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Links visited during the webinar
- IPv6:
  - Introduced in RFC1883
- OSPFv3: https://www.rfc-editor.org/info/rfc5340
- Multiprotocol extensions for BGP-4: https://www.rfc-editor.org/info/rfc4760
- BGP Route Reflectors: https://www.rfc-editor.org/info/rfc4456
- BGP Communities:
- Regular expressions:
  - Concept: https://en.wikipedia.org/wiki/Regular_expression
  - In Cisco IOS:
- Cisco Route-Maps
- Tools for network emulation:
  - GNS3: https://www.gns3.com
  - Mikrotik router image: https://mikrotik.com/download (use Cloud Hosted Router)
Example Network
GNS3 is used to emulate the routers in our example network. We are using Cisco routers with IOS. Routers in AS64500 are named R1-R4 and are "properly" configured, while routers in the other Autonomous Systems are just there to do BGP with AS64500 and are not "properly" configured.
Cisco IOS Router Configurations - AS64500

R1 (IPv6 related commands are highlighted)

hostname R1
!
ipv6 unicast-routing
!
interface Loopback0
  ip address 192.168.1.1 255.255.255.255
  ip router isis
  ipv6 address 2001:DB8:500::1:1/128
  ipv6 router isis
!
interface GigabitEthernet0/0
  description to R3
  ip address 192.168.2.1 255.255.255.252
  ip router isis
  ipv6 address autoconfig
  ipv6 router isis
!
interface GigabitEthernet1/0
  description to R2
  ip address 192.168.2.5 255.255.255.252
  ip router isis
  ipv6 address autoconfig
  ipv6 router isis
!
interface GigabitEthernet2/0
  description to AS64496
  ip address 10.96.1.2 255.255.255.252
  ipv6 address 2001:DB8:496::1:2/126
!
router isis
  net 49.0000.0000.0000.0001.00
!
router bgp 64500
  neighbor internal peer-group
  neighbor internal remote-as 64500
  neighbor internal update-source Loopback0
  neighbor internal-v6 peer-group
  neighbor internal-v6 remote-as 64500
  neighbor internal-v6 update-source Loopback0
  neighbor upstream peer-group
  neighbor upstream-v6 peer-group
!
neighbor 10.96.1.1 remote-as 64496
neighbor 10.96.1.1 peer-group upstream
neighbor 1001:DB8:496::1:1 remote-as 64496
neighbor 1001:DB8:496::1:1 peer-group upstream-v6
neighbor 1001:DB8:500::1:2 peer-group internal-v6
neighbor 1001:DB8:500::1:3 peer-group internal-v6
neighbor 192.168.1.2 peer-group internal
neighbor 192.168.1.3 peer-group internal
!
address-family ipv4
neighbor internal send-community both
neighbor internal next-hop-self
neighbor upstream soft-reconfiguration inbound
neighbor upstream route-map upstream-in in
neighbor upstream route-map upstream-out out
neighbor 10.96.1.1 activate
no neighbor 2001:DB8:496::1:1 activate
no neighbor 2001:DB8:500::1:2 activate
no neighbor 2001:DB8:500::1:3 activate
neighbor 192.168.1.2 activate
neighbor 192.168.1.3 activate
exit-address-family
!
address-family ipv6
neighbor upstream-v6 send-community both
neighbor upstream-v6 soft-reconfiguration inbound
neighbor upstream-v6 route-map upstream-in in
neighbor upstream-v6 route-map upstream-out out
neighbor internal-v6 send-community both
neighbor internal-v6 next-hop-self
neighbor 2001:DB8:496::1:1 activate
neighbor 2001:DB8:500::1:2 activate
neighbor 2001:DB8:500::1:3 activate
exit-address-family
!
!
ip bgp-community new-format
ip community-list expanded announce-to-customers permit 64500:4[1357][0-9][0-9][0-9]
ip community-list expanded announce-to-peers permit 64500:4[2367][0-9][0-9][0-9]i
ip community-list expanded announce-to-upstream permit 64500:4[4567][0-9][0-9][0-9][0-9]
ip community-list expanded delete-my-communities permit 64500:*
!
route-map upstream-in permit 100
set metric 0
set local-preference 10
set comm-list delete-my-communities delete
set community 64500:41000 additive
!
route-map upstream-in deny 65000

route-map upstream-out permit 100
    match community announce-to-upstream
    set metric 0
! route-map upstream-out deny 65000
! end

