



5GCHAMPION

*“Getting Ready for the
1st 5G system PoC in
conjunction with the
PyeongChang Winter Olympics”*

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Dr. Emilio Calvanese Strinati, CEA-LETI
5G CHAMPION EU project coordinator



5GCHAMPION Partners



Education /research Institutes



Electronics and Telecommunications
Research Institute



UNIVERSITY of OULU
OULUN YLIOPISTO



Fraunhofer
Heinrich Hertz Institute



Gwangju Institute of
Science and Technology



Network and Service Operators



서울특별시도시철도공사
Seoul Metropolitan Rapid Transit Corporation



Telespazio

A Finmeccanica/Thales Company



SK telecom



HFR, Inc.
for Mobile Internet

Manufacturers



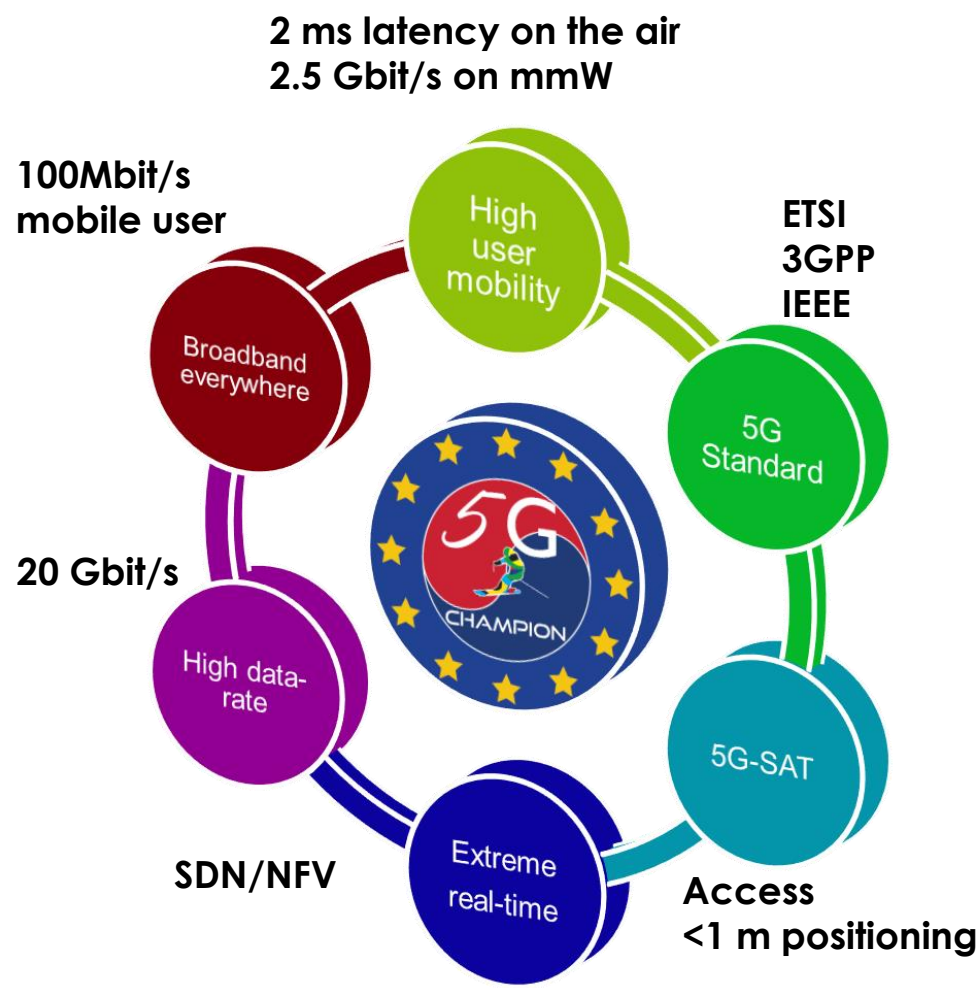
Technology providers



mobigen

Make The Best For Smart Business

Key facts	
Consortium	21 partners
Duration	2016-2018
Objective	EU-KR 5G system demonstration
Technology	mmW backhaul SDN/NFV core Inter-system interoperability
KPIs	2ms latency 10 Gbit/s backhaul SDN/NFV 20Gbit/s indoor 5G-satellite interoperability Standardisation
Demo day	20-22 February, Gaengung
Workshop	23 February, Seoul



