

CIS Amazon Web Services Foundations Benchmark

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Overview

All CIS Benchmarks focus on technical configuration settings used to maintain and/or increase the security of the addressed technology, and they should be used in **conjunction** with other essential cyber hygiene tasks like:

- Monitoring the base operating system for vulnerabilities and quickly updating with the latest security patches
- Monitoring applications and libraries for vulnerabilities and quickly updating with the latest security patches

In the end, the CIS Benchmarks are designed as a key **component** of a comprehensive cybersecurity program.

This document provides prescriptive guidance for configuring security options for a subset of Amazon Web Services with an emphasis on foundational, testable, and architecture agnostic settings. Some of the specific Amazon Web Services in scope for this document include:

- AWS Identity and Access Management (IAM)
- IAM Access Analyzer
- AWS Config
- AWS CloudTrail
- AWS CloudWatch
- AWS Simple Notification Service (SNS)
- AWS Simple Storage Service (S3)
- Elastic Compute Cloud (EC2)
- Relational Database Service (RDS)
- AWS VPC

To obtain the latest version of this guide, please visit <https://benchmarks.cisecurity.org>. If you have questions, comments, or have identified ways to improve this guide, please write us at BenchmarkInfo@cisecurity.org.

Intended Audience

This document is intended for system and application administrators, security specialists, auditors, help desk, platform deployment, and/or DevOps personnel who plan to develop, deploy, assess, or secure solutions in Amazon Web Services.

Consensus Guidance

This CIS Benchmark was created using a consensus review process comprised of a global community of subject matter experts. The process combines real world experience with data-based information to create technology specific guidance to assist users to secure their environments. Consensus participants provide perspective from a diverse set of backgrounds including consulting, software development, audit and compliance, security research, operations, government, and legal.

Each CIS Benchmark undergoes two phases of consensus review. The first phase occurs during initial Benchmark development. During this phase, subject matter experts convene to discuss, create, and test working drafts of the Benchmark. This discussion occurs until consensus has been reached on Benchmark recommendations. The second phase begins after the Benchmark has been published. During this phase, all feedback provided by the Internet community is reviewed by the consensus team for incorporation in the Benchmark. If you are interested in participating in the consensus process, please visit <https://workbench.cisecurity.org/>.

Typographical Conventions

The following typographical conventions are used throughout this guide:

Convention	Meaning
<code>Stylized Monospace font</code>	Used for blocks of code, command, and script examples. Text should be interpreted exactly as presented.
<code>Monospace font</code>	Used for inline code, commands, or examples. Text should be interpreted exactly as presented.
<i><italic font in brackets></i>	Italic texts set in angle brackets denote a variable requiring substitution for a real value.
<i>Italic font</i>	Used to denote the title of a book, article, or other publication.
Note	Additional information or caveats

Recommendation Definitions

The following defines the various components included in a CIS recommendation as applicable. If any of the components are not applicable it will be noted or the component will not be included in the recommendation.

Title

Concise description for the recommendation's intended configuration.

Assessment Status

An assessment status is included for every recommendation. The assessment status indicates whether the given recommendation can be automated or requires manual steps to implement. Both statuses are equally important and are determined and supported as defined below:

Automated

Represents recommendations for which assessment of a technical control can be fully automated and validated to a pass/fail state. Recommendations will include the necessary information to implement automation.

Manual

Represents recommendations for which assessment of a technical control cannot be fully automated and requires all or some manual steps to validate that the configured state is set as expected. The expected state can vary depending on the environment.

Profile

A collection of recommendations for securing a technology or a supporting platform. Most benchmarks include at least a Level 1 and Level 2 Profile. Level 2 extends Level 1 recommendations and is not a standalone profile. The Profile Definitions section in the benchmark provides the definitions as they pertain to the recommendations included for the technology.

Description

Detailed information pertaining to the setting with which the recommendation is concerned. In some cases, the description will include the recommended value.

Rationale Statement

Detailed reasoning for the recommendation to provide the user a clear and concise understanding on the importance of the recommendation.

Impact Statement

Any security, functionality, or operational consequences that can result from following the recommendation.

Audit Procedure

Systematic instructions for determining if the target system complies with the recommendation

Remediation Procedure

Systematic instructions for applying recommendations to the target system to bring it into compliance according to the recommendation.

Default Value

Default value for the given setting in this recommendation, if known. If not known, either not configured or not defined will be applied.

References

Additional documentation relative to the recommendation.

CIS Critical Security Controls® (CIS Controls®)

The mapping between a recommendation and the CIS Controls is organized by CIS Controls version, Safeguard, and Implementation Group (IG). The Benchmark in its entirety addresses the CIS Controls safeguards of (v7) "5.1 - Establish Secure Configurations" and (v8) "4.1 - Establish and Maintain a Secure Configuration Process" so individual recommendations will not be mapped to these safeguards.

Additional Information

Supplementary information that does not correspond to any other field but may be useful to the user.

Profile Definitions

The following configuration profiles are defined by this Benchmark:

- **Level 1**

Items in this profile intend to:

- be practical and prudent;
- provide security focused best practice hardening of a technology; and
- limit impact to the utility of the technology beyond acceptable means.

- **Level 2**

This profile extends the "Level 1" profile. Items in this profile exhibit one or more of the following characteristics:

- are intended for environments or use cases where security is more critical than manageability and usability
- acts as defense in depth measure
- may impact the utility or performance of the technology
- may include additional licensing, cost, or addition of third party software

Acknowledgements

This Benchmark exemplifies the great things a community of users, vendors, and subject matter experts can accomplish through consensus collaboration. The CIS community thanks the entire consensus team with special recognition to the following individuals who contributed greatly to the creation of this guide:

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Recommendations

1 Identity and Access Management

This section contains recommendations for configuring identity and access management related options.

1.1 Maintain current contact details (Manual)

Profile Applicability:

- Level 1

Description:

Ensure contact email and telephone details for AWS accounts are current and map to more than one individual in your organization.

An AWS account supports a number of contact details, and AWS will use these to contact the account owner if activity judged to be in breach of Acceptable Use Policy or indicative of likely security compromise is observed by the AWS Abuse team. Contact details should not be for a single individual, as circumstances may arise where that individual is unavailable. Email contact details should point to a mail alias which forwards email to multiple individuals within the organization; where feasible, phone contact details should point to a PABX hunt group or other call-forwarding system.

Rationale:

If an AWS account is observed to be behaving in a prohibited or suspicious manner, AWS will attempt to contact the account owner by email and phone using the contact details listed. If this is unsuccessful and the account behavior needs urgent mitigation, proactive measures may be taken, including throttling of traffic between the account exhibiting suspicious behavior and the AWS API endpoints and the Internet. This will result in impaired service to and from the account in question, so it is in both the customers' and AWS' best interests that prompt contact can be established. This is best achieved by setting AWS account contact details to point to resources which have multiple individuals as recipients, such as email aliases and PABX hunt groups.

Audit:

This activity can only be performed via the AWS Console, with a user who has permission to read and write Billing information (aws-portal:*Billing)

1. Sign in to the AWS Management Console and open the Billing and Cost Management console at <https://console.aws.amazon.com/billing/home#/>.
2. On the navigation bar, choose your account name, and then choose Account.
3. On the Account Settings page, review and verify the current details.
4. Under Contact Information, review and verify the current details.

Remediation:







This activity can only be performed via the AWS Console, with a user who has permission to read and write Billing information (aws-portal:*Billing).

1. Sign in to the AWS Management Console and open the Billing and Cost Management console at <https://console.aws.amazon.com/billing/home#/>.
2. On the navigation bar, choose your account name, and then choose Account.
3. On the Account Settings page, next to Account Settings, choose Edit.
4. Next to the field that you need to update, choose Edit.
5. After you have entered your changes, choose Save changes.
6. After you have made your changes, choose Done.
7. To edit your contact information, under Contact Information, choose Edit.
8. For the fields that you want to change, type your updated information, and then choose Update.

References:

1. <https://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/manage-account-payment.html#contact-info>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<p>17.2 <u>Establish and Maintain Contact Information for Reporting Security Incidents</u></p> <p>Establish and maintain contact information for parties that need to be informed of security incidents. Contacts may include internal staff, third-party vendors, law enforcement, cyber insurance providers, relevant government agencies, Information Sharing and Analysis Center (ISAC) partners, or other stakeholders. Verify contacts annually to ensure that information is up-to-date.</p>			
v7	<p>19.3 <u>Designate Management Personnel to Support Incident Handling</u></p> <p>Designate management personnel, as well as backups, who will support the incident handling process by acting in key decision-making roles.</p>			

1.2 Ensure security contact information is registered (Manual)

Profile Applicability:

- Level 1

Description:

AWS provides customers with the option of specifying the contact information for account's security team. It is recommended that this information be provided.

Rationale:

Specifying security-specific contact information will help ensure that security advisories sent by AWS reach the team in your organization that is best equipped to respond to them.

Audit:

Perform the following to determine if security contact information is present:

From Console:

1. Click on your account name at the top right corner of the console
2. From the drop-down menu Click `My Account`
3. Scroll down to the `Alternate Contacts` section
4. Ensure contact information is specified in the `Security` section

From Command Line:

1. Run the following command:

```
aws account get-alternate-contact --alternate-contact-type SECURITY
```

2. Ensure proper contact information is specified for the `Security` contact.

Remediation:

Perform the following to establish security contact information:

From Console:

1. Click on your account name at the top right corner of the console.
2. From the drop-down menu Click `My Account`
3. Scroll down to the `Alternate Contacts` section
4. Enter contact information in the `Security` section

From Command Line:

Run the following command with the following input parameters:

--email-address, --name, and --phone-number.








```
aws account put-alternate-contact --alternate-contact-type SECURITY
```

Note: Consider specifying an internal email distribution list to ensure emails are regularly monitored by more than one individual.

References:

1. CCE-79200-2

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<u>17.2 Establish and Maintain Contact Information for Reporting Security Incidents</u> Establish and maintain contact information for parties that need to be informed of security incidents. Contacts may include internal staff, third-party vendors, law enforcement, cyber insurance providers, relevant government agencies, Information Sharing and Analysis Center (ISAC) partners, or other stakeholders. Verify contacts annually to ensure that information is up-to-date.			
v8	<u>17.6 Define Mechanisms for Communicating During Incident Response</u> Determine which primary and secondary mechanisms will be used to communicate and report during a security incident. Mechanisms can include phone calls, emails, or letters. Keep in mind that certain mechanisms, such as emails, can be affected during a security incident. Review annually, or when significant enterprise changes occur that could impact this Safeguard.			
v7	<u>19 Incident Response and Management</u> Incident Response and Management			
v7	<u>19.2 Assign Job Titles and Duties for Incident Response</u> Assign job titles and duties for handling computer and network incidents to specific individuals and ensure tracking and documentation throughout the incident through resolution.			

1.3 Ensure security questions are registered in the AWS account (Manual)

Profile Applicability:

- Level 1

Description:

The AWS support portal allows account owners to establish security questions that can be used to authenticate individuals calling AWS customer service for support. It is recommended that security questions be established.

Rationale:

When creating a new AWS account, a default super user is automatically created. This account is referred to as the 'root user' or 'root' account. It is recommended that the use of this account be limited and highly controlled. During events in which the 'root' password is no longer accessible or the MFA token associated with 'root' is lost/destroyed it is possible, through authentication using secret questions and associated answers, to recover 'root' user login access.

Audit:

From Console:

1. Login to the AWS account as the 'root' user
2. On the top right you will see the `<Root_Account_Name>`
3. Click on the `<Root_Account_Name>`
4. From the drop-down menu Click `My Account`
5. In the `Configure Security Challenge Questions` section on the `Personal Information` page, configure three security challenge questions.
6. Click `Save questions`.




Remediation:

From Console:

1. Login to the AWS Account as the 'root' user
2. Click on the `<Root_Account_Name>` from the top right of the console
3. From the drop-down menu Click `My Account`
4. Scroll down to the `Configure Security Questions` section
5. Click on `Edit`
6. Click on each `Question`
 - From the drop-down select an appropriate question
 - Click on the `Answer` section

- Enter an appropriate answer
 - Follow process for all 3 questions
- 7. Click Update when complete
- 8. Save Questions and Answers and place in a secure physical location

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<p><u>17.2 Establish and Maintain Contact Information for Reporting Security Incidents</u></p> <p>Establish and maintain contact information for parties that need to be informed of security incidents. Contacts may include internal staff, third-party vendors, law enforcement, cyber insurance providers, relevant government agencies, Information Sharing and Analysis Center (ISAC) partners, or other stakeholders. Verify contacts annually to ensure that information is up-to-date.</p>			
v7	<p><u>16 Account Monitoring and Control</u></p> <p>Account Monitoring and Control</p>			

1.4 Ensure no 'root' user account access key exists (Automated)

Profile Applicability:

- Level 1

Description:

The 'root' user account is the most privileged user in an AWS account. AWS Access Keys provide programmatic access to a given AWS account. It is recommended that all access keys associated with the 'root' user account be deleted.

Rationale:

Deleting access keys associated with the 'root' user account limits vectors by which the account can be compromised. Additionally, deleting the 'root' access keys encourages the creation and use of role based accounts that are least privileged.

Audit:

Perform the following to determine if the 'root' user account has access keys:

From Console:

1. Login to the AWS Management Console.
2. Click `Services`.
3. Click `IAM`.
4. Click on `Credential Report`.
5. This will download a `.csv` file which contains credential usage for all IAM users within an AWS Account - open this file.
6. For the `<root_account>` user, ensure the `access_key_1_active` and `access_key_2_active` fields are set to `FALSE`.

From Command Line:

Run the following command:

```
aws iam get-account-summary | grep "AccountAccessKeysPresent"
```

If no 'root' access keys exist the output will show `"AccountAccessKeysPresent": 0,,`.
If the output shows a "1", then 'root' keys exist and should be deleted.

Remediation:

Perform the following to delete active 'root' user access keys.

From Console:

1. Sign in to the AWS Management Console as 'root' and open the IAM console at <https://console.aws.amazon.com/iam/>.
2. Click on `<root_account>` at the top right and select `My Security Credentials` from the drop down list.
3. On the pop out screen Click on `Continue to Security Credentials`.

4. Click on `Access Keys` (Access Key ID and Secret Access Key).
5. Under the `Status` column (if there are any Keys which are active).
6. Click `Delete` (Note: Deleted keys cannot be recovered).

Note: While a key can be made inactive, this inactive key will still show up in the CLI command from the audit procedure, and may lead to a key being falsely flagged as being non-compliant.










References:

1. <http://docs.aws.amazon.com/general/latest/gr/aws-access-keys-best-practices.html>
2. <http://docs.aws.amazon.com/general/latest/gr/managing-aws-access-keys.html>
3. http://docs.aws.amazon.com/IAM/latest/APIReference/API_GetAccountSummary.html
4. CCE-78910-7
5. <https://aws.amazon.com/blogs/security/an-easier-way-to-determine-the-presence-of-aws-account-access-keys/>

Additional Information:

IAM User account "root" for us-gov cloud regions is not enabled by default. However, on request to AWS support enables 'root' access only through access-keys (CLI, API methods) for us-gov cloud region.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v8	5.4 <u>Restrict Administrator Privileges to Dedicated Administrator Accounts</u> Restrict administrator privileges to dedicated administrator accounts on enterprise assets. Conduct general computing activities, such as internet browsing, email, and productivity suite use, from the user's primary, non-privileged account.			
v7	4.3 <u>Ensure the Use of Dedicated Administrative Accounts</u> Ensure that all users with administrative account access use a dedicated or secondary account for elevated activities. This account should only be used for administrative activities and not internet browsing, email, or similar activities.			

1.5 Ensure MFA is enabled for the 'root' user account (Automated)

Profile Applicability:

- Level 1

Description:

The 'root' user account is the most privileged user in an AWS account. Multi-factor Authentication (MFA) adds an extra layer of protection on top of a username and password. With MFA enabled, when a user signs in to an AWS website, they will be prompted for their username and password as well as for an authentication code from their AWS MFA device.

Note: When virtual MFA is used for 'root' accounts, it is recommended that the device used is NOT a personal device, but rather a dedicated mobile device (tablet or phone) that is managed to be kept charged and secured independent of any individual personal devices. ("non-personal virtual MFA") This lessens the risks of losing access to the MFA due to device loss, device trade-in or if the individual owning the device is no longer employed at the company.

Rationale:

Enabling MFA provides increased security for console access as it requires the authenticating principal to possess a device that emits a time-sensitive key and have knowledge of a credential.

Audit:

Perform the following to determine if the 'root' user account has MFA setup:

From Console:

1. Login to the AWS Management Console
2. Click `Services`
3. Click `IAM`
4. Click on `Credential Report`
5. This will download a `.csv` file which contains credential usage for all IAM users within an AWS Account - open this file
6. For the `<root_account>` user, ensure the `mfa_active` field is set to `TRUE`.

From Command Line:

1. Run the following command:

```
aws iam get-account-summary | grep "AccountMFAEnabled"
```

2. Ensure the `AccountMFAEnabled` property is set to 1

Remediation:

Perform the following to establish MFA for the 'root' user account:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.

Note: to manage MFA devices for the 'root' AWS account, you must use your 'root' account credentials to sign in to AWS. You cannot manage MFA devices for the 'root' account using other credentials.

2. Choose `Dashboard` , and under `Security Status` , expand `Activate MFA on your root account`.
3. Choose `Activate MFA`
4. In the wizard, choose `A virtual MFA device` and then choose `Next Step` .
5. IAM generates and displays configuration information for the virtual MFA device, including a QR code graphic. The graphic is a representation of the 'secret configuration key' that is available for manual entry on devices that do not support QR codes.
6. Open your virtual MFA application. (For a list of apps that you can use for hosting virtual MFA devices, see [Virtual MFA Applications](#).) If the virtual MFA application supports multiple accounts (multiple virtual MFA devices), choose the option to create a new account (a new virtual MFA device).
7. Determine whether the MFA app supports QR codes, and then do one of the following:
 - Use the app to scan the QR code. For example, you might choose the camera icon or choose an option similar to Scan code, and then use the device's camera to scan the code.
 - In the Manage MFA Device wizard, choose Show secret key for manual configuration, and then type the secret configuration key into your MFA application.

When you are finished, the virtual MFA device starts generating one-time passwords. In the Manage MFA Device wizard, in the Authentication Code 1 box, type the one-time password that currently appears in the virtual MFA device. Wait up to 30 seconds for the device to generate a new one-time password. Then type the second one-time password into the Authentication Code 2 box. Choose Assign Virtual MFA.






References:

1. CCE-78911-5
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_root-user.html#id_root-user_manage_mfa
3. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa_enable_virtual.html#enable-virt-mfa-for-root

Additional Information:

IAM User account "root" for us-gov cloud regions does not have console access. This recommendation is not applicable for us-gov cloud regions.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<u>6.5 Require MFA for Administrative Access</u> Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a third-party provider.			
v7	<u>4.5 Use Multifactor Authentication For All Administrative Access</u> Use multi-factor authentication and encrypted channels for all administrative account access.			

1.6 Ensure hardware MFA is enabled for the 'root' user account (Manual)

Profile Applicability:

- Level 2

Description:

The 'root' user account is the most privileged user in an AWS account. MFA adds an extra layer of protection on top of a user name and password. With MFA enabled, when a user signs in to an AWS website, they will be prompted for their user name and password as well as for an authentication code from their AWS MFA device. For Level 2, it is recommended that the 'root' user account be protected with a hardware MFA.

Rationale:

A hardware MFA has a smaller attack surface than a virtual MFA. For example, a hardware MFA does not suffer the attack surface introduced by the mobile smartphone on which a virtual MFA resides.

Note: Using hardware MFA for many, many AWS accounts may create a logistical device management issue. If this is the case, consider implementing this Level 2 recommendation selectively to the highest security AWS accounts and the Level 1 recommendation applied to the remaining accounts.

Audit:

Perform the following to determine if the 'root' user account has a hardware MFA setup:

1. Run the following command to determine if the 'root' account has MFA setup:

```
aws iam get-account-summary | grep "AccountMFAEnabled"
```

The `AccountMFAEnabled` property is set to 1 will ensure that the 'root' user account has MFA (Virtual or Hardware) Enabled.

If `AccountMFAEnabled` property is set to 0 the account is not compliant with this recommendation.

2. If `AccountMFAEnabled` property is set to 1, determine 'root' account has Hardware MFA enabled.

Run the following command to list all virtual MFA devices:

```
aws iam list-virtual-mfa-devices
```

If the output contains one MFA with the following Serial Number, it means the MFA is virtual, not hardware and the account is not compliant with this recommendation:

```
"SerialNumber": "arn:aws:iam::_<aws_account_number>_:mfa/root-account-mfa-device"
```

Remediation:

Perform the following to establish a hardware MFA for the 'root' user account:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.
Note: to manage MFA devices for the AWS 'root' user account, you must use your 'root' account credentials to sign in to AWS. You cannot manage MFA devices for the 'root' account using other credentials.
2. Choose `Dashboard` , and under `Security Status` , expand `Activate MFA on your root account`.
3. Choose `Activate MFA`
4. In the wizard, choose `A hardware MFA device` and then choose `Next Step` .
5. In the `Serial Number` box, enter the serial number that is found on the back of the MFA device.
6. In the `Authentication Code 1` box, enter the six-digit number displayed by the MFA device. You might need to press the button on the front of the device to display the number.
7. Wait 30 seconds while the device refreshes the code, and then enter the next six-digit number into the `Authentication Code 2` box. You might need to press the button on the front of the device again to display the second number.
8. Choose `Next Step` . The MFA device is now associated with the AWS account. The next time you use your AWS account credentials to sign in, you must type a code from the hardware MFA device.

Remediation for this recommendation is not available through AWS CLI.






References:

1. CCE-78911-5
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa_enable_virtual.html
3. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa_enable_physical.html#enable-hw-mfa-for-root

Additional Information:

IAM User account 'root' for us-gov cloud regions does not have console access. This control is not applicable for us-gov cloud regions.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	6.5 <u>Require MFA for Administrative Access</u> Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a third-party provider.			
v7	4.5 <u>Use Multifactor Authentication For All Administrative Access</u> Use multi-factor authentication and encrypted channels for all administrative account access.			

1.7 Eliminate use of the 'root' user for administrative and daily tasks (Manual)

Profile Applicability:

- Level 1

Description:

With the creation of an AWS account, a 'root user' is created that cannot be disabled or deleted. That user has unrestricted access to and control over all resources in the AWS account. It is highly recommended that the use of this account be avoided for everyday tasks.

Rationale:

The 'root user' has unrestricted access to and control over all account resources. Use of it is inconsistent with the principles of least privilege and separation of duties, and can lead to unnecessary harm due to error or account compromise.

Audit:

From Console:

1. Login to the AWS Management Console at <https://console.aws.amazon.com/iam/>
2. In the left pane, click Credential Report
3. Click on Download Report
4. Open or Save the file locally
5. Locate the <root account> under the user column
6. Review password_last_used, access_key_1_last_used_date, access_key_2_last_used_date to determine when the 'root user' was last used.

From Command Line:

Run the following CLI commands to provide a credential report for determining the last time the 'root user' was used:

```
aws iam generate-credential-report
aws iam get-credential-report --query 'Content' --output text | base64 -d |
cut -d, -f1,5,11,16 | grep -B1 '<root_account>'
```

Review password_last_used, access_key_1_last_used_date, access_key_2_last_used_date to determine when the *root user* was last used.

Note: There are a few conditions under which the use of the 'root' user account is required. Please see the reference links for all of the tasks that require use of the 'root' user.

Remediation:

If you find that the 'root' user account is being used for daily activity to include administrative tasks that do not require the 'root' user:

1. Change the 'root' user password.
2. Deactivate or delete any access keys associate with the 'root' user.

****Remember, anyone who has 'root' user credentials for your AWS account has unrestricted access to and control of all the resources in your account, including billing information.**

References:







1. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html>
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_root-user.html
3. https://docs.aws.amazon.com/general/latest/gr/aws_tasks-that-require-root.html

Additional Information:

The 'root' user for us-gov cloud regions is not enabled by default. However, on request to AWS support, they can enable the 'root' user and grant access only through access-keys (CLI, API methods) for us-gov cloud region. If the 'root' user for us-gov cloud regions is enabled, this recommendation is applicable.

Monitoring usage of the 'root' user can be accomplished by implementing recommendation 3.3 Ensure a log metric filter and alarm exist for usage of the 'root' user.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5.4 <u>Restrict Administrator Privileges to Dedicated Administrator Accounts</u> Restrict administrator privileges to dedicated administrator accounts on enterprise assets. Conduct general computing activities, such as internet browsing, email, and productivity suite use, from the user's primary, non-privileged account.			
v7	4.3 <u>Ensure the Use of Dedicated Administrative Accounts</u> Ensure that all users with administrative account access use a dedicated or secondary account for elevated activities. This account should only be used for administrative activities and not internet browsing, email, or similar activities.			

1.8 Ensure IAM password policy requires minimum length of 14 or greater (Automated)

Profile Applicability:

- Level 1

Description:

Password policies are, in part, used to enforce password complexity requirements. IAM password policies can be used to ensure password are at least a given length. It is recommended that the password policy require a minimum password length 14.

Rationale:

Setting a password complexity policy increases account resiliency against brute force login attempts.

Audit:

Perform the following to ensure the password policy is configured as prescribed:

From Console:

1. Login to AWS Console (with appropriate permissions to View Identity Access Management Account Settings)
2. Go to IAM Service on the AWS Console
3. Click on Account Settings on the Left Pane
4. Ensure "Minimum password length" is set to 14 or greater.

From Command Line:

```
aws iam get-account-password-policy
```

Ensure the output of the above command includes "MinimumPasswordLength": 14 (or higher)

Remediation:

Perform the following to set the password policy as prescribed:

From Console:

1. Login to AWS Console (with appropriate permissions to View Identity Access Management Account Settings)
2. Go to IAM Service on the AWS Console
3. Click on Account Settings on the Left Pane
4. Set "Minimum password length" to 14 or greater.
5. Click "Apply password policy"

From Command Line:




```
aws iam update-account-password-policy --minimum-password-length 14
```

Note: All commands starting with "aws iam update-account-password-policy" can be combined into a single command.

References:

1. CCE-78907-3
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_passwords_account-policy.html
3. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#configure-strong-password-policy>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5 Account Management Use processes and tools to assign and manage authorization to credentials for user accounts, including administrator accounts, as well as service accounts, to enterprise assets and software.			
v8	5.2 Use Unique Passwords Use unique passwords for all enterprise assets. Best practice implementation includes, at a minimum, an 8-character password for accounts using MFA and a 14-character password for accounts not using MFA.			
v7	16 Account Monitoring and Control Account Monitoring and Control			

1.9 Ensure IAM password policy prevents password reuse (Automated)

Profile Applicability:

- Level 1

Description:

IAM password policies can prevent the reuse of a given password by the same user. It is recommended that the password policy prevent the reuse of passwords.

Rationale:

Preventing password reuse increases account resiliency against brute force login attempts.

Audit:

Perform the following to ensure the password policy is configured as prescribed:

From Console:

1. Login to AWS Console (with appropriate permissions to View Identity Access Management Account Settings)
2. Go to IAM Service on the AWS Console
3. Click on Account Settings on the Left Pane
4. Ensure "Prevent password reuse" is checked
5. Ensure "Number of passwords to remember" is set to 24

From Command Line:

```
aws iam get-account-password-policy
```

Ensure the output of the above command includes "PasswordReusePrevention": 24

Remediation:

Perform the following to set the password policy as prescribed:

From Console:

1. Login to AWS Console (with appropriate permissions to View Identity Access Management Account Settings)
2. Go to IAM Service on the AWS Console
3. Click on Account Settings on the Left Pane
4. Check "Prevent password reuse"
5. Set "Number of passwords to remember" is set to 24

From Command Line:






```
aws iam update-account-password-policy --password-reuse-prevention 24
```

Note: All commands starting with "aws iam update-account-password-policy" can be combined into a single command.

References:

1. CCE-78908-1
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_passwords_account-policy.html
3. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#configure-strong-password-policy>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5.2 Use Unique Passwords Use unique passwords for all enterprise assets. Best practice implementation includes, at a minimum, an 8-character password for accounts using MFA and a 14-character password for accounts not using MFA.			
v7	4.4 Use Unique Passwords Where multi-factor authentication is not supported (such as local administrator, root, or service accounts), accounts will use passwords that are unique to that system.			

