# AWS Security

# Today's Topics

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

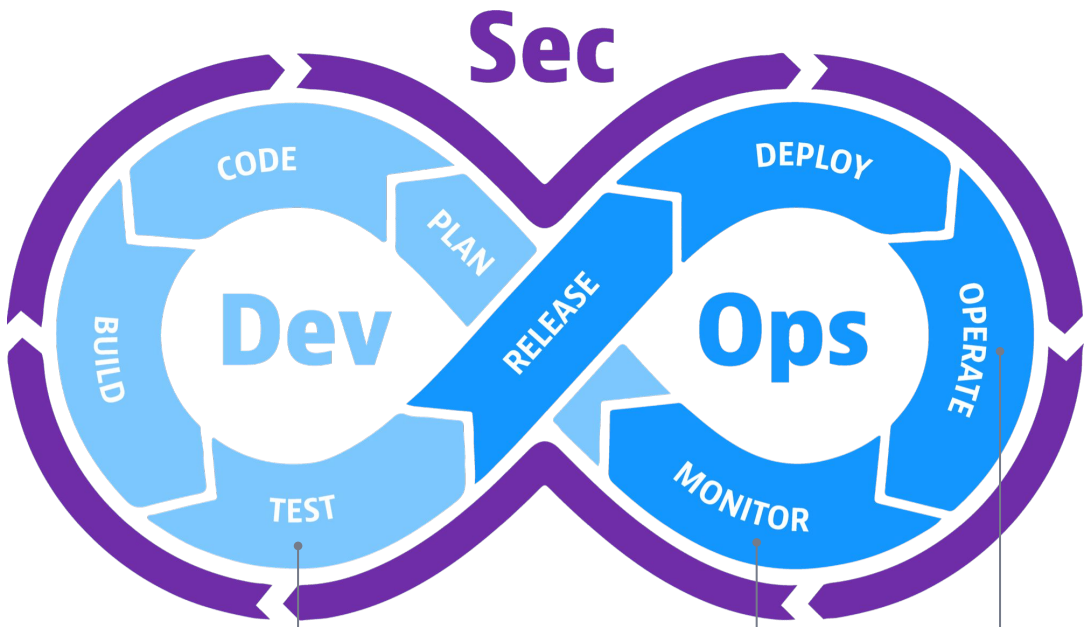
# Outcomes

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**

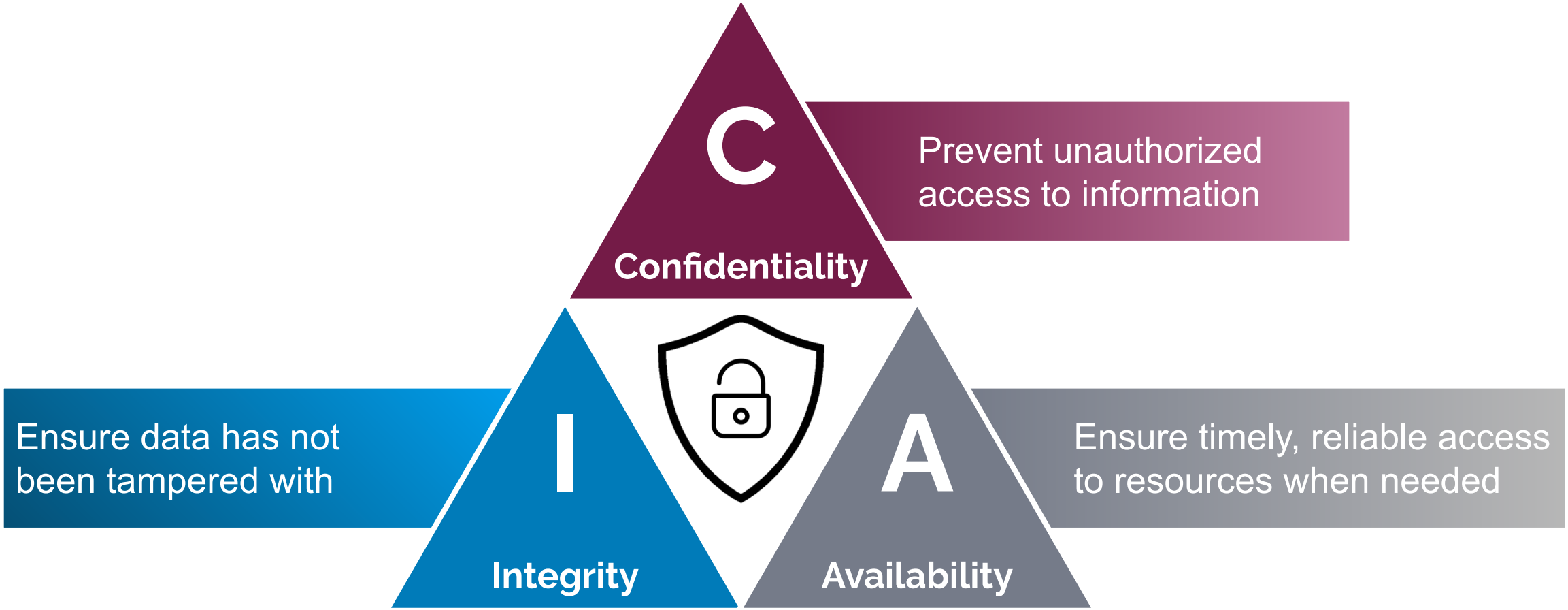
- Enforce configuration
- e.g. Firewall rules