- AR
- HD-video
- Real-time data



- VR
- 360 video
- IoT

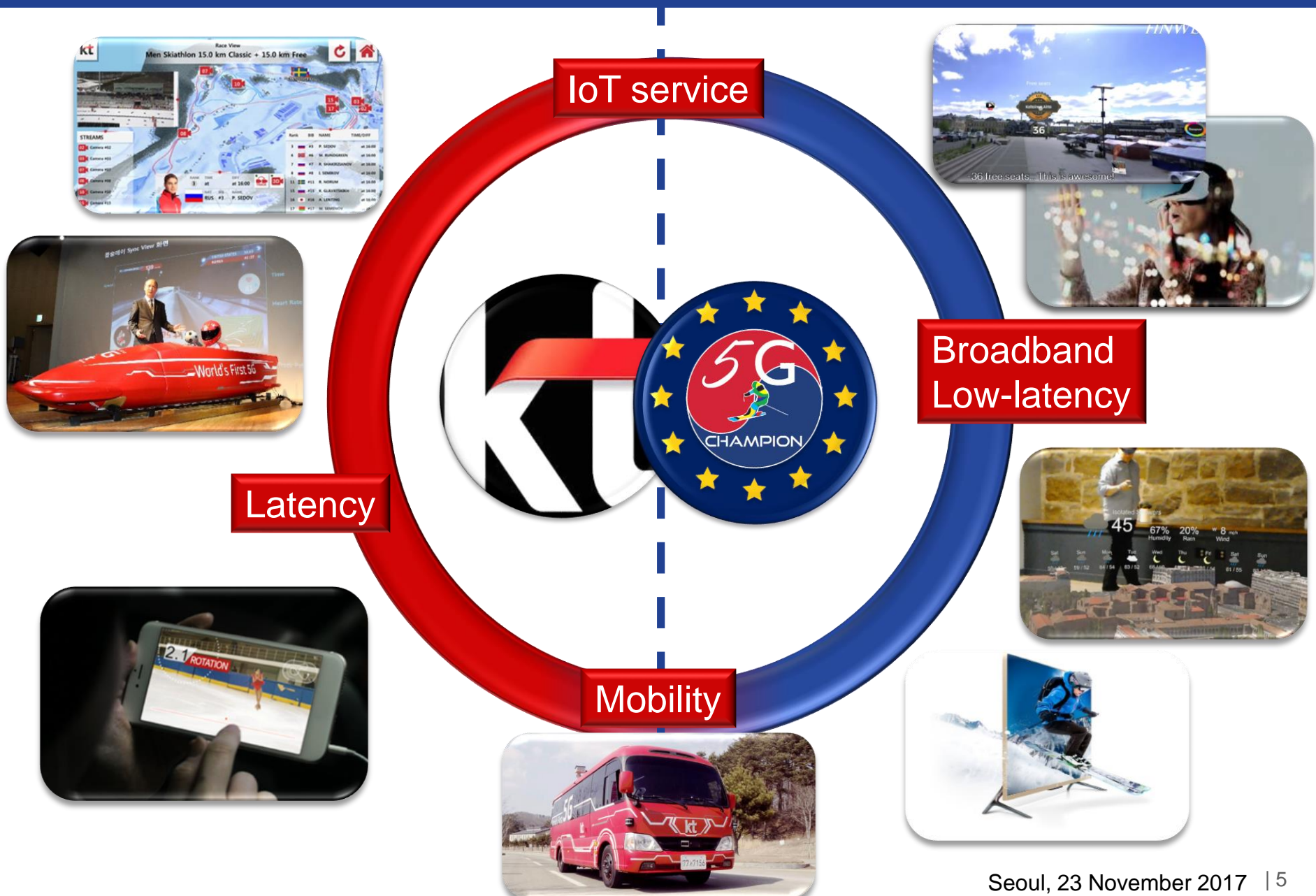


- 5G BUS
- Hot-spot



- 3D super multiview

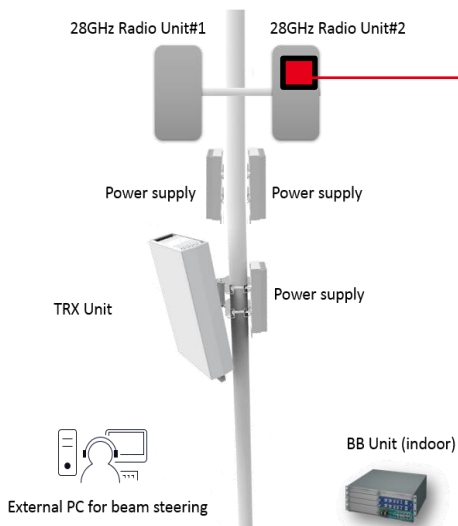






O.1: Provide a mmWave high capacity backhaul link with 2.5 Gbit/s minimum data-rate

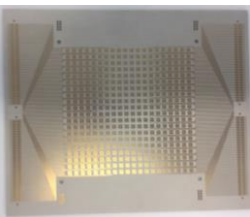
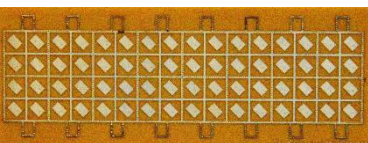
- **EU** mmW first prototype has been designed, manufactured and tested (up to 10Gbps).
- **KR** mmW platform based on a previous prototype development. Labs test executed (up to 5Gbps).



