

CONGRESO DE FP INNOVA 2019

# Incidencia da tecnoloxía 5G na actividade produtiva

## Innovation & Product Strategy



*Fco Javier Marcos Alvarez*  
Santiago, 08 de Mayo de 2019

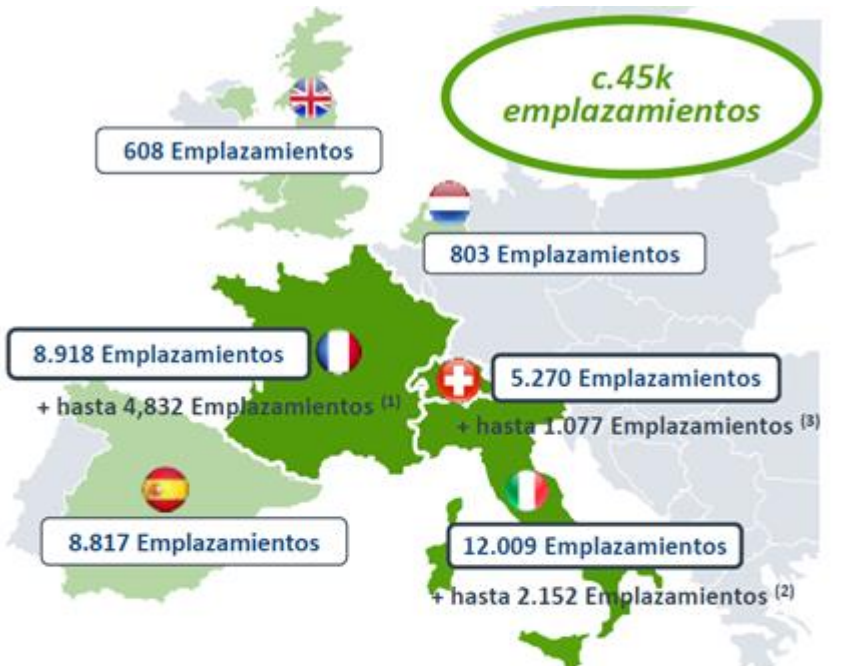
# Índice

- 1. Sobre Cellnex**
- 2. 5G**
- 3. Actividades de Innovación**
- 4. Impacto en Infraestructuras**
- 5. Impacto sectores productivos**

# 1. Sobre Cellnex

Cellnex Telecom es el **principal operador independiente** de infraestructuras de telecomunicaciones **en Europa...**

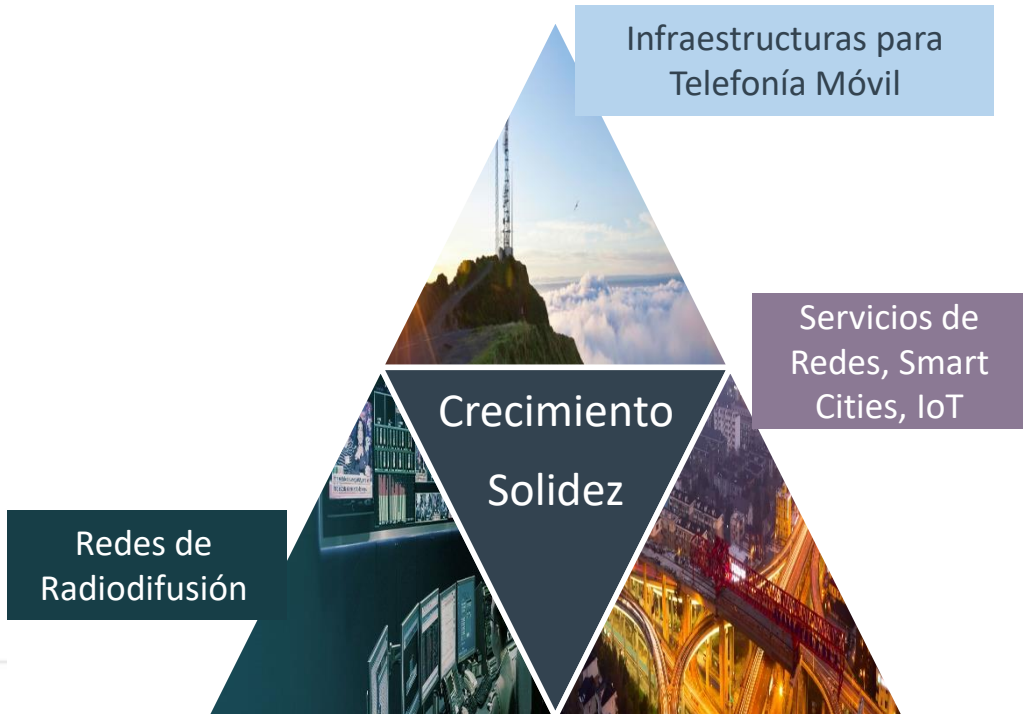
Cerca de 15.000 nuevos emplazamientos en Europa  
(hasta 4.000 son nuevos emplazamientos a desplegar entre 2020 y 2027)



Cellnex vs. comparables (miles de emplazamientos)



**+29.000 emplazamientos**



# 5<sup>th</sup> generation mobile communications



## 1G



1980's

Basic analogue voice  
No IP  
0 kbps

One network for voice

NMT, AMPS, TACS



## 2G GSM



1990's

Digital voice  
No IP  
14 kbps

One network for voice

GSM, IS-95  
2.5G (GPRS, EDGE)



## 3G UMTS



2000's

Digital voice  
WWW, Multimedia  
2 Mbps

One network for voice  
Other network for IP

UMTS, CDMA2000  
3.5G (HSDPA, HSUPA,  
HSPA+, LTE)



## 4G LTE



2010's

Voice over IP  
HD Video  
300 Mbps

One network for IP

LTE-Advanced  
4.5G (LTE-Advanced Pro)



