

CCIE Service Provider Workbook

Authored By:

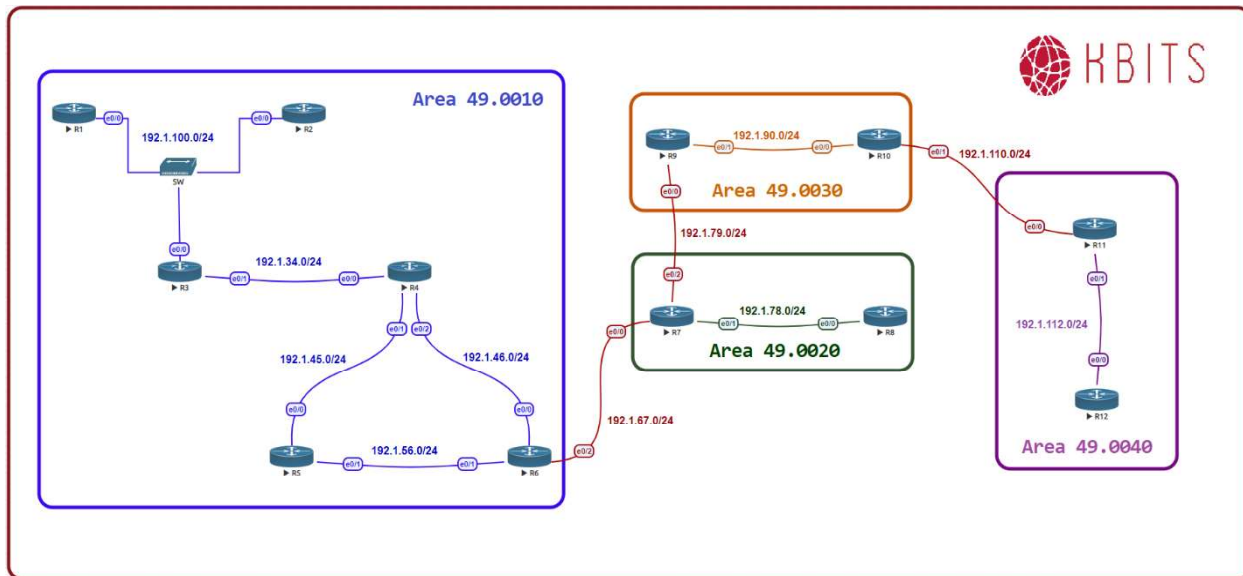
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Configuring IS-IS



Lab 1 – Basic IS-IS Configuration with Areas



Interface IP Address Configuration

R1

Interface	IP Address	Subnet Mask
Loopback 0	1.1.1.1	255.0.0.0
Loopback 1	201.1.4.1	255.255.255.0
Loopback 2	201.1.5.1	255.255.255.0
Loopback 3	201.1.6.1	255.255.255.0
Loopback 4	201.1.7.1	255.255.255.0
E 0/0	192.1.100.1	255.255.255.0

R2

Interface	IP Address	Subnet Mask
Loopback 0	2.2.2.2	255.0.0.0
E 0/0	192.1.100.2	255.255.255.0

R3

Interface	IP Address	Subnet Mask
Loopback 0	3.3.3.3	255.0.0.0
E 0/0	192.1.100.3	255.255.255.0

E 0/1	192.1.34.3	255.255.255.0
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R4

Interface	IP Address	Subnet Mask
Loopback 0	4.4.4.4	255.0.0.0
E 0/0	192.1.34.4	255.255.255.0
E 0/1	192.1.45.4	255.255.255.0
E 0/2	192.1.46.4	255.255.255.0

R5

Interface	IP Address	Subnet Mask
Loopback 0	5.5.5.5	255.0.0.0
E 0/0	192.1.45.5	255.255.255.0
E 0/1	192.1.56.5	255.255.255.0

R6

Interface	IP Address	Subnet Mask
Loopback 0	6.6.6.6	255.0.0.0
E 0/0	192.1.46.6	255.255.255.0
E 0/1	192.1.56.6	255.255.255.0
E 0/2	192.1.67.6	255.255.255.0

R7

Interface	IP Address	Subnet Mask
Loopback 0	7.7.7.7	255.0.0.0
E 0/0	192.1.67.7	255.255.255.0
E 0/1	192.1.78.7	255.255.255.0
E 0/2	192.1.79.7	255.255.255.0

R8

Interface	IP Address	Subnet Mask
Loopback 0	8.8.8.8	255.0.0.0
E 0/0	192.1.78.8	255.255.255.0

R9

Interface	IP Address	Subnet Mask
Loopback 0	9.9.9.9	255.0.0.0

E 0/0	192.1.79.9	255.255.255.0
E 0/1	192.1.90.9	255.255.255.0

R10

Interface	IP Address	Subnet Mask
Loopback 0	10.10.10.10	255.0.0.0
E 0/0	192.1.90.10	255.255.255.0
E 0/1	192.1.110.10	255.255.255.0

R11

Interface	IP Address	Subnet Mask
Loopback 0	11.11.11.11	255.0.0.0
E 0/0	192.1.110.11	255.255.255.0
E 0/1	192.1.112.11	255.255.255.0

R12

Interface	IP Address	Subnet Mask
Loopback 0	12.12.12.12	255.0.0.0
E 0/0	192.1.112.12	255.255.255.0

Task 1

Configure IS-IS on all 6 routers in Area **49.0010**. Use XXXX.XXX.XXXX as the System ID. Advertise all the Loopbacks in IS-IS. Make sure that the Routers only establish L1 Adjacencies with each other. Also, make sure that R6 is capable of Intra-area as well as Inter-area adjencies.

