D7078E Lab 2: Programming Cloud Services (Storage)

Submission: Deadline is November 30, 2025

Welcome to the second lab of the D7078E: Cloud Security course. In this lab, First, we will use AWS CLI to interact with AWS cloud resources through SSH. We will then use the application programming interfaces (APIs) provided by the Amazon Web services to program Cloud services that require storage, such as the Amazon S3 blob storage service.
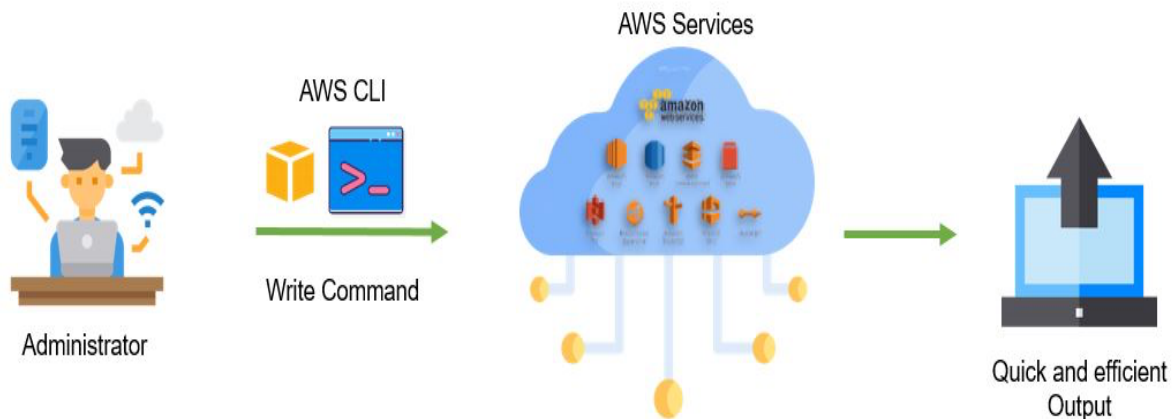
Prerequisites:

* Valid AWS Account with access to the AWS Management Console.
* Access to your school email address (@stud.ltu.se).

Important Note:
Complete this lab with group collaborations and clearly mentioning each member's contributions (More than one individual can work on similar tasks).

Task 2.1: Security Groups, IAM Policies & IAM Roles (with AWS CLI)

Objectives:

a) Create and manage Security Groups using AWS CLI.
b) Apply least privilege by designing and attaching IAM policies.
c) Create and attach an IAM Role (Instance Profile) to an EC2 instance.
d) Understand how Security Groups restrict inbound/outbound traffic.
e) Understand how IAM roles give permission to AWS resources without exposing access keys.

Exercises:

Configure AWS CLI in your machine. Using AWS CLI bash script:

a) Create the security group

b) Add inbound rules

c) Allow SSH only from your IP

d) Allow HTTP from anywhere

e) Create an S3 bucket

f) Create a custom IAM Policy (Labs3Policy.json)

