AWS Security

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WAY TO REINVENT YOURSELF

Today’s Topics

- General Cyber Security Concepts
- Cyber Security Tools & Technology
- AWS Security Tools & Technology

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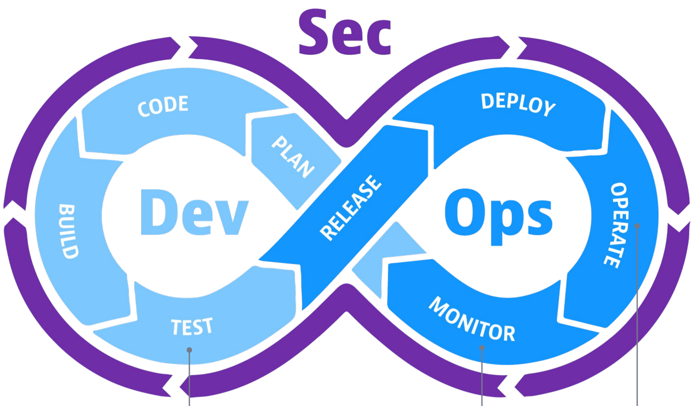
Outcomes

By the end of the class, you should be able to ...

- **Explain defense-in-depth**
- **Describe various security tools and what purpose they serve**
- **Explain AWS security tooling and how it supports defense-in-depth**

1 General Cyber Security Concepts

DevSecOps



- “DevOps” has extended to “**DevSecOps**”
- **Security is integrated** with development and operations
- It’s important to understand **security concepts and tooling**

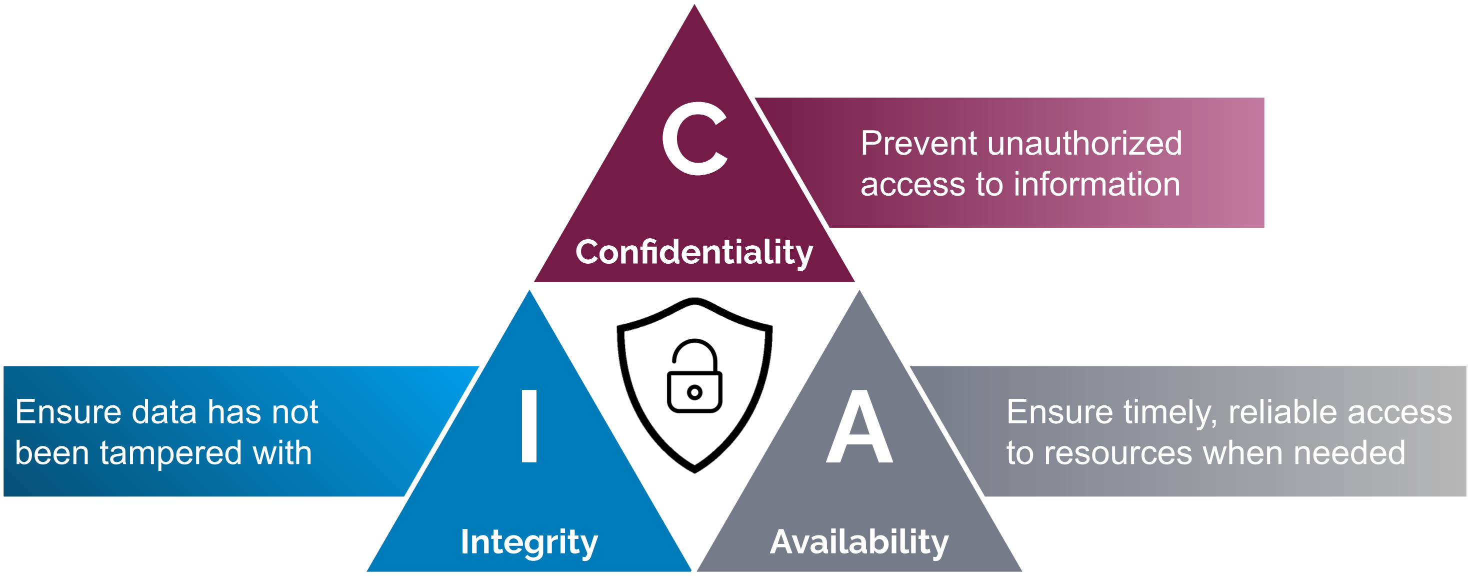
- Enforce configuration
- e.g. Firewall rules

