

SRv6을 통한 BGP 전역 IPv6 구성

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소개

이 문서에서는 BGP IPv6 유니캐스트 세션에 SRv6(Encapsulation Segment Routing over IPv6)를 적용할 때의 컨트롤 플레인 흐름에 대해 설명합니다.

배경 정보

자세한 내용은 [Cisco ASR 9000 Series 라우터의 세그먼트 라우팅 컨피그레이션 가이드, IOS XR 릴리스 24.1.x, 24.2.x, 24.3.x, 24.4.x](#)를 참조하십시오.

토폴로지

이 문서에 사용된 토폴로지는 그림 1에 나와 있습니다. SRv6 도메인은 3개의 라우터로 구성되며, 모두 Cisco IOS-XR에서 작동합니다. SRv6 언더레이 인프라는 uSID SRv6와 함께 IS-IS를 사용하여 구현됩니다. 라우터 R1과 R3 간에 BGP IPv6 유니캐스트 피어링이 설정되는 반면 라우터 R2는 BGP에 참여하지 않으며 이 컨피그레이션에서 P-라우터로 작동합니다. R1 및 R3 모두의 루프백 6 인터페이스는 두 BGP IPv6 유니캐스트 피어 간에 교환해야 하는 IPv6 접두사를 나타냅니다.

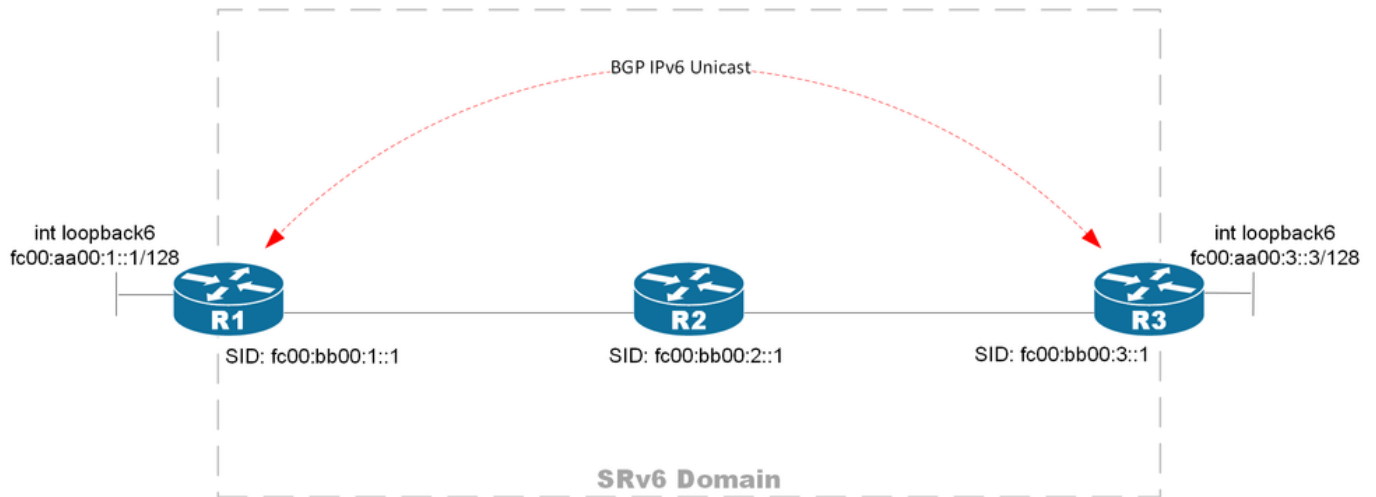


그림 1. SRv6를 통한 BGP ipv6 유니캐스트 토폴로지 다이어그램

SRv6 컨피그레이션

이 섹션에서는 세 SRv6 라우터 모두의 컨피그레이션을 보여줍니다. 라우터 R2는 BGP에 참여하지 않으므로 SRv6 컨피그레이션만 포함합니다.

라우터 R1 컨피그레이션

라우터 R1은 fc00:bb00:1::/48의 로케이터를 사용하는 SRv6 도메인의 일부입니다. 로컬 접두사 fc00:aa00:1::1/128을 시작하는 BGP IPv6 유니캐스트 라우터로도 작동합니다. 또한 SRv6 인프라를 통해 라우터 R3와 BGP IPv6 유니캐스트 피어링을 설정합니다. 굵게 강조 표시된 컨피그레이션은 이 문서에 설명된 제어 흐름을 디버깅하기 위한 시작점 역할을 하며 전체에서 사용되는 유일한 트리거입니다.

<#root>

```
interface Loopback0
  ipv4 address 10.0.0.1 255.255.255.255
  ipv6 address fc00:bb00:1::1/128
!
interface Loopback6
  ipv6 address fc00:aa00:1::1/128
!
interface TenGigE0/0/0/8
  ipv6 enable
!
router isis 1
  is-type level-1
  net 49.0000.0000.0001.00
  address-family ipv6 unicast
  metric-style wide
  segment-routing srv6
    locator MAIN
  !
!
!
interface TenGigE0/0/0/8
  point-to-point
```

```

    address-family ipv6 unicast
    !
    !
    !
router bgp 1
  bgp router-id 10.0.0.1
  segment-routing srv6
    locator MAIN
  !
  address-family ipv6 unicast
    segment-routing srv6
      locator MAIN
      alloc mode per-vrf
    !
    network fc00:aa00:1::1/128
  !
  neighbor fc00:bb00:3::1
    remote-as 1
    update-source Loopback0
  address-family ipv6 unicast

```

encapsulation-type srv6

```

    !
    !
segment-routing
  srv6
    encapsulation
      source-address fc00:bb00:1::1
    !
    locators
      locator MAIN
        micro-segment behavior unode psp-usd
        prefix fc00:bb00:1::/48
    !

```

라우터 R2 컨피그레이션

라우터 R2는 SRv6 도메인의 일부이며 로케이터가 fc00:bb00:2::/48입니다. BGP에는 참여하지 않으며 이 토폴로지 내에서 P-라우터로 작동합니다.

```

interface Loopback0
  ipv4 address 10.0.0.2 255.255.255.255
  ipv6 address fc00:bb00:2::1/128
!
interface TenGigE0/0/0/0
  description T0 R1
  ipv6 enable
!
interface TenGigE0/0/0/1
  description T0 R2
  ipv6 enable
!
router isis 1
  is-type level-1
  net 49.0000.0000.0002.00

```

```

address-family ipv6 unicast
  metric-style wide
  segment-routing srv6
    locator MAIN
  !
!
!
interface TenGigE0/0/0/0
  point-to-point
  address-family ipv6 unicast
  !
!
interface TenGigE0/0/0/1
  point-to-point
  address-family ipv6 unicast
  !
!
!
segment-routing
  srv6
    encapsulation
      source-address fc00:bb00:2::1
    !
    locators
      locator MAIN
        micro-segment behavior unode psp-usd
        prefix fc00:bb00:2::/48
      !

