G-SRv6 Introduction

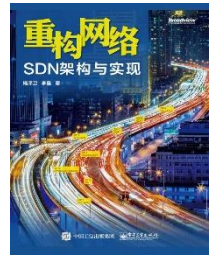
Cheng Li
c.l@Huawei.com

Introduction

Cheng Li

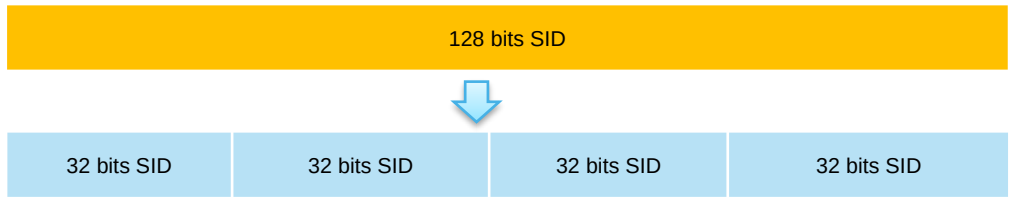
IP Standard Representative in Huawei

- 30+ IETF drafts， 10 + WG drafts
- Currently focus on SRv6， SFC， OAM，Security
- Author of books
  - “SRv6 Network Programming - Ushering in a New Era of IP Networks”
  - “Refactoring Network: Architecture and Implementation of SDN”



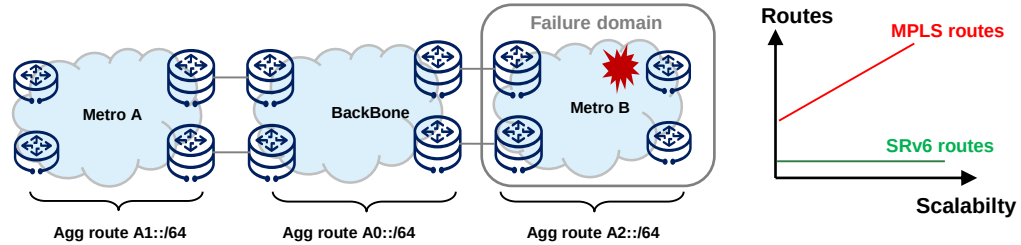
Design considerations

Compression efficiency



- Efficiency, Scalabilities, and Aligning should be considered.
- 32 bits is the ideal length， 16 bits is not scalable

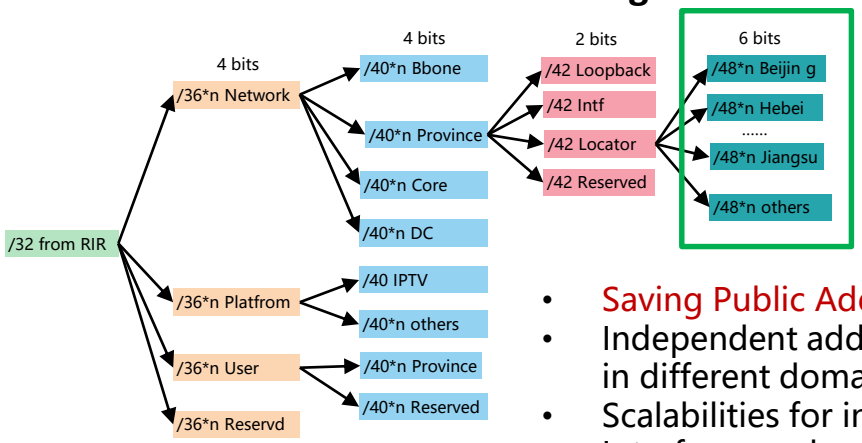
Native IPv6



Native IPv6 Routing

- Based on IP reachability, overlay routing on cmpr disable nodes
- Route aggregation， support super scale networking
- Failure domain isolation

