Chapter 94
Handover Delay Improvement in 5G Systems Using ICH Services

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ABSTRACT

As 5G networks become increasingly prevalent, seamless mobility and low-latency handovers are of paramount importance to provide uninterrupted connectivity and enhance user experience. The proposed solution addresses the challenges posed by high mobility, dense network deployments, and diverse user scenarios. By eliminating the router discovery time, the proposed technique can lower the handover delay for MIPv6. In 5G networks, ongoing research in network slicing, and edge computing further contribute to reducing handover delay and ensuring seamless connectivity. ICH services offer promising solutions to improve handover delay in 5G systems. Through simulations and performance evaluations, the authors demonstrated that the incorporation of ICH services significantly reduces handover delay and enhances overall network efficiency in 5G environments. The outcomes of this study shed light on the potential of ICH services as a promising solution to meet the stringent handover latency requirements of 5G networks, paving the way for a seamless and immersive mobile experience for users.

DOI: 10.4018/978-1-6684-7366-5.ch094

I. INTRODUCTION

In the realm of wireless communications, the transition to 5G networks marks a significant technological advancement, promising higher data speeds, increased connectivity, and reduced latency. These improvements are pivotal for supporting the burgeoning array of Internet of Things (IoT) applications and the ever-expanding demands of mobile data services. However, as these networks become more complex and heavily laden with data, maintaining seamless connectivity and service quality during the mobility of devices becomes a critical challenge. One of the primary issues associated with mobile connectivity in these advanced networks is the delay during the handover process the mechanism that transfers the connection from one base station to another as a user moves through the network coverage area (Ahmed et al., 2022). Due to improved wireless technology and increasing accessibility of portable devices, mobile communication has grown in popularity. Additionally, the core network of diverse internet access networks is transitioning to an all-IP based network. As a result, Mobile IPv6 (MIPv6) became known as a universal method to facilitate Internet mobility across different access networks. However, the MIPv6's lengthy handover latency reduces the impression of quality of service (QoS), particularly for real-time services (Anandakumar et al., 2019). Handover (also known as handoff) is a crucial process in wireless communication systems, where a mobile device or user equipment (UE) transitions its connection from one base station or access point to another as it moves within the network's coverage area. This seamless transition allows the UE to maintain continuous connectivity and service quality during mobility. Intra-cell Handover is the type of handover that occurs when the UE moves within the coverage area of the same base station. The handover is necessary when the UE's signal strength or quality deteriorates due to factors such as distance from the base station or interference, Intra-cell handovers are relatively simple and quick. Inter-cell Handover takes place when the UE moves from the coverage area of one base station to another within the same network (Sönmez et al., 2020). This occurs when the signal from the current base station becomes weaker than the signal strength from a neighbouring base station, which can provide better service for the moving UE. Inter-cell handovers are more complex than intra-cell handovers but are essential for maintaining continuous connectivity during mobility. Inter-system Handover occurs when the UE moves between different wireless communication systems or technologies (Kassev). For example, the UE may transition from a 5G network to a 4G LTE network or from a cellular network to a Wi-Fi network. Inter-system handovers are more complex than intra-cell and inter-cell handovers since they involve transitions between different network types or architectures. Handovers are critical for ensuring uninterrupted connectivity and providing a seamless user experience in modern wireless networks. The decision to initiate a handover is based on various parameters, including signal strength, quality, load balancing, and network policies, and it aims to optimize the UE's performance and Energy Efficiency while ensuring seamless mobility (Tortosa-Alted et al., 2021).

Similarly, the IETF has suggested rapid handovers for MIPv6 (FMIPv6) to lessen the handover frequency in MIPv6. By offering quick access to IP immediately as a fresh connection is formed, the FMIPv6 decreases packet loss. However, the FMIPv6 primarily focuses on the protocol function and ignores other difficulties that are crucial to the FMIPv6's handover performance, like radio entry finding and applicant access router discovery. Additionally, if the link suddenly breaks during handover beginning, the MN may lose communication with the oAR (Anandakumar et al., 2019; Leiter et al., 2020). A lengthy handover latency results from MN performing a standard handover operation in the MIPv6 or responding with FMIPv6 in this situation. To enable handover and compatibility between heterogeneous networks, IEEE 802 is creating standards. The media independent handover (MIH) method described in the IEEE 802.21