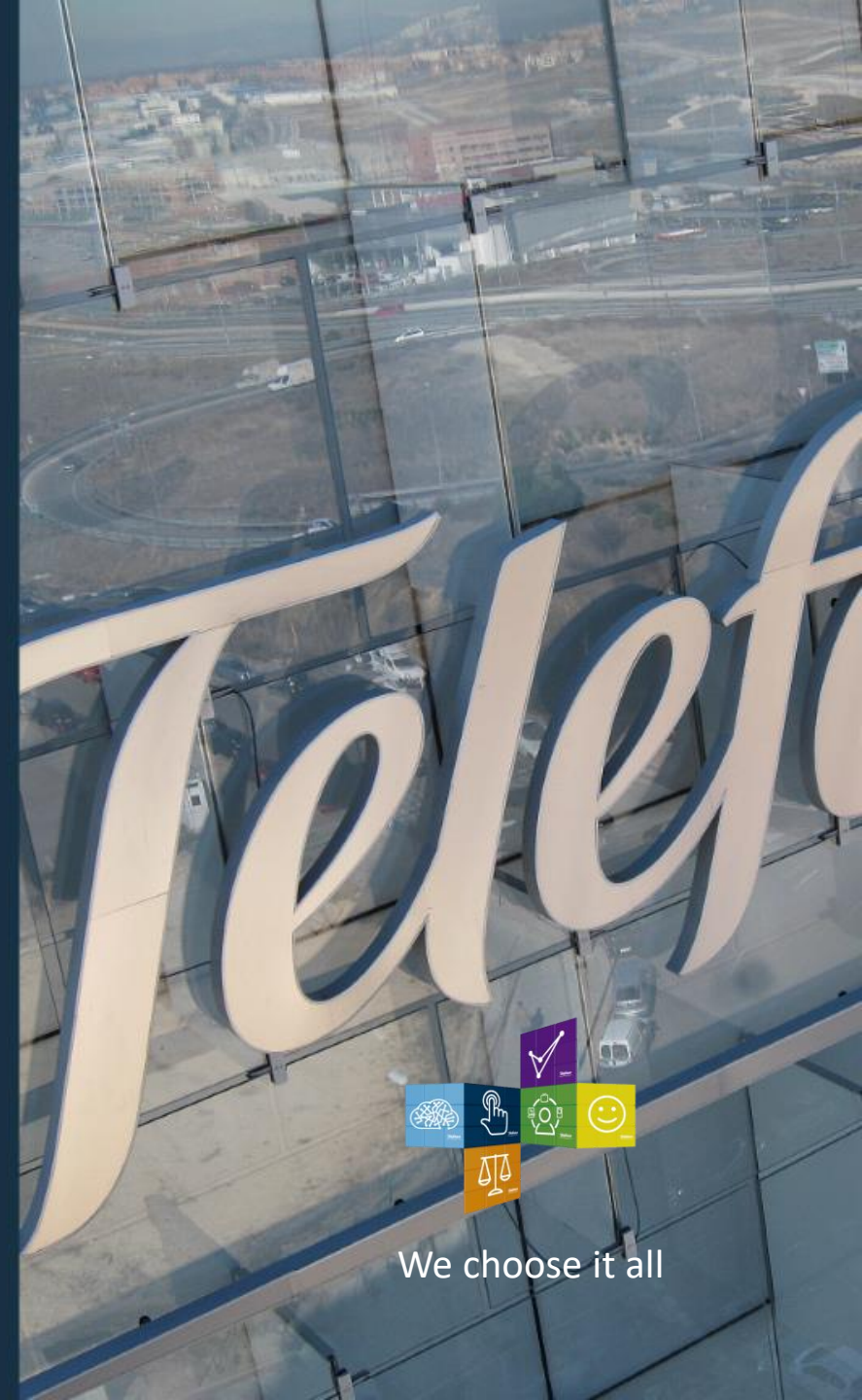
Network Transformation as the Path to 5G

Francisco-Javier Ramón Salguero
Head of Network Virtualisation Initiative
GCTIO, Telefónica

SDN World Congress
Intel Network Builders
The Hague, October 8th



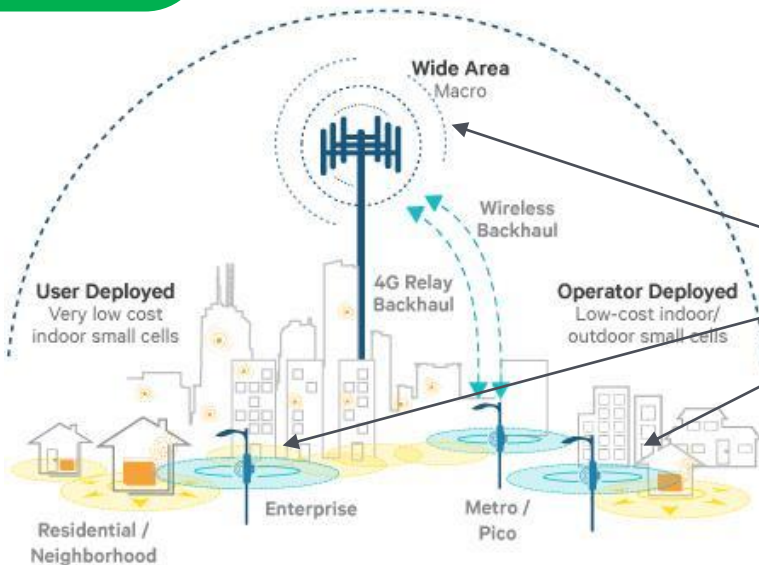
We choose it all



Networks are increasingly complex...

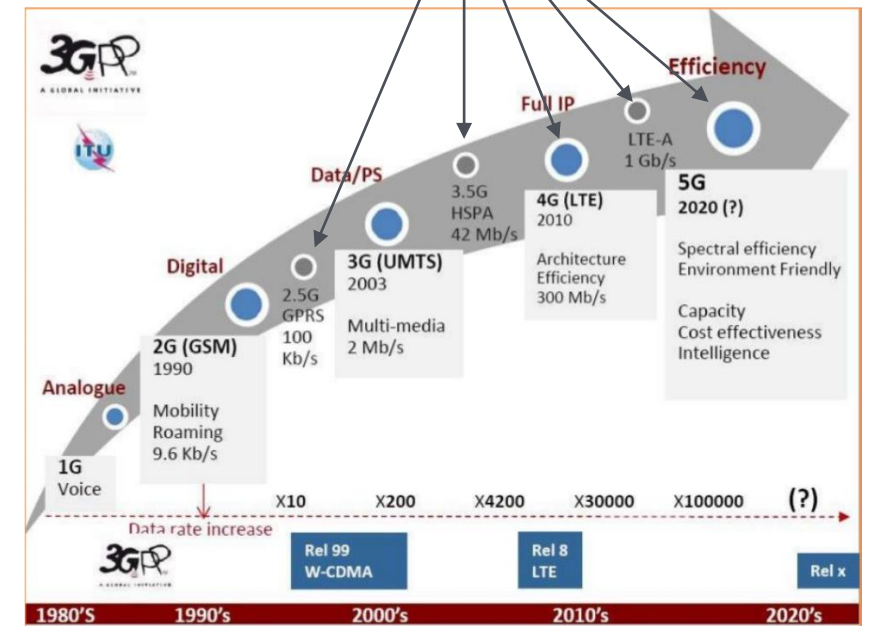
RAN Evolution

- Number of bands (low<1GHz, mid, high>6GHz)
- Number of radio technologies (2G/3G/4G+5G)
- Heterogeneity (macro + small/femtocells)
- Licensed+Unlicensed, FDD+TDD
- Density of sites, nodes, connections and traffic

