CCNA 200-301

CISCO™

Lesson 16

ARP table on Cisco routers

Static Routes

- Static Network routes

- Static Host routes

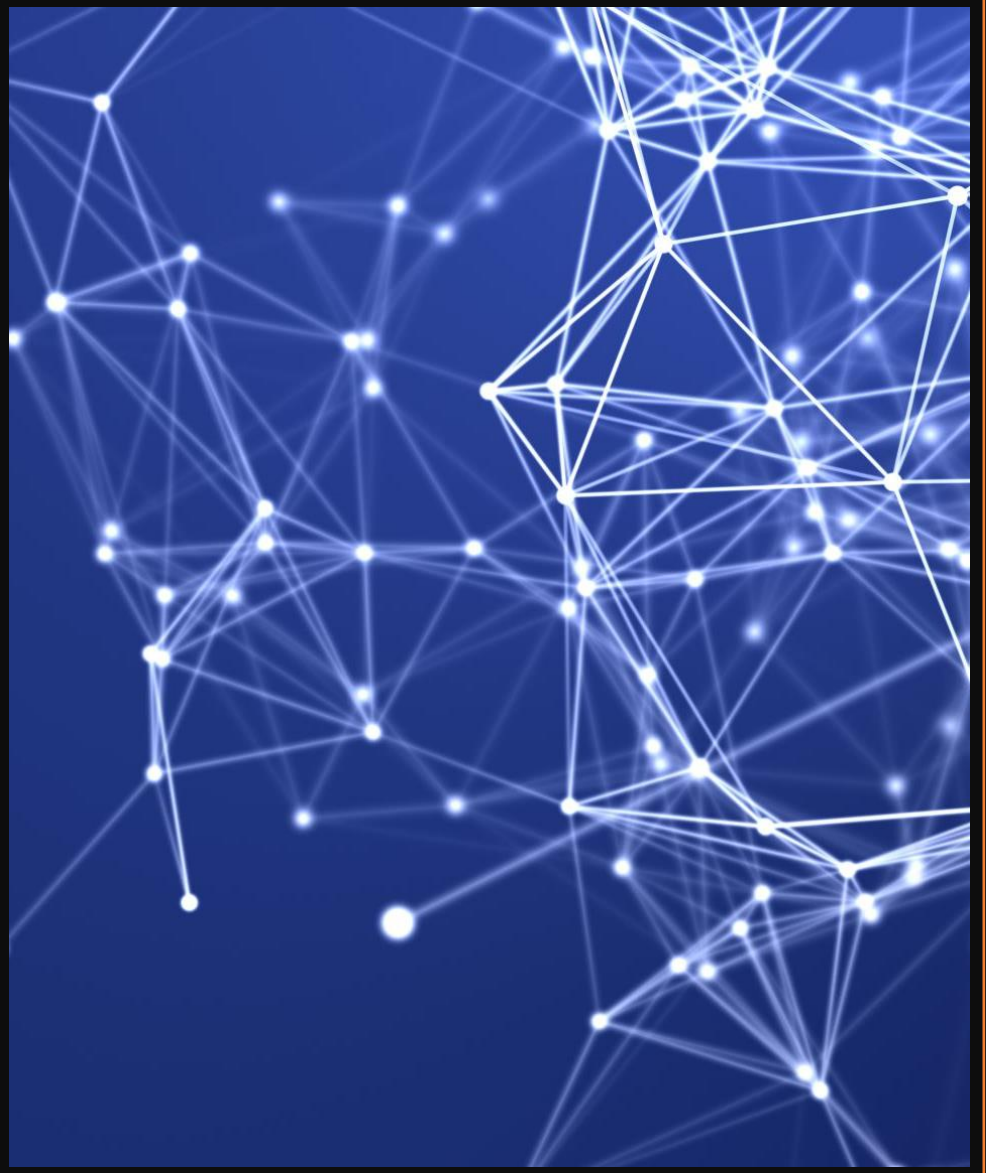
- Static Default routes

- AD (Administrative Distance)

