Telefónica Strategy for Systems and Network Evolution

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Leader in telecom infrastructures, platforms and services

#1 in fibre in Europe and Latin America

154.7 premises passed

UBB footprint, 80 million though own network (2021 H1)

4G 99% Coverage in Europe (78% Lat Am, 2021 H1)

5G Deployed in UK, Germany, Brazil and Spain

Fibre vehicles well on track

FiberCo in Germany
50% Allianz / 50% TEF. (40% T. Infra / 10% T.DE)

FiberCo in Brazil
50% CDPQ / 50% TEF. (25% T. Infra / 25% T.BR)

FiberCo in Chile
60% KKR / 40% T.CHIL

FiberCo in Colombia
60% KKR / 40% T.COL

Great effort deploying Ultra broadband networks...

80 m Ultra-Broadband Premised Passed

21.5 m Ultra-Broadband Connected Homes

51m FTTH Premise passed

80% yoy

10% yoy

56% of broadband customers with speed greater than 50 Mbps

Spain has more fiber deployed than the sum of UK, Italy and Germany

Source: Telefónica. Results Q2 2021. UBB Premises Passed includes FTTx + Cable including vehicles. UBB Connected Homes includes FTTx + Cable (1) FBB Commercial speeds does not include UK

The most digital telco

79% Of processes digitalised (2021 H1)

#1 in network virtualisation “Única” deployed in 10 countries

#1 shutting down legacy

1,000 CO decommissioned
... evolving Fiber technology towards 50G-PON by means of a multiservice approach...

- Multi-technology OLTs with GPON optics.
- XGS-PON is the next step over same passive network (up to 10 symmetrical Gbps).
- 50G-PON in mid-term (up 50 symmetrical Gbps).

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50G-PON

- Increasing FTTH coverage with better optics enabling the delivery to further customers using the same central office.
- Third party deployments

FTTH coverage

Base Station backhaul

- Connecting base stations backhaul with fiber enabling to move functions to the Edge node, and thus lighten the base stations.

Legacy Switch-off

- Copper evolution totally deprioritized focus on fiber.
- Facilitate copper and DSLAM switching-off, consolidation and compaction
- Telefónica Spain will be the first company to switch-off the copper in 2024 to fully transition to the fiber universe

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... while simplifying and performing the switch-off of legacies
Providing differential customer experience through excellent Wi-Fi quality and home equipment...

Customer demand for data keeps on growing

- Fixed Data traffic
  - Per customer, Q2 2021
  - 355 GB/month
  - +31% YoY
  - 7,546 Pbytes/month
  - ~1.9 Bn HD show episodes

Home Gateway Unit

- Up to 1 Gpbs
- Total Wi-Fi coverage at home, including roaming and band-steering
- Smart Wi-Fi (apps to control connectivity at home, managed Wi-Fi, Parental control, security)

Marco Polo family:
- same home connectivity services regardless the access

- Smart voice & display assistant
  - FTTH
    - Base HGU
    - HGU WiFi 6
    - XHGU
  - WiFi
    - Base Port
    - Base Port2
    - XPort
  - FWA
    - Router 4G
    - Router 5G
  - xDSL & HFC
    - Cablemodem TOP (Peru)
    - Cablemodem TOP (UK)
    - Homebox 2 Germany
    - Homebox 3 Germany

Equipment at FTTH homes

- 89%

Produced through this model [2014-2021]

*installed in TEF footprint
June 2021 data

(*) June 2021 data ESP

~255 x 2.4

42.5m devices

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>9.7m HGU*

~42.5m devices

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... and moving forward to Wi-Fi 6, using our home devices ecosystem as an open service platform at home and providing FWA solutions

Next Generation Home Gateway Unit – Wi-Fi 6

- First 10G Home router integrating WiFi 6
- 5G Router with WiFi6 Connectivity
- Wi-Fi 6 Access point and Wi-Fi repeater

Home devices ecosystem as an Open Service platform

- **Current approach**
  - Performance inefficiency
  - Lost control of customer data
  - No scalable (limited physical CPE resources)
  - Long time for integration and homologation

