Module 7 – Securing Routing Policy Using Route Map

Objective: All the routers are pre-configured with basic interface, OSPF and BGP configuration according to the following topology diagram. At this stage all POP routers are sending and receiving every prefixes it learn from other peers to and from the CPE routers. Without any policy filter lab network is acting as transit for all customer and upstream peers. You need to create proper policy filter (Using route map) to make sure organizational business policy is reflected into your configuration and that will secure your network to operate smoothly.

Prerequisites: Knowledge of Cisco router CLI, ACL, regular expression, IPv6 etc.

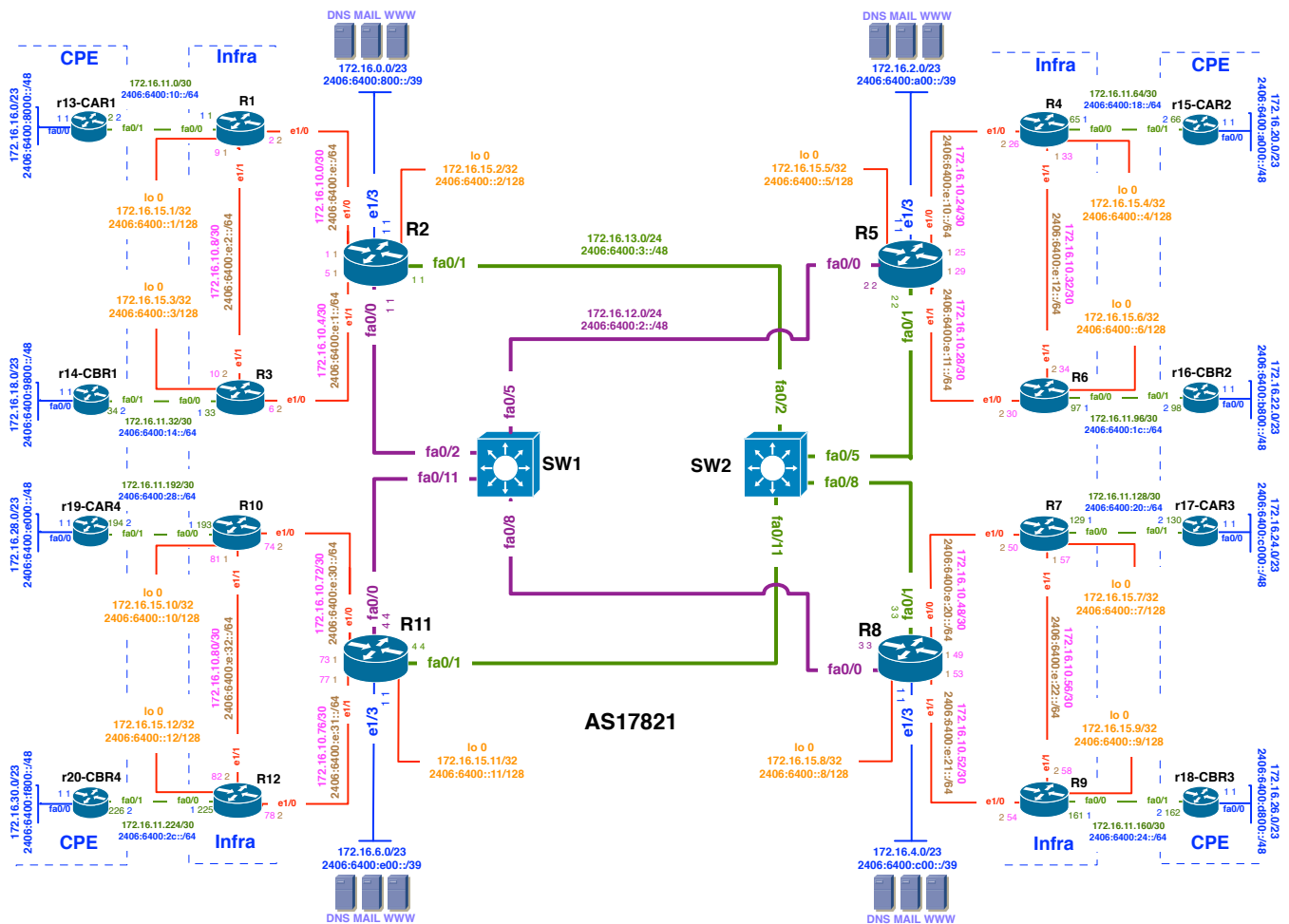The following will be the common topology and IP address plan used for the labs.

