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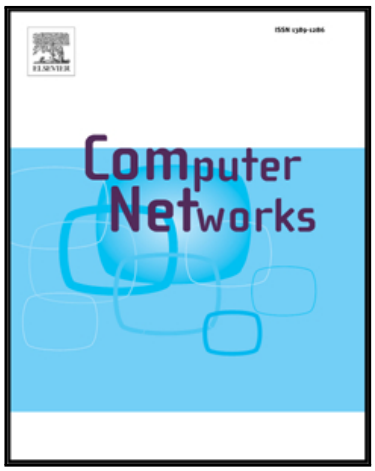

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Madhusanka Liyanage, An Braeken, Anca Delia Jurcut,
Mika Ylianttila, Andrei Gurtov

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Secure Communication Channel Architecture for Software Defined Mobile Networks

Madhusanka Liyanage[a], An Braeken[b], Anca Delia Jurcut[c], Mika Ylianttila[d], Andrei Gurtov[e]

[a]*Centre for Wireless Communications, University of Oulu, Finland.*
[b]*INDI and ETRO Department, Vrije Universiteit Brussel, Belgium.*
[c]*Department of Computer Science, University College Dublin, Ireland.*
[d]*Centre for Wireless Communications, University of Oulu, Finland.*
[e]*Department of Computer and Information Science, Linkping University, Sweden and ITMO University, Russia.*

Abstract

A Software-Defined Mobile Network (SDMN) architecture is proposed to enhance the performance, flexibility, and scalability of today's telecommunication networks. However, SDMN features such as centralized controlling, network programmability, and virtualization introduce new security challenges to telecommunication networks. In this article, we present security challenges related to SDMN communication channels (i.e., control and data channel) and propose a novel secure communication channel architecture based on Host Identity Protocol (HIP). IPsec tunneling and security gateways are widely utilized in present-day mobile networks to secure backhaul communication channels. However, the utilization of legacy IPsec mechanisms in SDMNs is challenging due to limitations such as distributed control, lack of visibility, and limited scalability. The proposed architecture also utilizes IPsec tunnels to secure the SDMN communication channels by eliminating these limitations. The proposed architecture is implemented in a testbed and we analyzed its security features. The performance penalty of security due to the proposed security mechanisms is measured on both control and data channels.

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Keywords:
SDN, NFV, 5G, Telecommunication, Security, Mobile Networks, IPsec, HIP, OpenFlow

1. Introduction

The next generation of mobile networks should support a rich set of network services such as VoIP (Voice over IP), High-Definition (HD) video streaming, gigabit broadband connectivity, mobile cloud services and online gaming. As a result, the mobile traffic usage is drastically growing regardless of the limited radio bandwidth. However, the legacy mobile networks are inflexible, costly and complex to upgrade in order to satisfy this demand [1].

Therefore, mobile network operators adopt innovative technologies to overcome above limitations. On these grounds, Software-Defined Networking (SDN) and Network Function Virtualization (NFV) are identified as promising technologies to solve the existing limitations in legacy mobile networks. The adaptation of SDN concepts is directing the current mobile network towards a flow centric model that employs inexpensive hardware and a centralized controller. Basically, it offers three new features: logically centralized intelligence, programmability and

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