

# Chapter 10

# Communication Technologies and Protocols in IoT Systems: Principles, Standards, and Security

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## **ABSTRACT**

*Internet of Things (IoT) technology has revolutionized the way devices interact and communicate, enabling seamless connectivity and automation across various domains including computer systems, networking and embedded systems. Communication is one of the most important fundamental aspects of any digital system. In IoT system, apart from modern paradigms, many classical computer systems communication technologies are used to achieve the main purpose of information acquisition and processing. The actual proposed chapter aims to provide an in-depth and comprehensive exploration of communication technologies and protocols used in IoT environments according to different context and use cases. This exploration will also take into account the data acquisition, storage, processing and transmission technics, internal and external electronic architecture and communication technics.*

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## COMMUNICATION TECHNOLOGIES AND PROTOCOLS IN IOT SYSTEMS

The integration of communication technologies and protocols is fundamental in establishing the foundation for effective IoT systems. IoT devices rely on robust communication channels to exchange data, receive commands, and facilitate interactions in real-time. Also, the synergy between IoT and embedded systems lies at the heart of today's interconnected world, where smart devices communicate, collect data, and perform actions autonomously. Embedded systems serve as the backbone of IoT infrastructure, enabling devices to interact and process information.

In this context, many research works highlights challenges, development and evolution of IoT systems notably in terms of communications technologies, communication protocols and embedded systems design. These studies explored a wide array of wireless and wired communication solutions, highlighting their respective strengths and limitations in supporting the diverse requirements of IoT deployments. Moreover hardware-software co-design strategies, security concerns and trends technologies that optimize the performance and reliability of IoT systems like edge computing, cloud computing, data analytics and machine learning was a focus for many researches.

Connectivity between IoT devices and IoT platforms at the infrastructural level relies on classic communication technologies used in Internet such as Wi-Fi, Ethernet, Cellular Networks and Satellites. Also, protocols like HTTP (Hyper-Text Transfer Protocol), TCP (Transport Control Protocol), TLS (Transport Layer Socket), IP (Internet Protocol) assure structured and secure communication establishment at high level. However, many communication technologies and protocols have evolved to satisfy IoT specific requirements in terms of optimization. This chapter explore several aspects of communication technologies and protocols in IoT systems including the following:

- IoT systems description and their interconnected nature with embedded systems.
- IoT systems communication technologies exploration, including wireless, wired, and hybrid solutions.
- Investigation of the significance of protocols in establishing efficient and secure communication channels within IoT networks.
- Analysis of the impact of communication technologies and protocols on the performance, scalability, and security of IoT deployments.
- Challenges and security considerations in designing and integrating IoT solutions.

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