Use Cases and 6G Architecture: New Needs and Challenges

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Introduction

The 6G networks are expected to deliver superior performance over 5G and satisfy new emerging services and applications that integrates space, air, ground, and underwater networks to provide ubiquitous and unlimited wireless connectivity.

There is a huge number of uses cases that poses varying requirements which include extreme mobility, extreme low latency, ultra high data rates, high energy efficiency, enhanced security, as well as high reliability.

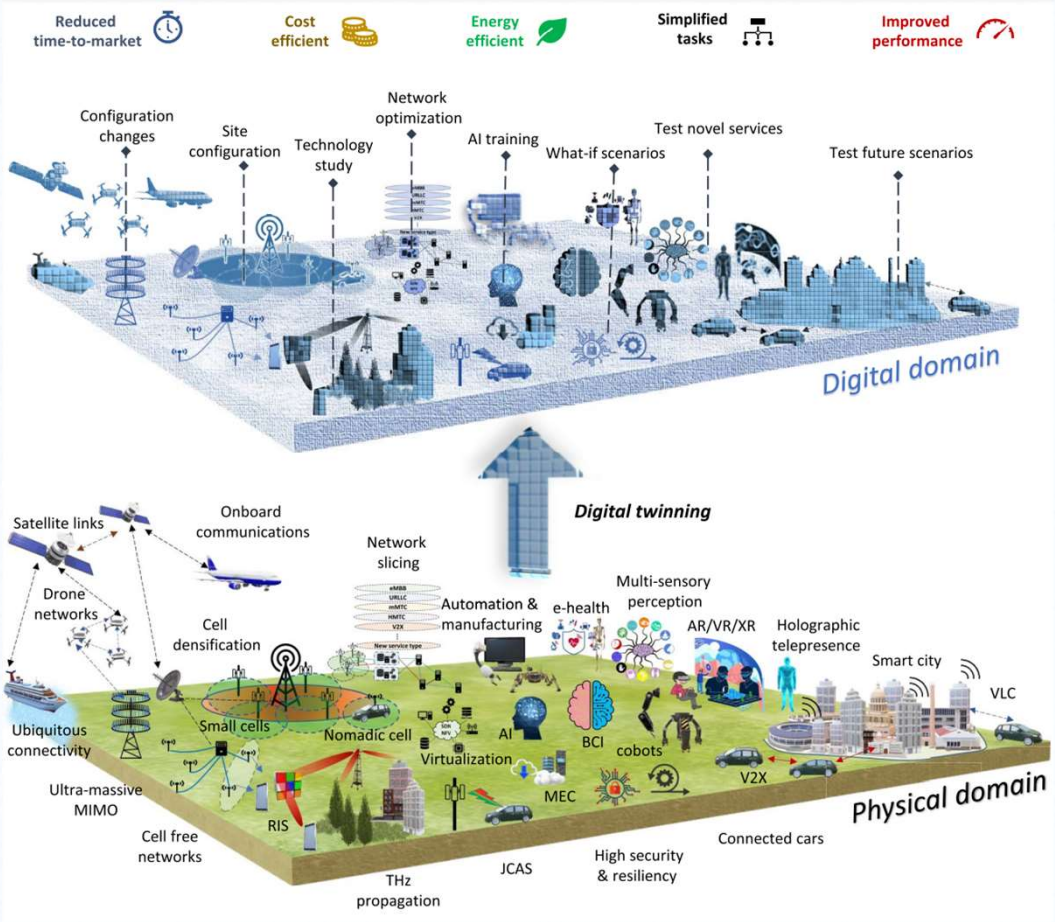
From this perspective, it is necessary to consider some of the key features that can be fundamental for the construction of the 6G network architecture.

Motivation

Use Cases

Digital Twins

It is a virtual representation of the elements and dynamics of a physical system. In an ideal scenario, a Digital Twin will be indistinguishable from the physical asset, both in terms of appearance and behavior, with the added benefit of making predictions.



Use cases

Human-centric immersive communications

Communication that until then was carried out strictly through a smartphone, mostly with touches on the screen, can evolve so that it is possible to enter data through gestures and even through nerve impulses generated by the brain. Obtaining data will also be improved and synesthesia becomes even more present through, for example, the combination of sounds and three-dimensional elements that can be inserted and merged with the user's perception of the real world through glasses or ocular lenses.

Use cases

Industry 5.0

Industry 5.0 is the enhancement of Industry 4.0 and brings new goals with resilient, sustainable and human-centric approaches in a variety of emerging applications. These industry 5.0 technology enablers are: Human-Machine Interaction, Real-time Virtual Simulation and Digital Twin, Artificial Intelligence-native Smart Systems, Data Infrastructure, Sharing and Analytics, Bio-inspired Technologies, among others.

Target Indicators for 6G

Latency

Latency was a critical KPI in 5G and is expected to continue to be a concern in 6G networks, given that many applications are dependent on this KPI. On 5G, the minimum user plan latency requirement is 4ms for eMBB and 1ms for URLLC. This value is expected to be further reduced in 6G, to 100 μs or even 10 μs. In addition to air interface latency, 6G must also consider E2E latency.