- Floating Static routes

Troubleshooting techniques

Interpeting the IP Routing Table



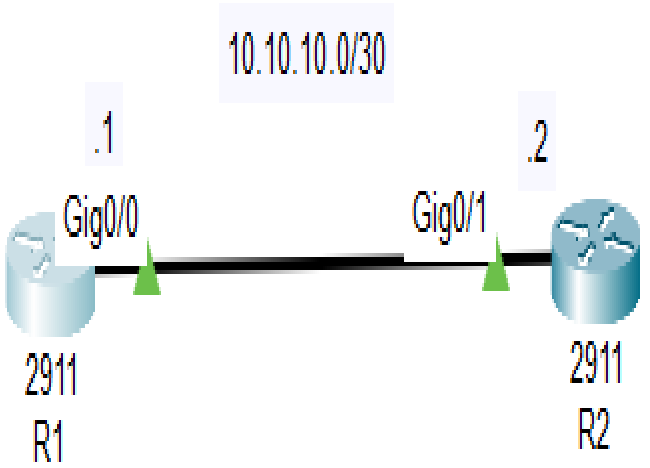
ARP table on Cisco routers

The IPv4 ARP table lists the IPv4 address and matching MAC address of hosts connected to the same subnet as the router. When forwarding a packet to a host on the same subnet, the router encapsulates the packet, with a destination MAC address as found in the ARP table. If the router wants to forward a packet to an IP address on the same subnet as the router but does not find an ARP table entry for that IP address, the router will use ARP messages to learn that device's MAC address.

By default, IOS will time out (remove) an ARP table entry after 240 minutes in which the entry is not used.

We have two routers: R1 and R2.

To check arp table entry on R1 we use **#show ip arp** command on privileged mode.




```
R1#show ip arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.10.10.1             -   0060.3EA0.9A01  ARPA   GigabitEthernet0/0
Internet  10.10.10.2             3   0001.4207.3402  ARPA   GigabitEthernet0/0
```

Static Routes

Networks use static routes—routes added to a routing table through direct configuration—much less often than dynamic routing. However, static routes can be useful at times, and they happen to be useful learning tools as well.

Configuring static routes are useful we have less network devices in our topology. If we have more network devices, we need to configure static routes on all of them. This is:

- error-prone

- time consuming

That is why in large size network dynamic routing protocols (like OSPF, EIGRP) are used.

Static Network routes

IOS allows the definition of individual static routes using the **ip route** global configuration command. Every **ip route** command defines a destination that can be matched, usually with a subnet ID and mask. The command also lists the forwarding instructions, typically listing either the outgoing interface or the next-hop router's IP address. IOS then takes that information and adds that route to the IP routing table.

The static route is considered a *network route* when the destination listed in the **ip route** command defines a subnet, or an entire Class A, B, or C network.

Static route configuration command:

Router(conf)#***ip route x.x.x.x y.y.y.y z.z.z.z***

Router(conf)#***ip route x.x.x.x y.y.y.y outgoing interface***

x.x.x.x – destination subnet ID

y.y.y.y – destination subnet mask

z.z.z.z – next hop IP adress

Static Network routes cont.

Let’s consider we have topology shiwn in the image. According to the topology we will configure static routes in routers (R1,R2,R3).

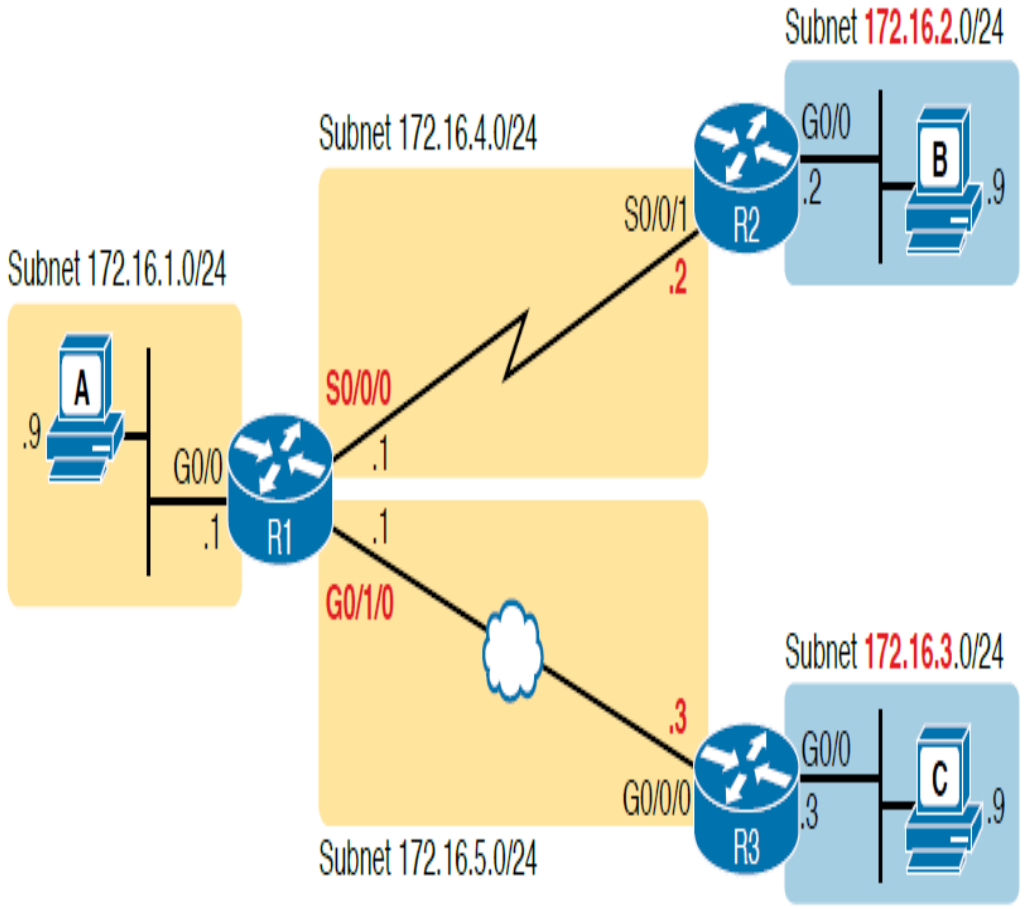
```
ip route 172.16.2.0 255.255.255.0 S0/0/0
ip route 172.16.3.0 255.255.255.0 172.16.5.3
```