- Monitor for security incidents
- e.g. Botnets

- Add security testing to code tests
- e.g. SQL Injection

examples of security integrated with development and operations

CIA Principles of Cyber Security

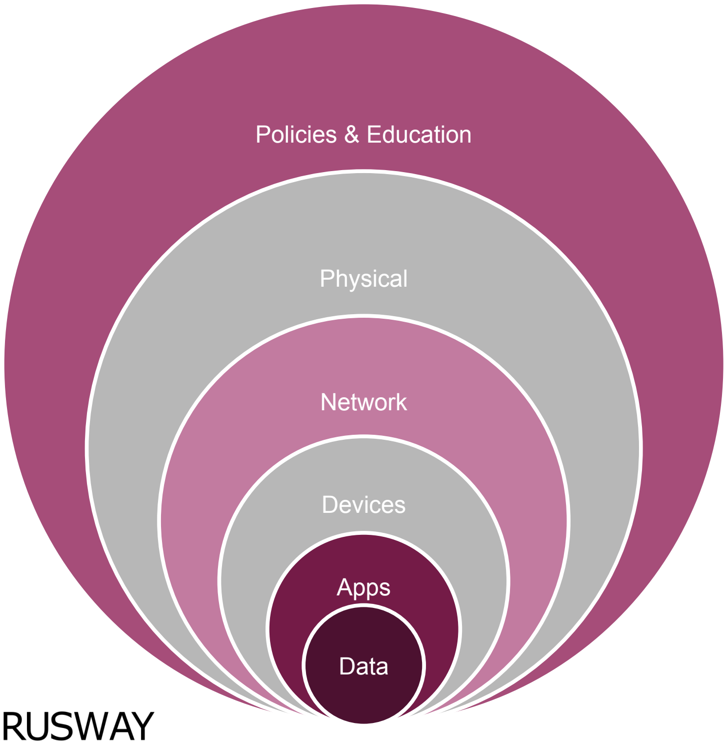


Confidentiality: Prevent unauthorized access to information

Integrity: Ensure data has not been tampered with

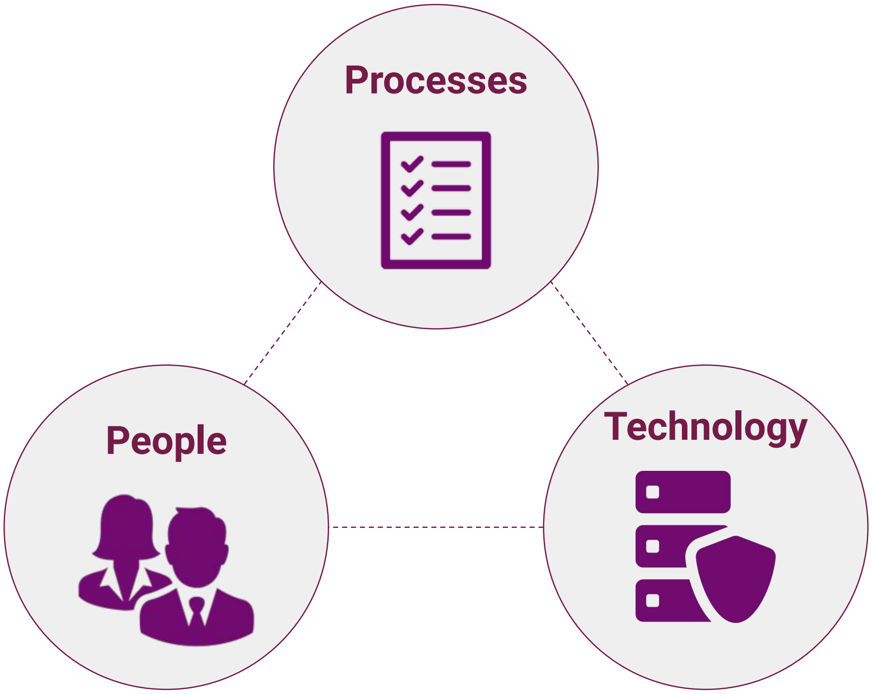
Availability: Ensure timely, reliable access to resources when needed

Defense-in-Depth



- Best practice for information security
- Layered approach
- No silver bullet at any layer

Cyber Security: More Than Technology



- **Technology plays a part** in cyber security
- Must be **complemented with policies and procedures**
- **Educating** people is also key

Preventative vs. Detective Controls

*A security control is a **safeguard** for an information system designed to **protect the confidentiality, integrity, and availability** of its information and to meet a set of defined **security requirements***

