February, 4th 2022

Exam of Switching technologies for data centers (2021/22)

Rules for the exam. It is **forbidden** to use notes, books or calculators. When needed, use approximations. The answers must be provided in correct English. Any notation must be defined.
Time available: 70 minutes.

Problem A

Answer in details to the following questions:

1. What is P4?
2. Why P4 is very relevant for networking nowadays?
3. What is the difference between P4 and OpenFlow?
4. Consider the following P4 code and comment as much as you can each line of code.

```
parser MyParser(..) {
    state start {
        transition parse_ethernet;
    }
    state parse_ethernet {
        packet.extract(hdr.ethernet);
        transition select(hdr.ethernet.etherType) {
            TYPE_IPV4: parse_ipv4;
            default: accept;
        }
    }
    state parse_ipv4 {
        packet.extract(hdr.ipv4);
        transition accept;
    }
}
```

Problem B

Consider a data center built with the switches in the table. All the servers are equipped with ports at 10 Gbps.

Switch model	Ports
Top-of-Rack	50 @ 10 Gbps + 10 @ 40 Gbps
Spine	10 @ 40 Gbps

1. Draw the largest 2-layer data center with the above switches
2. Compute the corresponding number of servers, ToR switches and spine switches
3. Compute the corresponding oversubscription ratio
4. Draw the largest 3-layer data center with the above switches
5. Compute the corresponding number of servers, ToR switches and spine switches
6. Compute the corresponding oversubscription ratio

Problem C

Answer to the following questions related to cloud computing and data centers.

1. What are the key aspects of cloud computing, according to the NIST definition?
2. Define each cloud computing service model and provide at least two examples.
3. What does it mean that the cpu is virtualized in a data center?
4. What does it mean that the memory is virtualized in a data center?
5. What does it mean that the storage is virtualized in a data center?
6. What does it mean that the network is virtualized in a data center?
7. Describe the traffic within a data center, specifying the end-points and providing some examples.
8. What is the purpose of BGP within a data center?

Hints for the solution

Problem B

Datacenter	Servers	ToR Switches	Spine switches	Oversubscription ratio
2 layers	500	10	10	1.25
3 layers	2500	50	150	1.25