Security Essentials & Best Practices

Overview

Overview of the AWS cloud security concepts such as the AWS Security Center, Shared Responsibility Model, and Identity and Access Management.

AWS Security

What are your perceptions on cloud security?

At AWS, cloud security is job zero.

All AWS customers benefit from a data center and network architecture built to satisfy the requirements of the most security-sensitive organizations.

aws

Gain access to a world-class security team

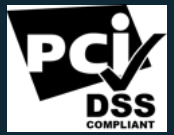
Where would some of the world's top security people like to work? At scale on huge challenges with huge rewards

So AWS has world-class security and compliance teams watching your back!

Every customer benefits from the tough scrutiny of other AWS customers

aws

Broad Accreditations & Certifications



Glacier Vault Lock
& SEC Rule 17a-4(f)

See https://aws.amazon.com/compliance/programs/ for full list

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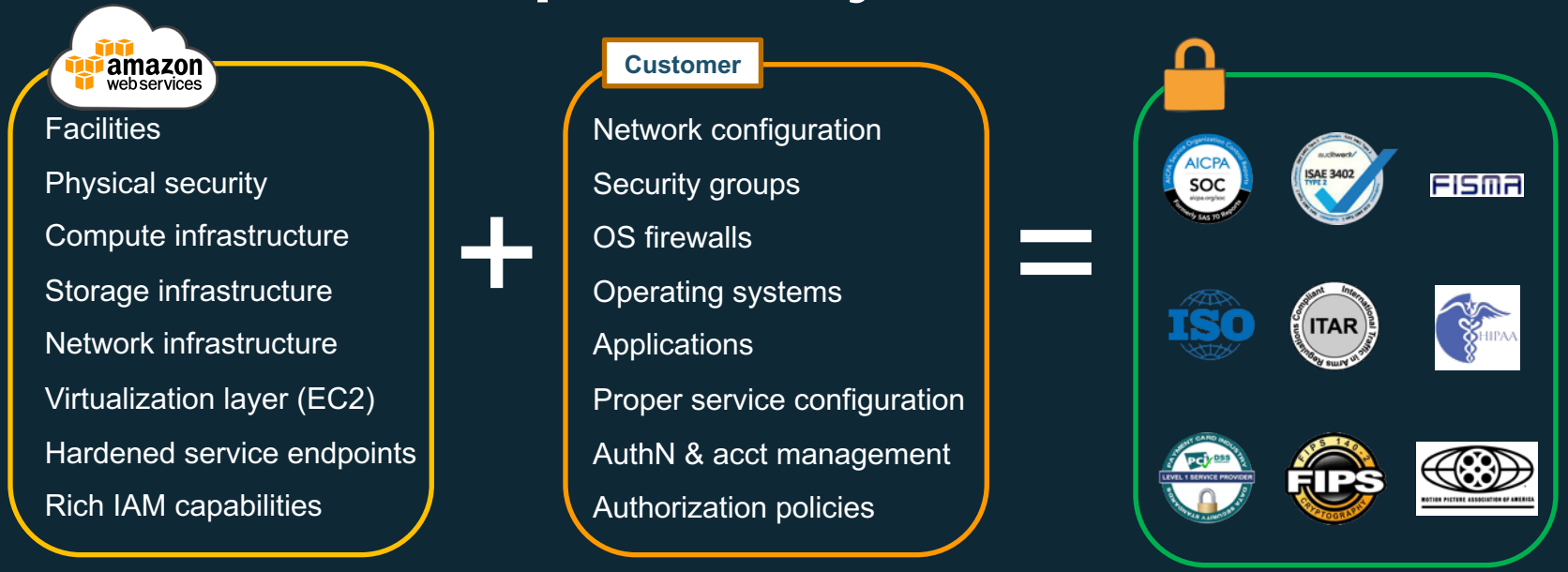
Shared Responsibility Model

AWS Shared Responsibility Model



- Scope of responsibility depends on the type of service offered by AWS: **Infrastructure, Container, Abstracted Services**
- Understanding who is responsible for what is critical to ensuring your AWS data and systems are secure!

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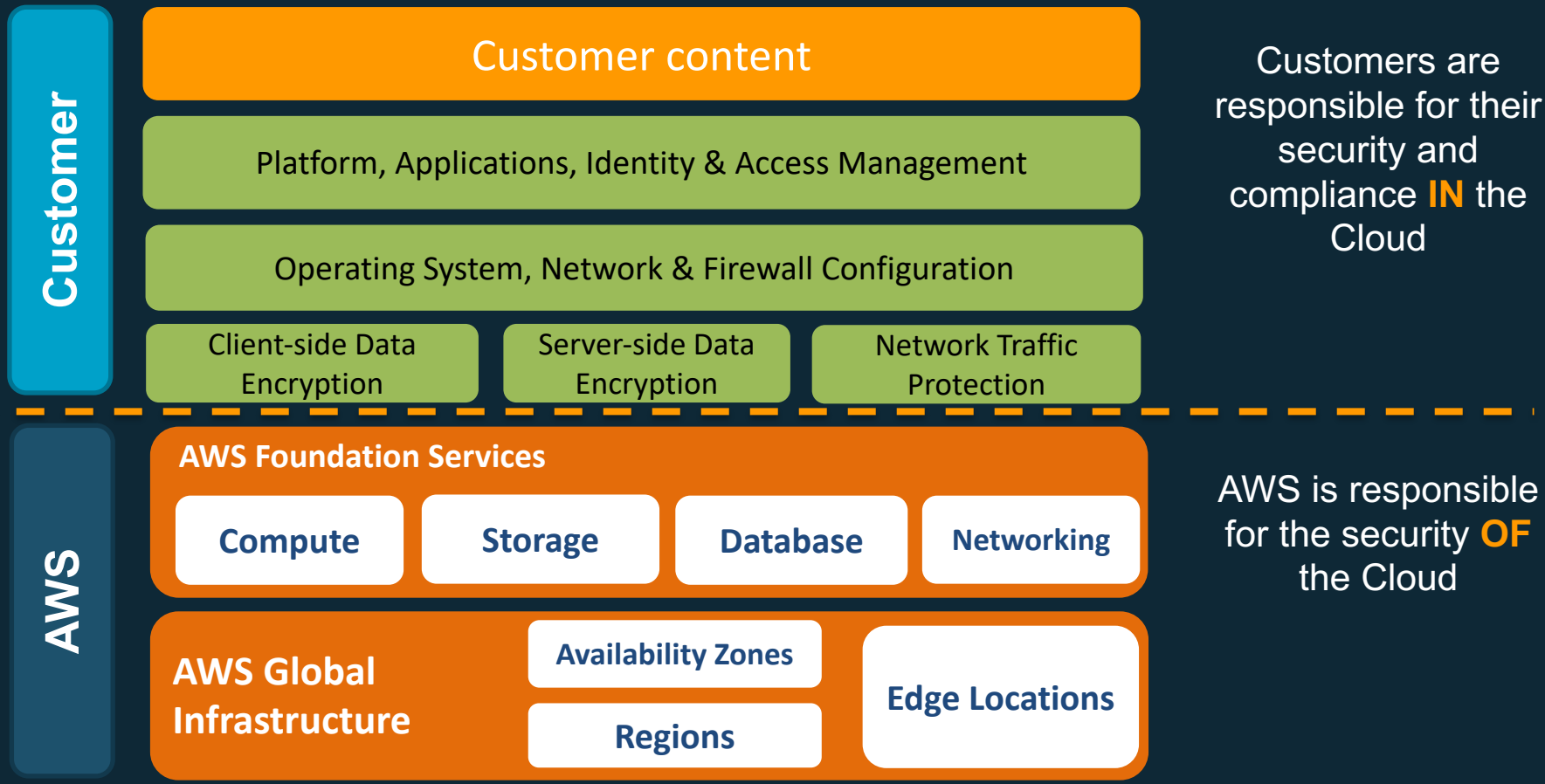
Shared Responsibility Model



Customers are responsible for their security and compliance **IN** the Cloud

AWS is responsible for the security **OF** the Cloud

Meet your own security objectives

Customer

Your own accreditation

Your own certifications

Your own external audits

Customer scope and effort is reduced

Better results through focused efforts

AWS

AWS Foundation Services

Compute | Storage | Database | Networking

AWS Global Infrastructure

Availability Zones

Regions

Edge Locations

Built on AWS consistent baseline controls

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AWS Responsibilities

Physical Security of Data Center

- **Amazon has been building large-scale data centers for many years.**
- **Important attributes:**
  - Non-descript facilities
  - Robust perimeter controls
  - Strictly controlled physical access
  - Two or more levels of two-factor authentication
- **Controlled, need-based access.**
- **All access is logged and reviewed.**
- **Separation of Duties**
  - Employees with physical access don't have logical privileges.