R2
hostname R2
ipv6 unicast-routing
!
interface Loopback0
    ip address 192.168.1.2 255.255.255.255
    ip router isis
    ipv6 address 2001:DB8:500::1:2/128
!
interface GigabitEthernet0/0
description to R3
    ip address 192.168.2.9 255.255.255.252
    ip router isis
    ipv6 address autoconfig
!
interface GigabitEthernet1/0
description to R1
    ip address 192.168.2.6 255.255.255.252
    ip router isis
    ipv6 address autoconfig
!
interface GigabitEthernet2/0
description to AS64497
    ip address 10.97.1.2 255.255.255.252
    ipv6 address 2001:DB8:497::1:2/126
!
interface GigabitEthernet3/0
description to DE-CIX / AS517
    ip address 80.81.192.200 255.255.252.0
    ipv6 address 2001:7F8::FBF4:0:1/64
router bgp 64500
neighbor internal peer-group
neighbor internal remote-as 64500
neighbor internal update-source Loopback0
neighbor internal-v6 peer-group
neighbor internal-v6 remote-as 64500
neighbor internal-v6 update-source Loopback0
neighbor upstream peer-group
neighbor upstream-v6 peer-group
neighbor peering peer-group
neighbor peering-v6 peer-group
neighbor 192.168.1.1 peer-group internal
neighbor 192.168.1.3 peer-group internal
neighbor 10.97.1.1 remote-as 64497
neighbor 10.97.1.1 peer-group upstream
neighbor 80.81.193.17 remote-as 517
neighbor 80.81.193.17 peer-group peering
neighbor 2001:7F8::205:0:1 remote-as 517
neighbor 2001:7F8::205:0:1 peer-group peering-v6
neighbor 2001:DB8:497::1:1 remote-as 64497
neighbor 2001:DB8:497::1:1 peer-group upstream-v6
neighbor 2001:DB8:500::1:1 peer-group internal-v6
neighbor 2001:DB8:500::1:3 peer-group internal-v6
!
address-family ipv4
neighbor internal send-community both
neighbor internal next-hop-self
neighbor upstream soft-reconfiguration inbound
neighbor upstream route-map upstream-in in
neighbor upstream route-map upstream-out out
neighbor peering soft-reconfiguration inbound
neighbor peering route-map peering-in in
neighbor peering route-map peering-out out
neighbor 10.97.1.1 activate
neighbor 80.81.193.17 activate
neighbor 192.168.1.1 activate
neighbor 192.168.1.3 activate
no neighbor 2001:7F8::205:0:1 activate
no neighbor 2001:DB8:497::1:1 activate
no neighbor 2001:DB8:500::1:1 activate
no neighbor 2001:DB8:500::1:3 activate
exit-address-family
address-family ipv6
neighbor internal-v6 send-community both
neighbor internal-v6 next-hop-self
neighbor upstream-v6 send-community both
neighbor upstream-v6 soft-reconfiguration inbound
neighbor upstream-v6 route-map upstream-in in
neighbor peering-v6 send-community both
neighbor peering-v6 soft-reconfiguration inbound
neighbor peering-v6 route-map peering-in in
neighbor peering-v6 route-map peering-out out
neighbor 2001:7F8::205:0:1 activate
neighbor 2001:DB8:497::1:1 activate
neighbor 2001:DB8:500::1:1 activate
neighbor 2001:DB8:500::1:3 activate
exit-address-family

! ip bgp-community new-format
ip community-list expanded announce-to-customers permit 64500:4[1357][0-9][0-9][0-9]
ip community-list expanded announce-to-peers permit 64500:4[2367][0-9][0-9][0-9]
ip community-list expanded announce-to-upstream permit 64500:4[4567][0-9][0-9][0-9]
ip community-list expanded delete-my-communities permit 64500:.*
!
route-map peering-out permit 100
match community announce-to-peers
set metric 0
set comm-list delete-my-communities delete
route-map peering-out deny 65000
!
route-map upstream-in permit 100
set local-preference 10
set comm-list delete-my-communities delete
set community 64500:41000 additive
route-map upstream-in deny 65000
!
route-map peering-in permit 100
set local-preference 1000
set comm-list delete-my-communities delete
set community 64500:41000 additive
route-map peering-in deny 65000
!
route-map upstream-out permit 100
match community announce-to-upstream
set metric 0
set comm-list delete-my-communities delete
route-map upstream-out deny 65000
!
end