- **HaaC Agent approach**
  - Optimized router performance
  - Improved time to market
  - Scalable model
  - Centralized data
  - Access control
  - Ecosystem for new services from both Telefonica and third parties, with easy integration

- Single Agent Architecture and Haac (Home as a Computer) platform as an element in the cloud:
  - Shorter time to develop and deploy NEW services (differentiation)
  - Chance to open to 3rd party developers and create and open development ecosystem
  - Customer might choose the “apps” at home
Completing coverage and capacity deployments of 4G networks as we activate 5G

Telefónica Mobile Networks

Europe

- Spain 98%
- UK 99%
- Germany 99.8%
- Brazil 92%

- 99% LTE Pop coverage

LatAm

- 78% LTE Pop coverage

Customer demand for data keeps on growing

- Mobile Data traffic Per customer, Q2 2021
  - 5.4 GB/month
  - +33% YoY

- Total Mobile Data traffic
  - 980 Petabytes/month
  - ~245m HD show episodes

Source: Telefónica Results Q2 2021
**5G deployment at the right pace according to business needs**

Commercial launch of DSS (Dynamic Spectrum Sharing) (4G-5G) as a mechanism to have 5G in FDD Bands by using dynamically the existing LTE spectrum to improve time to Market significantly vs 3.5GHz deployment

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**4.9G use cases**

Deployment of 5G capacity over 4G network
First experiences, pilots and use cases experiences

- 5G tech cities
- O2 Arena Experience
- FWA mmWave trials
- Pilots

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**5G Launches**

5G NSA commercialization in our main operations

- Commercial launch in Sep 20 (5G DSS)
- >80% cov Jun 21

- First 5G Private Network (Daimler Apr 19)
- Operates in 80 cities (Jun 21)
- >30% cov 2021YE, >50% 2022YE

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- Commercial launch in Oct 19
- >180 5G towns & cities on live in Jun 21

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5G massive deployment

Deployments based on markets and technology
Evolution to SA architecture

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**5G SA**

Spectrum auction by Q4 2021.
5G SA in auction conditions.

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Focus on strategic 5G rollouts (700 MHz, 3.5 GHz)

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2018/2019

2019/2021

2022/2025

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Commercial launch of DSS (Dynamic Spectrum Sharing) (4G-5G) as a mechanism to have 5G in FDD Bands by using dynamically the existing LTE spectrum to improve time to Market significantly vs 3.5GHz deployment
5G, in its final version (SA), will provide differential attributes for the provision of new services.
5G is an attractive technology to promote new enterprise businesses that demand specific use cases in Industrial IoT

5G Private Networks

- Private networks are **dedicated mobile networks for one B2B customer**, already being deployed with 4G technology, but the new functionalities (mainly latency) in 5G will allow more use cases. Private network massification expected with 5G.
- A **private network is the same technology as public 5G network** but the implementation will be **modular and simpler**. The flexibility is key:
  - Many implementation possibilities
  - Usage of part of the public network in the private implementation

Network Slicing

- Network Slicing is a new feature in 5G SA that brings the ability to **create virtual sub-networks** with dedicated resources and different configurations.
  - Network slicing will enhance private network and user experience handling.
  - Will drive **further automation** towards zero touch.
  - Enable software-based tailoring of the network to specific vertical needs.

Network as a Service

- Preparing for Network exposure with **Network as a Service (NaaS)**.
- Automation and APIfication of our network will allow full exposure of our network capabilities to foster development and interconnection of third parties opening the door to new monetization capabilities.
5G and Edge computing as enablers for new services requiring low latency and locality

Edge computing

- There are services that require 1 ms of latency and cloud platform (as we know it today) can not provide support to them.
- Edge computing, which brings the cloud closer to the customer. There are applications "on-premise" that can be hosted in the edge cloud.

Telco edge cloud

- Considered a complement to hyperscaler edge that allows providing differential MNO features, and further distributed topology following network core sites to deploy app loads.
- GSMA operator platform definition concluded as reference to guide telco edge implementations.
- Integration between 5G core and the telco edge platform to enable such features and provide a key differentiation to traditional cloud.
We are evolving our networks and systems towards virtualized and open architectures to ensure the strength of industry ecosystems...