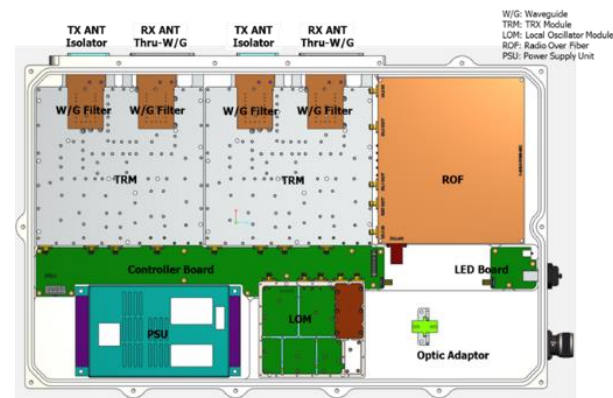
New RF-FE



Antennas



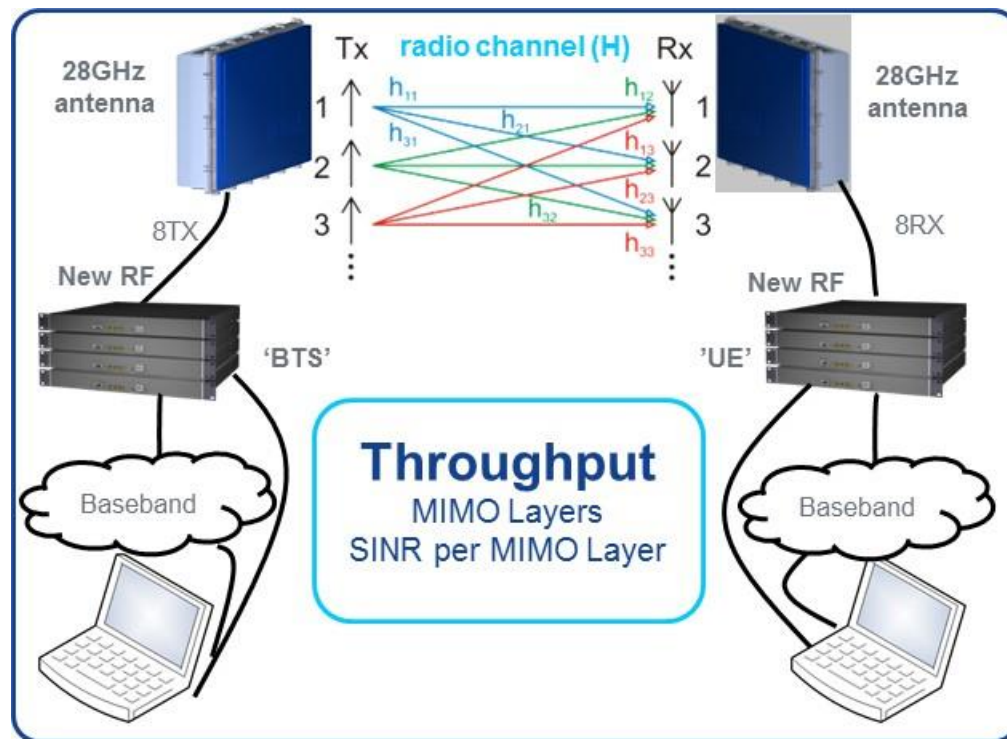
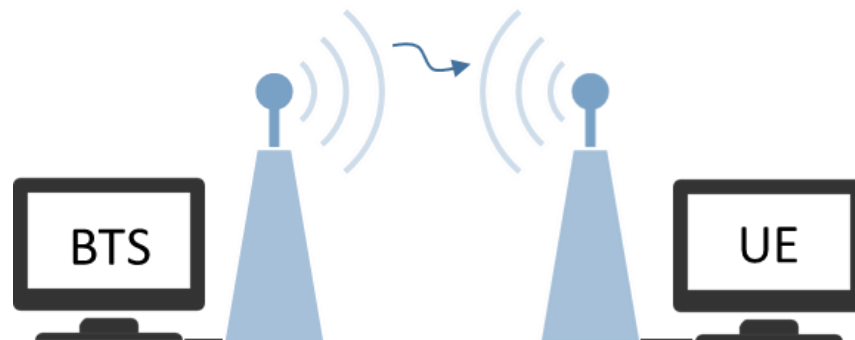
26.5 – 27.3 GHz



25.1 – 26.1 GHz

O.1: Provide a mmWave high capacity backhaul link with 2.5 Gbit/s maximum data-rate