AWS Responsibilities

EC2 Security

- **Host (hypervisor) operating system**
  - Individual SSH keyed logins via bastion host for AWS admins
  - All accesses logged and audited
- **Guest (EC2 Instance) operating system**
  - Customer controlled (customer owns root/admin)
  - AWS admins cannot log in
  - Customer-generated keypairs
- **Stateful firewall**
  - Mandatory inbound firewall, default deny mode
  - Customer controls configuration via Security Groups

Network Security

- IP Spoofing prohibited at host OS level.
- Packet sniffing (promiscuous mode) is ineffective (protected at hypervisor level).
- Unauthorized Port Scanning a violation of TOS and is detected/blocked.
- Inbound ports blocked by default.

AWS Responsibilities

Configuration Management

- Most updates are done in such a manner that they will not impact the customer.
- Changes are authorized, logged, tested, approved, and documented.
- AWS will communicate with customers, either via email, the AWS Service Health Dashboard (http://status.aws.amazon.com/), or the AWS Personal Health Dashboard (https://phd.aws.amazon.com/) when there is a potential for service being affected.

Built for "Continuous Availability"

- **Scalable, fault tolerant services.**
- **All availability zones (AZs) are always on.**
  - There is no "Disaster Recovery Datacenter"
  - All managed to the same standards
- **Robust Internet connectivity**
  - Each AZ has redundant, Tier 1 ISP Service Providers
  - Resilient network infrastructure

AWS Responsibilities

Disk Management

- Proprietary disk management prevents customers from accessing each other's data.
- Disks wiped prior to use.
- Disks can also be encrypted by the customer for additional security.

Storage Device Decommissioning

- All storage devices go through process using techniques from:
  - DoD 5220.22-M ("National Industrial Security Program Operating Manual ").
  - NIST 800-88 ("Guidelines for Media Sanitization").
- Ultimately devices are:
  - Degaussed.
  - Physically destroyed.

Under the AWS Shared Responsibility Model

AWS Responsibility? or Customer Responsibility?

Configuring the Security Group rules that determine which ports are open on the EC2 Linux instance

Patching the operating system with the latest security patches

Installing camera systems to monitor the physical datacenters

Shredding disk drives before they leave a datacenter

Toggling on the Server-side encryption feature for S3 buckets

Preventing packet sniffing at the hypervisor level

Securing the internal network inside the AWS datacenters

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Under the AWS Shared Responsibility Model

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Identity and Access Management

What is Identity Management?

"…the management of individual **principals**, their **authentication**, **authorization**, and **privileges**

…with the goal of increasing security and productivity while decreasing cost, downtime and repetitive tasks."

(Wikipedia)

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AAA with AWS

Authenticate	Authorize	Audit
IAM Username/Password Access Key (+ MFA) Federation	IAM Policies	CloudTrail

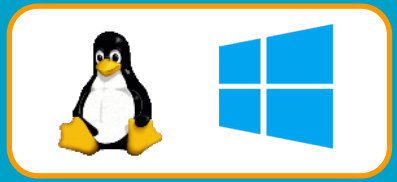
Considerations for Layers of Principals

Applications

- Identities: Application Users, Application Administrators

Operating Systems

- Identities: Developers, and/or Systems Engineers



Amazon Web Services

- **Identities: Developers, Solutions Architects, Testers, Software/Platform**
- **Interaction of AWS Identities:**
  - **Provisioning/deprovisioning EC2 instances and EBS storage.**
  - **Configuring Elastic Load Balancers.**
  - **Accessing S3 Objects or data in DynamoDB.**
  - **Accessing data in DynamoDB.**
  - **Interacting with SQS queues.**
  - **Sending SNS notifications.**

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AWS Principals

Account Owner ID (Root Account)

- Access to all subscribed services.
- Access to billing.
- Change Account settings, change AWS support plan, close AWS account.
- Register as a seller, sign up for GovCloud.

IAM Users, Groups and Roles

- Access to specific services.
- Access to console and/or APIs.
- Access to Customer Support (Business and Enterprise).

Temporary Security Credentials

- Access to specific services.
- Access to console and/or APIs.

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AWS Identity Authentication

Authentication: *How do we know you are who you say you are?*

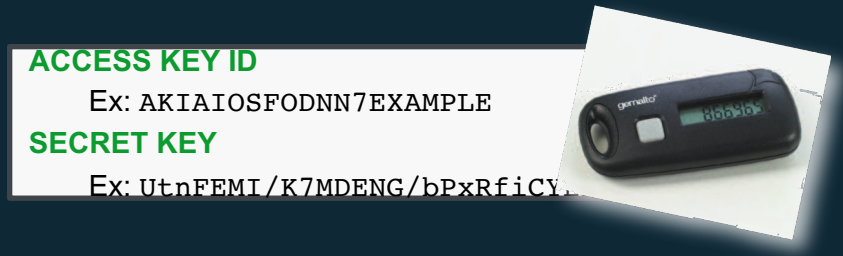
AWS Management Console

Login with **Username/Password** with optional **MFA** (recommended)

For time-limited access: **a Signed URL can** provide temporary access to the Console

API access

Access API using **Access Key + Secret Key**, with optional MFA



For time-limited access: Call the AWS Security Token Service (STS) to get a temporary AccessKeyId + SecretAccessKey + SessionToken

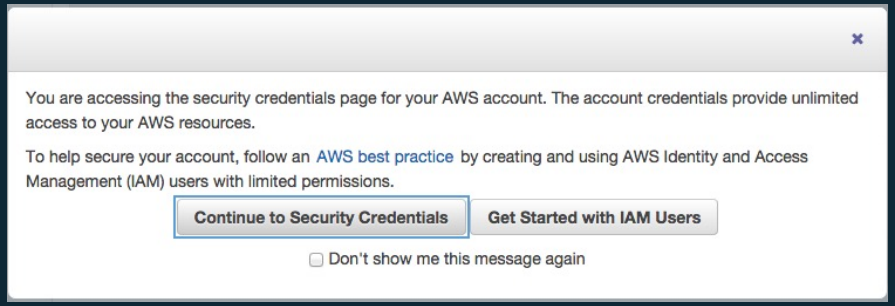
AWS Authorization and Privileges

Authorization: What are you allowed to do?

Account Owner (Root)

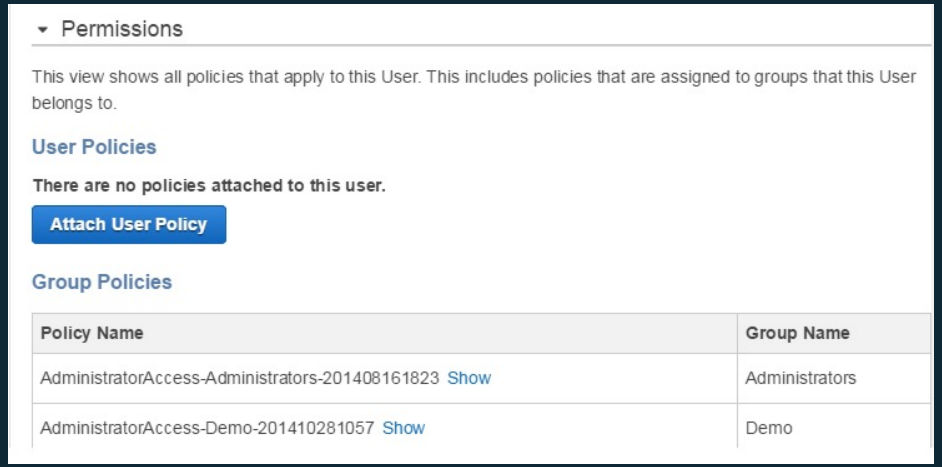
- Privileged for all actions.