## 5G 5G



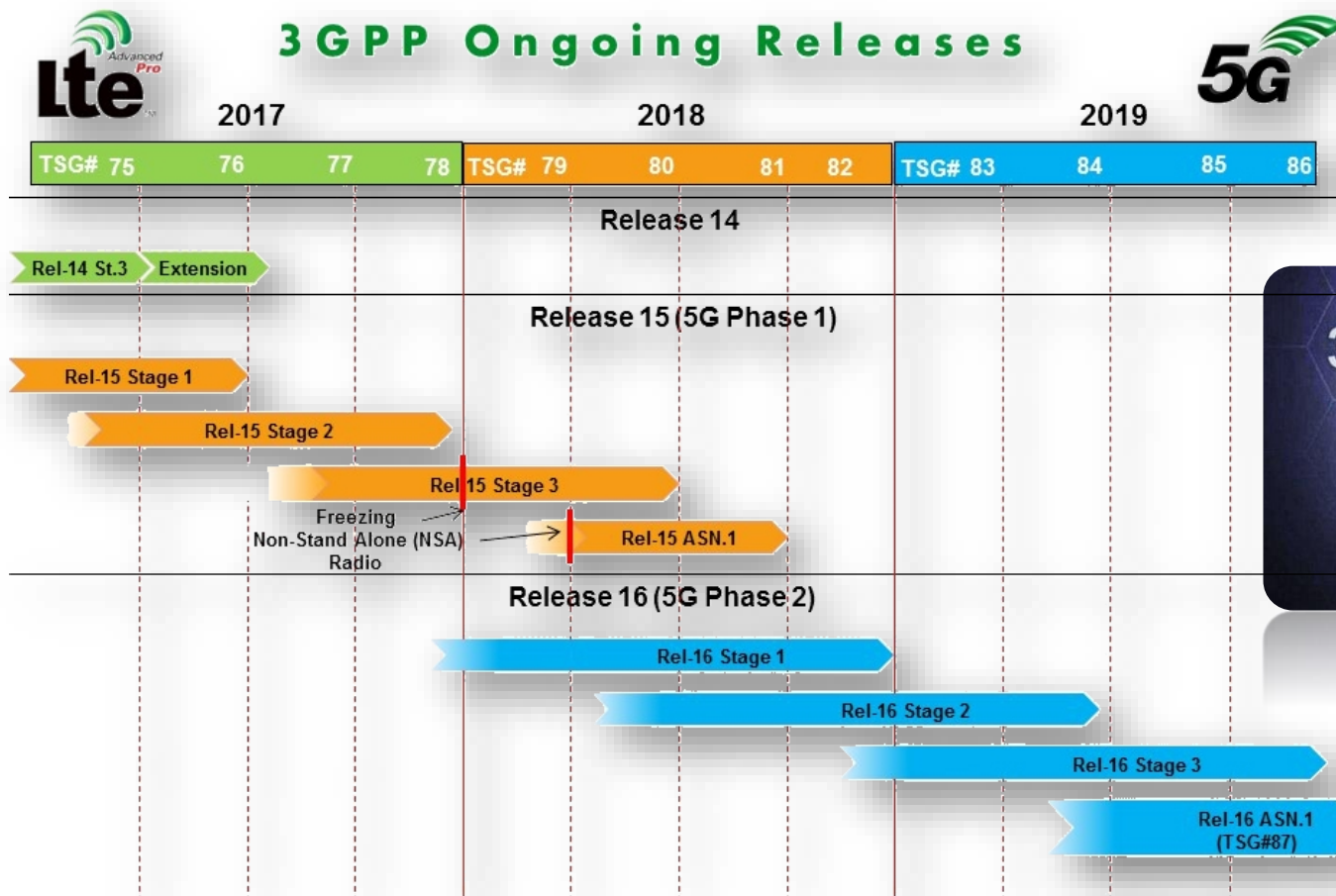
2020's

Voice over IP  
VR, V2X, IoT  
1 Gbps

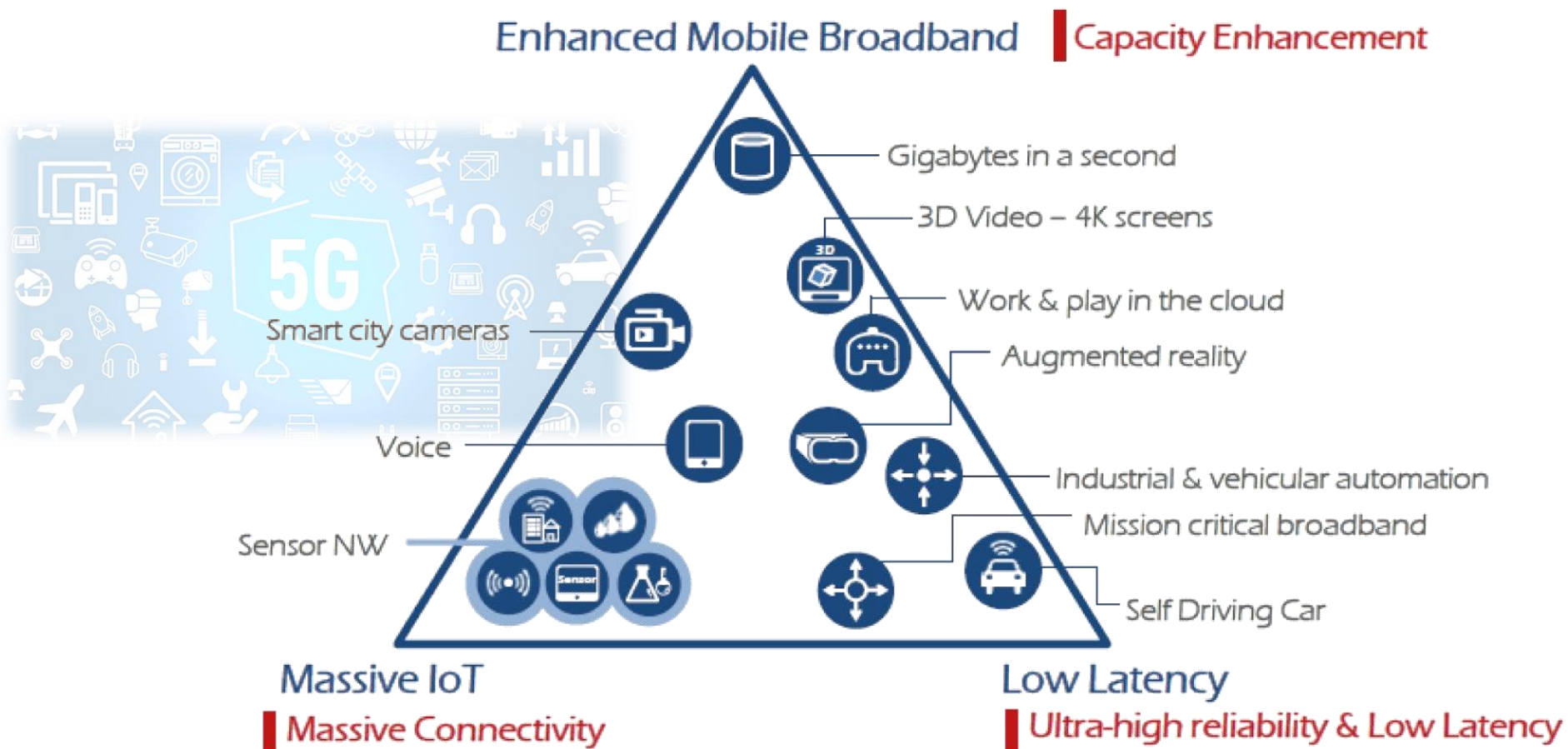
One network for IP

LTE-Advanced Pro  
NR

# 5G. Roadmap



# 5G. Key applications.





# 5G. Key features and benefits

## Spectrum

### 1 New spectrum



New <800 MHz bands (such as new coverage bands for IoT<sup>1</sup>)



New >3GHz bands (such as those for small-cell deployment in urban areas)



+ Unlicensed or secondary-license access



### 4 Core and features



SaaS<sup>5</sup>, network-function virtualization, ultra SON analytics



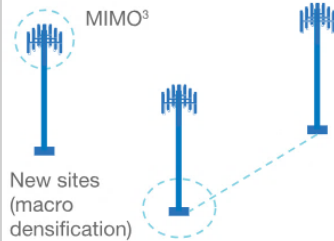
Separation of C-plane vs U-plane

Network slicing



## RAN<sup>2</sup> infrastructure

### 2a Macro-network densification and layer upgrades (legacy network evolution)



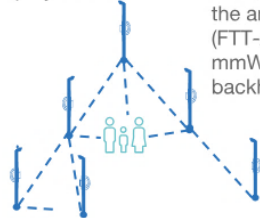
- Single data rate, SON<sup>4</sup> features
- Network slicing to support 5G applications

### 2b Small-cell (outdoor) and indoor densification

Hyper-dense deployments

Centralized RAN, fiber to the antenna (FTT-A), and mmWave backhaul

Advanced indoor distributed antenna system



## Transmission

### 3 Increased fiberization

80 to 100 percent backhaul fiberization



New technologies  
Fiber to the site  
FTT-A (Cloud-RAN)  
mmWave backhaul



<sup>1</sup>Internet of Things.

<sup>2</sup>Radio access network.

<sup>3</sup>Multiple input and multiple output.

<sup>4</sup>Self-organizing network.

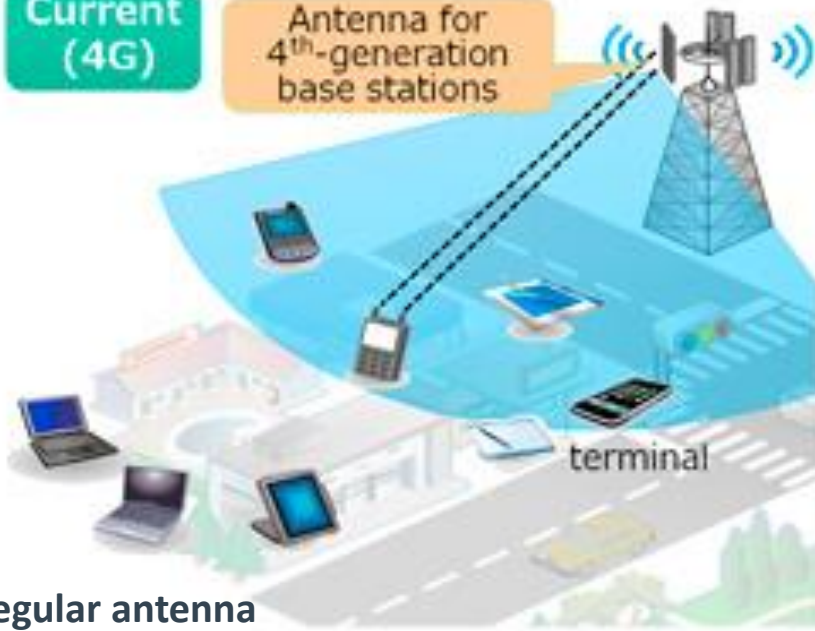
<sup>5</sup>Software as a X.

