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6G Wireless Communication Technology

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A B S T R A C T

The next wave of mobile technology is represented by 6G wireless communications, which promises previously unheard-of levels of connectivity, data speeds, and low-latency communication. 6G intends to transform a number of communication-related areas, including mission-critical services, immersive virtual and augmented reality experiences, and internet-of-things (IoT) applications. It builds on the groundwork established by its predecessors. This study highlights how 6G technology could change how we use and interact with wireless networks in the future by summarizing its main characteristics, prospective uses, and limitations. The development of 6G technology, which promises previously unheard-of capabilities to satisfy the growing demands of future applications, is a result of the advancement of wireless communication networks.

Keywords: Communication in quantum, Excellent dependability and accessibility.

1. Main text

Wireless communication has been at the front of innovation in our rapidly changing digital environment, consistently pushing limits and opening up new avenues.

1.1. Introduction

By 2030, 5G will have reached its limit, which will force the creation of new paradigms to address the shortcomings of earlier generations of mobile networks. High practical standards are anticipated for the 6G mobile network, which will satisfy the demands of IoE, VR, 3D apps, AI, M2M communication, EMBB, and their ancillary technical directions in terms of performance.
In comparison to the 5G network, the 6G network is anticipated to offer a 100x increase in energy and volumetric spectral efficiency. Because of its vast connection, the 6G infrastructure will be very complex. Between 2020 and 2030, there will be a 55% annual growth in the amount of mobile data used worldwide. By 2030, the projected increase in traffic will produce 5,016 exabytes (EBs) of data each month. With its vast quantity of data, new uses, Mobile communication networks have experienced tremendous revolutionary progress during the past thirty years. A number of (EMBB), etc. Radical changes have occurred in the immense potential of 5G, guiding a vast array of future possibilities. In some regions of the world, the 5G mobile network has already been put into use. By the end of 2025, almost 65% of people on Earth should have access to the 5G network. Significant limitations to the 5G mobile communication system are continually being revealed by its ongoing development. The idea behind it was to give the IoE more power. Nevertheless, the 5G technology cannot create a completely automated and intelligent network that allows IoE as a service because of its restricted capacity. For example, Tbsp.-data rate is needed for the upcoming edition of virtual augmented reality (VAR).

The ITU-T states that the following three factors will have the greatest influence on the design and future prospects of 6G networks over the next ten years in terms of lifestyle and societal changes: 1) High-Fidelity Holographic Society; 2) Connectivity for All Things; and 3) Time Sensitive/Time Engineered Applications. In the following, we outline our perspective on each disruptive change and discuss how future wireless networks may be affected by it.
These days, video is gradually taking over as the preferred communication medium, giving rise to augmented reality (AR). As a result, the ability to resolve videos is growing quickly. User equipment (UE) devices that support 4k video, for example, need a data rate of 15.4 Mb/s (per-UE). Furthermore, the average watching duration of a UE is rising to the point that end users are now expected to watch full TV shows, live sporting events, or on-demand streaming.

1.2. Review of Literature: Aspects of 6G Vision and Performance

A sizable number of studies have already examined potential uses and fixes for 6G systems. Giordani et al., for example, examine possible 6G use cases, offer a system-level view of 6G requirements, and outline various technologies that will be required to satisfy the stated criteria. The research in, and provide an overview of the enabling technologies required to realize the KPIs, including terahertz (THz) communications, intelligent reflecting surfaces (IRSs), orbital angular momentum (OAM), and holographic radio (which differs from standard holograms). Applications and enabling technologies for 6G are presented by Bariah et al., Chen et al., Tariq et al., Yuan et al., and Chen et al ().

1.3. Improvements in 6G technology

It is anticipated that 5G will become broadly accessible, setting the stage for 6G. It is evident from comparing all generations that internet coverage and speed rise progressively. The goal of 6G is to offer worldwide coverage. 6G will be distinguished from earlier generations by AI applications. The autonomous 6G network is anticipated to function as the core of 6G technology, despite its early beginnings. Data rates, security quality, and latency will all rise relative to the existing 5G capacity. The anticipated speed of 6G is between 1 and 10 Tbsp. Compared to all previous generations, it will occur more frequently. As the generations progress, the frequency usually rises. THz frequencies are indicative of high transmission rates.

