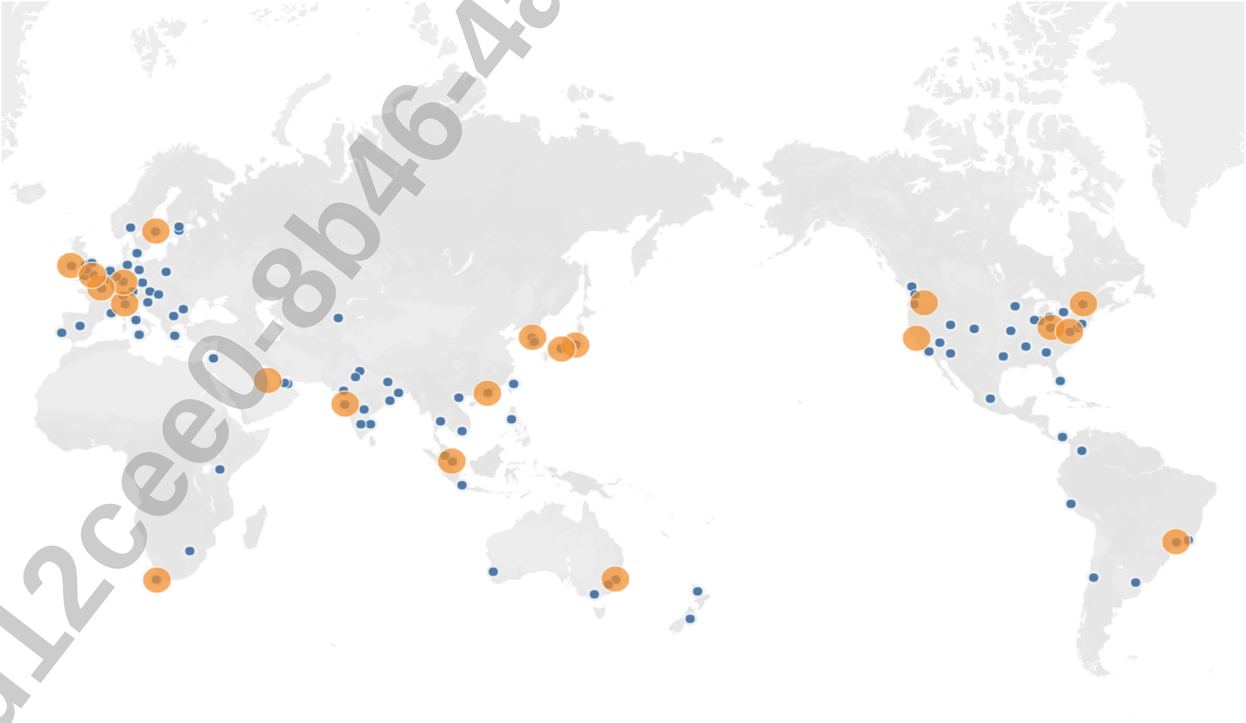
SOC 2 REPORT – TYPE 2

System and Organization Controls 2 (SOC 2) Type 2 Report

Description of the Amazon Web Services System Relevant to Security, Availability, and Confidentiality

For the Period October 1, 2021 to March 31, 2022



Proprietary and Confidential Information - Trade Secret

Description of the Amazon Web Services System Relevant to Security, Availability, and Confidentiality

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SECTION I – Assertion of Amazon Web Services

Amazon Web Services
410 Terry Avenue North
Seattle, WA 98109-5210

Amazon Web Services' Management Assertion

We prepared the accompanying "Description of the Amazon Web Services System Relevant to Security, Availability, and Confidentiality" (Description) of Amazon Web Services, Inc. ("AWS" or "Service Organization") in accordance with the criteria for a description of a service organization's system set forth in the Description Criteria DC section 200 *2018 Description Criteria for a Description of a Service Organization's System in a SOC 2 Report* (Description Criteria). The Description is intended to provide report users with information about the Amazon Web Services System (System) that may be useful when assessing the risks arising from interactions with the System throughout the period October 1, 2021 to March 31, 2022, particularly information about system controls that the Service Organization has designed, implemented and operated to provide reasonable assurance that its service commitments and system requirements were achieved based on the trust services criteria for security, availability, and confidentiality set forth in TSP section 100, *2017 Trust Services Criteria for Security, Availability, Processing Integrity, Confidentiality, and Privacy* (applicable trust services criteria). The System consists of the following services:

- AWS Amplify
- Amazon API Gateway
- Amazon AppFlow
- AWS Application Migration Service
- AWS App Mesh
- AWS App Runner
- Amazon AppStream 2.0
- AWS AppSync
- Amazon Athena
- AWS Audit Manager
- Amazon Augmented AI [Excludes Public Workforce and Vendor Workforce for all features]
- Amazon EC2 Auto Scaling
- AWS Backup
- AWS Batch
- AWS Certificate Manager (ACM)
- AWS Chatbot
- Amazon Chime
- AWS Cloud9
- Amazon Cloud Directory
- AWS Cloud Map
- AWS CloudFormation
- Amazon CloudFront
- AWS CloudHSM
- AWS CloudTrail
- Amazon CloudWatch
- Amazon CloudWatch Logs
- AWS IoT Events
- AWS IoT Greengrass
- AWS IoT SiteWise
- Amazon Kendra
- AWS Key Management Service (KMS)
- Amazon Keyspaces (for Apache Cassandra)
- Amazon Kinesis Data Analytics
- Amazon Kinesis Data Firehose
- Amazon Kinesis Data Streams
- Amazon Kinesis Video Streams
- AWS Lake Formation
- AWS Lambda
- Amazon Lex
- AWS License Manager
- Amazon Location Service
- Amazon Macie
- Amazon Macie Classic
- AWS Managed Services
- Amazon Managed Streaming for Apache Kafka
- Amazon MQ
- Amazon Neptune
- AWS Network Firewall
- Amazon OpenSearch Service [successor to Amazon Elasticsearch service]
- AWS OpsWorks Stacks

- Amazon CloudWatch SDK Metrics for Enterprise Support
- AWS CodeBuild
- AWS CodeCommit
- AWS CodeDeploy
- AWS CodePipeline
- Amazon Cognito
- Amazon Comprehend
- Amazon Comprehend Medical
- AWS Config
- Amazon Connect
- AWS Control Tower
- AWS Data Exchange
- AWS Database Migration Service (DMS)
- AWS DataSync
- Amazon Detective
- AWS Direct Connect
- AWS Directory Service [Excludes Simple AD]
- Amazon DocumentDB [with MongoDB compatibility]
- Amazon DynamoDB
- EC2 Image Builder
- AWS Elastic Beanstalk
- Amazon Elastic Block Store (EBS)
- Amazon Elastic Compute Cloud (EC2)
- Amazon Elastic Container Registry (ECR)
- Amazon Elastic Container Service – [both Fargate and EC2 launch types]
- Amazon Elastic Kubernetes Service (EKS)
- Amazon Elastic File System (EFS)
- Elastic Load Balancing (ELB)
- Amazon ElastiCache for Redis
- AWS Elemental MediaConnect
- AWS Elemental MediaConvert
- AWS Elemental MediaLive
- Amazon Elastic MapReduce (EMR)
- Amazon EventBridge
- Amazon FinSpace
- AWS Firewall Manager
- Amazon Forecast
- Amazon Fraud Detector
- Amazon FreeRTOS
- Amazon FSx
- Amazon S3 Glacier
- AWS OpsWorks [includes Chef Automate, Puppet Enterprise]
- AWS Organizations
- AWS Outposts
- AWS Health Dashboard
- Amazon Personalize
- Amazon Pinpoint
- Amazon Polly
- AWS Private Certificate Authority
- Amazon Quantum Ledger Database (QLDB)
- Amazon QuickSight
- Amazon Redshift
- Amazon Rekognition
- Amazon Relational Database Service (RDS)
- AWS Resource Access Manager (RAM)
- AWS Resource Groups
- AWS RoboMaker
- Amazon Route 53
- Amazon SageMaker [Excludes Public Workforce and Vendor Workforce for all features]
- AWS Secrets Manager
- AWS Security Hub
- AWS Server Migration Service (SMS)
- AWS Serverless Application Repository
- AWS Service Catalog
- AWS Shield
- Amazon Simple Email Service (SES)
- Amazon Simple Notification Service (SNS)
- Amazon Simple Queue Service (SQS)
- Amazon Simple Storage Service (S3)
- Amazon Simple Workflow Service (SWF)
- Amazon SimpleDB
- AWS Single Sign-On (SSO)
- AWS Snowball
- AWS Snowball Edge
- AWS Snowmobile
- AWS Step Functions
- AWS Storage Gateway
- AWS Systems Manager
- Amazon Textract
- Amazon Timestream

- AWS Global Accelerator
- AWS Glue
- AWS Glue DataBrew
- Amazon GuardDuty
- Amazon HealthLake
- AWS Identity and Access Management (IAM)
- VM Import/Export
- Amazon Inspector
- AWS IoT Core
- AWS IoT Device Management
- Amazon Transcribe
- AWS Transfer Family
- Amazon Translate
- Amazon Virtual Private Cloud (VPC)
- AWS Web Application Firewall (WAF)
- Amazon WorkDocs
- Amazon WorkLink
- Amazon WorkMail
- Amazon WorkSpaces
- AWS X-Ray

and their supporting data centers in the following locations:

- **Australia**: Asia Pacific (Sydney) (`ap-southeast-2`)
- **Bahrain**: Middle East (Bahrain) (`me-south-1`)
- **Brazil**: South America (São Paulo) (`sa-east-1`)
- **Canada**: Canada (Central) (`ca-central-1`)
- **England**: Europe (London) (`eu-west-2`)
- **France**: Europe (Paris) (`eu-west-3`)
- **Germany**: Europe (Frankfurt) (`eu-central-1`)
- **Hong Kong**: Asia Pacific (`ap-east-1`)
- **Indonesia**: Asia Pacific (`ap-southeast-3`)
- **India**: Asia Pacific (Mumbai) (`ap-south-1`)
- **Ireland**: Europe (Ireland) (`eu-west-1`)
- **Italy**: Europe (Milan) (`eu-south-1`)
- **Japan**: Asia Pacific (Tokyo) (`ap-northeast-1`), Asia Pacific (Osaka) (`ap-northeast-3`)
- **Singapore**: Asia Pacific (Singapore) (`ap-southeast-1`)
- **South Africa**: Africa (Cape Town) (`af-south-1`)
- **South Korea**: Asia Pacific (Seoul) (`ap-northeast-2`)
- **Sweden**: Europe (Stockholm) (`eu-north-1`)
- **United States**: US East (Northern Virginia) (`us-east-1`), US East (Ohio) (`us-east-2`), US West (Oregon) (`us-west-2`), US West (Northern California) (`us-west-1`), AWS GovCloud (US-East) (`us-gov-east-1`), AWS GovCloud (US-West) (`us-gov-west-1`)

and the following AWS Edge locations:

- Buenos Aires, Argentina
- Canberra, Australia
- Melbourne, Australia
- Perth, Australia
- Sydney, Australia
- Vienna, Austria
- Brussels, Belgium
- Rio de Janeiro, Brazil
- Budapest, Hungary
- Ahmedabad, India
- Bengaluru, India
- Bhubaneswar, India
- Chennai, India
- Hyderabad, India
- Jaipur, India
- Kolkata, India
- Singapore
- Cape Town, South Africa
- Johannesburg, South Africa
- Madrid, Spain
- Stockholm, Sweden
- Zurich, Switzerland
- Taipei, Taiwan
- Bangkok, Thailand

- São Paulo, Brazil
- Sofia, Bulgaria
- Montréal, Canada
- Toronto, Canada
- Vancouver, Canada
- Santiago, Chile
- Bogota, Colombia
- Prague, Czech Republic
- Hong Kong, China
- Zagreb, Croatia
- Copenhagen, Denmark
- Birmingham, England
- Bristol, England
- Hull, England
- London, England
- Manchester, England
- Tallinn, Estonia
- Helsinki, Finland
- Marseille, France
- Paris, France
- Berlin, Germany
- Dusseldorf, Germany
- Frankfurt, Germany
- Hamburg, Germany
- Munich, Germany
- Athens, Greece
- Mumbai, India
- New Delhi, India
- Patna, India
- Jakarta, Indonesia
- Dublin, Ireland
- Tel Aviv, Israel
- Milan, Italy
- Palermo, Italy
- Rome, Italy
- Osaka, Japan
- Tokyo, Japan
- Nairobi, Kenya
- Seoul, South Korea
- Kuala Lumpur, Malaysia
- Querétaro, Mexico
- Amsterdam, Netherlands
- Auckland, New Zealand
- Christchurch, New Zealand
- Oslo, Norway
- Panama City, Panama
- Lima, Peru
- Manila, Philippines
- Warsaw, Poland
- Lisbon, Portugal
- Bucharest, Romania
- Dubai, United Arab Emirates
- Fujairah, United Arab Emirates
- Arizona, United States
- California, United States
- Colorado, United States
- Florida, United States
- Georgia, United States
- Illinois, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- Missouri, United States
- Nevada, United States
- New Jersey, United States
- New York, United States
- Ohio, United States
- Oregon, United States
- Pennsylvania, United States
- Tennessee, United States
- Texas, United States
- Utah, United States
- Virginia, United States
- Washington, United States
- Hanoi, Vietnam
- Ho Chi Minh, Vietnam

and the following Wavelength locations in:

- Berlin, Germany
- Daejeon, South Korea
- Dortmund, Germany
- London, England
- Munich, Germany
- Osaka, Japan
- Tokyo, Japan
- Arizona, United States
- Florida, United States
- Georgia, United States
- Maryland, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- North Carolina, United States
- Nevada, United States
- New Jersey, United States
- Texas, United States
- Washington, United States
- California, United States
- Colorado, United States
- Wisconsin, United States

as well as Local Zones locations in:

- Arizona, United States
- California, United States
- Colorado, United States
- Illinois, United States
- Massachusetts, United States
- Minnesota, United States
- New Jersey, United States
- Oregon, United States
- Washington, United States

- Pennsylvania, United States
- Florida, United States
- Georgia, United States
- Texas, United States
- Missouri, United States
- Nevada, United States

The Description also indicates that certain trust services criteria specified in the Description can be met only if complementary user entity controls assumed in the design of AWS' controls are suitably designed and operating effectively, along with related controls at the Service Organization. The Description does not extend to controls of user entities.

We confirm, to the best of our knowledge and belief, that:

a. The Description presents the System that was designed and implemented throughout the period October 1, 2021 to March 31, 2022 in accordance with the Description Criteria.

b. The controls stated in the Description were suitably designed to provide reasonable assurance that the service commitments and system requirements would be achieved based on the applicable trust services criteria, if the controls operated as described and if user entities applied the complementary user entity controls assumed in the design of AWS' controls throughout the period October 1, 2021 to March 31, 2022.

c. The AWS controls stated in the Description operated effectively throughout the period October 1, 2021 to March 31, 2022 to achieve the service commitments and system requirements based on the applicable trust services criteria, if user entities applied the complementary user entity controls assumed in the design of AWS' controls throughout the period October 1, 2021 to March 31, 2022.

Amazon Web Services Management

SECTION II – Independent Service Auditor's Assurance Report

EY
Building a better working world

Ernst & Young LLP
725 South Figueroa St
Los Angeles, CA
90017-5418

Tel: +1 213 977 3200
Fax: +1 213 977 3729

Independent Service Auditor's Assurance Report

To the Management of Amazon Web Services, Inc.

Scope

We have examined Amazon Web Services Inc. ("AWS" or "Service Organization")'s accompanying "Description of the Amazon Web Services System Relevant to Security, Availability, and Confidentiality" (Description) of its Amazon Web Services system for providing cloud computing services throughout the period October 1, 2021 to March 31, 2022 for the following services:

- AWS Amplify
- Amazon API Gateway
- Amazon AppFlow
- AWS Application Migration Service
- AWS App Mesh
- AWS App Runner
- Amazon AppStream 2.0
- AWS AppSync
- Amazon Athena
- AWS Audit Manager
- Amazon Augmented AI [Excludes Public Workforce and Vendor Workforce for all features]
- Amazon EC2 Auto Scaling
- AWS Backup
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- AWS Certificate Manager (ACM)
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- AWS IoT Events
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- Amazon Kinesis Data Streams
- Amazon Kinesis Video Streams
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- AWS Lambda
- Amazon Lex
- AWS License Manager
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- Amazon Macie
- Amazon Macie Classic
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- Amazon Managed Streaming for Apache Kafka
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- AWS Storage Gateway
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- Amazon Timestream
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- Amazon Translate
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- AWS Web Application Firewall (WAF)
- Amazon WorkDocs
- Amazon WorkLink
- Amazon WorkMail
- Amazon WorkSpaces

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- Amazon Inspector
- AWS IoT Core
- AWS X-Ray

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- **Indonesia:** Asia Pacific (Jakarta) (`ap-southwest-3`)
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- Brussels, Belgium
- Rio de Janeiro, Brazil
- São Paulo, Brazil
- Sofia, Bulgaria
- Montréal, Canada
- Toronto, Canada
- Vancouver, Canada
- Santiago, Chile
- Budapest, Hungary
- Ahmedabad, India
- Bengaluru, India
- Bhubaneswar, India
- Chennai, India
- Hyderabad, India
- Jaipur, India
- Kolkata, India
- Mumbai, India
- New Delhi, India
- Patna, India
- Jakarta, Indonesia
- Dublin, Ireland
- Tel Aviv, Israel
- Singapore
- Cape Town, South Africa
- Johannesburg, South Africa
- Madrid, Spain
- Stockholm, Sweden
- Zurich, Switzerland
- Taipei, Taiwan
- Bangkok, Thailand
- Dubai, United Arab Emirates
- Fujairah, United Arab Emirates
- Arizona, United States
- California, United States
- Colorado, United States
- Florida, United States

- Bogota, Colombia
- Prague, Czech Republic
- Hong Kong, China
- Zagreb, Croatia
- Copenhagen, Denmark
- Birmingham, England
- Bristol, England
- Hull, England
- London, England
- Manchester, England
- Tallinn, Estonia
- Helsinki, Finland
- Marseille, France
- Paris, France
- Berlin, Germany
- Dusseldorf, Germany
- Frankfurt, Germany
- Hamburg, Germany
- Munich, Germany
- Athens, Greece
- Milan, Italy
- Palermo, Italy
- Rome, Italy
- Osaka, Japan
- Tokyo, Japan
- Nairobi, Kenya
- Seoul, South Korea
- Kuala Lumpur, Malaysia
- Querétaro, Mexico
- Amsterdam, Netherlands
- Auckland, New Zealand
- Christchurch, New Zealand
- Oslo, Norway
- Panama City, Panama
- Lima, Peru
- Manila, Philippines
- Warsaw, Poland
- Lisbon, Portugal
- Bucharest, Romania
- Georgia, United States
- Illinois, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- Missouri, United States
- Nevada, United States
- New Jersey, United States
- New York, United States
- Ohio, United States
- Oregon, United States
- Pennsylvania, United States
- Tennessee, United States
- Texas, United States
- Utah, United States
- Virginia, United States
- Washington, United States
- Hanoi, Vietnam
- Ho Chi Minh, Vietnam

and Wavelength in the following locations:

- Berlin, Germany
- Daejeon, South Korea
- Dortmund, Germany
- London, England
- Munich, Germany
- Osaka, Japan
- Tokyo, Japan
- Arizona, United States
- Florida, United States
- Georgia, United States
- Maryland, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- North Carolina, United States
- Nevada, United States
- New Jersey, United States
- Texas, United States
- Washington, United States
- California, United States
- Colorado, United States
- Wisconsin, United States

as well as Local Zone locations in:

- Arizona, United States
- California, United States
- Colorado, United States
- Pennsylvania, United States
- Florida, United States
- Georgia, United States
- Illinois, United States
- Massachusetts, United States
- Minnesota, United States
- Texas, United States
- Missouri, United States
- New Jersey, United States
- Nevada, United States
- Oregon, United States
- Washington, United States

in accordance with the criteria for a description of a service organization's system set forth in the Description Criteria DC section 200 *2018 Description Criteria for a Description of a Service Organization's System in a SOC 2 Report* (Description Criteria) and the suitability of the design and operating effectiveness of controls included in the Description throughout the period October 1, 2021 to March 31, 2022 to provide reasonable assurance that the service commitments and system requirements were achieved based on the trust services criteria for security, availability, and confidentiality set forth in TSP section 100, *2017 Trust Services Criteria for Security, Availability, Processing Integrity, Confidentiality, and Privacy (*applicable trust services criteria*).*

The Description also indicates that AWS' controls can provide reasonable assurance that certain service commitments and system requirements can be achieved only if complementary user entity controls assumed in the design of AWS' controls are suitably designed and operating effectively, along with related controls at the service organization. Our examination did not extend to such complementary user entity controls and we have not evaluated the suitability of the design or operating effectiveness of such complementary user entity controls.

The information in the accompanying "Other Information Provided by Amazon Web Services" section is presented by management of AWS to provide additional information and is not part of AWS' Description. Such information has not been subjected to the procedures applied in our examination and, accordingly we express no opinion on it.

AWS' responsibilities

AWS is responsible for its service commitments and system requirements and for designing, implementing and operating effective controls within the system to provide reasonable assurance that the service commitments and system requirements were achieved. AWS has provided the accompanying assertion titled, "Amazon Web Services' Management Assertion" (Assertion), about the presentation of the Description based on the Description Criteria and suitability of the design and operating effectiveness of the controls described therein to provide reasonable assurance that the service commitments and system requirements would be achieved based on the applicable trust criteria. AWS is responsible for (1) preparing the Description and Assertion; (2) the completeness, accuracy, and method of presentation of the Description and Assertion; (3) providing the services covered by the Description; (4) identifying the risks that would threaten the achievement of the service organization's service commitments and system requirements; and (5) designing, implementing, and documenting controls that are suitably designed and operating effectively to achieve its service commitments and system requirements .

Service auditor's responsibilities

Our responsibility is to express an opinion on the presentation of the Description and on the suitability of the design and operating effectiveness of the controls described therein to achieve the Service Organization's service commitments and system requirements, based on our examination.

Our examination was conducted in accordance with attestation standards established by the AICPA. Our examination was also performed in accordance with International Standard on Assurance Engagements 3000, *Assurance Engagements Other than Audits or Reviews of Historical Financial Information*, issued by the International Auditing and Assurance Standards Board. Those standards require that we plan and perform our examination to obtain reasonable assurance about whether, in all material respects, (1) the Description is presented in accordance with the Description Criteria, and (2) the controls described therein are suitably designed and operating effectively to provide reasonable assurance that the service organization's service commitments and system requirements would be achieved based on the applicable trust services criteria. The nature, timing, and extent of the procedures selected depend on our judgment, including an assessment of the risk of material misstatement, whether due to fraud or error. We believe that the evidence we have obtained is sufficient and appropriate to provide a reasonable basis for our opinion.

An examination of a description of a service organization's system and the suitability of the design and operating effectiveness of controls involves:

- obtaining an understanding of the system and the service organization's service commitments and system requirements
- performing procedures to obtain evidence about whether the controls stated in the Description are presented in accordance with the Description Criteria
- performing procedures to obtain evidence about whether controls stated in the Description were suitably designed to provide reasonable assurance that the service organization achieved its service commitments and system requirements based on the applicable trust services criteria.
- assessing the risks that the Description is not presented in accordance with the Description Criteria and that the controls were not suitably designed or operating effectively based on the applicable trust services criteria.
- testing the operating effectiveness of those controls based on the applicable trust services criteria.
- evaluating the overall presentation of the Description.

Our examination also included performing such other procedures as we considered necessary in the circumstances.

Service auditor's independence and quality control

We have complied with the independence and other ethical requirements set forth in the *Preface: Applicable to All Members* and *Part 1 – Members in Public Practice* of the *Code of Professional Conduct* established by the AICPA and applied the AICPA's *Statements on Quality Control Standards*.

Inherent limitations

The Description is prepared to meet the common needs of a broad range of users and may not, therefore, include every aspect of the system that each individual user may consider important to its own particular needs. Because of their nature, controls at a service organization may not always operate effectively to provide reasonable assurance that the service organization's service commitments and system requirements are achieved based on the applicable trust services criteria. Also, the projection to the future of any evaluation of the fairness of the presentation of the Description, or conclusions about the suitability of the design or operating effectiveness of the controls based on the applicable trust services criteria is subject to the risk that the system may change or that controls at a service organization may become ineffective.

Description of tests of controls

The specific controls we tested and the nature, timing and results of those tests are listed in the accompanying "Description of Criteria, AWS Controls, Tests and Results of Tests" (Description of Tests and Results).

Opinion

In our opinion, in all material respects:

a. the Description presents the Amazon Web Services system that was designed and implemented throughout the period October 1, 2021 to March 31, 2022 in accordance with the Description Criteria.

b. the controls stated in the Description were suitably designed to provide reasonable assurance that the service commitments and system requirements would be achieved based on the applicable trust services criteria if the controls operated effectively and user entities applied the controls assumed in the design of AWS' controls throughout the period October 1, 2021 to March 31, 2022.

c. the controls stated in the Description operated effectively to provide reasonable assurance that the service commitments and system requirements were achieved based on the applicable trust services criteria throughout the period October 1, 2021 to March 31, 2022, if the user entity controls assumed in the design of AWS' controls operated effectively throughout the period October 1, 2021 to March 31, 2022.

Restricted use

This report, including the description of tests of controls and results thereof in the Description of Tests and Results, is intended solely for the information and use of AWS, user entities of Amazon Web Services system during some or all of the period October 1, 2021 to March 31, 2022 and prospective user entities, independent auditors and practitioners providing services to such user entities, and regulators who have sufficient knowledge and understanding of the following:

- The nature of the service provided by the service organization
- How the service organization's system interacts with user entities, subservice organizations, or other parties, including complementary user entity controls assumed in the design of the service organization's controls
- Internal control and its limitations
- User entity responsibilities and how they interact with related controls at the service organization
- The applicable trust services criteria
- The risks that may threaten the achievement of the service organization's service commitments and system requirements and how controls address those risks

This report is not intended to be, and should not be, used by anyone other than these specified parties.

Ernst + Young LLP

May 12, 2022

SECTION III – Description of the Amazon Web Services System Relevant to Security, Availability, and Confidentiality

Amazon Web Services System Overview

Since 2006, Amazon Web Services (AWS) has provided flexible, scalable and secure IT infrastructure to businesses of all sizes around the world. With AWS, customers can deploy solutions on a cloud computing environment that provides compute power, storage, and other application services over the Internet as their business needs demand. AWS affords businesses the flexibility to employ the operating systems, application programs, and databases of their choice.

The scope of this system description includes the following services:

- AWS Amplify
- AWS Application Migration Service
- Amazon API Gateway
- Amazon AppFlow
- AWS App Mesh
- AWS App Runner
- Amazon AppStream 2.0
- AWS AppSync
- Amazon Athena
- AWS Audit Manager
- Amazon Augmented AI [excludes Public Workforce and Vendor Workforce for all features]
- Amazon EC2 Auto Scaling
- AWS Backup
- AWS Batch
- AWS Certificate Manager (ACM)
- AWS Chatbot
- Amazon Chime
- AWS Cloud9
- Amazon Cloud Directory
- AWS Cloud Map
- AWS CloudFormation
- Amazon CloudFront
- AWS CloudHSM
- AWS CloudTrail
- Amazon CloudWatch
- Amazon CloudWatch Logs
- Amazon CloudWatch SDK Metrics for Enterprise Support
- AWS CodeBuild
- AWS CodeCommit
- AWS CodeDeploy
- AWS CodePipeline
- Amazon Cognito
- Amazon Comprehend
- Amazon Comprehend Medical
- AWS IoT Device Management
- AWS IoT Events
- AWS IoT Greengrass
- AWS IoT SiteWise
- Amazon Kendra
- AWS Key Management Service (KMS)
- Amazon Keyspaces (for Apache Cassandra)
- Amazon Kinesis Data Analytics
- Amazon Kinesis Data Firehose
- Amazon Kinesis Data Streams
- Amazon Kinesis Video Streams
- Amazon Location Service
- AWS Lake Formation
- AWS Lambda
- Amazon Lex
- AWS License Manager
- Amazon Macie
- Amazon Macie Classic
- AWS Managed Services
- Amazon Managed Streaming for Apache Kafka
- Amazon MQ
- Amazon Neptune
- AWS Network Firewall
- Amazon OpenSearch Service [successor to Amazon Elasticsearch service]
- AWS OpsWorks Stacks
- AWS OpsWorks [includes Chef Automate, Puppet Enterprise]
- AWS Organizations
- AWS Outposts
- AWS Health Dashboard
- AWS Private Certificate Authority
- Amazon Personalize
- Amazon Pinpoint
- Amazon Polly
- Amazon Quantum Ledger Database (QLDB)

- AWS Config
- Amazon Connect
- AWS Control Tower
- AWS Data Exchange
- AWS Database Migration Service (DMS)
- AWS DataSync
- Amazon Detective
- AWS Direct Connect
- AWS Directory Service [excludes Simple AD]
- Amazon DocumentDB [with MongoDB compatibility]
- Amazon DynamoDB
- EC2 Image Builder
- AWS Elastic Beanstalk
- Amazon Elastic Block Store (EBS)
- Amazon Elastic Compute Cloud (EC2)
- Amazon Elastic Container Registry (ECR)
- Amazon Elastic Container Service [both Fargate and EC2 launch types]
- Amazon Elastic Kubernetes Service (EKS)
- Amazon Elastic File System (EFS)
- Elastic Load Balancing (ELB)
- Amazon ElastiCache for Redis
- AWS Elemental MediaConnect
- AWS Elemental MediaConvert
- AWS Elemental MediaLive
- Amazon Elastic MapReduce (EMR)
- Amazon EventBridge
- Amazon FinSpace
- AWS Firewall Manager
- Amazon Forecast
- Amazon Fraud Detector
- Amazon FreeRTOS
- Amazon FSx
- Amazon S3 Glacier
- AWS Global Accelerator
- AWS Glue
- AWS Glue DataBrew
- Amazon GuardDuty
- Amazon Healthlake
- AWS Identity and Access Management (IAM)
- VM Import/Export
- Amazon Inspector
- AWS IoT Core
- Amazon QuickSight
- Amazon Redshift
- Amazon Rekognition
- Amazon Relational Database Service (RDS)
- AWS Resource Access Manager
- AWS Resource Groups
- AWS RoboMaker
- Amazon Route 53
- Amazon SageMaker [excludes Public Workforce and Vendor Workforce for all features]
- AWS Secrets Manager
- AWS Security Hub
- AWS Server Migration Service (SMS)
- AWS Serverless Application Repository
- AWS Service Catalog
- AWS Shield
- Amazon Simple Email Service (SES)
- Amazon Simple Notification Service (SNS)
- Amazon Simple Queue Service (SQS)
- Amazon Simple Storage Service (S3)
- Amazon Simple Workflow Service (SWF)
- Amazon SimpleDB
- AWS Single Sign-On (SSO)
- AWS Snowball
- AWS Snowball Edge
- AWS Snowmobile
- AWS Step Functions
- AWS Storage Gateway
- AWS Systems Manager
- Amazon Textract
- Amazon Timestream
- Amazon Transcribe
- AWS Transfer Family
- Amazon Translate
- Amazon Virtual Private Cloud (VPC)
- AWS Web Application Firewall (WAF)
- Amazon WorkDocs
- Amazon WorkLink
- Amazon WorkMail
- Amazon WorkSpaces
- AWS X-Ray

More information about the in-scope services, including the namespace[1], can be found at https://aws.amazon.com/compliance/services-in-scope/

The scope of locations covered in this report includes the supporting data centers located in the following regions:

- **Australia**: Asia Pacific (Sydney) (`ap-southeast-2`)
- **Bahrain**: Middle East (Bahrain) (`me-south-1`)
- **Brazil**: South America (São Paulo) (`sa-east-1`)
- **Canada**: Canada (Central) (`ca-central-1`)
- **England**: Europe (London) (`eu-west-2`)
- **France**: Europe (Paris) (`eu-west-3`)
- **Germany**: Europe (Frankfurt) (`eu-central-1`)
- **Hong Kong**: Asia Pacific (`ap-east-1`)
- **India**: Asia Pacific (Mumbai) (`ap-south-1`)
- **Indonesia:** Asia Pacific (Jakarta) (`ap-southeast-3`)
- **Ireland**: Europe (Ireland) (`eu-west-1`)
- **Italy**: Europe (Milan) (`eu-south-1`)
- **Japan**: Asia Pacific (Tokyo) (`ap-northeast-1`), Asia Pacific (Osaka) (`ap-northeast-3`)
- **Singapore**: Asia Pacific (Singapore) (`ap-southeast-1`)
- **South Africa**: Africa (Cape Town) (`af-south-1`)
- **South Korea**: Asia Pacific (Seoul) (`ap-northeast-2`)
- **Sweden**: Europe (Stockholm) (`eu-north-1`)
- **United States**: US East (Northern Virginia) (`us-east-1`), US East (Ohio) (`us-east-2`), US West (Oregon) (`us-west-2`), US West (Northern California) (`us-west-1`), AWS GovCloud (US-East) (`us-gov-east-1`), AWS GovCloud (US-West) (`us-gov-west-1`)

and the following AWS Edge locations in:

- Buenos Aires, Argentina
- Canberra, Australia
- Melbourne, Australia
- Perth, Australia
- Sydney, Australia
- Vienna, Austria
- Brussels, Belgium
- Rio de Janeiro, Brazil
- São Paulo, Brazil
- Sofia, Bulgaria
- Montréal, Canada
- Toronto, Canada
- Vancouver, Canada
- Santiago, Chile
- Budapest, Hungary
- Ahmedabad, India
- Bengaluru, India
- Bhubaneswar, India
- Chennai, India
- Hyderabad, India
- Jaipur, India
- Kolkata, India
- Mumbai, India
- New Delhi, India
- Patna, India
- Jakarta, Indonesia
- Dublin, Ireland
- Tel Aviv, Israel
- Singapore
- Cape Town, South Africa
- Johannesburg, South Africa
- Madrid, Spain
- Stockholm, Sweden
- Zurich, Switzerland
- Taipei, Taiwan
- Bangkok, Thailand
- Dubai, United Arab Emirates
- Fujairah, United Arab Emirates
- Arizona, United States
- California, United States
- Colorado, United States
- Florida, United States

[1] When customers create IAM policies or work with Amazon Resource Names (ARNs), customers identify an AWS service using a *namespace*. For example, the namespace for Amazon S3 is s3, and the namespace for Amazon EC2 is ec2. Customers use namespaces when identifying actions and resources across AWS.

