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Shaofu. Peng  
ZTE Corporation  
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**Delay Options**  
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Abstract

This document introduces new IPv6 options for HBH or DOH Options header, to carry delay related information for deterministic forwarding.

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**1. Introduction**

[RFC8655] describes the architecture of deterministic network and defines the QoS goals of deterministic forwarding: Minimum and maximum end-to-end latency from source to destination, timely delivery, and bounded jitter (packet delay variation); packet loss ratio under various assumptions as to the operational states of the nodes and links; an upper bound on out-of-order packet delivery. In order to achieve these goals, deterministic networks use resource reservation, explicit routing, service protection and other means. In general, a deterministic path is a strictly explicit path calculated by a centralized controller, and resources are reserved on the nodes along the path.

To provide deterministic forwarding service, the scheduling mechanisms applied in the network generally require application flows to comply with predefine constraints, such as a token bucket specification consisting of a "token rate"  $r$  and a "bucket size"  $b$ . This can be achieved by configuring regulators with parameter  $(r, b)$  and states per flow on each node, however, the cost is too high. Another more feasible way is to carry the states in the packet, and the scheduling mechanism automatically regulate and sorts the packet based on the states read from the packet.



There are some common states that are used by multiple scheduling mechanisms. For example, the latency deviation (E) defined in [[I-D.peng-detnet-deadline-based-forwarding](#)], and the damping delay defined in [[ATS Damper](#)] or [[I-D.eckert-detnet-glb主](#)], are actually the same thing and can be considered as the latency compensation used for the forwarded path. Another example is that the endpoint damping delay defined in [[I-D.peng-detnet-policing-jitter-control](#)] can be combined with any on-time scheduling mechanisms to further avoid jitter caused by policing delay.

This document introduces new IPv6 options for HBH or DOH Options header, to carry common scheduling parameters for deterministic forwarding. Note that the motivation of the common scheduling parameters defined in this document is to be shared and used by multiple scheduling mechanisms, rather than a container that includes some different parameters.

### **1.1. Requirements Language**

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

## **2. Path Latency Deviation Option**

The path latency deviation is used to characterize the deviation between the delay budget (such as a planned residence time or estimated worst-case delay) and the actual delay of a packet at each hop. Each hop along the path can use this information to shape or sort arrived packets, to ensure that the flow conforms to predefined constraints. Examples include the latency deviation (E) defined in [[I-D.peng-detnet-deadline-based-forwarding](#)] and damping delay defined in [[ATS Damper](#)] or [[I-D.eckert-detnet-glb主](#)].

Strictly speaking, the path latency deviation should be a cumulative value, that is, it accumulates the latency deviation of all upstream nodes. If the scheduling mechanism used in the network can ensure that the path latency deviation is cleared and reset at each hop, then this cumulative value actually only includes the latency deviation generated by a single hop and updated again on the next hop.

The scope of use of the path latency deviation is the forwarded path. It is recommended to be included in HBH Options Header.

The path latency deviation option has the following format:



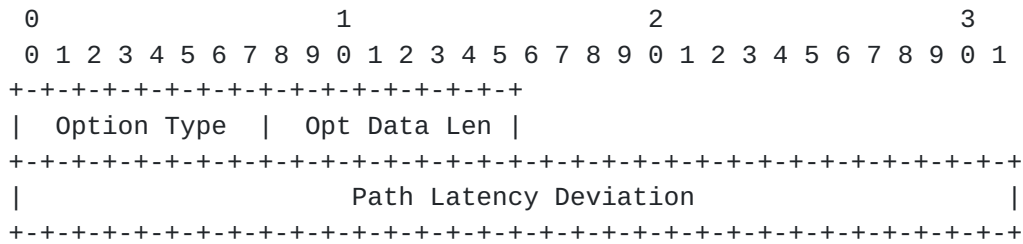


Figure 1: Path Latency Deviation Option

Option Type: 8-bit identifier of the type of option. Value TBD by IANA; the highest-order 3 bits of this field is 001 to skip over this option and continue processing the header if the processing IPv6 node does not recognize the Option Type and to permit the Option Data to be changed en route to the packet's final destination.

Opt Data Len: 8-bit unsigned integer. Length of the Option Data field of this option, in octets. It is set to 4.

Path Latency Deviation: 32-bit signed integer, represents the the deviation between delay budget and actual delay on each hop.

### 3. Endpoint Damping Delay Option

The endpoint damping delay is used to characterize the necessary holding time of the packet on the endpoint of the path, to avoid jitter caused by policing delay. Please refer to [\[I-D.peng-detnet-policing-jitter-control\]](#) for more details.

The scope of use of the endpoint damping delay is the endpoint. It is recommended to be included in DOH Options Header. Note that in the multi-domain case, each domain exit may also need to be aware of endpoint damping delay to control jitter. If so, it is recommended to place DOH before the corresponding Routing Header for each domain.

The endpoint damping delay option has the following format:

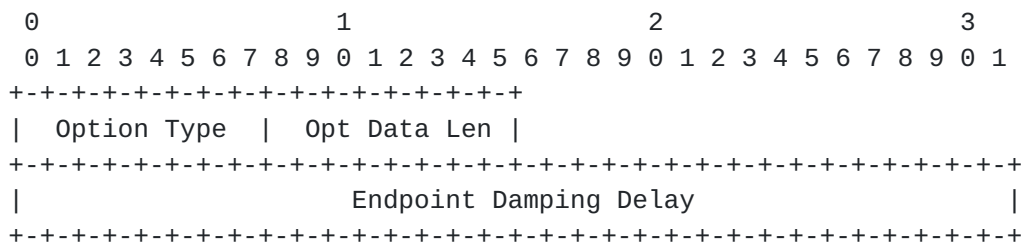


Figure 2: Endpoint Damping Delay Option



Option Type: 8-bit identifier of the type of option. Value TBD by IANA; the highest-order 3 bits of this field is 001 to skip over this option and continue processing the header if the processing IPv6 node does not recognize the Option Type and to permit the Option Data to be changed en route to the packet's final destination.

Opt Data Len: 8-bit unsigned integer. Length of the Option Data field of this option, in octets. It is set to 4.

Endpoint Damping Delay: 32-bit signed integer, represents the the holding time imposed on the endpoint before the packet is delivered to the application destination (or next domain).

**4. Process of Path Latency Deviation Option**

TBD.

**5. Process of Endpoint Damping Delay Option**

TBD.

**6. IANA Considerations**

This document updates the "Destination Options and Hop-by-Hop Options" under the "Internet Protocol Version 6 (IPv6) Parameters" registry:

Hex Value	act	chg	rest	Description	Reference
TBD1	00	1	00000	Path Latency Deviation	This document
TBD2	00	1	00000	Endpoint Damping Delay	This document

**7. Security Considerations**

TBD

**8. Acknowledgements**

TBD

**9. References**

**9.1. Normative References**





**[I-D.eckert-detnet-glbfb]**

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**[I-D.peng-detnet-deadline-based-forwarding]**

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**[ATS\_Damper]**

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Author's Address



Shaofu Peng  
ZTE Corporation  
China  
Email: peng.shaofu@zte.com.cn