Detective

- **Identifies** threats, **logs** events and sends **alerts**
- Requires **manual or automated remediation**

Preventative

- Automatically **disallows** actions
- Can lead to **stopping legitimate** behavior

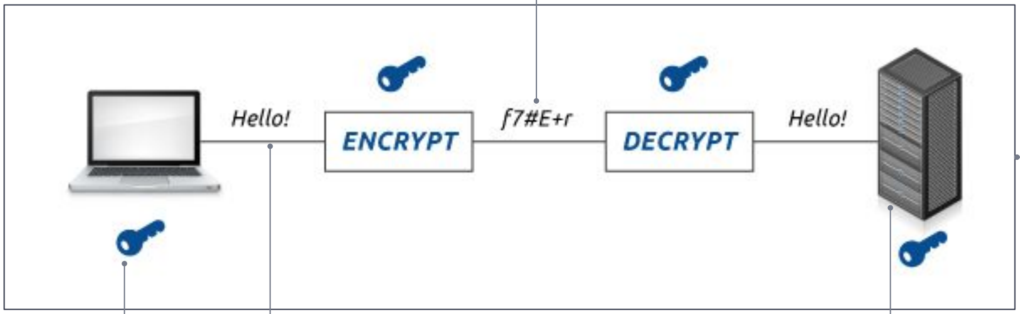
Compliance Regulations

- Cyber security and data protection regulations are defined sets of **policies, procedures and controls**
- They can be **industry specific** or more **generic**
- Organizations must undergo **audits** to prove compliance

2 Security Solutions

Encryption

Encryption is the means by which information is converted into **a secret code** so that its meaning is hidden

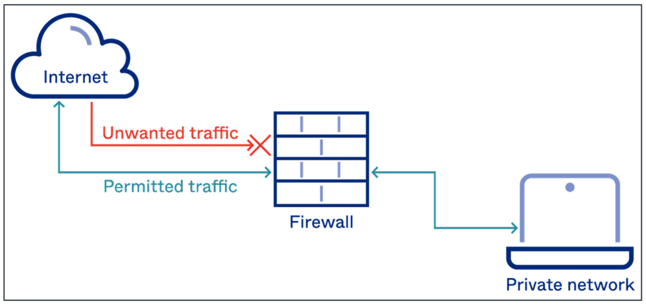


Encrypting data has a **performance impact**, although this has **improved greatly** in recent years

Data can be encrypted **in-transit** or **at-rest**

Encryption algorithms use **keys** to convert data. Without knowing an algorithm's key, it is **virtually impossible to decrypt the data**

Firewall



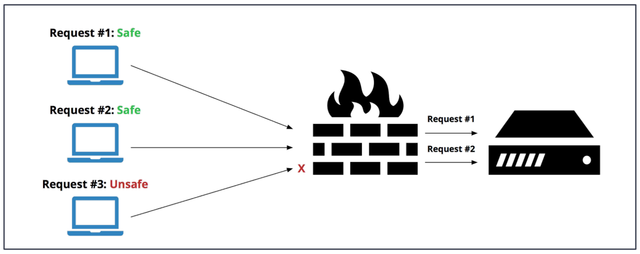
- **Network device** that controls inbound and outbound network traffic based on a set of security rules

- Typically control which traffic can ingress to or egress from an **internal network to an external network** (e.g. Internet)

- Can be an **appliance** (HW+SW) or just SW

- Today's firewalls are quite sophisticated and control traffic based on many factors:
  - **IP, port and protocol**
  - **Packet inspection**
  - **Anti-virus modules**
  - **Known bad IPs and domains**

Web Application Firewall (WAF)

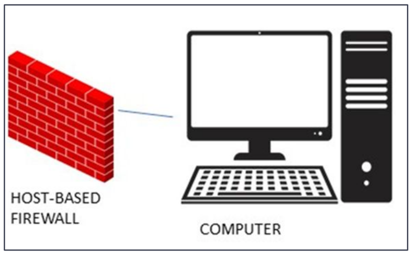


- Network device that operates specifically at protocol **layer 7** and monitors **HTTP traffic**

- Typically protects web applications against specific attacks:
  - **cross-site forgery**
  - **cross-site-scripting (XSS)**
  - **SQL injection**
  - **distributed-denial-of-service (DDOS)**

- Operates via a **set of rules** (policies)

