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6G: Co-creating a cyber-physical world

Extract from the Ericsson Mobility Report

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6G: Co-creating a cyber-physical world

Early deployments of 6G are expected in 2030, and the 6G journey is already well underway.

Key insights

- The first commercial 6G deployments are expected in 2030.
- Long term, the network capabilities of 6G will enable the promise of the cyber-physical world, making it possible to freely move between the connected physical world and the physical world's programmable digital representation.
- The journey begins with 5G standalone (SA) and 5G Advanced. 6G scales up these capabilities and brings entirely new ones to enhance existing use cases and allow for the innovation of completely new use cases.

Multiple waves of 5G deployments and upgrades are still yet to take place in many parts of the world. However, the ICT industry, academia and standardization bodies have already begun to discuss and invest in new technologies to power the next generation of wireless possibilities beyond 5G and 5G Advanced: 6G.

The cyber-physical world

In the long term, 6G's capabilities will make it possible to realize the vision of moving freely in the "cyber-physical world," building a critical bridge between the connected physical world of senses, actions and experiences, and the physical world's programmable digital representation. The 6G cyber-physical world includes AR/VR as well as today's digital twins, but goes further, providing a much closer link to reality. It will be possible to project digital objects onto physical objects that are represented digitally, allowing them to seamlessly coexist as "mixed reality" that enhances the real world. For example, holographic calls where a person is digitally represented within a physical environment could be possible.

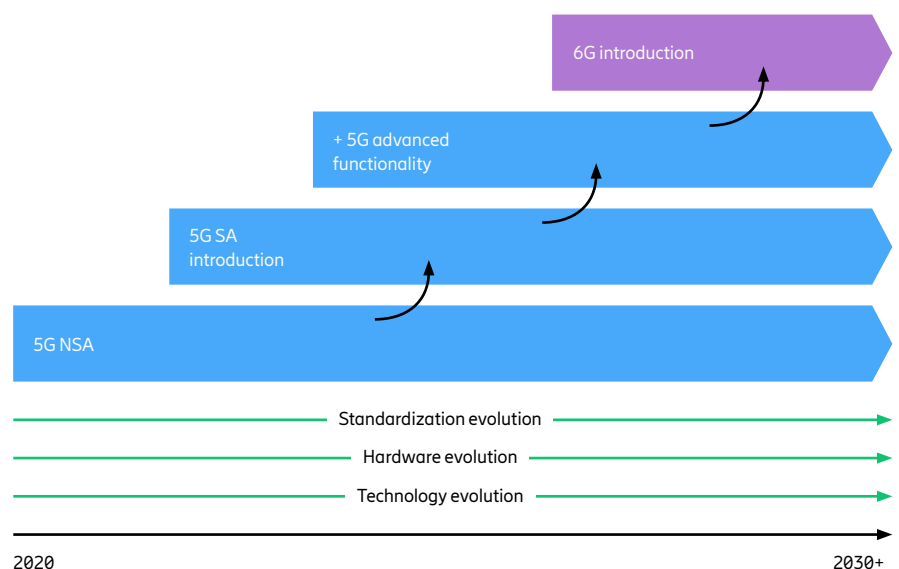
Countless sensors will be embedded in the physical world to send data that will update the digital representation in real time. Meanwhile, functions programmed in the digital representation will be carried out by actuators in the physical world. The purpose of the 6G network is to provide intelligence, ever-present connectivity and full synchronization to this emerging reality. This network is built on the foundation of a trustworthy system that is always available, reliable, performs as expected and recovers quickly when facing disturbances or attacks.

Future networks will be a fundamental component for the functioning of virtually all parts of life, including society and industry, fulfilling the communication needs of humans and intelligent machines. As accelerating automatization and digitalization continue to simplify people's lives, the emerging cyber-physical world will continuously improve efficiency and support the sustainable use of resources through digitalization.

Growing from 5G to 6G

The cyber-physical world will not fully materialize over the course of a day, but instead, we will see a gradual progression from the first deployments of 6G around 2030. There is not yet a detailed roadmap for 6G, but based on several years of research, pre-standardization work has now begun. Research into new technology areas for 6G will then continue in parallel with the evolution of 5G. Learnings from live 5G networks and interactions with the user ecosystems will continuously feed into the research, standardization and development of 6G. The capturing of the technology evolutions, alongside advancements in hardware capabilities into how the 6G standards evolve, is critical to delivering both enhanced and new network capabilities, while ensuring cost-efficient and sustainable solutions. It is expected that 6G will be built on the foundations of 5G SA and 5G Advanced.

Figure 14: Factors driving the path to, and evolution of, 6G



The 6G Radio Access Network (RAN) should connect to an evolved form of the 5G Core network.¹ 5G SA architecture is flexible and can easily be extended to handle new 6G features. Building upon the well-established baseline of the 5G Core network enables a cost-efficient introduction of the 6G RAN and other 6G features. It is expected that deployments will commence in 2030 with a smooth migration to 6G, utilizing the evolved 5G Core and highly efficient Multi-RAT spectrum sharing (MRSS) for existing spectrum in combination with new spectrum bands. More new capabilities will be added as 6G standards evolve.

