Network and Systems evolution

London, June 19th 2018
Network and Systems Evolution session

Pablo Eguirón
Global Director of Investor Relations
Key Objectives

Laura Abasolo
Chief Financial and Control Officer
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

<table>
<thead>
<tr>
<th>1st PLATFORM</th>
<th>2nd PLATFORM</th>
<th>3rd PLATFORM</th>
<th>4th PLATFORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Assets</td>
<td>IT &amp; Systems</td>
<td>Product &amp; Services</td>
<td>Cognitive Power</td>
</tr>
</tbody>
</table>

Build...

- Leading-edge Smart Networks
- Radical Processes Automation
- World-class Digital Customer Experience
- Distinctive Digital Value Proposition

...to deliver
A path of great effort and consistency deploying infrastructure
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 traffic¹
(EB/month)

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>96</td>
<td>278</td>
</tr>
</tbody>
</table>

Data traffic per smartphone²
(GB/month)

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

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

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
- ...

Huge increase in data traffic

Global IP traffic¹
(EB/month)

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>96</td>
<td>278</td>
</tr>
</tbody>
</table>

Data traffic per smartphone²
(GB/month)

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

- 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
Industrializing FTTH deployments
Telefónica is making a great effort in fixed Ultra Broadband deployments

- **Spain is leader in FTTH in Europe**
- **Users and coverage in Spain > Germany + France + Italy + UK**

**Source:** Telefónica. Results Q1 2018.

UBB Premises Passed includes FTTx + Cable

UBB Connected Homes includes FTTx + Cable + wholesale
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

- Improving quality
  - Fault Rate (2 Play) (2015-2017): -60%
  - Fault rate (3 Play) (2015-2017): -43%

Fault rate evolution (DSL vs FTTH)

- DSL (%)
- FTTH (%)

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%

*Average improvement of fault rate (22 months)

Benefitting from knowledge and scale to accelerate deployments in HispAm

- Home Connected Cost (2012-2015)

- Cost reduction
- Improving quality


- Fault rate evolution (DSL vs FTTH)

2016 2017 2018

Vivo 1 – São Paulo

Telefónica We choose it all

12
Infrastructure ready to evolve fiber technologies to achieve greater capacity in the future

Hyperfast broadband means fiber

- GPON Today: 2.5 Gbps down, 1.25 Gbps up
- XGSPON 2018: 10 Gbps down, 10 Gbps up
- 25G-PON Near Future: 25 Gbps down, 25 Gbps up

FTTH deployment plans

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

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

Iconic device: Home Gateway Unit

Improving quality ratios vs former equipment*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCIDENT RATE</td>
<td>43%</td>
</tr>
<tr>
<td>SUBSTITUTION RATE</td>
<td>82%</td>
</tr>
<tr>
<td>INSTALLATION TIME</td>
<td>41%</td>
</tr>
</tbody>
</table>

*Average HGU vs legacy ONT + Router in Spain

Unified and synergic home devices portfolio

- Smart voice & display assistant
- FTTH
- WiFi
- FWA
- xDSL & HFC

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

Iconic device: Home Gateway Unit

Improving quality ratios vs former equipment*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCIDENT RATE</td>
<td>43%</td>
</tr>
<tr>
<td>SUBSTITUTION RATE</td>
<td>82%</td>
</tr>
<tr>
<td>INSTALLATION TIME</td>
<td>41%</td>
</tr>
</tbody>
</table>

*Average HGU vs legacy ONT + Router in Spain

Unified and synergic home devices portfolio

- Smart voice & display assistant
- FTTH
- WiFi
- FWA
- xDSL & HFC

*Produced through this model (2014-2018)

30m Devices*
... 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

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

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

Convergent TV ecosystem (Open Platform)
- FBB (Cable, XDSL, FTTX)
- MBB (3G, 4G)

Management E2E
- Maximizing product sharing
- Global and local team

Next Set Top Box generation
- STBs portfolio simplification
- Device’s evolution (UHD, HDR,..)
- All video services (DTH / CATV / IPTV / OTT)