# 5G. Key features and benefits: beamforming



Current  
(4G)

Antenna for  
4<sup>th</sup>-generation  
base stations



Regular antenna



New  
(5G)

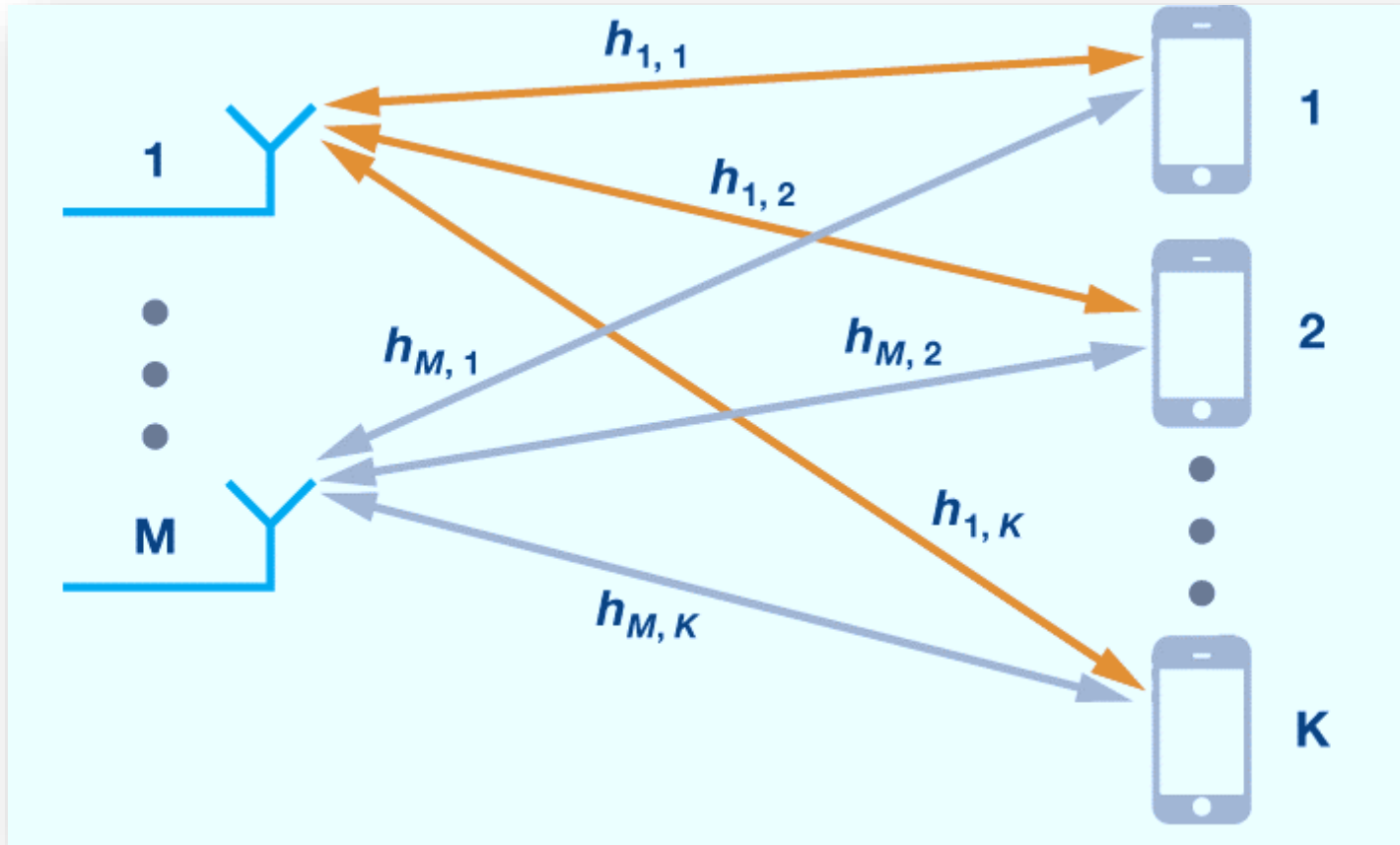
Massive APAA for  
5<sup>th</sup>-generation  
base stations



Beamforming



# 5G. Key features and benefits: MIMO



# 5G. Key features and benefits: MIMO

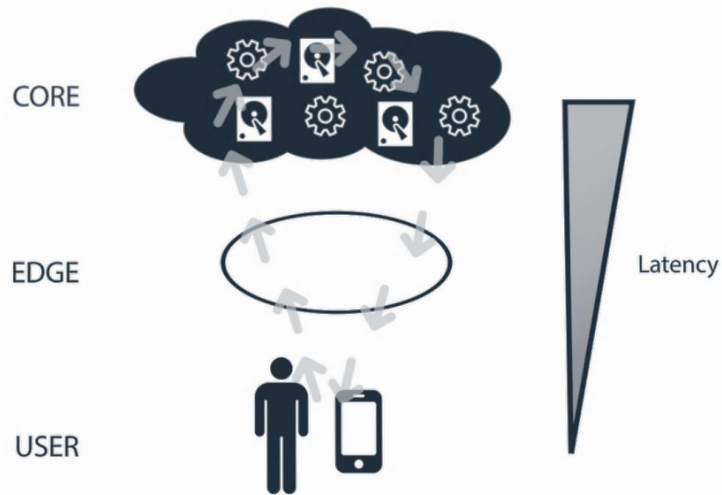


5G Active MIMO Antenna  
for 3,5 GHz Band

The image shows two technicians on a rooftop or tower. One technician, wearing a white hard hat and a dark jacket, is pointing towards a large, rectangular antenna array mounted on a metal structure. The other technician, wearing a white hard hat and an orange high-visibility jacket, is looking at the antenna. The background shows a cityscape under an overcast sky. A play button icon is visible in the bottom left corner of the video frame.

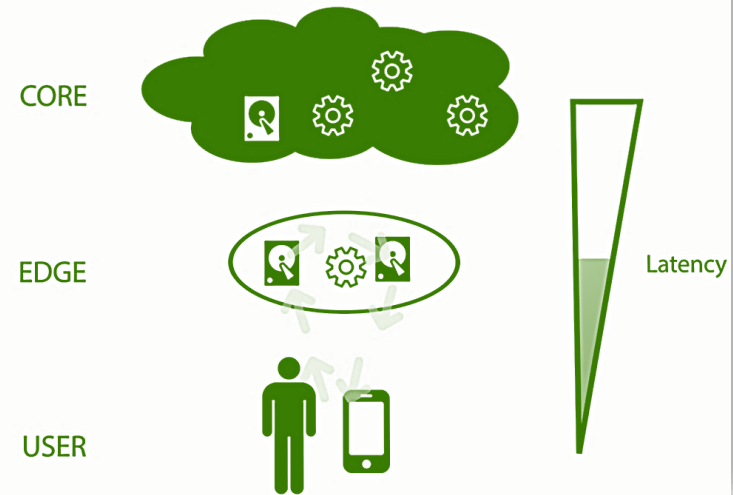
# 5G. Key features and benefits: MEC

## Mobile Edge Computing



4G

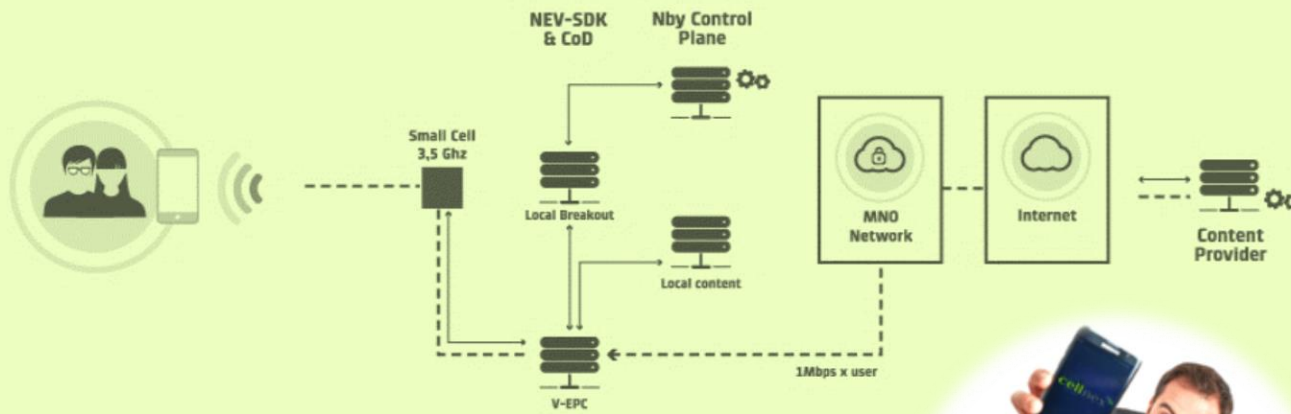
## Mobile Edge Computing



5G

# 5G. Adaptive Edge.

## Local Content Breakout



- Improve user experience.
- Backhaul optimization.