Host-Based Firewall



- A **software-based** firewall **installed on a host** to monitor and control incoming and outgoing network traffic
- Operates at layers 3 & 4 of the OSI model
  - i.e. **IP, port and protocol**
- Examples:
  - **Windows Defender**
  - **IPTables**

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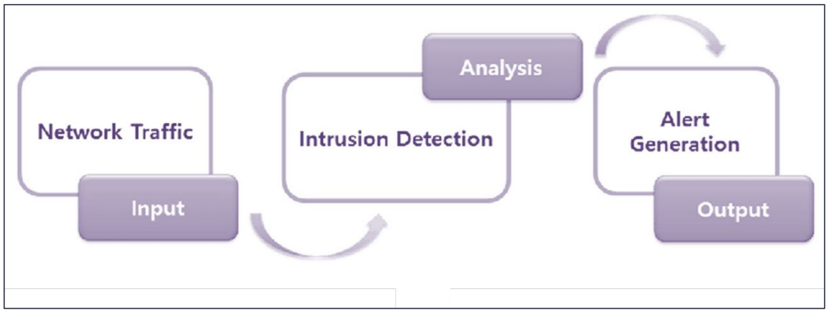
Intrusion Detection and Prevention



- Intrusion detection systems (**IDS**) **monitor and analyze** network traffic for for signs of imminent threats
- Intrusion prevention systems (**IPS**) go **one step further** and **block traffic** that pose such threats
- Together, IDS/IPS solutions are typically a module in a "**Next Generation Firewall**" (**NGFW**)
- Typically use 4 types of algorithms:
  - **signature-based** detection
  - **anomaly-based** detection
  - **stateful protocol** analysis
  - **reputation** analysis
- These are **dynamic rules** applied to network packets

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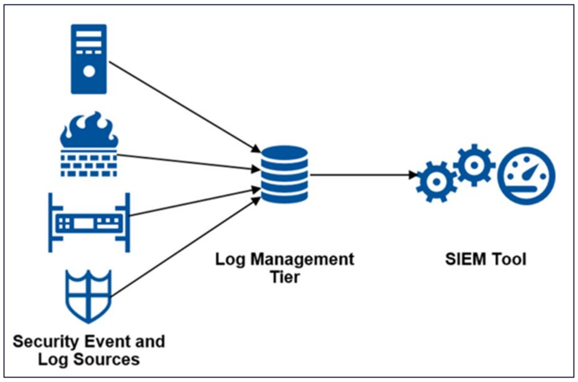
Security Information and Event Management (SIEM)



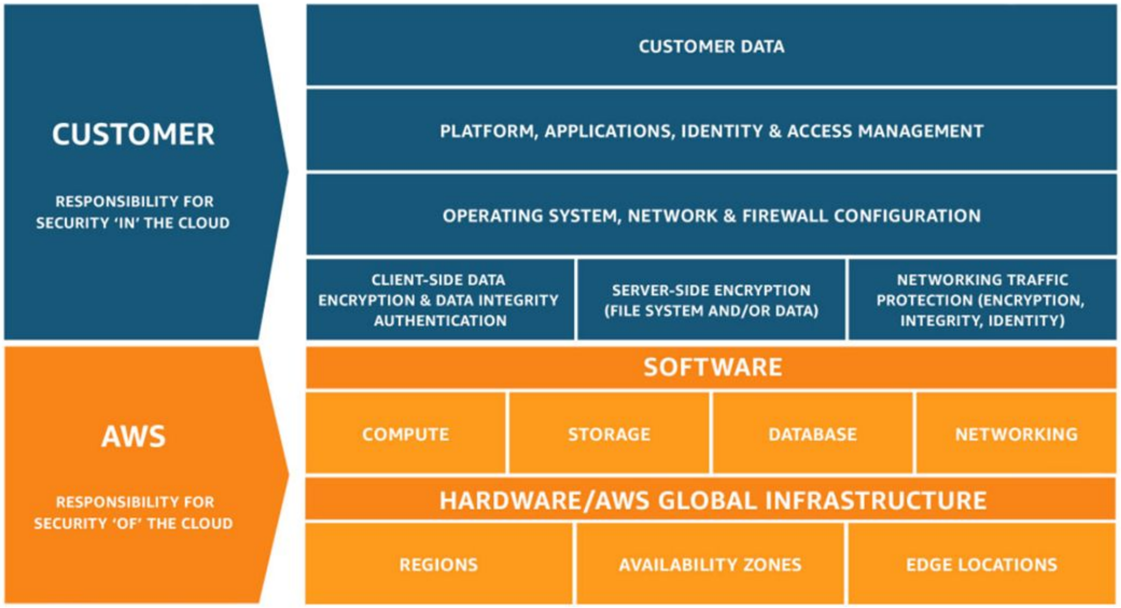
- A **SIEM** is a device that **ingests and aggregates logs**, including network log information
- Can perform analysis by cross-referencing various log information to **identify network-related threats**
- Unlike IDS/IPS, this type of **analysis is based on logs**, rather than traffic packets

