

CCNP ENARSI Cram Notes

1.0 Layer 3 technologies

1.1 Troubleshoot administrative distance (all routing protocols)

Administrative distance (AD) is a measure of the trustworthiness of a routing information source. It is used by routers to determine which route to use when there are multiple paths to a destination network that have been learned from different sources. The lower the AD value, the more trustworthy the source is considered to be.

Important steps to troubleshoot AD issues in all routing protocols:

1. Check the AD values for the routing protocols being used. The AD values for different routing protocols are predefined, and can be found in Cisco documentation. Make sure that the AD values being used are appropriate for the network topology and routing requirements.
2. Verify that the routing protocols are configured correctly on all routers. Check the configuration for errors or missing settings. Ensure that the routing protocols are enabled on the correct interfaces, and that the correct networks are being advertised.
3. Check the routing table on each router. Verify that the routing table is populated with the expected routes, and that the AD values are correct for each route.
4. Verify that the routers are exchanging routing information correctly. Check for connectivity between routers, and ensure that the correct routing updates are being sent and received.
5. Use debug commands to troubleshoot AD issues. Debugging can provide valuable information about routing protocol behavior and can help to identify configuration errors or network connectivity problems.
6. Check for duplicate routes. Duplicate routes can cause issues with AD, as routers may choose the incorrect route based on AD values. Use the "show ip route" command to check for duplicate routes and remove any that are unnecessary.

By following these troubleshooting steps, you can identify and resolve AD issues in all routing protocols.

The default administrative distances are as below:

Directly connected : 0

Static Route : 1

Enhanced Interior Gateway Routing Protocol (EIGRP) summary route : 5

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EIGRP (internal) : 90
OSPF : 110
RIP : 120
External BGP : 20
Internal BGP : 200
Unreachable : 255

The default metric for a redistributed route should be set to a value larger than the largest metric within the AS.

The proper command to set a different administrative distance is `distance <admin-distance> {ip-address {wildcard-mask}}`

example: `distance 150 10.1.1.0 0.0.0.255`

The command "`distance 99 0.0.0.0 255.255.255.255 11`" is used to assign an administrative distance of 99 for all routes matching access list 11 from any router.

The router will assign an administrative distance as specified in the command instead of the default AD to routes learned through this ip address. The ip-address and wildcard-mask refers to the IP address of the router from which the routes are being learned. This command is very useful when you want to assign different AD for redistributed routes into RIP from other protocols. In the example, a AD of 150 is assigned to the routes specified. This distance command should not be confused with route metrics that are used by the various routing protocols - RIP, EIGRP, OSPF, ISIS, etc.

Static Routing: It may be implemented in either one of two ways by using ip route command:

1. By using the next-hop address :

Ex: Router(config)#ip route 192.204.1.64 255.255.255.240 192.204.1.2

192.204.1.64 = destination network

255.255.255.240 = subnet mask

192.204.1.2 = next-hop address

Remember this by reading as: To get to the destination network of 192.204.1.64, with a subnet mask of 255.255.255.240, send all packets to 192.204.1.2

2. By using the exit interface

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```
Router(config)#ip route 192.204.1.64 255.255.255.240 s0/0
```

192.204.1.64 = destination network

255.255.255.240 = subnet mask

s0/0 = exit interface

Remember this by reading as: To get to the destination network of 192.204.1.64, with a subnet mask of 255.255.255.240, send all packets out interface Serial 0/0

A static route is one that is hard coded into the routing tables. Here, the destination network/host, and the next hop information are entered by hand. A static route on a Cisco router is most commonly defined by using the command:

```
Router(config)# ip route A.B.C.D (destination network/host) A.B.C.D (subnet mask) A.B.C.D (next hop)
```

You can also use the port identifier such as e0, s1 etc. to define the next hop address.

Optionally, the "administrative distance " can be added at the end of the command to change the default weight.

The correct syntax for setting default route is

```
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.1.1
```

You can also set default route by specifying the interface as below:

