In-situ OAM (IOAM) in IPv6

draft-ioametal-ippm-6man-ioam-ipv6-options-01

6man

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In-situ OAM in a nutshell

- Gather telemetry and OAM information along the path within the data packet, (hence "in-situ OAM") as part of an existing/additional header
 - No extra probe-traffic (as with ping, trace, ..)
 - "Hybrid, Type-1 OAM" per RFC 7799
- Generic, Transport independent data-fields for IOAM
 - Scope: Per-hop, specific-hops only, end-to-end
 - Data fields include: Node IDs, interface IDs, timestamps, sequence numbers, ...
- Encapsulation
 - IOAM data fields can be embedded into a variety of transports, including: IPv6, SRv6, SR, NSH, GRE, Geneve, VXLAN-GPE ...
- Main work on IOAM progressed in IPPM WG



IOAM over IPv6

(draft-ioametal-ippm-6man-ioam-ipv6-options-01)

IPv6 Option format for carrying in-situ OAM data fields:

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-	-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+	-+ -+<_+	IOAM Option	IPv6 Option type	
Option Data Option Data Defined in <u>draft-ietf-ippm-ioam-data-04</u> 		 . I . O . A	Pre-allocated Tracing Option	HbH Option	
		. M . O	Incremental Tracing Option	HbH Option	
		. P . T . I . O	Proof of Transit Option	HbH Option	
		• N • 	Edge to Edge Option	Destination Option	
т-т-т-т-т-т-т-т-т-т-т-т-т-т-т-т-т-т-т-	de points requested: x Value Binary Value act chg rest	Description	ination Option		
TB	TBD_1_0 00 0 TBD_1 TOAIN Destination Option TBD_1_1 00 1 TBD_1 TOAIN HbH Option				

lssues

- 1. HbH ext header and IOAM option insertion and removal by transit nodes in a restricted administrative domain.
 - a) Dealing with PMTU– Packet size changes can exceed PMTU.
 - b) Misleading ICMP errors confusing the source.
 - c) Possible leaks that affect the forwarding behavior and state of network elements outside the domain.
- 2. To support hardware friendly tracing option Incremental Trace IOAM HbH Option: Changes Option Data Len en-route.
 - a) Dealing with PMTU– Packet size changes can exceed PMTU.
- 3. Applicability statement and scope draft in the works, incomplete at the moment.

1. Supporting HbH ext header and option insertion/removal in transit

- No easy solutions
- 1. Fix PMTU and offset for packet size change in PMTU discovery https://tools.ietf.org/html/draft-troan-6man-pmtu-solution-space-00
- 2. New IPv6 packet is created with encapsulating node as source(E) and the original destination (D) as the destination
 - 1. Payload of this packet is the original IPv6 packet along with an extension header inserted inside.



- 2. The original packet is restored by removing the outer IPv6 header and the inner extension header by a node at the domain boundary.
- 3. Modified packet may still leak but will only confuse the destination node.
- 4. ECMP computation needs to be reworked.
- 5. Complex/costly implementation in HW & SW.
- 3. No support of IOAM in transit network. Only source initiated IOAM tracing, proof of transit.. *Limits usage of IOAM significantly*

2. Incremental Trace IOAM HbH Option

- Possible Solutions
- Use PMTU to determine max possible Incremental Trace IOAM Option length
- 2. Do not support Incremental Trace IOAM Option in IPv6?

+_							
Option Type	Opt Data Len	Reserved		IOAM Type			
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-		NodeLen	Flags	(RemainingLen)			
+-							
IOAM-Trace-Type Reserved							
The trace option data MUST be 4-octet aligned:							
+_+-+_+-+_+-+_+-+_+-+_+-+-+-+-+-+-+-+-+							
node data list [0]							
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-							
node data list [1]							
 +_+_+_+_+_+_+_+_+_+_+_+_+_+_+_+_+_+_+_							
~ ~ +_+-+_+-+_+-+_+-+_+-+-+-+-+-+-+-+-+-+-+							
node data list [n-1]							
+_							
node data list [n]							

Next steps

- IOAM data fields definition
 - <u>draft-ietf-ippm-ioam-data</u> Progressed in IPPM WG.
- IOAM data fields encapsulation for different protocols:
 - SFC : draft-ietf-sfc-ioam-nsh
 - VXLAN GPE: draft-brockners-ippm-ioam-vxlan-gpe
 - GENEVE: draft-brockners-ippm-ioam-geneve
 - Generic encap for protocols with Ethertype (GRE, etc): draft-weis-ippm-ioam-eth
 - IPv6: draft-ioametal-ippm-6man-ioam-ipv6-options
 - SRv6: draft-ali-spring-ioam-srv6
 - SR-MPLS: draft-gandhi-spring-ioam-sr-mpls

Joint review of drafts between IPPM and working groups which "own" the parent protocol.

Please review draft-ioametal-ippm-6man-ioam-ipv6-options