

Protocol Deep Dive: OSPF

COVERING OSPF BASICS



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Course Overview



Course Overview



Covering OSPF Basics



Course Overview



Covering OSPF Basics

Forming Basic OSPF Relationships



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Covering OSPF Basics

Forming Basic OSPF Relationships

Discussing Simple OSPF Communication Blocks



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Discussing Simple OSPF Communication Blocks

Introducing Multi-area OSPF



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Forming Basic OSPF Relationships

Discussing Simple OSPF Communication Blocks

Introducing Multi-area OSPF

Troubleshooting Common OSPF Issues



Module Overview



Module Overview



OSPF vs. Other Routing Protocols



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OSPF vs. Other Routing Protocols

Reviewing the OSPF Metric



Module Overview



OSPF vs. Other Routing Protocols

Reviewing the OSPF Metric

Selecting the Best Route Entry



Let's review the basics



OSPF Basics

Interior gateway protocol (IGP)



OSPF Basics

Controls traffic inside a single organization



OSPF Basics

Other IGP's Include:

EIGRP



OSPF Basics

Other IGP's Include:

IS-IS



Exterior Gateway Protocols



Alternative of IGPs



Exterior Gateway Protocols



Alternative of IGPs



Control traffic
between organizations



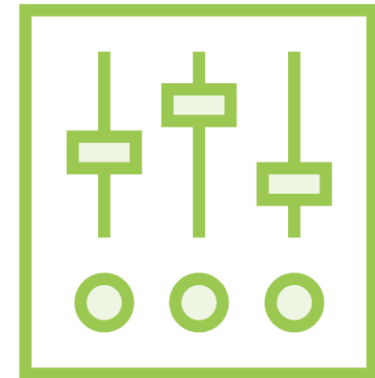
Exterior Gateway Protocols



Alternative of IGPs



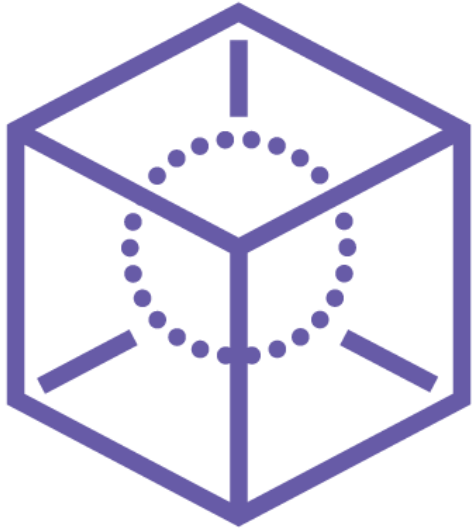
Control traffic
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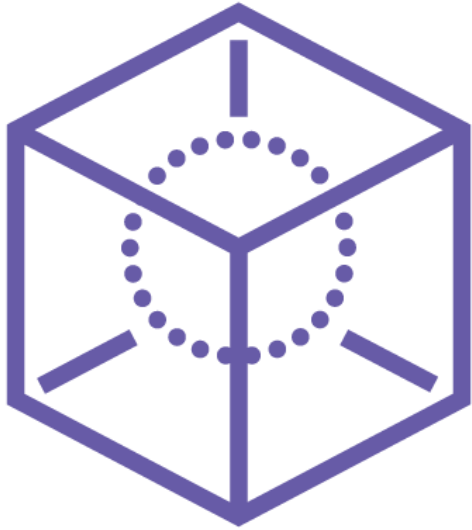
BGP the only current
option



Interior Gateway Protocols



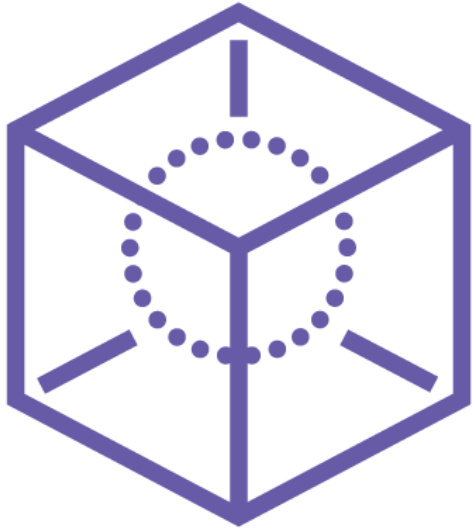
Interior Gateway Protocols



Two types including:



Interior Gateway Protocols

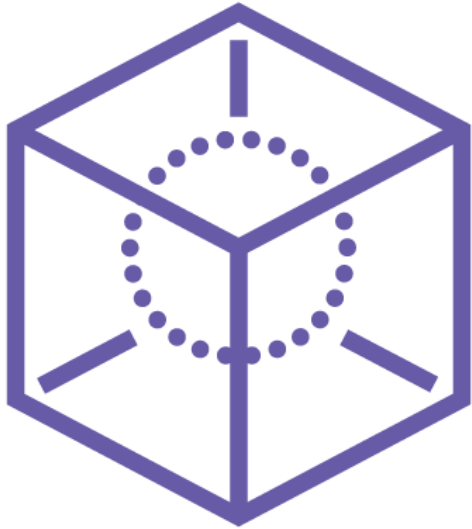


Two types including:

- Distance vector



Interior Gateway Protocols

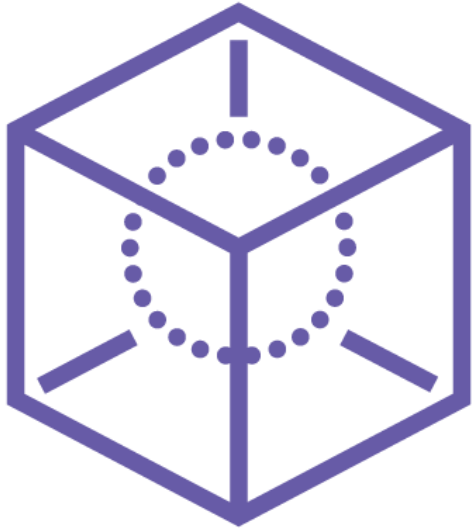


Two types including:

- Distance vector
- Link state



Interior Gateway Protocols



Two types including:

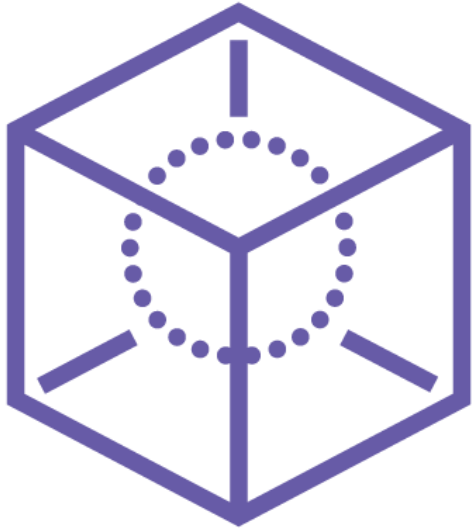
- Distance vector
- Link state

Distance vector:

Exchange distance (metric) and vector (direction)



Interior Gateway Protocols



Two types including:

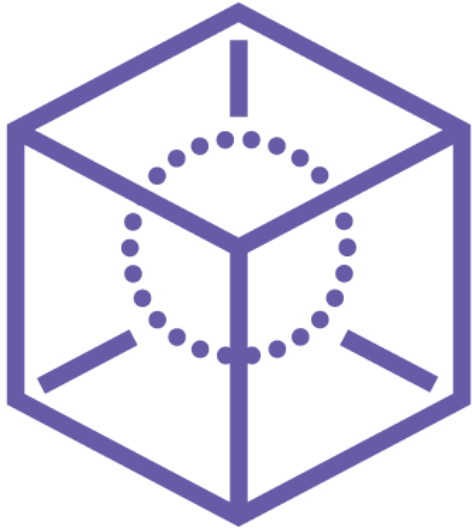
- Distance vector
- Link state

Distance vector:

