Departamento de Engenharia Eletrotécnica

Configuração e Gestão de Redes

2024 / 2025

Mestrado em Engenharia Eletrotécnica
e de Computadores

1º Project:
CLI configuration: L2 and L3 network configuration

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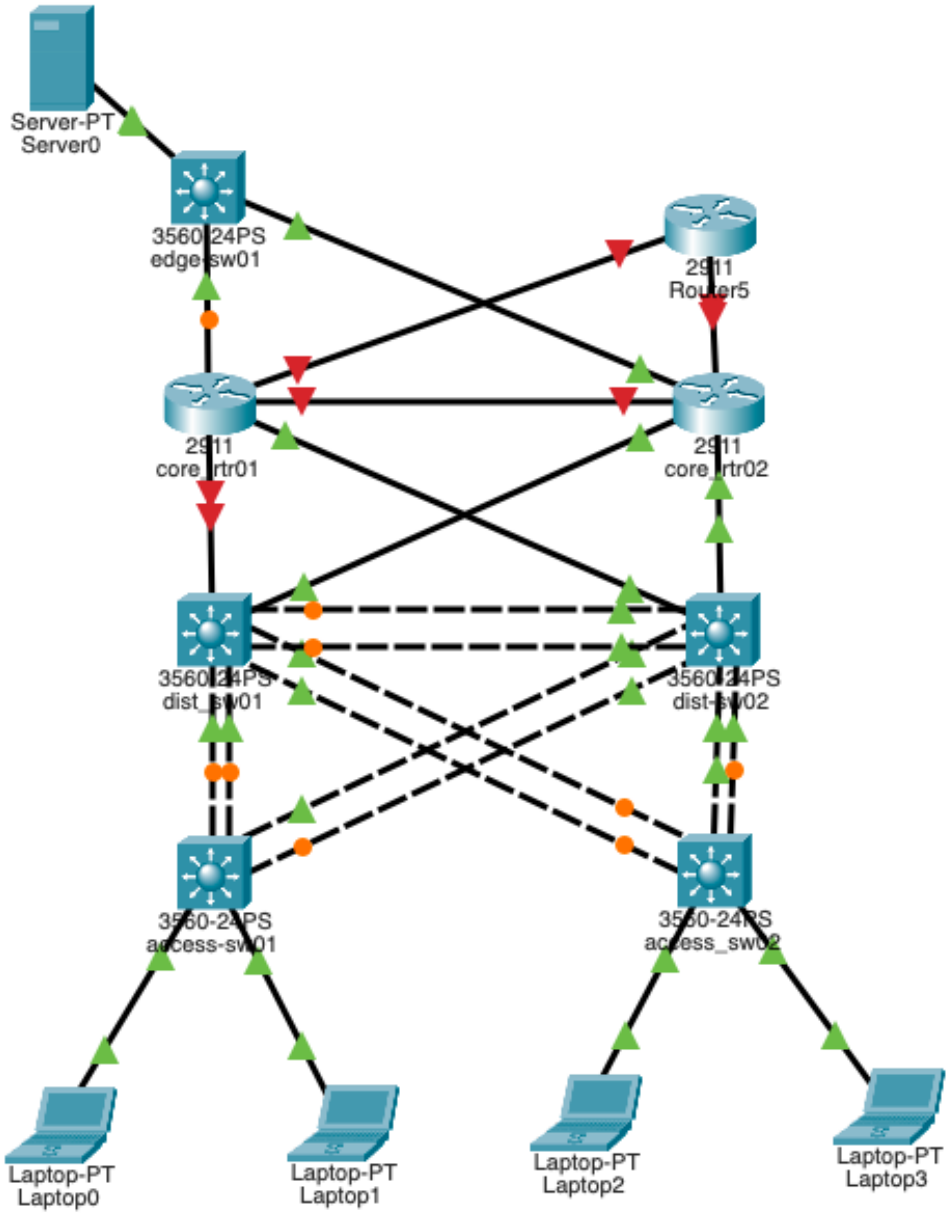
FIRST PART: DESIGN AND CONFIGURE AN ENTERPRISE NETWORK.

