Benchmarking Methodology for IPv6 Transition Technologies

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Draft overview

- RFC2544[1] and RFC5180[2] address both IPv4 and IPv6 performance benchmarking, but IPv6 transition technologies are outside their scope
- This draft provides complementary guidelines for evaluating the performance of IPv6 transition technologies
  - generic classification on IPv6 transition technologies → associated test setups
  - calculation formula for the maximum frame rate according to the *frame size overhead*
- Includes a tentative metric for benchmarking scalability
  - scalability as *performance degradation* under the stress of *multiple network flows*
- Proposes supplementary benchmarking tests for *stateful* IPv6 transition technologies in accordance with RFC3511[3]

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[1] S. Bradner and J. McQuaid. *Benchmarking Methodology for Network Interconnect Devices*. United States, 1999.

[2] A. Hamza C. Popoviciu, G. Van de Velde, and D. Dugatkin. *IPv6 Benchmarking Methodology for Network Interconnect Devices*. RFC 5180. Internet Engineering Task Force, 2008.

[3] B. Hickman et al. *Benchmarking Methodology for Firewall Performance*. RFC 3511 (Informational). Internet Engineering Task Force, Apr. 2003. URL: http://www.ietf.org/rfc/rfc3511.txt.

Update overview

- Added supplementary benchmarking tests for *stateful* IPv6 transition technologies in accordance with RFC3511
- additional tests to distinguish $6 \rightarrow 4$ vs. $4 \rightarrow 6$ translation performance
- recommended **UDP** traffic for Section 6 benchmarks (Throughput, Latency, Frame loss rate, Back-to-back Frames, System recovery) and **TCP** traffic for Section 7 benchmarks (Concurrent TCP Connection Capacity, Maximum TCP Connection Establishment Rate)
- recommended a **m:n** test setup to evaluate the scalability of encapsulation-based transition tech
- added *MTU* and *routing* recommendations
- specified multicast performance is outside the scope of the document

Update: Stateful vs Stateless

- generic definition of *stateful* IPv6 transition technologies in Section 1.1: technologies which create dynamic correlations between IP addreesses or {IP address, transport protocol, transport port number} tuples, which are stored in a state table.
- Added Section 7. Additional Benchmarking Tests for Stateful IPv6 Transition Technologies (in accordance with RFC3511)
  - **Concurrent TCP Connection Capacity**
    Objective: To determine the maximum number of concurrent TCP connections supported through or with the DUT
  - **Maximum TCP Connection Establishment Rate**
    Objective: To determine the maximum TCP connection establishment rate through or with the DUT

[4] **following the comments from Kaname Nishizuka**.

UPDATE: 6 $\rightarrow$ 4 VS. 4 $\rightarrow$ 6 TRANSLATION

Text added to Section 3.2:

In the case of translation based transition technology, the DUT CE and DUT PE machines MAY be tested separately as well. These tests can represent a fine grain performance analysis of the IPvX to IPvY translation direction versus the IPvY to IPvX translation direction. The tests SHOULD follow the test setup presented in Figure 1.

[5] **following the comments from Scott Bradner**.

Update: Traffic recommendations

Text added to Section 4.3:

Because of the simplicity of UDP, UDP measurements offer a more reliable basis for comparison than other transport layer protocols. Consequently, for the benchmarking tests described in Section 6 of this document UDP traffic SHOULD be employed.
Considering that the stateful transition technologies need to manage the state table for each connection, a connection-oriented transport layer protocol needs to be used with the test traffic. Consequently, TCP traffic SHOULD be employed for the tests described in Section 7 of this document.

[6] **following the comments from Al Morton; Scott Bradner and Andrew McGregor**.

Update: CE Scalability

Text added to Section 8.1:

This test setup can help to quantify the scalability of the PE device. However, for testing the scalability of the DUT CEs additional setups are needed. For encapsulation based transition technologies a m:n setup can be created, where m is the number of flows applied to the same CE device and n the number of CE devices connected to the same PE device. For the translation based transition technologies the CE devices can be separately tested with n network flows using the test setup presented in Figure 3.

[7] **following the comments from Andrew McGregor**.

UPDATE: MTU AND ROUTING RECOMMENDATIONS

Text added to Section 4.1:

In the context of frame size overhead MTU recommendations are needed in order to avoid frame loss due to MTU mismatch between the virtual encapsulation/translation interfaces and the physical network interface controllers (NICs). To avoid this situation, the larger MTU between the physical NICs and virtual encapsulation/translation interfaces SHOULD be set for all interfaces of the DUT and tester.

Text added to Section 3:

For the simple test setups described in the next two subsections, static routing MAY be employed. However, for more complex test setups (e.g. scalability testing setup) dynamic routing is a more reasonable choice. However, the presence of routing and management frames can represent unwanted background data that can affect the benchmarking result. To that end, the procedures defined in [RFC2544] (Sections 11.2 and 11.3) related to routing and management frames SHOULD be used here as well.

[8] **following the comments from Bhuvan Vengainathan**.

Comments not covered yet

- The comment from Nalini Elkins related to DNS resolution
  - Considering a DNS Resolution Performance metric: *Number of processed DNS requests/sec*
- The comments about *Jitter* (Delay variation) from Bhuvan Vengainathan and Al Morton
  - Considering adding a Delay variation metric to Section 6
- Suggestions are welcome

NEXT STEPS

- Propose solutions for *DNS Resolution Performance* and *Delay Variation* metrics
- Continue the revisions

⋆ Questions for BMWG:

- Were the comments covered well enough?
- Is the draft ready for adoption ?

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