PRACTICAL - 1

Configure Cisco Routers for OSPF MD5 Authentication, Syslog and NTP

OSPF, MD5 Authentication

- OSPF is a routing protocol. Two routers speaking OSPF to each other exchange information about the routes they know about and the cost for them to get there.

- When many OSPF routers are part of the same network, information about all of the routes in a network are learned by all of the OSPF routers within that network— technically called an **area**. (We'll talk more about area as we go on).

- Each OSPF router passes along information about the routes and costs they've heard about to all of their adjacent OSPF routers, called **neighbors**.

- OSPF routers rely on **cost** to compute the shortest path through the network between themselves and a remote router or network destination.

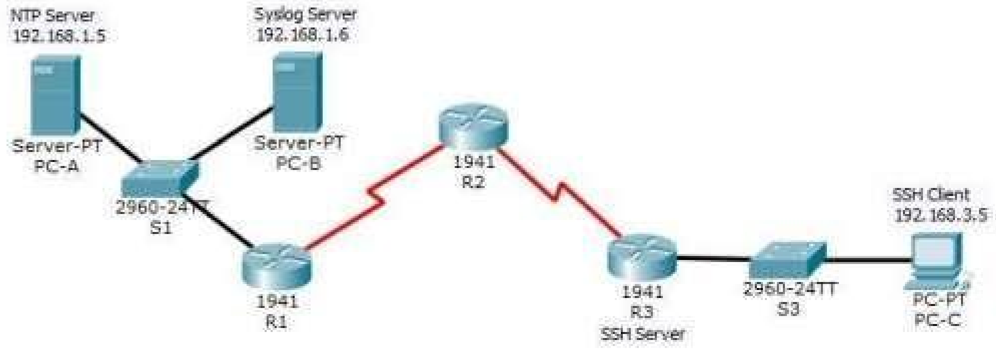
- The shortest path computation is done using Djikstra's algorithm. This algorithm isn't unique to OSPF. Rather, it's a mathematical algorithm that happens to have an obvious application to networking.

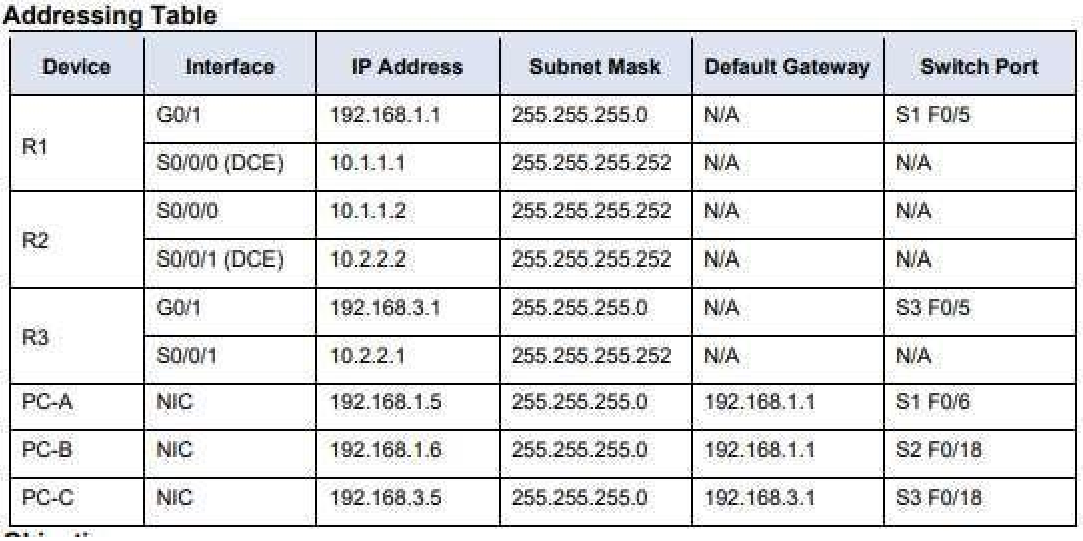
MD5 Authentication

- MD5 authentication provides higher security than plain text authentication.
- This method uses the MD5 algorithm to compute a hash value from the contents of the OSPF packet and a password (or key).
- This hash value is transmitted in the packet, along with a key ID and a non-decreasing sequence number.
- The receiver, which knows the same password, calculates its own hash value.
- If nothing in the message changes, the hash value of the receiver should match the hash value of the sender which is transmitted with the message.
- The key ID allows the routers to reference multiple passwords.

- This makes password migration easier and more secure.
- For example, to migrate from one password to another, configure a password under a different key ID and remove the first key.
- The sequence number prevents replay attacks, in which OSPF packets are captured, modified, and retransmitted to a router.
- As with plain text authentication, MD5 authentication passwords do not have to be the same throughout an area. However, they do need to be the same between neighbors.