Vulnerability Scanners

- After operating systems and software is released into the market, quite often **security vulnerabilities** are identified
- These vulnerabilities can be **exploited by hackers** in order to gain access to systems
- A publicly available **CVE ("common vulnerabilities and exposures") database** lists the vulnerabilities and remedies
- A vulnerability scanner **identifies unremediated exposures in hosts** within your environment

3 AWS Security Services

Shared responsibility model



CUSTOMER

RESPONSIBILITY FOR SECURITY 'IN' THE CLOUD

CUSTOMER DATA

PLATFORM, APPLICATIONS, IDENTITY & ACCESS MANAGEMENT

OPERATING SYSTEM, NETWORK & FIREWALL CONFIGURATION

CLIENT-SIDE DATA ENCRYPTION & DATA INTEGRITY AUTHENTICATION

SERVER-SIDE ENCRYPTION (FILE SYSTEM AND/OR DATA)

NETWORKING TRAFFIC PROTECTION (ENCRYPTION, INTEGRITY, IDENTITY)

AWS

RESPONSIBILITY FOR SECURITY 'OF' THE CLOUD

SOFTWARE

COMPUTE

STORAGE

DATABASE

NETWORKING

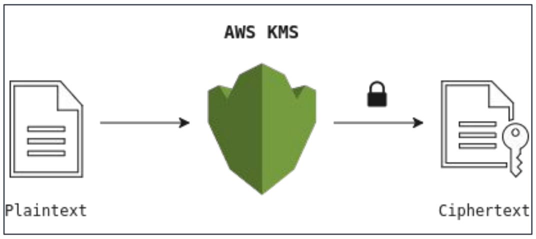
HARDWARE/AWS GLOBAL INFRASTRUCTURE

REGIONS

AVAILABILITY ZONES

EDGE LOCATIONS

AWS Key Management Service (KMS)



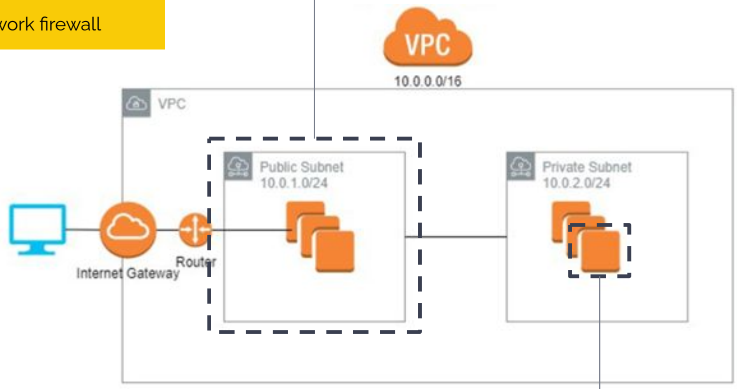
- Encrypts **data at rest**
  - EBS, S3, EFS, RDS, DynamoDB, more
- **Centralized management**
  - create, delete, view, set policies
  - Automatic **key rotation**
- Performance impact is **negligible**
- Permissions governed by **IAM and Key Policies**
- Must be cautious about **permissions and protecting keys from deletion**

KMS Key Types

Type of KMS Key	Specific to Account?	Customer Manages?	Automatic Rotation	Key Policy Possible?
Customer Managed Key	Yes	Yes	Optional	Yes
AWS Managed Key	Yes	No	Every 3 yrs.	No
AWS Owned Key	No	No	AWS Dependent	No

Security Groups and NACLs

- NACLs are firewall rules applied at the subnet level
- IP, Port & Protocol (i.e. layers 3, 4 protection)
- ***Similar*** to a basic network firewall