```

라우터 R3 컨피그레이션

라우터 R3은 fc00:bb00:3::/48의 로케이터를 사용하는 SRv6 도메인의 일부입니다. 라우터 R1과 BGP IPv6 유니캐스트 피어링을 가지며, 둘 다 루프백 6 인터페이스의 IPv6 접두사를 교환합니다.

```

interface Loopback0
  ipv4 address 10.0.0.3 255.255.255.255
  ipv6 address fc00:bb00:3::1/128
!
interface Loopback6
  ipv6 address fc00:aa00:3::3/128
!
interface TenGigE0/0/0/1
  description T0 R2
  ipv6 enable
!
router isis 1
  is-type level-1
  net 49.0000.0000.0003.00
  address-family ipv6 unicast
    metric-style wide
    segment-routing srv6
      locator MAIN
    !
  !
!
interface TenGigE0/0/0/1
  point-to-point

```

```

address-family ipv6 unicast
!
!
!
router bgp 1
  bgp router-id 10.0.0.3
  segment-routing srv6
    locator MAIN
  !
  address-family ipv6 unicast
    segment-routing srv6
      locator MAIN
      alloc mode per-vrf
    !
    network fc00:aa00:3::3/128
  !
  neighbor fc00:bb00:1::1
    remote-as 1
    update-source Loopback0
  address-family ipv6 unicast
    encapsulation-type srv6
  !
!
segment-routing
srv6
  encapsulation
    source-address fc00:bb00:3::1
  !
  locators
    locator MAIN
    micro-segment behavior unode psp-usd
    prefix fc00:bb00:3::/48
  !
!
!
!
!

```

SRv6 SID의 시그널링 흐름

언더레이 SRv6 인프라에서 각 라우터는 토폴로지 전체에 링크 상태 정보를 제공하며, 각 라우터는 링크 상태 ISIS 프로토콜을 통해 SRv6 로케이터를 광고합니다. R1의 ISIS 데이터베이스는 SRv6 도메인에 참여하는 모든 라우터의 로케이터를 표시합니다.

<#root>

RP/0/RSP0/CPU0:R1#

show isis database verbose R1 | include SRv6 Locator

SRv6 Locator: MT (IPv6 Unicast)

fc00:bb00:1::/48

D:0 Metric: 1 Algorithm: 0

RP/0/RSP0/CPU0:R1#

show isis database verbose R2 | include SRv6 Locator

```

SRv6 Locator:    MT (IPv6 Unicast)
fc00:bb00:2::/48

D:0 Metric: 0 Algorithm: 0

RP/0/RSP0/CPU0:R1#
show isis database verbose R3 | include SRv6 Locator

SRv6 Locator:    MT (IPv6 Unicast)
fc00:bb00:3::/48

D:0 Metric: 1 Algorithm: 0

```

이 SRv6 구현에서는 GRT(Global Routing Table) 트래픽 오버레이를 지원합니다. 전역 BGP IPv6 유니캐스트 오버레이 서비스가 R1 및 R3 모두에서 활성화된 경우 각 라우터는 새 서비스 SID를 생성합니다. 이 서비스 SID는 기본 VRF와 연결되어 있으며 이 시나리오에서 엔드포인트 동작 uDT6을 사용합니다. 두 BGP 피어 간에 SRv6 전달을 활성화하려면 BGP IPv6 유니캐스트 피어 간에 이 서비스 SID를 교환해야 합니다. 다음 섹션에서는 트리거 실행(캡슐화 유형 srv6 활성화)부터 라우터 R3에서 SRv6 전달이 프로그래밍되는 지점까지 BGP 신호 흐름의 단계를 간략하게 설명합니다.

1. SRv6의 캡슐화를 활성화하기 전의 상태

BGP 피어에 대한 IPv6 유니캐스트 SAFI에서 SRv6 캡슐화를 활성화하기 전에 라우터 R1에 서비스 SID가 할당된 BGP IPv6 접두사가 있어야 합니다. R1의 IPv6 유니캐스트 전역 SAFI에서 'segment-routing srv6'이 활성화되어 있을 때 발생합니다. 출력에 로컬 SID fc00:bb00:1:e002:: BGP ipv6 유니캐스트 아래의 모든 접두사에 할당됩니다.

```

<#root>

RP/0/RSP0/CPU0:R1#
show bgp ipv6 unicast local-sids

BGP router identifier 10.0.0.1, local AS number 1
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0800000   RD version: 7
BGP table nexthop route policy:
BGP main routing table version 7
BGP NSR Initial initsync version 7 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs

Status codes: s suppressed, d damped, h history, * valid, > best
               i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Local Sid                      Alloc mode   Locator
*> fc00:aa00:1::1/128 fc00:bb00:1:e002::          per-vrf      MAIN
*> ifc00:aa00:3::3/128 NO SRv6 Sid                  -            -

```

Processed 2 prefixes, 2 paths

이 서비스 SID는 R1의 sid_mgr 프로세스에 의해 로컬로 프로그래밍되며, 이는 기본 vrf와 연결되어 있고 bgp가 소유한 uDT6로서의 엔드포인트 동작을 가지고 있습니다. 이는 R1이 목적지 주소의 패킷을 수신할 때마다 서비스 SID fc00:bb00:1:e002:: 그리고 마지막 세그먼트입니다. R1은 헤더를 역캡슐화하고 역캡슐화된 패킷을 IPv6 기본 vrf 테이블의 FIB 조회에 제출해야 합니다. 이는 모든 SRv6 엔드포인트 동작을 나열하는 RFC8986에 따른 것입니다. sid_mgr이 서비스 SID fc00:bb00:1:e002::를 생성하는 것을 표시하는 출력을 확인합니다. 이 정보를 RIB와 FIB에 전달합니다.

<#root>

RP/0/RSP0/CPU0:R1#

show segment-routing srv6 sid all

*** Locator: 'MAIN' ***

SID	Behavior	Context	Owner	Sta
-----	-----	-----	-----	---
fc00:bb00:1::	uN (PSP/USD)	'default':1	sidmgr	InU
fc00:bb00:1:e001::	uA (PSP/USD)	[Te0/0/0/8, Link-Local]:0	isis-1	InU
fc00:bb00:1:e002::	uDT6	'default'	bgp-1	
InUse Y				

RP/0/RSP0/CPU0:R1#

show segment-routing srv6 sid fc00:bb00:1:e002:: internal

*** Locator: 'MAIN' ***

SID	Behavior	Context	Owner	Sta
-----	-----	-----	-----	---
fc00:bb00:1:e002::				
uDT6 'default' bgp-1 InUse Y				
SID Function: 0xe002				
SID context: { table-id=0xe0800000 ('default':IPv6/Unicast) }				
App data: [0000000000000000]				
Locator: 'MAIN'				
Allocation type: Dynamic				
Owner List:				
1) Name: bgp-1, Client-ID: 32, Proto-ID: 8, Node-ID: 0, Locator-ID: 5 ()				
RefCount: 1				
Flags: 0x0 ()				
Chkpt Obj ID: 0x2f60				
TI Object:				
Type: Entry				
Ptr: 0x140160285526000, Producer ID: 0				
Flags:				
Generic: 0x0 ()				

Specific: 0x0 ()
Modified: Fri Jun 27 16:27:05 EST 2025 (2d01h ago)
Created: Jun 27 16:17:40.796 (2d01h ago)
Event history:

SIDMGR-OPCODE-EVENT-CLASS
Total entries : 4

Event	Time Stamp	S, M
object create	Jun 27 16:17:40.864	1, 0
object delete	Jun 27 16:27:04.320	1, 1
object modify	Jun 27 16:27:04.320	0, 1
object refcount decrement	Jun 27 16:27:04.320	0, 1

RP/0/RSP0/CPU0:R1#

show route ipv6 fc00:bb00:1:e002:: detail

Routing entry for

fc00:bb00:1:e002::/64

Known via
"local-srv6 bgp-1"
, distance 0, metric 0,

SRv6 Endpoint uDT6

, SRv6 Format f3216
Installed Jun 27 16:27:06.040 for 2d01h
Routing Descriptor Blocks
 directly connected
 Route metric is 0
 Label: None
 Tunnel ID: None
 Binding Label: None
 Extended communities count: 0
 NHID: 0x0 (Ref: 0)
Route version is 0x15 (21)
No local label
IP Precedence: Not Set
QoS Group ID: Not Set
Flow-tag: Not Set
Fwd-class: Not Set
Route Priority: RIB_PRIORITY_LOCAL (3) SVD Type RIB_SVD_TYPE_LOCAL
Download Priority 0, Download Version 3140327
No advertising protos.

