Experience 3 – Static Routing and OSPF

After having obtained a working layer 2 topology, you will be asked to allow the connectivity with external networks and also focus on the ISP network.

The PE1 (*Provider Edge 1*) router will be configured in to be the attach point to the OSPF ISP network. The ISP network is composed by a central backbone that connects together multiple POPs (*Point of Presences*); the POP router will collect the traffic from all the router of a geographic area that connects the user/company networks connected to the Provider Edge routers (PEs).

In Figure 1 the simplified ISP topology to be realized in the experience is reported.

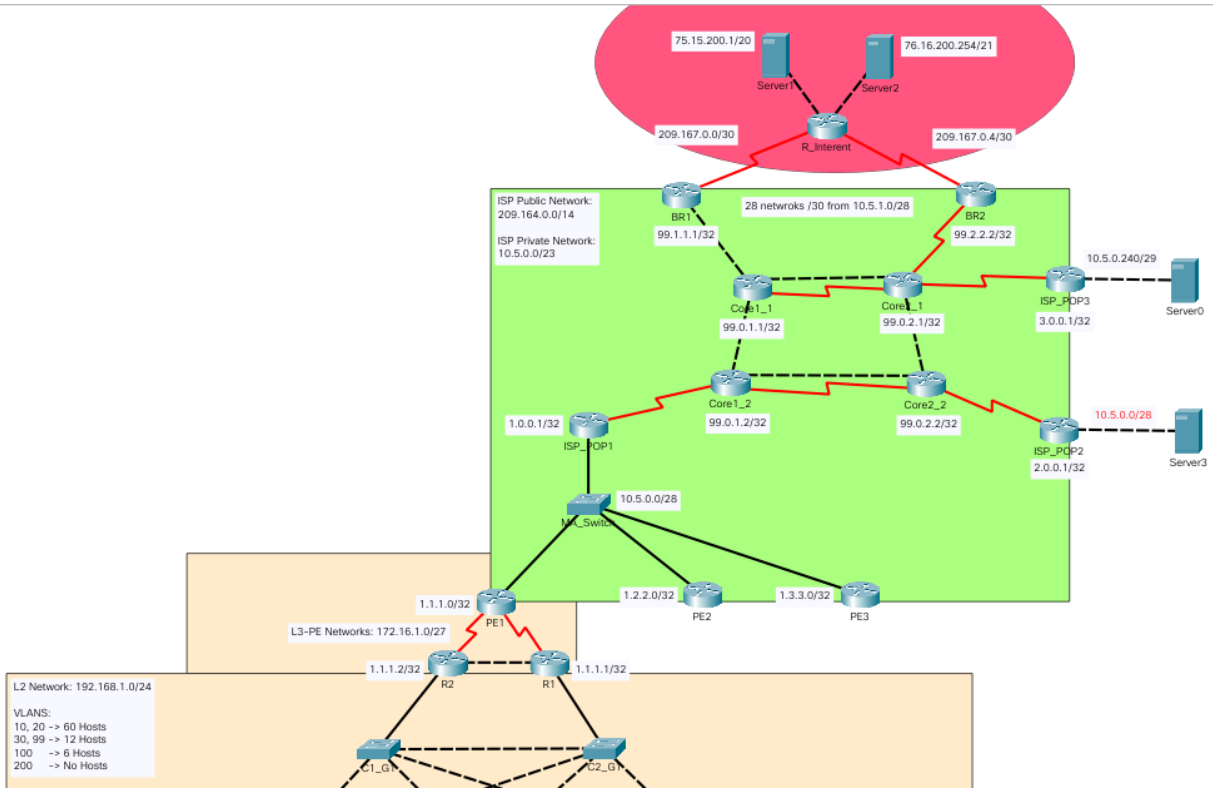

Figure 1: Experience3 topology

PART 1 – Static Routing

Topology Changes

Begin with the modifications to existing network before adding the ISP devices:

- add the router R2 to allow redundancy in case of the default gateway failure; connect it to C1_G1 while R1 should now be connected only to C2_G1.
- PE1 that represent the Provider Edge that connects R1 and R2 to the ISP network; perform all the initial configuration on the new devices.

Inter-VLAN Routing

- Modify the configurations to have R1 performing routing between VLAN 10 and 30 and R2 to route between VLAN 20, 99 and 100.

