Configure BGP to advertise a Default Route on Cisco Nexus Switches

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Introduction

This document describes different approaches to configure Border Gateway Protocol (BGP) to advertise a Default Route (0.0.0.0/0 network prefix) to BGP neighbors on Cisco Nexus NX-OS based Switches.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Nexus NX-OS Software.
- Routing Protocols, specifically BGP.

Components Used

The information in this document is based on Cisco Nexus 7000 with NX-OS version 7.3(0)D1(1)

The outputs in this document were taken from devices in a specific lab environment. All devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Configure

Network Command

The network 0.0.0.0/0 command injects the default route in the BGP RIB (BGP Routing
The prerequisite is to have the default route in the Routing Table via any other Routing Protocol or manually configured with a Static Route.

Once in the BGP RIB, the default route is advertised to all BGP neighbors unless specifically denied by an outbound filter configured per neighbor.

BGP configuration as seen in the `show running-config` output.

**Nexus BGP Configuration**

```
Nexus# show running-config bgp

!Command: show running-config bgp
!Time: Tue Dec  4 01:27:43 2018

version 7.3(0)D1(1)
feature bgp

router bgp 64512
    address-family ipv4 unicast
        network 0.0.0.0/0
    neighbor 10.1.3.3
        remote-as 64512
        address-family ipv4 unicast
```

In this example, Nexus receives the default route from EIGRP protocol. Therefore, the Nexus Routing Table shows the default route is available via EIGRP.

**Nexus Routing Table**

```
Nexus# show ip route 0.0.0.0
IP Route Table for VRF "default"
'*' denotes best uncast next-hop
'**' denotes best mcast next-hop
```
BGP RIB shows 0.0.0.0/0 as valid and best path since prerequisites are met. This is, default route is in Routing Table and network 0.0.0.0/0 command is configured in BGP configuration section.

### Nexus BGP RIB (BGP table)

Nexus# show bgp ipv4 unicast
BGP routing table information for VRF default, address family IPv4 Unicast
BGP table version is 13, local router ID is 10.255.255.1
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

<table>
<thead>
<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>*10.0.0.0/0</td>
<td>0.0.0.0</td>
<td>100</td>
<td>32768</td>
<td>i</td>
<td></td>
</tr>
</tbody>
</table>

The advertised-routes parameter shows the default-route is advertised to BGP peer 10.1.3.3

Nexus BGP Routes Advertised to a Specific BGP Peer

Nexus# show bgp ipv4 unicast neighbors 10.1.3.3 advertised-routes
Peer 10.1.3.3 routes for address family IPv4 Unicast:
BGP table version is 13, local router ID is 10.255.255.1
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

<table>
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<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>*10.0.0.0/0</td>
<td>0.0.0.0</td>
<td>100</td>
<td>32768</td>
<td>i</td>
<td></td>
</tr>
</tbody>
</table>

Redistribute and Default-Information Originate Commands

The redistribute command configured under the BGP process injects all the routes that exist in the Routing Table by a specific source routing protocol (and permitted by a route-map) in the BGP RIB with the exception of the default route.

To additional allow the default route to be installed from the source routing protocol in the BGP RIB, the command default-information originate is required.

Once in the BGP RIB, the default route is advertised to all BGP neighbors unless specifically denied by an outbound filter configured per neighbor.
BGP configuration section shows **redistribute eigrp** and **default-information originate** in place.

### Nexus BGP Configuration

Nexus# show running-config bgp

```plaintext
!Command: show running-config bgp
!Time: Tue Dec 4 01:33:41 2018

version 7.3(0)D1{1}
feature bgp

router bgp 64512
  address-family ipv4 unicast
    redistribute eigrp 1 route-map PERMIT-ALL
    default-information originate
  neighbor 10.1.3.3
    remote-as 64512
    address-family ipv4 unicast

!--- A route-map with no match entry permits all routes.
route-map PERMIT-ALL permit 10
```

In this example, Nexus receives the default route from EIGRP protocol. Therefore, the Nexus Routing Table shows the default route is available via EIGRP.

### Nexus Routing Table

Nexus# show ip route eigrp

```plaintext
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'!<string>' in via output denotes VRF <string>

0.0.0.0/0, ubest/mbest: 1/0
  *via 10.1.2.2, Eth2/1, [170/2816], 00:07:19, eigrp-1, external
192.168.2.0/24, ubest/mbest: 1/0
  *via 10.1.2.2, Eth2/1, [170/2816], 00:00:07, eigrp-1, external
```

BGP RIB shows 0.0.0.0/0 as valid and best path since prerequisites are met. This is, default route has been redistributed from source routing protocol in BGP and **default-information originate** command is configured in BGP configuration section.

### Nexus BGP RIB (BGP table)

Nexus# show bgp ipv4 unicast

```plaintext
BGP routing table information for VRF default, address family IPv4 Unicast
BGP table version is 17, local router ID is 10.255.255.1
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *=valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-i
jected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

<table>
<thead>
<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>*r0.0.0.0/0</td>
<td>0.0.0.0</td>
<td>2816</td>
<td>100</td>
<td>32768</td>
<td>?</td>
</tr>
</tbody>
</table>
```
The **advertised-routes** parameter shows the default-route is advertised to BGP peer 10.1.3.3

**Nexus BGP Routes Advertised to a Specific BGP Peer**

Nexus# show bgp ipv4 unicast neighbors 10.1.3.3 advertised-routes

Peer 10.1.3.3 routes for address family IPv4 Unicast:
BGP table version is 17, local router ID is 10.255.255.1
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

<table>
<thead>
<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>*r0.0.0.0/0</td>
<td>0.0.0.0</td>
<td>2816</td>
<td>100</td>
<td>32768</td>
<td></td>
</tr>
<tr>
<td>*r192.168.2.0/24</td>
<td>0.0.0.0</td>
<td>2816</td>
<td>100</td>
<td>32768</td>
<td></td>
</tr>
</tbody>
</table>

In the absence of the **default-information originate** command from BGP configuration, the BGP RIB does not install the default route.

