Written examination in Cloud Computing

February 11th 2014

Last name: _____

First name: _____

Student number: _____

- Provide on all sheets (including the cover sheet) your *last name*, *first name* and *student number*.
- Use the provided sheets. Own paper must *not* be used.
- Place your *ID card* and your *student ID card* on your table.
- You are allowed to use a *self prepared*, *single sided DIN-A4 sheet* in the exam. Only *handwritten originals* are allowed, but no copies.
- You are allowed to use a calculator.
- Answers, written with pencil or red pen are *not* accepted.
- Time limit: *90 minutes*
- Turn off your mobile phones!

Result:

1	2	3	4	5	6	7	8	9	10	11	12	**Σ**	Grade

Last name: First name: Student number:

Question 1)

Points: .....

Maximum points: 5+5=10

a) **How long** does it take to transfer 5 PB of data via a 40 Gbit/s network?

b) **How long** does it take to transfer 5 PB of data via a 1000 Mbps Ethernet?

Last name: First name: Student number:

Question 2)

Points: .....

Maximum points: 7

a) In which **category** of cloud services is human creativity offered for low cost or donated from volunteers?

b) Why is the term „Cloud Operating System“ **misleading**?

c) In which **category** of cloud services can customers run virtual server instances and even realize virtual data centers?

d) What is a **PaaS**, and what can customers do with it?

e) What software do customers **need to use** software services?

f) What is the **main difference** between Public and Private Cloud services?

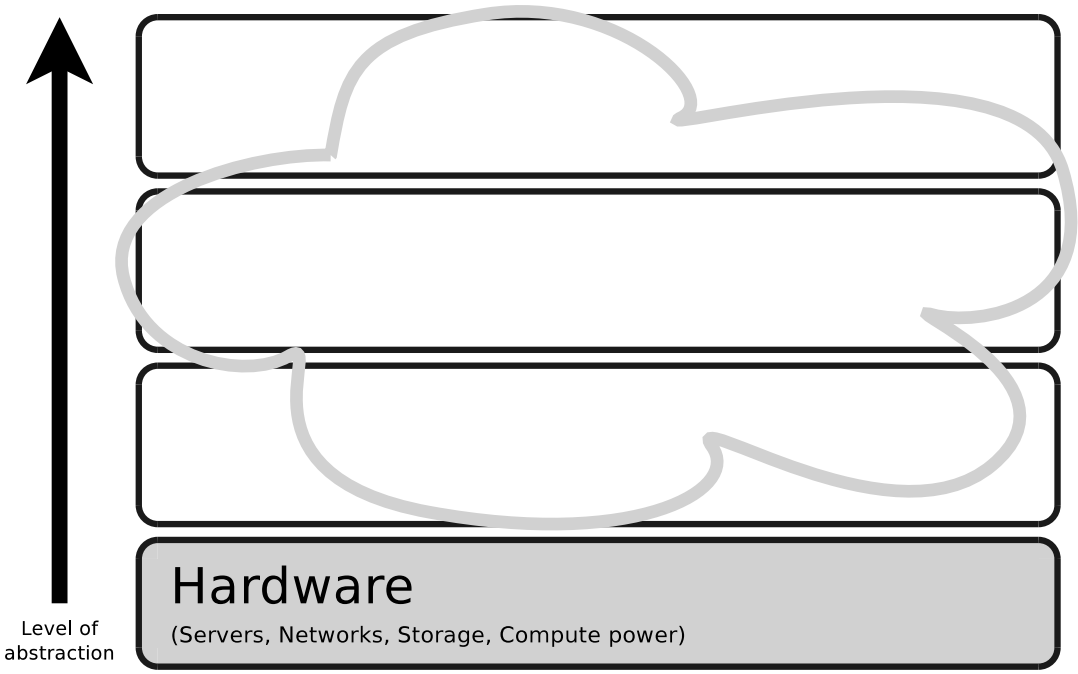
g) What is a **Hybrid Cloud**?

Last name: First name: Student number:

Question 3)

Points: .....

Maximum points: 6



Assign these categories of cloud services to the layers in the figure:

a) PaaS

b) Cloud Gaming

c) Cloud Printing

d) IaaS

e) HuaaS

f) SaaS

Last name: First name: Student number:

Question 4)

Points: .....