- Monitor for security incidents
- e.g. Botnets

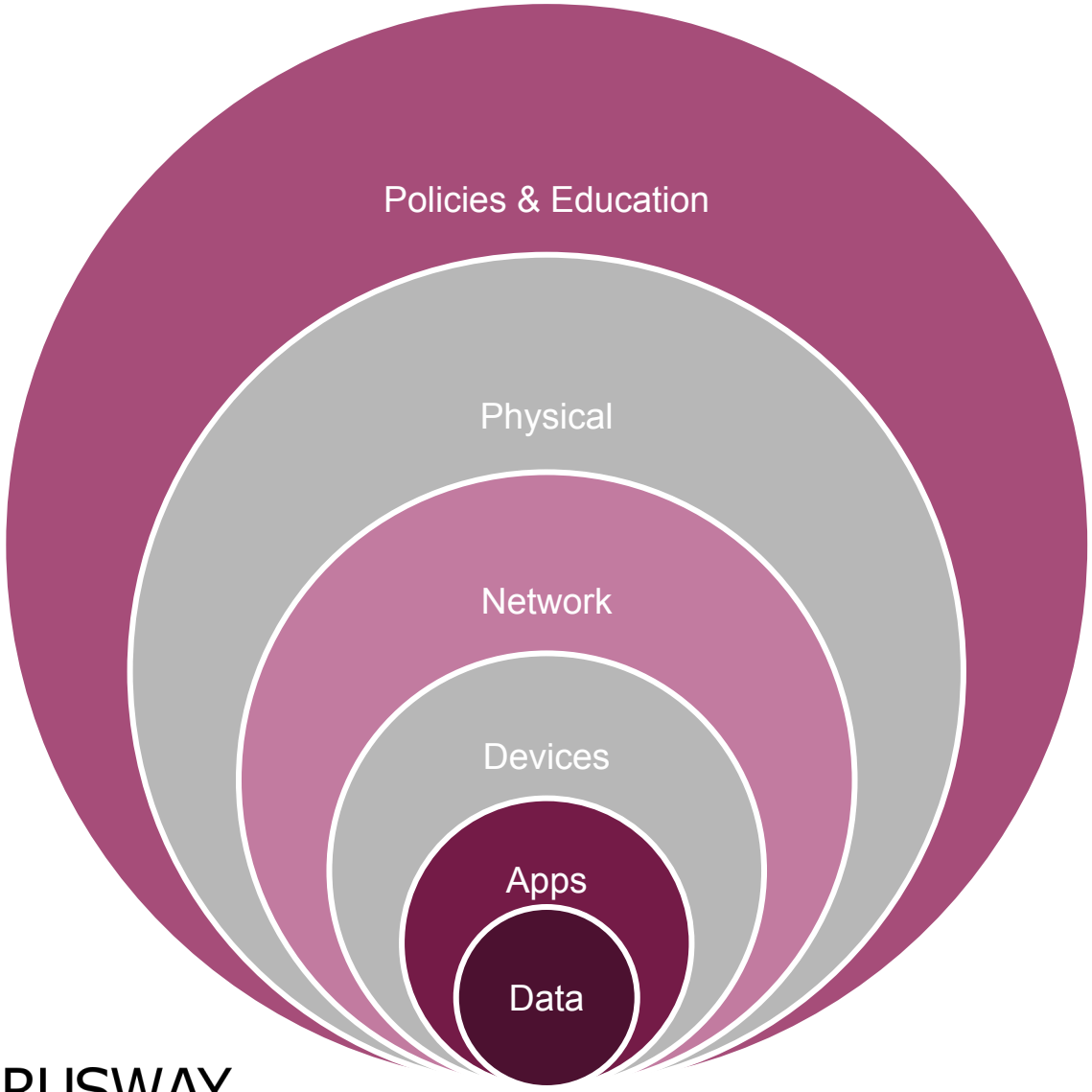
- Add security testing to code tests
- e.g. SQL Injection

examples of security integrated with development and operations

# CIA Principles of Cyber Security

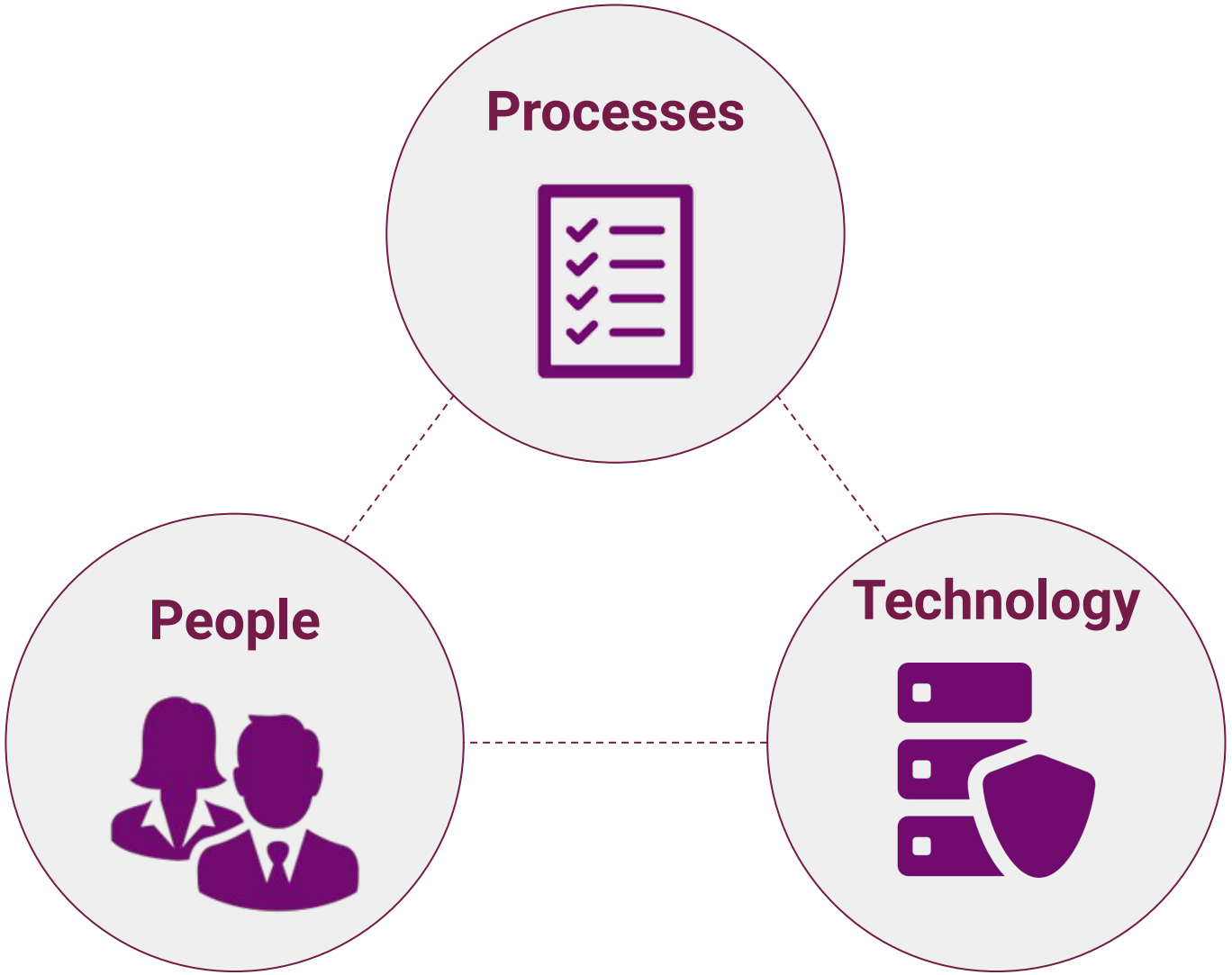


# Defense-in-Depth




- 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**
- Eg:- Something just happened...