- Bogota, Colombia
- Prague, Czech Republic
- Hong Kong, China
- Zagreb, Croatia
- Copenhagen, Denmark
- Birmingham, England
- Bristol, England
- Hull, England
- London, England
- Manchester, England
- Tallinn, Estonia
- Helsinki, Finland
- Marseille, France
- Paris, France
- Berlin, Germany
- Dusseldorf, Germany
- Frankfurt, Germany
- Hamburg, Germany
- Munich, Germany
- Athens, Greece
- Milan, Italy
- Palermo, Italy
- Rome, Italy
- Osaka, Japan
- Tokyo, Japan
- Nairobi, Kenya
- Seoul, South Korea
- Kuala Lumpur, Malaysia
- Querétaro, Mexico
- Amsterdam, Netherlands
- Auckland, New Zealand
- Christchurch, New Zealand
- Oslo, Norway
- Panama City, Panama
- Lima, Peru
- Manila, Philippines
- Warsaw, Poland
- Lisbon, Portugal
- Bucharest, Romania
- Georgia, United States
- Illinois, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- Missouri, United States
- Nevada, United States
- New Jersey, United States
- New York, United States
- Ohio, United States
- Oregon, United States
- Pennsylvania, United States
- Tennessee, United States
- Texas, United States
- Utah, United States
- Virginia, United States
- Washington, United States
- Hanoi, Vietnam
- Ho Chi Minh, Vietnam

and the following Wavelength locations in:

- Berlin, Germany
- Daejeon, South Korea
- Dortmund, Germany
- London, England
- Munich, Germany
- Osaka, Japan
- Tokyo, Japan
- Arizona, United States
- Florida, United States
- Georgia, United States
- Maryland, United States
- Massachusetts, United States
- Michigan, United States
- Minnesota, United States
- North Carolina, United States
- Nevada, United States
- New Jersey, United States
- Texas, United States
- Washington, United States
- California, United States
- Colorado, United States
- Wisconsin, United States

as well as Local Zone locations in:

- Arizona, United States
- California, United States
- Colorado, United States
- Pennsylvania, United States
- Florida, United States
- Georgia, United States
- Illinois, United States
- Massachusetts, United States
- Minnesota, United States
- Texas, United States
- Missouri, United States
- Nevada, United States
- New Jersey, United States
- Oregon, United States
- Washington, United States

Shared Responsibility Environment

Moving the customer’s IT infrastructure to AWS builds a shared responsibility model between customers and AWS. AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the services operate. In turn, customers assume responsibility and management of the design, implementation and operation of their AWS environment, which may include guest operating systems (including updates and security patches), other associated application software, as well as the configuration of the AWS-provided security group firewall. Customers should carefully consider the services they choose as customer responsibilities vary depending on the services they use, the integration of those services into their IT environments, and applicable laws and regulations. It is possible to enhance security and/or meet more stringent compliance requirements by leveraging technology such as host-based firewalls, host-based intrusion detection/prevention, and encryption. AWS provides tools and information to assist customers in their efforts to account for and to validate that controls are operating effectively in their extended IT environment. More information can be found on the AWS Compliance center at https://aws.amazon.com/compliance.

AWS offers a variety of different infrastructure and platform services. More information can be found on the AWS Shared Responsibility Model at https://aws.amazon.com/compliance/shared-responsibility-model/. For the purpose of understanding security and shared responsibility for AWS’ services, AWS has categorized them into three main categories: infrastructure, container, and abstracted. Each category comes with a slightly different security ownership model based on how customers interact and access the functionality. Customer responsibility is determined by the AWS Cloud services that a customer selects. This determines the amount of configuration work the customer must perform as part of their security responsibilities.

Infrastructure Services: Services such as Amazon Elastic Compute Cloud (Amazon EC2) and Amazon Virtual Private Cloud (Amazon VPC) are categorized as Infrastructure Services and, as such, require the customer to perform the necessary security configuration and management tasks. If a customer deploys an Amazon EC2 instance, they are responsible for management of the guest operating system (including updates and security patches), any application software or utilities installed by the customer on the instances, and the configuration of the AWS-provided firewall (called a security group) on each instance.

Container Services: Services in this category typically run separately on Amazon EC2 or other infrastructure instances, but sometimes customers are not required to manage the operating system or the platform layer. AWS provides a managed service for these application “containers”. Customers are responsible for setting up and managing network controls, such as firewall rules, and for managing platform-level identity and access management separately from IAM. Examples of container services include Amazon Relational Database Services (Amazon RDS), Amazon Elastic Map Reduce (Amazon EMR) and AWS Elastic Beanstalk.

Abstracted Services: This category includes high-level storage, database, and messaging services, such as Amazon Simple Storage Service (Amazon S3), Amazon Glacier, Amazon DynamoDB, Amazon Simple Queuing Service (Amazon SQS), and Amazon Simple Email Service (Amazon SES). These services abstract the platform or management layer on which the customers can build and operate cloud applications. The customers access the endpoints of these abstracted services using AWS APIs, and AWS manages the underlying service components or the operating system on which they reside.

As every customer deploys their environment differently in AWS, customers can take advantage of shifting the management of certain IT controls to AWS, which results in a (new) distributed control environment. Customers can then use the AWS control and compliance documentation available to them to perform their control evaluation and verification procedures as required. Certain functions of services have been identified as controls in the system description and are denoted as "service-specific" as they are unique to the respective service.

More information and examples on the AWS Security Best Practices can be found at https://aws.amazon.com/architecture/security-identity-compliance/.

Furthermore, AWS publishes security blogs related to best practices that cover best practices around using AWS services at https://aws.amazon.com/blogs/security/tag/best-practices/.

Relevant Aspects of Internal Controls

As defined by the American Institute of Certified Public Accountants (AICPA), internal control is a process affected by an entity's board of directors, management, and other personnel and consists of five interrelated components:

- Control Environment – Sets the tone of an organization, influencing the control consciousness of its people. It is the foundation for all other components of internal control, providing discipline and structure.
- Risk Management – The entity's identification and analysis of relevant risks to the achievement of its objectives, forming a basis for determining how the risks should be managed.
- Information and Communication – Surrounding these activities are information and communication systems. These enable the entity's people to capture and exchange information needed to conduct and control its operations.
- Monitoring – The entire process must be monitored, and modifications made as necessary. In this way, the system can react dynamically, changing as conditions warrant.
- Control Activities – Control policies and procedures must be established and executed to help ensure that the actions identified by management as necessary to address risks to the achievement of the entity's objectives are effectively carried out.

This section briefly describes the essential characteristics and other interrelated components of internal controls in achieving the service commitments and system requirements related to the trust services criteria of security, availability, confidentiality and privacy as they pertain to AWS that may be relevant to customers in five broad areas:

- Policies (Control Environment and Risk Management) – The entity has defined and documented its policies relevant to the applicable trust services criteria.
- Communications (Information and Communication) – The entity has communicated its defined policies to responsible parties and authorized users of the system.
- Service Commitments and System Requirements (Control Activities) – The entity has communicated its service commitments to customers in accordance with customer agreements.

- Procedures (Control Activities) – The entity has placed in operation procedures to achieve service commitments and systems requirements in accordance with its defined policies.
- Monitoring – The entity monitors the system and takes action to maintain compliance with its defined policies.

A. Policies

A.1 Control Environment

AWS is a unit within Amazon.com ("Amazon" or "the Company") that is aligned organizationally around each of the web services, such as Amazon EC2, Amazon S3, Amazon VPC, Amazon EBS and Amazon RDS. AWS leverages some aspects of Amazon's overall control environment in the delivery of these web services. The collective control environment encompasses management and employee efforts to establish and maintain an environment that supports the effectiveness of specific controls. AWS maintains internal informational websites describing the AWS environment, its boundaries, user responsibilities and services **(Control AWSCA-9.1)**.

The control environment at Amazon begins at the highest level of the Company. Executive and senior leadership play important roles in establishing the Company's core values and tone at the top. The Company's Code of Business Conduct and Ethics, which sets guiding principles, is made available to every employee.

Amazon is committed to having the highest qualified members as a part of its Board of Directors **(Control AWSCA-1.7)**. Annually, the Amazon Corporate Governance Committee provides each Board member a questionnaire that establishes whether they are independent and qualified to serve on each Board or Committee under the applicable rules. The Corporate Governance Committee periodically reviews and assesses the composition of the Board and evaluates the overall Board performance during the annual assessment of individual Board members. The Leadership Development and Compensation Committee, with the full Board present, annually evaluates the succession plan for each member of the Senior Management team **(Control AWSCA-1.8)**. This includes the annual Company and CEO performance and succession plan.

AWS is committed to protecting its customers' data and maintaining compliance with applicable regulatory requirements. This is demonstrated by the consolidated annual operational plan that includes regulatory and compliance requirements and objectives to enable the identification and assessment of risks relating to those objectives **(Control AWSCA-1.9)**. AWS' policies and procedures outline the required guidance for operation and information security that supports AWS environments, acceptable use of mobile devices, and access to data content and network devices **(Control AWSCA-3.16)**. All AWS employees are required to review all applicable policies and procedures, as updated from time to time. Evidence of compliance with the training on AWS policies is executed and retained by the employee resource team.

Amazon has setup an ethics hotline for the employees or third-party contractors to report any misconduct or violation of AWS policies, practices, rules, requirements or procedures **(Control AWSCA-9.6).** Any material violation of the Company Code of Business Conduct and Ethics or any other similar policies are appropriately handled accordingly which may include disciplinary action or termination of employment. Violations by vendors or third-party contractors are reported to their employers for disciplinary action, removal of assignment with Amazon, or termination **(Control AWSCA-9.7).**

AWS Management has implemented a formal audit program that monitors and audits controls that are designed to protect against organizational risks and customer data. This includes external independent assessments against regulatory, internal and external control frameworks. The internal and external audits are planned, performed and reported to the Audit Committee. The AWS compliance team performs and reviews the audit plan according to the documented audit schedule and communicates the audit requirements based on standard criteria that verifies compliance with the regulatory requirements and reported risk to the Audit Committee.

AWS Artifact is the primary resource for customers to obtain compliance-related information from AWS. It provides access to AWS' security and compliance reports and select online agreements. Reports available in AWS Artifact include: AWS Service Organization Control (SOC) reports, Payment Card Industry (PCI) Attestation of Compliance, and certifications from accreditation bodies across geographies and industry verticals that validate the implementation and operating effectiveness of AWS security controls. Amongst other things, compliance reports are made available to customers to enable them to evaluate AWS' conformance with security controls and associated compliance obligations **(Control AWSCA-9.8).**

The AWS organizational structure provides a framework for planning, executing and controlling business operations **(Control AWSCA-1.1).** The organizational structure assigns roles and responsibilities to provide for adequate staffing, efficiency of operations and the segregation of duties. Management has also established authority and appropriate lines of reporting for key personnel. The Company follows a structured on-boarding process to assist new employees as they become familiar with Amazon tools, processes, systems, policies and procedures.

AWS performs a formal evaluation of the appropriate resourcing and staffing to align employee qualifications with the entity's business objectives to support the achievement of the entity's business objectives. Appropriate feedback is given to the employee on strengths and growth areas during the annual performance review process. Employee strength and growth evaluations are shared by the employee's manager with the employee **(Control AWSCA-9.3).**

The GovCloud (US East) and GovCloud (US West) environments are AWS regions located in the United States (US) that are designed to maintain physical and logical access controls that limit access by AWS personnel to the AWS Network for the GovCloud (US) regions to US citizens. The AWS control environment described in this document is also applicable to the GovCloud (US) regions. The AWS control environment is subject to various internal and external risk assessments.

The AWS Security team has established an information security framework and regularly reviews and updates the security policies, provides security training, which includes data classification, to employees, and performs application security reviews. These reviews assess the availability, confidentiality, and integrity of data, as well as conformance to the security policies. Where necessary, AWS Security leverages the security framework and security policies established and maintained by Amazon Corporate Information Security.

AWS has a process in place to review environmental and geo-political risks before launching a new region **(Control AWSCA-1.10)**. Risk assessments encompass reviews of natural catastrophe (e.g., extreme weather events), technological (e.g., fire, nuclear radiation, industrial pollution) and man-made (e.g., vehicle impact, intentional acts, geo-political) hazards, including exposures presented by nearby entities;

as applicable. In addition to site-specific considerations, AWS evaluates scenarios potentially affecting separate AZs within a region.

A.2 Risk Management

AWS maintains a formal risk management program to continually discover, research, evaluate, plan, resolve, and optimize information security risks that impact AWS business objectives, regulatory requirements, and customers. Risk treatment options may include acceptance, avoidance, mitigation, and transfer. Risks are documented in a risk register which is updated as new risks are identified or there are changes to existing risks. AWS Business Risk Management (BRM) manages and reports risks, including risk treatment decisions, to AWS Management on at least a semi-annual basis **(Control AWSCA-1.5)**. The risk management program consists of the following phases:

1) Identifying Risks

   BRM has developed a tailored approach to identifying risks across the business. The approach is:

   - Bottom-up to identify existing risk management activities
   - Top down to gather information from key leaders
   - Cross-functional Kaizen sessions intended to deep dive in areas of need

   Where appropriate, BRM conducts ad-hoc engagements with the business prompted by inbound requests or proactive outreach by the team on specific questions.

2) Analyzing Risks

   BRM reviews the identified risks with senior leaders to calibrate, assess, and prioritize. This is accomplished by evaluating:

   - Probability (likelihood of occurrence in a defined time period);
   - Impact (degree of severity in terms of customers, employees, cost, operations, legal and regulatory compliance, and reputation); and
   - Current Risk Management Effectiveness (existence of practices or controls that reduce inherent risk).

3) Treating Risks

   BRM adopts risk treatment (versus risk mitigation) as a strategy, collaborating with business SMEs to develop response plans based on the appropriate treatment option. These might include:

   - Eliminating or avoiding the risk (e.g., stopping the activity)
   - Reducing the risk (e.g., implementing controls)
   - Transferring the risk (e.g., to a third party)
   - Accepting the risk (when capacity and appetite exist)

4) Monitoring and Reporting Risks

   BRM actively monitors material risks and their treatment plans. Reports are provided to senior leadership at least semi-annually. Reports may include important information about key risks and treatments, as well as emerging trends and general program updates.

In addition to the BRM Risk Assessment, Internal Audit performs a separate Risk Assessment to identify and prioritize significant AWS risks and uses this information to define the audit plan. The Risk Assessment incorporates input from multiple sources such as changes to the business, internal audits, operational events, and emerging risks. The audit plan and any changes to the plan during the year are presented to the Audit Committee. Internal Audit also communicates significant audit findings and associated action plans to the Audit Committee.

Additionally, at least on a monthly basis, AWS management reviews the AWS operational metrics and Correction of Errors (COEs) to improve the overall availability of AWS services and to identify areas of improvements while mitigating risks to our environments. The "COE" documents are used to perform deep root cause analysis of certain incidents across AWS, document actions taken, and assign follow-up action items and owners to track to resolution.

B. Communications

AWS has implemented various methods of internal communication at a global level to help employees understand their individual roles and responsibilities and to communicate significant events in a timely manner **(Control AWSCA-1.4).** These methods include orientation and training programs for newly hired employees; annual training programs tailored based on employee roles and responsibilities that may include Amazon Security Awareness (ASA), Software Developer Engineer (SDE) Bootcamp, ITAR Training, Fraud/Bribery/Foreign corrupt practices training, and confidentiality training; regular management meetings for updates on business performance and other matters; and electronic means such as video conferencing, electronic mail messages, and the posting of information via the Amazon intranet on topics such as reporting of information security incidents and guidelines describing change management.

C. Service Commitments and System Requirements

C.1 Service Commitments

AWS communicates service commitments to user entities (AWS customers) in the form of Service Level Agreements (SLAs), customer agreements (https://aws.amazon.com/agreement/), contracts or through the description of the service offerings provided online through the AWS website. More information regarding Service Level Agreements can be found at https://aws.amazon.com/legal/service-level-agreements/.

AWS uses various methods of external communication to support its customer base and the community. Mechanisms are in place to allow the AWS Support Escalation and Event Management (E2M) team to be notified and to notify customers of potential operational issues that could impact the customer experience. AWS Health Dashboard is available to alert customers of "General Service Events" which show the health of all AWS services and "Your Account Events" shows events specific to the account. Current status information can be checked by the customer on this site, or by leveraging Amazon EventBridge Integrations or RSS feeds which allow customers to be notified of interruptions to each individual service. Details related to security and compliance with AWS can also be obtained on the AWS Security Center and AWS Compliance websites.

Customers have the ability to contact AWS through the 'Contact us' page for any issues related to the AWS services. AWS provides publicly available mechanisms for external parties to contact AWS to report security events and publishes information including a system description and security and compliance information addressing AWS commitments and responsibilities **(Control AWSCA-9.5)**. Customers can also subscribe to Premium Support offerings that include direct communication with the customer support team and proactive alerts for any customer impacting issues. AWS also deploys monitoring and alarming mechanisms which are configured by AWS Service Owners to identify and notify operational and management personnel of incidents when early warning thresholds are crossed on key operational metrics **(Control AWSCA-8.1)**. Additionally, incidents are logged within a ticketing system, assigned a severity rating and tracked to resolution **(Control AWSCA-8.2)**.

C.2 System Requirements

The selection and use of services by AWS' customers must be set up and operated under a shared responsibility model so that the functionality of the services and the associated security is appropriately managed. AWS is responsible for protecting the infrastructure that runs the service(s) offered in the AWS Cloud. The customer's responsibility is determined by the AWS Cloud service(s) that a customer selects and the interdependencies of those services within the AWS Cloud and their own networked environment. Customers should assess the objectives for their network when designing IT components by identifying the risk and corresponding controls to be implemented to address those risks. Customers should carefully consider the services they choose as their responsibilities vary depending on the service(s) as well as the type of configuration(s) and operational controls required as part of their security responsibilities.

When designing and developing its services, AWS management has created internal policies that are relevant to the services and systems available to customers. The development of these policies and procedures supports management with decision making and the operational teams with business requirements and management of each service and system. As each AWS service is unique, the system requirements to use different services vary depending on the service and each customer's environment.

As explained in the Availability section of the report, AWS has processes and infrastructure in place to have the services available to customers to meet their needs. AWS communicates its system requirements to customers and how to get started with using the AWS services in the form of user guides, developer guides, API references, service specific tutorials, or SDK toolkits. More information regarding the AWS Documentation can be found at https://docs.aws.amazon.com/. These resources help the customers with architecting the AWS services to satisfy their business needs.

AWS has identified the following objectives to support the security, change, and operational processes underlying their service commitments and business requirements. The objectives ensure the system operates and mitigates the risks that threaten the achievement of the service commitments. The objectives below provide reasonable assurance that:

- Data integrity is maintained through all phases, including transmission, storage and processing.
- Procedures have been established so that Amazon employee user accounts are added, modified and deleted in a timely manner and reviewed on a periodic basis.
- Policies and mechanisms are in place to appropriately restrict unauthorized internal and external access to data and customer data is appropriately segregated from other customers.
- *S*ystem incidents are recorded, analyzed and resolved.

- Changes (including emergency/non-routine and configuration) to existing IT resources are logged, authorized, tested, approved and documented.
- Critical system components are replicated across multiple Availability Zones and authoritative backups are maintained and monitored to ensure successful replication to meet the service commitments.
- Controls are implemented to safeguard data from within and outside of the boundaries of environments which store a customer's content to meet the service commitments.
- Procedures have been established so that the collection, use, retention, disclosure, and disposal of customer data within AWS services is in accordance with the service commitments.

D. Procedures

D.1 Security Organization

AWS has an established information security organization managed by the AWS Security team and is led by the AWS Chief Information Security Officer (CISO). AWS Security establishes and maintains policies and procedures to delineate standards for logical access on the AWS system and infrastructure hosts. The policies also identify functional responsibilities for the administration of logical access and security. Where applicable, AWS Security leverages the information system framework and policies established and maintained by Amazon Corporate Information Security. AWS and Amazon Corporate Information Security policies are reviewed and approved on an annual basis by AWS Security Leadership and are used to support AWS in meeting the service commitments made to the customer **(Control AWSCA-1.1**, **AWSCA - 1.2**, and **AWSCA-1.3)**.

As part of this annual assessment, the following policies were inspected to verify approval occurred within the last year:

AWS Access Control Policy	AWS Media Protection Policy
AWS Configuration Management Policy	AWS Password Policy
AWS Contingency Planning Policy	AWS Personnel Security Policy
AWS Critical Permission Group Standard	AWS Physical and Environmental Protection Policy
Data Center Security Standard: Media Handling, Storage and Destruction	Secure Software Development Policy
AWS Data Classification and Handling Policy	AWS Security Assessment and Certification Standard
AWS Facility Badge Management and Use Standard	AWS Security Awareness Training Policy
AWS Identification and Authentication Policy	AWS System and Communications Protection Policy
AWS Incident Response Policy	AWS System and Information Integrity Policy
AWS Information Security Risk Management Policy	AWS System Maintenance Policy
AWS Internal Privacy Policy	AWS Third Party Information Sharing Policy

AWS has a security awareness and training policy that is disseminated via an internal Amazon communication portal to all employees. This policy addresses purpose, scope, roles, responsibilities, and management commitment. AWS maintains and provides security awareness training to all information system users on an annual basis **(Control AWSCA-1.4)**.

As a part of AWS' responsibilities within the shared responsibility model, AWS follows the three lines of defense model established by the Institute of Internal Auditors, discussed in The Three Lines of Defense in Effective Risk Management and Control whitepaper. In this model, operational management is the first line of defense, the various risk control and compliance over-sight functions established by management are the second line of defense **(Control AWSCA-1.5)**, and independent assurance is the third. Each of these lines of defense serve a different role.

As its third line of defense, Amazon has an Internal Audit function to periodically evaluate risks and assess conformance to AWS security processes with due professional care (**Control AWSCA-9.8**). Further, AWS Security Assurance works with third-party assessors to obtain an independent assessment of risk management content/processes by performing periodic security assessments and compliance audits or examinations (e.g., SOC, FedRAMP, ISO, PCI) to evaluate the security, integrity, confidentiality, and availability of information and resources. AWS management also collaborates with Internal Audit to determine the health of the AWS control environment and leverages this information to fairly present the assertions made within the reports.

D.2 Employee User Access

Procedures exist so that Amazon employee and contractor user accounts are added, modified, or disabled in a timely manner and are reviewed on a periodic basis. In addition, password configuration settings for user authentication to AWS systems are managed in compliance with Amazon's Password Policy.

AWS has established policies and procedures to delineate standards for logical access to AWS systems and infrastructure hosts. Where permitted by law, AWS requires that employees undergo a background screening, at the time of hiring, commensurate with their position and level of access, in accordance to the AWS Personnel Security Policy **(Control AWSCA-9.2)**. The policies also identify functional responsibilities for the administration of logical access and security.

Additionally, AWS employees who have access to systems that could impact the confidentiality, integrity, or availability of customer data are required to complete a post-hire background screening within a year from their last background check. Post-hire screening includes criminal screening requirements consistent with the pre-hire background screening. Access to the systems that could impact the confidentiality, integrity or availability of customer data is managed by membership in permission groups. Employees who support internal services or have access to network resources are not required to complete the post-hire background screening. Post-hire background screening is conducted where it is legally permissible by local law, in accordance to the AWS Personnel Security Policy **(Control AWSCA-9.9)**.

Account Provisioning

The responsibility for provisioning user access, which includes employee and contractor access is shared across Human Resources (HR), Corporate Operations, and Service Owners.

A standard employee or contractor account with minimum privileges is provisioned in a disabled state when a hiring manager submits his or her new employee or contractor onboarding request in Amazon's HR system. The account is automatically enabled after the employee's record is activated in Amazon's HR system. First time passwords are set to a unique value and are required to be changed on first use **(Control AWSCA-2.1)**.

Access Management

AWS employs the concept of least privilege, allowing only the necessary access for users to accomplish their job function. User accounts are created to have minimal access. Access above these least privileges requires appropriate and separate authorization.

Access to resources including Services, Hosts, Network devices, and Windows and UNIX groups is approved in Amazon's proprietary permission management system by the appropriate owner or manager. Requests for changes in access are captured in the Amazon permissions management tool audit log. When changes in an employee's job function occur, continued access must be approved to the resource or it will be automatically revoked **(Control AWSCA-2.2).**

Periodic Access Review

Access control lists or permission groups granting access to critical infrastructure are reviewed for appropriateness on a periodic basis. On a quarterly basis, AWS reviews the access to systems supporting the infrastructure and network; explicit re-approval is required, or access to the resource is revoked. On a semi-annual basis, AWS reviews the access to internal AWS accounts. When an internal user no longer has a required business need to access the operational management system, the user's privileges and access to the relevant systems are revoked. (**Control AWSCA-2.3**).

Access Removal

Access is revoked when an employee's record is terminated in Amazon's HR system. Windows and UNIX accounts are disabled, and Amazon's permission management system removes the user from all systems **(Control AWSCA-2.4).**

Password Policy

Access and administration of logical security for Amazon relies on user IDs, passwords and Kerberos to authenticate users to services, resources and devices as well as to authorize the appropriate level of access for the user. AWS Security has established a password policy with required configurations and expiration intervals. AWS has a credential monitoring and response process to monitor compromised credentials for Amazon employees. Impacted user credentials are identified, tracked and rotated in a timely manner **(Control AWSCA-2.5).**

Remote Access

AWS requires two-factor authentication over an approved cryptographic channel for authentication to the internal AWS network from remote locations **(Control AWSCA-2.6).**

D.3 Logical Security

Procedures and mechanisms are in place to appropriately restrict unauthorized internal and external access to data, and access to customer data is appropriately segregated from other customers.

APIs enable customers to articulate who has access to AWS services and resources (if resource-level permissions are applicable to the service) that they own. AWS prevents customers from accessing AWS resources that are not assigned to them via access permissions. User content is segregated by the service's software. Content is only returned to individuals authorized to access the specified AWS service or resource (if resource-level permissions are applicable to the service) **(Control AWSCA-3.5)**.

AWS performs Application Security (AppSec) reviews when needed for externally launched products, services, and significant feature additions prior to launch to ensure security risks are identified and mitigated. As a part of the security AppSec review, the Application Security team collects detailed information about the artifacts required for the review. The Application Security team tracks reviews against an independently managed inventory of products and features to be released to ensure that none are inadvertently launched before a completed review. The Application Security team then determines the granularity of review required based on the artifact's design, threat model, and impact to AWS' risk profile. During this process, they work with the service team to identify, prioritize, and remediate security findings, and perform penetration testing as needed. The Application Security team provides their final approval for launch only upon completion of the review **(Control AWSCA-3.6)**.

AWS Network Security

The AWS Network consists of the internal data center facilities, servers, networking equipment and host software systems that are within AWS' control and are used to provide the services.

The AWS network provides significant protection against traditional network security issues. The following are a few examples:

- **Distributed Denial of Service (DDoS) Attacks.** AWS API endpoints are hosted on large, Internet-scale infrastructure and use proprietary DDoS mitigation techniques. Additionally, AWS' networks are multi-homed across a number of providers to achieve Internet access diversity (**Control AWSCA-8.1**).
- **Man in the Middle (MITM) Attacks.** All of the AWS APIs are available via TLS/SSL-protected endpoints, which provide server authentication. Amazon EC2 AMIs automatically generate new SSH host certificates on first boot and log them to the instance's console. Customers can then use the secure APIs to call the console and access the host certificates before logging into the instance for the first time. Customers can use TLS/SSL for all of their interactions with AWS **(Control AWSCA-3.11).**
- **IP Spoofing.** The AWS-controlled, host-based firewall infrastructure will not permit an instance to send traffic with a source IP or MAC address other than its own **(Control AWSCA-3.10)**.
- **Port Scanning.** Unauthorized port scans by Amazon EC2 customers are a violation of the AWS Acceptable Use Policy. Violations of the AWS Acceptable Use Policy are taken seriously, and every reported violation is investigated. Customers can report suspected abuse via the contacts available on our website at: https://aws.amazon.com/contact-us/report-abuse/. When

unauthorized port scanning is detected by AWS, it is stopped and blocked. Port scans of Amazon EC2 instances are generally ineffective because, by default, all inbound ports on Amazon EC2 instances are closed and are only opened by the customer. Customers' strict management of security groups can further mitigate the threat of port scans. Customers may request permission to conduct vulnerability scans as required to meet specific compliance requirements. These scans must be limited to customers' own instances and must not violate the AWS Acceptable Use Policy. Advanced approval for these types of scans can be initiated by submitting a request via the website at: https://aws.amazon.com/security/penetration-testing/.

- **Packet sniffing by other tenants.** Virtual instances are designed to prevent other instances running in promiscuous mode to receive or "sniff" traffic that is intended for a different virtual instance. While customers can place instances into promiscuous mode, the hypervisor will not deliver any traffic to them that is not addressed to them. Even two virtual instances that are owned by the same customer located on the same physical host cannot listen to each other's traffic. While Amazon EC2 does provide protection against one customer inadvertently or maliciously attempting to view another's data, as standard practice customers can encrypt sensitive traffic **(Control AWSCA-3.10).**

- **Anti-virus software installed on workstations.** Anti-virus software is deployed and running on Amazon corporate workstations. Client Engineering and Enterprise Engineering teams deploy Anti-virus software at imaging to Amazon corporate workstations. Checks are in place to assure that Anti-virus software is installed, running and provide quarantining tooling that will isolate non-compliant workstations from the network until remediation is affected (**Control AWSCA-3.18**).

In addition, firewall devices are configured to restrict access to production networks **(Control AWSCA-3.1).** The configurations of these firewall policies are maintained via an automatic push from a parent server **(Control AWSCA-3.2).** All changes to the firewall policies are reviewed and approved **(Control AWSCA-3.3).**

AWS Security performs regular vulnerability scans on the host operating systems, web applications, and databases in the AWS environment using a variety of tools **(Control AWSCA-3.4).** AWS Security teams also subscribe to newsfeeds for applicable vendor flaws and proactively monitor vendors' websites and other relevant outlets for new patches. AWS customers also have the ability to report issues to AWS via the AWS Vulnerability Reporting website at: https://aws.amazon.com/security/vulnerability-reporting/.

AWS employs virtualization techniques including virtual networking devices and host-based firewalls, which control traffic flow restrictions via Access Control Lists (ACLs) in EC2 and VPC, and as EC2 instances which present a variety of operating systems. It is the responsibility of the customers to appropriately configure server resources within the customer VPC.

External Access Control

External access to services is configurable by customers via AWS Identity and Access Management (IAM). IAM enables customers to securely control access to AWS services and resources for their users. Using IAM, customers can create and manage AWS users, roles, groups, and create and attach policies to those entities with granular permissions that allow and deny access to AWS resources. Security Groups act as firewalls and may also be used to control access to some in-scope applications such as VPC, EFS, ElastiCache, and DMS. These groups default to a "deny all" access mode and customers must specifically authorize network connectivity. This can be achieved by authorizing a network IP range or authorizing an existing Security Group **(Control AWSCA-3.5)**.

Interacting with the Service

AWS provides several methods of interacting with the services in the form of APIs, Software Development Kits (SDKs), the AWS Management Console, and the AWS command line interface. All of the methods ultimately rely on the public APIs and follow standard AWS authentication and authorization practices.

Authenticated calls to AWS services are signed by either an X.509 certificate and/or the customer's AWS Secret Access Key. When using the AWS Command Line Interface (AWS CLI) or one of the AWS SDKs to make requests to AWS, these tools automatically sign the requests with the access key specified by the customer when the tools were configured. Manually created requests must be signed using Signature Version 4 or Signature Version 2. All AWS services support Signature Version 4, except Amazon SimpleDB, which requires Signature Version 2. For AWS services that support both versions, it is recommended to use Signature Version 4.

Internal Logging

AWS maintains centralized repositories that provide core log archival functionality available for internal use by AWS service teams. Leveraging S3 for high scalability, durability, and availability allows service teams to collect, archive, and view service logs in a central log service.

Production hosts at AWS are deployed using a master baseline image that is equipped with a standard set of configurations and functions including logging and monitoring for security purposes **(Control AWSCA-9.4)**.

These logs are stored and accessible by AWS security teams for root cause analysis in the event of a suspected security incident. Logs for a given host are also available to the team that owns that host in case the team needs to search their logs for operational and security analysis. Processes are implemented to protect logs and audit tools from unauthorized access, modification, and deletion.

Encryption

Amazon cryptographic policy defines the appropriate cryptography implementation through the Amazon cryptographic standard. The cryptography standard is based on FIPS standards, NIST standards, and/or the Commercial National Security Algorithm Suite (Suite B). Implementation guidance including appropriate key length and algorithm specific parameters are provided to service teams through application security reviews. Additionally, AWS Security Engineers within the cryptography review program review the appropriate use of cryptography within AWS. In addition, API calls can be encrypted with TLS/SSL to maintain confidentiality. It is the customer’s responsibility to appropriately configure and manage usage and implementation of available encryption options to meet compliance requirements.

The production firmware version of the AWS Key Management Service HSM (Hardware Security Module) has been validated with NIST under the latest FIPS 140-2 standard or is in the process of being validated **(Control AWSCA-4.14).** The AWS KMS team works with a vendor (Example: Acumen) who in turn works with NIST to get new HSM firmware versions validated. Every new firmware version that gets deployed into production goes through the NIST validation process and is submitted to NIST’s Cryptographic Module

Validation Program (CMVP) in order to obtain FIPS 140-2 validation. As the HSM validation process takes 4-6 months to complete, the AWS KMS team initiates the revalidation process with the vendor and may start deployment while the firmware validation is in process.

Deletion of Customer Content

AWS provides customers the ability to delete their content. Once successfully removed, the data is rendered unreadable **(Control AWSCA-7.7).** For services that utilize ephemeral storage, such as EC2, the ephemeral storage is deleted once the EC2 instance is deleted.

D.4 AWS Service Descriptions

AWS Amplify
AWS Amplify is a set of tools and services that can be used together or on their own, to help front-end web and mobile developers build scalable full stack applications, powered by AWS. With Amplify, customers can configure app backend and connect applications in minutes, deploy static web apps in a few clicks and easily manage app content outside of AWS console. Amplify supports popular web frameworks including JavaScript, React, Angular, Vue, Next.js, and mobile platforms including Android, iOS, React Native, Ionic, and Flutter.

AWS Application Migration Service
AWS Application Migration Service is the primary service that AWS recommends for lift-and-shift applications to AWS. The service minimizes time-intensive, error-prone manual processes by automatically converting customers' source servers from physical, virtual, or cloud infrastructure to run natively on AWS. Customers are able to use the same automated process to migrate a wide range of applications to AWS without making changes to applications, their architecture, or the migrated servers.