Maximum points: 8

a) What is a **Region** in AWS EC2?

b) What is an **Availabilty Zone** in AWS EC2?

c) What is the maximum number of Instances, an **EBS volume** can be connected with?

d) According to which principle works the storage service **S3**?

☐ block-based storage service ☐ object-based storage service

e) According to which principle works the service **EBS**?

☐ block-based storage service ☐ object-based storage service

f) Which storage services require the user/customer to choose and deploy a **file system**?

☐ block-based storage service ☐ object-based storage service

g) What is the purpose of the **Access Control List** at S3?

h) How can users/customers increase the **availabilty** of EBS storage?

Last name: First name: Student number:

Question 5)

Points: .....

Maximum points: 1+1+1+1+4+1=9

a) Which **three roles** contains the theoretical implementation of SOAP web services?

b) Which **markup language** is used by SOAP web services for interaction?

c) Describe the **difference** between the theoretical implementation of SOAP web services and the way, SOAP web services operate in **practice**.

d) Which **protocol** is used by RESTful web services for interaction?

e) Which four **HTTP methods** are enough to work with resources inside storage services like S3 or Google Cloud Storage?

f) Why is it recommendable, that storage services do not only implement support for the four HTTP methods of subtask e), but also for the **HTTP method** `HEAD`?

Last name: First name: Student number:

Question 6)

Points: .....

Maximum points: 6

a) **Google Cloud Print** implements...
☐ IaaS ☐ PaaS ☐ SaaS

b) **Amazon Simple Storage Service** (S3) implements...
☐ IaaS ☐ PaaS ☐ SaaS

c) **Google App Engine** implements...
☐ IaaS ☐ PaaS ☐ SaaS

d) **Amazon Elastic Compute Cloud** (EC2) implements...
☐ IaaS ☐ PaaS ☐ SaaS

e) **AppScale** implements...
☐ IaaS ☐ PaaS ☐ SaaS

f) **Google Cloud Storage** implements...
☐ IaaS ☐ PaaS ☐ SaaS

g) **Microsoft Windows Azure** implements...
☐ IaaS ☐ PaaS ☐ SaaS

h) **HP Cloud Compute** implements...
☐ IaaS ☐ PaaS ☐ SaaS

i) **RedHat OpenShift** implements...
☐ IaaS ☐ PaaS ☐ SaaS

j) **Amazon Mechanical Turk** implements...
☐ IaaS ☐ PaaS ☐ SaaS

k) **eyeOS** implements...
☐ IaaS ☐ PaaS ☐ SaaS

l) **OnLive** implements...
☐ IaaS ☐ PaaS ☐ SaaS

Last name: First name: Student number:

Question 7)

Points: .....

Maximum points: 10

Statement	**true**	**false**
The Google App Engine supports all programming languages.		
Applications inside the GAE can use different infrastructure and storage services.		
Free re-implementations of the GAE exist.		
The GAE supports authentication/authorization via Google accounts.		
Objects, stored in the Datastore are erased automatically after 24 h.		
Datastore is a persistent storage service, implemented as a key/value database.		
Datastore provides a query language, which is similar to the SQL (Structured Query Language).		
Memcache is a persistent storage service.		
Memcache uses tape storage to store the data.		
Memcache is a high-performance storage service for temporary data.		
Memcache uses physical main memory to store the data.		
Objects in the Datastore and Memcache can be of any size.		
Applications in the GAE can send and receive emails with any sender address.		
Applications in the GAE can send and receive XMPP messages.		
Applications in the GAE have read and write access to the file system of the physical servers.		
Applications in the GAE can communicate with other web services via all ports.		
The GAE provides support for Python 3.		
Customers of the GAE can upload and run multiple versions of each one of their applications.		
Each customer of the GAE can have an infinite number of applications.		
Application names must be unique inside the GAE namespace.		

Last name: First name: Student number:

Question 8)

Points: .....

Maximum points: 5

a) Name a **field of application**, where MapReduce is helpful.

b) What is the advantage of the 64 MB chunk size of the Hadoop Distributed File System (**HDFS**)?

c) What is the drawback of the 64 MB chunk size of the **HDFS**?

d) What kind of data stores the **Namenode**?

e) What kind of data store the **Datanodes**?

Last name: First name: Student number:

Question 9)

Points: .....