## Preventative

- Automatically **disallows** actions
- Can lead to **stopping legitimate** behavior
- Eg:- Something is about to happen...

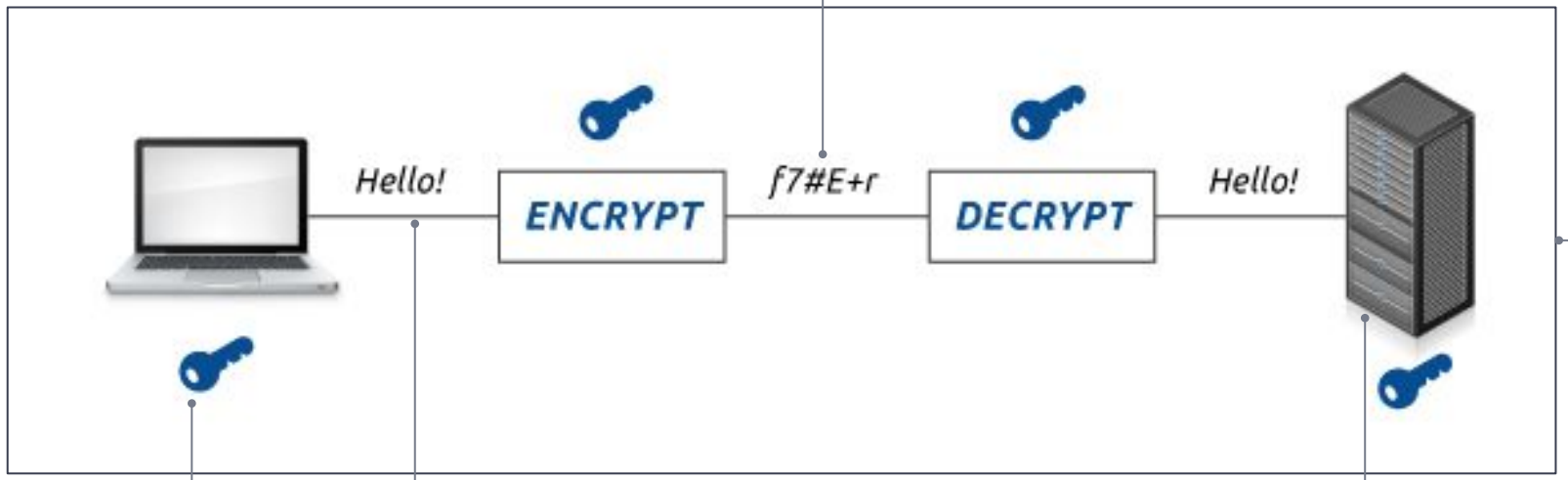
# Compliance Regulations


- 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

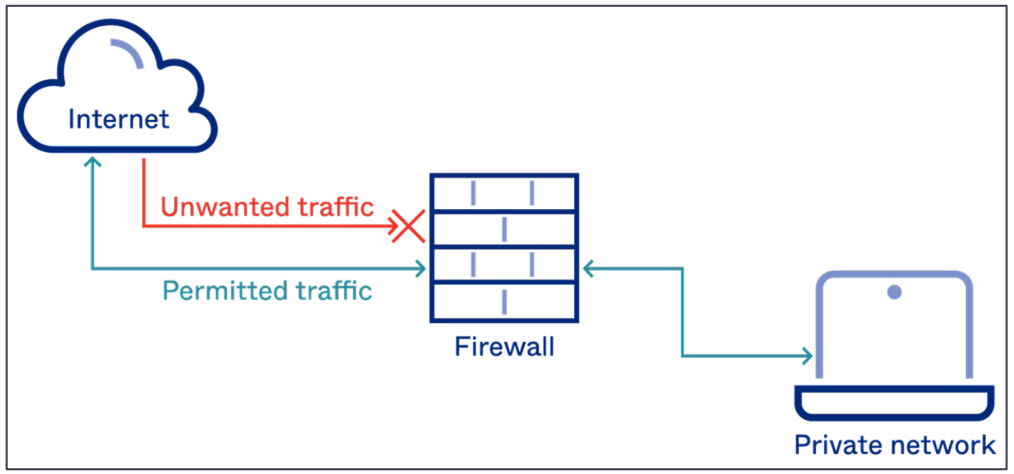



Encrypting data has a **performance impact**, although this has **improved greatly** in recent years

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

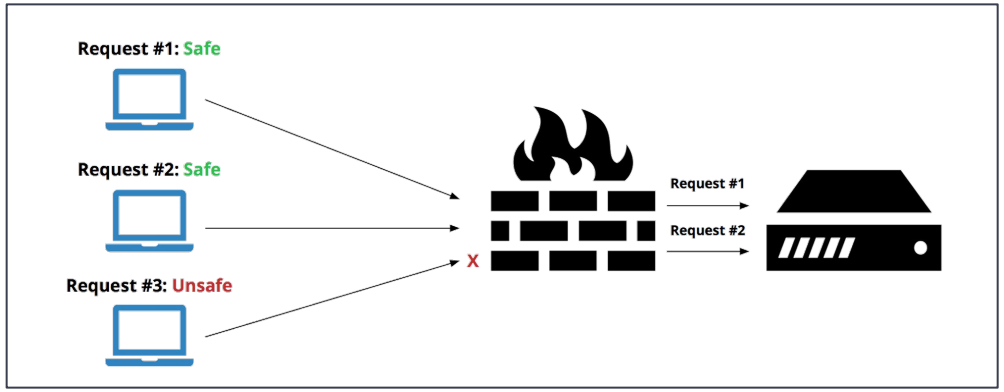
Encryption algorithms use **keys** to convert data. Without knowing an algorithm's key, it is **virtually impossible to decrypt the data**

# Firewall



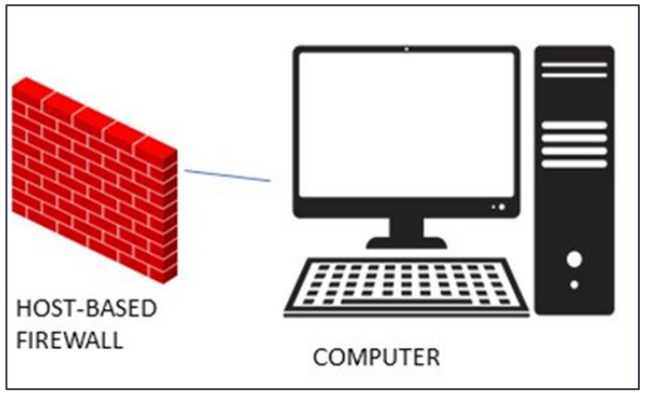

- **Network device** that controls inbound and outbound network traffic based on a set of security rules
- Typically control which traffic can ingress to or egress from an **internal network to an external network** (e.g. Internet)
- Can be an **appliance** (**H**ard**W**are+**SW**) or just **S**oft**W**are
- 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)