1.10 Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password (Automated)

Profile Applicability:

- Level 1

Description:

Multi-Factor Authentication (MFA) adds an extra layer of authentication assurance beyond traditional credentials. With MFA enabled, when a user signs in to the AWS Console, they will be prompted for their user name and password as well as for an authentication code from their physical or virtual MFA token. It is recommended that MFA be enabled for all accounts that have a console password.

Rationale:

Enabling MFA provides increased security for console access as it requires the authenticating principal to possess a device that displays a time-sensitive key and have knowledge of a credential.

Impact:

AWS will soon end support for SMS multi-factor authentication (MFA). New customers are not allowed to use this feature. We recommend that existing customers switch to one of the following alternative methods of MFA.

Audit:

Perform the following to determine if a MFA device is enabled for all IAM users having a console password:

From Console:

1. Open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the left pane, select `Users`
3. If the `MFA` or `Password age` columns are not visible in the table, click the gear icon at the upper right corner of the table and ensure a checkmark is next to both, then click `Close`.
4. Ensure that for each user where the `Password age` column shows a password age, the `MFA` column shows `Virtual`, `U2F Security Key`, or `Hardware`.

From Command Line:

1. Run the following command (OSX/Linux/UNIX) to generate a list of all IAM users along with their password and MFA status:

```
aws iam generate-credential-report
aws iam get-credential-report --query 'Content' --output text | base64 -d |
cut -d, -f1,4,8
```

2. The output of this command will produce a table similar to the following:

```
user,password_enabled,mfa_active
elise,false,false
brandon,true,true
rakesh,false,false
helene,false,false
paras,true,true
anitha,false,false
```

3. For any column having `password_enabled` set to `true`, ensure `mfa_active` is also set to `true`.

Remediation:

Perform the following to enable MFA:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at `'https://console.aws.amazon.com/iam/'`
2. In the left pane, select `Users`.
3. In the `User Name` list, choose the name of the intended MFA user.
4. Choose the `Security Credentials` tab, and then choose `Manage MFA Device`.
5. In the `Manage MFA Device` wizard, choose `Virtual MFA device`, and then choose `Continue`.

IAM generates and displays configuration information for the virtual MFA device, including a QR code graphic. The graphic is a representation of the 'secret configuration key' that is available for manual entry on devices that do not support QR codes.

6. Open your virtual MFA application. (For a list of apps that you can use for hosting virtual MFA devices, see [Virtual MFA Applications](https://aws.amazon.com/iam/details/mfa/#Virtual_MFA_Applications) at https://aws.amazon.com/iam/details/mfa/#Virtual_MFA_Applications). If the virtual MFA application supports multiple accounts (multiple virtual MFA devices), choose the option to create a new account (a new virtual MFA device).
7. Determine whether the MFA app supports QR codes, and then do one of the following:
 - Use the app to scan the QR code. For example, you might choose the camera icon or choose an option similar to `Scan code`, and then use the device's camera to scan the code.
 - In the `Manage MFA Device` wizard, choose `Show secret key for manual configuration`, and then type the secret configuration key into your MFA application.

When you are finished, the virtual MFA device starts generating one-time passwords.

8. In the Manage MFA Device wizard, in the MFA Code 1 box, type the one-time password that currently appears in the virtual MFA device. Wait up to 30 seconds for the device to generate a new one-time password. Then type the second one-time password into the MFA Code 2 box.
9. Click Assign MFA.

References:






1. <https://tools.ietf.org/html/rfc6238>
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa.html
3. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#enable-mfa-for-privileged-users>
4. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa_enable_virtual.html
5. CCE-78901-6
6. <https://blogs.aws.amazon.com/security/post/Tx2SJJYE082KBUK/How-to-Delegate-Management-of-Multi-Factor-Authentication-to-AWS-IAM-Users>

Additional Information:

Forced IAM User Self-Service Remediation

Amazon has published a pattern that forces users to self-service setup MFA before they have access to their complete permissions set. Until they complete this step, they cannot access their full permissions. This pattern can be used on new AWS accounts. It can also be used on existing accounts - it is recommended users are given instructions and a grace period to accomplish MFA enrollment before active enforcement on existing AWS accounts.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	6.5 <u>Require MFA for Administrative Access</u> Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a third-party provider.			
v7	4.5 <u>Use Multifactor Authentication For All Administrative Access</u> Use multi-factor authentication and encrypted channels for all administrative account access.			

1.11 Do not setup access keys during initial user setup for all IAM users that have a console password (Manual)

Profile Applicability:

- Level 1

Description:

AWS console defaults to no check boxes selected when creating a new IAM user. When creating the IAM User credentials you have to determine what type of access they require.

Programmatic access: The IAM user might need to make API calls, use the AWS CLI, or use the Tools for Windows PowerShell. In that case, create an access key (access key ID and a secret access key) for that user.

AWS Management Console access: If the user needs to access the AWS Management Console, create a password for the user.

Rationale:

Requiring the additional steps be taken by the user for programmatic access after their profile has been created will give a stronger indication of intent that access keys are [a] necessary for their work and [b] once the access key is established on an account that the keys may be in use somewhere in the organization.

Note: Even if it is known the user will need access keys, require them to create the keys themselves or put in a support ticket to have them created as a separate step from user creation.

Audit:

Perform the following to determine if access keys were created upon user creation and are being used and rotated as prescribed:

From Console:

1. Login to the AWS Management Console
 2. Click `Services`
 3. Click `IAM`
 4. Click on a User where column `Password age` and `Access key age` is not set to `None`
 5. Click on `Security credentials` Tab
 6. Compare the user `Creation time` to the `Access Key Created date`.
 7. For any that match, the key was created during initial user setup.
- Keys that were created at the same time as the user profile and do not have a last used date should be deleted. Refer to the remediation below.

From Command Line:

1. Run the following command (OSX/Linux/UNIX) to generate a list of all IAM users along with their access keys utilization:

```
aws iam generate-credential-report
aws iam get-credential-report --query 'Content' --output text | base64 -d |
cut -d, -f1,4,9,11,14,16
```

2. The output of this command will produce a table similar to the following:

```
user,password_enabled,access_key_1_active,access_key_1_last_used_date,access_
key_2_active,access_key_2_last_used_date
elise,false,true,2015-04-16T15:14:00+00:00,false,N/A
brandon,true,true,N/A,false,N/A
rakesh,false,false,N/A,false,N/A
helene,false,true,2015-11-18T17:47:00+00:00,false,N/A
paras,true,true,2016-08-28T12:04:00+00:00,true,2016-03-04T10:11:00+00:00
anitha,true,true,2016-06-08T11:43:00+00:00,true,N/A
```

3. For any user having `password_enabled` set to `true` AND `access_key_last_used_date` set to `N/A` refer to the remediation below.

Remediation:

Perform the following to delete access keys that do not pass the audit:

From Console:

1. Login to the AWS Management Console:
2. Click `Services`
3. Click `IAM`
4. Click on `Users`
5. Click on `Security Credentials`
6. As an Administrator
 - Click on the `X (Delete)` for keys that were created at the same time as the user profile but have not been used.
7. As an IAM User
 - Click on the `X (Delete)` for keys that were created at the same time as the user profile but have not been used.

From Command Line:

```
aws iam delete-access-key --access-key-id <access-key-id-listed> --user-name
<users-name>
```








References:

1. <https://docs.aws.amazon.com/cli/latest/reference/iam/delete-access-key.html>
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_users_create.html

Additional Information:

Credential report does not appear to contain "Key Creation Date"

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v8	5.4 <u>Restrict Administrator Privileges to Dedicated Administrator Accounts</u> Restrict administrator privileges to dedicated administrator accounts on enterprise assets. Conduct general computing activities, such as internet browsing, email, and productivity suite use, from the user's primary, non-privileged account.			
v7	16 <u>Account Monitoring and Control</u> Account Monitoring and Control			

1.12 Ensure credentials unused for 45 days or greater are disabled (Automated)

Profile Applicability:

- Level 1

Description:

AWS IAM users can access AWS resources using different types of credentials, such as passwords or access keys. It is recommended that all credentials that have been unused in 45 or greater days be deactivated or removed.

Rationale:

Disabling or removing unnecessary credentials will reduce the window of opportunity for credentials associated with a compromised or abandoned account to be used.

Audit:

Perform the following to determine if unused credentials exist:

From Console:

1. Login to the AWS Management Console
2. Click `Services`
3. Click `IAM`
4. Click on `Users`
5. Click the `Settings (gear)` icon.
6. Select `Console last sign-in`, `Access key last used`, and `Access Key Id`
7. Click on `Close`
8. Check and ensure that `Console last sign-in` is less than 45 days ago.

Note - `Never` means the user has never logged in.

9. Check and ensure that `Access key age` is less than 45 days and that `Access key last used` does not say `None`

If the user hasn't signed into the Console in the last 45 days or Access keys are over 45 days old refer to the remediation.

From Command Line: Download Credential Report:

1. Run the following commands:

```
aws iam generate-credential-report

aws iam get-credential-report --query 'Content' --output text | base64 -d |
cut -d, -f1,4,5,6,9,10,11,14,15,16 | grep -v '^<root_account>'
```

Ensure unused credentials do not exist:

2. For each user having `password_enabled` set to `TRUE` , ensure `password_last_used_date` is less than 45 days ago.
 - When `password_enabled` is set to `TRUE` and `password_last_used` is set to `No_Information` , ensure `password_last_changed` is less than 45 days ago.
3. For each user having an `access_key_1_active` or `access_key_2_active` to `TRUE` , ensure the corresponding `access_key_n_last_used_date` is less than 45 days ago.
 - When a user having an `access_key_x_active` (where x is 1 or 2) to `TRUE` and corresponding `access_key_x_last_used_date` is set to `N/A` , ensure `access_key_x_last_rotated`` is less than 45 days ago.

Remediation:

From Console:

Perform the following to manage Unused Password (IAM user console access)

1. Login to the AWS Management Console:
2. Click `Services`
3. Click `IAM`
4. Click on `Users`
5. Click on `Security Credentials`
6. Select user whose `Console last sign-in` is greater than 45 days
7. Click `Security credentials`
8. In section `Sign-in credentials`, `Console password` click `Manage`
9. Under `Console Access` select `Disable`
10. Click `Apply`

Perform the following to deactivate Access Keys:

1. Login to the AWS Management Console:
2. Click `Services`
3. Click `IAM`

4. Click on `Users`
5. Click on `Security Credentials`
6. Select any access keys that are over 45 days old and that have been used and
 - Click on `Make Inactive`
7. Select any access keys that are over 45 days old and that have not been used and
 - Click the X to `Delete`







References:

1. CCE-78900-8
2. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#remove-credentials>
3. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_finding-unused.html
4. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_passwords_admin-change-user.html
5. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_access-keys.html

Additional Information:

<root_account> is excluded in the audit since the root account should not be used for day to day business and would likely be unused for more than 45 days.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5.3 <u>Disable Dormant Accounts</u> Delete or disable any dormant accounts after a period of 45 days of inactivity, where supported.			
v7	16.9 <u>Disable Dormant Accounts</u> Automatically disable dormant accounts after a set period of inactivity.			

1.13 Ensure there is only one active access key available for any single IAM user (Automated)

Profile Applicability:

- Level 1

Description:

Access keys are long-term credentials for an IAM user or the AWS account 'root' user. You can use access keys to sign programmatic requests to the AWS CLI or AWS API (directly or using the AWS SDK)

Rationale:

Access keys are long-term credentials for an IAM user or the AWS account 'root' user. You can use access keys to sign programmatic requests to the AWS CLI or AWS API. One of the best ways to protect your account is to not allow users to have multiple access keys.

Audit:

From Console:

1. Sign in to the AWS Management Console and navigate to IAM dashboard at `https://console.aws.amazon.com/iam/`.
 2. In the left navigation panel, choose `Users`.
 3. Click on the IAM user name that you want to examine.
 4. On the IAM user configuration page, select `Security Credentials` tab.
 5. Under `Access Keys` section, in the Status column, check the current status for each access key associated with the IAM user. If the selected IAM user has more than one access key activated then the users access configuration does not adhere to security best practices and the risk of accidental exposures increases.
- Repeat steps no. 3 – 5 for each IAM user in your AWS account.

From Command Line:

1. Run `list-users` command to list all IAM users within your account:

```
aws iam list-users --query "Users[*].UserName"
```

The command output should return an array that contains all your IAM user names.

2. Run `list-access-keys` command using the IAM user name list to return the current status of each access key associated with the selected IAM user:

```
aws iam list-access-keys --user-name <user-name>
```

The command output should expose the metadata ("Username", "AccessKeyId", "Status", "CreateDate") for each access key on that user account.

3. Check the `Status` property value for each key returned to determine each key's current state. If the `Status` property value for more than one IAM access key is set to `Active`, the user access configuration does not adhere to this recommendation, refer to the remediation below.
- Repeat steps no. 2 and 3 for each IAM user in your AWS account.

Remediation:

From Console:

1. Sign in to the AWS Management Console and navigate to IAM dashboard at <https://console.aws.amazon.com/iam/>.
2. In the left navigation panel, choose `Users`.
3. Click on the IAM user name that you want to examine.
4. On the IAM user configuration page, select `Security Credentials` tab.
5. In `Access Keys` section, choose one access key that is less than 90 days old. This should be the only active key used by this IAM user to access AWS resources programmatically. Test your application(s) to make sure that the chosen access key is working.
6. In the same `Access Keys` section, identify your non-operational access keys (other than the chosen one) and deactivate it by clicking the `Make Inactive` link.
7. If you receive the `Change Key Status` confirmation box, click `Deactivate` to switch off the selected key.
8. Repeat steps no. 3 – 7 for each IAM user in your AWS account.

From Command Line:

1. Using the IAM user and access key information provided in the `Audit CLI`, choose one access key that is less than 90 days old. This should be the only active key used by this IAM user to access AWS resources programmatically. Test your application(s) to make sure that the chosen access key is working.
2. Run the `update-access-key` command below using the IAM user name and the non-operational access key IDs to deactivate the unnecessary key(s). Refer to the `Audit` section to identify the unnecessary access key ID for the selected IAM user

Note - the command does not return any output:

```
aws iam update-access-key --access-key-id <access-key-id> --status Inactive --user-name <user-name>
```

3. To confirm that the selected access key pair has been successfully deactivated run the `list-access-keys` audit command again for that IAM User:

```
aws iam list-access-keys --user-name <user-name>
```

- The command output should expose the metadata for each access key associated with the IAM user. If the non-operational key pair(s) `Status` is set to `Inactive`, the key has been successfully deactivated and the IAM user access configuration adheres now to this recommendation.
4. Repeat steps no. 1 – 3 for each IAM user in your AWS account.

References:

1. <https://docs.aws.amazon.com/general/latest/gr/aws-access-keys-best-practices.html>
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_access-keys.html

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5 Account Management Use processes and tools to assign and manage authorization to credentials for user accounts, including administrator accounts, as well as service accounts, to enterprise assets and software.			
v7	4 Controlled Use of Administrative Privileges Controlled Use of Administrative Privileges			

1.14 Ensure access keys are rotated every 90 days or less (Automated)

Profile Applicability:

- Level 1

Description:

Access keys consist of an access key ID and secret access key, which are used to sign programmatic requests that you make to AWS. AWS users need their own access keys to make programmatic calls to AWS from the AWS Command Line Interface (AWS CLI), Tools for Windows PowerShell, the AWS SDKs, or direct HTTP calls using the APIs for individual AWS services. It is recommended that all access keys be regularly rotated.

Rationale:

Rotating access keys will reduce the window of opportunity for an access key that is associated with a compromised or terminated account to be used.

Access keys should be rotated to ensure that data cannot be accessed with an old key which might have been lost, cracked, or stolen.

Audit:

Perform the following to determine if access keys are rotated as prescribed:

From Console:

1. Go to Management Console (<https://console.aws.amazon.com/iam>)
2. Click on `Users`
3. Click `setting` icon
4. Select `Console last sign-in`
5. Click `Close`
6. Ensure that `Access key age` is less than 90 days ago. note) `None` in the `Access key age` means the user has not used the access key.

From Command Line:

```
aws iam generate-credential-report
aws iam get-credential-report --query 'Content' --output text | base64 -d
```

The `access_key_1_last_rotated` and the `access_key_2_last_rotated` fields in this file notes The date and time, in ISO 8601 date-time format, when the user's access key was created or last changed. If the user does not have an active access key, the value in this field is N/A (not applicable).

Remediation:

Perform the following to rotate access keys:

From Console:

1. Go to Management Console (<https://console.aws.amazon.com/iam>)
2. Click on `Users`
3. Click on `Security Credentials`
4. As an Administrator
 - o Click on `Make Inactive` for keys that have not been rotated in 90 Days
5. As an IAM User
 - o Click on `Make Inactive` or `Delete` for keys which have not been rotated or used in 90 Days
6. Click on `Create Access Key`
7. Update programmatic call with new Access Key credentials

From Command Line:

1. While the first access key is still active, create a second access key, which is active by default. Run the following command:

```
aws iam create-access-key
```

At this point, the user has two active access keys.

2. Update all applications and tools to use the new access key.
3. Determine whether the first access key is still in use by using this command:

```
aws iam get-access-key-last-used
```

4. One approach is to wait several days and then check the old access key for any use before proceeding.

Even if step Step 3 indicates no use of the old key, it is recommended that you do not immediately delete the first access key. Instead, change the state of the first access key to `Inactive` using this command:

```
aws iam update-access-key
```

5. Use only the new access key to confirm that your applications are working. Any applications and tools that still use the original access key will stop working at this point because they no longer have access to AWS resources. If you find such an application or tool, you can switch its state back to `Active` to reenab the first access key. Then return to step Step 2 and update this application to use the new key.
6. After you wait some period of time to ensure that all applications and tools have been updated, you can delete the first access key with this command:

```
aws iam delete-access-key
```

References:

1. CCE-78902-4
2. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#rotate-credentials>
3. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_finding-unused.html
4. <https://docs.aws.amazon.com/general/latest/gr/managing-aws-access-keys.html>
5. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_access-keys.html

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5 Account Management Use processes and tools to assign and manage authorization to credentials for user accounts, including administrator accounts, as well as service accounts, to enterprise assets and software.			
v7	16 Account Monitoring and Control Account Monitoring and Control			

1.15 Ensure IAM Users Receive Permissions Only Through Groups (Automated)

Profile Applicability:

- Level 1

Description:

IAM users are granted access to services, functions, and data through IAM policies. There are four ways to define policies for a user: 1) Edit the user policy directly, aka an inline, or user, policy; 2) attach a policy directly to a user; 3) add the user to an IAM group that has an attached policy; 4) add the user to an IAM group that has an inline policy.

Only the third implementation is recommended.

Rationale:

Assigning IAM policy only through groups unifies permissions management to a single, flexible layer consistent with organizational functional roles. By unifying permissions management, the likelihood of excessive permissions is reduced.

Audit:

Perform the following to determine if an inline policy is set or a policy is directly attached to users:

1. Run the following to get a list of IAM users:

```
aws iam list-users --query 'Users[*].UserName' --output text
```

2. For each user returned, run the following command to determine if any policies are attached to them:

```
aws iam list-attached-user-policies --user-name <iam_user>  
aws iam list-user-policies --user-name <iam_user>
```

3. If any policies are returned, the user has an inline policy or direct policy attachment.

Remediation:

Perform the following to create an IAM group and assign a policy to it:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the navigation pane, click `Groups` and then click `Create New Group`.

3. In the `Group Name` box, type the name of the group and then click `Next Step`.
4. In the list of policies, select the check box for each policy that you want to apply to all members of the group. Then click `Next Step`.
5. Click `Create Group`

Perform the following to add a user to a given group:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the navigation pane, click `Groups`
3. Select the group to add a user to
4. Click `Add Users To Group`
5. Select the users to be added to the group
6. Click `Add Users`

Perform the following to remove a direct association between a user and policy:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the left navigation pane, click on `Users`
3. For each user:
 - Select the user
 - Click on the `Permissions` tab
 - Expand `Permissions policies`
 - Click `x` for each policy; then click `Detach` or `Remove` (depending on policy type)

References:

1. <http://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html>
2. http://docs.aws.amazon.com/IAM/latest/UserGuide/access_policies_managed-vs-inline.html
3. CCE-78912-3

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	6.8 Define and Maintain Role-Based Access Control Define and maintain role-based access control, through determining and documenting the access rights necessary for each role within the enterprise to successfully carry out its assigned duties. Perform access control reviews of enterprise assets to validate that all privileges are authorized, on a recurring schedule at a minimum annually, or more frequently.			●

Controls Version	Control	IG 1	IG 2	IG 3
v7	16 <u>Account Monitoring and Control</u> Account Monitoring and Control			

1.16 Ensure IAM policies that allow full "*" "*" administrative privileges are not attached (Automated)

Profile Applicability:

- Level 1

Description:

IAM policies are the means by which privileges are granted to users, groups, or roles. It is recommended and considered a standard security advice to grant *least privilege* -that is, granting only the permissions required to perform a task. Determine what users need to do and then craft policies for them that let the users perform *only* those tasks, instead of allowing full administrative privileges.

Rationale:

It's more secure to start with a minimum set of permissions and grant additional permissions as necessary, rather than starting with permissions that are too lenient and then trying to tighten them later.

Providing full administrative privileges instead of restricting to the minimum set of permissions that the user is required to do exposes the resources to potentially unwanted actions.

IAM policies that have a statement with "Effect": "Allow" with "Action": "*" over "Resource": "*" should be removed.

Audit:

Perform the following to determine what policies are created:

From Command Line:

1. Run the following to get a list of IAM policies:

```
aws iam list-policies --only-attached --output text
```

2. For each policy returned, run the following command to determine if any policies is allowing full administrative privileges on the account:

```
aws iam get-policy-version --policy-arn <policy_arn> --version-id  
<version>
```

3. In output ensure policy should not have any Statement block with "Effect": "Allow" and Action set to "*" and Resource set to "*"

Remediation:

From Console:

Perform the following to detach the policy that has full administrative privileges:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the navigation pane, click Policies and then search for the policy name found in the audit step.
3. Select the policy that needs to be deleted.
4. In the policy action menu, select first `Detach`
5. Select all Users, Groups, Roles that have this policy attached
6. Click `Detach Policy`
7. In the policy action menu, select `Detach`

From Command Line:

Perform the following to detach the policy that has full administrative privileges as found in the audit step:

1. Lists all IAM users, groups, and roles that the specified managed policy is attached to.

```
aws iam list-entities-for-policy --policy-arn <policy_arn>
```

2. Detach the policy from all IAM Users:

```
aws iam detach-user-policy --user-name <iam_user> --policy-arn <policy_arn>
```

3. Detach the policy from all IAM Groups:

```
aws iam detach-group-policy --group-name <iam_group> --policy-arn  
<policy_arn>
```




4. Detach the policy from all IAM Roles:

```
aws iam detach-role-policy --role-name <iam_role> --policy-arn <policy_arn>
```

References:

1. <https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html>
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/access_policies_managed-vs-inline.html
3. CCE-78912-3
4. <https://docs.aws.amazon.com/cli/latest/reference/iam/index.html#cli-aws-iam>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	4 <u>Controlled Use of Administrative Privileges</u> Controlled Use of Administrative Privileges			

1.17 Ensure a support role has been created to manage incidents with AWS Support (Automated)

Profile Applicability:

- Level 1

Description:

AWS provides a support center that can be used for incident notification and response, as well as technical support and customer services. Create an IAM Role, with the appropriate policy assigned, to allow authorized users to manage incidents with AWS Support.

Rationale:

By implementing least privilege for access control, an IAM Role will require an appropriate IAM Policy to allow Support Center Access in order to manage Incidents with AWS Support.

Impact:

All AWS Support plans include an unlimited number of account and billing support cases, with no long-term contracts. Support billing calculations are performed on a per-account basis for all plans. Enterprise Support plan customers have the option to include multiple enabled accounts in an aggregated monthly billing calculation. Monthly charges for the Business and Enterprise support plans are based on each month's AWS usage charges, subject to a monthly minimum, billed in advance.

When assigning rights, keep in mind that other policies may grant access to Support as well. This may include AdministratorAccess and other policies including customer managed policies.

Audit:

From Command Line:

1. List IAM policies, filter for the 'AWSSupportAccess' managed policy, and note the "Arn" element value:

```
aws iam list-policies --query "Policies[?PolicyName == 'AWSSupportAccess']"
```

2. Check if the 'AWSSupportAccess' policy is attached to any role:

```
aws iam list-entities-for-policy --policy-arn  
arn:aws:iam::aws:policy/AWSSupportAccess
```

3. In Output, Ensure `PolicyRoles` does not return empty. 'Example: Example:
`PolicyRoles: []`'

If it returns empty refer to the remediation below.

Remediation:

From Command Line:

1. Create an IAM role for managing incidents with AWS:
 - Create a trust relationship policy document that allows `<iam_user>` to manage AWS incidents, and save it locally as `/tmp/TrustPolicy.json`:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "AWS": "<iam_user>"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

2. Create the IAM role using the above trust policy:

```
aws iam create-role --role-name <aws_support_iam_role> --assume-role-policy-
document file:///tmp/TrustPolicy.json
```

3. Attach 'AWSSupportAccess' managed policy to the created IAM role:

```
aws iam attach-role-policy --policy-arn
arn:aws:iam::aws:policy/AWSSupportAccess --role-name <aws_support_iam_role>
```




References:

1. https://docs.aws.amazon.com/IAM/latest/UserGuide/access_policies_managed-vs-inline.html
2. <https://aws.amazon.com/premiumsupport/pricing/>
3. <https://docs.aws.amazon.com/cli/latest/reference/iam/list-policies.html>
4. <https://docs.aws.amazon.com/cli/latest/reference/iam/attach-role-policy.html>
5. <https://docs.aws.amazon.com/cli/latest/reference/iam/list-entities-for-policy.html>

Additional Information:

AWSSupportAccess policy is a global AWS resource. It has same ARN as `arn:aws:iam::aws:policy/AWSSupportAccess` for every account.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	17.1 <u>Designate Personnel to Manage Incident Handling</u> Designate one key person, and at least one backup, who will manage the enterprise's incident handling process. Management personnel are responsible for the coordination and documentation of incident response and recovery efforts and can consist of employees internal to the enterprise, third-party vendors, or a hybrid approach. If using a third-party vendor, designate at least one person internal to the enterprise to oversee any third-party work. Review annually, or when significant enterprise changes occur that could impact this Safeguard.			
v7	14 <u>Controlled Access Based on the Need to Know</u> Controlled Access Based on the Need to Know			

1.18 Ensure IAM instance roles are used for AWS resource access from instances (Automated)

Profile Applicability:

- Level 2

Description:

AWS access from within AWS instances can be done by either encoding AWS keys into AWS API calls or by assigning the instance to a role which has an appropriate permissions policy for the required access. "AWS Access" means accessing the APIs of AWS in order to access AWS resources or manage AWS account resources.

Rationale:

AWS IAM roles reduce the risks associated with sharing and rotating credentials that can be used outside of AWS itself. If credentials are compromised, they can be used from outside of the AWS account they give access to. In contrast, in order to leverage role permissions an attacker would need to gain and maintain access to a specific instance to use the privileges associated with it.

Additionally, if credentials are encoded into compiled applications or other hard to change mechanisms, then they are even more unlikely to be properly rotated due to service disruption risks. As time goes on, credentials that cannot be rotated are more likely to be known by an increasing number of individuals who no longer work for the organization owning the credentials.

Audit:

From Console:

1. Sign in to the AWS Management Console and navigate to EC2 dashboard at <https://console.aws.amazon.com/ec2/>.
 2. In the left navigation panel, choose `Instances`.
 3. Select the EC2 instance you want to examine.
 4. Select `Actions`.
 5. Select `View details`.
 6. Select `Security` in the lower panel.
- If the value for **Instance profile arn** is an instance profile ARN, then an instance profile (that contains an IAM role) is attached.
 - If the value for **IAM Role** is blank, no role is attached.
 - If the value for **IAM Role** contains a role
 - If the value for **IAM Role** is "No roles attached to instance profile: <Instance-Profile-Name>", then an instance profile is attached to the instance, but it does not contain an IAM role.