## 5G Smallcells

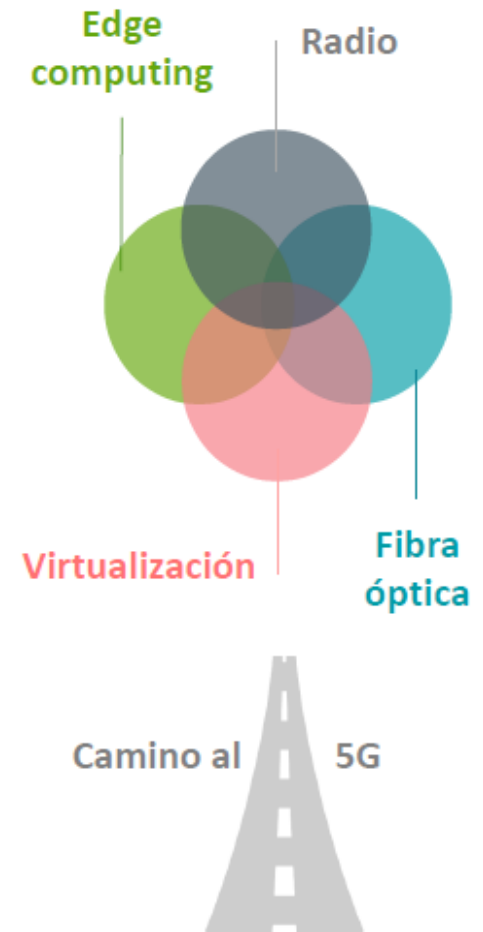
Qué papel  
juegan las  
**infraestructuras**  
urbanas?





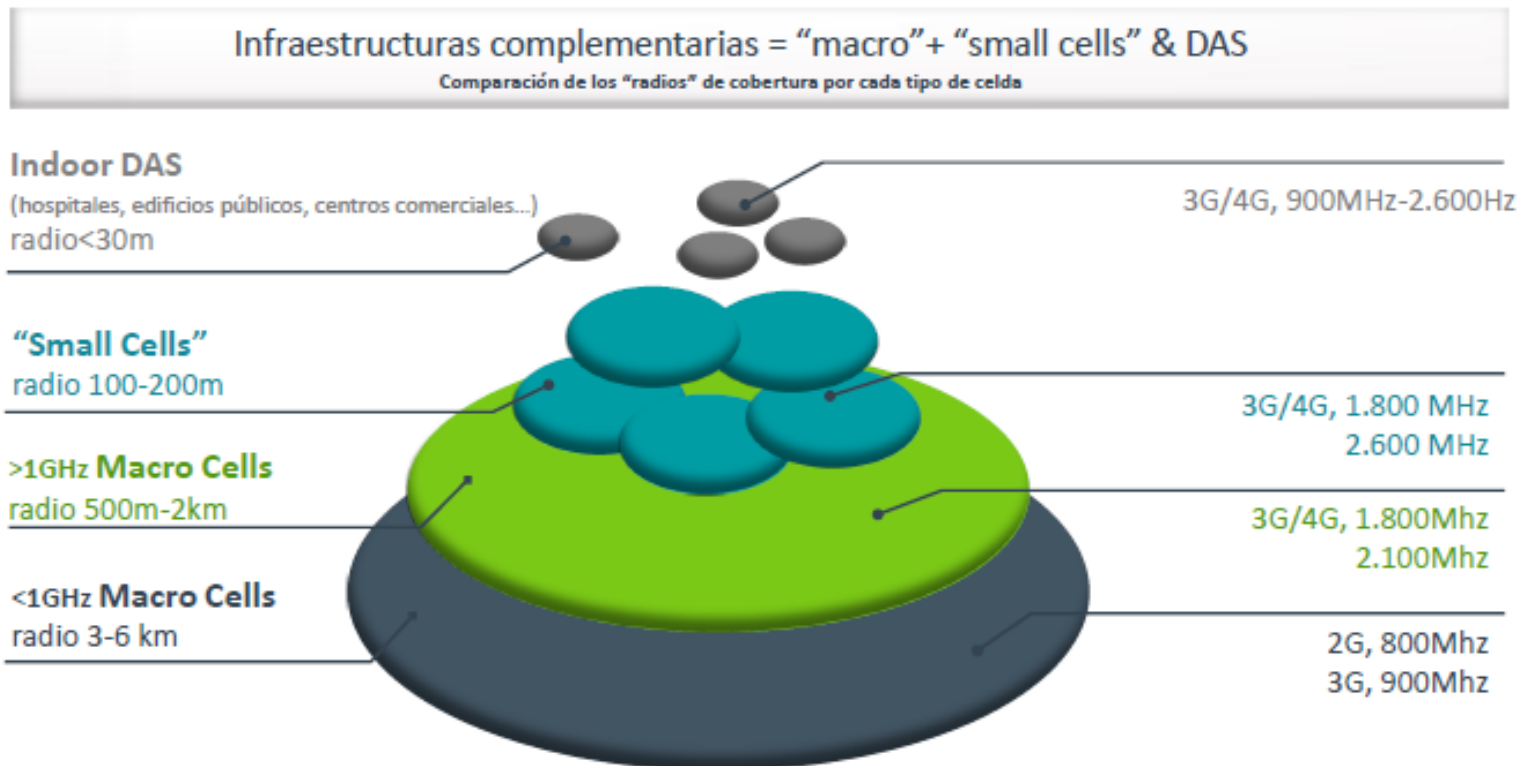
# 5G Smallcells

## Evolución del modelo de infraestructura pública



# 5G Smallcells

## La densificación



# 5G Smallcells

## GIX Barcelona

**INFRA-  
ESTRUCTURA  
PASIVA**

2.000 edificios públicos  
2.500 marquesinas y paneles publicitarios  
41.000 semáforos  
100.000 farolas