O.2: Provide up to 20 Gbit/s user data rate over a mmWave indoor link

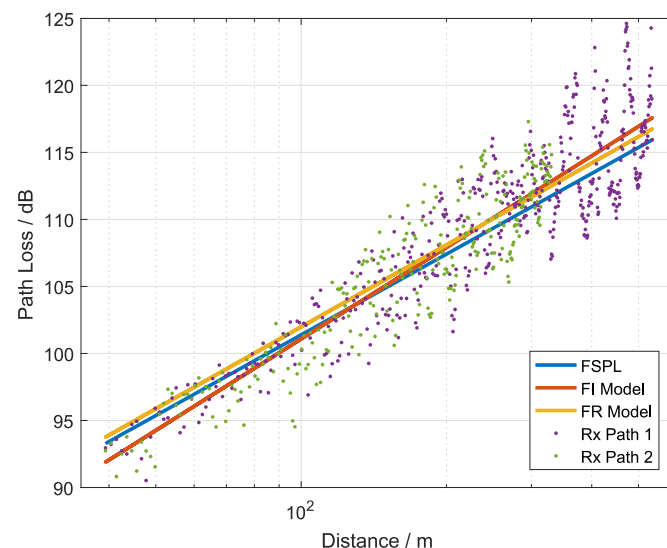
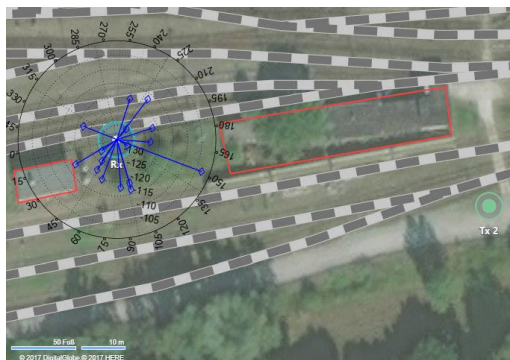


O.1: Provide a mmWave high capacity backhaul link with 2.5 Gbit/s maximum data-rate