Amazon API Gateway
Amazon API Gateway is a service that makes it easy for developers to publish, maintain, monitor, and secure APIs at any scale. With Amazon API Gateway, customers can create a custom API to code running in AWS Lambda, and then call the Lambda code from customers' API. Amazon API Gateway can execute AWS Lambda code in a customer's account, start AWS Step Functions state machines, or make calls to AWS Elastic Beanstalk, Amazon EC2, or web services outside of AWS with publicly accessible HTTP endpoints. Using the Amazon API Gateway console, customers can define customers' REST API and its associated resources and methods, manage customers' API lifecycle, generate customers' client SDKs, and view API metrics.

Amazon AppFlow
Amazon AppFlow is an integration service that enables customers to securely transfer data between Software-as-a-Service (SaaS) applications like Salesforce, SAP, Zendesk, Slack, and ServiceNow, and AWS services like Amazon S3 and Amazon Redshift. With AppFlow, customers can run data flows at enterprise scale at the frequency they choose - on a schedule, in response to a business event, or on demand. Customers are able to configure data transformation capabilities like filtering and validation to generate rich, ready-to-use data as part of the flow itself, without additional steps.

AWS App Mesh
AWS App Mesh is a service mesh that provides application-level networking which allows customer services to communicate with each other across multiple types of compute infrastructure. App Mesh gives

customers end-to-end visibility and high availability for their applications. AWS App Mesh makes it easy to run services by providing consistent visibility and network traffic controls, which helps to deliver secure services. App Mesh removes the need to update application code to change how monitoring data is collected or traffic is routed between services. App Mesh configures each service to export monitoring data and implements consistent communications control logic across applications.

AWS App Runner

AWS App Runner is a service that makes it easy for developers to quickly deploy containerized web applications and APIs, at scale and with no prior infrastructure experience required. The service provides a simplified infrastructure-less abstraction for multi-concurrent web applications and API-based services. With App Runner, infrastructure components like build, load balancers, certificates and application replicas are fully managed by AWS. Customers simply provide their source-code (or a pre-built container image) and get a service endpoint URL in return against which requests can be made.

Amazon AppStream 2.0

Amazon AppStream 2.0 is an application streaming service that provides customers instant access to their desktop applications from anywhere. Amazon AppStream 2.0 simplifies application management, improves security, and reduces costs by moving a customer’s applications from their users’ physical devices to the AWS Cloud. The Amazon AppStream 2.0 streaming protocol provides customers a responsive, fluid performance that is almost indistinguishable from a natively installed application. With Amazon AppStream 2.0, customers can realize the agility to support a broad range of compute and storage requirements for their applications.

AWS AppSync

AWS AppSync is a service that allows customers to easily develop and manage GraphQL APIs. Once deployed, AWS AppSync automatically scales the API execution engine up and down to meet API request volumes. AWS AppSync offers GraphQL setup, administration, and maintenance, with high availability serverless infrastructure built in.

Amazon Athena

Amazon Athena is an interactive query service that makes it easy to analyze data in Amazon S3 using standard SQL. Athena is serverless, so there is no infrastructure for customers to manage. Athena is highly available; and executes queries using compute resources across multiple facilities and multiple devices in each facility. Amazon Athena uses Amazon S3 as its underlying data store, making customers’ data highly available and durable.

AWS Audit Manager

AWS Audit Manager helps customers continuously audit AWS usage to simplify how customers manage risk and compliance with regulations and industry standards. AWS Audit Manager makes it easier to evaluate whether policies, procedures, and activities—also known as controls—are operating as intended. The service offers prebuilt frameworks with controls that are mapped to well-known industry standards and regulations, full customization of frameworks and controls, and automated collection and organization of evidence as designed by each control requirement.

Amazon Augmented AI [excludes Public Workforce and Vendor Workforce for all features]

Amazon Augmented AI is a machine learning service which makes it easy to build the workflows required for human review. Amazon A2I brings human review to all developers, removing the undifferentiated heavy lifting associated with building human review systems or managing large numbers of human reviewers whether it runs on AWS or not. The public and vendor workforce options of this service are not in scope for purposes of this report.

Amazon EC2 Auto Scaling

Amazon EC2 Auto Scaling launches/terminates instances on a customer's behalf according to conditions customers define, such as schedule, changing metrics like average CPU utilization, or health of the instance as determined by EC2 or ELB health checks. It allows customers to have balanced compute across multiple availability zones and scale their fleet based on usage.

AWS Backup

AWS Backup is a backup service that makes it easy to centralize and automate the back up of data across AWS services in the cloud as well as on premises using the AWS Storage Gateway. Using AWS Backup, the customers can centrally configure backup policies and monitor backup activity for AWS resources, such as Amazon EBS volumes, Amazon RDS databases, Amazon DynamoDB tables, Amazon EFS file systems, and AWS Storage Gateway volumes. AWS Backup automates and consolidates backup tasks previously performed service-by-service, removing the need to create custom scripts and manual processes.

AWS Batch

AWS Batch enables developers, scientists, and engineers to run batch computing jobs on AWS. AWS Batch dynamically provisions the optimal quantity and type of compute resources (e.g., CPU or memory optimized instances) based on the volume and specific resource requirements of the batch jobs submitted. AWS Batch plans, schedules, and executes customers' batch computing workloads across the full range of AWS compute services and features, such as Amazon EC2 and Spot Instances.

AWS Certificate Manager (ACM)

AWS Certificate Manager (ACM) is a service that lets the customer provision, manage, and deploy public and private Secure Sockets Layer/Transport Layer Security (SSL/TLS) certificates for use with AWS services and their internal connected resources. SSL/TLS certificates are used to secure network communications and establish the identity of websites over the Internet as well as resources on private networks. AWS Certificate Manager removes the manual process of purchasing, uploading, and renewing SSL/TLS certificates.

AWS Chatbot

AWS Chatbot is an AWS service that enables DevOps and software development teams to use Slack or Amazon Chime chat rooms to monitor and respond to operational events in their AWS Cloud. AWS Chatbot processes AWS service notifications from Amazon Simple Notification Service (Amazon SNS), and forwards them to Slack or Amazon Chime chat rooms so teams can analyze and act on them. Teams can respond to AWS service events from a chat room where the entire team can collaborate, regardless of location.

Amazon Chime

Amazon Chime is a communications service that lets customers meet, chat, and place business calls inside and outside organization, all using a single application. Developers can use the same communications infrastructure and services that power Amazon Chime, and add audio calling, video calling, and screen sharing capabilities directly to their applications using the Amazon Chime SDK.

AWS Cloud9

AWS Cloud9 is an integrated development environment, or IDE. The AWS Cloud9 IDE offers a rich code-editing experience with support for several programming languages and runtime debuggers, and a built-in terminal. It contains a collection of tools that customers use to code, build, run, test, and debug software, and helps customers release software to the cloud. Customers access the AWS Cloud9 IDE through a web browser. Customers can configure the IDE to their preferences. Customers can switch color themes, bind shortcut keys, enable programming language-specific syntax coloring and code formatting, and more.

Amazon Cloud Directory

Amazon Cloud Directory enables customers to build flexible cloud-native directories for organizing hierarchies of data along multiple dimensions. Customers also can create directories for a variety of use cases, such as organizational charts, course catalogs, and device registries. For example, customers can create an organizational chart that can be navigated through separate hierarchies for reporting structure, location, and cost center.

AWS Cloud Map

AWS Cloud Map is a cloud resource discovery service which allows customers to define custom names for their application resources. Cloud Map maintains the location of these changing resources to increase application availability.

Customers can register any application resource, such as databases, queues, microservices, and other cloud resources, with custom names. Cloud Map then constantly checks the health of resources to make sure the location is up-to-date. The application can then query the registry for the location of the resources needed based on the application version and deployment environment.

AWS CloudFormation

AWS CloudFormation is a service to simplify provisioning of AWS resources such as Auto Scaling groups, ELBs, Amazon EC2, Amazon VPC, Amazon Route 53, and others. Customers author templates of the infrastructure and applications they want to run on AWS, and the AWS CloudFormation service automatically provisions the required AWS resources and their relationships as defined in these templates.

Amazon CloudFront

Amazon CloudFront is a fast content delivery network (CDN) web service that securely delivers data, videos, applications and APIs to customers globally with low latency and high-transfer speeds. CloudFront offers the most advanced security capabilities, including field level encryption and HTTPS support, seamlessly integrated with AWS Shield, AWS Web Application Firewall and Route 53 to protect against multiple types of attacks including network and application layer DDoS attacks. These services co-reside at edge networking locations – globally scaled and connected via the AWS network backbone – providing a more secure, performant, and available experience for the users.

CloudFront delivers customers' content through a worldwide network of Edge locations. When an end user requests content that customers serve with CloudFront, the user is routed to the Edge location that provides the lowest latency, so content is delivered with the best possible performance. If the content is already in that Edge location, CloudFront delivers it immediately.

In addition to Edge locations, CloudFront also uses Amazon Cloud Extension (ACE). ACE is a CloudFront infrastructure (single-rack version) deployed to a non-Amazon controlled facility, namely an internet service provider (ISP) or partner network. Qualifying Network Operators can deliver CloudFront content efficiently and cost effectively from within their network by deploying ACE in their data centers.

AWS CloudHSM

AWS CloudHSM is a service that allows customers to use dedicated hardware security module (HSM) appliances within the AWS cloud. AWS CloudHSM is designed for applications where the use of HSM appliances for encryption and key storage is mandatory.

AWS acquires these production HSM devices securely using the tamper evident authenticable bags from the vendors. These tamper evident authenticable bag serial numbers and production HSM serial numbers are verified against data provided out-of-band by the manufacturer and logged by approved individuals in tracking systems **(Control AWSCA-4.15)**.

AWS CloudHSM allows customers to store and use encryption keys within HSM appliances in AWS data centers. With AWS CloudHSM, customers maintain full ownership, control, and access to keys and sensitive data while Amazon manages the HSM appliances in close proximity to customer applications and data. All HSM media is securely decommissioned and physically destroyed, verified by two personnel, prior to leaving AWS Secure Zones **(Control AWSCA-5.13)**.

AWS CloudTrail

AWS CloudTrail is a web service that records AWS activity for customers and delivers log files to a specified Amazon S3 bucket. 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.

AWS CloudTrail provides a history of AWS API calls for customer accounts, including API calls made via the AWS Management Console, AWS SDKs, command line tools, and higher-level AWS services (such as AWS CloudFormation). The AWS API call history produced by AWS CloudTrail enables security analysis, resource change tracking, and compliance auditing.

Amazon CloudWatch

Amazon CloudWatch is a monitoring and management service built for developers, system operators, site reliability engineers (SRE), and IT managers. CloudWatch provides the customers with data and actionable insights to monitor their applications, understand and respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health. CloudWatch collects monitoring and operational data in the form of logs, metrics, and events, providing the customers with a unified view of AWS resources, applications and services that run on AWS, and on-premises servers.

Amazon CloudWatch Logs

Amazon CloudWatch Logs is a service used to monitor, store, and access log files from Amazon Elastic Compute Cloud (EC2) instances, AWS CloudTrail, Route 53 and other sources. CloudWatch Logs enables customers to centralize the logs from systems, applications and AWS services used in a single, highly scalable service. Customers can easily view them, search for patterns, filter on specific fields or archive them securely for future analysis. CloudWatch Logs enables customers to view logs, regardless of their source, as a single and consistent flow of events ordered by time, and to query them based on specific criteria.

Amazon CloudWatch SDK Metrics for Enterprise Support

Amazon CloudWatch SDK Metrics for Enterprise Support is a monitoring and observability service built for DevOps engineers, developers, site reliability engineers (SREs), and IT managers. CloudWatch provides customers with data and actionable insights to monitor their applications, respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health. CloudWatch collects monitoring and operational data in the form of logs, metrics, and events, providing customers with a unified view of AWS resources, applications, and services that run on AWS and on-premises servers. Customers can use CloudWatch to detect anomalous behavior in their environments, set alarms, visualize logs and metrics side by side, take automated actions, troubleshoot issues, and discover insights to keep the applications running smoothly.

AWS CodeBuild

AWS CodeBuild is a build service that compiles source code, runs tests, and produces software packages that are ready to deploy. CodeBuild scales continuously and processes multiple builds concurrently, so that customers' builds are not left waiting in a queue. Customers can use prepackaged build environments or can create custom build environments that use their own build tools. AWS CodeBuild eliminates the need to set up, patch, update, and manage customers' build servers and software.

AWS CodeCommit

AWS CodeCommit is a source control service that hosts secure Git-based repositories. It allows teams to collaborate on code in a secure and highly scalable ecosystem. CodeCommit eliminates the need for customers to operate their own source control system or worry about scaling their infrastructure. CodeCommit can be used to securely store anything from source code to binaries, and it works seamlessly with the existing Git tools.

AWS CodeDeploy

AWS CodeDeploy is a deployment service that automates software deployments to a variety of compute services such as Amazon EC2, AWS Fargate, AWS Lambda, and the customer's on-premises servers. AWS CodeDeploy allows customers to rapidly release new features, helps avoid downtime during application deployment, and handles the complexity of updating the applications.

AWS CodePipeline

AWS CodePipeline is a continuous delivery service that helps customers automate release pipelines for fast and reliable application and infrastructure updates. CodePipeline automates the build, test, and deploy phases of customers release process every time there is a code change, based on the release model defined by the customer. This enables customers to rapidly and reliably deliver features and updates. Customers can easily integrate AWS CodePipeline with third-party services such as GitHub or with their own custom plugin.

Amazon Cognito

Amazon Cognito lets customers add user sign-up, sign-in, and manage permissions for mobile and web applications. Customers can create their own user directory within Amazon Cognito. Customers can also choose to authenticate users through social identity providers such as Facebook, Twitter, or Amazon; with SAML identity solutions; or by using customers' own identity system. In addition, Amazon Cognito enables customers to save data locally on users' devices, allowing customers' applications to work even when the devices are offline. Customers can then synchronize data across users' devices so that their app experience remains consistent regardless of the device they use.

Amazon Comprehend

Amazon Comprehend is a natural language processing (NLP) service that uses machine learning to find insights and relationships in text. Amazon Comprehend uses machine learning to help the customers uncover insights and relationships in their unstructured data without machine learning experience. The service identifies the language of the text; extracts key phrases, places, people, brands, or events; understands how positive or negative the text is; analyzes text using tokenization and parts of speech; and automatically organizes a collection of text files by topic.

Amazon Comprehend Medical

Amazon Comprehend Medical is a HIPAA-eligible natural language processing (NLP) service that facilitates the use of machine learning to extract relevant medical information from unstructured text. Using Amazon Comprehend Medical, customers can quickly and accurately gather information, such as medical condition, medication, dosage, strength, and frequency from a variety of sources like doctors' notes, clinical trial reports, and patient health records. Amazon Comprehend Medical uses advanced machine learning models to accurately and quickly identify medical information, such as medical conditions and medications, and determines their relationship to each other, for instance, medicine dosage and strength.

AWS Config

AWS Config enables customers to assess, audit, and evaluate the configurations of their AWS resources. AWS Config continuously monitors and records AWS resource configurations and allows customers to automate the evaluation of recorded configurations against desired configurations. With AWS Config, customers can review changes in configurations and relationships between AWS resources, dive into detailed resource configuration histories, and determine overall compliance against the configurations specified within the customers' internal guidelines. This enables customers to simplify compliance auditing, security analysis, change management, and operational troubleshooting.

Amazon Connect

Amazon Connect is an easy-to-use omnichannel cloud contact center that helps customers provide superior customer service across voice, chat, and tasks at lower cost than traditional contact center systems. Amazon Connect simplifies contact center operations, improves agent efficiency and lowers costs. Customers can setup a contact center in minutes that can scale to support millions of customers from the office or as a virtual contact center.

AWS Control Tower

AWS Control Tower provides the easiest way to set up and govern a new, secure, multi-account AWS environment based on AWS' best practices established through AWS' experience working with thousands of enterprises as they move to the cloud. With AWS Control Tower, builders can provision new AWS accounts that conform to customer policies. If customers are building a new AWS environment, starting out on the journey to AWS, starting a new cloud initiative, or are completely new to AWS, Control Tower will help customers get started quickly with governance and AWS' best practices built-in.

AWS Data Exchange

AWS Data Exchange makes it easy to find, subscribe to, and use third-party data in the cloud. Qualified data providers include category-leading brands. Once subscribed to a data product, customers can use the AWS Data Exchange API to load data directly into Amazon S3 and then analyze it with a wide variety of AWS analytics and machine learning services. For data providers, AWS Data Exchange makes it easy to reach the millions of AWS customers migrating to the cloud by removing the need to build and maintain infrastructure for data storage, delivery, billing, and entitling.

AWS Database Migration Service (DMS)

AWS Database Migration Service (DMS) is a cloud service that enables customers to migrate relational databases, data warehouses, NoSQL databases, and other types of data stores. AWS DMS can be used to migrate data into the AWS Cloud, between on-premises instances (through AWS Cloud setup), or between combinations of cloud and on-premises setups. The service supports homogenous migrations within one database platform, as well as heterogeneous migrations between different database platforms. AWS Database Migration Service can also be used for continuous data replication with high-availability.

AWS DataSync

AWS DataSync is an online data transfer service that simplifies, automates and accelerates moving data between on-premises storage and AWS Storage services, as well as between AWS Storage services. DataSync can copy data between Network File System (NFS), Server Message Block (SMB) file servers, self-managed object storage, AWS Snowcone, Amazon Simple Storage Service (Amazon S3) buckets, Amazon EFS file systems and Amazon FSx for Windows File Server file systems. DataSync automatically handles many of the tasks related to data transfers that can slow down migrations or burden customers' IT operations, including running customers own instances, handling encryption, managing scripts, network optimization, and data integrity validation.

Amazon Detective

Amazon Detective allows customers to easily analyze, investigate, and quickly identify the root cause of potential security issues or suspicious activity. Amazon Detective collects log data from customer's AWS resources and uses machine learning, statistical analysis, and graph theory to build a linked set of data that enables customers to conduct faster and more efficient security investigations. AWS Security services can be used to identify potential security issues or findings.

Amazon Detective can analyze trillions of events from multiple data sources and automatically creates a unified, interactive view of the resources, users, and the interactions between them over time. With this unified view, customers can visualize all the details and context in one place to identify the underlying reasons for the findings, drill down into relevant historical activities, and quickly determine the root cause.

AWS Direct Connect

AWS Direct Connect enables customers to establish a dedicated network connection between their network and one of the AWS Direct Connect locations. Using AWS Direct Connect, customers can establish private connectivity between AWS and their data center, office, or colocation environment.

AWS Directory Service [excludes Simple AD]

AWS Directory Service for Microsoft Active Directory, also known as AWS Managed Microsoft Active Directory (AD), enables customers' directory-aware workloads and AWS resources to use managed Active Directory in the AWS Cloud. AWS Managed Microsoft AD stores directory content in encrypted Amazon Elastic Block Store volumes using encryption keys. Data in transit to and from Active Directory clients is encrypted when it travels through Lightweight Directory Access Protocol (LDAP) over customers' Amazon Virtual Private Cloud (VPC) network. If an Active Directory client resides in an off-cloud network, the traffic travels to customers' VPC by a virtual private network link or an AWS Direct Connect link.

Amazon DocumentDB [with MongoDB compatibility]

Amazon DocumentDB [with MongoDB compatibility] is a fast, scalable, and highly available document database service that supports MongoDB workloads. Amazon DocumentDB is designed from the ground-up to give customers the performance, scalability, and availability customers need when operating mission-critical MongoDB workloads at scale. Amazon DocumentDB implements the Apache 2.0 open source MongoDB 3.6 API by emulating the responses that a MongoDB client expects from a MongoDB server, allowing customers to use their existing MongoDB drivers and tools with Amazon DocumentDB. Amazon DocumentDB uses a distributed, fault-tolerant, self-healing storage system that auto-scales up to 64 TB per database cluster.

Amazon DynamoDB

Amazon DynamoDB is a managed NoSQL database service. Amazon DynamoDB enables customers to offload to AWS the administrative burdens of operating and scaling distributed databases such as hardware provisioning, setup and configuration, replication, software patching, and cluster scaling.

Customers can create a database table that can store and retrieve data and serve any requested traffic. Amazon DynamoDB automatically spreads the data and traffic for the table over a sufficient number of servers to handle the request capacity specified and the amount of data stored, while maintaining consistent, fast performance. All data items are stored on Solid State Drives (SSDs) and are automatically replicated across multiple availability zones in a region.

EC2 Image Builder

EC2 Image Builder makes it easier to automate the creation, management, and deployment of customized, secure, and up-to-date “golden” server images that are pre-installed and pre-configured with software and settings to meet specific IT standards.

AWS Elastic Beanstalk

AWS Elastic Beanstalk is an application container launch program for customers to launch and scale their applications on top of AWS. Customers can use AWS Elastic Beanstalk to create new environments using Elastic Beanstalk curated programs and their applications, deploy application versions, update application configurations, rebuild environments, update AWS configurations, monitor environment health and availability, and build on top of the scalable infrastructure provided by underlying services such as Auto Scaling, Elastic Load Balancing, Amazon EC2, Amazon VPC, Amazon Route 53, and others.

Amazon Elastic Block Store (EBS)

Amazon Elastic Block Store (EBS) provides persistent block storage volumes for use with Amazon EC2 instances in the AWS Cloud. Each Amazon EBS volume is automatically replicated within its Availability Zone to protect customers from component failure. Amazon EBS allows customers to create storage volumes from 1 GB to 16 TB that can be mounted as devices by Amazon EC2 instances. Storage volumes behave like raw, unformatted block devices, with user supplied device names and a block device interface. Customers can create a file system on top of Amazon EBS volumes, or use them in any other way one would use a block device (e.g., a hard drive).

Amazon EBS volumes are presented as raw unformatted block devices that have been wiped prior to being made available for use. Wiping occurs before reuse. If customers have procedures requiring that all data be wiped via a specific method, customers can conduct a wipe procedure prior to deleting the volume for compliance with customer requirements. Amazon EBS includes Data Lifecycle Manager, which provides a simple, automated way to back up data stored on Amazon EBS volumes.

Amazon Elastic Compute Cloud (EC2)

Amazon Elastic Compute Cloud (EC2) is Amazon's Infrastructure as a Service (IaaS) offering, which provides scalable computing capacity using server instances in AWS' data centers. Amazon EC2 is designed to make web-scale computing easier by enabling customers to obtain and configure capacity with minimal friction. Customers create and launch instances, which are virtual machines that are available in a wide variety of hardware and software configurations.

Security within Amazon EC2 is provided on multiple levels: the operating system (OS) of the host layer, the virtual instance OS or guest OS, a firewall, and signed API calls. Each of these items builds on the capabilities of the others. This helps prevent data contained within Amazon EC2 from being intercepted by unauthorized systems or users and to provide Amazon EC2 instances themselves security without sacrificing flexibility of configuration. The Amazon EC2 service utilizes a hypervisor to provide memory and CPU isolation between virtual machines and controls access to network, storage, and other devices, and maintains strong isolation between guest virtual machines. Independent auditors regularly assess the security of Amazon EC2 and penetration teams regularly search for new and existing vulnerabilities and attack vectors.

AWS prevents customers from accessing physical hosts or instances not assigned to them by filtering through the virtualization software **(Control AWSCA-3.12).**

Amazon EC2 provides a complete firewall solution, referred to as a Security Group; this mandatory inbound firewall is configured in a default deny-all mode and Amazon EC2 customers must explicitly open the ports needed to allow inbound traffic **(Control AWSCA-3.9).**

Amazon provides a Time Sync function for time synchronization in EC2 Linux instances with the Coordinated Universal Time (UTC). It is delivered over the Network Time Protocol (NTP) and uses a fleet of redundant satellite-connected and atomic clocks in each region to provide a highly accurate reference clock via the local 169.254.169.123 IP address. Irregularities in the Earth's rate of rotation that cause UTC to drift with respect to the International Celestial Reference Frame (ICRF), by an extra second, are called leap second. Time Sync addresses this clock drift by smoothing out leap seconds over a period of time (commonly called leap smearing) which makes it easy for customer applications to deal with leap seconds **(Control AWSCA-7.10).**

Amazon Elastic Container Registry (ECR)

Amazon Elastic Container Registry is a Docker container image registry that makes it easy for developers to store, manage, and deploy Docker container images. Amazon Elastic Container Registry is integrated with Amazon Elastic Container Service (ECS) and Amazon Elastic Kubernetes Service (EKS).

Amazon Elastic Container Service [both Fargate and EC2 launch types]

Amazon Elastic Container Service is a highly scalable, high performance container management service that supports Docker containers and allows customers to easily run applications on a managed cluster of Amazon EC2 instances. Amazon Elastic Container Service eliminates the need for customers to install, operate, and scale customers' own cluster management infrastructure. With simple API calls, customers can launch and stop Docker-enabled applications, query the complete state of customers' clusters, and access many familiar features like security groups, Elastic Load Balancing, EBS volumes, and IAM roles. Customers can use Amazon Elastic Container Service to schedule the placement of containers across customers' clusters based on customers' resource needs and availability requirements.

Amazon Elastic Kubernetes Service (EKS)

Amazon Elastic Kubernetes Service (EKS) makes it easy to deploy, manage, and scale containerized applications using Kubernetes on AWS. Amazon EKS runs the Kubernetes management infrastructure for the customer across multiple AWS availability zones to eliminate a single point of failure. Amazon EKS is certified Kubernetes conformant so the customers can use existing tooling and plugins from partners and the Kubernetes community. Applications running on any standard Kubernetes environment are fully compatible and can be easily migrated to Amazon EKS.

Amazon Elastic File System (EFS)

Amazon Elastic File System (EFS) provides file storage for Amazon EC2 instances. EFS presents a network attached file system interface via the NFS v4 protocol. EFS file systems grow and shrink elastically as data is added and deleted by users. Amazon EFS spreads data across multiple Availability Zones; in the event that an Availability Zone is not reachable, the structure allows customers to still access their full set of data.

The customer is responsible for choosing which of their Virtual Private Clouds (VPCs) they want a file system to be accessed from by creating resources called mount targets. One mount target exists for each availability zone, which exposes an IP address and DNS name for mounting the customer's file system onto their EC2 instances. Customers then log into their EC2 instance and issue a 'mount' command, pointing at their mount target' IP address or DNS name. A mount target is assigned one or more VPC security groups to which it belongs. The VPC security groups define rules for what VPC traffic can reach the mount targets and in turn can reach the file system.

Elastic Load Balancing (ELB)

Elastic Load Balancing (ELB) provides customers with a load balancer that automatically distributes incoming application traffic across multiple Amazon EC2 instances in the cloud. It allows customers to achieve greater levels of fault tolerance for their applications, seamlessly providing the required amount of load balancing capacity needed to distribute application traffic.

Amazon ElastiCache for Redis

Amazon ElastiCache for Redis automates management tasks for in-memory cache environments, such as patch management, failure detection, and recovery. It works in conjunction with other AWS services to provide a managed in-memory cache. For example, an application running in Amazon EC2 can securely access an Amazon ElastiCache Cluster in the same region with very slight latency.

Using the Amazon ElastiCache service, customers create a Cache Cluster, which is a collection of one or more Cache Nodes, each running an instance of the Memcached, Redis Engine, or DAX Engine. A Cache Node is a self-contained environment which provides a fixed-size chunk of secure, network-attached RAM. Each Cache Node runs an instance of the Memcached, Redis Engine, or DAX Engine, and has its own DNS name and port. Multiple types of Cache Nodes are supported, each with varying amounts of associated memory.

AWS Elemental MediaConnect

AWS Elemental MediaConnect is a high-quality transport service for live video. MediaConnect enables customers to build mission-critical live video workflows in a fraction of the time and cost of satellite or fiber services. Customers can use MediaConnect to ingest live video from a remote event site (like a stadium), share video with a partner (like a cable TV distributor), or replicate a video stream for processing (like an over-the-top service). MediaConnect combines reliable video transport, highly secure stream sharing, and real-time network traffic and video monitoring that allow customers to focus on their content, not their transport infrastructure.

AWS Elemental MediaConvert

AWS Elemental MediaConvert is a file-based video transcoding service with broadcast-grade features. It allows customers to create video-on-demand (VOD) content for broadcast and multiscreen delivery at scale. The service combines advanced video and audio capabilities with a simple web services interface. With AWS Elemental MediaConvert, customers can focus on delivering media experiences without having to worry about the complexity of building and operating video processing infrastructure.

AWS Elemental MediaLive

AWS Elemental MediaLive is a live video processing service. Customers can create high-quality video streams for delivery to broadcast televisions and internet-connected multiscreen devices, like connected TVs, tablets, smart phones, and set-top boxes. The service works by encoding live video streams in real-time, taking a larger-sized live video source and compressing it into smaller versions for distribution to viewers. AWS Elemental MediaLive enables customers to focus on creating live video experiences for viewers without the complexity of building and operating video processing infrastructure.

Amazon Elastic MapReduce (EMR)

Amazon Elastic MapReduce (EMR) is a web service that provides managed Hadoop clusters on Amazon EC2 instances running a Linux operating system. Amazon EMR uses Hadoop processing combined with several AWS products to do such tasks as web indexing, data mining, log file analysis, machine learning, scientific simulation, and data warehousing. Amazon EMR actively manages clusters for customers, replacing failed nodes and adjusting capacity as requested. Amazon EMR securely and reliably handles a broad set of big data use cases, including log analysis, web indexing, data transformations (ETL), machine learning, financial analysis, scientific simulation, and bioinformatics.

Amazon EventBridge

Amazon EventBridge delivers a near real-time stream of events that describe changes in AWS resources. Customers can configure routing rules to determine where to send collected data to build application architectures that react in real time to the data sources. Amazon EventBridge becomes aware of operational changes as they occur and responds to these changes by taking corrective action as necessary by sending message to respond to the environment, activating functions, making changes and capturing state information

Amazon FinSpace

Amazon FinSpace is a data management and analytics service that makes it easy to store, catalog, and prepare financial industry data at scale. Amazon FinSpace reduces the time it takes for financial services industry (FSI) customers to find and access all types of financial data for analysis.

AWS Firewall Manager

AWS Firewall Manager is a security management service that makes it easier to centrally configure and manage AWS WAF rules across customer accounts and applications. Using Firewall Manager, customers can roll out AWS WAF rules for their Application Load Balancers and Amazon CloudFront distributions across accounts in AWS Organizations. As new applications are created, Firewall Manager also allows customers to bring new applications and resources into compliance with a common set of security rules from day one.

Amazon Forecast

Amazon Forecast uses machine learning to combine time series data with additional variables to build forecasts. With Amazon Forecast, customers can import time series data and associated data into Amazon Forecast from their Amazon S3 database. From there, Amazon Forecast automatically loads the data, inspects it, and identifies the key attributes needed for forecasting. Amazon Forecast then trains and optimizes a customer's custom model and hosts them in a highly available environment where it can be used to generate business forecasts.

Amazon Forecast is protected by encryption. Any content processed by Amazon Forecast is encrypted with customer keys through Amazon Key Management Service and encrypted at rest in the AWS Region where a customer is using the service. Administrators can also control access to Amazon Forecast through an AWS Identity and Access Management (IAM) permissions policy – ensuring that sensitive information is kept secure and confidential.

Amazon Fraud Detector

Amazon Fraud Detector helps detect suspicious online activities such as the creation of fake accounts and online payment fraud. Amazon Fraud Detector uses machine learning (ML) and 20 years of fraud detection expertise from AWS and Amazon.com to automatically identify fraudulent activity to catch more fraud, faster. With Amazon Fraud Detector, customers can create a fraud detection ML model with just a few clicks and use it to evaluate online activities in milliseconds.

Amazon FreeRTOS

Amazon FreeRTOS is an operating system for microcontrollers that makes small, low-power edge devices easy to program, deploy, secure, connect, and manage. Amazon FreeRTOS extends the FreeRTOS kernel, a popular open source operating system for microcontrollers, with software libraries that make it easy to securely connect the small, low-power devices to AWS cloud services like AWS IoT Core or to more powerful edge devices running AWS IoT Greengrass.

Amazon FSx

Amazon FSx provides third-party file systems. Amazon FSx provides the customers with the native compatibility of third-party file systems with feature sets for workloads such as Windows-based storage, high-performance computing (HPC), machine learning, and electronic design automation (EDA). The customers don't have to worry about managing file servers and storage, as Amazon FSx automates the time-consuming administration tasks such as hardware provisioning, software configuration, patching, and backups. Amazon FSx integrates the file systems with cloud-native AWS services, making them even more useful for a broader set of workloads.

Amazon S3 Glacier

Amazon S3 Glacier is an archival storage solution for data that is infrequently accessed for which retrieval times of several hours are suitable. Data in Amazon S3 Glacier is stored as an archive. Archives in Amazon S3 Glacier can be created or deleted, but archives cannot be modified. Amazon S3 Glacier archives are organized in vaults. All vaults created have a default permission policy that only permits access by the account creator or users that have been explicitly granted permission. Amazon S3 Glacier enables customers to set access policies on their vaults for users within their AWS Account. User policies can express access criteria for Amazon S3 Glacier on a per vault basis. Customers can enforce Write Once Read Many (WORM) semantics for users through user policies that forbid archive deletion.

AWS Global Accelerator

AWS Global Accelerator is a networking service that improves the availability and performance of the applications that customers offer to their global users. AWS Global Accelerator also makes it easier to manage customers' global applications by providing static IP addresses that act as a fixed entry point to customer applications hosted on AWS which eliminates the complexity of managing specific IP addresses for different AWS Regions and Availability Zones.

AWS Glue

AWS Glue is an extract, transform, and load (ETL) service that makes it easy for customers to prepare and load their data for analytics. The customers can create and run an ETL job with a few clicks in the AWS Management Console.

AWS Glue DataBrew

AWS Glue DataBrew is a visual data preparation tool that makes it easy for data analysts and data scientists to clean and normalize data to prepare it for analytics and machine learning. Customers can choose from pre-built transformations to automate data preparation tasks, all without the need to write any code.

Amazon GuardDuty

Amazon GuardDuty is a threat detection service that continuously monitors for malicious activity and unauthorized behavior to protect the customers' AWS accounts and workloads. With the cloud, the collection and aggregation of account and network activities is simplified, but it can be time consuming for security teams to continuously analyze event log data for potential threats. With GuardDuty, the customers now have an intelligent and cost-effective option for continuous threat detection in the AWS Cloud.

Amazon HealthLake

Amazon HealthLake is a service offering healthcare and life sciences companies a complete view of individual or patient population health data for query and analytics at scale. Using the HealthLake APIs, health organizations can easily copy health data, such as imaging medical reports or patient notes, from on-premises systems to a secure data lake in the cloud. HealthLake uses machine learning (ML) models to automatically understand and extract meaningful medical information from the raw data, such as medications, procedures, and diagnoses. Amazon HealthLake organizes and indexes information and stores it in the Fast Healthcare Interoperability Resources (FHIR) industry standard format to provide a complete view of each patient's medical history.

