


Chapter 13

Introduction to Cloud Computing

Ashima Narang

 <https://orcid.org/0000-0001-8961-8648>

Amity University, Gurgaon, India

Devashish Sharma

 <https://orcid.org/0009-0000-5706-2665>

Amity University, Gurgaon, India

Yojna Arora

 <https://orcid.org/0000-0002-6056-2465>

Sharda University, India

Ashwani Kumar

 <https://orcid.org/0000-0002-2100-900X>

*School of Computer Science, Engineering, and Technology, Bennett University,
Greater Noida, India*

ABSTRACT

Cloud computing, or remote resource environments, has revolutionized digital service delivery by enabling flexible, on-demand access to computing power. It allows local systems to execute tasks beyond their native capacities, leveraging models like IaaS, PaaS, and SaaS, each offering varied levels of control and abstraction. Most online services today—such as on-demand access, measured billing, and broad network connectivity—are cloud-based. However, challenges like data storage, transmission, exposure risks, and watermarking persist. The chapter highlights encryption, cryptography, GDPR, and HIPAA for improved security and concludes with applications in e-learning, streaming, and watermark detection using WaaS and real-time embeddings

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INTRODUCTION

In just a couple of decades, cloud computing has transformed everything. No more clunky servers, costly data centers, or rigid setups. The cloud serves as a global powerhouse, driving everything from a startup's rapid growth to AI breakthroughs that save lives in healthcare or guide self-driving cars. It provides computing power, storage, and tools on demand with impressive speed and scale. In the past, computing meant owning a lot of physical equipment—servers, cooling systems, and entire IT teams just to keep everything running. To scale up, you had to spend money on more hardware and space. The cloud changed that model completely. Now, computing resources can be accessed as easily as borrowing a cup of sugar; you just flip a switch, and it's ready to use. It's not only about getting rid of hardware. Virtualization and tools like Kubernetes have been created to allow developers to focus on building innovative projects rather than managing servers. This approach allows for fast building, smooth scaling, and quick adaptation. The cloud's real strength lies in its accessibility. It levels the playing field, giving everyone access to top-tier technology. Various approaches include Infrastructure as a Service (IaaS) for raw computing power, Platform as a Service (PaaS) for streamlined development, or Software as a Service (SaaS) for ready-to-use apps. Cutting-edge fields are now emerging, such as quantum computing and also they are becoming accessible because cloud platforms have been opening opportunities for growth of these powerful systems to researchers worldwide. All that's needed is an internet connection and a vision. With such power emerging by the day, significant responsibility has emerged in form of authentication. With that, concerns for security and privacy are also growing. Techniques such as encryption and digital watermarking protect information. For regulations, GDPR and HIPAA push cloud providers to prioritize trust from the ground up. Cloud tech keeps things running smoothly, no matter what. It is done by ensuring that even if one server goes down, another will step in seamlessly to keep everything on track. These systems are designed in such a way that they thrive in the face of chaos, not just sidestep it.

Diving into the story of cloud computing - in the domain where in the 1960s, visionary computer scientist John McCarthy dreamed of a world where computing power would flow like electricity. That idea stayed a dream until the early 2000s, when things started clicking into place. Contributions have been made to generate breakthroughs in virtualization, faster networks, and the internet's explosive growth, cloud computing began to take shape. Multinational companies have given game-changers, offering flexible, pay-as-you-go computing that anyone could tap into - such as Amazon's AWS of 2006. What the development began, they utilized a basic storage and computing services - the constituting technology has now grown into a vibrant ecosystem packed with APIs, deployment tools, databases, AI services, and

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