DetNet SRv6 Data Plane Encapsulation

draft-geng-dp-sol-srv6-01

Xuesong Geng (gengxuesong@huawei.com) Mach Chen (<u>mach.chen@huawei.com</u>) Yongqing Zhu (<u>zhuyq.gd@chinatelecom.cn</u>)

1

Overview of SRv6

- SRH
 - Segment Routing can be applied to the IPv6 data plane using a new type of Routing Extension Header, which is SRH;
- Segment List
 - The Segment List is encoded starting from the last segment of the SR Policy, which can steer the packet through an indicated path;
- Optional TLVs
 - TLVs behind the Segment List;
- Network Programming
 - Each segment can be an instruction, which represents a function to be called at
 - a specific location in the network;

0 0 1 2 3 4 5 6 7	1 8 9 0 1 2 3 4 5	2 67890123	3 4 5 6 7 8 9 0 1				
Next Header	Hdr Ext Len	Routing Type	Segments Left				
Last Entry	Flags	Ta	ag				
Segment List[0] (128 bits IPv6 address)							
Segment List[n] (128 bits IPv6 address)							
// // Optior //	nal Type Length	Value objects (va	// ariable) // //				

DetNet SRv6 Data Plane Requirement

- A method of identifying the SRv6 payload type;
- A suitable explicit route to deliver the DetNet flow ; (e.g., Segment List in SRH)
- A method of indicating packet processing, such as PREOF(Packet Replication/Elimination/Ordering Function); (detailed in next slides)
- A method of identifying the DetNet flow; (detailed in next slides)
- A method of carrying DetNet sequence number; (detailed in next slides)
- A method of carrying queuing and forwarding indication to do congestion protection; (not covered in the current version)

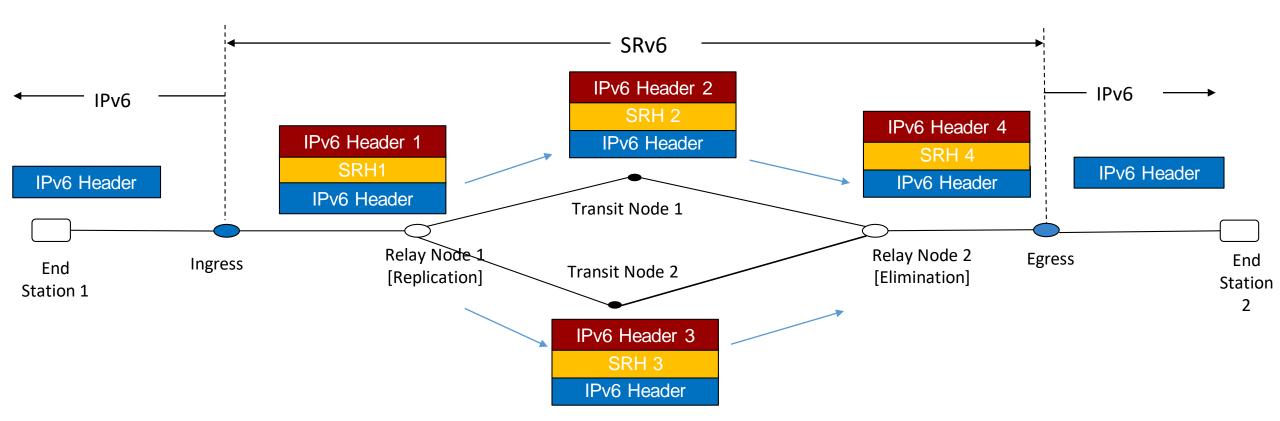
DetNet SRv6 Data Plane Solution

Flow Identification(20bits) and Sequence Number(28bits) are carried in:

- Option1: SRH TLVs
- **Opiton2 : arguments in the SID** for Relay Node
- **Option3:** DetNet SID in segment list

0 0 1 2 3 4 5 6	$\begin{smallmatrix}&&1\\7&8&9&0&1&2&3&4&5\end{smallmatrix}$	2 6 7 8 9 0 1 2 3 4 5 6 7 8	3 3 9 0 1
Next Header	Hdr Ext Len	Routing Type Segments	s Left
Last Entry	Flags	Tag	
2 Se	gment List[0] (12	8 bits IPv6 address) +-+-+-+-+	-+-+-+
Se	+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-	+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-++	+-+-+-+
// ① Opti	onal Type Length	+-+-++-+-+++++++++++++++++++++++++++++	// // //

SRv6 Based PREOF



What's next?