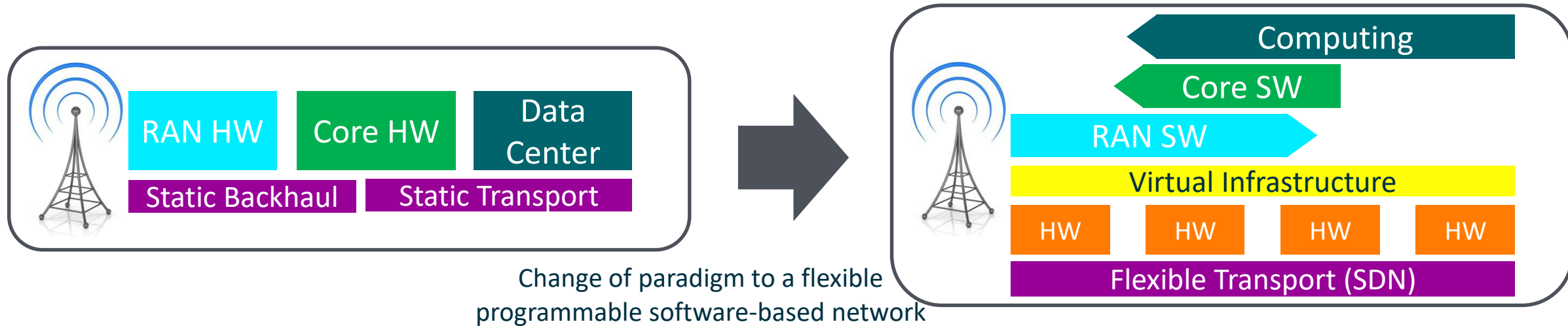


Indoor & outdoor equipment, with macros & small cells, create a **complex heterogeneous environment** that presents **new challenges** for network operation

All of them **coexisting** in our footprint!



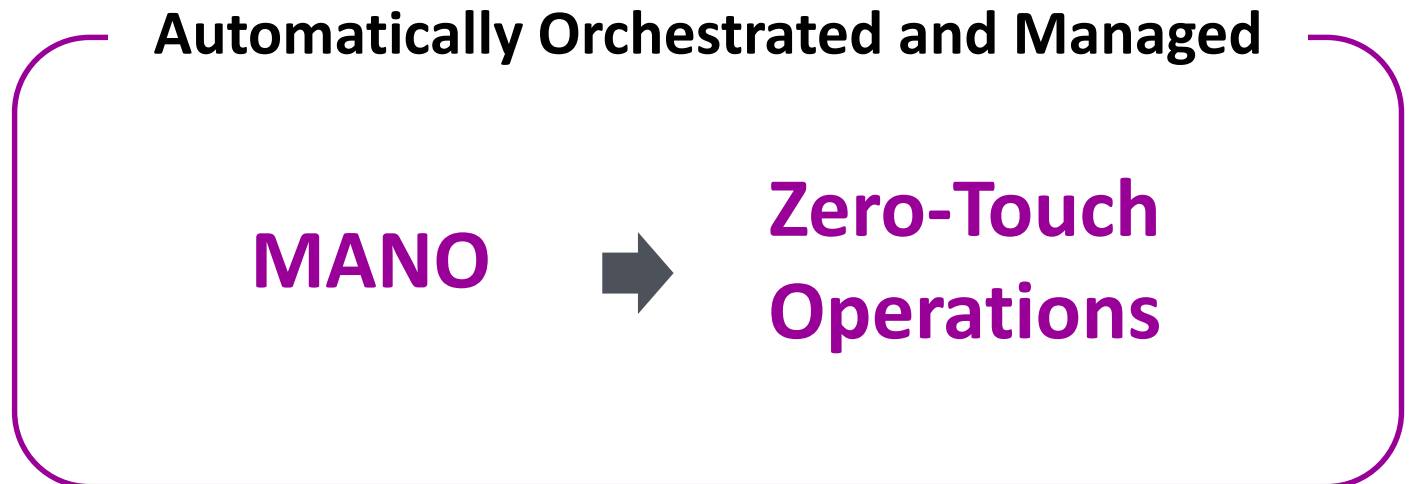
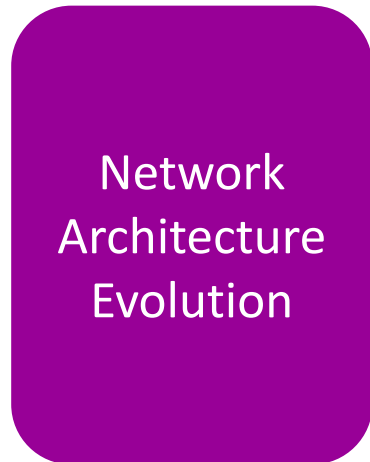
Networks are increasingly complex...



Network Architecture Evolution

- Separation of control and data planes (SDN)
- Virtualization (NFV)
- Cloudification
- Openness and programmability
- Service diversity, diverse traffic requirements (network slicing)

...requiring a step change in the Management paradigms



Telefónica has implemented SON across its footprint...

Successfully
deployed in our
17 markets...

...and we are
giving the next
steps with our
partners

5G
Rollout

4G
Rollout

With relevant
industry players

C-SON



Telefónica

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D-SON



Network Centric
Based on **Network data**

Basic SON for 3G&2G:

- ANR, CCO, MLB, SCO

SON for 4G:

- D-SON/C-SON coordination
- Automate site integration
- Integration, optimization of: VoLTE, CA, Energy...

Improve network KPIs

Tune SON tools

Customer Centric

- Based on **customer experience** & service quality
- Geolocation tools and SOC, inputs for CEX based decisions.
- Human-tuned, statistical learning
- **Software Development Kit (SDK)** for SON: Technicians may create/customize SON

Optimize CEX

CEX mindset

Cognitive SON

AI-based SON

- AI/DL algorithms, predictive
- Improve efficiency of SON actions on our networks
- extend automation to other network segments: core, transport, devices...

5G SON

- Increased complexity of network trouble-shooting and optimization in a universe of VNFs and multiple RATs.