AWS Identity and Access Management (IAM)

AWS Identity and Access Management is a web service that helps customers securely control access to AWS resources for their users. Customers use IAM to control who can use their AWS resources (authentication) and what resources they can use and in what ways (authorization). Customers can grant other people permission to administer and use resources in their AWS account without having to share their password or access key. Customers can grant different permissions to different people for different resources. Customers can use IAM features to. securely give applications that run on EC2 instances the credentials that they need in order to access other AWS resources, like S3 buckets and RDS or DynamoDB databases.

VM Import/Export

VM Import/Export is a service that enables customers to import virtual machine images from their existing environment to Amazon EC2 instances and export them back to their on premises environment. This offering allows customers to leverage their existing investments in the virtual machines that customers have built to meet their IT security, configuration management, and compliance requirements by bringing those virtual machines into Amazon EC2 as ready-to-use instances. Customers can also export imported instances back to their off-cloud virtualization infrastructure, allowing them to deploy workloads across their IT infrastructure.

Amazon Inspector

Amazon Inspector is an automated security assessment service for customers seeking to improve the security and compliance of applications deployed on AWS. Amazon Inspector automatically assesses applications for vulnerabilities or deviations from leading practices. After performing an assessment, Amazon Inspector produces a detailed list of security findings prioritized by level of severity.

AWS IoT Core

AWS IoT Core is a managed cloud service that lets connected devices easily and securely interact with cloud applications and other devices. AWS IoT Core provides secure communication and data processing across different kinds of connected devices and locations so that customers can easily build IoT applications such as industrial solutions and connected home solutions.

AWS IoT Device Management

AWS IoT Device Management provides customers with the ability to securely onboard, organize, and remotely manage IoT devices at scale. With AWS IoT Device Management, customers can register their connected devices individually or in bulk and manage permissions so that devices remain secure.

Customers can also organize their devices, monitor and troubleshoot device functionality, query the state of any IoT device in the fleet, and send firmware updates over-the-air (OTA). AWS IoT Device Management is agnostic to device type and OS, so customers can manage devices from constrained microcontrollers to connected cars all with the same service. AWS IoT Device Management allows customers to scale their fleets and reduce the cost and effort of managing large and diverse IoT device deployments.

AWS IoT Events

AWS IoT Events is a service that detects events across thousands of IoT sensors sending different telemetry data, such as temperature from a freezer, humidity from respiratory equipment, and belt speed on a motor. Customers can select the relevant data sources to ingest, define the logic for each event using simple 'if-then-else' statements, and select the alert or custom action to trigger when an event occurs. IoT Events continuously monitors data from multiple IoT sensors and applications, and it integrates with other services, such as AWS IoT Core, to enable early detection and unique insights into events. IoT Events automatically triggers alerts and actions in response to events based on the logic defined to resolve issues quickly, reduce maintenance costs, and increase operational efficiency.

AWS IoT Greengrass

AWS IoT Greengrass seamlessly extends AWS to edge devices so they can act locally on the data they generate, while still using the cloud for management, analytics, and durable storage. With AWS IoT Greengrass, connected devices can run AWS Lambda functions, execute predictions based on machine learning models, keep device data in sync, and communicate with other devices securely – even when not connected to the Internet.

AWS IoT SiteWise

AWS IoT SiteWise is a service that enables industrial enterprises to collect, store, organize, and visualize thousands of sensor data streams across multiple industrial facilities. AWS IoT SiteWise includes software that runs on a gateway device that sits onsite in a facility, continuously collects the data from a historian or a specialized industrial server, and sends it to the AWS Cloud. With the service, customers can skip months of developing undifferentiated data collection and cataloging solutions, and focus on using their data to detect and fix equipment issues, spot inefficiencies, and improve production output.

Amazon Kendra

Amazon Kendra is an intelligent search service powered by machine learning. Kendra reimagines enterprise search for customer websites and applications so employees and customers can easily find content, even when it's scattered across multiple locations and content repositories.

AWS Key Management Service (KMS)

AWS Key Management Service (KMS) allows users to create and manage cryptographic keys. One class of keys, KMS keys, are designed to never be exposed in plaintext outside the service. KMS keys can be used to encrypt data directly submitted to the service. KMS keys can also be used to protect other types of keys, Data Encryption Keys (DEKs), which are created by the service and returned to the user's application for local use. AWS KMS only creates and returns DEKs to users; the service does not store or manage DEKs.

AWS KMS is integrated with several AWS services so that users can request that resources in those services are encrypted with unique DEKs provisioned by KMS that are protected by KMS keys the user chooses at the time the resource is created **(Control AWSCA-4.6).** See in-scope services integrated with KMS at https://aws.amazon.com/kms/. Integrated services use the plaintext DEK from AWS KMS in volatile memory of service-controlled endpoints; they do not store the plaintext DEK to persistent disk. An encrypted copy of the DEK is stored to persistent disk by the service and passed back to AWS KMS for decryption each time the DEK is needed to decrypt content the customer requests. DEKs provisioned by AWS KMS are encrypted with a 256-bit key unique to the customer's account under a defined mode of AES – Advanced Encryption Standard **(Control AWSCA-4.7)**.

When a customer requests AWS KMS to create a KMS key, the service creates a key ID for the KMS key and (optionally) key material, referred to as a backing key, which is tied to the key ID of the KMS key. The 256-bit backing key can only be used for encrypt or decrypt operations by the service **(Control AWSCA-4.10).** Customers can choose to have a KMS key ID created and then securely import their own key material to associate with the key ID. If the customer chooses to enable key rotation for a KMS key with a backing key that the service generated, AWS KMS will create a new version of the backing key for each rotation event, but the key ID remains the same **(Control AWSCA-4.11).** All future encrypt operations under the key ID will use the newest backing key, while all previous versions of backing keys are retained to decrypt ciphertexts created under the previous version of the key. Backing keys and customer-imported keys are encrypted under AWS-controlled keys when created/imported and they are only ever stored on disk in encrypted form.

All requests to AWS KMS APIs are logged and available in the AWS CloudTrail of the requester and the owner of the key. The logged requests provide information about who made the request, under which KMS key, and describes information about the AWS resource that was protected through the use of the

KMS key. These log events are visible to the customer after turning on AWS CloudTrail in their account **(Control AWSCA-4.8).**

AWS KMS creates and manages multiple distributed replicas of KMS keys and key metadata automatically to enable high availability and data durability. KMS keys themselves are regional objects; plaintext versions of the KMS key can only be used in the AWS region in which they were created. KMS keys are only stored on persistent disk in encrypted form and in two separate storage systems to ensure durability. When a plaintext KMS keyis needed to fulfill an authorized customer request, it is retrieved from storage, decrypted on one of many AWS KMS hardened security appliances in the region, then used only in memory to execute the cryptographic operation (e.g., encrypt or decrypt). The plaintext key is then marked for deletion so that it cannot be re-used. Future requests to use the KMS key each require the decryption of the KMS key in memory for another one-time use.

AWS KMS endpoints are only accessible via TLS using the following cipher suites that support forward secrecy **(Control AWSCA-4.9)**:

- ECDHE-RSA-AES256-GCM-SHA384
- ECDHE-RSA-AES128-GCM-SHA256
- ECDHE-RSA-AES256-SHA384
- ECDHE-RSA-AES256-SHA
- ECDHE-RSA-AES128-SHA256
- ECDHE-RSA-3DES-CBC3-SHA
- DHE-RSA-AES256-SHA256 (ParamSize: 2048)
- DHE-RSA-AES128-SHA256 (ParamSize: 2048)
- DHE-RSA-AES256-SHA (ParamSize: 2048)
- DHE-RSA-AES128-SHA (ParamSize: 2048)

By design, no one can gain access to the plaintext KMS key material. Plaintext KMS keys are only ever present on hardened security appliances for the amount of time needed to perform cryptographic operations under them. AWS employees have no tools to retrieve plaintext keys from these hardened security appliances. In addition, multi-party access controls are enforced for operations on these hardened security appliances that involve changing the software configuration or introducing new hardened security appliances into the service. These multi-party access controls minimize the possibility of an unauthorized change to the hardened security appliances, exposing plaintext key material outside the service, or allowing unauthorized use of customer keys **(Control AWSCA-4.5).** Additionally, key material used for disaster recovery processes by KMS are physically secured such that no single AWS employee can gain access **(Control AWSCA-4.12).** Access attempts to recovery key materials are reviewed by authorized operators on a periodic basis **(Control AWSCA-4.13).** Roles and responsibilities for those cryptographic custodians with access to systems that store or use key material are formally documented and acknowledged **(Control AWSCA-1.6).**

Amazon Keyspaces (for Apache Cassandra)

Amazon Keyspaces (for Apache Cassandra) is a scalable, highly available Apache Cassandra–compatible database service. With Amazon Keyspaces, customers can run Cassandra workloads on AWS using the same Cassandra application code and developer tools that customers use today. Amazon Keyspaces is serverless and gives customers the performance, elasticity, and enterprise features customers need to operate business-critical Cassandra workloads at scale.

Amazon Kinesis Data Analytics

Amazon Kinesis Data Analytics is an easy way for customers to analyze streaming data, gain actionable insights, and respond to business and customer needs in real time. Amazon Kinesis Data Analytics reduces the complexity of building, managing, and integrating streaming applications with other AWS services. SQL users can easily query streaming data or build entire streaming applications using templates and an interactive SQL editor. Java developers can quickly build sophisticated streaming applications using open source Java libraries and AWS integrations to transform and analyze data in real-time.

Amazon Kinesis Data Firehose

Amazon Kinesis Data Firehose is a reliable way to load streaming data into data stores and analytics tools. It can capture, transform, and load streaming data into Amazon S3, Amazon Redshift, and Amazon OpenSearch Service enabling near real-time analytics with existing business intelligence tools and dashboards customers are already using today. The service automatically scales to match the throughput of the customers' data and requires no ongoing administration. It can also batch, compress, transform, and encrypt the data before loading it, minimizing the amount of storage used at the destination and increasing security.

Amazon Kinesis Data Streams

Amazon Kinesis Data Streams is a massively scalable and durable real-time data streaming service. Kinesis Data Streams can continuously capture gigabytes of data per second from hundreds of thousands of sources such as website clickstreams, database event streams, financial transactions, social media feeds, IT logs and location-tracking events. The collected data is available in milliseconds to enable real-time analytics use cases such as real-time dashboards, real-time anomaly detection, dynamic pricing and more.

Amazon Kinesis Video Streams

Amazon Kinesis Video Streams makes it easy to securely stream video from connected devices to AWS for analytics, machine learning (ML), playback, and other processing. Kinesis Video Streams automatically provisions and elastically scales the infrastructure needed to ingest streaming video data from millions of devices. It also durably stores, encrypts, and indexes video data in the streams, and allows the customers to access their data through easy-to-use APIs. Kinesis Video Streams enables the customers to playback video for live and on-demand viewing, and quickly build applications that take advantage of computer vision and video analytics.

Amazon Location Service

Amazon Location Service makes it easy for developers to add location functionality to applications without compromising data security and user privacy. With Amazon Location Service, customers can build applications that provide maps and points of interest, convert street addresses into geographic coordinates, calculate routes, track resources, and trigger actions based on location. Amazon Location Service uses high-quality geospatial data to provide maps, places, routes, tracking, and geofencing.

AWS Lake Formation

AWS Lake Formation is an integrated data lake service that makes it easy for customers to ingest, clean, catalog, transform, and secure their data and make it available for analysis and ML. AWS Lake Formation gives customers a central console where they can discover data sources, set up transformation jobs to move data to an Amazon Simple Storage Service (S3) data lake, remove duplicates and match records, catalog data for access by analytic tools, configure data access and security policies, and audit and control access from AWS analytic and ML services. Lake Formation automatically manages access to the registered data in Amazon S3 through services including AWS Glue, Amazon Athena, Amazon Redshift, Amazon QuickSight, and Amazon EMR to ensure compliance with customer defined policies. With AWS Lake Formation, customers can configure and manage their data lake without manually integrating multiple underlying AWS services.

AWS Lambda

AWS Lambda lets customers run code without provisioning or managing servers on their own. AWS Lambda uses a compute fleet of Amazon Elastic Compute Cloud (Amazon EC2) instances across multiple Availability Zones in a region, which provides the high availability, security, performance, and scalability of the AWS infrastructure.

Amazon Lex

Amazon Lex is a service for building conversational interfaces into any application using voice and text. Amazon Lex provides the advanced deep learning functionalities of automatic speech recognition (ASR) for converting speech to text, and natural language understanding (NLU) to recognize the intent of the text, to enable customers to build applications with highly engaging user experiences and lifelike conversational interactions. Amazon Lex scales automatically, so customers do not need to worry about managing infrastructure.

AWS License Manager

AWS License Manager makes it easier to manage licenses in AWS and on-premises servers from software vendors. AWS License Manager allows customer's administrators to create customized licensing rules that emulate the terms of their licensing agreements, and then enforces these rules when an instance of EC2 gets launched. Customer administrators can use these rules to limit licensing violations, such as using more licenses than an agreement stipulates or reassigning licenses to different servers on a short-term basis. The rules in AWS License Manager also enable customers to limit a licensing breach by stopping the instance from launching or by notifying the customer administrators about the infringement. Customer administrators gain control and visibility of all their licenses with the AWS License Manager dashboard and reduce the risk of non-compliance, misreporting, and additional costs due to licensing overages.

AWS License Manager integrates with AWS services to simplify the management of licenses across multiple AWS accounts, IT catalogs, and on-premises, through a single AWS account.

Amazon Macie

Amazon Macie is a data security and data privacy service that uses machine learning and pattern matching to help customers discover, monitor, and protect their sensitive data in AWS.

Macie automates the discovery of sensitive data, such as personally identifiable information (PII) and financial data, to provide customers with a better understanding of the data that organization stores in Amazon Simple Storage Service (Amazon S3). Macie also provides customers with an inventory of the S3 buckets, and it automatically evaluates and monitors those buckets for security and access control. Within minutes, Macie can identify and report overly permissive or unencrypted buckets for the organization.

If Macie detects sensitive data or potential issues with the security or privacy of customer data, it creates detailed findings for customers to review and remediate as necessary. Customers can review and analyze these findings directly in Macie, or monitor and process them by using other services, applications, and systems.

Amazon Macie Classic

Amazon Macie Classic is a legacy version of Amazon Macie, which is a security service that uses machine learning to automatically discover, classify, and protect sensitive data in AWS. Macie Classic recognizes sensitive data such as personally identifiable information (PII) or intellectual property. It provides customers with dashboards and alerts that give visibility into how this data is being accessed or moved.

AWS Managed Services

AWS Managed Services provides ongoing management of a customer's AWS infrastructure. AWS Managed Services automates common activities such as change requests, monitoring, patch management, security, and backup services, and provides full-lifecycle services to provision, run, and support a customer's infrastructure.

Amazon Managed Streaming for Apache Kafka

Amazon Managed Streaming for Apache Kafka is a service that makes it easy for customers to build and run applications that use Apache Kafka to process streaming data. Apache Kafka is an open-source platform for building real-time streaming data pipelines and applications. With Amazon MSK, customers can use Apache Kafka APIs to populate data lakes, stream changes to and from databases, and power machine learning and analytics applications.

Amazon MQ

Amazon MQ is a managed message broker service for Apache ActiveMQ that sets up and operates message brokers in the cloud. Message brokers allow different software systems – often using different programming languages, and on different platforms – to communicate and exchange information. Messaging is the communications backbone that connects and integrates the components of distributed applications, such as order processing, inventory management, and order fulfillment for e-commerce. Amazon MQ manages the administration and maintenance of ActiveMQ, a popular open-source message broker.

Amazon Neptune

Amazon Neptune is a fast and reliable graph database service that makes it easy to build and run applications that work with highly connected datasets. The core of Amazon Neptune is a purpose-built, high-performance graph database engine optimized for storing billions of relationships and querying the graph with milliseconds latency. Amazon Neptune supports popular graph models, Property Graph, and W3C's RDF, and their respective query languages Apache, TinkerPop Gremlin, and SPARQL, allowing customers to easily build queries that efficiently navigate highly connected datasets. Neptune powers graph use cases such as recommendation engines, fraud detection, knowledge graphs, drug discovery, and network security.

AWS Network Firewall

AWS Network Firewall is a stateful, managed, network firewall and intrusion detection and prevention service for customer virtual private cloud (VPC). With Network Firewall, customers can filter traffic at the perimeter of customer VPC. This includes filtering traffic going to and coming from an internet gateway, NAT gateway, or over VPN or AWS Direct Connect.

Amazon OpenSearch Service [successor to Amazon Elasticsearch service]

Amazon OpenSearch Service is a service that makes it easy for the customer to deploy, secure, and operate OpenSearch cost effectively at scale. Amazon OpenSearch Service lets the customers pay only for what they use – there are no upfront costs or usage requirements. With Amazon OpenSearch Service, the customers get the ELK stack they need, without the operational overhead.

AWS OpsWorks Stacks

AWS OpsWorks Stacks is an application and server management service. OpsWorks Stacks lets customers manage applications and servers on AWS and on-premises. With OpsWorks Stacks, customers can model their application as a stack containing different layers, such as load balancing, database, and application server. They can deploy and configure Amazon EC2 instances in each layer or connect other resources such as Amazon RDS databases. OpsWorks Stacks also lets customers set automatic scaling for their servers based on preset schedules or in response to changing traffic levels, and it uses lifecycle hooks to orchestrate changes as their environment scales.

AWS OpsWorks [includes Chef Automate, Puppet Enterprise]

AWS OpsWorks for Chef Automate is a configuration management service that hosts Chef Automate, a suite of automation tools from Chef for configuration management, compliance and security, and continuous deployment. OpsWorks also maintains customers' Chef server by automatically patching, updating, and backing up customer servers. OpsWorks eliminates the need for customers to operate their own configuration management systems or worry about maintaining its infrastructure. OpsWorks gives customers access to all of the Chef Automate features, such as configuration and compliance management, which customers manage through the Chef console or command line tools like Knife. It also works seamlessly with customers' existing Chef cookbooks.

AWS OpsWorks for Puppet Enterprise is a configuration management service that hosts Puppet Enterprise, a set of automation tools from Puppet for infrastructure and application management. OpsWorks also maintains customers' Puppet master server by automatically patching, updating, and backing up customers' servers. OpsWorks eliminates the need for customers to operate their own configuration management systems or worry about maintaining its infrastructure. OpsWorks gives customers' access to all of the Puppet Enterprise features, which customers manage through the Puppet console. It also works seamlessly with customers' existing Puppet code.

AWS Organizations

AWS Organizations helps customers centrally govern their environment as customers grow and scale their workloads on AWS. Whether customers are a growing startup or a large enterprise, Organizations helps customers to centrally manage billing; control access, compliance, and security; and share resources across customer AWS accounts.

Using AWS Organizations, customers can automate account creation, create groups of accounts to reflect their business needs, and apply policies for these groups for governance. Customers can also simplify billing by setting up a single payment method for all of their AWS accounts. Through integrations with other AWS services, customers can use Organizations to define central configurations and resource sharing across accounts in their organization.

AWS Outposts

AWS Outposts is a service that extends AWS infrastructure, AWS services, APIs and tools to any data center, co-location space, or an on-premises facility for a consistent hybrid experience. AWS Outposts is ideal for workloads that require low latency access to on-premises systems, local data processing or local data storage. Outposts offer the same AWS hardware infrastructure, services, APIs and tools to build and run applications on premises and in the cloud. AWS compute, storage, database and other services run locally on Outposts and customers can access the full range of AWS services available in the Region to build, manage and scale on-premises applications. Service Link is established between Outposts and the AWS region by use of a secured VPN connection over the public internet or AWS Direct Connect (**Control AWSCA-3.17**).

AWS Outposts are configured with a Nitro Security Key (NSK) which is designed to encrypt customer content and give customers the ability to mechanically remove content from the device. Customer content is cryptographically shredded if a customer removes the NSK from an Outpost device (Control **AWSCA-7.9**).

Additional information about Security in AWS Outposts, including the shared responsibility model, can be found in the AWS Outposts User Guide.

AWS Health Dashboard

AWS Health Dashboard provides alerts and remediation guidance when AWS is experiencing events that may impact customers. While the AWS Health Dashboard displays the general status of AWS services, AWS Health Dashboard gives customers a personalized view into the performance and availability of the AWS services underlying customer’s AWS resources.

The dashboard displays relevant and timely information to help customers manage events in progress and provides proactive notification to help customers plan for scheduled activities. With AWS Health Dashboard, alerts are triggered by changes in the health of AWS resources, giving event visibility, and guidance to help quickly diagnose and resolve issues.

AWS Private Certificate Authority

AWS Private Certificate Authority (CA) is a managed private CA service enables customers to easily and securely manage the lifecycle of their private certificates. Private CA allows developers to be more agile by providing them APIs to create and deploy private certificates programmatically. Customers also have the flexibility to create private certificates for applications that require custom certificate lifetimes or resource names. With Private CA, customers can create and manage private certificates for their connected resources in one place with a secure, pay as you go, managed private CA service.

Amazon Personalize

Amazon Personalize is a machine learning service that makes it easy for developers to create individualized recommendations for customers using their applications. Amazon Personalize makes it easy for developers to build applications capable of delivering a wide array of personalization experiences, including specific product recommendations, personalized product re-ranking and customized direct marketing. Amazon Personalize goes beyond rigid static rule based recommendation systems and trains, tunes, and deploys custom machine learning models to deliver highly customized recommendations to customers across industries such as retail, media and entertainment.

Amazon Pinpoint

Amazon Pinpoint helps customers engage with their customers by sending email, SMS, and mobile push messages. The customers can use Amazon Pinpoint to send targeted messages (such as promotional alerts and customer retention campaigns), as well as direct messages (such as order confirmations and password reset messages) to their customers.

Amazon Polly

Amazon Polly is a service that turns text into lifelike speech, allowing customers to create applications that talk, and build entirely new categories of speech-enabled products. Amazon Polly is a Text-to-Speech service that uses advanced deep learning technologies to synthesize speech that sounds like a human voice.

Amazon Quantum Ledger Database (QLDB)

Amazon Quantum Ledger Database (QLDB) is a ledger database that provides a transparent, immutable and cryptographically verifiable transaction log owned by a central trusted authority. Amazon QLDB can be used to track each and every application data change and maintains a complete and verifiable history of changes over time.

Amazon QuickSight

Amazon QuickSight is a fast, cloud-powered business analytics service that makes it easy to build visualizations, perform ad-hoc analysis, and quickly get business insights from customers' data. Using this cloud-based service customers can connect to their data, perform advanced analysis, and create visualizations and dashboards that can be accessed from any browser or mobile device.

Amazon Redshift

Amazon Redshift is a data warehouse service to analyze data using a customer's existing Business Intelligence (BI) tools. Amazon Redshift also includes Redshift Spectrum, allowing customers to directly run SQL queries against Exabytes of unstructured data in Amazon S3.

Amazon Rekognition

The easy-to-use Rekognition API allows customers to automatically identify objects, people, text, scenes, and activities, as well as detect any inappropriate content. Developers can quickly build a searchable content library to optimize media workflows, enrich recommendation engines by extracting text in images, or integrate secondary authentication into existing applications to enhance end-user security. With a wide variety of use cases, Amazon Rekognition enables the customers to easily add the benefits of computer vision to the business.

Amazon Relational Database Service (RDS)

Amazon Relational Database Service (RDS) enables customers to set up, operate, and scale a relational database in the cloud. Amazon RDS manages backups, software patching, automatic failure detection, and recovery. It provides cost-efficient and resizable capacity while automating time-consuming administration tasks such as hardware provisioning, database setup, patching and backups.

AWS Resource Access Manager

AWS Resource Access Manager helps customers securely share their resources across AWS accounts, within their organization or organizational units (OUs) in AWS Organizations, and with IAM roles and IAM users for supported resource types. Customers are able to use AWS Resource Access Manager to share transit gateways, subnets, AWS License Manager license configurations, Amazon Route 53 Resolver rules, and more resource types.

AWS Resource Groups

AWS Resource Groups is a service that helps customers organize AWS resources into logical groupings. These groups can represent an application, a software component, or an environment. Resource groups can include more than fifty additional resource types, bringing the overall number of supported resource types to seventy-seven. Some of these new resource types include Amazon DynamoDB tables, AWS Lambda functions, AWS CloudTrail trails, and many more. Customers can now create resource groups that accurately reflect their applications, and take action against those groups, rather than against individual resources.

AWS RoboMaker

AWS RoboMaker is a service that makes it easy to develop, test, and deploy intelligent robotics applications at scale. RoboMaker extends the most widely used open-source robotics software framework, Robot Operating System (ROS), with connectivity to cloud services. This includes AWS machine learning services, monitoring services, and analytics services that enable a robot to stream data, navigate, communicate, comprehend, and learn. RoboMaker provides a robotics development environment for application development, a robotics simulation service to accelerate application testing, and a robotics fleet management service for remote application deployment, update, and management.

Amazon Route 53

Amazon Route 53 provides managed Domain Name System (DNS) web service. Amazon Route 53 connects user requests to infrastructure running both inside and outside of AWS. Customers can use Amazon Route 53 to configure DNS health checks to route traffic to healthy endpoints or to independently monitor the health of their application and its endpoints. Amazon Route 53 enables customers to manage traffic globally through a variety of routing types, including Latency Based Routing, Geo DNS, and Weighted Round Robin, all of these routing types can be combined with DNS Failover. Amazon Route 53 also offers Domain Name Registration; customers can purchase and manage domain names such as example.com and Amazon Route 53 will automatically configure DNS settings for their domains. Amazon Route 53 sends automated requests over the internet to a resource, such as a web server, to verify that it is reachable, available, and functional. Customers also can choose to receive notifications when a resource becomes unavailable and choose to route internet traffic away from unhealthy resources.

Amazon SageMaker [excludes Public Workforce and Vendor Workforce for all features]

Amazon SageMaker is a platform that enables developers and data scientists to quickly and easily build, train, and deploy machine learning models at any scale. Amazon SageMaker removes the barriers that typically "slow down" developers who want to use machine learning.

Amazon SageMaker removes the complexity that holds back developer success with the process of building, training, and deploying machine learning models at scale. Amazon SageMaker includes modules that can be used together or independently to build, train, and deploy a customer's machine learning models.

AWS Secrets Manager

AWS Secrets Manager helps customers protect secrets needed to access their applications, services, and IT resources. The service enables customers to easily rotate, manage, and retrieve database credentials, API keys, and other secrets throughout their lifecycle. Users and applications retrieve secrets with a call to Secrets Manager APIs, eliminating the need to hardcode sensitive information in plain text. Secrets Manager offers secret rotation with built-in integration for Amazon RDS, Amazon Redshift, and Amazon DocumentDB. The service is also extensible to other types of secrets, including API keys and OAuth tokens. In addition, Secrets Manager allows customers to control access to secrets using fine-grained permissions and audit secret rotation centrally for resources in the AWS Cloud, third-party services, and on-premises.

AWS Security Hub

AWS Security Hub gives customers a comprehensive view of their high-priority security alerts and compliance status across AWS accounts. There are a range of powerful security tools at customers' disposal, from firewalls and endpoint protection to vulnerability and compliance scanners. With Security Hub, customers can now have a single place that aggregates, organizes, and prioritizes their security alerts, or findings, from multiple AWS services, such as Amazon GuardDuty, Amazon Inspector, and Amazon Macie, as well as from AWS Partner solutions. Findings are visually summarized on integrated dashboards with actionable graphs and tables.

AWS Server Migration Service (SMS)

AWS Server Migration Service (SMS) is an agentless service which makes it easier and faster for customers to migrate thousands of on-premises workloads to AWS. AWS SMS allows customers to automate, schedule, and track incremental replications of live server volumes, making it easier for customers to coordinate large-scale server migrations.

AWS Serverless Application Repository

The AWS Serverless Application Repository is a managed repository for serverless applications. It enables teams, organizations, and individual developers to store and share reusable applications, and easily assemble and deploy serverless architectures in powerful new ways. Using the Serverless Application Repository, customers do not need to clone, build, package, or publish source code to AWS before deploying it. Instead, customers can use pre-built applications from the Serverless Application Repository in their serverless architectures, helping customers reduce duplicated work, ensure organizational best practices, and get to market faster. Integration with AWS Identity and Access Management (IAM) provides resource-level control of each application, enabling customers to publicly share applications with everyone or privately share them with specific AWS accounts.

AWS Service Catalog

AWS Service Catalog allows customers to create and manage catalogs of IT services that are approved for use on AWS. These IT services can include everything from virtual machine images, servers, software, and databases to complete multi-tier application architectures. AWS Service Catalog allows customers to centrally manage commonly deployed IT services, and helps customers achieve consistent governance and meet their compliance requirements, while enabling users to quickly deploy only the approved IT services they need.

AWS Shield

AWS Shield is a managed Distributed Denial of Service (DDoS) protection service that safeguards web applications running on AWS. AWS Shield provides always-on detection and automatic inline mitigations that minimize application downtime and latency, so there is no need to engage AWS Support to benefit from DDoS protection.

Amazon Simple Email Service (SES)

Amazon Simple Email Service (SES) is a cost-effective, flexible and scalable email service that enables developers to send mail from within any application. Customers can configure Amazon SES to support several email use cases including transactional, marketing, or mass email communications. Amazon SES' flexible IP deployment and email authentication options help drive higher deliverability and protect sender reputation, while sending analytics to measure impact of each email. With Amazon SES, customers can send email securely, globally and at scale.

Amazon Simple Notification Service (SNS)

Amazon Simple Notification Service (SNS) is a web service to set up, operate, and send notifications. It provides developers the capability to publish messages from an application and deliver them to subscribers or other applications. Amazon SNS follows the “publish-subscribe” (pub-sub) messaging paradigm, with notifications being delivered to clients using a “push” mechanism. Using SNS requires defining a "Topic", setting policies on access and delivery of the Topic, subscribing consumers and designating delivery endpoints, and publishing messages to a Topic. Administrators define a Topic as an access point for publishing messages and allowing customers to subscribe to notifications. Security policies are applied to Topics to determine who can publish, who can subscribe, and to designate protocols supported.

Amazon Simple Queue Service (SQS)

Amazon Simple Queue Service (SQS) is a message queuing service that offers a distributed hosted queue for storing messages as they travel between computers. By using Amazon SQS, developers can move data between distributed components of their applications that perform different tasks, without losing messages or requiring each component to be always available. Amazon SQS allows customers to build an automated workflow, working in close conjunction with Amazon EC2 and the other AWS infrastructure web services.

Amazon SQS’ main components consist of a frontend request-router fleet, a backend data-storage fleet, a metadata cache fleet, and a dynamic workload management fleet. User queues are mapped to one or more backend clusters. Requests to read, write, or delete messages come into the frontends. The frontends contact the metadata cache to find out which backend cluster hosts that queue and then connect to nodes in that cluster to service the request.

For authorization, Amazon SQS has its own resource-based permissions system that uses policies written in the same language used for AWS IAM policies. User permissions for any Amazon SQS resource can be given either through the Amazon SQS policy system or the AWS IAM policy system, which is authorized by AWS Identity and Access Management Service. Such policies with a queue are used to specify which AWS Accounts have access to the queue as well as the type of access and conditions.

Amazon Simple Storage Service (S3)

Amazon Simple Storage Service (S3) provides a web services interface that can be used to store and retrieve data from anywhere on the web. To provide customers with the flexibility to determine how, when, and to whom they wish to expose the information they store in AWS, Amazon S3 APIs provide both bucket and object-level access controls, with defaults that only permit authenticated access by the bucket and/or object creator. Unless a customer grants anonymous access, the first step before a user can access Amazon S3 is to be authenticated with a request signed using the user's secret access key.

An authenticated user can read an object only if the user has been granted read permissions in an Access Control List (ACL) at the object level. An authenticated user can list the keys and create or overwrite objects in a bucket only if the user has been granted read and write permissions in an ACL at the bucket level. Bucket and object-level ACLs are independent; an object does not inherit ACLs from its bucket. Permissions to read or modify the bucket or object ACLs are themselves controlled by ACLs that default to creator-only access. Therefore, the customer maintains full control over who has access to its data. Customers can grant access to their Amazon S3 data to other AWS users by AWS Account ID or email, or DevPay Product ID. Customers can also grant access to their Amazon S3 data to all AWS users or to everyone (enabling anonymous access).

Network devices supporting Amazon S3 are configured to only allow access to specific ports on other Amazon S3 server systems **(Control AWSCA-3.7).** External access to data stored in Amazon S3 is logged and the logs are retained for at least 90 days, including relevant access request information, such as the data accessor IP address, object, and operation **(Control AWSCA-3.8).**

<u>Amazon Simple Workflow Service (SWF)</u>

Amazon Simple Workflow Service (SWF) is an orchestration service for building scalable distributed applications. Often an application consists of several different tasks to be performed in a particular sequence driven by a set of dynamic conditions. Amazon SWF enables developers to architect and implement these tasks, run them in the cloud or on-premise and coordinate their flow. Amazon SWF manages the execution flow such that tasks are load balanced across the workers, inter-task dependencies are respected, concurrency is handled appropriately, and child workflows are executed.

Amazon SWF enables applications to be built by orchestrating tasks coordinated by a decider process. Tasks represent logical units of work and are performed by application components that can take any form, including executable code, scripts, web service calls, and human actions.

Developers implement workers to perform tasks. They run their workers either on cloud infrastructure, such as Amazon EC2, or off-cloud. Tasks can be long-running, may fail, may timeout and may complete with varying throughputs and latencies. Amazon SWF stores tasks for workers, assigns them when workers are ready, tracks their progress, and keeps their latest state, including details on their completion. To orchestrate tasks, developers write programs that get the latest state of tasks from Amazon SWF and use it to initiate subsequent tasks in an ongoing manner. Amazon SWF maintains an application's execution state durably so that the application can be resilient to failures in individual application components.

Amazon SWF provides auditability by giving customers visibility into the execution of each step in the application. The Management Console and APIs let customers monitor all running executions of the application. The customer can zoom in on any execution to see the status of each task and its input and output data. To facilitate troubleshooting and historical analysis, Amazon SWF retains the history of executions for any number of days that the customer can specify, up to a maximum of 90 days.

The actual processing of tasks happens on compute resources owned by the end customer. Customers are responsible for securing these compute resources, for example if a customer uses Amazon EC2 for workers then they can restrict access to their instances in Amazon EC2 to specific AWS IAM users. In addition, customers are responsible for encrypting sensitive data before it is passed to their workflows and decrypting it in their workers.