**INFRA-  
ESTRUCTURA  
ACTIVA**

+525 km de fibra óptica  
+1.800 APs



# 5G Smallcells

## El aprovechamiento del mobiliario urbano

driving telecom connectivity



Marquesinas



Aseos públicos



Gran formato



Seniors



Paneles informativos



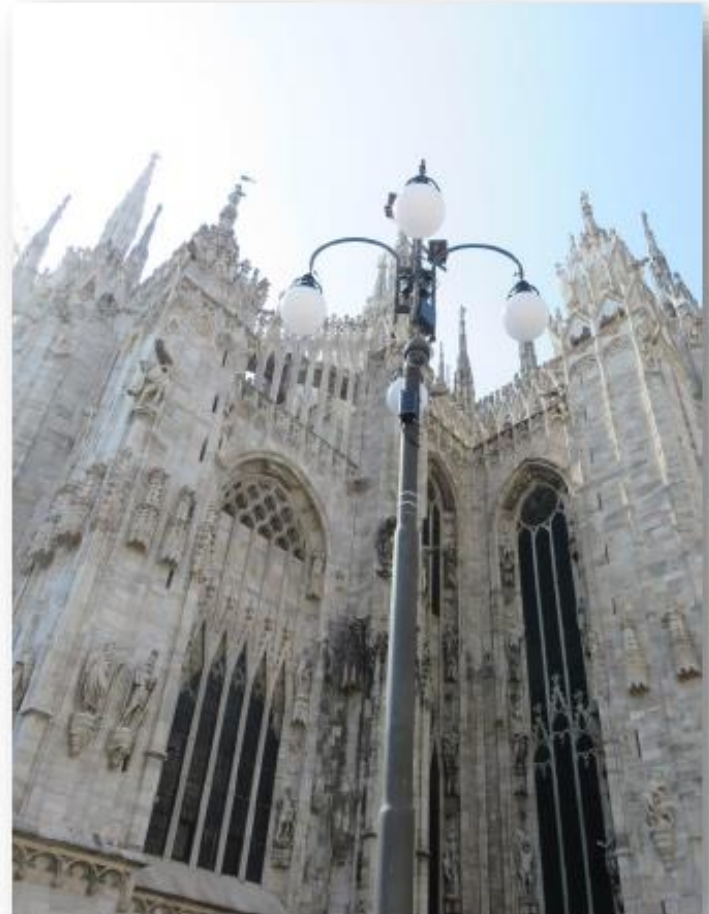
Columnas





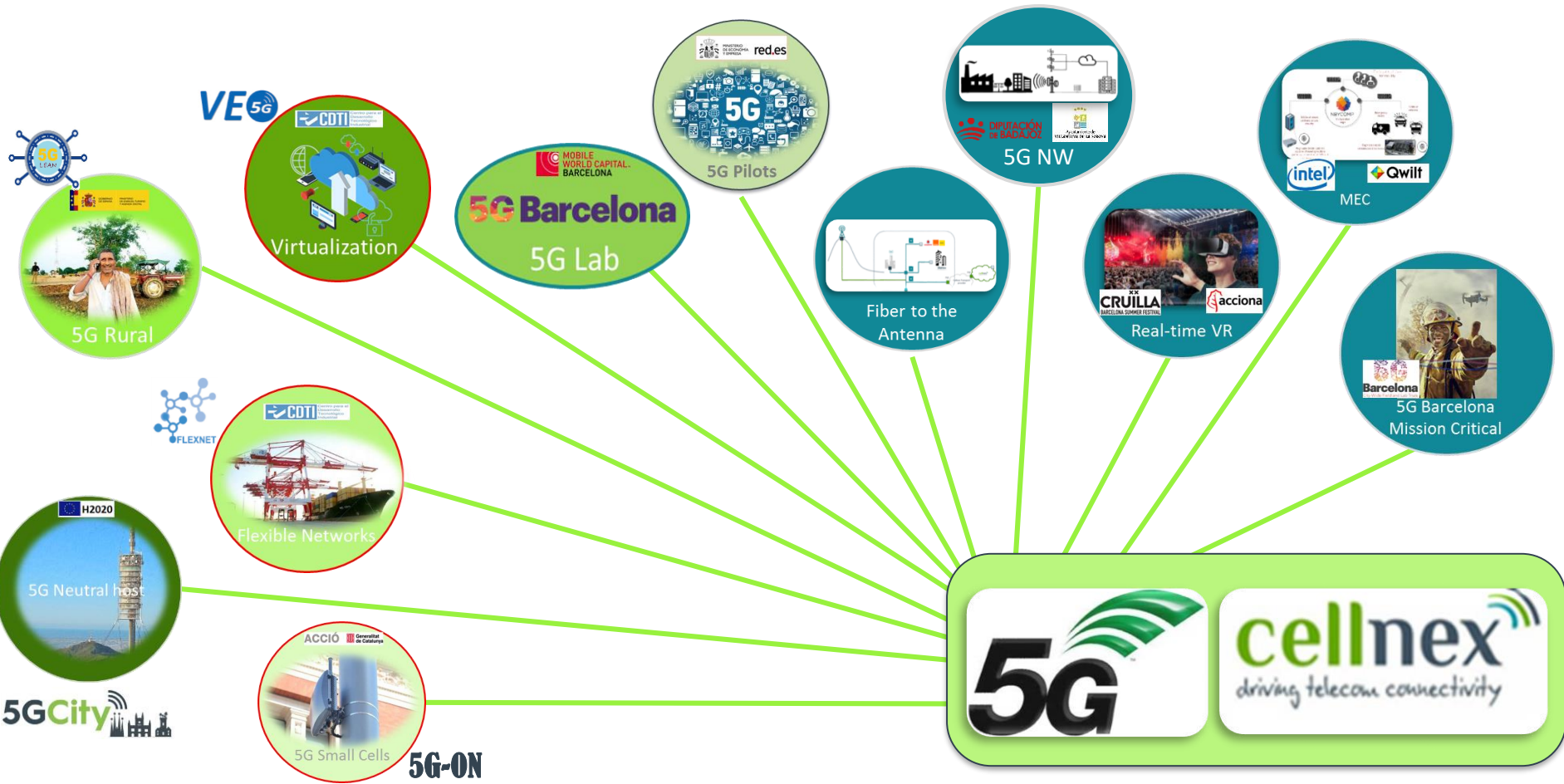
## 5G Smallcells

### Soluciones multi-operador y multi-tecnología: DAS & Small Cells driving telecom connectivity





# 5G. Initiatives and projects.



# Innovation Projects



**AI MARS** Comisión Nacional de Investigación Científica y Tecnológica

## Guardia Civil

Crowd Security by detecting people against a black list and displaying in a VR/AR to the police forces to identify the criminals:



Partners



**RESIST** Resilience Enhancement and Risk Control platform H2020

## Cybersecurity

Deploy protection system for Telco critical infrastructures (Marine, TV and Neutral host)



Partners



**GrowSmarter** Empowering growth through digital innovation H2020

## Smart Cities

Achieve low energy districts, integrated infrastructures and sustainable mobility



Partners



**APMEF**

## Agriculture 4.0

Use case where 5G is applied to smart agriculture using 5G to support automations



Partners



**SECUTIL**

## Utility Security

Development of an integral Management system of the Security chain applied to Utilities,



Partners



**SENIX**

## Utility 4.0

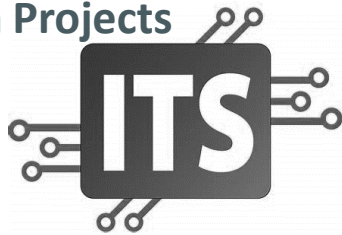
Monitoring system for Energy and Water critical infrastructures: new sensing, comms and harvesting



Partners




# Innovation Projects




**ESKALA** **HAZITEK** programa de apoyo a la I+D+i empresarial

## Connected Airport

Minimize the scale time using advanced technologies to track logistic vehicles



Partners



**polarys** **CDTI** Centro para el Desarrollo Tecnológico Industrial

## Maritime Comms

VDES Maritime security platform, 3D cartography, IoT network for alarms.



Partners



**V2XArch** **CDTI** Centro para el Desarrollo Tecnológico Industrial

## Connected Car

Define technologies and architectures to test: EVW, FCW, Media and GLOSA



Partners



**RESILTRACK** **CDTI** Centro para el Desarrollo Tecnológico Industrial

## Connected Train

Develop of trail in Barcelona of multi-Operator and multiservice small cell



Partners



**ESTIBA 4.0** **CDTI** Centro para el Desarrollo Tecnológico Industrial

## Smart Digital Port

Use of Technologies 4.0 to digitalize Spanish ports through the advanced automation of the logistics



Partners



**BICISENDAS** **CDTI** Centro para el Desarrollo Tecnológico Industrial

## Bike Lane of the Future

Apply V2X and advanced IoT to design the future of the bike lane to enable a modular, efficient and sustainable transport