Note: *Always associate the account owner ID with an MFA device and store it in a secured place!*



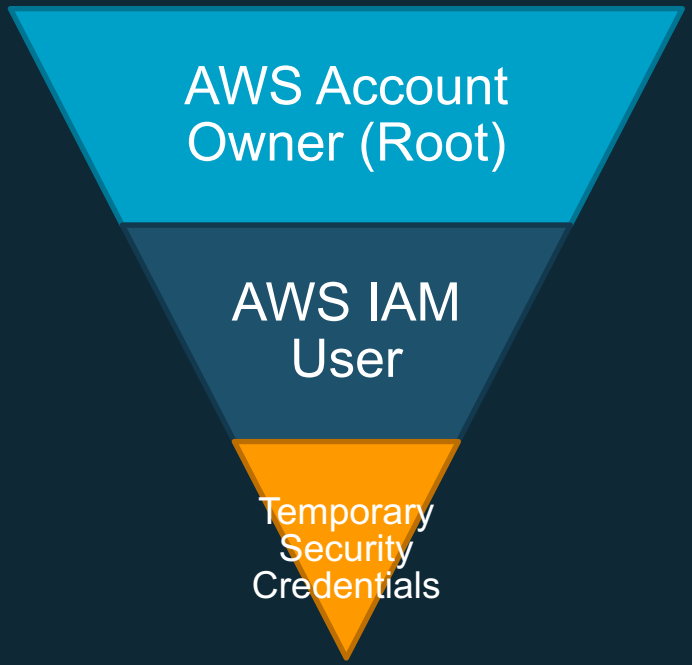
IAM Policies

- Privileges defined at User and Resource Level



AWS IAM Hierarchy of Privileges

Enforce principle of least privilege with Identity and Access Management (IAM) users, groups, and policies and temporary credentials.



Permissions	Example

Unrestricted access to all enabled services and resources.	`Action: *`
	`Effect: Allow`
	`Resource: *`
	`(implicit)`

Access restricted by Group and User policies	`Action:`
	`['s3:*','sts:Get*']`
	`Effect: Allow`
	`Resource: *`

Access restricted by generating identity and further by policies used to generate token	`Action: [ 's3:Get*' ]`
	`Effect: Allow`
	`Resource:`
	`'arn:aws:s3:::mybucket/*'`

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AWS Identity and Access Management (IAM)

Securely control access to AWS services and resources for your users.

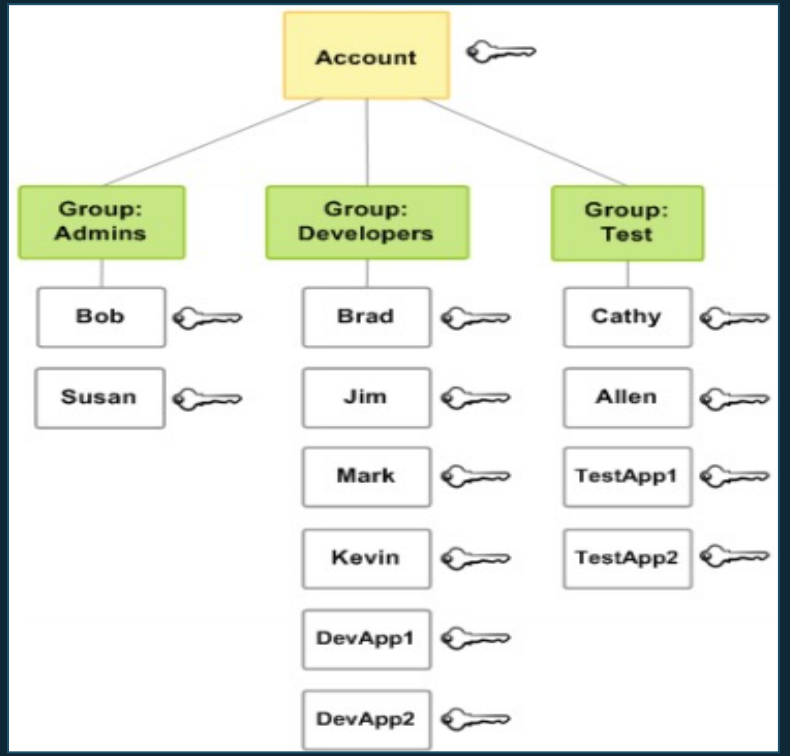
Username/ User

Manage groups of users

Centralized Access Control

Optional Configurations:

- Password for console access.
- Policies for controlling access AWS APIs.
- Two methods to sign API calls:
  - X.509 certificate
  - Access/Secret Keys
- Multi-factor Authentication (MFA)

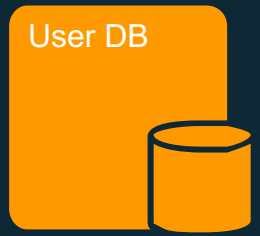


Identity and Access Management

Common approaches for Applications and Operating Systems

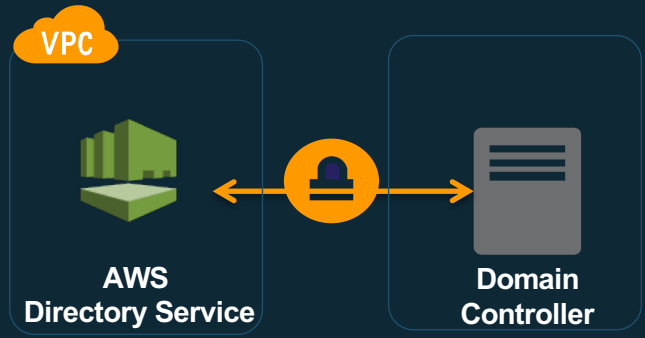
Local User Databases

- Local Password (passwd) files
- Local Windows admin accounts
- User Databases



LDAP Directories

- On-premise accessed over VPN.
- Replicated to AWS (read-only or read/write)
- Federated (one-way trusts, ADFS).
- Managed Samba-based directories via AWS Directory Services.



AWS Directory Service

Managed service for Active Directory

Use your existing Corporate Credentials for
- AWS-based applications
- AWS Management Console

Microsoft AD

Based on Microsoft Active Directory in Windows Server 2012 R2. Supports adding trust relationships with on-premises domains. Extend your schema using MS AD

Simple AD

A Microsoft Active-Directory compatible directory powered by Samba 4.

AD Connector

Connect to your on-premises Active Directory. Integrates with existing RADIUS MFA solutions.

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Encryption

How are you currently encrypting your data?

Encryption

Protecting data in-transit and at-rest.

Encryption In-Transit

- HTTPS
- SSL/TLS
- VPN / IPSEC
- SSH

Encryption At-Rest

- Object
- Database
- Filesystem
- Disk

Details about encryption can be found in the AWS Whitepaper, "Securing Data at Rest with Encryption".

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Encryption at Rest

Volume Encryption

- EBS Encryption
- Filesystem Tools
- AWS Marketplace/Partner

Object Encryption

- S3 Server Side Encryption (SSE)
- S3 SSE w/ Customer Provided Keys
- Client-Side Encryption

Database Encryption

- RDS MSSQL TDE
- RDS ORACLE TDE/HSM
- RDS MYSQL KMS
- RDS PostgreSQL KMS
- Redshift Encryption

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AWS Certificate Manager

A service that lets you easily provision, manage, and deploy public and private Secure Sockets Layer/Transport Layer Security (SSL/TLS) certificates for use with AWS services and your internal connected resources.