You will configure a hierarchical enterprise network. The network as an access pod composed by two access and two distribution switches. They represent for example the access network of two different buildings of a campus (each building with its access and distribution switch). These distribution switches are then connected via two core switches. The core switches connect to Internet via a router and to a datacenter simulated by a top of the rack (TOR) switch and one server. The following figure illustrates the topology:



There will be two different scenarios for the access part of the network, **you will need to configure both variations** and deliver the configuration files (text files containing the configuration of the devices) along with the packet tracer file(s) with the solution(s). The differences will be on the access and distribution switches, the other part of the network can work with the same configuration for both variations.

Access scenario1: end-to-end VLANs

In this scenario there are two access VLANS (VLAN 2 and VLAN 3) both with hosts in **Access1 and Access2** switches. This implies that the connections between the access switches and the distribution switches must be in layer 2.

Access scenario 2: local VLANs

In this case VLAN 2 only exists in the access 1 switch and VLAN 3 only exists in in the access 2 switch.

The goal for both scenarios is that all end hosts in **both** VLANs can communicate with each other, with the server in the datacenter and with the Internet host.

You should implement the following requirements:

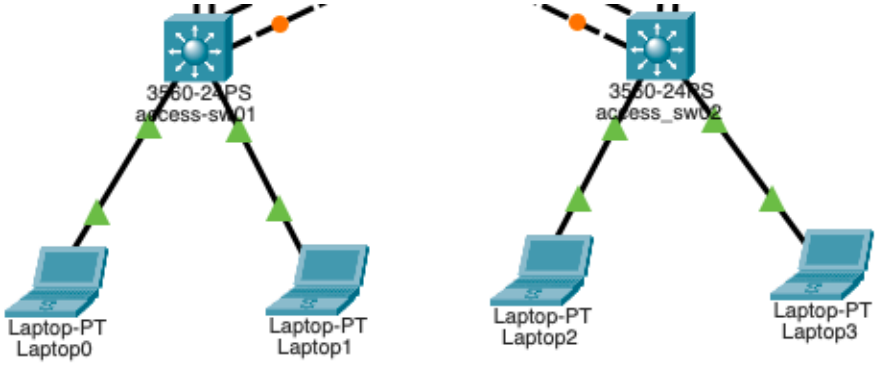
- The network has 2 access switches where end hosts connect.
- There are 2 different end user VLANs 2,3.
- **At least** the distribution and core part of the network work at layer 3, using EIRGP or single area OSPF.
- In scenario 1 VLAN 2 an VLAN 3 have access ports in both access switches
- IN scenario 2 VLAN 2 only has access ports in the access 1 switch and VLAN 3 only has access ports in the other switch. User-facing ports should be configured for access for the corresponding VLAN.
- The server in the data center should be reached by users in any of the VLANs
- The internet host must be reachable by hosts in all VLANs via a default route.
- Links between the access switches and distribution switches should be bundled together using etherchannel.
- Use an addressing scheme based in subnets of the 10.8.0.0 /16 block.
- In the L3 part of the network (at least the distribution and core) you must configure EIGRP or single area OSPF.
- The router-rtr01 should inject a default route, so that any traffic whose destination is not known inside this network is directed to the router.
- The distribution routers should summarize the networks of the VLANs in the announcements to the core routers. You should choose contiguous Subnets for the VLANs of a POD so that you can perform this summarization.
- You have to deliver the configuration for both scenario 1 and scenario 2.

