Orange's vision on Mobile Network Technology Evolutions Beyond 2030

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6G?

- 6G research has been ongoing for more than 5 years, however the technology will be decided by standardization, mainly 3GPP.
- The 6G design should be based on an assessment of
  - market needs
  - feasibility under sustainability constraints
- Orange calls on the industry to reassess the generation-based terminology which fosters misconceptions and may be less relevant in the future for users.

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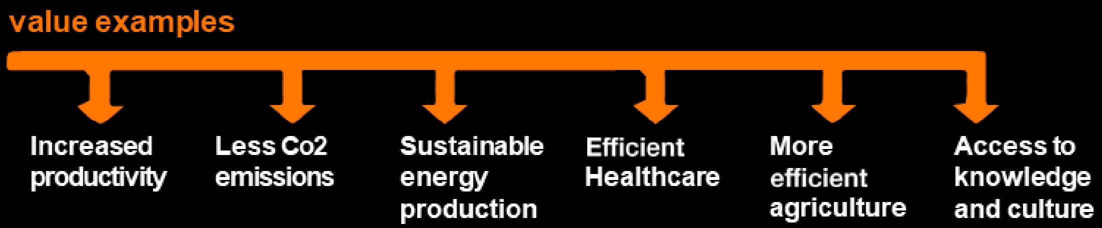
Value and sustainability should be the core drivers for defining future mobile network technology design



This is a necessary condition for the long-term economic sustainability of the telecommunications industry.

Future use cases should be driven by value and sustainability

Value areas

- Sustainable capacity extension
- Digital inclusion
- Exposure of network assets
- Value- and sustainability-enabling use cases

Generic use cases

Extension/massification of 5G use cases and capabilities

- Support traffic growth and coverage at minimum cost, under energy and environmental constraints
- Exposure of network data, functions and resources to third parties
- Immersive experiences
- Digital Twins
- Robots & autonomous systems

New uses cases, not yet identified

Application areas

- Human link
- CO2 emissions reduction
- Entertainment
- Healthcare
- Education
- Industry
- Agriculture
- Energy production & management
- …

Need to evaluate the value the use cases will enable to future users, and their relevance from a business, social and environmental perspective.

Strong value on empowering other sectors to meet their own environmental, social, and economic targets.

A societal dialogue is needed to help define what future technology evolutions should deliver, through an ecosystem-wide effort.

Performance requirements

KPI	Possible extreme value	5G reference [12]	Complement, e.g., target scenario
User experienced data rate (at cell edge)	300 Mbit/s 100 Mbit/s	300 Mbit/s 50 Mbit/s	dense urban other outdoor environments Note: 250 Mbit/s required for immersive experiences. The majority of identified future usages would require less than a hundred of Mb/s.
Area capacity	3 Tb/s/km² 450 Gb/s/km²	750 Gb/s/km² 100 Gb/s/km²	dense urban outdoor & wide area Note: 30% activity factor assumed
Connection density	35 000 / km² 15 000 / km² 1.10^6/ km²	25 000 / km² 10 000 / km² 1.10^6 / km²	mobile broadband – dense urban mobile broadband – urban macro massive IoT
Positioning accuracy	< 10cm < 1m	1m 3m	indoor deployment outdoor & wide area
Energy efficiency	x10 vs. 5G	no quantitive requirement	at least as much as capacity increase, so that the network energy consumption remains stable or decreases
Minimum end-to-end latency	N/A 0.5 ms (URLLC)	N/A 0.5 ms	in generic deployments, for services that require it for specific services & uses cases associated to specific deployments
Reliability	N/A 99.999 %	N/A idem	for most of services, typically (mobile broadband for specific services & uses cases associated to specific deployments
Mobility	500 km/h	idem	for specific services (very high speed trains, planes)

The envelope of extreme performance enabled by 5G specifications seem sufficient to accommodate the use cases currently identified for 2030-2040.

Future technology evolutions should aim at further improving the cost and energy efficiency in delivering the high 5G performance levels for a wider number of concurrent users.