OPEN FOUNDATIONS

• Define open architectures that guarantee the robustness of ecosystems avoiding vendor lock-in.
• Gain robustness, flexibility and efficiency in the supply chain by increasing the number of actors in different segments of the network and systems.
• Ensure the interoperability of technology.
• Have tools that are a lever for differentiation and accelerate innovation through open interfaces.
• Improve network economics by reducing TCO (Total cost of ownership).
Driven by Single Agent & HaaC platform
• Home gateways
• Baseport / XPORT
• CPE 5G / Base 4G
• Set top boxes
• Movistar Home

... guaranteeing robustness, flexibility and efficiency, enabling differentiation
Open RAN and Open Broadband: enabling the evolution of our access while managing our vendor map by creating robust ecosystems

Open RAN: concept and benefits

- Enrichment of the RAN ecosystem
- Full control over the final design and costs of the solution
- Avoid vendor lock-in through open interfaces
- Virtualized and flexible RAN architectures allowing new use cases
- Boost innovation

Open Broadband: concept and benefits

- HW and SW disaggregation
- Multi-vendor environment
- Open standard interfaces (not proprietary)
- Use of general-purpose processors and servers
- Enhance our vendor map
- Introduction of new services and applications to bring new incomes or improve customer experience and network performance
- Access programmability to improve operating model, automate network functions and simplify system integration, leading to reduced TTM and OPE
We count with our IT Architecture principles

Enable Telco Cloud
- Use of softwarization, cloudification and containers
  - Hybrid cloud (public and private)
  - Multicloud architecture. Allow mobility between clouds
  - Avoid vendor lock-in

Open source and use of standards
- Integration among components should be through standardized and secured open APIs
- Easy integration with third parties
- Use of opensource solutions

Decoupling channels from back-end
- Separation of concerns and de-coupling between blocks
- Use of discoverable microservices (repository)

Data/model driven operations
- Data as a core of a common architecture to give support to operative processes.
- Use of Artificial Intelligence and Machine Learning in the relationship with our customers and to manage our own networks and systems.

Network softwarization support
- Brings virtualized functionality closer to the customers
  - Ready for 5G, OpenRAN and EDGE applications
  - Auto-diagnosis and self healing in real time
  - Distributed topology of computing sites

Online Convergent Charging
- Online Charging is Digital Experience
- Convergence is Strategic
- B2B / B2B2X is Revenue Opportunities
- 5G SA Charging is new CCS Architecture

Use of DevOps
- Collaborative – Business centric approach with DevOps and CI/CD capabilities
- Use of agile governance principles that allow rapid changes to be managed in a complex environment.

Security and transparency
- Company information and data must stay safe, available, unedited and being used by the right people
- Access to customer information must be guaranteed by means of identity, privacy and confidentiality in a transparent way.

And strategic axes (Customer engagement, IT Basics, Core IT, Cloud & Infra (for Network and IT) and Security) that allow us to progress towards the cloudification and digitalization, and provide differential value to the market and customers
The new era of digital services over Open and Virtualized Networks needs a change of paradigm in the way we do things that will lead us into a new operating model.

While building a new operating model where AI would be a key component...

and defining the journey towards the Autonomous network until 2025.
To **create value** with 5G **beyond improvement** in browsing, speed and latency
Working with active sectors in 5G

- Vehicular Comms (V2X)
- Industry 4.0, airports and Logistics
- Tv and Media
- Tourism and entertainment

5G private networks
Edge services
Remote Maintenance based on AR, VR
Custom connectivity

And approaching horizontal multi-sector 5G applications
Serving Society as a whole while supporting sustainability

5G is 90% more energy efficient managing traffic vs 4G

Coping with a large increase in traffic demand

Health

Smart cities
Smart buildings
Smart Infra

Education
Becoming leaders in cutting-edge digital services

Unlocking the power of integrating technology

Connectivity  
Cloud  
Cybersecurity  
IoT  
Big Data