Amazon SimpleDB

Amazon SimpleDB is a non-relational data store that allows customers to store and query data items via web services requests. Amazon SimpleDB then creates and manages multiple geographically distributed replicas of data automatically to enable high availability and data durability.

Data in Amazon SimpleDB is stored in domains, which are similar to database tables except that functions cannot be performed across multiple domains. Amazon SimpleDB APIs provide domain-level controls that only permit authenticated access by the domain creator.

Data stored in Amazon SimpleDB is redundantly stored in multiple physical locations as part of normal operation of those services. Amazon SimpleDB provides object durability by protecting data across multiple availability zones on the initial write and then actively doing further replication in the event of device unavailability or detected bit-rot.

AWS Single Sign-On (SSO)

AWS Single Sign-On (AWS SSO) is a cloud-based service that simplifies managing SSO access to AWS accounts and business applications. Customers can control SSO access and user permissions across all AWS accounts in AWS Organizations. Customers can also administer access to popular business applications and custom applications that support Security Assertion Markup Language (SAML) 2.0. In addition, AWS SSO offers a user portal where users can find all their assigned AWS accounts, business applications, and custom applications in one place.

AWS Snowball

Snowball is a petabyte-scale data transport solution that uses secure appliances to transfer large amounts of data into and out of the AWS cloud. Using Snowball addresses common challenges with large-scale data transfers including high network costs, long transfer times, and security concerns. Transferring data with Snowball is simple and secure.

AWS Snowball Edge

AWS Snowball Edge is a 100TB data transfer device with on-board storage and compute capabilities. Customers can use Snowball Edge to move large amounts of data into and out of AWS, as a temporary storage tier for large local datasets, or to support local workloads in remote or offline locations. Snowball Edge connects to customers' existing applications and infrastructure using standard storage interfaces, streamlining the data transfer process and minimizing setup and integration. Snowball Edge can cluster together to form a local storage tier and process customers' data on-premises, helping ensure their applications continue to run even when they are not able to access the cloud.

AWS Snowmobile

AWS Snowmobile is an Exabyte-scale data transfer service used to move extremely large amounts of data to AWS. Customers can transfer their Exabyte data via a 45-foot long ruggedized shipping container, pulled by a semi-trailer truck. Snowmobile makes it easy to move massive volumes of data to the cloud, including video libraries, image repositories, or even a complete data center migration. After a customer's data is loaded, Snowmobile is driven back to AWS where their data is imported into Amazon S3 or Amazon Glacier.

AWS Step Functions

AWS Step Functions is a web service that enables customers to coordinate the components of distributed applications and microservices using visual workflows. Customers can build applications from individual components that each perform a discrete function, or task, allowing them to scale and change applications quickly. Step Functions provides a reliable way to coordinate components and step through the functions of a customer's application. Step Functions provides a graphical console to visualize the components of a customer's application as a series of steps. It automatically triggers and tracks each step, and retries when there are errors, so the customer's application executes in order and as expected, every time. Step Functions logs the state of each step, so when things do go wrong, customers can diagnose and debug problems quickly.

AWS Storage Gateway

The AWS Storage Gateway service connects customers' off-cloud software appliances with cloud-based storage. The service enables organizations to store data in AWS' highly durable cloud storage services: Amazon S3 and Amazon Glacier.

AWS Storage Gateway backs up data off-site to Amazon S3 in the form of Amazon EBS snapshots. AWS Storage Gateway transfers data to AWS and stores this data in either Amazon S3 or Amazon Glacier, depending on the use case and type of gateway used. There are three types of gateways: Tape, File, and Volume Gateways. The Tape Gateway allows customers to store more frequently accessed data in Amazon S3 and less frequently accessed data in Amazon Glacier.

The File Gateway allows customers to copy data to S3 and have those files appear as individual objects in S3. Volume gateways store data directly in Amazon S3 and allow customers to snapshot their data so that they can access previous versions of their data. These snapshots are captured as Amazon EBS Snapshots, which are also stored in Amazon S3. Both Amazon S3 and Amazon Glacier redundantly store these snapshots on multiple devices across multiple facilities, detecting and repairing any lost redundancy. The Amazon EBS snapshot provides a point-in-time backup that can be restored off-cloud or on a gateway running in Amazon EC2, or used to instantiate new Amazon EBS volumes. Data is stored within a single region that customers specify.

AWS Systems Manager

AWS Systems Manager gives customers the visibility and control to their infrastructure on AWS. AWS Systems Manager provides customers a unified user interface so that customers can view their operational data from multiple AWS services, and allows customers to automate operational tasks across the AWS resources.

With AWS Systems manager, customers can group resources, like Amazon EC2 instances, Amazon S3 buckets, or Amazon RDS instances, by application, view operational data for monitoring and troubleshooting, and taken action groups of resources.

Amazon Textract

Amazon Textract automatically extracts text and data from scanned documents. With Textract customers can quickly automate document workflows, enabling customers to process large volumes of document pages in a short period of time. Once the information is captured, customers can take action on it within their business applications to initiate next steps for a loan application or medical claims processing. Additionally, customers can create search indexes, build automated approval workflows, and better maintain compliance with document archival rules by flagging data that may require redaction.

Amazon Timestream

Amazon Timestream is a fast, scalable, and serverless time series database service for IoT and operational applications that makes it easy to store and analyze trillions of events per day up to 1,000 times faster and at as little as 1/10th the cost of relational databases. Amazon Timestream saves customers time and cost in managing the lifecycle of time series data by keeping recent data in memory and moving historical data to a cost optimized storage tier based upon user defined policies. Amazon Timestream's purpose-built query engine lets customers access and analyze recent and historical data together, without needing to specify explicitly in the query whether the data resides in the in-memory or cost-optimized tier. Amazon Timestream has built-in time series analytics functions, helping customers identify trends and patterns in data in real-time.

Amazon Transcribe

Amazon Transcribe makes it easy for customers to add speech-to-text capability to their applications. Audio data is virtually impossible for computers to search and analyze. Therefore, recorded speech needs to be converted to text before it can be used in applications.

Amazon Transcribe uses a deep learning process called automatic speech recognition (ASR) to convert speech to text quickly. Amazon Transcribe can be used to transcribe customer service calls, to automate closed captioning and subtitling, and to generate metadata for media assets to create a fully searchable archive.

Amazon Transcribe automatically adds punctuation and formatting so that the output closely matches the quality of manual transcription at a fraction of the time and expense.

AWS Transfer Family

AWS Transfer Family enables the transfer of files directly into and out of Amazon S3. With the support for Secure File Transfer Protocol (SFTP)—also known as Secure Shell (SSH) File Transfer Protocol, the File Transfer Protocol over SSL (FTPS) and the File Transfer Protocol (FTP), the AWS Transfer Family helps the customers seamlessly migrate their file transfer workflows to AWS by integrating with existing authentication systems and providing DNS routing with Amazon Route 53.

Amazon Translate

Amazon Translate is a neural machine translation service that delivers fast, high-quality, and affordable language translation. Neural machine translation is a form of language translation automation that uses deep learning models to deliver more accurate and more natural sounding translation than traditional statistical and rule based translation algorithms. Amazon Translate allows customers to localize content - such as websites and applications - for international users, and to easily translate large volumes of text efficiently.

Amazon Virtual Private Cloud (VPC)

Amazon Virtual Private Cloud (VPC) enables customers to provision a logically isolated section of the AWS cloud where AWS resources can be launched in a virtual network defined by the customer. Customers can connect their existing infrastructure to the network isolated Amazon EC2 instances within their Amazon VPC, including extending their existing management capabilities, such as security services, firewalls and intrusion detection systems, to include their instances via a Virtual Private Network (VPN) connection. The VPN service provides end-to-end network isolation by using an IP address range of a customer's choice, and routing all of their network traffic between their Amazon VPC and another network designated by the customer via an encrypted Internet Protocol security (IPsec) VPN.

Customers can optionally connect their VPC to the Internet by adding an Internet Gateway (IGW) or a NAT Gateway. An IGW allows bi-directional access to and from the internet for some instances in the VPC based on the routes a customer defines, which specify which IP address traffic should be routable from the internet, Security Groups, and Network ACLs (NACLS) which limit which instances can accept or send this traffic. Customers can also optionally configure a NAT Gateway which allows egress-only traffic initiated from a VPC instance to reach the internet, but not allow traffic initiated from the internet to reach VPC instances. This is accomplished by mapping the private IP addresses to a public address on the way out, and then map the public IP address to the private address on the return trip.

The objective of this architecture is to isolate AWS resources and data in one Amazon VPC from another Amazon VPC, and to help prevent data transferred from outside the Amazon network except where the customer has specifically configured internet connectivity options or via an IPsec VPN connection to their off-cloud network.

Further details are provided below:

- **Virtual Private Cloud (VPC):** An Amazon VPC is an isolated portion of the AWS cloud within which customers can deploy Amazon EC2 instances into subnets that segment the VPC's IP address range (as designated by the customer) and isolate Amazon EC2 instances in one subnet from another. Amazon EC2 instances within an Amazon VPC are accessible to customers via Internal Gateway (IGW), Virtual Gateway (VGW), or VPC Peerings established to the Amazon VPC **(Control AWSCA-3.13** and **AWSCA-3.15).**
- **IPsec VPN:** An IPsec VPN connection connects a customer's Amazon VPC to another network designated by the customer. IPsec is a protocol suite for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a data stream. Amazon VPC customers can create an IPsec VPN connection to their Amazon VPC by first establishing an Internet Key Exchange (IKE) security association between their Amazon VPC VPN gateway and another network gateway using a pre-shared key as the authenticator. Upon establishment, IKE negotiates an ephemeral key to secure future IKE messages. An IKE security association cannot be established unless there is complete agreement among the parameters. Next, using the IKE ephemeral key, keys are established between the VPN gateway and customer gateway to form an IPsec security association. Traffic between gateways is encrypted and decrypted using this security association. IKE automatically rotates the ephemeral keys used to encrypt traffic within the IPsec security association on a regular basis to ensure confidentiality of communications **(Control AWSCA-3.14** and **AWSCA-4.3)**.

AWS Web Application Firewall (WAF)

AWS Web Application Firewall (WAF) is a web application firewall that helps protect customer web applications from common web exploits that could affect application availability, compromise security, or consume excessive resources.

Customers can use AWS WAF to create custom rules that block common attack patterns, such as SQL injection or cross-site scripting, and rules that are designed for their specific application. New rules can be deployed within minutes, letting customers respond quickly to changing traffic patterns. Also, AWS WAF includes a full-featured API that customers can use to automate the creation, deployment, and maintenance of web security rules.

Amazon WorkDocs

Amazon WorkDocs is a, secure content creation, storage and collaboration service. Users can share files, provide rich feedback, and access their files on WorkDocs from any device. WorkDocs encrypts data in transit and at rest, and offers powerful management controls, active directory integration, and near real-time visibility into file and user actions. The WorkDocs SDK allows users to use the same AWS tools they are already familiar with to integrate WorkDocs with AWS products and services, their existing solutions, third-party applications, or build their own.

Amazon WorkLink

Amazon WorkLink lets the customers provide their employees with secure, easy access to their internal corporate websites and web apps using their mobile phones. Traditional solutions such as Virtual Private Networks (VPNs) and device management software are inconvenient to use on the go, and often require the use of custom browsers that have a poor user experience. With Amazon WorkLink, employees can access internal web content as easily as they access any public website, without the hassle of connecting to their corporate network.

Amazon WorkMail

Amazon WorkMail is a managed business email and calendaring service with support for existing desktop and mobile email clients. It allows access to email, contacts, and calendars using Microsoft Outlook, a browser, or native iOS and Android email applications. Amazon WorkMail can be integrated with a customer's existing corporate directory and the customer controls both the keys that encrypt the data and the location (AWS Region) under which the data is stored.

Customers can create an organization in Amazon WorkMail, select the Active Directory they wish to integrate with, and choose their encryption key to apply to all customer data. After setup and validation of their mail domain, users from the Active Directory are selected or added, enabled for Amazon WorkMail, and given an email address identity inside the customer owned mail domain.

Amazon WorkSpaces

Amazon WorkSpaces is a managed desktop computing service in the cloud. Amazon WorkSpaces enables customers to deliver a high-quality desktop experience to end-users as well as help meet compliance and security policy requirements. When using Amazon WorkSpaces, an organization's data is neither sent to nor stored on end-user devices. The PCoIP protocol used by Amazon WorkSpaces uses an interactive video stream to provide the desktop experience to the user while the data remains in the AWS cloud or in the organization's off-cloud environment.

When Amazon WorkSpaces is integrated with a corporate Active Directory, each WorkSpace joins the Active Directory domain, and can be managed like any other desktop in the organization. This means that customers can use Active Directory Group Policies to manage their Amazon WorkSpaces and can specify configuration options that control the desktop, including those that restrict users' abilities to use local storage on their devices. Amazon WorkSpaces also integrates with customers' existing RADIUS server to enable multi-factor authentication (MFA).

AWS X-Ray

AWS X-Ray helps developers analyze and debug production, distributed applications, such as those built using a microservices architecture. With X-Ray, customers or developers can understand how their application and its underlying services are performing to identify and troubleshoot the root cause of performance issues and errors. X-Ray provides an end-to-end view of requests as they travel through the customers' application and shows a map of the application's underlying components. Customers or developers can use X-Ray to analyze both applications in development and in production.

D.5 Secure Data Handling

AWS provides many methods for customers to securely handle their data. There are additional methods detailed in the Complementary User Entity Controls at the end of this section. AWS enables customers to open a secure, encrypted channel to AWS servers using HTTPS (TLS/SSL).

Amazon S3 provides a mechanism that enables users to utilize MD5 checksums to validate that data sent to AWS is bitwise identical to what is received, and that data sent by Amazon S3 is identical to what is received by the user. When customers choose to provide their own keys for encryption and decryption of Amazon S3 objects (S3 SSE-C), Amazon S3 does not store the encryption key provided by the customer. Amazon S3 generates and stores a one-way salted HMAC of the customer encryption key and that salted HMAC value is not logged **(Control AWSCA-4.4).**

Upon initial communication with an AWS-provided Windows AMI, AWS enables secure communication by configuring Terminal Services on the instance and generating a unique self-signed X.509 server certificate and delivering the certificate's thumbprint to the user over a trusted channel **(Control AWSCA-4.2).**

AWS further enables secure communication with Linux AMIs, by configuring SSH on the instance, generating a unique host-key and delivering the key's fingerprint to the user over a trusted channel **(Control AWSCA-4.1).**

Connections between customer applications and Amazon RDS MySQL instances can be encrypted using TLS/SSL. Amazon RDS generates a TLS/SSL certificate for each database instance, which can be used to establish an encrypted connection using the default MySQL client. Once an encrypted connection is established, data transferred between the database instance and a customer's application will be encrypted during transfer. If customers require data to be encrypted while "at rest" in the database, the customer application must manage the encryption and decryption of data. Additionally, customers can set up controls to have their database instances only accept encrypted connections for specific user accounts.

D.6 Physical Security and Environmental Protection

Amazon has significant experience in designing, constructing, and operating large-scale data centers. This experience has been applied to the AWS system and infrastructure. Refer to the "Amazon Web Services System Overview" section above for list of in-scope data centers.

Physical Security

AWS provides physical access to its data centers for approved employees and contractors who have a legitimate business need for such privileges **(Control AWSCA-5.1).** All visitors are required to present identification and are signed in and escorted by authorized staff.

When an employee or contractor no longer requires these privileges, his or her access is promptly revoked, even if he or she continues to be an employee of Amazon or AWS. In addition, access is automatically revoked when an employee's record is terminated in Amazon's HR system **(Control AWSCA-5.2).** Cardholder access to data centers is reviewed quarterly. Cardholders marked for removal have their access revoked as part of the review **(Control AWSCA-5.3).**

Physical access is controlled both at the perimeter and at building ingress points by professional security staff utilizing video surveillance, intrusion detection systems, and other electronic means. Authorized staff utilize multi-factor authentication mechanisms to access data center floors **(Control AWSCA-5.4**, **AWSCA-5.5**, and **AWSCA-5.6)**.

In addition to the physical security controls, physical access to data centers in the GovCloud (US) region is restricted to employees or contractors who have been validated as a U.S. person (green card holder or citizen as defined by the U.S. Department of State).

Amazon owns and operates many of its data centers, while others are housed in colocation spaces that are offered by various reputable companies under contract with Amazon. The physical access and security controls described above are also deployed by AWS at colocation spaces. In addition, AWS also has single racks deployed in non-Amazon controlled facilities, Amazon CloudFront Extension (ACE). In these facilities, the third-party vendor provides the first line of physical security that meets AWS' established requirements.

AWS Local Zones are a type of AWS infrastructure deployment managed and supported by AWS that places AWS compute, storage, database and other select services closer to large population, industry, IT centers or customers where no AWS Region currently exists today. With AWS Local Zones, customers can easily run latency-sensitive portions of applications local to end-users and resources in a specific geography, delivering single-digit millisecond latency for specific use cases. Private Local Zones are logical extensions of existing regions, delivered in accordance with a customer specific contract and dedicated to that customer, that meets AWS established physical security requirements.

AWS offers Wavelength infrastructure in partnership with Telco providers, which is optimized for mobile edge computing applications. Wavelength Zones are AWS infrastructure deployments that embed AWS compute and storage services within communications service providers' (CSP or telecom providers) data centers at the edge of the 5G network, so application traffic from 5G devices can reach application servers running in Wavelength Zones without leaving the telecommunications network. This avoids the latency that would result from application traffic having to traverse multiple hops across the Internet to reach their destination, enabling customers to take full advantage of the latency and bandwidth benefits offered by modern 5G networks.

Contracts with the third-party colocation providers support the protection of AWS assets **(Control AWSCA-5.11).** In addition, AWS provides monitoring of adherence with security and operational standards by performing periodic reviews of colocation service providers **(Control AWSCA-5.12).** The frequency of colocation reviews is based on a tiering that is dependent on the contracts and level of engagement with the colocation service provider.

AWS spaces within colocation facilities are installed with AWS-operated CCTV, intrusion detection systems, and access control devices that alert AWS personnel of access and incidents. Physical access to AWS spaces within colocation facilities is controlled by AWS and follows standard AWS access management processes.

Redundancy

Data centers are designed to anticipate and tolerate failure while maintaining service levels. Each AWS Region is comprised of multiple data centers. All data centers are online and serving traffic; no data center is "cold." In case of failure, automated processes move traffic away from the affected area. Core applications are deployed to an N+1 standard, so that in the event of a data center failure, there is sufficient capacity to enable traffic to be load-balanced to the remaining sites.

Fire Detection and Suppression

Automatic fire detection and suppression equipment has been installed to reduce risk. The fire detection system utilizes smoke detection sensors in Amazon-owned data center environments (e.g., VESDA, point source detection), mechanical and electrical infrastructure spaces, chiller rooms, and generator equipment rooms. These areas are protected by either wet-pipe, double-interlocked pre-action, or gaseous sprinkler systems **(Control AWSCA-5.7).**

Power

The data center electrical power systems supporting AWS are designed to be fully redundant and maintainable without impact to operations, 24 hours a day, and Uninterruptible Power Supply (UPS) units or equivalent in-rack battery units provide back-up power in the event of an electrical failure for critical and essential loads in Amazon-owned data centers and third-party colocation sites where Amazon maintains the UPS units. Amazon-owned data centers use generators to provide back-up power for the facility **(Control AWSCA-5.9** and **AWSCA-5.10)**.

Climate and Temperature

Climate control is required to maintain a constant operating temperature for servers and other hardware, which prevents overheating and reduces the possibility of service outages. Amazon-owned data centers are conditioned to maintain atmospheric conditions at specified levels. Personnel and systems monitor and control temperature and humidity at appropriate levels. This is provided at N+1 and also utilizes free cooling as primary source of cooling when and where it is available based on local environmental conditions **(Control AWSCA-5.8)**.

Environment Management

In Amazon-owned data centers, AWS monitors electrical, mechanical, and life support systems and equipment so that any issues are immediately identified. This is carried out by utilizing the Continuous Audit Tool (CAT) for daily rounds and readings, in tandem with an overview of our data centers provided via AWS' Building Management System (BMS) and Electrical Monitoring System (EMS). Preventative maintenance is performed to maintain the continued operability of equipment utilizing the Enterprise Asset Management (EAM) tool and trouble ticketing and change management system. The primary objective of this program is to provide a holistic insight into Mechanical, Electrical, Plumbing (MEP) Assets owned by AWS infrastructure teams. This includes providing a centralized repository for equipment, optimizing planned and unplanned maintenance and managing data center critical spare parts.

Management of Media

When a storage device has reached the end of its useful life, AWS procedures include a decommissioning process that is designed to prevent unauthorized access to assets. AWS uses techniques detailed in NIST 800-88 (“Guidelines for Media Sanitization”) as part of the decommissioning process. All production media is securely decommissioned in accordance with industry-standard practices **(Control AWSCA-5.13).** Production media is not removed from AWS control until it has been securely decommissioned.

D.7 Change Management

Software

AWS applies a systematic approach to managing changes so that changes to customer impacting services are reviewed, tested, approved, and well communicated. Change management processes are based on Amazon change management guidelines and tailored to the specifics of each AWS service **(Control AWSCA-6.1).** These processes are documented and communicated to the necessary personnel by service team management.

The goal of AWS’ change management process is to prevent unintended service disruptions and maintain the integrity of service to the customer. Change details are documented in one of Amazon’s change management or deployment tools **(Control AWSCA-6.2)**.

Prior to deployment to production environments, changes are:

- Developed: in a development environment that is segregated from the production environment **(Control AWSCA-6.4)**. Customer content is not used in test and development environments.
- Reviewed: by peers for technical aspects and appropriateness **(Control AWSCA-6.5)**.
- Tested: to confirm the changes will behave as expected when applied and not adversely impact performance **(Control AWSCA-6.3)**.
- Approved: by authorized team members to provide appropriate oversight and understanding of business impact **(Control AWSCA-6.5)**.

Changes are typically pushed into production in a phased deployment starting with lowest impact sites. Deployments are closely monitored so impact can be evaluated. Service owners have a number of configurable metrics that measure the health of the service’s upstream dependencies. These metrics are closely monitored with thresholds and alarming in place (e.g., latency, availability, fatals, CPU utilization, etc.). Rollback procedures are documented so that team members can revert back to the previous state if needed. Customer information, including personal information, and customer content are not used in test and development environments **(Control AWSCA-6.7).**

When possible, changes are scheduled during regular change windows. Emergency changes to production systems that require deviations from standard change management procedures are associated with an incident and are logged and approved as appropriate.

AWS performs deployment validations and change reviews to detect unauthorized changes to its environment and tracks identified issues to resolution. On a monthly basis, as part of the AWS Security Assurance business review, AWS management reviews and tracks deployment violations for services enrolled in the Deployment Monitoring program. For those services not enrolled in the Deployment Monitoring program, a secondary monthly review of deployments is conducted within 60 days of the month in which they were made. If any unauthorized changes are detected or deviated from the standard review and approval process, they are tracked to resolution **(Control AWSCA-6.6).**

Infrastructure

AWS internally developed configuration management software is installed when new hardware is provisioned. These tools are run on all UNIX hosts to validate that they are configured and software is installed in a standard manner based on host classes and updated regularly.

Only approved users with verified business needs are authorized through a permissions service may log in to the central configuration management servers. Host configuration settings are monitored to validate compliance with AWS security standards and automatically pushed to the host fleet **(Control AWSCA-9.4)**.

Emergency, non-routine and other configuration changes to existing AWS infrastructure are authorized, logged, tested, approved and documented in accordance with industry norms for similar systems. Updates to AWS infrastructure are performed in such a manner to minimize impact to the customer and their service use. AWS communicates with customers, either via email, or through the AWS Health Dashboard (https://status.aws.amazon.com/) when service use may be adversely affected.

D.8 Data Integrity, Availability, Redundancy and Data Retention

AWS seeks to maintain data integrity through all phases including transmission, storage, and processing. Amazon S3 utilizes checksums internally to confirm the continued integrity of data in transit within the system and at rest. Amazon S3 provides a facility for customers to send checksums along with data transmitted to the service. The service validates the checksum upon receipt of the data to determine that no corruption occurred in transit. Regardless of whether a checksum is sent with an object to Amazon S3, the service utilizes checksums internally to confirm the continued integrity of data in transit within the system and at rest. When disk corruption or device failure is detected, the system automatically attempts to restore normal levels of object storage redundancy **(Control AWSCA-7.1, AWSCA-7.2**, and **AWSCA-7.3).**

AWS services and systems hosting customer data are designed to retain customer content until the customer removes it or the customer agreement ends **(Control AWSCA-7.8)**. Once the contractual obligation to retain content ends, or upon a customer-initiated action to remove or delete content, AWS services have processes and procedures to detect a deletion and make the content inaccessible. AWS utilizes S3, EC2, EBS, and DDB as the primary services for customer content storage, which individually or in combination are also utilized by many of the other AWS services listed in the System Overview for storage of customer content. KMS, Glacier, RDS Aurora, SimpleDB, SQS, Cloud Directory, and CloudFront utilize local storage to store customer content but are not utilized for content storage functionalities by other services, similar to the primary AWS content storage Services. When customers request data to be deleted, automated processes are initiated to remove the data and render the content unreadable **(Control AWSCA-7.7).**

Availability

The AWS Resiliency Program encompasses the processes and procedures by which AWS identifies, responds to and recovers from a major event or incident within the AWS services environment. This program builds upon the traditional approach of addressing contingency management which incorporates elements of business continuity and disaster recovery plans and expands this to consider critical elements of proactive risk mitigation strategies such as engineering physically separate Availability Zones (AZs) and continuous infrastructure capacity planning.

AWS contingency plans and incident response playbooks are maintained and updated to reflect emerging risks and lessons learned from past incidents. Service team response plans are tested and updated through the due course of business, and the AWS Resiliency plan is tested, reviewed, and approved by senior leadership annually (**Control AWSCA-10.3**).

AWS has identified critical system components required to maintain the availability of the system and recover service in the event of outage. Critical system components (example: code bases) are backed up across multiple, isolated locations known as Availability Zones. Each Availability Zone runs on its own physically distinct, independent infrastructure, and is engineered to be highly reliable. Common points of failure like generators and cooling equipment are not shared across Availability Zones. Additionally, Availability Zones are physically separate, and designed such that even extremely uncommon disasters such as fires, tornados or flooding should only affect a single Availability Zone. AWS replicates critical system components across multiple Availability Zones and authoritative backups are maintained and monitored to ensure successful replication (**Control AWSCA-10.1** and **AWSCA-10.2**).

Data Backup

Data stored in Amazon S3, Amazon DynamoDB, Amazon SimpleDB, Amazon EBS, or Amazon EFS is redundantly stored in multiple physical locations as part of normal operation of those services. Customers should enable backups of their data across AWS services.

Amazon S3 is designed to provide 99.999999999% durability and 99.99% availability of objects over a given year. Objects are redundantly stored on multiple devices across multiple facilities in an Amazon S3 region. To help provide durability, Amazon S3 PUT and COPY operations synchronously store customer data across multiple facilities before returning SUCCESS. Once stored, Amazon S3 helps maintain the durability of the objects by detecting and repairing lost redundancy. Amazon S3 also regularly verifies the integrity of data stored using checksums. If corruption is detected, it is repaired using redundant data. In addition, Amazon S3 calculates checksums on all network traffic to detect corruption of data packets when storing or retrieving data **(Control AWSCA-7.3**, **AWSCA-7.4**, and **AWSCA-7.5)**.

Amazon EBS replication is stored within the same availability zone, not across multiple zones, but customers can conduct regular snapshots to Amazon Simple Storage Service (S3) in order to provide long-term data durability. For customers who have architected complex transactional databases using Amazon EBS, backups to Amazon S3 can be performed through the database management system so that distributed transactions and logs can be checkpointed. AWS does not perform backups of data that are maintained on virtual disks attached to running instances on Amazon EC2.

Amazon RDS provides two different methods for backing up and restoring customer DB Instance(s): automated backups and database snapshots (DB Snapshots). Turned on by default, the automated backup feature of Amazon RDS enables point-in-time recovery for a DB Instance. Amazon RDS will back up databases and transaction logs and store both for a user-specified retention period. This allows for restoration of a DB Instance to any second during the defined retention period, up to the last five minutes. The automatic backup retention period can be configured to up to 35 days. During the backup window, storage input/output (I/O) may be suspended for a few seconds, while data is being backed up. This I/O suspension is avoided with Multi-AZ DB deployments, since the backup is taken from the standby. DB Snapshots are user-initiated backups of DB Instances. These full database backups will be stored by Amazon RDS until customers explicitly delete them. Customers can create a new DB Instance from a DB Snapshot whenever they desire **(Control AWSCA-7.6)**.

AWS continuously monitors service usage to project infrastructure needs to support availability commitments and requirements. AWS maintains a capacity planning model to assess infrastructure usage and demands at least monthly, and usually more frequently (e.g., weekly). In addition, the AWS capacity planning model supports the planning of future demands to acquire and implement additional resources based upon current resources and forecasted requirements **(Control AWSCA-10.4)**.

D.9 Confidentiality

AWS is committed to protecting the security and confidentiality of its customers' content, defined as "Your Content" at https://aws.amazon.com/agreement/ **(Control AWSCA-11.3)**. AWS' systems and services are designed to enable authenticated AWS customers to access and manage their content. AWS notifies customers of third-party access to a customer's content on the third-party access page located at https://aws.amazon.com/compliance/third-party-access. AWS may remove a customer's content when compelled to do so by a legal order, or where there is evidence of fraud or abuse as described in the Customer Agreement (https://aws.amazon.com/agreement/) and Acceptable Use Policy (https://aws.amazon.com/aup/). In executing the removal of a customer's content due to the reasons stated above, employees may render it inaccessible as the situation requires. For clarity, this capability to render customer content inaccessible extends to encrypted content as well.

In the course of AWS system and software design, build, and test of product features, a customer's content is not used and remains in the production environment. A customer's content is not required for the AWS software development life cycle. When content is required for the development or test of a service's software, AWS service teams have tools to generate mock, random data.

AWS knows customers care about privacy and data security. That is why AWS gives customers ownership and control over their content by design through tools that allow customers to determine where their content is stored, secure their content in transit or at rest, and manage access to AWS services and resources. AWS also implements technical and physical controls designed to prevent unauthorized access to or disclosure of a customer's content. As described in the Physical Security and Change Management areas in Section III of this report, AWS employs a number of controls to safeguard data from within and outside of the boundaries of environments which store a customer's content. As a result of these measures, access to a customer's content is restricted to authorized parties.

AWS contingency plans and incident response playbooks have defined and tested tools and processes to detect, mitigate, investigate, and assess security incidents. These plans and playbooks include guidelines for responding to potential data breaches in accordance with contractual and regulatory requirements. AWS security engineers follow a protocol when responding to potential data security incidents. The protocol involves steps, which include validating the presence customer data within the AWS service (without actually viewing the data), determining the encryption status of a customer's content, and determining improper access to a customer's content to the extent possible.

During the course of their response, the security engineers document relevant findings in internal tools used to track the security issue. AWS Security Leadership is regularly apprised of all data security issue investigations. In the event there are positive indicators that customer data was potentially accessed by an unintended party, a security engineer engages AWS Security Leadership and the AWS Legal team to review the findings. AWS Security Leadership and the Legal team review the findings and determine if a notifiable data breach has occurred pursuant to contractual or regulatory obligations. If confirmed, affected customers are notified in accordance with the applicable reporting requirement.

Vendors and third parties with restricted access, that engage in business with Amazon, are subject to confidentiality commitments as part of their agreements with Amazon. Confidentiality commitments are included in agreements with vendors and third parties with restricted access are reviewed by AWS and the third party at time of contract creation or renewal **(Control AWSCA-11.1).** AWS monitors the performance of third parties through periodic reviews on a risk-based approach, which evaluate performance against contractual obligations **(Control AWSCA-11.2).**

AWS communicates its confidentiality commitments to customers on its public website located at https://aws.amazon.com/compliance/third-party-access/ for contractors and https://aws.amazon.com/compliance/sub-processors/ for sub-processors. The effective date of the policy is communicated there and updated periodically. Before AWS authorizes and permits any new subcontractor to access any customer content, AWS will update this website to inform customers. Vendor confidentiality commitments are governed by the terms of the contract between AWS and the vendor.

Internally, confidentiality requirements are communicated to employees through training and policies. Employees are required to attend Amazon Security Awareness (ASA) training, which includes policies and procedures related to protecting a customer's content. Confidentiality requirements are included in the Data Handling and Classification Policy. Policies are reviewed and updated at least annually.

AWS implements policies and controls to monitor access to resources that process or store customer content. In addition, a Master Service Agreement (MSA) or Non-Disclosure Agreement (NDA) bind a subcontractor to confidentiality in the unlikely event they are exposed to a customer's content. The MSA references both an NDA and a requirement to protect a customer's content in the event they do not have an NDA. AWS Legal maintains the most current MSA in a legal document portal. The portal serves as source to store contracts with the most current commitments, document owner, and date modified. A legal review is also performed when the MSA is executed with a vendor.

Services and systems hosted by AWS are designed to retain and protect a customer's content for the duration of the customer agreement period, and in some cases, up to 30 days beyond termination. The customer agreement, https://aws.amazon.com/agreement/, specifies the terms and conditions. AWS services are designed to retain a customer's content until the contractual obligation to retain a customer's content ends, or upon a customer-initiated action to remove or delete their content.

Once the contractual obligation to retain a customer's content ends, or upon a customer-initiated action to remove or delete their content, AWS services have processes and procedures to detect a deletion and make the content inaccessible. After a delete event, automated actions act on deleted content to render the content inaccessible **(Control AWSCA-7.7).**

E. Monitoring

E.1 Monitoring Activities

AWS utilizes a wide variety of automated monitoring systems to provide a high level of service performance and availability. AWS defines a Security Incident as a security-related adverse event in which there was a loss of data confidentiality, disruption of data or systems integrity, or disruption or denial of availability. AWS monitoring tools are implemented to detect unusual or unauthorized activities and conditions at ingress and egress communication points. These tools monitor server and network usage, port scanning activities, application usage, and unauthorized intrusion attempts.

Systems within AWS are further designed to monitor key operational metrics and alarms are configured to automatically notify operations and management personnel when early warning thresholds are crossed. An on-call schedule is used such that personnel are always available to respond to operational issues. This includes a pager system, so that notifications are quickly and reliably communicated to operations personnel **(Control AWSCA-8.1)**.

Documentation is maintained to aid and inform operations personnel in handling incidents or issues. If the resolution of an issue requires collaboration, a ticketing system is used which supports communication, progress updates, and logging capabilities. Trained call leaders facilitate communication and progress during the handling of operational issues that require collaboration. After action reviews are convened following any significant operational issue, regardless of external impact, and Correction of Errors (COE) documents are composed such that the root cause is captured and preventative actions may be taken for the future. Implementation of the preventative measures identified in COEs is tracked during weekly operations meetings.