O.2: Provide up to 20 Gbit/s user data rate over a mmWave indoor link

O.3: Provide in the high mobility scenario a user-experience of 100 Mbit/s

- Different activities running in parallel:
 - **Numerology** for HST defined and validated via simulations.
 - Studies on **pilot signals and precoding scheme** are ongoing.
 - **Channel models** for HST derived but not verified.
- **KR-PoC** demonstration will include **mobility**, but high-speed train is not an available resource.
 - Testing with low-mobility (bus) is ongoing



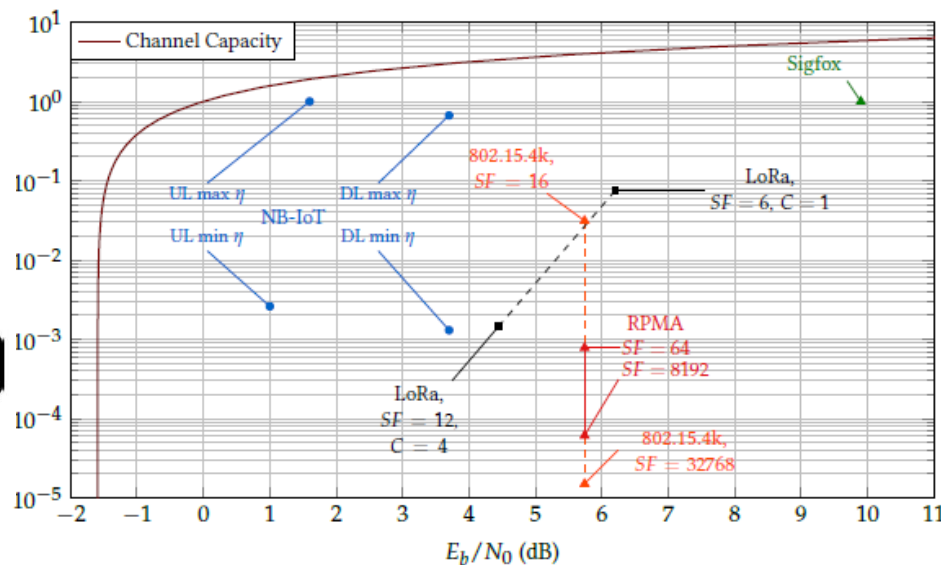
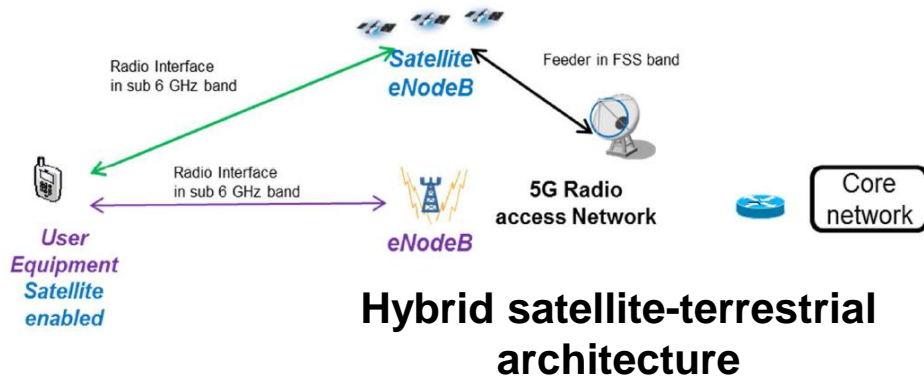
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O.4: Provide a seamless access to satellite communications for 5G devices

- Link budget calculations in the S-band,
- Performance comparison of candidate 5G radio interfaces (Lora, Sigfox, etc.) by simulations,
- Definition of configuration and operation modes at transmission and MAC level,
- Definition of test cases.