All communities starting with "64500:=" get deleted in and out
R3 (without IPv6, at start)
R4

```
hostname R4
ipv6 unicast-routing
!
interface Loopback0
  ip address 192.168.1.4 255.255.255.255
  ipv6 address 2001:DB8:500::1:4/128
  ipv6 router isis
!
interface GigabitEthernet0/0
description to R3
  ip address 192.168.2.14 255.255.255.252
  ip router isis
  ipv6 address autoconfig
  ipv6 router isis
!
routing isis
  net 49.0000.0000.0000.0004.00
!
routing bgp 64500
  neighbor internal peer-group
  neighbor internal remote-as 64500
  neighbor internal-v6 peer-group
  neighbor internal-v6 remote-as 64500
  neighbor 192.168.2.13 peer-group internal
  neighbor 2001:DB8:500::1:3 peer-group internal-v6
!
address-family ipv4
  redistribute static metric 0 route-map static-to-bgp
  neighbor internal send-community both
  neighbor internal next-hop-self
  no neighbor 2001:DB8:500::1:3 activate
  neighbor 192.168.2.13 activate
  exit-address-family
!
address-family ipv6
  redistribute static metric 0 route-map static-to-bgp
  neighbor internal-v6 send-community both
  neighbor internal-v6 next-hop-self
  neighbor 2001:DB8:500::1:3 activate
  exit-address-family
!
ip bgp-community new-format
!
ip route 192.168.200.0 255.255.255.0 Null0 tag 40000
ipv6 route 2001:DB8:500::200::/64 Null0 tag 40000
```
route-map static-to-bgp permit 100
  match tag 41000
  match source-protocol static
  set community 64500:41000

route-map static-to-bgp permit 200
  match tag 42000
  match source-protocol static
  set community 64500:42000

route-map static-to-bgp permit 300
  match tag 43000
  match source-protocol static
  set community 64500:43000

route-map static-to-bgp permit 400
  match tag 44000
  match source-protocol static
  set community 64500:44000

route-map static-to-bgp permit 500
  match tag 45000
  match source-protocol static
  set community 64500:45000

route-map static-to-bgp permit 600
  match tag 46000
  match source-protocol static
  set community 64500:46000

route-map static-to-bgp permit 700
  match tag 47000
  match source-protocol static
  set community 64500:47000

route-map static-to-bgp permit 1000
  match tag 40000
  match source-protocol static
  set community no-export

route-map static-to-bgp deny 10000
Router Configs: Neighbor Networks
Neighbor networks use minimal configuration only.

AS64511 - "Customer" Network

hostname AS64511
ipv6 unicast-routing
!
interface GigabitEthernet0/0
description to AS64500 R3
ip address 192.168.3.2 255.255.255.252
ipv6 address 2001:DB8:500::3:2/126
!
router bgp 64511
neighbor upstream peer-group
neighbor upstream-v6 peer-group
neighbor 2001:DB8:500::3:1 remote-as 64500
neighbor 2001:DB8:500::3:1 peer-group upstream-v6
neighbor 192.168.3.1 remote-as 64500
neighbor 192.168.3.1 peer-group upstream
!
address-family ipv4
network 172.16.1.0 mask 255.255.255.0
neighbor upstream send-community both
neighbor upstream route-map upstream-in in
neighbor upstream route-map upstream-out out
no neighbor 2001:DB8:500::3:1 activate
neighbor 192.168.3.1 activate
exit-address-family
!
address-family ipv6
network 2001:DB8:511::/48
neighbor upstream-v6 send-community both
neighbor upstream-v6 route-map upstream-in in
neighbor upstream-v6 route-map upstream-out out
neighbor 2001:DB8:500::3:1 activate
exit-address-family
!
ip bgp-community new-format
!
ip route 172.16.1.0 255.255.255.0 Null0
ipv6 route 2001:DB8:511::/48 Null0
!
route-map upstream-in permit 100
!
route-map upstream-out permit 100
set community 286:33 64500:1 64500:1234
!
end

