Chapter 3

IP-Based Virtual Private Network Implementations in Future Cellular Networks

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ABSTRACT

Virtual Private Network (VPN) services are widely used in the present corporate world to securely interconnect geographically distributed private network segments through unsecure public networks. Among various VPN techniques, Internet Protocol (IP)-based VPN services are dominating due to the ubiquitous use of IP-based provider networks and the Internet. Over last few decades, the usage of cellular/mobile networks has increased enormously due to the rapid increment of the number of mobile subscribers and the evolution of telecommunication technologies. Furthermore, cellular network-based broadband services are able to provide the same set of network services as wired Internet services. Thus, mobile broadband services are also becoming popular among corporate customers. Hence, the usage of mobile broadband services in corporate networks demands to implement various broadband services on top of mobile networks, including VPN services. On the other hand, the all-IP-based mobile network architecture, which is proposed for beyond-LTE (Long Term Evolution) networks, is fuel to adapt IP-based VPN services in to cellular networks. This chapter is focused on identifying high-level use cases and scenarios where IP-based VPN services can be implemented on top of cellular networks. Furthermore, the authors predict the future involvement of IP-based VPNs in beyond-LTE cellular networks.

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INTRODUCTION

Global marketing strategies increase abilities of a firm to conduct its business in various locations across the world. However, the secure communication among these sites is also mandatory to perform a smooth operation of the organization. Many firms use advance communication services such as VPN services to interconnect these geographically distributed branches to headquarters. A VPN service is the first choice of many organizations since it is the most prominent communication methodology to provide a secure inter-site connectivity.

The notion of VPN or Virtual Network (VN) services has been around for last four decades which is almost the same as the life span of data networks. The usage of VPN services is constantly improving due to various factors. Primarily, the implementation cost of VPNs is drastically decreasing with the use of low cost network equipments and communication devices. Furthermore, the competition between different network service providers causes to reduce subscription fee for a VPN service. On the other hand, the technological advancement of VPN technologies in terms of enhanced security, high speed connectivity and high reliability are motivating many organizations to use VPN based services.

The usage of mobile network based broadband services has drastically increased over the past few years. The number of mobile subscribers is increasing rapidly and the total mobile broadband traffic volume is growing faster than the fixed Internet traffic. Furthermore, the steady development in telecommunication techniques causes to provide almost the same level of broadband services as fixed Internet in terms of bandwidth, reliability and Quality of Service (QoS). The recent surveys showed that the number of worldwide mobile broadband subscribers has already exceeded the number of fixed broadband subscribers (Cisco, 2010). Moreover, a telecommunication network is able to provide anytime anywhere broadband connectivity regardless of the mobility pattern or the location of the subscriber. This is the most prominent advantage of a mobile broadband service. For instance, many organizations often have “road warriors” who equip with portable computing devices such as laptops, smart phones and various tablet devices. These road warriors need to work from anywhere without being physically present in the office. The integration of virtual networks and mobile broadband services is a promising solution to provide efficient and secure connectivity for these road warriors. Furthermore, there are large numbers of mobile network operators than fixed network service operators. Thus, the competition among the mobile network operators is very high and it drastically decreases the mobile broadband charges. These facts fuel corporate customers to choose mobile broadband over wired network services.

The LTE specification introduces all-IP network architecture and beyond LTE networks will operate on top of IP infrastructures. Thus, we focus only on IP VPNs in this chapter. We present high level use cases and scenarios of IP based VPN services which are implemented on top of cellular networks.

VIRTUAL PRIVATE NETWORK

A virtual network is a communication network which contains virtual network links. In other terms, it is a collection of virtual links which are established on top of a physical network. These virtual links are implemented by using methods of network virtualization and they are transparent to end users.

There are two commonly used methods of network virtualization; namely protocol based virtual networks and virtual device based virtual networks (Metz, 2003). However, protocol based virtual networks are easy to implement and globally ubiquitous than virtual device based virtual networks. For instance, VPNs, VLANs (Virtual Local Area Networks), VPLSs (Virtual Private