Practical 1

Configure Cisco Routers for Syslog, NTP, and SSH Operations

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.

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.

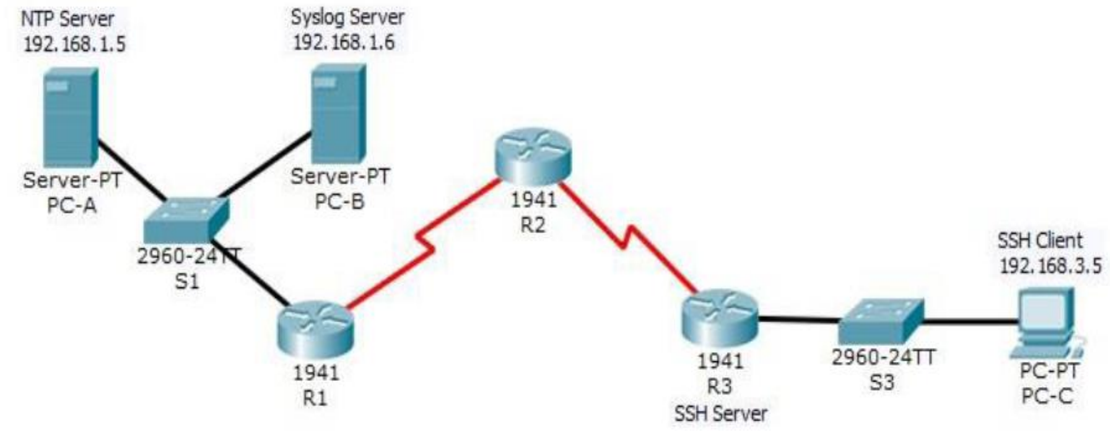
SYSLOG server

□ 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 tolog 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.

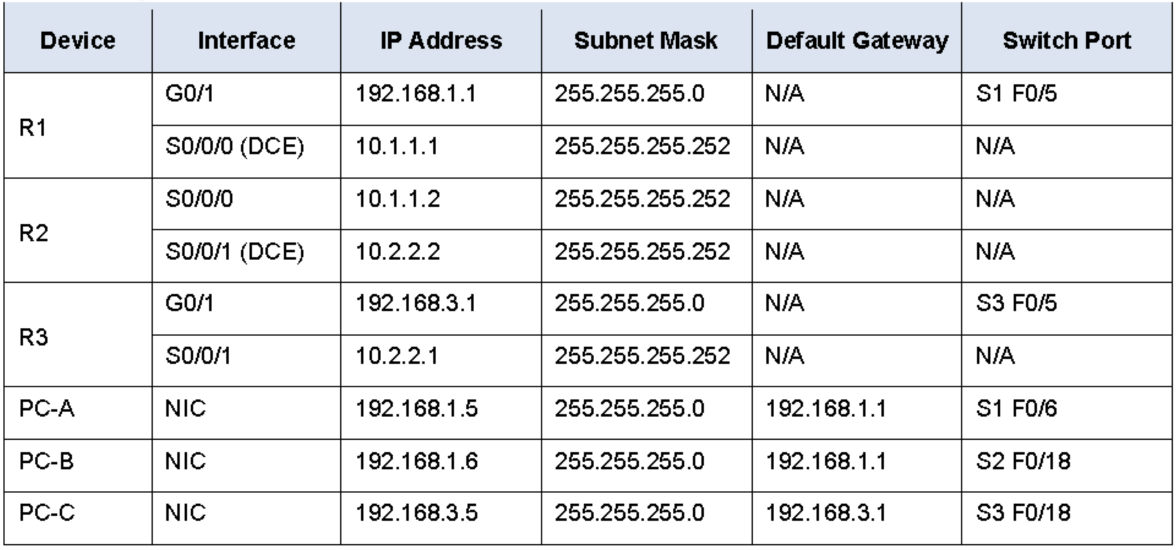
SSH

- An SSH server is a software program which uses the secure shell protocol to accept connections from remote computers.
- The way SSH works is by making use of a client-server model to allow for authentication of two remote systems and encryption of the data that passes between them.
- It organizes the secure connection by authenticating the client and opening the correct shell environment if the verification is successful.

