Lab Task 1: Design an IP Address Scheme

1. The network 172.16.10.0/24 was divided into eight subnets, as outlined below:
2. The value of the new subnet mask is 255.255.255.224.
3. 30 usable hosts exist per subnet.
4.

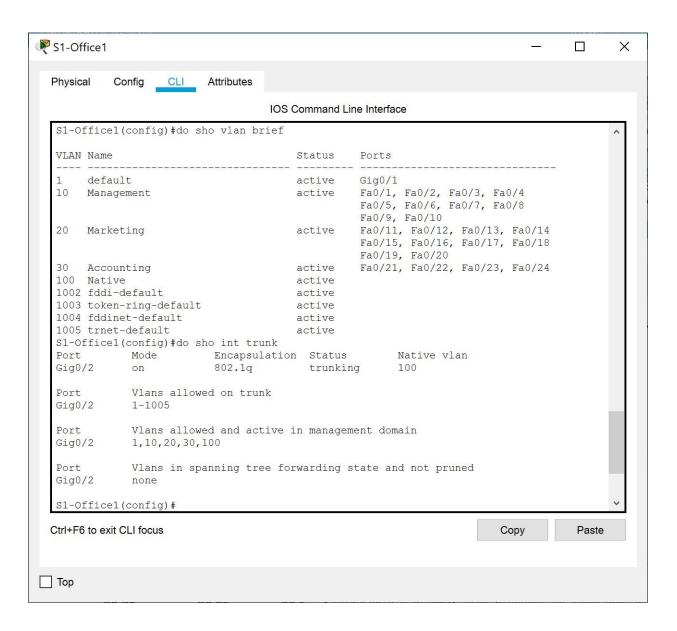| Subnet Number	Network Address	Usable Host Address Range	Broadcast Address
1	172.16.10.0	172.16.10.1 - 172.16.10.30	172.16.10.31
2	172.16.10.32	172.16.10.33 - 172.16.10.62	172.16.10.63
3	172.16.10.64	172.16.10.65 - 172.16.10.94	172.16.10.95
4	172.16.10.96	172.16.10.97 - 172.16.10.126	172.16.10.127
5	172.16.10.128	172.16.10.129 - 172.16.10.158	172.16.10.159
6	172.16.10.160	172.16.10.161 - 172.16.10.190	172.16.10.191
7	172.16.10.192	172.16.10.193 - 172.16.10.222	172.16.10.223
8	172.16.10.224	172.16.10.225 - 172.16.10.254	172.16.10.255

Lab Task 2: Implement VLANs and Trunk

(Listed commands were executed on S1-Office1 and S2-Office1.)

1. en
   conf t
   vlan 10
   name Management
   exit
   vlan 20
   name Marketing
   exit
   vlan 30
   name Accounting
   exit
   vlan 100
   name Native
   exit

2. int range fa0/1-10
   switchport mode access
   switchport access vlan 10
   exit
   int range fa0/11-20
   switchport mode access
   switchport access vlan 20
   exit
   int range fa0/21-24
   switchport mode access
   switchport access vlan 30
   exit

3.
   a. *On S1-Office1:*
      int gi0/2
      switchport mode trunk
      switchport trunk native vlan 100
      exit
      do sho vlan brief
      do sho int trunk
   b. *On S2-Office1:*
      int gi0/1

```
        switchport mode trunk
        switchport trunk native vlan 100
        exit
        do sho vlan brief
        do sho int trunk


   4. int range fa0/1-24
      switchport nonegotiate
      exit
      do wr
```

S1-Office1 — □ ✕

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
S1-Office1(config)#do sho vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig0/1
10   Management                       active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10
20   Marketing                        active    Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20
30   Accounting                       active    Fa0/21, Fa0/22, Fa0/23, Fa0/24
100  Native                           active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
S1-Office1(config)#do sho int trunk
Port       Mode         Encapsulation  Status      Native vlan
Gig0/2     on           802.1q         trunking    100

Port       Vlans allowed on trunk
Gig0/2     1-1005

Port       Vlans allowed and active in management domain
Gig0/2     1,10,20,30,100

Port       Vlans in spanning tree forwarding state and not pruned
Gig0/2     none

