An Empirical Evaluation of a Shim6 Implementation

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Abstract. Several solutions are proposed to enable scalable multihoming over IPv6. One of these proposals is Shim6, a host-based multihoming solution based on the modification of the Internet Protocol stack of the host. This modification adds a layer below the transport protocols but above the forwarding layer. As this approach makes the modifications to the network stack transparent, existing applications automatically benefit from Shim6 functionality.

In this paper we investigated aspects of the performance of the LinShim6 implementation from Université Catholique de Louvain. We also outline our modifications of the LinShim6 implementation to allow external software to control the locators used between hosts.

Keywords: Shim6, multihoming, ECN.

1 Introduction

For a number of years now, the IETF has been working on IPv6, a successor to IPv4. More recently, work has been done to address the scalability of the current internet architecture. The Internet Architecture Board (IAB) has identified several limitations of the current internet architecture[1]. These issues impact the scalability of inter-domain routing systems, which is reflected in the growth of Border Gateway Protocol (BGP)[2] routing tables, and also in the number of routes in the Default Free Zone (DFZ) Routing Information Base (RIB) processed by BGP routers. Several factors which influence the growth of BGP routing tables include, multihoming, traffic engineering, IP address allocation policy, and business events, such as large mergers and acquisitions. All of these factors can lead to an increased number of unique routing prefixes that cannot be aggregated within the DFZ RIB and hence cause routing table growth.

Several years ago, after examining the multihoming issue[3], the IETF chartered the Site Multihoming by IPv6 Intermediation (Shim6) working group to develop a host-based IPv6 multihoming solution, [4] presents a good overview of the requirements, constraints, and the process that led to the emergence of
Shim6 as a multihoming solution. The Shim6 specification documents are now published [5,6,7], and in this paper we report on our experiences with Université Catholique de Louvain’s (UCL) publicly available Shim6 implementation LinShim6 [8,9] for the Linux kernel.

This paper is organised as follows: Section 2 provides a brief description of the capabilities of Shim6 for the benefit of those readers unfamiliar with the protocol. Section 3 describes both our overall goal and experiences in creating a Shim6 testbed. Section 4 presents the baseline performance measurements, with a brief description of the results. In closing, section 5 discusses the work presented here within the broader context of the EU FP7 EFIPSANS [1] research project.

2 Shim6 Host-Based IPv6 Multihoming

The Shim6 protocol [6], has been designed to add multihoming capabilities to IPv6 end-hosts. Potentially, this allows for far more IPv6 enabled sites to protect their upstream connections, without having to go to the trouble of implementing BGP peering. This means that entities can retain control within their own site without incurring the overhead of deploying BGP.

Along with the Shim6 protocol, the IETF Site Multihoming by IPv6 Intermediation (Shim6) working group designed a failure detection and repair mechanism, called the REAchability protocol (REAP) [7] which allows hosts to detect and recover from failures.

Today, in the current (IPv4) Internet, a multihomed site is obliged to have a network connection with each of its upstream providers, and the site has to use IP addresses independent from those providers. These addresses come from what is called Provider Independent or PI address space (as opposed to Provider Aggregatable (PA) address space).

With Shim6 however, multihoming functionality is made available to the end host using Provider Aggregatable addresses — removing the need to involve BGP or any other protocol. At present, the default IPv6 address selection algorithm [10] defines how the address pair for a communication session is selected, this address pair does not change for the duration of the session. Shim6 offers the ability to change the address pair used (and thus the path) during the session, transparent to the application. The Shim6 approach uses routable IP addresses (locators) as the identifiers visible to the transport layer. This also provides the facility to change the locator pair in use should REAP detect that the currently used pair of addresses (or interfaces) between two communication nodes has failed. REAP will search for a working pair of locators and pick another working pair (if available) when this occurs [7]. This change is performed at the network layer, which means that applications and transport protocols do not need any changes to benefit from this new capability.

[1] Exposing the Features in IP version Six protocols that can be exploited/extended for the purposes of designing/building Autonomic Networks and Services.