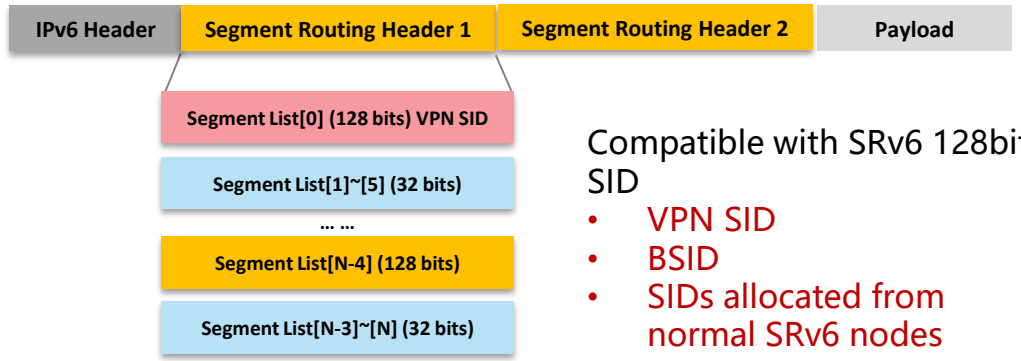
Address Planning



48/ prefix for An SRv6 domain

- Saving Public Address
- Independent address planning in different domains
- Scalabilities for increasing Interfaces and nodes