Exchange distance (metric) and vector (direction)
Devices route based on this information



Interior Gateway Protocols



Two types including:

- Distance vector
- Link state

Distance vector:

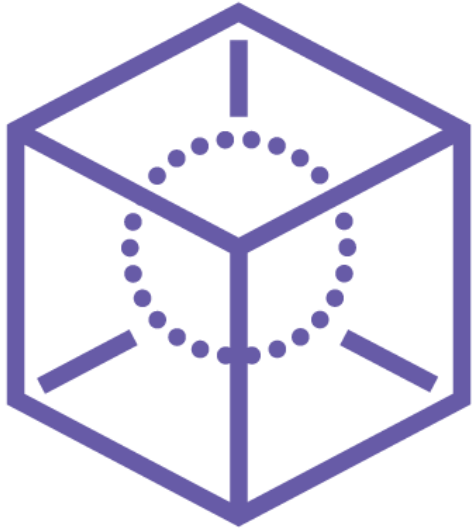
Exchange distance (metric) and vector (direction)

Devices route based on this information

Based on currently reachable destinations from neighbors



Interior Gateway Protocols



Two types including:

- Distance vector
- Link state

Distance vector:

Exchange distance (metric) and vector (direction)

Devices route based on this information

Based on currently reachable destinations from neighbors

Devices have limited view



Link State Protocols



Link State Protocols

Exchange state of all network links



Link State Protocols

Exchange state of all network links

Each device includes complete copy of link states



Link State

Updates are
appended to link
state database
(LSDB)



Link State

**Each device will
have same LSDB**



Link State

**Have better view
of network**



Link State

More complex
than distance
vector



Link State

OSPF is an
example



OSPF



Uses link state advertisements
(LSA)



OSPF



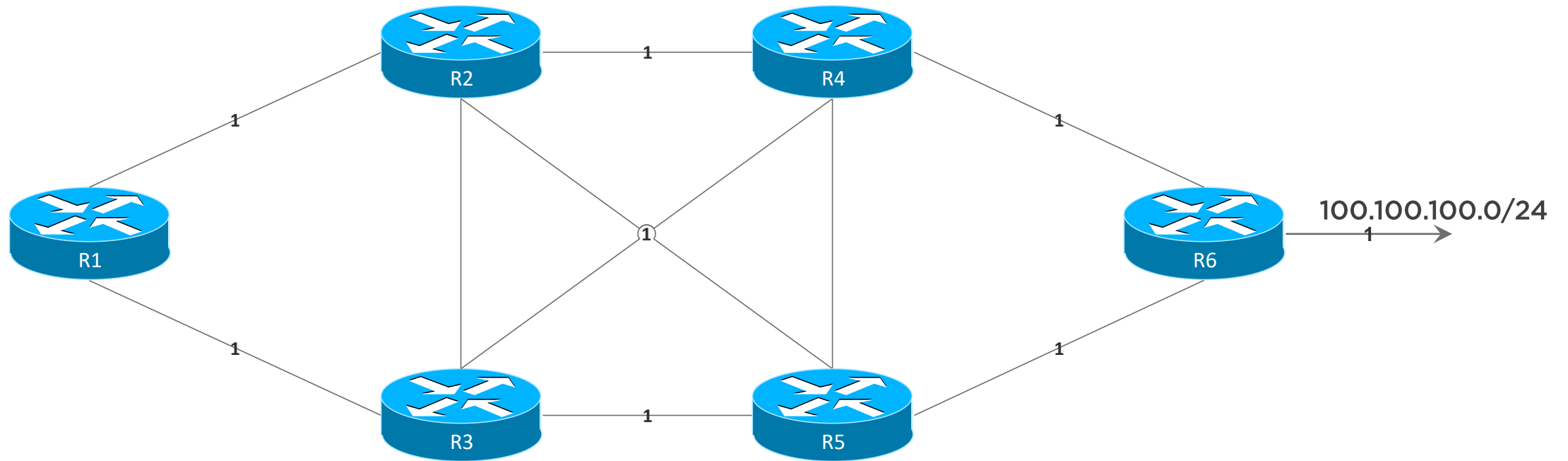
Uses link state advertisements
(LSA)