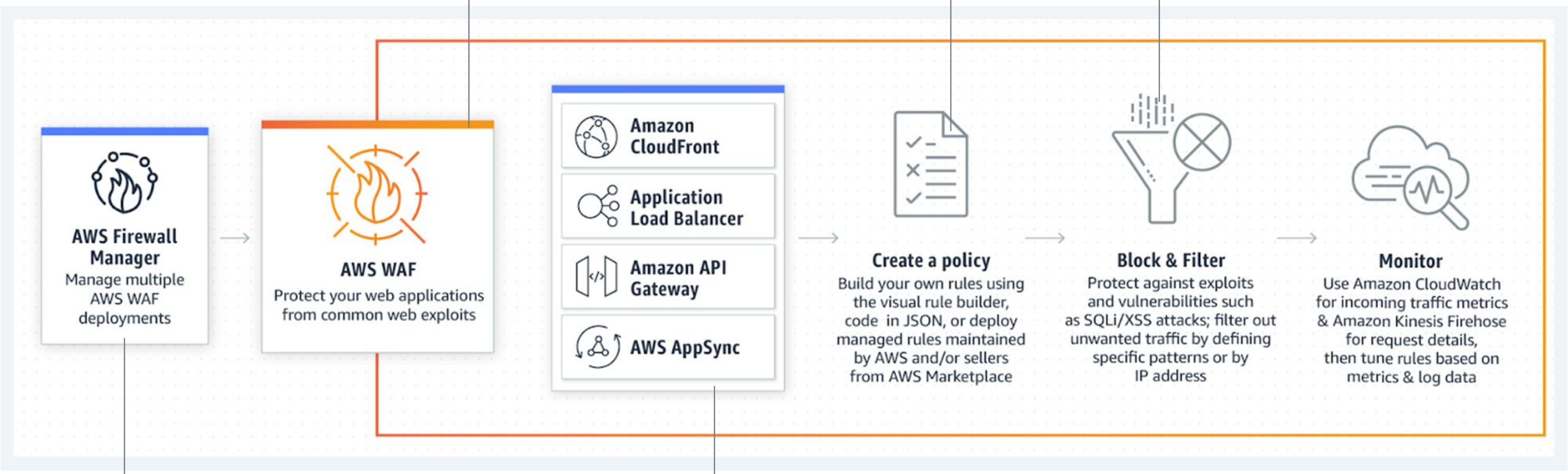
- Security Groups are firewall rules applied at the instance level
- IP, Port & Protocol (i.e. layers 3, 4 protection)
- ***Similar*** to a host-based firewall
- However, they do not belong to or run on the host

AWS WAF

- Functionality is same as a standard web application firewall
  - protect against web exploits
  - SQL injection, cross-site scripting, etc…

- Has available “rule packages”
  - AWS Managed
  - 3rd Party Vendors

- Can run in detective or preventative mode



AWS Firewall Manager
Manage multiple AWS WAF deployments

AWS WAF
Protect your web applications from common web exploits

Create a policy
Build your own rules using the visual rule builder, code in JSON, or deploy managed rules maintained by AWS and/or sellers from AWS Marketplace

Block & Filter
Protect against exploits and vulnerabilities such as SQLi/XSS attacks; filter out unwanted traffic by defining specific patterns or by IP address

Monitor
Use Amazon CloudWatch for incoming traffic metrics & Amazon Kinesis Firehose for request details, then tune rules based on metrics & log data

- Can manage rules centrally and apply to all endpoints in an organization

- Works with AWS endpoints

AWS Network Firewall

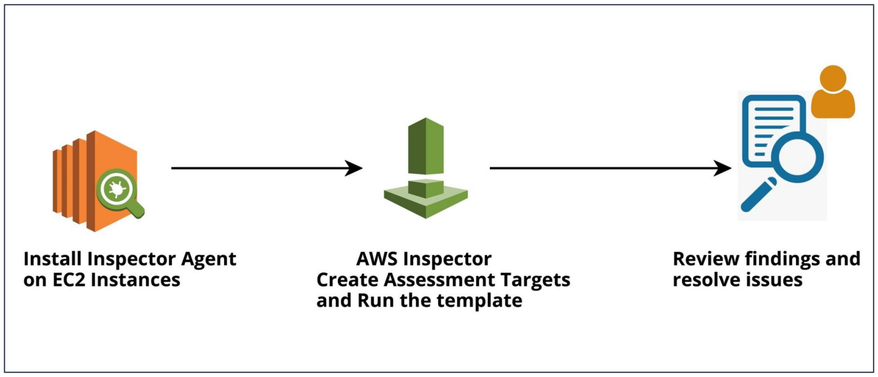
Going beyond IP/Port/Protocol filtering

Intrusion Prevention (IPS)
Preventative
Signature based IPS, centralized threat intelligence