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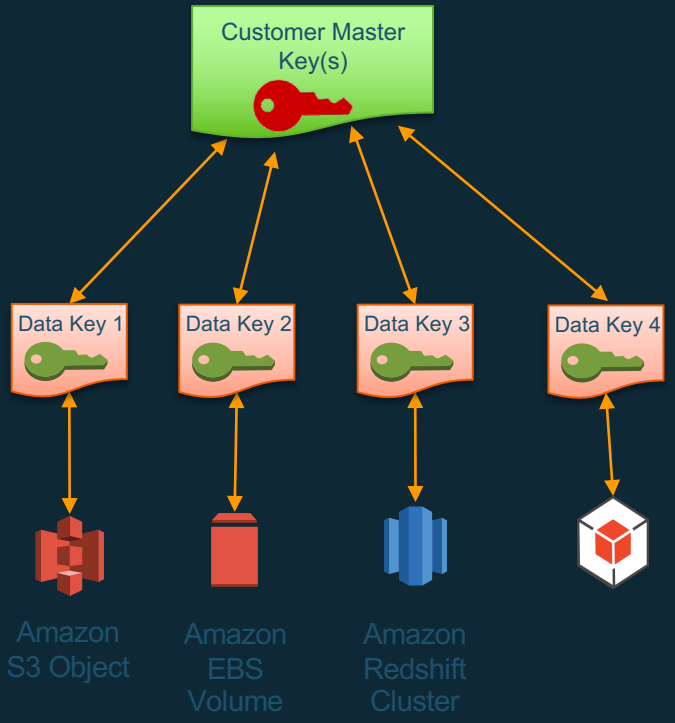
AWS Key Management Service

Managed service to create and manage cryptographic keys and control their use across a wide range of AWS services and in your applications.

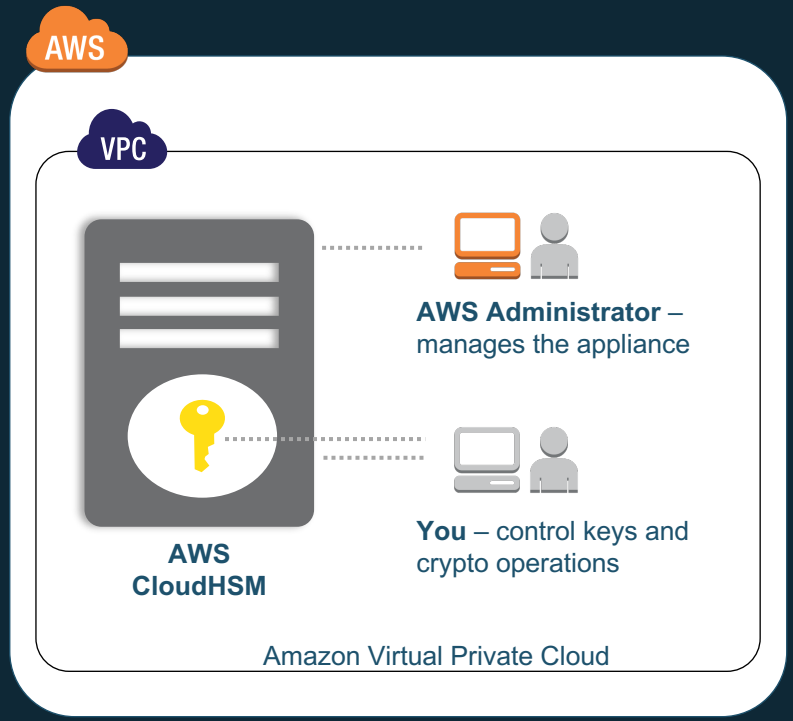


AWS CloudHSM

Help meet compliance requirements for data security by using a dedicated Hardware Security Module appliance with AWS.

- Dedicated, single-tenant hardware device
- Can be deployed as HA and load balanced

- Customer use cases:
  - Oracle TDE
  - MS SQL Server TDE
  - Setup SSL connections
  - Digital Rights Management (DRM)
  - Document Signing



Configuration Management

AWS CloudTrail

CloudTrail provides event history of your AWS account activity, including actions taken through the AWS Management Console, AWS SDKs, command line tools, and other AWS services.

Who?	When?	What?	Where to?	Where from?
Bill	3:27pm	Launch Instance	us-west-2	72.21.198.64
Alice	8:19am	Added Bob to admin group	us-east-1	127.0.0.1
Steve	2:22pm	Deleted DynamoDB table	eu-west-1	205.251.233.176


```
{
"Records": [
        {
        "eventVersion": "1.0",
        "userIdentity": {
            "type": "IAMUser",
            "principalId": "EX_PRINCIPAL_ID",
            "arn": "arn:aws:iam::123456789012:user/Alice",
            "accountId": "123456789012",
            "accessKeyId": "EXAMPLE_KEY_ID",
            "userName": "Alice",
            "sessionContext": {
                "attributes": {
                    "mfaAuthenticated": "false",
                    "creationDate": "2014-03-25T18:45:11Z"
                }
            }
        },
        "eventTime": "2014-03-25T21:08:14Z",
        "eventSource": "iam.amazonaws.com",
        "eventName": "AddUserToGroup",
        "awsRegion": "us-east-1",
        "sourceIPAddress": "127.0.0.1",
        "userAgent": "AWSConsole",
        "requestParameters": {
            "userName": "Bob",
            "groupName": "admin"
        },
        "responseElements": null
    },
    ...additional entries
  ]
}
```

AWS CloudWatch

Monitoring services for AWS Resources and AWS-based Applications.

What does it do?

- Collect and Track Metrics
- Monitor and Store Logs
- Set Alarms (react to changes)
- View Graphs and Statistics

How can you use it?

Monitor CPU, Memory, Disk I/O, Network, etc.	← CloudWatch Metrics
React to application log events and availability	← CloudWatch Logs / CloudWatch Events
Automatically scale EC2 instance fleet	← CloudWatch Alarms
View Operational Status and Identify Issues	← CloudWatch Dashboards