R1	R2
Router isis	Router isis
Net 49.0010.1111.1111.1111.00	Net 49.0010.2222.2222.2222.00
Is-type level-1	Is-type level-1
!	!
Int lo0	Int lo0
Ip router isis	Ip router isis
Int lo1	Int E 0/0
Ip router isis	Ip router isis
Int lo2	
Ip router isis	
Int lo3	
Ip router isis	

<pre> Int lo4 Ip router isis Int E 0/0 Ip router isis </pre>	
<p>R3</p> <pre> Router isis Net 49.0010.3333.3333.3333.00 Is-type level-1 ! Int lo0 Ip router isis Int E 0/0 Ip router isis Int E 0/1 Ip router isis </pre>	<p>R4</p> <pre> Router isis Net 49.0010.4444.4444.4444.00 Is-type level-1 ! Int lo0 Ip router isis Int E 0/0 Ip router isis Int E 0/1 Ip router isis Int E 0/2 Ip router isis </pre>
<p>R5</p> <pre> Router isis Net 49.0010.5555.5555.5555.00 Is-type level-1 ! Int lo0 Ip router isis Int E 0/0 Ip router isis Int E 0/1 Ip router isis </pre>	<p>R6</p> <pre> Router isis Net 49.0010.6666.6666.6666.00 ! Int lo0 Ip router isis Int E 0/0 Ip router isis Int E 0/1 Ip router isis </pre>

Task 2

Configure IS-IS on the 2 routers in Area **49.0020**. Use XXXX.XXX.XXXX as the System ID. Advertise all the Loopbacks in IS-IS. Make sure that the Routers only establish L1 Adjacencies with each other. Also, make sure that R7 is capable of Intra-area as well as Inter-area adjacencies.

<p>R7</p> <pre> Router isis Net 49.0020.7777.7777.7777.00 ! Int lo0 Ip router isis </pre>	<p>R8</p> <pre> Router isis Net 49.0020.8888.8888.8888.00 Is-type level-1 ! Int lo0 </pre>
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Int E 0/1 Ip router isis	Ip router isis Int E 0/0 Ip router isis
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Task 3

Configure IS-IS on the 2 routers in Area **49.0030**. Advertise all the Loopbacks in IS-IS. Make sure that the Routers only establish L1 Adjacencies with each other. Also, make sure that R11 is capable of Intra-area as well as Inter-area adjacencies. Configure the System ID's based on the following:

R11 – 0011.0011.0011

R12 – 0012.0012.0012

R11	R12
Router isis Net 49.0040.0011.0011.0011.00 ! Int lo0 Ip router isis Int E 0/1 Ip router isis	Router isis Net 49.0040.0012.0012.0012.00 Is-type level-1 ! Int lo0 Ip router isis Int E 0/0 Ip router isis

Task 4

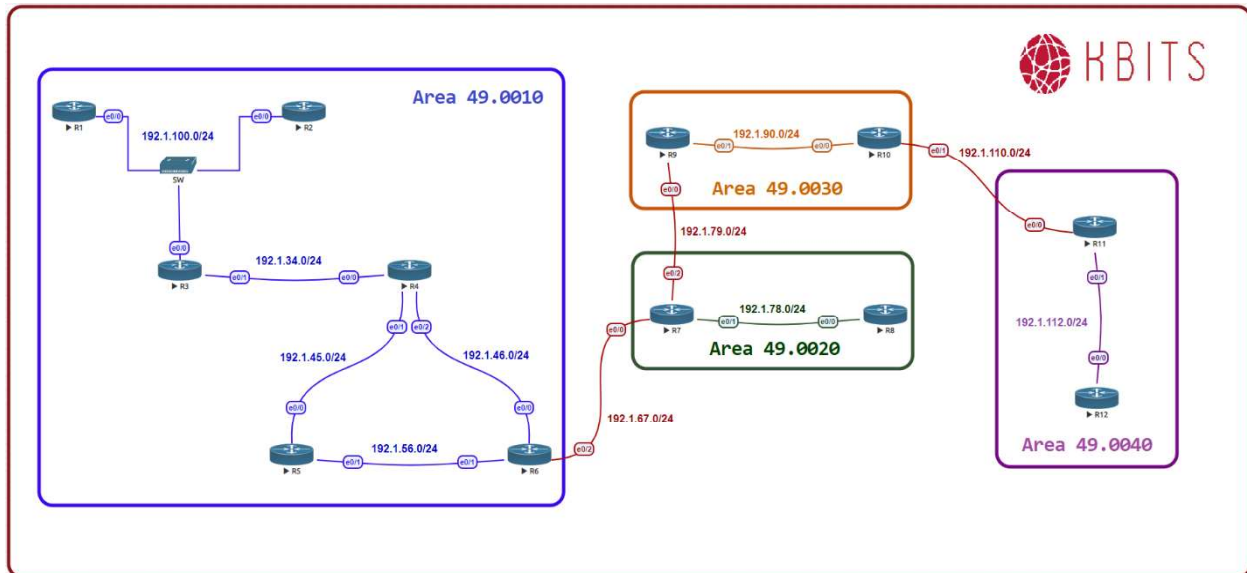
Configure IS-IS on the 2 routers in Area **49.0030**. Advertise all the Loopbacks in IS-IS. Make sure that the Routers only establish L2 Adjacencies with each other. Configure the System ID's based on the following:

R9 – 9999.9999.9999

R10 – 1010.1010.1010

R9	R10
Router isis Net 49.0030.9999.9999.9999.00 Is-type level-2 ! Int lo0 Ip router isis Int E 0/1 Ip router isis	Router isis Net 49.0030.1010.1010.1010.00 Is-type level-2 ! Int lo0 Ip router isis Int E 0/0 Ip router isis

Lab 2 - Optimizing IS-IS



Task 1

Make sure the R1 and R3 are the DIS for their respective Multi-Access Segments.

<p>R1</p> <p>Interface E 0/0 Isis priority 100</p>	<p>R3</p> <p>Interface F 0/0 Isis priority 100</p>
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Task 2

Configure the Hello between R3 and R4 to be 5 seconds with a dead timer of 15 seconds.

<p>R3</p> <p>Interface E 0/1 Isis hello-interval 5 isis hello-multiplier 3</p>	<p>R4</p> <p>Interface E 0/0 Isis hello-interval 5 isis hello-multiplier 3</p>
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Task 3

Configure all the Routers such that MPLS-TE is supported on them.

<p>R1</p> <p>Router isis</p>	<p>R2</p> <p>Router isis</p>
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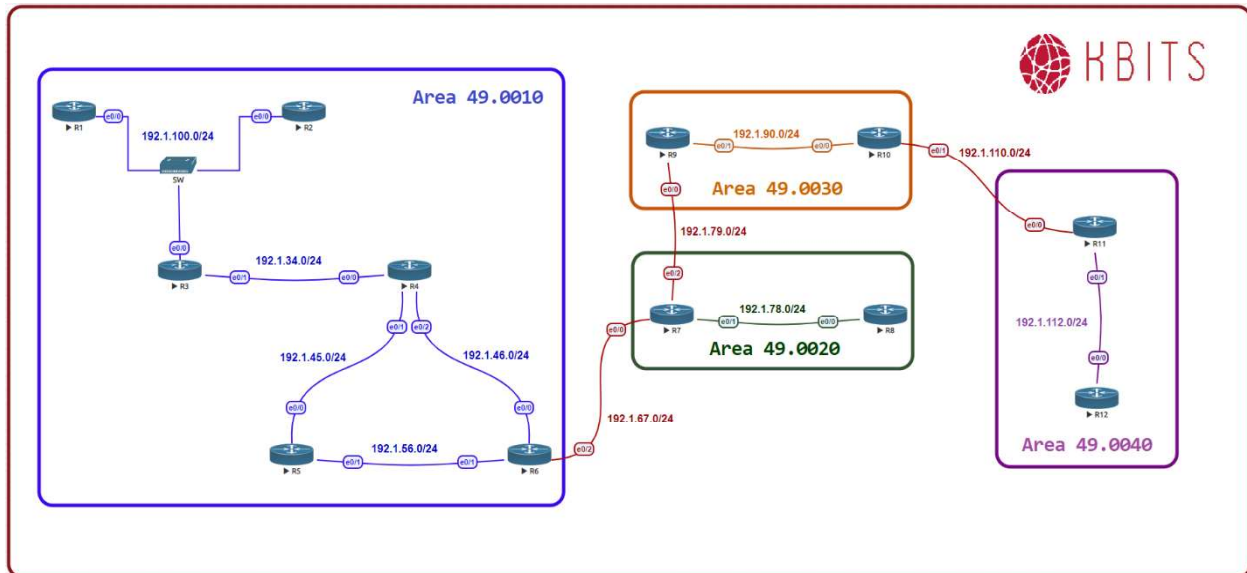
Metric-style wide	Metric-style wide
R3 Router isis Metric-style wide	R4 Router isis Metric-style wide
R5 Router isis Metric-style wide	R6 Router isis Metric-style wide
R7 Router isis Metric-style wide	R8 Router isis Metric-style wide
R9 Router isis Metric-style wide	R10 Router isis Metric-style wide
R11 Router isis Metric-style wide	R12 Router isis Metric-style wide

Task 4

Configure the link between R5 & R6 to be a low priority link. It should only be used in case R5 & R6 have lost their respective links towards R4.