Here we set some BGP communities to test AS64500s incoming filters.
hostname AS64496
ipv6 unicast-routing

interface GigabitEthernet0/0
description to AS64500 R1
ip address 10.96.1.1 255.255.255.252
ipv6 address 2001:DB8:496::1:1/126

interface GigabitEthernet1/0
description to AS517
ip address 10.96.1.5 255.255.255.252
ipv6 address 2001:DB8:496::1:5/126

router bgp 64496
neighbor customer peer-group
neighbor customer-v6 peer-group
neighbor 10.96.1.2 remote-as 64500
neighbor 10.96.1.2 peer-group customer
neighbor 10.96.1.6 remote-as 517
neighbor 10.96.1.6 peer-group customer
neighbor 2001:DB8:496::1:2 remote-as 64500
neighbor 2001:DB8:496::1:2 peer-group customer-v6
neighbor 2001:DB8:496::1:6 remote-as 517
neighbor 2001:DB8:496::1:6 peer-group customer-v6

address-family ipv4
network 10.96.0.0 mask 255.255.0.0
neighbor customer send-community both
neighbor customer route-map customer-in in
neighbor customer route-map customer-out out
neighbor 10.96.1.2 activate
neighbor 10.96.1.6 activate
no neighbor 2001:DB8:496::1:2 activate
no neighbor 2001:DB8:496::1:6 activate
exit-address-family

address-family ipv6
network 2001:DB8:496::/48
neighbor customer-v6 send-community both
neighbor customer-v6 soft-reconfiguration inbound
neighbor customer-v6 route-map customer-in in
neighbor customer-v6 route-map customer-out out
neighbor 2001:DB8:496::1:2 activate
neighbor 2001:DB8:496::1:6 activate
exit-address-family

ip route 10.96.0.0 255.255.0.0 Null0
ipv6 route 2001:DB8:496::/48 Null0
route-map customer-in permit 100
route-map customer-out permit 100
end
hostname AS64497
ipv6 unicast-routing
!
interface GigabitEthernet0/0
description to AS64500 R2
ip address 10.97.1.1 255.255.255.252
ipv6 address 2001:DB8:497::1:1/126
!
interface GigabitEthernet1/0
description to AS517
ip address 10.97.1.5 255.255.255.252
ipv6 address 2001:DB8:497::1:5/126
!
router bgp 64497
neighbor customer peer-group
neighbor customer-v6 peer-group
neighbor 10.97.1.2 remote-as 64500
eighbor 10.97.1.2 peer-group customer
neighbor 10.97.1.6 remote-as 517
neighbor 10.97.1.6 peer-group customer
neighbor 2001:DB8:497::1:2 remote-as 64500
neighbor 2001:DB8:497::1:2 peer-group customer-v6
neighbor 2001:DB8:497::1:6 remote-as 517
neighbor 2001:DB8:497::1:6 peer-group customer-v6
address-family ipv4
   network 10.97.0.0 mask 255.255.0.0
   neighbor customer send-community both
   neighbor customer route-map customer-in in
   neighbor customer route-map customer-out out
   neighbor 10.97.1.2 activate
   neighbor 10.97.1.6 activate
no neighbor 2001:DB8:497::1:2 activate
no neighbor 2001:DB8:497::1:6 activate
exit-address-family
address-family ipv6
   network 2001:DB8:497::/48
   neighbor customer-v6 send-community both
   neighbor customer-v6 soft-reconfiguration inbound
   neighbor customer-v6 route-map customer-in in
   neighbor customer-v6 route-map customer-out out
   neighbor 2001:DB8:497::1:2 activate
   neighbor 2001:DB8:497::1:6 activate
exit-address-family
ip bgp-community new-format
ip route 10.97.0.0 255.255.0.0 Null0
ipv6 route 2001:DB8:497::/48 Null0
route-map customer-out permit 100
route-map customer-out permit 100
end
AS517 - "some provider who peers"