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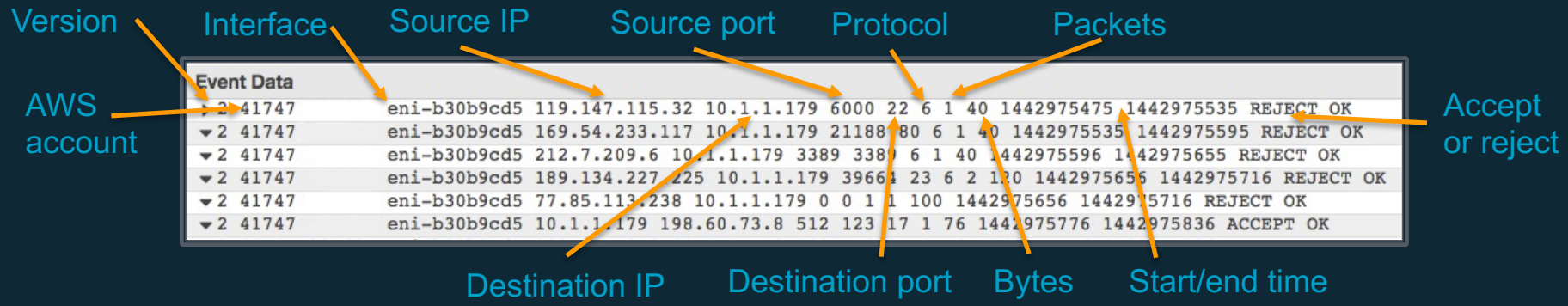
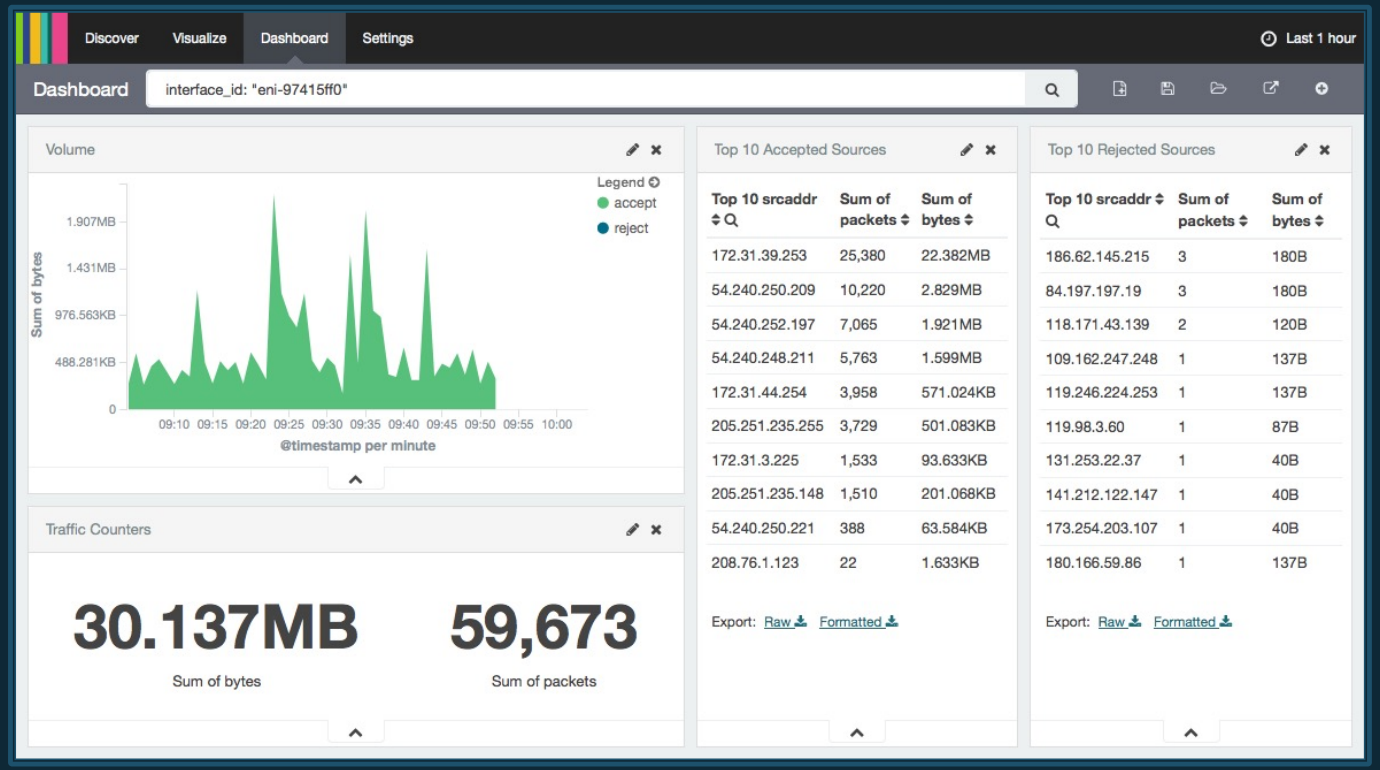
VPC Flow Logs

- Agentless
- Enable per ENI, per subnet, or per VPC
- Logged to AWS CloudWatch Logs
- Create CloudWatch metrics from log data
- Alarm on those metrics



VPC Flow Logs



- Amazon Elasticsearch Service
- Amazon CloudWatch Logs subscriptions

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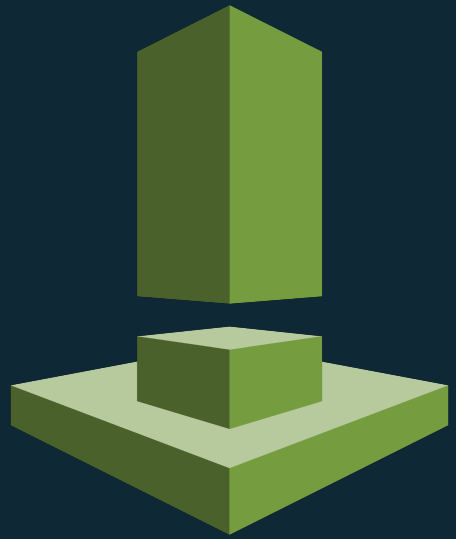
Amazon Inspector

- Vulnerability Assessment Service
  - Built from the ground up to support DevSecOps
  - Automatable via APIs
  - Integrates with CI/CD tools
  - On-Demand Pricing model
  - Static & Dynamic Rules Packages
  - Generates Findings



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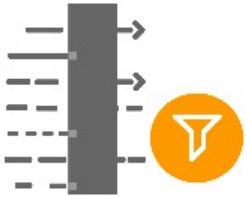
AWS WAF



Web Traffic Filtering with Custom Rules

Create custom rules that can block, allow or monitor requests based on IP address, HTTP headers, or a combination of both.

Malicious Request Blocking

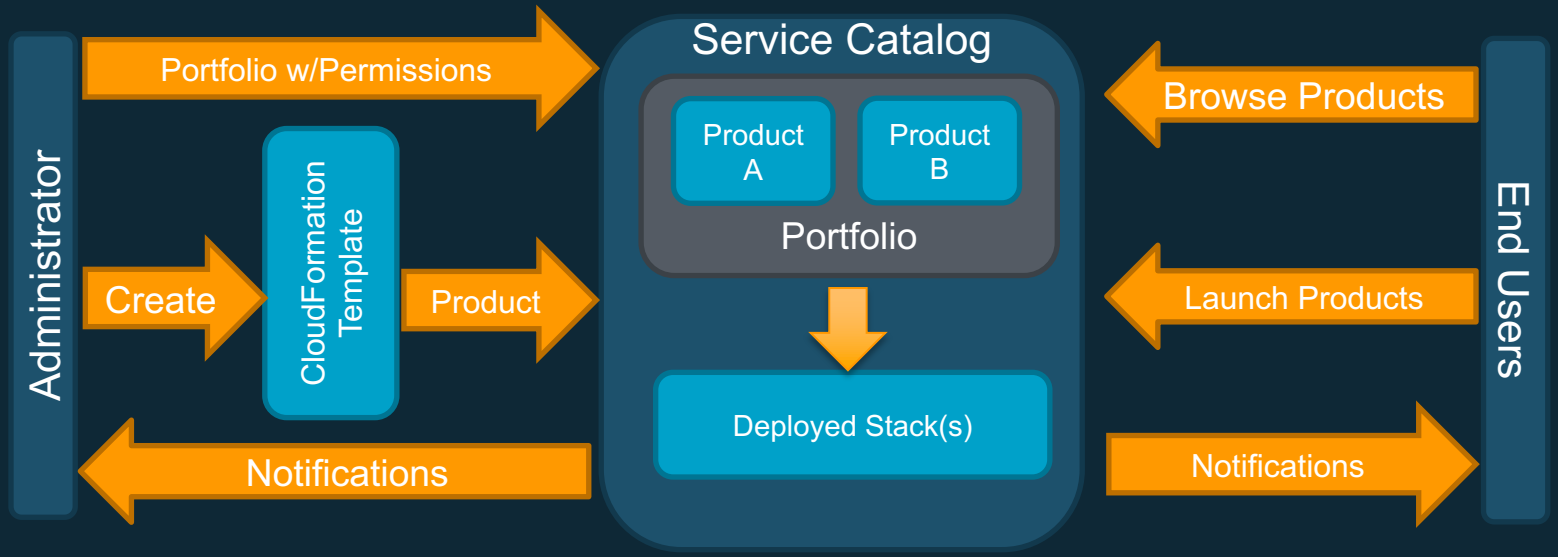
AWS WAF can recognize and block common web application security risks like SQL injection (SQLi) and cross-site scripting (XSS).

Active monitoring & tuning

Monitor and configure the requests that are being blocked and allowed by the Web ACL rules.

AWS Service Catalog

Self-service portal for creating and managing resources in AWS.



- Create and manage approved catalogs of resources.
- End users browse and launch products via self-service portal.
- Control user access to applications or AWS resources per compliance needs.
- Extensible via API to existing self-service frameworks.

