

CONNECTED AND LOCAL ROUTES

As we saw in chapter 30, when an interface with an IPv6 address is up/up (line status/protocol status), IOS automatically adds routes to the routing table expressing two fairly obvious things that can't help but be true

- Local Route ("L")—a /128 route specifying that the exact address of our own interface can be reached at that interface [Example, lines 16-17]
- Connected Route ("C")—a route stating that the network corresponding to the interface address (having the address prefix and prefix length of the interface's address) can be reached through that interface [lines 14-15]

Link-local addresses are not routable by definition, so neither of these routes will be created for them. Also, if the interface goes down, the routes will disappear until it comes back up.



```

1 R5(config)# interf gi0/0
2 R5(config-if)# description TO R6
3 R5(config-if)# ipv6 address 2001:db8:56::5/64
4 R5(config-if)# no shut
5 R5(config-if)# do show ipv6 route
6 IPv6 Routing Table - default - 3 entries
7 Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
8       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
9       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
10      D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, l - LISP
11      O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
12      ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
13 C   2001:DB8:56::/64 [0/0]
14     via GigabitEthernet0/0, directly connected
15 L   2001:DB8:56::5/128 [0/0]
16     via GigabitEthernet0/0, receive

```

STATIC ROUTES

Static (manually configured) routes are really no different than in IPv4. Just like before, the destination can be an exit interface [example line 1] or a next-hop address [line 2]. You can even use both [line 5]. In fact, if you use a link-local next-hop address, you'll need to use both to tell the router which interface that address is on [lines 3-4]. Since the scope of such an address is literally local to the link it's on, there's no reason why that same address can't appear on more than one interface. Naturally, you would choose one way to enter this route, not all three.

```

1 R5(config)# ipv6 route 2001:db8:67::/64 Gi0/0
2 R5(config)# ipv6 route 2001:db8:67::/64 2001:db8:56::6
3 R5(config)# ipv6 route 2001:db8:67::/64 FE80::21B:D4FF:FE76:6058
4 % Interface has to be specified for a link-local nexthop
5 R5(config)# ipv6 route 2001:db8:67::/64 Gi0/0 FE80::21B:D4FF:FE76:6058

```

As with local and connected routes, ios will remove a route when its exit interface becomes unavailable, but there is no attempt to verify the route beyond that. In the example below, I haven't even configured R6 and R7 for any of the three routes that are shown.

```

1 R5# show ipv6 route static
2                               Limiting the output to static routes eliminates the clutter of local and connected routes
3 IPv6 Routing Table - default - 6 entries
4 Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
5         B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
6         I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
7         D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, l - LISP
8         O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
9         ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
10 S    2001:DB8:67::/64 [1/0]
11     via 2001:DB8:56::6, GigabitEthernet0/0
12 S    2001:DB8:68::/64 [1/0]
13     via GigabitEthernet0/0, directly connected
14 S    2001:DB8:69::/64 [1/0]
15     via 2001:DB8:56::6
16
17 R5# show run | include route
18 ipv6 route 2001:DB8:67::/64 GigabitEthernet0/0 2001:DB8:56::6
19 ipv6 route 2001:DB8:68::/64 GigabitEthernet0/0
20 ipv6 route 2001:DB8:69::/64 2001:DB8:56::6
    As always, a next hop address is physically located on the remote router, R6. This router, R5, will have to silently do a second lookup to see which interface to use for this address.

```

The example above shows how each of the three static route formats show up in the "show ipv6 route static" output. Notice that 2001:DB8:68::/64 was entered as an exit interface (only) and is listed as "directly connected" [lines12-13]. It's not! The "S" on the left is correct; it's static.

