Universidade de Aveiro
Licenciatura em Engenharia Informática

Exam of Networks and Services – January 16, 2018

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

1. Regarding the network of switches (SW1 to SW5, SWL3A and SWL3B) belonging to the company network (AS 1111) in the 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) How could you optimize the operation of the network of switches? Specify all the steps that are necessary to implement that change. (1.0 points)

c) Suppose that SW5 fails. How will the Spanning Tree reconfigure itself and which configuration messages will circulate along the different connections of the network of switches? (1.0 points)

2. Consider that in the network of the figure in the annex, 3 VLANs are configured in all switches L2, SWL3A and SWL3B. The company owns the public IPv4 address range 194.1.1.0/25 and will used the private IPv4 address range 192.168.0.0/16. The company also has the IPv6 address range 2100:10:10::/60.

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 18 terminals that need public addresses; a VLAN 2 has a maximum of 14 terminals that need public addresses; DMZ needs 4 public addresses; Datacenter needs 12 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 neighbourhood 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 1, to PC C, connected to VLAN 3 (assume the *gateway* is the corresponding SWL3 A interface). (2.0 points)

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

a) Which 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). (2.0 points)

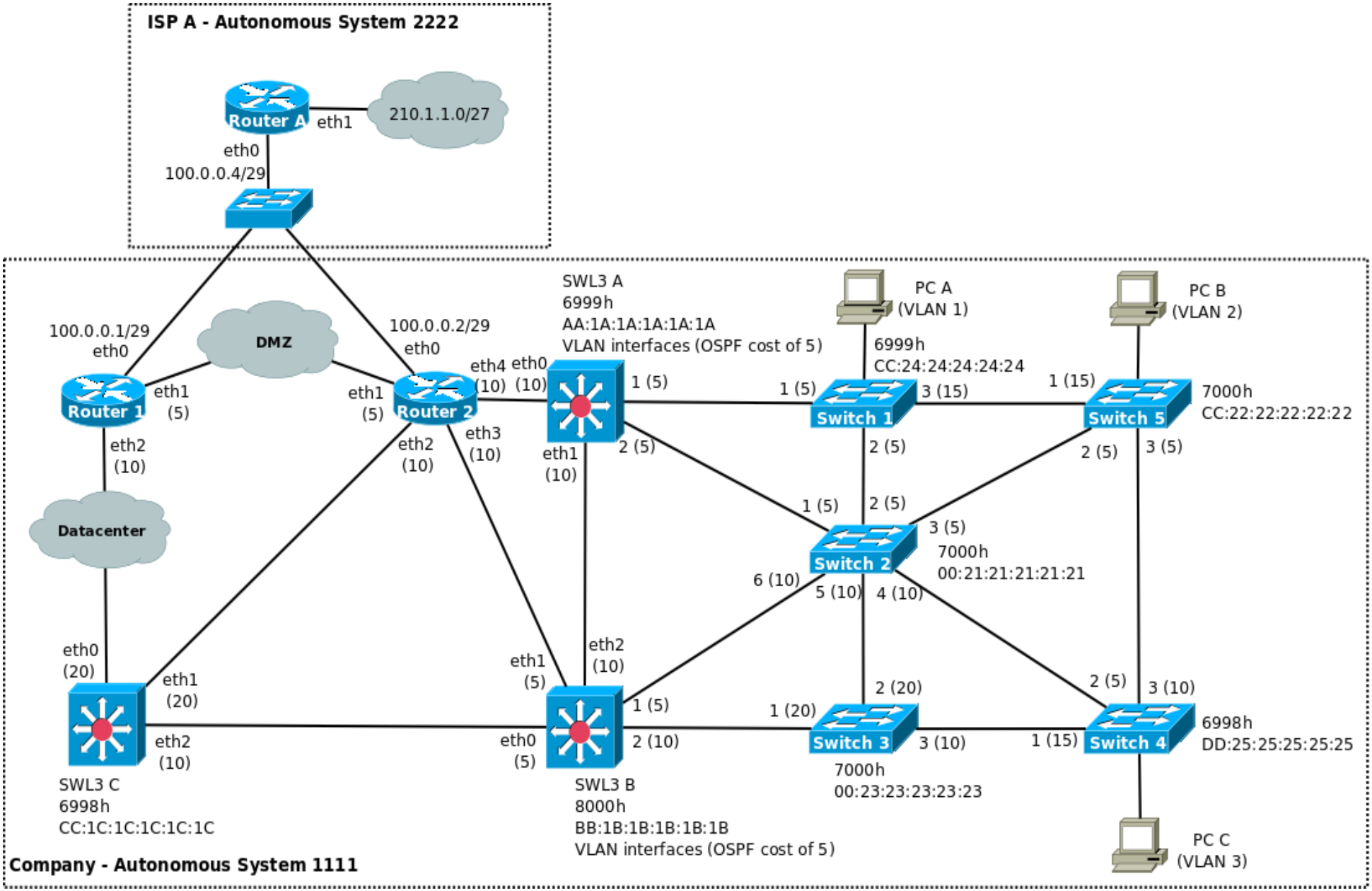
b) If the OSPFv3 protocol is activated in Routers 1 and 2 and L3 Switches SWL3A, SWL3B and SWL3C (considering that the OSPF costs of the physical ports are indicated between parenthesis), which are the changes on the routing table of SWL3 A? Assume that Routers 1 and 2 announce a type 2 default route both in IPv4 and IPv6. (2.0 points)