hostname AS517
ipv6 unicast-routing
!
interface GigabitEthernet0/0
description to AS64496
ip address 10.96.1.6 255.255.255.252
ipv6 address 2001:DB8:496::1:6/126
!
interface GigabitEthernet1/0
description to AS64497
ip address 10.97.1.6 255.255.255.252
ipv6 address 2001:DB8:497::1:6/126
!
interface GigabitEthernet2/0
description to DE-CIX
ip address 80.81.193.17 255.255.252.0
ipv6 address 2001:7F8::205:0:1/64
!
router bgp 517
 neighbor upstream peer-group
 neighbor peering peer-group
 neighbor upstream-v6 peer-group
 neighbor peering-v6 peer-group
 neighbor 10.96.1.5 remote-as 64496
 neighbor 10.96.1.5 peer-group upstream
 neighbor 10.97.1.5 remote-as 64497
 neighbor 10.97.1.5 peer-group upstream
 neighbor 80.81.192.200 remote-as 64500
 neighbor 80.81.192.200 peer-group peering
 neighbor 2001:7F8::FBF4:0:1 remote-as 64500
 neighbor 2001:7F8::FBF4:0:1 peer-group peering-v6
 neighbor 2001:DB8:496::1:5 remote-as 64496
 neighbor 2001:DB8:496::1:5 peer-group upstream-v6
 neighbor 2001:DB8:497::1:5 remote-as 64497
 neighbor 2001:DB8:497::1:5 peer-group upstream-v6
!
address-family ipv4
   network 172.17.1.0 mask 255.255.255.0
   network 172.17.2.0 mask 255.255.255.0
   neighbor upstream send-community both
   neighbor upstream soft-reconfiguration inbound
   neighbor upstream route-map upstream-in in
   neighbor upstream route-map upstream-out out
   neighbor peering send-community both
   neighbor peering soft-reconfiguration inbound
   neighbor peering route-map peering-in in
   neighbor peering route-map peering-out out
   neighbor 10.96.1.5 activate
   neighbor 10.97.1.5 activate
   neighbor 80.81.192.200 activate
   no neighbor 2001:7F8::FBF4:0:1 activate
   no neighbor 2001:DB8:496::1:5 activate
   no neighbor 2001:DB8:497::1:5 activate
exit-address-family
!
address-family ipv6
   network 2001:DB8:517::/48
   neighbor upstream-v6 send-community both
   neighbor upstream-v6 soft-reconfiguration inbound
   neighbor upstream-v6 route-map upstream-in in
   neighbor upstream-v6 route-map upstream-out out
   neighbor peering-v6 send-community both
   neighbor peering-v6 soft-reconfiguration inbound
   neighbor peering-v6 route-map peering-in in
   neighbor peering-v6 route-map peering-out out
   neighbor 2001:7F8::FBF4:0:1 activate
   neighbor 2001:DB8:496::1:5 activate
   neighbor 2001:DB8:497::1:5 activate
exit-address-family
!
ip route 172.17.1.0 255.255.255.0 Null0
ip route 172.17.2.0 255.255.255.0 Null0
ipv6 route 2001:DB8:517::/48 Null0
!
ip prefix-list via-peering seq 10 permit 172.17.1.0/24
ip prefix-list via-upstream seq 5 permit 172.17.1.0/24
ip prefix-list via-upstream seq 10 permit 172.17.2.0/24
!
route-map peering-in permit 100
route-map peering-out permit 100
match ip address prefix-list via-peering
!
route-map upstream-in permit 100
route-map upstream-out permit 100
match ip address prefix-list via-upstream
!
end
Experiments
During the webinar on router R3 the following experiments are performed.

Experiment 1: Setup ISIS as IGP
Here we turn on IPv6 routing and add an IPv6 address to the Loopback interface and configure IS-IS on all internal interfaces for IPv6.

```bash
ipv6 unicast-routing
!
int Loopback0
  ipv6 address 2001:DB8:500::1::3/128
  ipv6 router isis
!
int gig 0/0
  ipv6 address autoconfig
  ipv6 router isis
!
int gig 1/0
  ipv6 address autoconfig
  ipv6 router isis
!
int gig 2/0
  ipv6 address autoconfig
  ipv6 router isis
!
router isis
  net 49.0000.0000.0000.0003.00
!
int gig 3/0
  ipv6 address 2001:DB8:500::3/126
```
Experiment 2a: Setup fully meshed iBGP to R1 and R2

We need extra peer-groups for IPv6. Also we need to disable distributing of IPv4 prefixes via IPv6

```
router bgp 64500
  neighbor internal-v6 peer-group
  neighbor internal-v6 remote-as 64500
  neighbor internal-v6 update-source Loopback0
  address-family ipv6
    neighbor internal-v6 send-community both
    neighbor internal-v6 next-hop-self
  exit-address-family
!
neighbor 2001:DB8:500::1:1 peer-group internal-v6
neighbor 2001:DB8:500::1:2 peer-group internal-v6
address-family ipv4
  no neighbor 2001:DB8:500::1:1 activate
  no neighbor 2001:DB8:500::1:2 activate
  address-family ipv6
    neighbor 2001:DB8:500::1:1 activate
    neighbor 2001:DB8:500::1:2 activate
!
end
```
Experiment 2b: Setup R4 as route reflector client

