IPSLA and PBR

Lab Activity

Topology

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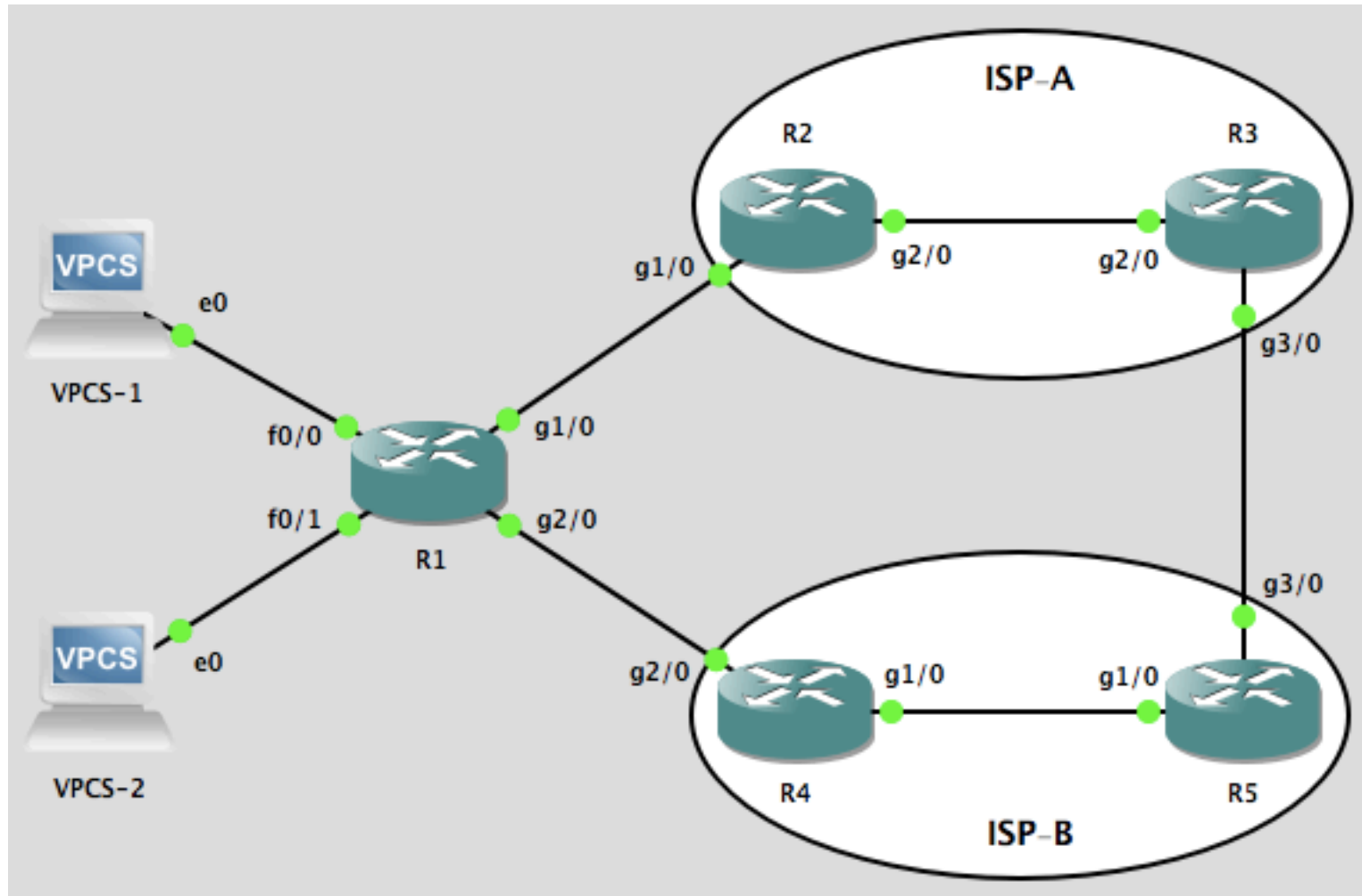
Network and IP Plan

- IP Plan
  - Peering: 100.100.XY.X(Y)/24
  - Loopback 0 in R3: 10.10.1.1/24
  - Loopback 0 in R5: 10.10.2.1/24
  - LAN-1 in R1: 192.168.1.0/24
  - LAN-2 in R1: 192.168.2.0/24
- OSPF for ISP-A and ISP-B
  - OSPF Process ID: 1
  - OSPF Router ID: X.X.X.X
  - OSPF Area: 0

Task 1.1: Basic Configuration

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- Configure all routers
  - Loopback
  - Interface IP

