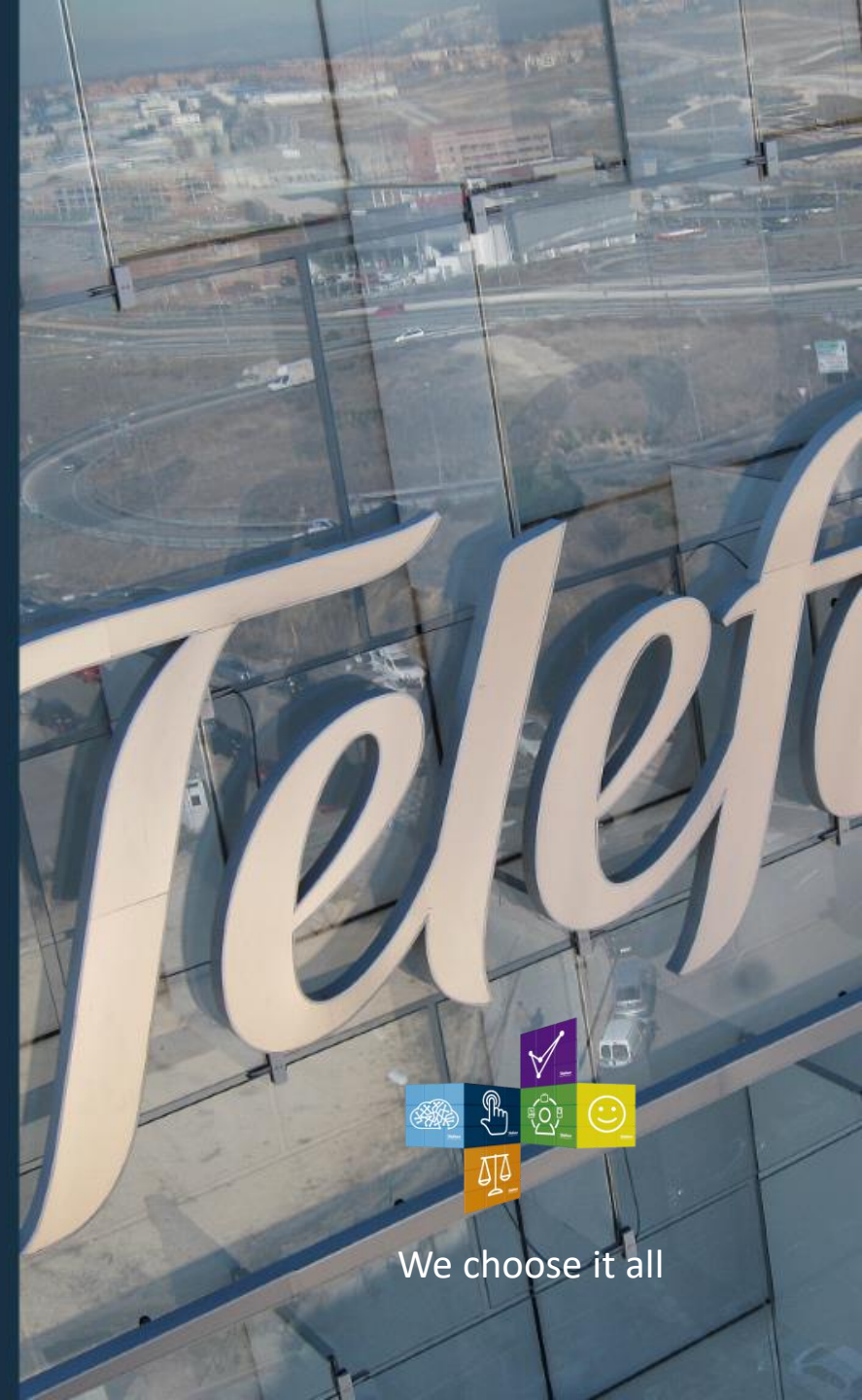# Telefonica

Network and Systems evolution

London, June 19th 2018

We choose it all

Network and Systems Evolution session

Pablo Eguirón

Global Director of Investor Relations

Telefónica

Key Objectives

Laura Abasolo
Chief Financial and Control Officer

Telefónica

Key Objectives

Network Transformation

- Growing **demand** and complex **technology**
- **Fiber and virtualisation**, pillars of Dynamic networks
- **Data driven networks** deliver **top user experience** and **internal efficiency**

Industrialisation advantage

- **Fiber deployment success story in Spain**, a key competitive advantage
  - Shorter time-to-market (-41% HGU installation time)
  - Lower cost per premise passed (-47%)
  - Operational excellence (-70% failures)
- **Industrialised Virtualisation**: Global UNICA program

Driving efficiencies

- CapEx peak behind us (17%/sales in 2016; 16% in 2017; 15% in 18E)
- **Smooth way to 5G**; leverage 4G replacement
- SDN delivers **operational efficiency**

Improved ROCE

- **Global scale** amplifies industrialisation gain
- New capabilities to **capture new business opportunities**
- **Optimized CapEx allocation** at network planning and operation

More sustainable business model

- Facilitate **scalability**, **data flow** between platforms
- **Big data** tools for optimization of cost/benefit
- **More capable, agile and efficient to accelerate growth**

Network and Systems Evolution

Enrique Blanco

Global Chief Technology and Information Officer (GCTIO)

Telefónica is a platform company

Future Network and Systems as enablers that will allow us to be a reference in Digitalization

4th PLATFORM — Cognitive Power

3rd PLATFORM — Product & Services

2nd PLATFORM — IT & Systems

1st PLATFORM — Physical Assets
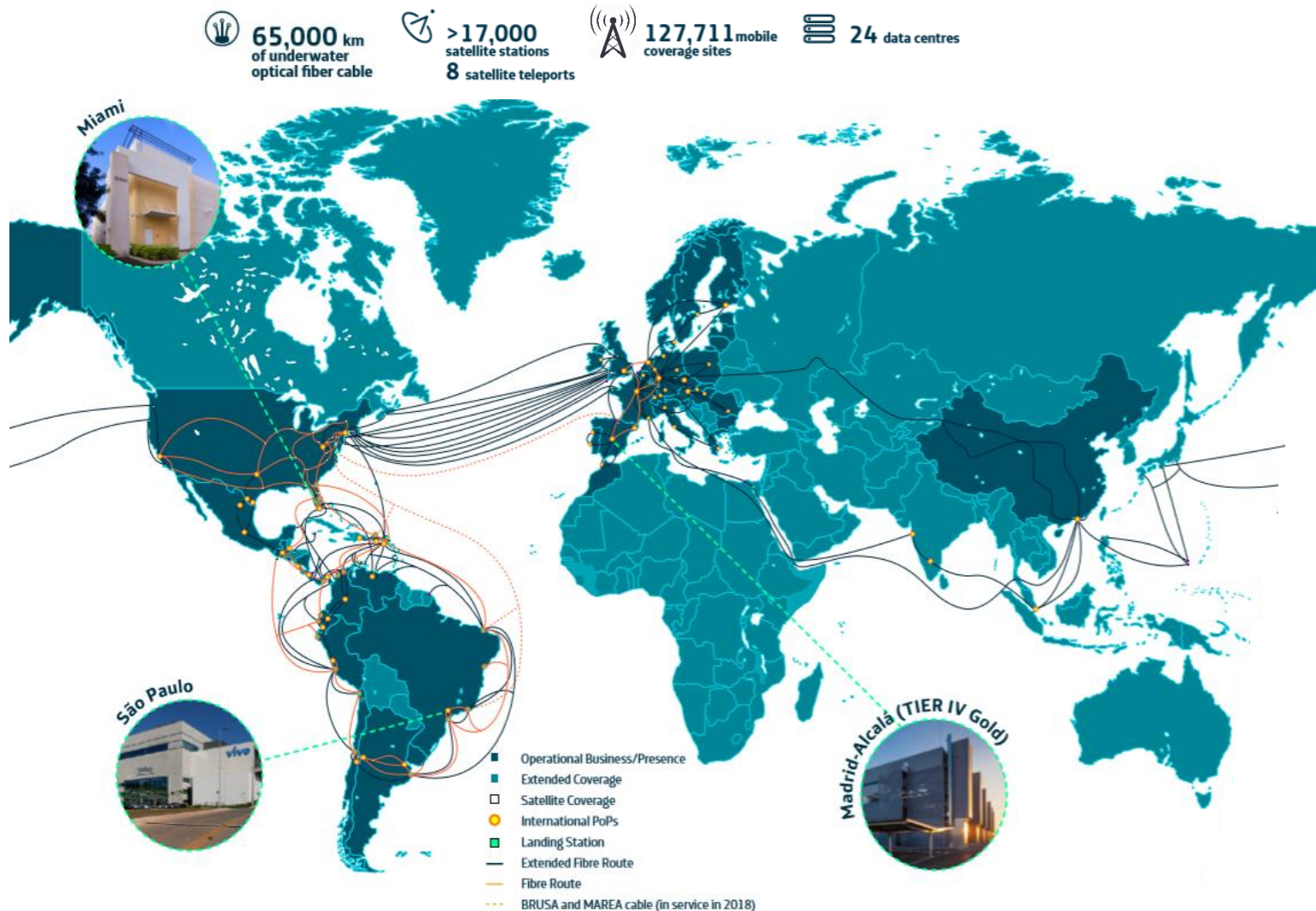
DIGITALIZATION