7. Repeat steps 3 to 6 for each EC2 instance in your AWS account.

From Command Line:

1. Run the `describe-instances` command to list all EC2 instance IDs, available in the selected AWS region. The command output will return each instance ID:

```
aws ec2 describe-instances --region <region-name> --query  
'Reservations[*].Instances[*].InstanceId'
```

2. Run the `describe-instances` command again for each EC2 instance using the `IamInstanceProfile` identifier in the query filter to check if an IAM role is attached:

```
aws ec2 describe-instances --region <region-name> --instance-id <Instance-ID>  
--query 'Reservations[*].Instances[*].IamInstanceProfile'
```

3. If an IAM role is attached, the command output will show the IAM instance profile ARN and ID.
4. Repeat steps 1 to 3 for each EC2 instance in your AWS account.

Remediation:

From Console:

1. Sign in to the AWS Management Console and navigate to EC2 dashboard at <https://console.aws.amazon.com/ec2/>.
2. In the left navigation panel, choose `Instances`.
3. Select the EC2 instance you want to modify.
4. Click `Actions`.
5. Click `Security`.
6. Click `Modify IAM role`.
7. Click `Create new IAM role` if a new IAM role is required.
8. Select the IAM role you want to attach to your instance in the `IAM role` dropdown.
9. Click `Update IAM role`.
10. Repeat steps 3 to 9 for each EC2 instance in your AWS account that requires an IAM role to be attached.

From Command Line:

1. Run the `describe-instances` command to list all EC2 instance IDs, available in the selected AWS region:

```
aws ec2 describe-instances --region <region-name> --query  
'Reservations[*].Instances[*].InstanceId'
```

2. Run the `associate-iam-instance-profile` command to attach an instance profile (which is attached to an IAM role) to the EC2 instance:

```
aws ec2 associate-iam-instance-profile --region <region-name> --instance-id  
<Instance-ID> --iam-instance-profile Name="Instance-Profile-Name"
```

3. Run the `describe-instances` command again for the recently modified EC2 instance. The command output should return the instance profile ARN and ID:

```
aws ec2 describe-instances --region <region-name> --instance-id <Instance-ID>  
--query 'Reservations[*].Instances[*].IamInstanceProfile'
```

4. Repeat steps 1 to 3 for each EC2 instance in your AWS account that requires an IAM role to be attached.

References:

1. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_roles_use_switch-role-ec2.html
2. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/iam-roles-for-amazon-ec2.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	6.8 Define and Maintain Role-Based Access Control Define and maintain role-based access control, through determining and documenting the access rights necessary for each role within the enterprise to successfully carry out its assigned duties. Perform access control reviews of enterprise assets to validate that all privileges are authorized, on a recurring schedule at a minimum annually, or more frequently.			●
v7	19 Incident Response and Management Incident Response and Management			

1.19 Ensure that all the expired SSL/TLS certificates stored in AWS IAM are removed (Automated)

Profile Applicability:

- Level 1

Description:

To enable HTTPS connections to your website or application in AWS, you need an SSL/TLS server certificate. You can use ACM or IAM to store and deploy server certificates. Use IAM as a certificate manager only when you must support HTTPS connections in a region that is not supported by ACM. IAM securely encrypts your private keys and stores the encrypted version in IAM SSL certificate storage. IAM supports deploying server certificates in all regions, but you must obtain your certificate from an external provider for use with AWS. You cannot upload an ACM certificate to IAM. Additionally, you cannot manage your certificates from the IAM Console.

Rationale:

Removing expired SSL/TLS certificates eliminates the risk that an invalid certificate will be deployed accidentally to a resource such as AWS Elastic Load Balancer (ELB), which can damage the credibility of the application/website behind the ELB. As a best practice, it is recommended to delete expired certificates.

Impact:

Deleting the certificate could have implications for your application if you are using an expired server certificate with Elastic Load Balancing, CloudFront, etc. One has to make configurations at respective services to ensure there is no interruption in application functionality.

Audit:

From Console:

Getting the certificates expiration information via AWS Management Console is not currently supported.

To request information about the SSL/TLS certificates stored in IAM via the AWS API use the Command Line Interface (CLI).

From Command Line:

Run list-server-certificates command to list all the IAM-stored server certificates:

```
aws iam list-server-certificates
```

The command output should return an array that contains all the SSL/TLS certificates currently stored in IAM and their metadata (name, ID, expiration date, etc):

```
{
  "ServerCertificateMetadataList": [
    {
      "ServerCertificateId": "EHDGFRW7EJFYTE88D",
      "ServerCertificateName": "MyServerCertificate",
      "Expiration": "2018-07-10T23:59:59Z",
      "Path": "/",
      "Arn": "arn:aws:iam::012345678910:server-
certificate/MySSLCertificate",
      "UploadDate": "2018-06-10T11:56:08Z"
    }
  ]
}
```

Verify the `ServerCertificateName` and `Expiration` parameter value (expiration date) for each SSL/TLS certificate returned by the `list-server-certificates` command and determine if there are any expired server certificates currently stored in AWS IAM. If so, use the AWS API to remove them.

If this command returns:

```
{ { "ServerCertificateMetadataList": [] } }
```

This means that there are no expired certificates, It DOES NOT mean that no certificates exist.

Remediation:

From Console:

Removing expired certificates via AWS Management Console is not currently supported. To delete SSL/TLS certificates stored in IAM via the AWS API use the Command Line Interface (CLI).

From Command Line:

To delete Expired Certificate run following command by replacing `<CERTIFICATE_NAME>` with the name of the certificate to delete:

```
aws iam delete-server-certificate --server-certificate-name
<CERTIFICATE_NAME>
```

When the preceding command is successful, it does not return any output.




Default Value:

By default, expired certificates won't get deleted.

References:

1. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_server-certs.html
2. <https://docs.aws.amazon.com/cli/latest/reference/iam/delete-server-certificate.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.1 <u>Establish and Maintain a Data Management Process</u> Establish and maintain a data management process. In the process, address data sensitivity, data owner, handling of data, data retention limits, and disposal requirements, based on sensitivity and retention standards for the enterprise. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.			
v7	13 <u>Data Protection</u> Data Protection			

1.20 Ensure that IAM Access analyzer is enabled for all regions (Automated)

Profile Applicability:

- Level 1

Description:

Enable IAM Access analyzer for IAM policies about all resources in each active AWS region.

IAM Access Analyzer is a technology introduced at AWS reinvent 2019. After the Analyzer is enabled in IAM, scan results are displayed on the console showing the accessible resources. Scans show resources that other accounts and federated users can access, such as KMS keys and IAM roles. So the results allow you to determine if an unintended user is allowed, making it easier for administrators to monitor least privileges access. Access Analyzer analyzes only policies that are applied to resources in the same AWS Region.

Rationale:

AWS IAM Access Analyzer helps you identify the resources in your organization and accounts, such as Amazon S3 buckets or IAM roles, that are shared with an external entity. This lets you identify unintended access to your resources and data. Access Analyzer identifies resources that are shared with external principals by using logic-based reasoning to analyze the resource-based policies in your AWS environment. IAM Access Analyzer continuously monitors all policies for S3 bucket, IAM roles, KMS (Key Management Service) keys, AWS Lambda functions, and Amazon SQS(Simple Queue Service) queues.

Audit:

From Console:

1. Open the IAM console at <https://console.aws.amazon.com/iam/>
2. Choose `Access analyzer`
3. Click 'Analyzers'
4. Ensure that at least one analyzer is present
5. Ensure that the `STATUS` is set to `Active`
6. Repeat these step for each active region

From Command Line:

1. Run the following command:

```
aws accessanalyzer list-analyzers | grep status
```

2. Ensure that at least one Analyzer the `status` is set to `ACTIVE`
3. Repeat the steps above for each active region.

If an Access analyzer is not listed for each region or the status is not set to active refer to the remediation procedure below.

Remediation:

From Console:

Perform the following to enable IAM Access analyzer for IAM policies:

1. Open the IAM console at <https://console.aws.amazon.com/iam/>.
2. Choose `Access analyzer`.
3. Choose `Create analyzer`.
4. On the `Create analyzer` page, confirm that the `Region` displayed is the `Region` where you want to enable Access Analyzer.
5. Enter a name for the analyzer. Optional as it will generate a name for you automatically.
6. Add any tags that you want to apply to the analyzer. Optional.
7. Choose `Create Analyzer`.
8. Repeat these step for each active region

From Command Line:

Run the following command:

```
aws accessanalyzer create-analyzer --analyzer-name <NAME> --type  
<ACCOUNT|ORGANIZATION>
```

Repeat this command above for each active region.

Note: The IAM Access Analyzer is successfully configured only when the account you use has the necessary permissions.







References:

1. <https://docs.aws.amazon.com/IAM/latest/UserGuide/what-is-access-analyzer.html>
2. <https://docs.aws.amazon.com/IAM/latest/UserGuide/access-analyzer-getting-started.html>
3. <https://docs.aws.amazon.com/cli/latest/reference/accessanalyzer/get-analyzer.html>
4. <https://docs.aws.amazon.com/cli/latest/reference/accessanalyzer/create-analyzer.html>

Additional Information:

Some regions in AWS are enabled by default and some are disabled by default. Regions introduced prior to March 20, 2019 are enabled by default and cannot be disabled. Regions introduced after can be disabled by default. For more information on managing AWS Regions, please see AWS's [documentation on managing AWS Regions](#).

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 Configure Data Access Control Lists Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14 Controlled Access Based on the Need to Know Controlled Access Based on the Need to Know			
v7	14.6 Protect Information through Access Control Lists Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

1.21 Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments (Manual)

Profile Applicability:

- Level 2

Description:

In multi-account environments, IAM user centralization facilitates greater user control. User access beyond the initial account is then provided via role assumption. Centralization of users can be accomplished through federation with an external identity provider or through the use of AWS Organizations.

Rationale:

Centralizing IAM user management to a single identity store reduces complexity and thus the likelihood of access management errors.

Audit:

For multi-account AWS environments with an external identity provider...

1. Determine the master account for identity federation or IAM user management
2. Login to that account through the AWS Management Console
3. Click `Services`
4. Click `IAM`
5. Click `Identity providers`
6. Verify the configuration

Then..., determine all accounts that should not have local users present. For each account...

1. Determine all accounts that should not have local users present
2. Log into the AWS Management Console
3. Switch role into each identified account
4. Click `Services`
5. Click `IAM`
6. Click `Users`
7. Confirm that no IAM users representing individuals are present

For multi-account AWS environments implementing AWS Organizations without an external identity provider...





1. Determine all accounts that should not have local users present
2. Log into the AWS Management Console

3. Switch role into each identified account
4. Click `Services`
5. Click `IAM`
6. Click `Users`
7. Confirm that no IAM users representing individuals are present

Remediation:

The remediation procedure will vary based on the individual organization's implementation of identity federation and/or AWS Organizations with the acceptance criteria that no non-service IAM users, and non-root accounts, are present outside the account providing centralized IAM user management.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	5.6 <u>Centralize Account Management</u> Centralize account management through a directory or identity service.			
v7	16.2 <u>Configure Centralized Point of Authentication</u> Configure access for all accounts through as few centralized points of authentication as possible, including network, security, and cloud systems.			

1.22 Ensure access to AWSCloudShellFullAccess is restricted (Manual)

Profile Applicability:

- Level 1

Description:

AWS CloudShell is a convenient way of running CLI commands against AWS services; a managed IAM policy ('AWSCloudShellFullAccess') provides full access to CloudShell, which allows file upload and download capability between a user's local system and the CloudShell environment. Within the CloudShell environment a user has sudo permissions, and can access the internet. So it is feasible to install file transfer software (for example) and move data from CloudShell to external internet servers.

Rationale:

Access to this policy should be restricted as it presents a potential channel for data exfiltration by malicious cloud admins that are given full permissions to the service. AWS documentation describes how to create a more restrictive IAM policy which denies file transfer permissions.

Audit:

From Console

1. Open the IAM console at <https://console.aws.amazon.com/iam/>
2. In the left pane, select Policies
3. Search for and select AWSCloudShellFullAccess
4. On the Entities attached tab, ensure that there are no entities using this policy

From Command Line

1. List IAM policies, filter for the 'AWSCloudShellFullAccess' managed policy, and note the "Arn" element value:

```
aws iam list-policies --query "Policies[?PolicyName == 'AWSCloudShellFullAccess']"
```

2. Check if the 'AWSCloudShellFullAccess' policy is attached to any role:

```
aws iam list-entities-for-policy --policy-arn arn:aws:iam::aws:policy/AWSCloudShellFullAccess
```

3. In Output, Ensure PolicyRoles returns empty. 'Example: Example: PolicyRoles: []'

If it does not return empty refer to the remediation below.

Note: Keep in mind that other policies may grant access.

Remediation:

From Console

1. Open the IAM console at <https://console.aws.amazon.com/iam/>
2. In the left pane, select Policies
3. Search for and select AWSCloudShellFullAccess
4. On the Entities attached tab, for each item, check the box and select Detach

References:

1. <https://docs.aws.amazon.com/cloudshell/latest/userguide/sec-auth-with-identities.html>

2 Storage

This section contains recommendations for configuring AWS Storage.

2.1 Simple Storage Service (S3)

This section contains recommendations for configuring AWS Simple Storage Service (S3) Buckets

2.1.1 Ensure S3 Bucket Policy is set to deny HTTP requests (Automated)

Profile Applicability:

- Level 2

Description:

At the Amazon S3 bucket level, you can configure permissions through a bucket policy making the objects accessible only through HTTPS.

Rationale:

By default, Amazon S3 allows both HTTP and HTTPS requests. To achieve only allowing access to Amazon S3 objects through HTTPS you also have to explicitly deny access to HTTP requests. Bucket policies that allow HTTPS requests without explicitly denying HTTP requests will not comply with this recommendation.

Audit:

To allow access to HTTPS you can use a condition that checks for the key "aws:SecureTransport: true". This means that the request is sent through HTTPS but that HTTP can still be used. So to make sure you do not allow HTTP access confirm that there is a bucket policy that explicitly denies access for HTTP requests and that it contains the key "aws:SecureTransport": "false".

From Console:

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Select the Check box next to the Bucket.
3. Click on 'Permissions', then Click on `Bucket Policy`.
4. Ensure that a policy is listed that matches:

```
'{
    "Sid": <optional>,
    "Effect": "Deny",
    "Principal": "*",
    "Action": "s3:*",
    "Resource": "arn:aws:s3:::<bucket_name>/*",
    "Condition": {
        "Bool": {
            "aws:SecureTransport": "false"
        }
    }
}'
```

<optional> and <bucket_name> will be specific to your account

5. Repeat for all the buckets in your AWS account.

From Command Line:

1. List all of the S3 Buckets

```
aws s3 ls
```

2. Using the list of buckets run this command on each of them:

```
aws s3api get-bucket-policy --bucket <bucket_name> | grep aws:SecureTransport
```

3. Confirm that `aws:SecureTransport` is set to false `aws:SecureTransport:false`
4. Confirm that the policy line has Effect set to Deny 'Effect:Deny'

Remediation:

From Console:

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Select the Check box next to the Bucket.
3. Click on 'Permissions'.
4. Click 'Bucket Policy'
5. Add this to the existing policy filling in the required information

```
{
    "Sid": <optional>",
    "Effect": "Deny",
    "Principal": "*",
    "Action": "s3:*",
    "Resource": "arn:aws:s3:::<bucket_name>/*",
    "Condition": {
        "Bool": {
            "aws:SecureTransport": "false"
        }
    }
}
```

6. Save
7. Repeat for all the buckets in your AWS account that contain sensitive data.

From Console

using AWS Policy Generator:

1. Repeat steps 1-4 above.
2. Click on `Policy Generator` at the bottom of the Bucket Policy Editor
3. Select Policy Type
`S3 Bucket Policy`
4. Add Statements
 - `Effect = Deny`

- Principal = *
- AWS Service = Amazon S3
- Actions = *
- Amazon Resource Name = <ARN of the S3 Bucket>

5. Generate Policy
6. Copy the text and add it to the Bucket Policy.

From Command Line:

1. Export the bucket policy to a json file.

```
aws s3api get-bucket-policy --bucket <bucket_name> --query Policy --output text > policy.json
```

2. Modify the policy.json file by adding in this statement:

```
{
    "Sid": <optional>,"
    "Effect": "Deny",
    "Principal": "*",
    "Action": "s3:*",
    "Resource": "arn:aws:s3:::<bucket_name>/*",
    "Condition": {
        "Bool": {
            "aws:SecureTransport": "false"
        }
    }
}
```





3. Apply this modified policy back to the S3 bucket:

```
aws s3api put-bucket-policy --bucket <bucket_name> --policy file://policy.json
```

References:

1. <https://aws.amazon.com/premiumsupport/knowledge-center/s3-bucket-policy-for-config-rule/>
2. <https://aws.amazon.com/blogs/security/how-to-use-bucket-policies-and-apply-defense-in-depth-to-help-secure-your-amazon-s3-data/>
3. <https://awscli.amazonaws.com/v2/documentation/api/latest/reference/s3api/get-bucket-policy.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.10 <u>Encrypt Sensitive Data in Transit</u> Encrypt sensitive data in transit. Example implementations can include: Transport Layer Security (TLS) and Open Secure Shell (OpenSSH).			
v7	14.4 <u>Encrypt All Sensitive Information in Transit</u> Encrypt all sensitive information in transit.			

2.1.2 Ensure MFA Delete is enabled on S3 buckets (Manual)

Profile Applicability:

- Level 2

Description:

Once MFA Delete is enabled on your sensitive and classified S3 bucket it requires the user to have two forms of authentication.

Rationale:

Adding MFA delete to an S3 bucket, requires additional authentication when you change the version state of your bucket or you delete and object version adding another layer of security in the event your security credentials are compromised or unauthorized access is granted.

Impact:

Enabling MFA delete on an S3 bucket could required additional administrator oversight. Enabling MFA delete may impact other services that automate the creation and/or deletion of S3 buckets.

Audit:

Perform the steps below to confirm MFA delete is configured on an S3 Bucket

From Console:

1. Login to the S3 console at <https://console.aws.amazon.com/s3/>
2. Click the `Check` box next to the Bucket name you want to confirm
3. In the window under `Properties`
4. Confirm that `Versioning` is `Enabled`
5. Confirm that `MFA Delete` is `Enabled`

From Command Line:

1. Run the `get-bucket-versioning`

```
aws s3api get-bucket-versioning --bucket my-bucket
```

Output example:

```
<VersioningConfiguration xmlns="http://s3.amazonaws.com/doc/2006-03-01/">
  <Status>Enabled</Status>
  <MfaDelete>Enabled</MfaDelete>
</VersioningConfiguration>
```

If the Console or the CLI output does not show `Versioning` and `MFA Delete` `enabled` refer to the remediation below.

Remediation:

Perform the steps below to enable MFA delete on an S3 bucket.

Note:

-You cannot enable MFA Delete using the AWS Management Console. You must use the AWS CLI or API.

-You must use your 'root' account to enable MFA Delete on S3 buckets.

From Command line:










1. Run the s3api put-bucket-versioning command

```
aws s3api put-bucket-versioning --profile my-root-profile --bucket
Bucket_Name --versioning-configuration Status=Enabled,MFADelete=Enabled --mfa
"arn:aws:iam::aws_account_id:mfa/root-account-mfa-device passcode"
```

References:

1. <https://docs.aws.amazon.com/AmazonS3/latest/dev/Versioning.html#MultiFactorAuthenticationDelete>
2. <https://docs.aws.amazon.com/AmazonS3/latest/dev/UsingMFADelete.html>
3. <https://aws.amazon.com/blogs/security/securing-access-to-aws-using-mfa-part-3/>
4. https://docs.aws.amazon.com/IAM/latest/UserGuide/id_credentials_mfa_lost-or-broken.html

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v8	6.5 <u>Require MFA for Administrative Access</u> Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a third-party provider.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

2.1.3 Ensure all data in Amazon S3 has been discovered, classified and secured when required. (Manual)

Profile Applicability:

- Level 2

Description:

Amazon S3 buckets can contain sensitive data, that for security purposes should be discovered, monitored, classified and protected. Macie along with other 3rd party tools can automatically provide an inventory of Amazon S3 buckets.

Rationale:

Using a Cloud service or 3rd Party software to continuously monitor and automate the process of data discovery and classification for S3 buckets using machine learning and pattern matching is a strong defense in protecting that information.

Amazon Macie is a fully managed data security and data privacy service that uses machine learning and pattern matching to discover and protect your sensitive data in AWS.

Impact:

There is a cost associated with using Amazon Macie. There is also typically a cost associated with 3rd Party tools that perform similar processes and protection.

Audit:

Perform the following steps to determine if Macie is running:

From Console:

1. Login to the Macie console at <https://console.aws.amazon.com/macie/>
2. In the left hand pane click on By job under findings.
3. Confirm that you have a Job setup for your S3 Buckets

When you log into the Macie console if you aren't taken to the summary page and you don't have a job setup and running then refer to the remediation procedure below. If you are using a 3rd Party tool to manage and protect your s3 data you meet this recommendation.

Remediation:

Perform the steps below to enable and configure Amazon Macie

From Console:

1. Log on to the Macie console at <https://console.aws.amazon.com/macie/>
2. Click Get started.

3. Click `Enable Macie`.

Setup a repository for sensitive data discovery results

1. In the Left pane, under Settings, click `Discovery results`.
2. Make sure `Create bucket` is selected.
3. Create a bucket, enter a name for the bucket. The name must be unique across all S3 buckets. In addition, the name must start with a lowercase letter or a number.
4. Click on `Advanced`.
5. Block all public access, make sure `Yes` is selected.
6. KMS encryption, specify the AWS KMS key that you want to use to encrypt the results. The key must be a symmetric, customer master key (CMK) that's in the same Region as the S3 bucket.
7. Click on `Save`

Create a job to discover sensitive data

1. In the left pane, click `S3 buckets`. Macie displays a list of all the S3 buckets for your account.
2. Select the `check box` for each bucket that you want Macie to analyze as part of the job
3. Click `Create job`.
4. Click `Quick create`.
5. For the Name and description step, enter a name and, optionally, a description of the job.
6. Then click `Next`.
7. For the Review and create step, click `Submit`.

Review your findings







1. In the left pane, click `Findings`.
2. To view the details of a specific finding, choose any field other than the check box for the finding.

If you are using a 3rd Party tool to manage and protect your s3 data, follow the Vendor documentation for implementing and configuring that tool.

References:

1. <https://aws.amazon.com/macie/getting-started/>
2. <https://docs.aws.amazon.com/workspaces/latest/adminguide/data-protection.html>
3. <https://docs.aws.amazon.com/macie/latest/user/data-classification.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.1 <u>Establish and Maintain a Data Management Process</u> Establish and maintain a data management process. In the process, address data sensitivity, data owner, handling of data, data retention limits, and disposal requirements, based on sensitivity and retention standards for the enterprise. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.			
v7	5.1 <u>Establish Secure Configurations</u> Maintain documented, standard security configuration standards for all authorized operating systems and software.			

2.1.4 Ensure that S3 Buckets are configured with 'Block public access (bucket settings)' (Automated)

Profile Applicability:

- Level 1

Description:

Amazon S3 provides Block public access (bucket settings) and Block public access (account settings) to help you manage public access to Amazon S3 resources. By default, S3 buckets and objects are created with public access disabled. However, an IAM principal with sufficient S3 permissions can enable public access at the bucket and/or object level. While enabled, Block public access (bucket settings) prevents an individual bucket, and its contained objects, from becoming publicly accessible. Similarly, Block public access (account settings) prevents all buckets, and contained objects, from becoming publicly accessible across the entire account.

Rationale:

Amazon S3 Block public access (bucket settings) prevents the accidental or malicious public exposure of data contained within the respective bucket(s).

Amazon S3 Block public access (account settings) prevents the accidental or malicious public exposure of data contained within all buckets of the respective AWS account.

Whether blocking public access to all or some buckets is an organizational decision that should be based on data sensitivity, least privilege, and use case.

Impact:

When you apply Block Public Access settings to an account, the settings apply to all AWS Regions globally. The settings might not take effect in all Regions immediately or simultaneously, but they eventually propagate to all Regions.

Audit:

If utilizing Block Public Access (bucket settings) From Console:

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Select the Check box next to the Bucket.
3. Click on 'Edit public access settings'.
4. Ensure that block public access settings are set appropriately for this bucket
5. Repeat for all the buckets in your AWS account.

From Command Line:

1. List all of the S3 Buckets

```
aws s3 ls
```

2. Find the public access setting on that bucket

```
aws s3api get-public-access-block --bucket <name-of-the-bucket>
```

Output if Block Public access is enabled:

```
{
  "PublicAccessBlockConfiguration": {
    "BlockPublicAcls": true,
    "IgnorePublicAcls": true,
    "BlockPublicPolicy": true,
    "RestrictPublicBuckets": true
  }
}
```

If the output reads `false` for the separate configuration settings then proceed to the remediation.

If utilizing Block Public Access (account settings)

From Console:

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Choose Block public access (account settings)
3. Ensure that block public access settings are set appropriately for your AWS account.

From Command Line:

To check Public access settings for this account status, run the following command,

```
aws s3control get-public-access-block --account-id <ACCT_ID> --region  
<REGION_NAME>
```

Output if Block Public access is enabled:

```
{
  "PublicAccessBlockConfiguration": {
    "IgnorePublicAcls": true,
    "BlockPublicPolicy": true,
    "BlockPublicAcls": true,
    "RestrictPublicBuckets": true
  }
}
```

If the output reads `false` for the separate configuration settings then proceed to the remediation.

Remediation:

If utilizing Block Public Access (bucket settings) From Console:

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Select the Check box next to the Bucket.
3. Click on 'Edit public access settings'.
4. Click 'Block all public access'
5. Repeat for all the buckets in your AWS account that contain sensitive data.

From Command Line:

1. List all of the S3 Buckets

```
aws s3 ls
```

2. Set the Block Public Access to true on that bucket

```
aws s3api put-public-access-block --bucket <name-of-bucket> --public-access-  
block-configuration  
"BlockPublicAcls=true,IgnorePublicAcls=true,BlockPublicPolicy=true,RestrictPu  
blicBuckets=true"
```

If utilizing Block Public Access (account settings)

From Console:

If the output reads `true` for the separate configuration settings then it is set on the account.

1. Login to AWS Management Console and open the Amazon S3 console using <https://console.aws.amazon.com/s3/>
2. Choose `Block Public Access` (account settings)
3. Choose `Edit` to change the block public access settings for all the buckets in your AWS account
4. Choose the settings you want to change, and then choose `Save`. For details about each setting, pause on the `i` icons.
5. When you're asked for confirmation, enter `confirm`. Then Click `Confirm` to save your changes.

From Command Line:







To set Block Public access settings for this account, run the following command:

```
aws s3control put-public-access-block  
--public-access-block-configuration BlockPublicAcls=true,  
IgnorePublicAcls=true, BlockPublicPolicy=true, RestrictPublicBuckets=true  
--account-id <value>
```

References:

1. <https://docs.aws.amazon.com/AmazonS3/latest/user-guide/block-public-access-account.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

2.2 Elastic Compute Cloud (EC2)

This section contains recommendations for configuring AWS Elastic Compute Cloud (EC2)

2.2.1 Ensure EBS Volume Encryption is Enabled in all Regions (Automated)

Profile Applicability:

- Level 1

Description:

Elastic Compute Cloud (EC2) supports encryption at rest when using the Elastic Block Store (EBS) service. While disabled by default, forcing encryption at EBS volume creation is supported.

Rationale:

Encrypting data at rest reduces the likelihood that it is unintentionally exposed and can nullify the impact of disclosure if the encryption remains unbroken.

Impact:

Losing access or removing the KMS key in use by the EBS volumes will result in no longer being able to access the volumes.

Audit:

From Console:

1. Login to AWS Management Console and open the Amazon EC2 console using <https://console.aws.amazon.com/ec2/>
2. Under Account attributes, click EBS encryption.
3. Verify Always encrypt new EBS volumes displays Enabled.
4. Review every region in-use.

Note: EBS volume encryption is configured per region.

From Command Line:

1. Run

```
aws --region <region> ec2 get-ebs-encryption-by-default
```

2. Verify that "EbsEncryptionByDefault": true is displayed.
3. Review every region in-use.

Note: EBS volume encryption is configured per region.

