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Recommended Usage of IPv6 PDM Option
draft-elkins-v6ops-ipv6-pdm-recommended-usage-00

Abstract

For a number of Enterprise Data Center Operators (EDCO) both real-time and after the fact problem resolution is critical. Two metrics are critical for timely end-to-end problem resolution, without impacting an operational production network. They are: packet sequence number and packet timestamp. Packet sequence number is required for diagnostics. Packet timestamp is required to calculate end-to-end response time. Current methods are inadequate for these purposes because they assume unreasonable access to intermediate devices, are cost prohibitive, require infeasible changes to a running production network, or do not provide timely data. This document details the recommended usage for the IPv6 Performance and Diagnostic Metrics Destination Option (PDM).

http://www.ietf.org/1id-abstracts.html

The list of Internet-Draft Shadow Directories can be accessed at http://www.ietf.org/shadow.html

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Table of Contents

1 Introduction

For a number of Enterprise Data Center Operators (EDCO) both real-time and after the fact problem resolution is critical. Two metrics are critical for timely end-to-end problem resolution, without impacting an operational production network. They are: packet sequence number and packet timestamp. Packet sequence number is required for diagnostics. Packet timestamp is required to calculate end-to-end response time.

This document details the recommended usage of the packet sequence number and packet timestamp which are a part of the IPv6 Performance and Diagnostic Metrics destination option (PDM).

For background, please see Draft-Elkins-6MAN-IPv6-PDM-Dest-Option-00 [PDMELK], Draft-Elkins-Packet-Sequence-Number-Needed-00 [PSNELK], and Draft-Elkins-End-To-End-Response-Time-00 [RSPELK]. These drafts are companion documents to this document. All four documents should be read together.

As discussed in the above Internet Drafts, current methods are inadequate for these purposes because they assume unreasonable access to intermediate devices, are cost prohibitive, require infeasible changes to a running production network, or do not provide timely data. The IPv6 Performance and Diagnostic Metrics destination option (PDM) provides a solution to these problems. This document will discuss how best to use the PDM.

2 How to use Packet Sequence Number

In many large Enterprise Networks, during network diagnostics of an end-to-end connection, it becomes necessary to find the device along

the path creating problems. Diagnostic data may be collected at multiple places along the path (if possible), or at the source and destination. Then, the diagnostic data must be matched. Packet sequence number is critical in this matching process. In IPv4 networks, the IPID field was used as a DeFacto sequence number. This was discussed at length in Draft-Elkins-Packet-Sequence-Number-Needed-00 [PSNELK].

The packet sequence number provided in the PDM may be used in large multi-tier networks to see where the packet loss or packet corruption is happening. Multi-tier networks are those which have multiple routers or switches on the path between the sender and the receiver.

2.1 Limitations of Packet Capture

As discussed in Draft-Elkins-Packet-Sequence-Number-Needed-00 [PSNELK], the only instrumentation which provides enough detail to diagnose end-to-end problems is a packet trace Even though packets are the only reliable way to provide data at the needed granularity, there are limitations in operations on live production networks. How packet sequence number can alleviate the limitations are detailed below the problem description.

2.1.1 Problem Scenario 1

1. Packets are captured for analysis at places like large core switches. All packets are kept. Again, not necessarily for diagnostic reasons but for regulatory. (Ex. Records of all stock trades may need to be kept for a certain number of years.)

2. When there is a problem, an analyst extracts the needed information.

3. If the extract is done incorrectly, as often happens, or the packet capture itself is incorrect, then there are false duplicate packets which can be quite misleading and can lead to wrong conclusions. Are these real TCP duplicates? Is there congestion on the subnet? Are these retransmissions? Situations have been seen

where routers incorrectly send two packets instead of one - is this such a situation?

2.1.2 Problem Scenario 2

Packet captures can be misleading for another.

1. In this scenario, packets are captured for analysis at places like a middleware box. The reason this is done is because problems are suspected with the box itself.

2. The box may not offer any way to tailor the packet capture. "You will get what we give you, how we give it to you!" is their philosophy,

3. The packet capture incorrectly duplicates only packets going to certain nodes. So, it is not possible to devise an algorithm or pattern whereby certain packets can be ignored

4. Again, there are false duplicate packets which can be misleading and can lead to wrong conclusions. Are these real TCP duplicates? Is there congestion on the subnet? Situations have been seen where routers incorrectly send two packets instead of one - is this such a situation?

2.1.3 Packet Sequence Number Provides Solution

If a packet is a duplicate sent by a stack at a source host, the packet sequence number will not be the same. If a duplicate packet is seen with the same packet sequence number, it can be safely assumed that this is a 'false' duplicate and can be ignored.

2.2 Packet Sequence Number Replaces IPv4 IPID DeFacto Diagnostic Function

Draft-Elkins-Packet-Sequence-Number-Needed-00 [PSNELK] discussed a number of use cases where the IPv4 IPID reduced the time to diagnose problems on EDCO networks. The packet sequence number in the PDM will serve the same function for IPv6. The recommendation is to have the PDM used for all packets for all protocols so that timely diagnosis can occur.

3 How to use the Timestamp

The timestamp contained in the PDM traveling along with the packet will be used to calculate end-to-end response time without requiring agents in devices along the path. The need for end-to-end response time, the background and current methods are discussed in Draft-Elkins-End-To-End-Response-Time-00 [RSPELK].

3.1 Time Synchronization

The timestamp used in the PDM is compatible with the Network Time Protocol (NTP) [RFC5905]. Many EDCO networks use NTP pervasively today. We recommend use of NTP so that the matching of timestamps and calculations of deltas can be easily done.

3.2 Response Time for Service Level Agreements

In EDCO Networks, end-to-end response times are a critical component of Service Levels Agreements (SLAs). So, the recommended use of the PDM is to have it turned on for all applications which require SLAs and / or have a requirement for timely transmission.

3.3 Trending

In addition to the need for tracking current service, end-to-end response time is valuable for capacity planning. By tracking response times, and identifying trends, it becomes possible to determine when network capacity is being approached. To allow tracking of trends in response time, we recommend having the PDM used

for applications which may need additional capacity so that summary data on response times and their distributions can be maintained.

4 Security Considerations

There are no security considerations.

5 IANA Considerations

There are no IANA considerations.

6 References

6.1 Normative References

[RFC5905] Mills, D., Martin, J., Ed., Burbank, J., and W. Kasch, "Network Time Protocol Version 4: Protocol and Algorithms Specification", RFC 5905, June 2010.

[PDMELK] Elkins, N., "Draft-Elkins-IPv6-PDM-Dest-Option-00", Internet Draft, May 2013.

[PSNELK] Elkins, N., "Draft-Elkins-Packet-Sequence-Number-Needed-00", Internet Draft, May 2013.

[RSPELK] Elkins, N., "Draft-Elkins-End-To-End-Response-Time-00", Internet Draft, May 2013

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