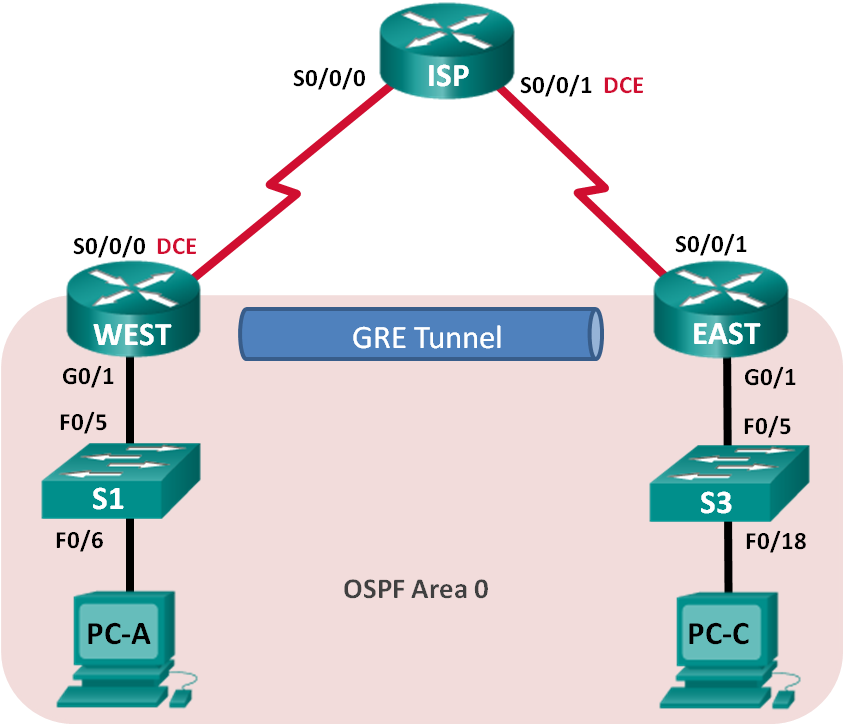
Lab – Configuring a Point-to-Point GRE VPN Tunnel

1. Topology



1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| WEST | G0/1 | 172.16.1.1 | 255.255.255.0 | N/A |
|  | S0/0/0 (DCE) | 10.1.1.1 | 255.255.255.252 | N/A |
|  | Tunnel0 | 172.16.12.1 | 255.255.255.252 | N/A |
| ISP | S0/0/0 | 10.1.1.2 | 255.255.255.252 | N/A |
|  | S0/0/1 (DCE) | 10.2.2.2 | 255.255.255.252 | N/A |
| EAST | G0/1 | 172.16.2.1 | 255.255.255.0 | N/A |
|  | S0/0/1 | 10.2.2.1 | 255.255.255.252 | N/A |
|  | Tunnel0 | 172.16.12.2 | 255.255.255.252 | N/A |
| PC-A | NIC | 172.16.1.3 | 255.255.255.0 | 172.16.1.1 |
| PC-C | NIC | 172.16.2.3 | 255.255.255.0 | 172.16.2.1 |

1. Objectives

Part 1: Configure Basic Device Settings

Part 2: Configure a GRE Tunnel

Part 3: Enable Routing over the GRE Tunnel

1. Background / Scenario

Generic Routing Encapsulation (GRE) is a tunneling protocol that can encapsulate a variety of network layer protocols between two locations over a public network, such as the Internet.

GRE can be used with:

* 1. Connecting IPv6 networks over IPv4 networks
  2. Multicast packets, such as OSPF, EIGRP, and streaming applications

In this lab, you will configure an unencrypted point-to-point GRE VPN tunnel and verify that network traffic is using the tunnel. You will also configure the OSPF routing protocol inside the GRE VPN tunnel. The GRE tunnel is between the WEST and EAST routers in OSPF area 0. The ISP has no knowledge of the GRE tunnel. Communication between the WEST and EAST routers and the ISP is accomplished using default static routes.

**Note**: The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

**Note**: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

1. Required Resources

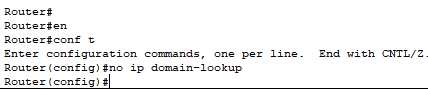
* 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
* 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
* 2 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term)
* Console cables to configure the Cisco IOS devices via the console ports
* Ethernet and serial cables as shown in the topology

1. Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic router settings, such as the interface IP addresses, routing, device access, and passwords.

* 1. Cable the network as shown in the topology.
  2. Initialize and reload the routers and switches.
  3. Configure basic settings for each router.
     1. Disable DNS lookup.

no ip domain-lookup



* + 1. Configure the device names.







* + 1. Encrypt plain text passwords.

