G-SRv6 Introduction

Cheng Li

chengli13@Huawei.com

Introduction

Cheng Li

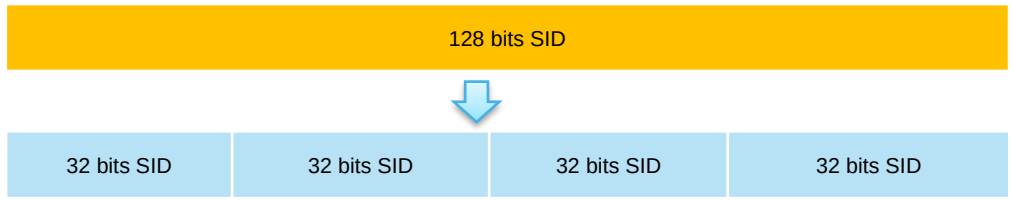
IP Standard Representative.

Huawei Technologies, Co., Ltd.

- 30+ IETF drafts， 9 WG drafts
- 15+ patents
- Currently focus on SRv6， SFC， OAM，Security

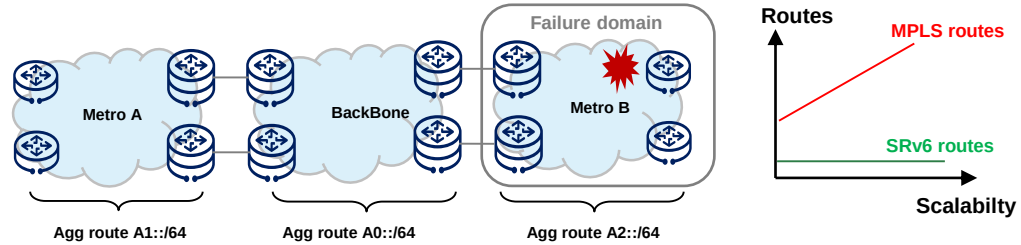
Design considerations

Compression efficiency



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

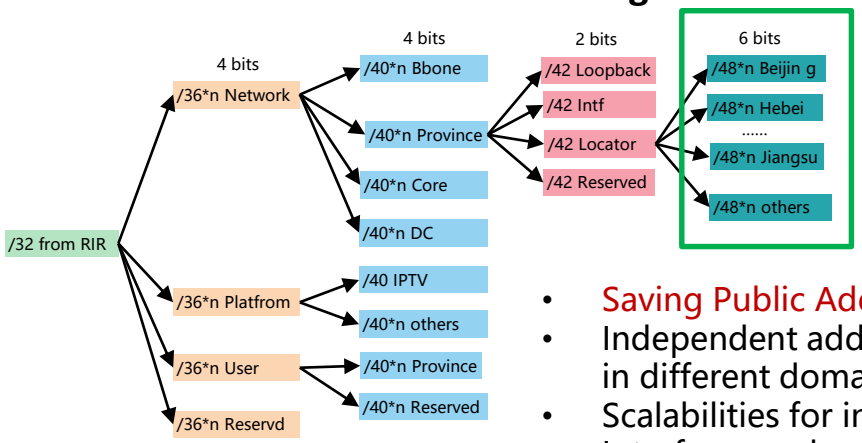