The AWS Security Operations team employs industry-standard diagnosis procedures (such as incident identification, registration and verification, initial incident classification and prioritizing actions) to drive resolution during business-impacting events. Staff operators in the US, EMEA, and APAC provide 24 x 7 x 365 coverage to detect incidents and to manage the impact and resolution **(Control AWSCA-8.2)**.

AWS monitors resourcing and staffing through an annual assessment of employee qualification alignment with entity objectives. As part of this process, management and employees formally evaluate, discuss, and recognize performance over the last year and set goals and priorities for the next year. Management further reviews operational plans and goals for the coming period to assess alignment of resources and employee skill sets.

E.2 Incident Notification

AWS has documented an incident response policy and plan which outlines an organized approach for responding to security breaches and incidents. The AWS Security team is responsible for monitoring systems, tracking issues, and documenting findings of security-related events. Records are maintained for security beaches and incidents, which includes status information, information required for supporting forensic activities, trend analysis, and evaluation of incident details.

As part of the process, potential breaches of customer content are investigated and escalated to AWS Security and AWS Legal. Affected customers and regulators are notified of breaches and incidents where legally required. Customers can subscribe to the AWS Security Bulletins page, which provides information regarding identified security issues.

Complementary User Entity Controls

AWS services were designed with the assumption that certain policies, procedures, and controls are implemented by its user entities (or customers). In certain situations, the application of specific policies, procedures, and controls by the customer is necessary to achieve the service commitments and system requirements that are based on the applicable trust services criteria included in this report. This section describes the additional policies, procedures, and controls customers may need to implement in order to satisfy the service commitments and system requirements for customers' specific use cases.

CC1.0 – Common Criteria Related to Control Environment

CC2.0 – Common Criteria Related to Communication and Information

CC3.0 – Common Criteria Related to Risk Assessment

CC4.0 – Common Criteria Related to Monitoring Activities

- Customers should ensure appropriate logging for events such as administrator activity, system errors, authentication checks, data deletions etc. is in place to support monitoring, and incident response processes.
- Customers should enable and configure service-specific logging features where available for all services and implement appropriate monitoring and incident response processes.

CC5.0 – Common Criteria Related to Control Activities

CC6.0 – Common Criteria Related to Logical and Physical Access Controls

- Customers should use asymmetric key-pairs or multi-factor authentication to access their hosts and avoid simple password-based authentication.
- Customers should implement access controls such as Security-Groups, IAM roles and/or ACLs to segment and isolate like-functioning instances.
- S3-Specific - Customers should utilize managed rules and Access control lists (ACLs) to secure their S3 buckets by controlling access to the S3 buckets and preventing them being accessible to the public.
- AppStream 2.0-Specific – Customers are responsible for managing user access to streaming instances and should maintain controls for approving and granting access, timely removing access when an employee leaves the organization or changes job responsibilities, and periodically reviewing appropriate access levels for existing users.

- Customers should utilize multi-factor authentication for controlling access to their root account credentials and should avoid using root account credentials beyond initial account configuration of AWS Identity and Access Management (IAM), except for Services for which IAM is not available. Customers should delete access key(s) for the root account when not in use.
- Outpost-Specific – Customers should restrict and monitor physical access to data centers and facilities hosting Outpost devices to personnel based on job responsibilities.
- Outpost-Specific – Customers are responsible for verifying their site meets the Outpost requirements for facility, networking, and power as published on https://docs.aws.amazon.com/outposts/latest/userguide/outposts-requirements.html.
- Outpost-Specific – Customers are responsible for removal of the Nitro Security Key (NSK) to ensure customer content is crypto shredded from the Outpost before returning it to AWS.

CC7.0 – Common Criteria Related to System Operations

- Customers may subscribe to Premium Support offerings that include direct communication with the customer support team and proactive alerting to any issues that may impact the customer.
- VPC-Specific – Customers are responsible for their network security requirements and connecting their Amazon Virtual Private Cloud to an appropriate point of their internal network.
- EC2-Specific – Customers are responsible for configuring the Time Sync functionality and monitoring the synchronization for accuracy across their EC2 instances, as published by AWS in user guide documentation - https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/set-time.html#configure-amazon-time-service-amazon-linux.

CC8.0 – Common Criteria Related to Change Management

- Customers are responsible for maintaining the application of patches to customer's Amazon instances. Customers can leverage automated patching tools such as AWS Systems Manager Patch Manager to help deploy operating systems and software patches automatically across large groups of instances.
- Customers should set up separate development and production accounts to isolate the production system from development work.
- App Mesh-Specific - Customers utilizing their own Envoy image should follow a documented change management process to ensure updated configurations are documented, tested and approved prior to deployment to customer production instances.

CC9.0 – Common Criteria Related to Risk Mitigation

- Customers should maintain formal policies that provide guidance for information security within the organization and the supporting IT environment.
- Customers should assess the objectives for their AWS cloud services network when designing IT components by identifying the risk and corresponding controls to be implemented to address those risks when using AWS services, software and implementing AWS operational controls.

A – Availability Criteria

- EC2 Classic–Specific – Customers using EC2 Classic service should augment the AWS instance firewalls with a host-based firewall for redundancy and egress filtering.
- EC2/VPC-Specific – Data stored on Amazon EC2 virtual disks should be proactively copied to another storage option for redundancy.
- Customers should ensure their AWS resources such as server and database instances have the appropriate levels of redundancy and isolation. Redundancy can be achieved through utilization of the Multi-Region and Multi-AZ deployment option where available.
- EBS-Specific – Amazon EBS replication is stored within the same Availability Zone, not across multiple zones, and therefore customers should conduct regular snapshots to Amazon S3 in order to provide long-term data durability.
- Customers should enable backups of their data across AWS services

C – Confidentiality Criteria

- Customers should utilize Amazon S3's option to specify an MD5 checksum as part of a REST PUT operation for the data being sent to Amazon S3. When the request arrives at Amazon S3, an MD5 checksum will be recalculated for the object data received and compared to the provided MD5 checksum. If there is a mismatch, the PUT will be failed, preventing data that was corrupted on the wire from being written into Amazon S3. Customers should use the MD5 checksums returned in response to REST GET requests to confirm that the data returned by the GET was not corrupted in transit.
- Any code customers write to call Amazon APIs should expect to receive and handle errors from the service. Specific guidance for each service can be found within the User Guide and API documentation for each service.
- Snowball/Snowmobile/Snowball Edge-Specific – Customers should not delete any local copies of their data until they have verified that it has been copied into AWS.
- Snowball Edge/Snowmobile-Specific – All data is encrypted before persisting. With Snowball Edge and Snowmobile there are short periods where customer data is in plain text prior to encryption and persistence. If a customer is concerned about this short period, they should encrypt their data before sending it to the device.
- Customers should transmit secret keys over secure channels. Customers should avoid embedding secret keys in web pages or other publicly accessible source code. Customers should encrypt sensitive data at rest as well as in transit over the network.
- Customers should appropriately configure and manage usage and implementation of available encryption options to meet their requirements.
- Customers should use encrypted (TLS/SSL) connections for all of their interactions with AWS. Best practices include the use of TLS 1.2. Customers should opt in for annual key rotation for any KMS key they would like rotated.

The list of control considerations presented above does not represent all the controls that should be employed by the customer. Other controls may be required. Customers should reference additional AWS service documentation on the AWS website

SECTION IV – Description of Criteria, AWS Controls, Tests and Results of Tests

Testing Performed and Results of Entity-Level Controls

In planning the nature, timing and extent of testing of the controls, EY considered the aspects of AWS' control environment and tested those that were considered necessary.

In addition to the tests of operating effectiveness of specific controls described below, procedures included tests of the following components of the internal control environment of AWS:

- Management controls and organizational structure
- Risk assessment process
- Information and communication
- Control activities
- Monitoring

Tests of the control environment included the following procedures, to the extent EY considered necessary: (a) a review of AWS' organizational structure, including the segregation of functional responsibilities, policy statements, processing manuals and personnel controls, (b) discussions with management, operations, administrative and other personnel who are responsible for developing, ensuring adherence to and applying controls, and (c) observations of personnel in the performance of their assigned duties.

The control environment was considered in determining the nature, timing and extent of the testing of controls and controls relevant to the achievement of the service commitments and system requirements based on the applicable trust services criteria.

Procedures for Assessing Completeness and Accuracy of Information Provided by the Entity (IPE)

For tests of controls requiring the use of IPE (e.g., controls requiring system-generated populations for sample-based testing), EY performed a combination of the following procedures where possible based on the nature of the IPE to address the completeness, accuracy, and data integrity of the data or reports used: (1) inspect the source of the IPE, (2) inspect the query, script, or parameters used to generate the IPE, (3) tie data between the IPE and the source, and/or (4) inspect the IPE for anomalous gaps in sequence or timing to determine the data is complete, accurate, and maintains its integrity. In addition to the above procedures, for tests of controls requiring management's use of IPE in the execution of the controls (e.g., periodic reviews of user access listings), EY inspected management's procedures to assess the validity of the IPE source and the completeness, accuracy, and integrity of the data or reports.

Trust Services Criteria and Related Controls for Systems and Applications

On the pages that follow, the applicable Trust Services criteria and the controls to achieve the service commitments and system requirements based on the criteria have been specified by and are the responsibility of AWS. The "Tests Performed by EY" and the "Results of Tests" are the responsibility of the service auditor.

Information System Control Environment

The following controls apply to the services listed in the System Description and their supporting data centers, except where controls are unique to one of the services – in those cases, the controls are indicated as "S3-Specific," "EC2-Specific," "VPC-Specific," "KMS-Specific," "RDS-Specific," "Outposts-Specific," or otherwise noted as being specific to a certain service or set of services.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description
CC1.0 – Common Criteria Related to Control Environment		

CC1.1	AWSCA-1.1;
	AWSCA-1.2;
	AWSCA-9.2;
	AWSCA-9.3;
	AWSCA-9.7;
	AWSCA-9.9;
	AWSCA-11.1;
	AWSCA-11.2
		COSO Principle 1: The entity demonstrates a commitment to integrity and ethical values.

CC1.2	AWSCA-1.7;
	AWSCA-1.8;
	AWSCA-9.8
		COSO Principle 2: The board of directors demonstrates independence from management and exercises oversight of the development and performance of internal control.

CC1.3	AWSCA-1.1; AWSCA-1.2	COSO Principle 3: Management establishes, with board oversight, structures, reporting lines, and appropriate authorities and responsibilities in the pursuit of objectives.

CC1.4	AWSCA-1.2;
	AWSCA-1.4;
	AWSCA-1.7;
	AWSCA-1.8;
	AWSCA-9.2;
	AWSCA-9.3;
	AWSCA-9.9;
	AWSCA-11.1;
	AWSCA-11.2
		COSO Principle 4: The entity demonstrates a commitment to attract, develop, and retain competent individuals in alignment with objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC1.5	AWSCA-1.1;
	AWSCA-1.2;
	AWSCA-1.3;
	AWSCA-9.3;
	AWSCA-9.7
		COSO Principle 5: The entity holds individuals accountable for their internal control responsibilities in the pursuit of objectives.

CC2.0 – Common Criteria Related to Communication and Information		

CC2.1	AWSCA-1.5;
	AWSCA-1.9;
	AWSCA-1.10;
	AWSCA-3.6;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.8
		COSO Principle 13: The entity obtains or generates and uses relevant, quality information to support the functioning of internal control.

CC2.2	AWSCA-1.2;
	AWSCA-1.4;
	AWSCA-1.6;
	AWSCA-1.9;
	AWSCA-9.1;
	AWSCA-10.3;
	AWSCA-11.1;
	AWSCA-11.3
		COSO Principle 14: The entity internally communicates information, including objectives and responsibilities for internal control, necessary to support the functioning of internal control.

CC2.3	AWSCA-1.4;
	AWSCA-1.6;
	AWSCA-9.1;
	AWSCA-9.5;
	AWSCA-11.1;
	AWSCA-11.2;
	AWSCA-11.3
		COSO Principle 15: The entity communicates with external parties regarding matters affecting the functioning of internal control.

CC3.0 – Common Criteria Related to Risk Assessment		

CC3.1	AWSCA-1.5;
	AWSCA-1.9;
	AWSCA-1.10;
	AWSCA-9.8
		COSO Principle 6: The entity specifies objectives with sufficient clarity to enable the identification and assessment of risks relating to objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC3.2	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-3.4;
	AWSCA-5.12;
	AWSCA-10.3
		COSO Principle 7: The entity identifies risks to the achievement of its objectives across the entity and analyzes risks as a basis for determining how the risks should be managed.

CC3.3	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-3.4;
	AWSCA-5.12;
	AWSCA-10.3
		COSO Principle 8: The entity considers the potential for fraud in assessing risks to the achievement of objectives.

CC3.4	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-3.4;
	AWSCA-5.12;
	AWSCA-10.3
		COSO Principle 9: The entity identifies and assesses changes that could significantly impact the system of internal control.

CC4.0 – Common Criteria Related to Monitoring Activities		

CC4.1	AWSCA-1.10;
	AWSCA-3.4;
	AWSCA-5.12;
	AWSCA-9.8;
	AWSCA-11.2
		COSO Principle 16: The entity selects, develops, and performs ongoing and/or separate evaluations to ascertain whether the components of internal control are present and functioning.

CC4.2	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-9.8
		COSO Principle 17: The entity evaluates and communicates internal control deficiencies in a timely manner to those parties responsible for taking corrective action, including senior management and the board of directors, as appropriate.

CC5.0 – Common Criteria Related to Control Activities		

CC5.1	AWSCA-1.2;
	AWSCA-1.3;
	AWSCA-1.5;
	AWSCA-1.10
		COSO Principle 10: The entity selects and develops control activities that contribute to the mitigation of risks to the achievement of objectives to acceptable levels.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC5.2	AWSCA-1.2;
	AWSCA-1.3;
	AWSCA-1.5;
	AWSCA-1.10
		COSO Principle 11: The entity also selects and develops general control activities over technology to support the achievement of objectives.

CC5.3	AWSCA-1.1;
	AWSCA-1.2;
	AWSCA-1.3;
	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-10.3
		COSO Principle 12: The entity deploys control activities through policies that establish what is expected and in procedures that put policies into action.

CC6.0 - Common Criteria Related to Logical and Physical Access Controls		

CC6.1	AWSCA-1.2;
	AWSCA-2.3;
	AWSCA-2.4;
	AWSCA-2.5;
	AWSCA-2.6;
	AWSCA-3.1;
	AWSCA-3.2;
	AWSCA-3.3;
	AWSCA-3.5;
	AWSCA-3.7;
	AWSCA-3.8;
	AWSCA-3.9;
	AWSCA-3.10;
	AWSCA-3.11;
	AWSCA-3.12;
	AWSCA-3.13;
	AWSCA-3.14;
	AWSCA-3.15;
	AWSCA-3.17;
	AWSCA-4.4;
	AWSCA-4.5;
	AWSCA-4.6;
	AWSCA-4.7;
	AWSCA-4.8;
	AWSCA-4.9;
	AWSCA-4.10;
	AWSCA-4.11;
	AWSCA-4.12;
	AWSCA-4.13;
		The entity implements logical access security software, infrastructure, and architectures over protected information assets to protect them from security events to meet the entity's objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

	AWSCA-4.14;
	AWSCA-4.15;
	AWSCA-6.1;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.4	

CC6.2	AWSCA-2.1;
	AWSCA-2.2;
	AWSCA-2.3;
	AWSCA-2.4
		Prior to issuing system credentials and granting system access, the entity registers and authorizes new internal and external users whose access is administered by the entity. For those users whose access is administered by the entity, user system credentials are removed when user access is no longer authorized.

CC6.3	AWSCA-2.1;
	AWSCA-2.2;
	AWSCA-2.3;
	AWSCA-2.4
		The entity authorizes, modifies, or removes access to data, software, functions, and other protected information assets based on roles, responsibilities, or the system design and changes, giving consideration to the concepts of least privilege and segregation of duties, to meet the entity's objectives.

CC6.4	AWSCA-4.12;
	AWSCA-4.13;
	AWSCA-4.15;
	AWSCA-5.1;
	AWSCA-5.2;
	AWSCA-5.3;
	AWSCA-5.4;
	AWSCA-5.5
		The entity restricts physical access to facilities and protected information assets (for example, data center facilities, back-up media storage, and other sensitive locations) to authorized personnel to meet the entity's objectives.

CC6.5	AWSCA-5.13;
	AWSCA-7.7;
	AWSCA-7.8;
	AWSCA-7.9
		The entity discontinues logical and physical protections over physical assets only after the ability to read or recover data and software from those assets has been diminished and is no longer required to meet the entity's objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC6.6	AWSCA-2.6;
	AWSCA-3.1;
	AWSCA-3.2;
	AWSCA-3.3;
	AWSCA-3.7;
	AWSCA-3.8;
	AWSCA-3.9;
	AWSCA-4.14;
	AWSCA-8.1;
	AWSCA-8.2
		The entity implements logical access security measures to protect against threats from sources outside its system boundaries.

CC6.7	AWSCA-1.2;
	AWSCA-1.4;
	AWSCA-1.6;
	AWSCA-2.2;
	AWSCA-2.3;
	AWSCA-3.16;
	AWSCA-3.17;
	AWSCA-3.18;
	AWSCA-4.1;
	AWSCA-4.2;
	AWSCA-4.3;
	AWSCA-4.4;
	AWSCA-4.6;
	AWSCA-4.7;
	AWSCA-4.9;
	AWSCA-4.11;
	AWSCA-4.14;
	AWSCA-4.15;
	AWSCA-5.1;
	AWSCA-5.2;
	AWSCA-5.3;
	AWSCA-5.13;
	AWSCA-7.1;
		The entity restricts the transmission, movement, and removal of information to authorized internal and external users and processes, and protects it during transmission, movement, or removal to meet the entity's objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC6.8	AWSCA-2.2;
	AWSCA-2.3;
	AWSCA-3.4;
	AWSCA-3.18;
	AWSCA-6.1;
	AWSCA-6.2;
	AWSCA-6.3;
	AWSCA-6.4;
	AWSCA-6.5;
	AWSCA-6.6;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.4
		The entity implements controls to prevent or detect and act upon the introduction of unauthorized or malicious software to meet the entity's objectives.

CC7.0 - Common Criteria Related to System Operations		

CC7.1	AWSCA-3.1;
	AWSCA-3.2;
	AWSCA-3.3;
	AWSCA-3.4;
	AWSCA-3.6;
	AWSCA-6.6;
	AWSCA-7.10;
	AWSCA-9.4
		To meet its objectives, the entity uses detection and monitoring procedures to identify (1) changes to configurations that result in the introduction of new vulnerabilities, and (2) susceptibilities to newly discovered vulnerabilities.

CC7.2	AWSCA-1.2;
	AWSCA-3.4;
	AWSCA-5.6;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.6
		The entity monitors system components and the operation of those components for anomalies that are indicative of malicious acts, natural disasters, and errors affecting the entity's ability to meet its objectives; anomalies are analyzed to determine whether they represent security events.

CC7.3	AWSCA-5.6;
	AWSCA-5.11;
	AWSCA-5.12;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.6;
	AWSCA-10.3
		The entity evaluates security events to determine whether they could or have resulted in a failure of the entity to meet its objectives (security incidents) and, if so, takes actions to prevent or address such failures.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description

CC7.4	AWSCA-1.1;
	AWSCA-1.2;
	AWSCA-3.4;
	AWSCA-5.11;
	AWSCA-5.12;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-9.6;
	AWSCA-10.3
		The entity responds to identified security incidents by executing a defined incident-response program to understand, contain, remediate, and communicate security incidents, as appropriate.

CC7.5	AWSCA-5.11;
	AWSCA-5.12;
	AWSCA-6.1;
	AWSCA-8.2;
	AWSCA-9.6;
	AWSCA-10.3
		The entity identifies, develops, and implements activities to recover from identified security incidents.

CC8.0 - Common Criteria Related to Change Management		

CC8.1	AWSCA-3.1;
	AWSCA-3.2;
	AWSCA-3.3;
	AWSCA-3.6;
	AWSCA-6.1;
	AWSCA-6.2;
	AWSCA-6.3;
	AWSCA-6.4;
	AWSCA-6.5;
	AWSCA-6.6;
	AWSCA-6.7;
	AWSCA-8.2;
	AWSCA-9.4
		The entity authorizes, designs, develops or acquires, configures, documents, tests, approves, and implements changes to infrastructure, data, software, and procedures to meet its objectives.

CC9.0 – Risk Mitigation		

CC9.1	AWSCA-1.2;
	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-10.3
		The entity identifies, selects, and develops risk mitigation activities for risks arising from potential business disruptions.

CC9.2	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-5.11;
	AWSCA-5.12;
	AWSCA-9.7;
	AWSCA-11.1;
	AWSCA-11.2;
	AWSCA-11.3
		The entity assesses and manages risks associated with vendors and business partners.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description
Additional Criteria for Availability		

A1.1	AWSCA-8.1;
	AWSCA-10.3;
	AWSCA-10.4
		The entity maintains, monitors, and evaluates current processing capacity and use of system components (infrastructure, data, and software) to manage capacity demand and to enable the implementation of additional capacity to help meet its objectives.

A1.2	AWSCA-1.2;
	AWSCA-1.5;
	AWSCA-1.10;
	AWSCA-5.5;
	AWSCA-5.6;
	AWSCA-5.7;
	AWSCA-5.8;
	AWSCA-5.9;
	AWSCA-5.10;
	AWSCA-5.11;
	AWSCA-5.12;
	AWSCA-7.3;
	AWSCA-7.4;
	AWSCA-7.5;
	AWSCA-7.6;
	AWSCA-8.1;
	AWSCA-8.2;
	AWSCA-10.1;
	AWSCA-10.2;
	AWSCA-10.3;
	AWSCA-10.4
		The entity authorizes, designs, develops or acquires, implements, operates, approves, maintains, and monitors environmental protections, software, data backup processes, and recovery infrastructure to meet its objectives.

A1.3	AWSCA-1.2;
	AWSCA-10.2;
	AWSCA-10.3
		The entity tests recovery plan procedures supporting system recovery to meet its objectives.

AWS Controls Mapped to the Security, Availability, and Confidentiality Criteria

Criteria	Supporting AWS Control Activity (AWSCA)	Criteria Description
Additional Criteria for Confidentiality		

C1.1	AWSCA-1.2;
	AWSCA-7.2;
	AWSCA-7.3;
	AWSCA-7.4;
	AWSCA-7.5;
	AWSCA-7.6;
	AWSCA-7.8
		The entity identifies and maintains confidential information to meet the entity's objectives related to confidentiality.

C1.2	AWSCA-5.13;
	AWSCA-7.7;
	AWSCA-7.9
		The entity disposes of confidential information to meet the entity's objectives related to confidentiality.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-1.1: The AWS organization has defined structures, reporting lines with assigned authority and responsibilities to appropriately meet requirements relevant to security, availability, confidentiality, and privacy.	CC1.1;
	CC1.3;
	CC1.5;
	CC5.3;
	CC7.4
		Inquired of an AWS Security Assurance Program Manager to ascertain the AWS organization has defined structures, reporting lines with assigned authority, and responsibilities to appropriately meet business requirements, including an information security function.	No deviations noted.

		Inspected the organizational chart and information security governance procedure document to ascertain the AWS organization has defined structures, reporting lines with assigned authority, and responsibilities to appropriately meet business requirements, including an information security function.	No deviations noted.
		Inspected the information security governance procedure document to ascertain the full document was approved within the last year by Security Leadership and that minor changes were approved by appropriate members of the Security team.	No deviations noted.

AWSCA-1.2: AWS maintains formal policies that provide guidance for information security within the organization and the supporting IT environment.	CC1.1;
	CC1.3;
	CC1.4;
	CC1.5;
	CC2.2;
	CC5.1;
	CC5.2;
	CC5.3;
	CC6.1;
	CC6.7;
	CC7.2;
	CC7.4;
	CC9.1;
	A1.2;
	A1.3;
	C1.1
		Inquired of an AWS Security Assurance Program Manager to ascertain formal security policies existed, included designation of responsibility and accountability for managing the system and controls, and provided guidance for information security within the organization and the supporting IT environment.	No deviations noted.

		Inspected the information security policies listed in the System Description to ascertain they included organization-wide security procedures as guidance for the AWS environment and the supporting IT environment.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-1.3: Security policies are reviewed and approved on an annual basis by Security Leadership.	CC1.5;
	CC5.1;
	CC5.2;
	CC5.3
		Inquired of an AWS Security Assurance Program Manager to ascertain the security policies were reviewed and approved at least annually by Security Leadership.	No deviations noted.

		Inspected the security policies listed in the System Description to ascertain they were approved at least annually by Security Leadership.	No deviations noted.

AWSCA-1.4: AWS maintains employee training programs to promote awareness of AWS information security requirements as defined in the AWS Security Awareness Training Policy.	CC1.4;
	CC2.2;
	CC2.3;
	CC6.7;
		Inquired of a Security Program Manager to ascertain employee training programs were established to promote awareness of AWS information security requirements.	No deviations noted.

		Inspected the training transcript for a sample of AWS employees and contractors to ascertain the employees completed the Amazon Security Awareness (ASA) training course within 60 days of role assignment and that the training course included information security requirements as defined in the AWS Security Awareness Training Policy.	No deviations noted.

AWSCA-1.5: AWS maintains a formal risk management program to identify, analyze, treat and continuously monitor and report risks that affect AWS' business objectives, regulatory requirements. The program identifies risks, documents them in a risk register as appropriate, and	CC2.1;
	CC3.1;
	CC3.2;
	CC3.3;
	CC3.4;
	CC4.2;
	CC5.1;
	CC5.2;
	CC5.3;
	CC9.1;
	CC9.2;
	A1.2
		Inquired of an AWS Risk Manager to ascertain a formal risk management program was maintained to continually discover, research, plan, resolve, monitor, and optimize information security risks, including an evaluation of the design and operating effectiveness of implemented controls.	No deviations noted.

		Inspected the risk management documentation to ascertain the AWS Business Risk Management Program policy was designed to include the continuous discovery, research, planning, resolution, monitoring, and optimization of information security risks as well as detailed risk treatment options such as acceptance, avoidance, mitigation, and transfer.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
reports results to leadership at least semi-annually		Inspected a security risk from the risk register to ascertain the risk was identified, researched, planned, resolved, and monitored.	No deviations noted.
		Inspected the semi-annual AWS Business Risk Management meeting agenda to ascertain risks were reported to appropriate AWS management and that members of management acknowledged and discussed risk treatments and/or formal approval of risk acceptance.	No deviations noted.
		Selected a sample of months and inspected the monthly AWS Security Operations meeting minutes to ascertain the meeting included the identification of risks within the business and the process of identifying, resolving, and setting up processes within the Security Organization to accept, avoid, mitigate, or transfer the risk.	No deviations noted.
		Inspected a COE to ascertain the impact, root cause, incident response analysis and corrective actions were discussed during the Security Operations Metrics meeting and the incident was assigned a severity level and tracked through to resolution.	No deviations noted.

AWSCA-1.6: KMS-Specific – Roles and responsibilities for KMS cryptographic custodians are formally	CC2.2;
	CC2.3;
	CC6.7
		Inquired of a Cryptography Software Development Manager to ascertain roles and responsibilities for KMS cryptographic custodians were formally documented and acknowledged by those individuals when assumed or when responsibilities change.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
documented and agreed to by those individuals when they assume the role or when responsibilities change.		Selected a sample of individuals from the KMS cryptographic custodians group with access to systems that store or use key material, inspected the roles and responsibilities documents to ascertain user responsibilities were formally documented and that the individuals signed the document.	No deviations noted.
AWSCA-1.7: The Board and its Committees have the required number of independent Board members and each Board and Committee member is qualified to serve in such capacity. Annually, Board members complete questionnaires to establish whether they are independent and qualified to serve on each Board Committee under applicable rules.	CC1.2; CC1.4	Inquired of a Vice President of General Counsel to ascertain the board and its committees have the required number of independent Board members and each Board and Committee member is qualified to serve in such capacity.	No deviations noted.
		Inspected Amazon's Company Bylaws and the Company's Corporate Governance guidelines to ascertain they defined the number and roles of officers on the Board of Directors and their responsibilities.	No deviations noted.
		Inspected the annual Board member questionnaire to ascertain the questionnaires were completed and included questions to establish whether members were independent and qualified to serve on each part of the Board Committee under the applicable bylaws and guidelines.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-1.8: The Board of Directors conducts an annual assessment of individual Board members and overall Board performance. The Nominating and Corporate Governance Committee periodically reviews and assesses the composition of the board. The Leadership Development and Compensation Committee, with the full Board present, annually evaluates the succession plan for each member of the senior management team. As part of the annual Company and CEO Performance review, the Board reviews the succession plan for the CEO.	CC1.2; CC1.4	Inquired of a Vice President of General Counsel to ascertain the Board of Directors conducted an annual assessment of individual Board members and overall Board performance, the nominating and Corporate Governance Committee periodically reviewed and assessed the composition of the board, and the Leadership Development and Compensation Committee evaluated the succession plan for each member of the senior management team including the CEO.	No deviations noted.
		Inspected the Nominating and Corporate Governance meeting minutes to ascertain the annual assessment and review of the composition of the Board of Directors was discussed and completed.	No deviations noted.
		Inspected the Leadership Development and Compensation Committee meeting minutes to ascertain the annual Company and Senior Leadership performance review and succession plan was discussed.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-1.9: AWS prepares and consolidates the operational planning document annually. The operational plan includes operational and performance objectives, regulatory and compliance requirements with sufficient clarity to enable the identification and assessment of risks relating to objectives.	CC2.1;
	CC2.2;
	CC3.1
		Inquired of a Financial Planning and Analysis Senior Manager to ascertain AWS prepared and consolidated the operational planning document annually including operational and performance objectives as well as regulatory and compliance requirements with sufficient clarity to enable the identification and assessment of risks relating to objectives.	No deviations noted.

		Inspected the annual meeting agenda and meeting action items related to the creation of the operational planning document to ascertain it included operational and performance objectives as well as regulatory and compliance requirements that identified and assessed risks relating to those objectives.	No deviations noted.

AWSCA-1.10: AWS has a process in place to review environmental and geo-political risks before launching a new region.	CC2.1;
	CC3.1;
	CC3.2;
	CC3.3;
	CC3.4;
	CC4.1;
	CC4.2;
	CC5.1;
	CC5.2;
	CC5.3;
	CC9.1;
	CC9.2;
	A1.2
		Inquired of a Risk and Resiliency Senior Manager to ascertain environmental and geo-political risks were reviewed before launching new data center regions.	No deviations noted.

		Inspected a listing of in-scope data center regions from the data center inventory system to ascertain a review of environmental and geopolitical risks was performed before a new data center region was launched.	No deviations noted.
AWSCA-2.1: User access to the internal Amazon network is not provisioned unless an active record is created in the HR System by Human Resources. Access is	CC6.2; CC6.3	Inquired of a Corporate Systems Manager to ascertain user access to the internal Amazon network was not activated unless an active record was created in the HR System by Human Resources, that access was automatically provisioned with least privilege per job function, and that first-time passwords were set to a unique value and changed immediately after first use.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
automatically provisioned with least privilege per job function. First time passwords are set to a unique value and changed immediately after first use.		Inspected the system configurations responsible for provisioning access to the internal Amazon network to ascertain access to Windows and UNIX user accounts could not be provisioned unless an active record was created in the HR System by Human Resources, that access was provisioned automatically with least privilege per job function prior to employees' start dates, and that first time passwords were configured to create a unique value and was required to be changed immediately after first use.	No deviations noted.
		Selected a new hire from an HR system generated listing of new hires and inspected the employee's HR System record to ascertain the HR system activated the employee's record prior to the creation of an employee's Windows and UNIX accounts.	No deviations noted.

AWSCA-2.2: IT access above least privileged, including administrator accounts, is approved by appropriate personnel prior to access provisioning.	CC6.2;
	CC6.3;
	CC6.7;
	CC6.8
		Inquired of Software Development Managers to ascertain IT access above least privileged, including administrator accounts, was approved by appropriate personnel prior to access provisioning.	No deviations noted.

		Inspected the system configurations responsible for the access provisioning process to ascertain IT access above least privileged, including administrator accounts, was required to be approved by appropriate personnel prior to automatic access provisioning.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Selected an active employee and inspected the process of access provisioning to ascertain approval of the access was provided by appropriate personnel prior to the automatic provisioning of the access.	No deviations noted.

AWSCA-2.3: IT access privileges are reviewed on a periodic basis by appropriate personnel.	CC6.1;
	CC6.2;
	CC6.3;
	CC6.7;
	CC6.8
		Inquired of Software Development Managers to ascertain IT access privileges above least privilege were reviewed and approved on a quarterly basis by appropriate personnel.	No deviations noted.