Example: R1

```
interface FastEthernet0/0
 description LAN-1
 ip address 192.168.1.1 255.255.255.0
 no shutdown
!
interface FastEthernet0/1
 description LAN-2
 ip address 192.168.2.1 255.255.255.0
 no shutdown
!
interface GigabitEthernet1/0
 description Connected to R2 Gi1/0
 ip address 100.100.12.1 255.255.255.0
 no shutdown
!
interface GigabitEthernet2/0
 description Connected to R4 Gi2/0
 ip address 100.100.14.1 255.255.255.0
 no shutdown
```

Task 1.2: IGP Configuration

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- Configure OSPF in ISP-A and ISP-B
  - Router ID
  - Interface with OSPF 1 and area 0

- Redistribute client routes
  - Configure static route in R2 and R4
  - Redistribute static routes in OSPF

- Check OSPF neighbors

- Check routing table

Example: R2

```
router ospf 1
 router-id 2.2.2.2
 passive-interface gi1/0
 redistribute static subnets
!
interface GigabitEthernet1/0
 ip ospf 1 area 0
!
interface GigabitEthernet2/0
 ip ospf 1 area 0
!
ip route 192.168.1.0 255.255.255.0 100.100.12.1
```

Example: R3

```
router ospf 1
 router-id 3.3.3.3
 default-information originate always
!
interface Loopback 0
 ip ospf 1 area 0
!
interface GigabitEthernet2/0
 ip ospf 1 area 0
```

Task 1.3: Static Route Configuration

Task 1.3: Static Route Configuration

- Configure static route in R3 and R5 to reach each others network
  - Loopback 0
  - LAN Block
  - P2P Address

Example: R3

```
ip route 10.10.2.0 255.255.255.0 100.100.35.5
ip route 192.168.2.0 255.255.255.0 100.100.35.5
ip route 100.100.14.0 255.255.255.0 100.100.35.5
ip route 100.100.45.0 255.255.255.0 100.100.35.5
```

Task 1.4: Default Route Configuration

Task 1.4: Default Route Configuration

- Configure default route in R1
  - Towards R2 with default AD
  - Towards R4 with AD=10

Example: R1

```
ip route 0.0.0.0 0.0.0.0 100.100.12.2
ip route 0.0.0.0 0.0.0.0 100.100.14.4 10
```

Task 1.5: VPCS Configuration

Example: VPCS-1

```
ip 192.168.1.2 255.255.255.0 192.168.1.1
```

Verify:

```
VPCS-1> show ip

NAME           : VPCS-1[1]
IP/MASK        : 192.168.1.2/24
GATEWAY        : 192.168.1.1
DNS            :
MAC            : 00:50:79:66:68:00
LPORT          : 10038
RHOST:PORT     : 127.0.0.1:10039
MTU            : 1500
```

Task 2: IP Service Level Agreement

Task 2: IP SLA

- Define one or more IP SLAs operations (or probes).
  ```
  ip sla operation_number
  ```
- Define an ICMP echo operation from source to target.
  ```
  icmp-echo {destination-ip-address
  frequency seconds
  timeout milliseconds
  ```
- Schedule an IP SLA operation.
  ```
  ip sla schedule operation-number [life {forever | seconds}]
  [start-time {hh:mm[:ss] [month day | day month] | pending |
  now | after hh:mm:ss}] [ageout seconds] [recurring]]
  ```
- Define one or more tracking objects, to track the state of IOS IP SLAs operations.
  ```
  track object-number ip sla operation-number {state |
  reachability}
  ```
- Specify a period of time to delay communicating state changes of a tracked object.
  ```
  delay {up seconds down seconds | [up seconds] down seconds}
  ```
- Define the action associated with the tracking object.
  ```
  ip route prefix mask address track number
  ```

Task 2: IP SLA

- Check R1's routing table for the default route

  ```
  R1# show ip route
  S*     0.0.0.0/0 [2/0] via 100.100.12.2
  ```

- Ping R3's loopback from the PC.

- Shutdown R2-R3 link.

- Check R1's routing table for the default route

  ```
  R1# show ip route
  S*     0.0.0.0/0 [2/0] via 100.100.12.2
  ```

- Ping R3's loopback from the PC.