Figure 1 – ISP Lab Basic Configuration

Lab Notes

All the required prefix filters need to be applied on to the edge routers. In our lab we need to create filter on POP routers i.e. R1, R3, R4, R6, R7, R9, R10, R12 and CPE routers R13, R14, R15, R16, R17, R18, R19, R20 for both IN and OUT direction. This is how we will secure our perimeter routers (Both Service provider and Customer) by filtering unwanted prefixes and eventually unauthorised traffic. There is a significant difference between filtering traffic using ACL (Data plane) and prefix list (Control plane). Before you start configuring filters please check routing tables on both edge and CPE routers and note down the available prefixes. Then look at the prefix exchange policy in next section, configure required route map and verify the outcome by looking at the routing table again on both POP and CPE routers.

It is advisable to spend some time (Before your start the lab) to be familiar with the network topology, addressing plan, check routing table, BGP table, received and advertised prefix to all BGP peers etc.

Route Exchange Policy:

a. POP Router OUT
1. ISP send its own prefix & originated locally. Create ACL to match ISP prefix, create as-path access list to match prefix originated locally.
2. ISP send other directly connected customer prefix & legitimate prefix length. Create prefix list to match /32 and /48, create as path access list to match directly connected customer.
3. Group all policy in a route map with proper sequence number.
4. Attach it in POP router OUR direction

b. POP Router IN
1. ISP accepts its customer prefix & originated by the customer AS. Create ACL to match customer prefix, create as-path access list to match prefix originated by customer AS.
2. Group those policy in a route map with proper sequence number.
3. Attach it in POP router IN direction

c. CEP Router IN
1. Customer router accepts default prefix from ISP & ISP own aggregated prefix. Create ACL to match default prefix, ISP own aggregated.
2. Customer routers accept legitimate prefixes of ISP's directly connected other customer prefix. Create prefix list to match legitimate prefixes and as-path access list to match prefixes originated by ISP and ISP directly connected customers.
3. Group all policy in a route map with proper sequence number.
4. Attach it in CEP router IN direction.

d. CEP Router OUT
1. Customer router send its own prefix & originated by its own AS number. Create ACL to match its own prefix, and as-path access list to match prefix originated locally.
2. Group all policy in a route map with proper sequence number.
3. Attach it in CEP router OUT direction.

e. List of Prefixes and AS numbers
1. ISP Prefix: 2406:6400::/32
2. ISP AS number 17821
3. Customer prefixes and AS number: R13 2406:6400:8000::/48, AS 65001
    R14 2406:6400:9800::/48, AS 65002
    R15 2406:6400:a000::/48, AS 65003
    R16 2406:6400:b800::/48, AS 65004
    R17 2406:6400:c000::/48, AS 65005
    R18 2406:6400:d800::/48, AS 65006
    R19 2406:6400:e000::/48, AS 65007
    R20 2406:6400:f800::/48, AS 65008

Lab Exercise

a) **Configuration steps for POP router OUT:**

   1.   IPv6 prefix list configuration on edge router to match ISP aggregated prefix.

       Here is an example configuration for POP router R1

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
```

   2.   IPv6 aggregation prefix filter to match /32 and /48 prefix length.

       Here is an example configuration for POP router R1

```
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
```

   3.   AS path filter to match prefix originated locally to this AS.

       Here is an example configuration for POP router R1