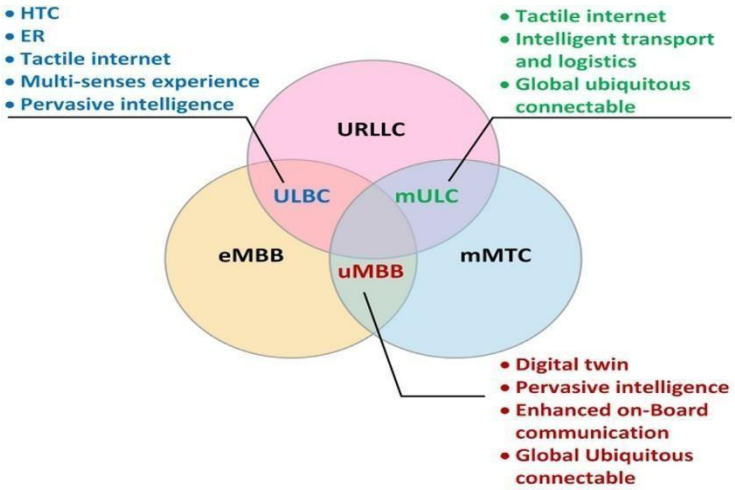

Figure 1 : 5G and 6G systems usage scenarios.

Determine the needs and possible applications for 6G technology. ii. Make basic research investments in fields including quantum communication, novel materials for device fabrication, terahertz communication, and better antenna technologies. Cooperate internationally to create standards for 6G technology. In this process, entities such as the Third Generation Partnership Project (3GPP) and the International Telecommunication Union (ITU) would be essential. Create terahertz communication systems to send data at extremely fast speeds. The bandwidth available at terahertz frequencies is much greater than that of existing radio frequencies. Incorporate machine learning (ML) and artificial intelligence (AI) approaches into the architecture and management of 6G networks to optimize resource distribution, strengthen security, and enhance user experience. Investigate the application of quantum communication concepts to safe, incredibly quick data transfer. For 6G networks, quantum key distribution (QKD) may offer previously unheard-of levels of security.

1.4. The structure of 6G wireless technologies

This is how the rest of the article is structured. Section II provides a vision for 6G, a description of the seven most notable use cases that 6G will enable, together with their technical needs. Additionally provided are a comparison with 4G and 5G systems as well as a summary table of the KPIs. In Section III, the new frequency bands and deployment scenarios are discussed after this. Section IV discusses the fundamental improvements in the core and transport networks that support 6G applications with a top-down approach. This is complemented by Section V's description of the new PHY techniques, which covers a wide range of subjects including waveforms, modulation techniques, multiple antenna techniques, AI applications, and machine learning (ML).

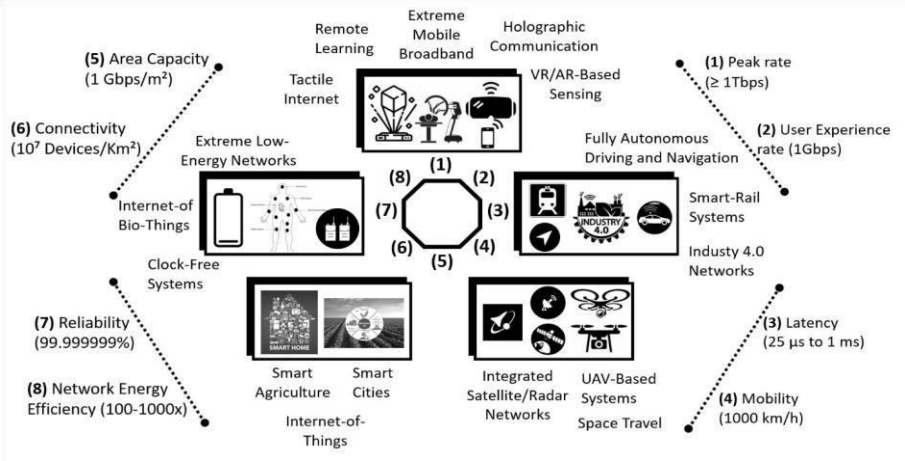

Figure 2: *Vision for 6G systems and its underlaying use cases. Here, we also summarize the key performance metrics that are of primary interest*

