How routers select best routes?

Routers select best routes based on the following criteria:

1. **Longest prefix match:** Routers select routes with the longest match to the destination address in the forwarded packet. For example if a packet is destined to 192.168.12.1 and the router has 192.168.0.0/16 and 192.168.12.0/24 in its routing table, it will forward the packet using the 192.168.12.0/24 route.
2. **Administrative distance:** If a router is receiving the same route from multiple routing protocols it will install the route with the lowest Administrative distance in the routing table. For example if the router is receiving 192.168.12.0/24 from both OSPF (AD:110) and RIP (AD:120) the OSPF route will be selected.
   The following table is listing from lowest to highest:

Routing protocol	Default AD
Connected interface	0
Static route	1
Enhanced Interior Gateway Routing Protocol (EIGRP) summary route	5
External Border Gateway Protocol (BGP)	20
Internal EIGRP	90
IGRP	100
OSPF	110
Intermediate System-to-Intermediate System (IS-IS)	115
Routing Information Protocol (RIP)	120
Exterior Gateway Protocol (EGP)	140
On Demand Routing (ODR)	160
External EIGRP	170
Internal BGP	200
Unknown	255

3. **Metric**: If the router is receiving the same route many times from the same routing protocol it will consult the metric value for its selection; the lowest the best. If routes has the same metric both will be installed in the routing table and the router will load balance packets over them. CISCO routers install up to 4 equal metric routes (IGP) by default in the routing tables and you can manipulate the number using the command **maximum-paths** under the protocol configuration mode.

- **Administrative distance** - This identifies the trustworthiness of the route source. Lower values indicate preferred route source.
- **Metric** - This identifies the value assigned to reach the remote network. Lower values indicate preferred routes.

Path Determination: IPv4 Longest Match Example

In the table, an IPv4 packet has the destination IPv4 address 172.16.0.10. The router has three route entries in its IPv4 routing table that match this packet: 172.16.0.0/12, 172.16.0.0/18, and 172.16.0.0/26. Of the three routes, 172.16.0.0/26 has the longest match and would be chosen to forward the packet.

Destination IPv4 Address		**Address in Binary**
172.16.0.10		**10101100.00010000.00000000.00**001010
Route Entry	Prefix/Prefix Length	Address in Binary
1	172.16.0.0/**12**	**10101100.0001**0000.00000000.00001010
2	172.16.0.0/**18**	**10101100.00010000.00**000000.00001010
3	172.16.0.0/**26**	**10101100.00010000.00000000.00**001010

Path Determination: Best Path

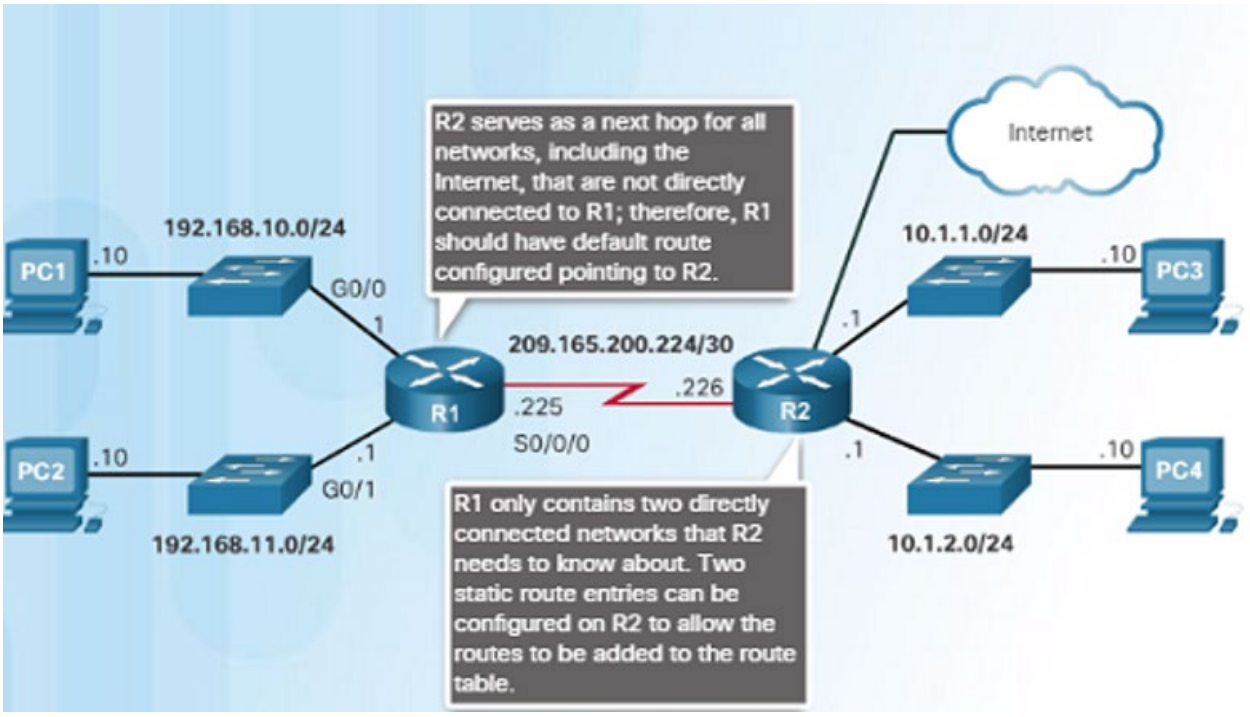
- The best path (lowest metric) is selected based on the metric or value that is used by the routing protocol.
- A metric is a value that is used to measure the distance to a given network.
- Metric (e.g. Hop count, Bandwidth, Delay, Load, Reliability)