ISP(config)#service password-encryption

* + 1. Create a message of the day (MOTD) banner warning users that unauthorized access is prohibited.

ISP(config)#banner motd $ Unauthorized access is prohibited $

* + 1. Assign **class** as the encrypted privileged EXEC mode password.

ISP(config)#enable password class

* + 1. Assign **cisco** as the console and vty password and enable login.

ISP(config)#line vty 0 15

ISP(config-line)#password cisco

ISP(config-line)#login

ISP(config-line)#exit

* + 1. Set console logging to synchronous mode.

ISP (config)#line console 0

ISP (config-line)#logging synchronous

* + 1. Apply IP addresses to Serial and Gigabit Ethernet interfaces according to the Addressing Table and activate the physical interfaces. Do NOT configure the Tunnel0 interfaces at this time.

[serial port may differ]

ISP(config)#int s0/1/1

ISP(config-if)#ip add 10.1.1.2 255.255.255.252

ISP(config-if)#no shut

ISP(config-if)#int s0/1/0

ISP(config-if)#ip add 10.2.2.2 255.255.255.252

ISP(config-if)#no shut

WEST(config)#int s0/1/1

WEST(config-if)#ip add 10.1.1.1 255.255.255.252

WEST(config)#no shut

WEST(config-if)#int g0/0/1

WEST(config-if)#ip add 172.16.1.1 255.255.255.0

WEST(config)#no shut

EAST(config)#int s0/1/0

EAST(config-if)#ip add 10.2.2.1 255.255.255.252

EAST(config)#no shut

EAST(config-if)#int g0/0/1

EAST(config-if)#ip add 172.16.2.1 255.255.255.0

EAST(config)#no shut

* + 1. Set the clock rate to **128000** for DCE serial interfaces.

ISP(config)#int s0/1/0

ISP(config-if)#clock rate 128000

WEST(config)#int s0/1/1

WEST(config)#clock rate 128000

* 1. Configure default routes to the ISP router.

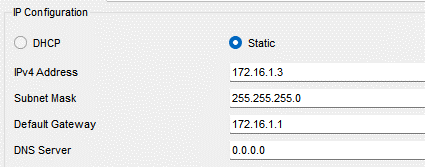
WEST(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.2

EAST(config)# ip route 0.0.0.0 0.0.0.0 10.2.2.2

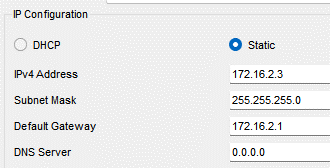
* 1. Configure the PCs.

Assign IP addresses and default gateways to the PCs according to the Addressing Table.

PC-A



PC-C

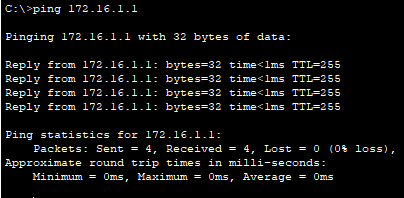


* 1. Verify connectivity.

At this point, the PCs are unable to ping each other. Each PC should be able to ping its default gateway. The routers are able to ping the serial interfaces of the other routers in the topology. If not, troubleshoot until you can verify connectivity.

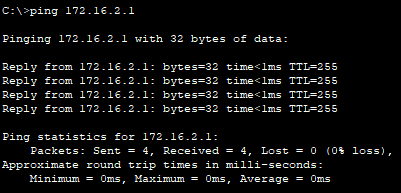
PC-A

ping 172.16.1.1



PC-C

ping 172.16.2.1



* 1. Save your running configuration.

ISP#copy running-config startup-config

EAST#copy running-config startup-config

WEST#copy running-config startup-config

1. Configure a GRE Tunnel

In Part 2, you will configure a GRE tunnel between the WEST and EAST routers.

* 1. Configure the GRE tunnel interface.
     1. Configure the tunnel interface on the WEST router. Use S0/0/0 on WEST as the tunnel source interface and 10.2.2.1 as the tunnel destination on the EAST router.

WEST(config)# interface tunnel 0

WEST(config-if)# ip address 172.16.12.1 255.255.255.252

WEST(config-if)# tunnel source s0/1/1

WEST(config-if)# tunnel destination 10.2.2.1

* + 1. Configure the tunnel interface on the EAST router. Use S0/0/1 on EAST as the tunnel source interface and 10.1.1.1 as the tunnel destination on the WEST router.

EAST(config)# interface tunnel 0

EAST(config-if)# ip address 172.16.12.2 255.255.255.252

EAST(config-if)# tunnel source s0/1/0

EAST(config-if)# tunnel destination 10.1.1.1

**Note**: For the **tunnel source** command, either the interface name or the IP address can be used as the source.

* 1. Verify that the GRE tunnel is functional.
     1. Verify the status of the tunnel interface on the WEST and EAST routers.