Service-aware SON

- **Connected Vehicles**
- **Massive IoT solutions.**
- **Private Networks.**

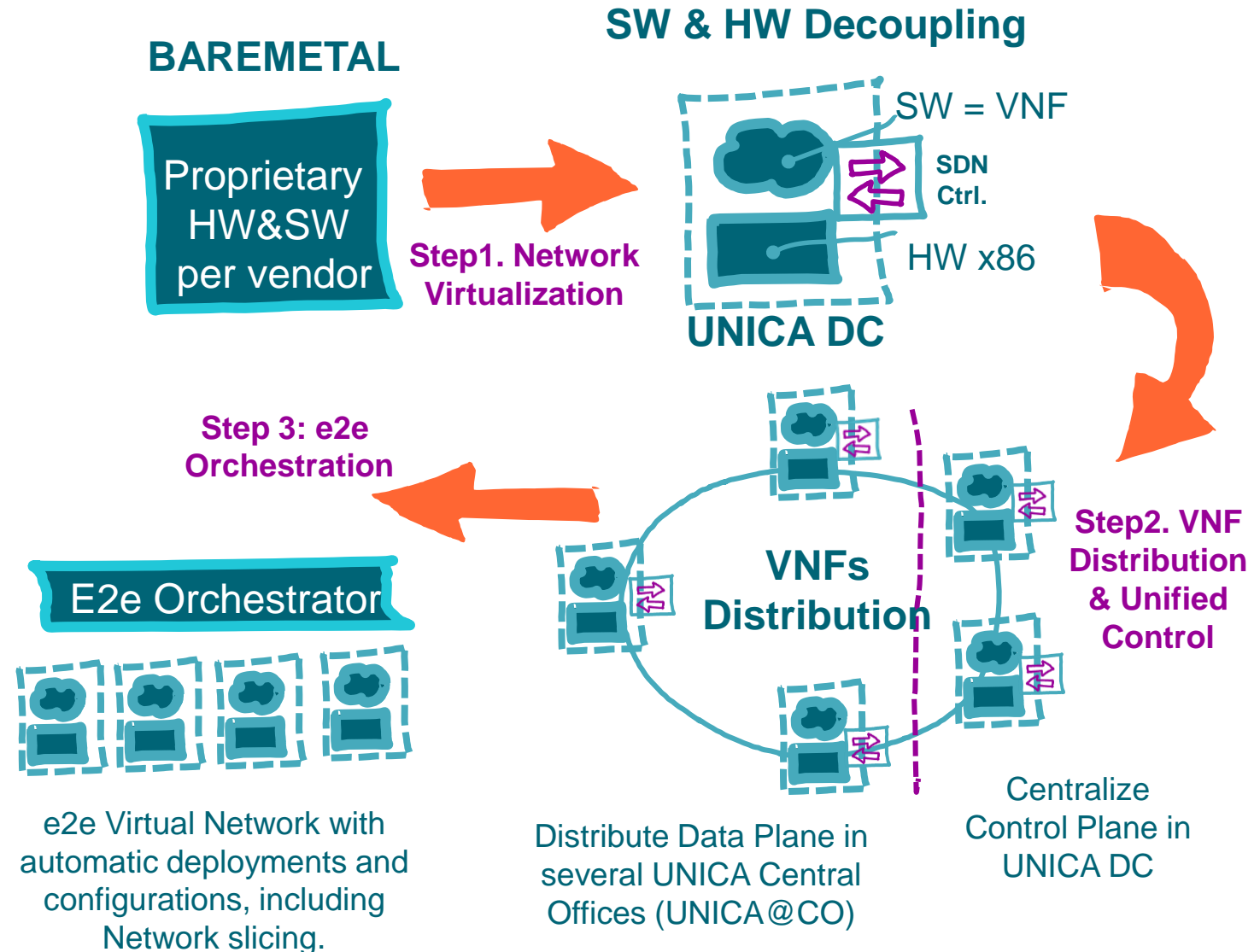
Optimal resource use

Machine-assisted learning

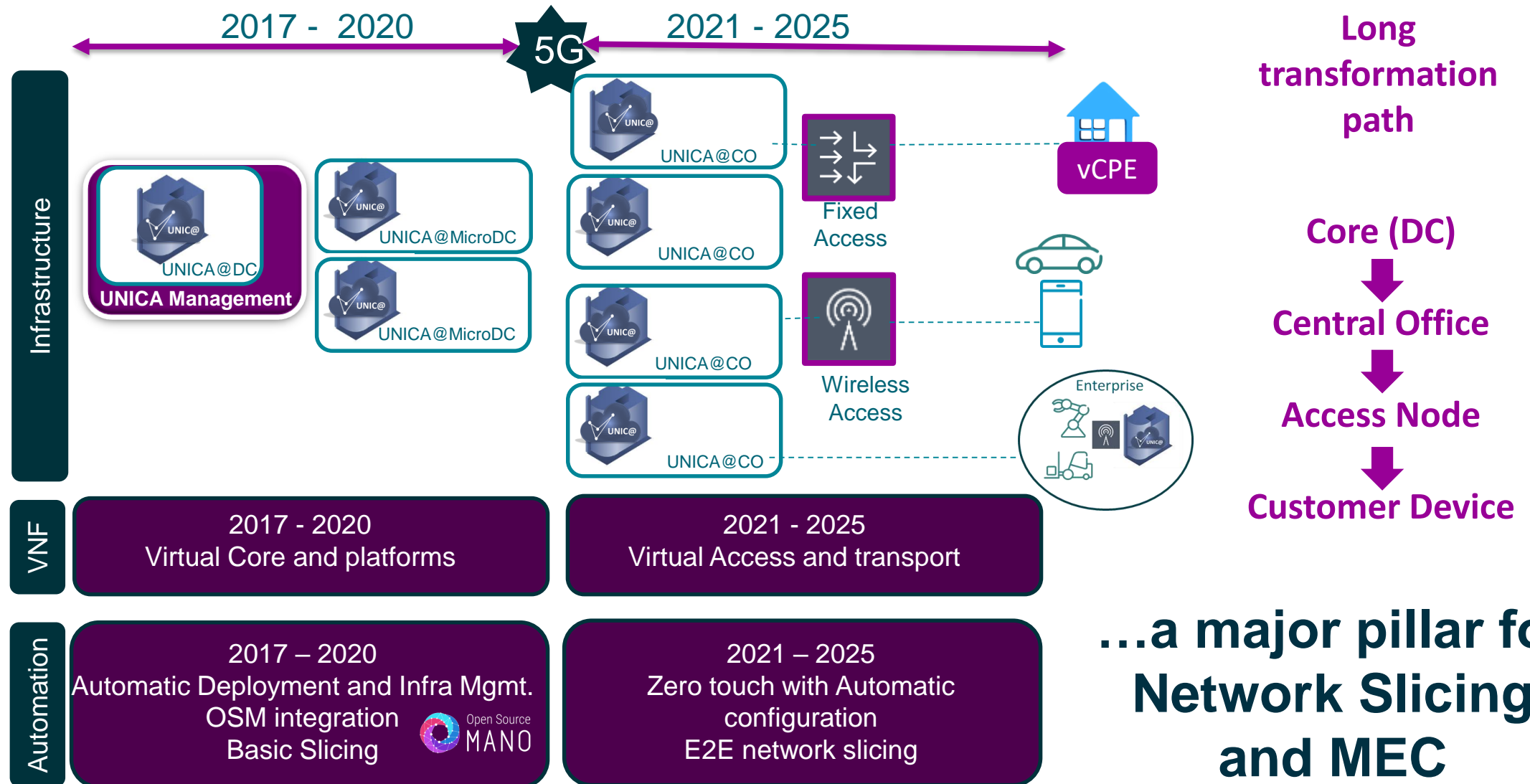
Virtualization is a key enabler of the 5G Architecture...

