HUDDLE2025

ANATEL

THE 6G VISION FOR LATIN AMERICA

VINICIUS CARAM

SUPERINTENDENT OF SPECTRUM PLANNING, ANATEL

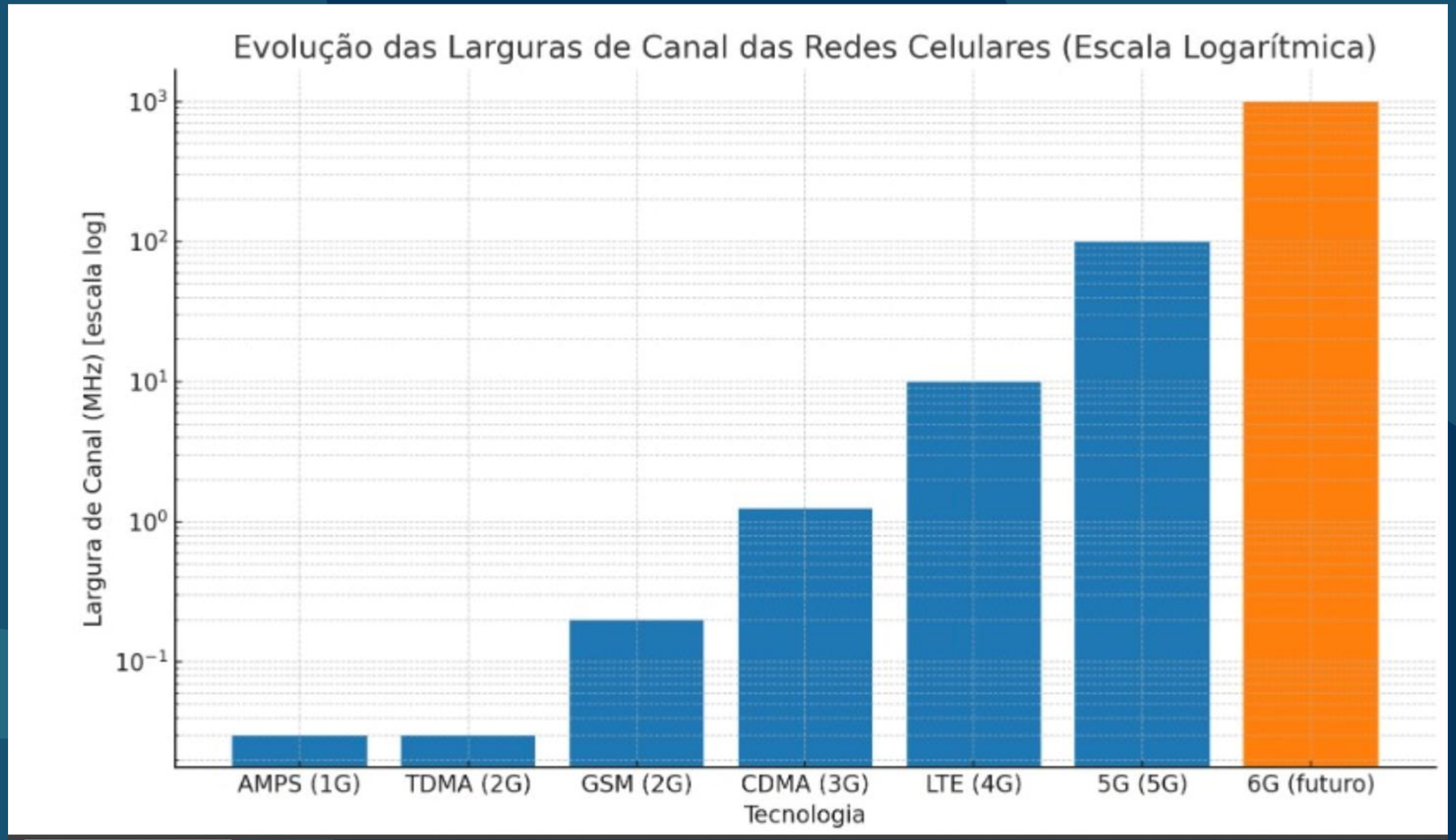
KEY MESSAGES ON BRAZIL'S MOBILE SECTOR AND SPECTRUM PLANNING

Spectrum as a mandatory resource for mobility, all operators and providers, sustainability and modernization of the telecommunications sector, with consequences for the entire economy.