Task 2: IP SLA

- Configure IP SLA in R1

```
ip sla 1
  icmp-echo 10.10.1.1
    frequency 5

ip sla schedule 1 life forever start-time now
track 1 ip sla 1 reachability
  delay down 5 up 1

ip route 10.10.1.0 255.255.255.0 100.100.12.2
ip route 0.0.0.0 0.0.0.0 100.100.12.2 2 track 1
```

Task 2: IP SLA

- Configure IP SLA in R1
- Check R1's routing table for the default route
  ```
  R1# show ip route
  S*     0.0.0.0/0 [2/0] via 100.100.12.2
  ```
- Ping R3's loopback from the PC.
- Shutdown R2-R3 link.
  ```
  R3(config)# int gi2/0
  R3(config-if)# shutdown
  ```
- Check R1's log
  ```
  %TRACKING-5-STATE: 1 ip sla 1 reachability Up->Down
  ```
- Check R1's routing table for the default route
  ```
  R1# show ip route
  S*     0.0.0.0/0 [3/0] via 100.100.14.4
  ```
- Ping R3's loopback from the PC.

Task 2: IP SLA

- Bring up R2-R3 link.

```
R3(config)# int gi2/0
R3(config-if)# no shutdown
```

- Check R1's log

```
%TRACKING-5-STATE: 1 ip sla 1 reachability
DOWN->UP
```

- Check R1's routing table for the default route

```
R1# show ip route
S*    0.0.0.0/0 [3/0] via 100.100.12.2
```
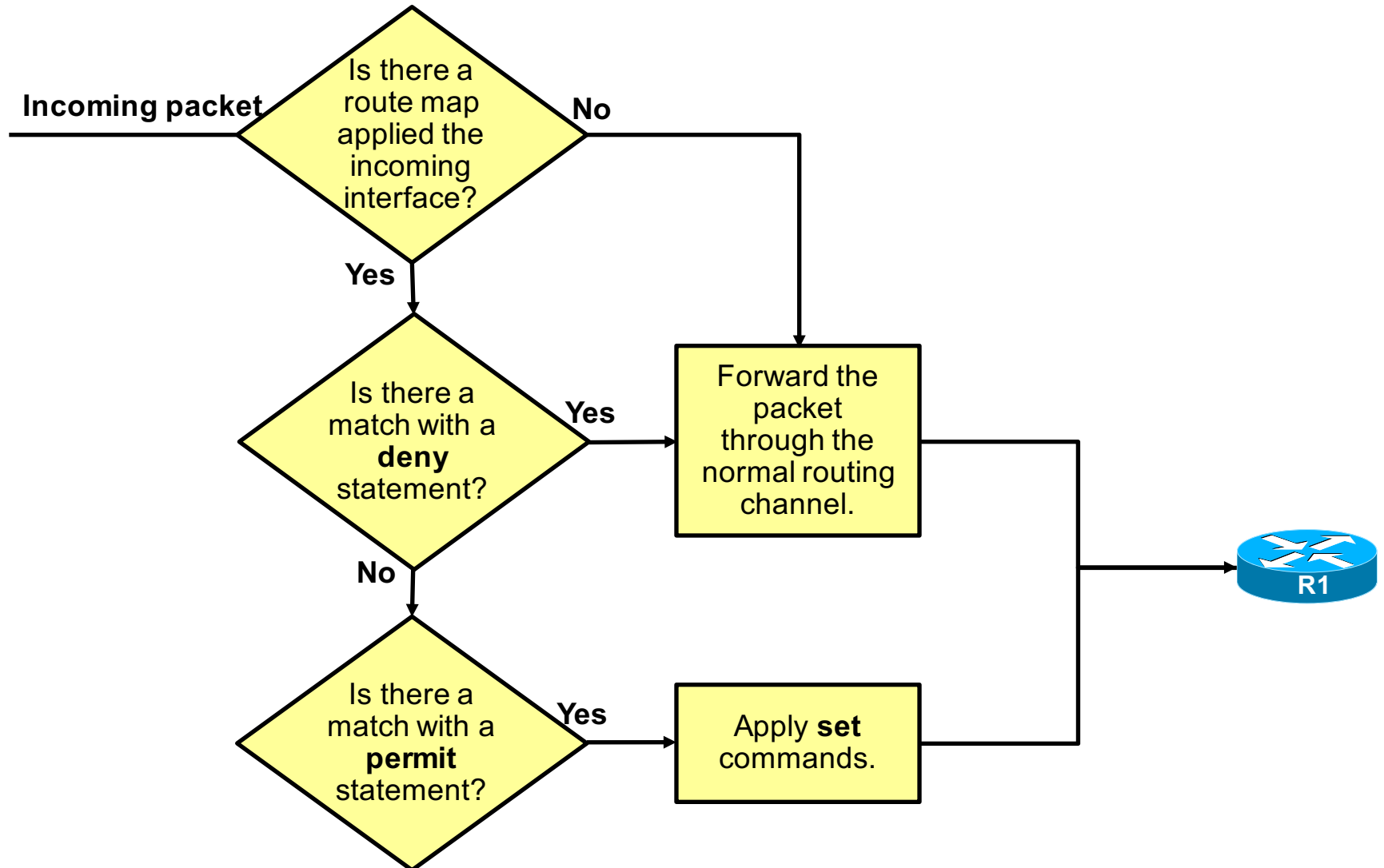
- Ping R3's loopback from the PC.

