

## The IS-IS Protocol



### BSCI Module 4 Lesson 3 Configuring Basic Integrated IS-IS



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## Integrated IS-IS: Requires NET Addresses

- A Common CLNS parameters (NET) and area planning are still required even in an IP environment.
- Even when Integrated IS-IS is used for IP routing only, routers still establish CLNS adjacencies and use CLNS packets.



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## OSI Area Routing: Building an OSI Forwarding Database (Routing Table)



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- When databases are synchronized, Dijkstra's algorithm (SPF) is run on the LSDB to calculate the SPF tree.
- The shortest path to the destination is the lowest total sum of metrics.
- Separate route calculations are made for Level 1 and Level 2 routes in Level 1-2 routers.
- Best paths are placed in the OSI forwarding database (CLNS routing table).



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## Building an IP Routing Table



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- Partial Route Calculation (PRC) is run to calculate reachability.
  - Since IP and ES are represented as leaf objects, they do not participate in SPF.
- Best paths are placed in the IP routing table following IP preferential rules.
  - They appear as Level 1 or Level 2 IP routes.



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# Integrated IS-IS Configuration Steps



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Define areas, prepare addressing plan (NETs) for routers, and determine interfaces.

1. Enable IS-IS on the router.
2. Configure the NET.
3. Enable Integrated IS-IS on the appropriate interfaces. Do not forget interfaces to stub IP networks, such as loopback interfaces (although there are no CLNS neighbors there).

These are each explained in the next few slides.



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# Integrated IS-IS Routing Three Basic Commands



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Command	Description
<b>router isis</b> [ <i>area-tag</i> ]	Enables IS-IS as an IP routing protocol and assigns a tag to the process (optional). Given in the global configuration mode.
<b>net network-</b> <b>entity-title</b>	Identifies the router for IS-IS by assigning a NET to the router. Given in the router configuration mode.
<b>ip router isis</b> [ <i>area-tag</i> ]	Enables IS-IS on the interfaces that run IS-IS. (This approach is slightly different from most other IP routing protocols, where the interfaces are defined by network statements; there is no network statement under the IS-IS process.) Given in interface configuration mode.



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## Step 1: Enable IS-IS on the Router



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```
router(config)#
```

```
router isis [area-tag]
```

- Enable the IS-IS routing protocol.
  - *area-tag* – name for a process
- When routing of CLNS packets is also needed, use the **clns routing** command.



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## Step 2: Configure the NET



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```
Router(config-router)#
```

```
net network-entity-title
```

- Configure an IS-IS NET address for the routing process.



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## Step 3: Enable Integrated IS-IS



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```
router(config-if)#
```

```
ip router isis [area-tag]
```

- Includes an interface in an IS-IS routing process



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## Simple Integrated IS-IS Example



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The configured router acts as an IP-only Level 1-2 router.

```
interface FastEthernet0/0
ip address 10.1.1.2 255.255.255.0
ip router isis
!
interface Serial 0/0/1
ip address 10.2.2.2 255.255.255.0
ip router isis
!
<output omitted>

router isis
net 49.0001.0000.0000.0002.00
```



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## Change IS-IS Router Level



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```
Router(config-router)#
```

```
isis-type {level-1 | level-1-2 | level-2-only}
```

- Configure the IS-IS level globally on a router; the default is level 1-2.



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## Change IS-IS Interface Level



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```
Router(config-if)#
```

```
isis circuit-type {level-1 | level-1-2 | level-2-only}
```

- Configure the type of adjacency on an interface; the default is Level 1-2.



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# Change IS-IS Metric



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Router(config-if)#

```
isis metric metric [delay-metric [expense-metric [error-metric]]]
{level-1 | level-2}
```

- Configure the metric for an interface; the default is 10.
- Metric value is from 1 to 63.

Router(config-router)#

```
metric default-value {level-1 | level-2}
```

- Alternately, configure the metric globally for all interfaces.

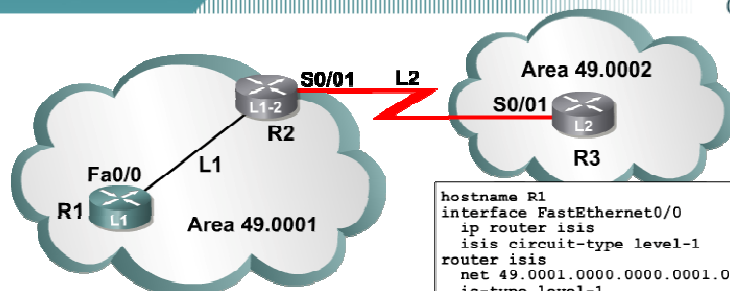


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# Example: Tuning IS-IS Configuration



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- Change router type on R1 and R3
- Change interface levels on R2
- Change metric on S0/0/1

