

## IPv6 Module 1b – IS-IS

**Objective:** Create a basic physical lab interconnection using IPv6 with one IS-IS Area running on top of an existing IPv4 infrastructure.

**Prerequisites:** The setup section of IPv6 Module 1.

The following will be the common topology used for this supplement.

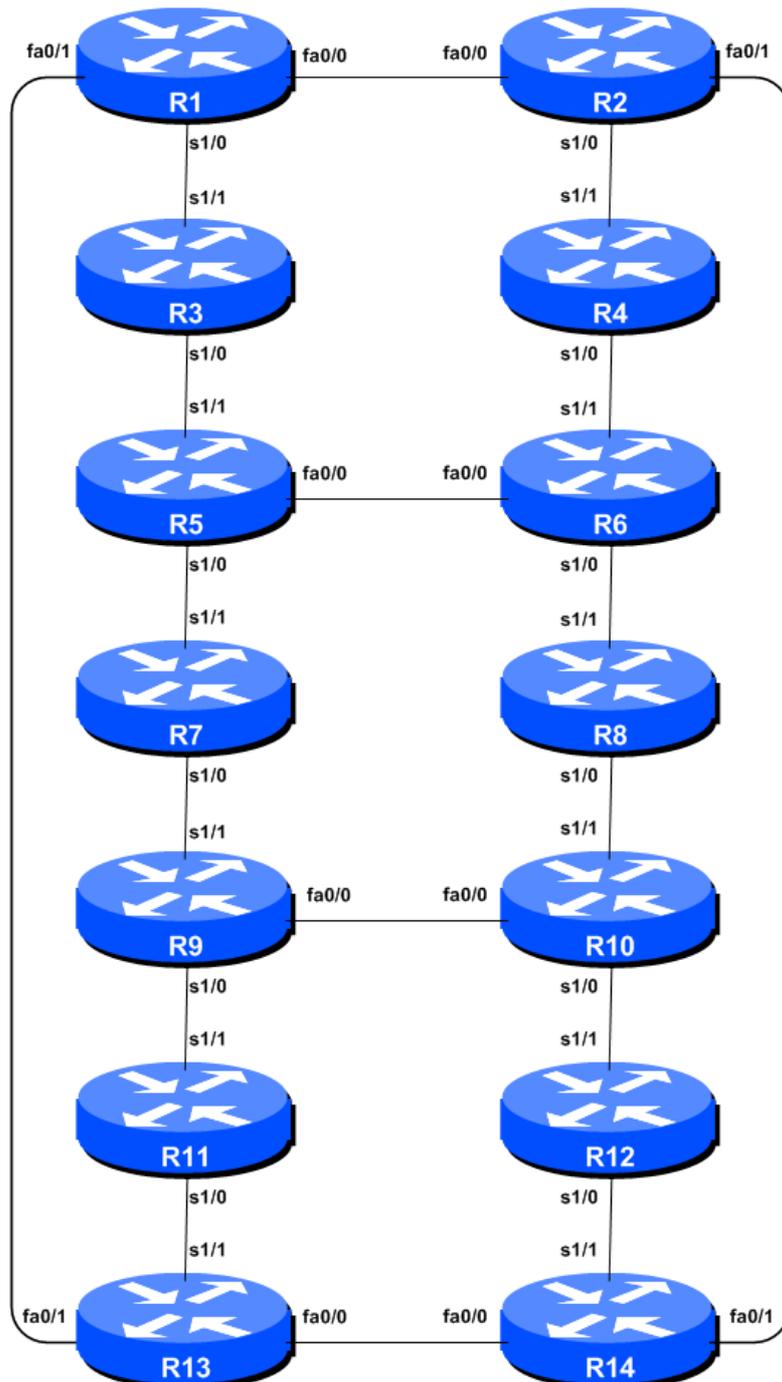


Figure 1 – ISP Lab Basic Configuration

## Lab Notes

This lab continues from the previous one by adding IS-IS to the configured, addressed and confirmed working interfaces. Please refer to the Setup Module for further information and reference points about the purpose of Module 1.

### Lab Exercise

1. **IS-IS within the same AS.** IS-IS will have already been set up in the AS for IPv4 – each team should confirm that the IGP is still operational before starting the next steps to add in IPv6 topology support.
2. **Activating Multi-Topology IS-IS.** We also need to activate multi-topology IS-IS to roll out IS-IS support for IPv6 if the existing network is already using IPv4 IS-IS. This allows the IPv6 topology to be incrementally rolled out, very useful during deployment of IPv6. This means that each team can add IS-IS IPv6 support without having to coordinate with their neighbouring teams.

```
Router1(config)# router isis workshop
Router1(config-router)# address-family ipv6
Router1(config-router-af)# multi-topology
```

**NB.** If we do not enable multi-topology, then each team will have to coordinate the enabling of IPv6 IS-IS on each interface with their respective neighbouring teams. Failure to do so will result in the IS-IS session going down, as there will be a topology mismatch on that interface.