S1-Office1(config)#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

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S2-Office1

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
S2-Office1(config)#do sho vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig0/2
10   Management                       active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10
20   Marketing                        active    Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20
30   Accounting                       active    Fa0/21, Fa0/22, Fa0/23, Fa0/24
100  Native                           active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
S2-Office1(config)#do sho int trunk
Port        Mode            Encapsulation  Status       Native vlan
Gig0/1      on              802.1q         trunking     100

Port        Vlans allowed on trunk
Gig0/1      1-1005

Port        Vlans allowed and active in management domain
Gig0/1      1,10,20,30,100

Port        Vlans in spanning tree forwarding state and not pruned
Gig0/1      10,20,30
```

Ctrl+F6 to exit CLI focus   Copy   Paste

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Lab Task 3: Assign IP Addresses

1. Address 172.16.10.1 (from subnet 1) was assigned to the R3 / S1-Office3 link.
   On R3:
   ```
   en
   conf t
   int gi0/0
   ip address 172.16.10.1 255.255.255.224
   desc To S1-Office3
   no shut
   exit
   ```

2. Address 172.16.10.33 (from subnet 2) was assigned to the R3 / S1-Office2 link.
   On R3:
   ```
   int gi0/1
   ip address 172.16.10.33 255.255.255.224
   desc To S1-Office2
   no shut
   exit
   ```

3. For the R1 / R2 WAN link, addresses from subnet 3 were used. Address 172.16.10.65 was assigned on the R1 side, and address 172.16.10.66 was assigned on the R2 side.
   On R1:
   ```
   en
   conf t
   int se0/0/1
   ip addr 172.16.10.65 255.255.255.224
   desc To R2
   no shut
   ex
   ```
   On R2:
   ```
   en
   conf t
   int se0/0/1
   ip addr 172.16.10.66 255.255.255.224
   desc To R1
   no shut
   ex
   ```

4. For the R1 / R3 WAN link, addresses from subnet 4 were used. Address 172.16.10.97 was assigned on the R1 side, and address 172.16.10.98 was assigned on the R3 side.
   On R1:

```
int se0/0/0
ip addr 172.16.10.97 255.255.255.224
desc To R3
no shut
ex
do wr
```
On R3:
```
int se0/0/0
ip addr 172.16.10.98 255.255.255.224
desc To R1
no shut
ex
```

5. For the R2 / R3 WAN link, addresses from subnet 5 were used. Address 172.16.10.129 was assigned on the R2 side, and address 172.16.10.130 was assigned on the R3 side.
On R2:
```
int se0/0/0
ip addr 172.16.10.129 255.255.255.224
desc To R3
no shut
ex
do wr
```
On R3:
```
int se0/0/1
ip addr 172.16.10.130 255.255.255.224
desc To R2
no shut
ex
do wr
```

6. The last usable addresses on subnet 6 were assigned to end devices on VLAN 10 on the Office 1 LAN. The first usable address in subnet 6, 172.16.10.161, was set as the default gateway.
   a. CEO1: 172.16.10.189
   b. CEO2: 172.16.10.190

7. The last usable addresses on subnet 7 were assigned to end devices on VLAN 20 on the Office 1 LAN. The first usable address in subnet 7, 172.16.10.193, was set as the default gateway.
   a. Copywriter1: 172.16.10.221
   b. Copywriter2: 172.16.10.222

8. The last usable addresses on subnet 8 were assigned to end devices on VLAN 30 on the Office 1 LAN. The first usable address in subnet 8, 172.16.10.225, was set as the default gateway.
    a. Dialer1: 172.16.10.253
    b. Dialer2: 172.16.10.254

9. IP addresses were assigned to end devices in Offices 2 and 3:
    a. The last usable addresses on subnet 2 were assigned to end devices on the Office 2 LAN. The first usable address in subnet 2, 172.16.10.33, was set as the default gateway.
        i. Employee 1: 172.16.10.60
        ii. Employee 2: 172.16.10.61
        iii. Guest: 172.16.10.62
    b. The last usable addresses on subnet 1 were assigned to end devices on the Office 3 LAN. The first usable address in subnet 1, 172.16.10.1, was set as the default gateway (as configured in step 1).
        i. Email Server: 172.16.10.28
        ii. Syslog / NTP Server: 172.16.10.29
        iii. Admin: 172.16.10.30

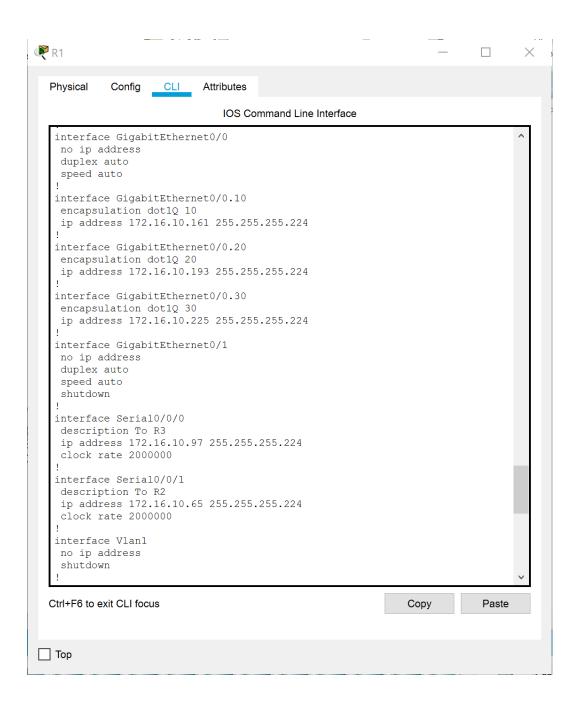| IP Address Usage Summary	
Subnet	Use
1	Office 3 LAN
2	Office 2 LAN
3	R1 / R2 WAN link
4	R1 / R3 WAN link
5	R2 / R3 WAN link
6	VLAN 10 (Management)
7	VLAN 20 (Marketing)
8	VLAN 30 (Accounting)

Lab Task 4: Configure R1 for Inter-VLAN Routing

(Listed commands were executed on R1, unless otherwise stated.)

1. ```
   en
   conf t
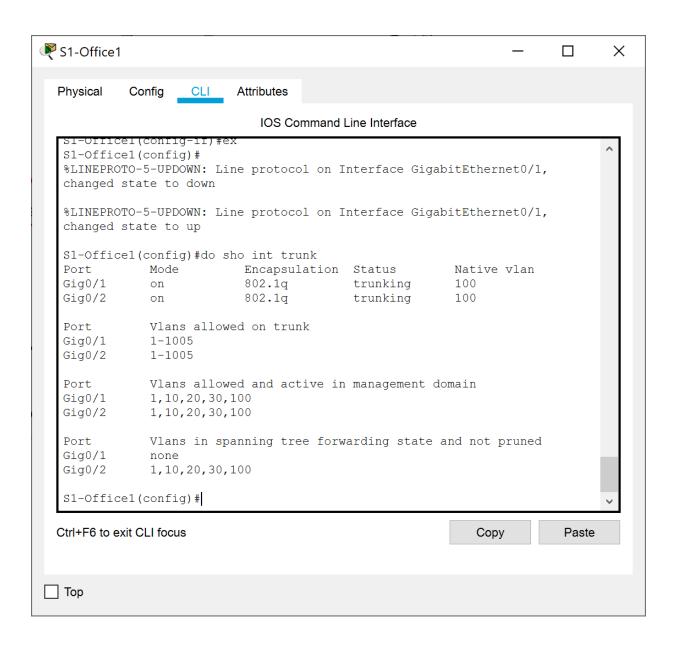   int gi0/0
   no shut
   ex
   ```

2. *(The commands below cover lab steps 2 through 4)*
   ```
   int gi0/0.10
   encapsulation dot1q 10
   ip addr 172.16.10.161 255.255.255.224
   ex
   int gi0/0.20
   encapsulation dot1q 20
   ip addr 172.16.10.193 255.255.255.224
   ex
   int gi0/0.30
   encapsulation dot1q 30
   ip addr 172.16.10.225 255.255.255.224
   ex
   ```