Work Plan and links for documentation

1. You should start by opening the provided project file in packet tracer.

2. You can familiarize yourself with IOS by following the instructions in the document “IOS introduction” in https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/fundamentals/configuration/xe-16/fundamentals-xe-16-book.html (This should have been done in the first week of lab classes)

3. You should then start by configuring the Access Switches.

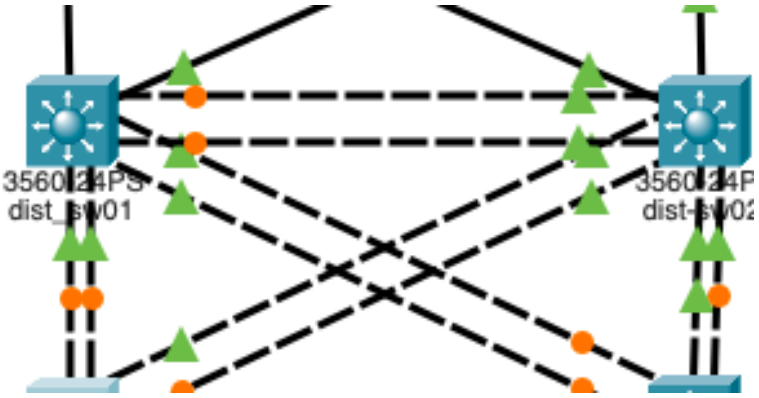


Create the host VLANs in both switches, configure the access ports in access mode and attribute them to the respective VLANs. Finally, you should configure the links between the switches as trunks or L3 links (depending on the scenario) and add them to the same Etherchannel port. After you complete this if you configure two host from the same VLAN with IP addresses from the same network they should be able to communicate. You can find configuration information about configuring VLANS and VTP in the Cisco catalyst 3560 configuration guide at:

https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/15-0_1_se/configuration/guide/scg3560.html

Information about Port-channel configuration can be found in:
https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/15-0_1_se/configuration/guide/scg3560/swethchl.html#12539

4. You can then configure the Distribution switches:



5. If you need to have layer 2 up to the distribution switches you need to create the VLANs in the distribution switches, the links between the access and distribution switches are in that case 802.1Q trunks that you should configure to transport all the relevant VLANs.
6. You have to decide, according to needed connectivity and VLAN host distribution in the two scenarios, if the links between Distribution 1 and 2 and switches Access 1 and Access 2 will either be configured as trunks or as layer 3 links in either case, they should be group together in EtherChannels.
7. Finally, you should create the SVIs for the VLANs, thus defining the IP subnets for each VLAN and then enable routing in the switches were you create them. You can find configuration documentation on configuring SVIs and Layer 3 interfaces in:

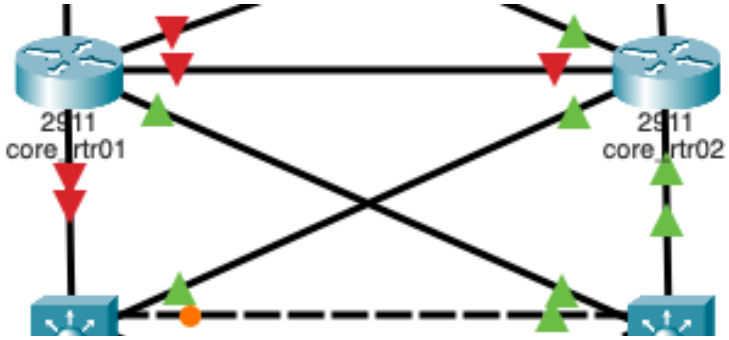
https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/15-0_1_se/configuration/guide/scg3560/swint.html#48776

8. You should test connectivity by assigning IP addresses to the hosts belonging to the corresponding VLAN IP subnet and configuring the hosts gateway to the IP address of the SVIs.

9. Finally if the links between the Access and distribution switches are in layer 2 you can define the most suitable root bridges. You can documentation on configuring STP in Cisco catalyst switches in:

https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/15-0_1_se/configuration/guide/scg3560/swstp.html

10. Configure the core layer routers:



11. Here you should configure the Layer 3 links between the distribution switches and the core routers, each in its own IP subnet. You should enable routing and configure EIGRP or OSPF with:
    1. The appropriate networks to announce.
    2. The summarization of the addresses announced from the aggregation switches.

