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Mobile Network Modelling of OpenFlow-related Handover Messages

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Introduction

The software-defined networking (SDN) paradigm has proven critical in addressing a number of concerns and challenges in traditional networking, particularly in mobile and cellular networks. We investigate the effects of SDN in combination with the OpenFlow protocol on the handover procedure in order to achieve the benefits of SDN in mobility management. However, due to the exchange of OpenFlow signalling messages, the handover is still delayed in this new configuration. We focus on SDN in mobile networks in this research and quantify the latency of handover-related OpenFlow messages to discover performance indicators and underlying problems. We propose an analytical model for our investigation, which we used to describe two handover-related OpenFlow messages in such networks. Other than Packet-in messages, no previous study has modelled OpenFlow messages to our knowledge. We simulate Port-status messages in addition to the Packet-in message in this work. We suggest a novel solution based on our findings to make handover more efficient and less disruptive. We also examine our solution in the context of LTE architecture and compare it to an existing solution. In normal traffic conditions, we show that our method can reduce the handover delay by up to 20% [1].

Description

On big scales, today's computer networks are made up of a tremendous number of forwarding devices and middle boxes. To execute particular duties, each device has some logic and local intelligence. Multiple concerns have been documented with this network's architecture, which are exacerbated by increased traffic needs and new application and protocol requirements. Network managers have a number of challenges, including inflexible flexibility to changing network circumstances and high costs due to commodity technology. Furthermore, growing and managing are inescapable issues due to the requirement to configure network devices at a low level. Another global issue is "Internet ossification," which refers to the difficulty of Internet evolution in terms of physical infrastructure and protocol implementation [2].

The software-defined networking (SDN) paradigm was created to address some of the challenges listed above, and it provides solutions such as lower upgrade costs and more efficient use of network resources. The paradigm divides the network architecture into two planes: control and data, allowing for the programming and configuration of a controller as well as dynamic and global network management. In fact, SDN makes managing large-scale congested networks like datacentres and cloud infrastructures much easier. Cisco announced plans to incorporate Application Centric Infrastructure (ACI), a software-defined networking product, with the top three public cloud platforms in the market: Amazon Web Services, Microsoft Azure, and Google Cloud Platform. This incentive demonstrates the SDN concept's projected broad adoption in the future. Both wired and wireless networks have embraced the SDN paradigm. Despite the introduction of SDN technology to address some concerns in current wireless design, the nature of today's wireless networks offers significant hurdles due to the rapid and widespread expansion of mobile traffic. Meeting the needs of users and offering high-quality service becomes more important and difficult. Maintaining a user's continuous session continuity with minimal interruption, or decreasing handover delay, is one of the primary concerns of mobility management. As a result, we focus our research on mobile/cellular networks and the handover of hosts between multiple switches [3,4].

The exchange of signalling messages between the control and data planes is required to complete a handover operation, especially in the case of hard handover, when the "breakage" in an ongoing session correlates to the transmission of management and reconfiguration messages. Surprisingly, an SDN-based solution is better for applications that are "less sensitive" to latency. However, we know that latency is a factor in handover, and the major purpose here is to reduce handover delay. This fact prompted us to dig more into the factors that cause delays. The SDN concept has been incorporated into various parts of cellular networks such as Long Term Evolution (LTE), particularly the Evolved Packet Core (EPC). Mobility Management Entity (MME), Home Subscriber Server (HSS), Serving Gateway (S-GW), and Packet Data Network Gateway are some of the components that make up EPC (P-GW). MME is a critical module that handles some mobility management duties. Module HSS is a central database that contains all of the information on the subscribers. S-GW and P-GW are gateways that send data between eNodeBs and connect the end-user to external networks [5].

Conclusion

The control plane can be deployed centrally or distributed in an SDN-based LTE design. All EPC components are virtualized and integrated into a single controller in the centralised approach. Alternatively, the distributed EPC controller architecture can be represented in a variety of ways, including establishing a distributed set of EPC controllers or distributing an EPC controller's functionality. As a result, depending on the control plane deployment, mobility management might be centralised or dispersed.

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Conflict of Interest

The author shows no conflict of interest towards this manuscript.

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