Target Indicators for 6G

Reliability

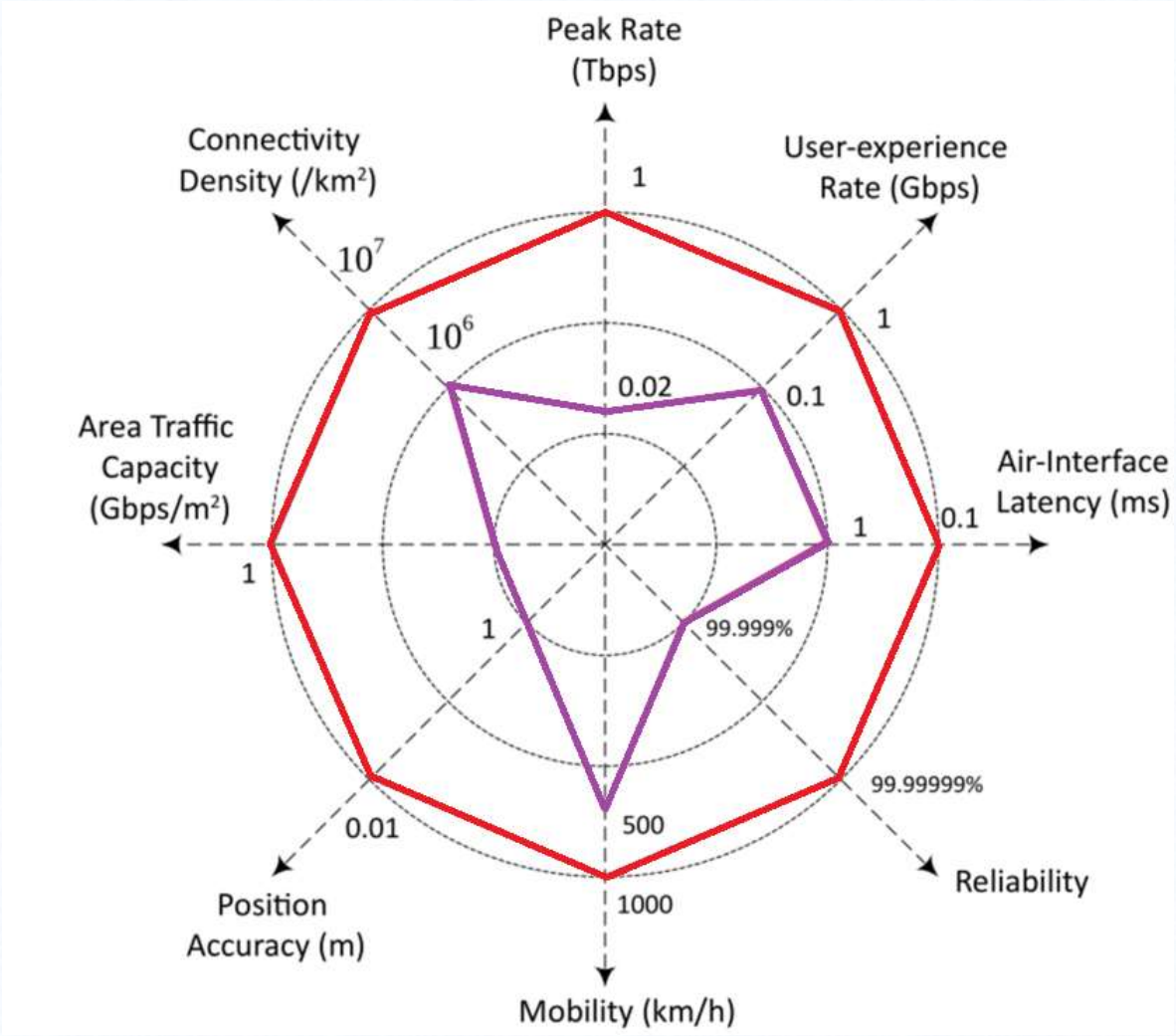
The communication sections between the end device and the application will receive treatment from the 6G network, which will surely promote another layer of reliability for the system, making it a really ultra-reliable network.

Target Indicators for 6G

TeraHertz Communication

Communications in Terahertz work between 100GHz and 10THz and, compared to millimeter waves, it brings a great potential for high frequency connectivity, enabling high data rates, in the order of hundreds of Gbps, which is what is expected from 6G.

Comparison between 5G and 6G requirements



Conclusions

After studying these use cases, the requirements, also known as target indicators, were discussed bringing confirmation of the need for a new network architecture.

With ultra-low latencies, in the order of 10 micros, ultra-reliable networks and transmissions in the order of Terahertz, it is expected that new network elements will be introduced, as well as the communication structure between them will be modified.

6G is expected to have intelligent and distributed network management in such a way that it can handle all demands privately and securely. All this must occur so that the success of the 6G deployment is possible and that all the desired objectives are achieved.

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