Remediation:

From Console:

1. Login to AWS Management Console and open the Amazon EC2 console using <https://console.aws.amazon.com/ec2/>
2. Under Account attributes, click EBS encryption.
3. Click Manage.
4. Click the Enable checkbox.
5. Click Update EBS encryption
6. Repeat for every region requiring the change.

Note: EBS volume encryption is configured per region.

From Command Line:

1. Run

```
aws --region <region> ec2 enable-ebs-encryption-by-default
```

2. Verify that "EbsEncryptionByDefault": true is displayed.
3. Repeat every region requiring the change.

Note: EBS volume encryption is configured per region.



References:

1. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSEncryption.html>
2. <https://aws.amazon.com/blogs/aws/new-opt-in-to-default-encryption-for-new-ebs-volumes/>

Additional Information:

Default EBS volume encryption only applies to newly created EBS volumes. Existing EBS volumes are **not** converted automatically.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.11 Encrypt Sensitive Data at Rest Encrypt sensitive data at rest on servers, applications, and databases containing sensitive data. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.			

Controls Version	Control	IG 1	IG 2	IG 3
v7	14.8 <u>Encrypt Sensitive Information at Rest</u> Encrypt all sensitive information at rest using a tool that requires a secondary authentication mechanism not integrated into the operating system, in order to access the information.			●

2.3 Relational Database Service (RDS)

This section contains recommendations for configuring AWS Relational Database Services (RDS)

2.3.1 Ensure that encryption-at-rest is enabled for RDS Instances (Automated)

Profile Applicability:

- Level 1

Description:

Amazon RDS encrypted DB instances use the industry standard AES-256 encryption algorithm to encrypt your data on the server that hosts your Amazon RDS DB instances. After your data is encrypted, Amazon RDS handles authentication of access and decryption of your data transparently with a minimal impact on performance.

Rationale:

Databases are likely to hold sensitive and critical data, it is highly recommended to implement encryption in order to protect your data from unauthorized access or disclosure. With RDS encryption enabled, the data stored on the instance's underlying storage, the automated backups, read replicas, and snapshots, are all encrypted.

Audit:

From Console:

1. Login to the AWS Management Console and open the RDS dashboard at <https://console.aws.amazon.com/rds/>
2. In the navigation pane, under RDS dashboard, click `Databases`.
3. Select the RDS Instance that you want to examine
4. Click `Instance Name` to see details, then click on `Configuration` tab.
5. Under Configuration Details section, In Storage pane search for the `Encryption Enabled Status`.
6. If the current status is set to `Disabled`, Encryption is not enabled for the selected RDS Instance database instance.
7. Repeat steps 3 to 7 to verify encryption status of other RDS Instance in same region.
8. Change the region from the top of the navigation bar and repeat audit for other regions.

From Command Line:

1. Run `describe-db-instances` command to list all RDS Instance database names, available in the selected AWS region, Output will return each Instance database identifier-name.

```
aws rds describe-db-instances --region <region-name> --query  
'DBInstances[*].DBInstanceIdentifier'
```

2. Run again `describe-db-instances` command using the RDS Instance identifier returned earlier, to determine if the selected database instance is encrypted, The command output should return the encryption status `True` Or `False`.

```
aws rds describe-db-instances --region <region-name> --db-instance-identifier  
<DB-Name> --query 'DBInstances[*].StorageEncrypted'
```

3. If the `StorageEncrypted` parameter value is `False`, Encryption is not enabled for the selected RDS database instance.
4. Repeat steps 1 to 3 for auditing each RDS Instance and change Region to verify for other regions

Remediation:

From Console:

1. Login to the AWS Management Console and open the RDS dashboard at <https://console.aws.amazon.com/rds/>.
2. In the left navigation panel, click on `Databases`
3. Select the Database instance that needs to be encrypted.
4. Click on `Actions` button placed at the top right and select `Take Snapshot`.
5. On the `Take Snapshot` page, enter a database name of which you want to take a snapshot in the `Snapshot Name` field and click on `Take Snapshot`.
6. Select the newly created snapshot and click on the `Action` button placed at the top right and select `Copy snapshot` from the Action menu.
7. On the `Make Copy of DB Snapshot` page, perform the following:
 - In the `New DB Snapshot Identifier` field, Enter a name for the `new snapshot`.
 - Check `Copy Tags`, New snapshot must have the same tags as the source snapshot.
 - Select `Yes` from the `Enable Encryption` dropdown list to enable encryption, You can choose to use the AWS default encryption key or custom key from Master Key dropdown list.
8. Click `Copy Snapshot` to create an encrypted copy of the selected instance snapshot.
9. Select the new `Snapshot Encrypted Copy` and click on the `Action` button placed at the top right and select `Restore Snapshot` button from the Action menu, This will restore the encrypted snapshot to a new database instance.
10. On the `Restore DB Instance` page, enter a unique name for the new database instance in the `DB Instance Identifier` field.
11. Review the instance configuration details and click `Restore DB Instance`.

12. As the new instance provisioning process is completed can update application configuration to refer to the endpoint of the new Encrypted database instance
Once the database endpoint is changed at the application level, can remove the unencrypted instance.

From Command Line:

1. Run `describe-db-instances` command to list all RDS database names available in the selected AWS region, The command output should return the database instance identifier.

```
aws rds describe-db-instances --region <region-name> --query  
'DBInstances[*].DBInstanceIdentifier'
```

2. Run `create-db-snapshot` command to create a snapshot for the selected database instance, The command output will return the new snapshot with name DB Snapshot Name.

```
aws rds create-db-snapshot --region <region-name> --db-snapshot-identifier  
<DB-Snapshot-Name> --db-instance-identifier <DB-Name>
```

3. Now run `list-aliases` command to list the KMS keys aliases available in a specified region, The command output should return each key alias currently available. For our RDS encryption activation process, locate the ID of the AWS default KMS key.

```
aws kms list-aliases --region <region-name>
```

4. Run `copy-db-snapshot` command using the default KMS key ID for RDS instances returned earlier to create an encrypted copy of the database instance snapshot, The command output will return the encrypted instance snapshot configuration.

```
aws rds copy-db-snapshot --region <region-name> --source-db-snapshot-  
identifier <DB-Snapshot-Name> --target-db-snapshot-identifier <DB-Snapshot-  
Name-Encrypted> --copy-tags --kms-key-id <KMS-ID-For-RDS>
```

5. Run `restore-db-instance-from-db-snapshot` command to restore the encrypted snapshot created at the previous step to a new database instance, If successful, the command output should return the new encrypted database instance configuration.

```
aws rds restore-db-instance-from-db-snapshot --region <region-name> --db-  
instance-identifier <DB-Name-Encrypted> --db-snapshot-identifier <DB-  
Snapshot-Name-Encrypted>
```

6. Run `describe-db-instances` command to list all RDS database names, available in the selected AWS region, Output will return database instance identifier name Select encrypted database name that we just created DB-Name-Encrypted.

```
aws rds describe-db-instances --region <region-name> --query  
'DBInstances[*].DBInstanceIdentifier'
```




7. Run again `describe-db-instances` command using the RDS instance identifier returned earlier, to determine if the selected database instance is encrypted, The command output should return the encryption status `True`.

```
aws rds describe-db-instances --region <region-name> --db-instance-identifier  
<DB-Name-Encrypted> --query 'DBInstances[*].StorageEncrypted'
```

References:

1. <https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Overview.Encryption.html>
2. <https://aws.amazon.com/blogs/database/selecting-the-right-encryption-options-for-amazon-rds-and-amazon-aurora-database-engines/#:~:text=With%20RDS%2Dencrypted%20resources%2C%20data,transparent%20to%20your%20database%20engine.>
3. <https://aws.amazon.com/rds/features/security/>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.11 Encrypt Sensitive Data at Rest Encrypt sensitive data at rest on servers, applications, and databases containing sensitive data. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.			
v7	14.8 Encrypt Sensitive Information at Rest Encrypt all sensitive information at rest using a tool that requires a secondary authentication mechanism not integrated into the operating system, in order to access the information.			

2.3.2 Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances (Automated)

Profile Applicability:

- Level 1

Description:

Ensure that RDS database instances have the Auto Minor Version Upgrade flag enabled in order to receive automatically minor engine upgrades during the specified maintenance window. So, RDS instances can get the new features, bug fixes, and security patches for their database engines.

Rationale:

AWS RDS will occasionally deprecate minor engine versions and provide new ones for an upgrade. When the last version number within the release is replaced, the version changed is considered minor. With Auto Minor Version Upgrade feature enabled, the version upgrades will occur automatically during the specified maintenance window so your RDS instances can get the new features, bug fixes, and security patches for their database engines.

Audit:

From Console:

1. Log in to the AWS management console and navigate to the RDS dashboard at <https://console.aws.amazon.com/rds/>.
 2. In the left navigation panel, click on `Databases`.
 3. Select the RDS instance that wants to examine.
 4. Click on the `Maintenance and backups` panel.
 5. Under the `Maintenance` section, search for the Auto Minor Version Upgrade status.
- If the current status is set to `Disabled`, means the feature is not set and the minor engine upgrades released will not be applied to the selected RDS instance

From Command Line:

1. Run `describe-db-instances` command to list all RDS database names, available in the selected AWS region:

```
aws rds describe-db-instances --region <regionName> --query  
'DBInstances[*].DBInstanceIdentifier'
```

2. The command output should return each database instance identifier.
3. Run again `describe-db-instances` command using the RDS instance identifier returned earlier to determine the Auto Minor Version Upgrade status for the selected instance:

```
aws rds describe-db-instances --region <regionName> --db-instance-identifier <dbInstanceIdentifier> --query 'DBInstances[*].AutoMinorVersionUpgrade'
```

4. The command output should return the feature current status. If the current status is set to `true`, the feature is enabled and the minor engine upgrades will be applied to the selected RDS instance.

Remediation:

From Console:

1. Log in to the AWS management console and navigate to the RDS dashboard at <https://console.aws.amazon.com/rds/>.
2. In the left navigation panel, click on `Databases`.
3. Select the RDS instance that wants to update.
4. Click on the `Modify` button placed on the top right side.
5. On the `Modify DB Instance: <instance identifier>` page, In the `Maintenance` section, select `Auto minor version upgrade` click on the `Yes` radio button.
6. At the bottom of the page click on `Continue`, check to `Apply Immediately` to apply the changes immediately, or select `Apply during the next scheduled maintenance window` to avoid any downtime.
7. Review the changes and click on `Modify DB Instance`. The instance status should change from `available` to `modifying` and back to `available`. Once the feature is enabled, the `Auto Minor Version Upgrade` status should change to `Yes`.

From Command Line:

1. Run `describe-db-instances` command to list all RDS database instance names, available in the selected AWS region:

```
aws rds describe-db-instances --region <regionName> --query 'DBInstances[*].DBInstanceIdentifier'
```

2. The command output should return each database instance identifier.
3. Run the `modify-db-instance` command to modify the selected RDS instance configuration this command will apply the changes immediately, Remove `--apply-immediately` to apply changes during the next scheduled maintenance window and avoid any downtime:

```
aws rds modify-db-instance --region <regionName> --db-instance-identifier <dbInstanceIdentifier> --auto-minor-version-upgrade --apply-immediately
```

4. The command output should reveal the new configuration metadata for the RDS instance and check `AutoMinorVersionUpgrade` parameter value.
5. Run `describe-db-instances` command to check if the Auto Minor Version Upgrade feature has been successfully enable:







```
aws rds describe-db-instances --region <regionName> --db-instance-identifier <dbInstanceIdentifier> --query 'DBInstances[*].AutoMinorVersionUpgrade'
```

6. The command output should return the feature current status set to `true`, the feature is `enabled` and the minor engine upgrades will be applied to the selected RDS instance.

References:

1. https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_RDS_Managing.html
2. https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/USER_UpgradeDBInstance.Upgrading.html
3. <https://aws.amazon.com/rds/faqs/>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	7.4 <u>Perform Automated Application Patch Management</u> Perform application updates on enterprise assets through automated patch management on a monthly, or more frequent, basis.			
v7	3.5 <u>Deploy Automated Software Patch Management Tools</u> Deploy automated software update tools in order to ensure that third-party software on all systems is running the most recent security updates provided by the software vendor.			

2.3.3 Ensure that public access is not given to RDS Instance (Automated)

Profile Applicability:

- Level 1

Description:

Ensure and verify that RDS database instances provisioned in your AWS account do restrict unauthorized access in order to minimize security risks. To restrict access to any publicly accessible RDS database instance, you must disable the database Publicly Accessible flag and update the VPC security group associated with the instance.

Rationale:

Ensure that no public-facing RDS database instances are provisioned in your AWS account and restrict unauthorized access in order to minimize security risks. When the RDS instance allows unrestricted access (0.0.0.0/0), everyone and everything on the Internet can establish a connection to your database and this can increase the opportunity for malicious activities such as brute force attacks, PostgreSQL injections, or DoS/DDoS attacks.

Audit:

From Console:

1. Log in to the AWS management console and navigate to the RDS dashboard at <https://console.aws.amazon.com/rds/>.
2. Under the navigation panel, On RDS Dashboard, click `Databases`.
3. Select the RDS instance that you want to examine.
4. Click `Instance Name` from the dashboard, Under `Connectivity and Security`.
5. On the `Security`, check if the Publicly Accessible flag status is set to `Yes`, follow the below-mentioned steps to check database subnet access.
 - In the `networking` section, click the subnet link available under `Subnets`
 - The link will redirect you to the VPC Subnets page.
 - Select the subnet listed on the page and click the `Route Table` tab from the dashboard bottom panel. If the route table contains any entries with the destination `CIDR block set to 0.0.0.0/0` and with an `Internet Gateway` attached.
 - The selected RDS database instance was provisioned inside a public subnet, therefore is not running within a logically isolated environment and can be accessible from the Internet.

6. Repeat steps no. 4 and 5 to determine the type (public or private) and subnet for other RDS database instances provisioned in the current region.
7. Change the AWS region from the navigation bar and repeat the audit process for other regions.

From Command Line:

1. Run `describe-db-instances` command to list all RDS database names, available in the selected AWS region:

```
aws rds describe-db-instances --region <region-name> --query  
'DBInstances[*].DBInstanceIdentifier'
```

2. The command output should return each database instance identifier.
3. Run again `describe-db-instances` command using the `PubliclyAccessible` parameter as query filter to reveal the database instance Publicly Accessible flag status:

```
aws rds describe-db-instances --region <region-name> --db-instance-identifier  
<db-instance-name> --query 'DBInstances[*].PubliclyAccessible'
```

4. Check for the Publicly Accessible parameter status, If the Publicly Accessible flag is set to `Yes`. Then selected RDS database instance is publicly accessible and insecure, follow the below-mentioned steps to check database subnet access
5. Run again `describe-db-instances` command using the RDS database instance identifier that you want to check and appropriate filtering to describe the VPC subnet(s) associated with the selected instance:

```
aws rds describe-db-instances --region <region-name> --db-instance-identifier  
<db-name> --query 'DBInstances[*].DBSubnetGroup.Subnets[]'
```

- The command output should list the subnets available in the selected database subnet group.
6. Run `describe-route-tables` command using the ID of the subnet returned at the previous step to describe the routes of the VPC route table associated with the selected subnet:

```
aws ec2 describe-route-tables --region <region-name> --filters  
"Name=association.subnet-id,Values=<SubnetID>" --query  
'RouteTables[*].Routes[]'
```

- If the command returns the route table associated with database instance subnet ID. Check the `GatewayId` and `DestinationCidrBlock` attributes values returned in the output. If the route table contains any entries with the `GatewayId` value set to `igw-xxxxxxx` and the `DestinationCidrBlock` value set to `0.0.0.0/0`, the selected RDS database instance was provisioned inside a public subnet.

- Or
 - If the command returns empty results, the route table is implicitly associated with subnet, therefore the audit process continues with the next step
7. Run again `describe-db-instances` command using the RDS database instance identifier that you want to check and appropriate filtering to describe the VPC ID associated with the selected instance:

```
aws rds describe-db-instances --region <region-name> --db-instance-identifier <db-name> --query 'DBInstances[*].DBSubnetGroup.VpcId'
```

- The command output should show the VPC ID in the selected database subnet group
8. Now run `describe-route-tables` command using the ID of the VPC returned at the previous step to describe the routes of the VPC main route table implicitly associated with the selected subnet:

```
aws ec2 describe-route-tables --region <region-name> --filters "Name=vpc-id,Values=<VPC-ID>" "Name=association.main,Values=true" --query 'RouteTables[*].Routes[]'
```

- The command output returns the VPC main route table implicitly associated with database instance subnet ID. Check the `GatewayId` and `DestinationCidrBlock` attributes values returned in the output. If the route table contains any entries with the `GatewayId` value set to `igw-xxxxxxx` and the `DestinationCidrBlock` value set to `0.0.0.0/0`, the selected RDS database instance was provisioned inside a public subnet, therefore is not running within a logically isolated environment and does not adhere to AWS security best practices.

Remediation:

From Console:

1. Log in to the AWS management console and navigate to the RDS dashboard at <https://console.aws.amazon.com/rds/>.
2. Under the navigation panel, On RDS Dashboard, click `Databases`.
3. Select the RDS instance that you want to update.
4. Click `Modify` from the dashboard top menu.
5. On the Modify DB Instance panel, under the `Connectivity` section, click on `Additional connectivity configuration` and update the value for `Publicly Accessible` to `Not publicly accessible` to restrict public access. Follow the below steps to update subnet configurations:
 - Select the `Connectivity and security` tab, and click on the VPC attribute value inside the `Networking` section.

- Select the `Details` tab from the VPC dashboard bottom panel and click on Route table configuration attribute value.
 - On the Route table details page, select the Routes tab from the dashboard bottom panel and click on `Edit routes`.
 - On the Edit routes page, update the Destination of Target which is set to `igw-xxxxxx` and click on `Save routes`.
6. On the Modify DB Instance panel Click on `Continue` and In the Scheduling of modifications section, perform one of the following actions based on your requirements:
 - Select `Apply during the next scheduled maintenance window` to apply the changes automatically during the next scheduled maintenance window.
 - Select `Apply immediately` to apply the changes right away. With this option, any pending modifications will be asynchronously applied as soon as possible, regardless of the maintenance window setting for this RDS database instance. Note that any changes available in the pending modifications queue are also applied. If any of the pending modifications require downtime, choosing this option can cause unexpected downtime for the application.
 7. Repeat steps 3 to 6 for each RDS instance available in the current region.
 8. Change the AWS region from the navigation bar to repeat the process for other regions.

From Command Line:

1. Run `describe-db-instances` command to list all RDS database names identifiers, available in the selected AWS region:

```
aws rds describe-db-instances --region <region-name> --query
'DBInstances[*].DBInstanceIdentifier'
```

2. The command output should return each database instance identifier.
3. Run `modify-db-instance` command to modify the selected RDS instance configuration. Then use the following command to disable the `Publicly Accessible` flag for the selected RDS instances. This command use the `apply-immediately` flag. If you want to avoid any downtime `--no-apply-immediately` flag can be used:

```
aws rds modify-db-instance --region <region-name> --db-instance-identifier
<db-name> --no-publicly-accessible --apply-immediately
```







4. The command output should reveal the `PubliclyAccessible` configuration under pending values and should get applied at the specified time.

5. Updating the Internet Gateway Destination via AWS CLI is not currently supported To update information about Internet Gateway use the AWS Console Procedure.
6. Repeat steps 1 to 5 for each RDS instance provisioned in the current region.
7. Change the AWS region by using the --region filter to repeat the process for other regions.

References:

1. <https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/UsingWithRDS.html>
2. https://docs.aws.amazon.com/vpc/latest/userguide/VPC_Scenario2.html
3. https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/USER_VPC.WorkingWithRDSInstanceinaVPC.html
4. <https://aws.amazon.com/rds/faqs/>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 Configure Data Access Control Lists Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14.6 Protect Information through Access Control Lists Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

2.4 Elastic File System (EFS)

2.4.1 Ensure that encryption is enabled for EFS file systems (Manual)

Profile Applicability:

- Level 1

Description:

EFS data should be encrypted at rest using AWS KMS (Key Management Service).

Rationale:

Data should be encrypted at rest to reduce the risk of a data breach via direct access to the storage device.

Audit:

From Console:

1. Login to the AWS Management Console and Navigate to `Elastic File System (EFS) dashboard.
2. Select `File Systems` from the left navigation panel.
3. Each item on the list has a visible `Encrypted` field that displays data at rest encryption status.
4. Validate that this field reads `Encrypted` for all EFS file systems in all AWS regions.

From CLI:

1. Run `describe-file-systems` command using custom query filters to list the identifiers of all AWS EFS file systems currently available within the selected region:

```
aws efs describe-file-systems --region <region> --output table --query 'FileSystems[*].FileSystemId'
```

2. The command output should return a table with the requested file system IDs.
3. Run `describe-file-systems` command using the ID of the file system that you want to examine as identifier and the necessary query filters:

```
aws efs describe-file-systems --region <region> --file-system-id <file-system-id from step 2 output> --query 'FileSystems[*].Encrypted'
```

4. The command output should return the file system encryption status true or false. If the returned value is `false`, the selected AWS EFS file system is not encrypted and if the returned value is `true`, the selected AWS EFS file system is encrypted.

Remediation:

It is important to note that EFS file system data at rest encryption must be turned on when creating the file system.

If an EFS file system has been created without data at rest encryption enabled then you must create another EFS file system with the correct configuration and transfer the data.

Steps to create an EFS file system with data encrypted at rest:

From Console:

1. Login to the AWS Management Console and Navigate to Elastic File System (EFS) dashboard.
2. Select File Systems from the left navigation panel.
3. Click Create File System button from the dashboard top menu to start the file system setup process.
4. On the Configure file system access configuration page, perform the following actions.
 - Choose the right VPC from the VPC dropdown list.
 - Within Create mount targets section, select the checkboxes for all of the Availability Zones (AZs) within the selected VPC. These will be your mount targets.
 - Click Next step to continue.
5. Perform the following on the Configure optional settings page.
 - Create tags to describe your new file system.
 - Choose performance mode based on your requirements.
 - Check Enable encryption checkbox and choose aws/elasticfilesystem from Select KMS master key dropdown list to enable encryption for the new file system using the default master key provided and managed by AWS KMS.
 - Click Next step to continue.
6. Review the file system configuration details on the review and create page and then click Create File System to create your new AWS EFS file system.
7. Copy the data from the old unencrypted EFS file system onto the newly create encrypted file system.
8. Remove the unencrypted file system as soon as your data migration to the newly create encrypted file system is completed.
9. Change the AWS region from the navigation bar and repeat the entire process for other aws regions.

From CLI:

1. Run describe-file-systems command to describe the configuration information available for the selected (unencrypted) file system (see Audit section to identify the right resource):

```
aws efs describe-file-systems --region <region> --file-system-id <file-system-id from audit section step 2 output>
```

2. The command output should return the requested configuration information.
3. To provision a new AWS EFS file system, you need to generate a universally unique identifier (UUID) in order to create the token required by the create-file-system command. To create the required token, you can use a randomly generated UUID from "https://www.uuidgenerator.net".
4. Run create-file-system command using the unique token created at the previous step.

```
aws efs create-file-system --region <region> --creation-token <Token (randomly generated UUID from step 3)> --performance-mode generalPurpose --encrypted
```

5. The command output should return the new file system configuration metadata.
6. Run create-mount-target command using the newly created EFS file system ID returned at the previous step as identifier and the ID of the Availability Zone (AZ) that will represent the mount target:

```
aws efs create-mount-target --region <region> --file-system-id <file-system-id> --subnet-id <subnet-id>
```

7. The command output should return the new mount target metadata.
8. Now you can mount your file system from an EC2 instance.
9. Copy the data from the old unencrypted EFS file system onto the newly create encrypted file system.
10. Remove the unencrypted file system as soon as your data migration to the newly create encrypted file system is completed.

```
aws efs delete-file-system --region <region> --file-system-id <unencrypted-file-system-id>
```

11. Change the AWS region by updating the --region and repeat the entire process for other aws regions.




Default Value:

EFS file system data is encrypted at rest by default when creating a file system via the Console. Encryption at rest is not enabled by default when creating a new file system using the AWS CLI, API, and SDKs.

References:

1. <https://docs.aws.amazon.com/efs/latest/ug/encryption-at-rest.html>
2. <https://awscli.amazonaws.com/v2/documentation/api/latest/reference/efs/index.html#efs>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.11 <u>Encrypt Sensitive Data at Rest</u> Encrypt sensitive data at rest on servers, applications, and databases containing sensitive data. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.			
v7	14.8 <u>Encrypt Sensitive Information at Rest</u> Encrypt all sensitive information at rest using a tool that requires a secondary authentication mechanism not integrated into the operating system, in order to access the information.			

3 Logging

This section contains recommendations for configuring AWS logging features.

3.1 Ensure CloudTrail is enabled in all regions (Automated)

Profile Applicability:

- Level 1

Description:

AWS CloudTrail is a web service that records AWS API calls for your account and delivers log files to you. The recorded information includes the identity of the API caller, the time of the API call, the source IP address of the API caller, the request parameters, and the response elements returned by the AWS service. CloudTrail provides a history of AWS API calls for an account, including API calls made via the Management Console, SDKs, command line tools, and higher-level AWS services (such as CloudFormation).

Rationale:

The AWS API call history produced by CloudTrail enables security analysis, resource change tracking, and compliance auditing. Additionally,

- ensuring that a multi-regions trail exists will ensure that unexpected activity occurring in otherwise unused regions is detected
- ensuring that a multi-regions trail exists will ensure that `Global Service Logging` is enabled for a trail by default to capture recording of events generated on AWS global services
- for a multi-regions trail, ensuring that management events configured for all type of Read/Writes ensures recording of management operations that are performed on all resources in an AWS account

Impact:

S3 lifecycle features can be used to manage the accumulation and management of logs over time. See the following AWS resource for more information on these features:

1. <https://docs.aws.amazon.com/AmazonS3/latest/dev/object-lifecycle-mgmt.html>

Audit:

Perform the following to determine if CloudTrail is enabled for all regions:

From Console:

1. Sign in to the AWS Management Console and open the CloudTrail console at <https://console.aws.amazon.com/cloudtrail>
 2. Click on `Trails` on the left navigation pane
- You will be presented with a list of trails across all regions

3. Ensure at least one Trail has `All` specified in the `Region` column
4. Click on a trail via the link in the `Name` column
5. Ensure `Logging is set to ON`
6. Ensure `Apply trail to all regions is set to Yes`
7. In section `Management Events` ensure `Read/Write Events` set to `ALL`

From Command Line:

```
aws cloudtrail describe-trails
```

Ensure `IsMultiRegionTrail` is set to `true`

```
aws cloudtrail get-trail-status --name <trailname shown in describe-trails>
```

Ensure `IsLogging` is set to `true`

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

Remediation:

Perform the following to enable global (Multi-region) CloudTrail logging:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/cloudtrail>
2. Click on *Trails* on the left navigation pane
3. Click `Get Started Now`, if presented
 - Click `Add new trail`
 - Enter a trail name in the `Trail name` box
 - Set the `Apply trail to all regions` option to `Yes`
 - Specify an S3 bucket name in the `S3 bucket` box
 - Click `Create`
4. If 1 or more trails already exist, select the target trail to enable for global logging
5. Click the edit icon (pencil) next to `Apply trail to all regions`, Click `Yes` and Click `Save`.
6. Click the edit icon (pencil) next to `Management Events` click `All` for setting `Read/Write Events` and Click `Save`.

From Command Line:

```
aws cloudtrail create-trail --name <trail_name> --bucket-name <s3_bucket_for_cloudtrail> --is-multi-region-trail
aws cloudtrail update-trail --name <trail_name> --is-multi-region-trail
```


Note: Creating CloudTrail via CLI without providing any overriding options configures Management Events to set All type of Read/Writes by default.






Default Value:

Not Enabled

References:

1. CCE-78913-1
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-concepts.html#cloudtrail-concepts-management-events>
3. https://docs.aws.amazon.com/awscloudtrail/latest/userguide/logging-management-and-data-events-with-cloudtrail.html?icmpid=docs_cloudtrail_console#logging-management-events
4. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-supported-services.html#cloud-trail-supported-services-data-events>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.5 <u>Collect Detailed Audit Logs</u> Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			

3.2 Ensure CloudTrail log file validation is enabled (Automated)

Profile Applicability:

- Level 2

Description:

CloudTrail log file validation creates a digitally signed digest file containing a hash of each log that CloudTrail writes to S3. These digest files can be used to determine whether a log file was changed, deleted, or unchanged after CloudTrail delivered the log. It is recommended that file validation be enabled on all CloudTrails.