Again we need an extra peer group for this.

```
router bgp 64500
neighbor internal-rr-v6 peer-group
neighbor internal-rr-v6 remote-as 64500
  address-family ipv6
    neighbor internal-rr-v6 send-community both
    neighbor internal-rr-v6 route-reflector-client
    neighbor internal-rr-v6 next-hop-self all
  exit-address-family
!
neighbor 2001:DB8:500::1:4 peer-group internal-rr-v6
  address-family ipv4
    no neighbor 2001:DB8:500::1:4 activate

  address-family ipv6
    neighbor 2001:DB8:500::1:4 activate
!
end
```
Experiment 3: Setup eBGP to customer AS64511

```
router bgp 64500
    neighbor customer-v6 peer-group
    address-family ipv6
        neighbor customer-v6 send-community both
        neighbor customer-v6 soft-reconfiguration inbound
        neighbor customer-v6 route-map customer-in in
        neighbor customer-v6 route-map customer-out out
    exit-address-family
    neighbor 2001:DB8:500::3:2 remote-as 64511
    neighbor 2001:DB8:500::3:2 peer-group customer-v6
    address-family ipv4
        no neighbor 2001:DB8:500::3:2 activate
    address-family ipv6
        neighbor 2001:DB8:500::3:2 activate
    exit-address-family

ip community-list expanded delete-incoming permit 64500:[0-35-9][0-9]*
route-map customer-in permit 100
    set metric 0
    set local-preference 10000
    set comm-list delete-incoming delete
    continue
ip community-list expanded announce-community-set permit 64500:4[0-9][0-9][0-9][0-9]
route-map customer-in permit 200
    match community announce-community-set
route-map customer-in permit 300
    set community 64500:47000 additive
route-map customer-in deny 65000
route-map customer-out permit 100
    match community announce-to-customers
    set metric 0
    set comm-list announce-to-customers delete
route-map customer-out deny 65000
```
Experiment 4: Adding our own prefixes to BGP

```plaintext
ipv6 route 2001:DB8:500::/48 Null0 tag 47000

router bgp 64500
    address-family ipv6
        redistribute static metric 0 route-map static-to-bgp

route-map static-to-bgp permit 100
    match tag 41000
    match source-protocol static
    set community 64500:41000

route-map static-to-bgp permit 200
    match tag 42000
    match source-protocol static
    set community 64500:42000

route-map static-to-bgp permit 300
    match tag 43000
    match source-protocol static
    set community 64500:43000

route-map static-to-bgp permit 400
    match tag 44000
    match source-protocol static
    set community 64500:44000

route-map static-to-bgp permit 500
    match tag 45000
    match source-protocol static
    set community 64500:45000

route-map static-to-bgp permit 600
    match tag 46000
    match source-protocol static
    set community 64500:46000

route-map static-to-bgp permit 700
    match tag 47000
    match source-protocol static
    set community 64500:47000

route-map static-to-bgp permit 1000
    match tag 49000
    match source-protocol static
    set community no-export

route-map static-to-bgp deny 10000
```