RP/0/RSP0/CPU0:R1#

show cef ipv6 fc00:bb00:1:e002::

fc00:bb00:1:e002::/64, version 3140327,

SRv6 Endpoint uDT6

, internal 0x1000001 0x0 (ptr 0x7bb98f54) [1], 0x400 (0x7ba7cfa0), 0x0 (0x7a90d290)
Updated Jun 27 16:27:06.043
Prefix Len 64, traffic index 0, precedence n/a, priority 0
gateway array (0x78e92608) reference count 3, flags 0x0, source rib (7), 0 backups
 [4 type 3 flags 0x8401 (0x78f35598) ext 0x0 (0x0)]

```
LW-LDI[type=3, refc=1, ptr=0x7ba7cfa0, sh-ldi=0x78f35598]
gateway array update type-time 1 Jun 26 15:54:48.345
LDI Update time Jun 26 15:54:48.349
LW-LDI-TS Jun 27 16:17:42.533
Accounting: Disabled
  via ::/128, 0 dependencies, weight 0, class 0 [flags 0x0]
  path-idx 0 NHID 0x0 [0x781b61e8 0x0]
  next hop ::/128

Load distribution: 0 (refcount 4)

Hash  OK  Interface          Address
0     Y   recursive          Lookup in table
```

R1은 BGP ipv6 유니캐스트 피어 아래에서 SRv6 캡슐화를 활성화하지 않았으므로, R1은 R1이 로컬로 로컬 SID를 할당했더라도 BGP 업데이트에서 SRv6 TLV가 없는 R3에 접두사를 알립니다.

<#root>

RP/0/RSP0/CPU0:R1#

show bgp ipv6 unicast

```
BGP router identifier 10.0.0.1, local AS number 1
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0800000 RD version: 7
BGP table nexthop route policy:
BGP main routing table version 7
BGP NSR Initial initsync version 7 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs

Status codes: s suppressed, d damped, h history, * valid, > best
                i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop          Metric LocPrf Weight Path
*> fc00:aa00:1::1/128 ::                0          32768 i
*> ifc00:aa00:3::3/128 fc00:bb00:3::1      0         100      0 i
```

Processed 2 prefixes, 2 paths

RP/0/RSP0/CPU0:R1#

show bgp ipv6 unicast advertised neighbor fc00:bb00:3::1

```
fc00:aa00:1::1/128 is advertised to fc00:bb00:3::1
Path info:
  neighbor: Local          neighbor router id: 10.0.0.1
  valid local best
Received Path ID 0, Local Path ID 1, version 4
Attributes after inbound policy was applied:
  next hop: ::
  MET ORG AS
```

```
origin: IGP metric: 0
aspath:
Attributes after outbound policy was applied:
next hop: fc00:bb00:1::1
MET ORG AS
origin: IGP metric: 0
aspath:
```

라우터 R3은 SID 없이 라우터 R1에서 업데이트를 수신합니다. R3은 SRv6 헤더 없이 R1에서 수신한 접두사를 RIB 및 FIB 테이블에 설치합니다.

<#root>

RP/0/RSP0/CPU0:R3#

show bgp ipv6 unicast received-sids

```
BGP router identifier 10.0.0.3, local AS number 1
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0800000 RD version: 44
BGP table nexthop route policy:
BGP main routing table version 44
BGP NSR Initial initsync version 6 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs
```

```
Status codes: s suppressed, d damped, h history, * valid, > best
                i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
  Network                Next Hop                Received Sid
*> ifc00:aa00:1::1/128 fc00:bb00:1::1          NO SRv6 Sid
*> fc00:aa00:3::3/128 ::                        NO SRv6 Sid
```

Processed 2 prefixes, 2 paths

RP/0/RSP0/CPU0:R3#

show route ipv6 unicast fc00:aa00:1::1/128 detail

```
Routing entry for fc00:aa00:1::1/128
  Known via "bgp 1", distance 200, metric 0, type internal
  Installed Jun  8 17:34:24.126 for 00:12:38
  Routing Descriptor Blocks
    fc00:bb00:1::1, from fc00:bb00:1::1
      Route metric is 0
      Label: None
      Tunnel ID: None
      Binding Label: None
      Extended communities count: 0
      NHID: 0x0 (Ref: 0)
      Path Grouping ID: 1
  Route version is 0x1d (29)
  No local label
```

IP Precedence: Not Set
QoS Group ID: Not Set
Flow-tag: Not Set
Fwd-class: Not Set
Route Priority: RIB_PRIORITY_RECURSIVE (12) SVD Type RIB_SVD_TYPE_LOCAL
Download Priority 4, Download Version 162
No advertising protos.

RP/0/RSP0/CPU0:R3#

show cef ipv6 fc00:aa00:1::1/128

fc00:aa00:1::1/128, version 162, internal 0x5000001 0x40 (ptr 0x7941f0f4) [1], 0x0 (0x0), 0x0 (0x0)
Updated Jun 8 17:34:24.128
Prefix Len 128, traffic index 0, precedence n/a, priority 4
gateway array (0x78eac518) reference count 1, flags 0x2010, source rib (7), 0 backups
[1 type 3 flags 0x48441 (0x78f4f538) ext 0x0 (0x0)]
LW-LDI[type=0, refc=0, ptr=0x0, sh-ldi=0x0]
gateway array update type-time 1 Jun 8 17:34:24.129
LDI Update time Jun 8 17:34:24.129

Level 1 - Load distribution: 0
[0] via fc00:bb00:1::1/128, recursive

Accounting: Disabled
via fc00:bb00:1::1/128, 5 dependencies, recursive [flags 0x6000]
path-idx 0 NHID 0x0 [0x7941edb4 0x0]
next hop fc00:bb00:1::1/128 via fc00:bb00:1::/48

Load distribution: 0 (refcount 1)

Hash	OK	Interface	Address
0	Y	TenGigE0/0/0/1	remote

2. 캡슐화 SRv6 활성화

SRv6 캡슐화를 활성화하면 R1이 특성 유형 40의 피어로 BGP 업데이트 메시지를 보냅니다. 이는 세그먼트 라우팅에서 특정 SID(Segment Routing Identifier)로 BGP 접두사를 광고하는 데 사용됩니다. 라우터 R1은 IPv6 접두사 fc00:bb00:3::1(1단계)에 대한 UPDATE를 관련 SID fc00:bb00:1:e002::와 함께 R3로 전송합니다. 업데이트를 수신하면 라우터 R3은 BGP IPv6 유니캐스트 테이블을 업데이트하고(2단계), 그 후 RIB 및 FIB 테이블을 업데이트합니다(3단계). 그림 2는 BGP 신호 흐름과 해당 단계를 보여줍니다.