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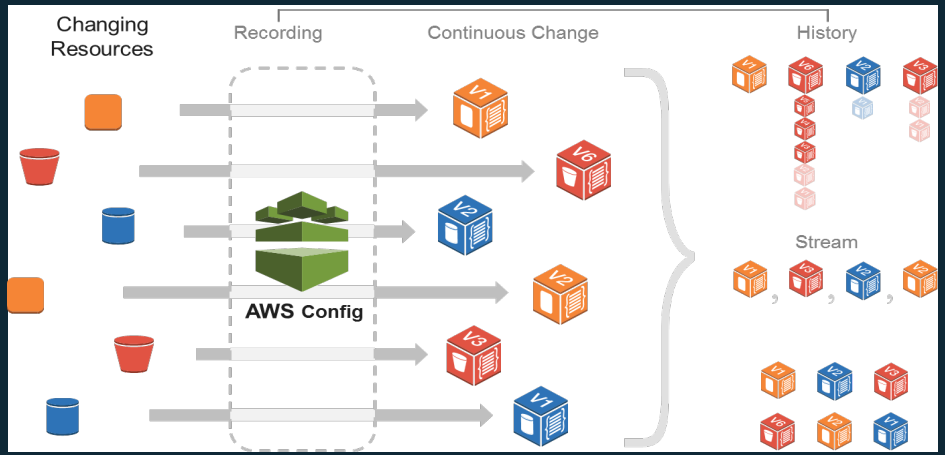
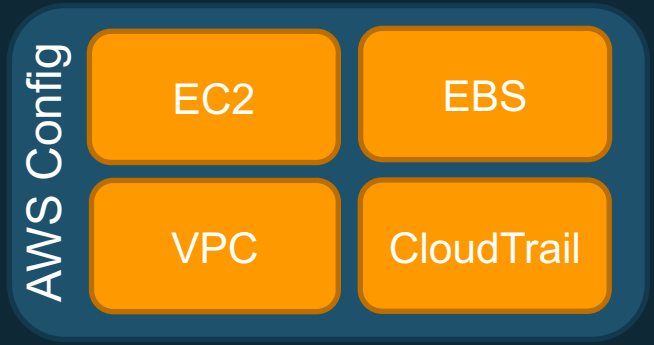
AWS Config

Managed service for tracking AWS inventory and configuration, and configuration change notification.





Security Analysis

Audit Compliance

Change Management

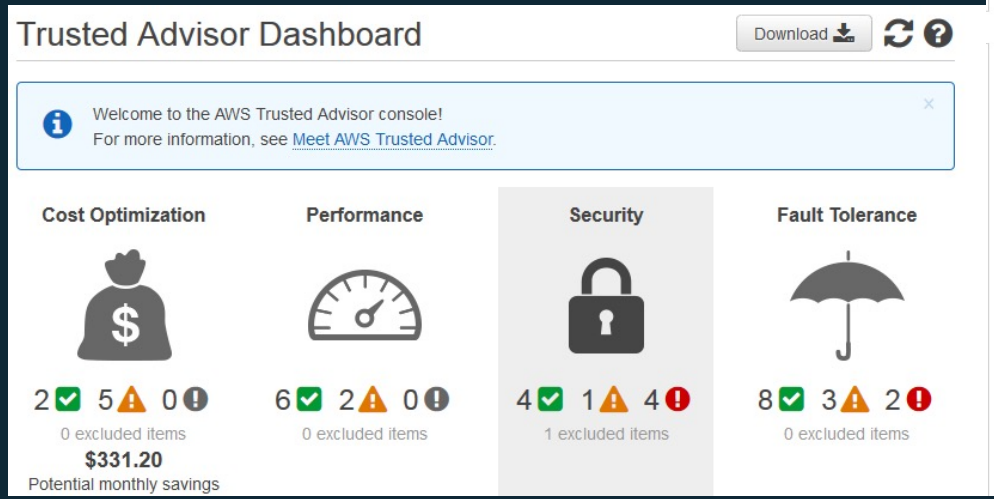
Troubleshooting

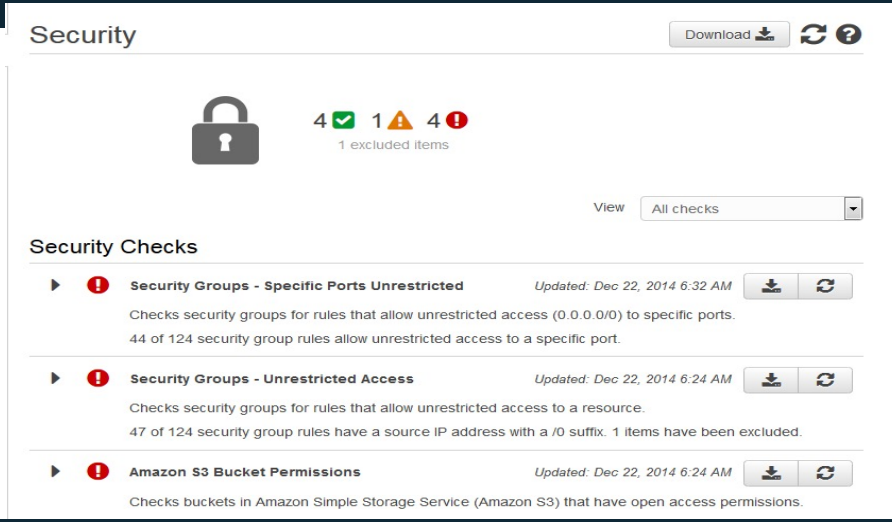
Discovery

Additional Best Practices

AWS Trusted Advisor

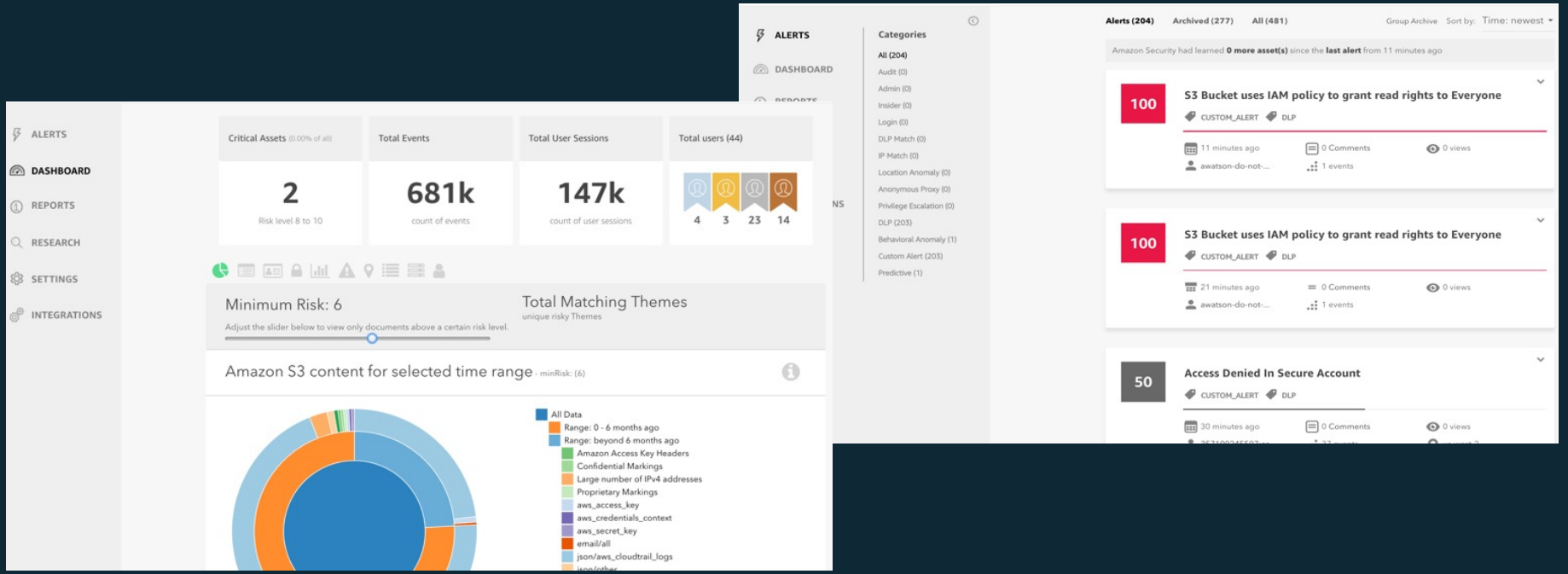
Leverage Trusted Advisor to analyze your AWS resources for best practices for availability, cost, performance and security.



