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Deadline Option
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Abstract

This document introduces new IPv6 options for Hop-by-Hop Options header, to carry deadline related information for deterministic flows.

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Deadline Options

January 2022

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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 meet the SLA requirements of deterministic services.

[I-D.peng-detnet-deadline-based-forwarding] describes a deadline based forwarding mechanism to get bounded latency and jitter. A single or multiple planned deadline offset time, as well as dynamic delay budget adjustment, are used to control the packets scheduling of all nodes along the path. The offset time is based on the time when the packet enters the node and represents the maximum time allowed for the packet to stay inside the node.

This document introduces new IPv6 options for Hop-by-Hop Options header, to carry deadline related information for deterministic flows.

[1.1.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",

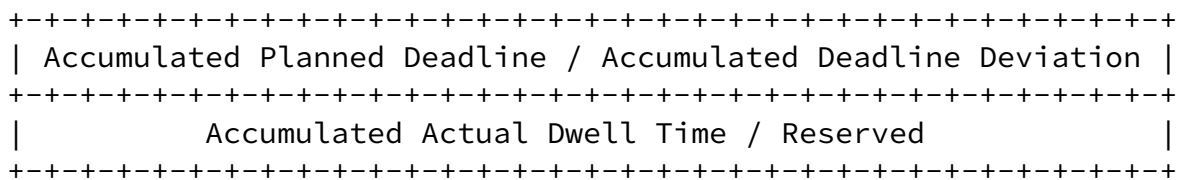


Figure 1: Deadline Option Format

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 12.

Flags: 8-bit flags. Currently D-flag is defined. If D-flag is 0, the "Accumulated Planned Deadline / Accumulated Deadline Deviation" field contains Accumulated Planned Deadline information, and "Accumulated Actual Dwell Time / Reserved" contains Accumulated Actual Dwell Time information, otherwise these fields contain Accumulated Deadline Deviation and Reserved, respectively.

Planned Deadline: 24-bit unsigned integer, represents the delay budget allowed for the packet to stay inside the received node. A single planned deadline is used for each node along the path. For multiple planned deadlines case, it is defined in future.

Accumulated Planned Deadline: 32-bit unsigned integer, represents the sum of the planned deadline of all upstream nodes before the packet is transmitted to the received node.

Accumulated Deadline Deviation: 32-bit signed integer, represents the sum of the deviation between delay budget and actual dwell time of all upstream nodes before the packet is transmitted to the received node.

Accumulated Actual Dwell Time: 32-bit unsigned integer, represents the sum of the actual dwell time of all upstream nodes before the

packet is transmitted to the received node.

Reserved: 32-bit unused.

3. Encapsulation of Deadline Options On Ingress Node

The ingress PE node, when encapsulating the deterministic service flow, can explicitly insert the deadline option into the packet according to SLA.

For a deterministic delay path based on deadline queue scheduling, the path it passes through has deterministic end-to-end delay requirements. It includes two parts, one is the accumulated node delay and the other is the accumulated link transmission delay. The end-to-end delay requirement is subtracted from the accumulated link transmission delay to obtain the accumulated node delay. A simple method is that the accumulated node delay is shared equally by each intermediate node along the path to obtain the planning deadline of each node.

Suppose that the planned deadline is D , the actual dwell time is R , then the packet sent by the ingress PE may have one of the following deadline option information:

D-flag is set to 0; Planned Deadline is set to D ; Accumulated Planned Deadline is set to D ; Accumulated Actual Dwell Time is set to R .

D-flag is set to 1; Planned Deadline is set to D ; Accumulated Deadline Deviation is set to D minus R ;

4. Operations of Deadline Options On Transit Node

The intermediate node, after receiving the packet, can obtain the planned deadline from the packet as the delay budget of this node. It need get the existing accumulated deadline deviation, and then add it to the planned deadline of this node, to obtain the deadline adjustment value, and then on the basis of the deadline adjustment value, deducting the forwarding delay of the packet in the node, the allowable queuing delay value is obtained, and then the packet will be put to the deadline queue with TTL as the above allowable queuing delay value for sending. See

[[I-D.peng-detnet-deadline-based-forwarding](#)] for more details.

If D-flag of the received packet is set to 0, the existing accumulated deadline deviation is the value of the Accumulated Planned Deadline field minus the value of the Accumulated Actual Dwell Time field.

If D-flag of the received packet is set to 1, the existing accumulated deadline deviation is directly get from the Accumulated Deadline Deviation field.

When the intermediate node continues to send the packet to the downstream node, it need update the Accumulated Planned Deadline field and the Accumulated Actual Dwell Time field, or the Accumulated Deadline Deviation field. Note that field Planned Deadline remains unchanged.

For the update of field Accumulated Planned Deadline, it can add the planned deadline of this node to this field.

For the update of field Accumulated Actual Dwell Time, it can add the actual dwell time of this node to this field. A possible method to get the actual dwell time in the node is that, the receiving and sending time of the packet can be recorded in the auxiliary data structure (note that is not packet itself) of the packet, then the

actual dwell time of the packet in the node can be calculated according to these two times.

For the update of field Accumulated Deadline Deviation, it can add the difference of the planned deadline and the actual dwell time to this field.

[5.](#) 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
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TBD	00	1	00000	Deadline Option	This document
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6. Security Considerations

TBD

7. Acknowledgements

TBD

8. Normative References

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