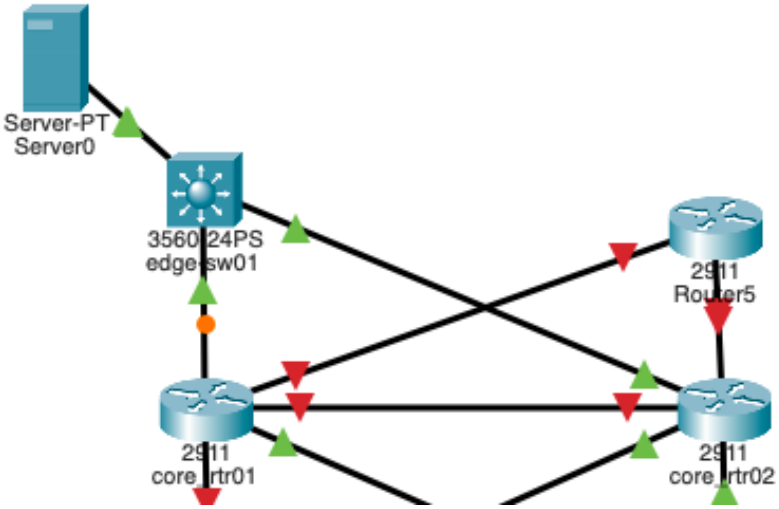
Information on routing configuration in the switches can be found in:

https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/15-0_1_se/configuration/guide/scg3560/swiprout.html

And for the router in:

https://www.cisco.com/c/en/us/td/docs/routers/access/1900/software/configuration/guide/Software_Configuration/routconf.html?bookSearch=true

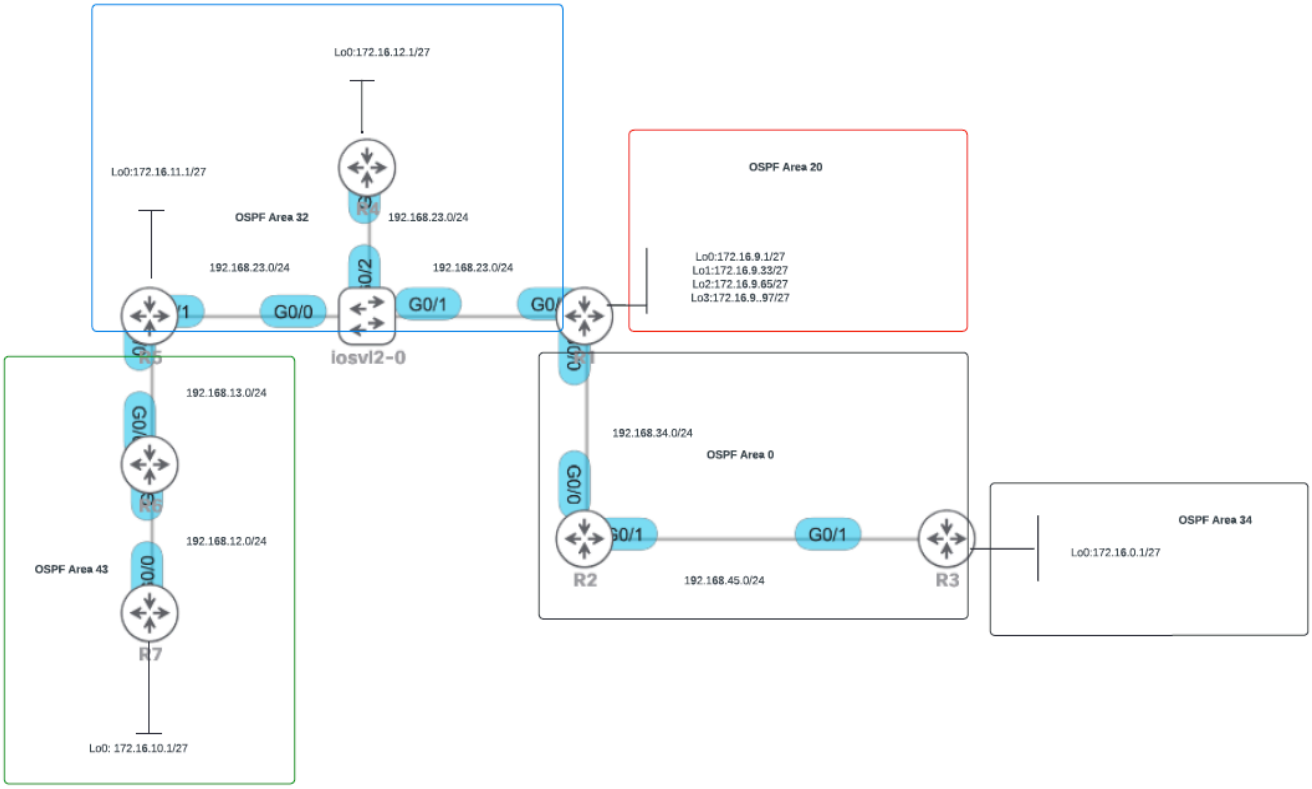
12. Configure the connections between the core routers, the internet router and the Data Center TOR switch (edge-sw01).