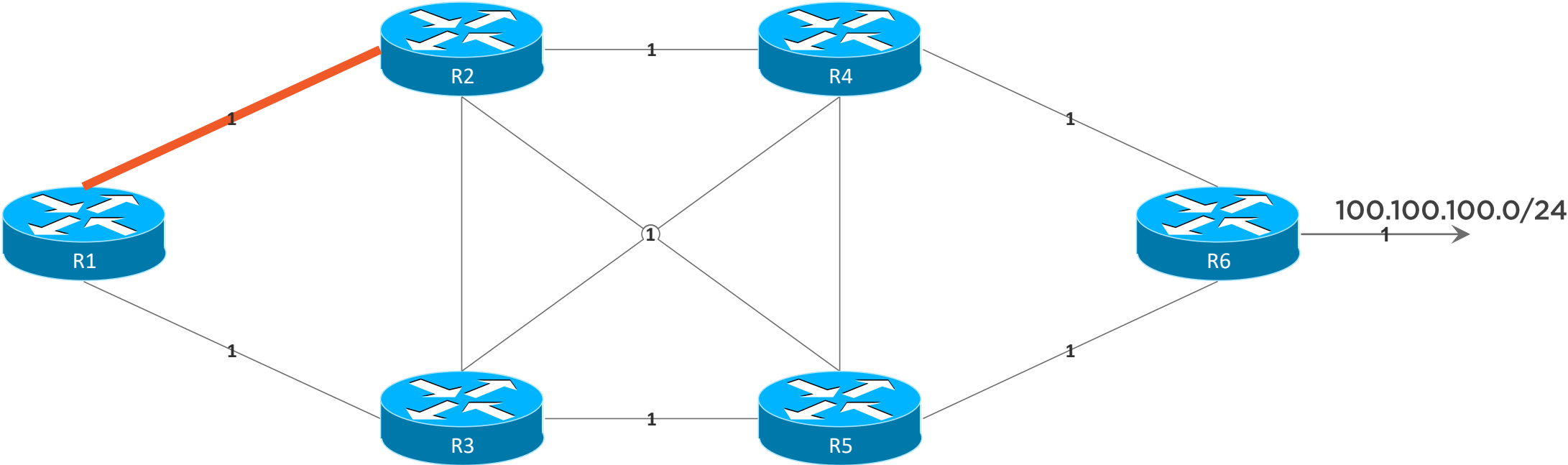
Used with SPF to
determine routes used



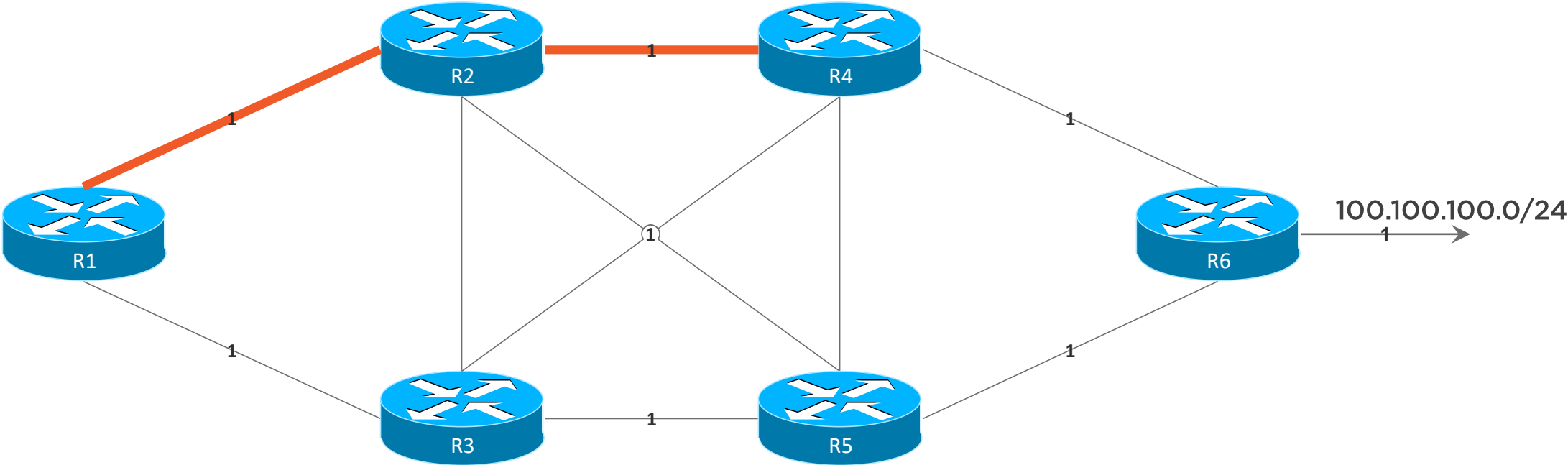
Course Topology - Simple Metrics



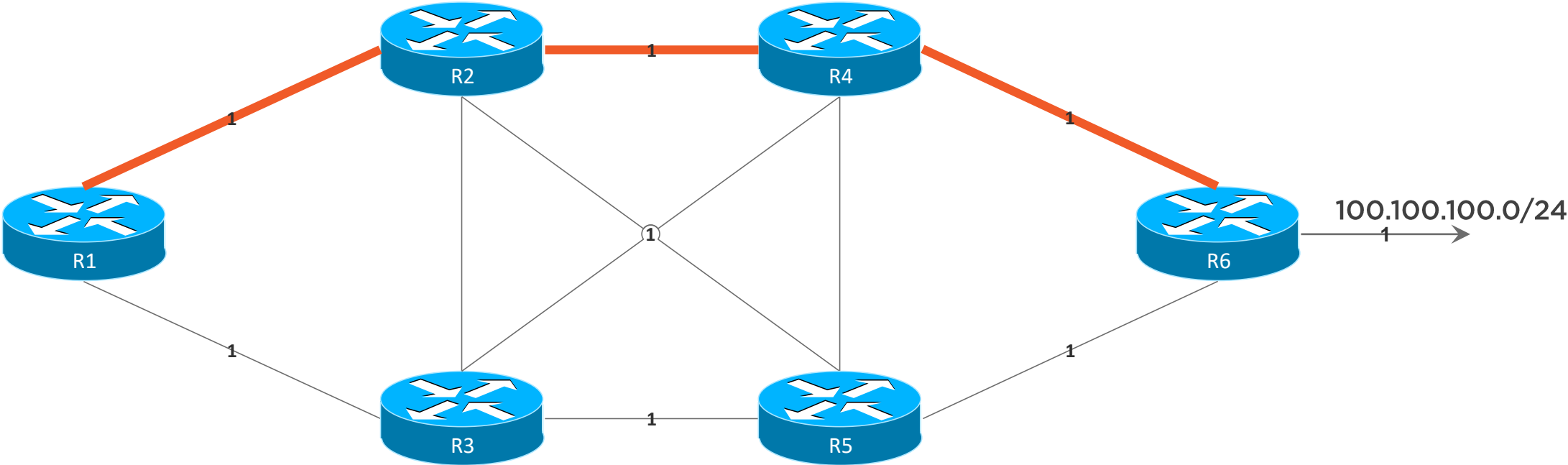
Course Topology - Simple Metrics



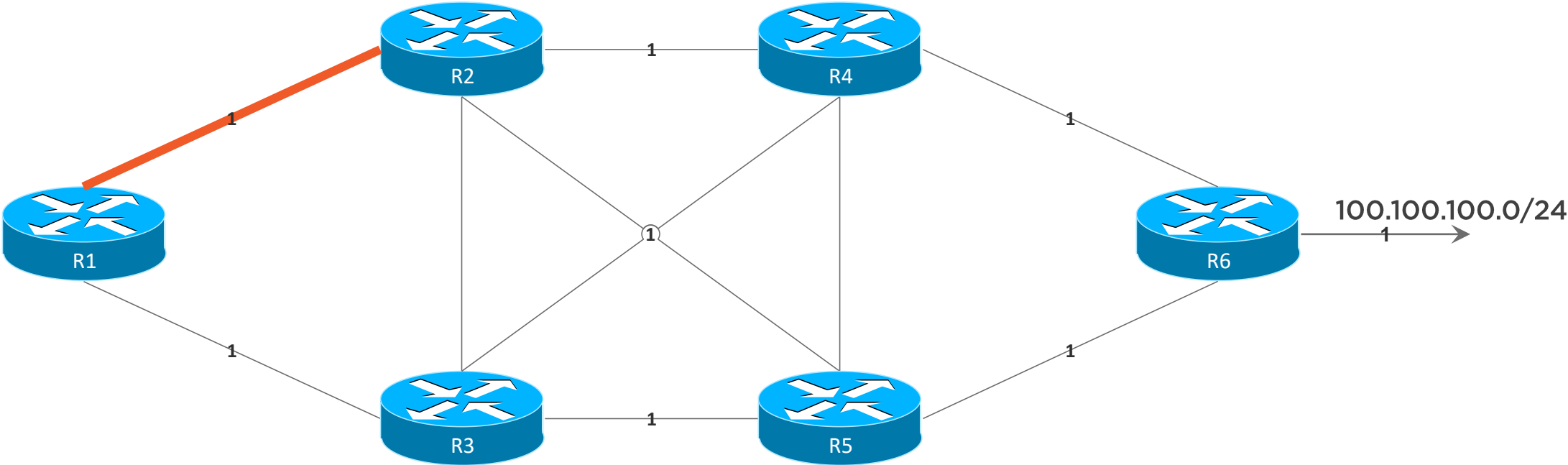
Course Topology - Simple Metrics



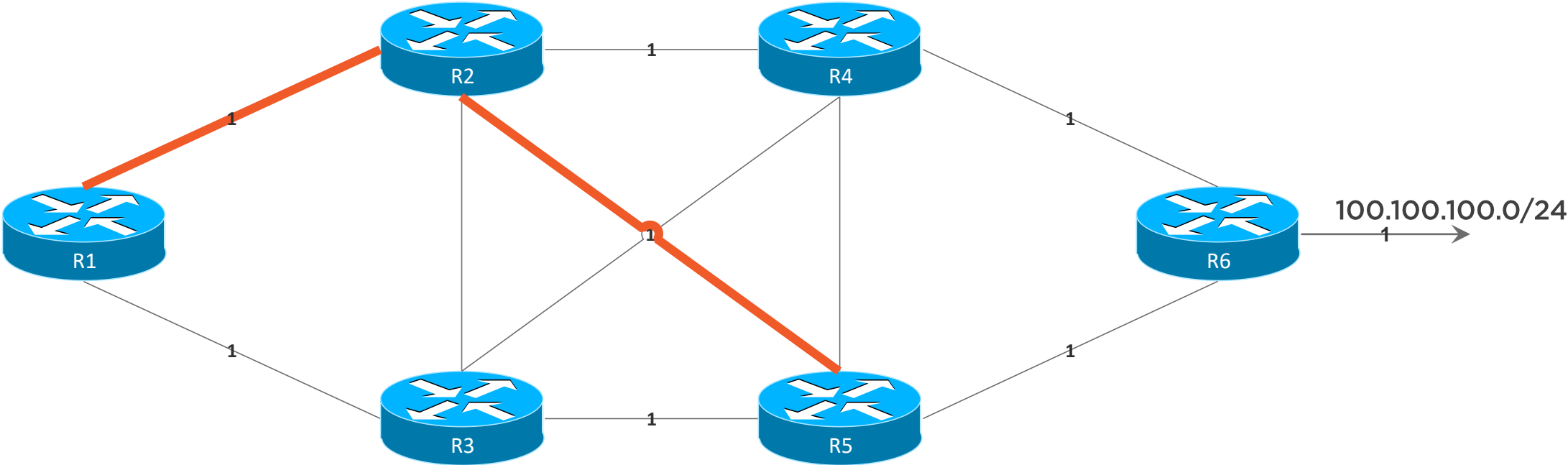
Course Topology - Simple Metrics



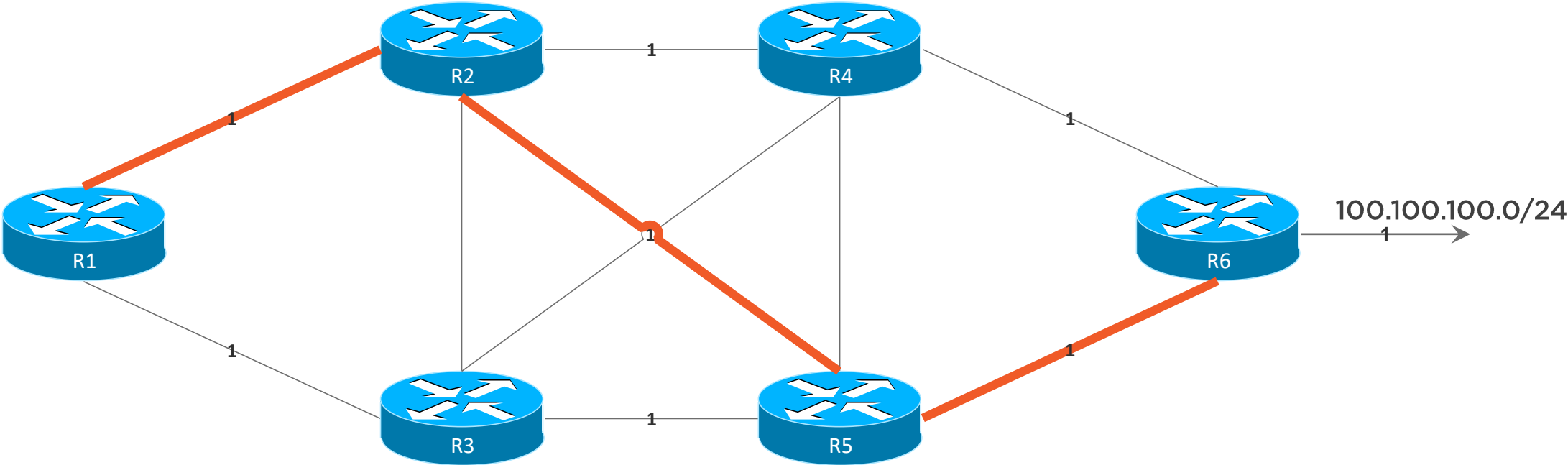
Course Topology - Simple Metrics



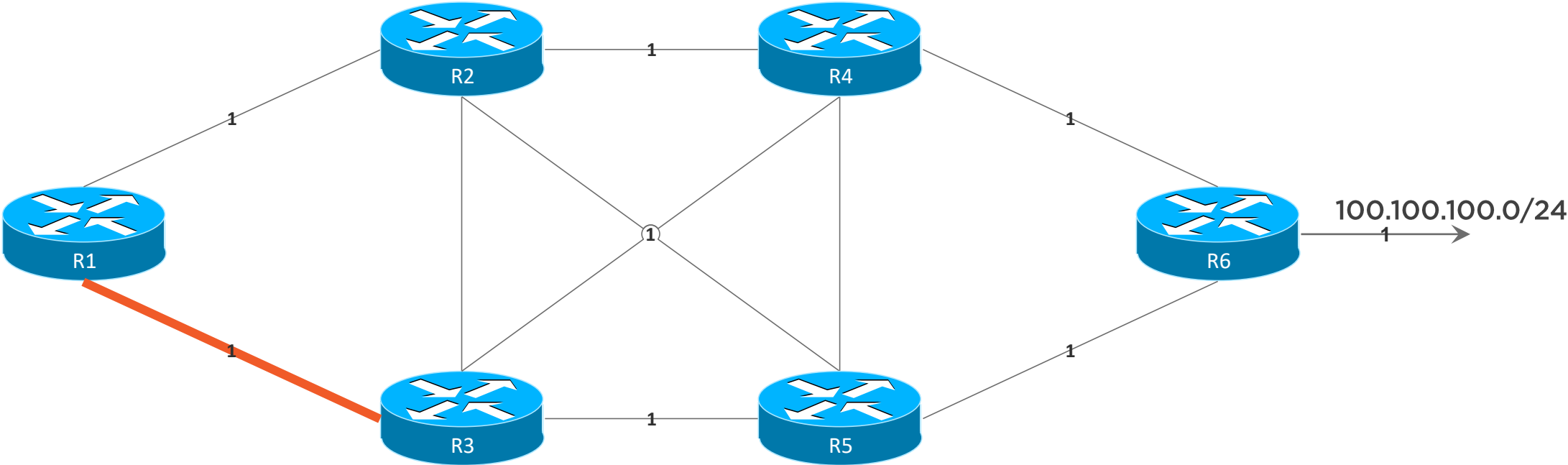
Course Topology - Simple Metrics



