

Chapter 11

Enhancing the Internet of Things (IoT) Through Cloud Computing

Salaheldin Mohamed Ibrahim Edam

 <https://orcid.org/0000-0002-8280-8745>

Sudan University of Science and Technology, Sudan

Loay Ahmed Hassan Bushara

Sudan University of Science and Technology, Sudan

Abuagla Babiker Mohammed

Sudan University of Science and Technology, Sudan

ABSTRACT

In this chapter, the convergence of IoT and Cloud Computing are discussed with an emphasis on scalability, elasticity, real-time processing, cost-effectiveness, resource optimization, and security. Giant amounts of data are generated by IoT networks; hence the role cloud computing can play in efficient data storage and management becomes critical. In addition, it discusses the importance of disaster recovery, fault tolerance, global access, and management in the cloud-enabled IoT ecosystem. Finally, the authors present the future trends highlighting the advancements that will drive the IoT and cloud computing integration. The research gives insight on how cloud computing support IoT applications to help companies build strong, scalable, secure systems-all with resource efficiency and operational costs in check.

DOI: 10.4018/979-8-3693-9984-2.ch011

I. INTRODUCTION TO IOT AND CLOUD COMPUTING

The IoT ecosystem integrates sets of devices that communicate, work, and interact with one another. This has made it easier to develop smart environments within homes, cities, and industries. With IoT, physical things such as cars, household devices, and even industrial machines are connected through sensors, software, and the internet. As a result, devices can autonomously capture and share data. It is expected that the number of IoT devices will surpass 30 billion by 2030, which means data generation will increase drastically, making it more challenging to store and process it as well as analyze it in real time (Khan & Gupta, 2022). Recent research has noted important limitations for IoT ecosystems such as data security, system scalability, and interoperability. One example is the development of the Internet of Things (IoT) sensors that focus on adopting new technologies to improve data accuracy and increase energy efficiency in resource-constrained environments (Aljarrah et al., 2023).

The integration of IoT with AI and blockchain facilitates intelligent and secure data management, crucial for industries needing real-time, high-stakes decisions (Rajora et al., 2024). Meanwhile, cloud computing is vital for managing the immense data generated by IoT devices. It provides scalable and efficient storage and processing, freeing businesses from physical infrastructure limitations and enabling large-scale, real-time data management for faster decision-making. Cloud platforms also offer dynamic scalability, adapting to growing IoT networks and data volumes (Eljak et al., 2023).

Combining IoT with cloud platforms enhances system flexibility and cost efficiency by providing access to robust computational resources, thus reducing the need for complex on-premises setups. This integration enables real-time analysis crucial for applications like smart cities and industrial predictive maintenance (Jha & Chaturvedi, 2024).

The synergy between IoT and cloud computing extends beyond storage, significantly improving real-time analytics, security, and scalability. Cloud platforms facilitate advanced analytics on IoT data, yielding actionable insights that drive innovation and operational efficiency. For instance, in smart cities, cloud-enabled IoT systems manage real-time traffic, enhance energy efficiency, and improve public services (Jha & Chaturvedi, 2024). In healthcare, cloud-integrated IoT devices support real-time patient monitoring, leading to faster interventions and personalized care. Furthermore, this integration fortifies data security with cloud-based encryption and access control, addressing privacy concerns. The powerful analytics capabilities of cloud computing also aid in predictive maintenance and smart energy grid management, underscoring the vast potential of IoT-cloud collaboration (Abaee et al., 2024a).

50 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/enhancing-the-internet-of-things-iot-through-cloud-computing/385166

Related Content

Role of Security Mechanisms in the Building Blocks of the Cloud Infrastructure

Kowsigan Mohan, P. Balasubramanie Palanisamy, G.R. Kanagachidambaresan, Siddharth Rajeshand Sneha Narendran (2019). *Cloud Security: Concepts, Methodologies, Tools, and Applications* (pp. 31-53).

www.irma-international.org/chapter/role-of-security-mechanisms-in-the-building-blocks-of-the-cloud-infrastructure/224566

Cloud Computing-Based Smart Agriculture

Kaushal Kishorand Raj Kishor Verma (2023). *Convergence of Cloud Computing, AI, and Agricultural Science* (pp. 120-136).

www.irma-international.org/chapter/cloud-computing-based-smart-agriculture/329131

The Challenge of Service Level Scalability for the Cloud

Luis M. Vaquero, Juan Cáceresand Daniel Morán (2011). *International Journal of Cloud Applications and Computing* (pp. 34-44).

www.irma-international.org/article/challenge-service-level-scalability-cloud/53141

Designing Health Systems for Better, Faster, and Less Expensive Treatment

Rita Komalasari (2023). *Exploring the Convergence of Computer and Medical Science Through Cloud Healthcare* (pp. 1-13).

www.irma-international.org/chapter/designing-health-systems-for-better-faster-and-less-expensive-treatment/313554

Night Vision-Based Human Identification and Path Planning in Rescue Operations Using an Autonomous Robot

Sandeep Bhat (2024). *Shaping the Future of Automation With Cloud-Enhanced Robotics* (pp. 302-318).

www.irma-international.org/chapter/night-vision-based-human-identification-and-path-planning-in-rescue-operations-using-an-autonomous-robot/345548