DESIGN PRINCIPLES

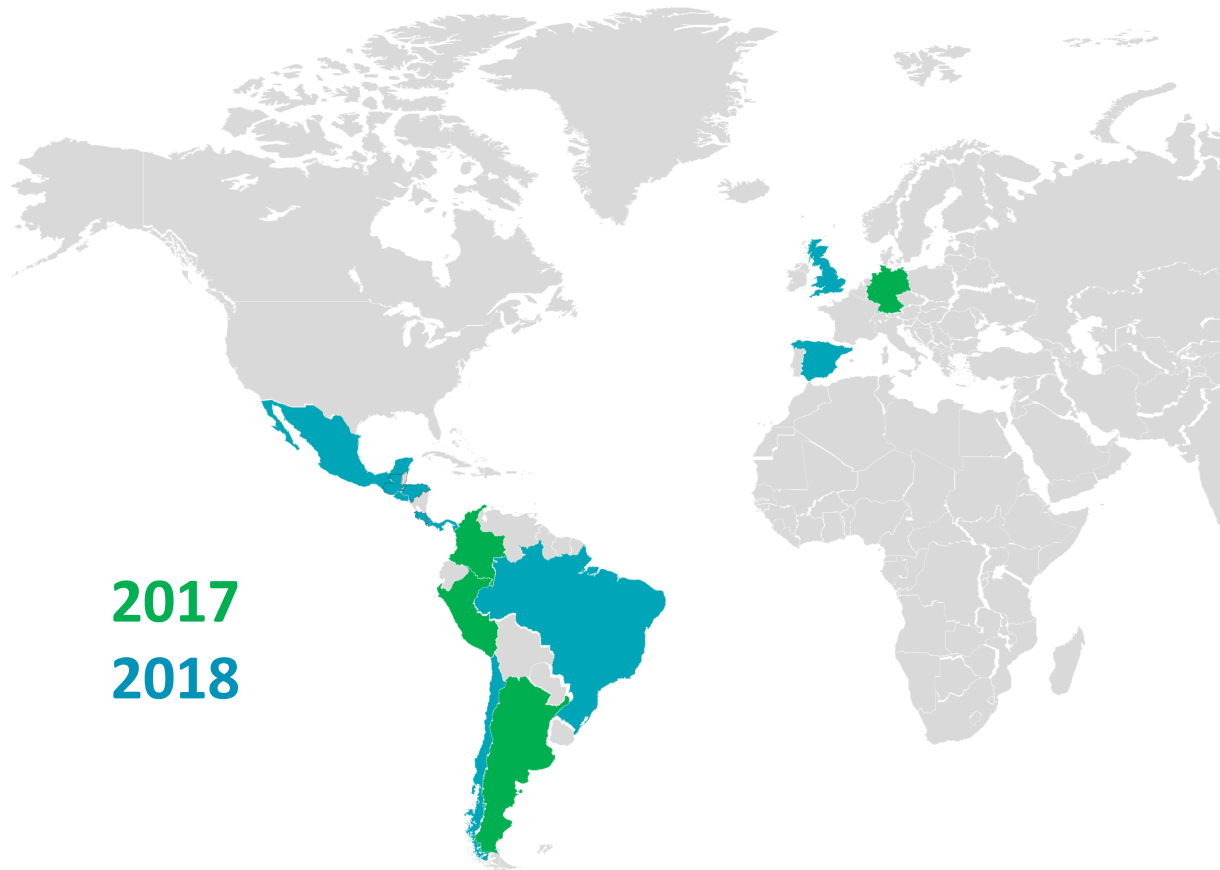
- Elasticity
- Common shared infrastructure
- Automate infra management and software deployment
- Telco grade
- Evolve to E2E Network Orchestration & Zero Touch
- Agile and open to innovation



...that is transforming our networks in an end-to-end way

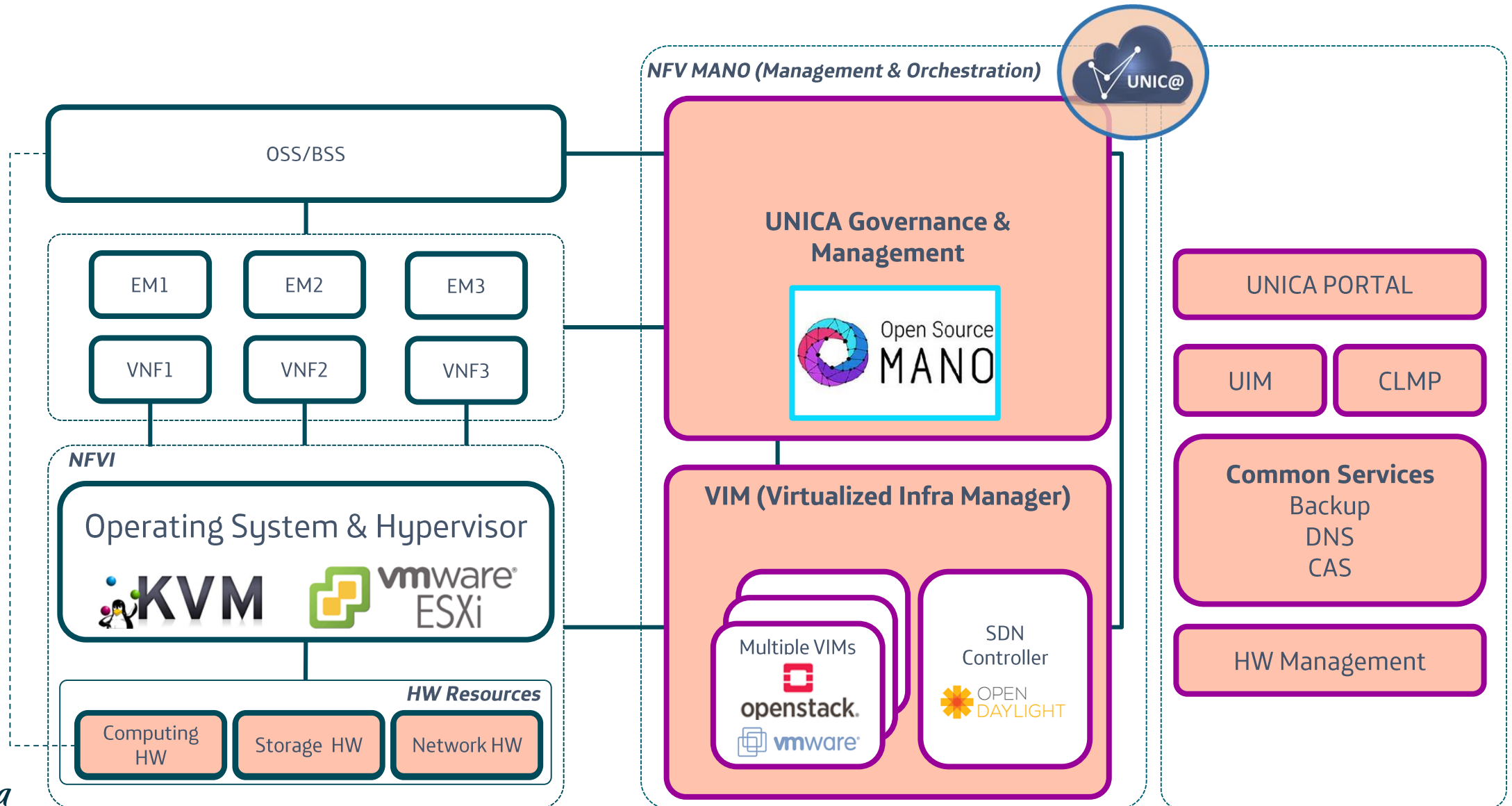


Telefonica has started to deploy UNICA...