FQDN & IP Blacklisting
Preventative
Guard against botnets, misuse

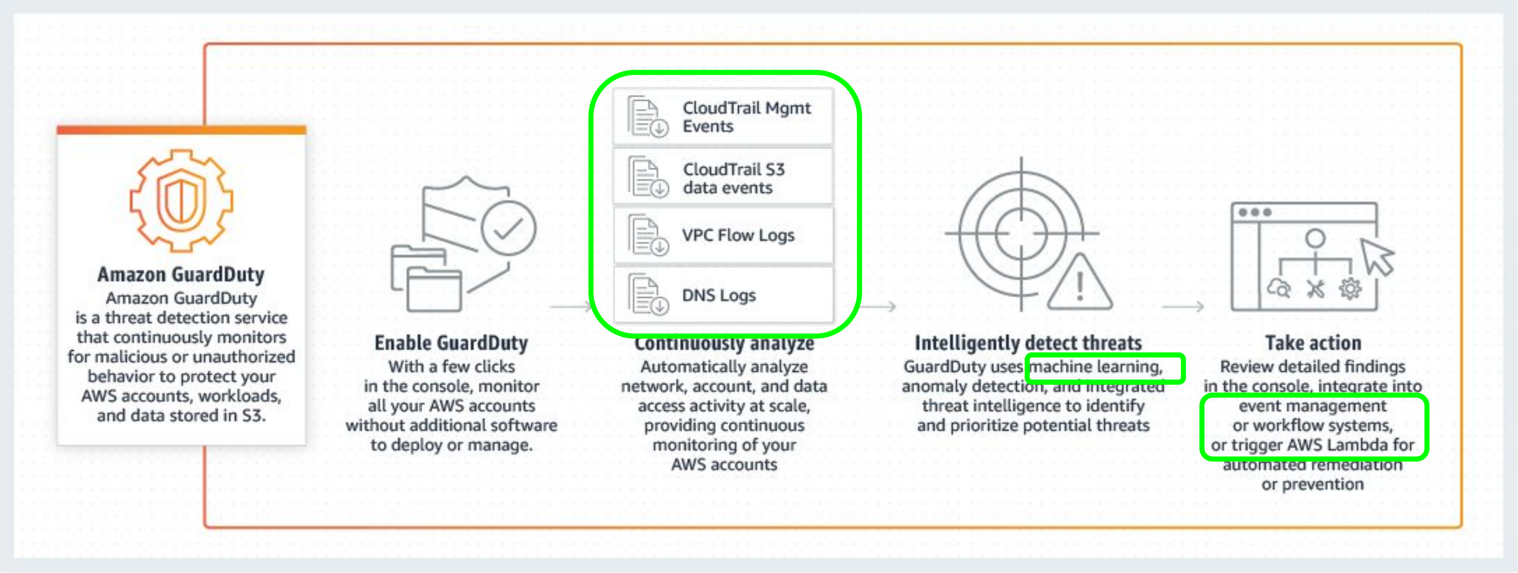
Stateful Packet Inspection
Preventative
Improved security through dynamic/deeper packet inspection

AWS Inspector


Install Inspector Agent on EC2 Instances
AWS Inspector Create Assessment Targets and Run the template
Review findings and resolve issues

- **Vulnerability management** service that can continuously scans AWS workloads for vulnerabilities
    - EC2 and ECR
- Creates **findings** AND provides **remediation recommendations**
- Customer responsibility to remediate any issues

Guard Duty



Amazon GuardDuty
Amazon GuardDuty is a threat detection service that continuously monitors for malicious or unauthorized behavior to protect your AWS accounts, workloads, and data stored in S3.

Enable GuardDuty
With a few clicks in the console, monitor all your AWS accounts without additional software to deploy or manage.

CloudTrail Mgmt Events
CloudTrail S3 data events
VPC Flow Logs
DNS Logs

Continuously analyze
Automatically analyze network, account, and data access activity at scale, providing continuous monitoring of your AWS accounts

Intelligently detect threats
GuardDuty uses machine learning, anomaly detection, and integrated threat intelligence to identify and prioritize potential threats

Take action
Review detailed findings in the console, integrate into event management or workflow systems, or trigger AWS Lambda for automated remediation or prevention

