OSPF Metric Calculation

- As OSPF is a Link State routing protocol, the router will learn about all destinations in its area, the links and their cost

- The router will select routes based on its lowest cost to get to the destination

OSPF Link States

- An OSPF router knows about all links in its OSPF area, and each link's cost

- In a multiple area OSPF network, ABRs know the information for each area they are connected to

- When multiple areas are in use, each router has individual routes for each IP subnet in its own area, and summary routes to other areas which go via an ABR
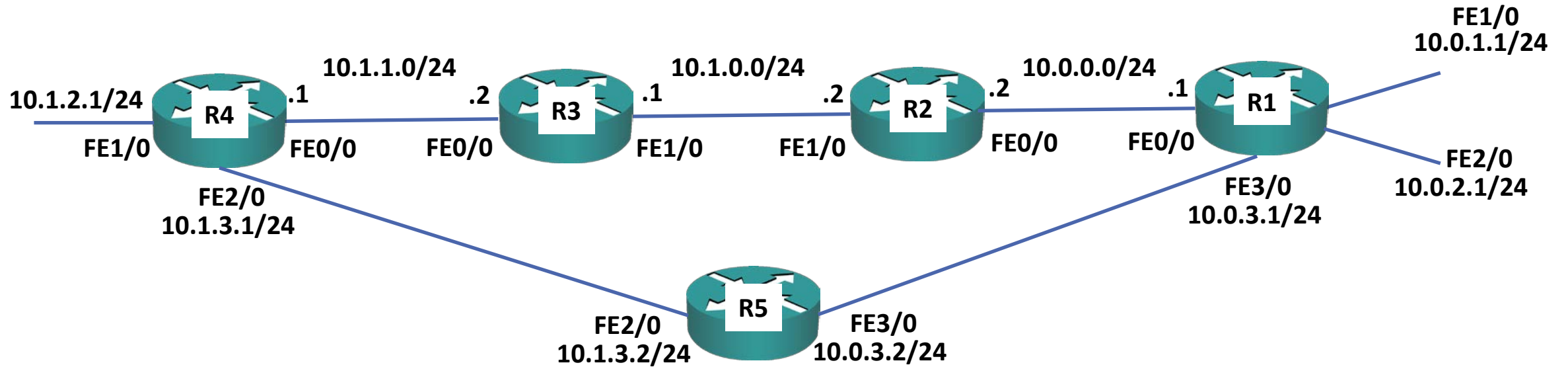
OSPF Metric Calculation

- For destinations in its own area, a router looks at all available links to get there, and chooses the path with the lowest overall cost

- For destinations in another area, a router looks at all available links to get to the ABR and chooses the path with the lowest overall cost to the ABR. It's then up to the ABR to choose the best path onwards from there
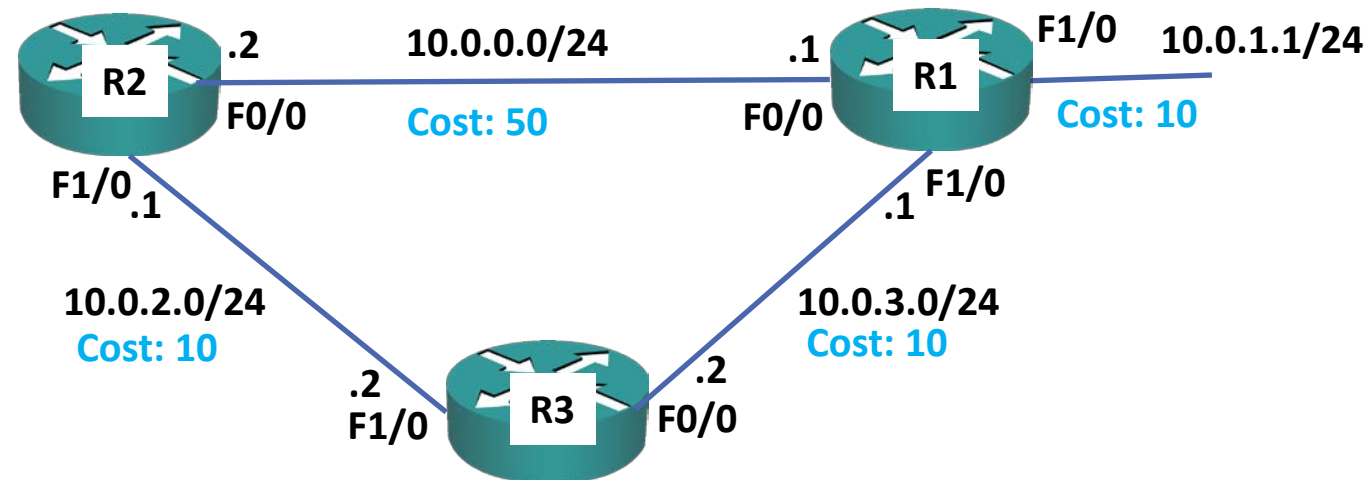
SPF Shortest Path First Algorithm