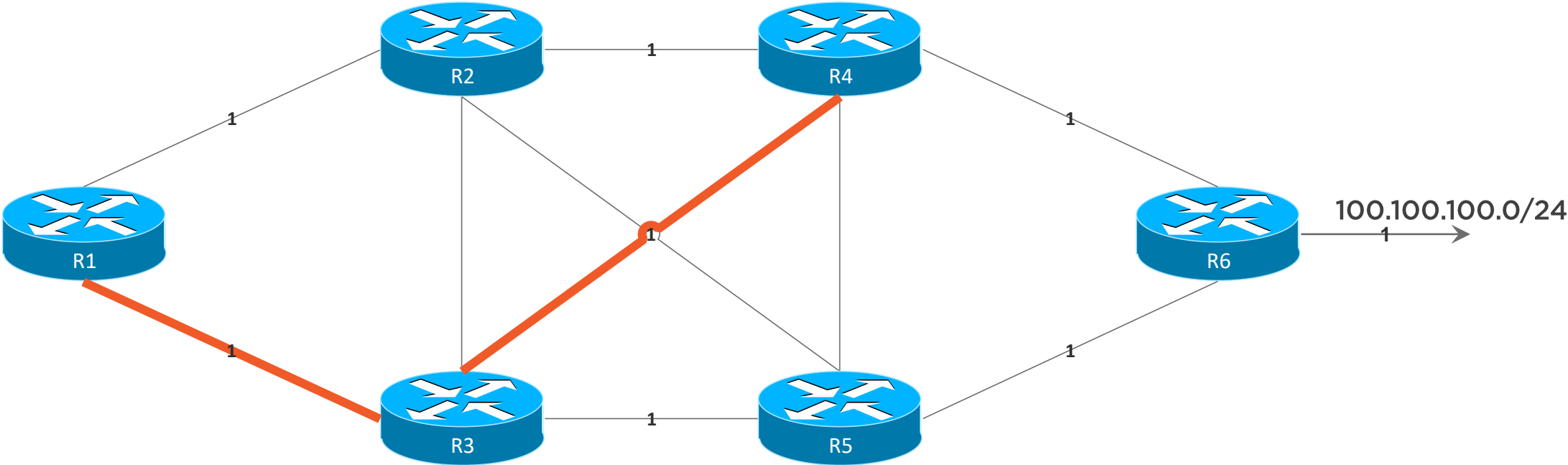
Course Topology - Simple Metrics



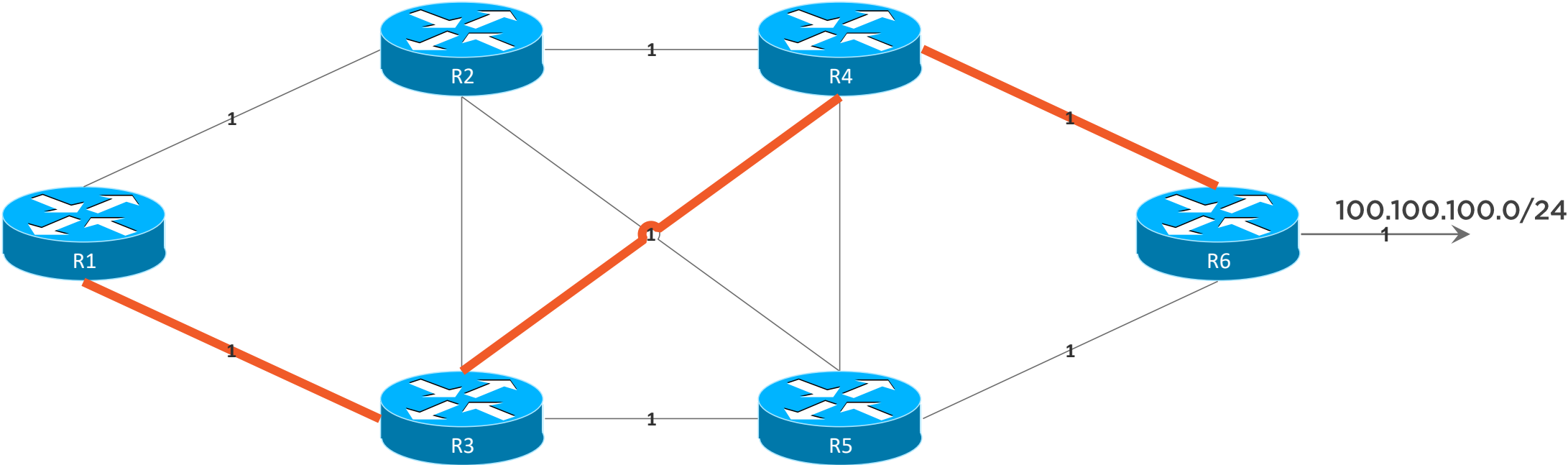
Course Topology - Simple Metrics



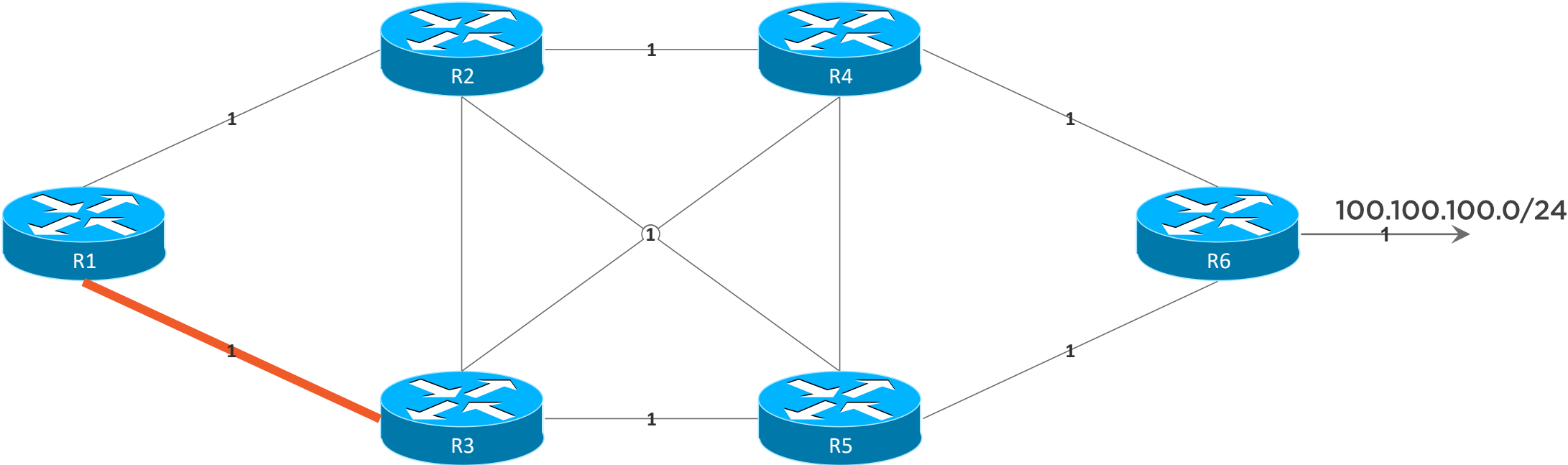
Course Topology - Simple Metrics



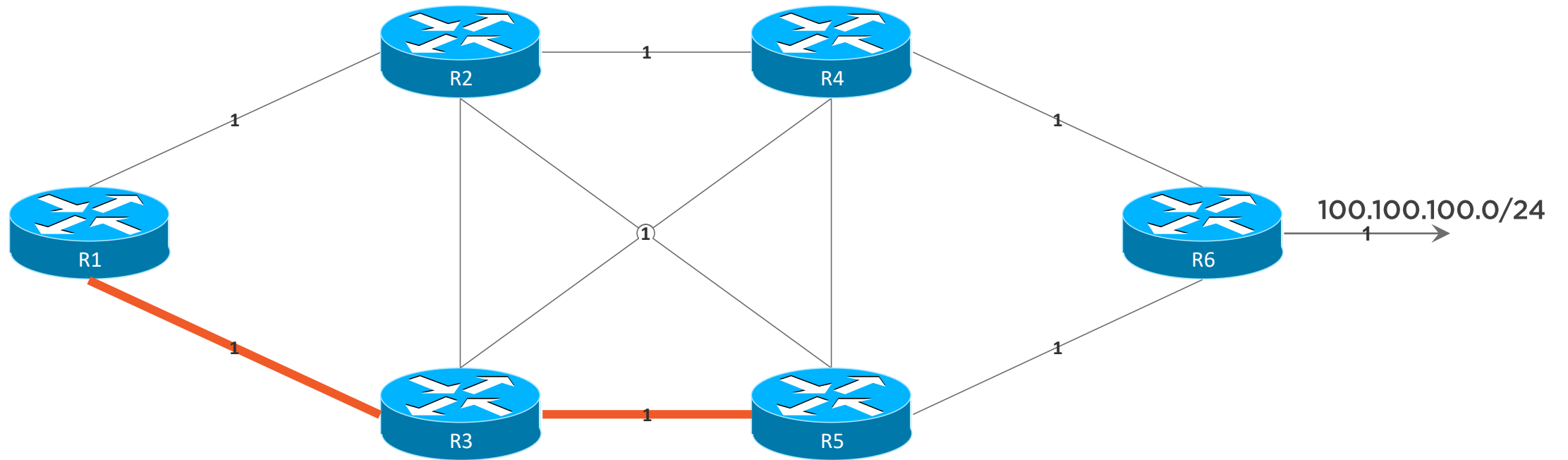
Course Topology - Simple Metrics



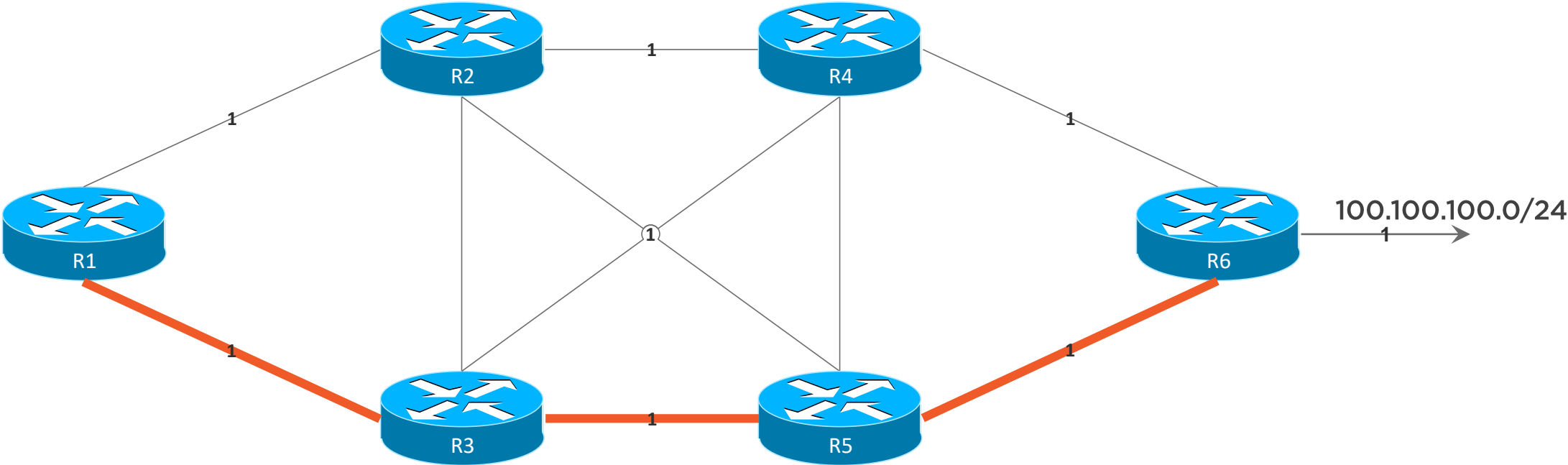
Course Topology - Simple Metrics



Course Topology - Simple Metrics



Course Topology - Simple Metrics



OSPF Metric

Simple metric

{y, x}



OSPF Metric

Simple metric

