CONTENTS

Multi-Topology IS-IS

« Single-Topology IS-IS (/workbook/view/service-provider-v4/task/single-topology-is-is-Mjg0NA%3D%3D) | Basic LDP (/workbook/view/service-provider-v4/task/basic-ldp-Mjg0Ng%3D%3D) »

Last updated: April 23, 2016

Note:

This task assumes that you have already completed the Single-Topology IS-IS (http://labs.ine.com/workbook/view/service-provider-v4/task/single-topology-is-is-Mjg0NA%3D%3D) task. Refer to the **Base IPv4 Diagram** in order to complete this task.

Task

- Configure IS-IS to run in Multi Topology mode on all devices.
- Change the IS-IS metric on the path from R2 to R3 to R6 to XR1 and back so that IPv4 traffic between R1 and XR2 prefers to use R4 and R5 in the transit path.
- Change the IS-IS metric on the path from R2 to R4 to R5 to XR1 and back so that IPv6 traffic between R1 and XR2 prefers to use R3 and R6 in the transit path.

Configuration **Click to *collapse***

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```
R1:
router isis
 metric-style wide
 !
 address-family ipv6
  multi-topology

R2:
interface GigabitEthernet1.23
 isis metric 20
!
interface GigabitEthernet1.24
 isis ipv6 metric 20
!
 router isis
   metric-style wide
 !
address-family ipv6
multi-topology

R3:
interface GigabitEthernet1.36
 isis metric 20
!
router isis
 metric-style wide
 !
 address-family ipv6
  multi-topology

R4:
interface GigabitEthernet1.24
 isis ipv6 metric 20
!
interface GigabitEthernet1.45
 isis ipv6 metric 20
!
router isis
 metric-style wide
 !
 address-family ipv6
  multi-topology

R5:
interface GigabitEthernet1.45
 isis ipv6 metric 20
!
interface GigabitEthernet1.519
 isis ipv6 metric 20
!
router isis
 metric-style wide
 !
```

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```
 address-family ipv6
  multi-topology

R6:
interface GigabitEthernet1.36
 isis metric 20
!
interface GigabitEthernet1.619
 isis metric 20
!
router isis
 metric-style wide
 !
 address-family ipv6
  multi-topology

XR1:
router isis 1
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  no single-topology
 !
 interface GigabitEthernet0/0/0/0.519
  address-family ipv6 unicast
   metric 20
  !
 !
 interface GigabitEthernet0/0/0/0.619
  address-family ipv4 unicast
   metric 20
  !
 !
!

XR2:
router isis 1
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  no single-topology
 !
!
```

Verification

In Multi Topology IS-IS, separate protocol stacks maintain separate database structures and use separate SPF runs, which means that one topology is independent of another. Multi Topology IS-IS is most useful in practical IPv4 to IPv6 migration scenarios, where IPv6 is slowly introduced to the already existing IPv4 core. During migration the IPv4 and IPv6 topologies are kept separate from a database

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calculation point of view inside of IS-IS. Once the migration is complete and IPv4 and IPv6 run on a 1:1 basis with each other, Single Topology IS-IS can be enabled, which means that both IPv4 and IPv6 topology share the same database and SPF run. Note that this design is only possible if IPv4 runs on all interfaces that IPv6 runs on and vice-versa, otherwise database inconsistencies can occur which can result in loss of reachability in the network.

Prior to making any changes to the previous example, R1's IPv4 and IPv6 traffic follow the same path to reach XR2.


```
R1#traceroute 20.20.20.20


Type escape sequence to abort.

Tracing the route to 20.20.20.20


 1  10.1.2.2    0   msec    0   msec    0  msec

 2  20.2.3.3    0   msec    4   msec    0  msec

 3  20.3.6.6    0   msec    4   msec    0  msec

 4  20.6.19.19  0   msec    0   msec    4  msec

 5  10.19.20.20 4   msec *  4   msec


R1#traceroute 2001::20:20:20:20


Type escape sequence to abort.

Tracing the route to 2001::20:20:20:20


 1 2000:10:1:2::2    8 msec  0  msec  0  msec

 2 2000:20:2:3::3    8 msec  4  msec  0  msec

 3 2000:20:3:6::6    8 msec  12 msec  0  msec

 4 2000:20:6:19::19  4 msec  4  msec  0  msec

 5 2000::20:20:20:20 8 msec  4  msec  4  msec
```

After the Multi Topology and metric changes, IPv4 traffic follows the path along the bottom of the topology through R4 and R5, while IPv6 traffic follows the path along the top of the topology through R3 and R6.

