Computer Networks (ICT-2224) FISAC (23.04.2024)

SECTION: IT B
NUMBER: GROUP 13

MEMBERS AND CONTRIBUTIONS:

ADITYA HARISHCHANDRA KALME (220911560 ROLL NO 50)-Did the hello interval timer and also configured RIP and OSPF.

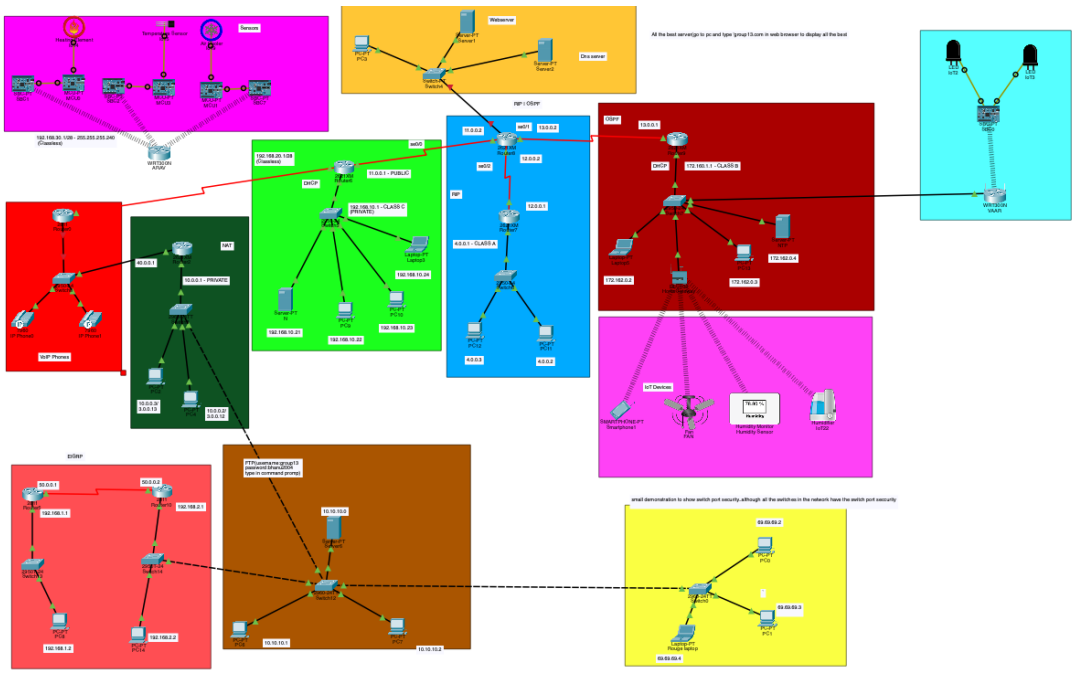
BHAVESH GUPTA (220911562 ROLL NO 51)-Did the switch port security in all the switches in the network.

NAVANEETH L (220911568 ROLL NO 52)-Configured EIGRP and NTP and also FTP.

KUNCHAM BHANU SHASHANK (220911572 ROLL NO 52)-Configured DHCP, Web server and the IOT system(sensors, fan, leds)

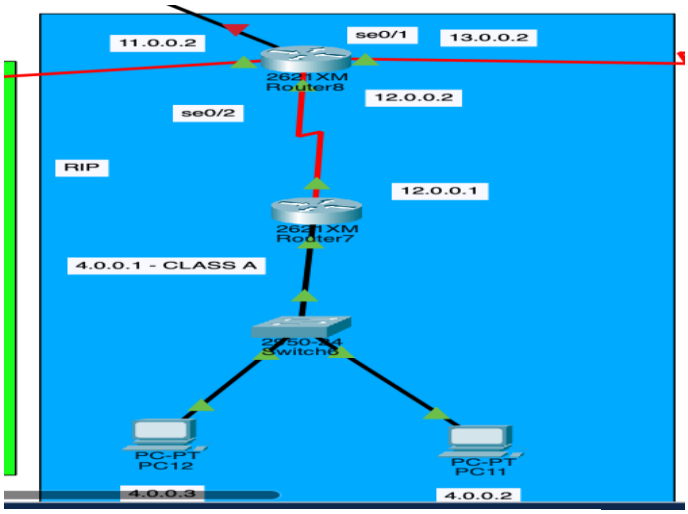
The topology selected for our Network Scenario is Bus Topology.

