Chapter 76
Security and Privacy Mechanisms for 6G Internet of Everything Networks in Banking

Ilgin Safak
https://orcid.org/0000-0002-2788-7276
Fibabanka R&D Center, Istanbul, Turkey

Fatih Alagöz
Boğaziçi University, Computer Engineering Department, Istanbul, Turkey

Emin Anarım
https://orcid.org/0000-0002-3305-7674
Boğaziçi University, Electrical and Electronics Engineering Department, Istanbul, Turkey

ABSTRACT

6G, as a platform for the internet of everything, supports high data rates and low latency and satisfies the requirements for services, massive data traffic, storage, and processing, thus providing new opportunities for accessing consumer goods and digital services. Due to its enhanced autonomy, accuracy, and predictive capabilities, artificial intelligence (AI) is anticipated to play a significant role in the evolution of 6G by enabling large-scale deployments of self-optimized and automated systems, and enhancing applications and services, including augmented/virtual/mixed reality, Industry 5.0, banking, and financial services. 6G and AI can potentially revolutionize the banking and financial industry despite cost, scalability, security, privacy, and adoption constraints. This chapter discusses security and privacy concerns in 6G and potential solutions, the relevance and impact of 6G technology to the banking and financial industry, solutions and recommendations for developing secure 6G banking and financial systems, and future research directions.

INTRODUCTION

6G wireless telecommunications technology, still under development, is expected to be operational in the early 2030s. In addition to SHF (3-30 GHz) and EHF (mm-waves) bands employed in 5G, EHF (30-300 GHz) and THz (300-3000 GHz) frequency bands are likely to be used in 6G (Akyildiz, C. Han, Nie, & Jornet, 2022). Much larger transmission bandwidths available in EHF and THz bands will improve the

DOI: 10.4018/978-1-6684-7366-5.ch076

capabilities of 6G. This leads to dramatically higher data rates in 6G, especially for indoor and short-range cellular links. However, free space, atmospheric and precipitation losses also increase rapidly with increasing frequencies. Therefore, outdoor communication links in 6G may need higher margins for reliable operation. Increased gains of transmit and receive antennas in these bands can compensate for these losses and allow operation at reasonable transmit power levels (Jiang, Han, Habibi, & Schotten, 2021).

Optical bands, an option for 6G, also offer high data rates, better resolution, robustness to interference, and inherent security. As in EHF and THz bands, optical waves cannot penetrate walls and suffer large atmospheric and precipitation losses. In addition to indoor-based systems, optical links may also be suitable for short-range outdoor communications such as vehicle-to-vehicle communications (Akhtar, et al., 2020). Since 6G systems must have line-of-sight (LOS) and short ranges, base stations are expected to be more densely located than 5G systems.

Utilization of artificial intelligence (AI), augmented/virtual reality (AR/VR), blockchain, robotics, THz band communications, molecular communication, vortex millimeter waves, and quantum communication can drastically improve the performance of 6G systems (Porambage, Gur, Osorio, Liyanage, & Ylianttila, 2021). Vortex millimeter waves, due to rapidly changing spins, enable transmission at extremely fast data rates. Due to dramatic improvements over 5G, 6G is expected to enable people to enjoy consumer goods and digital services equally. 6G is not just about increased data rates, but also about a major shift in networks driven by quantum technology advances. Architectural designs are being transformed by technological advances in quantum devices. Note that quantum computers are still in the early stages of development, hardware is limited and architecture is uncertain. However, as quantum computers become more powerful, quantum software is expected to play a more significant role (Tripathi, Sabu, Gupta, & Dhillon, 2021).

Parallelism inherent in quantum communication networks increases capacity and security (Chehimi & Saad, 2021). Transferring quantum bits is a key component of quantum computing and communications. In a quantum computing network, quantum bits, or qubits, are fundamental units of data transmission. Qubits differ from standard computing bits in that they can take multiple values, including 0 and 1, at the same time. Qubits are transferred over a channel using quantum entanglement. Multiple qubits are entangled together and can be linked over longer distances. Quantum memory preserves a photon's quantum state without destroying the quantum information it carries. Quantum memory releases a photon with the same quantum state as the stored photon after a predetermined period of time (Brennen, Giacobino, & Simon, 2015). This is critical in quantum communications.

In standard cryptographic practices, data transmitted over the Internet is secured by posing a difficult-to-solve mathematical problem or algorithm. An attacker can see all the protected information if it solves this problem. Quantum cryptography, on the other hand, operates differently. As a result of entanglement, any attempt to gain access to protected information alters the cryptographic formula. This can easily be detected by communicating peers. Therefore, quantum cryptography significantly increases data security compared to standard cryptography (Muheidat, Dajania, & Tawalbeh, 2022).

6G anticipates the realisation of the Internet of Everything (IoE), which entails the interconnectivity of people, processes, data, and things, a concept much broader than the traditional Internet of Things (IoT), to enhance efficiency, productivity, and decision-making. This creates a highly interconnected network in which virtually all elements of the digital and physical world can communicate, interact, and exchange information. Not only do these include devices and sensors, but also individuals, applications, and contextual data associated with objects. Customer data plays a critical role in the IoE, enabling personalized experiences, optimizing services, and enabling seamless interactions across intercon-