- The SPF Shortest Path First algorithm calculates the overall cost for each available path to each destination network, and then selects the lowest cost path

- The overall cost = cumulative cost of all outgoing interfaces

- You should ensure the cost is set the same on the interfaces on both sides of a link or you can get asymmetric routing

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Outgoing Interfaces

10.1.2.1/24

10.1.1.0/24

R4

.1

FE1/0

FE0/0

FE2/0
10.1.3.1/24

.2

FE0/0

R3

10.1.0.0/24

.1

FE1/0

.2

FE1/0

R2

10.0.0.0/24

.2

FE0/0

.1

FE0/0

R1

FE1/0
10.0.1.1/24

FE2/0
10.0.2.1/24

FE3/0
10.0.3.1/24

FE2/0
10.1.3.2/24

R5

FE3/0
10.0.3.2/24

OSPF Metric Calculation

- In this example R2 will choose the path via R3 to get to the 10.0.1.0/24 network as it is lower cost

R2   .2   10.0.0.0/24   .1   R1   F1/0   10.0.1.1/24

F0/0   Cost: 50   F0/0   Cost: 10

F1/0 .1

10.0.2.0/24
Cost: 10

.2
F1/0   R3   F0/0

.1 F1/0

10.0.3.0/24
Cost: 10

.2

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Reference Bandwidth

- The cost is automatically derived from the interface bandwidth
- Cost = Reference Bandwidth / Interface Bandwidth
- The default reference bandwidth is 100 Mbps
- FastEthernet link cost defaults to 1 (100 / 100)
- T1 link cost defaults to 64 (100 / 1.544)

