Cloud Foundations
COSC2757/ Semester 1, 2024
Milestone 2 (Timed AWS cloud implementation)

Assessment Type	To be attempted individually. Submit online via Canvas→Assignments→Second Milestone Marks are awarded for meeting requirements as closely as possible. Clarifications/updates may bemade via announcements/relevant discussion forums.
Due Date	Week 12, Friday 31 May 2024, **5:00** pm AEST (*please note the time*)
Marks	45

1. Overview (<u>you must read this first</u>)

You are to attempt this assignment individually, <u>no group work is allowed</u>. You will use material and knowledge gained from reading AWS Academy 'Cloud Foundations' course.

- You will need your **AWS academy** accounts for this milestone. Email invites to use this account were sent earlierin the semester. Please accept the invite and start using this account. *If you have any account-related issue, please email Course Coordinator:* Hai Dong (hai.dong@rmit.edu.au) at your earliest. Most of the time these queries will be directed to AWS and may take few days to resolve.

If you find a specification open to interpretation, post a query identifying the specification in the corresponding discussion board for assignment 2. Software development and deployment in real life does not come with a definitive roadmap and flowcharts complete with instructions. More often than not, it is the job of the developer/analyst to clarify requirements from the client.

All of us have been affected by the unfortunate COVID-19 scenario and its aftermath. It is often hard to concentrate and study online; but as a student enrolled in this course, it is your responsibility to regularly attend the online session(s).

- Bring your questions to online facilitation sessions
- Watch the online recordings on a regular basis if you cannot attend the live sessions.
- Do NOT start the work on the assignment at the last minute.
- Do NOT ask for **last minute extensions**, these are often rejected. Extensions can only be granted for personaland medical reasons, provided you submit an extension form (link) as well as supply some **evidence**.

2. Learning Outcomes

This assessment relates to all of the learning outcomes of the course which are:

- CLO 1: Define and understand AWS and its components
- CLO 2: Create a virtual private cloud (VPC) and demonstrate Amazon Elastic Compute Cloud (Amazon EC2)
- CLO 3: Comprehend AWS storage services
- CLO 4: Comprehend AWS database services
- CLO 5: Understand architectural principles, security and compliance issues in AWS Cloud

3. **Academic integrity and plagiarism (standard warning)**

Academic integrity is about the honest presentation of your academic work. It means acknowledging the work of others while developing your own insights, knowledge, and ideas. You should take extreme care that you have:

- Acknowledged words, data, diagrams, models, frameworks and/or ideas of others you have quoted (i.e. directly copied), summarised, paraphrased, discussed or mentioned in your assessment through the appropriate referencing methods,
- Provided a reference list of the publication details so your reader can locate the source if necessary. This includes material taken from Internet sites.

If you do not acknowledge the sources of your material, you may be accused of plagiarism because you have passed off the work and ideas of another person without appropriate referencing, as if they were your own.

RMIT University treats plagiarism as a very serious offence constituting misconduct. Plagiarism covers a variety of inappropriate behaviours, including:

- Contract cheating- paying/asking someone to do your work
- Failure to properly document a source involving none, insufficient or incorrect referencing
- Copyright material from the internet or databases
- Collusion between students

4. **Extension and late submissions**

- Email course coordinator: Hai Dong (hai.dong@rmit.edu.au) for any extension related queries.

- Do NOT ask for last minute extensions, these are often rejected. Extensions can only be granted for personal and medical reasons, provided you can supply some evidence.

- According to RMIT assessment policy as outlined here: https://www.rmit.edu.au/students/my-course/assessment-results/special-consideration-extensions/extensions

   If you are seeking an extension of seven calendar days or less (from the original due date) you must apply at least one working day before the assessment deadline.

- After the due date, you will have 5 business days to submit your assignment as a late submission. Late submissions will incur a penalty of 10% per day. After these five days, Canvas will be closed, and you will lose ALL the assignment marks.

5. **Marking Guidelines**

The marks allocated have been added to each of the tasks.

6. **Assignment 2 tasks**

There are two types of tasks:
- Solutions of **Basic Tasks** can mostly be referenced from existing lectorial and lab notes and recordings or demonstration videos.
- Solutions of **Advanced Tasks** require you to conduct research yourself to find.

The tasks need to be completed in the classroom titled **AWS Academy Learner Lab [78895]**; uponlogging in to the correct classroom you should see the following:

PLEASE NOTE- Your entry times are logged each time you work in the 'AWS Academy Learner Lab [78895]' classroom created for you under your AWS account. If you work under an incorrect or personal account, these log entries will not exist, and you will get a ZERO for the whole assignment 2. No marks will be awarded for using a personal AWS account.

NOTE: You will be required to submit a <u>series of screenshots</u> to show that you have completed the tasks.