Rationale:

Enabling log file validation will provide additional integrity checking of CloudTrail logs.

Audit:

Perform the following on each trail to determine if log file validation is enabled:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/cloudtrail>
2. Click on `Trails` on the left navigation pane
3. For Every Trail:
 - Click on a trail via the link in the *Name* column
 - Under the `General details` section, ensure `Log file validation` is set to `Enabled`

From Command Line:

```
aws cloudtrail describe-trails
```

Ensure `LogFileValidationEnabled` is set to `true` for each trail

Remediation:

Perform the following to enable log file validation on a given trail:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/cloudtrail>
2. Click on `Trails` on the left navigation pane
3. Click on target trail
4. Within the `General details` section click `edit`
5. Under the `Advanced settings` section
6. Check the enable box under `Log file validation`
7. Click `Save changes`

From Command Line:

```
aws cloudtrail update-trail --name <trail_name> --enable-log-file-validation
```

Note that periodic validation of logs using these digests can be performed by running the following command:

```
aws cloudtrail validate-logs --trail-arn <trail_arn> --start-time  
<start_time> --end-time <end_time>
```



Default Value:

Not Enabled

References:

1. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-log-file-validation-enabling.html>
2. CCE-78914-9

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6 <u>Maintenance, Monitoring and Analysis of Audit Logs</u> Maintenance, Monitoring and Analysis of Audit Logs			

3.3 Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible (Automated)

Profile Applicability:

- Level 1

Description:

CloudTrail logs a record of every API call made in your AWS account. These logs file are stored in an S3 bucket. It is recommended that the bucket policy or access control list (ACL) applied to the S3 bucket that CloudTrail logs to prevent public access to the CloudTrail logs.

Rationale:

Allowing public access to CloudTrail log content may aid an adversary in identifying weaknesses in the affected account's use or configuration.

Audit:

Perform the following to determine if any public access is granted to an S3 bucket via an ACL or S3 bucket policy:

From Console:

1. Go to the Amazon CloudTrail console at <https://console.aws.amazon.com/cloudtrail/home>.
2. In the `API activity history` pane on the left, click `Trails`.
3. In the `Trails` pane, note the bucket names in the `S3 bucket` column.
4. Go to Amazon S3 console at <https://console.aws.amazon.com/s3/home>.
5. For each bucket noted in step 3, right-click on the bucket and click `Properties`.
6. In the `Properties` pane, click the `Permissions` tab.
7. The tab shows a list of grants, one row per grant, in the bucket ACL. Each row identifies the grantee and the permissions granted.
8. Ensure no rows exists that have the `Grantee` set to `Everyone` or the `Grantee` set to `Any Authenticated User`.
9. If the `Edit bucket policy` button is present, click it to review the bucket policy.
10. Ensure the policy does not contain a `Statement` having an `Effect` set to `Allow` and a `Principal` set to `""` or `{"AWS": ""}`, or if it does, ensure that it has a condition in place to restrict access, such as `aws:PrincipalOrgID`.

From Command Line:

1. Get the name of the S3 bucket that CloudTrail is logging to:

```
aws cloudtrail describe-trails --query 'trailList[*].S3BucketName'
```

2. Ensure the `AllUsers` principal is not granted privileges to that `<bucket>` :

```
aws s3api get-bucket-acl --bucket <s3_bucket_for_cloudtrail> --query 'Grants[?Grantee.URI== `https://acs.amazonaws.com/groups/global/AllUsers` ]'
```

3. Ensure the `AuthenticatedUsers` principal is not granted privileges to that `<bucket>`:

```
aws s3api get-bucket-acl --bucket <s3_bucket_for_cloudtrail> --query 'Grants[?Grantee.URI== `https://acs.amazonaws.com/groups/global/AuthenticatedUsers`]'
```

4. Get the S3 Bucket Policy

```
aws s3api get-bucket-policy --bucket <s3_bucket_for_cloudtrail>
```

5. Ensure the policy does not contain a `Statement` having an `Effect` set to `Allow` and a `Principal` set to `"*"` or `{"AWS": "*"}`. Additionally, check to see whether a condition has been added to the bucket policy covering `aws:PrincipalOrgID`, as having this (in the `StringEquals` or `StringEqualsIgnoreCase`) would restrict access to only the named Org ID.

Note: Principal set to `"*"` or `{"AWS": "*"}`, without any conditions, allows anonymous access.

Remediation:

Perform the following to remove any public access that has been granted to the bucket via an ACL or S3 bucket policy:

1. Go to Amazon S3 console at <https://console.aws.amazon.com/s3/home>.
2. Right-click on the bucket and click `Properties`
3. In the `Properties` pane, click the `Permissions` tab.
4. The tab shows a list of grants, one row per grant, in the bucket ACL. Each row identifies the grantee and the permissions granted.
5. Select the row that grants permission to `Everyone` or `Any Authenticated User`.
6. Uncheck all the permissions granted to `Everyone` or `Any Authenticated User` (click `x` to delete the row).
7. Click `Save` to save the ACL.
8. If the `Edit bucket policy` button is present, click it.
9. Remove any `Statement` having an `Effect` set to `Allow` and a `Principal` set to `"*"` or `{"AWS": "*"}`, that doesn't also have a condition to restrict access, such as `aws:PrincipalOrgID`.







Default Value:

By default, S3 buckets are not publicly accessible.

References:

1. CCE-78915-6
2. https://docs.aws.amazon.com/IAM/latest/UserGuide/reference_policies_elements_principal.html

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

3.4 Ensure CloudTrail trails are integrated with CloudWatch Logs (Automated)

Profile Applicability:

- Level 1

Description:

AWS CloudTrail is a web service that records AWS API calls made in a given AWS account. The recorded information includes the identity of the API caller, the time of the API call, the source IP address of the API caller, the request parameters, and the response elements returned by the AWS service. CloudTrail uses Amazon S3 for log file storage and delivery, so log files are stored durably. In addition to capturing CloudTrail logs within a specified S3 bucket for long term analysis, real time analysis can be performed by configuring CloudTrail to send logs to CloudWatch Logs. For a trail that is enabled in all regions in an account, CloudTrail sends log files from all those regions to a CloudWatch Logs log group. It is recommended that CloudTrail logs be sent to CloudWatch Logs.

Note: The intent of this recommendation is to ensure AWS account activity is being captured, monitored, and appropriately alarmed on. CloudWatch Logs is a native way to accomplish this using AWS services but does not preclude the use of an alternate solution.

Rationale:

Sending CloudTrail logs to CloudWatch Logs will facilitate real-time and historic activity logging based on user, API, resource, and IP address, and provides opportunity to establish alarms and notifications for anomalous or sensitivity account activity.

Impact:

Note: By default, CloudWatch Logs will store Logs indefinitely unless a specific retention period is defined for the log group. When choosing the number of days to retain, keep in mind the average days it takes an organization to realize they have been breached is 210 days (at the time of this writing). Since additional time is required to research a breach, a minimum 365 day retention policy allows time for detection and research. You may also wish to archive the logs to a cheaper storage service rather than simply deleting them. See the following AWS resource to manage CloudWatch Logs retention periods:

1. <https://docs.aws.amazon.com/AmazonCloudWatch/latest/DeveloperGuide/SettingLogRetention.html>

Audit:

Perform the following to ensure CloudTrail is configured as prescribed:

From Console:

1. Login to the CloudTrail console at `https://console.aws.amazon.com/cloudtrail/`
2. Under `Trails` , click on the CloudTrail you wish to evaluate
3. Under the `CloudWatch Logs` section.
4. Ensure a `CloudWatch Logs` log group is configured and listed.
5. Under `General details` confirm `Last log file delivered` has a recent (~one day old) timestamp.

From Command Line:

1. Run the following command to get a listing of existing trails:

```
aws cloudtrail describe-trails
```

2. Ensure `CloudWatchLogsLogGroupArn` is not empty and note the value of the `Name` property.
3. Using the noted value of the `Name` property, run the following command:

```
aws cloudtrail get-trail-status --name <trail_name>
```

4. Ensure the `LatestcloudwatchLogdDeliveryTime` property is set to a recent (~one day old) timestamp.

If the `CloudWatch Logs` log group is not setup and the delivery time is not recent refer to the remediation below.

Remediation:

Perform the following to establish the prescribed state:

From Console:

1. Login to the CloudTrail console at `https://console.aws.amazon.com/cloudtrail/`
2. Select the `Trail` the needs to be updated.
3. Scroll down to `CloudWatch Logs`
4. Click `Edit`
5. Under `CloudWatch Logs` click the box `Enabled`
6. Under `Log Group` pick new or select an existing log group
7. Edit the `Log group name` to match the CloudTrail or pick the existing `CloudWatch Group`.
8. Under `IAM Role` pick new or select an existing.
9. Edit the `Role name` to match the CloudTrail or pick the existing `IAM Role`.

10. Click `Save changes.










From Command Line:

```
aws cloudtrail update-trail --name <trail_name> --cloudwatch-logs-log-group-arn <cloudtrail_log_group_arn> --cloudwatch-logs-role-arn <cloudtrail_cloudwatchLogs_role_arn>
```

References:

1. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-user-guide.html>
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/how-cloudtrail-works.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-aws-service-specific-topics.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.5 <u>Collect Detailed Audit Logs</u> Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.			
v8	8.9 <u>Centralize Audit Logs</u> Centralize, to the extent possible, audit log collection and retention across enterprise assets.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	6.5 <u>Central Log Management</u> Ensure that appropriate logs are being aggregated to a central log management system for analysis and review.			

3.5 Ensure AWS Config is enabled in all regions (Automated)

Profile Applicability:

- Level 2

Description:

AWS Config is a web service that performs configuration management of supported AWS resources within your account and delivers log files to you. The recorded information includes the configuration item (AWS resource), relationships between configuration items (AWS resources), any configuration changes between resources. It is recommended AWS Config be enabled in all regions.

Rationale:

The AWS configuration item history captured by AWS Config enables security analysis, resource change tracking, and compliance auditing.

Impact:

It is recommended AWS Config be enabled in all regions.

Audit:

Process to evaluate AWS Config configuration per region

From Console:

1. Sign in to the AWS Management Console and open the AWS Config console at <https://console.aws.amazon.com/config/>.
2. On the top right of the console select target Region.
3. If a Config recorder is enabled in this region, you should navigate to the Settings page from the navigation menu on the left hand side. If a Config recorder is not yet enabled in this region then you should select "Get Started".
4. Ensure "Record all resources supported in this region" is checked.
5. Ensure "Include global resources (e.g., AWS IAM resources)" is checked, unless it is enabled in another region (this is only required in one region)
6. Ensure the correct S3 bucket has been defined.
7. Ensure the correct SNS topic has been defined.
8. Repeat steps 2 to 7 for each region.

From Command Line:

1. Run this command to show all AWS Config recorders and their properties:

```
aws configservice describe-configuration-recorders
```

2. Evaluate the output to ensure that all recorders have a `recordingGroup` object which includes `"allSupported": true`. Additionally, ensure that at least one recorder has `"includeGlobalResourceTypes": true`

Note: There is one more parameter "ResourceTypes" in recordingGroup object. We don't need to check the same as whenever we set "allSupported": true, AWS enforces resource types to be empty ("ResourceTypes":[])

Sample Output:

```
{
  "ConfigurationRecorders": [
    {
      "recordingGroup": {
        "allSupported": true,
        "resourceTypes": [],
        "includeGlobalResourceTypes": true
      },
      "roleARN": "arn:aws:iam::<AWS_Account_ID>:role/service-
role/<config-role-name>",
      "name": "default"
    }
  ]
}
```

3. Run this command to show the status for all AWS Config recorders:

```
aws configservice describe-configuration-recorder-status
```

4. In the output, find recorders with `name` key matching the recorders that were evaluated in step 2. Ensure that they include `"recording": true` and `"lastStatus": "SUCCESS"`

Remediation:

To implement AWS Config configuration:

From Console:

1. Select the region you want to focus on in the top right of the console
2. Click Services
3. Click Config
4. If a Config recorder is enabled in this region, you should navigate to the Settings page from the navigation menu on the left hand side. If a Config recorder is not yet enabled in this region then you should select "Get Started".
5. Select "Record all resources supported in this region"
6. Choose to include global resources (IAM resources)
7. Specify an S3 bucket in the same account or in another managed AWS account
8. Create an SNS Topic from the same AWS account or another managed AWS account

From Command Line:

1. Ensure there is an appropriate S3 bucket, SNS topic, and IAM role per the [AWS Config Service prerequisites](#).
2. Run this command to create a new configuration recorder:

```
aws configservice put-configuration-recorder --configuration-recorder
name=default,roleARN=arn:aws:iam::012345678912:role/myConfigRole --recording-
group allSupported=true,includeGlobalResourceTypes=true
```

3. Create a delivery channel configuration file locally which specifies the channel attributes, populated from the prerequisites set up previously:

```
{
  "name": "default",
  "s3BucketName": "my-config-bucket",
  "snsTopicARN": "arn:aws:sns:us-east-1:012345678912:my-config-notice",
  "configSnapshotDeliveryProperties": {
    "deliveryFrequency": "Twelve_Hours"
  }
}
```

4. Run this command to create a new delivery channel, referencing the json configuration file made in the previous step:

```
aws configservice put-delivery-channel --delivery-channel
file://deliveryChannel.json
```











5. Start the configuration recorder by running the following command:

```
aws configservice start-configuration-recorder --configuration-recorder-name
default
```

References:

1. CCE-78917-2
2. <https://docs.aws.amazon.com/cli/latest/reference/configservice/describe-configuration-recorder-status.html>
3. <https://docs.aws.amazon.com/cli/latest/reference/configservice/describe-configuration-recorders.html>
4. <https://docs.aws.amazon.com/config/latest/developerguide/gs-cli-prereq.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<p><u>1.1 Establish and Maintain Detailed Enterprise Asset Inventory</u></p> <p>Establish and maintain an accurate, detailed, and up-to-date inventory of all enterprise assets with the potential to store or process data, to include: end-user devices (including portable and mobile), network devices, non-computing/IoT devices, and servers. Ensure the inventory records the network address (if static), hardware address, machine name, enterprise asset owner, department for each asset, and whether the asset has been approved to connect to the network. For mobile end-user devices, MDM type tools can support this process, where appropriate. This inventory includes assets connected to the infrastructure physically, virtually, remotely, and those within cloud environments. Additionally, it includes assets that are regularly connected to the enterprise's network infrastructure, even if they are not under control of the enterprise. Review and update the inventory of all enterprise assets bi-annually, or more frequently.</p>			
v7	<p><u>1.4 Maintain Detailed Asset Inventory</u></p> <p>Maintain an accurate and up-to-date inventory of all technology assets with the potential to store or process information. This inventory shall include all hardware assets, whether connected to the organization's network or not.</p>			
v7	<p><u>11.2 Document Traffic Configuration Rules</u></p> <p>All configuration rules that allow traffic to flow through network devices should be documented in a configuration management system with a specific business reason for each rule, a specific individual's name responsible for that business need, and an expected duration of the need.</p>			
v7	<p><u>16.1 Maintain an Inventory of Authentication Systems</u></p> <p>Maintain an inventory of each of the organization's authentication systems, including those located onsite or at a remote service provider.</p>			

3.6 Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket (Automated)

Profile Applicability:

- Level 1

Description:

S3 Bucket Access Logging generates a log that contains access records for each request made to your S3 bucket. An access log record contains details about the request, such as the request type, the resources specified in the request worked, and the time and date the request was processed. It is recommended that bucket access logging be enabled on the CloudTrail S3 bucket.

Rationale:

By enabling S3 bucket logging on target S3 buckets, it is possible to capture all events which may affect objects within any target buckets. Configuring logs to be placed in a separate bucket allows access to log information which can be useful in security and incident response workflows.

Audit:

Perform the following ensure the CloudTrail S3 bucket has access logging is enabled:

From Console:

1. Go to the Amazon CloudTrail console at <https://console.aws.amazon.com/cloudtrail/home>
2. In the API activity history pane on the left, click Trails
3. In the Trails pane, note the bucket names in the S3 bucket column
4. Sign in to the AWS Management Console and open the S3 console at <https://console.aws.amazon.com/s3>.
5. Under All Buckets click on a target S3 bucket
6. Click on Properties in the top right of the console
7. Under Bucket: _ <bucket_name> _ click on Logging
8. Ensure Enabled is checked.

From Command Line:

1. Get the name of the S3 bucket that CloudTrail is logging to:

```
aws cloudtrail describe-trails --query 'trailList[*].S3BucketName'
```

2. Ensure Bucket Logging is enabled:

```
aws s3api get-bucket-logging --bucket <s3_bucket_for_cloudtrail>
```

Ensure command does not returns empty output.
Sample Output for a bucket with logging enabled:

```
{
  "LoggingEnabled": {
    "TargetPrefix": "<Prefix_Test>",
    "TargetBucket": "<Bucket_name_for_Storing_Logs>"
  }
}
```

Remediation:

Perform the following to enable S3 bucket logging:

From Console:

1. Sign in to the AWS Management Console and open the S3 console at <https://console.aws.amazon.com/s3>.
2. Under All Buckets click on the target S3 bucket
3. Click on Properties in the top right of the console
4. Under Bucket: <s3_bucket_for_cloudtrail> click on Logging
5. Configure bucket logging
 - o Click on the Enabled checkbox
 - o Select Target Bucket from list
 - o Enter a Target Prefix
6. Click Save.

From Command Line:

1. Get the name of the S3 bucket that CloudTrail is logging to:

```
aws cloudtrail describe-trails --region <region-name> --query  
trailList[*].S3BucketName
```

2. Copy and add target bucket name at <Logging_BucketName>, Prefix for logfile at <LogFilePrefix> and optionally add an email address in the following template and save it as <FileName.Json>:

```
{
  "LoggingEnabled": {
    "TargetBucket": "<Logging_BucketName>",
    "TargetPrefix": "<LogFilePrefix>",
    "TargetGrants": [
      {
        "Grantee": {
          "Type": "AmazonCustomerByEmail",
          "EmailAddress": "<EmailID>"
        },
        "Permission": "FULL_CONTROL"
      }
    ]
  }
}
```

3. Run the `put-bucket-logging` command with bucket name and `<FileName.Json>` as input, for more information refer at [put-bucket-logging](#):

```
aws s3api put-bucket-logging --bucket <BucketName> --bucket-logging-status
file://<FileName.Json>
```

Default Value:

Logging is disabled.

References:

1. CCE-78918-0
2. <https://docs.aws.amazon.com/AmazonS3/latest/dev/ServerLogs.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.14 <u>Log Sensitive Data Access</u> Log sensitive data access, including modification and disposal.			●
v8	8.2 <u>Collect Audit Logs</u> Collect audit logs. Ensure that logging, per the enterprise's audit log management process, has been enabled across enterprise assets.	●	●	●
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.	●	●	●

Controls Version	Control	IG 1	IG 2	IG 3
v7	<p>14.9 <u>Enforce Detail Logging for Access or Changes to Sensitive Data</u></p> <p>Enforce detailed audit logging for access to sensitive data or changes to sensitive data (utilizing tools such as File Integrity Monitoring or Security Information and Event Monitoring).</p>			●

3.7 Ensure CloudTrail logs are encrypted at rest using KMS CMKs (Automated)

Profile Applicability:

- Level 2

Description:

AWS CloudTrail is a web service that records AWS API calls for an account and makes those logs available to users and resources in accordance with IAM policies. AWS Key Management Service (KMS) is a managed service that helps create and control the encryption keys used to encrypt account data, and uses Hardware Security Modules (HSMs) to protect the security of encryption keys. CloudTrail logs can be configured to leverage server side encryption (SSE) and KMS customer created master keys (CMK) to further protect CloudTrail logs. It is recommended that CloudTrail be configured to use SSE-KMS.

Rationale:

Configuring CloudTrail to use SSE-KMS provides additional confidentiality controls on log data as a given user must have S3 read permission on the corresponding log bucket and must be granted decrypt permission by the CMK policy.

Impact:

Customer created keys incur an additional cost. See <https://aws.amazon.com/kms/pricing/> for more information.

Audit:

Perform the following to determine if CloudTrail is configured to use SSE-KMS:

From Console:

1. Sign in to the AWS Management Console and open the CloudTrail console at <https://console.aws.amazon.com/cloudtrail>
2. In the left navigation pane, choose `Trails`.
3. Select a Trail
4. Under the `s3` section, ensure `Encrypt log files` is set to `Yes` and a KMS key ID is specified in the `KMS Key Id` field.

From Command Line:

1. Run the following command:

```
aws cloudtrail describe-trails
```

2. For each trail listed, SSE-KMS is enabled if the trail has a `KmsKeyId` property defined.

Remediation:

Perform the following to configure CloudTrail to use SSE-KMS:

From Console:

1. Sign in to the AWS Management Console and open the CloudTrail console at <https://console.aws.amazon.com/cloudtrail>
2. In the left navigation pane, choose `Trails`.
3. Click on a Trail
4. Under the `S3` section click on the edit button (pencil icon)
5. Click `Advanced`
6. Select an existing CMK from the `KMS key Id` drop-down menu
 - Note: Ensure the CMK is located in the same region as the S3 bucket
 - Note: You will need to apply a KMS Key policy on the selected CMK in order for CloudTrail as a service to encrypt and decrypt log files using the CMK provided. Steps are provided [here](#) for editing the selected CMK Key policy
7. Click `Save`
8. You will see a notification message stating that you need to have decrypt permissions on the specified KMS key to decrypt log files.
9. Click `Yes`

From Command Line:

```
aws cloudtrail update-trail --name <trail_name> --kms-id  
<cloudtrail_kms_key>  
aws kms put-key-policy --key-id <cloudtrail_kms_key> --policy  
<cloudtrail_kms_key_policy>
```

References:

1. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/encrypting-cloudtrail-log-files-with-aws-kms.html>
2. <https://docs.aws.amazon.com/kms/latest/developerguide/create-keys.html>
3. CCE-78919-8

Additional Information:

3 statements which need to be added to the CMK policy:

1. Enable Cloudtrail to describe CMK properties

```
<pre class="programlisting" style="font-style: normal;">{
  "Sid": "Allow CloudTrail access",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "kms:DescribeKey",
  "Resource": "*"
}
```

2. Granting encrypt permissions

```
<pre class="programlisting" style="font-style: normal;">{
  "Sid": "Allow CloudTrail to encrypt logs",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "kms:GenerateDataKey*",
  "Resource": "*",
  "Condition": {
    "StringLike": {
      "kms:EncryptionContext:aws:cloudtrail:arn": [
        "arn:aws:cloudtrail:*:aws-account-id:trail/*"
      ]
    }
  }
}
```

3. Granting decrypt permissions

```
<pre class="programlisting" style="font-style: normal;">{
  "Sid": "Enable CloudTrail log decrypt permissions",
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::aws-account-id:user/username"
  },
  "Action": "kms:Decrypt",
  "Resource": "*",
  "Condition": {
    "Null": {
      "kms:EncryptionContext:aws:cloudtrail:arn": "false"
    }
  }
}
```

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.11 <u>Encrypt Sensitive Data at Rest</u> Encrypt sensitive data at rest on servers, applications, and databases containing sensitive data. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.		●	●
v7	6 <u>Maintenance, Monitoring and Analysis of Audit Logs</u> Maintenance, Monitoring and Analysis of Audit Logs			
v7	14.8 <u>Encrypt Sensitive Information at Rest</u> Encrypt all sensitive information at rest using a tool that requires a secondary authentication mechanism not integrated into the operating system, in order to access the information.			●

3.8 Ensure rotation for customer created symmetric CMKs is enabled (Automated)

Profile Applicability:

- Level 2

Description:

AWS Key Management Service (KMS) allows customers to rotate the backing key which is key material stored within the KMS which is tied to the key ID of the Customer Created customer master key (CMK). It is the backing key that is used to perform cryptographic operations such as encryption and decryption. Automated key rotation currently retains all prior backing keys so that decryption of encrypted data can take place transparently. It is recommended that CMK key rotation be enabled for symmetric keys. Key rotation can not be enabled for any asymmetric CMK.

Rationale:

Rotating encryption keys helps reduce the potential impact of a compromised key as data encrypted with a new key cannot be accessed with a previous key that may have been exposed. Keys should be rotated every year, or upon event that would result in the compromise of that key.

Impact:

Creation, management, and storage of CMKs may require additional time from and administrator.

Audit:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam>.
2. In the left navigation pane, choose `Customer managed keys`
3. Select a customer managed CMK where `Key spec = SYMMETRIC_DEFAULT`
4. Underneath the `General configuration` panel open the tab `Key rotation`
5. Ensure that the checkbox `Automatically rotate this KMS key every year.` is activated
6. Repeat steps 3 - 5 for all customer managed CMKs where "Key spec = SYMMETRIC_DEFAULT"

From Command Line:

1. Run the following command to get a list of all keys and their associated `KeyIds`

```
aws kms list-keys
```

2. For each key, note the KeyId and run the following command

```
describe-key --key-id <kms_key_id>
```

3. If the response contains "KeySpec = SYMMETRIC_DEFAULT" run the following command

```
aws kms get-key-rotation-status --key-id <kms_key_id>
```

4. Ensure `KeyRotationEnabled` is set to `true`
5. Repeat steps 2 - 4 for all remaining CMKs

Remediation:

From Console:

1. Sign in to the AWS Management Console and open the IAM console at <https://console.aws.amazon.com/iam>.
2. In the left navigation pane, choose `Customer managed keys`.
3. Select a customer managed CMK where `Key spec = SYMMETRIC_DEFAULT`
4. Underneath the "General configuration" panel open the tab "Key rotation"
5. Check the "Automatically rotate this KMS key every year." checkbox

From Command Line:




1. Run the following command to enable key rotation:

```
aws kms enable-key-rotation --key-id <kms_key_id>
```

References:

1. <https://aws.amazon.com/kms/pricing/>
2. <https://csrc.nist.gov/publications/detail/sp/800-57-part-1/rev-5/final>
3. CCE-78920-6

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.11 <u>Encrypt Sensitive Data at Rest</u> Encrypt sensitive data at rest on servers, applications, and databases containing sensitive data. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.			
v7	6 <u>Maintenance, Monitoring and Analysis of Audit Logs</u> Maintenance, Monitoring and Analysis of Audit Logs			
v7	14.8 <u>Encrypt Sensitive Information at Rest</u> Encrypt all sensitive information at rest using a tool that requires a secondary authentication mechanism not integrated into the operating system, in order to access the information.			

3.9 Ensure VPC flow logging is enabled in all VPCs (Automated)

Profile Applicability:

- Level 2

Description:

VPC Flow Logs is a feature that enables you to capture information about the IP traffic going to and from network interfaces in your VPC. After you've created a flow log, you can view and retrieve its data in Amazon CloudWatch Logs. It is recommended that VPC Flow Logs be enabled for packet "Rejects" for VPCs.

Rationale:

VPC Flow Logs provide visibility into network traffic that traverses the VPC and can be used to detect anomalous traffic or insight during security workflows.

Impact:

By default, CloudWatch Logs will store Logs indefinitely unless a specific retention period is defined for the log group. When choosing the number of days to retain, keep in mind the average days it takes an organization to realize they have been breached is 210 days (at the time of this writing). Since additional time is required to research a breach, a minimum 365 day retention policy allows time for detection and research. You may also wish to archive the logs to a cheaper storage service rather than simply deleting them. See the following AWS resource to manage CloudWatch Logs retention periods:

1. <https://docs.aws.amazon.com/AmazonCloudWatch/latest/DeveloperGuide/SettingLogRetention.html>

Audit:

Perform the following to determine if VPC Flow logs are enabled:

From Console:

1. Sign into the management console
2. Select `Services` then `VPC`
3. In the left navigation pane, select `Your VPCs`
4. Select a VPC
5. In the right pane, select the `Flow Logs` tab.
6. Ensure a Log Flow exists that has `Active` in the `Status` column.