Topology



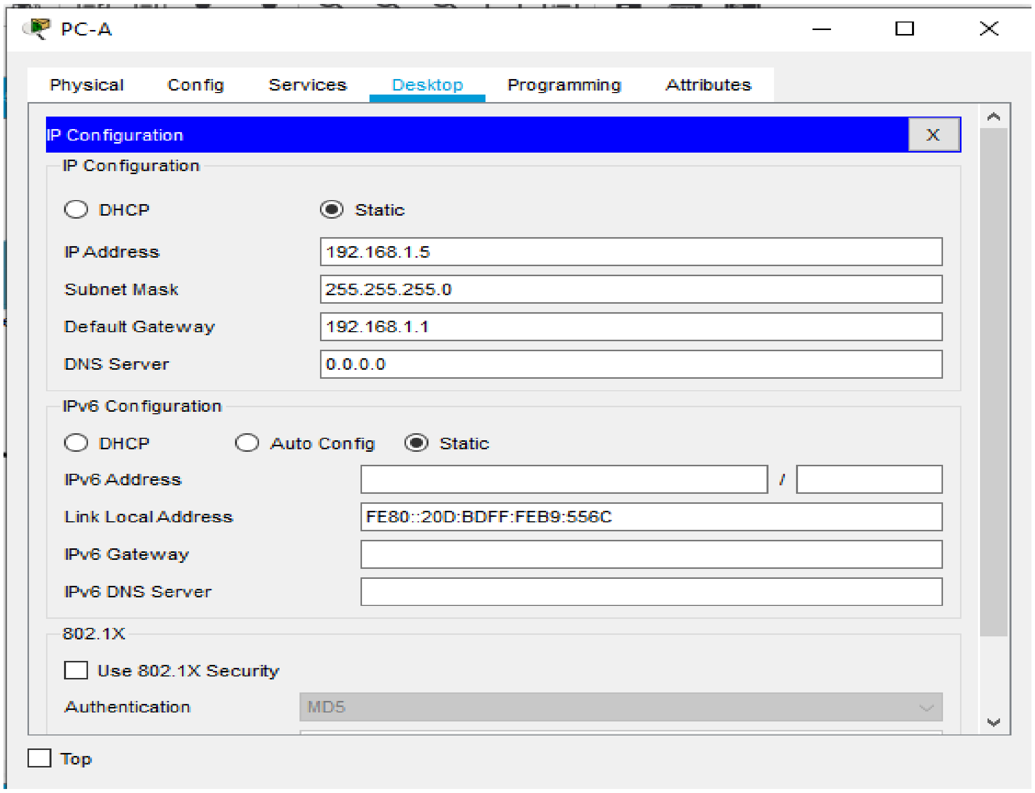


Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway	Switch Port
R1	G0/1	192.168.1.1	255.255.255.0	N/A	S1 F0/5
	S0/0/0 (DCE)	10.1.1.1	255.255.255.252	N/A	N/A
R2	S0/0/0	10.1.1.2	255.255.255.252	N/A	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A	N/A
R3	G0/1	192.168.3.1	255.255.255.0	N/A	S3 F0/5
	S0/0/1	10.2.2.1	255.255.255.252	N/A	N/A
PC-A	NIC	192.168.1.5	255.255.255.0	192.168.1.1	S1 F0/6
PC-B	NIC	192.168.1.6	255.255.255.0	192.168.1.1	S2 F0/18
PC-C	NIC	192.168.3.5	255.255.255.0	192.168.3.1	S3 F0/18

Configuration

PC - A



IP Configuration

○ DHCP ● Static

IP Address	192.168.1.5
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0

IPv6 Configuration

○ DHCP ○ Auto Config ● Static

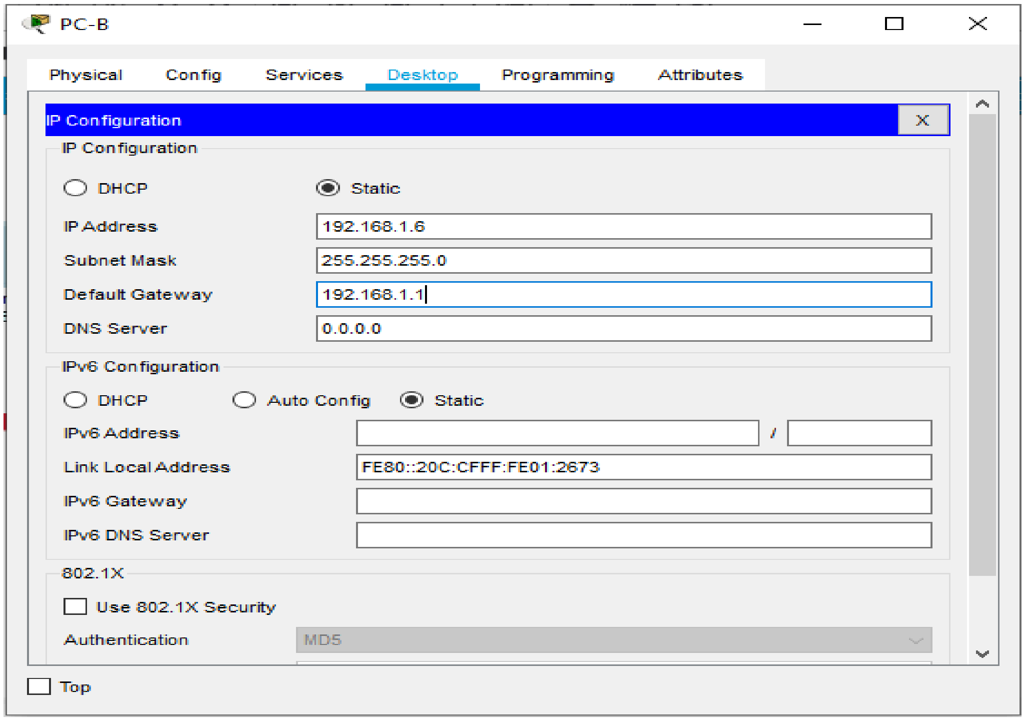
IPv6 Address	/
Link Local Address	FE80::20D:BDFF:FEB9:556C
IPv6 Gateway	
IPv6 DNS Server	