**NB.** Multi-topology is configurable in IOS 12.3 and 12.4 but it does not work due to a bug which Cisco hasn't fixed. The workaround is to use single topology, noting the caveat above, or use 12.2SRE, 12.2SXH, 12.4T, 15.0 or later IOS images. (No operator should be using IOS images prior to 15.2 in any case!)

**Checkpoint #1:** *demonstrate that you have enabled multi-topology IS-IS to the lab demonstrators.*

3. **Activating IS-IS on each interface.** All connected point to point and shared ethernet interfaces need to be configured with IPv6 IS-IS. Otherwise, you may not be able to see network advertisements via IS-IS from routers two or more hops away.

The example for the Router Team 1 is:

```
Router1(config)# interface fastethernet 0/0
Router1(config-if)# ipv6 router isis workshop
!
Router1(config)# interface fastethernet 0/1
Router1(config-if)# ipv6 router isis workshop
!
Router1(config)# interface serial 1/0
Router1(config-if)# ipv6 router isis workshop
```

**Note:** the IS-IS ID on the interfaces must be matched with the router's IS-IS ID.

4. **IS-IS Metrics.** Now each team needs to set the IS-IS metric on each physical interface. The default IS-IS metric for all interface types is 10. Unlike OSPF in IOS, IS-IS has no automatic scheme to convert the interface bandwidth into a metric value. ISPs deploying IS-IS have to come up with their own scheme (as in fact many ISPs using OSPF now also do)

In the lab we use metric 2 for the Ethernet interfaces and metric 20 for the Serial interfaces. For example:

```
Router1(config)# interface fastethernet 0/0
Router1(config-if)# isis ipv6 metric 2 level-2
!
Router1(config)# interface fastethernet 0/1
Router1(config-if)# isis ipv6 metric 2 level-2
!
Router1(config)# interface serial 1/0
Router1(config-if)# isis ipv6 metric 20 level-2
```

5. **Announcing the Loopback /128.** The loopback interface will have already been marked as passive when IS-IS was set up for IPv4 routing on the network. Each team should confirm that the passive-interface command is still present for the Loopback.
6. **Avoiding Traffic Blackhole on Reboot.** When a router restarts after being taken out of service, IS-IS will start distribute prefixes as soon as adjacencies are established with its neighbours. In the next part of the workshop lab, we will be introducing iBGP. So if a router restarts, IS-IS will start up well before the iBGP mesh is re-established. This will result in the router landing in the transit path for traffic, with out the routing table being completed by BGP. There will not be complete routing information on the router, so any transit traffic (from customer to peer or upstream, or vice-versa) will be either dropped, or resulting in packets bouncing back and forth between adjacent routers. To avoid this problem, we require the router to not announce it is availability until the iBGP mesh is up and running. To do this, we have to provide the following command:

```
Router1(config)#router isis workshop
Router1(config-router)#address-family ipv6
Router1(config-router-af)#set-overload-bit on-startup wait-for-bgp
```

This sets IS-IS' overload bit such that all IPv6 routes via this router will be marked as unreachable (very high metric) until iBGP is up and running. Once iBGP is running, the prefixes distributed by IS-IS will revert to standard metric values, and the router will pass transit traffic as normal.

7. **Ping Test #2.** Ping all loopback interfaces in the classroom. This will ensure the IS-IS IGP is connected End-to-End. If there are problems, use the following commands to help determine the problem:

show ipv6 route	: see if there is a route for the intended destination
show clns neighbor	: see a list of CLNS-IS neighbours that the router sees
show clns interface	: see if IS-IS is configured and see the IS type
show isis database	: see IS-IS link state database that the router has learned
show isis ipv6 rib	: see IPv6 IS-IS routes that the router has learned
show isis topology	: see the IS-IS topology as learned by the router

**Checkpoint #2:** call lab assistant to verify the connectivity. Save the configuration as it is on the router – use a separate worksheet, or the workspace at the end of this Module. You will require this configuration several times throughout the workshop.

**8. Traceroute to all routers.** Once you can ping all the routers, try tracing routes to all the routers using `trace x:x` command. For example, Router Team 1 would type:

```
Router1# trace 2001:db8::c
```

to trace a route to Router R12. If the trace times out each hop due to unreachable destinations, it is possible to interrupt the `traceroute` using the Cisco break sequence CTRL-^.

**Q.** Why do some trace paths show multiple IP addresses per hop?

**A.** If there are more than one equal cost paths, IS-IS will “load share” traffic between those paths.

```
Router1>trace 2001:db8::c
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2001:db8::c
```

```
 1 2001:db8:0:3::1      4 msec
   2001:db8:0:2::1      0 msec
   2001:db8:0:3::1      0 msec
 2 2001:db8:0:f::1      4 msec
   2001:db8:0:8::1      4 msec
   2001:db8:0:f::1      0 msec
 3 2001:db8:0:13::      4 msec * 4 msec
```

```
Router1>
```

**9. Other Features in IS-IS.** Review the documentation or use command line help by typing `?` to see other `show` commands and other IS-IS configuration features.

## Review Questions

1. What IOS show command(s) will display the router’s IPv6 forwarding table?
2. What IOS show command(s) will display the router’s IPv6 IS-IS database?