IPv6 Lab - Securing BGP

BGP neighbour authentication

Configure passwords on the iBGP sessions

Passwords should now be configured on the iBGP sessions. Go back to the peer-groups which were configured earlier in this workshop and now add passwords to them. For example, here is the peer-group on the Core router:

```
router bgp X0
 address-family ipv4
  neighbor ibgp-partial password cisco
  neighbor ibgp-full password cisco
!
 address-family ipv6
  neighbor ibgp-v6partial password cisco
  neighbor ibgp-v6full password cisco
!
```

Do the same for the peer-groups on the border, access and peering routers.

Once the passwords have been added to the IPv4 and IPv6 peer-groups, reset the BGP sessions. Cisco IOS does not automatically reset peerings once passwords have been added to the configuration.

Watch the router logs – with the BGP session neighbour changes being logged, any mismatch in the password should be easy to spot. A missing password on one side of the BGP session will result in the neighbouring router producing these errors:

```
%TCP-6-BADAUTH: No MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
%TCP-6-BADAUTH: No MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
%TCP-6-BADAUTH: No MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
```

whereas a mismatch in the configured passwords will result in these messages:

```
%TCP-6-BADAUTH: Invalid MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
%TCP-6-BADAUTH: Invalid MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
%TCP-6-BADAUTH: Invalid MD5 digest from 2001:18:0:10::1(54614) to
2001:18:0:10::(179)
```

Configure password on the eBGP session

Passwords should now be configured on the eBGP sessions between your and your upstream. Just use “cisco” as the password on the eBGP session. Here is an example for AS10:

```
router bgp 10
 address-family ipv4
  neighbor 100.121.1.1 password cisco
!
 address-family ipv6
  neighbor 2001:18:0:10:: password cisco
!
```

Bogon Filtering

Configuring Inbound IPv4 BGP Prefix Filtering

Prefix lists allow a network administrator to permit or deny specific prefixes that are sent or received via BGP. Prefix lists should be used where possible to ensure network traffic is sent over the intended paths. Prefix lists should be applied to each eBGP peer in both the inbound and outbound directions.

Configured prefix lists limit the prefixes that are sent or received to those specifically permitted by the routing policy of a network. If this is not feasible due to the large number of prefixes received, a prefix list should be configured to specifically block known bad prefixes. These known bad prefixes include unallocated IP address space and networks that are reserved for internal or testing purposes by RFC 6890/BCP153. Outbound prefix lists should be configured to specifically permit only the prefixes that an organization intends to advertise.

This configuration example uses prefix lists to ensure that no bogon routes are learned or advertised. Create the IPv4 prefix filter named ‘bogon-filter’ (we will do the same for IPv6 shortly):

```
ip prefix-list bogon-filter description == IPv4 Bogons ==
! Allow our workshop prefixes
ip prefix-list bogon-filter permit 100.68.1.0/24
ip prefix-list bogon-filter permit 100.68.2.0/24
ip prefix-list bogon-filter permit 100.68.3.0/24
ip prefix-list bogon-filter permit 100.68.4.0/24
ip prefix-list bogon-filter permit 100.68.5.0/24
ip prefix-list bogon-filter permit 100.68.6.0/24
ip prefix-list bogon-filter permit 100.121.0.0/16
ip prefix-list bogon-filter permit 100.122.0.0/16
! All default route so we can propagate in IGP
ip prefix-list bogon-filter permit 0.0.0.0/0
! Drop all the Bogons
ip prefix-list bogon-filter deny 0.0.0.0/8 le 32
ip prefix-list bogon-filter deny 10.0.0.0/8 le 32
ip prefix-list bogon-filter deny 100.64.0.0/10 le 32
ip prefix-list bogon-filter deny 127.0.0.0/8 le 32
```

```
ip prefix-list bogon-filter deny 169.254.0.0/16 le 32
ip prefix-list bogon-filter deny 172.16.0.0/12 le 32
ip prefix-list bogon-filter deny 192.0.0.0/24 le 32
ip prefix-list bogon-filter deny 192.0.2.0/24 le 32
ip prefix-list bogon-filter deny 192.168.0.0/16 le 32
ip prefix-list bogon-filter deny 198.18.0.0/15 le 32
ip prefix-list bogon-filter deny 198.51.100.0/24 le 32
ip prefix-list bogon-filter deny 203.0.113.0/24 le 32
ip prefix-list bogon-filter deny 224.0.0.0/3 le 32
ip prefix-list bogon-filter deny 0.0.0.0/0 ge 25
! Allow everything else
ip prefix-list bogon-filter permit 0.0.0.0/0 le 32
```

Note the last line – it has a permit statement, allowing the remaining addresses in the BGP session. Cisco IOS has a default deny for its prefix-list filter. Also remember that we need to allow the address space used in our workshop here too – those are the first 4 permit lines of the prefix-list.