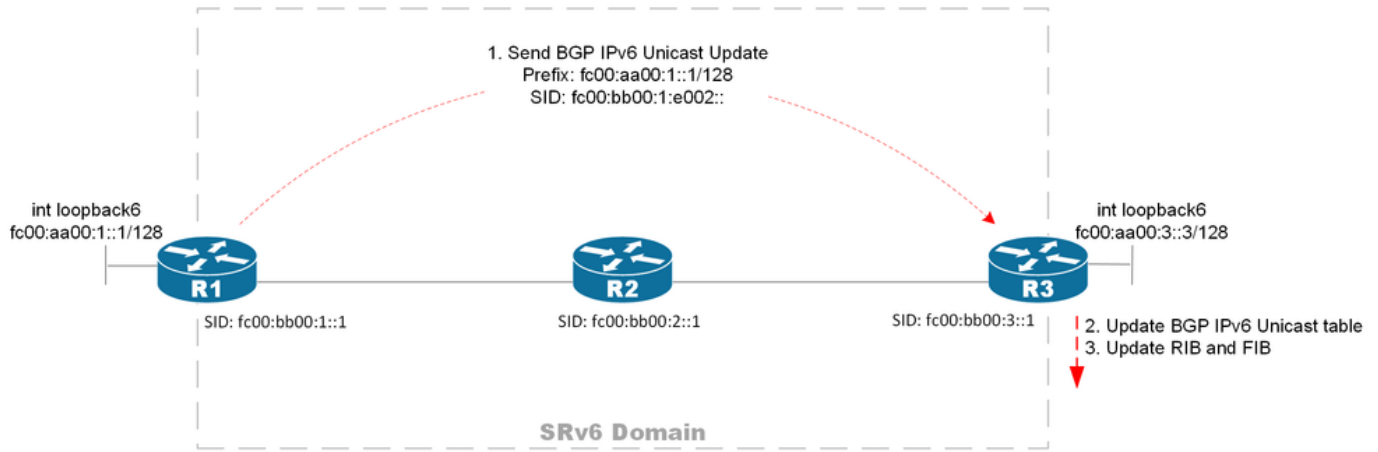


그림 2. 캡슐화 srv6 활성화 후의 BGP 신호 흐름

출력은 R3 피어에서 SRv6 캡슐화를 활성화한 직후 BGP 디버그 로그를 표시하여 R1이 R3에 BGP 업데이트 메시지를 전송함을 보여줍니다.

```
router bgp 1
 neighbor fc00:bb00:3::1
 address-family ipv6 unicast
 encapsulation-type srv6
 !
 !
 !
end
```

```
RP/0/RSP0/CPU0:R1(config)#commit
```

```
bgp[1100]: [default-upd] (ip6u): Added reference to table TBL:default (2/1) refcount 9
bgp[1100]: [default-upd] (ip6u): Created update group for table TBL:default (2/1), index 0.3 neighbor f
bgp[1100]: [default-upd] (ip6u): Removed neighbor fc00:bb00:3::1 from update group 0.2 for IPv6 Unicast
bgp[1100]: [default-upd] (ip6u): Removing neighbor fc00:bb00:3::1 from update filter-group 0.2 in IPv6 U
bgp[1100]: [default-upd]: Enqueue Wdw: Nbr:fc00:bb00:3::1(5) Wdw:0 Del:0 Pending:0 RefreshPending:0
bgp[1100]: [default-upd]: Deleting filter-group 0.2 in TBL:default (2/1) refcount 2
bgp[1100]: [default-upd] (ip6u): Deleted update group 0.2
bgp[1100]: [default-upd] (ip6u): Added reference to table TBL:default (2/1) refcount 10
bgp[1100]: [default-upd]: Compute RT set for vrf default neighbor fc00:bb00:3::1 from old filter-group
bgp[1100]: [default-upd]: Allocating filter-group 0.3in TBL:default (2/1)
bgp[1100]: [default-upd] (ip6u): Added reference to table TBL:default (2/1) refcount 11
bgp[1100]: [default-upd] (ip6u): Adding vrf default neighbor fc00:bb00:3::1 to new filter-group 0.3 in
bgp[1100]: [default-upd] (ip6u): Added vrf default neighbor fc00:bb00:3::1 to update filter-group 0.3 i
bgp[1100]: [default-upd] (ip6u): Added neighbor fc00:bb00:3::1 to update sub-group 0.1 in IPv6 Unicast
bgp[1100]: [default-upd] (ip6u): Started updgrp timer for updgrp 0.3:: delay=0.010, delaytype=0
bgp[1100]: [default-upd] (ip6u): Removed reference to Table TBL:default (2/1) refcount 9
bgp[1100]: [default-upd] (ip6u): Starting updgen walk for updgrp 0.3:: targetver=27: tblver=27, labelv
bgp[1100]: [default-upd] (ip6u): Computing updates for update sub-group 0.1 (Regular)
bgp[1100]: [default-upd] (ip6u): bgp_srv6_execute_sid_alloc_mode_policy: Use default SRv6 alloc mode pe
bgp[1100]: [default-upd]: table-attr walk for table TBL:default (2/1), resume version 0, subgrp version
bgp[1100]: [default-upd] (ip6u): process UPDATE for: tbl=TBL:default (2/1), afi=5: ug=0.3, (Regular), p
bgp[1100]: [default-upd] (ip6u): Ran 'internal' policy '(null)', result 'TRUE', ptr 0x7f4584005f30, use
bgp[1100]: [default-upd] (ip6u):      : tbl=TBL:default (2/1), afi=5: ug=0.3, sg=0.1, ugfl=0x00104183: n
bgp[1100]: [default-upd] (ip6u):      <NH&LABEL-SEL>: tbl=TBL:default (2/1), afi=5: ug=0.3, sg=0.1, ugfl
bgp[1100]: [default-upd] (ip6u):      <nh&label-sel>:: labselectdone=1, labselectdone=0, updlab=1048577(0
bgp[1100]: [default-upd]: Comm-lib: Assigned ID (0x1d000008) for elem-type PREFIX_SID SRV6_L3SVC
bgp[1100]: [default-upd]: Comm-lib: Assigned ID (0x9000000c) for elem-type Attribute
bgp[1100]: [default-upd] (ip6u): Permit UPDATE to filter-group 0.3 (Regular, pelem Regular) for fc00:aa
```

```

bgp[1100]: [default-upd] (ip6u): Sending UPDATE message(0x0x7f4589fd4ba4) to sub-group 0.1 (Regular, pe
bgp[1100]: [default-upd] (ip6u): origin i, path , metric 0, localpref 100, Prefix-SID attribute 0x05002
bgp[1100]: [default-upd] (ip6u): Created msg elem 0x0x7f4589e3afc8 (pointing to message 0x0x7f4589fd4ba
bgp[1100]: [default-upd] (ip6u): process UPDATE for: tbl=TBL:default (2/1), afi=5: ug=0.3, (Regular), p
bgp[1100]: [default-upd] (ip6u): No unreachable (not advertising to sender: fc00:bb00:3::1) sent to sub
bgp[1100]: [default-upd] (ip6u): Generated 1 updates for update sub-group 0.1 (average size = 126 bytes
bgp[1100]: [default-upd] (ip6u): Updates replicated to neighbor fc00:bb00:3::1
bgp[1100]: [default-iowt]: fc00:bb00:3::1 send UPDATE length (incl. header) 126
bgp[1100]: [default-iowt]: Send message dump for fc00:bb00:3::1:
bgp[1100]: [default-iowt]: ffff ffff ffff ffff ffff ffff ffff ffff
bgp[1100]: [default-iowt]: 007e 0200 0000 6790 0e00 2600 0201 10fc
bgp[1100]: [default-iowt]: 00bb 0000 0100 0000 0000 0000 0000 0100
bgp[1100]: [default-iowt]: 80fc 00aa 0000 0100 0000 0000 0000 0000
bgp[1100]: [default-iowt]: 0140 0101 0040 0200 8004 0400 0000 0040
bgp[1100]: [default-iowt]: 0504 0000 0064 c028 2505 0022 0001 001e
bgp[1100]: [default-iowt]: 00fc 00bb 0000 01e0 0200 0000 0000 0000
bgp[1100]: [default-iowt]: 0000 003e 0001 0006 2010 1000 0000
bgp[1100]: [default-iowt]: bgp_io_nbr_add_version: New ver: nbr=fc00:bb00:3::1, io_wr_txsn=58992, acksn
bgp[1100]: [default-iowt]: bgp_io_nbr_derive_acked_version: nbr=fc00:bb00:3::1, io_wr_txsn=58992, acksn
bgp[1100]: [default-iowt]: fc00:bb00:3::1 (afi:4) advancedpeer_acked_version to 10refresh peer acked ve
bgp[1100]: [default-iowt]: fc00:bb00:3::1 (afi:5) received ack for version 27
bgp[1100]: [default-iowt]: bgp_write_list_tonet: IO_SENDMSG: nbr=fc00:bb00:3::1, fd=530: total=1, send-
bgp[1100]: [default-iowt] (ip6u): Deleting msg elem 0x0x7f4589e3afc8 (message 0x0x7f4589fd4ba4), for fi
bgp[1100]: [default-iowt] (ip6u): Deleting message 0x0x7f4589fd4ba4, from subgroup 0.1
bgp[1100]: [default-iowt]: Keepalive timer started for fc00:bb00:3::1(loc 10): last 529293 this 529308
bgp[1100]: [default-iowt]: bgp write for afi 4 for neighbor fc00:bb00:3::1 (fd 530)
bgp[1100]: [default-iowt]: bgp write for afi 5 for neighbor fc00:bb00:3::1 (fd 530)
bgp[1100]: [default-iowt]: bgp_io_nbr_derive_acked_version: nbr=fc00:bb00:3::1, io_wr_txsn=58992, acksn
bgp[1100]: [default-iowt]: fc00:bb00:3::1 (afi:4) advancedpeer_acked_version to 10refresh peer acked ve
bgp[1100]: [default-iowt]: fc00:bb00:3::1 (afi:5) advancedpeer_acked_version to 27refresh peer acked ve
bgp[1100]: [default-iowt]: bgp_io_write_nbr_ver_timer_process: nbr_ver_timer handler: Walk complete: nb