		Inspected the system configurations responsible for the access review process to ascertain IT infrastructure and network access privileges were reviewed on a quarterly basis by appropriate personnel on an automated basis.	No deviations noted.
		Selected an active access group from a listing of AWS production accounts and inspected the access review process to ascertain IT infrastructure and network access privileges were reviewed quarterly by appropriate personnel.	No deviations noted.
		Inspected the system configurations responsible for the access review process to ascertain if IT infrastructure and network access privileges were not reviewed on a quarterly basis, access to the resources were removed.	No deviations noted.
		Selected an active access group of IT infrastructure and network access privileges that was not reviewed during the quarter to ascertain access privileges were automatically revoked.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Selected a sample of active internal AWS accounts and inspected the access review process to ascertain internal AWS account access privileges were reviewed semi-annually by appropriate personnel.	No deviations noted.
AWSCA-2.4: User access to Amazon systems is revoked within 24 hours of the employee record being terminated (deactivated) in the HR System by Human Resources.	CC6.1; CC6.2; CC6.3	Inquired of a Corporate Systems Manager to ascertain access to systems was automatically revoked within 24 hours of an employee record being terminated (deactivated) in the HR System.	No deviations noted.
		Inspected the system configurations responsible for terminating access to Amazon systems, to ascertain access to Windows and UNIX user accounts was configured to be automatically revoked within 24 hours after an employee's records was terminated (deactivated) in the HR System by Human Resources.	No deviations noted.
		Selected a terminated employee from an HR system generated listing of terminated employees and inspected the employee's HR system record, to ascertain access to the Amazon systems was automatically revoked within 24 hours on both Unix/LDAP and Windows/AD accounts.	No deviations noted.
AWSCA-2.5: Password settings are managed in compliance with Amazon.com's Password Policy.	CC6.1	Inquired of a Corporate Systems Manager and Corporate Response Manager to ascertain password complexity, length, maximum age, history, lockout and credential monitoring was enforced per the Amazon.com Password Policy.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Inspected the password configurations to the Amazon network to ascertain they were configured to enforce the Amazon.com Password Policy, including: • Passwords must be at least eight characters long • Passwords must contain a combination of letters, numbers, and special characters • Passwords must not contain the user's real name or username • Passwords must be different from last 15 passwords • Passwords must be changed every 90 days. If a process is in place to detect credential compromise, then passwords can be changed every 365 days • Accounts are set to lockout after 6 invalid attempts	No deviations noted.
		Attempted to set a combination of out-of-policy passwords to ascertain the following password configurations were enforced according to the Amazon.com Password Policy: • Passwords must be at least eight characters long • Passwords must contain a combination of letters, numbers, and special characters • Passwords must not contain the user's real name or username • Passwords must be different from last 15 passwords • Passwords expire every 365 days	No deviations noted.
		Inspected the credential monitoring compromise configuration to ascertain that tickets for incidents were cut automatically and logged within a ticketing system per the Amazon.com Password Policy.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Inspected an incident ticket created for impacted user credentials to ascertain credentials of flagged Amazon accounts were identified, tracked and rotated in a timely manner.	No deviations noted.
AWSCA-2.6: AWS requires two-factor authentication over an approved cryptographic channel for authentication to the internal AWS network from remote locations.	CC6.1; CC6.6	Inquired of a Corporate Systems Manager to ascertain two-factor authentication over an approved cryptographic channel was required to access the Amazon corporate network from remote locations.	No deviations noted.
		Inspected the authentication protocol configuration to ascertain authentication to the internal AWS network from remote locations required two-factor authentication over an approved cryptographic channel.	No deviations noted.
		Attempted to login to the Amazon corporate network from a remote location to ascertain both a physical token and password were required to access the Amazon corporate network over an approved cryptographic channel.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-3.1: Firewall devices are configured to restrict access to the computing environment and enforce boundaries of computing clusters.	CC6.1;
	CC6.6;
	CC7.1;
	CC8.1
		Inquired of an AWS Network Engineering Software Development Manager to ascertain firewall devices were configured to restrict access to the computing environment and enforce boundaries of computing clusters.	No deviations noted.

		Inspected the access control lists and firewall rules for a sample of in-scope firewalls to ascertain the devices were configured to deny all access to the computing environment and enforce boundaries of computing clusters, unless explicitly authorized.	No deviations noted.

AWSCA-3.2: Firewall policies (configuration files) are automatically pushed to production firewall devices.	CC6.1;
	CC6.6;
	CC7.1;
	CC8.1
		Inquired of an AWS Network Engineering Software Development Manager to ascertain firewall policies were automatically pushed to production firewall devices.	No deviations noted.

		Inspected the deployment log output for a sample of in-scope firewall devices to ascertain policies were automatically pushed to production firewall devices.	No deviations noted.

AWSCA-3.3: Firewall policy updates are reviewed and approved.	CC6.1;
	CC6.6;
	CC7.1;
	CC8.1
		Inquired of an AWS Network Engineering Software Development Manager to ascertain data center firewall policy updates were reviewed and approved.	No deviations noted.

		Inspected approval evidence for a sample of firewall policy updates to ascertain they were reviewed and approved by appropriate personnel.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-3.4: AWS performs external vulnerability assessments at least quarterly, identified issues are investigated and tracked to resolution in a timely manner.	CC3.2;
	CC3.3;
	CC3.4;
	CC4.1;
	CC6.8;
	CC7.1;
	CC7.2;
	CC7.4
		Inquired of an AWS Security Technical Program Manager to ascertain quarterly external vulnerability assessments were performed and that identified issues were investigated and tracked to resolution.	No deviations noted.

		Inspected the listing of production end points used by the vulnerability assessment tools of the quarterly external vulnerability assessments performed to ascertain production hosts for the in-scope services (that supported public end points) were included in the quarterly scans.	No deviations noted.
		Inspected evidence of quarterly external vulnerability assessments to ascertain the assessments were performed, results were documented, and that the process existed for any identified issues to be tracked, addressed, and resolved in a timely manner.	No deviations noted.
AWSCA-3.5: AWS enables customers to articulate who has access to AWS services and resources (if resource-level permissions are applicable to the service) that they own. AWS prevents customers from accessing AWS resources that are not assigned to them via access permissions. Content is only returned to individuals authorized to access the specified AWS	CC6.1	Inquired of Software Development Managers to ascertain AWS enabled customers to allocate who had access to AWS services and resources that they owned, that customers were prevented from accessing AWS resources that were not assigned to them via access permissions, and that content was only returned to individuals authorized to access the specific AWS service or resource.	No deviations noted.
		Inspected the configurations in-place for the AWS services that managed external access to AWS services and resources (if resource-level permissions are applicable to the service), to ascertain services were designed to return content only to individuals authorized to access the specified AWS service or resource, and that AWS prevented customers from accessing resources that had not been assigned to them via access permissions.	No deviations noted.

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
service or resource (if resource-level permissions are applicable to the service).		Inspected the access permissions to ascertain unauthorized individuals were prevented from accessing AWS services or resources (if resource-level permissions were applicable to the service).	No deviations noted.
		Observed a user with authorized access permissions attempt to access AWS services and resources, to ascertain that services returned content only to individuals authorized to access the specified AWS service or resource.	No deviations noted.
		Observed a user without authorized access permissions attempt to access AWS services and resources, to ascertain that services did not return content to individuals without authorized access to the specified service or resource.	No deviations noted.

AWSCA-3.6: AWS performs application security reviews for externally launched products, services, and significant feature additions prior to launch to evaluate whether security risks are identified and mitigated.	CC2.1;
	CC7.1;
	CC8.1
		Inquired of an Application Security Technical Program Manager to ascertain AWS performed application security reviews for launched products, services, and significant feature additions prior to launch to evaluate whether security risks were identified and mitigated.	No deviations noted.

		Selected a sample of products, services, and significant feature additions launched during the period and inspected the Application Security team's review, to ascertain the products, services, and significant feature additions were reviewed prior to launch.	No deviations noted.

AWSCA-3.7: S3-Specific – Network devices are configured by AWS to only allow access to specific ports on other server systems within Amazon S3.	CC6.1;
	CC6.6;
		Inquired of an S3 Software Development Manager to ascertain network devices were configured to only allow access to specific ports on server systems within Amazon S3.	No deviations noted.

		Selected a sample of S3 network devices from the AWS Git repository and inspected the configuration settings to ascertain the devices were configured to only allow access to specified ports.	No deviations noted.

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-3.8: S3-Specific – External data access is logged with the following information: data accessor IP address, object and operation. Logs are retained for at least 90 days.	CC6.1;
	CC6.6;
		Inquired of an S3 Software Development Manager to ascertain external data access was logged with the following information: data accessor IP address, object, and operation and that logs were retained for at least 90 days.	No deviations noted.

		Inspected the configuration settings pushed to the S3 web servers to ascertain the servers were configured to log the data accessor IP address, object, and operation information and that the logs were configured to be retained for 90 days.	No deviations noted.
		Observed a Software Development Engineer perform an access operation on an S3 object and inspected the external data access log output to ascertain the following information was logged: data accessor IP accessing the data, object accessed, and operation performed.	No deviations noted.
AWSCA-3.9: EC2-Specific – Physical hosts have host-based firewalls to prevent unauthorized access.	CC6.1; CC6.6	Inquired of an EC2 Security Manager to ascertain EC2 physical hosts had host-based firewalls, or access was logically restricted, to prevent unauthorized access.	No deviations noted.
		Inspected the system configurations responsible for logical access restriction to ascertain unauthorized access was prevented through host based access tokens.	No deviations noted.
		Observed an EC2 Security Engineer log into an EC2 physical host with and without the appropriate token to ascertain a host based access token was required to authorize access to the host.	No deviations noted.
		Selected a sample of EC2 physical hosts, and inspected the host-based firewall settings to ascertain host-based firewalls were in place and operational to prevent unauthorized access.	No deviations noted.

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-3.10: EC2-Specific – Virtual hosts are behind software firewalls which are configured to prevent TCP/IP spoofing, packet sniffing, and restrict incoming connections to customer-specified ports.	CC6.1	Inquired of an EC2 Security Manager to ascertain virtual hosts were behind software firewalls, which prevented TCP/IP spoofing, packet sniffing, and restricted incoming connections to customer-specified ports.	No deviations noted.
		Observed an EC2 Security Engineer create a virtual EC2 host with a firewall configured to communicate with only specified IP addresses and observed communication with the specified IP address to ascertain the attempts were successful.	No deviations noted.
		Observed an EC2 Security Engineer attempt to communicate with an unspecified IP address to ascertain the attempts were denied.	No deviations noted.
		Observed an EC2 Security Engineer create a virtual EC2 host and inspected the IP table configurations to ascertain traffic was routed to prevent TCP/IP spoofing.	No deviations noted.
		Observed an EC2 Security Engineer create two EC2 instances on a single physical EC2 host and generate network traffic on each instance to ascertain neither of the instances were able to packet sniff the traffic of the other instance.	No deviations noted.
AWSCA-3.11: EC2-Specific – AWS prevents customers from accessing	CC6.1	Inquired of an EC2 Security Manager to ascertain AWS prevented customers from accessing custom AMIs not assigned to them by default launch-permissions.	No deviations noted.

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
custom AMIs not assigned to them by a property of the AMI called launch-permissions. By default, the launch-permissions of an AMI restrict its use to the customer/account that created and registered it.		Created an AMI, attempted to access the AMI without the designated launch permissions, and per inspection of the error message within the AWS management console, ascertained access was restricted.	No deviations noted.
AWSCA-3.12: EC2-Specific – AWS prevents customers from accessing physical hosts or instances not assigned to them by filtering through the virtualization software.	CC6.1	Inquired of an EC2 Security Manager to ascertain customers were restricted from accessing physical hosts or instances not assigned to them by filtering through the virtualization software.	No deviations noted.
		Observed an EC2 Security Engineer attempt to IP ping the physical EC2 host from an EC2 instance within the host, to ascertain the physical host was isolated from instances.	No deviations noted.
		Observed an EC2 Security Engineer attempt to access a file stored on an EC2 instance while logged into the physical EC2 host the instance was located on, to ascertain the instance located on physical hosts were unable to be accessed.	No deviations noted.
		Observed an EC2 Security Engineer attempt to access a file stored on an EC2 instance from a different instance on the same physical EC2 host, to ascertain the instances on the same physical hosts were isolated from one another.	No deviations noted.
AWSCA-3.13: VPC-Specific – Network communications within a VPC are	CC6.1	Inquired of an EC2 Networking Software Development Engineer to ascertain network communications between different VPCs were isolated from one another.	No deviations noted.

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
isolated from network communications within other VPCs.		Observed an EC2 Networking Software Development Engineer create a scenario with two VPCs, attempt to communicate between instances across the two VPCs, to ascertain network communications between the two VPCs were isolated.	No deviations noted.
AWSCA-3.14: VPC-Specific – Network communications within a VPN Gateway are isolated from network communications within other VPN Gateways.	CC6.1	Inquired of an EC2 Networking Software Development Engineer to ascertain network communications between VPN gateways were isolated from one another.	No deviations noted.
		Observed an EC2 Networking Software Development Engineer create a scenario with two VPN Gateways, attempt to communicate between instances across the two VPN Gateways, to ascertain network communications between VPN gateways were isolated.	No deviations noted.
AWSCA-3.15: VPC-Specific – Internet traffic through an Internet Gateway is forwarded to an instance in a VPC only when an Internet Gateway is attached to the VPC and a public IP is mapped to the instance in the VPC.	CC6.1	Inquired of an EC2 Security Engineer to ascertain internet traffic through an Internet Gateway was only forwarded to an instance in a VPC when an Internet Gateway was attached to the VPC and a public IP was mapped to the instance in the VPC.	No deviations noted.
		Created a VPC, attached an Internet Gateway, allocated a public IP, and per inspection of traffic on an instance, ascertained traffic was successfully forwarded.	No deviations noted.
		Removed the Internet Gateway and public IP from the VPC and per inspection of the traffic on the instance, ascertained traffic was prevented from being forwarded.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-3.16: AWS maintains formal policies and procedures that provide guidance for operations and information security within the organization and the supporting AWS environments. The mobile device policy provides guidance on: • Use of mobile devices. • Protection of devices that access content for which Amazon is responsible. • Remote wipe capability. • Password-guessing protection restrictions. • Remote synchronization requirements. • Security patch requirements • Approved methods for accessing Amazon data.	CC6.7	Inquired of an AWS Security Assurance Program Manager to ascertain formal policies and procedures for the use of mobile devices existed and included guidance for operations and information security for organizations that support AWS environments.	No deviations noted.
		Inspected the mobile device policy to ascertain it included organization-wide security procedures as guidance for the AWS environment regarding: • Use of mobile devices • Protection of devices that access content for which Amazon is responsible • Remote wipe capability • Password-guessing protection restrictions • Remote synchronization requirements • Security patch requirements • Approved methods for accessing Amazon data	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-3.17: Outpost-Specific – Service link is established between Outpost and AWS Region by use of a secured VPN connection over public internet or AWS Direct Connect.	CC6.1;
	CC6.7;
		Inquired of an AWS Senior Security Engineer to ascertain Service link was established between Outposts and an AWS Region by use of a secured VPN connection over public internet or AWS Direct Connect.	No deviations noted.

		Inspected the Outposts configurations to ascertain Service link was established between Outpost and an AWS Region by use of a secured VPN connection over public internet or AWS Direct Connect.	No deviations noted.
		Inspected dashboards of an active Outpost to ascertain the health of the secure VPN connection between Outpost and an AWS region was tracked and monitored.	No deviations noted.
		Inspected the monitoring configurations of an active Outpost to ascertain alarming around the secure VPN connection was configured to notify service team members in the case of network issues.	No deviations noted.

AWSCA-3.18: Anti-virus software is installed, updated and running on workstations.	CC6.7;
	CC6.8;
		Inquired of an AWS Senior Security Engineer to ascertain anti-virus software is installed, updated, and running on workstations.	No deviations noted.

		Inspected the anti-virus configurations on the administrator console for the imaging of workstations to ascertain the anti-virus software is in place to monitor for malicious code, is automatically updated with new release or virus definitions and prevents end-users from disabling the service.	No deviations noted
		Inspected a workstation that had disabled anti-virus software to ascertain that the workstation was in process of being isolated from the network.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Inspected a workstation to ascertain anti-virus software was installed, updated, and running in accordance with the AWS System and Information Integrity Policy.	No deviations noted.
AWSCA-4.1: EC2-Specific – Upon initial communication with an AWS-provided Linux AMI, AWS enables secure communication by SSH configuration on the instance, by generating a unique host-key and delivering the key's fingerprint to the user over a trusted channel.	CC6.7	Inquired of an EC2 Security Engineer to ascertain upon initial communication with an AWS-provided Linux AMI, AWS enabled a secure communication by SSH configuration on the instance by generating and delivering a unique host-key fingerprint to the user over a trusted channel.	No deviations noted.
		Launched a public Linux AMI EC2 instance and inspected the EC2 console to ascertain the unique host-key fingerprint was accessible from the system log.	No deviations noted.
		Using the launched public Linux AMI EC2 instance, connected to the instance via SSH and inspected the connection logs to ascertain the unique host-key fingerprint was listed.	No deviations noted.
		Launched a new public Linux AMI EC2 instance and inspected the EC2 console and instance connection logs to ascertain the unique host-key fingerprint was different than for the first instance.	No deviations noted.
AWSCA-4.2: EC2-Specific – Upon initial communication with an AWS-provided Windows AMI, AWS enables secure communication by configuring Windows	CC6.7	Inquired of an EC2 Security Engineer to ascertain upon initial communication with an AWS-provided Windows AMI, AWS enabled a secure communication by configuring Windows Terminal Services on the instance by generating a unique self-signed server certificate and delivering the certificate's thumbprint to the user over a trusted channel.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
Terminal Services on the instance by generating a unique self-signed server certificate and delivering the certificate's thumbprint to the user over a trusted channel.		Launched a public Windows AMI EC2 instance and inspected the EC2 console and the system log to ascertain the self-signed server certificate was accessible.	No deviations noted.
		Using the launched public Windows AMI EC2 instance, connected to the instance to ascertain the connection logs matched the unique self-signed server certificate from the instance's EC2 console system log.	No deviations noted.
		Launched a new public Windows AMI EC2 instance and inspected the EC2 console and instance connection logs to ascertain the unique self-signed server certificate was different than for the first instance.	No deviations noted.
AWSCA-4.3: VPC-Specific – Amazon enables secure VPN communication to a VPN Gateway by providing a shared secret key that is used to establish IPSec Associations.	CC6.7	Inquired of a VPC Manager of Software Development to ascertain Amazon enabled secure VPN communication to a VPN Gateway through a secret key that established IPSec Associations.	No deviations noted.
		Observed a VPC Manager of Software Development use the shared secret key to establish IPSec Associations to ascertain the connection was successful.	No deviations noted.
		Observed the VPC Manager of Software Development alter the shared secret key to establish IPSec Security Associations to ascertain the connection was unsuccessful.	No deviations noted.
AWSCA-4.4: S3-Specific – S3 generates and stores a one-way salted	CC6.1; CC6.7	Inquired of an S3 Systems Manager to ascertain S3 generated and stored a one-way salted HMAC of the customer encryption key, and that the HMAC value was not logged.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
HMAC of the customer encryption key. This salted HMAC value is not logged.		Observed a Software Development Engineer upload an encrypted object to S3 and, inspected the metadata for the stored object to ascertain the encryption information included a one-way salted HMAC of the customer encryption key.	No deviations noted.
		Observed a Software Development Engineer upload an encrypted object to S3 and searched the S3 host logs for the one-way salted HMAC value to ascertain it was not logged.	No deviations noted.
		Observed a Software Development Engineer attempt to decrypt an object in S3 with an incorrect encryption key to ascertain the decrypt function failed and the object was unreadable.	No deviations noted.
AWSCA-4.5: KMS-Specific – KMS keys used for cryptographic operations in KMS are logically secured so that no single AWS employee can gain access to the key material.	CC6.1	Inquired of an AWS Cryptography Technical Program Manager and a Software Development Manager to ascertain recovery key materials used for disaster recovery processes by KMS, were logically secured such that no single AWS employee could gain logical access to the hardened security appliance where customer keys are used in memory.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer attempt to gain logical access to the hardened security appliance where customer keys are used in memory to ascertain this was not possible.	No deviations noted.
		Inspected the KMS key material access configurations to ascertain no single AWS employee could modify rulesets, host or operator membership to the domain of the hardened security appliance.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Observed an AWS Cryptography Software Development Engineer attempt to add a host or operator without meeting the quorum rules to ascertain the actions resulted in a quorum rule error.	No deviations noted.
AWSCA-4.6: KMS-Specific – AWS Services that integrate with AWS KMS for key management use a 256-bit data key locally to protect customer content.	CC6.1; CC6.7	Inquired of Software Development Engineers to ascertain AWS Services which integrate with AWS KMS for key management use a 256-bit AES data key locally to protect customer content.	No deviations noted.
		Inspected the API call configurations of the services which integrate with KMS for services that store customer content to ascertain each service was configured to send 256-bit AES key requests to KMS.	No deviations noted.
AWSCA-4.7: KMS-Specific – The key provided by KMS to integrated services is a 256-bit key and is encrypted with a 256-bit AES key unique to the customer's AWS account.	CC6.1; CC6.7	Inquired of an AWS Cryptography Technical Program Manager to ascertain keys provided by KMS to integrated services were 256-bit AES keys and were themselves encrypted by AES-256-bit AES keys unique to each customer's AWS account.	No deviations noted.
		Inspected the KMS key creation configuration to ascertain KMS keys created by KMS utilized the AES-256 cryptographic algorithm.	No deviations noted.
		Inspected the KMS encryption activity configuration to ascertain 256-bit AES keys were returned for 256-bit AES key requests coming from the integrated KMS services to encrypt customer data.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Observed an AWS Cryptography Software Development Engineer create a resource with content enabled for encryption using KMS to ascertain a KMS key was used to encrypt a 256-bit AES data encryption key (which was used to encrypt the content) as requested from the service.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer create a resource with content enabled for encryption using KMS and then attempt to access the data without decrypting to ascertain it was unreadable.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer create a resource with content enabled for encryption using KMS and then attempt to decrypt the data using the required AES-256-bit data encryption key to ascertain the data was successfully decrypted.	No deviations noted.
		Uploaded test data using a KMS-integrated service encrypted with a data encryption key, encrypted by a KMS key relating to an AWS account and attempted to perform the same activity, using another AWS account, calling upon the same KMS key to ascertain an upload failure occurred due to an authorization failure caused by a mismatch between the owner of the KMS key and the AWS account.	No deviations noted.
AWSCA-4.8: KMS-Specific – Requests in KMS are logged in AWS CloudTrail.	CC6.1	Inquired of an AWS Cryptography Technical Program Manager to ascertain API calls made by the AWS services that integrate with KMS were captured when the logging feature was enabled.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Inspected the configuration for KMS logging to ascertain requests in KMS were designed to be logged in AWS CloudTrail.	No deviations noted.
		Enabled CloudTrail logging on a service that integrates with KMS, uploaded data using a KMS key for encryption, and downloaded the same file for decryption and inspected the logs in AWS CloudTrail to ascertain activity from both encryption and decryption API calls was logged.	No deviations noted.
AWSCA-4.9: KMS-Specific – KMS endpoints can only be accessed by customers using TLS with cipher suites that support forward secrecy.	CC6.1; CC6.7	Inquired of an AWS Cryptography Technical Program Manager to ascertain KMS endpoints could only be accessed using TLS with cipher suites to support forward secrecy.	No deviations noted.
		Inspected the configuration for KMS TLS communication to ascertain the cipher suites listed supported forward secrecy.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer attempt to connect to a public KMS service endpoint using an unsupported cipher suite to ascertain the endpoints could not be accessed.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer attempt to connect to a public KMS service endpoint using a supported cipher suite supporting forward secrecy to ascertain the endpoint connection was successful.	No deviations noted.
AWSCA-4.10: KMS-Specific – Keys used in AWS KMS are only used for a single purpose as defined	CC6.1	Inquired of an AWS Cryptography Technical Program Manager to ascertain keys used in AWS KMS were only used for a single purpose as defined by the key_usage parameter for each key.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
by the key_usage parameter for each key.		Inspected the source code responsible for AWS KMS key usage, to ascertain the key_usage parameter was configured at the key level and that key operations required the use of keys designated by the system for that operation.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer create an AWS KMS key, attempt to perform a key operation in alignment with the key_usage parameter, to ascertain the operation was performed in accordance with the set parameter.	No deviations noted.
		Observed an AWS Cryptography Software Development Engineer create an AWS KMS key and attempt to perform a key operation not in alignment with the key_usage parameter, to ascertain the operation resulted in a key_usage error.	No deviations noted.
AWSCA-4.11: KMS-Specific – KMS keys created by KMS are rotated on a defined frequency if enabled by the customer.	CC6.1; CC6.7	Inquired of an AWS Cryptography Technical Program Manager to ascertain the KMS service included functionality for KMS keys to be rotated on a defined frequency, if enabled by the customer.	No deviations noted.
		Inspected the source code responsible for KMS key rotation, to ascertain a new backing key would be created in accordance with the defined frequency (currently set as 1 year), if enabled.	No deviations noted.
		Inspected a key rotation event log for an AWS internal key to ascertain the backing key was rotated.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-4.12: KMS-Specific – Recovery key materials used for disaster recovery processes by KMS are physically secured offline so that no single AWS employee can gain access to the key material.	CC6.1; CC6.4	Inquired of an AWS Cryptography Technical Program Manager to ascertain recovery key materials used for disaster recovery processes by KMS were physically secured offline so that no single AWS employee could gain access to the key material.	No deviations noted.
		Inspected the listing of employees with physical access to the recovery key material resources used for disaster recovery processes by KMS to ascertain employees were appropriate based on their job title and responsibilities.	No deviations noted.
		Inspected a physical access log of access attempts to recovery key materials to ascertain no single AWS employee can gain access by themselves.	No deviations noted.
AWSCA-4.13: KMS-Specific – Access attempts to recovery key materials are reviewed by authorized operators on a cadence defined in team documentation.	CC6.1; CC6.4	Inquired of an AWS Cryptography Technical Program Manager to ascertain access attempts to recovery key materials were reviewed by authorized operators on a cadence defined in team documentation.	No deviations noted.
		Inspected the reviews of access attempts or requests to recovery key materials to ascertain reviews were performed and documented by authorized operators on a cadence defined in team documentation.	No deviations noted.

AWSCA-4.14: KMS-Specific – The production firmware version of the AWS Key Management Service HSM	CC6.1;
	CC6.6;
	CC6.7
		Inquired of an AWS Cryptography Technical Program Manager to ascertain the production firmware version of the AWS Key Management Service HSM was validated with NIST under the latest FIPS 140-2 standard.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
(Hardware Security Module) has been validated with NIST under the FIPS 140-2 standard or is in the process of being validated.		Inspected the firmware version on the latest NIST Cryptographic Module Validation Program Certificate (or documentation of in-progress certification) and the HSM firmware version deployed to production AWS Key Management Service HSMs, to ascertain the production firmware version of the AWS Key Management Service HSMs was validated by NIST (or updated firmware is in the process of revalidation) under the latest FIPS 140-2 standard.	No deviations noted.

AWSCA-4.15: CloudHSM-Specific - Production HSM devices are received in tamper evident authenticable bags. Tamper evident authenticable bag serial numbers and production HSM serial numbers are verified against data provided out-of-band by the manufacturer and logged into tracking systems by approved individuals.	CC6.1;
	CC6.4;
	CC6.7;
		Inquired of a CloudHSM Technical Program Manager to ascertain production HSM devices are received in tamper evident authenticable bags. Tamper evident authenticable bag serial numbers and production HSM serial numbers are verified against data provided out-of-band by the manufacturer and logged into tracking systems by approved individuals.	No deviations noted.

		Inspected the configuration of the automated verifications performed prior to moving an HSM device to production to ascertain HSM serial numbers are verified against data provided out-of-band before entering production.	No deviations noted.
		Selected a production HSM device to ascertain the HSM device's serial number was verified against data provided out-of-band before it entered into production.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-5.1: Physical access to data centers is approved by an authorized individual.	CC6.4; CC6.7	Inquired of an AWS Security Technical Program Manager to ascertain physical access to data centers was approved by an authorized individual.	No deviations noted.
		Inspected the configuration for executing the physical access approval and provisioning within the data center access management system to ascertain physical access to data centers was designed to be granted after an approval by an authorized individual.	No deviations noted.
		Selected a user whose data center access was provisioned during the period and inspected the data center physical access provisioning records to ascertain physical access was granted after it was approved by an authorized individual.	No deviations noted.
AWSCA-5.2: Physical access is revoked within 24 hours of the employee or vendor record being deactivated.	CC6.4; CC6.7	Inquired of an AWS Security Technical Program Manager to ascertain physical access was automatically revoked within 24 hours of the employee or vendor record being deactivated.	No deviations noted.
		Inspected the system configurations within the data center access management system to ascertain physical access was automatically revoked within 24 hours of the employee or vendor record being deactivated in the HR system.	No deviations noted.
		Selected a terminated employee and inspected the HR System record to ascertain physical access was systematically revoked within 24 hours of the employee record being deactivated in the HR system by the access provisioning system.	No deviations noted.
AWSCA-5.3: Physical access to data centers is reviewed on a quarterly basis	CC6.4; CC6.7	Inquired of an AWS Security Technical Program Manager to ascertain physical access to data centers was reviewed on a quarterly basis by appropriate personnel.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
by appropriate personnel.		Inspected the system configurations within the data center access management system to ascertain access marked for removal was automatically removed once the review was marked complete.	No deviations noted.
		Haphazardly selected a user marked for removal during the quarterly physical access review to ascertain the user's access was appropriately removed by the data center access management system.	No deviations noted.
		Selected a sample of quarterly data centers access reviews for a sample of data centers and inspected the reviews to ascertain the reviews were performed, that access was re-approved by appropriate personnel.	No deviations noted.
AWSCA-5.4: Closed circuit television camera (CCTV) are used to monitor server locations in data centers. Images are retained for 90 days, unless limited by legal or contractual obligations.	CC6.4	Inquired of an AWS Security Technical Program Manager and Data Center Operations Managers to ascertain physical access points to server locations were monitored by a closed circuit television camera (CCTV) and that images were retained for 90 days unless limited by legal or contractual obligations.	No deviations noted.
		Selected a sample of data centers and observed areas around access points to server locations, to ascertain CCTV cameras were placed to record physical access points to server locations.	No deviations noted.
		Selected a sample of CCTV cameras and observed the CCTV footage, to ascertain physical access points to server locations were recorded.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Selected a sample of server locations and inspected the network video recorder configuration to ascertain CCTV images were retained for 90 days, unless limited by legal or contractual obligations.	No deviations noted.
AWSCA-5.5: Access to server locations is managed by electronic access control devices.	CC6.4; A1.2	Inquired of an AWS Security Technical Program Manager and Data Center Operations Managers to ascertain physical access points to server locations were managed by electronic access control devices.	No deviations noted.
		Selected a sample of data centers and inspected the physical security access control configurations to ascertain electronic access control devices were installed at physical access points to server locations and that they required authorized Amazon badges with corresponding PINs to enter server locations.	No deviations noted.

AWSCA-5.6: Electronic intrusion detection systems are installed within data server locations to monitor, detect, and automatically alert appropriate personnel of security incidents.	CC7.2;
	CC7.3;
	A1.2
		Inquired of an AWS Security Technical Program Manager and Data Center Operations Managers to ascertain electronic intrusion detection systems were installed and capable of detecting breaches into data center server locations.	No deviations noted.

		Selected a sample of data centers, inspected the physical security access control configurations and corresponding alarm records for a server access location to ascertain electronic intrusion detection systems were installed, that they were capable of detecting intrusion attempts, and that they automatically alerted security personnel of detected events for investigation and resolution.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-5.7: Amazon-owned data centers are protected by fire detection and suppression systems.	A1.2	Inquired of Data Center Operations Managers to ascertain Amazon-owned data centers were protected by fire detection and fire suppression systems.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected maintenance logs for fire detection systems to ascertain they were located on premise at the data centers.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected maintenance logs for fire suppression devices to ascertain they were located on premise at the data centers.	No deviations noted.
AWSCA-5.8: Amazon-owned data centers are air conditioned to maintain appropriate atmospheric conditions. Personnel and systems monitor and control air temperature and humidity at appropriate levels.	A1.2	Inquired of Data Center Operations Managers to ascertain Amazon-owned data centers were air conditioned to maintain appropriate atmospheric conditions and that the units were monitored by personnel and systems to control air temperature and humidity at appropriate levels.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected the building monitoring system outputs to ascertain HVAC equipment monitored and controlled temperature and humidity at appropriate levels.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected maintenance records for air-conditioning systems to ascertain they were located on premise at the data centers.	No deviations noted.
AWSCA-5.9: Uninterruptible Power Supply (UPS) units provide backup power in the event of an electrical	A1.2	Inquired of Data Center Operations Managers to ascertain UPS units provided backup power in the event of an electrical failure in Amazon-owned data centers or in colocation sites where Amazon manages the UPS units.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
failure in Amazon-owned data centers and third-party colocation sites where Amazon maintains the UPS units.		Selected a sample of third-party colocation data centers and inspected monitoring configurations to ascertain that UPS units were being monitored and would send an alert in the event of an electrical failure.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected building monitoring system outputs to ascertain UPS units existed and that they monitored electrical power and were available to provide backup power in the event of an electrical failure.	No deviations noted.
AWSCA-5.10: Amazon-owned data centers have generators to provide backup power in case of electrical failure.	A1.2	Inquired of Data Center Operations Managers to ascertain Amazon-owned data centers had generators to provide backup power in case of electrical failure.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected building monitoring system outputs to ascertain generators were monitored and primed for electrical failure.	No deviations noted.
		Selected a sample of Amazon-owned data centers and inspected maintenance logs for generator equipment to ascertain they were located on premise at the data centers.	No deviations noted.

AWSCA-5.11: Contracts are in place with third-party colocation service providers which include provisions to provide fire suppression	CC7.3;
	CC7.4;
	CC7.5;
	CC9.2;
	A1.2
		Inquired of AWS Legal Corporate Counsel to ascertain contracts were in place at the colocation service providers which included provisions for fire suppression systems, air conditioning, UPS units, and redundant power supplies as well as provisions requiring communication of incidents or events that impact Amazon assets or customers to AWS.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
systems, air conditioning to maintain appropriate atmospheric conditions, Uninterruptible Power Supply (UPS) units (unless maintained by Amazon), and redundant power supplies. Contracts also include provisions requiring communication of incidents or events that impact Amazon assets and/or customers to AWS.		Selected a sample of data centers managed by colocation service providers and inspected the current contractual agreements between service providers and AWS to ascertain they included provisions for fire suppression systems, air conditioning, UPS units, and redundant power supplies as well as provisions requiring colocation service providers to notify Amazon immediately of discovery of any unauthorized use or disclosure of confidential information or any other breach.	No deviations noted.
		Selected a sample of ACE sites and inspected site monitoring outputs to ascertain that ACE sites were monitored in the event of a crossed threshold or outage.	No deviations noted.
		Haphazardly selected an ACE site and inspected an incident ticket automatically raised by a monitoring configuration to ascertain the incident was tracked through to resolution.	No deviations noted.

AWSCA-5.12: AWS performs periodic reviews of colocation service providers to validate adherence with AWS security and operational standards.	CC3.2;
	CC3.3;
	CC3.4;
	CC4.1;
	CC7.3;
	CC7.4;
	CC7.5;
	CC9.2;
	A1.2
		Inquired of a Vendor Performance Manager to ascertain periodic reviews were performed for colocation vendor relationships to validate adherence with AWS security and operational standards.	No deviations noted.

		Selected a sample of data centers managed by colocation service providers and inspected the corresponding vendor reviews to ascertain they were performed at least once within the last year and included an evaluation of adherence to AWS security and operational standards.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-5.13: All AWS production media is securely decommissioned and physically destroyed, verified by two personnel, prior to leaving AWS Secure Zones.	CC6.5;
	CC6.7;
	C1.2
		Inquired of Data Center Operations Managers to ascertain AWS production media was securely decommissioned and physically destroyed prior to leaving AWS Secure Zones.	No deviations noted.

		Inspected the AWS Media Destruction Standard Operating Procedures document to ascertain that it included procedures for data center personnel to securely decommission production media prior to leaving AWS Secure Zones.	No deviations noted.
		Selected a sample of data centers and inspected media destruction logs for secure decommissioning and physical destruction to ascertain production media was securely decommissioned and physically destroyed prior to leaving AWS Secure Zones.	No deviations noted.