O.1: Provide a mmWave high capacity backhaul link with 2.5 Gbit/s maximum data-rate

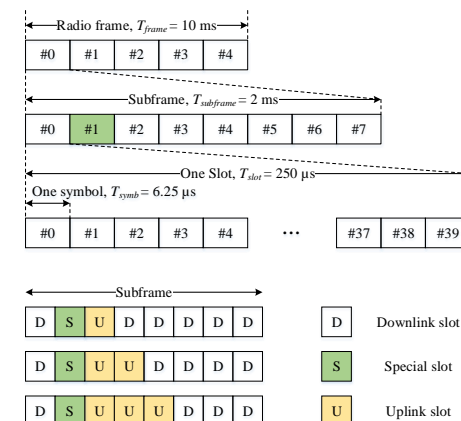
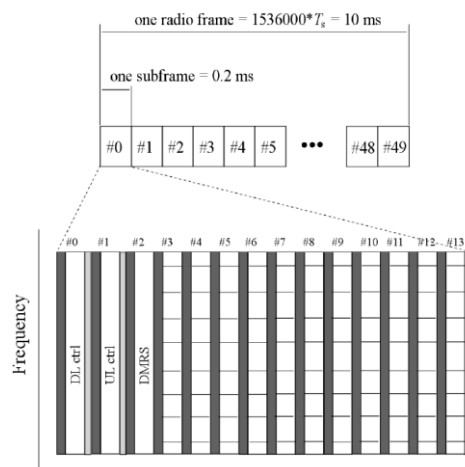
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O.5: Demonstrate 1-2 ms latency over the 5G wireless backhaul link

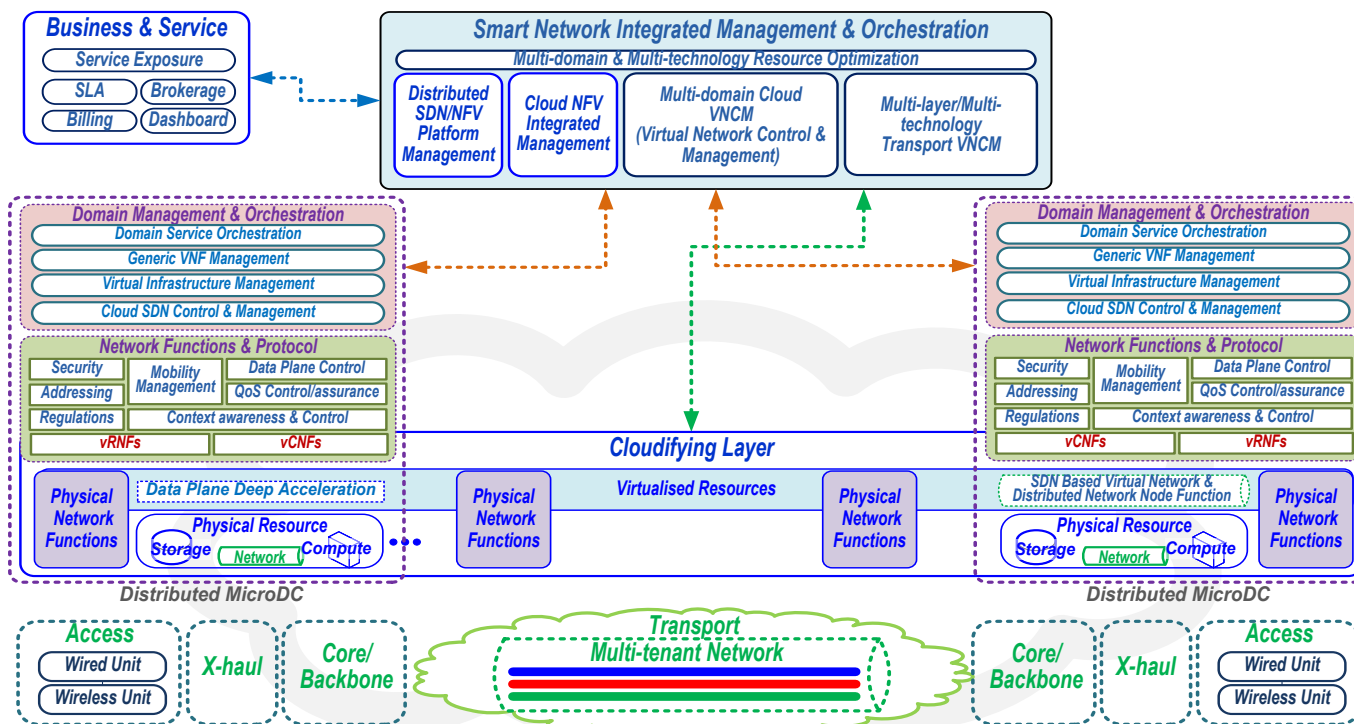
- EU and KR platforms TDD is supported by base-band units,
- EU integration and testing with RF-FE units is foreseen in the first months of the second period,
- KR the TDD functionality.