```
hostname R1
interface FastEthernet0/0
ip router isis
isis circuit-type level-1
router isis
net 49.0001.0000.0000.0001.00
is-type level-1
```

```
hostname R2
interface FastEthernet0/0
ip router isis
isis circuit-type level-1
interface Serial0/0/1
ip router isis
isis circuit-type level-2-only
isis metric 35 level-2
router isis
net 49.0001.0000.0000.0002.00
```



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# IP Summarization



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```
Router(config-router)#
```

```
summary-address address mask [level-1 | level-2  
|level-1-2][tag tag-number] [metric metric-value]
```

- Creates summary
- Default is Level 2

Example:

```
P3R1(config-router)# summary-address 10.3.2.0 255.255.254.0  
level-1-2
```

- Summarizes 10.3.2.0/23 into Level 1-2



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# Example: Is Integrated IS-IS Running?



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```
R2#show ip protocols  
Routing Protocol is "isis"  
  Invalid after 0 seconds, hold down 0, flushed after 0  
  Outgoing update filter list for all interfaces is not set  
  Incoming update filter list for all interfaces is not set  
  Redistributing: isis  
  Address Summarization:  
    None  
  Maximum path: 4  
  Routing for Networks:  
    FastEthernet0/0  
    Loopback0  
    Serial0/0/1  
  Routing Information Sources:  
    Gateway         Distance      Last Update  
    10.10.10.10      115          00:00:02  
    10.30.30.30      115          00:00:03  
  Distance: (default is 115)
```

Displays the parameters and current state of the active routing protocol processes



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## Example: Are There Any IP Routes?



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```
router#
```

```
show ip route [address [mask]] | [protocol [process-id]]
```

```
R2#show ip route isis
```

```
10.0.0.0/24 is subnetted, 5 subnets  
i L2 10.30.30.0 [115/45] via 10.2.2.3, Serial0/0/1  
i L1 10.10.10.0 [115/20] via 10.1.1.1, FastEthernet0/0  
R2#
```

- Displays the current state of the routing table



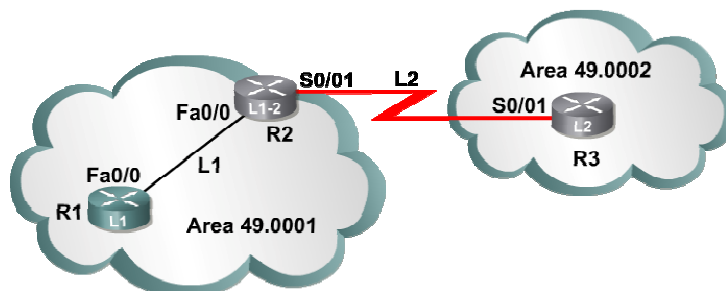
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## Example: OSI Intra-Area and Interarea Routing



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Routing in a Two-Level Area Structure



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# Are Adjacencies Established?



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```
R2# show clns neighbors
System Id      Interface  SNPA          State Holdtime  Type Protocol
R3             Se0/0/1   *HDLC*        Up    28        L2  IS-IS
R1             Fa0/0     0016.4610.fdb0 Up    23        L1  IS-IS
```

```
R2#show clns interface s0/0/1
Serial0/0/1 is up, line protocol is up
Checksums enabled, MTU 1500, Encapsulation HDLC
ERPDU enabled, min. interval 10 msec.
CLNS fast switching enabled
CLNS SSE switching disabled
DEC compatibility mode OFF for this interface
Next ESH/ISH in 45 seconds
Routing Protocol: IS-IS
Circuit Type: level-2
Interface number 0x1, local circuit ID 0x100
Neighbor System-ID: R3
Level-2 Metric: 35, Priority: 64, Circuit ID: R2.00
Level-2 IPv6 Metric: 10
Number of active level-2 adjacencies: 1
Next IS-IS Hello in 5 seconds
if state UP
```



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