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**Synopsis-2**

**Project Report on**[**AWS InfraControl CLI Tool**](https://github.com/Nitanshu715)

1. **Synopsis of the Problem Statement**

In cloud computing environments, it becomes increasingly important to monitor virtual machine (EC2 instance) lifecycle activities like starting, stopping, and terminating. Traditionally, tracking these activities requires manual intervention or third-party tools. This project automates the monitoring of EC2 instances by sending email notifications for state changes and logging all events into an S3 bucket for centralized storage. Using AWS EventBridge, SNS, Lambda, and S3 services, a fully automated, real-time notification and logging system has been developed without requiring constant manual supervision.

1. **Literature Review**

Several research papers and articles discuss the need for automated cloud resource monitoring:

* According to [IEEE Access 2019](https://ieeexplore.ieee.org/document/8850174), cloud infrastructure resource monitoring and event-driven workflows are crucial to minimize human errors and improve system resilience.
* A study published in [IEEE Transactions on Cloud Computing, 2021](https://ieeexplore.ieee.org/document/9352755) emphasizes the importance of automating cloud instance management to maintain operational efficiency.
* AWS whitepapers also recommend using EventBridge, SNS, and Lambda for event-driven architectures, which enhance cloud service observability ([AWS Event-Driven Architecture](https://docs.aws.amazon.com/eventbridge/latest/userguide/what-is-amazon-eventbridge.html)).

1. **Objective**

* To build an automated real-time notification system for EC2 instance state changes.
* To log all EC2 instance lifecycle events such as start, stop, and terminate into a centralized Amazon S3 bucket.
* To minimize human intervention and maintain detailed activity logs for security, auditing, and future reference.
* To use fully serverless AWS services (EventBridge, SNS, Lambda, and S3) to ensure cost-effectiveness and scalability.

1. **Reference**

The project is developed following AWS best practices and guidelines:

* [AWS EventBridge Documentation](https://docs.aws.amazon.com/eventbridge/latest/userguide/)
* [AWS Simple Notification Service (SNS) Documentation](https://docs.aws.amazon.com/sns/latest/dg/welcome.html)
* [AWS Lambda Documentation](https://docs.aws.amazon.com/lambda/latest/dg/welcome.html)
* [Amazon S3 Documentation](https://docs.aws.amazon.com/s3/index.html)

1. **Software Requirement Specification (SRS)**

**1. Introduction:**

* Purpose: Real-time monitoring and logging of EC2 instance events.
* Scope: Capture instance lifecycle changes (start, stop, terminate) and automate responses.

**2. Functional Requirements:**

* Setup SNS topic for sending email notifications.
* Configure EventBridge rules to detect EC2 state changes.
* Create a Lambda function to process EC2 event data and upload logs to S3.
* Store logs in S3 with instance ID and timestamps.

**3. Non-Functional Requirements:**

* Real-time performance with minimal delay (within seconds).
* High availability and durability of logs stored in S3.
* Serverless architecture to minimize cost and complexity.

**4. System Configuration:**

* AWS CLI version 2 installed.
* IAM permissions for S3, SNS, Lambda, and EventBridge.
* EC2 instances created under Free Tier (t2.micro) to avoid cost.

**5. Constraints:**

* Relies on AWS service availability.
* Limited to the AWS account limits for free tier usage.

1. **Bibliography (IEEE Research Papers & Sources)**
2. Cloud Infrastructure Monitoring Using Event-Driven Workflows, IEEE Access, 2019. Link: <https://ieeexplore.ieee.org/document/8850174>
3. Automation in Cloud Resource Management, IEEE Transactions on Cloud Computing, 2021. Link: <https://ieeexplore.ieee.org/document/9352755>
4. Best Practices for Event-Driven Architecture on AWS. Link: <https://docs.aws.amazon.com/eventbridge/latest/userguide/what-is-amazon-eventbridge.html>
5. AWS Serverless Architectures with Lambda. Link: <https://docs.aws.amazon.com/lambda/latest/dg/welcome.html>
6. Cloud Storage Solutions for Real-Time Logging, AWS S3. Link: <https://docs.aws.amazon.com/s3/index.html>
7. **Implementation**
8. **S3 Bucket Creation:**
   * Created a bucket group20-ec2-logs-bucket for storing event logs.
9. **SNS Topic Creation and Subscription:**
   * Created an SNS topic EC2NotificationsGroup20.
   * Subscribed an email address for receiving instance event notifications.
10. **EventBridge Rule Setup:**
    * Created a rule EC2StateChangeCaptureGroup20 to detect EC2 instance state changes (pending, running, stopping, stopped, terminated).
    * Added two targets:
      + SNS topic for email notifications.
      + Lambda function for log saving.
11. **Lambda Function Development:**
    * Wrote a Python-based Lambda function to save EC2 event details into S3.
    * The Lambda function parses instance-id, state, and timestamp and saves them into the bucket in a structured JSON format.
12. **Testing:**
    * EC2 instances were launched and terminated.
    * Verified email notifications were received.
    * Verified event log files were correctly generated in the S3 bucket.

This project provides a scalable, real-time event monitoring and logging system using fully managed AWS services, reducing manual monitoring efforts and ensuring centralized event tracking.