Build...

Leading-edge Smart Networks

Radical Processes Automation

...to deliver

World-class Digital Customer Experience

Distinctive Digital Value Proposition

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We choose it all

A path of great effort and consistency deploying infrastructure

65,000 km of underwater optical fiber cable

>17,000 satellite stations
8 satellite teleports

127,711 mobile coverage sites

24 data centres

Miami

São Paulo

Madrid-Alcalá (TIER IV Gold)

- Operational Business/Presence
- Extended Coverage
- Satellite Coverage
- International PoPs
- Landing Station
- Extended Fibre Route
- Fibre Route
- BRUSA and MAREA cable (in service in 2018)

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Source: Telefónica 2017 Integrated Annual Report

New customer demand and technology trends: opportunities and challenges
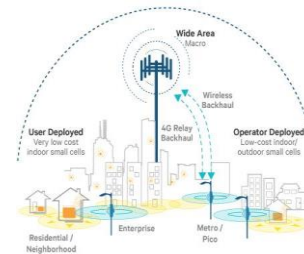
More technologies and spectrum bands
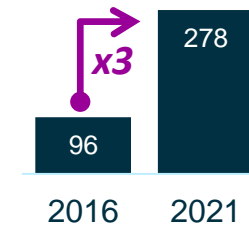
- FTTx
- xGPON
- 5G
- TDD
- mmWave
- Unlicensed
- …
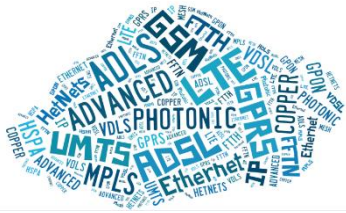
Greater network heterogeneity

- Macro
- Small, pico, femto, micro cells
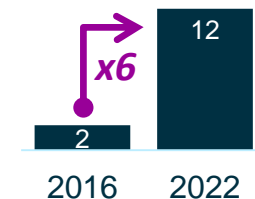- FWA (Fixed Wireless Access)

Huge increase in data traffic

Global IP traffic[1]
(EB/month)

x3

96 → 278

2016   2021

Higher density / capillarity

- Small, pico, femto, micro cells
- Massive IoT
- Traffic density
- Network sharing
- …

New services and user demands

- Virtual / Augmented Reality / Video 360º
- 4K / 8K video
- Connected cars
- Smart cities
- IoT explosion
- …

Data traffic per smartphone[2]
(GB/month)

x6

2 → 12

2016   2022

1. Source: Cisco Visual Network Index.
2. Source: Ericsson Mobility Report.

1 Industrializing FTTH deployments

2 Advancing in LTE deployments while preparing for 5G

3 Towards E2E Digitalization leveraging on BSS and OSS transformation

4 Building a global architecture and common data model to expose capabilities

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Industrializing FTTH deployments

Telefónica is making a great effort in fixed Ultra Broadband deployments

46 m
UBB Premises Passed

+13% yoy

11 m
UBB Connected Homes

+20% yoy
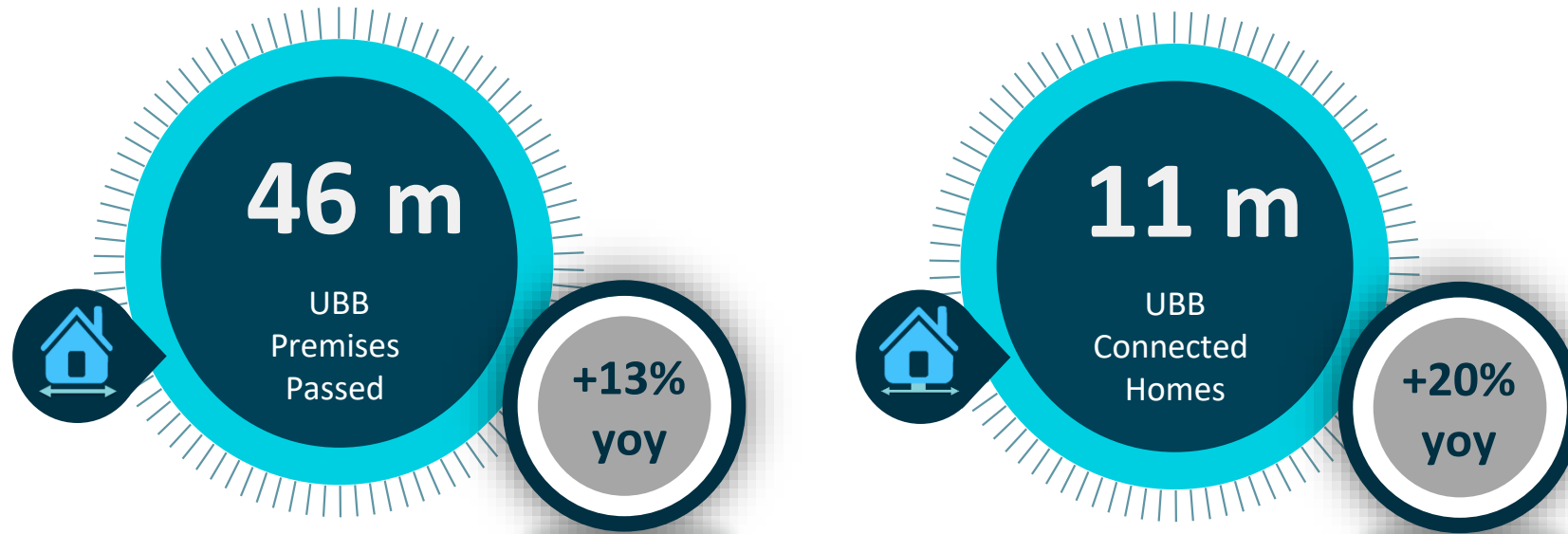
- Spain is **leader in FTTH in Europe**