In the first command, outgoing S0/0/0 interface is used. This commands says which interface is used to send IP Packet to reach destination network.

In the second command, next-hop IP address (R3’s G0/0/0/ IP address) is used. According to the second command, the IP packet destined to 172.16.3.0 will be sent next-hop 172.15.5.3 IP address.

The routes created by these two **ip route** commands actually look a little different in the IP routing table compared to each other. Both are static routes. However, the route that used the outgoing interface configuration is also noted as a connected route; this is just a quirk of the output of the **show ip route | static** command.

Packet tracer practice…



Static Host route

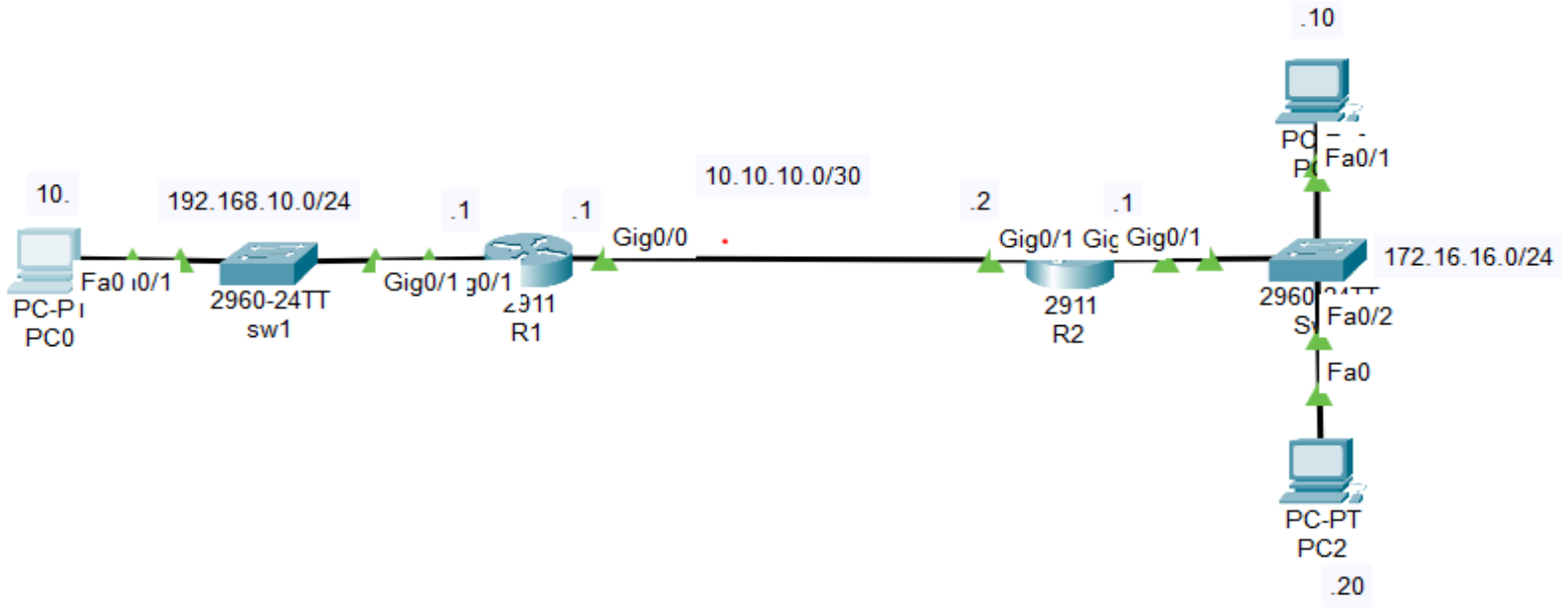
When we analyze routing table with the **#show ip route** command we can see host route with the code **L.** we can also configure static host route to destination network. In that case we only show single IP address in destination network.

the command is: **Router(conf)#*ip route x.x.x.x 255.255.255.255 z.z.z.z***

Let's look at the next topology.