Task 2: IP SLA

- Verification
  ```
  show ip sla configuration [operation]
  show ip sla statistics [operation-number | details]
  ```

Task 3: Policy Based Routing (PBR)

Logical PBR Operation

Incoming packet

Is there a route map applied the incoming interface?

No

Yes

Is there a match with a **deny** statement?

Yes

Forward the packet through the normal routing channel.

No

Is there a match with a **permit** statement?

Yes

Apply **set** commands.

R1

PBR Configuration

Router(config)#

```
route-map map-tag [permit | deny] [sequence-number]
```

- Defines the route map conditions.

Router(config-route-map)#

```
match {conditions}
```

- Defines the conditions to match.

Router(config-route-map)#

```
set {actions}
```

- Defines the action to be taken on a match.

Router(config-if)#

```
ip policy route-map map-tag
```

- Apply the route-map to the incoming interface.

Task 3: PBR

- Check R1's routing table
  ```
  show ip route
  ```
- Check the trace repot
  - Path from VPCS-1 to Loopback 0 of R3 and R5
  - Path from VPCS-2 to Loopback 0 of R3 and R5
    ```
    trace ip_address
    ```

Example: R1

```
S*   0.0.0.0/0 [1/0] via 100.100.12.2
     100.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       100.100.12.0/24 is directly connected, GigabitEthernet1/0
L       100.100.12.1/32 is directly connected, GigabitEthernet1/0
C       100.100.14.0/24 is directly connected, GigabitEthernet2/0
L       100.100.14.1/32 is directly connected, GigabitEthernet2/0
     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
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, FastEthernet0/1
L       192.168.2.1/32 is directly connected, FastEthernet0/1
```

Example: VPCS-2

```
VPCS-2> trace 10.10.1.1
trace to 10.10.1.1, 8 hops max, press Ctrl+C to stop

 1    192.168.2.1    22.656 ms   11.524 ms   10.454 ms
 2    100.100.12.2   58.633 ms   57.973 ms   60.503 ms
 3    100.100.23.3   58.248 ms

VPCS-2> trace 10.10.2.1
trace to 10.10.2.1, 8 hops max, press Ctrl+C to stop

 1    192.168.2.1    6.402 ms    11.427 ms   11.532 ms
 2    100.100.12.2   70.443 ms   71.961 ms   61.167 ms
 3    100.100.23.3   59.697 ms   57.277 ms   60.513 ms
 4    100.100.35.5   59.003 ms
```

Task 3: PBR

- Configure PBR in R1
  - Configure ACL for the LAN IP Block
  - Configure Route-map
    - Match the ACL
    - Set next-hop
  - Configure the route-map in the ingress interface

Example: R1

```
R1(config)# access-list 1 permit 192.168.1.0 0.0.0.255
R1(config)# access-list 2 permit 192.168.2.0 0.0.0.255

R1(config)# route-map UPLOAD permit 10
R1(config-route-map)# match ip address 1
R1(config-route-map)# set ip default next-hop 100.100.12.2
R1(config-route-map)# route-map UPLOAD permit 20
R1(config-route-map)# match ip address 2
R1(config-route-map)# set ip default next-hop 100.100.14.4
R1(config-route-map)# route-map UPLOAD permit 30

R1(config-if)# int fa0/0
R1(config-if)# ip policy route-map UPLOAD
R1(config-if)# int fa0/1
R1(config-if)# ip policy route-map UPLOAD
```

Example: VPCS-1 and VPCS-2

```
VPCS-1> trace 10.10.1.1
trace to 10.10.1.1, 8 hops max, press Ctrl+C to stop
 1    192.168.1.1   12.064 ms   11.235 ms   11.178 ms
 2    100.100.12.2   34.924 ms   36.099 ms   34.880 ms
 3    *100.100.23.3   60.178 ms

VPCS-2> trace 10.10.2.1
trace to 10.10.2.1, 8 hops max, press Ctrl+C to stop
 1    192.168.2.1   2.495 ms   11.186 ms   11.253 ms
 2    100.100.14.4   34.335 ms   35.169 ms   35.925 ms
 3    100.100.45.5   59.837 ms
```

Task 3: PBR

- Verification
  show ip policy
  show route-map [_map-name_**]**

Question?