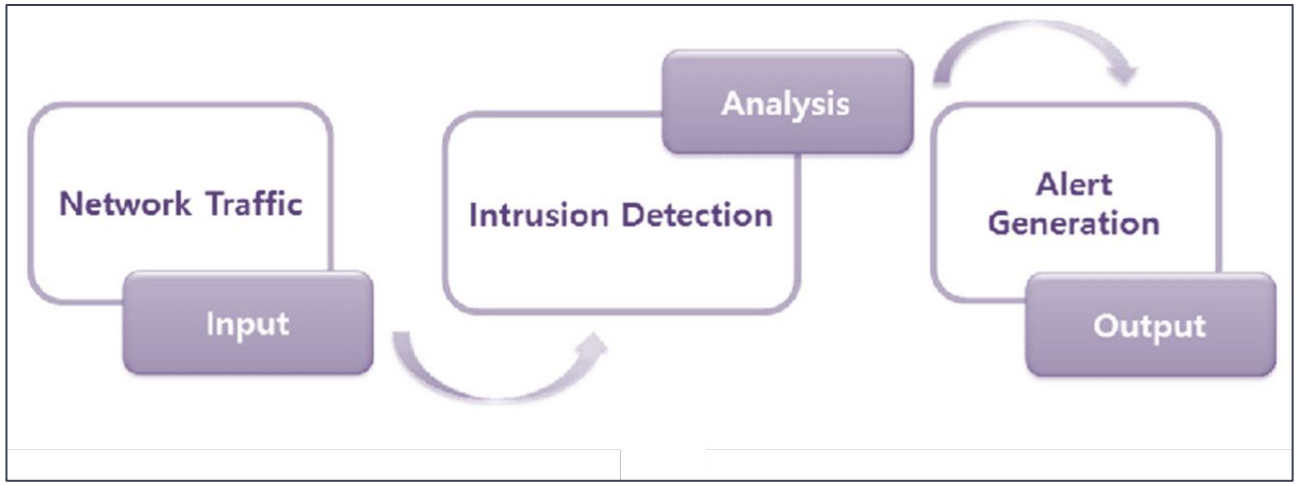

- Network device that operates specifically at protocol **layer 7** (human computer interaction layer where apps can access network services) and monitors **HTTP traffic**
- Typically protects web applications against specific attacks:
  - **cross-site forgery** - a cyber attack that tricks users into using their credentials to perform actions that change a state
  - **cross-site-scripting (XSS)** - an attack in which an attacker injects malicious executable scripts into the code of a trusted application or website
  - **SQL injection -** insertion or "injection" of a SQL query via the input data from the client to the application
  - **distributed-denial-of-service (DDOS)** - malicious attempt to disrupt normal traffic to a web property
- Operates via a **set of rules** (policies)

# Host-Based Firewall



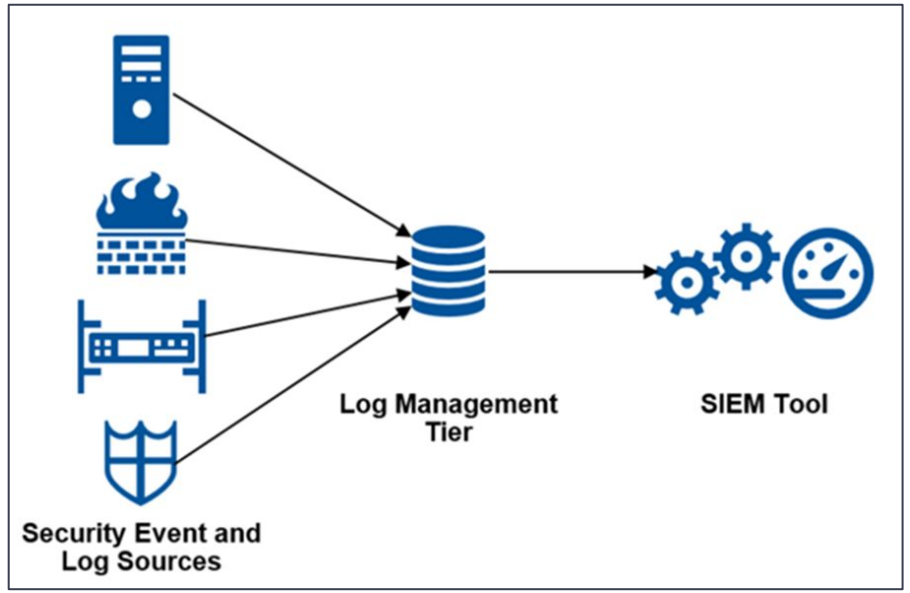

- A **software-based** firewall **installed on a host** to monitor and control incoming and outgoing network traffic
- Operates at layers 3 & 4 of the OSI model
  - i.e. **IP, port and protocol**
- Examples:
  - **Windows Defender**
  - **IPTables**

# 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 - compares signatures(pattern which indicates a malicious attack) against observed events to identify possible incidents. This is the simplest detection method because it compares only the current unit of activity (such as a packet or a log entry, to a list of signatures) using string comparison operations.
  - **anomaly-based** detection - compares definitions of what is considered normal activity with observed events in order to identify significant deviations. This detection method can be very effective at spotting previously unknown threats.
  - **stateful protocol** analysis - compares predetermined profiles of generally accepted definitions for begin protocol activity for each protocol state against observed events in order to identify deviations.
  - **reputation** analysis - Another common variant is reputation-based detection (recognizing the potential threat according to the reputation scores)
- These are **dynamic rules** applied to network packets