WEST# **show ip interface brief**

Interface IP-Address OK? Method Status Protocol

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 unassigned YES unset administratively down down

GigabitEthernet0/1 172.16.1.1 YES manual up up

Serial0/0/0 10.1.1.1 YES manual up up

Serial0/0/1 unassigned YES unset administratively down down

Tunnel0 172.16.12.1 YES manual up up

EAST# **show ip interface brief**

Interface IP-Address OK? Method Status Protocol

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 unassigned YES unset administratively down down

GigabitEthernet0/1 172.16.2.1 YES manual up up

Serial0/0/0 unassigned YES unset administratively down down

Serial0/0/1 10.2.2.1 YES manual up up

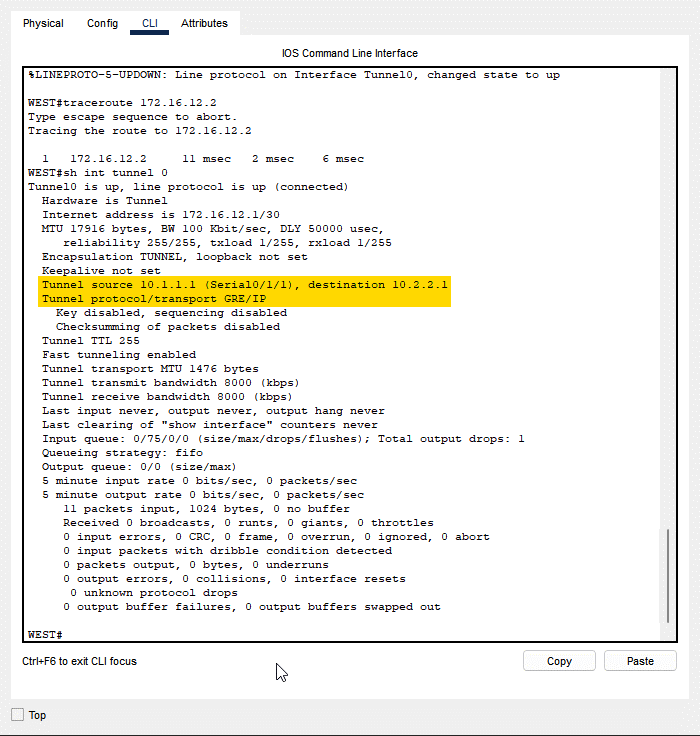
Tunnel0 172.16.12.2 YES manual up up

* + 1. Issue the **show interfaces tunnel 0** command to verify the tunneling protocol, tunnel source, and tunnel destination used in this tunnel.

What is the tunneling protocol used? What are the tunnel source and destination IP addresses associated with GRE tunnel on each router?

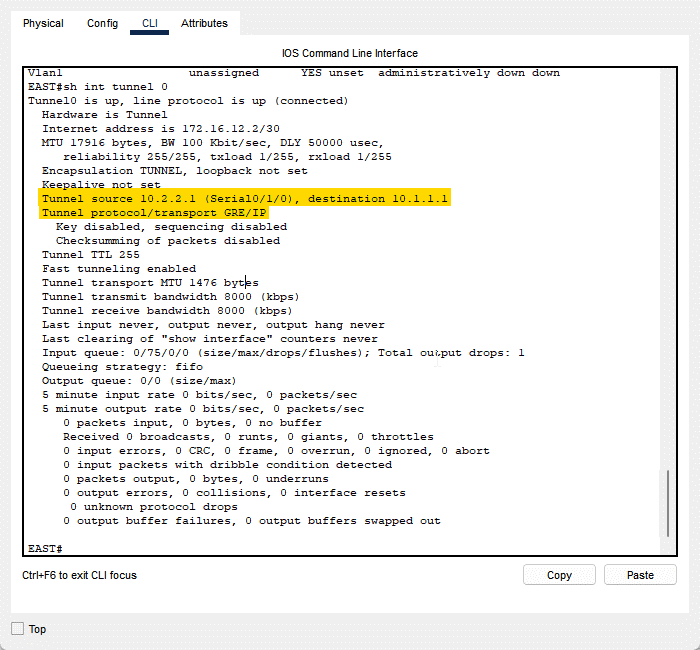
WEST

GRE tunnel protocol, Tunnel source 10.1.1.1 (Serial0/1/1), destination 10.2.2.1



EAST

GRE tunnel protocol, Tunnel source 10.2.2.1 (Serial0/1/0), destination 10.1.1.1



* + 1. Ping across the tunnel from the WEST router to the EAST router using the IP address of the tunnel interface.

WEST# **ping 172.16.12.2**

Type escape sequence to abort.