```
ip as-path access-list 100 permit ^$
```

   4.   AS path filter to match prefix originated from direct connected customer using their AS number.

       Here is an example configuration for POP router R1

```
ip as-path access-list 101 permit ^[0-9]+$
```

   5.   Create route-map to match ISP aggregated prefix and originated by ISP ASN.

       Here is an example configuration for POP router R1

```
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
```

   6.   Create route-map to match aggregation filter and direct customer originated prefix

       Here is an example configuration for POP router R1

```
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
```

7. Add route-map to BGP neighbor or peer group

   Here is an example configuration for POP router R1

   ```
   router bgp 17821
   address-family ipv6
   neighbor IPV6-eBGP-CUSTOMER-REG1-POP1 route-map IPV6-CUSTOMER-OUT out
   exit
   exit
   exit
   ```

8. Send dynamic refresh to your BGP peer for the new policy to be activated.

   Here is an example configuration for POP router R1

   ```
   clear bgp ipv6 unicast 2406:6400:10::2 soft out
   wr
   ```

b) **Configuration steps for POP router IN:**

1. IPv6 prefix-list match customer prefix.

   Here is an example configuration for POP router R1

   ```
   config t
   ipv6 prefix-list IPV6-CAR1-IN seq 15 permit 2406:6400:8000::/48
   ```

2. AS path match customer AS number.

   Here is an example configuration for POP router R1

   ```
   ip as-path access-list 500 permit _65001$
   ```

3. Create route-map to match customer prefix and customer origin AS..

   Here is an example configuration for POP router R1

   ```
   route-map IPV6-CUST-CAR1-IN permit 10
   match as-path 500
   match ipv6 address prefix-list IPV6-CAR1-IN
   exit
   ```

4. Add route-map to BGP neighbor.

   Here is an example configuration for POP router R1

   ```
   router bgp 17821
   address-family ipv6
   neighbor 2406:6400:10::2 route-map IPV6-CUST-CAR1-IN in
   exit
   exit
   exit
   ```

5. Send dynamic refresh to your BGP peer for the new policy to be activated.

Here is an example configuration for POP router R13

```
clear bgp ipv6 unicast 2406:6400:10::2 soft in
wr
```

c) **Configuration steps for CPE router IN:**

1. IPv6 prefix list configuration on CPE router to match default prefix and ISP aggregated prefix.

Here is an example configuration for POP router R13

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
```

2. IPv6 aggregation prefix filter to match /32 and /48 prefix length.

Here is an example configuration for POP router R13

```
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
```

3. AS path filter to match prefix originated ISP and originated by ISP direct customer.

Here is an example configuration for POP router R13

```
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
```

4. Create route-map to match ISP prefix and origin by ISP AS.

Here is an example configuration for POP router R13

```
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
```

5. Create route-map to match other prefix via ISP and with legitimate prefix length (/32 & /48).

Here is an example configuration for POP router R13

```
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
```

6. Add route-map to BGP neighbor.

   Here is an example configuration for POP router R13

   ```
   router bgp 65001
   address-family ipv6
   neighbor 2406:6400:10::1 route-map IPV6-ISP-IN in
   exit
   exit
   exit
   ```

7. Send dynamic refresh to your BGP peer for the new policy to be activated.

   Here is an example configuration for POP router R13

   ```
   clear bgp ipv6 unicast 2406:6400:10::1 soft in
   wr
   ```

d) **Configuration steps for CPE router OUT:**

1. IPv6 prefix-list match customer prefix

   Here is an example configuration for POP router R13

   ```
   config t
   ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:8000::/48
   ```

2. AS path match customer AS number.

   Here is an example configuration for POP router R13

   ```
   ip as-path access-list 200 permit ^$
   ```

3. Create route-map to match customer prefix and customer origin AS.

   Here is an example configuration for POP router R13

   ```
   route-map IPV6-MY-PREFIX-OUT permit 10
   match as-path 200
   match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
   exit
   ```

