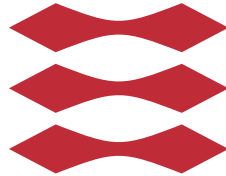


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TECHNICAL UNIVERSITY OF DENMARK

02228 FAULT-TOLERANT SYSTEMS

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# Fault-Tolerant Cloud Computing Architectures

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# Chapter 1

## Introduction

In this report we will describe what cloud computing is, further we will give a detailed description of the architecture and fault-tolerant features of two cloud system, at last we will compare how the systems handle failures and discuss the pros and cons of these methods. As a result of the comparison, we will be able to conclude on what the systems do well and where they might be able to improve.

### 1.1 Scope

We will focus on the fault-tolerant features of the cloud computing architecture within the two selected cloud computing systems. We have chosen to focus on Amazon Web Services and Google Cloud Platform. We have chosen these cloud computing systems because both systems are among the most popular<sup>1</sup> cloud computing systems [10].

### 1.2 Cloud Computing

The National Institute of Standards and Technology is a federal technology agency in the United States of America. They define cloud computing by the following:

*"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction."* [11]

This definition states that shared networks, servers, applications, services etc can easily be distributed globally and quickly maintained by using cloud computing.

There are five essential characteristics of the cloud computing model

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<sup>1</sup>Popular means that they are among the most commonly used platforms for enterprise cloud developers

**On-demand self-service** No required human interaction when needing more or less computing capabilities

**Broad network access** Capabilities are accessed through standard mechanisms and available over the network

**Resource pooling** Computing resources are pooled in order to serve multiple consumers

**Rapid elasticity** Capabilities can be elastically released to scale rapidly according to the demand

**Measured service** In an automatic way the cloud computing systems control and optimize resource use

There are four different deployment models. One cloud infrastructure is for exclusive use by a single organization comprising the multiple consumers - the *private cloud*. Another cloud infrastructure is for exclusive use by a specific community of users from organizations with shared concerns - the *community cloud*. The *public cloud* is an infrastructure open for use by the general public. The last cloud infrastructure is a mixture of two or more distinct cloud infrastructures that remain unique entities - the *hybrid cloud*.

### 1.3 Fault tolerance in cloud computing

Fault tolerance is a key factor for cloud computing systems due to the rapid exponential growth in use of cloud computing [12]. The purpose of fault tolerance in any system is to achieve robustness and dependability. Fault tolerance policies and techniques allow us to classify this techniques into 2 types

**Proactive fault tolerance policy** aims to avoid recovering from fault, errors and failure by predicting them and replacing the suspicious component. This means detecting problems before they actually occur.

**Reactive fault tolerance policy** reduces the effect of failures when the failure actually occurs.

These policies can be divided into two further sub techniques error processing and fault treatment. The aim of error processing is to remove errors from the computational state and the aim of fault treatment is to prevent faults from reoccurring.

## Chapter 2

# Amazon Web Services

The Amazon Web Services, henceforth *AWS*...

### 2.1 Architecture

### 2.2 Fault-Tolerant Features

## Chapter 3

# Google Cloud Platform

### 3.1 Architecture

### 3.2 Fault-Tolerant Features

## Chapter 4

# Comparison of Failure Handling

List of faults that the systems handle along with a description of how it's handled and why it works. If the methods for handling the failure differ, we will discuss the methods, highlighting their pros and cons.

## Chapter 5

# Conclusion

Conclude on our findings, focus on what the systems do well and where it might be possible to improve.

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