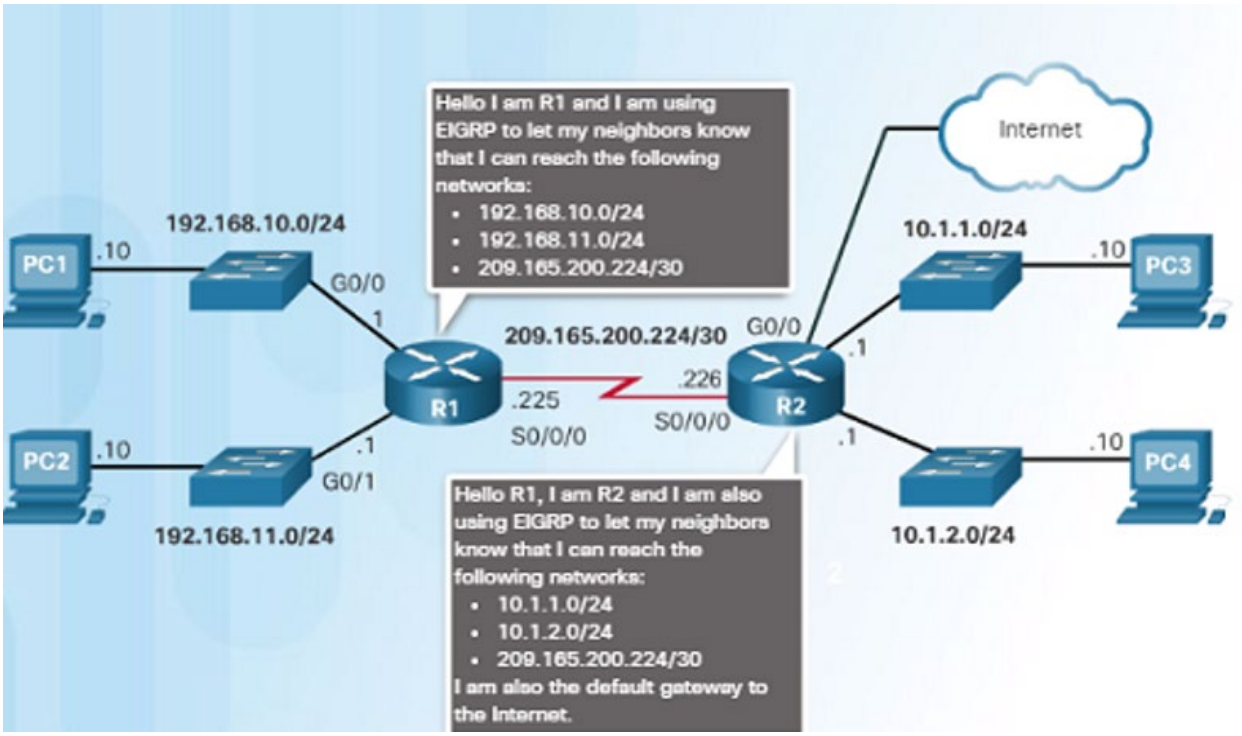
Path Determination: Load Balancing

- If a router has two or more paths with identical metrics to the same destination network, the router will forward the packets using both paths equally (equal cost load balancing).
- EIGRP supports unequal cost load balancing.

Dynamic Routing Protocols

	Interior Gateway Protocols				Exterior Gateway Protocols
	Distance Vector		Link-State		Path Vector
IPv4	RIPv2	EIGRP	OSPFv2	IS-IS	BGP-4
IPv6	RIPng	EIGRP for IPv6	OSPFv3	IS-IS for IPv6	BGP-MP




Hello I am R1 and I am using EIGRP to let my neighbors know that I can reach the following networks:
• 192.168.10.0/24
• 192.168.11.0/24
• 209.165.200.224/30
Internet
192.168.10.0/24
PC1
.10
G0/0
.1
209.165.200.224/30
G0/0
.1
10.1.1.0/24
.10
PC3
R1
.225
S0/0/0
.226
S0/0/0
R2
PC2
.10
.1
G0/1
.1
.10
PC4
192.168.11.0/24
10.1.2.0/24
Hello R1, I am R2 and I am also using EIGRP to let my neighbors know that I can reach the following networks:
• 10.1.1.0/24
• 10.1.2.0/24
• 209.165.200.224/30
I am also the default gateway to the Internet.