R5 Interface E 0/1 Isis metric 50	R6 Interface E 0/1 Isis metric 50
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Lab 3 – IS-IS Authentication



Task 1

Configure MD5 authentication for the Link between R3 & R4. Use ccie as the key-string with a key-id of 1.

R3

```
Key chain AUTH
Key 1
Key-string ccie
!
Interface E 0/1
Isis authentication key-chain AUTH
Isis authentication mode MD5
```

R4

```
Key chain AUTH
Key 1
Key-string ccie
!
Interface E 0/0
Isis authentication key-chain AUTH
Isis authentication mode MD5
```

Task 2

Configure Text authentication for the Link between R5 & R6. Use ccie as the key-string with a key-id of 1.

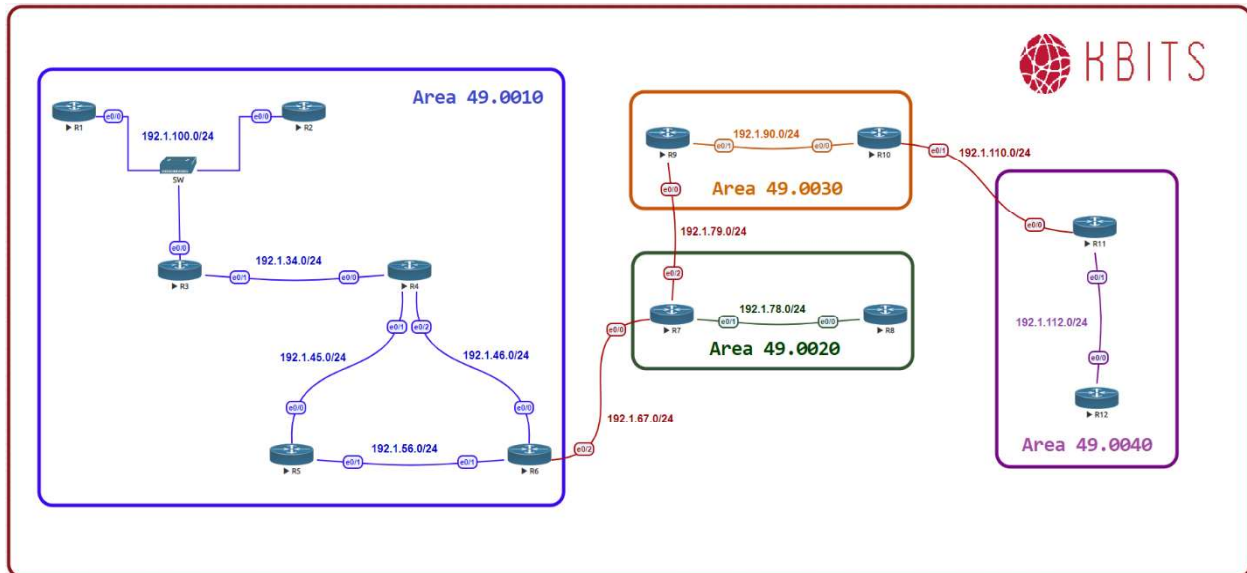
R5

```
Key chain AUTH
Key 1
  Key-string ccie
!
Interface E 0/1
  Isis authentication key-chain AUTH
  Isis authentication mode text
```

R6

```
Key chain AUTH
Key 1
  Key-string ccie
!
Interface E 0/1
  Isis authentication key-chain AUTH
  Isis authentication mode text
```

Lab 4 – Configure Inter-area Interfaces



Task 1

Configure IS-IS between R6 & R7 to connect Area 49.0010 to Area 49.0020.

R6

Interface E 0/2
Ip router isis

R7

Interface E 0/0
Ip router isis

Task 2

Configure IS-IS between R7 & R9 to connect Area 49.0020 to Area 49.0030.

R7

Interface E 0/2
Ip router isis

R9

Interface E 0/0
Ip router isis

Task 3

Configure IS-IS between R10 & R11 to connect Area 49.0030 to Area 49.0040.

