

Chapter 9

Exploring SDN & NFV in 5G Using ONOS & POX Controllers

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ABSTRACT

This article describes how novel functionalities will take advantage of the cloud networking and will gradually replace the existing infrastructure of mobile networks with a virtualized one. Two technologies, namely software defined networking (SDN) and network function virtualization (NFV), offer their important benefits and a combination of them is an answer to the demands raised, such as central office re-architected as a data center (CORD). Open network operating system (ONOS) and POX are SDN controllers and offer an option to combine SDN and NFV addressing many ongoing problems in the field of mobile networks. In this paper, technologies and both controllers are compared and contrasted. Indicative cases of topologies are simulated and help evaluating both controllers. According to the experimental findings, ONOS is one of the most important controllers for practical, theoretical, research and educational purposes, while POX is a useful and simpler controller for other educative applications.

1. INTRODUCTION

Mobile communication networks face several problems, no matter how much progress has been made in the field during the last 20 years. Their transmission medium, namely the air, brings serious problems related to interferences (Inter-cell, Co-channel, Electro-magnetic etc.), handovers, performance, quality, costs etc. The large information load that stems from novel technologies (smart homes/cities, Machine

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to Machine (M2M) communications, Internet of Things (IoT) etc.) brings a huge onus of data in mobile and wireless networks.

5G networks raise demands such as: lower power consumption, high data rates, reduction of expenses, scalable architectures, optimized management of radio resources, efficient handovers, increased CPU demands, lower delays. Novel networks differ from conventional ones, because they tend to centralize the network structure, e.g. network controllers. Software Defined Networking (SDN) policies enable better routing and more efficient management of network resources.

5G mobile requirements are addressed using the SDN, which also introduces new ways of addressing alternative control suggestions and faces the basic problems mobile networks induce and are closely related to their transmission medium.

Economic crisis and market laws result in diminishing the overall costs. It is essential to simplify the network devices and lessen the usage and complexity of hardware. Network Functions Virtualization (NFV) contributes in providing programmable network functionalities and several simplistic devices, that function as more complicated hardware.

The most significant advantage of SDN is the split of the network in planes, namely the control and data plane. Planes are orchestrated in a way, that better management and orchestration are succeeded. NFVs define the introduction of devices everywhere and almost immediately. As a result, this leads to scalability, which is vital as nowadays most applications induce large data load in the networks and the need for network expansion raises.

The central policy followed for the controllers existing in SDN networks based on the OpenFlow protocol, induces an amazing fact. For example, the central controller gathers information of all the network traffic and functionality and possibly applies network statistics to imply conclusions and implement policies.

The Open Network Operating System (ONOS) is a controller with many advantages. ONOS is implemented by the Open Networking Lab (ON.LAB). It includes many use cases, which are related to wired and wireless matters. Several different topologies are introduced and tested checking important addressable questions, when it comes to SDN and NFV. The Internet Protocol Radio Access Network (IPRAN) use case is used for testing mobile topologies and mobility from one base station to another alongside with handovers and policies.

There is a lot of debating when it comes to Central Office Re-architected as a Data center (CORD) and how it is going to be more efficient. The Mobile CORD (MCORD) is the corresponding CORD case for mobile networks.

POX is a SDN controller, which also offers several fundamental benefits. As every SDN controller, it enables users to insert and run their own applications into the controller.

Although, the controllers' capabilities have been investigated thoroughly, there are not many studies regarding the advantages of these controllers in education, also there are not known studies comparing these two controllers. In this study, authors gather the most important studies of SDN and NFV, also compare and contrast the usages of ONOS and POX. The vRouter (Virtual Router), IPRAN and MCORD use cases of the ONOS controller are tested. Several important conclusions are drawn when it comes to ONOS functionality and testing capabilities. The same topologies are also introduced into POX. Important conclusions are drawn concerning the POX controller. Both controllers' outcomes are examined, the controllers are compared and contrasted and results when it comes to the applications of each one in education are summarized. This study does not contain experiments regarding other applications of these controllers.

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