Please make sure that all your AWS Management Console screenshots show **all the details** and **your AWS username** (appearing in the top-right corner of the management console) otherwise you will receive a **ZERO mark for any tasks that miss the details and username.**

Scenario: You have a small business with a website that is hosted on an Amazon Elastic Compute Cloud (Amazon EC2) instance. You have customer data that is stored on a backend database server that you want to keep private. You also have an on-premise network. You want to use Amazon VPC to set up a VPC that meets the following requirements:

TASK A) VPC (7 marks)

1. (Basic) Create a new VPC in us-east-1, and name it as **s1234567** (i.e. your student ID).
    - You will create three public subnets, and three private subnets in three availability zones (each pair of public subnet and private subnet is within an availability zone). Give them appropriate names. (1 mark)
    - The first address of your network must be xx (the last two digits of your student id, e.g. 67 for s1234567).xx (the last fourth and third digits of your student ID, e.g. 45 for s1234567).0.0. Each subnet must have 1024 IPv4 addresses in total. (1 mark)
    - Ensure your three public subnets are associated with a route table and three private subnets are associated with another route table. Each table is properly named and configured. (1 mark)
    - Create a security group to allow HTTP, HTTPS and SSH Access inside the public subnets from the wider internet and name it as **s1234567-public**. (1 mark)
    Note: if the last two digits of your student ID are 00 (e.g. s1234500), the first IP address of your network address must be 10.xx.0.0 (e.g. 10.45.0.0 for s1234500).
2. (Advanced) Connect the private subnets of this VPC with your on-premises network (CIDR: 192.168.10.0/24) to form a virtual private network. (3 marks)

TASK B) EC2 (5 marks)

1. (Basic) Inside EC2, launch:
    - An instance with Amazon Linux 2023 AMI and t2.small Instance Type and name it as **s1234567-Web Server 1**. Make sure it is inside Public Subnet 3 of the s1234567 VPC and assign the Security Group you created earlier. (1 mark)
    - Install a web server, a database, and PHP libraries into the EC2 (see Lab 2 instructions). Assign a permanent public IP address to the EC2 (i.e. the IP address will not change when the instance is restarted) so that you can access the website using the public IP address after launching the instance. (1 mark)
    - Choose 'Choose an existing key pair' when you launch the instance. Access the instance using Putty/Terminal/Command Prompt/Git Bash/PowerShell (No EC2 Instance Connect or Session Manager Allowed) and the key pair provided by the Learner Lab. (1 mark)
2. (Advanced) Enabling HTTPS on your web server so that the web server can be accessed through HTTPS protocol. (2 marks)

TASK C) S3&IAM&Lambda (6 marks)

1. (Basic) Create an S3 bucket (name it as **s1234567-s3**) in us-east-1 and create and upload a webpage that can show your name, student ID, and registered COSC2757 practical name (in HTML format) to the S3 bucket and make S3 host this webpage as a public website (so the public can access it from its object URL). (2 marks)
2. (Advanced) Create a Lambda function and configure a trigger for the bucket. Every time that you add an object to your Amazon S3 bucket, your function runs and outputs the object type to CloudWatch Logs. (2 marks)
3. (Advanced) Create another S3 bucket (name it as **s1234567-iam**) in us-east-1 and a private connection between the public subnets of VPC and this bucket without using authentication. (2 marks)

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TASK D) EBS&EFS (6 marks)

1. (Basic) Create a new EBS volume (Type: GP3, Size: 8 GB) and attach it to the EC2 instance.

    -   Create a file system and a file on this new volume and create a snapshot for this volume. (1 mark)

    -   Delete this volume, recreate a volume (10 GB) based on the snapshot, attach the restored volume to the instance, and show the file system is restored and resized. (2 marks)

2. (Basic) Create an EFS (name it as **s1234567-EFS**) and mount it to the EC2 instance (i.e. only allowing the EC2 instance to access it). (3 marks)

TASK E) RDS&DynamoDB (7 marks)

1. (Basic) Create a security group for the s1234567 VPC called **s1234567-DB Access**. This security group should allow inbound connections on the port used for MySQL connections from the instance that has the security group you created in Task A.
    -   Create a Subnet Group (containing Private Subnet-1 and Private Subnet-2) for Database (name it as **s1234567-Subnet-Group**). (1 mark)
    -   Create Database (2 marks)
        -   Go to Create Database under RDS, and select MySQL.
        -   Leave the 'Settings' as default, but set password to ' s1234567'
        -   Set the DB instance type to db.t3.micro with 8 GB SSD (GP2).
        -   The deployment must be a Multi-AZ deployment (with replicas).
        -   Ensure it is launched in the s1234567 VPC, using the subnet group you created previously.
        -   Ensure you attach the DB Security Group.
        -   Disable automatic backups, encryption and enhanced monitoring.
    -   (Advanced) Use Putty/Terminal/Command Prompt/Git Bash/PowerShell to show that the EC2 instance can access the DB instance. (1 mark)
2. Inside DynamoDB,
    -   (Basic) Create a DynamoDB table (**s1234567-Shopping**) exactly following the schema and containing the information below. (1 mark)

Customer_ID	Purchase_Date	Item_1	Item_2	Item_3
10004	20-05-2024	Tea	Salad	Sandwich
10004	25-05-2024	Tea	Sandwich	
10005	22-05-2024	Juice	Soda	Soda
10005	26-05-2024	Pizza	Tea	Salad
10006	25-05-2024	Water	Pizza	Fries
10006	29-05-2024	Fries	Salad	Tea
10007	28-05-2024	Soda	Sandwich	
10007	29-05-2024	Soda	Sandwich	Tea