- Available in 2017 in 4 Telefonica operations
- Being deployed in 7 new markets along 2018
- Reaching 27 DCs in 11 local domains and 1 global domain.

...one of the first industrial Telco Clouds in the world



CHANGING THE MINDSET

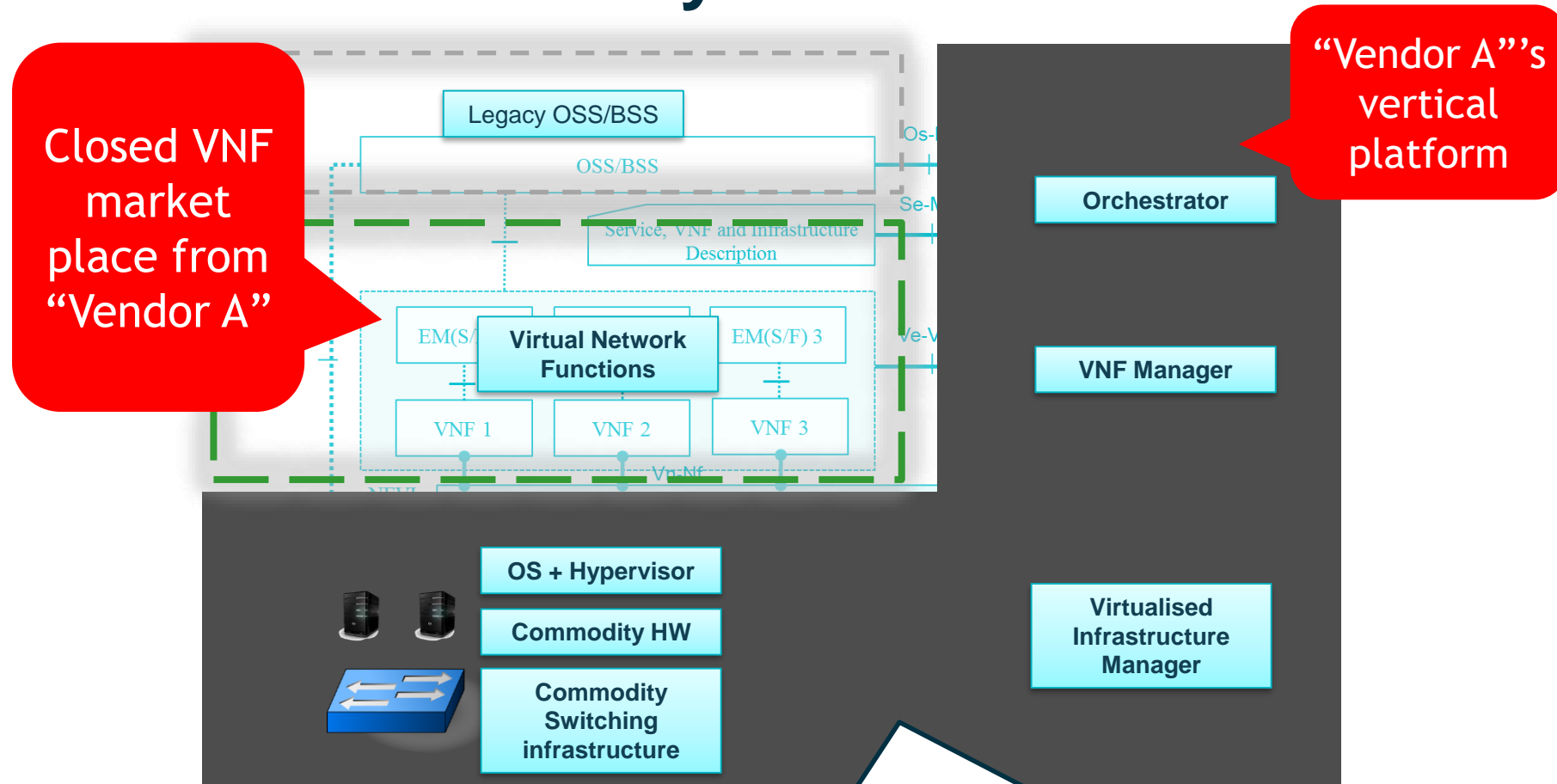
Some lessons learnt



Some mind-set changes to get the most from this network virtualization and operation automation journey

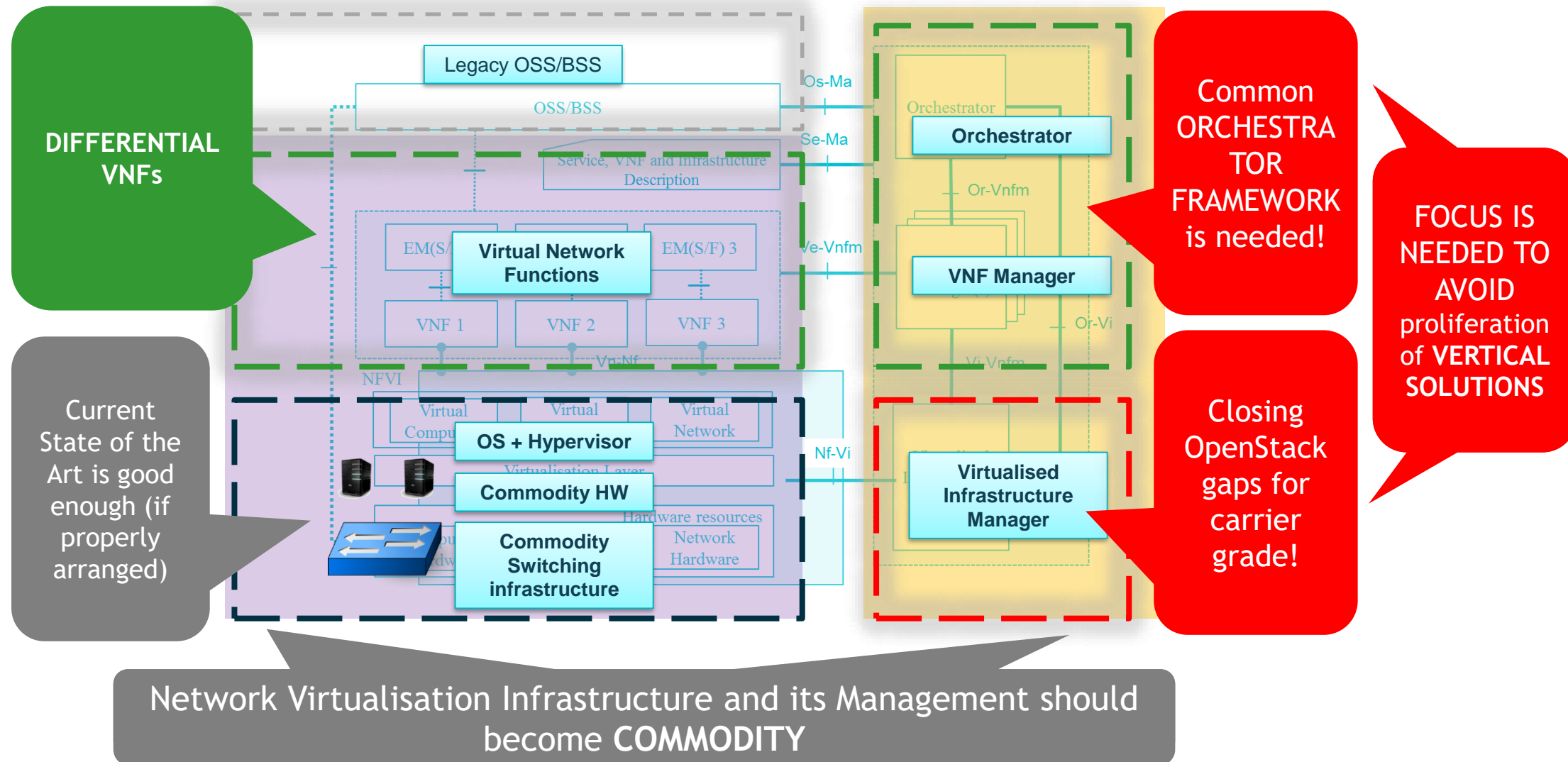
FROM...	... TO
Vertical integration	INTEROPERABILITY
One technology per element	Several options per element <i>(but still coherently modelled)</i>
Single-vendor	Multi-vendor by design
Vendor roadmap	Community roadmap
Request	Convince and/or compromise
Large and Comprehensive	Lean and Reliable
Design on paper	Get your hands dirty!