802.1X

□ Use 802.1X Security

Authentication MD5

PC - B



IP Configuration

○ DHCP ● Static

IP Address	192.168.1.6
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0

IPv6 Configuration

○ DHCP ○ Auto Config ● Static

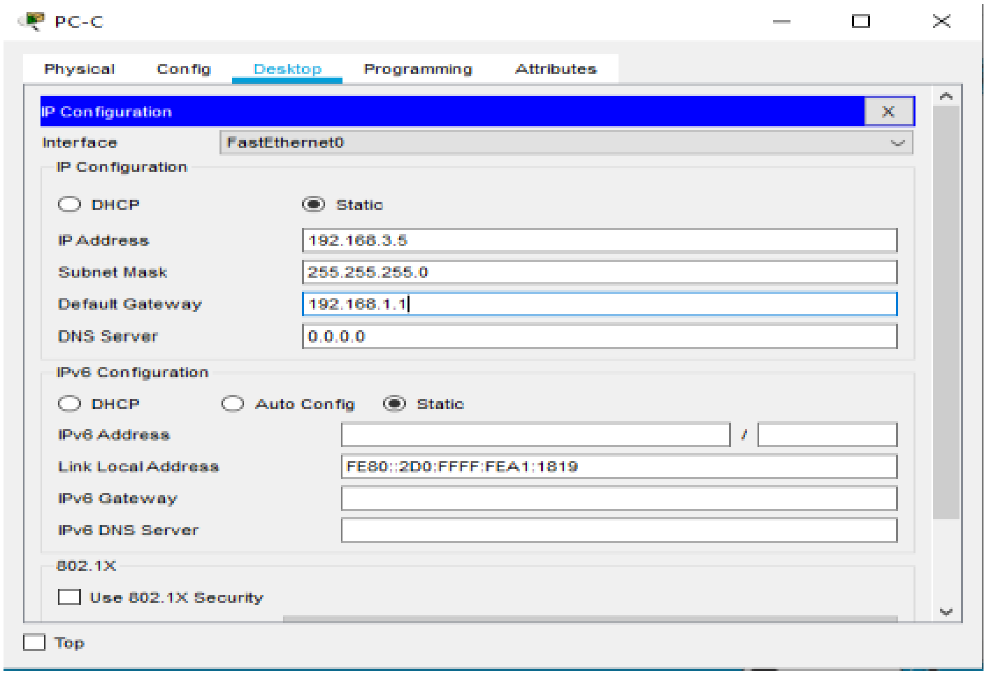
IPv6 Address	/
Link Local Address	FE80::20C:CFFF:FE01:2673
IPv6 Gateway	
IPv6 DNS Server	

802.1X

□ Use 802.1X Security

Authentication MD5

PC - C



Interface: FastEthernet0

IP Configuration

○ DHCP ● Static

IP Address: 192.168.3.5

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 0.0.0.0

IPv6 Configuration

○ DHCP ○ Auto Config ● Static

IPv6 Address: /

Link Local Address: FE80::2D0:FFFF:FEA1:1819

IPv6 Gateway:

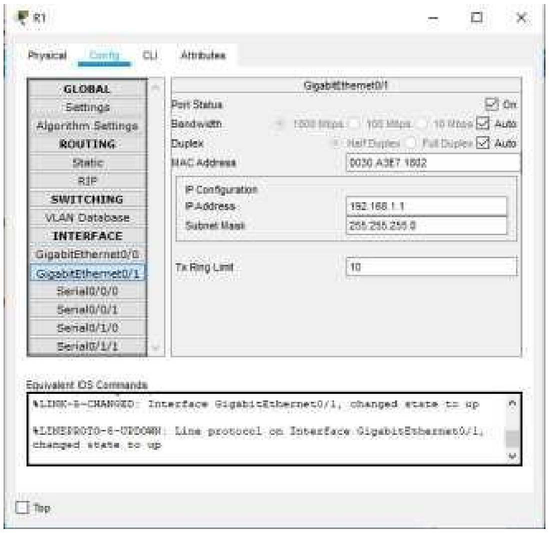
IPv6 DNS Server:

802.1X

□ Use 802.1X Security

□ Top

ROUNTER - 1



GigabitEthernet0/1

Port Status ☑ On

Bandwidth ● 1000 Mbps ○ 100 Mbps ○ 10 Mbps ☑ Auto

Duplex ● Half Duplex ○ Full Duplex ☑ Auto

MAC Address: 0030.A3E7.1802

IP Configuration

IP Address: 192.168.1.1

Subnet Mask: 255.255.255.0

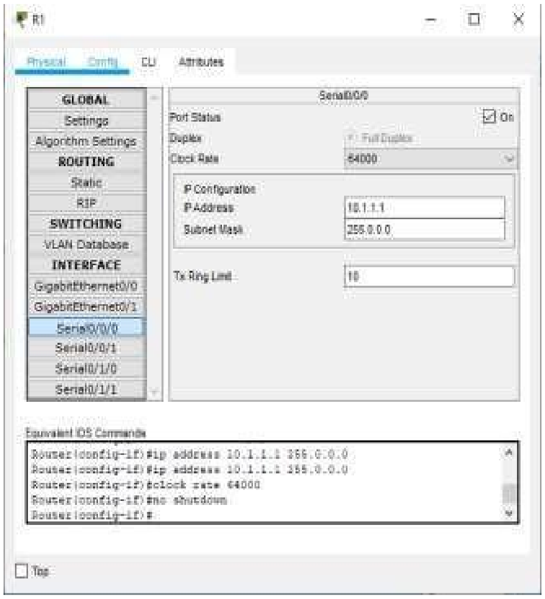
Tx Ring Limit: 10

Equivalent IOS Commands

```
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

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

□ Top



Serial0/0/0

Port Status ☑ On

Duplex ● Full Duplex

Clock Rate: 64000

IP Configuration

IP Address: 10.1.1.1

Subnet Mask: 255.0.0.0

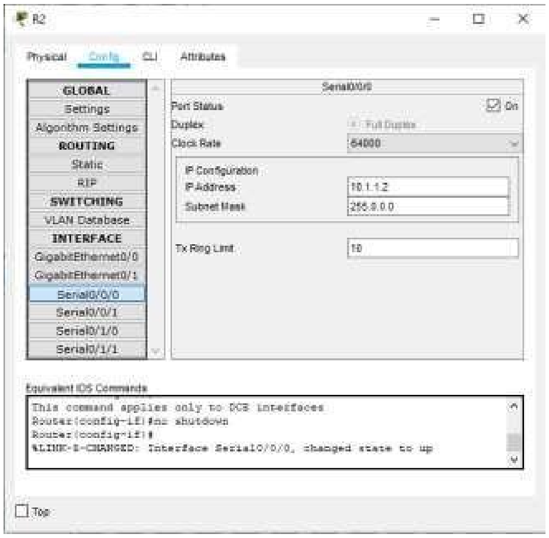
Tx Ring Limit: 10

Equivalent IOS Commands

```
Router(config-if)#ip address 10.1.1.1 255.0.0.0
Router(config-if)#ip address 10.1.1.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
```

□ Top

ROUNTER - 2

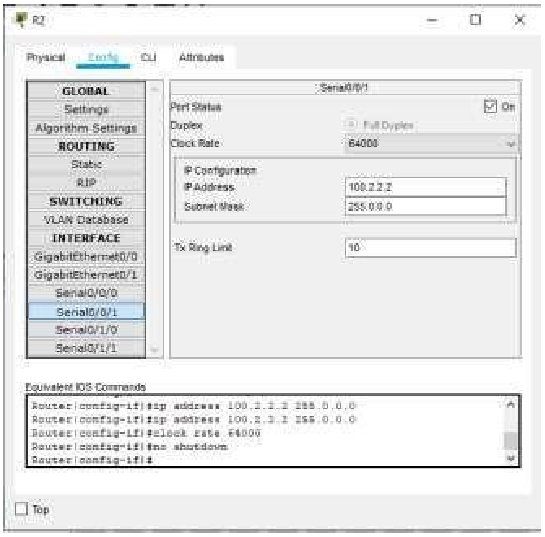


Serial0/0/0

Port Status ☑ On
Duplex ● Full Duplex
Clock Rate 64000
IP Configuration
IP Address 10.1.1.2
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
```