Utilizing terahertz frequencies—beyond 100 GHz—6G wireless technologies are distinguished by their ability to deliver previously unheard-of data rates and spectral efficiency. By drastically lowering latency to microseconds or even nanoseconds, these technologies hope to enable real-time connectivity for crucial applications like remote surgery and driverless cars. Dynamic performance and efficiency optimization in 6G networks is made possible by the integration of artificial intelligence into network management and resource allocation. With the potential to create immersive experiences and telepresence that blurs the boundaries between the real and virtual worlds, holographic communication capabilities have the potential to completely transform digital interaction. Beyond communication, 6G technologies have the ability to use AI-powered systems and real-time monitoring capabilities to spark revolutionary transformations in industries including healthcare, education, transportation, and manufacturing. 6G promises to be faster than current networks while also cutting latency to nanoseconds or microseconds, allowing for real-time communication. For applications like remote surgery, industrial automation, and autonomous vehicles, ultra-low latency is essential. It is anticipated that 6G networks will be extremely durable and dependable, ready to provide mission-critical services. In 6G networks, massive MIMO (Multiple Input Multiple Output) technology is crucial. It enhances spectral efficiency by enabling the transmission and reception of numerous data streams simultaneously.

Figure 3:5G V/S 6G Spectrum Comparison

4. Data analysis and Visualization

Collect information about 6G wireless communication technologies from technical specifications, industry reports, and research papers. Comparative Analysis: Use bar charts or line graphs to compare the performance of 6G with that of earlier generations, such as 5G. Determine summary statistics for important metrics, such as mean, median, standard deviation, and range, using descriptive statistics. Regulatory Compliance Analysis: Using regulatory heatmaps or compliance matrices, evaluate how well 6G networks adhere to regulations around data protection and spectrum allocation.

Future scope

Terahertz communication refers to the use of terahertz frequencies in communication, which allows for extremely high bandwidth and data speeds. Ultra-Low Latency: Significantly lower latency that allows for real-time communication, which is essential for applications such as remote surgery and driverless cars. High-Speed Data Transmission: Exceptionally fast data speeds, expressed in terabits per second, that allow large file downloads and smooth streaming of high-definition video. Quantum Communication: Utilizing quantum-resistant cryptography and quantum key distribution, quantum communication integrates quantum principles for dependable and secure communication.

REFERENCES

1. M.H. Alsharif, A.H. Kelechi, M.A. Albreem, S.A. Chaudhry, M.S. Zia, S. Kim, Sixth generation (6G) wireless networks: Vision, research activities, challenges and potential solutions, Symmetry 12 (2020) 676.
2. I. Shayea, M. Ergen, M.H. Azmi, S.A. C¸ olak, R. Nordin, Y.I. Daradkeh, Key challenges, drivers and solutions for mobility management in 5G networks: a survey, IEEE Access 8 (2020) 172534–172552.
3. A. Kumar, R. Dhanagopal, M.A. Albreem, D.-N. Le, A comprehensive study on the role of advanced technologies in 5G based smart hospital, Alexandria Eng. J. 60 (2021) 5527–5536.
4. I. Shayea, M.H. Azmi, T.A. Rahman, M. Ergen, C.T. Han, A. Arsad, Spectrum gap analysis with practical solutions for future mobile data traffic growth in Malaysia, IEEE Access 7 (2019) 24910– 24933.
5. S.J. Nawaz, S.K. Sharma, S. Wyne, M.N. Patwary, M. Asaduzzaman, Quantum machine learning for 6G communication networks: State-of-the-art and vision for the future, IEEE Access 7 (2019) 46317– 46350.