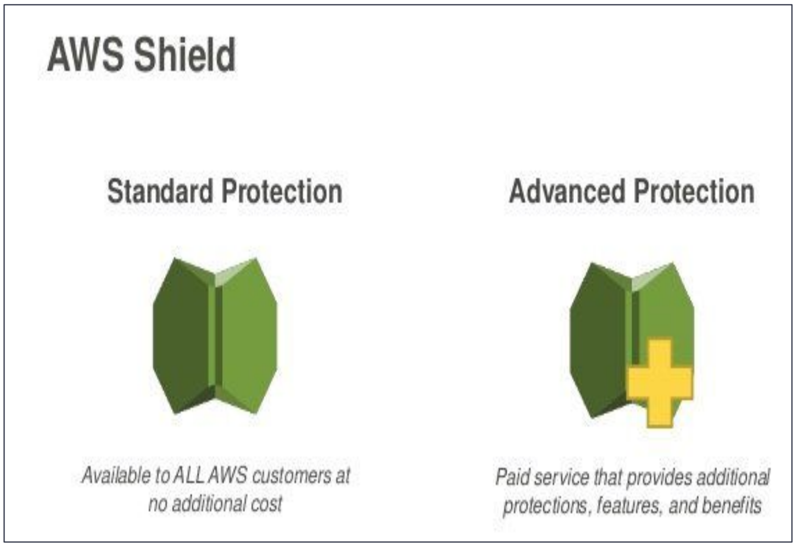
Security Information and Event Management (SIEM)

Security Hub

AWS Security Hub

- **Integrates** with other AWS & 3rd party security services
  - Guard Duty
  - Inspector
  - Firewall manager
  - and more …
- Provides a comprehensive view of security state
  - "**single pane of glass**"
- Also **creates alerts** based on security best practices

AWS Shield



AWS Shield

Standard Protection

Available to ALL AWS customers at no additional cost

Advanced Protection

Paid service that provides additional protections, features, and benefits

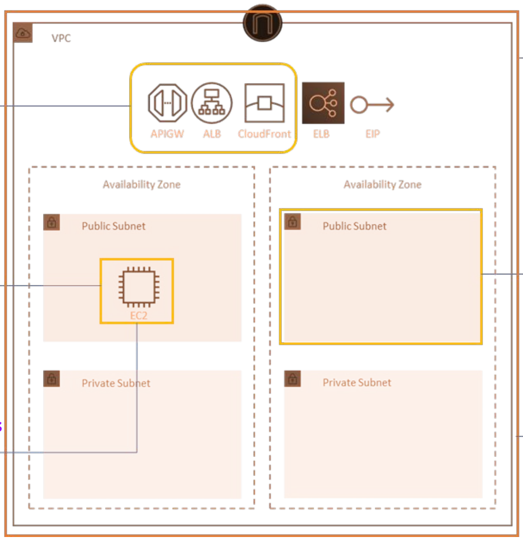
Although AWS WAF minimize the effect of DDoS attack you can use AWS Shield Standard and AWS Shield Advanced for additional protection.

Summary of AWS Security Services

AWS WAF ⁄Web App. Firewall
Preventative
L7 protection on AWS APIGW, AWS ALBs, and AWS CloudFront

Security Groups ⁄Host-Based Firewall
Preventative
IP/Port/Protocol filtering protection on instances

AWS Inspector ⁄Vulnerability Scanners
Detective
Rule-based vulnerability detection



AWS Network Firewall
Preventative
IP/Port/Protocol filtering at VPC
⁄Intrusion Prevention⁄Detection System

Network Access Control List (NACL)⁄ Network Firewall
Preventative
IP/Port/Protocol filtering at subnet level

GuardDuty⁄ Security Information and Event Management (SIEM)
Detective
Log monitoring and alerting

Summary of AWS Security Services

AWS Security Service	Protects Against	Applies To	Similar To
Security Groups	Unauthorized access to VPC resources	İnstance @ Layer 3, 4 (IP, Port, Protocol)	Host-based Firewall
Network Access Control List (NACL)	Unauthorized access to VPC resources	Subnet @ Layer 3, 4 (IP, Port, Protocol)	Network Firewall
AWS WAF	Web attacks e.g. SQL Injection, cross-site scripting	Layer 7 (HTTP)	WAF
AWS Network Firewall	Malicious network intrusion	Layer 3, 4, 7	IPS / IDS
Guard Duty	Malicious network traffic	Log analysis	SIEM
AWS Inspector	Exploitable vulnerabilities	EC2, ECR	Vulnerability scanner
SecurityHub	Provides single pane of glass view	Network, accounts	SIEM

THANKS!

Any questions?