- **Users and coverage in Spain** > Germany + France + Italy + UK

Telefónica
We choose it all

Fiber industrialization in Spain has enabled us to deploy more efficiently in HispAm

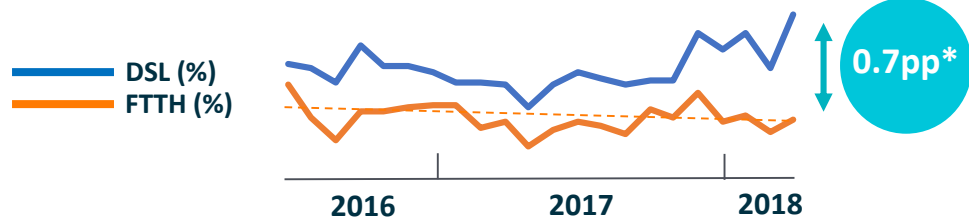## Deployment cost reduction while improving quality, productivity and Time to Market

Cost reduction

Home Passed Cost (2012-2015) — **-47%**

Home Connected Cost (2012-2015) — **-22%**

Improving quality

Fault Rate (2 Play) (2015-2017) — **-60%**

Fault rate (3 Play) (2015-2017) — **-43%**

Fault rate evolution (DSL vs FTTH)

DSL (%)
FTTH (%)

2016   2017   2018

0.7pp*
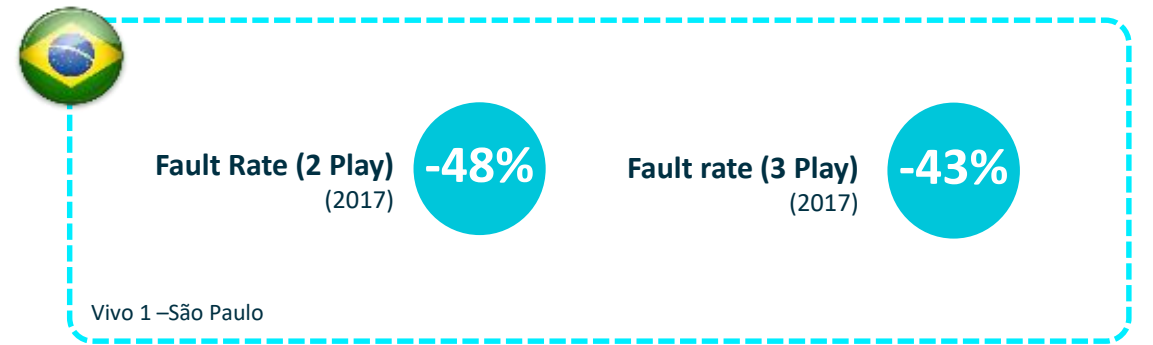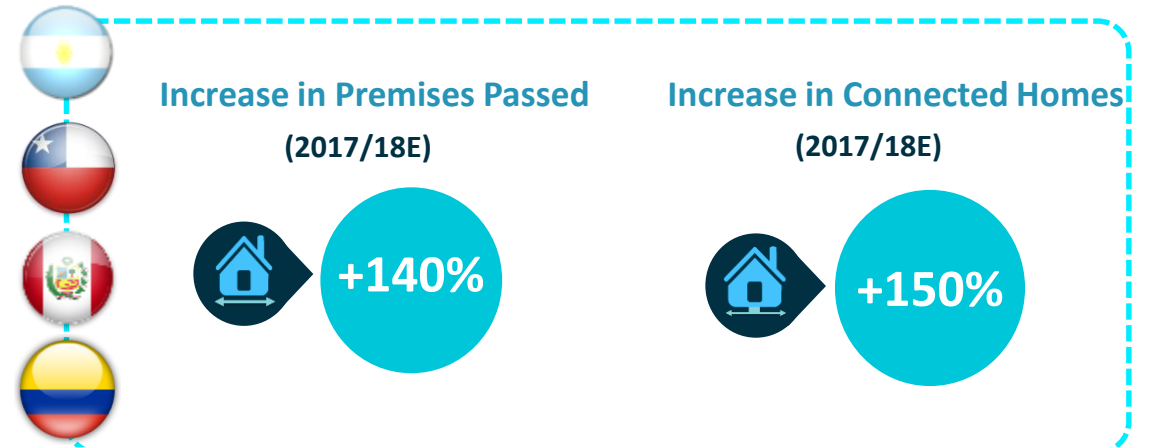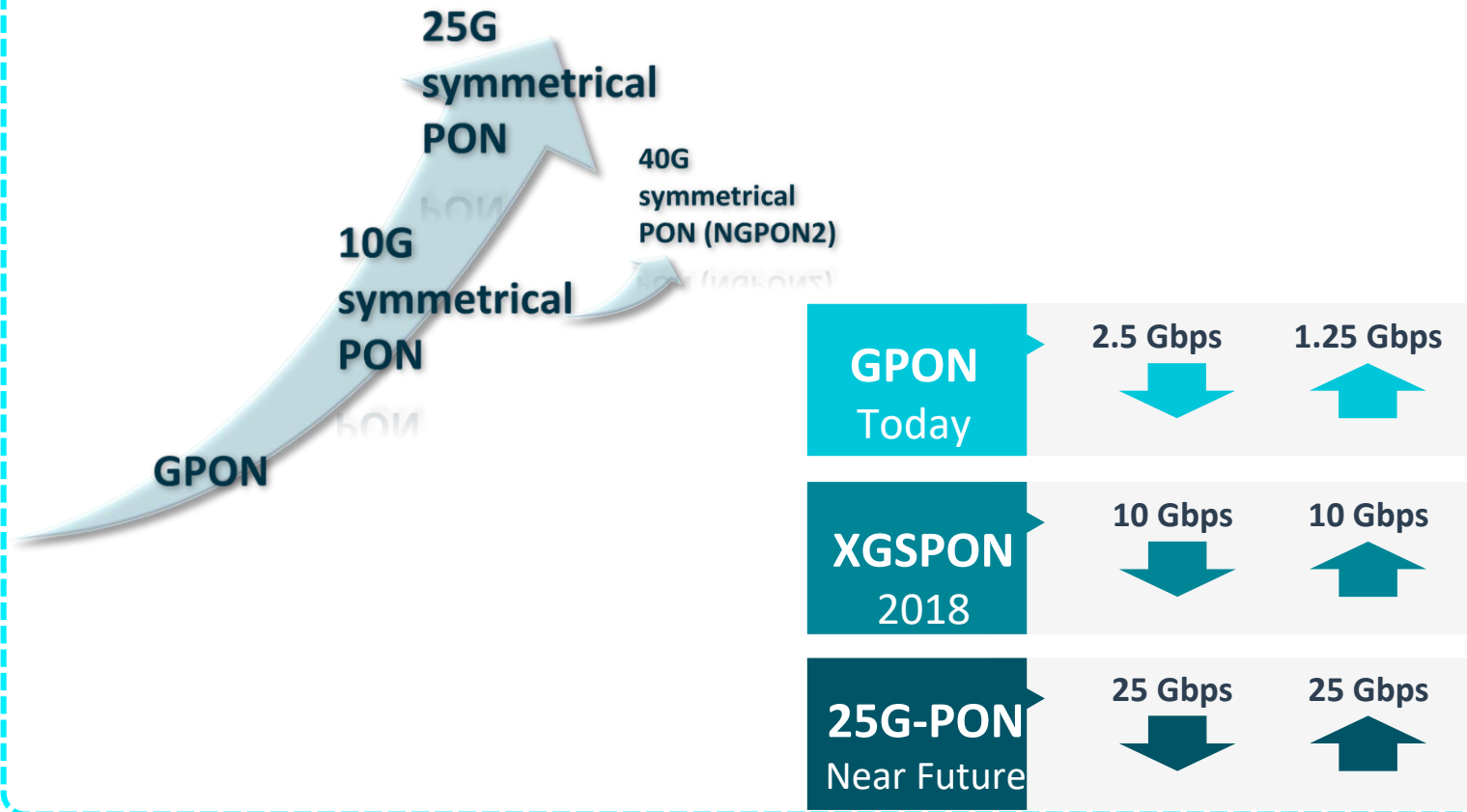
*Average improvement of fault rate (22 months)