R10

```
Interface E 0/1  
Ip router isis
```

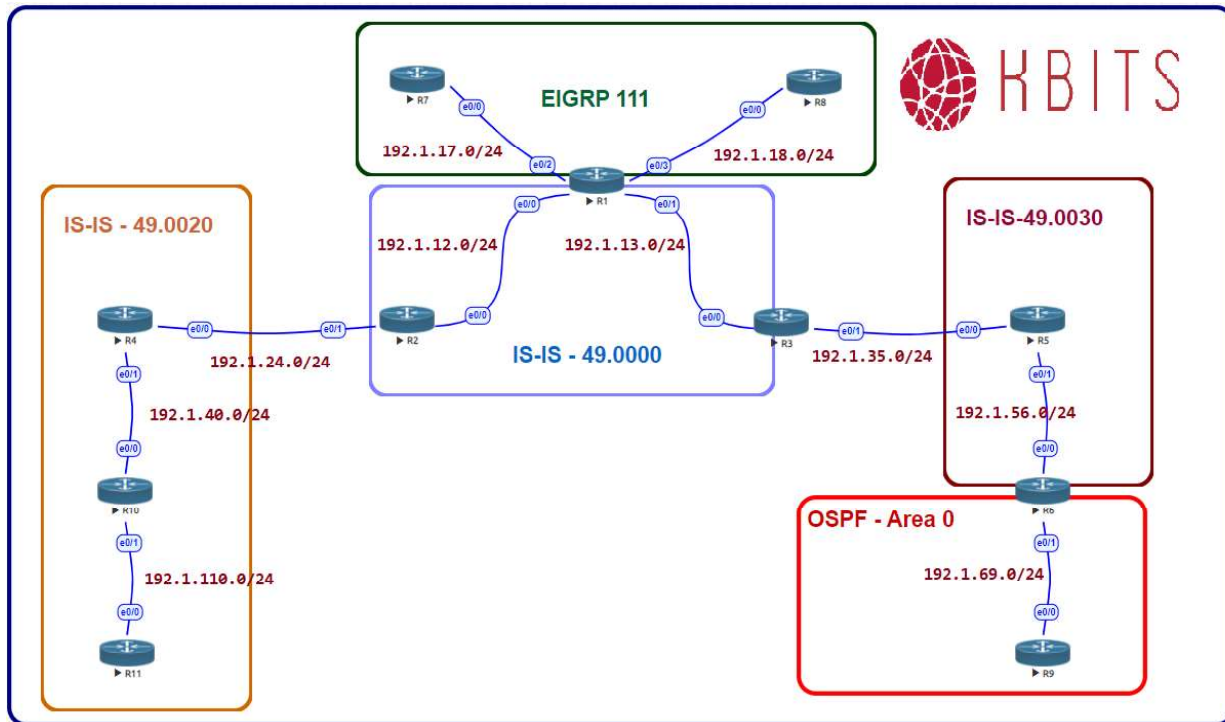
R11

```
Interface E 0/0  
Ip router isis
```

Task 4

Verify connectivity from R1 to R12 using Ping. What type of routes do you have in the routing tables? Do you have full connectivity?

Lab 5 -IS-IS Multi-Area / Multi-Domain Configuration



Interface IP Address Configuration

R1

Interface	IP Address	Subnet Mask
Loopback 0	1.1.1.1	255.0.0.0
Loopback 1	11.11.11.11	255.0.0.0
E 0/0	192.1.12.1	255.255.255.0
E 0/1	192.1.13.1	255.255.255.0
E 0/2	192.1.17.1	255.255.255.0
E 0/3	192.1.18.1	255.255.255.0

R2

Interface	IP Address	Subnet Mask
Loopback 0	2.2.2.2	255.0.0.0
E 0/0	192.1.12.2	255.255.255.0

E 0/1	192.1.24.2	255.255.255.0
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R3

Interface	IP Address	Subnet Mask
Loopback 0	3.3.3.3	255.0.0.0
E 0/0	192.1.13.3	255.255.255.0
E 0/1	192.1.35.3	255.255.255.0

R4

Interface	IP Address	Subnet Mask
Loopback 0	4.4.4.4	255.0.0.0
E 0/0	192.1.24.4	255.255.255.0
E 0/1	192.1.40.4	255.255.255.0

R5

Interface	IP Address	Subnet Mask
Loopback 0	5.5.5.5	255.0.0.0
E 0/0	192.1.35.5	255.255.255.0
E 0/1	192.1.56.5	255.255.255.0

R6

Interface	IP Address	Subnet Mask
Loopback 0	6.6.6.6	255.0.0.0
Loopback 1	66.66.66.66	255.0.0.0
E 0/0	192.1.56.6	255.255.255.0
E 0/1	192.1.69.6	255.255.255.0

R7

Interface	IP Address	Subnet Mask
Loopback 0	7.7.7.7	255.0.0.0
Loopback 1	107.7.72.1	255.255.255.0
Loopback 2	107.7.73.1	255.255.255.0
Loopback 3	107.7.74.1	255.255.255.0
Loopback 4	107.7.75.1	255.255.255.0
E 0/0	192.1.17.7	255.255.255.0

R8

Interface	IP Address	Subnet Mask
Loopback 0	8.8.8.8	255.0.0.0
E 0/0	192.1.18.8	255.255.255.0

R9

Interface	IP Address	Subnet Mask
Loopback 0	9.9.9.9	255.0.0.0
E 0/0	192.1.69.9	255.255.255.0

R10

Interface	IP Address	Subnet Mask
Loopback 0	10.10.10.10	255.0.0.0
E 0/0	192.1.40.10	255.255.255.0
E 0/1	192.1.110.10	255.255.255.0