g) Create role

h) Attach Policy to role

i) Launch a EC2 instance with role and security group

j) Validate iam role acess

Reflection & Analysis Questions

1. Why is it more secure to use IAM roles instead of embedding AWS access keys?

2. What principle of cloud security is applied when restricting SSH access to a single IP?

3. What happens if you remove the S3 actions from the IAM policy and try the upload again?

4. How would you modify the Security Group to restrict HTTP access to an internal network only?

5. What challenges did you face when designing least-privilege policies?
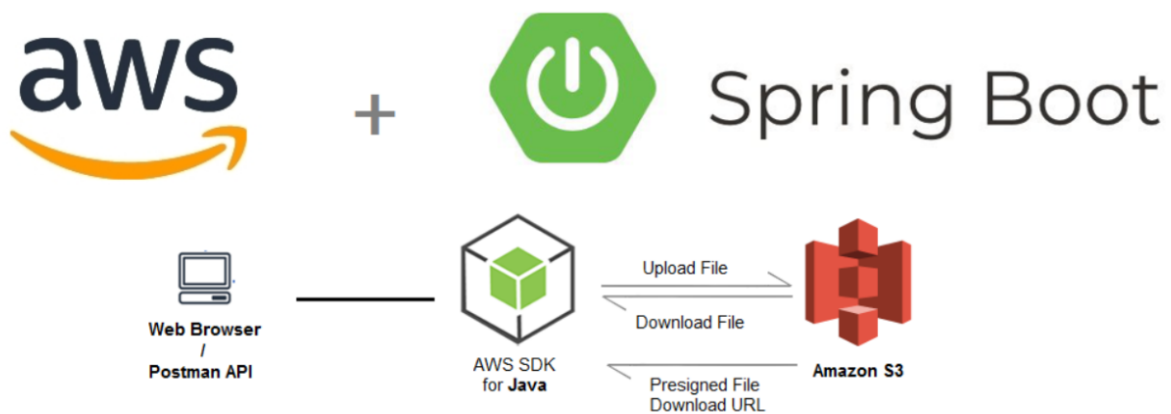
Clean up resources to avoid charges

a) Terminate AWS instance
b) Delete key-pair
c) Delete security group
d) Delete IAM roles
e) Delete S3 Bucket

Ref: https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-welcome.html

https://docs.aws.amazon.com/cli/latest/userguide/cli-configure-files.html

Task 2.2: Using AWS SDK with Java IDE to create and use AWS storage services

Objective:

1. The objective of this lab is to setup a programming environment for building (using programming tools and languages) Cloud services for a major Cloud provider, for example, Amazon Web services (AWS).

2. Develop Cloud services for file storage, listing and retrieval using the APIs provided by the AWS.

Part I: Configuration of Environment

In this exercise, you will learn how to setup the programming environment to create Cloud services using the APIs provided by AWS. Setup the AWS SDK for Java and download and setup Java IDE (Netbeans/Eclipse/IntelliJor).

https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-started.html
AWS SDK for Java 2.x (Pdf in Canvas)

Part II: Using Storage Service

    a) Identify ways of creating the Amazon S3 service clients. Explain in detail how the Amazon S3 service clients are created by providing details of the packages and classes involved. Create a diagram of the dependencies involved.
    b) Create a Java program to create a bucket in three regions of your choice.
    c) Explain in detail the steps involved, and explain the output.
    d) Create a Java program that lists your buckets in the region of your choice.
    e) Create a Java program to upload objects in your newly created bucket.
    f) Create a Java program to delete a particular objects from your newly created bucket.
    g) Create a Java program to upload and download objects (at least 1 MB) from the three regions used in the above exercise. Measure the object upload and download latency from these regions. Plot and explain the results in your report.

Reflection & Analysis Questions

    1. What is the major difference between AWS CLI and AWS SDK?

Lab Report Submission

The report should be written in the lab report format template file. This can be found here [2] (Do not edit this template file, make a copy in your own Overleaf account to edit!) using LaTeX in Overleaf. Download the PDF file after you finish writing and submit the PDF along with your zipped code files to Canvas. You must document your code properly so its readable.

    I.   Submit a lab report to the designated LAB 2 folder in Canvas.
    II.   Submit as a zip file (report, codes).
    III.   Follow the template instructions.
    IV.   The report *must* be well-formatted and easy to read.
    V.   Mention each group member's contribution in a section.
    VI.   Screenshots: Consider including screenshots for all steps to aid you in the grading.
    VII.   Submit the code files as well.

References

[1] "LTU Plagiarism Policy." https://www.ltu.se/en/student-web/your-studies/students-rights-and-obligations/cheating-and-plagiarism

[2] "A7078E Lab Report Format on Overleaf." https://www.overleaf.com/latex/templates/lulea-university-of-technology-english-report-template-tvm-department/tfhyswbgngsr