Apply the prefix-filter to the IPv4 eBGP sessions

We now apply this prefix filter incoming to our external BGP sessions. For example for AS10:

```
router bgp 10
 address-family ipv4
  neighbor 100.121.1.1 prefix-list bogon-filter in
!
```

Once you have entered the above configuration, refresh the BGP session by entering the following command (example again for AS10). This refresh command applies the newly added BGP configuration to the BGP session.

```
clear ip bgp 121 in
```

Configuring Outbound IPv4 BGP Prefix Filtering

Note that it is also important to create an outbound prefix lists to announce only the aggregate allocated prefix outbound to the upstream Network Operator. The configuration would look something like the following:

```
ip prefix-list upstream permit 100.68.1.0/24
!
router bgp 10
 address-family ipv4
  neighbor 100.121.1.1 prefix-list upstream out
!
```

Again remember to refresh the BGP session outbound.

```
clear ip bgp 121 out
```

Configuring Inbound IPv6 BGP Prefix Filtering

Each Group should now repeat the previous steps above using IPv6 instead. First of all, we will create the IPv6 bogon prefix-list:

```
ipv6 prefix-list v6bogon-filter description == IPv6 Bogons ==
! Allow our workshop prefixes
ipv6 prefix-list v6bogon-filter permit 2001:DB8:1::/48
ipv6 prefix-list v6bogon-filter permit 2001:DB8:2::/48
ipv6 prefix-list v6bogon-filter permit 2001:DB8:3::/48
ipv6 prefix-list v6bogon-filter permit 2001:DB8:4::/48
ipv6 prefix-list v6bogon-filter permit 2001:DB8:5::/48
ipv6 prefix-list v6bogon-filter permit 2001:DB8:6::/48
ipv6 prefix-list v6bogon-filter permit 2001:18::/32
ipv6 prefix-list v6bogon-filter permit 2001:19::/32
! Allow default route so we can propagate in IGP
ipv6 prefix-list v6bogon-filter permit ::/0
! Drop all the Bogons
ipv6 prefix-list v6bogon-filter permit 64:FF9B::/96
ipv6 prefix-list v6bogon-filter permit 2001::/32
ipv6 prefix-list v6bogon-filter deny 2001::/23 le 128
ipv6 prefix-list v6bogon-filter deny 2001:2::/48 le 128
ipv6 prefix-list v6bogon-filter deny 2001:10::/28 le 128
ipv6 prefix-list v6bogon-filter deny 2001:DB8::/32 le 128
ipv6 prefix-list v6bogon-filter deny 2002::/16 le 128
ipv6 prefix-list v6bogon-filter deny 3FFE::/16 le 128
! Allow rest of Global Unicast space
ipv6 prefix-list v6bogon-filter permit 2000::/3 le 48
ipv6 prefix-list v6bogon-filter deny ::/0 le 128
```

Note that the logic here is reversed from the IPv4 filter – basically the only routable IPv6 address space is the 2000::/3 Global Unicast address block, so that is what is permitted through our filters. The exceptions to this last permit line are listed in the previous entries of the prefix filter.

Apply the prefix-filter to the IPv6 eBGP sessions

We now apply the prefix filter to our IPv6 eBGP session (or sessions) with our neighbours, in the same style as we did for IPv4.

```
router bgp 10
 address-family ipv6
  neighbor 2001:18:0:10:: prefix-list v6bogon-filter in
!
```

Once you have entered the above configuration, refresh the BGP session by entering the following command (example again for AS10). This refresh command applies the newly added BGP configuration to the BGP session.

```
clear bgp ipv6 unicast 121 in
```

Configuring Outbound IPv6 BGP Prefix Filtering

Note that it is also important to create an outbound prefix lists to announce only the aggregate allocated prefix outbound to the upstream Network Operator. The configuration would look something like the following:

```
ipv6 prefix-list upstreamv6 permit 2001:DB8:1::/48
!
router bgp 10
 address-family ipv6
  neighbor 2001:18:0:10:: prefix-list upstreamv6 out
!
```

Again remember to refresh the BGP session outbound.

```
clear bgp ipv6 unicast 121 out
```

Summary

We have now applied inbound bogon filters for both IPv4 and IPv6 on the eBGP session on our border routers. And we have configured outbound filters on our eBGP sessions to only allow the address block originated by our AS to get to our transit provider.

Note: in cases where the upstream provider only supplies the default route, we would not need to do the bogon filtering, but instead replace it with a filter only allowing the default route inbound.

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