# Security Information and Event Management (SIEM)



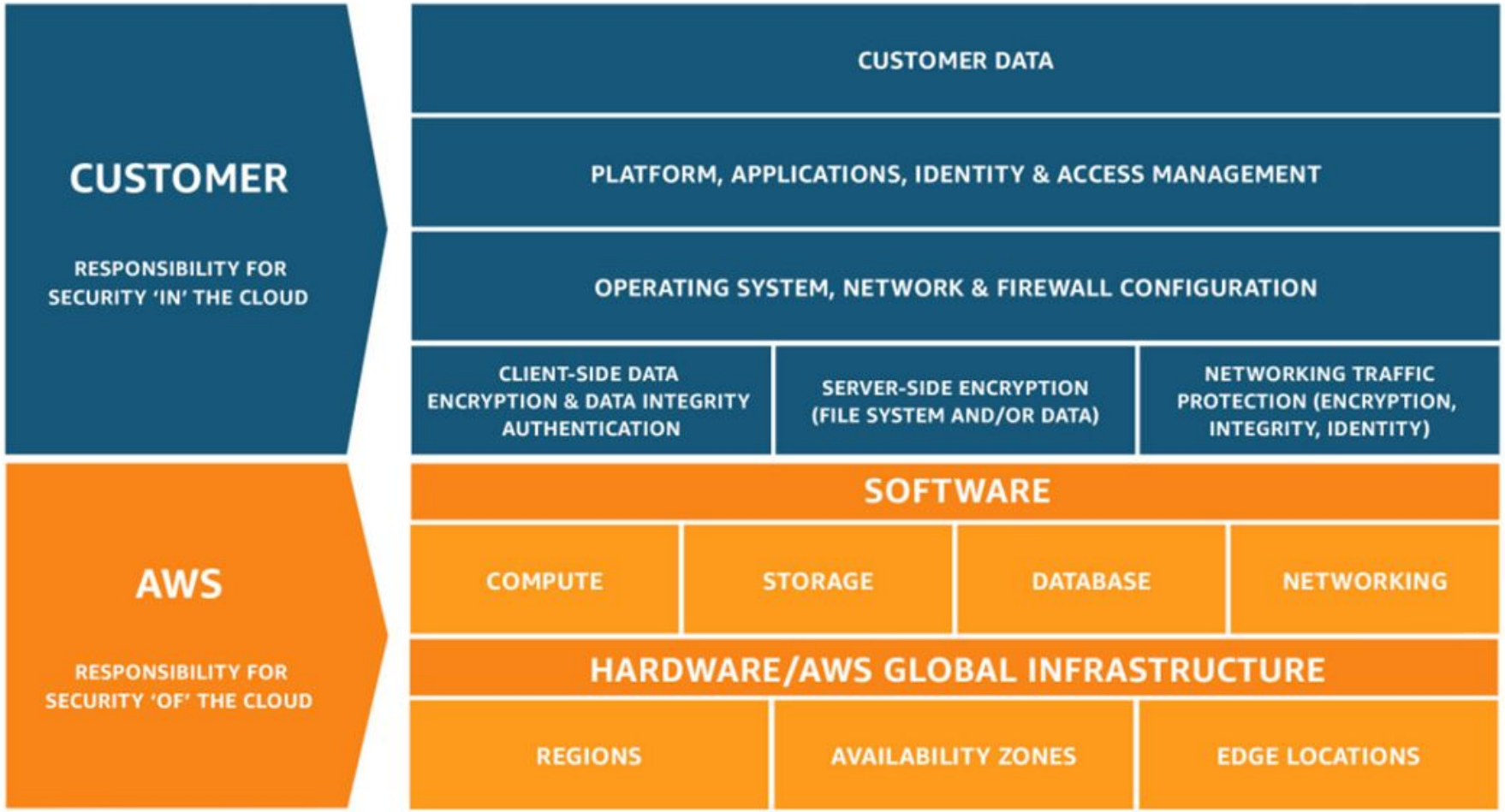

- A **SIEM** is a device that **ingests and aggregates logs**, including network log information
- Can perform analysis by cross-referencing various log information to **identify network-related threats**
- Unlike IDS/IPS, this type of **analysis is based on logs**, rather than traffic packets

# Vulnerability Scanners

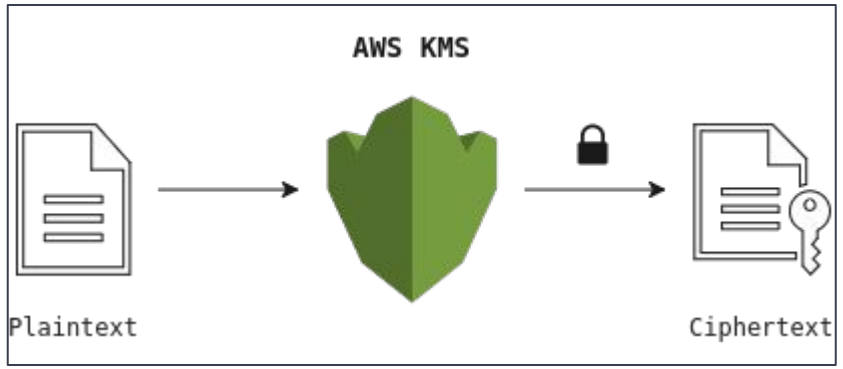
- After operating systems and software is released into the market, quite often **security vulnerabilities** are identified
- These vulnerabilities can be **exploited by hackers** in order to gain access to systems
- A publicly available **CVE ("common vulnerabilities and exposures") database** lists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