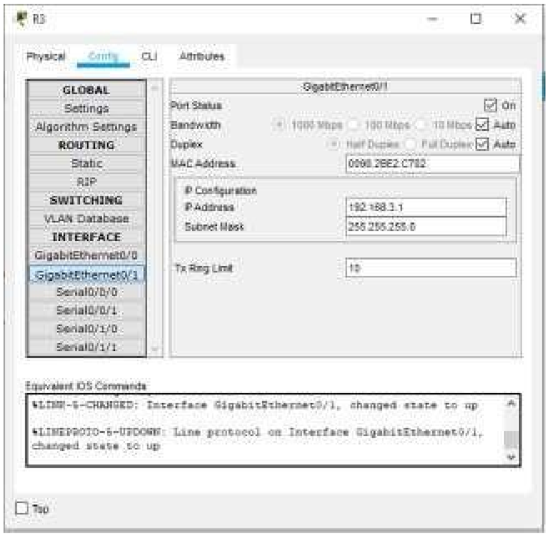
Serial0/0/1

Port Status ☑ On
Duplex ● Full Duplex
Clock Rate 64000
IP Configuration
IP Address 100.2.2.2
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config-if)#ip address 100.2.2.2 255.0.0.0
Router(config-if)#ip address 100.2.2.2 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
```

ROUNTER - 3



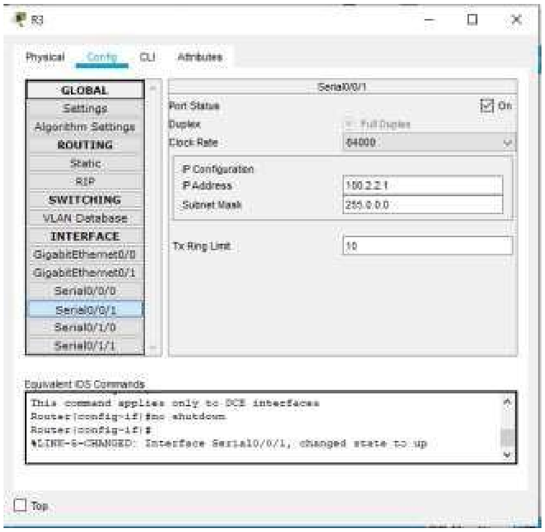
GigabitEthernet0/1

Port Status ☑ On
Bandwidth ● 1000 Mbps ○ 100 Mbps ○ 10 Mbps ☑ Auto
Duplex ● Half Duplex ○ Full Duplex ☑ Auto
MAC Address 0090.2BE2.C782
IP Configuration
IP Address 192.168.3.1
Subnet Mask 255.255.255.0
Tx Ring Limit 10

Equivalent IOS Commands

```
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

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



Serial0/0/1

Port Status ☑ On
Duplex ● Full Duplex
Clock Rate 64000
IP Configuration
IP Address 100.2.2.1
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
```

Part 1: Configure OSPF MD5 Authentication

ROUTER 1: Type the following command in the CLI mode
Router>enable
Router#configure
terminal
Router(config)#router
ospf 1
Router(config-router)#network 192.168.1.0 0.255.255.255 area 1
Router(config-router)#network 10.1.1.0
0.255.255.255 area 1 Router(config-router)#exit
Router(config)#exit

Router#

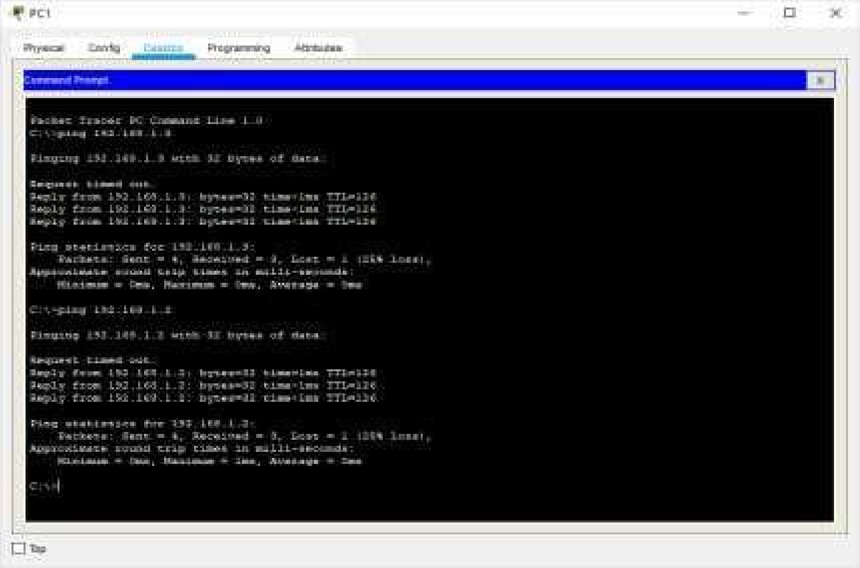
ROUTER 2: Type the following command in the CLI mode

```
Router>enable
Router#configure
terminal
Router(config)#router
ospf 1
Router(config-router)#network 10.1.1.0 0.255.255.255 area 1
Router(config-router)#network 100.2.2.0
0.255.255.255 area 1 Router(config-router)#exit
Router(config)#exit
Router#
```

ROUTER 3: Type the following command in the CLI mode