6G capabilities and use cases

To serve as the platform for a vast range of new and evolving services, the capabilities of wireless access networks need to be enhanced and extended in various dimensions. This includes enhancing classic capabilities,

such as achievable data rates, latency and energy performance. Alongside these, entirely new capabilities are expected within 6G, including services offering functionality beyond communication, such as AI and compute services, as well as information services such as integrated sensing and communication.

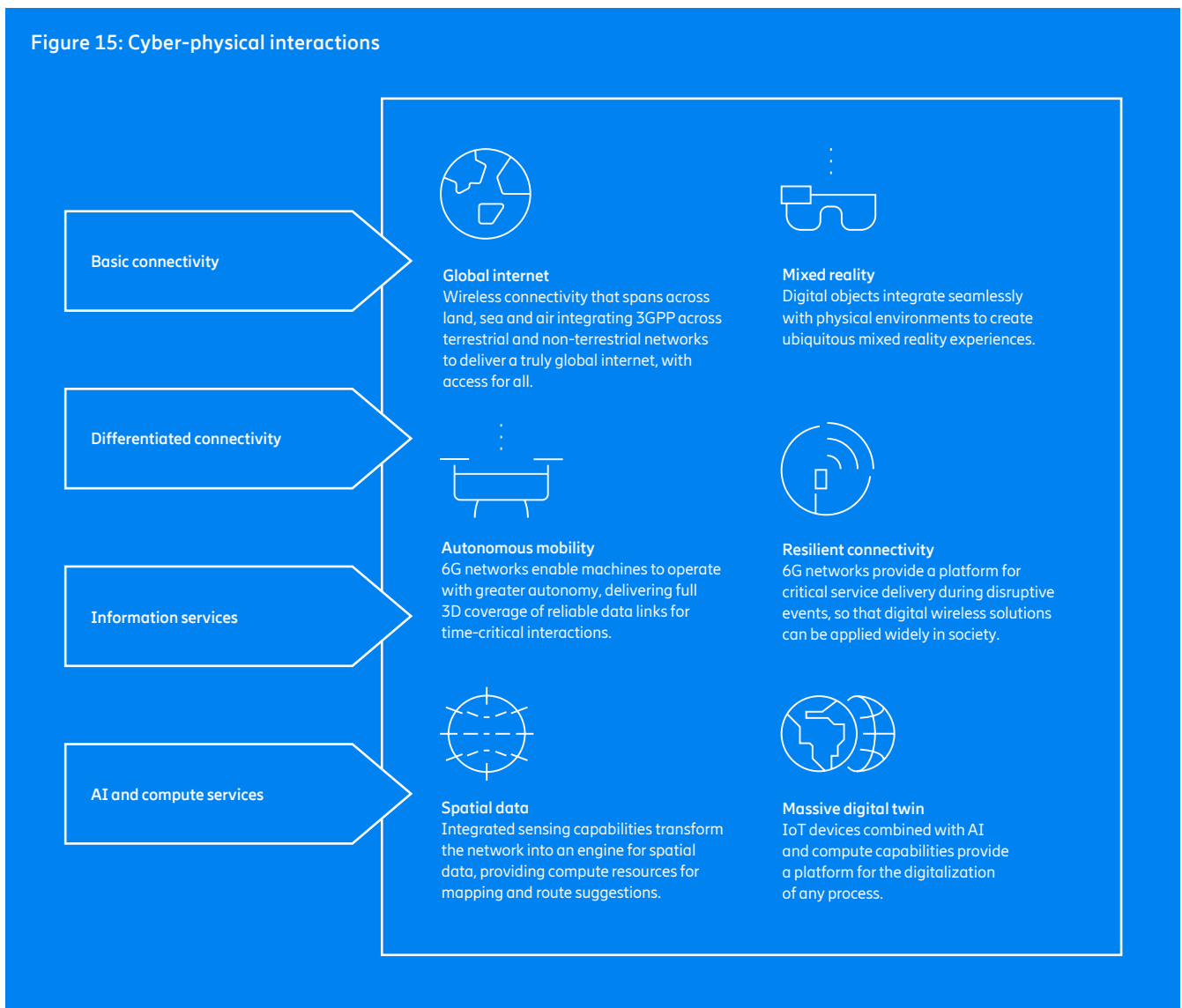
These new concepts are already under development, enabling 6G to support cyber-physical interactions with basic connectivity, differentiated connectivity, spatial and timing data, and AI and compute services.

A multi-purpose platform

The core elements of 6G will form one seamless system, with all the capabilities necessary to empower the vision of ever-present intelligent communication connecting a cyber-physical world. With a foundation of trustworthy systems and a highly efficient cloud compute with

built-in AI capacities, the networks of the future will deliver global connectivity as well as services beyond connectivity for upcoming applications. This will make 6G the information backbone of society, leading to the creation of a fully digitalized and programmable physical world.² Network APIs are critical to realizing the cyber-physical world, as they allow developers to easily access valuable network capabilities and insights. These can then be used to enhance existing applications and develop new ones. This has begun already with 5G network capabilities such as differentiated connectivity, location-secure authentication and network insights, but will continue to evolve and accelerate with entirely new 6G network capabilities.

Figure 15: Cyber-physical interactions



¹Ericsson, "6G network architecture – a proposal for early alignment" (October 2023).

²Ericsson Technology Review, "Beyond bit-pipes – new opportunities on the 6G platform" (July 2024).

About Ericsson

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