-   (Advanced) Create a single query to retrieve all the records that contain tea. (2 marks)

TASK F) ELB&Auto Scaling (4 marks)

(Basic) Create an Elastic Load Balancer (called **s1234567-ELB**) and an Auto Scaling Group (called **s1234567-Auto Scaling**) that launch instances (called **s1234567-instance**) of the same type and configuration across Private Subnet-1 and Private Subnet-3, where

- The target group is named as **s1234567-Target-Group.**
- Enable EC2 instance detailed monitoring within CloudWatch.
- Enable group metrics collection within CloudWatch.
- Desired capacity: 3, Minimum capacity: 2, Maximum capacity: 4.
- The scaling policy is that Average CPU Utilization is greater than 70% in 2 mins.
- Automatically send AWS notifications to your student email for only scale-in and scale-out events. (1 mark)
- Test your Autoscaling group by using the load test function of the hosted website. (3 marks)

TASK G) System Architecture (10 marks)

(Basic) Draw a system architecture to precisely illustrate all the components included in Tasks A-F as detailed as possible (including all services and their connections, region, AZs, VPC, subnets, security groups, CIDRs, IP addresses, details of route tables, etc.)

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7. Submission Instructions

You need to create a single zipped archive containing the following:

Tasks	Subtasks	Screenshots required	Name of screenshot files
Task A	VPC_1	Resource Map Subnets (including CIDRs) Public Route Table Private Route Table Public Security Group	Name all screenshots with **TaskA_1** *e.g. Task A_1-Resource Map, etc.*
	VPC_2	Route Table Security Group VPN	Name all screenshots with **TaskA_2**
Task B	EC2_1	Instances (with instance selected to show details, security and networking) Website (show URL in HTTP) Instance access (using Putty/Terminal/Command Prompt/Git Bash/PowerShell)	Name all screenshots with **TaskB_1**
	EC2_2	Operations (in Putty/Terminal/Command Prompt/Git Bash/PowerShell) Website (show URL in HTTPS)	Name all screenshots with **TaskB_2**
Task C	S3&IAM&Lambda_1	The website (with the URL)	Name all screenshots with **TaskC_1**
	S3&IAM&Lambda_2	Lambda Function Overview S3 Object Uploading CloudWatch Log Events	Name all screenshots with **TaskC_2**
	S3&IAM&Lambda_3	VPC Endpoint (full information) Bucket Policy	Name all screenshots with **TaskC_3**
TASK D	EBS&EFS_1	EBS Volume (Details) File System Operations Snapshot (Details) Volume Deletion Volume Recreation File System Restoration and Resizing Restored File System Demonstration	Name all screenshots with **TaskD_1**
	EBS&EFS_2	EFS (Network Information) Mount Operations Mounted EFS Demonstration	Name all screenshots with **TaskD_2**
TASK E	RDS&DynamoDB_1	Security Group Subnet Groups DB Instance (full information) EC2 and DB Instances Interactions	Name all screenshots with **TaskE_1**
	RDS&DynamoDB_2	Table Query and Results	Name all screenshots with **TaskE_2**
TASK F	ELB&AutoScaling	Launch Configuration (Details) Autoscaling Group (Summary of all the steps) Target Groups (Details (show healthy status) and Targets) Website (with the URL of ELB DNS and shown in different availability zones) CloudWatch Alarms (showing "In alarm" status) Alarm Message (in your student email) Scale-Out EC2 Instances and Their Located Subnets	Name all screenshots with **TaskF_**
Task G	System Architecture	System Architecture Graph	Name it with **TaskG_**

Note:

1) Make sure the font size in your screenshots is **large enough** to identify.

2) You may make **two or more screenshots** for the same required screenshot if a single screenshot cannot cover all the details.

3) Include your username (appearing in the top-right corner of your AWS management console) in all submitted screenshots otherwise you will receive a **0 mark** for any screenshots missing the username.

4) You may create folders (use the task/subtask titles to name the folders) to contain the screenshots of each task/subtask.

You must submit this single zipped archive via Assignment submission link under Milestone 2 Canvas.

The zipped file must be named as yourStudentNumber_a2.zip, as an example if your student number is s1234567 the file must be named as

s1234567_a2.zip

INCORRECT file name will attract a penalty of **5 marks** from the total score.

Note: You won't receive a penalty for the Canvas auto-generated file name appendix (e.g. s1234567_a2-1.zip)

Assessment declaration: When you submit work electronically, you agree to the assessment declaration:

https://www.rmit.edu.au/students/student-essentials/assessment-and-exams/assessment/assessment-declaration

For further information on our policies and procedures, please refer to:

https://www.rmit.edu.au/students/student-essentials/rights-and-responsibilities/academic-integrity

8. **Assignment queries**

Please attend **Week11-12 tutelab sessions** or **post questions on the discussion board** to query doubts concerning this assignment.