R11

Interface	IP Address	Subnet Mask
Loopback 0	111.111.100.11	255.255.255.0
Loopback 1	111.111.101.11	255.255.255.0
Loopback 2	111.111.102.11	255.255.255.0
Loopback 3	111.111.103.11	255.255.255.0
E 0/0	192.1.110.11	255.255.255.0

Task 1

Configure IS-IS in Area 49.0000 on R1, R2 & R3. Besides the physical links, enable IS-IS on the Loopback 0 interfaces of all 3 routers. Configure the routers as Level-2 routers. Configure the System-IDs based on the following:

R1 - 1111.1111.1111

R2 - 2222.2222.2222

R3 - 3333.3333.3333

R1	R2
Router isis Net 49.0000.1111.1111.1111.00 Is-type level-2 ! Interface loopback0	Router isis Net 49.0000.2222.2222.2222.00 Is-type level-2 ! Interface loopback0

<pre> Ip router isis ! Interface E 0/0 Ip router isis ! Interface E 0/1 Ip router isis </pre>	<pre> Ip router isis ! Interface E 0/0 Ip router isis ! Interface E 0/1 Ip router isis </pre>
<p>R3</p> <pre> Router isis Net 49.0000.3333.3333.3333.00 Is-type level-2 ! Interface loopback0 Ip router isis ! Interface E 0/0 Ip router isis ! Interface E 0/1 Ip router isis </pre>	

Task 2

Configure IS-IS in Area 49.0010 on R4, R10 & R11. Besides the physical links, enable IS-IS on Loopback 0 interfaces of R4 & R10. Configure all the interfaces on R11 for IS-IS. Configure R10 & R11 routers as Level-1 routers. Configure R4 to such that it can establish either a Level-1 or Level-2 neighbor relationships. Configure the System-IDs based on the following:

- R4 – 4444.4444.4444
- R10 – 1010.1010.1010
- R11 – 0011.0011.0011

<p>R4</p> <pre> Router isis Net 49.0010.4444.4444.4444.00 ! Interface loopback0 Ip router isis ! Interface E 0/0 Ip router isis ! Interface E 0/1 </pre>	<p>R10</p> <pre> Router isis Net 49.0010.1010.1010.1010.00 Is-type level-1 ! Interface loopback0 Ip router isis ! Interface E 0/0 Ip router isis ! </pre>
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Ip router isis	Interface E 0/1 Ip router isis
R11 Router isis Net 49.0010. 0011.0011.0011.00 Is-type level-1 ! Interface loopback0 Ip router isis ! Interface loopback1 Ip router isis ! Interface loopback2 Ip router isis ! Interface loopback3 Ip router isis ! Interface E 0/0 Ip router isis	

Task 3

Configure IS-IS in Area 49.0020 on R5 & R6. Besides the physical links, enable IS-IS on Loopback 0 interfaces of R5 & R6. Configure R5 & R6 routers as Level-2 routers. Configure the System-IDs based on the following:

R5 – 5555.5555.5555

R6 – 6666.6666.6666

R5 Router isis Net 49.0020.5555.5555.5555.00 Is-type level-2 ! Interface loopback0 Ip router isis ! Interface E 0/0 Ip router isis ! Interface E 0/1 Ip router isis	R6 Router isis Net 49.0020.6666.6666.6666.00 Is-type level-2 ! Interface loopback0 Ip router isis ! Interface E 0/0 Ip router isis
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Task 4

Configure EIGRP in AS 111 between R1, R7 & R8. Enable all loopbacks on R7 & R8 in EIGRP 111. Enable Loopback 1 on R1 in EIGRP 111.

R1 Router EIGRP 111 Network 192.1.17.0 Network 192.1.18.0 Network 11.0.0.0	R7 Router EIGRP 111 Network 192.1.17.0 Network 7.0.0.0 Network 107.0.0.0
R8 Router EIGRP 111 Network 192.1.18.0 Network 8.0.0.0	

Task 5

Configure OSPF in Area 0 between R6 & R9. Enable all loopbacks on R9 in OSPF. Enable Loopback 1 on R6 in OSPF.

