

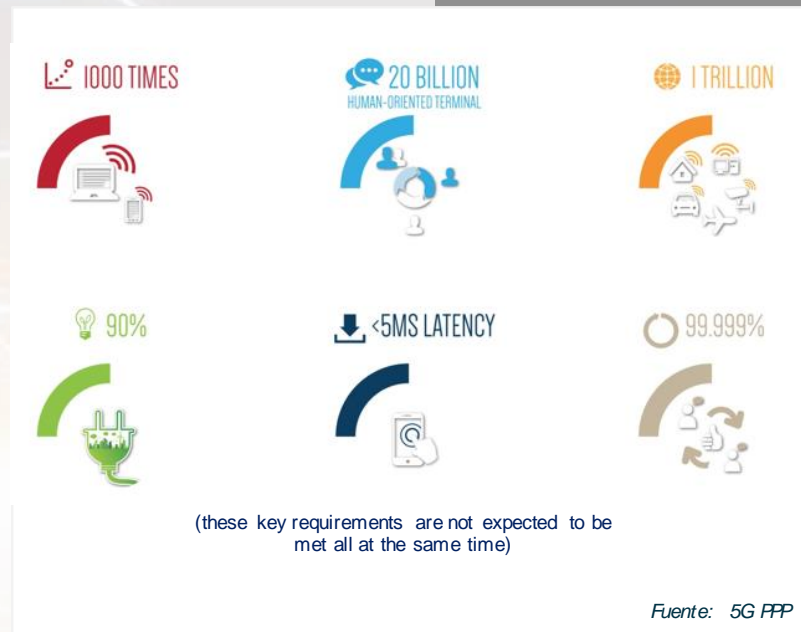
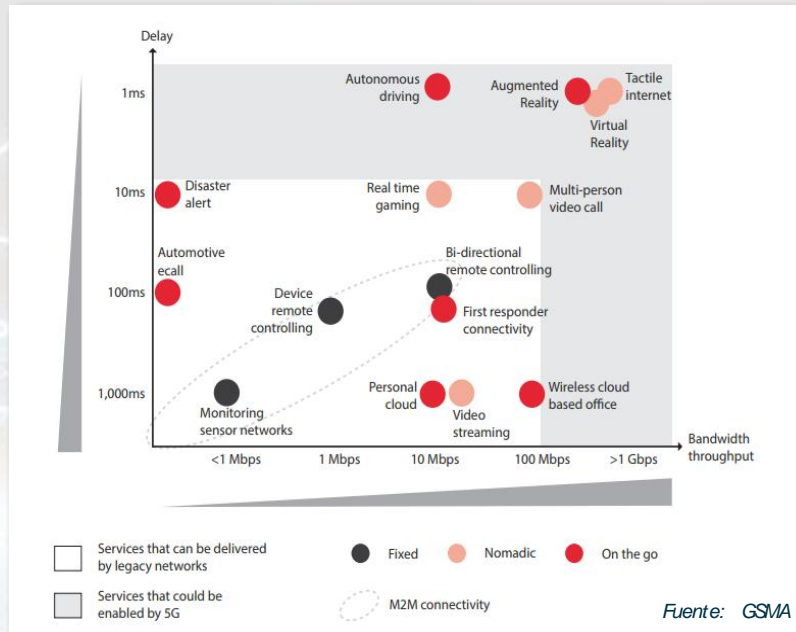
# 5TONIC, a 5G Open Research and Innovation Ecosystem

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# Defining 5TONIC

- A leading European hub for knowledge sharing and industry collaboration in the area of 5G technologies.
- An open research and innovation ecosystem
  - Where industry and academia come together
  - Boost technology and business innovative ventures
  - In the area of 5G products and services
- A wide variety of activities at an international level
  - 5G technology testbed
  - Joint project development
  - Joint entrepreneurial ventures
  - Discussion fora
  - Events
  - Field-tests
  - Plug-in fests
  - Seminars and conferences
  - You name it...



- A programmable and elastic infrastructure integrating telecommunications, compute and storage capabilities
  - The realization of the ICT concept
- New services beyond current network infrastructures
  - Tactile Internet, critical services, massive IoT/MTC...
- A more efficient way to provide network services
  - Convergence, automation, better user experience, sustainability...
- Personalized services for specific applications
  - And the *network slice* as virtual network with independent management

# Why 5TONIC

- **A rich open innovation ecosystem with Telefonica**
  - Developing and testing new products and services, together with other leading industries and researchers
- **A venue for inter-operability testing meetings**
  - Verifying the real interoperation of recent developments and new products
- **A place for prototype evaluation**
  - Checking capacity, performance, stability and interoperation of pre-commercial products
- **A site for pre-commercial showcasing to/with customers**
  - Participating in trials with large customers in relevant vertical sectors
- **Cost reduction by sharing the experimental facilities among multiple tenants**
- **Promotion of technology trends**
  - Impactful whitepapers, joint research papers, workshops, conferences, seminars...
- **Entrepreneurship activities**
  - Preparing the launching spin-off companies, agreeing on joint product development...
- **Demonstration of results of joint research projects**
  - Development and demonstration of testbeds for H2020 projects
- **A superb academic environment around IMDEA Networks**
  - Joint research activities, sponsoring PhD and Master students, recruiting, internship programs, master programs and training courses, open courses...
- **Meeting point for knowledge exchange on 5G technologies for leading industry and academia**