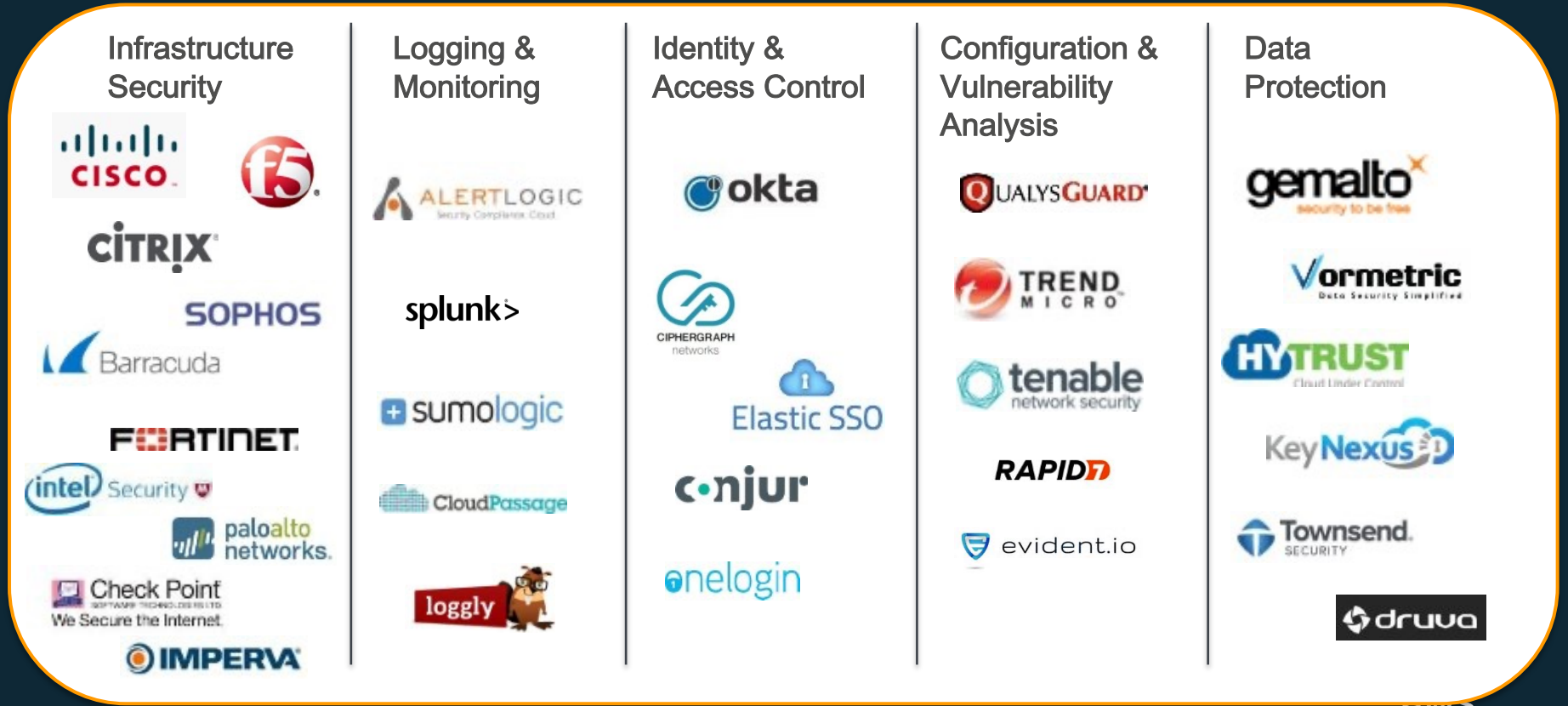


Amazon Macie

Leverage Amazon Macie to help prevent data loss in AWS.



AWS Marketplace Security Partners



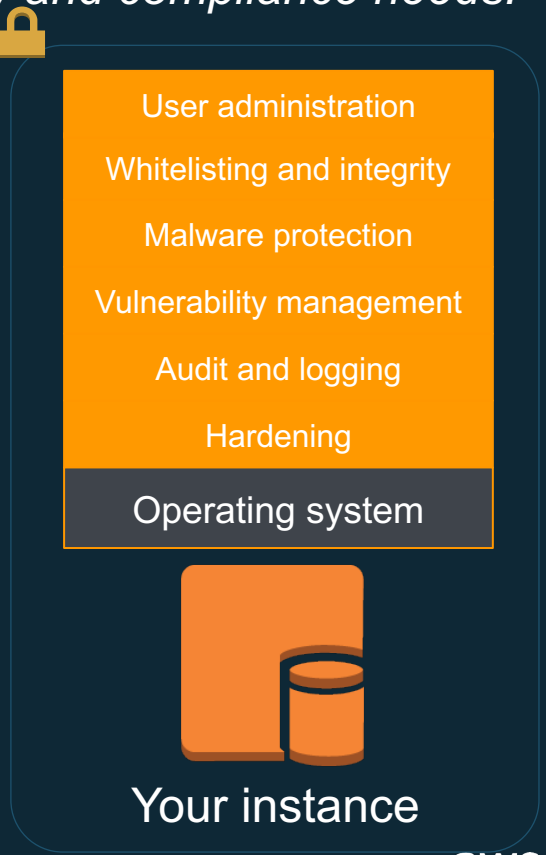
Enforce consistent security on your hosts

Configure and harden EC2 instances based on security and compliance needs.

Host-based Protection Software

Restrict Access Where Possible

Launch with IAM Role



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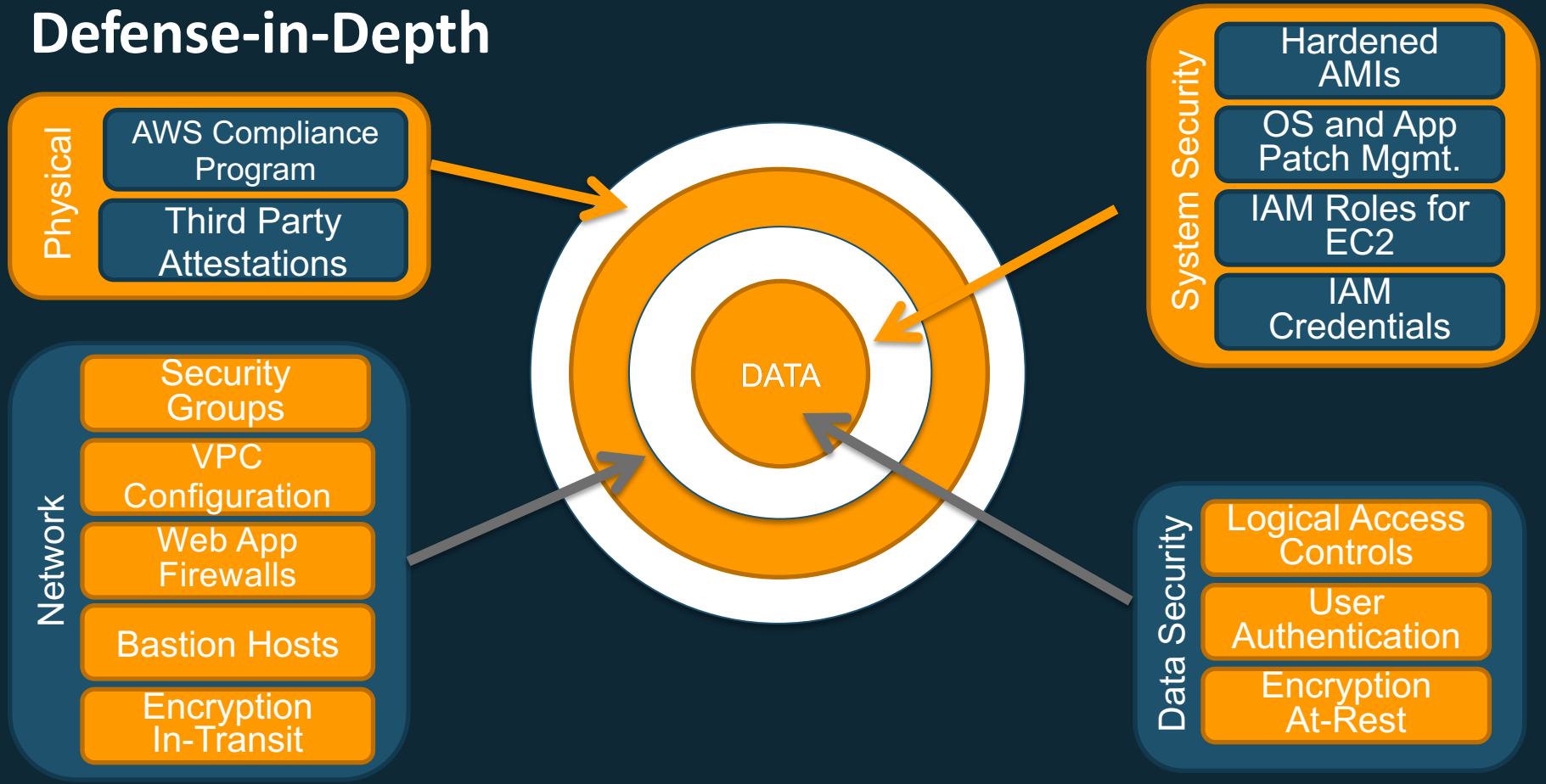
Defense-in-Depth