Based on configured bandwidth



OSPF Metric

Simple metric

Based on configured bandwidth

$$\frac{\text{Reference bandwidth}}{\text{Configured bandwidth}}$$



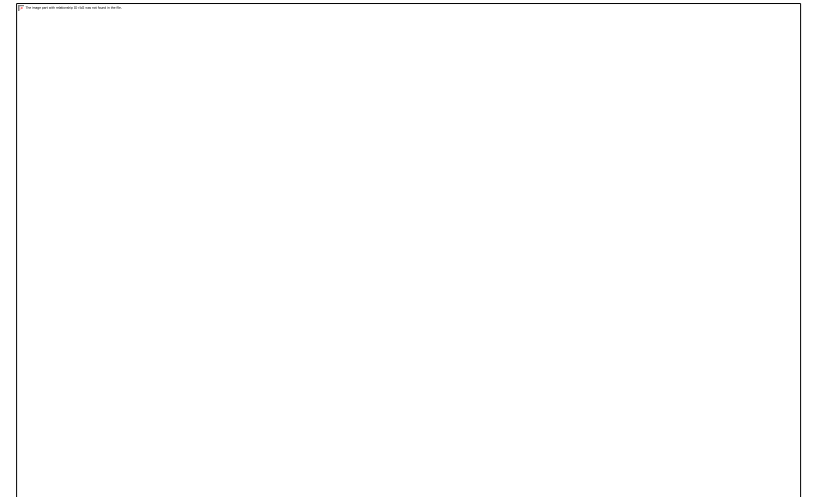
OSPF Metric

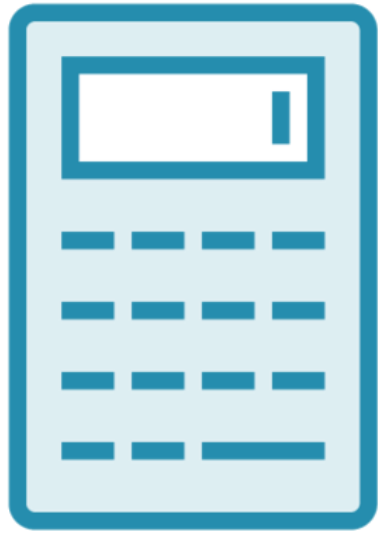
Simple metric

Based on configured bandwidth

$$\frac{\text{Reference bandwidth}}{\text{Configured bandwidth}}$$

Cost associated with outbound link

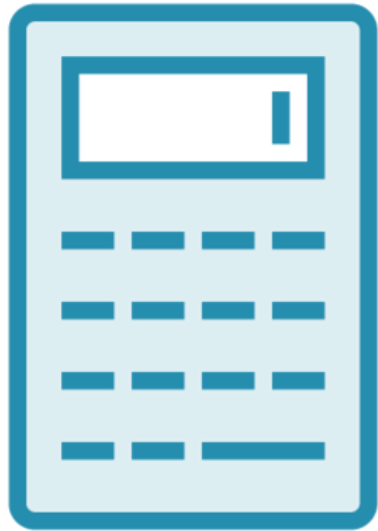






Default reference bandwidth is 100 Mbps





Default reference bandwidth is 100 Mbps