a. Here is the network Scenario consisting of 15 hosts, 4 routers, 2 wireless routers, 3 switches, 4 sensors, 1 fan, 2 LED, 2 VOIP Phones and 2 servers



b)The topology consists of RIP, OSPF, NAT, DHCP, NTP, EIGRP protocols

1)RIP



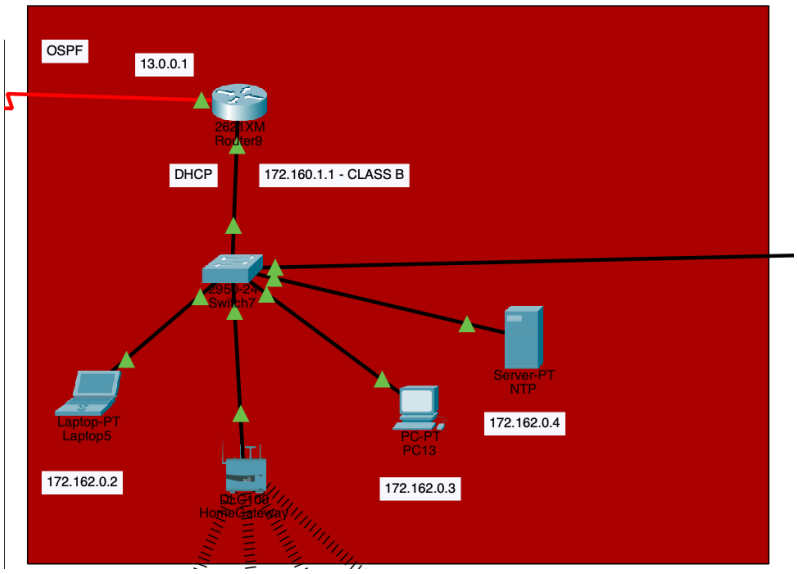

```
R2>
R2>show ip rip database
4.0.0.0/8    auto-summary
4.0.0.0/8
    [1] via 12.0.0.1, 00:00:21, Serial0/2
11.0.0.0/8    auto-summary
11.0.0.0/8    redistributed
    [1] via 0.0.0.0, 00:03:04, Serial0/0
12.0.0.0/8    auto-summary
12.0.0.0/8    directly connected, Serial0/2
13.0.0.0/8    auto-summary
13.0.0.0/8    redistributed
    [1] via 0.0.0.0, 00:03:10, Serial0/1
172.162.0.0/16    auto-summary
172.162.0.0/16    redistributed
    [1] via 13.0.0.1, 00:02:55, Serial0/1
192.168.10.0/24    auto-summary
192.168.10.0/24    redistributed
    [1] via 11.0.0.1, 00:03:04, Serial0/0
```

2)OSPF

OSPF Protocol : Between Router 8 and Router 9, we have configured OSPF protocol.

We can use the command ‘show ip ospf database’ to view the OSPF configuration. This should give us details about the OSPF process ID, router ID, networks advertised into OSPF and other OSPF-related information.

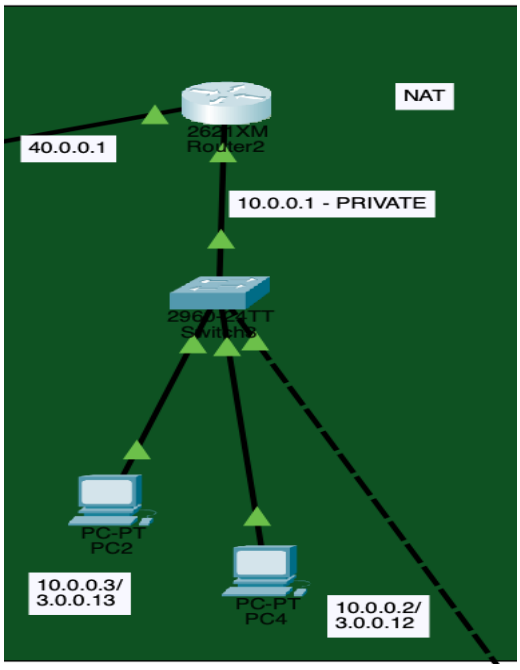
```
R4>show ip ospf database
            OSPF Router with ID (172.162.1.1) (Process ID 20)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
172.162.1.1     172.162.1.1     226         0x80000004 0x00ddf8 3
13.0.0.2        13.0.0.2        226         0x80000002 0x007dfa 2

                Type-5 AS External Link States
Link ID         ADV Router      Age         Seq#       Checksum Tag
12.0.0.0        13.0.0.2        235         0x80000001 0x00abf9 0
11.0.0.0        13.0.0.2        229         0x80000001 0x00b8ed 0
192.168.10.0    13.0.0.2        229         0x80000001 0x002816 0
4.0.0.0         13.0.0.2        228         0x80000001 0x001499 0
```



3)NAT

NAT: NAT is implemented at Router2. We can use the command 'sh ip nat tr' to view the local and global IP address translations.