MOBILE SERVICE (SMP)

Geração	Tecnologia	Largura típica de canal (MHz)	Taxa de dados de pico (Downlink)	Eficiência espectral típica (bps/Hz)	Eficiência espectral pico (bps/Hz)
1G	AMPS analógico	0,03	≈2 kbit/s	~0,01	—
2G	GSM / TDMA	0,2	~100 kbit/s (GPRS/EDGE)	~0,1–0,3	~0,5
3G	W-CDMA / HSPA	1,25–5	~2 Mbit/s (HSPA inicial); até 42 Mbit/s (HSPA+)	~0,5–1,5	até 2–3
4G	LTE	5–20 (agregação >100)	~100 Mbit/s (Release 8); até 1 Gbit/s (LTE-A)	~3–5	até 15–30
5G	NR (FR1)	até 100 (FR1 sub-6 GHz); até 400 (FR2 mmWave)	~10 Gbit/s pico teórico	~6–10	até 20–30
6G (meta)	Futuro (sub-THz)	200–1000	~100 Gbit/s pico projetado	~10–15	—

MOBILE SERVICE (SMP) - Channel Bandwidth



MARKET SIZE AND COVERAGE

- Brazil with continental dimensions and more than 200 million inhabitants
- 267 million mobile telephony accesses
- High demand for service coverage expansion

Mobile Broadband Numbers and Speed

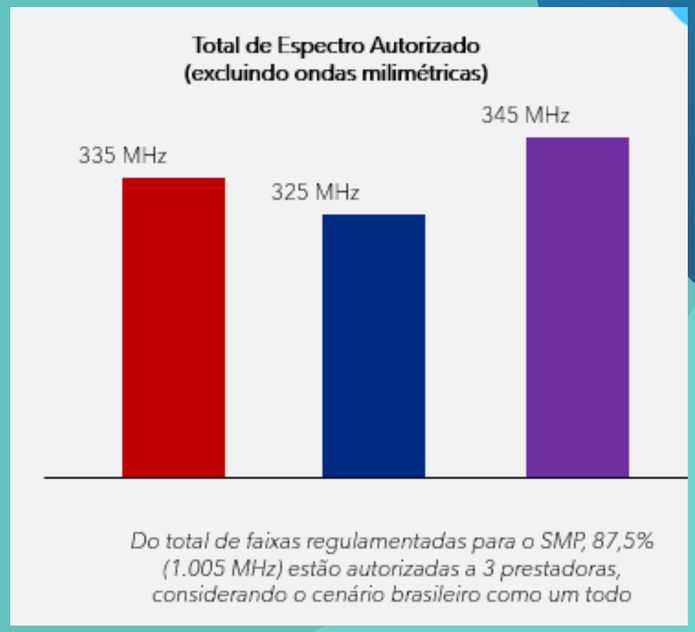
- 220 million mobile broadband accesses (about 90% 4G or above)
- Average speeds: 30 Mbps (4G) and 150 Mbps (5G)
- Nearly 108,000 SMP stations nationwide
- 47,000 standalone 5G stations (43% of total)
- 50 million 5G users

5G AUCTION – OBLIGATIONS

- All municipal seats with 5G (1,174 >30k pop, 4,396 <30k pop)
- 1,700 non-seat localities with 5G
- 391 municipal seats with 4G or higher
- 7,430 localities with 4G or higher
- 2,349 highway stretches (35,784 km) with 4G or higher
- 530 municipal seats with fiber backhaul
- Provide R$ 3.1 billion for school connectivity
- By 12/31/2029: all 5,570 municipalities with 5G implemented
- U$ 30 billion – since 2021 (+R$ 150 bilhões)

SPECTRUM

	Duplexação	Largura Total das Subfaixas Destinadas (MHz)
450 MHz	FDD	14
700 MHz	FDD	80
800 MHz	FDD	60
900 MHz	FDD	25
1.800 MHz	FDD	150
1.900 MHz	TDD	20
2.100 MHz	FDD	120
2.300 MHz	TDD	90
2.500 MHz	FDD	140
2.500 MHz	TDD	50
3.500 MHz	TDD	400
26 GHz	TDD	3.250



