Chapter 12
Host Identity Protocol: The Enabler of Advanced Mobility Management Schemes

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ABSTRACT

This chapter is committed to give a comprehensive overview of the Host Identity Protocol (HIP), to introduce the basic ideas and the main paradigms behind it, and to show how HIP emerges from the list of potential alternatives with its wide range of possible usability in next generation mobile architectures. The broad scale of feasible advanced mobility management proposals and scenarios, together with the promising mobility management capabilities of HIP and its cryptographic identifier/locator separation technique, will be introduced based on an exhaustive survey of existing mobility solutions designed for the Host Identity Protocol. This broad and up-to-date outline of advanced HIP-based mobility supporting schemes will guide the readers from the basics of HIP through the protocol’s main functions to its complex feature set and power to create a novel Internet architecture for future mobility-centric communications.

INTRODUCTION

Actual trends in mobile telecommunication show rapid growth of Internet related applications, and ever-growing demand for them. The phenomenon of convergence in means of communication protocols, services, and terminals accelerates this process: mobile applications are able to become more and more popular; users are willing to access Internet resources from their portable devices seamlessly, anytime and anywhere. The continuously growing number of mobile users generates an increasing demand for more widespread and more sophisticated support of mobility, such as...
creating serious challenges for today's Internet architecture, which is the TCP/IP stack.

The Internet Protocol (IP) itself was designed in the 1970's, when all hosts of the early Internet were connected using wires: they were fixed hosts, not able to change their network point of attachment. That is why the basics of TCP/IP systems were not designed with any kind of mobility in mind. However, nowadays users are much rarely interconnected by wires: a remarkable mass of modern Internet devices are mobile and thus require the support of frequent changes in their network point of attachments. The shortcomings, which make this support hard to provide, come from the early days of the Internet. The most important one is the double role of IP addresses. On one hand, an IP address identifies the host on the global network: all communication sessions initiated from or terminated at a given terminal is identified by its IP address. On the other hand, IP addresses have a topological locator role too: a special network identifier belongs to IP addresses telling the position of the node on the Internet. In other words IP addresses have dual significance (i.e., being identifier and locator at the same time), thus becoming semantically overloaded. These two roles make things complicated and inconvenient when the host starts to move: if the node changes its network point of attachment (and thus its IP address), active communication sessions (which are mostly connected to the TCP/IP numbers) are interrupted and even lost in many cases. Obviously, users want ubiquitous connection with seamless handovers and uninterrupted sessions, so engineers started to find an answer here.

One of the many solutions for the above-mentioned problem is a brand new protocol, which is called Host Identity Protocol (Moskowitz & Ni- kander, Host Identity Protocol (HIP) Architecture, 2006). HIP is a novel approach, which decouples IP addresses from applications by proposing a new, cryptographic namespace to identify hosts or other network entities while IP addresses will remain to act as pure locators. In this architecture, separation of identifier and locator roles of IP addresses (i.e., ID/Loc split) is provided: transport level connections are no more bound to IP addresses but to permanent identifiers, which remain the same for quite a long time. Therefore, HIP provides sophisticated and secure mobility/multihoming support, and creates a powerful toolset as the basis of several advanced mobility management schemes and extensions.

The rest of this chapter is organized as follows. The next section gives a general overview of the ID/Loc splitting paradigm together with the introduction of Host Identity Protocol, its fundamentals and main instruments. Some alternatives of HIP are also described here in order to present a wider view on the ID/Loc separation concept and its possible ways of implementation. This is followed by the discussion of HIP’s built-in mobility/multihoming support and the introduction of several enhancements, improvements, and applications designed to extend the main standard with advanced capabilities in the area of mobility management. At the end of the chapter, we will discuss the expected future trends in HIP-based mobile telecommunication and present our concluding remarks.

BACKGROUND

Current IP networks are based on two basic kinds of namespaces. On one hand, there are human readable domain names, which can be resolved to IP addresses by Internet applications via Domain Name System (DNS) lookups. DNS provides fast queries but it is not designed for fast updates and quick retrieval of dynamic information. On the other hand, there are IP addresses used in the network layer as locator (Loc) for packet routing purposes and also used as identifier (ID) in upper layers to refer to the host or a particular communication session. The inseparable bond between the locator and identifier functions of IP address makes it inconvenient or even impos-
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