hostname R3
ipv6 unicast-routing
!
interface Loopback0
  ip address 192.168.1.3 255.255.255.255
  ipv6 address 2001:DB8:500::1:3/128
  ipv6 router isis
!
interface GigabitEthernet0/0
description to R1
  ip address 192.168.2.2 255.255.255.252
  ipv6 address autoconfig
  ipv6 router isis
!
interface GigabitEthernet1/0
description to R2
  ip address 192.168.2.10 255.255.255.252
  ipv6 address autoconfig
  ipv6 router isis
!
interface GigabitEthernet2/0
description to R4
  ip address 192.168.2.13 255.255.255.252
  ipv6 address autoconfig
  ipv6 router isis
!
interface GigabitEthernet3/0
description to AS64511
  ip address 192.168.3.1 255.255.255.252
  ipv6 address 2001:DB8:500::3:1/126
  router isis
  net 49.0000.0000.0000.0003.00
!
router bgp 64500
neighbor internal peer-group
neighbor internal remote-as 64500
neighbor internal update-source Loopback0
neighbor internal-rr peer-group
neighbor internal-rr remote-as 64500
neighbor customer peer-group
neighbor customer-v6 peer-group
neighbor internal-v6 peer-group
neighbor internal-v6 remote-as 64500
neighbor internal-v6 update-source Loopback0
neighbor internal-rr-v6 peer-group
neighbor internal-rr-v6 remote-as 64500
neighbor customer-v6 peer-group
neighbor 192.168.1.1 peer-group internal
neighbor 192.168.1.2 peer-group internal
neighbor 192.168.2.14 peer-group internal-rr
neighbor 192.168.3.2 remote-as 64511
neighbor 192.168.3.2 peer-group customer
neighbor 2001:DB8:500::1:1 peer-group internal-v6
neighbor 2001:DB8:500::1:2 peer-group internal-v6
neighbor 2001:DB8:500::1:4 peer-group internal-rr-v6
neighbor 2001:DB8:500::3:2 remote-as 64511
neighbor 2001:DB8:500::3:2 peer-group customer-v6
address-family ipv4
  redistribute static metric 0 route-map static-to-bgp
  neighbor internal send-community both
  neighbor internal send-community both
  neighbor internal-rr route-reflector-client
  neighbor internal-rr next-hop-self all
  neighbor customer send-community both
  neighbor customer route-map customer-in
  neighbor customer route-map customer-out out
no neighbor 2001:DB8:500::1:1 activate
no neighbor 2001:DB8:500::1:2 activate
no neighbor 2001:DB8:500::1:4 activate
no neighbor 2001:DB8:500::3:2 activate
neighbor 192.168.1.1 activate
neighbor 192.168.1.2 activate
neighbor 192.168.2.14 activate
neighbor 192.168.3.2 activate
exit-address-family
address-family ipv6
Here we redistribute static routes into BGP

Only difference in config between a route-reflector client and a standard iBGP neighbor

Static prefix to be redistributed into BGP and announced to everybody

This prefix goes into BGP but is not announced externally
route-map static-to-bgp permit 100
match tag 41000
match source-protocol static
set community 64500:41000
route-map static-to-bgp permit 200
match tag 42000
match source-protocol static
set community 64500:42000
route-map static-to-bgp permit 300
match tag 43000
match source-protocol static
set community 64500:43000
route-map static-to-bgp permit 400
match tag 44000
match source-protocol static
set community 64500:44000
route-map static-to-bgp permit 500
match tag 45000
match source-protocol static
set community 64500:45000
route-map static-to-bgp permit 600
match tag 46000
match source-protocol static
set community 64500:46000
route-map static-to-bgp permit 700
match tag 47000
match source-protocol static
set community 64500:47000
route-map static-to-bgp permit 1000
match tag 40000
match source-protocol static
set community no-export
route-map static-to-bgp deny 10000
end

This matches the "tag" of the static routes

Static routes with no "tag" do not get into BGP
Mikrotik Router Configurations - AS64500

Many ISPs use Mikrotik routers. As Mikrotik offers a free "Cloud Hosted Router" software image (with some limitations) I also generated a config file for Mikrotik. Note that Mikrotik does not support IS-IS, so IGP in this case is OSPF.
R1

/system identity
set name=R1

/interface bridge
add name=loopback0

/interface ethernet
set [ find default-name=ether1 ] comment="to R3"
set [ find default-name=ether2 ] comment="to R2"
set [ find default-name=ether3 ] comment="to AS64496"

/ip address
add address=192.168.2.1/30 interface=ether1 network=192.168.2.0
add address=192.168.2.5/30 interface=ether2 network=192.168.2.4
add address=10.96.1.2/30 interface=ether3 network=10.96.1.0
add address=192.168.1.1 interface=loopback0 network=192.168.1.1

/routing ospf instance
set [ find default=yes ] redistribute-connected=as-type-2 router-id=192.168.1.1
/routing ospf network
add area=backbone network=192.168.2.0/24

/routing bgp instance
set default as=64500 router-id=192.168.1.1

/routing bgp peer
add name=R2 nexthop-choice=force-self remote-address=192.168.1.2 remote-as=64500 update-source=loopback0
add name=R3 nexthop-choice=force-self remote-address=192.168.1.3 remote-as=64500 update-source=loopback0
add in-filter=upstream-in name=AS64496 out-filter=upstream-out remote-address=10.96.1.1 remote-as=64496