```
Router>enable
Router#configure
terminal
Router(config)#router
ospf 1
Router(config-router)#network 192.168.3.0 0.255.255.255 area 1
Router(config-router)#network 100.2.2.0
0.255.255.255 area 1 Router(config-router)#exit
Router(config)#exit
Router#
```

Now we verify the connectivity by using the following



```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.3: bytes=32 time<1ms TTL=126
Reply from 192.168.1.3: bytes=32 time<1ms TTL=126
Reply from 192.168.1.3: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.2: bytes=32 time=1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

Hence OSPF has been verified

MD5 Authentication

ROUTER 1: Type the following command in the CLI mode

```
Router>e
nable
Router#
Router#configure terminal
Router(config)#interface
Serial0/0/0
Router(config-if)#ip ospf authentication
message-digest Router(config-if)#ip ospf
message-digest-key 1 md5 smile
Router(config-if)#exit
Router(config)#exit
```

ROUTER 2: Type the following command in the CLI mode

```
Router>e
nable
Router#
Router#configure terminal
Router(config)#interface
Serial0/0/0
Router(config-if)#ip ospf authentication
message-digest Router(config-if)#ip ospf
message-digest-key 1 md5 smile
Router(config-if)#exit
Router(config)#exit
```

Verify the MD5 Authentication using the following command in the CLI mode of Router1

```
Router#show ip ospf interface gigabitEthernet 0/1
```

We get the following output:

```
GigabitEthernet0/1 is up, line protocol
is up Internet address is
192.168.2.1/24, Area 1
Process ID 1, Router ID 192.168.2.1, Network Type BROADCAST,
Cost: 1 Transmit Delay is 1 sec, State BDR, Priority 1
Designated Router (ID) 192.168.3.1, Interface address 192.168.2.2
Backup Designated Router (ID) 192.168.2.1, Interface address
192.168.2.1 Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
```

```
Hello due in 00:00:06
Index 2/2, flood queue
length 0 Next
0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with neighbor 192.168.3.1 (Designated
Router) Suppress hello for 0 neighbor(s)
Message digest authentication enabled
Youngest key id is 1

MD5 Authentication has been verified
```