Native IPv6



Native IPv6 Routing

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

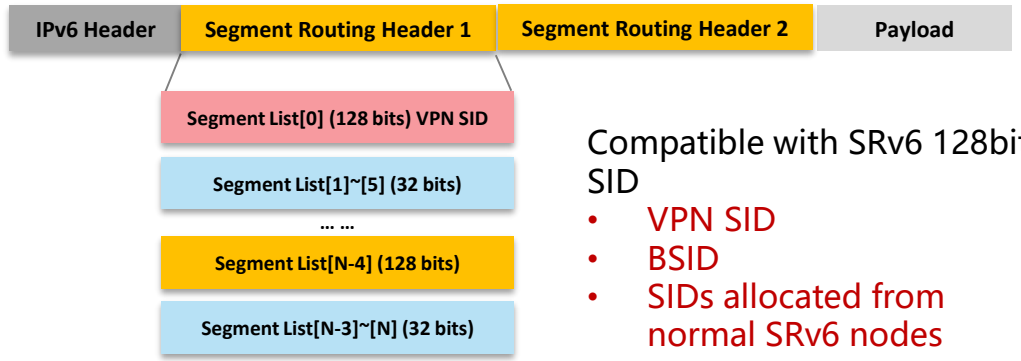
Address Planning



48/ prefix for An SRv6 domain

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

Compatible with SRv6



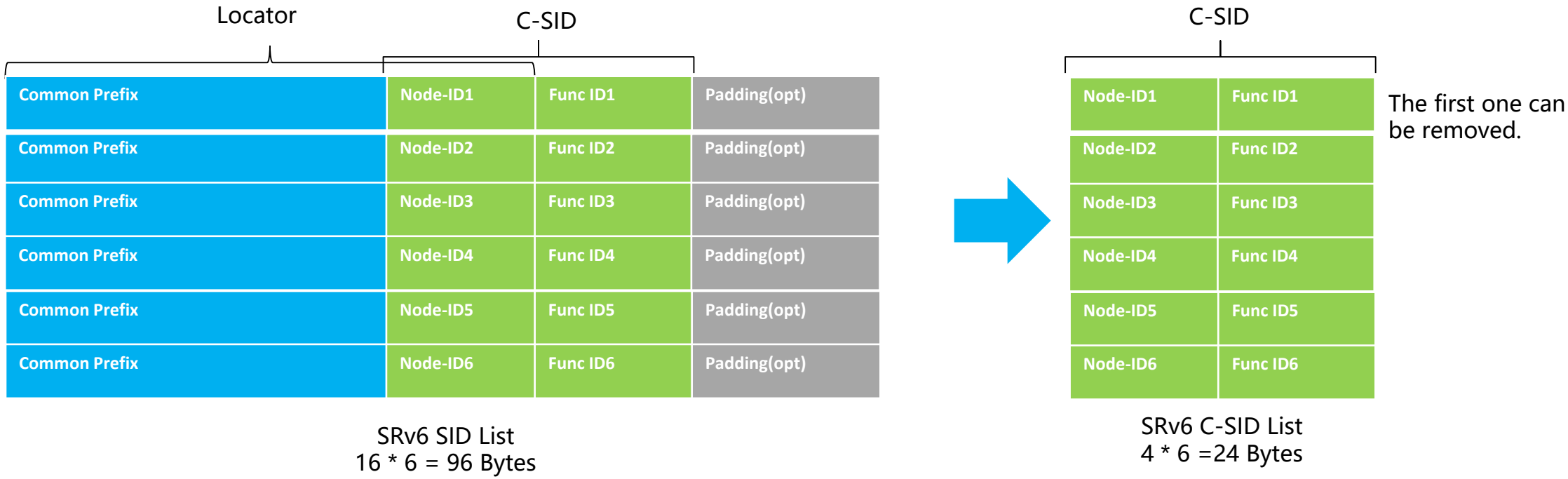
Compatible with SRv6 128bit SID

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

Generalized SRv6

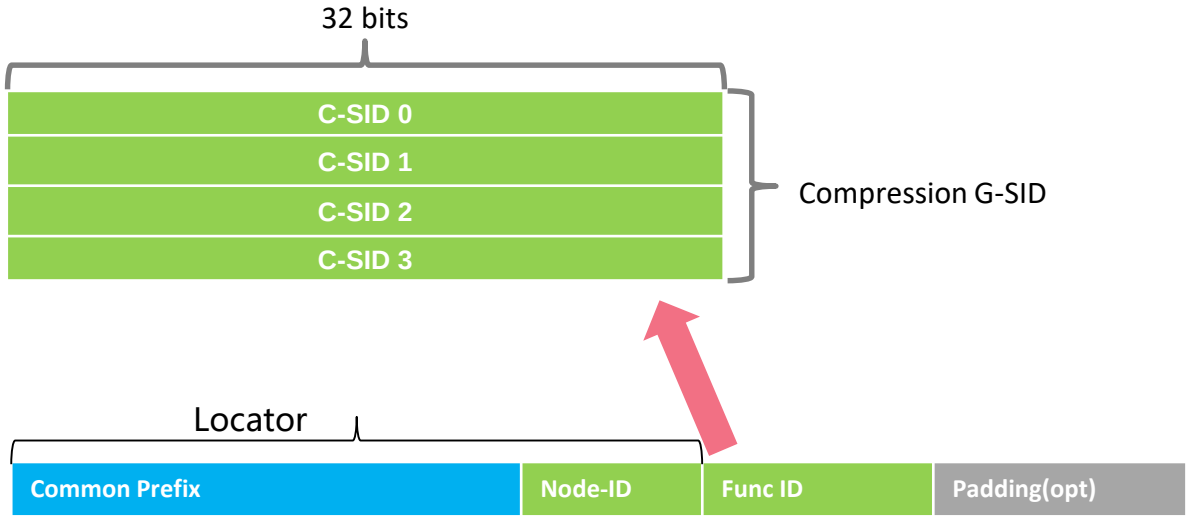