In this topology we will configure static host route to PC1 on R2's LAN. As a result, we can only ping PC1's IP address 172.16.16.10.

Let's continue with Packet Tracer.



Administrative distance

By default, routes have administrative distance according to the static route or dynamic routing protocols. All dynamic routing protocols has AD (administrative distance) based on predefined algorithm.

In the table, default AD is shown based on protocols.

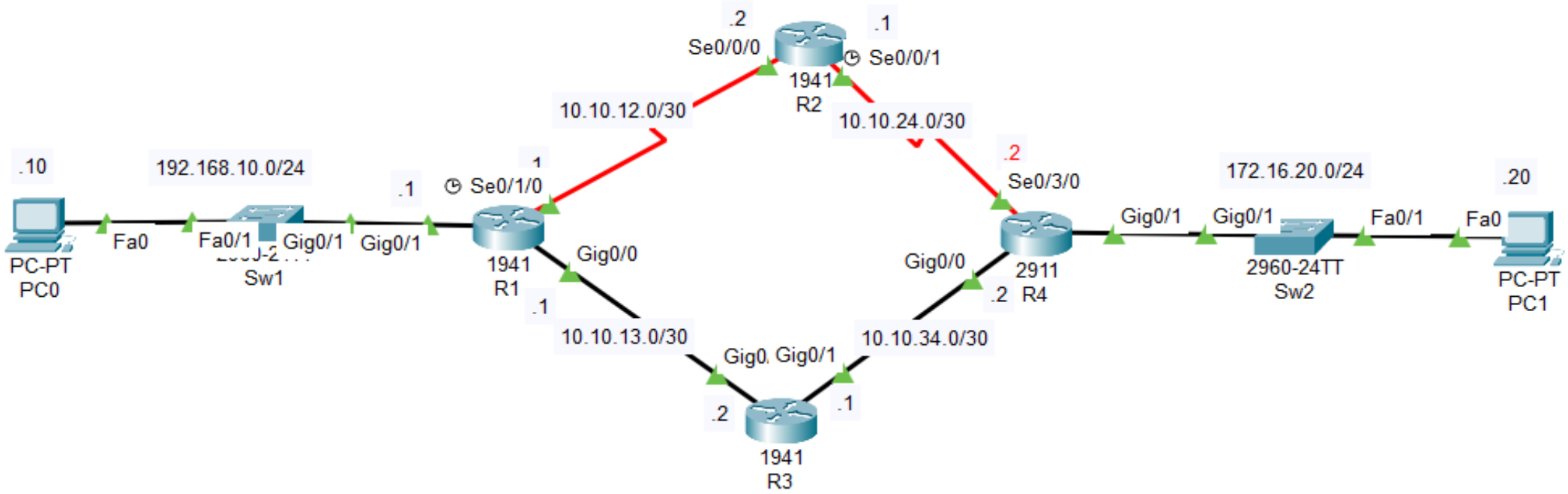
Route Source	Default Distance values
Connected interface	0
Static route	1
Enhanced Interior Gateway Routing Protocol (EIGRP) summary route	5
External Border Gateway Protocol (BGP)	20
Internal EIGRP	90
IGRP	100
OSPF	110
Intermediate System-to-Intermediate System (IS-IS)	115
Routing Information Protocol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

Floating Static routes

A Floating static route is a route that has a higher administrative distance then the current route in a routing table. Default static route configuration, we have two routes to the network 172.16.20.0/24 through R2 and R3.

We will configure floating static route through R3 and keep route through R2 as a redundant route.

Packet tracer example.



Default static route

When a router tries to route a packet, the router might not match the packet's destination IP address with any route. When that happens, the router normally just discards the packet.

Routers can be configured so that they use either a statically configured or dynamically learned default route. The *default route* matches all packets, so that if a packet does not match any other more specific route in the routing table, the router can at least forward the packet based on the default route.

We can configure static route on enterprise router where we do not know exact subnets on the rest of the global network.

Default static route cont.