4. Add route-map to BGP neighbor.

   Here is an example configuration for POP router R13

   ```
   router bgp 65001
   address-family ipv6
   neighbor 2406:6400:10::1 route-map IPV6-MY-PREFIX-OUT out
   exit
   exit
   exit
   ```

5. Send dynamic refresh to your BGP peer for the new policy to be activated.

Here is an example configuration for POP router R13

```
clear bgp ipv6 unicast 2406:6400:10::1 soft out
wr
```

Workshop templates for reference purpose only:

Router 1 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG1-POP1 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:10::2 soft out
wr
```

Router 1 In

```
config t
ipv6 prefix-list IPV6-CAR1-IN seq 15 permit 2406:6400:8000::/48
ip as-path access-list 500 permit _65001$
route-map IPV6-CUST-CAR1-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CAR1-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:10::2 route-map IPV6-CUST-CAR1-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:10::2 soft in
wr
```

Router 13 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
```

```
exit
router bgp 65001
address-family ipv6
neighbor 2406:6400:10::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:10::1 soft in
wr
```

Router 13 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:8000::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65001
address-family ipv6
neighbor 2406:6400:10::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:10::1 soft out
wr
```

Router 3 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG1-POP2 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:14::2 soft out
wr
```

Router 3 In

```
config t
ipv6 prefix-list IPV6-CBR1-IN seq 15 permit 2406:6400:9800::/48
ip as-path access-list 500 permit _65002$
route-map IPV6-CUST-CBR1-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CBR1-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:14::2 route-map IPV6-CUST-CBR1-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:14::2 soft in
wr
```

Router 14 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
router bgp 65002
address-family ipv6
neighbor 2406:6400:14::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:14::1 soft in
wr
```

Router 14 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:9800::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65002
address-family ipv6
neighbor 2406:6400:14::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:14::1 soft out
wr
```

Router 4 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG2-POP1 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:18::2 soft out
wr
```

Router 4 In

```
config t
ipv6 prefix-list IPV6-CAR2-IN seq 15 permit 2406:6400:a000::/48
ip as-path access-list 500 permit _65003$
route-map IPV6-CUST-CAR2-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CAR2-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:18::2 route-map IPV6-CUST-CAR2-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:18::2 soft in
wr
```

Router 15 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
```

```
router bgp 65003
address-family ipv6
neighbor 2406:6400:18::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:18::1 soft in
wr
```

Router 15 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:a000::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65003
address-family ipv6
neighbor 2406:6400:18::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:18::1 soft out
wr
```

Router 6 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG2-POP2 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:1c::2 soft out
wr
```

Router 6 In

```
config t
ipv6 prefix-list IPV6-CBR2-IN seq 15 permit 2406:6400:b800::/48
ip as-path access-list 500 permit _65004$
route-map IPV6-CUST-CBR2-IN permit 10
match as-path 500
```

```
match ipv6 address prefix-list IPV6-CBR2-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:1c::2 route-map IPV6-CUST-CBR2-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:1c::2 soft in
wr
```

Router 16 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
router bgp 65004
address-family ipv6
neighbor 2406:6400:1c::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:1c::1 soft in
wr
```

Router 16 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:b800::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65004
address-family ipv6
neighbor 2406:6400:1c::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:1c::1 soft out
wr
```

Router 7 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG3-POP1 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:20::2 soft out
wr
```

Router 7 In

```
config t
ipv6 prefix-list IPV6-CAR3-IN seq 15 permit 2406:6400:c000::/48
ip as-path access-list 500 permit _65005$
route-map IPV6-CUST-CAR3-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CAR3-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:20::2 route-map IPV6-CUST-CAR3-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:20::2 soft in
wr
```

Router 17 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
```

```
router bgp 65005
address-family ipv6
neighbor 2406:6400:20::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:20::1 soft in
wr
```

Router 17 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:C000::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65005
address-family ipv6
neighbor 2406:6400:20::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:20::1 soft out
wr
```

Router 9 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG3-POP2 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:24::2 soft out
wr
```

