University of Aveiro
Licenciatura em Engenharia Informática

Exam of Networks and Services – January, 22nd 2019

Duration: 2h30m. Without consultation. Justify all your answers carefully.

1. Regarding the network of switches (SW1 to SW4, SWL3A, SWL3B and SWL3C) belonging to the company network (SA 1111) in annex, consider that: (i) all connections between layer 2 switches (layer 2-layer 2) and between layer 2 and layer 3 switches (layer 2-layer 3) are inter-switch/trunk ports, (ii) the Spanning Tree Protocol (STP) is active in all switches/bridges.

a) For the Spanning-tree process, identify and justify which is the root switch/bridge, which is the root path cost of each switch/bridge, which are the root ports and which ports are designated and blocked in each switch/bridge. Justify your answer.

Note: the STP priority and the MAC address are indicated next to the corresponding switch/bridge, while the STP cost of all ports is located between parenthesis next to the corresponding port. (2.5 points)

b) Suppose that SWL3C fails. How will the Spanning Tree reconfigure itself and which configuration messages will circulate along the different connections of the network of switches? Present the new spanning tree that results from this change. (1.5 points)

2. Consider that in the network of the figure in the annex, 3 VLANs are configured in all L2 switches, SWL3A, SWL3B and SWL3C. The company owns the public IPv4 address range 193.3.3.0/24 and will used the private IPv4 address range 192.168.0.0/16. The company also has the IPv6 address range 2000:A:A::/56.

a) Define public and/or private IPv4 sub-networks (identifier and subnet mask) for all LAN and VLAN, assuming that there are services running at terminals/servers that effectively need public IPv4 addresses, namely: VLAN 1 has a maximum of 25 terminals that need public addresses; VLAN 2 has a maximum of 35 terminals that need public addresses; the DMZ needs 4 public addresses; the Datacenter needs 8 public addresses; the NAT/PAT mechanism needs 5 public addresses. Also define IPv6 sub- networks (identifier and subnet mask) for all LAN and VLAN. (2.0 points)

b) Considering that the ARP tables and the IPv6 neighborhood tables are empty, identify which packets are exchanged (between devices), and their sequence, when the IPv4 and IPv6 ping commands are executed from PC A, connected to VLAN 3, to PC B, connected to VLAN 32 (assume that the gateway is the corresponding SWL3 C interface). (1.5 points)

c) When capturing in the network of switches any of the packets mentioned in the previous question, how can we know the VLAN that it belongs to? Which protocol allows physical connections (between interswitch ports) to be shared by different virtual networks (VLANs)? (1.0 points)

3. Consider now that Routers 1 and 2 and L3 Switches SWL3A, SWL3B and SWL3C are configured with the RIPv2 and OSPFv3 routing protocols. Also assume that Routers 1 and 2 are announcing a default route in both IPv4 and IPv6.

a) How is the IPv4 routing table of SWL3A? Note: Identify the networks, IP addresses and interface names by and explicit alphanumeric identifier (ex: redeIPv4VLAN1, endIPv4eth0Router1, intEth0Router1). (1.5 points)

b) How is the IPv6 routing table of SWL3C? Assume that Routers 1 and 2 announce a Type 2 (E2) default route through OSPFv3. Note: Identify the networks, IP addresses and interface names by and explicit alphanumeric identifier (ex: redeIPv4VLAN1, endIPv4eth0Router1, intEth0Router1). (1.5 points)