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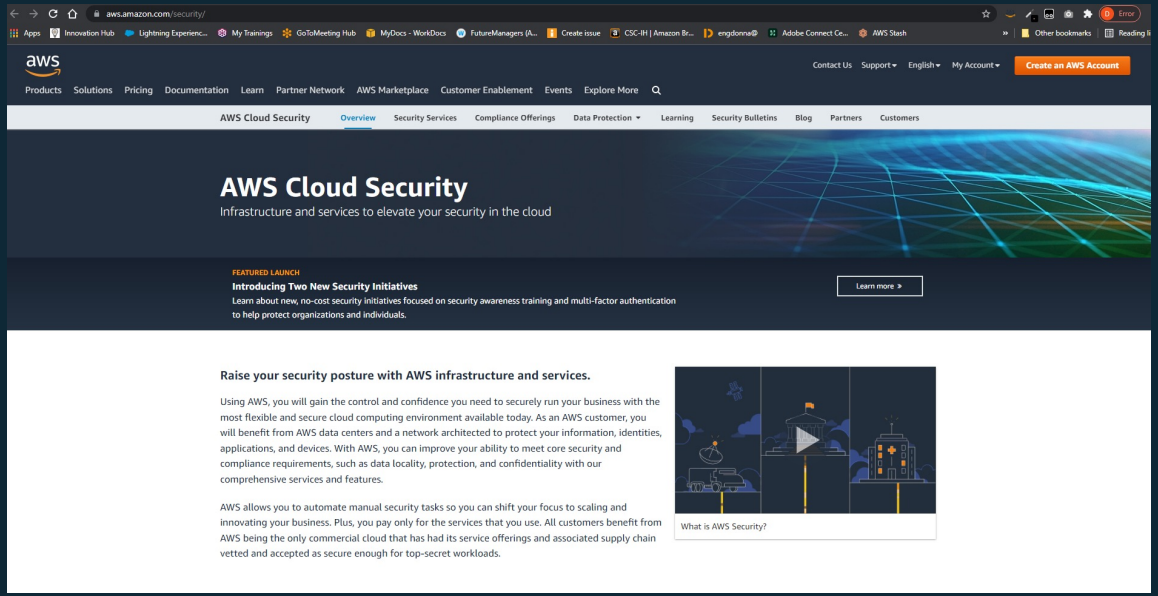
AWS Security Center

AWS Security Center

Comprehensive security portal to provide a variety of security notifications, information and documentation.

http://aws.amazon.com/security



Security Whitepapers

- Overview of Security Process
- AWS Risk and Compliance
- AWS Security Best Practices

Security Services

Compliance Offerings

Data Protection

Learning

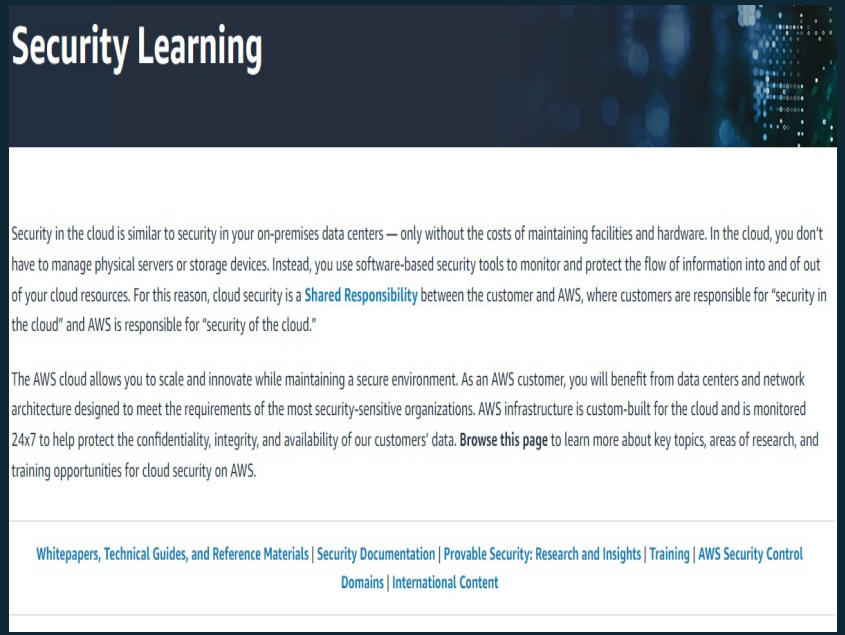
Security Bulletins

Report Suspicious Emails

Security Resources

http://aws.amazon.com/security/security-resources/

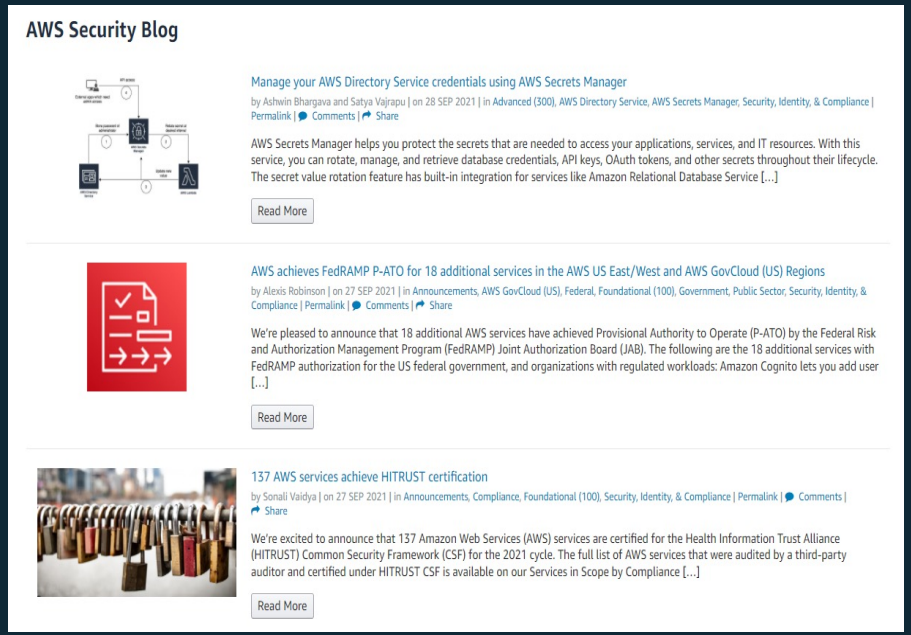
Developer Information, Articles and Tutorials,
Security Products, and Whitepapers



AWS Security Blog

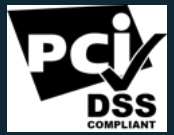
http://blogs.aws.amazon.com/security/

Subscribe to the blog – it's a great way to stay up-to-date on AWS security and compliance.



AWS Compliance

List of compliance, assurance programs and resources:
http://aws.amazon.com/compliance/.



Glacier Vault Lock
& SEC Rule 17a-4(f)

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Questions