- Over-the-air 1-2 ms,
- End-to-end latency 10 ms,
- Typical latency using LTE 20 ms.

O.6: Demonstrate agile management of the core net. functionality and services

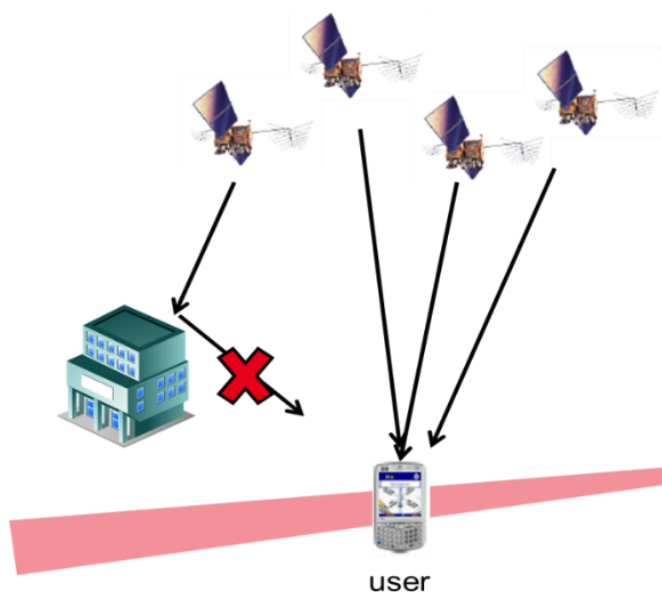
- For agile management, virtualize, cloudify, and **distribute (low latency)** EPC functionality,
- NFV/SDN-based Integrated Management & Orchestration (on-boarding NS & VNF, Lifecycle mgmt. of NS, global resource mgmt. and optimization),
- Real-time monitoring & Fast Isolation/Recovery,
- High-Performance Data Plane Acceleration via DPDK and other traffic management capabilities.



O.6: Demonstrate agile management of the core net. functionality and services

O.7: Ubiquitous (in- & outdoor) location accuracy < 1 m

- Selection of the best **GNSS** precise positioning method,
- Selection of a **GNSS equipment** and a **reference station** compatible with Galileo,
- Development of a **5G positioning algorithm**,
- Definition of an algorithm combining GNSS and 5G data for positioning,
- Preliminary definition of a test bed and use cases.