Before G-SRv6：SRv6 Compressed SID

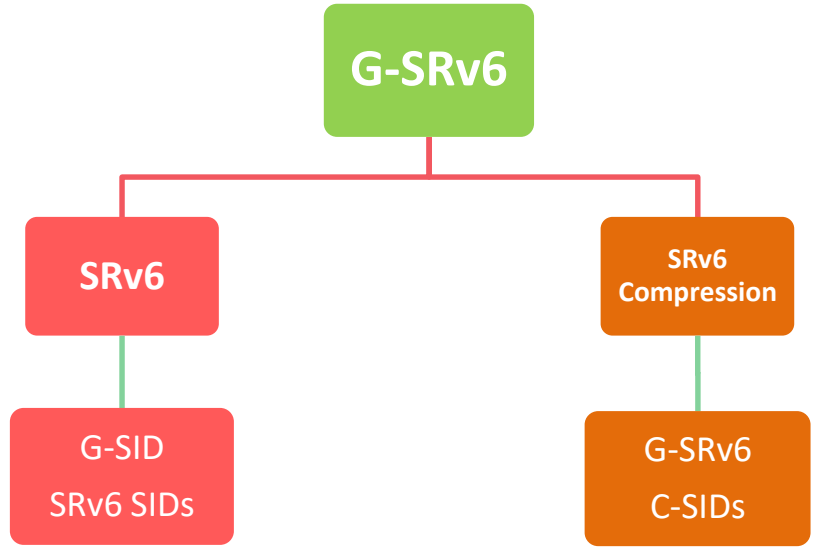
- A normal SRv6 SID is a 128 bits IPv6 address allocated from an address block, called SID Space.
- For the SIDs in the SID list within an SRH， they may share the common prefix, and the common prefix is redundant that can be deleted to reduce the overhead.
- Each SRv6 SID has the format shown below, 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