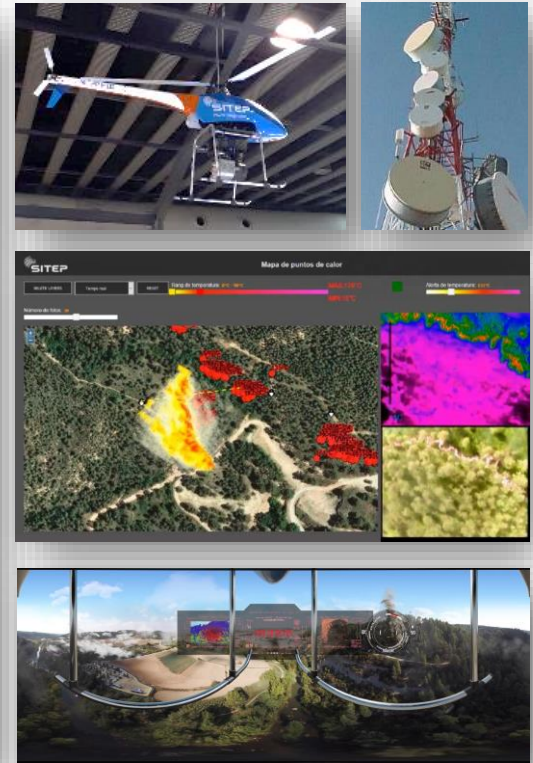
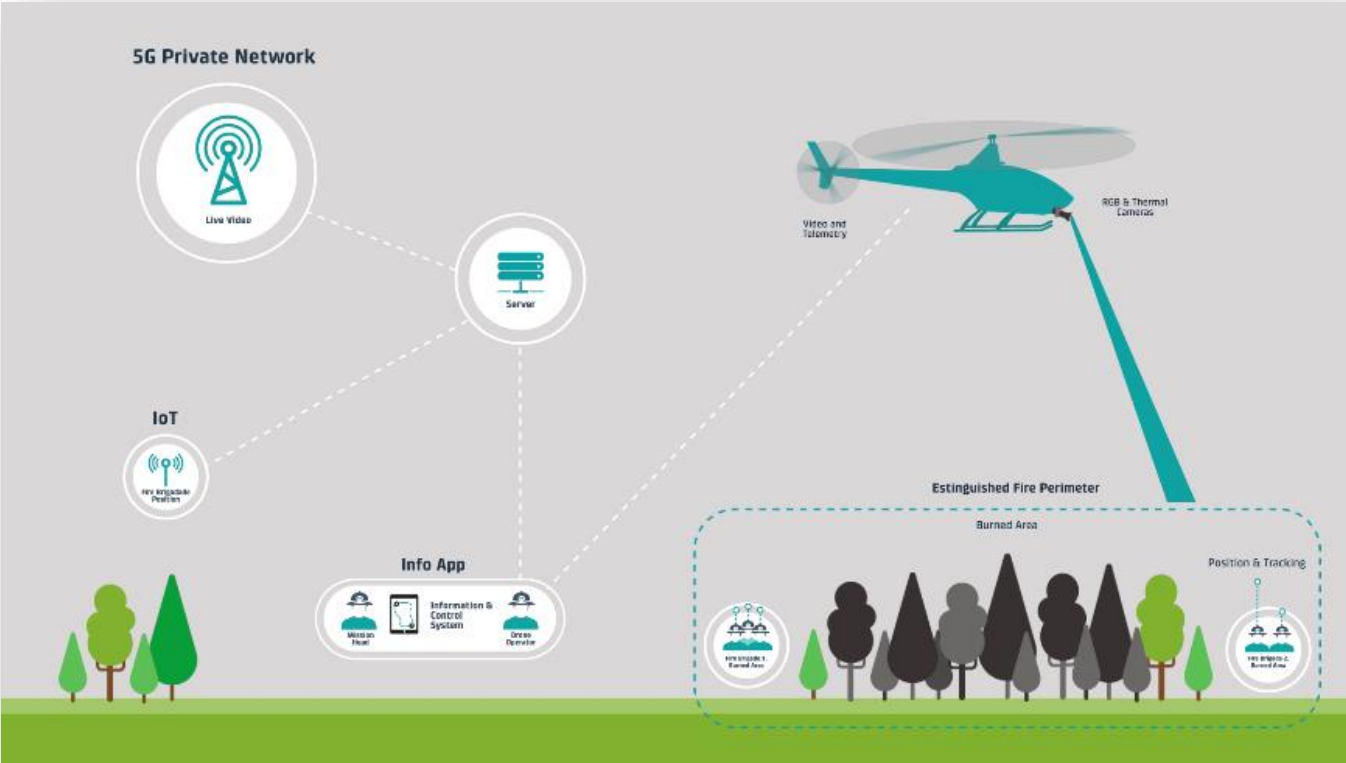