# 5TONIC Technology Focus

- Research and innovation on 5G communications, services and applications
- Structured in two broad areas
- 5G Virtual Software Network Area
  - Network Function Virtualization, Software Defined Networking, security services, network control and management planes, cloud services, signaling...
  - All around the new Software Networks paradigm
- 5G Wireless Systems Area
  - Air interface, radio aspects, duplexing, multiplexing, media access control, spectrum, interference, mobility tracking...
  - All based on a multi-RAT approach

## And More on Technology Focus

- Horizontal technical topics
  - Energy Efficiency, harvesting and management specially in the area of IoT
  - Security and privacy
  - Measurements and monitoring
- 5TONIC includes a wide range of systems, functionality, services and applications
  - Including user terminals and outdoors equipment
  - And edge and cloud based back-office functionality
- Focused on vertical sectors

# Introducing Virtual Software Networks

- Experimentation and innovation on the next generation of virtual services and infrastructures
  - Network Function Virtualization
  - Software Defined Networks
  - Internet of Things and M2M
  - Security and Privacy
  - Performance
  - Co-existence with non-virtualized infrastructures and E2E interoperability aspects

# Introducing Wireless Systems

- Next generation of physical and MAC layer improvements
- Considering two of the key scenarios driving the 5G development
  - The densification of the access network
  - The upcoming of the IoT and prevalence of machine-type communications
- Not only requiring higher bitrates
- Open a new set of challenges coming from the density of users and points of attachment
  - Increased capillarity of the transport network required to feed the dense RAN
  - Interference cancellation
  - Beamforming

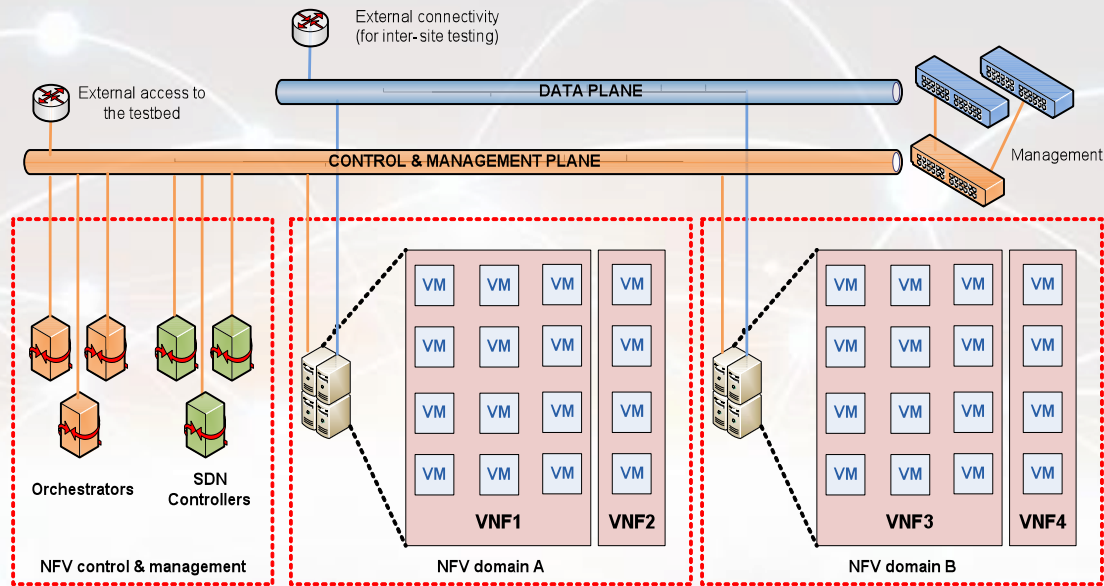


# 5TONIC Members



- More than 20 expressions of interest under discussion
  - Other leading technology providers and academic institutions
  - Key verticals: Automotive, Manufacturing, Public Safety, Gaming, Financial Services and Retail
  - Even individuals
- Flexible participation model for SMEs and specific collaborations

# SDN/NFV and Cloud Infrastructure



- Mini and single-board computers
  - VNF hosting, virtual switches and other network elements
- SDN-enabled switches
  - High performance fabric
- High-performance servers
  - Management, control, orchestration
  - Data analytics, high-end computational tasks
  - Experimental data storage and management

# Radio and Mobile Infrastructure

- UE/eNodeB equipment
  - Execute MAC and PHY control algorithms
  - Support of high speed and computationally intensive physical layer operations
  - Operating in the frequency range from 200 MHz to 4.4 GHz
  - Support experimentation with SDR platforms in the frequency band between 30GHz and 300GHz (mmWave)
- Wireless measurement equipment
- End-user equipment
  - Laptops/workstations
  - Pool of smartphones
- A fleet of programmable Micro Air Vehicles (MAVs)

## Member Infrastructure

- Members are expected to bring the infrastructure required for specific experiments
  - Supported by the appropriate physical environment
  - Remote hands
- Security environment to guarantee confidentiality when required
  - Open innovation does not imply full disclosure
- The highest added value of 5TONIC is based precisely on this array of interconnected prototype equipment





# Additional Sites



- Additional sites will be available at suitable distance and locations
  - Providing multisite capability for trialing the required transmission technologies
- Connection to the Telefónica I+D Next Gen Network Labs
- Additional connections and federations soon
  - The FIRE European infrastructure
  - Academic networks through the Spanish NREN RedIRIS
  - Other 5G testbeds in Europe

## Concluding: What 5TONIC Brings

- Perform a realistic evaluation of technology choices
  - In an open, co-creative environment
  - Together with the latest innovations in services, core network and wireless network
- Evaluate the feasibility and costs of a given technology
  - Hidden deployment costs
  - Solution complexity
  - Regulatory aspects to tackle



# Thanks! - Questions Welcome