Compatible with SRv6



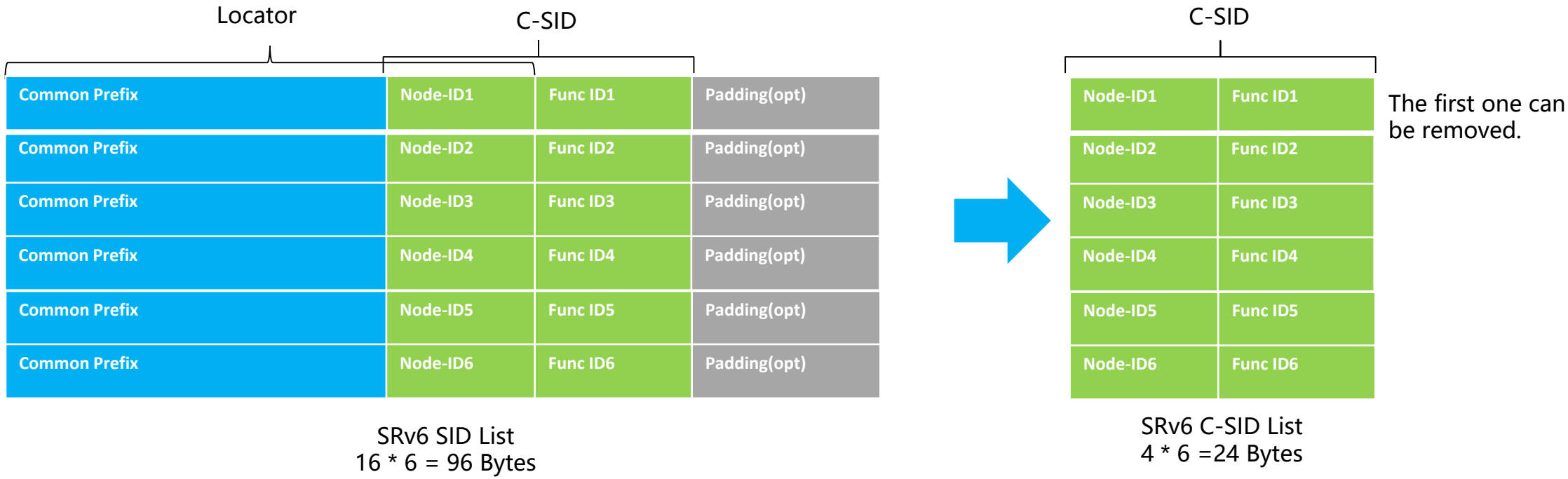
Compatible with SRv6 128bit SID

- VPN SID
- BSID
- SIDs allocated from normal SRv6 nodes

Generalized SRv6

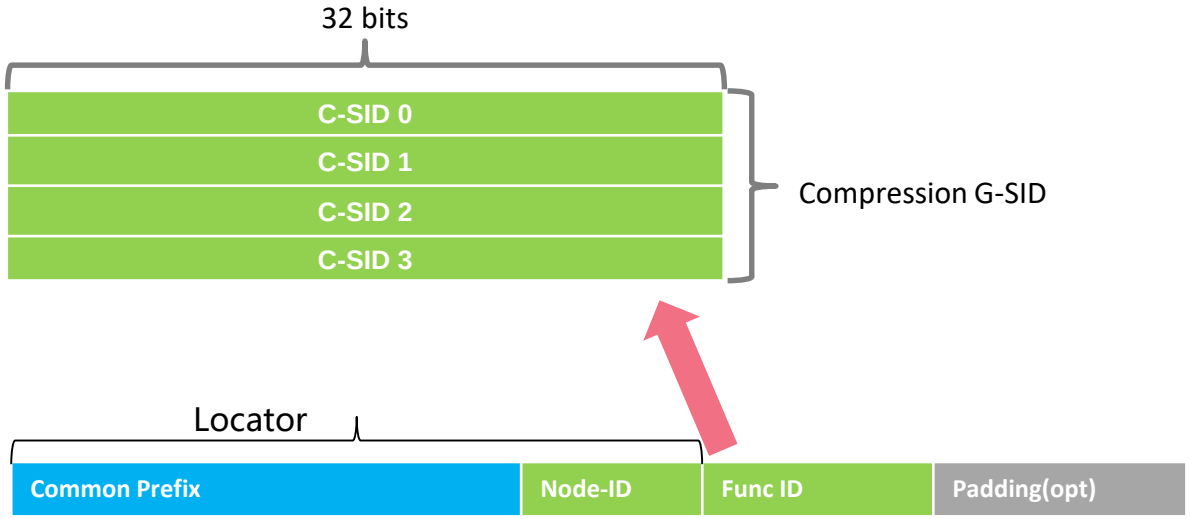
Before G-SRv6：SRv6 Compressed SID

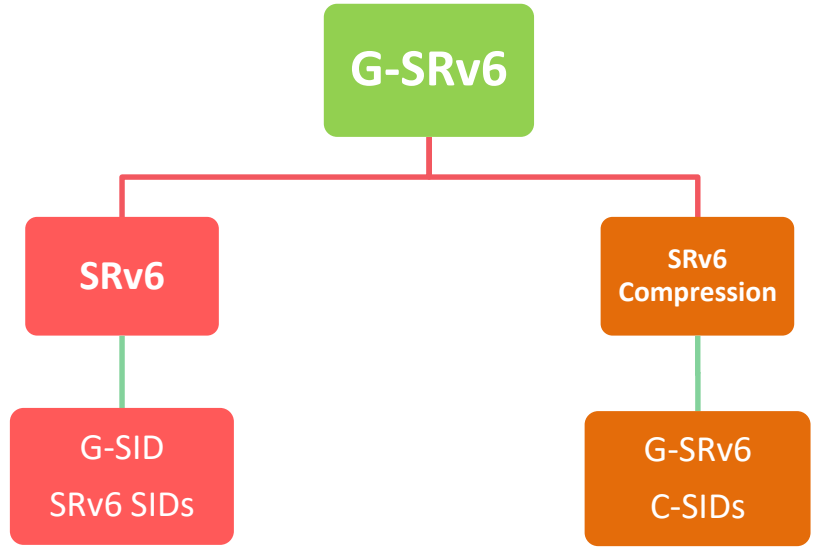
- A normal SRv6 SID is a 128 bits IPv6 address allocated from an address block, called SID Space.
- For the SIDs in the SID list within an SRH， they may share the common prefix, and the common prefix is redundant that can be deleted to reduce the overhead.
- Each SRv6 SID has the format shown below, we called the different part of the SRv6 SID is compressed SID(C-SID), and the SID is a Compressible SRv6 SID.
- The prefix can be managed according to the real network address planning.
- Common Prefix is included in the first SID in the IPv6 Destination address.