Static Routing

- Connect R1 and R2 using a free Gbit port and use the link to route between the network of the other VLANs; the link should have addresses from the last /30 subnet of the 172.16.1.0/27. Add *Loopback0* interface also on R2 with the address 1.1.1.2/32.
- Configure the static routing in order to have the VLAN 10 and 30 to exit form R1, cross the link R1<-->R2 and enter again on R2 to reach the VLAN 20, 99 and 100 (and vice-versa). Do **NOT** use a default route for this task. Ensure also the reachability of the *Loopback0* of every router.
- Add the router PE1, connect it to R1 and R2 using a serial connection (PE1 should be the DCE) and use other two /30 subnets for those links (always start from the end).
- Configure a floating static route to be used as a backup when the R1<-->R2 link goes down (remember to add a static route also on PE1; do not use the floating routes on this router or you may create routing loops).
- Configure a default route on R1 and R2 to send all the remaining traffic through PE1; PE1 should have a reachable *Loopback0* with the address 1.1.1.0/32.

Update the **topology map**, to reflect the new topology; report also the tests performed to assess the correctness of the configurations and to test the floating routes.

PART 2 – OSPF

Topology Changes (add the ISP)

Proceed now to create the ISP network.

- The connection between the PE1 and the ISP (ISP_POP1) is realized with a switch in the middle to attach to the same router multiple PEs: PE1, PE2 and PE3 (this is a simplification of a real topology and the switch should be seen as all the routers in the middle between the PE and the POP);
- connect the ISP_POP1 as well as the other ISP_POPs the backbone network with a serial link;
- create the backbone network using 4 routers connected as in Figure 1; the double link emulates a long distance redundant connection (in the past made in copper and now in fiber);
- the backbone network has two external connections to other ISPs, represented by the border routers BR1 and BR2;
- the big Internet is simulated with the router R_Internet connected to BR1 and BR2 and with two test servers connected to it.

Static Routing

- R_Internet should be able to return the traffic from the servers to the POPs (and to the devices able to reach the servers); configure the static routing to do this in order to use both the links that connects to the BRs and minimize the written routes but remember to still guarantee the connectivity.

Addressing

- The ISP uses the 10.5.0.0/23 as a private block (in a real network also public addresses are used here as well as the address translation, NAT). The block is subnetted and used on the connections between the routers of the ISP.
- Subnet the 10.5.0.0/23, to obtain the /28 and /29 networks to satisfy up to 20 POPs; use the first /28 for POP1, the first /29 for POP2 and the last /29 for POP3. Subnet the 10.5.1.0/23 to obtain the /30 networks to be used on the point to point links inside the ISP.
- On the public interfaces of the border routers (BR1 and BR2) the 209.164.0.0/14 public internet routable block should be used (we do not use NAT here; this is a simplification compared the real world). Use the first two /30 for the connections with R_Internet.
- Where reported use the addresses in Figure 1 for the external networks and the servers. Also configure the Loopback0 on every router with the address in the topology.

OSPF

- The routing in the ISP network (the green one in Figure 1) should be done with the Single-Area OSPF protocol. The OSPF process should be enabled also on the routers R1 and R2 and the subnet of the VLANs should participate in the routing process.
- The Router-ID should be manually configured to the same address of the Loopback 0 on the Core and BR routers while on the other you must allow the automatic election on the interfaces address. Examine what is selected by the router and explain why.
- BR1 and BR2 should inject the default route in the ISP network to enable the company network to reach the Internet (do **not use** static routes that point directly to the address of the Servers). The links between them and the R_Internet should **not** partecipate in the OSPF process.
- The addresses of the two servers on ISP_POP2 and ISP_POP3 should also be announced in the OSPF process.
- Due to an imminent maintenance procedure, the link between Core1_2 and Core1_1 should be non preferred by OSPF, so modify its bandwidth value to allow its use only as a backup link. Ensure also that OSPF could be able to prefer the Gigabit link over the FastEthernet links when multiple paths are available.
- Note that the link between ISP_POP1 and the PEs is a multi-access segment: observe the Operational State of the link here (DR and BDR were not explained in the course).

Update the **topology map**, to reflect the new topology; report also the tests performed to assess the correctness of the configurations. Verify that the link between Core1_2<->Core1_1 is not preferred, verify the propagation of the correct default routes (from BR1 and BR2). Verify the routing table on the routers.