Maximum points: 1+1+1+1+1+2=7

a) By which approach does High Availability Clustering achieve its **objective**?

b) Give an **advantage** of High Performance Clusters, compared with supercomputers (mainframes).

c) Give a **drawback** of High Performance Clusters, compared with supercomputers (mainframes).

d) What is a **Beowulf Cluster**?

e) What is the difference of a **Beowulf Cluster** in contrast to a **Wulfpack Cluster**?

f) Can High Throughput Clusters be used to process the same **tasks** as High Performance Clusters? (*Explain your answer in just 1 or 2 sentences.*)

Last name: First name: Student number:

Question 10)

Points: .....

Maximum points: 4

a) **Physical resources** are offered in...
☐ Grids ☐ Clouds

b) **Virtualized resources** are offered in...
☐ Grids ☐ Clouds

c) **Full-automatization** (*industrialized IT*) is an attribute of...
☐ Grids ☐ Clouds

d) **Weak automatization** (*traditional IT*) is an attribute of...
☐ Grids ☐ Clouds

e) **Virtual Organizations** are implemented in...
☐ Grids ☐ Clouds

f) **Resources without centralized control** are usually connected in...
☐ Grids ☐ Clouds

g) **Resources under central control** are usually connected in...
☐ Grids ☐ Clouds

h) **Consumption-based billing** (Pay-as-you-go principle) is an attribute of...
☐ Grids ☐ Clouds

Last name: First name: Student number:

Question 11)

Points: .....

Maximum points: 4

a) No **centralized services** exist with...
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

b) A **central point of attack** exists with...
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

c) Which architecture causes the biggest **network overhead**?
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

d) Which architecture causes the **lowest network overhead**?
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

e) Which architecture implements a kind of **dynamic, centralized service**?
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

f) **Napster** (1999 - 2001) implemented...
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

g) **Gnutella v0.4** implements...
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

h) **Gnutella v0.6** implements...
☐ Centralized P2P ☐ Pure P2P ☐ Hybrid P2P

Last name: First name: Student number:

Question 12)

Points: .....

Maximum points: 1+1+1+10+1=14

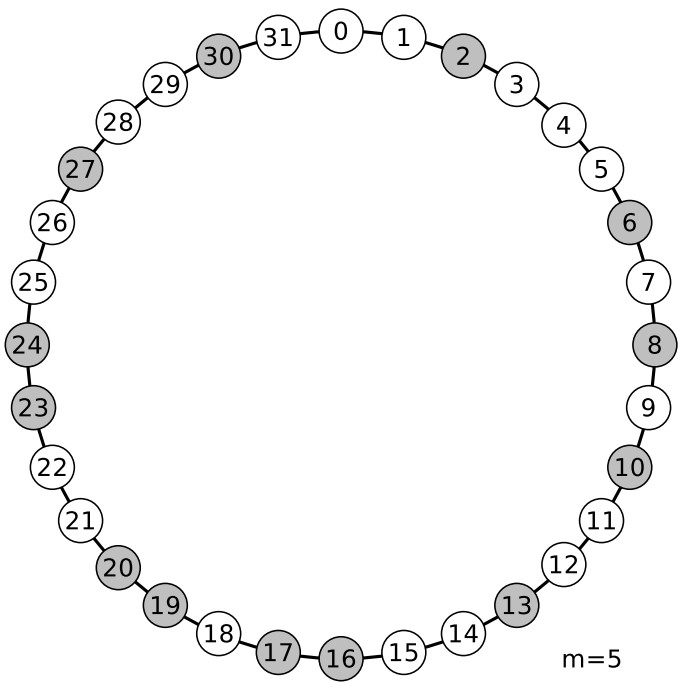
a) What is the **drawback** of linear search in the Chord ring?

b) What way of **searching** in the Chord ring is preferred?

c) To which node n gets a key k **assigned** to?

- ☐ Direct predecessor
- ☐ Direct successor
- ☐ First node (starting from ID 1) without any keys assigned yet

d) Calculate the **Finger Table values** of node $n = 20$ and **insert** the correct values into the provided Finger Table.



Finger Table of node $n = 20$

Entry	Start	Node
1		
2		
3		
4		
5		

The table has 5 entries, because m contains the length of the ID in bits and $m = 5$

The Start value of entry i of the table on node n is $(n + 2^{i-1}) \bmod 2^m$

The Node value of entry i points to the first node, which follows to n at a distance of at least 2^{i-1}

e) Which node is **responsible** for the key (resource) with ID 11 ?