- Aim to become a WG Document
- More comments are welcome
- WG Adoption?

Thanks

Overview of SRv6

- SRH
 - Segment Routing can be applied to the IPv6 data plane using a new type of Routing Extension Header, which is SRH;
- Segment List
 - The Segment List is encoded starting from the last segment of the SR Policy, which can steer the packet through an indicated path;
- Optional TLVs
 - TLVs behind the Segment List;
- Network Programming
 - Each segment can be an instruction, which represents a function to be called at
 - a specific location in the network;

0 0 1 2 3 4 5 6 7	1 8 9 0 1 2 3 4 5	2 67890123	3 4 5 6 7 8 9 0 1				
Next Header	Hdr Ext Len	Routing Type	Segments Left				
Last Entry	Flags	Ta	ag				
Segment List[0] (128 bits IPv6 address)							
Segment List[n] (128 bits IPv6 address)							
// // Optior //	nal Type Length	Value objects (va	// ariable) // //				

SRv6 Data Plane Solution Option1-Encapsulation

• Flow Identification(32bits) and Sequence Number(32bits) are carried as TLVs

	0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 +	0 0 1 2 +-+-+-	2345	$\begin{smallmatrix} 1 \\ 6 & 7 & 8 & 9 & 0 & 1 & 2 & 3 & 4 & 5 \\ -+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+$	2 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 +-+-+++++++++++++++++++++++++++++++++
	+-	1	Туре	Length	RESERVED
	+-	RESERVE Sequence Number			
IPv6 Header	Last Entry Flags Tag Location & Function SID for Relay Node (Segment List[0] for relay node or edge node)	•	 Type: 8bits, to be assigned by IANA. Length: 8. RESERVED: 28 bits, MUST be 0 on transmission and ignored c receipt. Flow Identification: 20 bits, which is used for identifying DetN flow. 		
IPv6 Header	 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-	0	12345	1 678901234	2 3 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
Payload	Segment List[n]	+-+- +-+- ++	-+-+-+- Type -+-+-+- RES	+-+-+-+-+-+-+-+ Length +-+-+-+-+-++-++++ ERVED +-+-+-+++++++++++++++++++++++++++++++	-+-++ ++++++++++++++++++++++++++++++++
	Optional TLVs 	• •	Length: RESERV receipt.	ED: 20 bits. MUST be	y IANA. e 0 on transmission and ignored on which is used for indicating

sequence number of a DetNet flow.

SRv6 Data Plane Solution Option1-Replication Function

- End. B.Replication: Packet Replication Function
 - 1. IF NH=SRH & SL>0 THEN
 - 2. extract the DetNet TLV values from the SRH
 - 3. create two new outer IPv6+SRH headers: IPv6-SRH-1 and IPv6-SRH-2 Insert the policy-instructed segment lists in each newly created SRH (SRH-1 and SRH-2). Also, add the extracted DetNet TLVs into SRH-1 and SRH-2.
 - 4. remove the incoming outer IPv6+SRH header.
 - 5. create a duplication of the incoming packet.
 - 6. encapsulate the original packet into the first outer IPv6+SRH header: (IPv6-SRH-1) (original packet)
 - 7. encapsulate the duplicate packet into the second outer IPv6+SRH header: (IPv6-SRH-2) (duplicate packet)
 - 8. set the IPv6 SA as the local address of this node.
 - 9. set the IPv6 DA of IPv6-SRH-1 to the first segment of the SRv6 Policy in of SRH-1 segment list.
 - 10. set the IPv6 DA of IPv6-SRH-2 to the first segment of the SRv6 Policy in of SRH-2 segment list.
 - 11. ELSE
 - 12. drop the packet