```

출력에 R1의 BGP 추적 항목이 표시됩니다.

```

default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:7799: trying to find update group for nbr fc00:bb00:3
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:6752: created update group for table TBL:default (2/1
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:2039: Filter-group op (Filter-group Rm Nbr) Tbl/Nbr(A
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:1501: Filter-group op (Delete) Tbl/Nbr(TBL:default (2
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:6798: Delete update group for table TBL:default (2/1)
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:2181: Filter-group op (Filter-group Compute Nbr RT) T
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:1411: Filter-group op (Alloc) Tbl/Nbr(TBL:default (2/
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:2725: Filter-group op (Filter-group Add Nbr new) Tbl/
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:2751: created filtergrp 3 for vrf default nbr fc00:bb
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:4473: Created subgrp:1(0x840070a0) refr:0 for nbr fc0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:6935: added vrf default nbr fc00:bb00:3::1 to update
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:3088: TBL:default (2/1) free subgrp SG:2 subgrp:0x840
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:1316: Update gen Start bit operation Filtergrp delete
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:11342: Updgen - TBL:default (2/1) UG: 0.3 SG: 0.1 msg
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:11344: Updgen - pfx: [tot] adv/wdn/sup/skp/be[2] 1/0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:11351: Updgen - fpx: wdn/skp[0/0] ver: 0 -> 27 res ve
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:4009: Updgen - UG: 3 FG: 3 afi:5 msg: 1 ver -> 27
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t32561 [UPD]:4011: pfx: adv/wdn/sup/skp 1/0/0/1
default-bgp/spkr-tr2-common 0/RSP0/CPU0 t32558 [COMMON]:638: vrf default nbr fc00:bb00:3::1, set peer a
default-bgp/spkr-tr2-gen 0/RSP0/CPU0 t32501 [GEN]:617: vrf default nbr 2000:0:0:1::1, old state 1, new

```

디코딩된 BGP UPDATE 메시지는 서비스 SID fc00:bb00:1:e002::를 포함하는 특성 유형 40 및 TLV 유형 5를 보여줍니다.

Attribute

```
ATTRIBUTE FLAG:          0xC0
ATTRIBUTE FLAG binary:   11000000
    Bit 0, the Optional bit, is 1 so this is an optional attribute
    Bit 1, the Transitive bit, is 1 so this is a transitive attribute
    Bit 2, the Partial bit, is not set
    Bit 3, the Extended Length Bit, is 0 so the length field is 1 byte
    The lower-order four bits of the Attribute Flag are unused and are set to 0000

ATTRIBUTE TYPE:          0x28      - 40
ATTRIBUTE LENGTH:        0x25      - 37 bytes
ATTRIBUTE CONTENT:       0x0500220001001E00FC00BB0000001E0020000000000000000000003E00010006201010000000

    BGP Prefix-SID:
    Type:                5 (0x05) - SRv6 L3 Service
    Length:               34 - 0x0022
    Value:                0x0001001E00FC00BB0000001E0020000000000000000000003E00010006201010000000
    Reserved:             0x00
    Sub Type:             1 (0x01)
    Sub Length:           30 (0x001E)
    SRv6 SID = FC00:BB00:0001:E002:0000:0000:0000:0000
    SID Flags:            0 (0x00)
    Endpoint Behavior:    62 (0x003E)
    Reserved2 :           0 (0x00)
    SRv6 SID Optional Type: 1 (0x01)
    SRv6 SID Optional Len: 6 (0x0006)
    SRv6 SID Optional Value: 35253360001024 (0x201010000000)
```

전체 디코딩된 BGP UPDATE 메시지는 다음과 같습니다.