From Command Line:

1. Run `describe-vpcs` command (OSX/Linux/UNIX) to list the VPC networks available in the current AWS region:

```
aws ec2 describe-vpcs --region <region> --query Vpcs[].VpcId
```

2. The command output returns the `VpcId` available in the selected region.
3. Run `describe-flow-logs` command (OSX/Linux/UNIX) using the VPC ID to determine if the selected virtual network has the Flow Logs feature enabled:

```
aws ec2 describe-flow-logs --filter "Name=resource-id,Values=<vpc-id>"
```

4. If there are no Flow Logs created for the selected VPC, the command output will return an empty list `[]`.
5. Repeat step 3 for other VPCs available in the same region.
6. Change the region by updating `--region` and repeat steps 1 - 5 for all the VPCs.

Remediation:

Perform the following to determine if VPC Flow logs is enabled:

From Console:

1. Sign into the management console
2. Select `Services` then `VPC`
3. In the left navigation pane, select `Your VPCs`
4. Select a VPC
5. In the right pane, select the `Flow Logs` tab.
6. If no Flow Log exists, click `Create Flow Log`
7. For Filter, select `Reject`
8. Enter in a `Role` and `Destination Log Group`
9. Click `Create Log Flow`
10. Click on `CloudWatch Logs Group`

Note: Setting the filter to "Reject" will dramatically reduce the logging data accumulation for this recommendation and provide sufficient information for the purposes of breach detection, research and remediation. However, during periods of least privilege security group engineering, setting this the filter to "All" can be very helpful in discovering existing traffic flows required for proper operation of an already running environment.

From Command Line:

1. Create a policy document and name it as `role_policy_document.json` and paste the following content:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "test",
      "Effect": "Allow",
      "Principal": {
        "Service": "ec2.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

2. Create another policy document and name it as `iam_policy.json` and paste the following content:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:DescribeLogGroups",
        "logs:DescribeLogStreams",
        "logs:PutLogEvents",
        "logs:GetLogEvents",
        "logs:FilterLogEvents"
      ],
      "Resource": "*"
    }
  ]
}
```

3. Run the below command to create an IAM role:

```
aws iam create-role --role-name <aws_support_iam_role> --assume-role-policy-document file://<file-path>role_policy_document.json
```

4. Run the below command to create an IAM policy:

```
aws iam create-policy --policy-name <ami-policy-name> --policy-document file://<file-path>iam-policy.json
```

5. Run `attach-group-policy` command using the IAM policy ARN returned at the previous step to attach the policy to the IAM role (if the command succeeds, no output is returned):

```
aws iam attach-group-policy --policy-arn arn:aws:iam::<aws-account-id>:policy/<iam-policy-name> --group-name <group-name>
```

6. Run `describe-vpcs` to get the VpcId available in the selected region:

```
aws ec2 describe-vpcs --region <region>
```

7. The command output should return the VPC Id available in the selected region.

8. Run `create-flow-logs` to create a flow log for the vpc:

```
aws ec2 create-flow-logs --resource-type VPC --resource-ids <vpc-id> --traffic-type REJECT --log-group-name <log-group-name> --deliver-logs-permission-arn <iam-role-arn>
```











9. Repeat step 8 for other vpcs available in the selected region.

10. Change the region by updating `--region` and repeat remediation procedure for other vpcs.

References:

1. CCE-79202-8
2. <https://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/flow-logs.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.2 Collect Audit Logs Collect audit logs. Ensure that logging, per the enterprise's audit log management process, has been enabled across enterprise assets.			
v8	13.6 Collect Network Traffic Flow Logs Collect network traffic flow logs and/or network traffic to review and alert upon from network devices.			
v7	6.2 Activate audit logging Ensure that local logging has been enabled on all systems and networking devices.			
v7	12.5 Configure Monitoring Systems to Record Network Packets Configure monitoring systems to record network packets passing through the boundary at each of the organization's network boundaries.			

3.10 Ensure that Object-level logging for write events is enabled for S3 bucket (Automated)

Profile Applicability:

- Level 2

Description:

S3 object-level API operations such as `GetObject`, `DeleteObject`, and `PutObject` are called data events. By default, CloudTrail trails don't log data events and so it is recommended to enable Object-level logging for S3 buckets.

Rationale:

Enabling object-level logging will help you meet data compliance requirements within your organization, perform comprehensive security analysis, monitor specific patterns of user behavior in your AWS account or take immediate actions on any object-level API activity within your S3 Buckets using Amazon CloudWatch Events.

Audit:

From Console:

1. Login to the AWS Management Console and navigate to CloudTrail dashboard at <https://console.aws.amazon.com/cloudtrail/>
2. In the left panel, click `Trails` and then click on the CloudTrail Name that you want to examine.
3. Review `General details`
4. Confirm that `Multi-region trail` is set to `Yes`
5. Scroll down to `Data events`
6. Confirm that it reads:
Data events: `S3`
Bucket Name: `All current and future S3 buckets`
Read: `Enabled`
Write: `Enabled`
7. Repeat steps 2 to 6 to verify that Multi-region trail and Data events logging of S3 buckets in CloudTrail.
If the CloudTrails do not have multi-region and data events configured for S3 refer to the remediation below.

From Command Line:

1. Run `list-trails` command to list the names of all Amazon CloudTrail trails currently available in all AWS regions:

```
aws cloudtrail list-trails
```

2. The command output will be a list of all the trail names to include.
"TrailARN": "arn:aws:cloudtrail::<account#>:trail/",
"Name": "",
"HomeRegion": ""
3. Next run 'get-trail- command to determine Multi-region.

```
aws cloudtrail get-trail --name <trailname> --region <region_name>
```

4. The command output should include:
"IsMultiRegionTrail": true,
5. Next run `get-event-selectors` command using the `Name` of the trail and the `region` returned in step 2 to determine if Data events logging feature is enabled within the selected CloudTrail trail for all S3 buckets:

```
aws cloudtrail get-event-selectors --region <HomeRegion> --trail-name  
<trailname> --query EventSelectors[*].DataResources[]
```

6. The command output should be an array that contains the configuration of the AWS resource(S3 bucket) defined for the Data events selector.
"Type": "AWS::S3::Object",
"Values": [
"arn:aws:s3"
7. If the `get-event-selectors` command returns an empty array '[]', the Data events are not included in the selected AWS Cloudtrail trail logging configuration, therefore the S3 object-level API operations performed within your AWS account are not recorded.
8. Repeat steps 1 to 5 for auditing each CloudTrail to determine if Data events for S3 are covered.
If Multi-region is not set to true and the Data events does not show S3 defined as shown refer to the remediation procedure below.

Remediation:

From Console:

1. Login to the AWS Management Console and navigate to S3 dashboard at <https://console.aws.amazon.com/s3/>
2. In the left navigation panel, click `buckets` and then click on the S3 Bucket Name that you want to examine.
3. Click `Properties` tab to see in detail bucket configuration.
4. Click on the `Object-level` logging setting, enter the CloudTrail name for the recording activity. You can choose an existing Cloudtrail or create a new one by navigating to the Cloudtrail console link <https://console.aws.amazon.com/cloudtrail/>

5. Once the Cloudtrail is selected, check the `Write` event checkbox, so that `object-level` logging for Write events is enabled.
6. Repeat steps 2 to 5 to enable object-level logging of write events for other S3 buckets.

From Command Line:

1. To enable `object-level` data events logging for S3 buckets within your AWS account, run `put-event-selectors` command using the name of the trail that you want to reconfigure as identifier:








```
aws cloudtrail put-event-selectors --region <region-name> --trail-name
<trail-name> --event-selectors '[{"ReadWriteType": "WriteOnly",
"IncludeManagementEvents":true, "DataResources": [{"Type":
"AWS::S3::Object", "Values": ["arn:aws:s3:::<s3-bucket-name>/"] }] }]'
```

2. The command output will be `object-level` event trail configuration.
3. If you want to enable it for all buckets at once then change Values parameter to `["arn:aws:s3"]` in command given above.
4. Repeat step 1 for each s3 bucket to update `object-level` logging of write events.
5. Change the AWS region by updating the `--region` command parameter and perform the process for other regions.

References:

1. <https://docs.aws.amazon.com/AmazonS3/latest/user-guide/enable-cloudtrail-events.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.5 Collect Detailed Audit Logs Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.			
v7	6.2 Activate audit logging Ensure that local logging has been enabled on all systems and networking devices.			
v7	6.3 Enable Detailed Logging Enable system logging to include detailed information such as an event source, date, user, timestamp, source addresses, destination addresses, and other useful elements.			

3.11 Ensure that Object-level logging for read events is enabled for S3 bucket (Automated)

Profile Applicability:

- Level 2

Description:

S3 object-level API operations such as `GetObject`, `DeleteObject`, and `PutObject` are called data events. By default, CloudTrail trails don't log data events and so it is recommended to enable Object-level logging for S3 buckets.

Rationale:

Enabling object-level logging will help you meet data compliance requirements within your organization, perform comprehensive security analysis, monitor specific patterns of user behavior in your AWS account or take immediate actions on any object-level API activity using Amazon CloudWatch Events.

Audit:

From Console:

1. Login to the AWS Management Console and navigate to S3 dashboard at <https://console.aws.amazon.com/s3/>
2. In the left navigation panel, click `buckets` and then click on the S3 Bucket Name that you want to examine.
3. Click `Properties` tab to see in detail bucket configuration.
4. If the current status for `Object-level` logging is set to `Disabled`, then object-level logging of read events for the selected s3 bucket is not set.
5. If the current status for `Object-level` logging is set to `Enabled`, but the `Read` event check-box is unchecked, then object-level logging of read events for the selected s3 bucket is not set.
6. Repeat steps 2 to 5 to verify `object-level` logging for `read` events of your other S3 buckets.

From Command Line:

1. Run `describe-trails` command to list the names of all Amazon CloudTrail trails currently available in the selected AWS region:

```
aws cloudtrail describe-trails --region <region-name> --output table --query trailList[*].Name
```

2. The command output will be table of the requested trail names.
3. Run `get-event-selectors` command using the name of the trail returned at the previous step and custom query filters to determine if Data events logging feature

is enabled within the selected CloudTrail trail configuration for s3 bucket resources:

```
aws cloudtrail get-event-selectors --region <region-name> --trail-name <trail-name> --query EventSelectors[*].DataResources[]
```

4. The command output should be an array that contains the configuration of the AWS resource(S3 bucket) defined for the Data events selector.
5. If the `get-event-selectors` command returns an empty array, the Data events are not included into the selected AWS Cloudtrail trail logging configuration, therefore the S3 object-level API operations performed within your AWS account are not recorded.
6. Repeat steps 1 to 5 for auditing each s3 bucket to identify other trails that are missing the capability to log Data events.
7. Change the AWS region by updating the `--region` command parameter and perform the audit process for other regions.

Remediation:

From Console:

1. Login to the AWS Management Console and navigate to S3 dashboard at <https://console.aws.amazon.com/s3/>
2. In the left navigation panel, click `buckets` and then click on the S3 Bucket Name that you want to examine.
3. Click `Properties` tab to see in detail bucket configuration.
4. Click on the `Object-level` logging setting, enter the CloudTrail name for the recording activity. You can choose an existing Cloudtrail or create a new one by navigating to the Cloudtrail console link <https://console.aws.amazon.com/cloudtrail/>
5. Once the Cloudtrail is selected, check the `Read` event checkbox, so that `object-level` logging for `Read` events is enabled.
6. Repeat steps 2 to 5 to enable `object-level` logging of read events for other S3 buckets.

From Command Line:

1. To enable `object-level` data events logging for S3 buckets within your AWS account, run `put-event-selectors` command using the name of the trail that you want to reconfigure as identifier:








```
aws cloudtrail put-event-selectors --region <region-name> --trail-name <trail-name> --event-selectors '[{"ReadWriteType": "ReadOnly", "IncludeManagementEvents": true, "DataResources": [{"Type": "AWS::S3::Object", "Values": ["arn:aws:s3:::<s3-bucket-name>/"] }]} ]'
```

2. The command output will be `object-level` event trail configuration.
3. If you want to enable it for all buckets at once then change Values parameter to `["arn:aws:s3"]` in command given above.
4. Repeat step 1 for each s3 bucket to update `object-level` logging of read events.
5. Change the AWS region by updating the `--region` command parameter and perform the process for other regions.

References:

1. <https://docs.aws.amazon.com/AmazonS3/latest/user-guide/enable-cloudtrail-events.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.5 <u>Collect Detailed Audit Logs</u> Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	6.3 <u>Enable Detailed Logging</u> Enable system logging to include detailed information such as an event source, date, user, timestamp, source addresses, destination addresses, and other useful elements.			

4 Monitoring

This section contains recommendations for configuring AWS to assist with monitoring and responding to account activities.

Metric filter-related recommendations in this section are dependent on the `Ensure CloudTrail is enabled in all regions` and `Ensure CloudTrail trails are integrated with CloudWatch Logs` recommendation in the "Logging" section.

4.1 Ensure unauthorized API calls are monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for unauthorized API calls.

Rationale:

Monitoring unauthorized API calls will help reduce time to detect malicious activity and can alert you to a potential security incident.

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Impact:

This alert may be triggered by normal read-only console activities that attempt to opportunistically gather optional information, but gracefully fail if they don't have permissions.

If an excessive number of alerts are being generated then an organization may wish to consider adding read access to the limited IAM user permissions simply to quiet the alerts.

In some cases doing this may allow the users to actually view some areas of the system - any additional access given should be reviewed for alignment with the original limited IAM user intent.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with "Name": `note<cloudtrail__name>`

- From value associated with "CloudWatchLogsLogGroupArn" note <cloudtrail_log_group_name>

Example: for CloudWatchLogsLogGroupArn that looks like
arn:aws:logs::<aws_account_number>:log-group:NewGroup:*,
<cloudtrail_log_group_name> would be NewGroup

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <"Name" as shown in describe-
trails>
```

Ensure there is at least one Event Selector for a Trail with IncludeManagementEvents set to true and ReadWriteType set to All

2. Get a list of all associated metric filters for this <cloudtrail_log_group_name> that you captured in step 1:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.errorCode = "*UnauthorizedOperation") || ($.errorCode
="AccessDenied*") && ($.sourceIPAddress!="delivery.logs.amazonaws.com") &&
($.eventName!="HeadBucket") }",
```

4. Note the "filterName" <unauthorized_api_calls_metric> value associated with the filterPattern found in step 3.
5. Get a list of CloudWatch alarms and filter on the <unauthorized_api_calls_metric> captured in step 4.

```
aws cloudwatch describe-alarms --query "MetricAlarms[?MetricName ==
`unauthorized_api_calls_metric`]"
```

6. Note the AlarmActions value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":  
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for unauthorized API calls and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name "cloudtrail_log_group_name" --  
filter-name "<unauthorized_api_calls_metric>" --metric-transformations  
metricName=unauthorized_api_calls_metric,metricNamespace=CISBenchmark,metricV  
alue=1 --filter-pattern "{ ($.errorCode = "*UnauthorizedOperation") ||  
($.errorCode = "AccessDenied*") &&  
($.sourceIPAddress != "delivery.logs.amazonaws.com") &&  
($.eventName != "HeadBucket") }"
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

Note: Capture the TopicArn displayed when creating the SNS Topic in Step 2.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn from step 2> --protocol  
<protocol_for_sns> --notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name "unauthorized_api_calls_alarm"  
--metric-name "unauthorized_api_calls_metric" --statistic Sum --period 300  
--threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --  
evaluation-periods 1 --namespace "CISBenchmark" --alarm-actions  
<sns_topic_arn>
```

References:







1. <https://aws.amazon.com/sns/>
2. CCE-79186-3
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
4. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
5. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6.5 <u>Central Log Management</u> Ensure that appropriate logs are being aggregated to a central log management system for analysis and review.			
v7	6.7 <u>Regularly Review Logs</u> On a regular basis, review logs to identify anomalies or abnormal events.			

4.2 Ensure management console sign-in without MFA is monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for console logins that are not protected by multi-factor authentication (MFA).

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring for single-factor console logins will increase visibility into accounts that are not protected by MFA. These type of accounts are more susceptible to compromise and unauthorized access.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails:

```
aws cloudtrail describe-trails
```

- Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
- From value associated with CloudWatchLogsLogGroupArn note <cloudtrail_log_group_name>

Example: for CloudWatchLogsLogGroupArn that looks like

arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,
<cloudtrail_log_group_name> would be NewGroup

- Ensure Identified Multi region CloudTrail is active


```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
```

Ensure in the output that `IsLogging` is set to `TRUE`

- Ensure identified Multi-region 'Cloudtrail' captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure in the output there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name  
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = \"ConsoleLogin\") &&  
($.additionalEventData.MFAUsed != \"Yes\") }"
```

Or (To reduce false positives incase Single Sign-On (SSO) is used in organization):

```
"filterPattern": "{ ($.eventName = \"ConsoleLogin\") &&  
($.additionalEventData.MFAUsed != \"Yes\") && ($.userIdentity.type = \"IAMUser\")  
&& ($.responseElements.ConsoleLogin = \"Success\") }"
```

4. Note the `<no_mfa_console_signin_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<no_mfa_console_signin_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==  
`<no_mfa_console_signin_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":  
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for AWS Management Console sign-in without MFA and the `<cloudtrail_log_group_name>` taken from audit step 1.

Use Command:

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --  
filter-name '<no_mfa_console_signin_metric>' --metric-transformations  
metricName= '<no_mfa_console_signin_metric>'  
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{  
($.eventName = "ConsoleLogin") && ($.additionalEventData.MFAUsed != "Yes") }'
```

Or (To reduce false positives incase Single Sign-On (SSO) is used in organization):

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --  
filter-name '<no_mfa_console_signin_metric>' --metric-transformations  
metricName= '<no_mfa_console_signin_metric>'  
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{  
($.eventName = "ConsoleLogin") && ($.additionalEventData.MFAUsed != "Yes") &&  
($.userIdentity.type = "IAMUser") && ($.responseElements.ConsoleLogin =  
"Success") }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> --  
notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<no_mfa_console_signin_alarm>' --  
metric-name '<no_mfa_console_signin_metric>' --statistic Sum --period 300  
--threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --  
evaluation-periods 1 --namespace 'CISBenchmark' --alarm-actions  
<sns_topic_arn>
```

References:



1. https://docs.aws.amazon.com/AmazonCloudWatch/latest/DeveloperGuide/viewing_metrics_with_cloudwatch.html
2. CCE-79187-1
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
4. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
5. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored -Filter pattern set to { (\$.eventName = "ConsoleLogin") && (\$.additionalEventData.MFAUsed != "Yes") && (\$.userIdentity.type = "IAMUser") && (\$.responseElements.ConsoleLogin = "Success")} reduces false alarms raised when user logs in via SSO account.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 Conduct Audit Log Reviews Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	16 Account Monitoring and Control Account Monitoring and Control			

4.3 Ensure usage of 'root' account is monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for 'root' login attempts to detect the unauthorized use, or attempts to use the root account.

Rationale:

Monitoring for 'root' account logins will provide visibility into the use of a fully privileged account and an opportunity to reduce the use of it.

Cloud Watch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails:

```
aws cloudtrail describe-trails
```

- Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
- From value associated with CloudWatchLogsLogGroupArn note <cloudtrail_log_group_name>

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ $.userIdentity.type = \"Root\" && $.userIdentity.invokedBy
NOT EXISTS && $.eventType != \"AwsServiceEvent\" }"
```

4. Note the `<root_usage_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<root_usage_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<root_usage_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for 'Root' account usage and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name `<cloudtrail_log_group_name>` --  
filter-name `<root_usage_metric>` --metric-transformations metricName=  
`<root_usage_metric>`,metricNamespace='CISBenchmark',metricValue=1 --filter-  
pattern '{ $.userIdentity.type = "Root" && $.userIdentity.invokedBy NOT  
EXISTS && $.eventType != "AwsServiceEvent" }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -  
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name `<root_usage_alarm>` --metric-  
name `<root_usage_metric>` --statistic Sum --period 300 --threshold 1 --  
comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1 --  
namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:





1. CCE-79188-9
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	4.9 <u>Log and Alert on Unsuccessful Administrative Account Login</u> Configure systems to issue a log entry and alert on unsuccessful logins to an administrative account.			

4.4 Ensure IAM policy changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established changes made to Identity and Access Management (IAM) policies.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring changes to IAM policies will help ensure authentication and authorization controls remain intact.

Impact:

Monitoring these changes may cause a number of "false positives" more so in larger environments. This alert may need more tuning then others to eliminate some of those erroneous alerts.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:

- List all CloudTrails:

```
aws cloudtrail describe-trails
```

- Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
- From value associated with CloudWatchLogsLogGroupArn note
<cloudtrail_log_group_name>

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```


- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-
trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern":
"{ ($.eventName=DeleteGroupPolicy) || ($.eventName=DeleteRolePolicy) || ($.eventNa
me=DeleteUserPolicy) || ($.eventName=PutGroupPolicy) || ($.eventName=PutRolePolic
y) || ($.eventName=PutUserPolicy) || ($.eventName=CreatePolicy) || ($.eventName=Del
etePolicy) || ($.eventName=CreatePolicyVersion) || ($.eventName=DeletePolicyVersi
on) || ($.eventName=AttachRolePolicy) || ($.eventName=DetachRolePolicy) || ($.event
Name=AttachUserPolicy) || ($.eventName=DetachUserPolicy) || ($.eventName=AttachGr
oupPolicy) || ($.eventName=DetachGroupPolicy) }"
```

4. Note the `<iam_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<iam_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<iam_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for IAM policy changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name '<cloudtrail_log_group_name>' --
filter-name '<iam_changes_metric>' --metric-transformations metricName=
'<iam_changes_metric>' ,metricNamespace='CISBenchmark',metricValue=1 --
filter-pattern
'{$.eventName=DeleteGroupPolicy)||($.eventName=DeleteRolePolicy)||($.eventNa
me=DeleteUserPolicy)||($.eventName=PutGroupPolicy)||($.eventName=PutRolePolic
y)||($.eventName=PutUserPolicy)||($.eventName=CreatePolicy)||($.eventName=Del
etePolicy)||($.eventName=CreatePolicyVersion)||($.eventName=DeletePolicyVersi
on)||($.eventName=AttachRolePolicy)||($.eventName=DetachRolePolicy)||($.event
Name=AttachUserPolicy)||($.eventName=DetachUserPolicy)||($.eventName=AttachGr
oupPolicy)||($.eventName=DetachGroupPolicy)}'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<iam_changes_alarm>' --
metric-name '<iam_changes_metric>' --statistic Sum --period 300 --threshold
1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1
--namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:



1. CCE-79189-7
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	16 <u>Account Monitoring and Control</u> Account Monitoring and Control			

4.5 Ensure CloudTrail configuration changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, where metric filters and alarms can be established.

It is recommended that a metric filter and alarm be utilized for detecting changes to CloudTrail's configurations.

Rationale:

Monitoring changes to CloudTrail's configuration will help ensure sustained visibility to activities performed in the AWS account.

Impact:

These steps can be performed manually in a company's existing SIEM platform in cases where CloudTrail logs are monitored outside of the AWS monitoring tools within CloudWatch.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured, or that the filters are configured in the appropriate SIEM alerts:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the `filterPattern` output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = CreateTrail) || ($.eventName =
UpdateTrail) || ($.eventName = DeleteTrail) || ($.eventName = StartLogging)
|| ($.eventName = StopLogging) }"
```

4. Note the `<cloudtrail_cfg_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<cloudtrail_cfg_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<cloudtrail_cfg_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for cloudtrail configuration changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<cloudtrail_cfg_changes_metric>' --metric-transformations
metricName= '<cloudtrail_cfg_changes_metric>'
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{
($.eventName = CreateTrail) || ($.eventName = UpdateTrail) || ($.eventName =
DeleteTrail) || ($.eventName = StartLogging) || ($.eventName = StopLogging)
}'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name
'<cloudtrail_cfg_changes_alarm>' --metric-name
'<cloudtrail_cfg_changes_metric>' --statistic Sum --period 300 --threshold 1
--comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1 --
namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:

1. CCE-79190-5
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored

- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.		●	●
v7	6 <u>Maintenance, Monitoring and Analysis of Audit Logs</u> Maintenance, Monitoring and Analysis of Audit Logs			

4.6 Ensure AWS Management Console authentication failures are monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for failed console authentication attempts.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring failed console logins may decrease lead time to detect an attempt to brute force a credential, which may provide an indicator, such as source IP address, that can be used in other event correlation.

Impact:

Monitoring for these failures may create a large number of alerts, more so in larger environments.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

`arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,`
`<cloudtrail_log_group_name>` would be NewGroup

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-
trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = ConsoleLogin) && ($.errorMessage = "Failed
authentication") }"
```

4. Note the `<console_signin_failure_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<console_signin_failure_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<console_signin_failure_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for AWS management Console Login Failures and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --  
filter-name '<console_signin_failure_metric>' --metric-transformations  
metricName= '<console_signin_failure_metric>'  
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{  
($.eventName = ConsoleLogin) && ($.errorMessage = "Failed authentication") }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -  
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name  
'<console_signin_failure_alarm>' --metric-name  
'<console_signin_failure_metric>' --statistic Sum --period 300 --threshold 1  
--comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1 --  
namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:



1. CCE-79191-3
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	16 <u>Account Monitoring and Control</u> Account Monitoring and Control			

4.7 Ensure disabling or scheduled deletion of customer created CMKs is monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for customer created CMKs which have changed state to disabled or scheduled deletion.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Data encrypted with disabled or deleted keys will no longer be accessible. Changes in the state of a CMK should be monitored to make sure the change is intentional.

Impact:

Creation, storage, and management of CMK may create additional labor requirements compared to the use of Provide Managed Keys.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-
trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventSource = kms.amazonaws.com) &&
(( $.eventName=DisableKey) || ($.eventName=ScheduleKeyDeletion)) }"
```

4. Note the `<disable_or_delete_cmk_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<disable_or_delete_cmk_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<disable_or_delete_cmk_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for disabled or scheduled for deletion CMK's and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --  
filter-name '<disable_or_delete_cmek_changes_metric>' --metric-  
transformations metricName= '<disable_or_delete_cmek_changes_metric>'  
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern  
'{ ($.eventSource = kms.amazonaws.com) &&  
(($.eventName=DisableKey)||($.eventName=ScheduleKeyDeletion)) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -  
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name  
'<disable_or_delete_cmek_changes_alarm>' --metric-name  
'<disable_or_delete_cmek_changes_metric>' --statistic Sum --period 300 --  
threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-  
periods 1 --namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:



1. CCE-79192-1
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	16 <u>Account Monitoring and Control</u> Account Monitoring and Control			

4.8 Ensure S3 bucket policy changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for changes to S3 bucket policies.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring changes to S3 bucket policies may reduce time to detect and correct permissive policies on sensitive S3 buckets.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

`arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,`
`<cloudtrail_log_group_name>` would be NewGroup

- Ensure Identified Multi region CloudTrail is active

`aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>`
ensure IsLogging is set to TRUE

- Ensure identified Multi-region Cloudtrail captures all Management Events


```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name  
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventSource = s3.amazonaws.com) && ($.eventName =  
PutBucketAcl) || ($.eventName = PutBucketPolicy) || ($.eventName =  
PutBucketCors) || ($.eventName = PutBucketLifecycle) || ($.eventName =  
PutBucketReplication) || ($.eventName = DeleteBucketPolicy) || ($.eventName =  
DeleteBucketCors) || ($.eventName = DeleteBucketLifecycle) || ($.eventName =  
DeleteBucketReplication)) }"
```

4. Note the `<s3_bucket_policy_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<s3_bucket_policy_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==  
`<s3_bucket_policy_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":  
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for S3 bucket policy changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<s3_bucket_policy_changes_metric>' --metric-transformations
metricName= '<s3_bucket_policy_changes_metric>'
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{
($.eventSource = s3.amazonaws.com) && (($.eventName = PutBucketAcl) ||
($.eventName = PutBucketPolicy) || ($.eventName = PutBucketCors) ||
($.eventName = PutBucketLifecycle) || ($.eventName = PutBucketReplication) ||
($.eventName = DeleteBucketPolicy) || ($.eventName = DeleteBucketCors) ||
($.eventName = DeleteBucketLifecycle) || ($.eventName =
DeleteBucketReplication)) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name
`s3_bucket_policy_changes_alarm` --metric-name
`s3_bucket_policy_changes_metric` --statistic Sum --period 300 --threshold
1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1
--namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:






1. CCE-79193-9
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	14 <u>Controlled Access Based on the Need to Know</u> Controlled Access Based on the Need to Know			

4.9 Ensure AWS Config configuration changes are monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms.

It is recommended that a metric filter and alarm be established for detecting changes to AWS Config's configurations.

