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SoftAir: A software defined networking architecture for 5G wireless systems

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ABSTRACT

One of the main building blocks and major challenges for 5G cellular systems is the design of flexible network architectures which can be realized by the software defined networking paradigm. Existing commercial cellular systems rely on closed and inflexible hardware-based architectures both at the radio frontend and in the core network. These problems significantly delay the adoption and deployment of new standards, impose significant challenges in implementing and innovation of new techniques to maximize the network capacity and accordingly the coverage, and prevent provisioning of truly- differentiated services which are able to adapt to growing and uneven and highly variable traffic patterns. In this paper, a new software-defined architecture, called SoftAir, for next generation (5G) wireless systems, is introduced. Specifically, the novel ideas of network function cloudification and network virtualization are exploited to provide a scalable, flexible and resilient network architecture. Moreover, the essential enabling technologies to support and manage the proposed architecture are discussed in details, including fine-grained base station decomposition, seamless incorporation of Openflow, mobility- aware control traffic balancing, resource-efficient network virtualization, and distributed and collaborative traffic classification. Furthermore, the major benefits of SoftAir architecture with its enabling technologies are showcased by introducing software- defined traffic engineering solutions. The challenging issues for realizing SoftAir are also discussed in details.

1. Introduction

Existing commercial wireless networks are inherently hardware-based and rely on closed and inflexible architectural designs. Such inflexible hardware-based architectures typically lead to a 10-year cycle for a new generation of wireless networks to be standardized and deployed, impose significant challenges into adopting new wireless networking technologies to maximize the network capacity and coverage, and prevent the provision of truly-differentiated services able to adapt to increasingly growing, uneven, and highly variable traffic patterns. In particular, for 5G cellular system requirements, the ultra high capacity should have 1000-fold capacity/km^2 compared to LTE, the user-plane latency should be less than 1 ms over the radio access network, and the ultra high data rates should provide 100-fold increase in user-experienced throughput (targeting 1 Gbps experienced user throughput everywhere). The challenges faced by the current network architectures cannot be solved without a radical paradigm shift in the design of next-generation wireless networks. Hence, in this paper, we propose the utilization of Software-Defined Networking (SDN) concept for next generation (5G) wireless networks, introduce a new architecture for wireless software- defined networks, called SoftAir, and

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