Message #1 - 126 bytes

```
FF FF FF FF  FF FF FF FF  FF FF FF FF  FF FF FF FF
00 7E 02 00  00 00 67 90  0E 00 26 00  02 01 10 FC
00 BB 00 00  01 00 00 00  00 00 00 00  00 00 01 00
80 FC 00 AA  00 00 01 00  00 00 00 00  00 00 00 00
01 40 01 01  00 40 02 00  80 04 04 00  00 00 00 40
05 04 00 00  00 64 C0 28  25 05 00 22  00 01 00 1E
00 FC 00 BB  00 00 01 E0  02 00 00 00  00 00 00 00
00 00 00 3E  00 01 00 06  20 10 10 00  00 00
```

```
BGP Marker:    0xFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
BGP Length:    0x007E      - 126 bytes
BGP Type:      0x02      - UPDATE
```

```
UPDATE
UNFEASIBLE ROUTES LENGTH:    0x0000      - 0 bytes
TOTAL PATH ATTRIBUTES LENGTH: 0x0067      - 103 bytes
```

Attribute

```
ATTRIBUTE FLAG:          0x90
ATTRIBUTE FLAG binary:   10010000
```


Bit 1, the Transitive bit, is 0 so this is a non-transitive attribute
Bit 2, the Partial bit, is not set
Bit 3, the Extended Length Bit, is 0 so the length field is 1 byte
The lower-order four bits of the Attribute Flag are unused and are set to 0000

ATTRIBUTE TYPE: 0x04 - 4
ATTRIBUTE LENGTH: 0x04 - 4 bytes
ATTRIBUTE CONTENT: 0x00000000 - 0

Attribute

ATTRIBUTE FLAG: 0x40
ATTRIBUTE FLAG binary: 01000000
Bit 0, the Optional bit, is 0 so this is a well-known attribute
Bit 1, the Transitive bit, is 1 so this is a transitive attribute
Bit 2, the Partial bit, is not set
Bit 3, the Extended Length Bit, is 0 so the length field is 1 byte
The lower-order four bits of the Attribute Flag are unused and are set to 0000

ATTRIBUTE TYPE: 0x05 - 5
ATTRIBUTE LENGTH: 0x04 - 4 bytes
ATTRIBUTE CONTENT: 0x00000064 - 100

Attribute

ATTRIBUTE FLAG: 0xC0
ATTRIBUTE FLAG binary: 11000000
Bit 0, the Optional bit, is 1 so this is an optional attribute
Bit 1, the Transitive bit, is 1 so this is a transitive attribute
Bit 2, the Partial bit, is not set
Bit 3, the Extended Length Bit, is 0 so the length field is 1 byte
The lower-order four bits of the Attribute Flag are unused and are set to 0000

ATTRIBUTE TYPE: 0x28 - 40
ATTRIBUTE LENGTH: 0x25 - 37 bytes
ATTRIBUTE CONTENT: 0x0500220001001E00FC00BB000001E00200000000000000000003E00010006201010000000

BGP Prefix-SID:

Type: 5 (0x05) - SRv6 L3 Service
Length: 34 - 0x0022
Value: 0x0001001E00FC00BB000001E00200000000000000000003E00010006201010000000
Reserved: 0x00
Sub Type: 1 (0x01)
Sub Length: 30 (0x001E)
SRv6 SID = FC00:BB00:0001:E002:0000:0000:0000:0000
SID Flags: 0 (0x00)
Endpoint Behavior: 62 (0x003E)
Reserved2 : 0 (0x00)
SRv6 SID Optional Type: 1 (0x01)
SRv6 SID Optional Len: 6 (0x0006)
SRv6 SID Optional Value: 35253360001024 (0x201010000000)