G-SRv6：Compatible and Scalable

- Generalized SRv6 supports to encode multiple types of Segments in an enhanced SRH. G-SRv6 is compatible with SRv6 and uSID as well.
- These Segments can be called Generalized Segment. G-SID(Generalized Segment Identifier) is a 128-bits value，and it may contain：
  - an SRv6 SID(can be a Micro SID carrier)
  - a compression G-SID(4 32 bits C-SIDs at most)





https://tools.ietf.org/html/draft-cl-spring-generalized-srv6-np-00

G-SRH: Compatible with SRv6, Incremental Deployment, Hardware Friendly

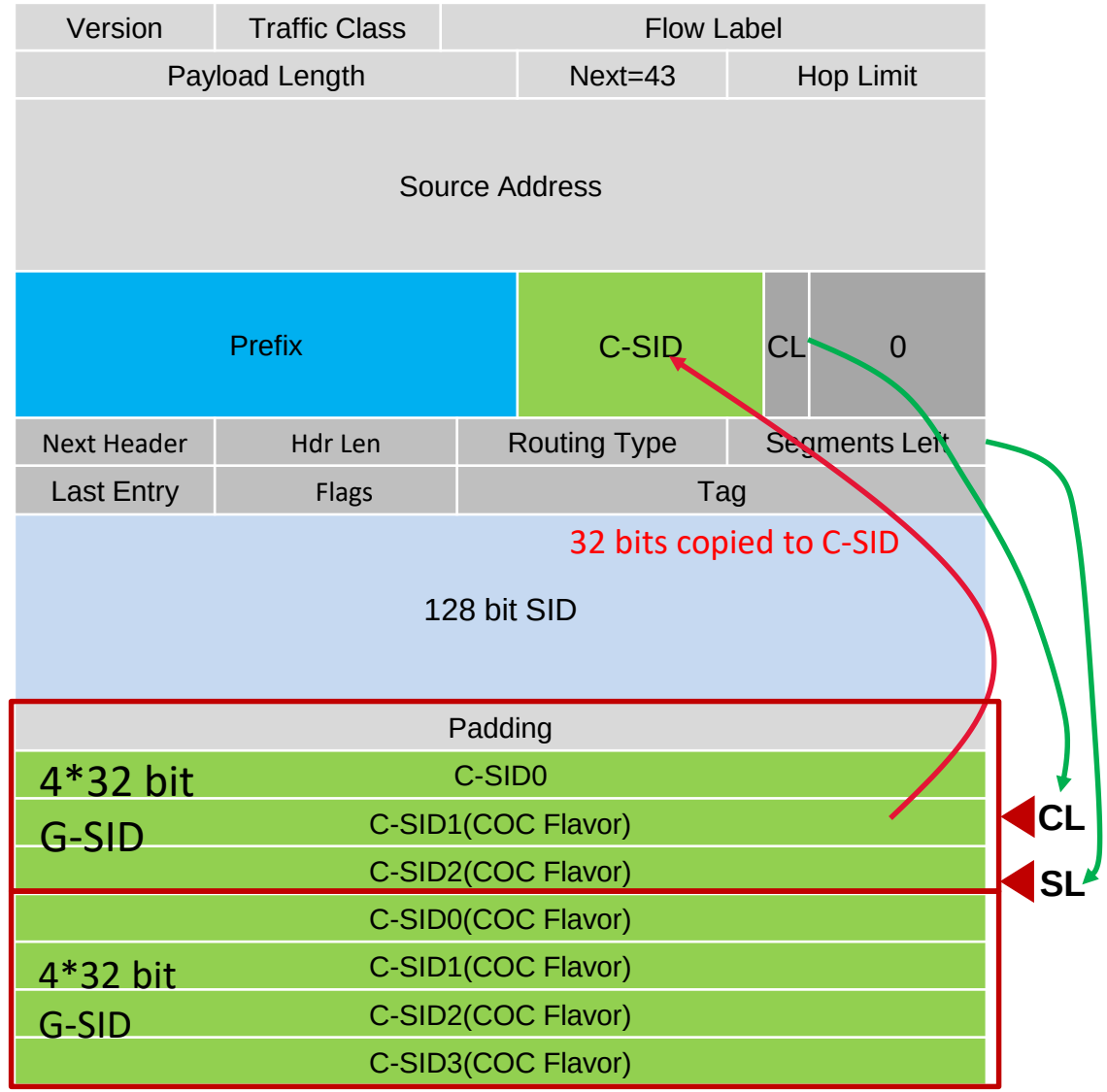
Solution: use SL to index a 128 bit G-SID, use CL to index C-SID inside this G-SID!