$$\frac{100 \text{ Mbps}}{10 \text{ Mbps}} = 10$$



OSPF Metric

Most interfaces
are > 100 Mbps



OSPF Metric

100 Mbps
interface =
Cost of 1



OSPF Metric

1 Gbps interface =
Cost of 1



OSPF Reference Bandwidth



Faster interfaces have the same cost



OSPF Reference Bandwidth

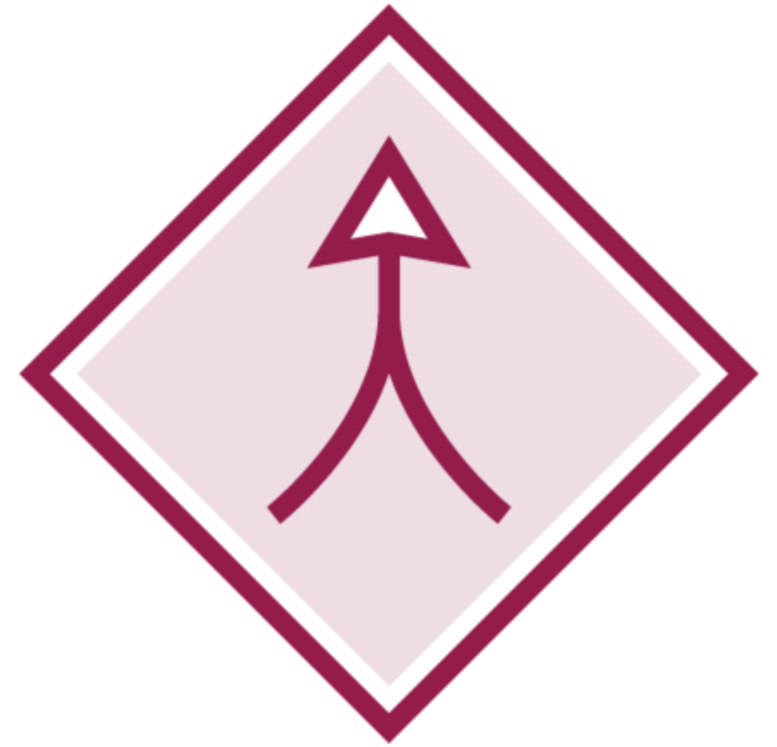


Faster interfaces have the same cost

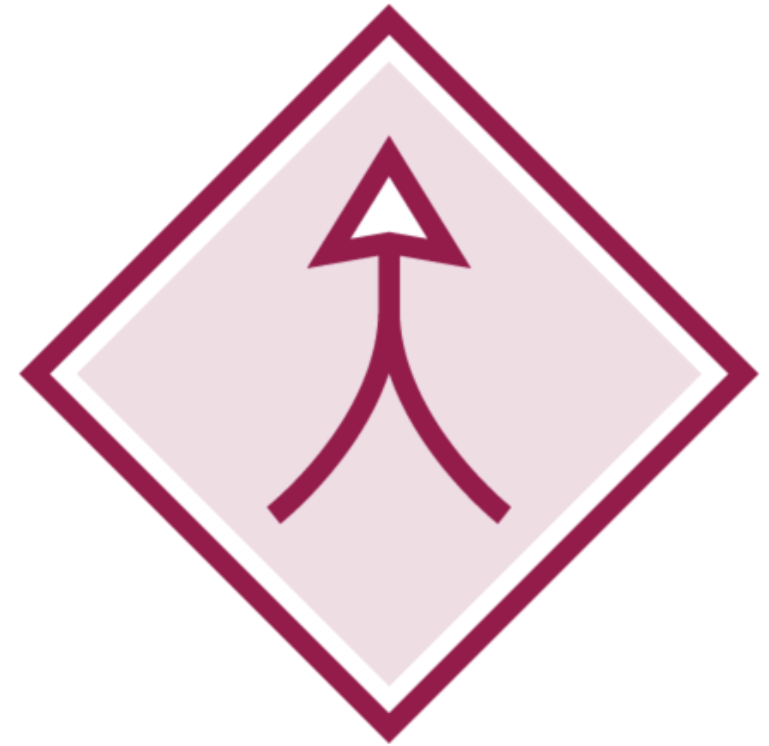


Often results in higher reference bandwidth



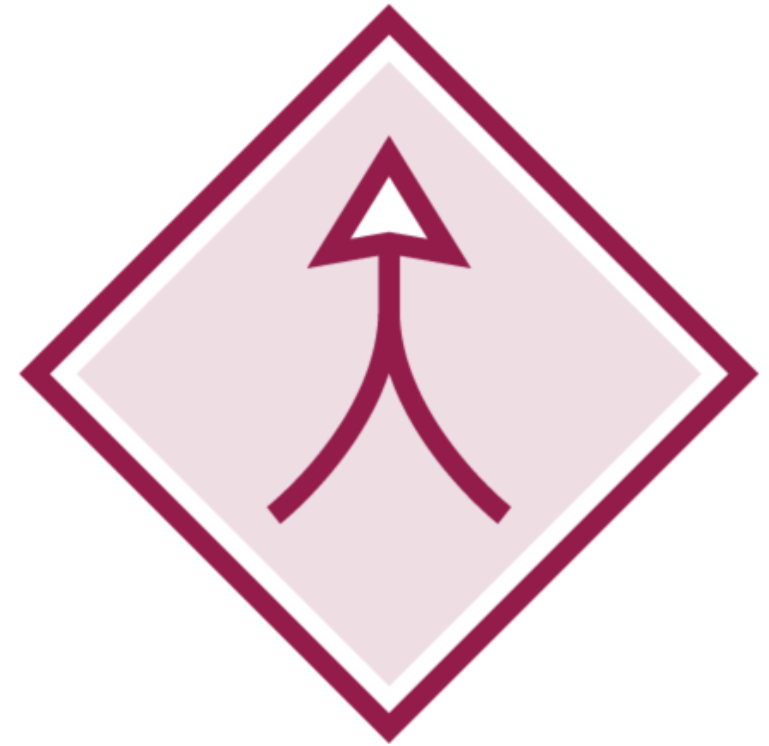


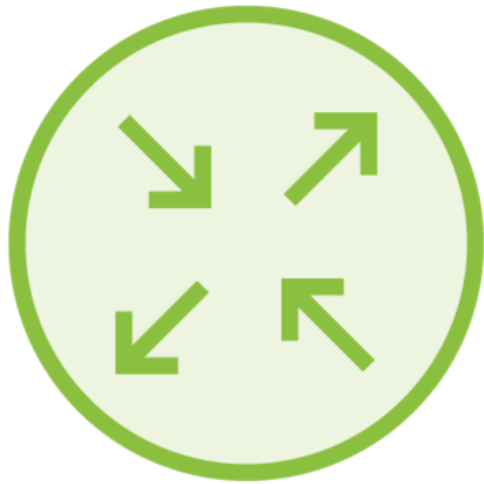
