

Module 1b – IS-IS

Objective: Create a basic physical lab interconnection with one IS-IS Area. Ensure that all routers, interfaces, cables and connections are working properly.

Prerequisites: The setup section of Module 1.

The following will be the common topology used for the first series of labs.

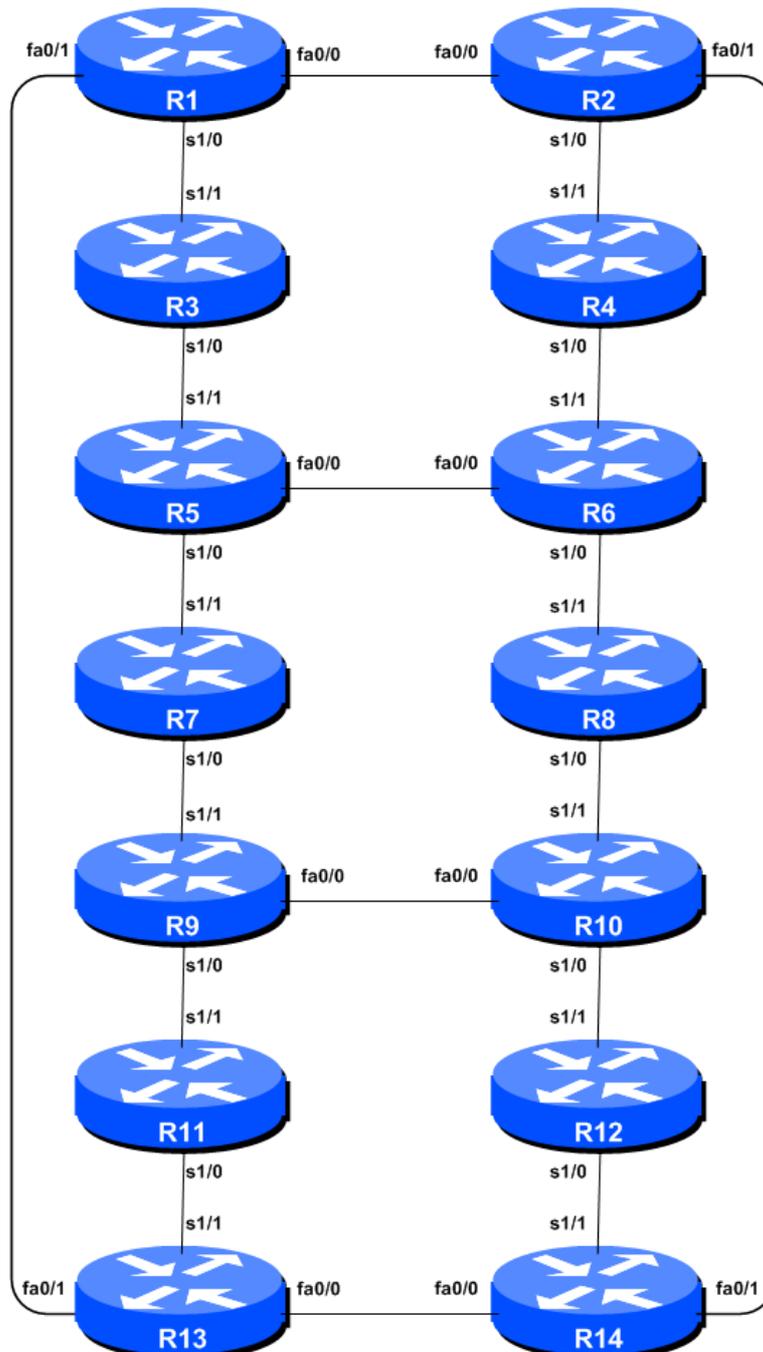


Figure 1 – ISP Lab Basic Configuration

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 with one area and one level (level-2) within the same AS.** Each router team should enable IS-IS on their router, and use *workshop* as the IS-IS ID in the configuration. In this module, we use level-2 in one area (*49.0001*) and use wide metrics (IOS default is the historical narrow metric and is not considered good practice). The NET should be *49.0001.x.x.x.x.00*, where *x.x.x.x* represents the router loopback IP address. For example, the loopback for Router1 is 10.0.15.241 which will make the NSAP address *49.0001.0100.0001.5241.00*.

```
Router1(config)# router isis workshop
Router1(config-router)#net 49.0001.0100.0001.5241.00
Router1(config-router)#is-type level-2-only
```

Q: Why do you have *is-type level-2-only* configured?