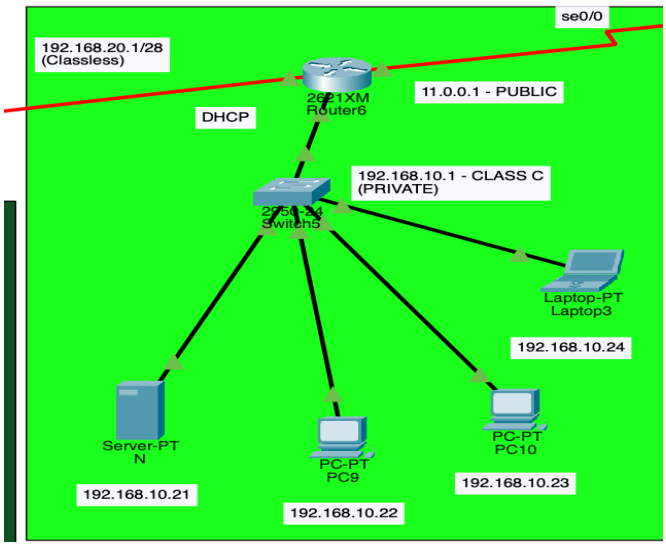
```
Router>sh ip nat tr
Pro  Inside global     Inside local       Outside local      Outside global
---  3.0.0.12          10.0.0.2           ---                ---
---  3.0.0.13          10.0.0.3           ---                ---
---  3.0.0.14          10.0.0.4           ---                ---
```

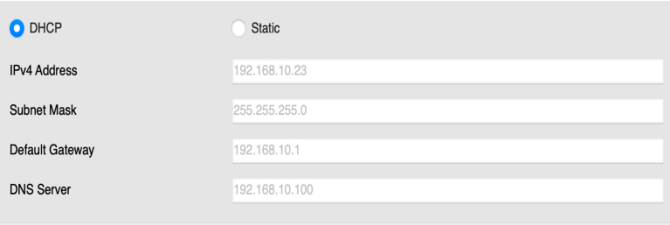


4)DHCP

DHCP is implemented at Router9. We can see the Hardware

Address and IP address bindings using ‘show ip dhcp binding’






```
R1>show
% Incomplete command.
R1>show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.10.22    00E0.B0CC.4246           --                     Automatic
192.168.10.21    000C.85AB.6566           --                     Automatic
192.168.10.23    00E0.F9B9.C199           --                     Automatic
192.168.10.24    0001.6470.08E6           --                     Automatic
```

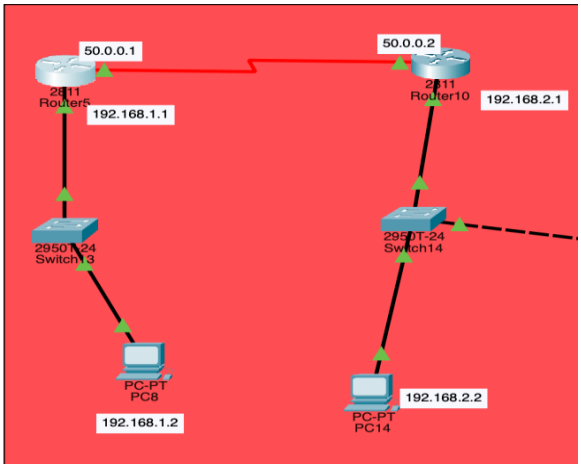
5)NTP

NTP: NTP is implemented at our HTTP server to synchronize the time of devices on the network to a common reference time source.

```
R4>show clock
*1:7:1.351 UTC Thu Oct 13 2022
R4>
```

