Chapter 18

SCTP:
Solution for Transport Layer
Mobility and Multihoming

Árpád Huszák
Budapest University of Technology and Economics, Hungary

Sándor Imre
Budapest University of Technology and Economics, Hungary

ABSTRACT

Numerous protocols were introduced in the transport layer, which can be very different depending on the provided services. Beside the traditional TCP and UDP, new transport protocols (SCTP, DCCP) have appeared in recent years to overcome limitations of the conventional protocols. The unique features of SCTP like multihoming and multistreaming make this protocol very attractive for reliable data delivery of streams, even in a mobile environment. It can be also used for applications where monitoring and detection of loss is required. SCTP is the only transport protocol that is able to manage mobility issues and handle handovers in the transport layer. The multihoming feature allows an endpoint of a SCTP association to be mapped to multiple IP addresses, and change the delivery path according to the link conditions. The handover process is hardly influenced by several protocol parameters that can be adjusted by the user. The effects of different protocol settings are investigated in details in this chapter. We have studied the performance of multihomed SCTP hosts through experimental studies in an integrated heterogeneous environment. SCTP will also play a significant role in future LTE–EPS architecture, because it can also be used for core network signaling purposes, not just for user data delivery.
INTRODUCTION

The transport layer is a crucial part of the ISO/OSI reference model, as well as the TCP/IP protocol stack. Different transport layer protocols were already introduced, which can be very diverse depending on the provided services. The responsibilities of the transport protocols include end-to-end message transfer capabilities independent of the underlying network, along with error control, segmentation, flow control, congestion control, and application addressing (port numbers). In order to select the most appropriate protocol to effectively fulfill the users’ requirements, the properties and characteristics of the different transport protocols must be studied. For delay-sensitive multimedia applications and fast protocols are recommended, while for reliable data transfer, the information must be delivered ordered and without any error.

In the next-generation mobile network, the need for mobility management even in the transport layer has been revealed. Mobility is becoming increasingly popular for Internet users; however, the developers of the early network protocols did not consider this possibility. For the next-generation Internet, one of the most essential requirements is to make roaming possible without losing the connection between the corresponding hosts. Anywhere, anytime communications is an indispensable need in the future networks. Moreover, with the extensive growth of the Internet and mobile/wireless systems, the user demand for high-speed data access caused the introduction of many different kinds of access technologies. Therefore, future telecommunication architectures could easily appear as an integration of multiple wireless access technologies (e.g., Bluetooth, UMTS, WLAN, WiMAX, etc.). Mobile hosts equipped with multiple network interfaces can be connected to the Internet via different ISPs. Failures in one network cannot easily break ongoing communication sessions if hosts are capable of switching over to another connection. Moreover, if both connections are active at once, but higher packet loss and delay is experienced on one path, multihoming capabilities can be used to hand over current sessions to the connection offering better values of Quality of Service (QoS) parameters.

Mobility and multihoming support can be provided in different layers of the ISO/OSI architecture (Ratola, M., 2004; Eddy, W. M., 2004). Mobile IP (Johnson, D & Perkins, C. & Arkko, J., 2004) with Multiple Care-of Addresses (MCoA) (R. Wakikawa et al., 2007) extension is a layer 3 solution, while several proposals exist also in the transport (Stewart, R., 2007) and even in the application layer (Rosenberg, J et al., 2002). Novel solutions for mobility handling based on HIP (Host Identity Protocol) were also appeared in the recent years (Bokor, L. et al., 2007; Bokor, L., et al., 2009).

In this chapter, we introduce SCTP and its unique multihoming and multistreaming features implemented in the transport layer. The most well known transport protocols are the TCP (Transmission Control Protocol) (Postel, J., 1981) and UDP (User Datagram Protocol) (Postel, J., 1980) standardized in the early years of the Internet age. In the last decade, new protocols were investigated with enhanced features. SCTP is one of these protocols, which uniquely provides multihoming and multistreaming. With multihoming capabilities, SCTP is the only transport layer protocol, which can be utilized in mobile networks, where the hosts are continuously changing their access points to the network.

In this chapter, we focus on SCTP and its multihoming and multistreaming performance over heterogeneous IP networks. We used a native IPv6 UMTS–WLAN environment to analyze the behavior of the protocol from mobility point of view. Building our SCTP testbed based on a native IPv6 architecture resides in the fact that IP is considered as the best solution to integrate heterogeneous wireless access networks, and IPv6 will actually be the main networking protocol of the next generation Internet. In order to study