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

* +5 million users*

April 2018
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

**Transforming our Transport Network**

- **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)

- **9 m** VoIP active customers
- **7 OBs** VoLTE + **2 OBs** VoWiFi

- **8 layers**
- **4 layers**

**Telefónica**

PSTN: Public Switched Telephone Network; VoIP: Voice over IP
Data as Q1 2018
Advancing in LTE deployments while preparing for 5G
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.
Extending coverage and capacity to offer support to new services

**Evolving to 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**

Possible scenarios representation

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

MIMO: massive input massive output
RAN: Radio Access Network

IoT: Internet of Things
FWA: Fixed Wireless Access
eMBB: enhanced Mobile Broadband
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
... enabling a future proof network designed to be agilely changed and operated in an automated fashion
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**

![Diagram of Network Slicing](image)

### 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

![Diagram of Edge Computing](image)

### 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
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

Accelerating the migration of our customers to Full Stack

% of customers migrated

- Initial stage
- Migration started
- Advanced state / Fully Migrated

2016: 14
2018E: 30

x2
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

**Resource Management**
- Resource Lifecycle Management
- Workforce Management

**Fulfilment & inventory**
- Service Problem
- Service Quality
- Performance management
- Fault management

**Resource Domain Management**
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
... 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

Creating value based on real-time analysis of customer experience

- **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

- **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

**Vision**

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

**Phase I**

**Phase II**

**Telefónica**

MCS: marketing campaign support
NPS: net promoter score
CSI: customer satisfaction index
VAP: very annoyed person
NOC: network operation center
FCR: first call resolution

We choose it all
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

Automation

Expert Systems

Machine Learning

Artificial Intelligence

EFFICIENCY

REVENUES

CUSTOMER SATISFACTION
Building a global architecture and common data model to expose capabilities
Enabling management and operation data flow between all Telefónica’s platforms
So, which future network are we evolving towards?

**FUTURE**

- **100% VoIP, VoLTE, WiFi**
  - CPE as a Service Platform

- **FTTH → >10Gbps**
  - All-IP
  - UBB

- **5G → >1Gbps Latency <5ms**
  - IP over Optics

- **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)
Key Takeaways

Laura Abasolo
Chief Financial and Control Officer
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
Telefonica
We choose it all
Disclaimer

This document and the Q&A session may contain forward-looking statements and information (hereinafter, the “Statements”) relating to the Telefónica Group (hereinafter, the “Company” or “Telefónica”) or otherwise. These Statements may include financial forecasts and estimates based on assumptions or statements regarding plans, objectives and expectations that make reference to different matters, such as the customer base and its evolution, growth of the different business lines and of the global business, market share, possible acquisitions, divestitures or other transactions, Company’s results and other aspects related to the activity and situation of the Company.

The Statements can be identified, in certain cases, through the use of words such as “forecast”, “expectation”, “anticipation”, “aspiration”, “purpose”, “belief” or similar expressions or variations of such expressions. These Statements reflect the current views of Telefónica with respect to future events, do not represent, by their own nature, any guarantee of future fulfilment, and are subject to risks and uncertainties that could cause the final developments and results to materially differ from those expressed or implied by such Statements. These risks and uncertainties include those identified in the documents containing more comprehensive information filed by Telefónica before the different supervisory authorities of the securities markets in which its shares are listed and, in particular, the Spanish National Securities Market Commission.

Except as required by applicable law, Telefónica does not assume any obligation to publicly update the Statements to adapt them to events or circumstances taking place after the date hereof, including changes in the Company’s business or business development strategy or any other unexpected circumstance.

This document and the Q&A session may contain summarized, non-audited or non-GAAP financial information. The information contained herein and therein should therefore be considered as a whole and in conjunction with all the public information regarding the Company available, including any other documents released by the Company that may contain more detailed information.

This presentation has been prepared by Telefónica for illustrative purposes only. Neither this document nor and the Q&A session nor any of their contents constitute an offer to purchase, sale or exchange any securities, a solicitation of any offer to purchase, sale or exchange of any securities, or a recommendation or advice regarding any security.