Enterprise Secret Management and Credential Protection on AWS
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Platform: Amazon Web Services (AWS)

1. Problem Statement.

A payment processing company handling sensitive financial transactions identified hardcoded credentials and inconsistent secret storage across environments. This created elevated risk exposure and compliance concerns. A centralized secrets management strategy was required to secure credentials and enforce encryption standards.

I implemented this framework to eliminate insecure storage of credentials, reduce the risk of credential compromise, and support regulatory compliance through centralized governance and automation.

2. Objectives

The primary objectives were to:

- Centralize secret storage
- Encrypt sensitive data using KMS
- Enforce least-privilege access
- Automate credential rotation
- Detect hardcoded secrets
- Prevent future credential exposure
- Improve governance and audit readiness

3. Secure Secret Storage Architecture

3.1 AWS Secrets Manager

High-risk credentials were stored in AWS Secrets Manager using encrypted key/value pairs.

Examples include:

- Database credentials
- API keys
- Service tokens

Secrets were protected using KMS encryption and standardized naming conventions.

Secrets Manager was selected for its built-in rotation, auditing, and fine-grained access control.

3.2 AWS Systems Manager Parameter Store

Application configuration secrets were stored in Parameter Store using SecureString parameters.

All parameters were encrypted using KMS and protected by IAM policies.

Naming standards were enforced to maintain consistency.

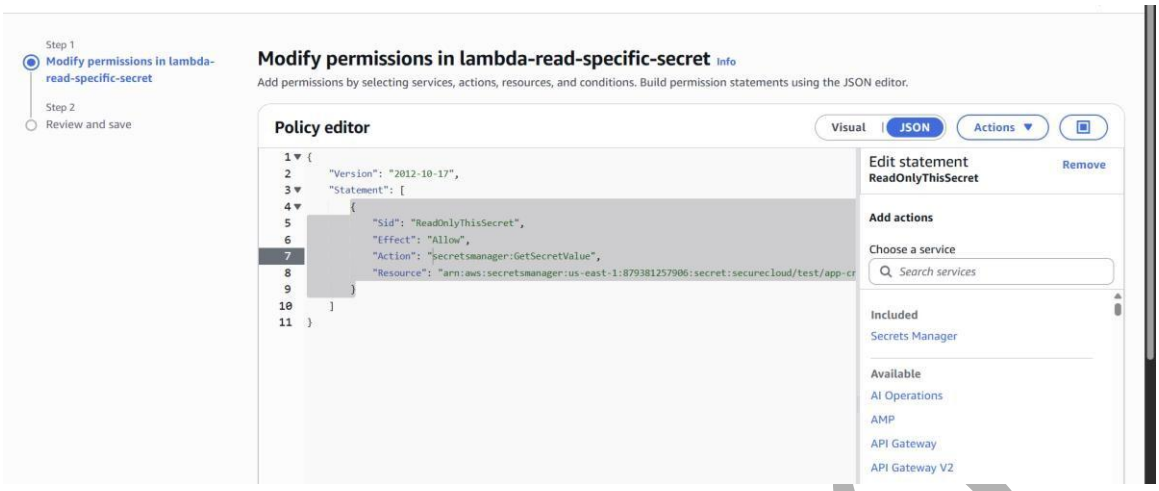
4. IAM Access Control and Least Privilege

Dedicated IAM roles were created for applications and services accessing secrets.

Policies were scoped to specific secret ARNs and parameters.

Granted permissions included:

- secretsmanager:GetSecretValue
- ssm:GetParameter



Access testing confirmed that unauthorized access attempts resulted in AccessDenied errors.

This validated least-privilege enforcement.