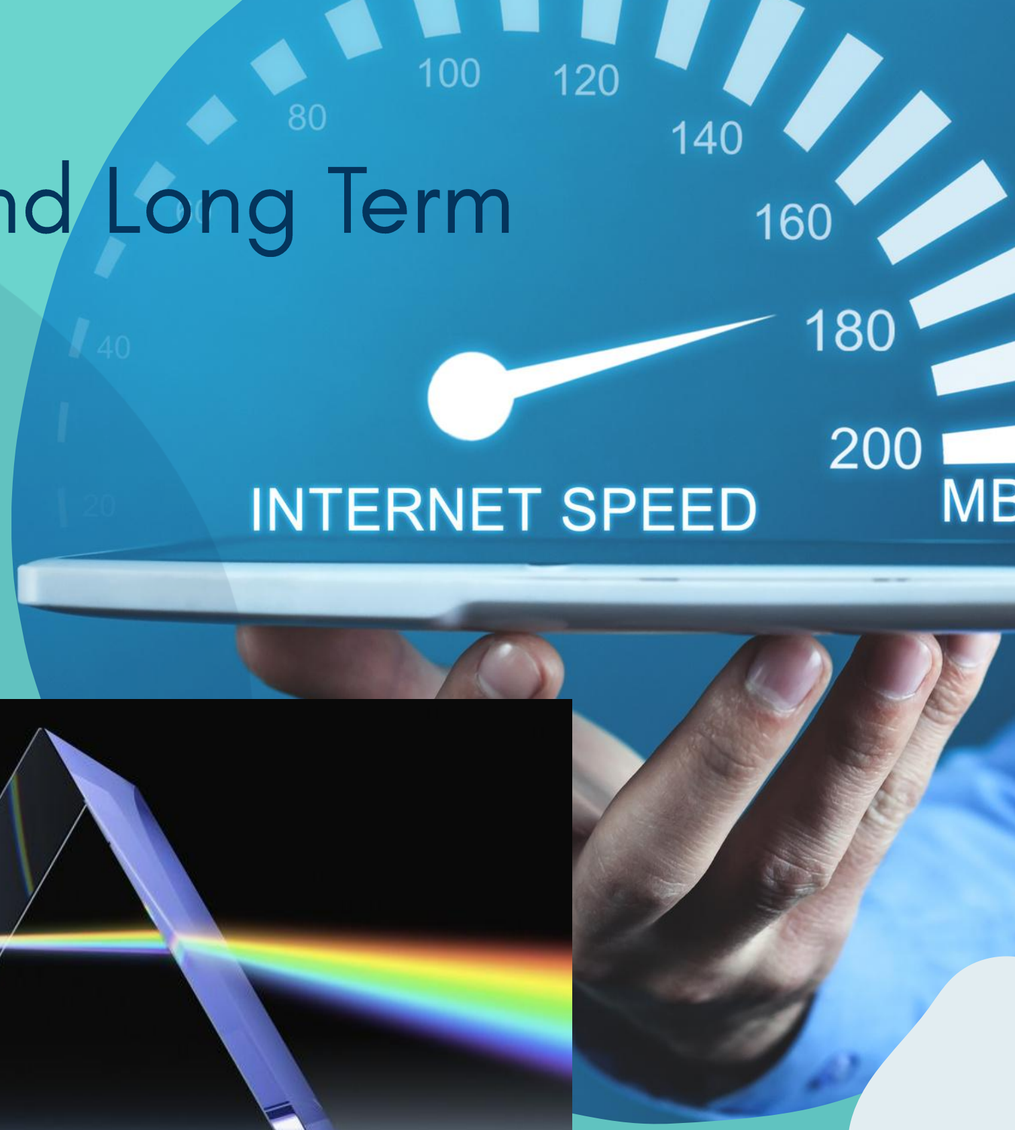
1,1 GHz

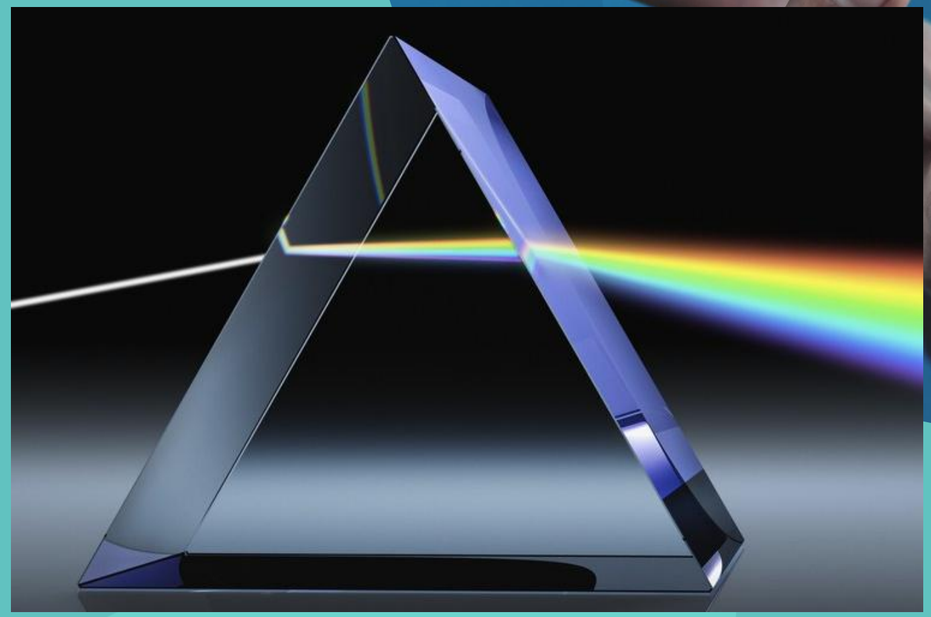
>4,4GHz TOTAL

SPECTRUM

Planning: Short, Medium and Long Term

Período de realização das licitações	Faixas de frequências candidatas
até 2026	6 GHz
até 2028	850 MHz 2,3 GHz 2,5 GHz (FDD) 3,5 GHz 26 GHz