NLRI

NLRI LENGTH: UPDATE Length - 23 - TOTAL PATH ATTRIBUTES LENGTH - UNFEASIBLE ROUTES LENGTH

NLRI LENGTH: 126 - 23 - 103 - 0
NLRI LENGTH: 0 bytes

3. R3 BGP 업데이트를 수신하여 BGP IPv6 유니캐스트 테이블에 설치합니다

라우터 R3은 R1에서 BGP 업데이트를 수신합니다. 이는 R3에서 BGP 디버깅을 활성화하여 관찰할 수 있습니다. 수신된 BGP 업데이트 패킷은 디버그 출력에 표시된 것처럼 R1에서 보낸 패킷과 일치해야 합니다.

```
bgp[1100]: [default-rtr]: UPDATE from fc00:bb00:1::1 contains nh fc00:bb00:1::1/128, gw_afi 5, flags 0x0
bgp[1100]: [default-rtr]: NH-Validate-Create: addr=fc00:bb00:1::1/128, len=16, nlrifi=5, nbr=fc00:bb00:1::1/128
bgp[1100]: [default-rtr]: --bgp4_rcv_attributes--: END: nbr=fc00:bb00:1::1: msg=0x0x7fc420108bdc/126,
bgp[1100]: [default-rtr]: Comm-lib: Assigned ID (0x1d0000ac) for elem-type PREFIX_SID SRV6_L3SVC
bgp[1100]: [default-rtr]: Comm-lib: Assigned ID (0x900000de) for elem-type Attribute
bgp[1100]: [default-rtr] (ip6u): Received UPDATE from fc00:bb00:1::1 with attributes:
bgp[1100]: [default-rtr] (ip6u): nexthop fc00:bb00:1::1/128, origin i, localpref 100, metric 0
bgp[1100]: [default-rtr] (ip6u): Received prefix fc00:aa00:1::1/128 (path ID: none) from fc00:bb00:1::1
bgp[1100]: [default-rtr] (ip6u): Handling OCRIB attrs while relacing path 0x7fc3e1be61d8. Old oc attr (
bgp[1100]: [default-rtr]: bgp_bmp_table_path_update_cb: Operation: 0x1, Inbound Post-Policy Route Mon i
bgp[1100]: [default-rtr] (ip6u): Done modify path (old tlv size=0 new tlv size=0) for net=fc00:aa00:1::1/128
bgp[1100]: [default-rtr]: bgp_set_path_metric:8712 afi 5 net fc00:aa00:1::1/128 path 0x7fc3e1be61d8 nh
bgp[1100]: [default-rtr] (ip6u): bestpath: (full bp 1) start for net=fc00:aa00:1::1/128, nver=2000371,
bgp[1100]: [default-rtr] (ip6u): bestpath: (full 1) calculated for net=fc00:aa00:1::1/128, nver=2000371
bgp[1100]: [default-rtr] (ip6u): bestpath: change for net=fc00:aa00:1::1/128, nver=2000371, nfl=0x000003
bgp[1100]: [default-rtr] (ip6u): bestpath: update flags for net=fc00:aa00:1::1/128, nver=2000371, nfl=0
bgp[1100]: [default-rtr] (ip6u): bestpath: modified path: net=fc00:aa00:1::1/128, nver=2000371, nfl=0x0
bgp[1100]: [default-rtr] (ip6u): bgp_srv6_get_alloc_mode_locator_from_policy: Use default SRv6 alloc mo
bgp[1100]: [default-rtr] (ip6u): bestpath: complete for net=fc00:aa00:1::1/128, nver=2000371, nfl=0x0000
bgp[1100]: [default-rtr]: Received UPDATE from fc00:bb00:1::1 (length incl. header = 126)
bgp[1100]: [default-rtr]: Receive message dump for fc00:bb00:1::1:
bgp[1100]: [default-rtr]: ffff ffff ffff ffff ffff ffff ffff ffff
bgp[1100]: [default-rtr]: 007e 0200 0000 6790 0e00 2600 0201 10fc
bgp[1100]: [default-rtr]: 00bb 0000 0100 0000 0000 0000 0000 0100
bgp[1100]: [default-rtr]: 80fc 00aa 0000 0100 0000 0000 0000 0000
bgp[1100]: [default-rtr]: 0140 0101 0040 0200 8004 0400 0000 0040
bgp[1100]: [default-rtr]: 0504 0000 0064 c028 2505 0022 0001 001e
bgp[1100]: [default-rtr]: 00fc 00bb 0000 01e0 0200 0000 0000 0000
bgp[1100]: [default-rtr]: 0000 003e 0001 0006 2010 1000 0000
bgp[1100]: [default-rtr]: Enabling read from: fc00:bb00:1::1 readset: 1 msgcount: 0
bgp[1100]: [default-iowt]: bgp write for afi 4 for neighbor fc00:bb00:1::1 (fd 516)
bgp[1100]: [default-iowt]: bgp write for afi 5 for neighbor fc00:bb00:1::1 (fd 516)
bgp[1100]: [default-imp] (ip6u): START import walk from 2000371 to 2000372 skip_walk 1
bgp[1100]: [default-rib2] (ip6u): RIB thread triggered for versioned walk: current version 2000371, ack
bgp[1100]: [default-rib2] (ip6u): RNH rib opaque update for (IPv6 Unicast)
bgp[1100]: [default-rib2] (ip6u): RIB thread triggered for RNH walk for nh table(IPv6 Unicast): current
bgp[1100]: [default-lbl] (ip6u): Label update triggered: current version 2000371, target version 200037
bgp[1100]: [default-lbl]: Table: TBL:default (2/1) bgp_label_srv6_sid_config_release: label_sid_need_ev
bgp[1100]: [default-lbl]: uSID WLIB allocation is (LIB Default)
bgp[1100]: [default-lbl]: Table: TBL:default (2/1) bgp_label_thread_walk_type: rd:0x7fc3e1efbf30(ALLzer
bgp[1100]: [default-lbl] (ip6u): rd:0x7fc3e1efbf30 sid_walk:1 label_walk:0
bgp[1100]: [default-lbl]: uSID WLIB allocation is (LIB Default)
bgp[1100]: [default-upd] (vpn4u): Started updgrp timer for updgrp 0.1:: delay=0.010, delaytype=0
bgp[1100]: [default-lbl] (ip6u): SRv6 SID process for net: TBL:default (2/1)fc00:aa00:1::1/128(SID N) e
bgp[1100]: [default-lbl] (ip6u): SRv6 SID process for net: TBL:default (2/1)fc00:aa00:1::1/128 point 1
bgp[1100]: [default-lbl]: uSID WLIB allocation is (LIB Default)
bgp[1100]: [default-lbl] (ip6u): Label update run from 2000371 target label version 2000372, rib version
```

```

bgp[1100]: [default-lbl] (ip6u): Wake up rib thread, label version 2000372, rib version 2000371, bgp table version 2000371
bgp[1100]: [default-rib2] (ip6u): RIB thread triggered for versioned walk: current version 2000371, acknowledged version 2000371
bgp[1100]: [default-rib2] (ip6u): RNH rib opaque update for (IPv6 Unicast)
bgp[1100]: [default-rib2] (ip6u): RIB thread triggered for RNH walk for nh table(IPv6 Unicast): current version 2000371, acknowledged version 2000371
bgp[1100]: [default-rib2] (ip6u): Rib Batch-buf Route ADD: table=TBL:default (2/1), tableid=0xe0800000, table version 2000371
bgp[1100]: [default-rib2] (ip6u): Revise route batch: installing fc00:aa00:1::1/128 with next hop fc00:aa00:1::1
bgp[1100]: [default-rib2] (ip6u): [0]: Rib Batch-buf Path ADD: table=TBL:default (2/1), net=fc00:aa00:1::1, pathid=0, path version 2000371
bgp[1100]: [default-rib2] (ip6u): Sending convergence info for IPv6 Unicast - not converged, version: 0
bgp[1100]: [default-upd] (ip6u): Started updgrp timer for updgrp 0.1:: delay=0.010, delaytype=0
bgp[1100]: [default-rib2] (ip6u): vrf default: RIB update run to 2000372: installed 0, modified 1, skipped 0
bgp[1100]: [default-rib2] (ip6u): RIB thread finished versioned walk: table version 2000372, acknowledged version 2000371
bgp[1100]: [default-upd] (vpn4u): Starting updgen walk for updgrp 0.1:: targetver=463: tblver=463, labelver=463
bgp[1100]: [default-upd] (ip6u): Starting updgen walk for updgrp 0.1:: targetver=2000372: tblver=2000371
bgp[1100]: [default-upd] (ip6u): Computing updates for update sub-group 0.1 (Regular)
bgp[1100]: [default-upd] (ip6u): bgp_srv6_execute_sid_alloc_mode_policy: Use default SRv6 alloc mode policy
bgp[1100]: [default-upd]: table-attr walk for table TBL:default (2/1), resume version 0, subgrp version 0
bgp[1100]: [default-upd] (ip6u): process UPDATE for: tbl=TBL:default (2/1), afi=5: ug=0.1, (Regular), pathid=0
bgp[1100]: [default-upd] (ip6u): No unreachable (not advertising to sender: fc00:bb00:1::1) sent to sub

```

라우터 R3은 R1의 업데이트 처리에 해당하는 BGP 추적을 생성하며, 이는 결국 R3가 BGP IPv6 유니캐스트 테이블을 업데이트하는 결과를 낳습니다. BGP 특성 유형 40을 포함하는 이 업데이트에서는 R1의 관련 BGP IPv6 유니캐스트 접두사와 함께 수신된 SID를 설치합니다.

```

RP/0/RSP0/CPU0:R3#show bgp trace
default-bgp/spkr-tr2-imp 0/RSP0/CPU0 t16100 [IMPORT]:6661: Skipping Import walk: import ver 2000371 -> 2000372
default-bgp/spkr-tr2-rib 0/RSP0/CPU0 t30391 [RIB]:17177: RIB walk for afi IPv6 Unicast: target version 2000371, current version 2000371
default-bgp/spkr-tr2-label 0/RSP0/CPU0 t16061 [LABEL]:8505: label walk afi:IPv6 Unicast, lbl ver 2000371, current ver 2000371
default-bgp/spkr-tr2-label 0/RSP0/CPU0 t16061 [LABEL]:8510: label walk afi:IPv6 Unicast, lbl ver 2000371, current ver 2000371
default-bgp/spkr-tr2-rib 0/RSP0/CPU0 t30391 [RIB]:17177: RIB walk for afi IPv6 Unicast: target version 2000371, current version 2000371
default-bgp/spkr-tr2-rib 0/RSP0/CPU0 t30391 [RIB]:14681: send converge to RIB, afi IPv6 Unicast, tableid=0xe0800000, table version 2000371
default-bgp/spkr-tr2-rib 0/RSP0/CPU0 t30391 [RIB]:15892: RIB(default:v6u): ver 2000371 -> 2000372 :pfx [tot] adv/wdn/sup/skp/be[1] 0/0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t16101 [UPD]:11342: Updgen - TBL:default (2/1) UG: 0.1 SG: 0.1 msg 0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t16101 [UPD]:11344: Updgen - pfx: [tot] adv/wdn/sup/skp/be[1] 0/0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t16101 [UPD]:11351: Updgen - fpx: wdn/skp[0/0] ver: 2000371 -> 2000372
default-bgp/spkr-tr2-common 0/RSP0/CPU0 t16101 [COMMON]:3628: vrf default nbr fc00:bb00:1::1, set peer 0
default-bgp/spkr-tr2-upd 0/RSP0/CPU0 t16101 [UPD]:11663: Updgen - Skip EoR for Tbl:(TBL:default (2/1))