5. ```
   do sho run
   ```

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
interface GigabitEthernet0/0
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/0.10
 encapsulation dot1Q 10
 ip address 172.16.10.161 255.255.255.224
!
interface GigabitEthernet0/0.20
 encapsulation dot1Q 20
 ip address 172.16.10.193 255.255.255.224
!
interface GigabitEthernet0/0.30
 encapsulation dot1Q 30
 ip address 172.16.10.225 255.255.255.224
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 description To R3
 ip address 172.16.10.97 255.255.255.224
 clock rate 2000000
!
interface Serial0/0/1
 description To R2
 ip address 172.16.10.65 255.255.255.224
 clock rate 2000000
!
interface Vlan1
 no ip address
 shutdown
!
```

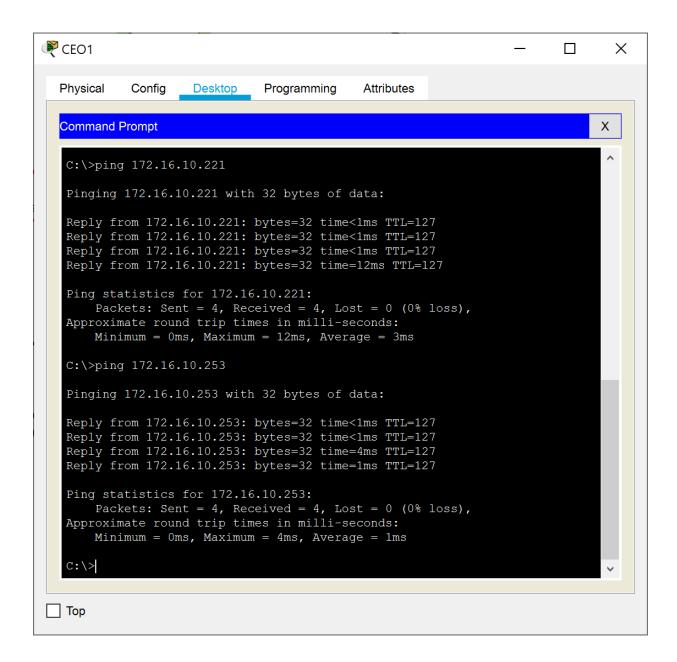Ctrl+F6 to exit CLI focus   Copy   Paste

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6. *On S1-Office1:*
```
en
conf t
int gi0/1
switchport mode trunk
switchport trunk native vlan 100
no shut
ex
```

7. *On S1-Office1:* `do sho int trunk`

8. I was able to successfully ping Copywriter1 and Dialer1 from the CEO1 PC.
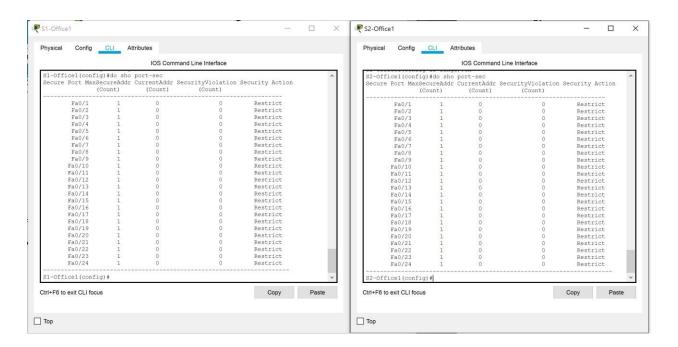
S1-Office1 — □ ✕

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
S1-Office1(config-if)#ex
S1-Office1(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up

S1-Office1(config)#do sho int trunk
Port        Mode          Encapsulation  Status        Native vlan
Gig0/1      on            802.1q         trunking      100
Gig0/2      on            802.1q         trunking      100

Port        Vlans allowed on trunk
Gig0/1      1-1005
Gig0/2      1-1005

Port        Vlans allowed and active in management domain
Gig0/1      1,10,20,30,100
Gig0/2      1,10,20,30,100

Port        Vlans in spanning tree forwarding state and not pruned
Gig0/1      none
Gig0/2      1,10,20,30,100