Benefiting from knowledge and scale to accelerate deployments in HispAm

Increase in Premises Passed (2017/18E) — **+140%**

Increase in Connected Homes (2017/18E) — **+150%**

Fault Rate (2 Play) (2017) — **-48%**

Fault rate (3 Play) (2017) — **-43%**

Vivo 1 –São Paulo

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Infrastructure ready to evolve fiber technologies to achieve greater capacity in the future

Hyperfast broadband means fiber

25G
symmetrical
PON

40G
symmetrical
PON (NGPON2)

10G
symmetrical
PON

GPON

|		Downstream	Upstream
GPON Today		2.5 Gbps ↓	1.25 Gbps ↑
XGSPON 2018		10 Gbps ↓	10 Gbps ↑
25G-PON Near Future		25 Gbps ↓	25 Gbps ↑

FTTH deployment plans

- Industrializing fiber rollout
- Accelerating our coverage goals
- Increasing speed
- Improving user experience

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Guaranteeing excellent connectivity by enhancing customer's equipment...

We own our home strategy and our products

- Changing the relationship model with the industry, creating a prosperous 3rd parties ecosystem

- Managing E2E residential equipment industrialization process

SW stack (3rd parties)

Chipset

HW components (3rd parties)
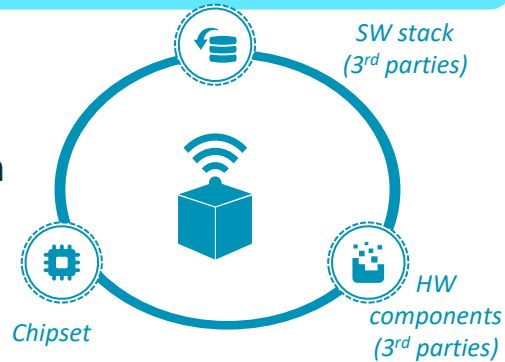
Unified and synergic home devices portfolio

Smart voice & display assistant

Movistar Home

Powered by

FTTH — Base HGU — Base XHGU

WiFi — Base Port — Base Port2 — Base XPort

FWA — Router 4G — Base portable 4G — Router 5G

xDSL & HFC — Cablemodem (Peru) — Cablemodem TOP (Peru)

VDSL Light — VDSL Germany — VDSL Light Plus

BHS ADSL

30m Devices* *produced through this model (2014-2018)

Differential connectivity: excellent Wi-Fi quality and Smart Wi-Fi

- Up to 1 Gbps
- Total Wi-Fi coverage at home
- Smart WiFi
- Facing a more complex environment

SMART

Iconic device: Home Gateway Unit

> 3m HGU*

*installed in TEF foorprint

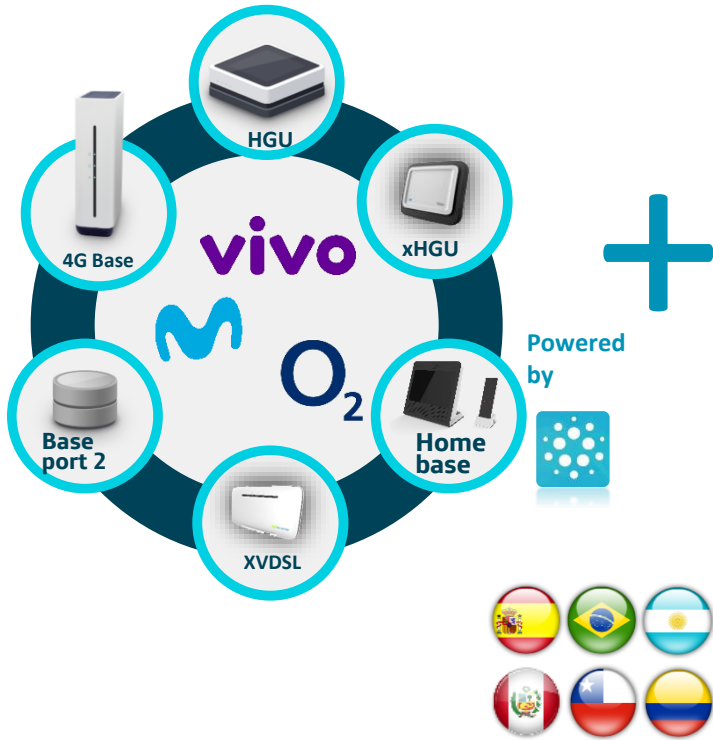### Improving quality ratios vs former equipment*

INCIDENT RATE	↓ 43%
SUBSTITUTION RATE	↓ 82%
INSTALLATION TIME	↓ 41%

*Average HGU vs legacy ONT + Router in Spain

... and moving forward to use our smart devices ecosystem as a service platform at home

Improving value for our customers

Same service regardless the access + Smart voice assistant

HGU

4G Base

xHGU

vivo

o2

Base port 2

Home base

Powered by

XVDSL

Open platform at home to provide new differential B2C and B2B services

NEW SERVICES

API CAPABILITY

VIRT CLI

CLI   API CAPABILITY

ICES

FIRMWARE

S.O. LINUX

movistar

Open ecosystem

SW stack (3rd parties)

Apps (3rd parties)