- C-flag in control plane: indicates the format of the SRv6 SID is compressible. The SID can be encoded as 128 or 32 bits in SRH
- COC(Continuation of Compression) flavor indicate the next SID is a 32-bits Compressed SID(C-SID)
- CL（Compressed SID left, the args of the compressible SRv6 SID）indicates the location of C-SID within the G-SID
  - Update C-SID from SRH[SL][CL] to IPv6 DA[CP: CP+31]

COC Flavor SRv6 SID in IPv6 DA

Pros

1. **Fully compatible with SRH， NO modification of SRH**
2. **Fully compatible with SRv6， add COC Flavor endpoint behaviors, no affect of existing SIDs**
3. **Fully compatible with SRv6 control plane: (Can be) No modification of Control Plane**
4. **Address saving & easy to deploy：**
   1. **Flexible address planning, does not require for a short common prefix**
   2. **No new address required when reusing the Locator**
   3. **No new route, no modification of routing scheme(can share the same locator with normal SRv6 SIDs)**
   4. Compressible SRv6 SID can be used as 128 bits or 32 bits. Reduce the number of SIDs.
5. **Less overhead**: A common prefix for a compressed sub-path instead of per 128 bits SID
6. **Smooth upgrade/Incremental deployment**: encode SRv6 SIDs and C-SIDs in a G-SRH
7. **Hardware Friendly**： No index mapping table
8. **Compatible with Micro SID**



Compression G-SID

https://tools.ietf.org/html/draft-lc-6man-generalized-srh-00

Pseudo code: Only add code for COC Flavor SIDs, no Affection on Existing SIDs

Version	Traffic Class	Flow Label	
Payload Length		Next=43	Hop Limit
Source Address			
Prefix		C-SID	CL	0
Next Header	Hdr Len	Routing Type	Segments Left
Last Entry	Flags	Tag	
128 bit SID			
0	C-SID	C-SID(COC)	C-SID(COC)
Prefix		C-SID(COC)	0（Padding）
128 SID			
C-SID	C-SID(COC)	C-SID(COC)	C-SID(COC)
C-SID(COC)	C-SID(COC)	C-SID(COC)	C-SID(COC)
Payload			

PS. For easy understanding， the length of a row in SID list is 128bit

if LOCAL SID is a COC Flavor SID: **//update 32bits C-SID to DA**

if DA.CL = 0: //first C-SID in next 128 bits

SL--

DA.CL = 3;

Else //next C-SID in current 128 bits

DA.CL--

DA[CP..CP+31] = SRH[SL][DA.CL]

Forward the packet based on new DA

Else **//update 128 bits SID to DA, original SRv6 Processing**

SRv6 processing

CL is a location argument of the Compressible SID,
And it is the last 2 bits in Arguments