# 3 AWS Security Services

# Shared responsibility model



# AWS Key Management Service (KMS)



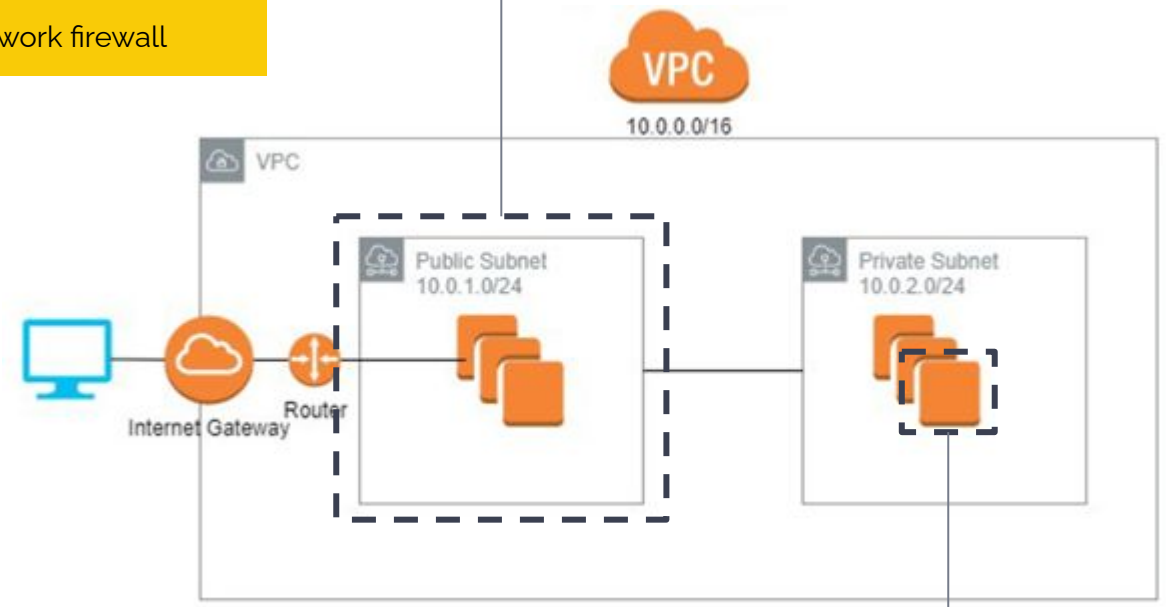

- Encrypts **data at rest**
  - EBS, S3, EFS, RDS, DynamoDB, more
- **Centralized management**
  - create, delete, view, set policies
  - Automatic **key rotation**
- Performance impact is **negligible**
- Permissions governed by **IAM and Key Policies**
- Must be cautious about **permissions and protecting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



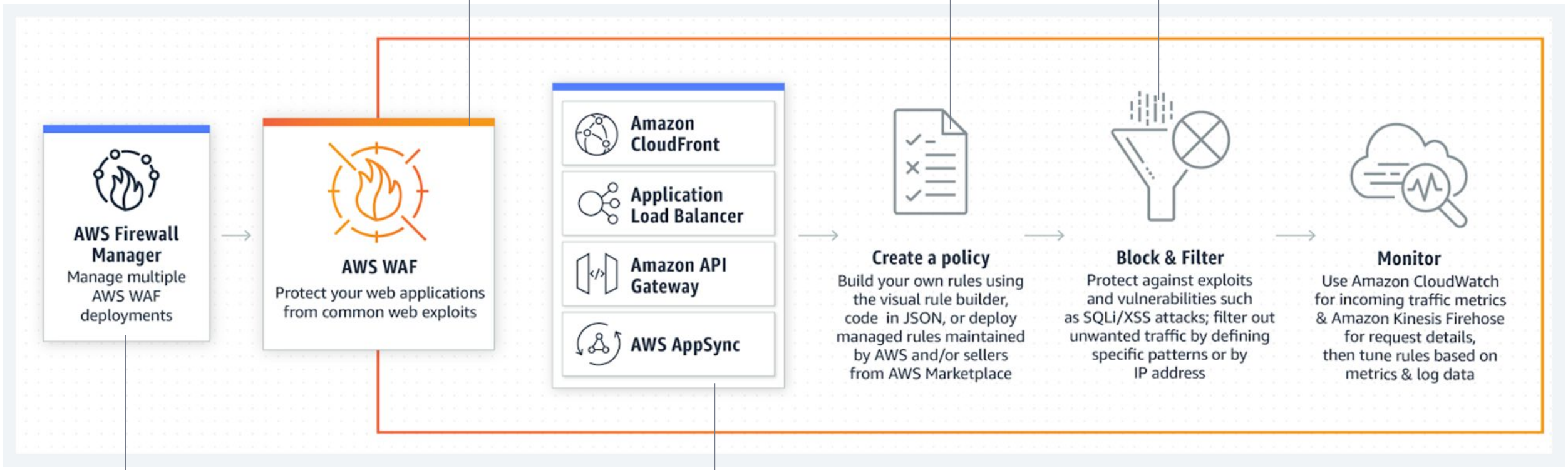

- Security Groups are firewall rules applied at the instance level
- IP, Port & Protocol (i.e. layers 3, 4 protection)
- ***Similar*** to a host-based firewall
- However, they do not belong to or run on the host