A robust configuration may have more than one route to a destination. To see which will be used, you can limit the display to just the chosen route for that destination network or host. The output will vary slightly, depending on whether the route was configured with a next hop address an exit interface, or both. The big difference is that the routing path for an exit interface without a next-hop address is called "directly connected via..."

| EXIT INTERFACE | NEXT HOP ADDRESS |
|---|---|
| <pre> R5# show ipv6 route 2001:db8:68::6 Routing entry for 2001:DB8:68::/64 Known via "static", distance 1, metric 0 Route count is 1/1, share count 0 Routing paths: directly connected via GigabitEthernet0/0 Last updated 23:11:08 ago </pre> <p><i>Think of the phrase "directly connected" as an indication that the router won't be doing an ARP-like lookup of an L2 (MAC) address for an L3 next-hop address (because there isn't one) and has to trust that the next-hop is "directly connected" to the exit interface and will hear the frame without such help.</i></p> | <pre> R5# show ipv6 route 2001:db8:69::6 Routing entry for 2001:DB8:69::/64 Known via "static", distance 1, metric 0 Route count is 1/1, share count 0 Routing paths: 2001:DB8:56::6 Last updated 23:10:43 ago </pre> |
| BOTH | |
| | <pre> R5# show ipv6 route 2001:db8:67:: Routing entry for 2001:DB8:67::/64 Known via "static", distance 1, metric 0 Route count is 1/1, share count 0 Routing paths: 2001:DB8:56::6, GigabitEthernet0/0 Last updated 23:31:04 ago </pre> |

Static Default Route—These give a direction to all destinations that aren't explicitly in the routing table. Generally, default routes will point toward the internet on the assumption that any address not local to the enterprise must be "out there somewhere." Without a default route, a packet with no destination will be dropped.

Default routes exploit the fact that routing uses the most specific match available in the routing table. The default route is defined as completely unspecific (prefix-length = 0). In this way, it matches everything but will only be used for packets that match absolutely nothing else.

```
R5(config)# ipv6 route ::/0 gi0/0
```

```
R5# show ipv6 route
```

```

                [stuff omitted]
S    ::/0 [1/0]
    via GigabitEthernet0/0, directly connected
```

Static Host Route—a route with a /128 prefix-length specifies an individual host.

F L O A T I N G S T A T I C R O U T E S

Administrative Distance (AD)—Routers can learn routes from many sources. We've learned two, directly connected and static configuration. When choosing which route to put in the routing table for the same destination, IOS prioritizes sources according to "administrative distance." If the exact same route (same destination prefix *and* prefix length) is available from two sources, the source with the lowest administrative distance wins.

| ROUTE SOURCE | ADMIN DIST |
|------------------------|------------|
| Connected | 0 |
| Static | 1 |
| NDP | 2 |
| EIGRP | 90 |
| OSPF | 110 |
| RIP | 120 |
| Unknown / Unbelievable | 255 |

In the "show ipv6 route" command, the first number in square-brackets is the administrative distance of that route, telling you how the route was learned.

```
S    2001:DB8:67::/64 [1/0]
```

This static (S) route has an administrative distance of 1, as expected

Floating Static Routes—It's possible to explicitly set the AD of a static route to something other than one. If the chosen AD is higher than the AD of some other source, the static route act as a backup, only placed in the routing table when the other route is (or becomes) unavailable. For example, a route with an AD of 115 will only take effect when an OSPF route (AD of 110) to that destination is unavailable.

```
R5(config)# ipv6 route 2001:db8:67::/64 2001:db8:56::6 115
```

This route will only be placed in the routing table when no route is available from any source with an AD lower than 115

DEFAULT ROUTES FROM SLAAC

A router interface (perhaps on the enterprise edge facing the ISP) can configure itself using SLAAC. It can even generate a default route, using whatever router answered it's RS (Router Solicitation) as the next hop. Such a route will receive an administrative distance of 2 because it is sourced from NDP (Neighbor Discovery Protocol).

```
R5 (config-if)# ipv6 address autoconfig
```

Use SLAAC to configure the interface IP address

```
R5 (config-if)# ipv6 address autoconfig default
```

Use SLAAC to configure the interface IP address AND create a default route out that interface

TROUBLESHOOTING

IOS only checks syntax, not correctness. For incorrect static routes successfully placed in the routing table, verify:

- Next hop addresses should be on the neighboring router, not your own
- Exit interfaces should be on your own router, not the other end of the link.
- Link-local next hop addresses are a combination of the above two and obey both.
- Network Prefix & Prefix length are correct (destination match)

If the route doesn't appear in the routing table, check:

- A named exit interface must be up/up
- If the next hop is an address, the router must have a route to *that* network too
- The route you're missing in the routing table must have the lowest admin distance of all routes that have the exact same prefix and prefix length.