Chipset

HW components (3rd parties)
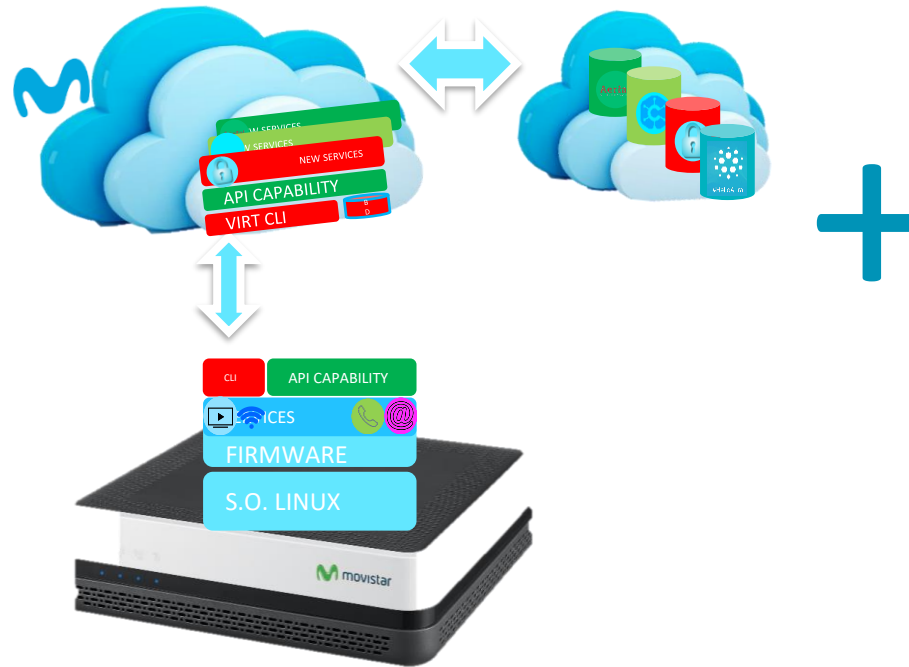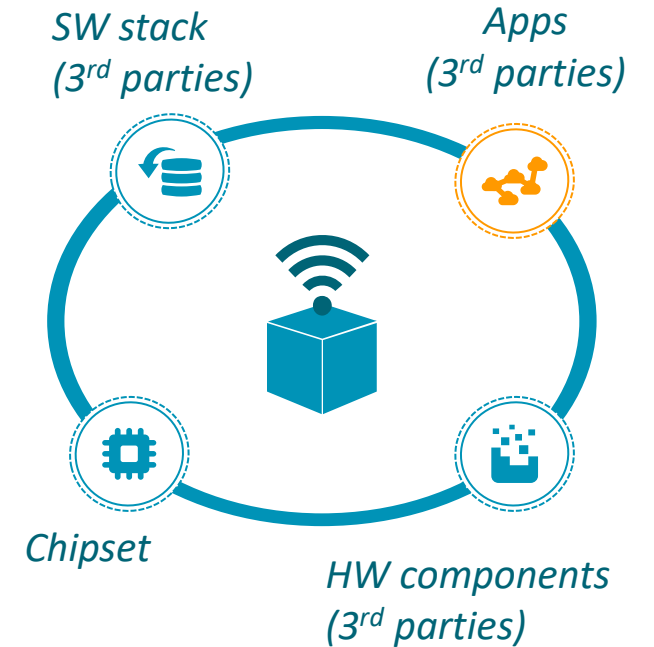
Evolving our video ecosystem to be ready for the market reality

+5 million users*

Convergent TV ecosystem (Open Platform)

- FBB (Cable, XDSL, FTTX)
- MBB (3G, 4G)

Next Set Top Box generation

- STBs portfolio simplification
- Device´s evolution (UHD, HDR,..)
- All video services (DTH / CATV / IPTV / OTT)

Management E2E

- Maximizing product sharing
- Global and local team

Unified video services evolution

- Homogenous user experience in all devices, access networks and video commercial proposal

Service Quality

99.99% service availability

Cost Sustainability

Open "best of breed" solution

Future proof ecosystem

New formats and integration with third party platforms

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* April 2018

16

Managing our legacy while advancing towards an All-IP Network

All-IP transformation

- **VoIP commercial offer** in a transparent way for the customer
- **Compaction and shutdown plans** for PSTN
- **Spain pioneer** in Central Office decommissioning

+7% yoy

9 m
VoIP active customers

+3 OBs yoy

7 OBs
VoLTE
+
2 OBs
VoWiFi

+ VoWiFi
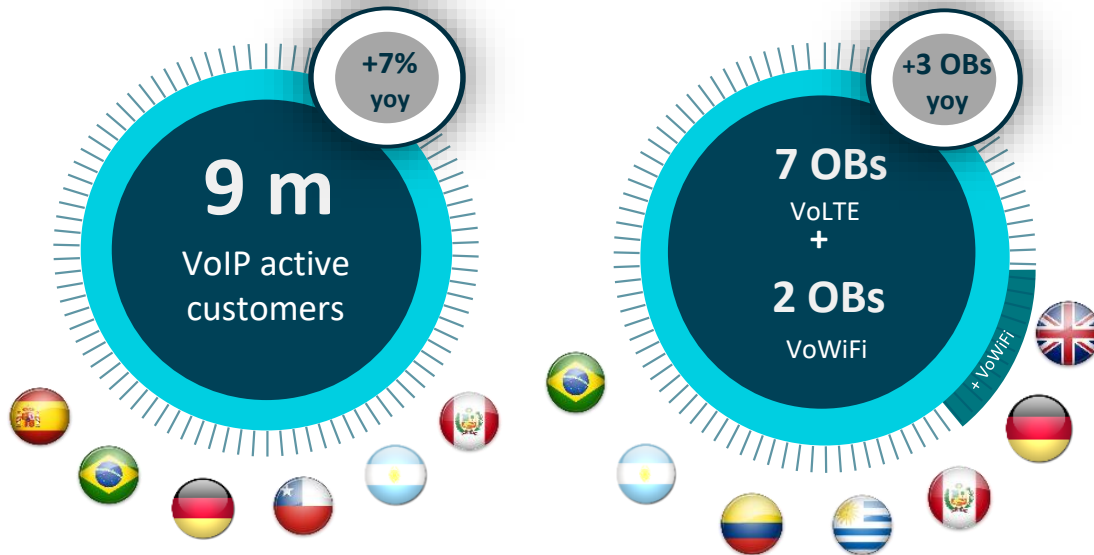
Transforming our Transport Network

HL1 — PEERING LEVEL

HL2 — BACKBONE LEVEL

HL3 — PROVINCIAL LEVEL

HL4 — LOCAL LEVEL
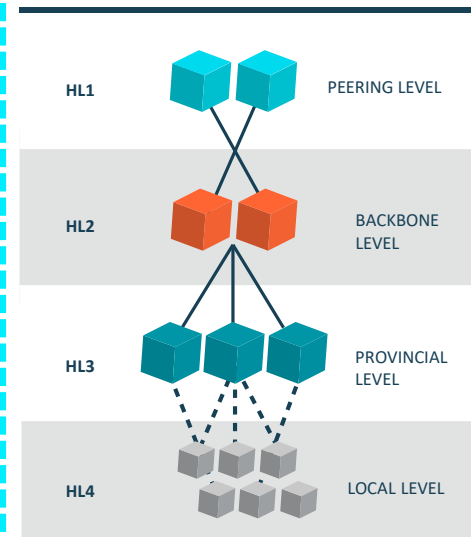
IP over Optics technology

Less layers
(collapsing from 8 to 4)

Scalable and resilience
(MPLS and SDN architecture)

Simplification
(less than half of the equipment)

8 layers → **4** layers

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Advancing in LTE deployments while preparing for 5G

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Telefónica is advancing in LTE deployments in all our footprint