Rationale:

Monitoring changes to AWS Config configuration will help ensure sustained visibility of configuration items within the AWS account.

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name  
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventSource = config.amazonaws.com) &&  
(($.eventName=StopConfigurationRecorder)||($.eventName=DeleteDeliveryChannel)  
||($.eventName=PutDeliveryChannel)||($.eventName=PutConfigurationRecorder))  
}"
```

4. Note the `<aws_config_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<aws_config_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==  
'<aws_config_changes_metric>']'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":  
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for AWS Configuration changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<aws_config_changes_metric>' --metric-transformations
metricName= '<aws_config_changes_metric>'
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{
($.eventSource = config.amazonaws.com) &&
(($.eventName=StopConfigurationRecorder)||($.eventName=DeleteDeliveryChannel)
||($.eventName=PutDeliveryChannel)||($.eventName=PutConfigurationRecorder))
}'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<aws_config_changes_alarm>' -
-metric-name '<aws_config_changes_metric>' --statistic Sum --period 300 --
threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-
periods 1 --namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:

1. CCE-79194-7
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored

- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.		●	●
v7	1.4 <u>Maintain Detailed Asset Inventory</u> Maintain an accurate and up-to-date inventory of all technology assets with the potential to store or process information. This inventory shall include all hardware assets, whether connected to the organization's network or not.	●	●	●
v7	11.2 <u>Document Traffic Configuration Rules</u> All configuration rules that allow traffic to flow through network devices should be documented in a configuration management system with a specific business reason for each rule, a specific individual's name responsible for that business need, and an expected duration of the need.		●	●
v7	16.1 <u>Maintain an Inventory of Authentication Systems</u> Maintain an inventory of each of the organization's authentication systems, including those located onsite or at a remote service provider.		●	●

4.10 Ensure security group changes are monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms. Security Groups are a stateful packet filter that controls ingress and egress traffic within a VPC.

It is recommended that a metric filter and alarm be established for detecting changes to Security Groups.

Rationale:

Monitoring changes to security group will help ensure that resources and services are not unintentionally exposed.

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Impact:

This may require additional 'tuning' to eliminate false positive and filter out expected activity so anomalies are easier to detect.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

`arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,
<cloudtrail_log_group_name>` would be NewGroup

- Ensure Identified Multi region CloudTrail is active


```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-
trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = AuthorizeSecurityGroupIngress) ||
($.eventName = AuthorizeSecurityGroupEgress) || ($.eventName =
RevokeSecurityGroupIngress) || ($.eventName = RevokeSecurityGroupEgress) ||
($.eventName = CreateSecurityGroup) || ($.eventName = DeleteSecurityGroup) }"
```

4. Note the `<security_group_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<security_group_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query "MetricAlarms[?MetricName==
'<security_group_changes_metric>']"
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for security groups changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name "<cloudtrail_log_group_name>" --
filter-name "<security_group_changes_metric>" --metric-transformations
metricName= "<security_group_changes_metric>"
,metricNamespace="CISBenchmark",metricValue=1 --filter-pattern "{
($.eventName = AuthorizeSecurityGroupIngress) || ($.eventName =
AuthorizeSecurityGroupEgress) || ($.eventName = RevokeSecurityGroupIngress)
|| ($.eventName = RevokeSecurityGroupEgress) || ($.eventName =
CreateSecurityGroup) || ($.eventName = DeleteSecurityGroup) }"
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name "<sns_topic_name>"
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn "<sns_topic_arn>" --protocol <protocol_for_sns>
--notification-endpoint "<sns_subscription_endpoints>"
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name
"<security_group_changes_alarm>" --metric-name
"<security_group_changes_metric>" --statistic Sum --period 300 --threshold 1
--comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1 --
namespace "CISBenchmark" --alarm-actions "<sns_topic_arn>"
```

References:

1. CCE-79195-4
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>












Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored

- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

4.11 Ensure Network Access Control Lists (NACL) changes are monitored (Manual)

Profile Applicability:

- Level 2

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms. NACLs are used as a stateless packet filter to control ingress and egress traffic for subnets within a VPC. It is recommended that a metric filter and alarm be established for changes made to NACLs.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring changes to NACLs will help ensure that AWS resources and services are not unintentionally exposed.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = CreateNetworkAcl) || ($.eventName =
CreateNetworkAclEntry) || ($.eventName = DeleteNetworkAcl) || ($.eventName =
DeleteNetworkAclEntry) || ($.eventName = ReplaceNetworkAclEntry) ||
($.eventName = ReplaceNetworkAclAssociation) }"
```

4. Note the `<nac1_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<nac1_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<nac1_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for NACL changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<nacl_changes_metric>' --metric-transformations metricName=
'<nacl_changes_metric>' ,metricNamespace='CISBenchmark',metricValue=1 --
filter-pattern '{ ($.eventName = CreateNetworkAcl) || ($.eventName =
CreateNetworkAclEntry) || ($.eventName = DeleteNetworkAcl) || ($.eventName =
DeleteNetworkAclEntry) || ($.eventName = ReplaceNetworkAclEntry) ||
($.eventName = ReplaceNetworkAclAssociation) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<nacl_changes_alarm>' --
metric-name '<nacl_changes_metric>' --statistic Sum --period 300 --
threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-
periods 1 --namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:





1. CCE-79196-2
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	11.3 <u>Use Automated Tools to Verify Standard Device Configurations and Detect Changes</u> Compare all network device configuration against approved security configurations defined for each network device in use and alert when any deviations are discovered.			

4.12 Ensure changes to network gateways are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms. Network gateways are required to send/receive traffic to a destination outside of a VPC. It is recommended that a metric filter and alarm be established for changes to network gateways.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring changes to network gateways will help ensure that all ingress/egress traffic traverses the VPC border via a controlled path.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

`arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,`
`<cloudtrail_log_group_name>` would be NewGroup

- Ensure Identified Multi region CloudTrail is active

`aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>`
ensure IsLogging is set to TRUE

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = CreateCustomerGateway) || ($.eventName =
DeleteCustomerGateway) || ($.eventName = AttachInternetGateway) ||
($.eventName = CreateInternetGateway) || ($.eventName =
DeleteInternetGateway) || ($.eventName = DetachInternetGateway) }"
```

4. Note the `<network_gw_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<network_gw_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<network_gw_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for network gateways changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<network_gw_changes_metric>' --metric-transformations
metricName= '<network_gw_changes_metric>'
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{
($.eventName = CreateCustomerGateway) || ($.eventName =
DeleteCustomerGateway) || ($.eventName = AttachInternetGateway) ||
($.eventName = CreateInternetGateway) || ($.eventName =
DeleteInternetGateway) || ($.eventName = DetachInternetGateway) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<network_gw_changes_alarm>' -
-metric-name '<network_gw_changes_metric>' --statistic Sum --period 300 --
threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-
periods 1 --namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:

1. CCE-79197-0
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored

- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	<u>8.11 Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.		●	●
v7	<u>6.2 Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.	●	●	●
v7	<u>11.3 Use Automated Tools to Verify Standard Device Configurations and Detect Changes</u> Compare all network device configuration against approved security configurations defined for each network device in use and alert when any deviations are discovered.		●	●

4.13 Ensure route table changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms. Routing tables are used to route network traffic between subnets and to network gateways. It is recommended that a metric filter and alarm be established for changes to route tables.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring changes to route tables will help ensure that all VPC traffic flows through an expected path and prevent any accidental or intentional modifications that may lead to uncontrolled network traffic. An alarm should be triggered every time an AWS API call is performed to create, replace, delete, or disassociate a Route Table.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```

- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name  
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = CreateRoute) || ($.eventName =  
CreateRouteTable) || ($.eventName = ReplaceRoute) || ($.eventName =  
ReplaceRouteTableAssociation) || ($.eventName = DeleteRouteTable) ||  
($.eventName = DeleteRoute) || ($.eventName = DisassociateRouteTable) }"
```

4. Note the `<route_table_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<route_table_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==  
'<route_table_changes_metric>']'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":  
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for route table changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<route_table_changes_metric>' --metric-transformations
metricName= '<route_table_changes_metric>'
,metricNamespace='CISBenchmark',metricValue=1 --filter-pattern '{
($.eventName = CreateRoute) || ($.eventName = CreateRouteTable) ||
($.eventName = ReplaceRoute) || ($.eventName = ReplaceRouteTableAssociation)
|| ($.eventName = DeleteRouteTable) || ($.eventName = DeleteRoute) ||
($.eventName = DisassociateRouteTable) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<route_table_changes_alarm>'
--metric-name '<route_table_changes_metric>' --statistic Sum --period 300 -
-threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --
evaluation-periods 1 --namespace 'CISBenchmark' --alarm-actions
<sns_topic_arn>
```

References:

1. CCE-79198-8
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>








Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored

- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	11.3 <u>Use Automated Tools to Verify Standard Device Configurations and Detect Changes</u> Compare all network device configuration against approved security configurations defined for each network device in use and alert when any deviations are discovered.			

4.14 Ensure VPC changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, or an external Security information and event management (SIEM) environment, and establishing corresponding metric filters and alarms. It is possible to have more than 1 VPC within an account, in addition it is also possible to create a peer connection between 2 VPCs enabling network traffic to route between VPCs. It is recommended that a metric filter and alarm be established for changes made to VPCs.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

VPCs in AWS are logically isolated virtual networks that can be used to launch AWS resources. Monitoring changes to VPC configuration will help ensure VPC traffic flow is not getting impacted. Changes to VPCs can impact network accessibility from the public internet and additionally impact VPC traffic flow to and from resources launched in the VPC.

Audit:

If you are using CloudTrails and CloudWatch, perform the following to ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:

1. Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails: `aws cloudtrail describe-trails`
 - Identify Multi region Cloudtrails: Trails with "IsMultiRegionTrail" set to true
 - From value associated with CloudWatchLogsLogGroupArn note `<cloudtrail_log_group_name>`

Example: for CloudWatchLogsLogGroupArn that looks like

```
arn:aws:logs:<region>:<aws_account_number>:log-group:NewGroup:*,  
<cloudtrail_log_group_name> would be NewGroup
```

- Ensure Identified Multi region CloudTrail is active

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>  
ensure IsLogging is set to TRUE
```


- Ensure identified Multi-region Cloudtrail captures all Management Events

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to `true` and `ReadWriteType` set to `All`

2. Get a list of all associated metric filters for this `<cloudtrail_log_group_name>`:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventName = CreateVpc) || ($.eventName = DeleteVpc) ||
($.eventName = ModifyVpcAttribute) || ($.eventName =
AcceptVpcPeeringConnection) || ($.eventName = CreateVpcPeeringConnection) ||
($.eventName = DeleteVpcPeeringConnection) || ($.eventName =
RejectVpcPeeringConnection) || ($.eventName = AttachClassicLinkVpc) ||
($.eventName = DetachClassicLinkVpc) || ($.eventName = DisableVpcClassicLink)
|| ($.eventName = EnableVpcClassicLink) }"
```

4. Note the `<vpc_changes_metric>` value associated with the `filterPattern` found in step 3.
5. Get a list of CloudWatch alarms and filter on the `<vpc_changes_metric>` captured in step 4.

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<vpc_changes_metric>`]'
```

6. Note the `AlarmActions` value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

```
Example of valid "SubscriptionArn":
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for VPC changes and the `<cloudtrail_log_group_name>` taken from audit step 1.

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name '<vpc_changes_metric>' --metric-transformations metricName=
'<vpc_changes_metric>' ,metricNamespace='CISBenchmark',metricValue=1 --
filter-pattern '{ ($.eventName = CreateVpc) || ($.eventName = DeleteVpc) ||
($.eventName = ModifyVpcAttribute) || ($.eventName =
AcceptVpcPeeringConnection) || ($.eventName = CreateVpcPeeringConnection) ||
($.eventName = DeleteVpcPeeringConnection) || ($.eventName =
RejectVpcPeeringConnection) || ($.eventName = AttachClassicLinkVpc) ||
($.eventName = DetachClassicLinkVpc) || ($.eventName = DisableVpcClassicLink)
|| ($.eventName = EnableVpcClassicLink) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2

```
aws cloudwatch put-metric-alarm --alarm-name '<vpc_changes_alarm>' --
metric-name '<vpc_changes_metric>' --statistic Sum --period 300 --threshold
1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-periods 1
--namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:





1. CCE-79199-6
2. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/receive-cloudtrail-log-files-from-multiple-regions.html>
3. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>
4. <https://docs.aws.amazon.com/sns/latest/dg/SubscribeTopic.html>

Additional Information:

Configuring log metric filter and alarm on Multi-region (global) CloudTrail

- ensures that activities from all regions (used as well as unused) are monitored
- ensures that activities on all supported global services are monitored
- ensures that all management events across all regions are monitored

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	5.5 <u>Implement Automated Configuration Monitoring Systems</u> Utilize a Security Content Automation Protocol (SCAP) compliant configuration monitoring system to verify all security configuration elements, catalog approved exceptions, and alert when unauthorized changes occur.			

4.15 Ensure AWS Organizations changes are monitored (Manual)

Profile Applicability:

- Level 1

Description:

Real-time monitoring of API calls can be achieved by directing CloudTrail Logs to CloudWatch Logs, and establishing corresponding metric filters and alarms. It is recommended that a metric filter and alarm be established for AWS Organizations changes made in the master AWS Account.

Rationale:

CloudWatch is an AWS native service that allows you to observe and monitor resources and applications. CloudTrail Logs can also be sent to an external Security information and event management (SIEM) environment for monitoring and alerting.

Monitoring AWS Organizations changes can help you prevent any unwanted, accidental or intentional modifications that may lead to unauthorized access or other security breaches. This monitoring technique helps you to ensure that any unexpected changes performed within your AWS Organizations can be investigated and any unwanted changes can be rolled back.

Audit:

If you are using CloudTrails and CloudWatch, perform the following:

1. Ensure that there is at least one active multi-region CloudTrail with prescribed metric filters and alarms configured:
 - Identify the log group name configured for use with active multi-region CloudTrail:
 - List all CloudTrails:

```
aws cloudtrail describe-trails
```

- Identify Multi region Cloudtrails, Trails with "IsMultiRegionTrail" set to true
- From value associated with CloudWatchLogsLogGroupArn note
<cloudtrail_log_group_name>
Example: for CloudWatchLogsLogGroupArn that looks like
arn:aws:logs::<aws_account_number>:log-group:NewGroup:*,
<cloudtrail_log_group_name> would be NewGroup
- Ensure Identified Multi region CloudTrail is active:

```
aws cloudtrail get-trail-status --name <Name of a Multi-region CloudTrail>
```

Ensure IsLogging is set to TRUE

- Ensure identified Multi-region Cloudtrail captures all Management Events:

```
aws cloudtrail get-event-selectors --trail-name <trailname shown in describe-trails>
```

- Ensure there is at least one Event Selector for a Trail with `IncludeManagementEvents` set to true and `ReadWriteType` set to All.

2. Get a list of all associated metric filters for this <cloudtrail_log_group_name>:

```
aws logs describe-metric-filters --log-group-name
"<cloudtrail_log_group_name>"
```

3. Ensure the output from the above command contains the following:

```
"filterPattern": "{ ($.eventSource = organizations.amazonaws.com) &&
(($.eventName = "AcceptHandshake") || ($.eventName = "AttachPolicy") ||
($.eventName = "CreateAccount") || ($.eventName = "CreateOrganizationalUnit")
|| ($.eventName = "CreatePolicy") || ($.eventName = "DeclineHandshake") ||
($.eventName = "DeleteOrganization") || ($.eventName =
"DeleteOrganizationalUnit") || ($.eventName = "DeletePolicy") ||
($.eventName = "DetachPolicy") || ($.eventName = "DisablePolicyType") ||
($.eventName = "EnablePolicyType") || ($.eventName =
"InviteAccountToOrganization") || ($.eventName = "LeaveOrganization") ||
($.eventName = "MoveAccount") || ($.eventName =
"RemoveAccountFromOrganization") || ($.eventName = "UpdatePolicy") ||
($.eventName = "UpdateOrganizationalUnit")) }"
```

4. Note the <organizations_changes> value associated with the filterPattern found in step 3.
5. Get a list of CloudWatch alarms and filter on the <organizations_changes> captured in step 4:

```
aws cloudwatch describe-alarms --query 'MetricAlarms[?MetricName==
`<organizations_changes>`]'
```

6. Note the AlarmActions value - this will provide the SNS topic ARN value.
7. Ensure there is at least one active subscriber to the SNS topic:

```
aws sns list-subscriptions-by-topic --topic-arn <sns_topic_arn>
```

at least one subscription should have "SubscriptionArn" with valid aws ARN.

Example of valid "SubscriptionArn":

```
"arn:aws:sns:<region>:<aws_account_number>:<SnsTopicName>:<SubscriptionID>"
```

Remediation:

If you are using CloudTrails and CloudWatch, perform the following to setup the metric filter, alarm, SNS topic, and subscription:

1. Create a metric filter based on filter pattern provided which checks for AWS Organizations changes and the <cloudtrail_log_group_name> taken from audit step 1:

```
aws logs put-metric-filter --log-group-name <cloudtrail_log_group_name> --
filter-name `<organizations_changes>` --metric-transformations metricName=
`<organizations_changes>`,metricNamespace='CISBenchmark',metricValue=1 --
filter-pattern '{ ($.eventSource = organizations.amazonaws.com) &&
(($.eventName = "AcceptHandshake") || ($.eventName = "AttachPolicy") ||
($.eventName = "CreateAccount") || ($.eventName = "CreateOrganizationalUnit")
|| ($.eventName = "CreatePolicy") || ($.eventName = "DeclineHandshake") ||
($.eventName = "DeleteOrganization") || ($.eventName =
"DeleteOrganizationalUnit") || ($.eventName = "DeletePolicy") ||
($.eventName = "DetachPolicy") || ($.eventName = "DisablePolicyType") ||
($.eventName = "EnablePolicyType") || ($.eventName =
"InviteAccountToOrganization") || ($.eventName = "LeaveOrganization") ||
($.eventName = "MoveAccount") || ($.eventName =
"RemoveAccountFromOrganization") || ($.eventName = "UpdatePolicy") ||
($.eventName = "UpdateOrganizationalUnit")) }'
```

Note: You can choose your own metricName and metricNamespace strings. Using the same metricNamespace for all Foundations Benchmark metrics will group them together.

2. Create an SNS topic that the alarm will notify:

```
aws sns create-topic --name <sns_topic_name>
```

Note: you can execute this command once and then re-use the same topic for all monitoring alarms.

3. Create an SNS subscription to the topic created in step 2:

```
aws sns subscribe --topic-arn <sns_topic_arn> --protocol <protocol_for_sns> -
-notification-endpoint <sns_subscription_endpoints>
```

Note: you can execute this command once and then re-use the SNS subscription for all monitoring alarms.

4. Create an alarm that is associated with the CloudWatch Logs Metric Filter created in step 1 and an SNS topic created in step 2:









```
aws cloudwatch put-metric-alarm --alarm-name `<organizations_changes>` --
metric-name `<organizations_changes>` --statistic Sum --period 300 --
threshold 1 --comparison-operator GreaterThanOrEqualToThreshold --evaluation-
periods 1 --namespace 'CISBenchmark' --alarm-actions <sns_topic_arn>
```

References:

1. <https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudwatch-alarms-for-cloudtrail.html>

2. https://docs.aws.amazon.com/organizations/latest/userguide/orgs_security_incident-response.html

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	8.11 <u>Conduct Audit Log Reviews</u> Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.			
v7	6.2 <u>Activate audit logging</u> Ensure that local logging has been enabled on all systems and networking devices.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

4.16 Ensure AWS Security Hub is enabled (Automated)

Profile Applicability:

- Level 2

Description:

Security Hub collects security data from across AWS accounts, services, and supported third-party partner products and helps you analyze your security trends and identify the highest priority security issues. When you enable Security Hub, it begins to consume, aggregate, organize, and prioritize findings from AWS services that you have enabled, such as Amazon GuardDuty, Amazon Inspector, and Amazon Macie. You can also enable integrations with AWS partner security products.

Rationale:

AWS Security Hub provides you with a comprehensive view of your security state in AWS and helps you check your environment against security industry standards and best practices - enabling you to quickly assess the security posture across your AWS accounts.

Impact:

It is recommended AWS Security Hub be enabled in all regions. AWS Security Hub requires AWS Config to be enabled.

Audit:

The process to evaluate AWS Security Hub configuration per region

From Console:

1. Sign in to the AWS Management Console and open the AWS Security Hub console at <https://console.aws.amazon.com/securityhub/>.
2. On the top right of the console, select the target Region.
3. If presented with the Security Hub > Summary page then Security Hub is set-up for the selected region.
4. If presented with Setup Security Hub or Get Started With Security Hub - follow the online instructions.
5. Repeat steps 2 to 4 for each region.

From Command Line:

Run the following to list the Securityhub status:

```
aws securityhub describe-hub
```

This will list the Securityhub status by region. Audit for the presence of a 'SubscribedAt' value

Example output:


```
{
  "HubArn": "<Securityhub ARN>",
  "SubscribedAt": "2022-08-19T17:06:42.398Z",
  "AutoEnableControls": true
}
```

An error will be returned if Securityhub is not enabled.

Example error:

```
An error occurred (InvalidAccessException) when calling the DescribeHub
operation: Account <Account ID> is not subscribed to AWS Security Hub
```

Remediation:

To grant the permissions required to enable Security Hub, attach the Security Hub managed policy `AWSSecurityHubFullAccess` to an IAM user, group, or role.

Enabling Security Hub

From Console:

1. Use the credentials of the IAM identity to sign in to the Security Hub console.
2. When you open the Security Hub console for the first time, choose **Enable AWS Security Hub**.
3. On the welcome page, Security standards list the security standards that Security Hub supports.
4. Choose **Enable Security Hub**.

From Command Line:

1. Run the `enable-security-hub` command. To enable the default standards, include `--enable-default-standards`.

```
aws securityhub enable-security-hub --enable-default-standards
```



2. To enable the security hub without the default standards, include `--no-enable-default-standards`.

```
aws securityhub enable-security-hub --no-enable-default-standards
```

References:

1. <https://docs.aws.amazon.com/securityhub/latest/userguide/securityhub-get-started.html>
2. <https://docs.aws.amazon.com/securityhub/latest/userguide/securityhub-enable.html#securityhub-enable-api>
3. <https://awscli.amazonaws.com/v2/documentation/api/latest/reference/securityhub/enable-security-hub.html>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v7	<u>11.3 Use Automated Tools to Verify Standard Device Configurations and Detect Changes</u> Compare all network device configuration against approved security configurations defined for each network device in use and alert when any deviations are discovered.			

5 Networking

This section contains recommendations for configuring security-related aspects of AWS Virtual Private Cloud (VPC).

5.1 Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports (Automated)

Profile Applicability:

- Level 1

Description:

The Network Access Control List (NACL) function provide stateless filtering of ingress and egress network traffic to AWS resources. It is recommended that no NACL allows unrestricted ingress access to remote server administration ports, such as SSH to port 22 and RDP to port 3389, using either the TDP (6), UDP (17) or ALL (-1) protocols

Rationale:

Public access to remote server administration ports, such as 22 and 3389, increases resource attack surface and unnecessarily raises the risk of resource compromise.

Audit:

From Console:

Perform the following to determine if the account is configured as prescribed:

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. In the left pane, click `Network ACLs`
3. For each network ACL, perform the following:
 - Select the network ACL
 - Click the `Inbound Rules` tab
 - Ensure no rule exists that has a port range that includes port 22, 3389, using the protocols TDP (6), UDP (17) or ALL (-1) or other remote server administration ports for your environment and has a `Source` of `0.0.0.0/0` and shows `ALLOW`

Note: A Port value of `ALL` or a port range such as `0-1024` are inclusive of port 22, 3389, and other remote server administration ports

Remediation:

From Console:

Perform the following:

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. In the left pane, click `Network ACLs`
3. For each network ACL to remediate, perform the following:
 - Select the network ACL

- Click the `Inbound Rules` tab
- Click `Edit inbound rules`
- Either A) update the `Source` field to a range other than `0.0.0.0/0`, or, B)
Click `Delete` to remove the offending inbound rule
- Click `Save`

References:

1. <https://docs.aws.amazon.com/vpc/latest/userguide/vpc-network-acls.html>
2. https://docs.aws.amazon.com/vpc/latest/userguide/VPC_Security.html#VPC_Security_Comparison

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v7	9.2 <u>Ensure Only Approved Ports, Protocols and Services Are Running</u> Ensure that only network ports, protocols, and services listening on a system with validated business needs, are running on each system.		●	●
v7	12.4 <u>Deny Communication over Unauthorized Ports</u> Deny communication over unauthorized TCP or UDP ports or application traffic to ensure that only authorized protocols are allowed to cross the network boundary in or out of the network at each of the organization's network boundaries.	●	●	●

5.2 Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports (Automated)

Profile Applicability:

- Level 1

Description:

Security groups provide stateful filtering of ingress and egress network traffic to AWS resources. It is recommended that no security group allows unrestricted ingress access to remote server administration ports, such as SSH to port 22 and RDP to port 3389, using either the TDP (6), UDP (17) or ALL (-1) protocols

Rationale:

Public access to remote server administration ports, such as 22 and 3389, increases resource attack surface and unnecessarily raises the risk of resource compromise.

Impact:

When updating an existing environment, ensure that administrators have access to remote server administration ports through another mechanism before removing access by deleting the 0.0.0.0/0 inbound rule.

Audit:

Perform the following to determine if the account is configured as prescribed:

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. In the left pane, click `Security Groups`
3. For each security group, perform the following:
4. Select the security group
5. Click the `Inbound Rules` tab
6. Ensure no rule exists that has a port range that includes port 22, 3389, using the protocols TDP (6), UDP (17) or ALL (-1) or other remote server administration ports for your environment and has a `Source` of `0.0.0.0/0`

Note: A Port value of `ALL` or a port range such as `0-1024` are inclusive of port 22, 3389, and other remote server administration ports.

Remediation:

Perform the following to implement the prescribed state:






1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>

2. In the left pane, click `Security Groups`
3. For each security group, perform the following:
4. Select the security group
5. Click the `Inbound Rules` tab
6. Click the `Edit inbound rules` button
7. Identify the rules to be edited or removed
8. Either A) update the Source field to a range other than 0.0.0.0/0, or, B) Click `Delete` to remove the offending inbound rule
9. Click `Save rules`

References:

1. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-security-groups.html#deleting-security-group-rule>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v7	9.2 <u>Ensure Only Approved Ports, Protocols and Services Are Running</u> Ensure that only network ports, protocols, and services listening on a system with validated business needs, are running on each system.			
v7	12.4 <u>Deny Communication over Unauthorized Ports</u> Deny communication over unauthorized TCP or UDP ports or application traffic to ensure that only authorized protocols are allowed to cross the network boundary in or out of the network at each of the organization's network boundaries.			

5.3 Ensure no security groups allow ingress from `::/0` to remote server administration ports (Automated)

Profile Applicability:

- Level 1

Description:

Security groups provide stateful filtering of ingress and egress network traffic to AWS resources. It is recommended that no security group allows unrestricted ingress access to remote server administration ports, such as SSH to port 22 and RDP to port 3389.

Rationale:

Public access to remote server administration ports, such as 22 and 3389, increases resource attack surface and unnecessarily raises the risk of resource compromise.

Impact:

When updating an existing environment, ensure that administrators have access to remote server administration ports through another mechanism before removing access by deleting the `::/0` inbound rule.

Audit:

Perform the following to determine if the account is configured as prescribed:

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. In the left pane, click `Security Groups`
3. For each security group, perform the following:
4. Select the security group
5. Click the `Inbound Rules` tab
6. Ensure no rule exists that has a port range that includes port 22, 3389, or other remote server administration ports for your environment and has a `Source` of `::/0`

Note: A Port value of `ALL` or a port range such as `0-1024` are inclusive of port 22, 3389, and other remote server administration ports.

Remediation:

Perform the following to implement the prescribed state:






1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. In the left pane, click `Security Groups`
3. For each security group, perform the following:

4. Select the security group
5. Click the `Inbound Rules` tab
6. Click the `Edit inbound rules` button
7. Identify the rules to be edited or removed
8. Either A) update the Source field to a range other than `::/0`, or, B) Click `Delete` to remove the offending inbound rule
9. Click `Save rules`

References:

1. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-security-groups.html#deleting-security-group-rule>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v7	9.2 <u>Ensure Only Approved Ports, Protocols and Services Are Running</u> Ensure that only network ports, protocols, and services listening on a system with validated business needs, are running on each system.			
v7	12.4 <u>Deny Communication over Unauthorized Ports</u> Deny communication over unauthorized TCP or UDP ports or application traffic to ensure that only authorized protocols are allowed to cross the network boundary in or out of the network at each of the organization's network boundaries.			

5.4 Ensure the default security group of every VPC restricts all traffic (Automated)

Profile Applicability:

- Level 2

Description:

A VPC comes with a default security group whose initial settings deny all inbound traffic, allow all outbound traffic, and allow all traffic between instances assigned to the security group. If you don't specify a security group when you launch an instance, the instance is automatically assigned to this default security group. Security groups provide stateful filtering of ingress/egress network traffic to AWS resources. It is recommended that the default security group restrict all traffic.

The default VPC in every region should have its default security group updated to comply. Any newly created VPCs will automatically contain a default security group that will need remediation to comply with this recommendation.

NOTE: When implementing this recommendation, VPC flow logging is invaluable in determining the least privilege port access required by systems to work properly because it can log all packet acceptances and rejections occurring under the current security groups. This dramatically reduces the primary barrier to least privilege engineering - discovering the minimum ports required by systems in the environment. Even if the VPC flow logging recommendation in this benchmark is not adopted as a permanent security measure, it should be used during any period of discovery and engineering for least privileged security groups.

Rationale:

Configuring all VPC default security groups to restrict all traffic will encourage least privilege security group development and mindful placement of AWS resources into security groups which will in-turn reduce the exposure of those resources.

Impact:

Implementing this recommendation in an existing VPC containing operating resources requires extremely careful migration planning as the default security groups are likely to be enabling many ports that are unknown. Enabling VPC flow logging (of accepts) in an existing environment that is known to be breach free will reveal the current pattern of ports being used for each instance to communicate successfully.

Audit:

Perform the following to determine if the account is configured as prescribed:
Security Group State

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. Repeat the next steps for all VPCs - including the default VPC in each AWS region:
3. In the left pane, click `Security Groups`
4. For each default security group, perform the following:
5. Select the `default` security group
6. Click the `Inbound Rules` tab
7. Ensure no rule exist
8. Click the `Outbound Rules` tab
9. Ensure no rules exist

Security Group Members

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. Repeat the next steps for all default groups in all VPCs - including the default VPC in each AWS region:
3. In the left pane, click `Security Groups`
4. Copy the id of the default security group.
5. Change to the EC2 Management Console at <https://console.aws.amazon.com/ec2/v2/home>
6. In the filter column type 'Security Group ID : < security group id from #4 >'

Remediation:

Security Group Members

Perform the following to implement the prescribed state:

1. Identify AWS resources that exist within the default security group
2. Create a set of least privilege security groups for those resources
3. Place the resources in those security groups
4. Remove the resources noted in #1 from the default security group

Security Group State

1. Login to the AWS Management Console at <https://console.aws.amazon.com/vpc/home>
2. Repeat the next steps for all VPCs - including the default VPC in each AWS region:
3. In the left pane, click `Security Groups`
4. For each default security group, perform the following:
5. Select the `default` security group
6. Click the `Inbound Rules` tab
7. Remove any inbound rules
8. Click the `Outbound Rules` tab

9. Remove any Outbound rules







Recommended:

IAM groups allow you to edit the "name" field. After remediating default groups rules for all VPCs in all regions, edit this field to add text similar to "DO NOT USE. DO NOT ADD RULES"

References:

1. CCE-79201-0
2. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/using-network-security.html>
3. <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-security-groups.html#default-security-group>

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

5.5 Ensure routing tables for VPC peering are "least access" (Manual)

Profile Applicability:

- Level 2

Description:

Once a VPC peering connection is established, routing tables must be updated to establish any connections between the peered VPCs. These routes can be as specific as desired - even peering a VPC to only a single host on the other side of the connection.

Rationale:

Being highly selective in peering routing tables is a very effective way of minimizing the impact of breach as resources outside of these routes are inaccessible to the peered VPC.

Audit:

Review routing tables of peered VPCs for whether they route all subnets of each VPC and whether that is necessary to accomplish the intended purposes for peering the VPCs.

From Command Line:

1. List all the route tables from a VPC and check if "GatewayId" is pointing to a *<peering_connection_id>* (e.g. pcx-1a2b3c4d) and if "DestinationCidrBlock" is as specific as desired.