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```
R1#traceroute 20.20.20.20
Type escape sequence to abort.
Tracing the route to 20.20.20.20
VRF info: (vrf in name/id, vrf out name/id)
  1 10.1.2.2 4 msec 1 msec 6 msec
  2 20.2.4.4 2 msec 1 msec 1 msec
  3 20.4.5.5 1 msec 1 msec 1 msec
  4 20.5.19.19 8 msec 12 msec 13 msec
  5 10.19.20.20 13 msec *  3 msec


R1#traceroute 2001::20:20:20:20
Type escape sequence to abort.
Tracing the route to 2001::20:20:20:20

  1 2001:10:1:2::2 4 msec 2 msec 1 msec
  2 2001:20:2:3::3 2 msec 1 msec 6 msec
  3 2001:20:3:6::6 5 msec 15 msec 14 msec
  4 2001:20:6:19::19 16 msec 13 msec 15 msec
  5 2001::20:20:20:20 24 msec 20 msec 20 msec


R2#show ip route 20.20.20.20
Routing entry for 20.20.20.20/32
  Known via "isis", distance 115, metric 40, type level-2
  Redistributing via isis
  Last update from 20.2.4.4 on GigabitEthernet1.24, 00:04:25 ago
  Routing Descriptor Blocks:
  *  20.2.4.4, from 20.20.20.20, 00:04:25 ago, via GigabitEthernet1.24
       Route metric is 40, traffic share count is 1

R2#show ipv6 route 2001::20:20:20:20
Routing entry for 2001::20:20:20:20/128
  Known via "isis", distance 115, metric 40, type level-2
  Route count is 1/1, share count 0
  Routing paths:
     FE80::250:56FF:FE9E:6E6A, GigabitEthernet1.23
       Last updated 00:04:10 ago


RP/0/0/CPU0:XR2#traceroute 1.1.1.1
Wed Apr 29 23:24:16.468 UTC

Type escape sequence to abort.
Tracing the route to 1.1.1.1

 1  10.19.20.19 0 msec  0 msec  0 msec
 2  20.5.19.5 0 msec  0 msec  0 msec
 3  20.4.5.4 0 msec  0 msec  0 msec
 4  20.2.4.2 0 msec  0 msec  0 msec
 5  10.1.2.1 0 msec  *  0 msec


RP/0/0/CPU0:XR2#traceroute 2001::1:1:1:1
```

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```
Wed Apr 29 23:24:45.326 UTC


Type escape sequence to abort.
Tracing the route to 2001::1:1:1:1


 1  2001:10:19:20::19 19 msec 19 msec 9 msec
 2  2001:20:6:19::6 9 msec 9 msec 9 msec
 3  2001:20:3:6::3 9 msec 9 msec 9 msec
 4  2001:20:2:3::2 69 msec 19 msec 9 msec
 5  2001:10:1:2::1 9 msec 9 msec 9 msec



RP/0/0/CPU0:XR1#show route ipv4 1.1.1.1
Wed Apr 29 23:27:27.715 UTC


Routing entry for 1.1.1.1/32
  Known via "isis 1", distance 115, metric 40, type level-2
  Installed Apr 29 23:21:42.999 for 00:05:44
  Routing Descriptor Blocks
    20.5.19.5, from 1.1.1.1, via GigabitEthernet0/0/0/0.519
      Route metric is 40
  No advertising protos.


RP/0/0/CPU0:XR1#show route ipv6 2001::1:1:1:1
Wed Apr 29 23:27:40.274 UTC


Routing entry for 2001::1:1:1:1/128
  Known via "isis 1", distance 115, metric 50, type level-2
  Installed Apr 29 23:21:41.289 for 00:05:59
  Routing Descriptor Blocks
    fe80::250:56ff:fe9e:5cec, from 2001::1:1:1:1, via GigabitEthernet0/0/0/0.619
      Route metric is 50
  No advertising protos.
```

When we look at the detailed view of the IS-IS database we can see that the IPv6 information is encoded as MT for Multi Topology, and that separate IPv4 and IPv6 metrics can exist. Note that Wide Metric Style is required in order to encode the Multi Topology information in the database.

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```
RP/0/0/CPU0:XR2#show isis database R1.00-00 detail

Wed Apr 29 23:28:59.849 UTC


IS-IS 1 (Level-2) Link State Database

LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL

R1.00-00              0x00000005   0xc206        720             0/0/0

  Area Address: 49.0001

  NLPID:        0xcc

  NLPID:        0x8e

   MT:           Standard (IPv4 Unicast)

   MT:           IPv6 Unicast                                     0/0/0

  Hostname:     R1

  Metric: 10         IS-Extended R1.01

  Metric: 10         MT (IPv6 Unicast) IS-Extended R1.01

  IP Address:   1.1.1.1

  Metric: 0          IP-Extended 1.1.1.1/32

  Metric: 10         IP-Extended 10.1.2.0/24

  IPv6 Address: 2001::1:1:1:1

  Metric: 10         MT (IPv6 Unicast) IPv6 2001::1:1:1:1/128

  Metric: 10         MT (IPv6 Unicast) IPv6 2001:10:1:2::/64
```

« Single-Topology IS-IS (/workbook/view/service-provider-v4/task/single-topology-is-is-Mjg0NA%3D%3D) | Basic LDP (/workbook/view/service-provider-v4/task/basic-ldp-Mjg0Ng%3D%3D) »

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