/routing filter
add chain=upstream-in set-bgp-communities=64500:41000 set-bgp-local-pref=10 set-bgp-med=0
add action=accept bgp-communities=64500:41000 chain=upstream-out set-bgp-med=0
add action=accept bgp-communities=64500:45000 chain=upstream-out set-bgp-med=0
add action=accept bgp-communities=64500:46000 chain=upstream-out set-bgp-med=0
add action=accept bgp-communities=64500:47000 chain=upstream-out set-bgp-med=0
add action=discard chain=upstream-out

Define Loopback
Interface IP Addresses
OSPF as IGP
Mikrotik does not support regular expressions here
So we need one rule per possible Community
R3 (complete)

/system identity
set name=R3

(interface bridge
add name=loopback0

(interface ethernet
set [ find default-name=ether1 ] comment="to R1"
set [ find default-name=ether2 ] comment="to R2"
set [ find default-name=ether3 ] comment="to R4"
set [ find default-name=ether4 ] comment="to AS64511"

/ip address
add address=192.168.2.2/30 interface=ether1 network=192.168.2.0
add address=192.168.2.10/30 interface=ether2 network=192.168.2.8
add address=192.168.2.13/30 interface=ether3 network=192.168.2.12
add address=192.168.3.1/30 interface=ether4 network=192.168.3.0
add address=192.168.1.3/32 interface=loopback0 network=192.168.1.3

/routing ospf instance
set [ find default=yes ] redistribute-connected=as-type-2 router-id=192.168.1.3
/routing ospf network
add area=backbone network=192.168.2.0/24

/routing filter
add action=accept bgp-communities=64500:40000 chain=bgp-out
add action=accept bgp-communities=64500:41000 chain=bgp-out
add action=accept bgp-communities=64500:42000 chain=bgp-out
add action=accept bgp-communities=64500:43000 chain=bgp-out
add action=accept bgp-communities=64500:44000 chain=bgp-out
add action=accept bgp-communities=64500:45000 chain=bgp-out
add action=accept bgp-communities=64500:46000 chain=bgp-out
add action=accept bgp-communities=64500:47000 chain=bgp-out
add action=discard chain=bgp-out
/routing bgp instance
set default as=64500 out-filter=bgp-out redistribute-static=yes router-id=192.168.1.3

/routing bgp peer
add name=R1 nexthop-choice=force-self remote-address=192.168.1.1 remote-as=\64500 update-source=loopback0
add name=R2 nexthop-choice=force-self remote-address=192.168.1.2 remote-as=\64500 update-source=loopback0
add chain=ibgp-rr set-out-nexthop=192.168.2.13
/routing bgp peer
add name=R4 nexthop-choice=force-self out-filter=ibgp-rr remote-address=\192.168.2.14 remote-as=64500 route-reflect=yes update-source=ether3
add name=AS64511 in-filter=customer-in out-filter=customer-out \remote-address=192.168.3.2 remote-as=64511
/routing filter
add chain=customer-in set-bgp-local-pref=10000 set-bgp-med=0
add action=accept bgp-communities=64500:41000 chain=customer-in set-bgp-communities=64500:41000
add action=accept bgp-communities=64500:42000 chain=customer-in set-bgp-communities=64500:42000
add action=accept bgp-communities=64500:43000 chain=customer-in set-bgp-communities=64500:43000
add action=accept bgp-communities=64500:44000 chain=customer-in set-bgp-communities=64500:44000
add action=accept bgp-communities=64500:45000 chain=customer-in set-bgp-communities=64500:45000
add action=accept bgp-communities=64500:46000 chain=customer-in set-bgp-communities=64500:46000
add action=accept chain=customer-in set-bgp-communities=64500:47000
add action=accept bgp-communities=64500:41000 chain=customer-out \set-bgp-communities="" set-bgp-med=0
add action=accept bgp-communities=64500:43000 chain=customer-out \set-bgp-communities="" set-bgp-med=0
add action=accept bgp-communities=64500:45000 chain=customer-out \set-bgp-communities="" set-bgp-med=0
add action=accept bgp-communities=64500:47000 chain=customer-out \set-bgp-communities="" set-bgp-med=0
add action=discard chain=customer-out