Reference Bandwidth

- OSPF treats all interfaces of 100 Mbps or faster as equal
- FastEthernet, Gigabit Ethernet, 10 Gigabit Ethernet etc. all default to a cost of 1
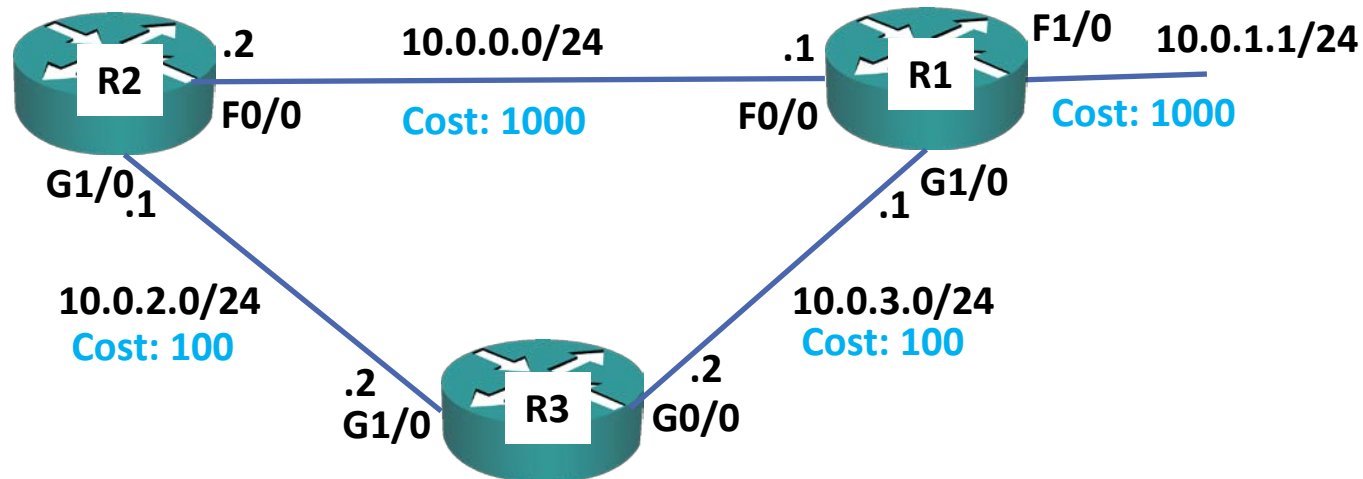- This can cause undesirable routing in modern networks
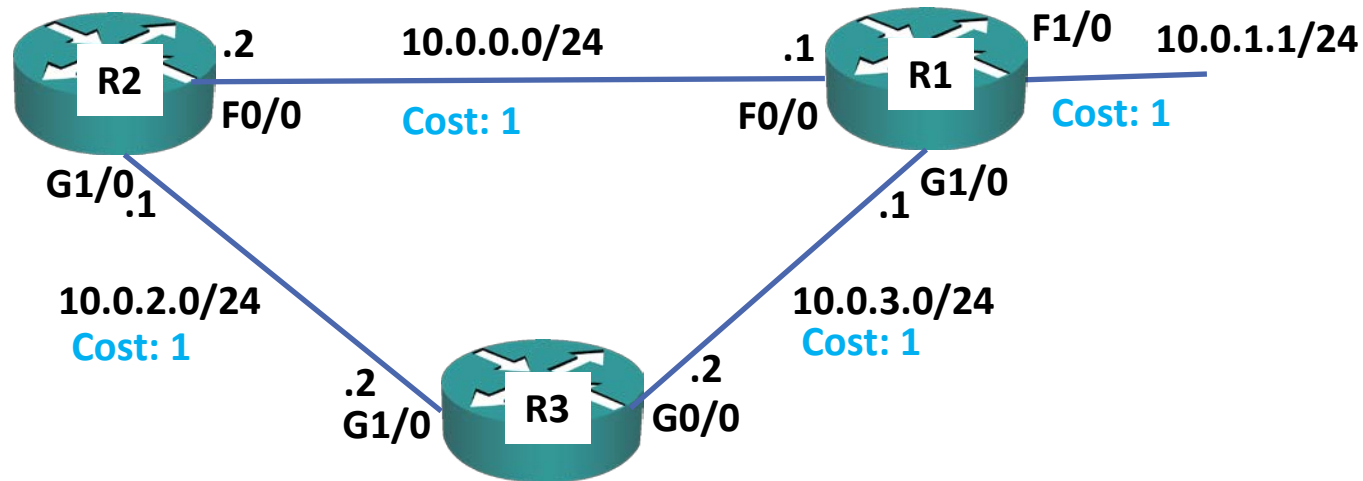
Reference Bandwidth

```
R1(config)#router ospf 1
R1(config-router)#auto-cost reference-bandwidth 100000
```

- The reference bandwidth should be changed on all routers

Manipulating the OSPF Metric

- OSPF takes the bandwidth of an interface into account when calculating the metric, so paths along higher bandwidth links will be preferred

- The most desirable path will typically be automatically selected

Manipulating the OSPF Metric (Cont.)

- If you want to use a different path, you can manipulate this by manually changing the bandwidth or OSPF cost on interfaces

- It is recommended to use cost because the bandwidth setting can affect many features other than OSPF (such as QoS)

OSPF Metric - Bandwidth

R1#show interface serial1/0
Serial1/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, **BW 1544 Kbit/sec**, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
!
R1(config)#interface serial1/0
R1(config-if)#bandwidth 768
!
R1#show interface serial1/0
Serial1/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, **BW 768 Kbit/sec**, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255

OSPF Metric - Cost

- A manually configured OSPF cost overrides the value automatically derived from the bandwidth

```
R1(config)#interface FastEthernet 0/0
R1(config-if)#ip ospf cost 50
```

OSPF Metric - Cost

R1#show ip ospf interface FastEthernet 0/0
FastEthernet0/0 is up, line protocol is up
  Internet Address 10.0.0.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 192.168.0.1, Network Type BROADCAST, Cost: 1

Topology-MTID	Cost	Disabled	Shutdown	Topology Name
0	**50**	no	no	Base

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:02
Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.1.0.2 (Designated Router)
    ! truncated

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FE1/0
10.0.1.1/24

10.1.1.0/24

10.1.0.0/24

10.0.0.0/24

10.1.2.1/24

R4 .1 .2 **R3** .1 .2 **R2** .2 .1 **R1**

FE1/0
FE0/0 FE0/0 FE1/0 FE1/0 FE0/0 FE0/0

FE2/0
10.1.3.1/24

FE2/0
10.0.2.1/24

FE3/0
10.0.3.1/24

R5

FE2/0 FE3/0
10.1.3.2/24 10.0.3.2/24

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