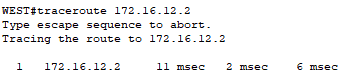
Sending 5, 100-byte ICMP Echos to 172.16.12.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 32/34/36 ms

* + 1. Use the **traceroute** command on the WEST to determine the path to the tunnel interface on the EAST router. What is the path to the EAST router?

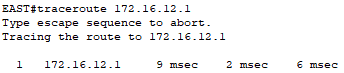
Direct path (172.16.12.1 to 172.16.12.2)



* + 1. Ping and trace the route across the tunnel from the EAST router to the WEST router using the IP address of the tunnel interface.

What is the path to the WEST router from the EAST router?

Direct path (172.16.12.2 to 172.16.12.1)



With which interfaces are these IP addresses associated? Why?

The tunnel0 interfaces on both WEST and EAST routers. The traffic is using the tunnel.

* + 1. The **ping** and **traceroute** commands should be successful. If not, troubleshoot before continuing to the next part.

1. Enable Routing over the GRE Tunnel

In Part 3, you will configure OSPF routing so that the LANs on the WEST and EAST routers can communicate using the GRE tunnel.

After the GRE tunnel is set up, the routing protocol can be implemented. For GRE tunneling, a network statement will include the IP network of the tunnel, instead of the network associated with the serial interface. just like you would with other interfaces, such as Serial and Ethernet. Remember that the ISP router is not participating in this routing process.

* 1. Configure OSPF routing for area 0 over the tunnel.
     1. Configure OSPF process ID 1 using area 0 on the WEST router for the 172.16.1.0/24 and 172.16.12.0/24 networks.

WEST(config)# **router ospf 1**

WEST(config-router)# **network 172.16.1.0 0.0.0.255 area 0**

WEST(config-router)# **network 172.16.12.0 0.0.0.3 area 0**

* + 1. Configure OSPF process ID 1 using area 0 on the EAST router for the 172.16.2.0/24 and 172.16.12.0/24 networks.

EAST(config)# **router ospf 1**

EAST(config-router)# **network 172.16.2.0 0.0.0.255 area 0**

EAST(config-router)# **network 172.16.12.0 0.0.0.3 area 0**

* 1. Verify OSPF routing.
     1. From the WEST router, issue the **show ip route** command to verify the route to 172.16.2.0/24 LAN on the EAST router.

WEST# **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 10.1.1.2 to network 0.0.0.0

S\* 0.0.0.0/0 [1/0] via 10.1.1.2

10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 10.1.1.0/30 is directly connected, Serial0/0/0

L 10.1.1.1/32 is directly connected, Serial0/0/0

172.16.0.0/16 is variably subnetted, 5 subnets, 3 masks

C 172.16.1.0/24 is directly connected, GigabitEthernet0/1

L 172.16.1.1/32 is directly connected, GigabitEthernet0/1

O 172.16.2.0/24 [110/1001] via 172.16.12.2, 00:00:07, Tunnel0

C 172.16.12.0/30 is directly connected, Tunnel0

L 172.16.12.1/32 is directly connected, Tunnel0

What is the exit interface and IP address to reach the 172.16.2.0/24 network?

The tunnel 0 interface with an IP address of 172.16.12.2 is used to reach 172.16.2.0/24.

* + 1. From the EAST router issue the command to verify the route to 172.16.1.0/24 LAN on the WEST router.

What is the exit interface and IP address to reach the 172.16.1.0/24 network?

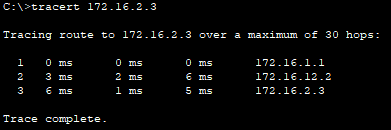
The tunnel 0 interface with an IP address of 172.16.12.1 is used to reach 172.16.1.0/24.

* 1. Verify end-to-end connectivity.
     1. Ping from PC-A to PC-C. It should be successful. If not, troubleshoot until you have end-to-end connectivity.

**Note**: It may be necessary to disable the PC firewall to ping between PCs.

* + 1. Traceroute from PC-A to PC-C. What is the path from PC-A to PC-C?

172.16.1.1 > 172.16.12.2(Tunnel interface on the EAST router)> 172.16.2.3



1. Reflection
   1. What other configurations are needed to create a secured GRE tunnel?

IPsec can be configured to encrypt the data for a secured GRE tunnel.

* 1. If you added more LANs to the WEST or EAST router, what would you need to do so that the network will use the GRE tunnel for traffic?

The new networks would need to be added to the same routing protocols as the tunnel interface.

1. Router Interface Summary Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Router Interface Summary | | | | |
| Router Model | Ethernet Interface #1 | Ethernet Interface #2 | Serial Interface #1 | Serial Interface #2 |
| 1800 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 1900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2801 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |
| 2811 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| **Note**: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface. | | | | |