Rounding up is limited to
between 0 and 1



Rounding up is limited to
between 0 and 1

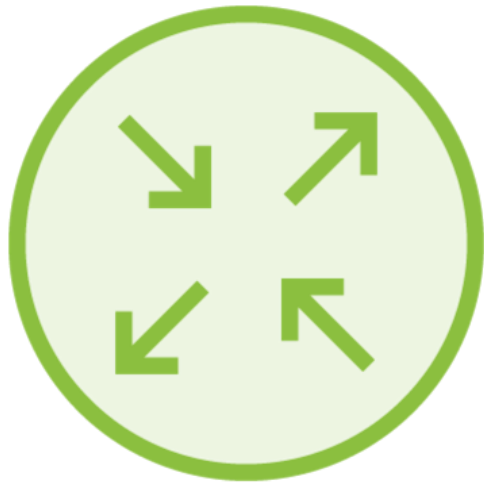
OSPF normally rounds
down to the whole number





OSPF External Routes

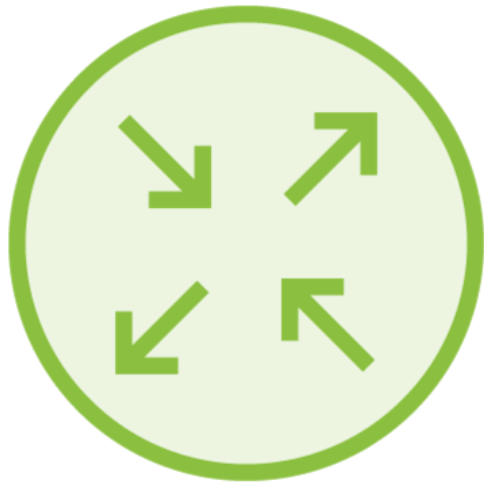




OSPF External Routes

Routes taken from other sources





OSPF External Routes

Routes taken from other sources

Referred to as redistribution



OSPF External Routes

Two types:



OSPF External Routes

Two types:

Type 1

Type 2 (Default)



OSPF External Routes

Type 2:

**Metric given
initially then
locked**



OSPF Type 1 External Routes



Initial metric is given



OSPF Type 1 External Routes



Initial metric is given



Used as base value



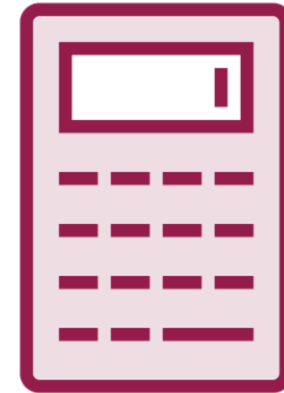
OSPF Type 1 External Routes



Initial metric is given



Used as base value

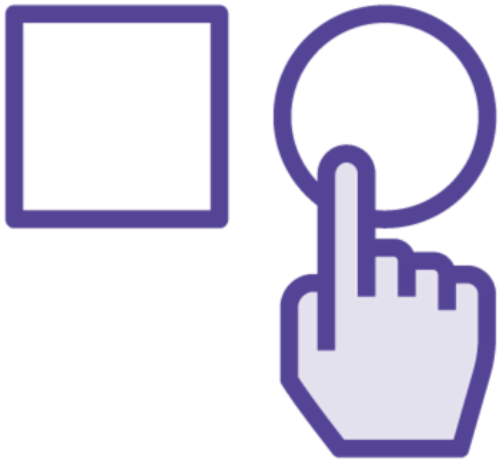


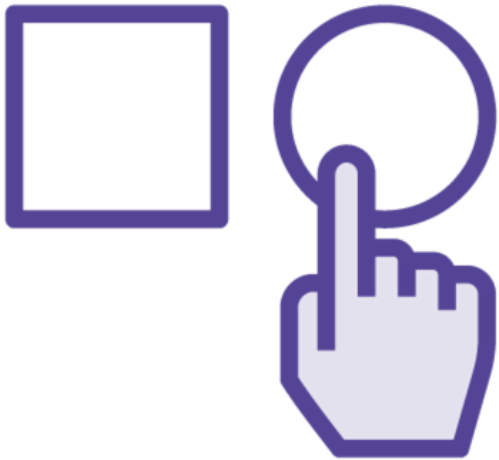
Incremented like
normal OSPF costs



Route Selection!

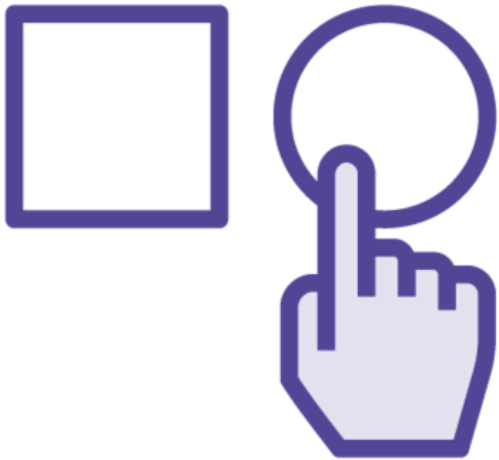






Many vendors use administrative distance





Many vendors use administrative distance
Used to determine source preference



Source	Administrative Distance
Connected	0
Static	1
eBGP	20
EIGRP (internal)	90
OSPF	110
IS-IS	115
RIP	120
EIGRP (external)	170
iBGP	200



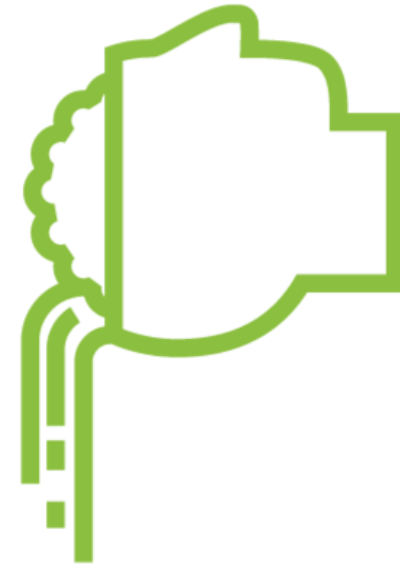


OSPF has its own
route selection process



OSPF has its own
route selection process

Some context must be given first



OSPF Hierarchy



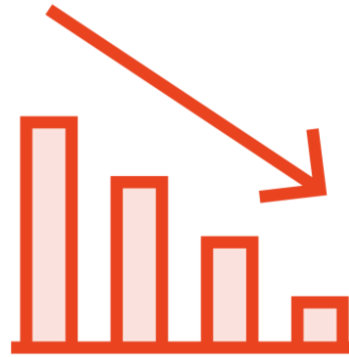
Uses areas



OSPF Hierarchy



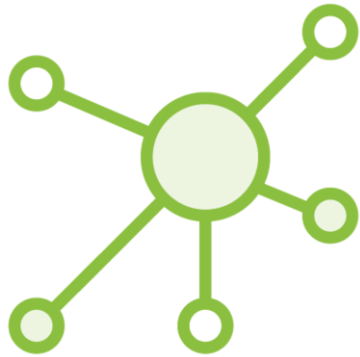
Uses areas



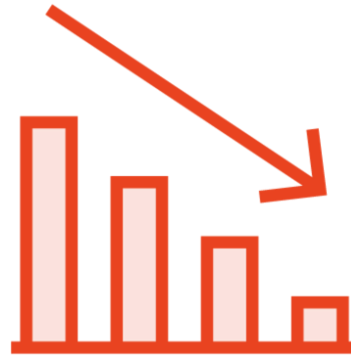
Used to limit size of
LSDB



OSPF Hierarchy



Uses areas



Used to limit size of
LSDB



Several types exist



OSPF Areas

Several differences exist



OSPF Areas

**Specifics will be covered in
later module**



Intra-Area Entries



Intra-Area Entries

Routes sourced inside same area



Intra-Area Entries

Routes sourced inside same area

Preferred over all other OSPF sources



Inter-Area Entries



Inter-Area Entries



Sourced from other OSPF area



Inter-Area Entries



Sourced from other OSPF area
Preferred after intra-area entries



External entries only
considered if internal entries
don't exist



OSPF External Entries

Type 1/Type 2

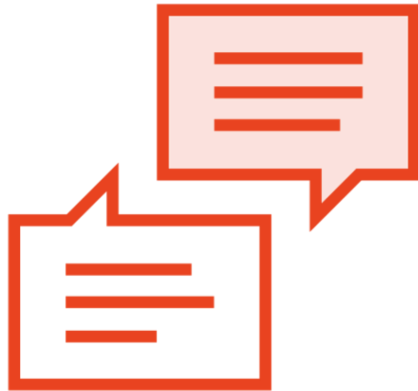


OSPF External Entries

**Type 1 entries preferred over
type 2 entries**



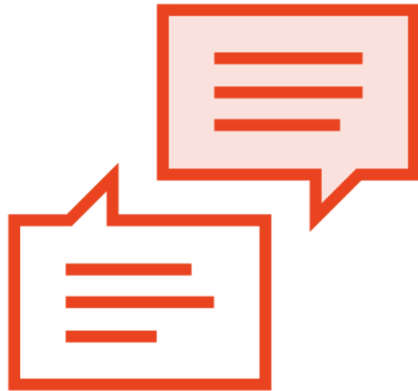
NSSA External Entries



Type 1 and Type 2



NSSA External Entries



Type 1 and Type 2



NSSA type 1 preferred over
NSSA type 2



OSPF Route Selection



Intra-Area (O)

Inter-Area (O IA)

External Type 1 (E1)

External Type 2 (E2)

NSSA Type 1 (N1)

NSSA Type 2 (N2)



Summary



Summary



OSPF vs. Other Routing Protocols



Summary



OSPF vs. Other Routing Protocols

Reviewing the OSPF Metric



Summary



OSPF vs. Other Routing Protocols

Reviewing the OSPF Metric

Selecting the Best Route Entry