Partners





# 5G. Fire Surveillance.



5G private network for live video  
Thermal and HD on-board cameras

Geo-referenced heat images  
Team position and tracking

# 5G. Takeaways.

**Capacity.  
Connectivity.  
Latency.**

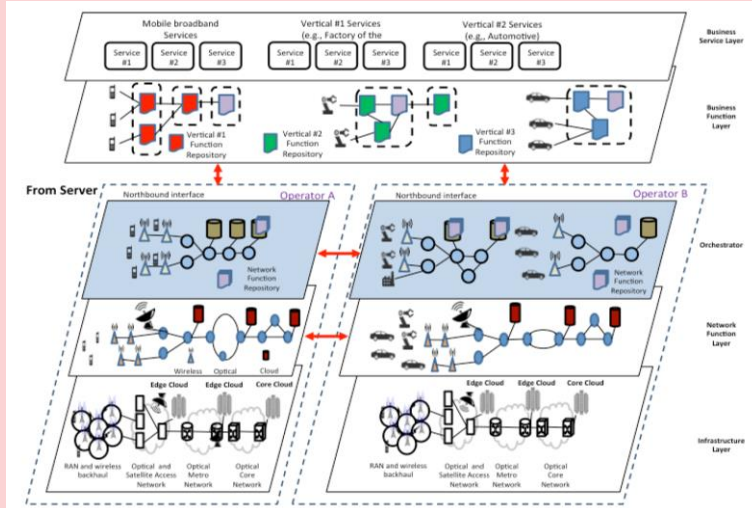
**New use cases.  
New applications.**

**Smooth  
transition**

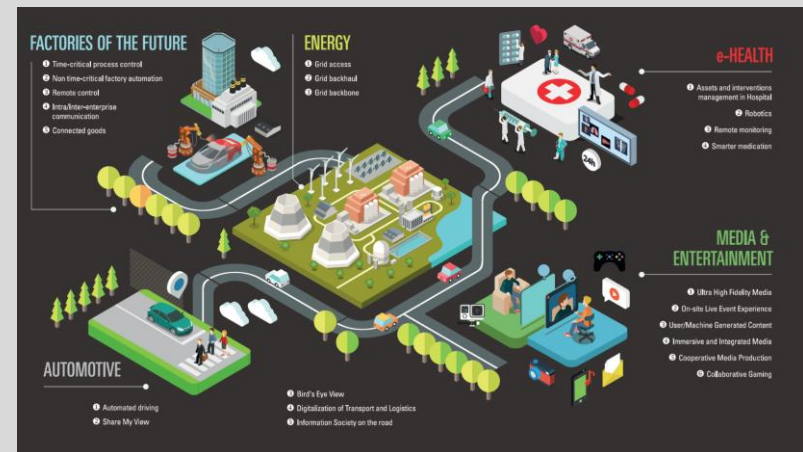




# 5G. Oportunidades



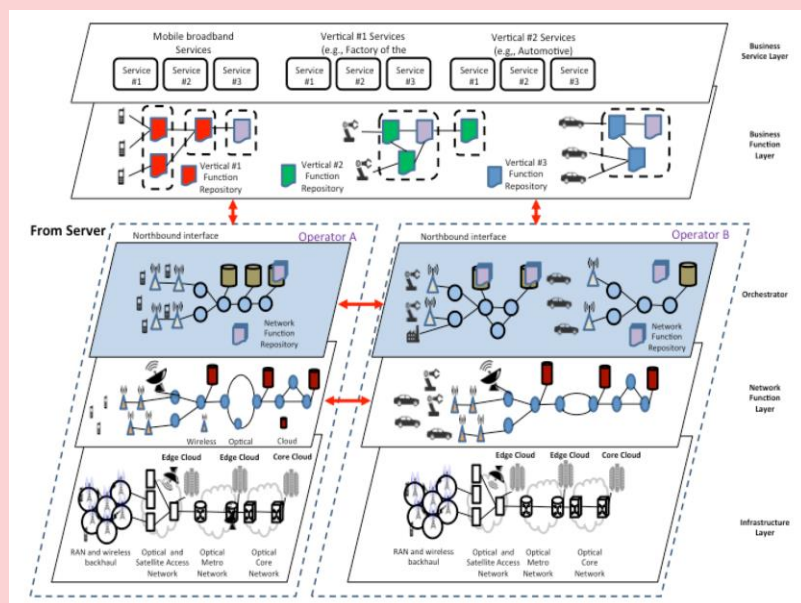
Oportunidades en la Tecnología 5G



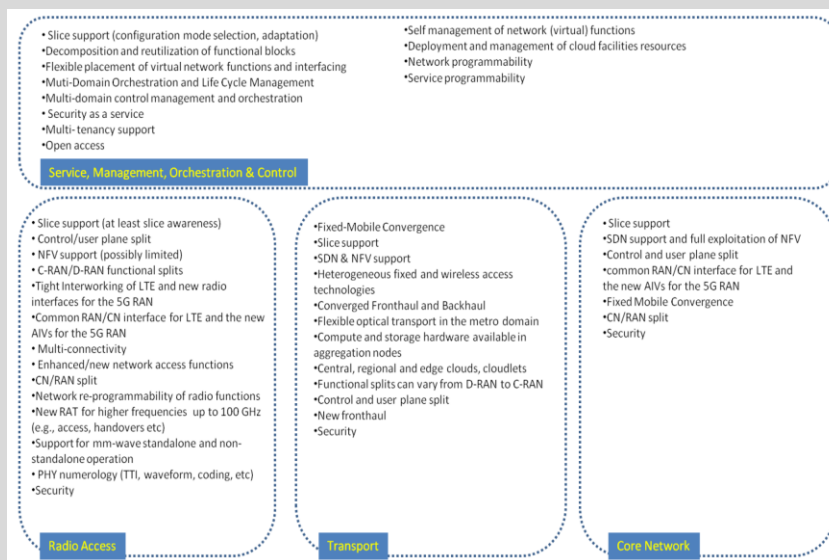
Oportunidades en los Casos de Uso (+ 70!) y Modelos de Negocio soportados por redes 5G

Fuente 1: 5G PPP Architecture Working Group, "View on 5G Architecture", 2016  
 Fuente 2: 5G PPP, "5G empowering vertical industries", 2015

# 5G. Oportunidades



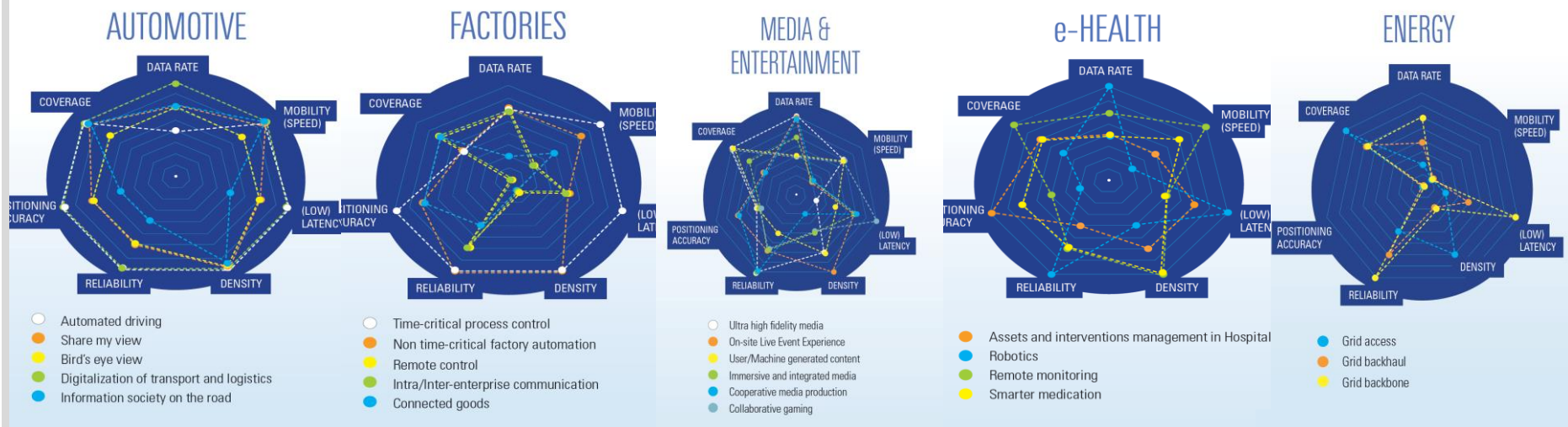
Oportunidades en la Tecnología 5G



Prioridades en I+D para 5G

Fuente 1: 5G PPP Architecture Working Group, "View on 5G Architecture", 2016

# 5G. Oportunidades



Fuente 1: 5G PPP, "5G empowering vertical industries", 2015

# 5G. Oportunidades

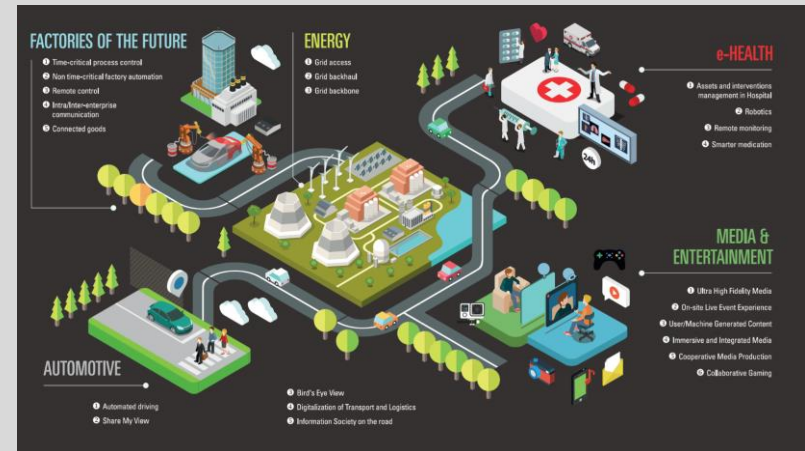
Algunos **modelos de negocio**:

**Automoción:** Pay as you drive, Mobility as a Service, Predictive Maintenance, ProSe (Servicios de proximidad) ...

**Factorías del futuro:** Modelos de negocio basados en datos, Servitización - Machines as a Service (MaaS), Dirección remota de fábricas ...

**Energía:** Operador de red privada virtual, Red dedicada privada, Pay-as-you-go, Bartering (Trueque), Real-time peak pricing, Calidades variedades de provisión (tradicional, bajo coste, ambiental, ...)

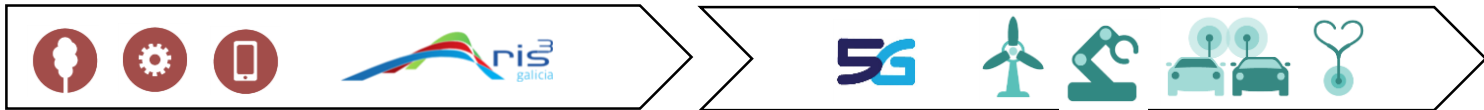
...



Oportunidades en los Casos de Uso (+ 70!) y Modelos de Negocio soportados por redes 5G

## 5G. Oportunidades Galicia

Un sector **TIC gallego diversificado** que abarca desde desarrolladores de software, fabricantes de componentes o hardware, hasta operadores de telefonía e infraestructura de difusión.