AWSCA-6.1: AWS applies a systematic approach to managing change to ensure changes to customer-impacting aspects of a service are reviewed, tested and approved. Change management standards are based on Amazon guidelines and tailored to the specifics of each AWS service.	CC6.1;
	CC6.8;
	CC7.5;
	CC8.1
		Inquired of Software Development Managers to ascertain customer-impacting changes of service to the production environment were reviewed, tested, approved, and followed Amazon's change management guidelines and that service-specific change management processes (if applicable) were maintained, followed, and communicated to the service teams.	No deviations noted.

		Inspected the Amazon Change Management Guidelines document and service-specific change management documents (if applicable) to ascertain they communicated specific guidance on change management processes, including initiation, testing and approval, and that service team-specific steps (if applicable) were documented and maintained by the teams.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-6.2: Change details are documented within one of Amazon's change management or deployment tools.	CC6.8; CC8.1	Inquired of Software Development Managers to ascertain changes were documented within one of Amazon's change management or deployment tools.	No deviations noted.
		Selected a sample of changes from a system-generated listing of changes deployed to production, inspected the relevant documentation, to ascertain the change details were documented within one of Amazon's change management or deployment tools and communicated to service team management.	No deviations noted.
AWSCA-6.3: Changes are tested according to service team change management standards prior to migration to production.	CC6.8; CC8.1	Inquired of Software Development Managers to ascertain changes were tested according to service team change management standards prior to migration to production.	No deviations noted.
		Selected a sample of changes from a system-generated listing of changes migrated to production and inspected the relevant documentation to ascertain changes were tested according to service team change management standards prior to migration to production.	No deviations noted.
		Inspected an AWS managed IAM policy to ascertain that policies managed by AWS are tested prior to being moved to production.	No deviations noted.
AWSCA-6.4: AWS maintains separate production and	CC6.8; CC8.1	Inquired of Software Development Managers to ascertain AWS maintained separate production and development environments.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
development environments.		Selected a sample of changes migrated to production from a system generated listing of changes to ascertain testing occurred in a development environment.	No deviations noted.
		Selected a sample of changes migrated to production from a system-generated listing of changes, and inspected the related deployment pipelines to ascertain the production and development environments were separate.	No deviations noted.
AWSCA-6.5: Changes are reviewed for business impact and approved by authorized personnel prior to migration to production according to service team change management standards.	CC6.8; CC8.1	Inquired of Software Development Managers to ascertain changes were reviewed for business impact and approved by authorized personnel prior to migration to production according to service team change management standards.	No deviations noted.
		Selected a sample of changes from a system-generated listing of changes migrated to production and inspected the corresponding documentation to ascertain changes were reviewed and approved by authorized personnel prior to migration to production according to service team change management standards.	No deviations noted.
		Inspected the configurations in-place for publishing AWS managed IAM policies to ascertain that policies are designed to require approvals prior to being moved to production.	No deviations noted.
		Inspected an AWS managed IAM policy to ascertain that policies managed by AWS are approved prior to being moved to production.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-6.6: AWS performs deployment validations and change reviews to detect unauthorized changes to its environment and tracks identified issues to resolution.	CC6.8;
	CC7.1;
	CC8.1
		Inquired of Software Development Managers to ascertain AWS performed deployment validations and change reviews to detect changes that did not follow the change management process and that appropriate actions were taken to track identified issues to resolution.	No deviations noted.

		Selected a sample of changes from a system-generated listing of changes migrated to production and, inspected the corresponding documentation to ascertain AWS performed deployment validations and change reviews to detect unauthorized changes and that follow-up actions were taken as necessary to remediate any issues identified.	No deviations noted.
		Selected a sample of months from the Monthly Security Business review and inspected the contents of the deployment violations dashboard to ascertain unauthorized changes were tracked to resolution by AWS management.	No deviations noted.
		Selected a sample of months for services using manual deployment monitoring and inspected review documentation to ascertain that the related AWS service team generated a listing of all changes deployed to production during the month, assessed the changes for appropriateness, and follow-up actions were taken as necessary to remediate any issues identified.	No deviations noted.
		Selected a sample of months from the Monthly Security Business Review and Inspected the contents of the deployment violation dashboard to ascertain unauthorized changes were tracked to resolution by AWS management.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-6.7: Customer information, including personal information, and customer content are not used in test and development environments.	CC8.1	Inquired of software development managers, to ascertain customer information, including personal information, and customer content was not used in test or development environments.	No deviations noted.
		Inspected the contents of the Secure Software Development Policy intended for software development engineers and software development managers throughout AWS to ascertain it provided instructions to not use production customer information and content in test or development environments.	No deviations noted.
AWSCA-7.1: S3-Specific – S3 compares user provided checksums to validate the integrity of data in transit. If the customer provided MD5 checksum does not match the MD5 checksum calculated by S3 on the data received, the REST PUT will fail, preventing data that was corrupted on the wire from being written into S3.	CC6.7	Inquired of an S3 Software Development Manager to ascertain S3 compared user provided checksums to validate the integrity of data in transit, and that customer provided MD5 checksum must match the MD5 checksum calculated by S3 on the data received, otherwise the REST PUT request would fail, preventing corrupted data from being written into S3.	No deviations noted.
		Inspected the MD5 checksum configurations to ascertain S3 was configured to continually compare the user provided checksums to validate the integrity of data in transit.	No deviations noted.
		Observed a Software Development Engineer upload a file with an invalid MD5 checksum, to ascertain the transfer was aborted and an error message was displayed.	No deviations noted.
		Observed a Software Development Engineer upload a file with a valid MD5 checksum that matched the S3 calculated checksum to ascertain the transfer was completed successfully.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-7.2: S3-Specific – S3 performs continuous integrity checks of the data at rest. Objects are continuously validated against their checksums to prevent object corruption.	C1.1	Inquired of an S3 Software Development Manager to ascertain S3 performed continuous integrity checks of the data at rest and that objects were automatically validated against their checksums to prevent object corruption.	No deviations noted.
		Inspected the configurations of the integrity checks for data at rest to ascertain S3 was configured to continuously validate against object checksums to prevent object corruption.	No deviations noted.
		Observed a Software Development Engineer locate an object whose checksum was not validated against its object locator, to ascertain the object was automatically detected by the S3 service to prevent object corruption.	No deviations noted.
		Inspected system log files for an object at rest to ascertain checksums were utilized to assess the continuous integrity checks of data.	No deviations noted.
AWSCA-7.3: S3-Specific – When disk corruption or device failure is detected, the system automatically attempts to restore normal levels of object storage redundancy.	A1.2; C1.1	Inquired of an S3 Software Development Manager to ascertain when disk corruption or device failure was detected, the system automatically attempted to restore normal levels of object storage redundancy.	No deviations noted.
		Inspected the system configurations utilized by S3 to ascertain S3 was configured to automatically attempt to restore normal levels of object storage redundancy when disk corruption or device failure was detected.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Observed a Software Development Engineer locate an object that was corrupted or suffered device failure to ascertain the object was rewritten to a known location, which restored normal levels of object storage redundancy.	No deviations noted.
AWSCA-7.4: S3-Specific – Objects are stored redundantly across multiple fault-isolated facilities.	A1.2; C1.1	Inquired of an S3 Software Development Manager to ascertain objects were stored redundantly across multiple fault-isolated facilities.	No deviations noted.
		Uploaded an object and observed a Software Development Engineer access the object location configuration to ascertain the object was stored redundantly across multiple fault-isolated facilities.	No deviations noted.
AWSCA-7.5: S3-Specific – The design of systems is sufficiently redundant to sustain the loss of a data center facility without interruption to the service.	A1.2; C1.1	Inquired of an S3 Software Development Manager to ascertain systems were designed to sustain the loss of a data center facility without interruption to the service.	No deviations noted.
		Inspected the system configuration utilized by S3 on stored objects to ascertain critical services were designed to sustain the loss of a facility without interruption to the service.	No deviations noted.
AWSCA-7.6: RDS-Specific – If enabled by the customer, RDS backs up customer databases, stores backups for user-defined retention periods, and supports point-in-time recovery.	A1.2; C1.1	Inquired of an RDS Systems Engineer Manager to ascertain, if enabled by the customer, RDS backed up customer databases, stored backups for user-defined retention periods, and supported point-in-time recovery.	No deviations noted.
		Created an RDS database, enabled backups, backed up the database, restored a backup, to ascertain RDS backed up customer databases via scheduled backups according to a user-defined retention period, and that the database was capable of a point-in-time recovery.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-7.7: AWS provides customers the ability to delete their content. Once successfully removed the data is rendered unreadable.	CC6.5; C1.2	Inquired of Software Development Managers to ascertain AWS provided customers the ability to delete their content and render it unreadable.	No deviations noted.
		Observed an EC2 Security Manager create a virtual host, upload content, delete the underlying storage volume, then create a different instance within the same virtual memory slot and query for the original content to ascertain that the underlying storage volume and in memory data was removed.	No deviations noted.
		For the services that provide content storage as described in the System Description, inspected the configurations designed to automatically delete content from buckets, volumes, instances, or other means of content storage, to ascertain it was designed to delete and render the data unreadable.	No deviations noted.
		For a service that provides content storage as described in the System Description, created sample content into buckets, volumes, instances, or other means of content storage, and deleted the content and/or the underlying buckets, volumes, instances, or other means of content storage, to ascertain the data identifiers were removed or the data itself was zeroed out after being deleted and that it was rendered unreadable.	No deviations noted.
AWSCA-7.8: AWS retains customer content per customer agreements.	CC6.5; C1.1	Inquired of an AWS Security Assurance Technical Program Manager to ascertain AWS retained customer content per the customer agreements.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Inspected the most recent copy of the AWS Customer Agreement to ascertain it was communicated externally to customers and contained an effective date, which was the most recent version of the agreement.	No deviations noted.
		Inspected the AWS Customer Agreement to ascertain the contractual language in section 7.3b stated that AWS will not delete customer information for up to 30 days in the event of AWS account termination, and that the language explicitly stated the customer agreed to the responsibilities regarding confidential information disposal.	No deviations noted.
		Inspected the customer account content retention configuration to ascertain a centralized account service was designed to send notifications to services to delete customer content 90 days after account closure.	No deviations noted.
		Selected a service that stores customer content integrated with the centralized account service, created a unit of content storage, closed the AWS account and inspected the content throughout the 90 day lifecycle to ascertain customer content was retained until deleted 90 days after customer account closure.	No deviations noted.
		For a sample service that stored customer content for more than 30 days, created a unit of content storage, closed the AWS account, reopened the AWS account 30 days after termination, and per observation, ascertained content was retained.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA7.9: Outpost-Specific – Nitro Security Key is configured in Outpost to encrypt customer content and allow a customer to have a mechanical means to perform crypto shredding of the content.	CC6.5; C1.2	Inquired of an AWS Senior Security Engineer to ascertain the Nitro Security Key was configured in Outpost to encrypt customer content and allow a customer to have a mechanical means to perform crypto shredding of the content.	No deviations noted.
		Inspected the Outpost configurations to ascertain Outpost was configured to encrypt customer content with the Nitro Security Key.	No deviations noted.
		Inspected the Standard Operating Procedures for Outpost Retrieval document to ascertain the Nitro Security Key was mechanically destroyed at the time of retrieval.	No deviations noted.
		Inspected logs of an Outpost with a valid Nitro Security Key to ascertain that it successfully encrypted the content on the Outpost with a valid Nitro Security Key.	No deviations noted.
		Inspected logs of an Outpost without a valid Nitro Security Key to ascertain that it was not able to unencrypt the content on the Outpost without the valid Nitro Security Key.	No deviations noted.
AWSCA-7.10: EC2-Specific - Amazon EC2 enables clock synchronization based on Network Time Protocol in EC2 Linux instances, to achieve accuracy within 1 millisecond of Coordinated Universal Time	CC7.1	Inquired of an AWS Software Development Engineer to ascertain Amazon EC2 enables clock synchronization based on Network Time Protocol in EC2 instances, to achieve accuracy within 1 millisecond of Coordinated Universal Time.	No deviations noted.
		Inspected the clock synchronization configurations to ascertain the different infrastructure layers were all linked to ensure clock synchronization.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
		Observed an EC2 Software Development Engineer create an EC2 instance and enable clock synchronization to ascertain that clock synchronization achieved an accuracy within 1 millisecond of Coordinated Universal Time.	No deviations noted.
		Selected a sample of AWS managed Grandmaster clock devices to ascertain that monitoring was in place to ensure that an accuracy within 1 millisecond of Coordinated Universal Time was achieved.	No deviations noted.

AWSCA-8.1: Monitoring and alarming are configured by Service Owners to identify and notify operational and management personnel of incidents when early warning thresholds are crossed on key operational metrics.	CC2.1;
	CC6.1;
	CC6.6;
	CC6.8;
	CC7.2;
	CC7.3;
	CC7.4;
	A1.1;
	A1.2
		Inquired of Software Development Managers to ascertain the production environment was monitored and that alarming was configured by Service Owners to notify operational and management personnel when early warning thresholds were crossed on key operational metrics.	No deviations noted.

		Selected a sample of key operational metrics and inspected their configurations to ascertain related monitoring and alarming configurations existed and were configured to notify appropriate personnel when a threshold was reached or exceeded.	No deviations noted.

AWSCA-8.2: Incidents are logged within a ticketing system, assigned	CC2.1;
	CC6.1;
	CC6.6;
	CC6.8;
		Inquired of Software Development Managers to ascertain incidents were logged in a ticketing system, assigned a severity level, and tracked through resolution.	No deviations noted.

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Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

severity rating and tracked to resolution.	CC7.2;
	CC7.3;
	CC7.4;
	CC7.5;
	CC8.1;
	A1.2
		Inspected the network monitoring tool configurations that automatically cuts tickets for Network Monitoring incidents to ascertain incidents were logged within a ticketing system, assigned severity rating and tracked to resolution.	No deviations noted.

		Selected a sample of incidents from a system generated listing of the key operational metrics and security alerts (as stated in the system description) and inspected associated entries in the ticketing system to ascertain incidents were assigned a severity level and tracked through to resolution.	No deviations noted.
AWSCA-9.1: AWS maintains internal informational websites describing the AWS environment, its boundaries, user responsibilities and services.	CC2.2; CC2.3	Inquired of the AWS Security Assurance Technical Program Manager to ascertain AWS maintained internal informational websites describing the AWS environment, its boundaries, user responsibilities, and the services.	No deviations noted.
		Inspected AWS internal informational websites for each in-scope AWS service to ascertain they described the AWS environment, its boundaries, user responsibilities, and the services.	No deviations noted.
AWSCA-9.2: AWS conducts pre-employment screening of candidates commensurate with the employee's position and level, in accordance with local law and the AWS Personnel Security Policy.	CC1.1; CC1.4	Inquired of the HR Compliance Manager to ascertain AWS conducted pre-employment screening of full-time candidates prior to the employees' start dates in accordance with local laws.	No deviations noted.
		Selected a sample of AWS full-time new hires, inspected their pre-employment screening records, to ascertain pre-employment screening was performed prior to each employee's start date.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-9.3: AWS performs annual formal evaluation of resourcing and staffing including assessment of employee qualification alignment with entity objectives. Employees receive feedback on their strengths and growth ideas annually.	CC1.1;
	CC1.4;
	CC1.5
		Inquired of a Director of Talent Management to ascertain a process was in place to perform a formal evaluation of resourcing and staffing annually, including an assessment of employee qualification alignment with entity objectives and that employees receive feedback on their strengths and growth ideas.	No deviations noted.

		Selected a sample of AWS employees from an HR system-generated listing, inspected their performance evaluation records, to ascertain each employee was formally evaluated against entity objectives during the most recent annual formal evaluation of resourcing and staffing.	No deviations noted.

AWSCA-9.4: AWS host configuration settings are monitored to validate compliance with AWS security standards and automatically pushed to the host fleet.	CC6.1;
	CC6.8;
	CC7.1;
	CC8.1
		Inquired of a System Engineering Manager and Software Development Manager to ascertain AWS host configuration settings were monitored to validate compliance with AWS security standards and that they were automatically pushed to the fleet.	No deviations noted.

		Inspected the monitoring configurations to ascertain production hosts were configured to monitor compliance with AWS security standards and to automatically request and install host configuration setting updates pushed to the fleet.	No deviations noted.
		Selected production hosts and inspected the automated deployment logs to ascertain production hosts automatically requested and installed host configuration setting updates pushed to the fleet.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
AWSCA-9.5: AWS provides publicly available mechanisms for customers to contact AWS to report security events and publishes information including a system description and security and compliance information addressing AWS commitments and responsibilities.	CC2.3	Inquired of an AWS Security Assurance Technical Program Manager to ascertain AWS provided publicly available mechanisms for customers to contact AWS to report security events and published information including a system description and security and compliance information addressing AWS commitments and responsibilities.	No deviations noted.
		Inspected AWS informational websites to ascertain they provided publicly available mechanisms for customers to contact AWS to report security events.	No deviations noted.
		Inspected the AWS whitepapers and public websites to ascertain they provided information including a system description and security and compliance information addressing AWS commitments and responsibilities.	No deviations noted.

AWSCA-9.6: The Company provides a hotline for employees to anonymously report on possible violations of conduct.	CC7.2;
	CC7.3;
	CC7.4;
	CC7.5
		Inquired of a Vice President of Litigation Legal to ascertain the company provided a hotline for employees to anonymously report on possible violations of conduct.	No deviations noted.

		Inspected the Owner's Manual and Guide to Employment policy to ascertain employees were provided access to the ethics hotline in all geographies during orientation.	No deviations noted.
		Called the fraud hotline number to ascertain it was available for employees to anonymously report on possible violations of conduct.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-9.7: Material violations of the Company's Code of Business Conduct and Ethics and similar policies are appropriately handled in terms of communication and possible disciplinary action or termination. Violations involving third parties or contractors are reported to their respective employers which will carry out any possible disciplinary action, removal of assignment with Amazon, or termination.	CC1.1;
	CC1.5;
	CC9.2
		Inquired of a Director of Human Resources to ascertain material violations of the Company's Code of Business Conduct and Ethics and similar policies were appropriately handled in terms of communications and possible disciplinary action or termination, and violations involving third parties or contractors were reported to their respective employers which were responsible for any possible disciplinary action, removal of assignment with Amazon, or termination.	No deviations noted.

		Inspected the Code of Business Conduct and Ethics policy to ascertain that employee expectations were published on the intranet for employees to review and consequences for certain violations were documented within the policy.	No deviations noted.
		Inspected the Human Resources team investigation process wiki to ascertain it detailed standard operating procedures for the handling of a potential material violation of the Company's Code of Business Conduct Ethics for both employee's and vendors, including the handling of communication and possible disciplinary action.	No deviations noted.

AWSCA-9.8: AWS has established a formal audit program that includes continual, independent internal and external	CC1.2;
	CC2.1;
	CC3.1;
	CC4.1;
	CC4.2;
		Inquired of a Business Risk Management Director to ascertain AWS had established a formal audit program that included continual, independent internal and external assessments to validate the implementation and operating effectiveness of the AWS control environment.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
assessments to validate the implementation and operating effectiveness of the AWS control environment.		Inspected the audit framework and list of interviewees to ascertain AWS functional areas including AWS Security and AWS Service teams were covered within the Internal Audit Risk assessment creation.	No deviations noted.
		Inspected the yearly audit plan created by Internal Audit and submitted to the Audit Committee to ascertain Internal Audit formalized and outlined their specific audit plan as a response of the risk assessment conducted, and that the audit plan contained the AWS organization.	No deviations noted.

AWSCA-9.9: AWS has a process to assess whether AWS employees who have access to resources that store or process customer data via permission groups are subject to a post-hire background check as applicable with local law. AWS employees who have access to resources that store or process customer data will have a background check in accordance to the AWS Personnel Security Policy.	CC1.1;
	CC1.4;
		Inquired of a Security Assurance Program Manager to ascertain employees with access to resources that store or process customer data via permission groups receive a background check, as applicable with local law, no less than once a year.	No deviations noted.

		Selected a sample of AWS employees with access to resources that store or process customer data, inspected their background check status to ascertain background checks were completed within the last year from their previous background check.	No deviations noted.
AWSCA-10.1: Critical AWS system components are replicated across multiple Availability	A1.2	Inquired of Repository Software Development Managers to ascertain critical AWS system components were replicated across multiple Availability Zones and that backups were maintained.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
Zones and backups are maintained.		Inspected the replication configurations to ascertain critical AWS system components were configured to be replicated across multiple Availability Zones.	No deviations noted.
		Inspected the backup configurations to ascertain critical AWS system components were backed up as changes were deployed or in accordance with periodically-configured jobs throughout the day.	No deviations noted.
		For a package of system component files, inspected the production environment replication and backup logs for the related AWS service to ascertain data was replicated and backed up across multiple Availability Zones.	No deviations noted.
AWSCA-10.2: Backups of critical AWS system components are monitored for successful replication across multiple Availability Zones.	A1.2; A1.3	Inquired of Repository Software Development Managers to ascertain critical AWS system components were monitored for replication across multiple Availability Zones.	No deviations noted.
		Inspected monitoring dashboards, alarms, and email notification configurations to ascertain alarming configurations existed to notify appropriate personnel of replication and backup successes and failures and when files were insufficiently replicated across multiple Availability Zones.	No deviations noted.
		Inspected notifications of when a backup did not complete and when files were insufficiently represented across multiple Availability Zones to ascertain the service team initiated the remediation process and tracked the issues to resolution.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests

AWSCA-10.3: AWS contingency planning and incident response playbooks are maintained and updated to reflect emerging continuity risks and lessons learned from past incidents. The AWS contingency plan is tested on at least an annual basis.	CC2.2;
	CC3.2;
	CC3.3;
	CC3.4;
	CC5.3;
	CC7.3;
	CC7.4;
	CC7.5;
	CC9.1;
	A1.1;
	A1.2;
	A1.3
		Inquired of an AWS Compliance Technical Program Manager to ascertain AWS maintained an overall contingency planning procedure that reflected emerging continuity risks and incorporated lessons learned from past incidents, and that the AWS contingency plan was tested on at least an annual basis.	No deviations noted.

		Inquired of Software Development Managers to ascertain AWS contingency planning and incident response playbooks specific to each service team were maintained and updated to reflect emerging continuity risks and lessons learned from past incidents.	No deviations noted.
		Inspected the AWS contingency plan documentation to ascertain it was reviewed and approved at least annually, and that playbooks for each service existed, were maintained, and updated to reflect emerging continuity risks and lessons learned from past incidents.	No deviations noted.
		Inspected documentation for a recent AWS contingency plan test, to ascertain the contingency plan was tested within the past year, and that drills conducted to imitate incidents were resolved and service availability was restored.	No deviations noted.
AWSCA-10.4: AWS maintains a capacity planning model to assess infrastructure usage and demands at least monthly, and usually more	A1.1; A1.2	Inquired of a Data Center Capacity Planning Senior Manager and Edge Technical Program Manager, to ascertain AWS maintained a capacity planning model that assessed infrastructure usage, forecasted demand, and additional resources required to meet the availability requirements.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
frequently (e.g., weekly). In addition, the AWS capacity planning model supports the planning of future demands to acquire and implement additional resources based upon current resources and forecasted requirements.		Inquired of Software Development Managers to ascertain in-scope services had capacity programs in-place to monitor usage and send additional capacity needs to the central capacity planning team.	No deviations noted.
		Selected a sample of regions and edge locations, inspected the capacity planning model, to ascertain capacity was assessed per the defined cadence, and contained forecasting for future demands and resource availability.	No deviations noted.

AWSCA-11.1: Vendors and third parties with restricted access, that engage in business with Amazon are subject to confidentiality commitments as part of their agreements with Amazon. Confidentiality commitments included in agreements with vendors and third parties with restricted access are reviewed by AWS and the third party at time of contract creation or renewal.	CC1.1;
	CC1.4;
	CC2.2;
	CC2.3;
	CC9.2
		Inquired of AWS Legal Corporate Counsel to ascertain vendors or third parties with restricted access, that engage in business with AWS, were subject to confidentiality agreements as part of their agreements with Amazon and that these agreements were reviewed by AWS and the third party at the time of contract creation or renewal.	No deviations noted.

		Inspected a sample of vendor agreements from a population of external vendors and third parties with restricted access, who engage in business with Amazon, to ascertain the agreements contained confidentiality commitments.	No deviations noted.
		Inspected a sample of vendor agreements between AWS and vendors from a population of external vendors and third parties with restricted access to ascertain the agreements were signed and approved by the vendor and AWS.	No deviations noted.

AWSCA-11.2: AWS has a program in place for evaluating vendor performance	CC1.1;
	CC1.4;
	CC2.3;
		Inquired of the Data Center Global Services team to ascertain AWS had a program in place for evaluating vendor performance and compliance with contractual obligations.	No deviations noted.

Security, Availability, and Confidentiality Criteria Mapped to AWS Controls & Auditor Testing Performed and Results

Controls Specified by AWS	Criteria	Tests Performed by EY	Results of Tests
and compliance with contractual obligations.	CC4.1; CC9.2	Inspected the AWS evaluation program calendar for vendor performance and compliance with contractual obligations to ascertain reviews for vendors with restricted access were scheduled on a frequency subject to the overall risk of doing business with each vendor.	No deviations noted.
		Inspected a sample of vendor evaluations of performance and compliance with contractual obligations to ascertain reviews were performed within the reporting period and served as means for evaluations of vendor performance with contractual obligations, based on risk.	No deviations noted.

AWSCA-11.3: AWS communicates confidentiality requirements in agreements when they are renewed with vendors and third parties with restricted access. Changes to standard confidentiality commitments to customers are communicated on the AWS website via the AWS customer agreement.	CC2.2;
	CC2.3;
	CC9.2
		Inquired of an AWS Security Assurance Technical Program Manager to ascertain AWS communicated confidentiality requirements in agreements when they were renewed with vendors and third parties with restricted access and that changes to standard confidentiality commitments to customers were communicated on the AWS website via the AWS customer agreement.	No deviations noted.

		Inspected a sample of vendor agreements from a population of external vendors and third parties with restricted access to ascertain AWS communicated confidentiality requirements as part of the agreements.	No deviations noted.
		Inspected the public-facing AWS Customer Agreement located on the AWS website to ascertain changes to standard confidentiality commitments were communicated via the AWS Customer Agreement and made publicly available via an embedded change log.	No deviations noted.

SECTION V – Other Information Provided By Amazon Web Services

Spring 2022 SOC Control Adjustment Overview

The section below provides an overview of the key changes to SOC controls from the Fall 2021 (04/01/2021 – 9/30/2021) to the Spring 2022 (10/01/2021 – 3/31/2022) reporting periods.

Section I: Modifications to existing controls

OLD – Fall 2021	NEW – Spring 2022
AWSCA-4.5: KMS-Specific – Customer master keys used for cryptographic operations in KMS are logically secured so that no single AWS employee can gain access to the key material.	**AWSCA-4.5:** KMS-Specific – KMS keys used for cryptographic operations in KMS are logically secured so that no single AWS employee can gain access to the key material.
Rationale: In an effort of continuous improvement, AWS updates the report to reflect its most current process documentation. AWS KMS is replacing the term customer master keys (CMK) with AWS KMS Key and KMS key. The concept has not changed. No significant change to the control design and operation.	
AWSCA-4.7: KMS-Specific – The key provided by KMS to integrated services is a 256-bit key and is encrypted with a 256-bit AES master key unique to the customer's AWS account.	**AWSCA-4.7:** KMS-Specific – The key provided by KMS to integrated services is a 256-bit key and is encrypted with a 256-bit AES key unique to the customer's AWS account.
Rationale: In an effort of continuous improvement, AWS updates the report to reflect its most current process documentation. AWS KMS is replacing the term customer master key (CMK) with AWS KMS Key and KMS key. The concept has not changed. No significant change to the control design and operation.	
AWSCA-4.11: KMS-Specific – Customer master keys created by KMS are rotated on a defined frequency if enabled by the customer.	**AWSCA-4.11:** KMS-Specific – KMS keys created by KMS are rotated on a defined frequency if enabled by the customer.
Rationale: In an effort of continuous improvement, AWS updates the report to reflect its most current process documentation. AWS KMS is replacing the term customer master key (CMK) with AWS KMS Key and KMS key. The concept has not changed. No significant change to the control design and operation.	
AWSCA-7.10: EC2- Specific - Amazon EC2 enables clock synchronization based on Network Time Protocol in EC2 instances, to achieve accuracy within 1 millisecond of Coordinated Universal Time.	**AWSCA-7.10:** AWSCA-7.10: EC2- Specific - Amazon EC2 enables clock synchronization based on Network Time Protocol in EC2 Linux instances, to achieve accuracy within 1 millisecond of Coordinated Universal Time.

Rationale: In an effort of continuous improvement, AWS updated the control language to clarify that this control is applicable to EC2 Linux instances. No significant change to the control design and operation.

Section II: Addition of new controls

OLD – Fall 2021	NEW – Spring 2022
Not applicable.	**AWSCA-3.18:** Anti-virus software is installed, updated and running on workstations.
Rationale: In an effort of continuous improvement, adding an additional control as an enhancement to the report to reflect the most current control environment. Anti-virus-related procedures were previously included in the testing of control AWSCA-8.1.	
Rationale: Adding Service specific controls as an enhancement to the report.	

AWS Service Event in the Northern Virginia (US-EAST-1) Region

On December 7, 2021, AWS experienced a temporary service disruption in the Northern Virginia (US-EAST-1) Region. The details of this event and actions taken were posted to the AWS Public Blog.

As part of our analysis of this event, AWS determined that the monitoring controls for the system description within the SOC report were operating as intended and effectively identified the large surge connection of activity that overwhelmed the networking devices. AWS assessed the risks related to this event and made enhancements, deploying additional network configurations that protect impacted networking devices even in the face of a similar congestion event.

Additionally, we determined the AWS controls as described within the system description and service commitments were not impacted as this was an isolated event. AWS effectively identified and resolved the temporary disruption, and risks relating to the event were assessed and addressed.

AWS Initiatives and Response to COVID-19

As part of our response to COVID-19, Amazon Web Services (AWS) is providing highly scalable and reliable infrastructure capacity, technical support, and AWS services to help customers with their research, remote work and learning, and other solutions to address their needs and the effects this is having on communities and businesses.

To learn about other ways AWS is responding to COVID-19, please visit AWS Initiatives and Response to COVID-19.

With regard to the effects of the COVID-19 pandemic on the Amazon Web Services' System and our response to it:

- There have been no changes to the System other than those deemed inconsequential.
- There have been no instances in which the design of existing controls was not effective due to changes to the environment in which the System operates, data, personnel, or other factors.
- There have been no instances in which controls did not operate as designed due to changes in the environment, data, personnel, availability of resources or other factors.
- There have been no instances in which the Company has failed to achieve the related control objectives.

APPENDIX – Glossary of Terms

Appendix – Glossary of Terms

AMI: An Amazon Machine Image (AMI) is an encrypted machine image stored in Amazon S3. It contains all the information necessary to boot instances of a customer's software.

API: Application Programming Interface (API) is an interface in computer science that defines the ways by which an application program may request services from libraries and/or operating systems.

Authentication: Authentication is the process of determining whether someone or something is, in fact, who or what it is declared to be.

Availability Zone: Amazon EC2 locations are composed of regions and Availability Zones. Availability Zones are distinct locations that are engineered to be insulated from failures in other Availability Zones and provide inexpensive, low latency network connectivity to other Availability Zones in the same region.

Bucket: A container for objects stored in Amazon S3. Every object is contained within a bucket. More information can be found in https://docs.aws.amazon.com/AmazonS3/latest/dev/Introduction.html #BasicsBucket

Customer Content: Defined as "Your Content" in https://aws.amazon.com/agreement/

HMAC: In cryptography, a keyed-Hash Message Authentication Code (HMAC or KHMAC), is a type of message authentication code (MAC) calculated using a specific algorithm involving a cryptographic hash function in combination with a secret key. As with any MAC, it may be used to simultaneously verify both the data integrity and the authenticity of a message. Any iterative cryptographic hash function, such as MD5 or SHA-1, may be used in the calculation of an HMAC; the resulting MAC algorithm is termed HMAC-MD5 or HMAC-SHA1, accordingly. The cryptographic strength of the HMAC depends upon the cryptographic strength of the underlying hash function, on the size and quality of the key and the size of the hash output length in bits.

Hypervisor: A hypervisor, also called Virtual Machine Monitor (VMM), is computer software/hardware virtualization software that allows multiple operating systems to run on a host computer concurrently.

IP Address: An Internet Protocol (IP) address is a numerical label that is assigned to devices participating in a computer network utilizing the Internet Protocol for communication between its nodes.

IP Spoofing: Creation of Internet Protocol (IP) packets with a forged source IP address, called spoofing, with the purpose of concealing the identity of the sender or impersonating another computing system.

MD5 checksums: In cryptography, MD5 (Message-Digest algorithm 5) is a widely used cryptographic hash function with a 128-bit hash value. As an Internet standard (RFC 1321), MD5 has been employed in a wide variety of security applications and is also commonly used to check the integrity of files.

Object: The fundamental entities stored in Amazon S3. Objects consist of object data and metadata. The data portion is opaque to Amazon S3. The metadata is a set of name-value pairs that describe the object. These include some default metadata such as the date last modified and standard HTTP metadata such as Content-Type. The developer can also specify custom metadata at the time the Object is stored.

Port Scanning: A port scan is a series of messages sent by someone attempting to break into a computer to learn which computer network services, each associated with a "well-known" port number, the computer provides.

User entity: The entities that use the services of a service organization during some or all of the review period.

Service: Software or computing ability provided across a network (e.g., Amazon EC2, Amazon S3).

Service Organization: An organization or segment of an organization that provides services to user entities that are likely to be relevant to those user entities' internal control over financial reporting.

Signature Version 4: Signature Version 4 is the process to add authentication information to AWS requests. For security, most requests to AWS must be signed with an access key, which consists of an access key ID and secret access key.

Subservice Organization: A service organization used by another service organization to perform some of the services provided to user entities that are likely to be relevant to those user entities' internal control over financial reporting.

Virtual Instance: Once an AMI has been launched, the resulting running system is referred to as a virtual instance. All instances based on the same AMI start out identical and any information on them is lost when the instances are terminated or fail.

X.509: In cryptography, X.509 is an ITU-T standard for a Public Key Infrastructure (PKI) for Single Sign-On (SSO) and Privilege Management Infrastructure (PMI). X.509 specifies, among other things, standard formats for public key certificates, certificate revocation lists, attribute certificates and a certification path validation algorithm.