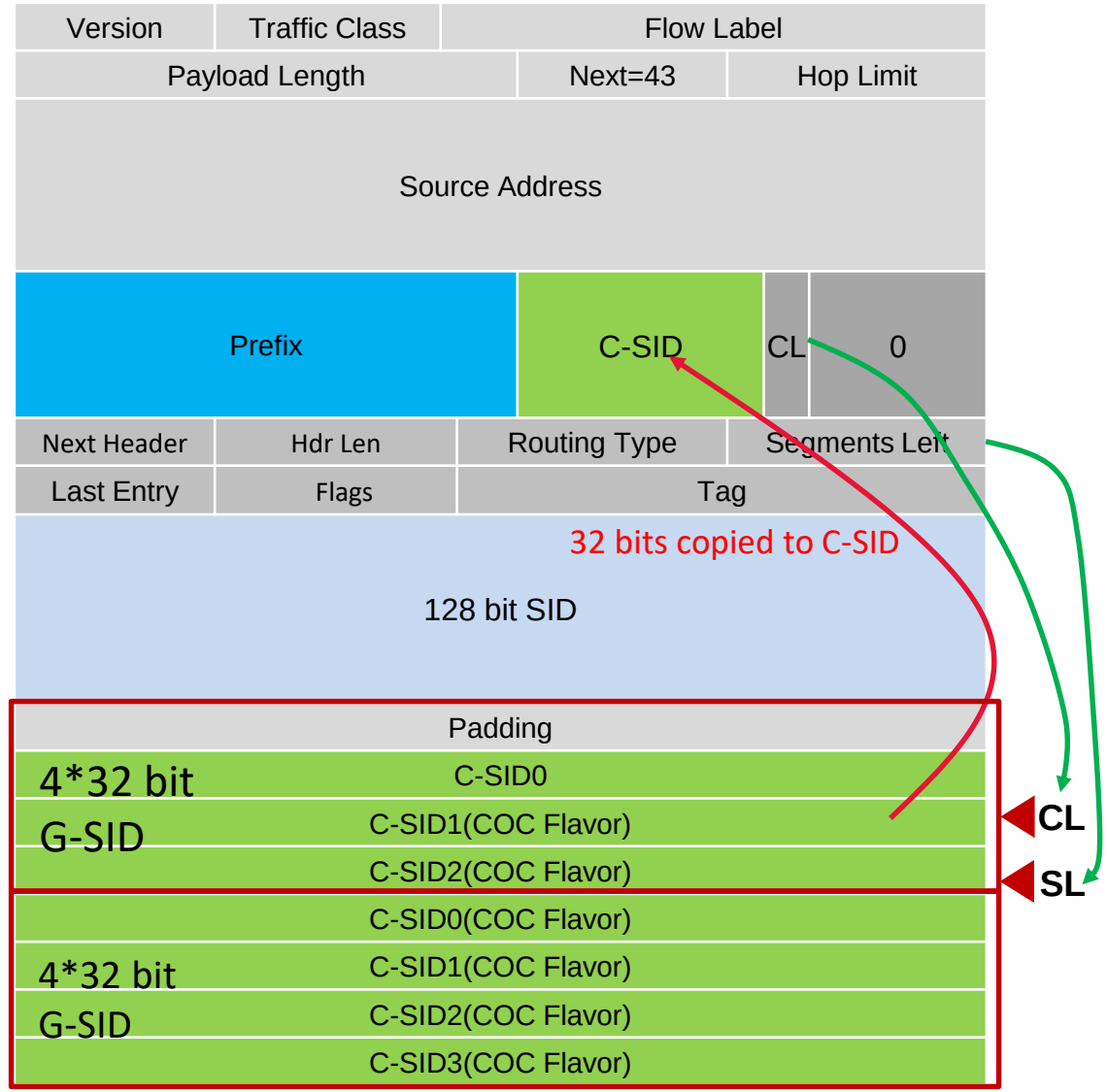
Solution: use SL to index a 128 bit G-SID, use CL to index C-SID inside this G-SID!