SRv6 Data Plane Solution Option2-Elimination Function

- End. B. Elimination: Packet Elimination Function
 - 1. IF NH=SRH & SL>0 & "the packet is not a redundant packet" THEN
 - 2. do not decrement SL nor update the IPv6 DA with SRH[SL]
 - 3. extract the value of DetNet TLVs from the SRH
 - 4. create a new outer IPv6+SRH header
 - 5. insert the policy-instructed segment lists in the newly created SRH and add the retrieved DetNet TLVs in the newly created SRH
 - 6. remove the incoming outer IPv6+SRH header.
 - 7. set the IPv6 DA to the first segment of the SRv6 Policy in the newly created SRH
 - 8. ELSE
 - 9. drop the packet

SRv6 Data Plane Solution Option2-Encapsulation

• Flow Identification(20bits) and Sequence Number(28bits) are carried as arguments in the SID for Relay Node

	0 0 1 2 3 4 5 6 7	$\begin{smallmatrix}&1\\8&9&0&1&2&3&4&5\end{smallmatrix}$	2 6 7 8 9 0 1 2 3 4	3 4 5 6 7 8 9 0 1	
	Next Header	Hdr Ext Len	Routing Type	Segment Left	+
	Last Entry	Flags	Ταε	-+-+	+
	(Segmer	Location & nt List[0] for re	Function elay node or edge	node)	Ţ
eader .H - eader oad	+-+-+-+-+-+-+-+-+ Location &	+-+-+-+-+-+-+-+-+-+-+ Function	-+-+-+-+-+-+-+- Flow Ider	SID for Relay Node	
	+-+-+-+-+-+-+-+ Flow ID	Ĩ			
	+-+-+-+-+-+-+-+-++++++++-	· · · · · · · · · · · · · · · · · · ·	+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-	-+	• +
	 +-+-+-+-+-+-+++++++++	+-+-+-+-+-+-+	+-+-+-+-+-+-+-+-+-+-+-+-+-+-+++	-+-+-+-+-+-++	+
		Option 	nal TLVS		
	+-+-+-+-+-+-+-+-++++++++-	+-+-+-+-+-+-+	-+	-+-+-+-+-+-+-+++++++++-	+

IPv6 F

IPv6 F

Payl

- Location & Function: the 80 most significant bits that are used for routing
- Flow Identification: 20 bits, which is used for DetNet flow identification in the DetNet relay node;
- Sequence Number: 28 bits, which are used for

dis crime packets in the same DetNet flow;

SRv6 Data Plane Solution Option3-Encapsulation

• Flow Identification and Sequence Number are carried as in DetNet SID

	0 0 1 2 3 4 5 6 7	1 8 9 0 1 2 3 4 5 6	2 7 8 9 0 1 2 3	3 4 5 6 7 8 9 0 1	
	Next Header	Hdr Ext Len	Routing Type	Segment Left	+
	Last Entry	Flags	Ta	g 	+
		Location & F ment List[0] for r		ge node)	SID for Relay Node
IPv6 Header	+-	-+-+-+-+-+-+-+-+++	+-	-+-+-+-+-+-+-+-++++++++	+
SRH _ IPv6 Header Payload		Segment Li	st[n]	-+-+-+-+-+-+-+-+-	+
		SID for DetNet			
	+-	-+-+-+-+-+-+-+- Optional	TLVs	-+-+-+-+-+-+-	+
	 +-+-+-+-+-+-+-+-+	···-	+-+-+++++++++++++++++++++++++++++++++++	-+-+-+-+-+-+-+-	 +

DetNet SRv6 Data Plane Solution Example