92%
LTE Pop coverage

66%
LTE Pop coverage
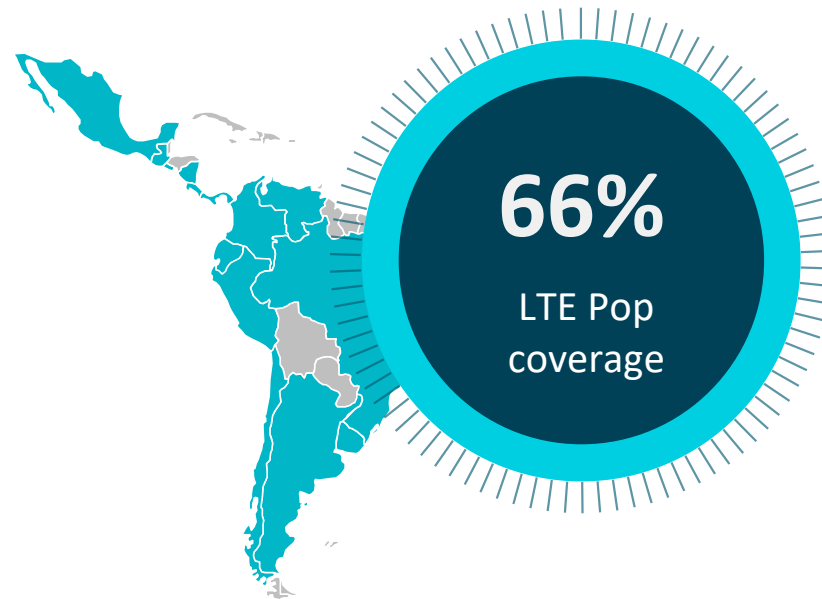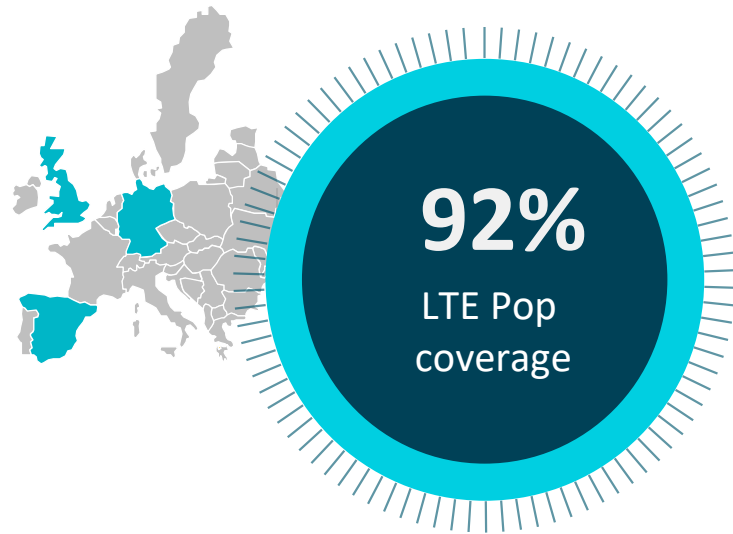
Total sites LTE
>75k

3G/4G Sites with UBB
97%

Source: Telefónica. Results Q1 2018.

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Extending coverage and capacity to offer support to new services

Evolving to 5G

4.5G
4.9G

2017 2018 2019 2020 2021

5G

Coverage
- Extending 4G PoP coverage in all our footprint

New services
- NB-IoT / LTE-M. IoT and Industry 4.0
- Fixed Wireless Access (FWA)
- Vehicular comms (V2X)
- 5G devices (H2 19E)

Capacity
- Spectrum management (refarming)
- Carrier Aggregation (up to 3-5)
- Multi and Massive MIMO Antennas

New Architectures
- Single RAN
- Heterogeneous Networks
- Virtualization in the Mobile Access

Moving towards a convergent UBB access

eMBB
IOT
V2X
x 10K
Cellular
Fiber
WiFi
Mobile Operators
SmartHome
x 100K
Fiber
Cellular / WiFi
TE
Convergent Operators
FWA
Fixed Operators
x 1M
Fiber
FTTH
WiFi
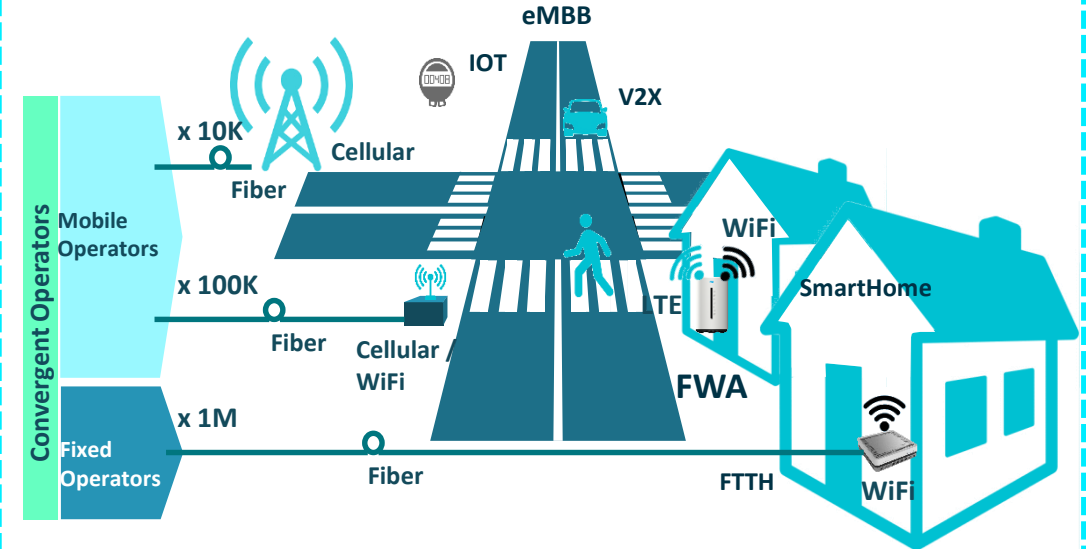
Possible scenarios representation

K: kilo = x 1,000. M: million = x 1,000,000 (potential customers/connections)

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MIMO: massive input massive output
RAN: Radio Access Network

IoT: Internet of Things
FWA: Fixed Wireless Access
eMBB: enhanced Mobile Broadband

20

A strong Network Virtualization program: UNICA, one of the first industrial Telco Clouds…
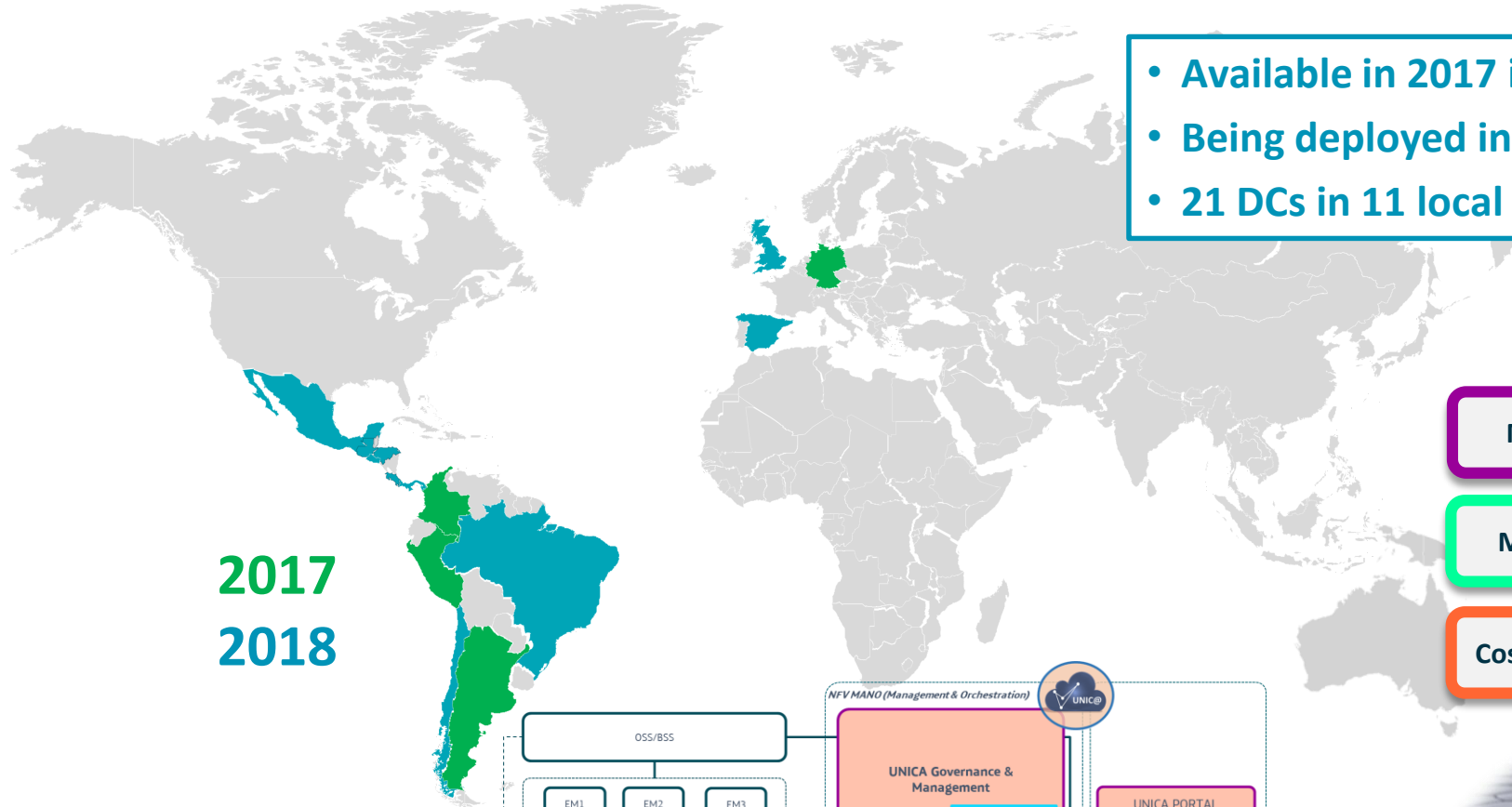
- **Available in 2017 in 4 Telefonica operations**
- **Being deployed in 7 new markets along 2018**
- **21 DCs in 11 local domains + 1 global domain**