**BGP configuration section next shows only redistribute eigrp in place.**

**Nexus BGP Configuration**

Nexus# show run bgp

!Command: show running-config bgp
!Time: Tue Dec 4 01:39:30 2018

version 7.3(0)D1(1)
feature bgp
router bgp 64512
  address-family ipv4 unicast
    redistribute eigrp 1 route-map PERMIT-ALL
neighbor 10.1.3.3
  remote-as 64512
  address-family ipv4 unicast

!--- A route-map with no match entry permits all routes.
route-map PERMIT-ALL permit 10

**Routing Table output shows the default route is available from EIGRP protocol.**

**Nexus Routing Table**

Nexus# show run bgp

!Command: show running-config bgp
With no `default-information originate` command, BGP RIB does not install the 0.0.0.0/0 network prefix.

**Nexus BGP RIB (BGP table)**

**Note**: Before NX-OS version 6.2(2) for Nexus 7000 series and version 6.0(2)N3(1) for Nexus 5000 series, the command `default-information originate` was not required. Default route used to be also injected in BGP RIB only by the `redistribute` command.

**Default-Originate Command**

The `default-originate` command is configured on a per BGP neighbor basis. This command artificially generates and advertises a default route only to the specific BGP peer.

The default route does not need to exist in the Routing Table and it is not created in the BGP RIB.
The **default-originate** command is configured on a per neighbor basis.

**Nexus BGP Configuration**

Nexus# show running-config bgp

!Command: show running-config bgp
!Time: Tue Dec 4 02:22:43 2018

version 7.3(0)D1{1}
feature bgp

router bgp 64512
  address-family ipv4 unicast
    network 192.168.1.0/24
  neighbor 10.1.3.3
    remote-as 64512
  address-family ipv4 unicast
    default-originate

There is no need to have a default route in the Routing Table.

**Nexus Routing Table**

Nexus# show running-config bgp

!Command: show running-config bgp
!Time: Tue Dec 4 02:22:43 2018

version 7.3(0)D1{1}
feature bgp

router bgp 64512
  address-family ipv4 unicast
    network 192.168.1.0/24
  neighbor 10.1.3.3
    remote-as 64512
  address-family ipv4 unicast
    default-originate

No 0.0.0.0/0 entry is created in the BGP table.

**Nexus BGP RIB (BGP table)**

Nexus# show running-config bgp

!Command: show running-config bgp
!Time: Tue Dec 4 02:22:43 2018

version 7.3(0)D1{1}
feature bgp

router bgp 64512
  address-family ipv4 unicast
    network 192.168.1.0/24
  neighbor 10.1.3.3
    remote-as 64512
The entry **Originating default network 0.0.0.0/0** can be found in the routes advertised to BGP peer 10.1.3.3

**Nexus BGP Routes Advertised to a Specific BGP Peer**

Nexus# show bgp ipv4 unicast neighbors 10.1.3.3 advertised-routes

Peer 10.1.3.3 routes for address family IPv4 Unicast:
BGP table version is 20, local router ID is 10.255.255.1
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

**Originating default network 0.0.0.0/0**

<table>
<thead>
<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>*&gt;192.168.1.0/24</td>
<td>0.0.0.0</td>
<td>100</td>
<td>32768</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Optionally, the **default-originate** command can use a **route-map** as a parameter to conditionally advertise the default-route.

**Optional default-originate route-map**

Nexus(config-router-neighbor-af)# default-originate ?

<CR>

route-map Route-map to specify criteria for originating default

The **route-map** needs to match a route installed in the Routing Table in order to make **default-originate** advertise the default-route to the BGP peer.

**Nexus Routing Table**

Nexus# show ip route 192.168.3.0

IP Route Table for VRF "default"
'**' denotes best ucast next-hop
'***' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'&<string>' in via output denotes VRF <string>

Route not found

In this case, the **route-map** named ADVERTISE-DEFAULT-IF references a prefix-list named NETWORKS and the latter the 192.168.3.0/24 network prefix which should exist in the Routing Table in order to advertise the default-route.

**Nexus BGP Configuration**
ip prefix-list NETWORKS seq 5 permit 192.168.3.0/24
! route-map ADVERTISE-DEFAULT-IF permit 10
  match ip address prefix-list NETWORKS
!
router bgp 64512
  address-family ipv4 unicast
    network 192.168.1.0/24
    neighbor 10.1.3.3
    remote-as 64512
    address-family ipv4 unicast
      default-originate route-map ADVERTISE-DEFAULT-IF

Since 192.168.3.0/24 is not in the Routing Table, the default-route is not advertised.

Nexus BGP Routes Advertised to a Specific BGP Peer

ip prefix-list NETWORKS seq 5 permit 192.168.3.0/24
! route-map ADVERTISE-DEFAULT-IF permit 10
  match ip address prefix-list NETWORKS
!
router bgp 64512
  address-family ipv4 unicast
    network 192.168.1.0/24
    neighbor 10.1.3.3
    remote-as 64512
    address-family ipv4 unicast
      default-originate route-map ADVERTISE-DEFAULT-IF