Role of Artificial Intelligence in Next Generation Networks

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ABSTRACT

The rise of digital transformation and advancement in networking technologies has changed enterprise connectivity in recent years. As technologies continue to develop, network infrastructure is revolutionized in the way devices connect, communicate, and interact. Next Generation Networks (NGNs) represent a significant advancement over traditional telecommunication networks and offer a robust and flexible infrastructure for data communication. The increasing reliance on data and the ever-growing demand for connectivity are driving the need for more powerful and versatile networks. With the explosion of data-intensive real-time applications, managing NGNs are challenging. Therefore, this article explores the advancement of NGN, its benefits and challenges. A detailed study on the AI technologies in NGN for transforming the networks is presented. The study also highlights the future of AI-powered NGN. By harnessing the power of AI, NGNs can become more intelligent, efficient, and adaptable, paving the way for a future of networks.

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1. INTRODUCTION

The networking world is constantly evolving to keep pace with our ever-growing reliance on data and connectivity. As networking and telecommunication technologies progress, the Next Generation Networks (NGNs) are garnering more attention for their inventiveness and encompassing services (P. R. Singh et al., 2023). Telecommunication networks are widely used for more than just phone calls in the modern digital environment. These networks completely transform how we live, work, and communicate, which can do anything from managing smart home appliances to streaming movies. Traditional techniques for establishing, installing, and maintaining networks become more laborious, error-prone, and time-consuming as they get more complex.

NGNs are becoming more and more essential and a turning point in the history of telecommunications because they not only improve upon their predecessors but also represent a paradigm shift in terms of speed, latency, capacity, and reliability, opening up new opportunities for developing service areas and applications. NGNs are a big improvement over typical telecom networks (Kabir et al., 2023). They provide a more reliable, flexible, and effective data communication infrastructure. Voice, data, and multimedia services are all seamlessly integrated over a single network by NGNs. As a result, distinct networks are no longer required for various services (such as voice calls and internet access). NGNs have a modular architecture that makes it simpler to integrate newly developed services and technologies. This adaptability maintains the network flexible enough to meet changing demands and encourages innovation. NGNs keep service delivery and the underlying network infrastructure apart.

NGNs are responsible for routing and managing data traffic across the network. A more connected and effective digital world is made possible by NGNs, which lay the groundwork for a variety of communication services by efficiently routing and managing data traffic. Data traffic management and routing in an NGN are managed by several network devices that collaborate within the core network. These devices such as routers, switches, gateway and servers together guarantee effective data traffic management. Routers choose the optimal paths for data packets with the use of routing protocols. Within network segments, switches provide seamless delivery. Communication between NGNs and other networks is translated by gateways. Control signaling for real-time services is handled by call servers. The coordinated effort of all the devices enables voice calls, video streaming, and data transfers to be delivered swiftly with high QoS.

As NGNs evolve, Artificial Intelligence (AI) is becoming increasingly important. The importance of incorporating AI in Next Generation Networks (NGN) lies in its ability to revolutionize the way networks operate and provide services to users. AI can optimize and troubleshoot functions within communication networks, enabling network operators to strategically plan, execute, and manage services in response to evolving consumer demands. AI in NGN can facilitate process automation, enhancing efficiency while minimizing operating costs (P. R. Singh et al., 2023). Incorporating AI into NGNs is crucial as AI algorithms can analyze network traffic patterns in real-time to allow dynamic resource allocation, to predict potential equipment failures, to detect suspicious activity and potential cyberattacks. AI can automate routine network tasks and optimize network performance for individual users. AI can also provide precise predictions without actual implementations, allowing operators to make informed decisions. Furthermore, AI can support customization and data generation, introducing a new dimension to communication networks with dynamic adaptation. The integration of AI in NGN can also redefine interactions, communication, and information access. AI's lifelike speech and language generation can elevate virtual assistants and chatbots, while its applications in network performance can enhance