- 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(Continue 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

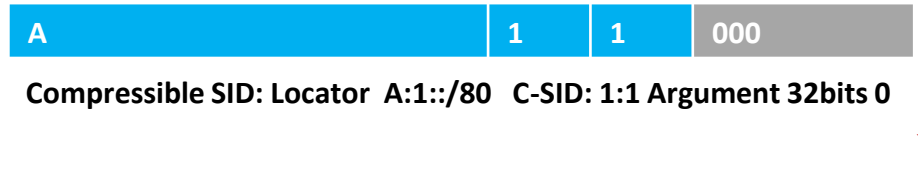
SID List: 10 SIDs：

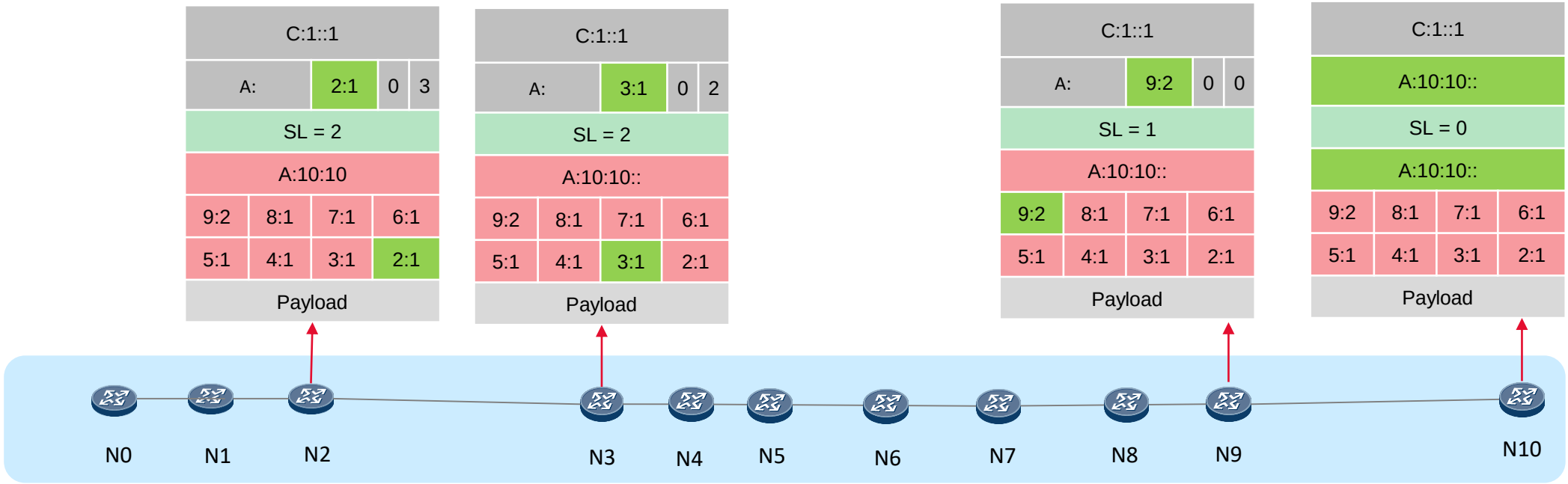
- A:1:1::, A:2:1::, A:3:1::, A:4:1::, A:5:1::, A:6:1:: , A:7:1::, A:8:1:: are End.X with COC Flavor SIDs
- A:9:2:: is an End.X SID(C-flag=1， Without COC flavor)
- A:10:10:: is an End.DT4 VPN SID

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!