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

Objectives

- Configure OSPF MD5 authentication.
- Configure NTP.
- Configure routers to log messages to the syslog server.
- Configure R3 to support SSH connections.

Background / Scenario

In this activity, you will configure OSPF MD5 authentication for secure routing updates.

The NTP Server is the master NTP server in this activity. You will configure authentication on the NTP server and the routers. You will configure the routers to allow the software clock to be synchronized by NTP to the time server. Also, you will configure the routers to periodically update the hardware clock with the time learned from NTP.

The Syslog Server will provide message logging in this activity. You will configure the routers to identify the remote host (Syslog server) that will receive logging messages.

You will need to configure timestamp service for logging on the routers. Displaying the correct time and date in Syslog messages is vital when using Syslog to monitor a network.

You will configure R3 to be managed securely using SSH instead of Telnet. The servers have been preconfigured for NTP and Syslog services respectively. NTP will not require authentication. The routers have been pre-configured with the following passwords:

- Enable password: **ciscoenpa55**
- Password for vty lines: **ciscovtypa55**

Note: Note: MD5 is the strongest encryption supported in the version of Packet Tracer used to develop this activity (v6.2). Although MD5 has known vulnerabilities, you should use the encryption that meets the security requirements of your organization. In this activity, the security requirement specifies MD5.

Part 1: Configure OSPF MD5 Authentication

Step 1: Test connectivity. All devices should be able to ping all other IP addresses.

Step 2: Configure OSPF MD5 authentication for all the routers in area 0. Configure OSPF MD5 authentication for all the routers in area 0.

```
R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest
R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest

R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest
```

Step 3: Configure the MD5 key for all the routers in area 0. Configure an MD5 key on the serial interfaces on **R1**, **R2** and **R3**. Use the password **MD5pa55** for key **1**.

```
R1(config)# interface s0/0/0
R1(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

R2(config)# interface s0/0/0
R2(config-if)# ip ospf message-digest-key 1 md5 MD5pa55
R2(config-if)# interface s0/0/1
R2(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

R3(config)# interface s0/0/1
R3(config-if)# ip ospf message-digest-key 1 md5 MD5pa55
```

Step 4: Verify configurations.

a. Verify the MD5 authentication configurations using the commands **show ip ospf interface**. b.

Verify end-to-end connectivity.

Part 2: Configure NTP

Step 1: Enable NTP authentication on PC-A.

a. On **PC-A**, click **NTP** under the Services tab to verify NTP service is enabled.

b. To configure NTP authentication, click **Enable** under Authentication. Use key **1** and password **NTPpa55** for authentication.

Step 2: Configure R1, R2, and R3 as NTP clients.

```
R1(config)# ntp server 192.168.1.5
R2(config)# ntp server 192.168.1.5
R3(config)# ntp server 192.168.1.5
```

Verify client configuration using the command **show ntp status**.

Step 3: Configure routers to update hardware clock. Configure **R1**, **R2**, **and R3** to periodically update the hardware clock with the time learned from NTP.

```
R1(config)# ntp update-calendar
R2(config)# ntp update-calendar
R3(config)# ntp update-calendar
```

Exit global configuration and verify that the hardware clock was updated using the command **show clock**.

Step 4: Configure NTP authentication on the routers. Configure NTP authentication on **R1**, **R2**, and **R3** using key **1** and password **NTPpa55**.

```
R1(config)# ntp authenticate
R1(config)# ntp trusted-key 1
R1(config)# ntp authentication-key 1 md5 NTPpa55

R2(config)# ntp authenticate
R2(config)# ntp trusted-key 1
R2(config)# ntp authentication-key 1 md5 NTPpa55

R3(config)# ntp authenticate
R3(config)# ntp trusted-key 1
R3(config)# ntp authentication-key 1 md5 NTPpa55
```

Step 5: Configure routers to timestamp log messages.