```
Router(config)#ip route 0.0.0.0 0.0.0.0 s0
```

Distance Vector routing protocols use frequent broadcasts (255.255.255.255 or FF:FF:FF:FF) of their entire routing table every 30 sec. on all their interfaces in order to communicate with their neighbors. The bigger the routing tables, the more broadcasts. This methodology limits significantly the size of network on which Distance Vector can be used. Routing Information Protocol (RIPv1 and RIPv2) and Interior Gateway Routing Protocol (IGRP and EIGRP) are two popular Distance Vector routing protocols.

Link state routing protocols maintain complete road map of the network in each router running a link state routing protocol. Each router running a link state routing protocol originates information about the router, its directly connected links, and the state of those links. This information is sent to all the routers in the network as multicast messages. Link-state routing always try to maintain full networks topology by updating itself incrementally whenever a change happen in network. Examples of Link State protocol is OSPF (Open Shortest Path First) and IS-IS. Link State Routing Protocols converge more quickly and they are less prone to Routing Loops than Distance Vector Routing Protocols. On the other hand, Link State Routing Protocols require more CPU power and memory than Distance Vector Routing Protocol algorithms.

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A Floating static route is a route that has a higher administrative distance than the current route in a routing table. The routes that have a lower administrative distance number will be the ones installed into the routing table whereas higher AD numbers will not. Static floating route is static route like any other but with added administrative distance in the configuration. The Administrative Distance of a static route can be changed to form a floating static route, which will only be used if there are no other routes with a lesser AD in the routing table. A floating static route is often used as a backup route to a dynamic routing protocol. To create a floating static route, we need to use the distance option at the end of the ip route command. We really just need to set an AD for the static route.

There are three ways a router learns how to forward a packet:

1. **Static Routes** - Configured by the administrator manually. The administrator must also update the table manually every time a change to the network takes place. Static routes are commonly used when routing from a network to a stub (a network with a single route) network. The command is

```
ip route network mask address/interface [distance]
```

```
ex: ip route 165.44.34.0 255.255.255.0 165.44.56.5
```

Here, 165.44.34.0 is the destination network or subnet

255.255.255.0 is the subnet mask

165.44.56.5 is the default gateway.

2. **Default Routes** - The default route (gateway of last resort) is used when a route is not known or is infeasible. The command is

```
ip route 0.0.0.0 0.0.0.0 165.44.56.5
```

The default gateway is set to 165.44.56.5

3. **Dynamic Routes** - As soon as dynamic routing is enabled, the routing tables are automatically updated. Dynamic routing uses broadcasts and multicasts to communicate with other routers. Each route entry includes a subnet number, the interface out to that subnet, and the IP address of the next router that should receive the packet. The commands to enable rip are:

```
router rip
```

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network <major network number>.

1.2 Troubleshoot route map for any routing protocol (attributes, tagging, filtering)

Route maps are a powerful tool used to manipulate and filter routing updates. They can be used to modify the attributes of routes, tag routes with additional information, and filter routes based on various criteria. Here are some steps to troubleshoot route maps for any routing protocol:

1. Check the configuration of the route map. Verify that the route map is configured correctly, with the correct match and set statements. Check for any errors in the configuration that may be causing issues.
2. Check the routing table for the expected routes. Verify that the routing table is populated with the expected routes, and that the route map is being applied correctly.
3. Check the route map processing order. Route maps are processed in the order in which they are applied, with the first match being used. Verify that the route map processing order is correct, and that there are no overlapping or conflicting route maps.
4. Use the "show route-map" command to troubleshoot. This command displays detailed information about the route map, including the match and set statements and the number of routes matched.
5. Use debug commands to troubleshoot route map issues. Debugging can provide valuable information about route map behavior and can help to identify configuration errors or network connectivity problems.
6. Check for filtering issues. If routes are not being advertised or received correctly, check the route map filtering criteria to ensure that they are correct. Verify that the route map is not filtering out valid routes.
7. Verify that tagging is working correctly. If routes are being tagged with additional information, check that the tagging is working correctly and that the correct tags are being applied.

By following these troubleshooting steps, you can identify and resolve issues with route maps for any routing protocol.

When configuring route map, the match and set route map configuration commands are used to define the condition portion of a route map. The match command specifies a criteria that must be matched, and the set command specifies an action that is to be performed if the routing update meets the condition defined by the match command. Here the sequence number of 10 is used. Route map starts with the lowest sequence number and go on with increasing sequence numbers (if exists) till a match is occurred. Once a match occurs, it stops there and performs the

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match/set statements on the route. If no match occurs, there is an implicit deny at the end and the route is not redistributed or controlled.

Packets originated by the router are not policy routed. There is a feature for policy routing of locally generated traffic through local PBR. Local PBR policies are applied to the router with the global configuration command

ip local policy *route-map-name*

The command `ip policy route-map route-map-name` used to apply the route map to the inbound interface. Configure the route map by using the command **route-map** *route-map-name* [permit | deny] [sequence-number]

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