S1-Office1(config)#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

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CEO1

Physical   Config   **Desktop**   Programming   Attributes

Command Prompt   X

```
C:\>ping 172.16.10.221

Pinging 172.16.10.221 with 32 bytes of data:

Reply from 172.16.10.221: bytes=32 time<1ms TTL=127
Reply from 172.16.10.221: bytes=32 time<1ms TTL=127
Reply from 172.16.10.221: bytes=32 time<1ms TTL=127
Reply from 172.16.10.221: bytes=32 time=12ms TTL=127

Ping statistics for 172.16.10.221:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 3ms

C:\>ping 172.16.10.253

Pinging 172.16.10.253 with 32 bytes of data:

Reply from 172.16.10.253: bytes=32 time<1ms TTL=127
Reply from 172.16.10.253: bytes=32 time<1ms TTL=127
Reply from 172.16.10.253: bytes=32 time=4ms TTL=127
Reply from 172.16.10.253: bytes=32 time=1ms TTL=127

Ping statistics for 172.16.10.253:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\>
```

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Lab Task 5: Secure Switch Physical Ports

(Listed commands were executed on both S1-Office1 and S2-Office1, unless otherwise stated)

1. en
   conf t
   int range fa0/1-24
   switchport port-security
   switchport port-security violation restrict

2. switchport port-security mac-address sticky
   switchport port-security maximum 1
   ex

3. do sho port-sec

4. *On S1-Office1:*
   int range fa0/2-10
   shut
   ex
   int range fa0/12-20
   shut
   ex
   int range fa0/22-24
   shut

```
ex
do wr
```
On S2-Office1:
```
int range fa0/2-10
shut
ex
int range fa0/12-20
shut
ex
int range fa0/22-24
shut
ex
int gi0/2
shut
ex
do wr
```

Lab Task 6: Configure OSPF

(Listed commands were executed on R1, R2, and R3, unless otherwise stated)
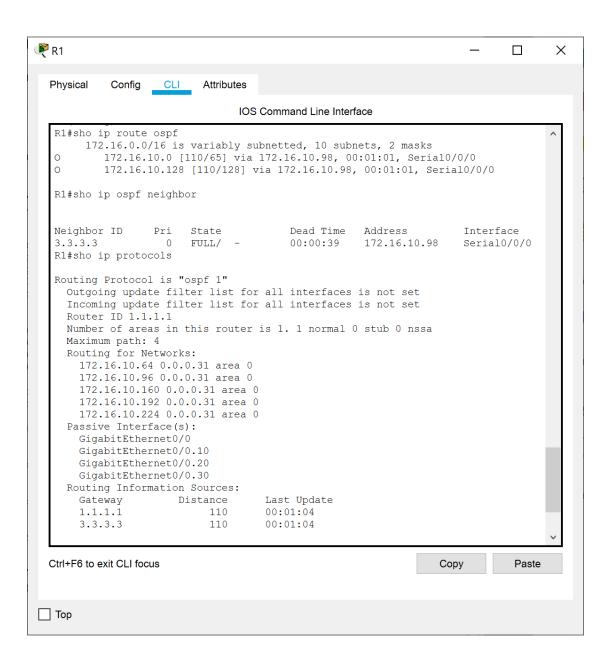
1. en
   conf t
   int se0/0/0
   no shut
   ex
   int se0/0/1
   no shut
   ex

2. *On R3 only:*
   int range gi0/0-1
   no shut
   ex

3. router ospf 1
   auto-cost reference-bandwidth 1000
   On R1:
   router-id 1.1.1.1
   network 172.16.10.64 0.0.0.31 area 0
   network 172.16.10.96 0.0.0.31 area 0
   network 172.16.10.160 0.0.0.31 area 0
   network 172.16.10.192 0.0.0.31 area 0
   network 172.16.10.224 0.0.0.31 area 0
   On R2:
   router-id 2.2.2.2
   network 172.16.10.64 0.0.0.31 area 0
   network 172.16.10.128 0.0.0.31 area 0
   On R3:
   router-id 3.3.3.3
   network 172.16.10.96 0.0.0.31 area 0
   network 172.16.10.128 0.0.0.31 area 0
   network 172.16.10.32 0.0.0.31 area 0
   network 172.16.10.0 0.0.0.31 area 0

4. *On R1:*
   passive-int gi0/0
   passive-int gi0/0.10
   passive-int gi0/0.20
   passive-int gi0/0.30