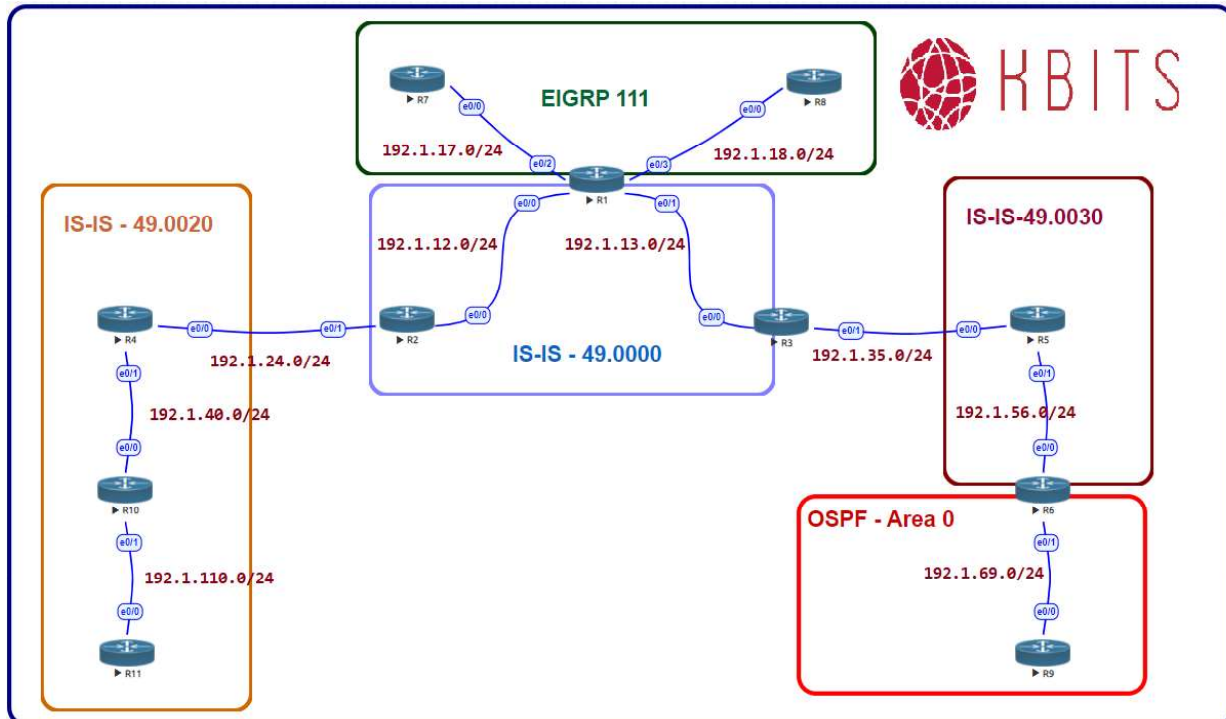
R6 Router ospf 1 Network 192.1.69.0 0.0.0.255 area 0 Network 66.0.0.0 0.255.255.255 area 0	R9 Router ospf 1 Network 192.1.69.0 0.0.0.255 area 0 Network 9.0.0.0 0.255.255.255 area 0
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Task 6

Configure Mutual Redistribution between the appropriate routers to allow end-to-end connectivity between all routing domains. Use Seed metric of your choice.

R1 Router isis Redistribute eigrp 111 ! Router eigrp 111 Redistribute isis metric 10 10 10 10 10	R6 Router isis Redistribute ospf 1 ! Router ospf 1 Redistribute isis subnets
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Lab 6 – Configuring Route Leaking



Task 1

Configure Area's 49.0010 & 49.0020 to receive all routes from all areas.

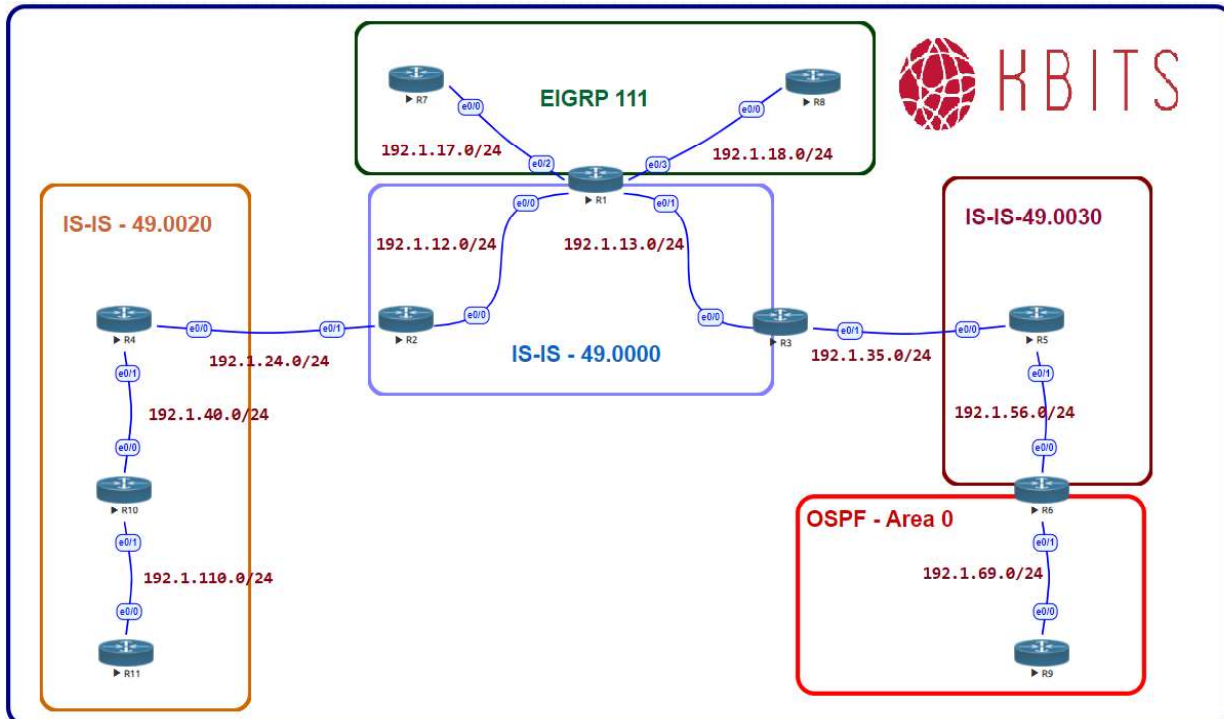
R3

```
Access-list 101 permit ip any any
!  
router isis  
redistribute isis ip level-2 into level-1 distribute-list 101
```

