

From 5G to 6G: Technologies, Architecture, AI, and Security

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Commercial deployments of 5G networks gained momentum following the release of 3GPP specifications for 5G and subsequent advances in new wireless radio hardware that enable the 5G. Remarkable advancements, such as the integration of non-terrestrial satellite networks with terrestrial 5G networks, were standardized successfully during this period. This is the time research communities and standardization efforts started conceptualizing beyond 5G and the future 6G. The transition from 5G to 6G represents a pivotal moment in technological evolution, making it crucial for a comprehensive exploration. The current book, "From 5G to 6G: Technologies, Architecture, AI, and Security," aptly addresses this timely need and presents this significant topic.

The book is structured into 12 chapters that delve deep into various technical concepts, such as network architectures, advancements in wireless communications, AI, and cybersecurity to the Future of 6G mobile networks.

Chapter one opens with an introduction to the evolution of mobile networking and the current standardization status of 5G as led by the 3GPP. The author shares his perspectives on smart society living, exploring technologies like extended reality, smart healthcare, IoT, and haptic communications. The chapter also introduces IoT, AI, and cybersecurity within the context of a hyperconnected world, highlighting their crucial roles in the global ecosystem of heterogeneous networks.

Chapter two illustrates various communication networks emerging from the advancements in quantum computing, blockchain, distributed AI, and edge computing. The author underscores the seamless integration of these advanced networking forms within matured 6G networks and emphasizes the vital role of specification bodies, like 3GPP, in ensuring hyperscale integration.

The convergence of multiple industries, such as healthcare, IoT, satellite, and cloud are investigated in chapter three. The dynamic market needs to motivate several technologies and industries to collaborate and solve critical problems at scale. The author reviews the repercussions of these industry mergers on future space, mobile, and IT sectors. The chapter concludes by emphasizing the need for intensified research and innovation efforts to address the challenges that lie beyond 6G.

In chapter four, the author exclusively discusses the AI/ML techniques for 5G and 6G more from the ethical and cybersecurity aspects of them. The author delves into the advantages of these techniques while also sounding a cautionary note about their malicious use by cybercriminals and vulnerabilities.

Chapter five briefly introduces the 6G system-level architecture and consolidates its enabling technologies, such as blockchain, terahertz communications, and quantum communications. The author employs tabular presentations effectively to articulate the manifold challenges and impacts of harnessing these powerful techniques in real-life 6G and beyond networking.

Chapter six succinctly illustrates the vision of 6G evolution towards an energy-efficient hyperconnected high-performance networking. 6G use cases, such as holographic applications, digital healthcare, autonomous vehicles, etc., are illustrated with particular attention to their respective set of challenges. The author comments on how AI could be a potential game-changer in addressing those challenges.

In chapter seven, the author expresses his concerns about cybersecurity and the gap that exists between its status and the maturity required to ensure a robust 6G. From wireless mesh networking and its security analysis, the author presents the evolution of the security of wireless networking and future risks associated with 6G networks.

Chapter eight provides a comparative discussion of 5G and 6G. How 6G can benefit the stakeholders over 5G in enabling diverse services and use cases with enhanced security and privacy requirements are systematically presented. The chapter envisages advanced AI/ML techniques, such as federated learning-based applications that can be harnessed to achieve user data privacy for a trustworthy 6G.

Chapter nine and 10, pick up AI/ML for 6G in more detail and unpacks various aspects of the applicability of AI/ML in ubiquitous 6G networks. Manyfold challenges, such as vulnerabilities of AI systems toward cyberattacks, can compromise the robustness of the 6G networks are discussed in chapter nine, which leads to chapter 10. Chapter 10 Explores the impact of such cyberattacks on the security of 6G. It then illustrates the both promises and risks of AI-driven 6G networks and their evolving security paradigm. The author briefly mentions the political, economic, and military implications of AI-driven applications that are yet not immune to adversarial attacks.

In chapter 11, the author explores the risks associated with poor data management in a data-driven hyperconnected world and highlights the vulnerability of cyberspace to disinformation. The author emphasizes the crucial significance of how AI/ML is harnessed, deployed, and managed in the 6G era, underscoring that the responsible utilization of AI/ML technologies will determine the extent to which AI/ML-driven 6G can be truly beneficial.

Chapter 12 closes the book by discussing the features of 6G, such as terabyte per second data rate, AI-powered networking, hyper integrated networking with satellites, underwater communication systems, and tactical communications. Readers can also get an overview of what a future 6G network would look like by the end of this chapter.

In conclusion, this book offers a comprehensive and in-depth analysis of the latest technological advancements paving the way for 6G. The author examines the role of AI-powered networking technologies and their implications for future mobile networks, especially from a security perspective. The article, "From 5G to 6G: Technologies, Architecture, AI, and Security," offers a timely presentation of existing mobile technologies while delving into the challenges for future evolution. This makes the book an invaluable resource catering to a diverse range of readers, offering unique insights into the emerging mobile landscape.