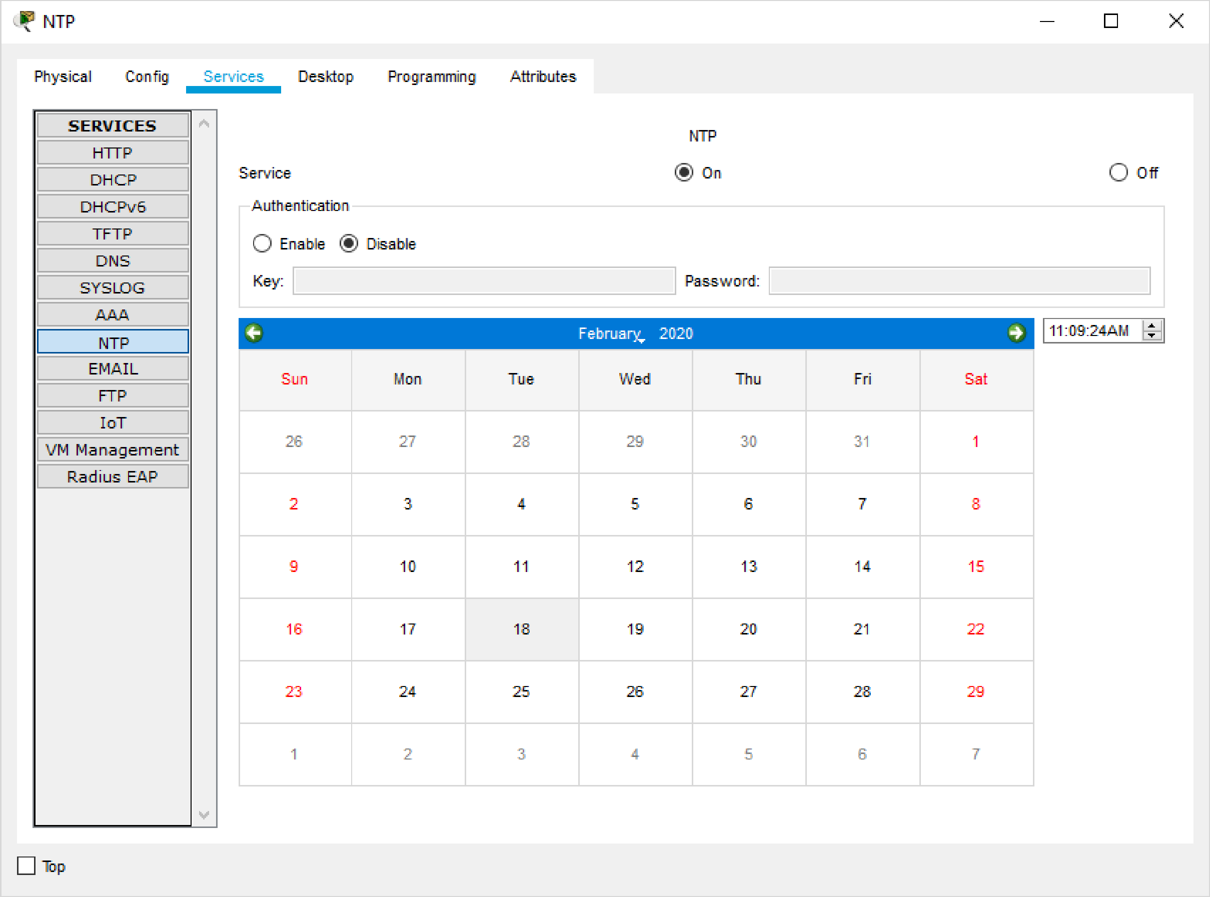
PART - 2 NTP

Network Time Protocol (NTP) is a TCP/IP protocol used to synchronize computer clocks across data networks.

NTP was developed in the 1980s by D.L. Mills at the University of Delaware to achieve highly accurate time synchronization and to sustain the effects of variable latency over packet-switched data networks through a jitter buffer.

We use the same topology to study the given protocol

Configure NTP Server and enable the NTP service



NTP

Service ● On ○ Off

Authentication

○ Enable ● Disable

Key: Password:

February 2020

11:09:24AM

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
1	2	3	4	5	6	7

Now Go to CLI Mode of Router1 and type the following commands on both the Routers

```
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ntp server 192.168.1.5
Router(config)#ntp update-calendar
Router(config)#exit
Router#
```

To verify the Output we use the following command

```
Router#show clock
```

```
 18:12:43.760 UTC Fri Jan 14 2022
  Router#
```

PART - 3 SYSLOG server

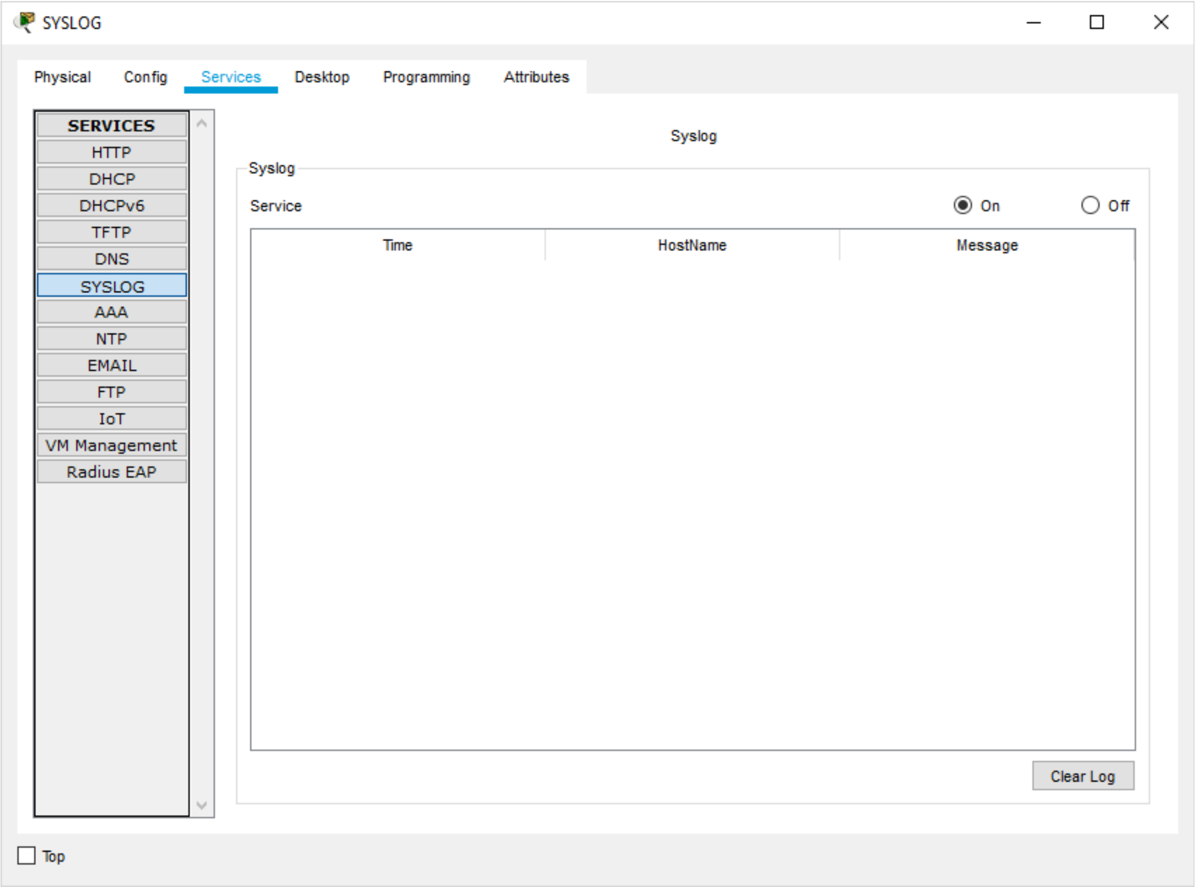
<u>Configure SYSLOG Server and enable the service</u>

Syslog is a way for network devices to send event messages to a logging server usually known as a Syslog server.