6)EIGPR

EIGRP: EIGRP is implemented at Router 6 and Router 8. We can run the command ‘show ip eigrp topology’ at Router 6 to find information about the network topology as seen by EIGRP.




```
Router>show ip eigrp topology
IP-EIGRP Topology Table for AS 1/ID(192.168.1.1)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status

P 50.0.0.0/8, 1 successors, FD is 2169856
         via Connected, Serial0/0/0
P 192.168.1.0/24, 1 successors, FD is 28160
         via Connected, FastEthernet0/0
P 192.168.2.0/24, 1 successors, FD is 2172416
         via 50.0.0.2 (2172416/28160), Serial0/0/0
```

d) The index file of our HTTP server has been edited to display “All the best”, going to the web browser from a PC at 198.165.5.11 and entering the server’s IP address 192.168.5.12 or name ie,**group13.com**

e) Our FTP server at 10.0.0.0 has been setup . Accessing it with a PC from 10.0.0.1 using FTP commands we display the files. We have configured 2 users at the FTP server – username:group13,password:bhanu2004
We can use the command ‘ftp 10.0.0.0’ to connect to the server using FTP. Then we enter our username and password. After that using ‘dir’ we can display the files on the server

```
C:\>ftp 10.10.10.0
Trying to connect...10.10.10.0
Connected to 10.10.10.0
220- Welcome to PT Ftp server
Username:group13
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dr
 Invalid or non supported command.
ftp>dir

Listing /ftp directory from 10.10.10.0:
0    : asa842-k8.bin                                    5571584
1    : asa923-k8.bin                                    30468096
2    : c1841-advipservicesk9-mz.124-15.T1.bin           33591768
3    : c1841-ipbase-mz.123-14.T7.bin                    13832032
4    : c1841-ipbasek9-mz.124-12.bin                     16599160
5    : c1900-universalk9-mz.SPA.155-3.M4a.bin           33591768
6    : c2600-advipservicesk9-mz.124-15.T1.bin           33591768
7    : c2600-i-mz.122-28.bin                            5571584
8    : c2600-ipbasek9-mz.124-8.bin                      13169700
9    : c2800nm-advipservicesk9-mz.124-15.T1.bin         50938004
10   : c2800nm-advipservicesk9-mz.151-4.M4.bin          33591768
11   : c2800nm-ipbase-mz.123-14.T7.bin                  5571584
12   : c2800nm-ipbasek9-mz.124-8.bin                    15522644
13   : c2900-universalk9-mz.SPA.155-3.M4a.bin           33591768
14   : c2950-i6q412-mz.121-22.EA4.bin                   3058048
15   : c2950-i6q412-mz.121-22.EA8.bin                   3117390
16   : c2960-lanbase-mz.122-25.FX.bin                   4414921
17   : c2960-lanbase-mz.122-25.SEE1.bin                 4670455
18   : c2960-lanbasek9-mz.150-2.SE4.bin                 4670455
19   : c3560-advipservicesk9-mz.122-37.SE1.bin          8662192
20   : c3560-advipservicesk9-mz.122-46.SE.bin           10713279
21   : c800-universalk9-mz.SPA.152-4.M4.bin             33591768
22   : c800-universalk9-mz.SPA.154-3.M6a.bin            83029236
23   : cat3k_caa-universalk9.16.03.02.SPA.bin           505532849
24   : cgr1000-universalk9-mz.SPA.154-2.CG              159487552
25   : cgr1000-universalk9-mz.SPA.156-3.CG              184530138
26   : ir800-universalk9-bundle.SPA.156-3.M.bin         160968869
27   : ir800-universalk9-mz.SPA.155-3.M                 61750062
28   : ir800-universalk9-mz.SPA.156-3.M                 63753767
29   : ir800_yocto-1.7.2.tar                            2877440
30   : ir800_yocto-1.7.2_python-2.7.3.tar               6912000
31   : pt1000-i-mz.122-28.bin                           5571584
32   : pt3000-i6q412-mz.121-22.EA4.bin                  3117390
```

f) To store router3 (Label Router8 in our diagram) configuration to secondary memory, we can enter EXEC mode on our router using the command `enable` then we enter 'copy running-config nvram:startup-config' this saves the running-config to secondary memory.

```
%Error copying nvram:y (Invalid argument)
R2#copy running-config startup-config
Destination filename [startup-config]? startup-config
Building configuration...
[OK]
R2#
```

To change the Hello Interval timer of router2 to 20 seconds,

```
R4(config-if)#ip ospf hello-interval 20
```