On R3:
```
passive-int gi0/0
passive-int gi0/1
```

5. ex
   ```
   ex
   sho ip route ospf
   sho ip ospf neighbor
   sho ip protocols
   wr
   ```



```
R1#sho ip route ospf
     172.16.0.0/16 is variably subnetted, 10 subnets, 2 masks
O       172.16.10.0 [110/65] via 172.16.10.98, 00:01:01, Serial0/0/0
O       172.16.10.128 [110/128] via 172.16.10.98, 00:01:01, Serial0/0/0

R1#sho ip ospf neighbor


Neighbor ID      Pri    State           Dead Time    Address          Interface
3.3.3.3            0    FULL/  -        00:00:39     172.16.10.98     Serial0/0/0
R1#sho ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    172.16.10.64 0.0.0.31 area 0
    172.16.10.96 0.0.0.31 area 0
    172.16.10.160 0.0.0.31 area 0
    172.16.10.192 0.0.0.31 area 0
    172.16.10.224 0.0.0.31 area 0
  Passive Interface(s):
    GigabitEthernet0/0
    GigabitEthernet0/0.10
    GigabitEthernet0/0.20
    GigabitEthernet0/0.30
  Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1              110      00:01:04
    3.3.3.3              110      00:01:04
```

Lab Task 7: Initial and Security Settings for Network Devices
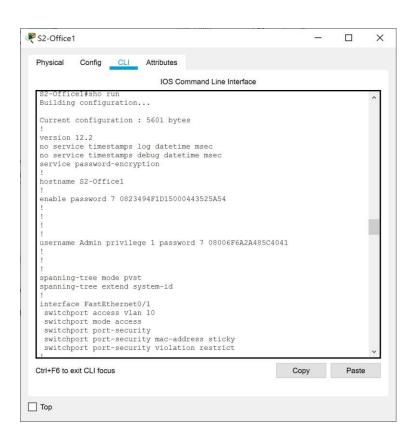
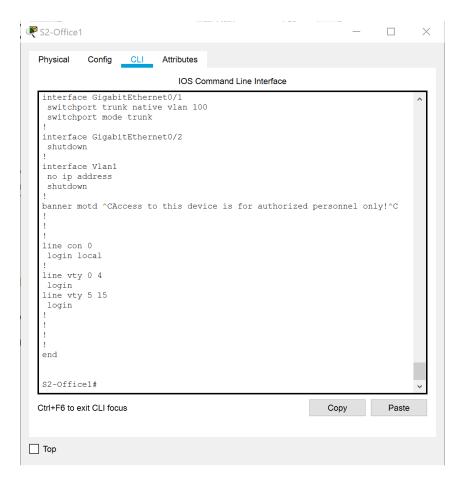*(Listed commands were executed on all routers and switches)*

1. `en`
   `conf t`
   `username Admin password ACDC1973`

2. `line console 0`
   `login local`
   `exit`

3. `enable password beatles1960`

4. `service password-encryption`

5. `banner motd #Access to this device is for authorized personnel`
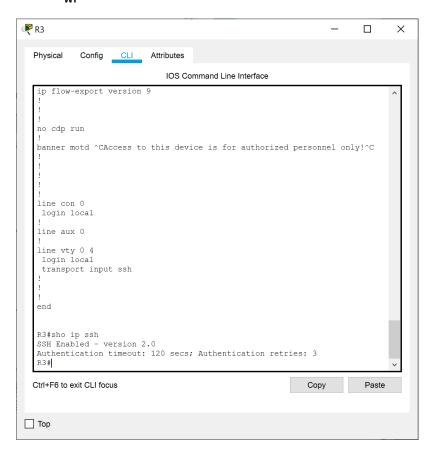   `only!#`
   `ex`
   `wr`
   `ex`

Physical | Config | CLI | Attributes

IOS Command Line Interface

```
interface GigabitEthernet0/1
 switchport trunk native vlan 100
 switchport mode trunk
!
interface GigabitEthernet0/2
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
banner motd ^CAccess to this device is for authorized personnel only!^C
!
!
!
line con 0
 login local
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end

S2-Office1#
```