c) Suppose that we want that any IPv6 packet coming from the network of L2 switches and destined to the Datacenter be preferentially routed through SWL3C. Which configurations do you need in order to achieve that goal? (1.0 points)

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

a) Assuming that Routers 1 and 2 announce through BGP the aggregate of all IPv4 networks of their Autonomous System (AS 1111), which is the IPv4 routing table of Router A? (1.5 points)
b) If the eth1 interface of Router 2 is turned off (*shutdown*), which BGP messages will circulate in network 100.0.0.0/29? (1.0 points)
c) If you want the output of AS 1111 to be preferentially made through Router 1, which configurations do you need in order to achieve that goal? Justify. (1.0 points)
d) If you want the input of AS 1111 to be preferentially made through Router 2, which configurations do you need in order to achieve that goal? Justify. (1.0 points)

5. For security reasons, we want to assure that: (i) users external to AS 1111 should not be allowed to execute the *ping* command to any public IP address that is internal to AS 1111; (ii) users from VLAN 1 should not have access to the DMZ. Explain which configurations are necessary in order to achieve theses objectives and in which devices should they be made. (2.0 points)


ISP A - Autonomous System 2222
Router A
eth1
210.1.1.0/27
eth0
100.0.0.4/29
Company - Autonomous System 1111
100.0.0.1/29
eth0
DMZ
100.0.0.2/29
eth0
Router 1
eth1
(5)
Router 2
eth1
(5)
eth2
(10)
eth2
(10)
eth3
(10)
eth4
(10)
eth0
(10)
eth1
(10)
SWL3 A
6999h
AA:1A:1A:1A:1A:1A
VLAN interfaces (OSPF cost of 5)
1 (5)
2 (5)
PC A
(VLAN 1)
6999h
CC:24:24:24:24:24
PC B
(VLAN 2)
1 (5)
3 (15)
Switch 1
1 (15)
Switch 5
7000h
CC:22:22:22:22:22
2 (5)
3 (5)
Datacenter
1 (5)
2 (5)
Switch 2
3 (5)
7000h
00:21:21:21:21:21
6 (10)
5 (10)
4 (10)
eth0
(20)
eth1
(20)
eth2
(10)
SWL3 C
6998h
CC:1C:1C:1C:1C:1C
eth1
(5)
eth2
(10)
eth0
(5)
1 (5)
2 (10)
SWL3 B
8000h
BB:1B:1B:1B:1B:1B
VLAN interfaces (OSPF cost of 5)
1 (20)
2 (20)
Switch 3
3 (10)
7000h
00:23:23:23:23:23
2 (5)
3 (10)
1 (15)
Switch 4
6998h
DD:25:25:25:25:25
PC C
(VLAN 3)