We use this command, to check it has been changed we can execute **'show ip ospf interface FastEthernet 0/0'** which outputs:

```
FastEthernet0/0 is up, line protocol is up
  Internet address is 172.162.1.1/16, Area 0
  Process ID 20, Router ID 172.162.1.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 172.162.1.1, Interface address 172.162.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 20, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:14
  Index 1/1, 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 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Confirming the new Hello Interval as 20s.

g) To display detail list of neighbours at router 4, we can use the command 'show ip ospf neighbor'

```
R4#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
13.0.0.2          0   FULL/  -        00:00:38    13.0.0.2        Serial0/0
R4#
```

To reset the ospf counter

```
R4#clear ip ospf process
Reset ALL OSPF processes? [no]: yes

R4#
01:23:31: %OSPF-5-ADJCHG: Process 20, Nbr 13.0.0.2 on Serial0/0 from FULL to DOWN, Neighbor Down: Adjacency forced to reset

01:23:31: %OSPF-5-ADJCHG: Process 20, Nbr 13.0.0.2 on Serial0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

R4#
01:23:34: %OSPF-5-ADJCHG: Process 20, Nbr 13.0.0.2 on Serial0/0 from LOADING to FULL, Loading Done
```

h) To display the routing table of all routers, we can use the command **'show ip route'** at all the routers.

1)Voip phone router

```
Router>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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, Serial0/3/0
L       192.168.20.2/32 is directly connected, Serial0/3/0
```

2)NAT ROUTER

```
Router>show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    40.0.0.0/8 is directly connected, FastEthernet0/1
```

3)DHCP ROUTER

```
R1>show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

D EX 4.0.0.0/8 [170/40512000] via 11.0.0.2, 01:08:44, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/0
D EX 12.0.0.0/8 [170/40512000] via 11.0.0.2, 01:08:45, Serial0/0
D EX 13.0.0.0/8 [170/40537600] via 11.0.0.2, 01:08:45, Serial0/0
D EX 172.162.0.0/16 [170/40537600] via 11.0.0.2, 00:45:28, Serial0/0
C    192.168.10.0/24 is directly connected, FastEthernet0/0
     192.168.20.0/28 is subnetted, 1 subnets
C       192.168.20.0 is directly connected, Serial0/1
```

4)RIP ROUTER

```
R2>
R2>show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

R    4.0.0.0/8 [120/1] via 12.0.0.1, 00:00:08, Serial0/2
C    11.0.0.0/8 is directly connected, Serial0/0
C    12.0.0.0/8 is directly connected, Serial0/2
C    13.0.0.0/8 is directly connected, Serial0/1
O    172.162.0.0/16 [110/1563] via 13.0.0.1, 00:46:43, Serial0/1
D    192.168.10.0/24 [90/40514560] via 11.0.0.1, 01:10:00, Serial0/0
```

5)OSPF ROUTER

```
R4>show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

O E2 4.0.0.0/8 [110/20] via 13.0.0.2, 01:11:15, Serial0/0
O E2 11.0.0.0/8 [110/20] via 13.0.0.2, 01:11:15, Serial0/0
O E2 12.0.0.0/8 [110/20] via 13.0.0.2, 01:11:15, Serial0/0
C    13.0.0.0/8 is directly connected, Serial0/0
C    172.162.0.0/16 is directly connected, FastEthernet0/0
O E2 192.168.10.0/24 [110/20] via 13.0.0.2, 01:11:15, Serial0/0
```

6)EIGRP ROUTER(2)

```
Router>
Router>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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

     50.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       50.0.0.0/8 is directly connected, Serial0/0/0
L       50.0.0.2/32 is directly connected, Serial0/0/0
D    192.168.1.0/24 [90/2172416] via 50.0.0.1, 01:12:37, Serial0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, FastEthernet0/0
L       192.168.2.1/32 is directly connected, FastEthernet0/0
```

```
Router>
Router>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, E - EGP
       i - IS-IS, 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