Ctrl+F6 to exit CLI focus
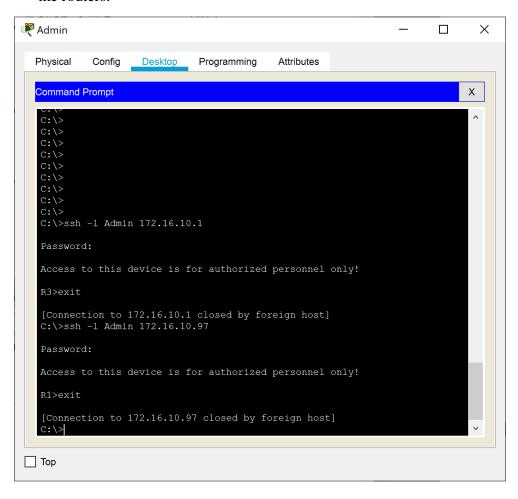
Copy   Paste

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Lab Task 8: Secure Remote Access
(Listed commands were executed on R1, R2, and R3)

1. `ip domain-name Cyber.com`

2. `crypto key generate rsa 2048`

3. `ip ssh version 2`

4. `line vty 0 4`
   `login local`
   `motd-banner`
   `transport input ssh`
   `exit`

5. `ex`
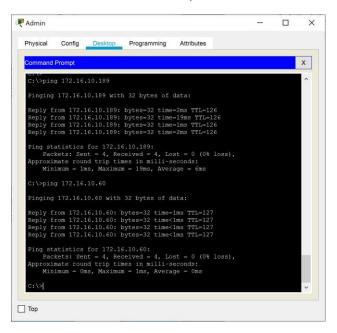   `sho ip ssh`
   `sho run`
   `wr`

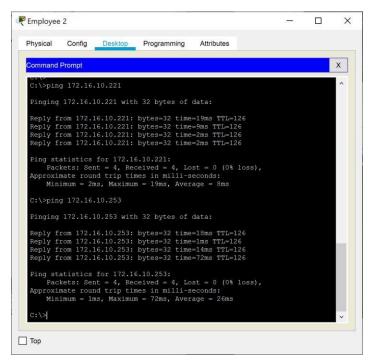6. Using the command `ssh -l Admin` *IP-Address*, I was able to successfully SSH into the routers.

Lab Task 9: Full Connectivity Test

7. The configuration of IP addresses, subnet masks, default gateways, and wildcard masks were verified to be correct on all devices.

8. From the Admin PC, I was able to successfully ping CEO1 and Employee1.

9. From the Employee2 PC, I was able to successfully ping Copywriter1 and Dialer1.

Lab Task 10: Extended ACL

(The below commands were executed on R3.)

1. en
   conf t
   access-list 100 deny ip host 172.16.10.62 host 172.16.10.29
   access-list 100 permit ip any any
   int gi0/1
   ip access-group 100 in
   ex

2. ex
   sho access-lists
   sho run
   wr

3. From the Guest PC, I was able to ping the email server but was not able to ping the NTP server.

```
interface GigabitEthernet0/1
 description To S1-Office2
 ip address 172.16.10.33 255.255.255.224
 ip access-group 100 in
 duplex auto
 speed auto
!
interface Serial0/0/0
 description To R1
 ip address 172.16.10.98 255.255.255.224
!
interface Serial0/0/1
 description To R2
 ip address 172.16.10.130 255.255.255.224
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 router-id 3.3.3.3
 log-adjacency-changes
 passive-interface GigabitEthernet0/0
 passive-interface GigabitEthernet0/1
 auto-cost reference-bandwidth 1000
 network 172.16.10.96 0.0.0.31 area 0
 network 172.16.10.128 0.0.0.31 area 0
 network 172.16.10.32 0.0.0.31 area 0
 network 172.16.10.0 0.0.0.31 area 0
!
ip classless
!
ip flow-export version 9
!
!
access-list 100 deny ip host 172.16.10.62 host 172.16.10.29
access-list 100 permit ip any any
!
no cdp run
!
banner motd ^CAccess to this device is for authorized personnel only!^C
!
!
!
!
!
line con 0
 login local
!
line aux 0
!
line vty 0 4
 login local
 transport input ssh
!
!
!
end


R3#sho access-lists
Extended IP access list 100
    10 deny ip host 172.16.10.62 host 172.16.10.29
    20 permit ip any any
```