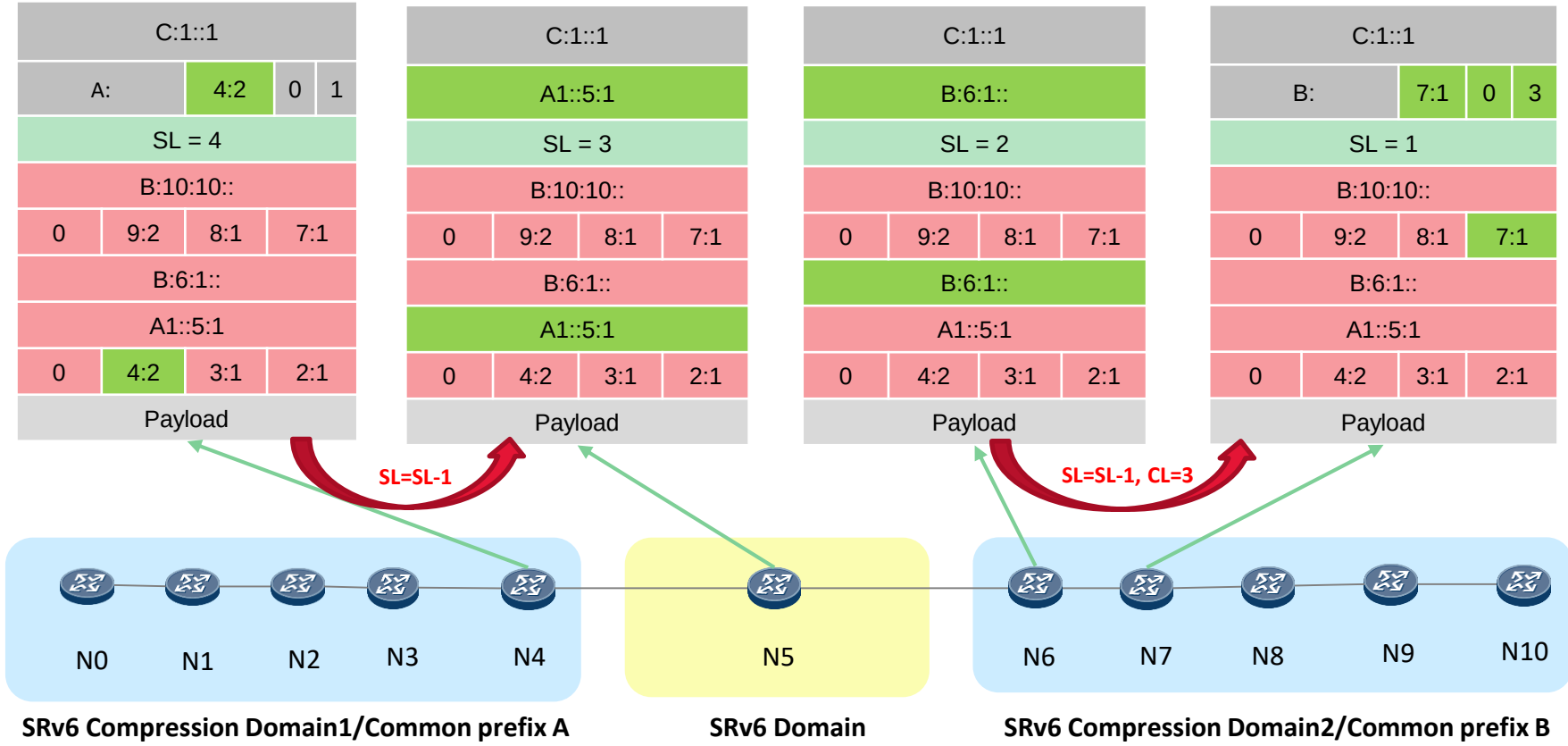




Mixed Encoding with SRv6 SID for incremental deployment

SID List: 10 SIDs：

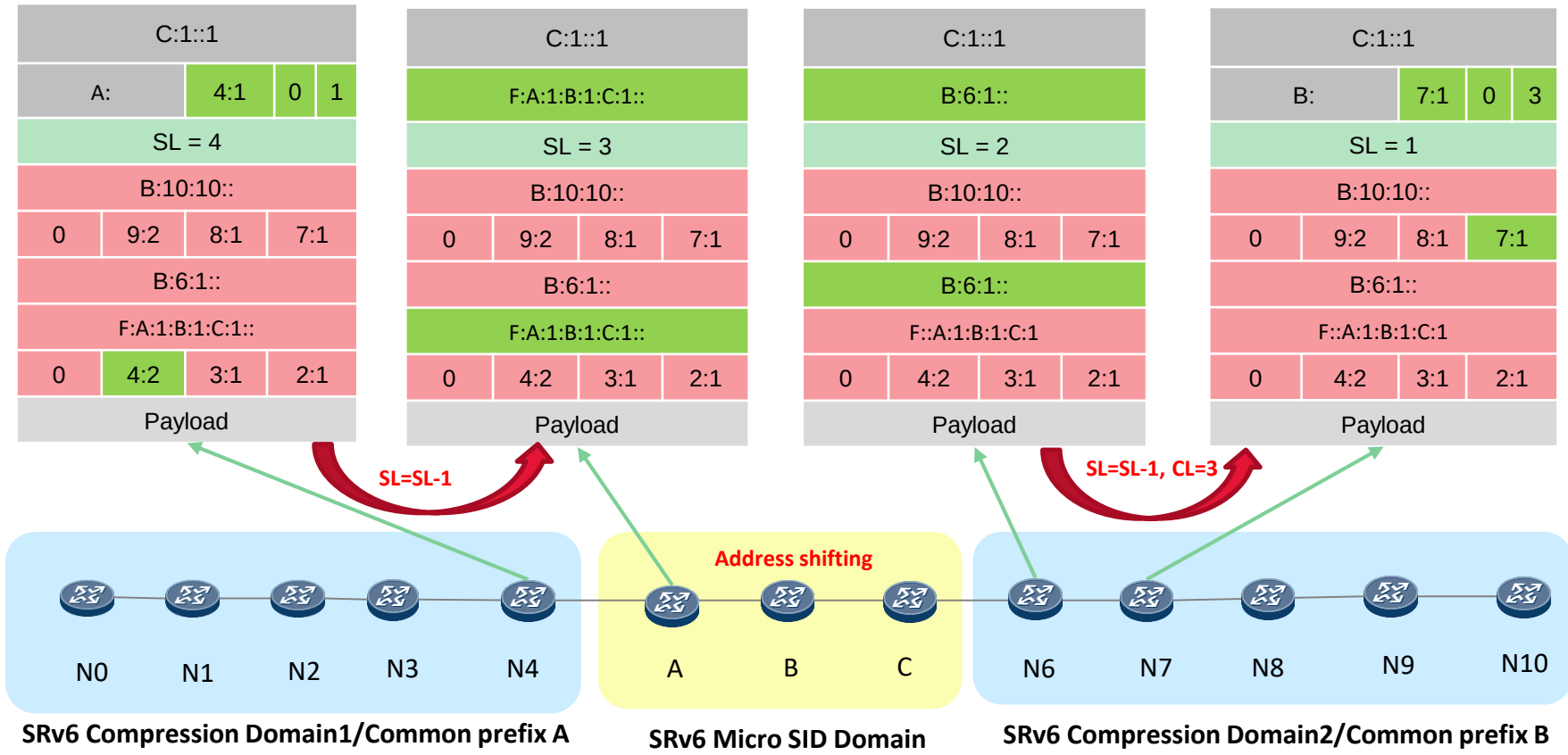
- A:1:1::, A:2:1::, A:3:1::, B:6:1:: , B:7:1::, B:8:1:: are End.X with COC Flavor SIDs
- A1::5:1 End.X does not support SRv6 compression.
- A:4:2:: , B:9:2:: are End.X SID(Without COC flavor)
- B:10:10:: is an End.DT4 VPN SID



Mixed Encoding with uSID

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
- **F::A:1:B:1:C:1 is an uSID carrier, F is a 32/ prefix, A:1, B:1, C:1 is the uSID allocated by Node A, B and C.**
- A:4:2:: , B:9:2:: are End.X SID(Without COC flavor)
- B:10:10:: is an End.DT4 VPN SID



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.**

Thanks

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