```

<#root>

RP/0/RSP0/CPU0:R3#

show bgp ipv6 unicast received-sids

```

BGP router identifier 10.0.0.3, local AS number 1
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0800000 RD version: 46
BGP table nexthop route policy:
BGP main routing table version 46
BGP NSR Initial initsync version 6 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs

```

```

Status codes: s suppressed, d damped, h history, * valid, > best
                i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
    Network                Next Hop                Received Sid
*>ifc00:aa00:1::1/128 fc00:bb00:1::1
fc00:bb00:1:e002::
*> fc00:aa00:3::3/128 :: NO SRv6 Sid

Processed 2 prefixes, 2 paths

```

4. R3 RIB와 FIB를 설치합니다.

결국 R3는 RIB와 FIB를 설치하여 신호 처리 과정을 완료합니다. 그런 다음 R3는 SID 목록 fc00:bb00:1:e002::을 사용하여 SRv6 헤드엔드로 작동합니다. 이 인그레스 R1은 H.Encaps(RFC 8986, 섹션 5.1)로 약칭되는 SR 정책에서 캡슐화를 통한 SRv6 헤드엔드의 역할을 합니다. 이 동작은 패킷을 IPv6 헤더에 캡슐화하여 세그먼트 목록을 적용하고 필요한 경우 SRH를 추가합니다. 이 경우 세그먼트가 하나뿐이므로 SRH를 추가할 필요가 없습니다. 패킷은 목적지 주소 fc00:bb00:1:e002::(동작 SRv6 엔드포인트 UDT6가 있는 R1의 서비스 SID)와 함께 전송됩니다.

```
<#root>
```

```
RP/0/RSP0/CPU0:R3#
```

```
show route ipv6 fc00:aa00:1::1/128 detail
```

```

Routing entry for fc00:aa00:1::1/128
  Known via "bgp 1", distance 200, metric 0, type internal
  Installed Jun  8 17:52:31.546 for 00:53:55
  Routing Descriptor Blocks
    fc00:bb00:1::1, from fc00:bb00:1::1
      Route metric is 0
      Label: None
      Tunnel ID: None
      Binding Label: None
      Extended communities count: 0
      NHID: 0x0 (Ref: 0)
      Path Grouping ID: 1

```

```
SRv6 Headend: H.Encaps.Red [f3216], SID-list {fc00:bb00:1:e002::}
```

```

Route version is 0x1f (31)
No local label
IP Precedence: Not Set
QoS Group ID: Not Set
Flow-tag: Not Set
Fwd-class: Not Set
Route Priority: RIB_PRIORITY_RECURSIVE (12) SVD Type RIB_SVD_TYPE_LOCAL
Download Priority 4, Download Version 166
No advertising protos.

```

```
RP/0/RSP0/CPU0:R3#
```

show cef ipv6 fc00:aa00:1::1/128

fc00:aa00:1::1/128, version 166,

SRv6 Headend

, internal 0x5000001 0x40 (ptr 0x7941f0f4) [1], 0x0 (0x0), 0x0 (0x7ad58368)
Updated Jun 8 17:52:31.551
Prefix Len 128, traffic index 0, precedence n/a, priority 4
gateway array (0x78eac428) reference count 1, flags 0x2010, source rib (7), 0 backups
[1 type 3 flags 0x48441 (0x78f4f4d8) ext 0x0 (0x0)]
LW-LDI[type=0, refc=0, ptr=0x0, sh-ldi=0x0]
gateway array update type-time 1 Jun 8 17:52:31.551
LDI Update time Jun 8 17:52:31.551

Level 1 - Load distribution: 0
[0] via fc00:bb00:1::/128, recursive

Accounting: Disabled

via fc00:bb00:1::/128, 5 dependencies, recursive [flags 0x6000]
path-idx 0 NHID 0x0 [0x7941edb4 0x0]
next hop fc00:bb00:1::/128 via fc00:bb00:1::/48

SRv6 H.Encaps.Red SID-list {fc00:bb00:1:e002::}

Load distribution: 0 (refcount 1)

Hash	OK	Interface	Address
0	Y	TenGigE0/0/0/1	remote

그림 4는 라우터 R3(fc00:aa00:3::3)이 R1(fc00:aa00:1::1)을 ping할 때의 패킷 형식을 보여줍니다.

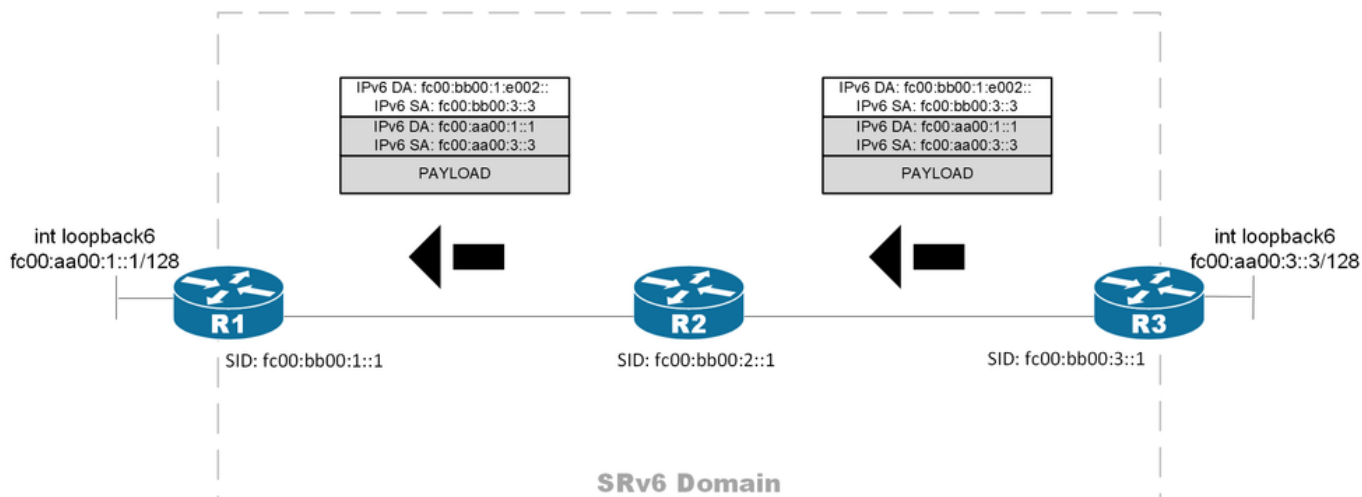


그림 4. BGP IPv6 Unicast over SRv6의 경로를 따른 패킷 처리

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