Our industry is offering closed and vertical platforms with their own closed VNF ecosystem

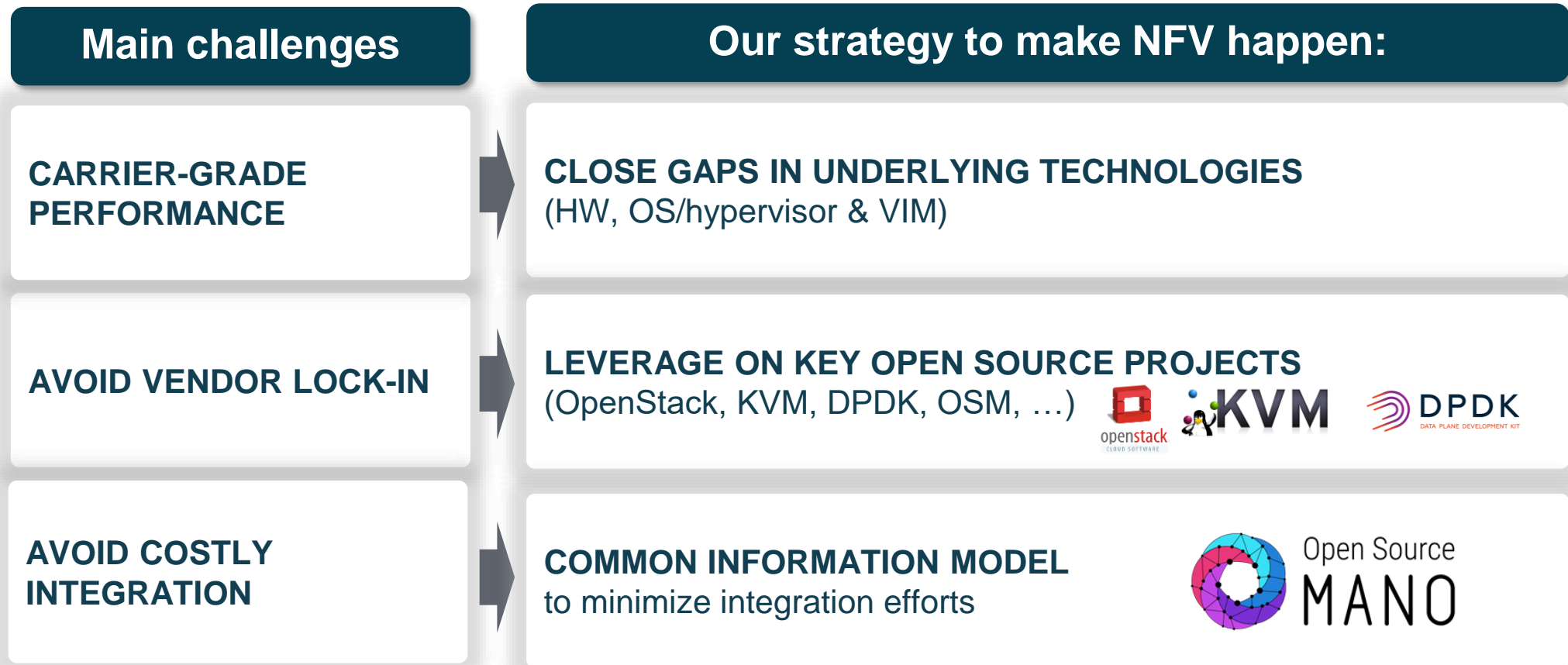


The objective is not using white boxes for constructing YET ANOTHER SILOED SOLUTION (at square one again!!!)

In order to get the industry focused on providing real value...



... we need to leverage on key Open Source projects to accelerate NFV technology readiness and avoid vendor lock-in



Led by Service Providers, ETSI OSM has demonstrated to be key to set up a common reference framework for orchestration