2017
2018

Modular

Open

Secure

Multi-site

Elastic

Multi-tenant

Cost Effective

Multi-vendor

Standard aligned

Robust

Flexible

UNIC@

OSS/BSS

NFV MANO (Management & Orchestration)

UNICA Governance & Management

Open Source MANO

UNICA PORTAL

EM1 EM2 EM3

UIM CLMP

VNF1 VNF2 VNF3

NFVI

VIM (Virtualized Infra Manager)

Common Services
Backup
DNS
CAS

Operating System & Hypervisor

KVM vmware ESXi

Multiple VIMs
openstack.
vmware

SDN Controller
OPEN DAYLIGHT

HW Management

HW Resources

Computing HW Storage HW Network HW

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... enabling a future proof network designed to be agilely changed and operated in an automated fashion

2017 - 2020   5G   2021 - 2025

Infrastructure

UNICA@DC — UNICA Management
UNICA@MicroDC
UNICA@MicroDC

UNICA@CO
UNICA@CO
UNICA@CO
UNICA@CO

Fixed Access OPA-F
Radio Access OPA-M

Enterprise

Virtual network Functions

Virtual Core and Platforms

Virtual Access and Edge

Transport

FUSION IP/Optical

SDN Transport/Backhaul

Automation

Automatic Deployment and Infra Mgmt. OSM integration

Open Source MANO

Basic Slicing

Zero touch with Automatic configuration
Edge Computing E2E network slicing

OPA: Open Access (Fixed and Mobile)

22

Driving additional value and bringing new business opportunities with all these new network capabilities

Network Slicing

- **E2E logical (virtual) networks** that consist of a mix of shared and dedicated virtual network functions

- These **differentiated capabilities** (latency, performance, reliability, availability...) are **tuned for each use case or service**
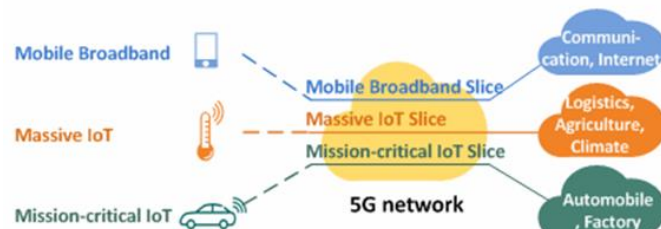
Edge Computing

- Placing **computing and storage assets close to the end user**

- **Increase efficiency in the use of network resources** (e.g. transport capacity), improve QoE, reduce latency, and increase security and privacy

VIDEO

CONNECTED CARS / AUTONOMOUS DRIVING

VIRTUAL & AUGMENTED REALITY

ARTIFICIAL INTELLIGENCE

Network as a Service (NaaS)

- Sale of **network services to third parties** that want to deliver services to their customers without building their own network infrastructure

- **Services:**
  - Wide Area Networking (WAN) connectivity
  - Edge Computing capacity
  - Data-center connectivity
  - Bandwidth on demand (BoD)
  - Security services
  - Content Distribution
  - other applications

QoE: Quality of service

Towards E2E Digitalization leveraging on BSS and OSS transformation

Telefónica

Advancing in Full Stack deployments while consolidating global management models to enhance digital experience

Transforming business support processes and systems in all our footprint

7 OBs with > 60 % migrated
2 OBs Fully migrated

Full Stack Excellence Global Center

Initial stage

Migration started

Advanced state / Fully Migrated

Accelerating the migration of our customers to Full Stack

% of customers migrated

x**2** → 30

14

2016   2018E
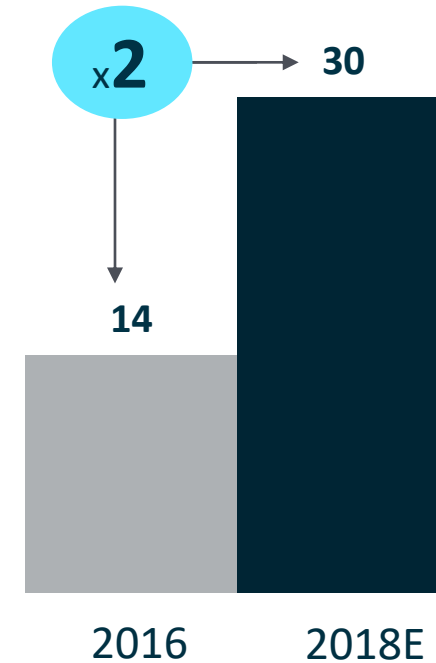
Building a unified Operational Support Systems (OSS) Map

OSS simplification and automation

Same processes and same tools across all 17 Operating Business

1,000

OSS applications

15

Virtualized OSS applications to manage all operations (2020E)

Unified OSS strategy for all Operating Business

Common Map Best of Breed Solutions

Service Management

- Test Management
- Fulfilment & inventory
- Service Problem
- Service Quality
- Performance management

Resource Management

- Resource Lifecycle Management
- Workforce Management
- Fault management

Resource Domain Management

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Transforming Global Operation levels (L1, L2 & L3) to make our Network Operation Center (NOC) more efficient...