C-SID List + 128 VPN SID，64 CP + 32 C-SID+32 Argument

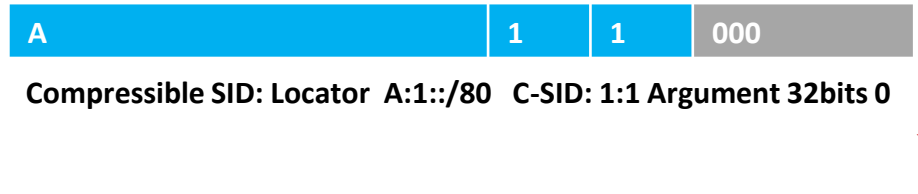
SID List: 10 SIDs：

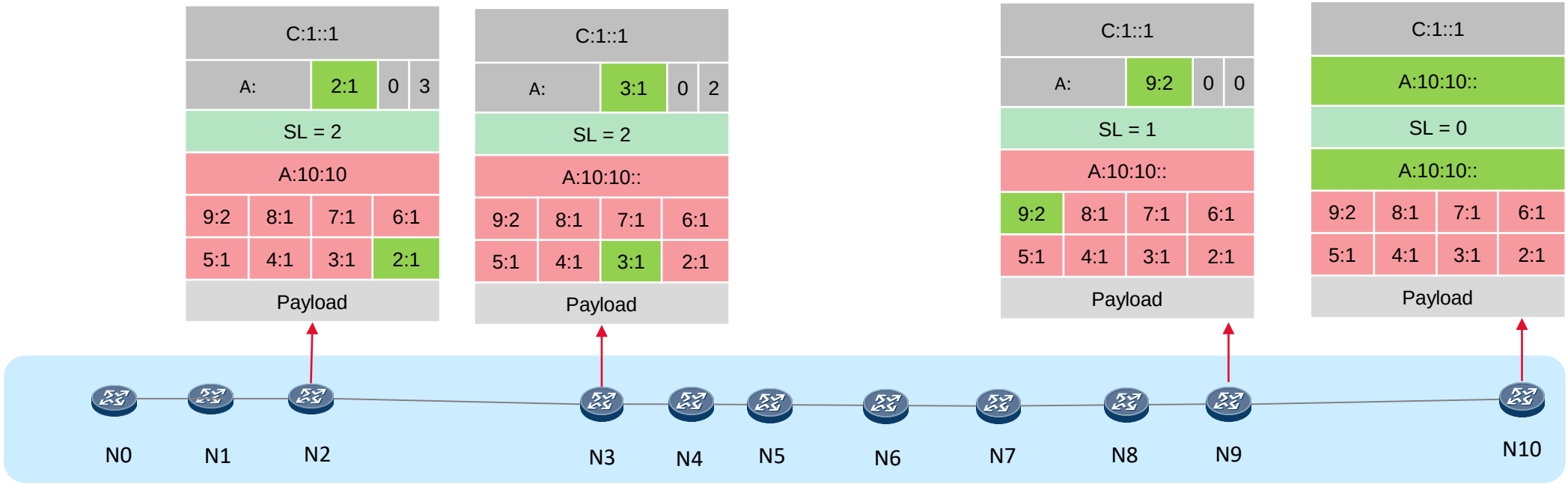
- A:1:1::, A:2:1::, A:3:1::, A:4:1::, A:5:1::, A:6:1:: , A:7:1::, A:8:1:: are End.X with COC Flavor SIDs
- A:9:2:: is an End.X SID(C-flag=1， Without COC flavor)
- A:10:10:: is an End.DT4 VPN SID

Initialization：SL=3， CL=0，**Reduced mode.**

10 * 128 bits to 3 * 128 bits including a 128bit VPN SID. 70% overhead off.

Compressible SRv6 SID and normal SRv6 SID use the same Locator, no new route is created!