Open Source
MANO



ETSI World Class Standards



Open Source
MANO
Release FOUR

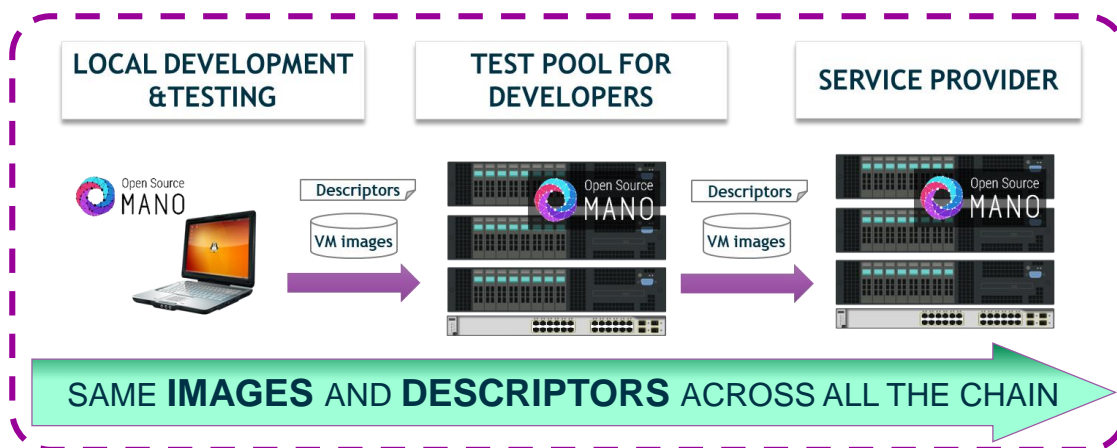
Available at:
osm.etsi.org

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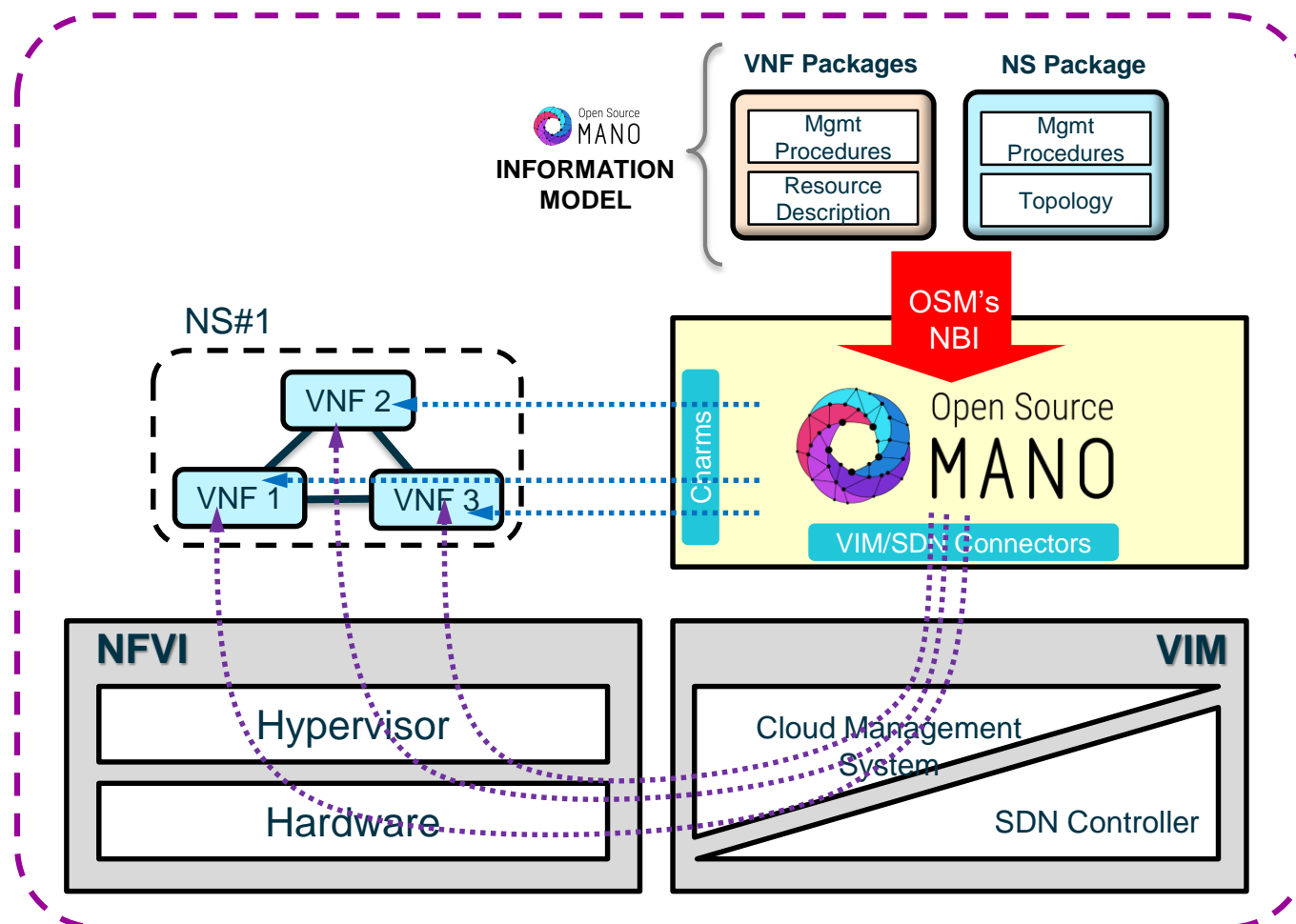


- 12 Global Service Providers
- Leading IT/ Cloud players
- VNF providers

Telefonica has an Agile approach to Automation...



- Avoiding to become stuck to a rigid architecture
- Retaining essential interoperability requirements
- Integrating existing solutions
- Considering NFV and SDN in a holistic approach



Model-Driven and Continuous Integration: basic toolset for automation

...with an ambition of Zero Touch operations

ETSI ZSM (Zero-Touch Service Management) Open Standard for Open Collaboration

- Recently created ETSI ISG
 - Horizontal and vertical end-to-end operational framework
 - Agile, efficient, and qualitative management and automation
 - Focused on emerging and future networks and services
- Committed to collaborate with external bodies
 - Acknowledge and encourage the integration of existing solutions
 - Direct cooperation with open-source projects



- Five active work items
 - Use cases and requirements
 - Reference architecture
 - Reference technologies
 - Solution landscape
 - Management of network slicing