R4

```
Access-list 101 permit ip any any
!  
router isis  
redistribute isis ip level-2 into level-1 distribute-list 101
```

Lab 7 – Route Summarization



Task 1

Configure Area 49.0010 such that all the 111.0.0.0/8 routes are summarized out of the area.

R4

```
router isis
summary-address 111.111.100.0 255.255.252.0
```

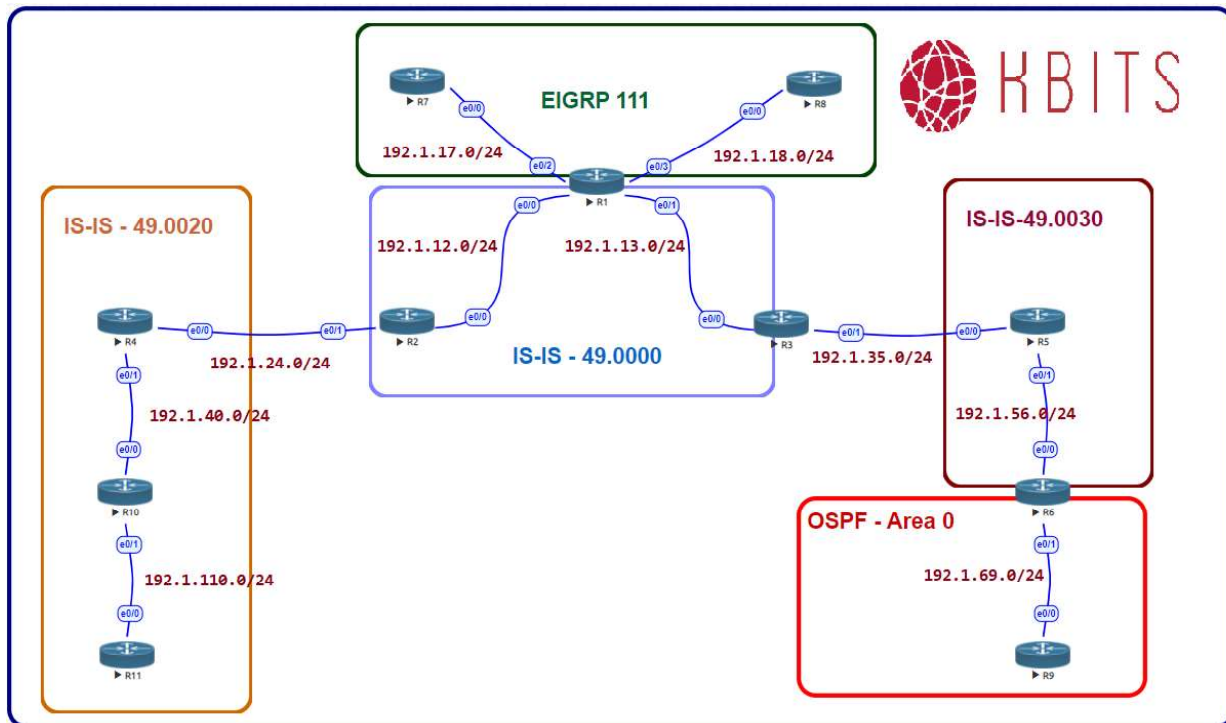
Task 2

Configure R1 such that all the 107.0.0.0/8 routes are summarized in IS-IS.

R1

```
router isis
summary-address 107.7.72 255.255.252.0
```

Lab 8 - Configuring BFD for IS-IS



Task 1

Configure BFD between all routers in area 49.0000. Configure the BFD Interface interval to be 300 for sending and receiving. A neighbor should be deemed dead is the router misses 3 hellos.

R1 Interface E 0/0 bfd interval 300 min_rx 300 multiplier 3 ! Interface E 0/1 bfd interval 300 min_rx 300 multiplier 3 ! Router isis bfd all-interfaces	R2 Interface E 0/0 bfd interval 300 min_rx 300 multiplier 3 ! Router isis bfd all-interfaces
R3 Interface E 0/0 bfd interval 300 min_rx 300 multiplier 3 ! Router isis bfd all-interfaces bfd all-interfaces	