Terrestrial network coverage is expected to be the same as 5G.

Area capacity to be higher than for 5G (potentially x4), and to rely on the existing macro radio sites without additional densification.

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Future networks Key Design Principles – Evolution from 5G

Support deployment on existing macro radio sites with similar coverage as 5G 3.5 GHz

6 GHz licensed as prime band
7-15 GHz of high interest
Native spectrum sharing with 5G

Benefits and costs of changing the air interfaces to be carefully weighted

Environmentally sustainable

Enhance 5G Core Network mechanisms, relying on Service Based Architecture

Seamless interaction with other access networks (Wi-Fi, NTN, Non-Public Networks)

Architecture options reduced to the strict minimum, potentially Stand-Alone only

Cloud native

AI native

Trustworthy (secure, resilient, inclusive)

Impact on initial launches for mass market: Upgrade 5G radio sites + Upgrade 5G Core

Focus on Environmental Sustainability

Environmental sustainability includes

- Energy efficiency and absolute energy consumption
- Greenhouse gases emissions, including for equipment and terminals manufacturing
- Raw materials usage
- Impacts on water and biodiversity

Not studied so far in 3GPP

Key design principles towards environmental sustainability

Monitor energy use and evaluate embedded environmental impact	Consume zero Watt at zero load, and consume little at low loads: energy-saving features	Rely on software upgrades and hardware modularity to extend equipment usage duration	Extend and strengthen resource sharing

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Initial deployment considerations

The 3GPP roadmap makes initial 6G commercial deployments possible from end 2030 at the earliest.

- The bulk of deployments are likely to happen from 2031 or 2032
- A coordinated launch at European level is desirable, as it would foster economies of scales and 3rd party (OTT) service availability

From infrastructure perspective, commercial deployments for mass market will involve upgrade of 5G radio sites with new frequencies, and upgrade of the 5G Core Network to support 6G features

- The 6G Core Network needs to be available from the start, for customers to enjoy straightforwardly the full 6G promise. Architecture options need to be reduced to the strict minimum, potentially Stand-Alone only
- Dynamic spectrum sharing will be needed from Day 1 to enable access of 6G UEs to legacy spectrum thereby ensuring performance gain for 6G UEs compared to 5G, without disrupting service to legacy UEs
- Where new frequencies are not needed, software upgrade of network equipment and terminals is to be privileged

Role of private networks in 6G

We see 6G as an evolution of 5G addressing both public networks and private networks.

- The market needs will dictate which type of networks are addressed first
- Usually the economies of scale of mass market drive the availability of equipment for private networks
- Spectrum should not be reserved a priori for private uses to avoid underutilization

The key role of the upper 6GHz band in the success of 6G

As convergent operators we are in the best position to understand our customer’s connectivity needs.

- As with previous generation of mobile technologies, a key prerequisite is the availability of a coverage band. The 6425-7125GHz in its totality is the only viable solution for Europe.
- The MNOs are the main enablers of the Wi-Fi technology. The current spectrum allocations in Europe for this technology are sufficient to meet the objectives set by the European Commission's Digital Decade 2030 strategy.
- Any plans for splitting the band or imposing technical constraints (e.g. power limitations) in order to introduce the use of Wi-Fi, will result in the inability to deploy 6G as a capacity solution, as the coverage and the capacity limitations will not justify the investments.

Key take-aways

- Value and sustainability should be the core drivers for defining future mobile network technology design, as a necessary condition for the long-term economic sustainability of the telecommunications industry.

- A new collaboration and societal dialogue is needed to help define what future technology evolutions should deliver, through an ecosystem-wide effort.

- The generation-based terminology needs to be reassessed, as it fosters misconceptions and may be less relevant in the future for users.

- The availability of the entire upper 6GHz band is crucial for enabling a cost effective 6G solution for the European citizens, on par with other regions.

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Thank you!

Orange white paper
[Mobile Network Technology Evolutions Beyond 2030]