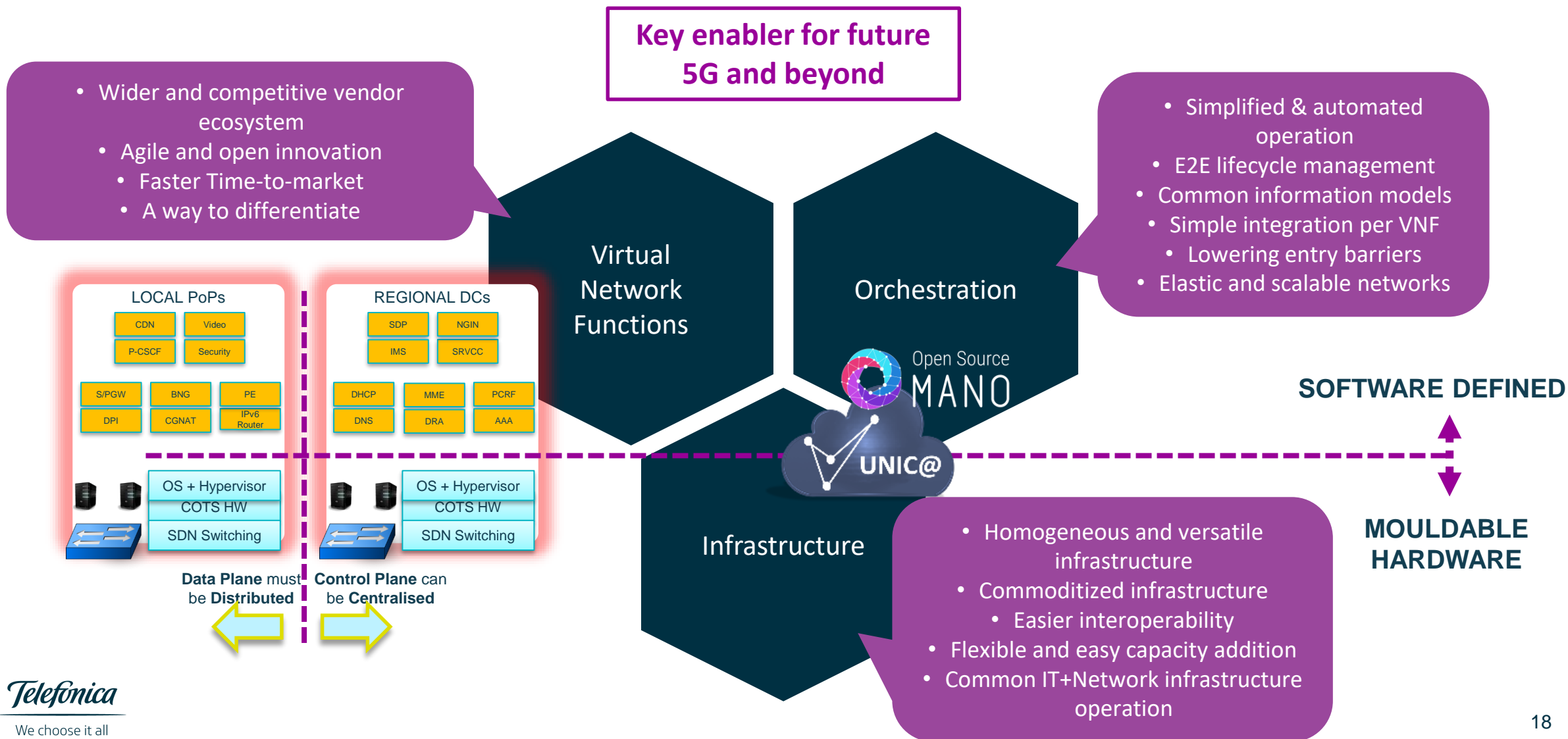
40+

**Members and
participants**

Automation gains relevance in a scenario of increasing network complexity

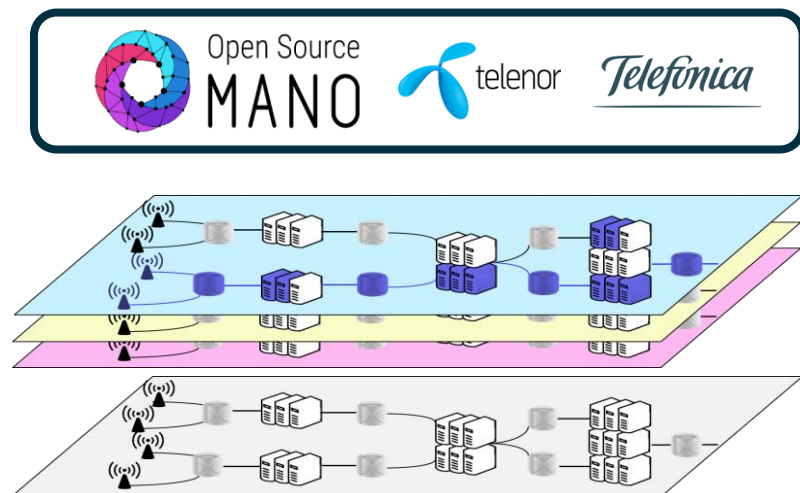
- **Network complexity growing** due to the Evolution of the Radio and Network Architecture required for **massive 5G deployments**
- The **SON (Self-Organized Network) functionality** has been crucial in the LTE rollout and is evolving from the initial Network-centric solution to a **Customer-centric** approach and later on to **Cognitive solutions**
- The rollout of the **Network Cloud Infrastructure** needs to accelerate now to allow 5G deployment over common infrastructure with **automated SW deployment**.
- The **orchestration** capabilities need to evolve to handle **E2E life cycle management with automatic network configuration**.
- Integrate orchestration capabilities with customer management layer to open new business opportunities such as **Network as a Service**.
- **Telefonica is already using AI techniques** in Telefonica in **Service Operation Centers** (Argentina, Chile and Germany) for the intelligent management of our networks based on customer experience analysis in real time. These techniques are equally relevant in orchestration.
- The goal is to have an **extreme automation** (Zero Touch operation) ready for massive **5G deployments between 2021 and 2025**
- Enhance network automation by building an **AI layer** requesting in real time network configuration and adaptations
- Automation will apply to **all Network and Service layers**

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

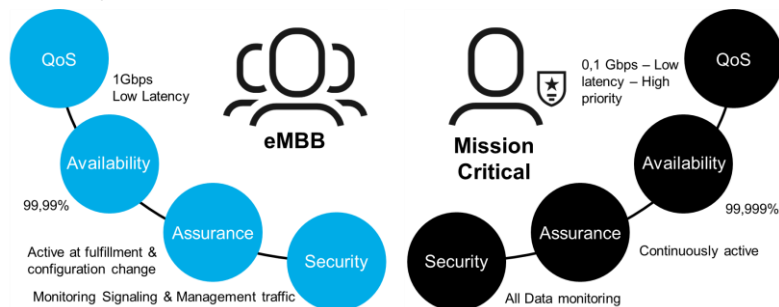


Telenor and Telefónica are working on a common PoC to demonstrate how OSM can orchestrate 5G Network Slices

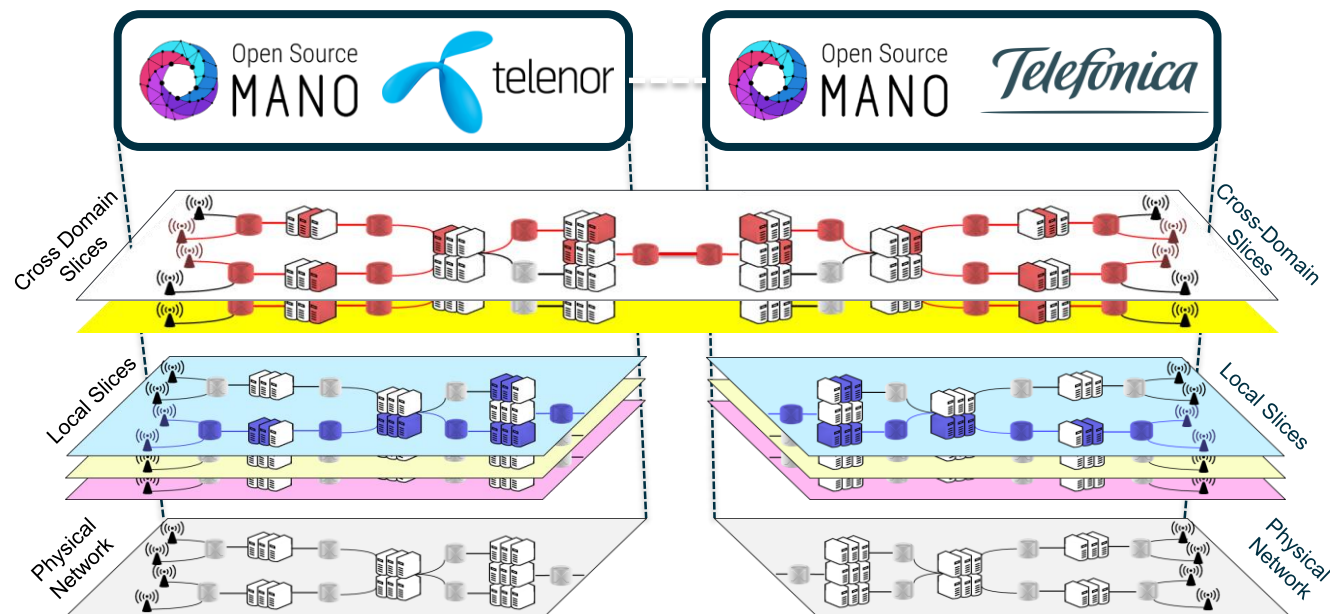
1. Operationalize Network Slicing with coexistence of eMBB and Public Safety services



OSM to orchestrate and manage delivery of differentiated; QoS, Availability, Assurance and Security for the slices (across ONE network)



2. Capability towards cross-domain Orchestration



Telefonica

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