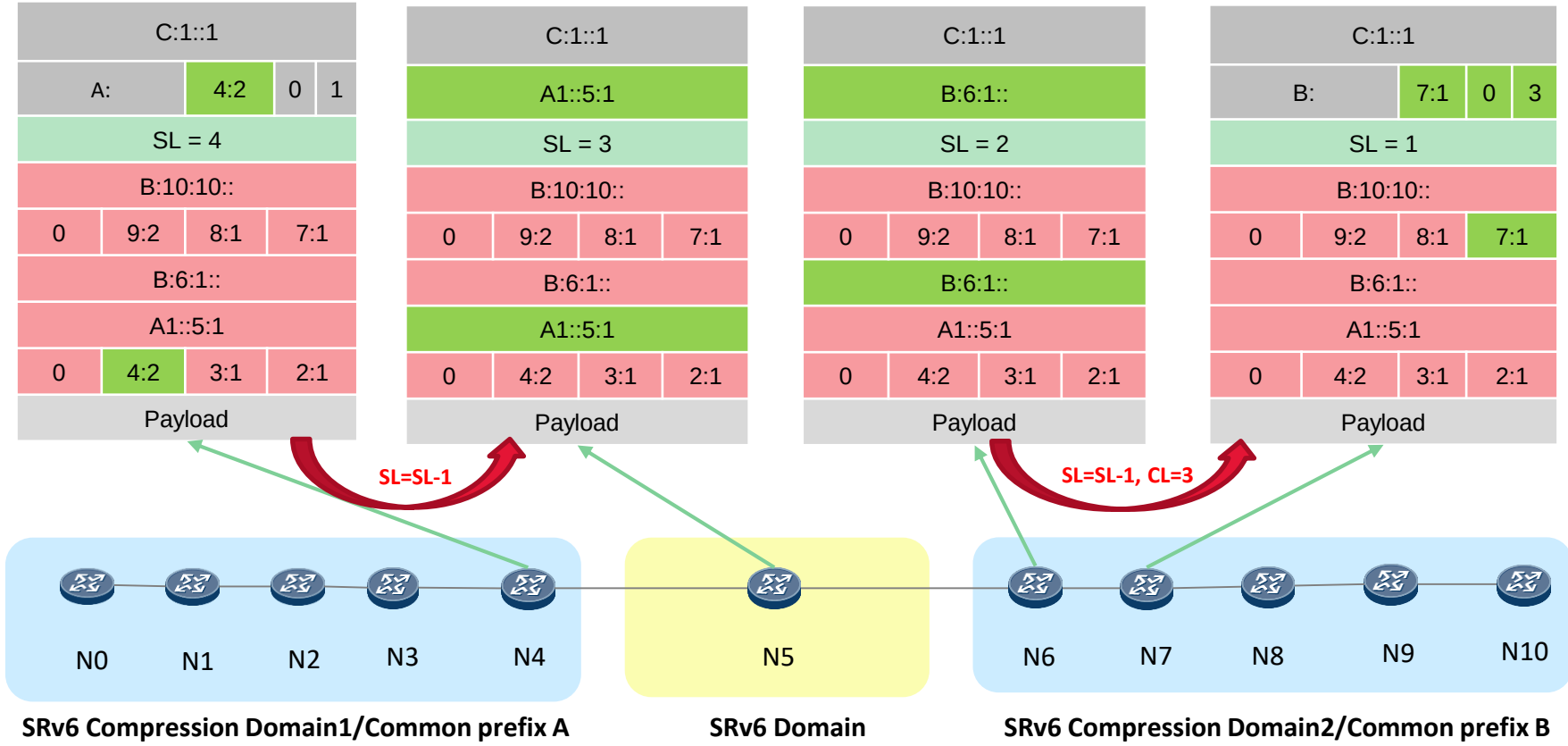




Mixed Encoding with SRv6 SID for incremental deployment

SID List: 10 SIDs：

- A:1:1::, A:2:1::, A:3:1::, B:6:1:: , B:7:1::, B:8:1:: are End.X with COC Flavor SIDs
- A1::5:1 End.X does not support SRv6 compression.
- A:4:2:: , B:9:2:: are End.X SID(Without COC flavor)
- B:10:10:: is an End.DT4 VPN SID