```
aws ec2 describe-route-tables --filter "Name=vpc-id,Values=<vpc_id>" --query "RouteTables[*].{RouteTableId:RouteTableId, VpcId:VpcId, Routes:Routes, AssociatedSubnets:Associations[*].SubnetId}"
```

Remediation:

Remove and add route table entries to ensure that the least number of subnets or hosts as is required to accomplish the purpose for peering are routable.

From Command Line:

1. For each *<route_table_id>* containing routes non compliant with your routing policy (which grants more than desired "least access"), delete the non compliant route:

```
aws ec2 delete-route --route-table-id <route_table_id> --destination-cidr-block <non_compliant_destination_CIDR>
```

2. Create a new compliant route:

```
aws ec2 create-route --route-table-id <route_table_id> --destination-cidr-block <compliant_destination_CIDR> --vpc-peering-connection-id <peering_connection_id>
```







References:

1. <https://docs.aws.amazon.com/AmazonVPC/latest/PeeringGuide/peering-configurations-partial-access.html>
2. <https://docs.aws.amazon.com/cli/latest/reference/ec2/create-vpc-peering-connection.html>

Additional Information:

If an organization has AWS transit gateway implemented in their VPC architecture they should look to apply the recommendation above for "least access" routing architecture at the AWS transit gateway level in combination with what must be implemented at the standard VPC route table. More specifically, to route traffic between two or more VPCs via a transit gateway VPCs must have an attachment to a transit gateway route table as well as a route, therefore to avoid routing traffic between VPCs an attachment to the transit gateway route table should only be added where there is an intention to route traffic between the VPCs. As transit gateways are able to host multiple route tables it is possible to group VPCs by attaching them to a common route table.

CIS Controls:

Controls Version	Control	IG 1	IG 2	IG 3
v8	3.3 <u>Configure Data Access Control Lists</u> Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.			
v7	14.6 <u>Protect Information through Access Control Lists</u> Protect all information stored on systems with file system, network share, claims, application, or database specific access control lists. These controls will enforce the principle that only authorized individuals should have access to the information based on their need to access the information as a part of their responsibilities.			

5.6 Ensure that EC2 Metadata Service only allows IMDSv2 (Automated)

Profile Applicability:

- Level 1

Description:

When enabling the Metadata Service on AWS EC2 instances, users have the option of using either Instance Metadata Service Version 1 (IMDSv1; a request/response method) or Instance Metadata Service Version 2 (IMDSv2; a session-oriented method).

Rationale:

Allowing Version 1 of the service may open EC2 instances to Server-Side Request Forgery (SSRF) attacks, so Amazon recommends utilizing Version 2 for better instance security.

Audit:

From Console:

1. Login to AWS Management Console and open the Amazon EC2 console using <https://console.aws.amazon.com/ec2/>
2. Under the Instances menu, select Instances.
3. For each Instance, select the instance, then choose Actions > Modify instance metadata options.
4. If the Instance metadata service is enabled, verify whether IMDSv2 is set to required.

From Command Line:

1. Use the describe-instances CLI command
2. Ensure for all ec2 instances that the metadata-options.http-tokens setting is set to required.
3. Repeat for all active regions.

```
aws ec2 describe-instances --filters "Name=metadata-options.http-tokens", "Values=optional" "Name=metadata-options.state", "Values=applied" --query "Reservations[*].Instances[*]."
```

Remediation:

From Console:

1. Login to AWS Management Console and open the Amazon EC2 console using <https://console.aws.amazon.com/ec2/>

2. Under the Instances menu, select Instances.
3. For each Instance, select the instance, then choose Actions > Modify instance metadata options.
4. If the Instance metadata service is enabled, set IMDSv2 to Required.

From Command Line:

```
aws ec2 modify-instance-metadata-options --instance-id <instance_id> --http-tokens required
```

References:

1. <https://aws.amazon.com/blogs/security/defense-in-depth-open-firewalls-reverse-proxies-ssrf-vulnerabilities-ec2-instance-metadata-service/>
2. <https://docs.aws.amazon.com/cli/latest/reference/ec2/describe-instances.html>

Appendix: Summary Table

CIS Benchmark Recommendation		Set Correctly	
		Yes	No
1	Identity and Access Management		
1.1	Maintain current contact details (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.3	Ensure security questions are registered in the AWS account (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.8	Ensure IAM password policy requires minimum length of 14 or greater (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.11	Do not setup access keys during initial user setup for all IAM users that have a console password (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled (Automated)	<input type="checkbox"/>	<input type="checkbox"/>

CIS Benchmark Recommendation		Set Correctly	
		Yes	No
1.13	Ensure there is only one active access key available for any single IAM user (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.14	Ensure access keys are rotated every 90 days or less (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.15	Ensure IAM Users Receive Permissions Only Through Groups (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.16	Ensure IAM policies that allow full "*" administrative privileges are not attached (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.17	Ensure a support role has been created to manage incidents with AWS Support (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.18	Ensure IAM instance roles are used for AWS resource access from instances (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.19	Ensure that all the expired SSL/TLS certificates stored in AWS IAM are removed (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
1.21	Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
1.22	Ensure access to AWS CloudShellFullAccess is restricted (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
2	Storage		
2.1	Simple Storage Service (S3)		
2.1.1	Ensure S3 Bucket Policy is set to deny HTTP requests (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required. (Manual)	<input type="checkbox"/>	<input type="checkbox"/>

CIS Benchmark Recommendation		Set Correctly	
		Yes	No
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)' (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.2	Elastic Compute Cloud (EC2)		
2.2.1	Ensure EBS Volume Encryption is Enabled in all Regions (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.3	Relational Database Service (RDS)		
2.3.1	Ensure that encryption-at-rest is enabled for RDS Instances (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
2.4	Elastic File System (EFS)		
2.4.1	Ensure that encryption is enabled for EFS file systems (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
3	Logging		
3.1	Ensure CloudTrail is enabled in all regions (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.2	Ensure CloudTrail log file validation is enabled (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket (Automated)	<input type="checkbox"/>	<input type="checkbox"/>

CIS Benchmark Recommendation		Set Correctly	
		Yes	No
3.7	Ensure CloudTrail logs are encrypted at rest using KMS CMKs (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.8	Ensure rotation for customer created symmetric CMKs is enabled (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
4	Monitoring		
4.1	Ensure unauthorized API calls are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Ensure management console sign-in without MFA is monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Ensure usage of 'root' account is monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.4	Ensure IAM policy changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.5	Ensure CloudTrail configuration changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.6	Ensure AWS Management Console authentication failures are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.7	Ensure disabling or scheduled deletion of customer created CMKs is monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Ensure AWS Config configuration changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>

CIS Benchmark Recommendation		Set Correctly	
		Yes	No
4.11	Ensure Network Access Control Lists (NACL) changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.14	Ensure VPC changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
4.16	Ensure AWS Security Hub is enabled (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
5	Networking		
5.1	Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Ensure no security groups allow ingress from ::/0 to remote server administration ports (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic (Automated)	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access" (Manual)	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Ensure that EC2 Metadata Service only allows IMDSv2 (Automated)	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v7 IG 1 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Ensure CloudTrail is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
4.9	Ensure AWS Config configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
5.1	Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Ensure no security groups allow ingress from ::/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v7 IG 2 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
1.21	Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments	<input type="checkbox"/>	<input type="checkbox"/>
2.1.1	Ensure S3 Bucket Policy is set to deny HTTP requests	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Ensure CloudTrail is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
4.1	Ensure unauthorized API calls are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Ensure usage of 'root' account is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Ensure AWS Config configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.11	Ensure Network Access Control Lists (NACL) changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.14	Ensure VPC changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.16	Ensure AWS Security Hub is enabled	<input type="checkbox"/>	<input type="checkbox"/>
5.1	Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Ensure no security groups allow ingress from ::/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v7 IG 3 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
1.21	Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments	<input type="checkbox"/>	<input type="checkbox"/>
2.1.1	Ensure S3 Bucket Policy is set to deny HTTP requests	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.2.1	Ensure EBS Volume Encryption is Enabled in all Regions	<input type="checkbox"/>	<input type="checkbox"/>
2.3.1	Ensure that encryption-at-rest is enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
2.4.1	Ensure that encryption is enabled for EFS file systems	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Ensure CloudTrail is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.7	Ensure CloudTrail logs are encrypted at rest using KMS CMKs	<input type="checkbox"/>	<input type="checkbox"/>
3.8	Ensure rotation for customer created symmetric CMKs is enabled	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
4.1	Ensure unauthorized API calls are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Ensure usage of 'root' account is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Ensure AWS Config configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.11	Ensure Network Access Control Lists (NACL) changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.14	Ensure VPC changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.16	Ensure AWS Security Hub is enabled	<input type="checkbox"/>	<input type="checkbox"/>
5.1	Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
5.3	Ensure no security groups allow ingress from ::/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v7 Unmapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.22	Ensure access to AWSCloudShellFullAccess is restricted	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Ensure that EC2 Metadata Service only allows IMDSv2	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v8 IG 1 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered	<input type="checkbox"/>	<input type="checkbox"/>
1.3	Ensure security questions are registered in the AWS account	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.8	Ensure IAM password policy requires minimum length of 14 or greater	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.11	Do not setup access keys during initial user setup for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.16	Ensure IAM policies that allow full "*" administrative privileges are not attached	<input type="checkbox"/>	<input type="checkbox"/>
1.17	Ensure a support role has been created to manage incidents with AWS Support	<input type="checkbox"/>	<input type="checkbox"/>
1.19	Ensure that all the expired SSL/TLS certificates stored in AWS IAM are removed	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v8 IG 2 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered	<input type="checkbox"/>	<input type="checkbox"/>
1.3	Ensure security questions are registered in the AWS account	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.8	Ensure IAM password policy requires minimum length of 14 or greater	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.11	Do not setup access keys during initial user setup for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.16	Ensure IAM policies that allow full "*" administrative privileges are not attached	<input type="checkbox"/>	<input type="checkbox"/>
1.17	Ensure a support role has been created to manage incidents with AWS Support	<input type="checkbox"/>	<input type="checkbox"/>
1.19	Ensure that all the expired SSL/TLS certificates stored in AWS IAM are removed	<input type="checkbox"/>	<input type="checkbox"/>
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
1.21	Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
2.1.1	Ensure S3 Bucket Policy is set to deny HTTP requests	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.2.1	Ensure EBS Volume Encryption is Enabled in all Regions	<input type="checkbox"/>	<input type="checkbox"/>
2.3.1	Ensure that encryption-at-rest is enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>
2.4.1	Ensure that encryption is enabled for EFS file systems	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Ensure CloudTrail is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.2	Ensure CloudTrail log file validation is enabled	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.7	Ensure CloudTrail logs are encrypted at rest using KMS CMKs	<input type="checkbox"/>	<input type="checkbox"/>
3.8	Ensure rotation for customer created symmetric CMKs is enabled	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
4.1	Ensure unauthorized API calls are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Ensure management console sign-in without MFA is monitored	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
4.3	Ensure usage of 'root' account is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.4	Ensure IAM policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.5	Ensure CloudTrail configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.6	Ensure AWS Management Console authentication failures are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.7	Ensure disabling or scheduled deletion of customer created CMKs is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Ensure AWS Config configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.11	Ensure Network Access Control Lists (NACL) changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.14	Ensure VPC changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v8 IG 3 Mapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.1	Maintain current contact details	<input type="checkbox"/>	<input type="checkbox"/>
1.2	Ensure security contact information is registered	<input type="checkbox"/>	<input type="checkbox"/>
1.3	Ensure security questions are registered in the AWS account	<input type="checkbox"/>	<input type="checkbox"/>
1.4	Ensure no 'root' user account access key exists	<input type="checkbox"/>	<input type="checkbox"/>
1.5	Ensure MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.6	Ensure hardware MFA is enabled for the 'root' user account	<input type="checkbox"/>	<input type="checkbox"/>
1.7	Eliminate use of the 'root' user for administrative and daily tasks	<input type="checkbox"/>	<input type="checkbox"/>
1.8	Ensure IAM password policy requires minimum length of 14 or greater	<input type="checkbox"/>	<input type="checkbox"/>
1.9	Ensure IAM password policy prevents password reuse	<input type="checkbox"/>	<input type="checkbox"/>
1.10	Ensure multi-factor authentication (MFA) is enabled for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.11	Do not setup access keys during initial user setup for all IAM users that have a console password	<input type="checkbox"/>	<input type="checkbox"/>
1.12	Ensure credentials unused for 45 days or greater are disabled	<input type="checkbox"/>	<input type="checkbox"/>
1.15	Ensure IAM Users Receive Permissions Only Through Groups	<input type="checkbox"/>	<input type="checkbox"/>
1.16	Ensure IAM policies that allow full "*" administrative privileges are not attached	<input type="checkbox"/>	<input type="checkbox"/>
1.17	Ensure a support role has been created to manage incidents with AWS Support	<input type="checkbox"/>	<input type="checkbox"/>
1.18	Ensure IAM instance roles are used for AWS resource access from instances	<input type="checkbox"/>	<input type="checkbox"/>
1.19	Ensure that all the expired SSL/TLS certificates stored in AWS IAM are removed	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
1.20	Ensure that IAM Access analyzer is enabled for all regions	<input type="checkbox"/>	<input type="checkbox"/>
1.21	Ensure IAM users are managed centrally via identity federation or AWS Organizations for multi-account environments	<input type="checkbox"/>	<input type="checkbox"/>
2.1.1	Ensure S3 Bucket Policy is set to deny HTTP requests	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2	Ensure MFA Delete is enabled on S3 buckets	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3	Ensure all data in Amazon S3 has been discovered, classified and secured when required.	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4	Ensure that S3 Buckets are configured with 'Block public access (bucket settings)'	<input type="checkbox"/>	<input type="checkbox"/>
2.2.1	Ensure EBS Volume Encryption is Enabled in all Regions	<input type="checkbox"/>	<input type="checkbox"/>
2.3.1	Ensure that encryption-at-rest is enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.2	Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances	<input type="checkbox"/>	<input type="checkbox"/>
2.3.3	Ensure that public access is not given to RDS Instance	<input type="checkbox"/>	<input type="checkbox"/>
2.4.1	Ensure that encryption is enabled for EFS file systems	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Ensure CloudTrail is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.2	Ensure CloudTrail log file validation is enabled	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Ensure CloudTrail trails are integrated with CloudWatch Logs	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Ensure AWS Config is enabled in all regions	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
3.7	Ensure CloudTrail logs are encrypted at rest using KMS CMKs	<input type="checkbox"/>	<input type="checkbox"/>
3.8	Ensure rotation for customer created symmetric CMKs is enabled	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Ensure VPC flow logging is enabled in all VPCs	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Ensure that Object-level logging for write events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>

Recommendation		Set Correctly	
		Yes	No
3.11	Ensure that Object-level logging for read events is enabled for S3 bucket	<input type="checkbox"/>	<input type="checkbox"/>
4.1	Ensure unauthorized API calls are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Ensure management console sign-in without MFA is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Ensure usage of 'root' account is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.4	Ensure IAM policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.5	Ensure CloudTrail configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.6	Ensure AWS Management Console authentication failures are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.7	Ensure disabling or scheduled deletion of customer created CMKs is monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Ensure S3 bucket policy changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Ensure AWS Config configuration changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Ensure security group changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.11	Ensure Network Access Control Lists (NACL) changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.12	Ensure changes to network gateways are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.13	Ensure route table changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.14	Ensure VPC changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
4.15	Ensure AWS Organizations changes are monitored	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Ensure the default security group of every VPC restricts all traffic	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Ensure routing tables for VPC peering are "least access"	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: CIS Controls v8 Unmapped Recommendations

Recommendation		Set Correctly	
		Yes	No
1.22	Ensure access to AWSCloudShellFullAccess is restricted	<input type="checkbox"/>	<input type="checkbox"/>
4.16	Ensure AWS Security Hub is enabled	<input type="checkbox"/>	<input type="checkbox"/>
5.1	Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Ensure no security groups allow ingress from ::/0 to remote server administration ports	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Ensure that EC2 Metadata Service only allows IMDSv2	<input type="checkbox"/>	<input type="checkbox"/>

Appendix: Change History

Date	Version	Changes for this version
Mar 21, 2023	2.0.0	UPDATE - Ensure CloudTrail trails are integrated with CloudWatch Logs - correct property name (Ticket 17189)
Apr 3, 2023	2.0.0	UPDATE - Ensure access keys are rotated every 90 days or less - add last rotated 2nd value (Ticket 18223)
Apr 3, 2023	2.0.0	DELETE - Ensure all S3 buckets employ encryption-at-rest (Ticket 17879)
Apr 18, 2023	2.0.0	UPDATE - Ensure IAM Users Receive Permissions Only Through Groups - Add method to description (Ticket 18224)
Apr 25, 2023	2.0.0	UPDATE - Ensure MFA Delete is enabled on S3 buckets - make L2 and expand impact statement (Ticket 18442)
May 16, 2023	2.0.0	UPDATE - Ensure hardware MFA is enabled for the 'root' user account - change to manual assessment status (Ticket 17360)
May 16, 2023	2.0.0	UPDATE - Eliminate use of the 'root' user for administrative and daily tasks - Change to Manual (Ticket 16559)
May 16, 2023	2.0.0	UPDATE - Ensure IAM instance roles are used for AWS resource access from instances - Add CLI steps for audit and remediation (Ticket 17698)
May 22, 2023	2.0.0	UPDATE - Ensure that encryption is enabled for RDS Instances - Change Tile to include At Rest (Ticket 17648)
May 22, 2023	2.0.0	UPDATE - Ensure security contact information is registered - Add CLI step for remediation (Ticket 18087)
May 22, 2023	2.0.0	UPDATE - Ensure that IAM Access analyzer is enabled for all regions - Add Additional Language for All Enabled Regions (Ticket 17184)
May 22, 2023	2.0.0	UPDATE - Multiple in section 5 (networking) - Wrong control mapping to port restrictions recommendations (Ticket 16228)

Date	Version	Changes for this version
May 22, 2023	2.0.0	UPDATE - Ensure AWS Security Hub is enabled - Recommend to change this check to Manual instead of Automated (Ticket 16590)
Jun 2, 2023	2.0.0	UPDATE - Ensure AWS Config is enabled in all regions - Correct Remediation Steps (Ticket 16320)
Jun 2, 2023	2.0.0	ADD - Ensure that EC2 Metadata Service only allows IMDSv2 (Ticket 15900)
Jun 2, 2023	2.0.0	UPDATE - Ensure a log metric filter and alarm exist for unauthorized API calls - Fix metric filter to avoid including all events (Ticket 16623)
Jun 5, 2023	2.0.0	UPDATE - Do not setup access keys during initial user setup for all IAM users that have a console password - change assessment status to manual (Ticket 16561)
Jun 6, 2023	2.0.0	Update - Ensure no 'root' user account access key exists - Re-wording of audit section (Ticket 18719)
Jun 14, 2023	2.0.0	ADD - Restrict use of AWS CloudShell (Ticket 17641)
Jun 14, 2023	2.0.0	UPDATE - All recommendations in the monitoring section - changing wording to be more agnostic (Ticket 18846)
Jun 27, 2023	2.0.0	UPDATE - Ensure route table changes are monitored - expand rational (Ticket 18946)
Jun 28, 2023	2.0.0	UPDATE - Ensure a support role has been created to manage incidents with AWS Support - change language to note other ways to assign AWS Support role (Ticket 17185)
Jun 28, 2023	2.0.0	UPDATE - Ensure the S3 bucket used to store CloudTrail logs is not publicly accessible - add PrincipalOrgID wording (Ticket 19073)
Jun 28, 2023	2.0.0	UPDATE - Ensure no Network ACLs allow ingress from 0.0.0.0/0 to remote server administration ports - Inclusion of protocols for the ports (Ticket 19035)
Jun 28, 2023	2.0.0	UPDATE - Ensure no security groups allow ingress from 0.0.0.0/0 to remote server administration ports - Inclusion of protocols for the ports (Ticket 19036)

Date	Version	Changes for this version
Mar 30, 2022	1.5.0	UPDATE - Ensure EBS Volume Encryption is Enabled in all Regions - Update to title as this is Region level Configuration (Ticket 15165)
Jun 14, 2022	1.5.0	UPDATE - Ensure CloudTrail log file validation is enabled - Console section names (Ticket 15682)
Jun 30, 2022	1.5.0	UPDATE - Do not setup access keys during initial user setup for all IAM users that have a console password - Assessment Status change (Ticket 14270)
Jun 30, 2022	1.5.0	UPDATE - Ensure all S3 buckets employ encryption-at-rest - Assessment Status change (Ticket 14269)
Jun 30, 2022	1.5.0	UPDATE - Ensure EBS Volume Encryption is Enabled in all Regions - Change Assessment Status (Ticket 14272)
Jul 12, 2022	1.5.0	UPDATE - Ensure credentials unused for 45 days or greater are disabled - root account should be excluded (Ticket 14251)
Jul 12, 2022	1.5.0	UPDATE - Ensure rotation for customer created CMKs is enabled - Update to specify symmetric keys (Ticket 13616)
Jul 12, 2022	1.5.0	UPDATE - Ensure S3 Bucket Policy is set to deny HTTP requests - Console output update (Ticket 15679)
Jul 12, 2022	1.5.0	ADD - Ensure Auto Minor Version Upgrade feature is Enabled for RDS Instances (Ticket 15680)
Jul 12, 2022	1.5.0	UPDATE - Ensure S3 bucket access logging is enabled on the CloudTrail S3 bucket - add CLI for remediation (Ticket 15683)
Jul 12, 2022	1.5.0	UPDATE - Ensure VPC flow logging is enabled in all VPCs - add CLI steps for audit and remediation (Ticket 15684)
Jul 12, 2022	1.5.0	UPDATE - Ensure S3 Bucket Policy is set to deny HTTP requests - Assessment Status (Ticket 14271)
Jul 12, 2022	1.5.0	UPDATE - Ensure that Object-level logging for write events is enabled for S3 bucket - Logging is cross region but automation is per region (Ticket 13233)

Date	Version	Changes for this version
Jul 29, 2022	1.5.0	ADD - Ensure no security groups allow ingress from ::/0 to remote server administration ports (Ticket 13557)
Aug 2, 2022	1.5.0	UPDATE - Ensure a log metric filter and alarm exist for unauthorized API calls - Step 3 of Audit Procedure and Step 1 of remediation procedure are not aligned. (Ticket 13787)
Aug 2, 2022	1.5.0	UPDATE - Ensure that encryption is enabled for RDS Instances - MITRE mapping appears to have misspelled mitigation in spreadsheet (Ticket 15844)
Aug 2, 2022	1.5.0	UPDATE - Ensure IAM password policy prevents password reuse - MITRE mapping appears to have misspelled Tactic in spreadsheet (Ticket 15846)
Aug 2, 2022	1.5.0	UPDATE - Ensure IAM password policy requires minimum length of 14 or greater - MITRE mapping appears to have misspelled Tactic in spreadsheet (Ticket 15845)
Aug 4, 2022	1.5.0	ADD - Ensure that public access is not given to RDS Instance (Ticket 15681)
Aug 4, 2022	1.5.0	ADD - Ensure AWS Security Hub is enabled (Ticket 12763)
Aug 12, 2022	1.5.0	Add - Ensure that encryption is enabled for EFS file systems (Ticket 12867)