Attention levels at Network Operation Center (NOC)

L3: Supplier support → **Global supplier model**
- Unified and standardized model of support contracts
- Common technical and economic templates

L2: Advanced remote support → **Internal knowledge to give support**
- Internal teams with deep network and systems knowledge formed by Telefónica experts

L1: Basic support → **Standardized and outsourced support**
- Standard and global automation model

L0: Automatic monitoring → **Unified network monitoring**
- Unified monitoring and first resolution of networks and systems

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... and evolving towards customer centric operations through Service Operation Centers (SOC)

Evolving from network centric operations to customer centric operations

Become a truly Customer-Centric Telco

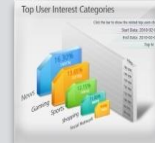**Deliver the best customer experience**

Offer high quality services

Vision

User Experience | **Device & Apps analysis** | **Service Quality Assurance** | **Network Traffic Analytics**

Phase I

Phase II

Creating value based on real-time analysis of customer experience

Revenue

Customer retention
- **Faster resolution** causing **5% churn reduction**
- **Service Monitor of VIPs, VAPs and Enterprise Customers** (segmentation approach ARPU/VIP)
- **Proactive Management** of user perceived quality

Revenue generation
- **Marketing campaign** support (MCS)
- **Service monetization** and fast restoration
- Ability to offer **premium services, CSI/NPS Increase**

Cost

OpEx reduction
- **Reduced Call** Centre and NOC workload
- **Proactive trend** analysis and Service performance
- **Dynamic SLA** to drive operation efficiency (FCR)

Improve CapEx allocation
- **Improved utilization** of Network resources
- **Analysis** and Management of **Service Capacity**
- **Flexible Business Model**

MCS: marketing campaign support
NPS: net promoter score
CSI: customer satisfaction index

VAP: very annoyed person
NOC: network operation center
FCR: first call resolution

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Evolving our operations towards extreme automation leveraging on Artificial Intelligence

Evolving towards Data-Driven, Customer Centric and Zero Touch Operations

Data driven & zero touch operations

Customer Centric operations

+170 Data sources

+300 use cases

- Planning & Capacity Mng.
- Infrastructure Management
- Devices Management
- Customer Care
- Network Maintenance
- Video Operations
- Stock Management
- Customer Experience
- Purchasing Processes

Artificial Intelligence

Expert Systems

Machine Learning

Automation

CUSTOMER SATISFACTION

REVENUES

EFFICIENCY

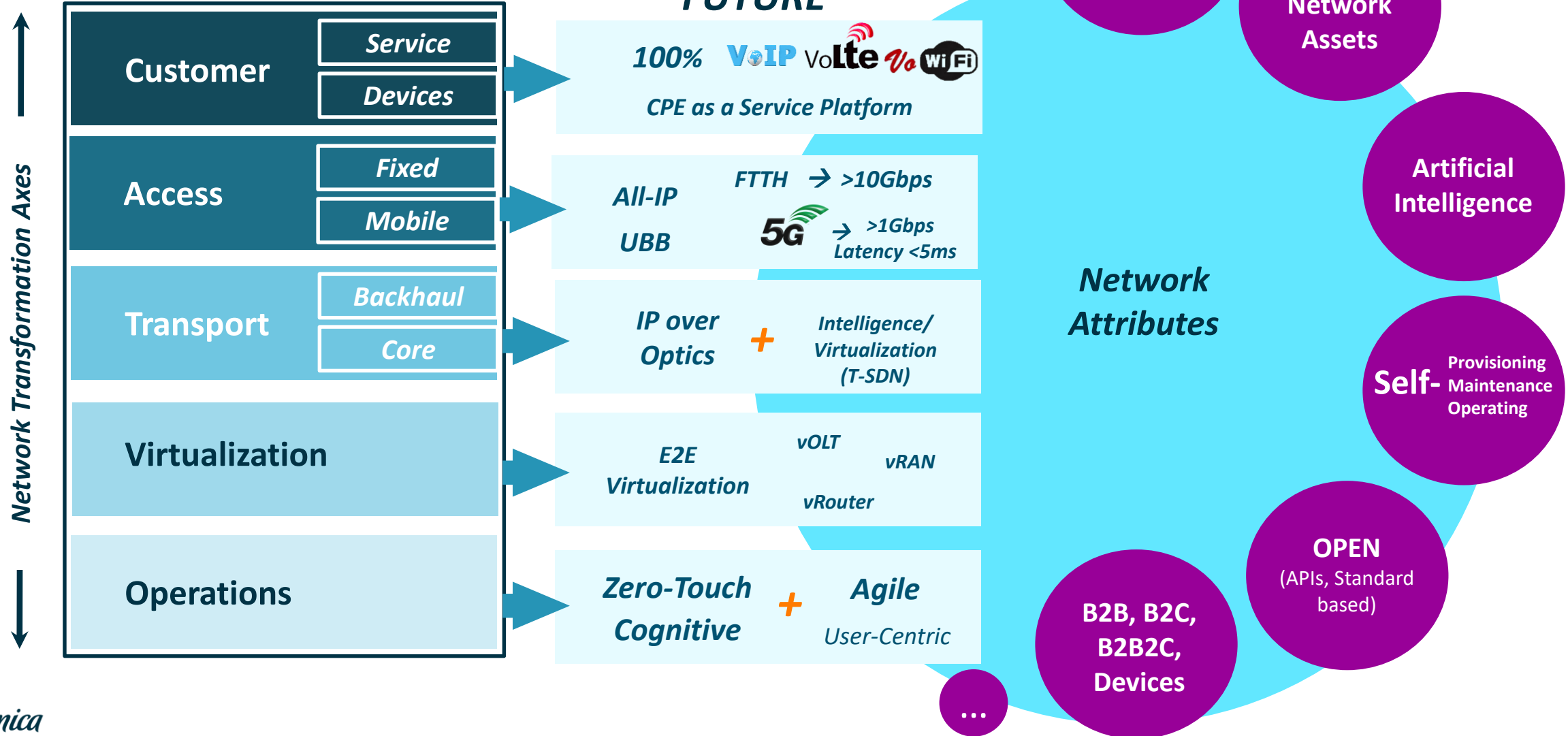# Building a global architecture and common data model to expose capabilities

Enabling management and operation data flow between all Telefónica's platforms

Cognitive power — 4th PLATFORM

Products & Services — 3rd PLATFORM

IT & Systems — 2nd PLATFORM

Physical assets — 1st PLATFORM

So, which future network are we evolving towards?

Network Transformation Axes

Customer	Service
	Devices
Access	Fixed
	Mobile
Transport	Backhaul
	Core
Virtualization	
Operations	

FUTURE

100% VoIP VoLTE Vo WiFi

CPE as a Service Platform

All-IP | FTTH → >10Gbps
UBB | 5G → >1Gbps Latency <5ms

IP over Optics **+** Intelligence/ Virtualization (T-SDN)

E2E Virtualization | vOLT | vRAN
| vRouter

Zero-Touch Cognitive **+** **Agile** User-Centric

Network Attributes

- Network Operating System
- ...
- Virtualized Network Assets
- Artificial Intelligence
- **Self-** Provisioning Maintenance Operating
- **OPEN** (APIs, Standard based)
- **B2B, B2C, B2B2C, Devices**
- ...

Key Takeaways

Laura Abasolo

Chief Financial and Control Officer

Telefónica

Key Takeaways

Differential platform

We accelerate transformation and deliver spread efficiency

11M UBB base (+20% y-o-y)   4 OBs in UNICA

-47% cost/Fibre prem. passed (Spain)

30m in-house home devices   61% E2E Digitalisation

Customer centric

Privileged position to capture future growth

ARPU uplift; +10% LTE; +20% Fiber

53% Connectivity + SoC/Group Revenue

Open Ecosystem   5G   Artificial Intelligence

Sustainable and profitable

More resilient network and business

CapEx peak behind   Data Analytics

Cutting-edge services (IoT, Edge..)   SON, Zero touch

Value creation through transformation

Q&A Session

Laura Abasolo

Enrique Blanco

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