The output of the **show ip route** command lists a few new and interesting facts. First, it lists the route with a code of S, meaning static, but also with a *****, meaning it is a ***candidate default route***. A router can learn about more than one default route, and the router then has to choose which one to use; the * means that it is at least a candidate to become the default route. Just above, the "Gateway of Last Resort" refers to the chosen default route, which in this case is the just-configured static route with outgoing interface Fa0/0.

Packet tracer example…

```
R2# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0
```

Static Route Troubleshooting techniques

When you see an exam question that has static routes, and you see them in the output of **show ip route**, remember to check on these items:

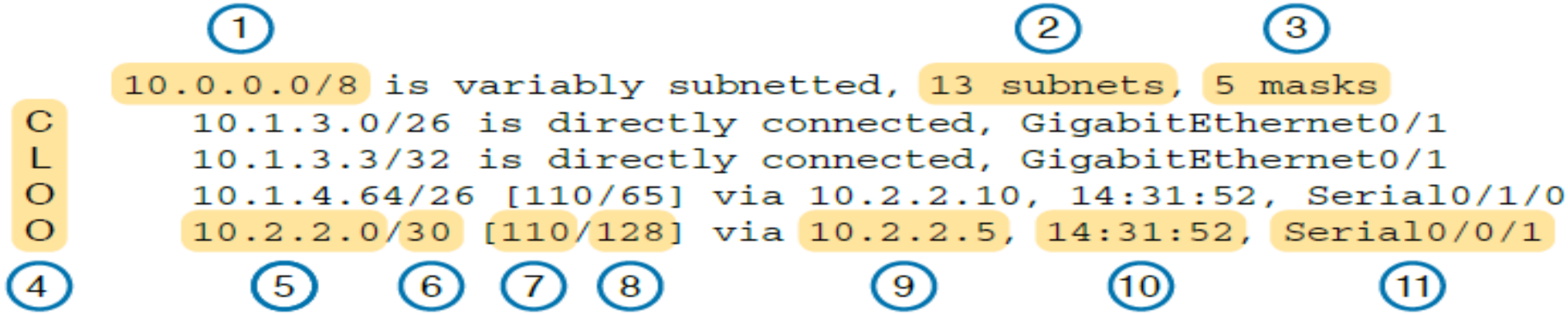
- Is there a subnetting math error in the subnet ID and mask?
- Is the next-hop IP address correct and referencing an IP address on a neighboring router?
- Does the next-hop IP address identify the correct router?
- Is the outgoing interface correct, and referencing an interface on the local router (that is, the same router where the static route is configured)?

You can configure a static route so that IOS ignores these basic checks, always putting the IP route in the routing table. To do so, just use the **permanent** keyword on the **ip route** command.

```
ip route 172.16.2.0 255.255.255.0 S0/0/0 permanent
ip route 172.16.3.0 255.255.255.0 172.16.5.3 permanent
```

Interpreting the IP Routing Table

show ip route command output reference.



1. Classful Network.
2. Number of Subnets.
3. Number of Masks.
4. Legend code
5. Prefix (Subnet ID)
6. Prefix length(Mask)
7. Administrative distance
8. Metric
9. Next-hop router
10. Timer
11. Outgoing Interface

Interpreting the IP Routing Table

1	Classful network	10.0.0.0/8	The routing table is organized by classful network. This line is the heading line for classful network 10.0.0.0; it lists the default mask for Class A networks (/8).
2	Number of subnets	13 subnets	The number of routes for subnets of the classful network known to this router, from all sources, including local routes—the /32 routes that match each router interface IP address.
3	Number of masks	5 masks	The number of different masks used in all routes known to this router inside this classful network.
4	Legend code	C, L, O	A short code that identifies the source of the routing information. *O* is for OSPF, *D* for EIGRP, *C* for Connected, *S* for static, and *L* for local. (See Example 16-8 for a sample of the legend.)
5	Prefix (Subnet ID)	10.2.2.0	The subnet number of this particular route.
6	Prefix length (Mask)	/30	The prefix mask used with this subnet.
7	Administrative distance	110	If a router learns routes for the listed subnet from more than one source of routing information, the router uses the source with the lowest administrative distance (AD).
8	Metric	128	The metric for this route.
9	Next-hop router	10.2.2.5	For packets matching this route, the IP address of the next router to which the packet should be forwarded.
10	Timer	14:31:52	For OSPF and EIGRP routes, this is the time since the route was first learned.
11	Outgoing interface	Serial0/0/1	For packets matching this route, the interface out which the packet should be forwarded.

That is all for Lesson 16

The key is :

Learn

Repeat

Practice

You will be able to reach your goals.

GOOD LUCK !!!!!...