# 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




- 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*

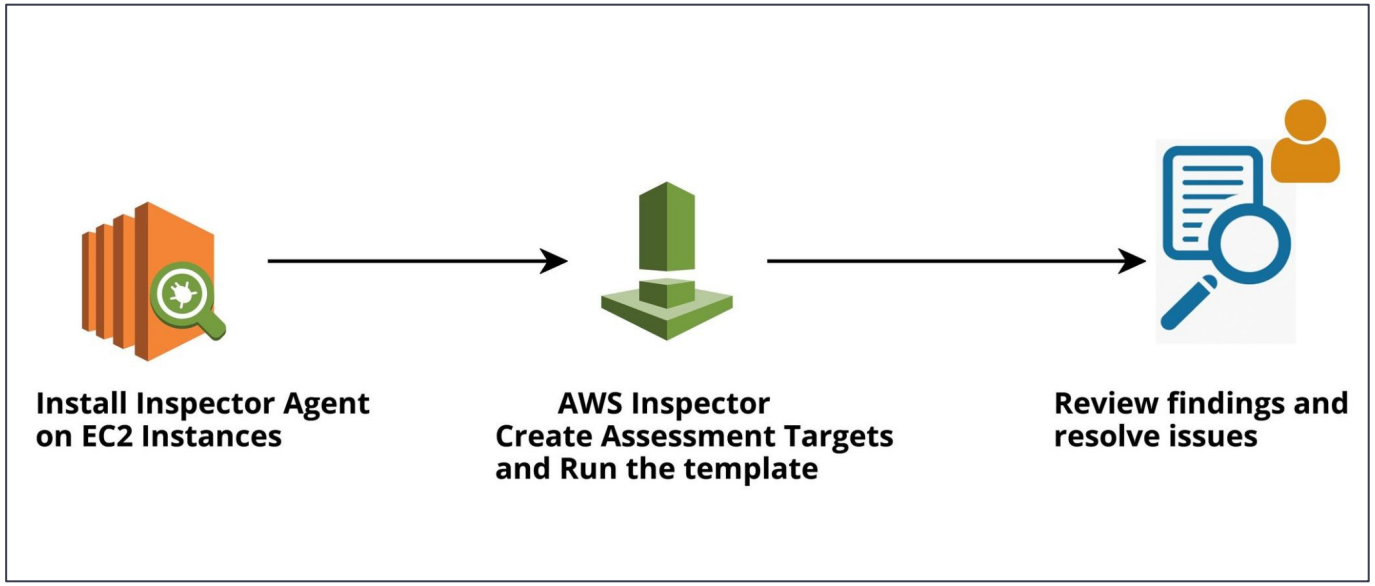
*Guard against botnets, misuse*

**Stateful Packet Inspection**

*Preventative*

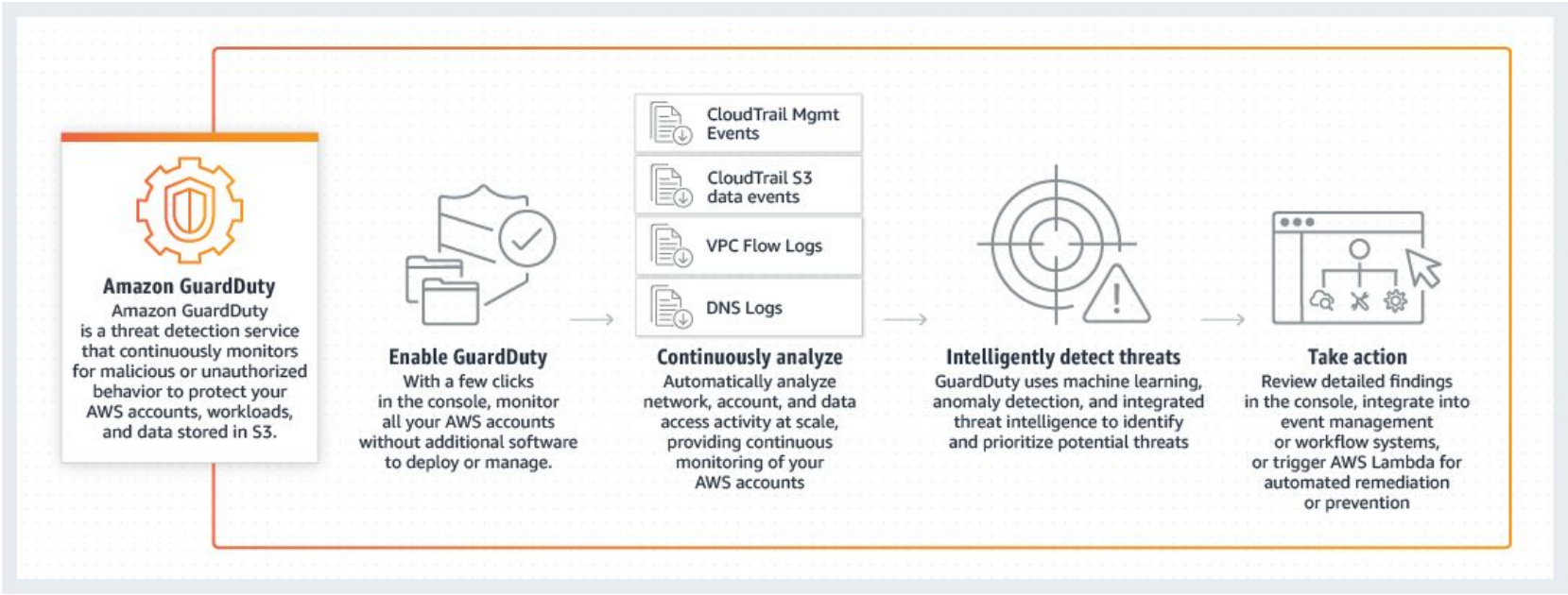
*Improved security through dynamic/deeper packet inspection*

# AWS Inspector




- **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

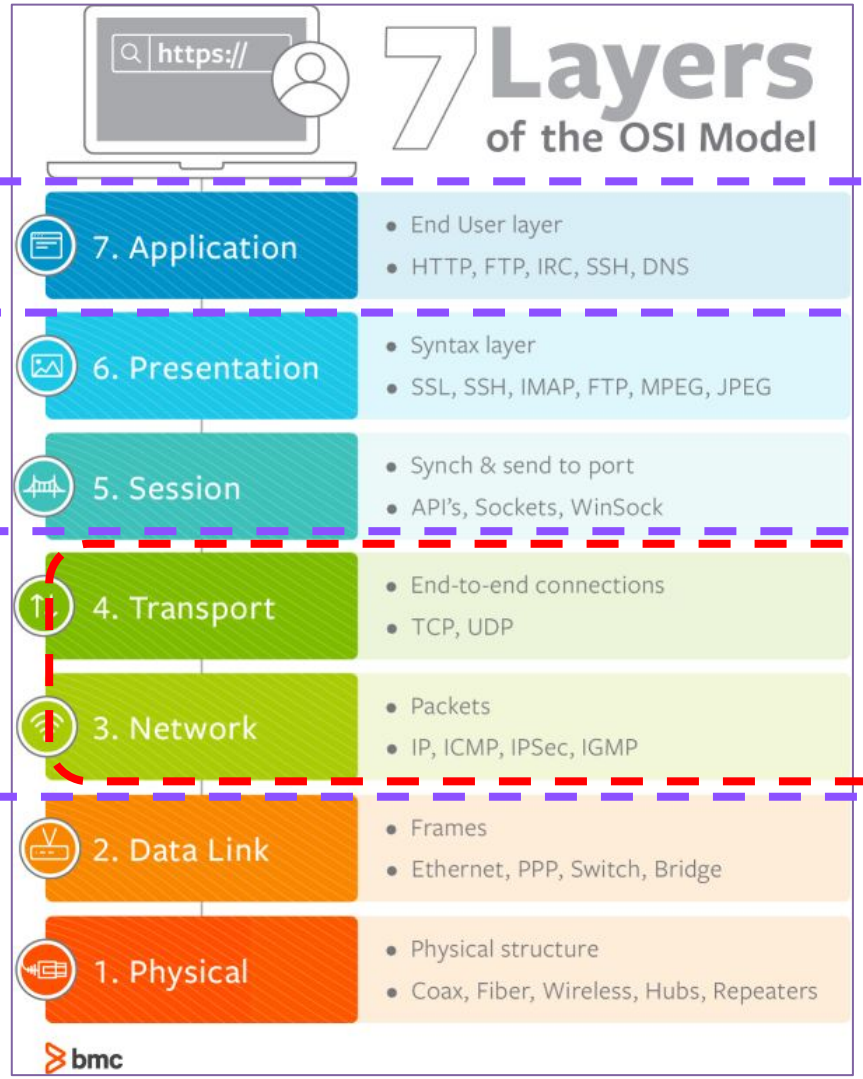



- "Intelligent Threat Detection"
- Continuous security monitoring using 3 data sources
  - VPC flow logs
  - Route 53 DNS logs
  - CloudTrail logs
- Uses threat intelligent feeds as input
- Examples of threats
  - privilege escalation
  - communication with malicious servers
  - compromised EC2 instances