Gateway of last resort is not set

     50.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       50.0.0.0/8 is directly connected, Serial0/0/0
L       50.0.0.1/32 is directly connected, Serial0/0/0
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, FastEthernet0/0
L       192.168.1.1/32 is directly connected, FastEthernet0/0
D    192.168.2.0/24 [90/2172416] via 50.0.0.2, 01:12:17, Serial0/0/0
```

i)Switch port Security

Attackers' task is comparatively very easy when they can enter the network they want to attack. Ethernet LANs are very much vulnerable to attack as the switch ports are open to use by default. Various attacks such as Dos attack at layer 2, address spoofing can take place. If the administrator has control over the network then obviously the network is safe. To take total control over the switch ports, the user can use a feature called port-security. If somehow prevent an unauthorized user to use these ports, then the security will increase up to a great extent at layer 2.

Users can secure a port in two steps:

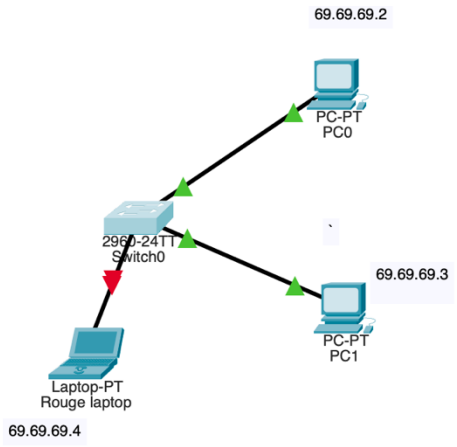
1. Limiting the number of MAC addresses to a single switch port, i.e if more than the limit, Mac addresses are learned from a single port then appropriate action will be taken.
2. If unauthorized access is observed, the traffic should be discarded by using any of the options, or more appropriately, the user should generate a log message so that unauthorized access can be easily observed.

Port security –
Switches learn MAC addresses when the frame is forwarded through a switch port. By using port security, users can limit the number of MAC addresses that can be learned to a port, set static MAC addresses, and set penalties for that port if it is used by an unauthorized user. Users can either use restrict, shut down or protect port-security commands.
Let's discuss these violation modes:

- **protect –** This mode drops the packets with unknown source mac addresses until you remove enough secure mac addresses to drop below the maximum value.
- **restrict –** This mode performs the same function as protecting, i.e drops packets until enough secure mac addresses are removed to drop below the maximum value. In addition to this, it will generate a log message, increment the counter value, and will also send an SNMP trap.
- **shut down –** This mode is mostly preferred as compared to other modes as it shut down the port immediately if unauthorized access is done. It will also generate a log, increment counter value, and send an SNMP trap. This port will remain in a shutdown state until the administrator will perform the "no shutdown" command.
- **Sticky –** This is not a violation mode. By using the sticky command, the user provides static Mac address security without typing the absolute Mac address. For example, if user provides a maximum limit of 2 then the first 2 Mac addresses learned on that port will be placed in the running configuration. After the 2nd learned Mac address, if the 3rd user wants to access then the appropriate action will be taken according to the violation mode applied.

Small scenario in our network where switch port security is implemented:

Step 1:Intial configuration of switch with 2 pcs and one rouge laptop tries to enter but is denied access.



Step 2: The table of access to ports of switch 0 is being shown here by using command "**do show ip int br".**

:

Step 3: As we can see that the rouge laptop isn't give connection in the switch which was previously depicted in step 1 where the connection between the laptop and the switch was red in color.

```
Pinging 69.69.69.4 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 69.69.69.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Step 4: In this step we perform the most important part of the switch port-security where we grant the access to fastethernet port 0/3 which can be connected to the laptop

```
Switch(config-if-range)#int f0/3
Switch(config-if)#no shutdown

Switch(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

Switch(config-if)#
```