You must configure the interface connecting the router and the core 2 router. And the internet-router should inject a default route into the routing domain.

SECOND PART: OSPF:

You should configure a routing scenario that represents the routing between branches of an enterprise network using OSPF. The following figure represents the scenario.



Work Plan and links for examples

You should implement the following configuration requirements such as to provide full connectivity between all addresses in the topology. You can find OSPF configuration information at:
https://www.cisco.com/c/en/us/td/docs/dcn/nx-os/nexus9000/104x/unicast-routing-configuration/cisco-nexus-9000-series-nx-os-unicast-routing-configuration-guide.html

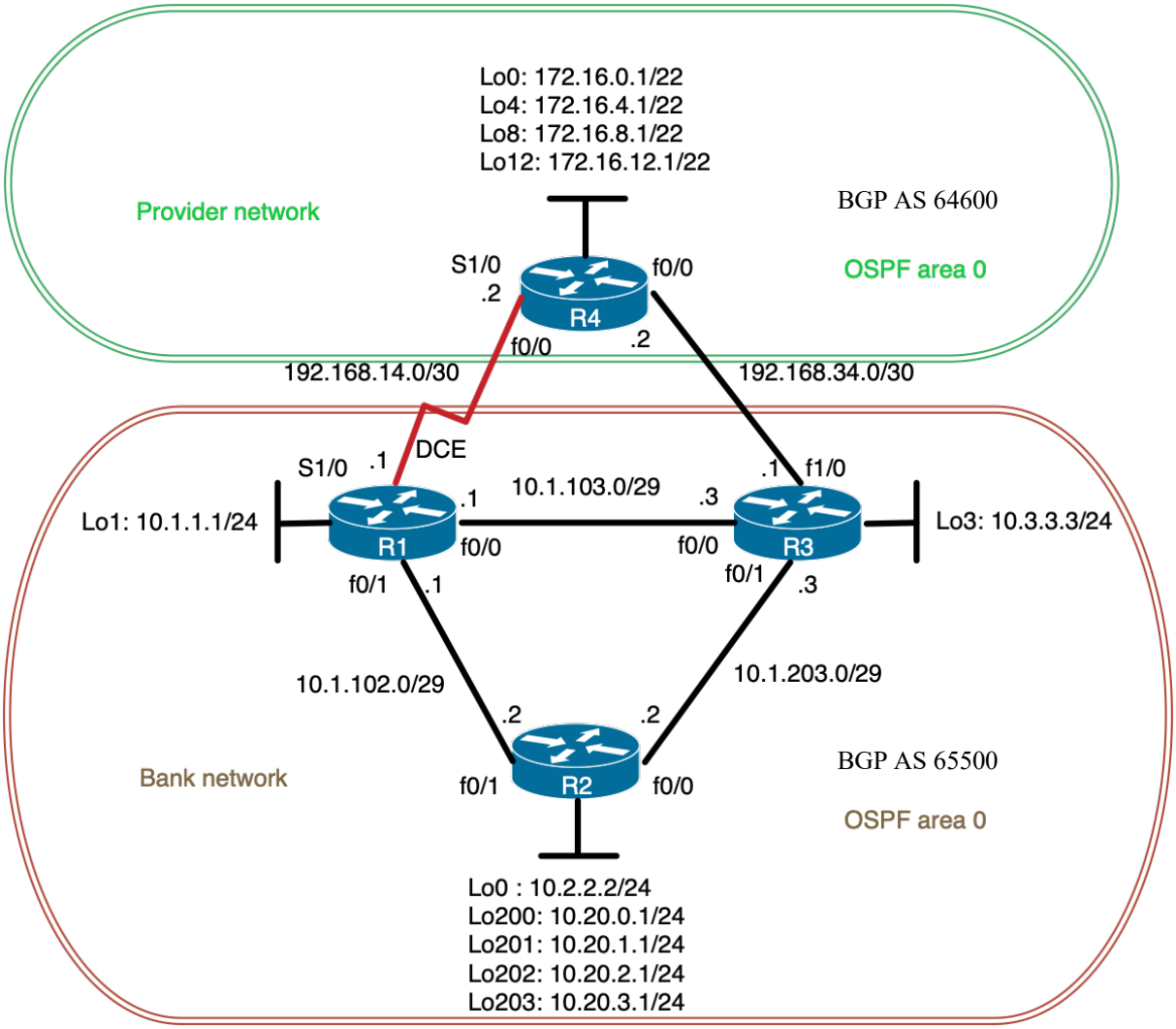
1. Configure the interfaces in the diagram with the IP addresses shown.
2. Configure OSPF with the interfaces in the areas shown in the diagram.
3. Configure R1 to summarize area 20 with the most specific mask possible.
4. Make the links between R1, R4 and R5 have the OSPF network type of broadcast, with R1 as the DR, configure the switch ports in access mode VLAN 1.
5. Configure R3 to always originate a default route.
6. Figure out the hidden issue in the topology that you need to address to have full connectivity.
7. Verify connectivity between all addresses in the topology.

