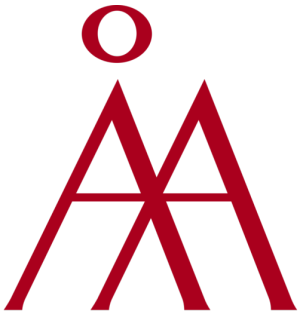

Åbo Akademi University

Cloud Computing

Assignment 6

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June 03, 2021

Contents

Chapter 1

Questions

1.1 What are the main advantages and challenges of cloud computing?

1.1.1 From an end-user point of view

Advantages

- Accessibility and reliability - It is very easy and reliable to access a cloud service, being only needed a subscription and good internet connectivity.
- Cost and operational efficiency - Cloud is cost-effective since one uses the shared infrastructure of the cloud service provider via pay-as-you-go modes of payment
- Rapid and flexible deployment - Services providers offer ready-to-use services that are easy and fast to deploy.
- Security - Cloud service providers take care of the security, which most of the time professionals are behind this protection.

Challenges

- Internet connectivity - Users need good internet connectivity to access cloud services.
- Financial commitment - It is true that cloud services are very cheap, but at the same time, and since most of the services are based on a monthly or annual subscription, you are making a financial commitment.
- Data security and protection - Even though most of the time cloud services provide good protection, there's no guarantee that you won't lose your data.
- Vendor lock-in - It is rough making a migration from one provider to another.

1.1.2 From a cloud service provider point of view

Advantages

- Scalability - Could services can be scalable to grow easily overnight.
- Elasticity - Allows for a sudden change in cloud computing resources to respond to spikes in demand.

Challenges

- Energy and Heat problems - Data centers demand a high amount of energy and also generates a lot of heat problems, and for that cloud providers have to choose carefully where the data centers are going to be installed.

1.2 What are the different layers of a computer system where virtualization can be used? Provide a short description for each.

The different layers of a computer system where virtualization can be used are:

- Application - To execute a different set of applications, this is usually done by introducing a high-level language like java. This virtualization can run programs written and compiled to a particular abstract machine definition.
- Library support - Not that common but can create execution environments for running alien programs on a platform rather than creating a VM to run the entire operating system.
- OS - The layer between the OS and the user's applications, this level contains an isolated container that provides concurrent access to a defined OS and hardware. A solution to create visual hosting environments for a large number of users.
- Hardware - Virtualization of hardware is the most common one. This kind of virtualization permits users to access the full hardware environment for a virtual machine. This manages the access to the underlying hardware such as processors, memoirs, I/O devices.
- Instruction set architecture (ISA) - This is done to emulate the different types of instruction set architecture on a hardware platform, this allows the running of the instruction set architectures of different processors among each other.

1.3 When you instantiate an instance on AWS, at which layer the virtualization is done?

When launching an instance on AWS, the operating layer of virtualization is the hardware layer. Amazon EC2 relies on Xen Virtualization for launching all of its instances

1.4 Provide at least three different types of cloud computing service and provide a short description and few examples for each ("X as a service")

- Infrastructure-as-a-Service (IaaS) - Users pay to get access to computing, storage, and networking resources. Users rent a piece of virtualizing hardware and is up to them to diced the OS, amount of storage, application. Examples of this service are AWS, Google Cloud Platform, Microsoft Azure, others.
- Platform as a Service (PaaS) - The providers provide a proper software environment, an OS, and runtime libraries that the users cannot control. Examples of this are Google app engine, salesforce, others.
- Software as a Service (SaaS) - Providers take care of the running application provided by the user. Examples of this are Facebook, Gmail, Netflix, others.

1.5 Can you explain Amdahl's law? Provide and explain the law based on a small example and use graph(s) to illustrate your answer.

To reduce the runtime of a possible parallel part of an application, different cores can be used at the same time. However, applications not only are made of possible parallel part, but it also has a sequential part, which runtime cannot reduce. Because of that, introducing a high number of processors might not be cost-efficient. So, we have to find the sweet spot between the number of processors and speedup.

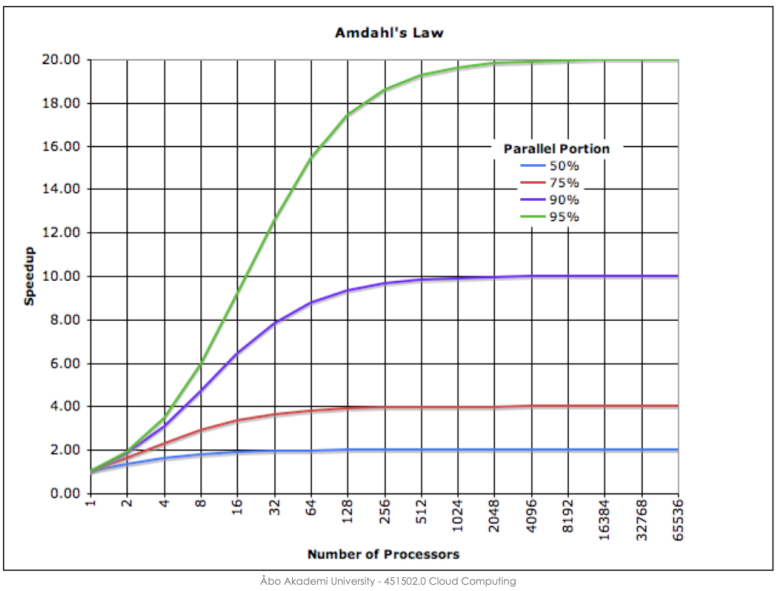

Figure 1.1: Amdahl's law

1.6 Which component of a server typically consumes most of the energy? What is a typical power dissipation value for a server?

The component that typically consumes the most energy in a server is the processor (CPU). At the typical server level, the power dissipation value can be around as 150W or more.

1.7 How can the energy efficiency of a data center be evaluated? Which metric(s) can be used for it and what are the possible drawback of the used metric(s)?

Most companies use something called Power usage effectiveness (PUE), a rating that represents the energy efficiency of a data center.

$$\text{PUE} = \frac{ToalFacilityEnergy}{ITEquipmentEnergy}$$

Even though, this metric provides a good measurement when talking about not expending that most energy in the light or in the cooling, it does not say anything about the efficient of the server

A better evaluations of the efficiency of the server would be the number of operations per joule.