Step 5: As we can see now after the grant of the port we can ping the laptop and the process is succesful

```
C:\>ping 69.69.69.4

Pinging 69.69.69.4 with 32 bytes of data:

Reply from 69.69.69.4: bytes=32 time<1ms TTL=128
Reply from 69.69.69.4: bytes=32 time<1ms TTL=128
Reply from 69.69.69.4: bytes=32 time<1ms TTL=128
Reply from 69.69.69.4: bytes=32 time<1ms TTL=128

Ping statistics for 69.69.69.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

:

WRITTEN CODES:

a)

* Connection Establishment

- Router 0 (2811) {Hostname : VoIPPhone} (CLI)
  VoIPPhone >en
  VoIPPhone # configure terminal
  VoIPPhone (config) # int serial 0/3/0
  VoIPPhone (config-if) # ip address 192.168.20.2 255.255.255.0
  VoIPPhone (config-if) # no shutdown
  VoIPPhone (config-if) # exit
  VoIPPhone (config) # int serial 0/3/1
  VoIPPhone (config-if) # ip address 45.0.0.2 255.0.0.0

- Router 2 (2821 x M) {Hostname : Router} (CLI)
  Router (config) # int fa 0/0
  Router (config-if) # ip address 10.0.0.1 255.0.0.0
  Router (config-if) # no shutdown

- Router 6 (2621 x M) {Hostname : R1} (CLI)
  R1 # configure terminal
  R1 (config) # int se 0/0
  R1 (config-if) # ip address 11.0.0.1 255.0.0.0
  R1 (config-if) # no shutdown.
  R1 (config-if) # int fa0/0 → int fa0/0
  R1 (config-if) # ip adress 192.168.10.1 255.255.255.0
  R1 (config-if) # no shutdown
  R1 (config) # int se0/1
  R1 (config-if) # ip address 192.168.20.1 255.255.255.240

- Router 8 (2621 x M) {Hostname : R2} (CLI).
  R2 (config) # int se0/0
  R2 (config-if) # ip address 11.0.0.2 255.0.0.0

R2 (config-if) # no shutdown
R2 (config) # int se 0/1
R2 (config-if) # ip address 13.0.0.2 255.0.0.0
R2 (config-if) # no shut
R2 (config) # int se 0/3
R2 (config-if) # ip address 12.0.0.2 255.0.0.0.
R2 (config-if) # no shut

- Router 9 (2621 XM) {Hostname : R4} (CLI)
  R4 (config) # int fa 0/0
  R4 (config) # ip-address 172.168.1.1 255.255.0.0
  R4 (config-if) # no shut
  R4 (config) # int se 0/0
  R4 (config-if) # ip address 13.0.0.1 255.0.0.0
  R4 (config-if) # no shut

* VoIP configuration :-
- Router 0 (2811) {Hostname : ephone}
  (Initially hostname was R0).
  R0 (config) # ip dhcp pool ephone
  R0 (dhcp-config) # network 10.0.0.0 255.0.0.0
  R0 (dhcp-config) # exit
  R0 (config) # telephony-service
  R0 (config) # max-ephone 5

b)

B) Protocols.

* RIP : (Router R3 (hostname))

- R3 # config) # router rip.
  R3 (config-router) # network 4.0.0.0
  R3 (config-router) # network 12.0.0.0
  R3 (config-router) # network 50.0.0.0

* OSPF :

- R2 (config) # network ospf 1
  R2 (config-router) # network 11.0.0.0 0.255.255.255 area 0
  R2 (config-router) # network 13.0.0.0 0.255.255.255 area 0
  R2 (config-router) # network 12.0.0.0 0.255.255.255 area 0
- R4 (config) # network ospf 1
  R4 (config-router) # network 172.16.2.0.0 0.0.255.255 area 0
  R4 (config-router) # network 13.0.0.0 0.0.0.255 area 0

* DHCP

R1 (config-if) # ip dhcp mypool.
R1 (dhcp-config) # network 192.168.10.0 255.255.255.0
R1 (dhcp-config) # exit
R1 (config) # int fa 0/0
R1 (config) # ip address dhcp.
R1 (config-if) # exit

☆ NAT

- Router > (Router ← hostname)
- Router (config)# ip nat inside source static
  10.0.0.1 40.0.0.1

Router (config)# int fa 0/0
Router (config-if)# ip nat inside
Router (config-if)# exit
Router (config-if)# in se 0/0.
Router (config-if)# ip nat outside.

☆ NTP

R1 (config)# ntp server 192.168.10.24.
R1 (config)# exit
R1# exit
R1 > show clock
R1 > 23 Apr 2024 (as set on server).

EIGRP

Routers {2811 router}

```
Router>en
Router# conf t
Router(config)# hostname R5
R5(config)# int s0/0/0
R5(config-if)# ip addr s0.0.0.1 255.0.0.0
R5(config-if)# no shut
R5(config-if)# exit
R5(config)# int fa0/0
R5(config-if)# ip add 192.168.1.1 255.255.255.0
R5(config-if)# no shut
R5(config-if)# end
R5# wr
R5#
```

Router10 {2811 router}