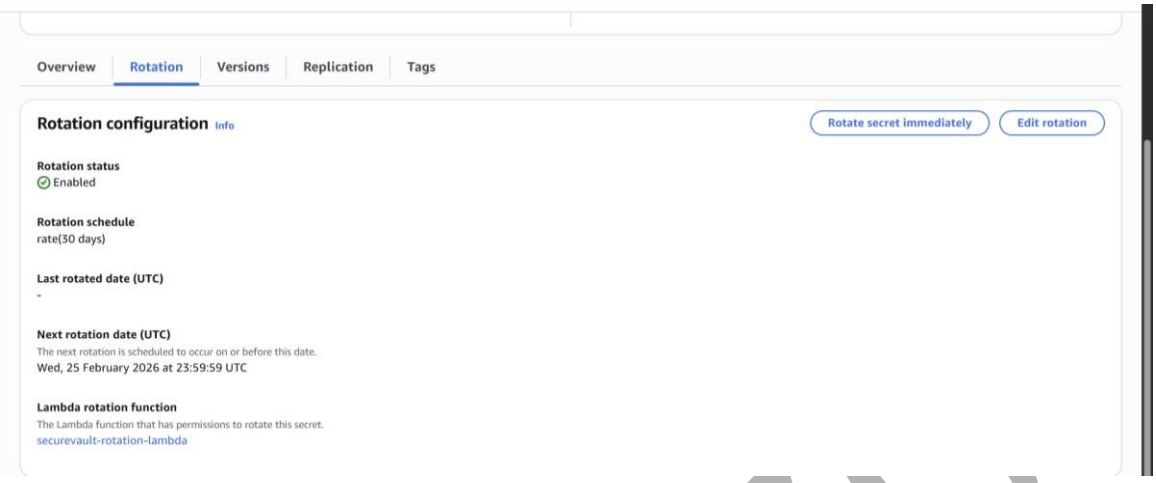
5. Automated Secret Rotation

5.1 Rotation Architecture

Secrets Manager was integrated with a custom Lambda rotation function.

The function generates new credentials and updates dependent services.

Rotation schedules were defined based on security requirements.



5.2 Permission Configuration

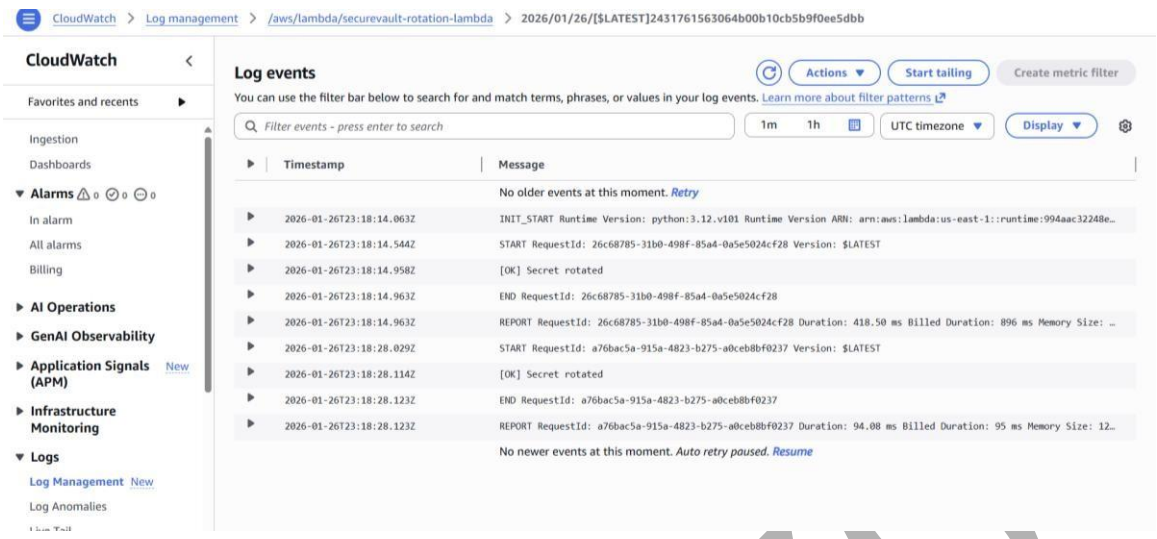
Resource-based policies were configured to allow Secrets Manager to invoke the rotation function.