### Desarrollos *específicos* para 5G

- Monitor. & diagnóstico multicapa de red (QoE)
- Comms. RF > 6GHz, fibra, satélite, ópticas
- Aprovechamiento espectral (full duplex, sharing)
- Softwarización de componentes de red
- Analítica para gestión de red – Inteligencia
- Antenas, sistemas MIMO y sistemas distribuidos
- Seguridad

### 5G como soporte de la *digitalización* y de las nuevas tendencias en casos de uso

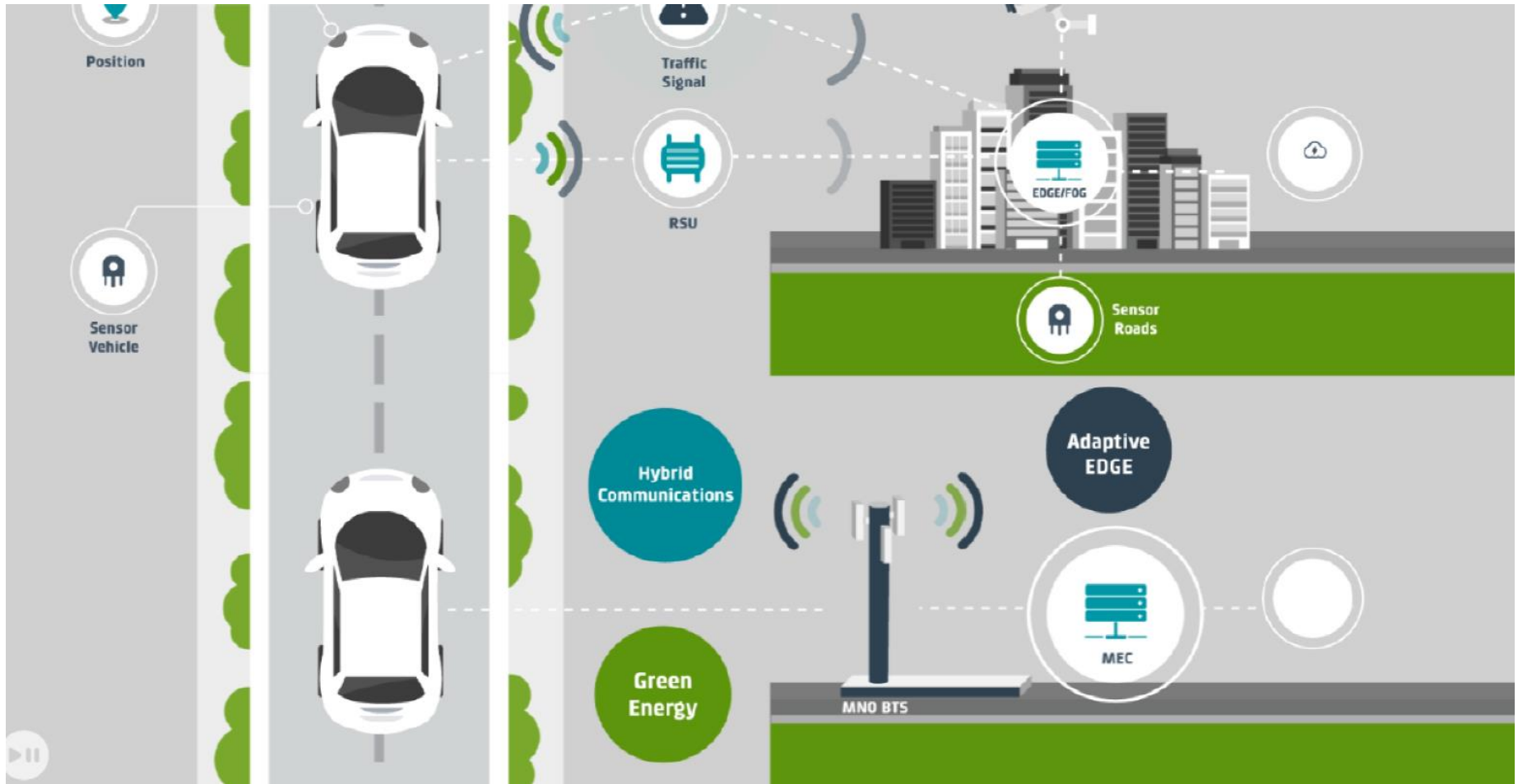
- En términos generales:
  - Valorización del dato (Inteligencia & Negocio)
  - Seguridad
  - XaaS (Anything as a Service)
  - Cloud + Softwarización
- En las verticales:
  - Agricultura inteligente apoyada en IoT
  - Salud y envejecimiento activo
  - Vehículos autónomos
  - Fábrica inteligente. Gestión industrial en el Cloud
  - Apps y Contenidos de VR y AR en Media & Ent.



# COOPERATIVE AND AUTOMATED DRIVING: C-ITS SERVICES



# COOPERATIVE AND AUTOMATED DRIVING: C-ITS SERVICES



# COOPERATIVE AND AUTOMATED DRIVING: C-ITS SERVICES

## THE SITE

On the road



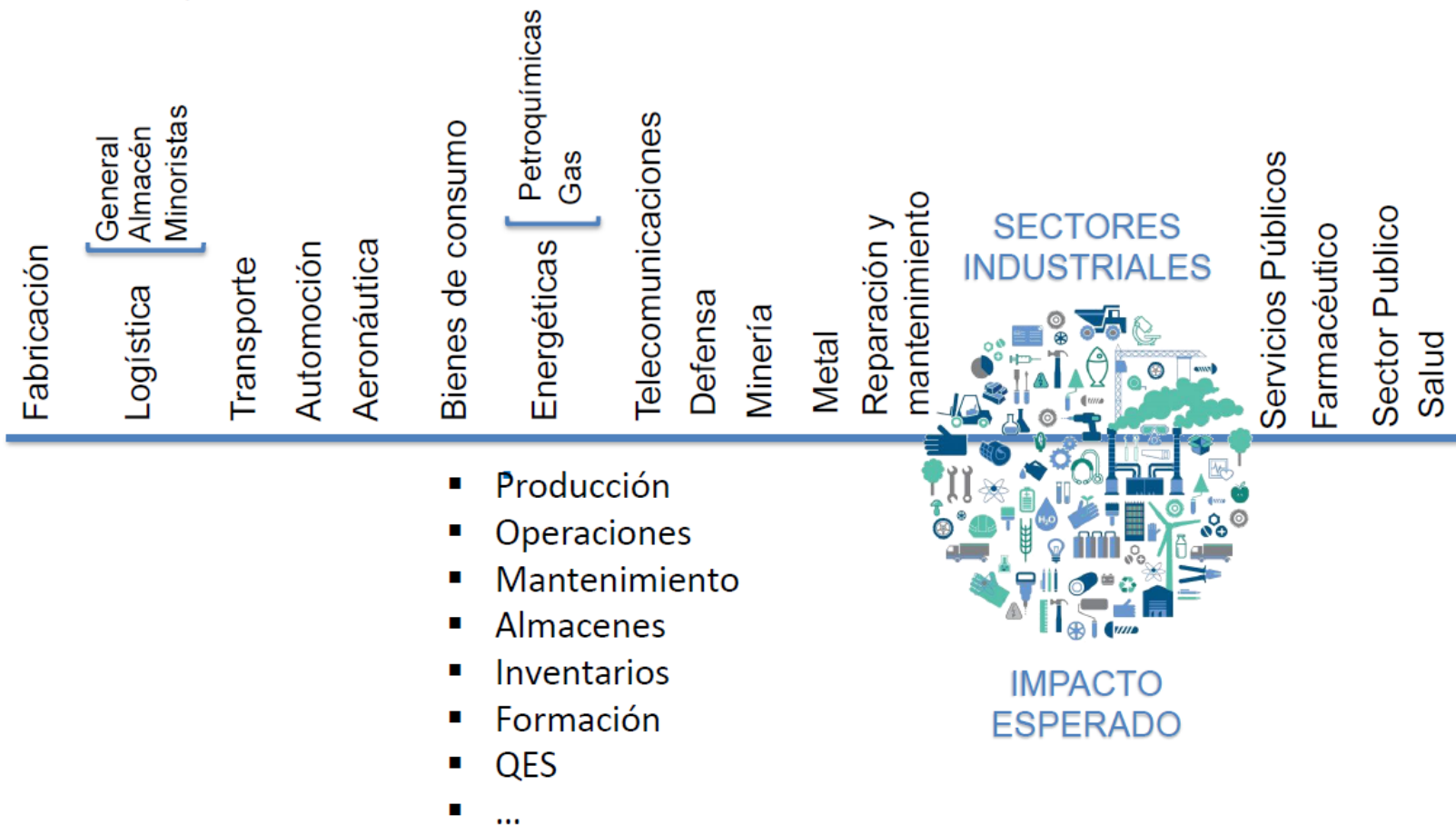
- Solar & Wind energy
- IoT sensors
- Edge node
- Energy switching
- Radio nodes





## SECTORES INDUSTRIALES

El **Operario 4.0** abre la posibilidad a escenarios industriales irresolubles sin el uso las nuevas herramientas inteligentes (wearables, smart PPEs, smart glass, smart rings, HW platforms, smart clothes, wrist computers, smart tools, ....).



# Muchas gracias

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