Configure timestamp service for logging on the routers.

```
R1(config)# service timestamps log datetime msec
R2(config)# service timestamps log datetime msec
R3(config)# service timestamps log datetime msec
```

Part 3: Configure Routers to Log Messages to the Syslog Server

Step 1: Configure the routers to identify the remote host (Syslog Server) that will receive logging messages.

```
R1(config)# logging host 192.168.1.6
R2(config)# logging host 192.168.1.6
R3(config)# logging host 192.168.1.6
```

The router console will display a message that logging has started.

Step 2: Verify logging configuration.

Use the command **show logging** to verify logging has been enabled.

Step 3: Examine logs of the Syslog Server.

From the **Services** tab of the **Syslog Server**'s dialogue box, select the **Syslog** services button. Observe the logging messages received from the routers.

Note: Log messages can be generated on the server by executing commands on the router. For example, entering and exiting global configuration mode will generate an informational configuration message. You may need to click a different service and then click **Syslog** again to refresh the message display.

Part 4: Configure R3 to Support SSH Connections

Step 1: Configure a domain name.

Configure a domain name of **ccnasecurity.com** on **R3**.

```
R3(config)# ip domain-name ccnasecurity.com
```

Step 2: Configure users for login to the SSH server on R3.

Create a user ID of **SSHadmin** with the highest possible privilege level and a secret password of **ciscosshpa55**.

```
R3(config)# username SSHadmin privilege 15 secret ciscosshpa55
```

Step 3: Configure the incoming vty lines on R3.

Use the local user accounts for mandatory login and validation. Accept only SSH connections.

```
R3(config)# line vty 0 4
R3(config-line)# login local
R3(config-line)# transport input ssh
```

Step 4: Erase existing key pairs on R3.

Any existing RSA key pairs should be erased on the router.

```
R3(config)# crypto key zeroize rsa
```

Note: If no keys exist, you might receive this message: `% No Signature RSA Keys found in configuration.`

Step 5: Generate the RSA encryption key pair for R3.

The router uses the RSA key pair for authentication and encryption of transmitted SSH data. Configure the RSA keys with a modulus of **1024**. The default is 512, and the range is from 360 to 2048.

```
R3(config)# crypto key generate rsa
The name for the keys will be: R3.ccnasecurity.com
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.


How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]
```

Note: The command to generate RSA encryption key pairs for **R3** in Packet Tracer differs from those used in the lab.

Step 6: Verify the SSH configuration.

Use the **show ip ssh** command to see the current settings. Verify that the authentication timeout and retries are at their default values of 120 and 3.

Step 7: Configure SSH timeouts and authentication parameters.

The default SSH timeouts and authentication parameters can be altered to be more restrictive. Set the timeout to **90** seconds, the number of authentication retries to **2**, and the version to **2**.

```
R3(config)# ip ssh time-out 90
R3(config)# ip ssh authentication-retries 2
R3(config)# ip ssh version 2
```

Issue the **show ip ssh** command again to confirm that the values have been changed.

Step 8: Attempt to connect to R3 via Telnet from PC-C.

Open the Desktop of **PC-C**. Select the Command Prompt icon. From **PC-C**, enter the command to connect to **R3** via Telnet.

```
PC> telnet 192.168.3.1
```

This connection should fail because **R3** has been configured to accept only SSH connections on the virtual terminal lines.

Step 9: Connect to R3 using SSH on PC-C.

Open the Desktop of **PC-C**. Select the Command Prompt icon. From **PC-C**, enter the command to connect to R3 via SSH. When prompted for the password, enter the password configured for the administrator **ciscosshpa55**.

```
PC> ssh -l SSHadmin 192.168.3.1
```

Step 10: Connect to R3 using SSH on R2.

To troubleshoot and maintain **R3**, the administrator at the ISP must use SSH to access the router CLI. From the CLI of **R2**, enter the command to connect to **R3** via SSH version **2** using the **SSHadmin** user account. When prompted for the password, enter the password configured for the administrator: **ciscosshpa55**.

```
R2# ssh -v 2 -l SSHadmin 10.2.2.1
```

Step 11: Check results.

Your completion percentage should be 100%. Click **Check Results** to view the feedback and verification of which required components have been completed.

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