Invocation was restricted to approved secret ARNs.

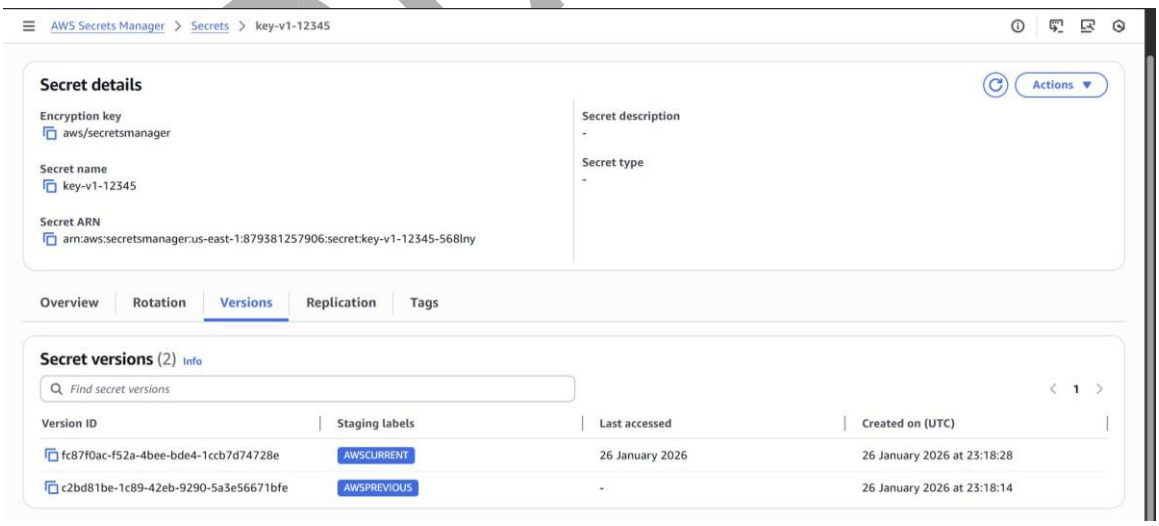
5.3 Rotation Validation

Manual and scheduled rotations were tested.

CloudWatch Logs confirmed successful execution.



New version stages were created automatically after rotation.



This ensures continuous credential freshness.

6. Hardcoded Secret Detection

6.1 Scanning Tool Implementation

TruffleHog was implemented as the primary secret scanning tool.

Docker-based execution was used for consistency across environments.

Scans analyzed repositories for:

- Credential patterns
- High-entropy strings
- Provider tokens

6.2 Detection and Analysis

Test credentials were detected successfully during scanning.

Findings were documented and classified by severity.

6.3 Remediation

All exposed secrets were removed from source code.

Secure references to Secrets Manager and Parameter Store replaced hardcoded values.

Follow-up scans confirmed remediation.

7. Preventive Controls

7.1 Pre-Commit Enforcement

Git pre-commit hooks were implemented to run TruffleHog before commits.

Commits containing sensitive data were blocked automatically.

7.2 Validation Testing

Controlled tests confirmed that insecure commits were prevented.

Only sanitized code was permitted.

8. Governance and Documentation

All secret management procedures, access policies, and rotation workflows were documented.

Documentation supports:

- Security audits
- Compliance reviews
- Incident investigations
- Operational continuity

9. Testing and Validation Framework

Security controls were validated through:

- Secret retrieval testing
- Permission reduction testing
- Rotation testing
- Detection scanning
- Pre-commit enforcement testing

All controls functioned as designed.

10. Outcomes and Impact

This implementation delivered:

- Centralized credential governance

- Reduced credential exposure risk
- Automated rotation capability
- Improved code hygiene
- Strong audit readiness
- Enhanced security posture

11. Conclusion

I designed and implemented an enterprise-grade secret management framework on AWS.

Through secure storage, automated rotation, preventive scanning, and strict access control, this solution ensures sensitive credentials are protected throughout their lifecycle.