Hint: A nice trick for converting the loopback interface address into the NSAP address is to take the loopback address and put the missing leading zeroes in. For example, Router 5 loopback address is 10.0.15.245; this is rewritten to 010.000.015.245 putting in the missing zeroes. Then rather than having the dot after every third character, move it to be after every fourth character. So 010.000.015.245 becomes 0100.0001.5245.

2. **Setting Wide Metrics.** We also set the metric-style to wide. IS-IS supports two types of metric, narrow (historic now and not suitable for modern networks) and wide. IOS still defaults to narrow metrics, so we need to enter explicit configuration to change this to wide. We will set the metric style to be wide for level-2:

```
Router1(config)# router isis workshop
Router1(config-router)#metric-style wide level-2
```

3. **Changing the default metric.** The default metric in IS-IS is 10, on all interfaces irrespective of their physical bandwidth. It is considered best practice these days to change the default metric from 10 to a very high value, for example 10000, so that there are no network outages caused by misconfiguration of newly introduced routers, or misconfigured interfaces which could accidentally and unintentionally take full traffic load:

```
Router1(config)# router isis workshop
Router1(config-router)# metric 100000
```

4. **Activating IS-IS on each interface.** Now that the IS-IS process is configured, all connected point-to-point and shared ethernet interfaces need to be configured with IS-IS. Else, you will not be able to see network advertisements via IS-IS from routers two or more hops away. Here is an example configuration as would be used on Router1:

```
Router1(config)# interface fastethernet 0/0
Router1(config-if)# ip router isis workshop
```

```

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

```

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

- 5. IS-IS Circuit Type and IS-IS Metrics.** Now each team needs to set the circuit type and IS-IS metric on each physical interface.

The default circuit type is level-1-2 even though the router has been defined to be a level-2-only router.

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 will use metric 2 for the Ethernet interfaces and metric 20 for the Serial interfaces.

Combining the above, gives the example:

```

Router1(config)# interface fastethernet 0/0
Router1(config-if)# isis metric 2 level-2
Router1(config-if)# isis circuit-type level-2-only
!
Router1(config)# interface fastethernet 0/1
Router1(config-if)# isis metric 2 level-2
Router1(config-if)# isis circuit-type level-2-only
!
Router1(config)# interface serial 1/0
Router1(config-if)# isis metric 20 level-2
Router1(config-if)# isis circuit-type level-2-only

```

- 6. Announcing the Loopback /32.** We do not need to set up IS-IS adjacencies on the loopback interface as there are no neighbours there, so we mark it as passive:

```

Router1(config)# router isis workshop
Router1(config-router)# passive-interface Loopback0

```

Note that this will tell IS-IS to install the loopback interface address in the IS-IS RIB. We do NOT need to add an `ip router isis` statement onto the loopback interface itself. This is different from the required OSPF configuration, and often catches many engineers out, especially those who are learning IS-IS after gaining experience with OSPF.

- 7. IS-IS Adjacencies.** Enable logging of IS-IS adjacency changes. This is so that a notification is generated every time the state of a CLNS neighbor changes, and is useful for debugging purposes.

(**Note:** From IOS 12.4 onwards, *log-adjacency-changes* is activated by default when IS-IS is first configured.)

```

Router1(config)# router isis workshop
Router1(config-router)# log-adjacency-changes

```

- 8. 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)# set-overload-bit on-startup wait-for-bgp
```

This sets IS-IS' overload bit such that all 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.

- 9. Ping Test #2.** Ping all loopback interfaces. 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 ip route           : see if there is a route for the intended destination
show clns neighbor      : see a list of CLNS-IS neighbors 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 rib           : see 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.

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

```
Router1# trace 10.0.15.252
```

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 router12
```

Type escape sequence to abort.

```
Tracing the route to router12.workshop.net (10.0.15.224)
```

```
 1 fe0-0.router2.workshop.net (10.0.15.2) 4 msec
  fe0-1.router13.workshop.net (10.0.15.6) 0 msec
  fe0-0.router2.workshop.net (10.0.15.2) 0 msec
 2 fe0-0.router14.workshop.net (10.0.15.54) 4 msec
```

```
fe0-1.router14.workshop.net (10.0.15.26) 4 msec
fe0-0.router14.workshop.net (10.0.15.54) 0 msec
3 ser0-0.router12.workshop.net (10.0.15.69) 4 msec * 4 msec
Router1>
```

- 11. 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.
- 12. Advanced Configuration.** Those router teams who have completed this module should refer to Module 11 of the Advanced BGP Workshop. The set-up steps have been extended to include all the basic requirements of a router being used in an ISP backbone. While waiting for the module to complete, now would be a good time to review the advanced Module and incorporate the additions to the configuration used here.

Review Questions

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