

Chapter 7

Routing Optimization for Inter-Domain Traffic Engineering under Identifier Network

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ABSTRACT

The routing architecture of today's Internet is facing scalability problems. Multi-homing, traffic engineering, suboptimal address allocations are making the Forwarding Information Base (FIB) of the Default Free Zone (DFZ) growing at a nonlinear rate. Such scalability problems are mainly caused by the overloading of the IP address semantics. That is, an IP address represents not only the location but also the identity of a host. To address the scalability problem, Identifier Network, as a novel proposed network architecture, separates the identifier and locator roles of IP addresses into two evolving spaces: Accessing Identifier (AID) and Routing Identifier (RID) by Identifier/Locator separation mechanism. Such separation provides opportunities to reconsider routing optimization for inter-domain Traffic Engineering, as which is a main contribution to the Border Gateway Protocol (BGP) routing table growth.

Based on Identifier Network, we propose a solution for traffic engineering, which can be divided into two distinct parts: End-to-End traffic engineering and Neighbor-to-Neighbor traffic engineering. For each scenario, we develop a routing decision method for both routers and other network entities, such as IDMS (Identifier Mapping Server in Identifier Network). To analyze the feasibility of the solution, we collect Routeviews data set and the results show that the scheme proposed could reduce the burden of the core routing table.

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INTRODUCTION

With the rapid development of Internet, today's Internet has become the center of the global information, resource, application and service. However, the Internet is facing serious scaling problems (Xiaoliang, 2010; Meyer, 2007). In 2007, there were about 200,000 IP address prefixes in the routing tables of the core Internet Routers (Huston, 2012). Until 2012, the routing entries have exceeded 400,000 prefixes for IPv4 and almost 11,000 prefixes for IPv6, and the global routing table size has experienced an increase in a nonlinear rate (Huston, 2012; Elmokashfi, 2010). Regarding the working report of Internet Assigned Numbers Authority (IANA) (Meyer, 2007), the reasons contributing to the fast explosion of the global routing table mainly include the following: multi-homing, inbound Traffic Engineering (TE), non-aggregated address allocations (a big portion of which is inherited from historical allocations), and business events such as mergers and acquisitions.

To address this routing scalability problem, many organizations including IETF (Internet Engineering Task Force) LISP (Locator/ID Separation Protocol) Working Group (LISP, 2012) and IRTF (Internet Research Task Force) RRG (Routing Research Group) (RRG, 2012) have discussed the idea of separating the node's identity from its topological location. Identifier Network, as a novel ID/Loc (Identifier/Locator) separation architecture, separates the identifier and locator roles of IP addresses into two evolving spaces: Accessing Identifier (AID) and Routing Identifier (RID).

The AID indicates a host's identity and is applied in the transport and application layers, whereas the RID indicates the current topological location of a host and is used in the network layer. In addition, Access Router (AR) deploys on the edge of the core network and provides the mapping functionalities between the AID and RID.

The ID/Loc separation solution not only can reduce the routing table size in the Default Free Zone (DFZ) (Quoitin, 2007) and natively support mobility (Zhang, 2009; Luo, 2011), but also provides promising opportunities to reconsider routing optimization for inter-domain (inbound) traffic engineering.

In this chapter, we propose a solution for implementing Traffic Engineering in Identifier Network. The method contains two distinct parts: End-to-End traffic engineering and Neighbor-to-Neighbor traffic engineering. For each scenario, we develop a routing decision scheme for both routers and other network entities, such as IDMS (Identifier Mapping Server in Identifier Network) (Luo, 2011). The aim of both the above proposed solutions is to reduce the burden of the core routing tables.

In Identifier Network, the routers in the core network do not need to maintain the AID information, which reduces the burden of the routing in the core network. In addition, the RID would be allocated in a manner strictly conforming to the topology of the core network in the proposed TE solution of Identifier Network, and the allocation result would be stored in the mapping system, so any arbitrary deaggregation of the RID space is not allowed. Using Routeviews data set, we analyze the burden of the core routing table.

The rest of the chapter is organized as follows: we first review the related works. Then, we give an overview of Identifier Network including the architecture, the design principles, work procedures, current deployment and its benefits. Next, we introduce the design of traffic engineering under separation and mapping mechanism and describe the details of protocol design regarding relative situation. After that, we analyze the feasibility of the solution and provide the results in term of reducing the burden of the core routing table. Finally, we discuss the trends of Identifier Network in the future. The last section concludes this chapter.

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