10+ Vendors/10+ Customers support, CMCC network Live trial done

[Docs] [txt|pdf|xml|html] [Tracker] [Email] [Diff1] [Diff2] [Nits]

Versions: 00 01

SPRING Working Group — Z. Li
Internet-Draft — C. Li
Intended status: Standards Track — Huawei Technologies
Expires: February 15, 2021 — W. Cheng
China Mobile
C. Xie
C. Li
China Telecom
H. Tian
F. Zhao
CAICT
August 14, 2020

Generalized Segment Routing Header
draft-lc-6man-generalized-srh-01

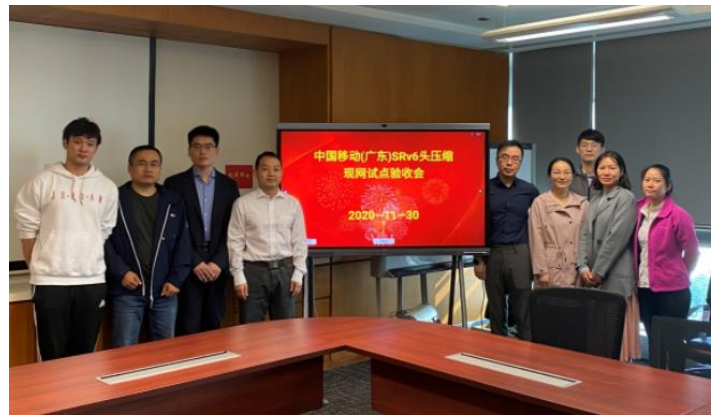
[Docs] [txt|pdf] [Tracker] [Email] [Diff1] [Diff2] [Nits]

SPRING Working Group — W. Cheng
Internet-Draft — China Mobile
Intended status: Standards Track — Z. Li
Expires: November 21, 2020 — C. Li
Huawei Technologies
F. Clad
Cisco Systems, Inc
A. Liu
ZTE Corporation
C. Xie
China Telecom
Y. Liu
China Mobile
S. Zadok
Broadcom
May 20, 2020

Generalized SRv6 Network Programming for SRv6 Compression
draft-cl-spring-generalized-srv6-for-cmpr-01

HUAWEI ZTE中兴 H3C BROADCOM
Ruijie MARVELL centec intel
CISCO SPIRENT Communications 中盈优创 China Unitechs

10+ Vendors have PASSED Interop-test



https://www.c114.com.cn/news/118/a1146858.html

2020.Nov: Trial deployment in CMCC Live Network

- Guangdong Province
- Zhejiang Province
- Henan Province

Conclusion

- **G-SRv6 is fully compatible with SRv6,**
  - **No SRH encapsulation modification**
  - **No new address consumption**: allocated SIDs from the Locator/ allocated to the node.
  - **No new route creation**: share the same locator with the normal SRv6 SID.
  - **No control plane modification**: Controller can install the SR policy with 128 bit G-SIDs, endpoint nodes understand the COC Flavor behaviors, Compression disable SRv6 nodes are unaware of Compression.
  - **No security policy modification.**
- **G-SRv6 has less overhead**
  - Each compression sub-path has only one common prefix, instead of for each 128 bits.
- **G-SRv6 has efficient address consumption**
  - It is **not** required to allocate a short common prefix for better compression.
- **G-SRv6 supports incremental deployments, which can be deployed on demand.**
- **Excellent Industry support, mature solution, live trails in CMCC networks completed.**

Thanks