Router 9 In

```
config t
ipv6 prefix-list IPV6-CBR3-IN seq 15 permit 2406:6400:d800::/48
ip as-path access-list 500 permit _65006$
route-map IPV6-CUST-CBR3-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CBR3-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:24::2 route-map IPV6-CUST-CBR3-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:24::2 soft in
wr
```

Router 18 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
router bgp 65006
address-family ipv6
neighbor 2406:6400:24::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:24::1 soft in
wr
```

Router 18 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:d800::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65006
address-family ipv6
neighbor 2406:6400:24::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
```

```
clear bgp ipv6 unicast 2406:6400:24::1 soft out
wr
```

Router 10 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG4-POP1 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:28::2 soft out
wr
```

Router 10 In

```
config t
ipv6 prefix-list IPV6-CBR1-IN seq 15 permit 2406:6400:e000::/48
ip as-path access-list 500 permit _65007$
route-map IPV6-CUST-CAR4-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CAR4-IN
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG4-POP1 route-map IPV6-CUST-CAR4-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:28::2 soft in
wr
```

Router 19 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
```

```
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
router bgp 65007
address-family ipv6
neighbor 2406:6400:28::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:28::1 soft in
wr
```

Router 19 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:e000::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65007
address-family ipv6
neighbor 2406:6400:28::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:28::1 soft out
wr
```

Router 12 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-CUSTOMER-OUT seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit ^$
ip as-path access-list 101 permit ^[0-9]+$
route-map IPV6-CUSTOMER-OUT permit 10
match as-path 100
match ipv6 address prefix-list IPV6-MY-PREFIX
route-map IPV6-CUSTOMER-OUT permit 20
match as-path 101
match ipv6 address prefix-list IPV6-CUSTOMER-OUT
exit
router bgp 17821
address-family ipv6
neighbor IPV6-eBGP-CUSTOMER-REG4-POP2 route-map IPV6-CUSTOMER-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:2c::2 soft out
wr
```

Router 12 In

```
config t
ipv6 prefix-list IPV6-CBR1-IN seq 15 permit 2406:6400:f800::/48
ip as-path access-list 500 permit _65008$
route-map IPV6-CUST-CBR4-IN permit 10
match as-path 500
match ipv6 address prefix-list IPV6-CBR4-IN
exit
router bgp 17821
address-family ipv6
neighbor 2406:6400:2c::2 route-map IPV6-CUST-CBR4-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:2c::2 soft in
wr
```

Router 20 In

```
config t
ipv6 prefix-list IPV6-ISP-PREFIX seq 10 permit ::/0
ipv6 prefix-list IPV6-ISP-PREFIX seq 15 permit 2406:6400::/32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 20 permit ::/0 ge 32 le 32
ipv6 prefix-list IPV6-AGGREGATION-IN seq 25 permit ::/0 ge 48 le 48
ip as-path access-list 100 permit _17821$
ip as-path access-list 101 permit _17821_
route-map IPV6-ISP-IN permit 10
match as-path 100
match ipv6 address prefix-list IPV6-ISP-PREFIX
route-map IPV6-ISP-IN permit 20
match as-path 101
match ipv6 address prefix-list IPV6-AGGREGATION-IN
exit
router bgp 65008
address-family ipv6
neighbor 2406:6400:2c::1 route-map IPV6-ISP-IN in
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:2c::1 soft in
wr
```

Router 20 Out

```
config t
ipv6 prefix-list IPV6-MY-PREFIX-OUT seq 15 permit 2406:6400:f800::/48
ip as-path access-list 200 permit ^$
route-map IPV6-MY-PREFIX-OUT permit 10
match as-path 200
match ipv6 address prefix-list IPV6-MY-PREFIX-OUT
exit
router bgp 65008
address-family ipv6
neighbor 2406:6400:2c::1 route-map IPV6-MY-PREFIX-OUT out
exit
exit
exit
clear bgp ipv6 unicast 2406:6400:2c::1 soft out
wr
```