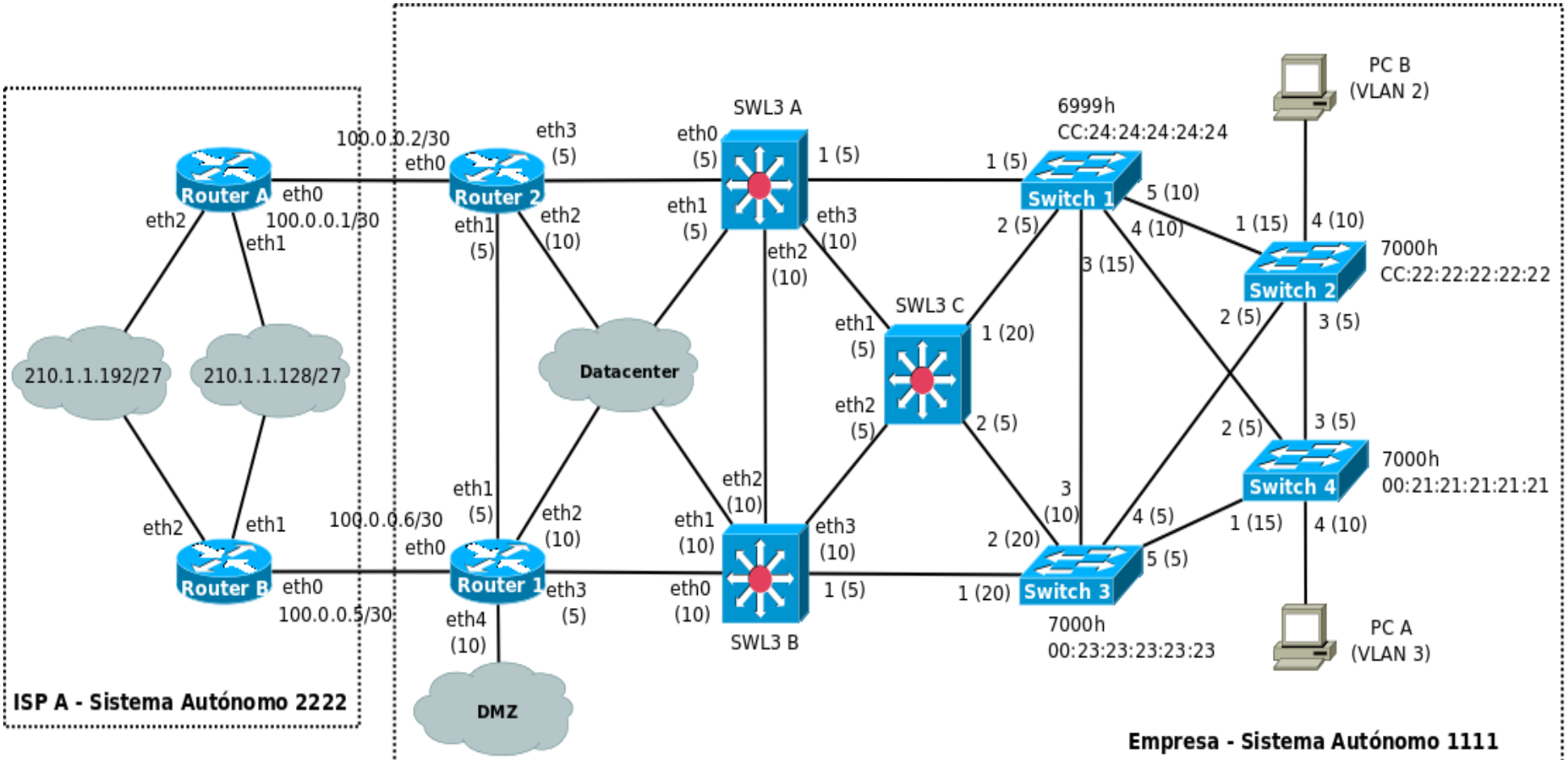
c) Suppose that we want that any IPv6 packet coming from the network of L2 switches and destined to the outside of the company network be preferentially routed through Router 2. Which configurations do you need in order to achieve that goal? (1.0 points)

4. Consider that Routers 1, 2, A and B are configured with the BGP protocol and have already established BGP neighbourhoods between their corresponding autonomous systems.

a) Assuming that Routers 1 and 1 announce through BGP the aggregate of all IPv4 networks of their Autonomous System (AS 1111) and Routers A and B announce through BGP the aggregate of all IPv4 networks of their Autonomous System (AS 2222), which is the IPv4 routing table of Router A? (1.5 points)
b) If the eth1 interface of Router B is turned off (*shutdown*), which BGP messages will circulate in network 100.0.0.4/30? (1.0 points)
c) If you want the output of AS 1111 to be preferentially made through Router 1 and the input to AS 1111 to be preferentially made through Router 2 , which configurations do you need in order to achieve that goal? Justify. (1.5 points)

5. For security reasons, we want to assure that: (i) users external to AS 1111 should not be allowed to execute the *telnet* command to any public IP address that is internal to AS 1111; (ii) users from VLAN 2 should not have access to the FTP server that is located at the Datacenter. Explain which configurations are necessary in order to achieve theses objectives and in which devices/interfaces should they be made. (2.0 points)

6. If you have a Videoconference server located at VLAN 3 that should be accessible from the outside of the company network, which mechanisms do you have to configure and in which equipments? Specify their main configuration steps. (1.5 points)



SWL3 A
Priority: 7999h
MAC Address: AA:1A:1A:1A:1A:1A
Interfaces VLAN (custo OSPF 5)

SWL3 B
Priority: 7000h
MAC Address: BB:1B:1B:1B:1B:1B
Interfaces vlan (custo OSPF 5)

SWL3 C
Priority: 6000h
MAC Address: CC:CC:CC:CC:CC:CC
Interfaces vlan (custo OSPF 10)