GNSS receiver



GNSS base station



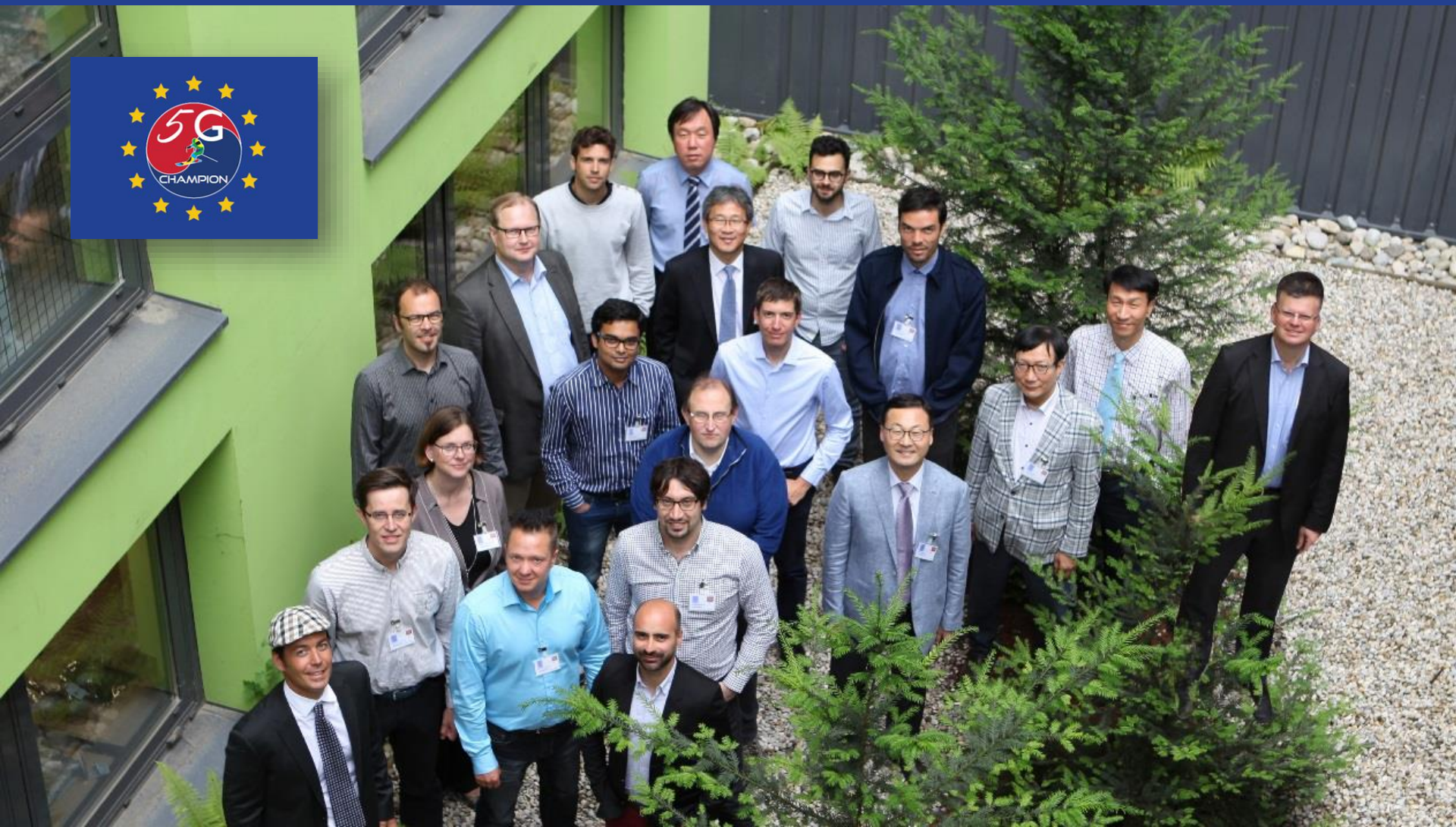
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O.8: Contribute to Global 5G standardization & regulation



- ITU, ETSI, IETF, 3GPP ...
- ITU-T IMT-2020 Management Framework Standardization & Regulation,
- ETSI RRS (Reconfigurable Radio System) Software Reconfiguration,
- 3GPP High-speed channel model Standardization,
- IETF Distributed Mobility Management architecture for 5G contributions.



See you at the Olympics

EU platform**KR platform****Antenna**

Wideband 1GHz	Wideband 1GHz
Phased-array (16x4) with/without p-i-n transmitarray	Slotted waveguide array antenna (Tx: 4x4, Rx: 6x6)
Structure 8x2 RF beamformer – with 2x2 antenna subarray in each, linearly polarized	N/A
Maximum gain 22.7 dBi	Maximum gain 19 dBi (TX), 22 dBi (RX)

RF-FE

26.5-29.3 GHz	25.1056-25.5376 GHz
Operational band at the Olympics 26.5 to 27.5 GHz	Operational band at the Olympics 25.14-26.14 GHz
4 RF adaptive beamformers	2 TX and 2 RX paths
Digital phase-shift control	Fixed beams
Digital branch enable control	N/A
Digital automatic gain control	Digital automatic gain/frequency control

Base-band

TDD	TDD
8x8 MIMO-OFDM	2x2 MIMO-OFDM
Max bandwidth: 8x100 MHz carrier components	Max bandwidth: 8x125MHz carrier components
Modulation: UpTo 64QAM	Modulation: UpTo 64QAM