até 2032	900 MHz 1,5 GHz 1,8 GHz 1,9 GHz (TDD) 4,9 GHz
entre 2032 e 2036	1,9 - 2,1 GHz (FDD) 2,5 GHz 10,5 GHz





SPECTRUM

6GHz TO 6G

Avoid Co-Channel Coexistence

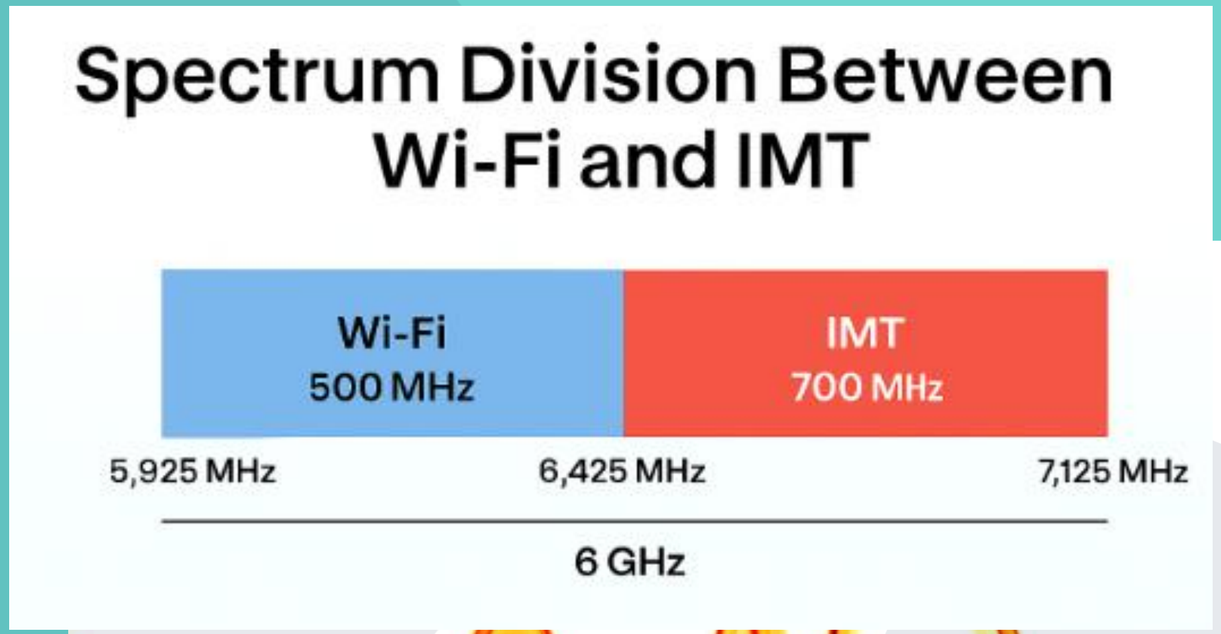
Co-channel coexistence degrades IMT and Wi-Fi performance, reducing the 6 GHz band's value for mobile services.