The Syslog **protocol** is supported by a wide range of devices and can be used to log different types of events.

For example, a router might send messages about users logging on to console sessions, while a web-server might log access-denied events.

Turn ON the SYSLOG service on the server



Syslog

Syslog

Service ● On ○ Off

Time	HostName	Message

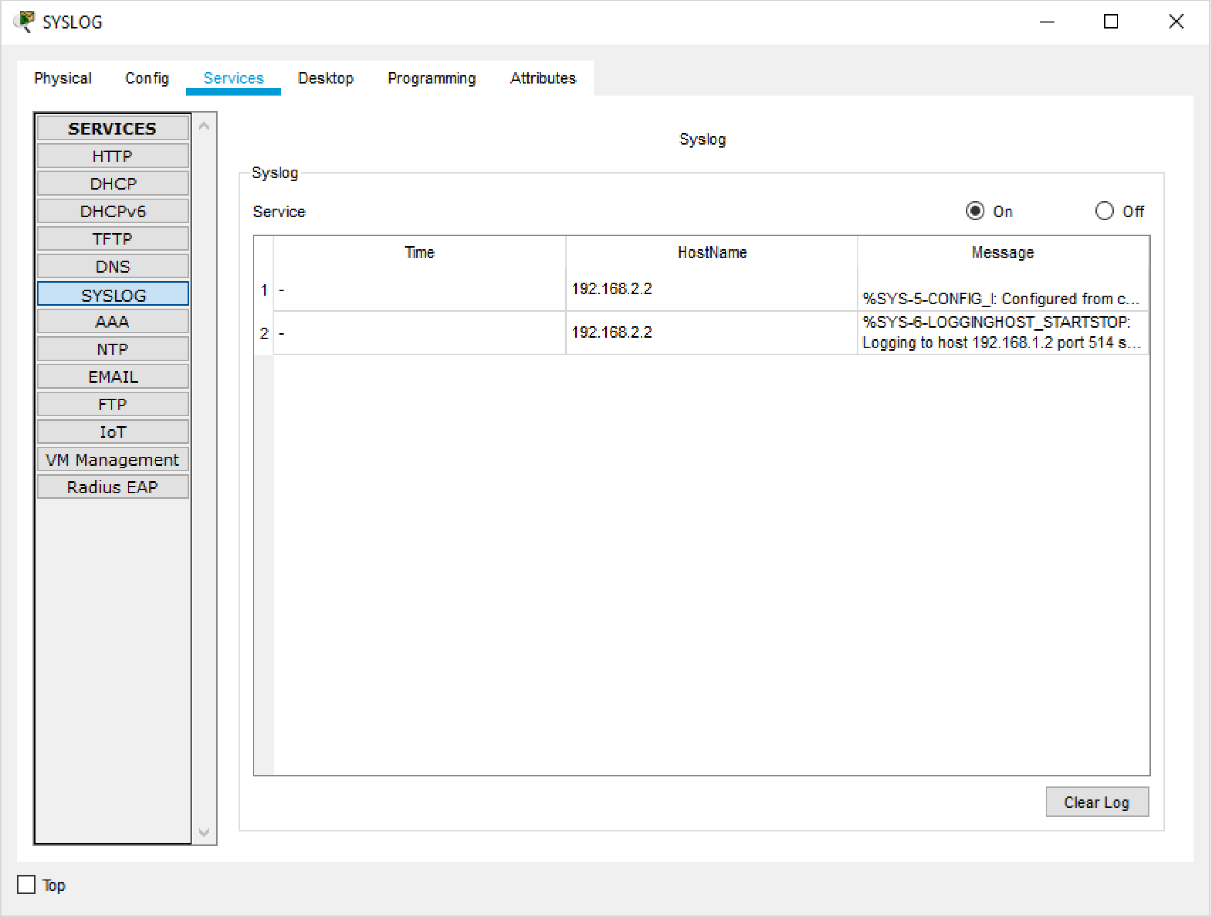
And Turn OFF on all other Servers

<u>Now Go to CLI Mode of any Router and type the following commands in all the</u>

Routers.

```
Router#
Router#configure terminal
Router(config)#logging 192.168.1.6
Router(config)#exit
Router#
```

Output



Syslog

Syslog

Service ● On ○ Off

	Time	HostName	Message
1	-	192.168.2.2	%SYS-5-CONFIG_I: Configured from c...
2	-	192.168.2.2	%SYS-6-LOGGINGHOST_STARTSTOP: Logging to host 192.168.1.2 port 514 s...

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