# 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




Layer 7

Layer 3, 4

Layer 3, 4

**Advanced Protection**

*Paid service that provides additional protections, features, and benefits*

**Standard Protection**

*Available to ALL AWS customers at no additional cost*

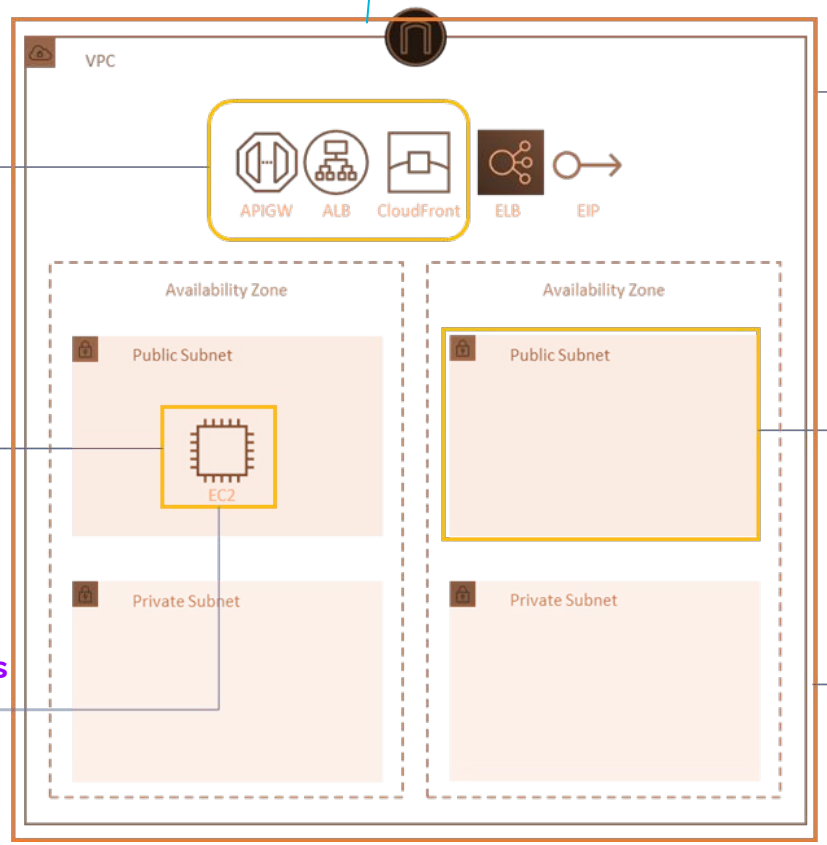
# Summary of AWS Security Services

**AWS Shield Advanced/**
**DDos Attack**

**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**

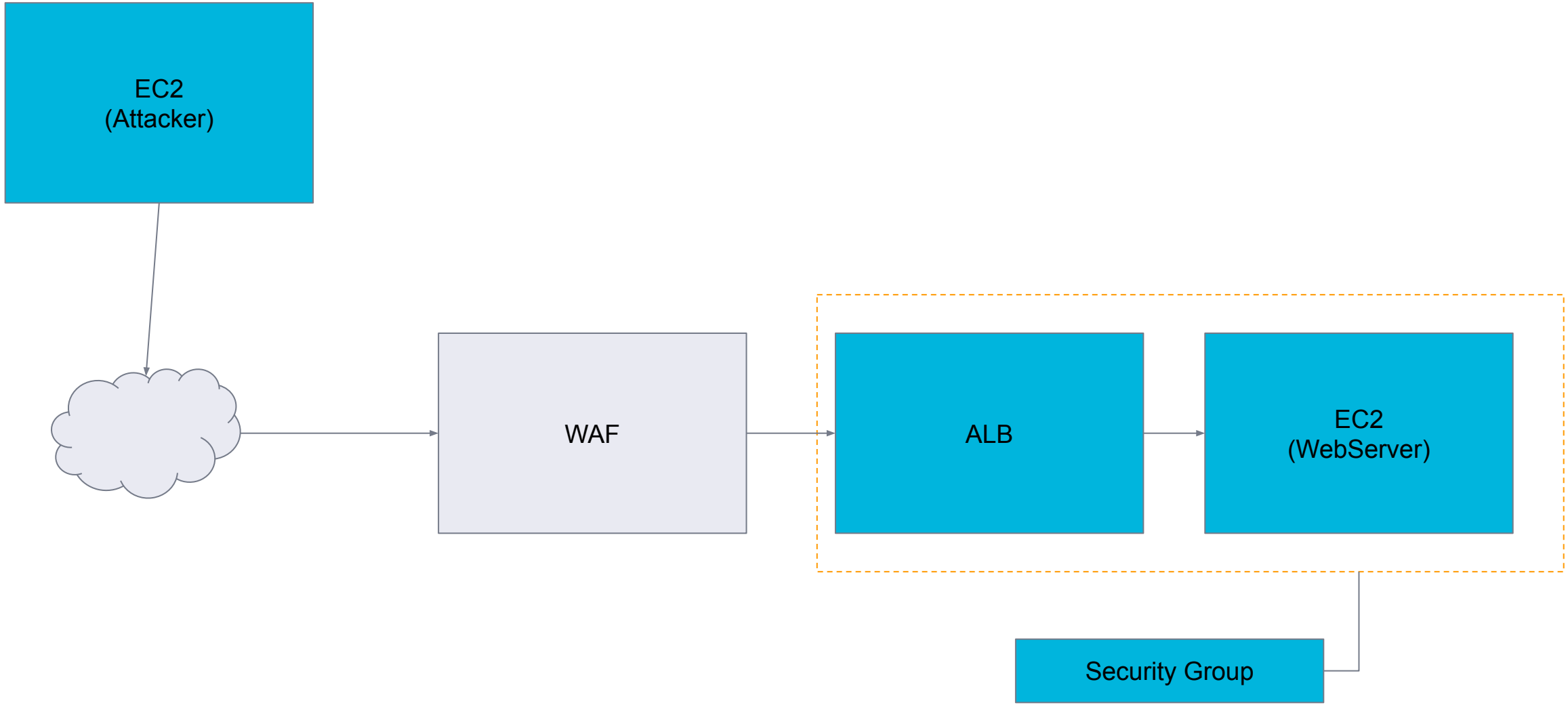
**Network Access Control List**
**(NACL) / Network Firewall**
*Preventative*
*IP/Port/Protocol filtering at subnet level*

**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 |
| AWS Shield | DDos Attack | Layer 3, 4 (Shield Standard)<br>Layer 7 (Shield Advanced) | WAF |


Hands On!
AWS WAF


EC2
(Attacker)
WAF
ALB
EC2
(WebServer)
Security Group

# THANKS!

## Any questions?

You can find me at:

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