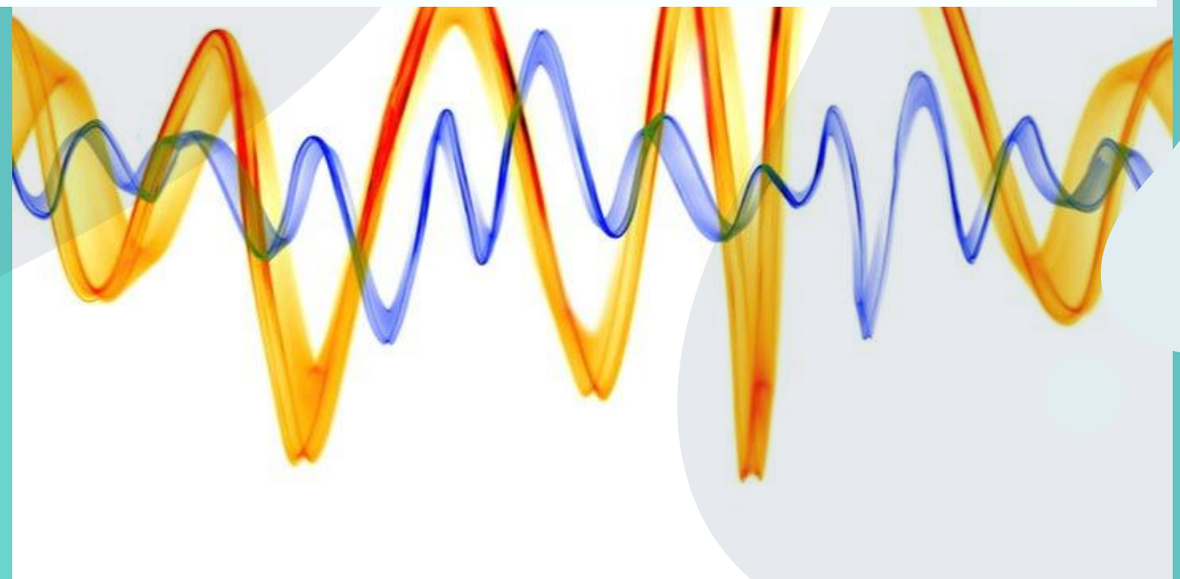
Adjacent Band Coexistence

Coexistence is feasible in adjacent bands, minimizing interference and enabling efficient spectrum use.

Collaboration and Research

Ongoing research and cooperation between regulators, industry, and academia are critical to optimize spectrum allocation.





6GHz TO 6G

- 6 GHz band critical to sustain mobile data growth, larger carriers and economic sustainability of the sector
- New entrants need smart deployment strategies (macro + smallcell + sharing)
- 6 GHz band (6425–7125 MHz) offered in upcoming Anatel auction
- Four blocks: 3x200 MHz, 1×100 MHz (4.9GHz CC)
- Enables high-capacity 5G systems and prepares for 6G ecosystem
- Commitments expand fiber backbone and SMP service to underserved areas
- Prepares regulatory and technical ground for 5G-Advanced and 6G
- 6 GHz signal attenuation higher than 3.5 GHz but compensated by larger antenna arrays
- More degrees of freedom improve diversity gains and coverage radius
- Required base stations x 15GHz

FUTURE TRENDS

IMT 2030 AND BEYOND

- EMERGING SERVICES: HOLOGRAPHY, TACTILE/HAPTIC INTERNET, MASSIVE IOT
- MODULAR AND COMPLEMENTARY NETWORKS, INTENSIVE USE OF AI AND DATA
- SUPPORT FOR UN SUSTAINABLE DEVELOPMENT GOALS
- CONVERGENCE OF NETWORKS AND COMPUTING (MEC), CONNECTIVITY FOR EVERYTHING
- ENERGY EFFICIENCY, OPTIMIZATION OF DATA RATE, LATENCY AND JITTER
- GLOBAL COVERAGE AND TOTAL CONNECTIVITY

FUTURE TECHNOLOGIES AND ARCHITECTURES

- AI-native networks: automation, optimization and fault recovery
- Integrated sensing and communication (ISAC)
- Convergence of communication and computing for digital twins, robotics
- D2D, THz and optical communications for high capacity
- Efficient spectrum use and new bands
- Energy efficiency and energy-neutral devices

Advanced Requirements and Multiple Access

- Ultra-low latency and precise synchronization
- Privacy, security and quantum cryptography
- New modulation and coding techniques
- Massive multiple access (NOMA, MUSA, PDMA, SCMA, CP-CDMA)
- Advanced antenna technologies (E-MIMO, holographic)
- Terahertz band communications: hundreds of Gbit/s to Tbit/s

OTHER TRENDS AND TECHNOLOGIES

- Precise positioning: centimeters and milliseconds by 2030
- RAN slicing and user-centric architecture
- Resilient networks and QoS assurance
- Digital twin networks for simulation and management

- Interconnection with non-terrestrial networks (HIBS, UASs)
- Densification and RAN infrastructure sharing
- Spectrum is mandatory for mobility, larger carriers and economic sustainability of the sector

The best way to predict the future is to invent it

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THANK YOU