The project file for use in the Cisco Modelling Labs Sandbox can be found in:
http://tele1.dee.fct.unl.pt/cgr_2023_2024/pages/laboratorios.html

It has as similar management network architecture to the one in part I so that you can configure the devices and test connectivity both via the management interfaces and/or via console access.

BGP – THIS IS TO BE DELIVERED AS PART OF THE SECOND PROJECT

The second BGP routing scenario is represented in the following figure:



Work Plan and links for examples

You should implement and verify the following requirements. You can find BGP configuration examples in the "BGP scenario 1" in http://tele1.dee.fct.unl.pt/cgr_2020_2021/files/LabBGP1.pdf and "BGP scenario 2" in the http://tele1.dee.fct.unl.pt/cgr_2020_2021/files/LabBGP2.pdf.

1. Use the addressing scheme shown in the diagram
1. Configure OSPF inside the bank Network with a single area (area 0).
2. Configure OSPF inside the provider network with a single area (area 0).
3. Configure the Bank network to be in BGP AS 65500 and the provider network in BGP AS 64600.
4. Include the 192.168.14.0/30 and the 192.168.34.0/30 networks in the OSPF instances inside the two ASes.
5. Configure the interfaces on the border routers between the two autonomous systems, so they do not send OSPF packets.
6. All routers will be participating in BGP. Configure all routers for a full mesh of IBGP peers in each system.

7. Advertise all loopback interfaces into the BGP process, except on R2 where the only advertised should be loopback 0.
8. In R2 for the rest of the loopback interfaces create a summary route and advertise this static route into BGP.
9. R4 should send a summary route via BGP to the bank network representing all R4 loopback interfaces.
10. R4 should prefer the path to the Bank network via the Ethernet link R4-R3.
11. Routers in the Bank network should prefer the link R1-R4 to reach provider networks.