```
Router>en
Router# conf t
Router(config)# hostname R10
R10(config)# int s0/0/0
R10(config-if)# ip add s0.0.0.2 255.0.0.0
R10(config-if)# no shut
R10(config-if)# exit
R10(config)# int fa0/0
R10(config-if)# ip add 192.168.2.1 255.255.255.0
R10(config-if)# no shut
R10(config-if)# end
R10# wr
R10#
```

After pinging:

R5# config t
R5(config)# router eigrp 1
R5(config-router)# network 50.0.0.0 0.255.255.255
R5(config-router)# network 192.168.1.0 0.0.0.255
R5(config-router)# end
R5# wr
R5#

R10# config t
R10(config)# router eigrp 1
R10(config-router)# network 50.0.0.0
R10(config-router)# network 192.168.2.0
R10(config-router)# end
R10# wr
R10#

R5# sh ip route

Date: / /

☆ IOT Configuration

① Heating Element

MCU-PT MCU0

```
function setup (){
    pinMode (1, OUTPUT);
    Serial .println ("Blinking");
}
function loop (){
    digitalWrite (1, HIGH);
    delay (1000);
    digitalWrite (1, LOW);
    delay (500);
}
```

SBC-PT SBC1

```
from gpio import *
from time import *

def main():
    pinMode (1, OUT);
    print ("Blinking")
    While True:
        digitalWrite (1, HIGH);
        delaly (1000)
        digitalWrite (1, LOW);
        delay (500)
if __name__ == "__main__":
    main()
```

Date: / /

② Temperature Sensor

MCU-PT MCU3

```
var ledpin = 1;
var potPin = A0;
var value = 0;

function setup(){
   pinMode (ledpin, OUTPUT);
}
function loop(){
   // read from pot
   var newValue = analogRead(potPin);

   // map it from 1023 to 255
   newValue = Math.floor(map(newValue, 0, 1023, 0, 255));

   if (newValue != value){
      Serial.println("newValue:" + newValue);

      // analog write to led
      analogWrite(ledPin, newValue);
      value = newValue;
   }
}
```

SBC-PT SBC2

```
from gpio import *
```

```
from time import *

def main():
    pinMode(1, OUT)
    print("Blinking")
    while True:
        digitalWrite(1, HIGH);
        delay(1000)
        digitalWrite(1, LOW);
        delay(500)

if __name__ == "__main__":
    main()
```

③ Air Cooler

MCU-PT MCU1

```
function setup(){
    pinMode(1, OUTPUT);
    Serial.println("Blinking");
}

function loop(){
    digitalWrite(1, HIGH);
    delay(1000);
    digitalWrite(1, LOW);
    delay(500);
}
```

Date: / /

SBC-PT SBC 7

```
from gpio import *
from time import *

def main():
    pinMode (1, OUT)
    print("Blinking")
    while True:
    digitalWrite (1, HIGH);
    delay (1000)
    digitalWrite (1, LOW);
    delay (500)

if __name__ == "__main__":
    main()
```

(c) Class full : 40.0.0.1 → Class A
192.168.20.2 → class C
192.168.10.21 → class C
192.168.10.22 → class C
192.168.10.22 → class C
192.168.10.23 → class C
192.168.10.24 → class C
4.0.0.1 → class A
13.0.0.1 → class A
~~176.160~~.192.168.5.12 → class C
176.162.1.1 → class B
50.0.0.0 → class A
10.10.10.0 → class A
69.69.69.0 → class A

Classless: 192.168.20.1 /28
192.168.30.1 /28

(d) Server-PT-
Server1 & PC-PT(PC3) → All the Best
Server → Services → HTTP → ON & HTTPS → ON
File Manager → index.html → <h1> All the Best </h1>
Now go to PC3 → Web Browser (in desktop)
Search for: "group13.com"

(e) Server → Services → FTP-ON
Add Username: group13
Password: bhanu2004
Go to PC → desktop → Command Prompt
C:\>ftp 10.10.10.0
enter username: group13
enter password: bhanu2004

ftp > dir //To check

(f) Router>en ⇒ Router# write
Router(config)# int f 0/0
Router(config)# ip ospf hello interval 20
Router(config)# ex

(g) List Neighbours & reset ospf counter
(i) show ip ospf neighbor
(ii) clear ip ospf process

(h) show ip route

(i) Switch>en
(range) Switch> conf t
Switch(config)# int range f0/1-2
switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport port-security
switch(config-if-range)# switchport port-security maximum 2
switch(config-if-range)# switchport-security mac-address sticky
Switch(config-if-range)# switchport-security violation restrict
switch(config-if-range)# do show ip int br

Date :