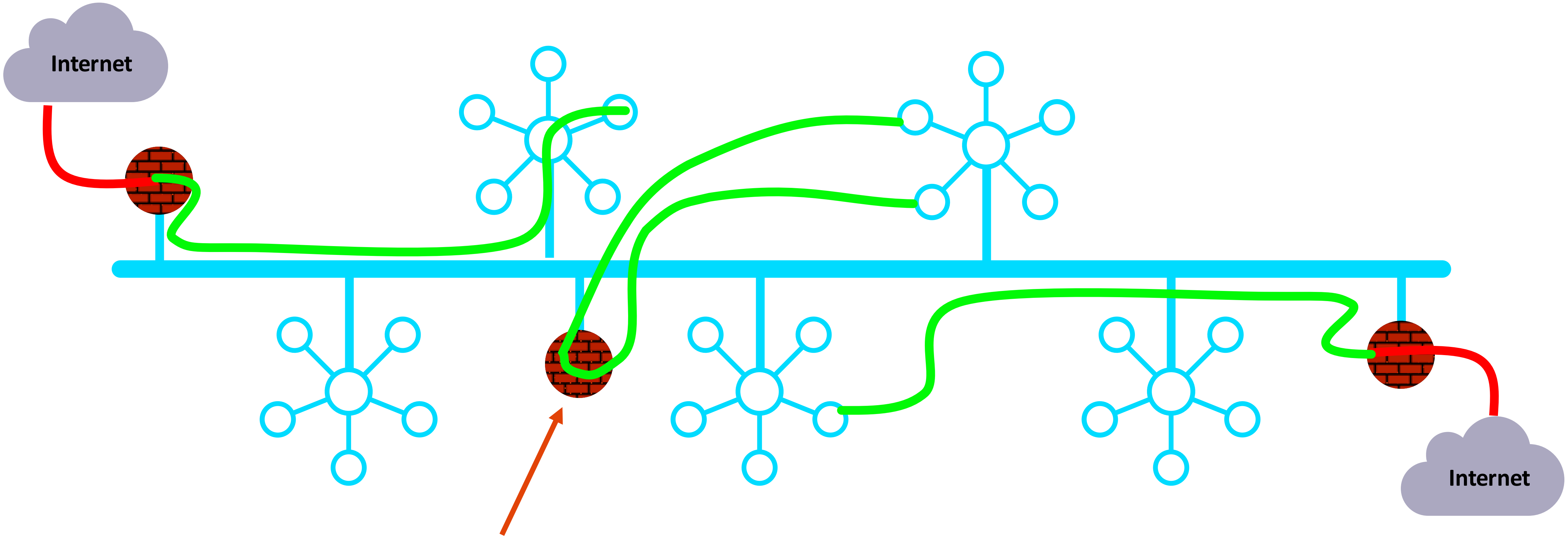
Distributed Cloud Firewall

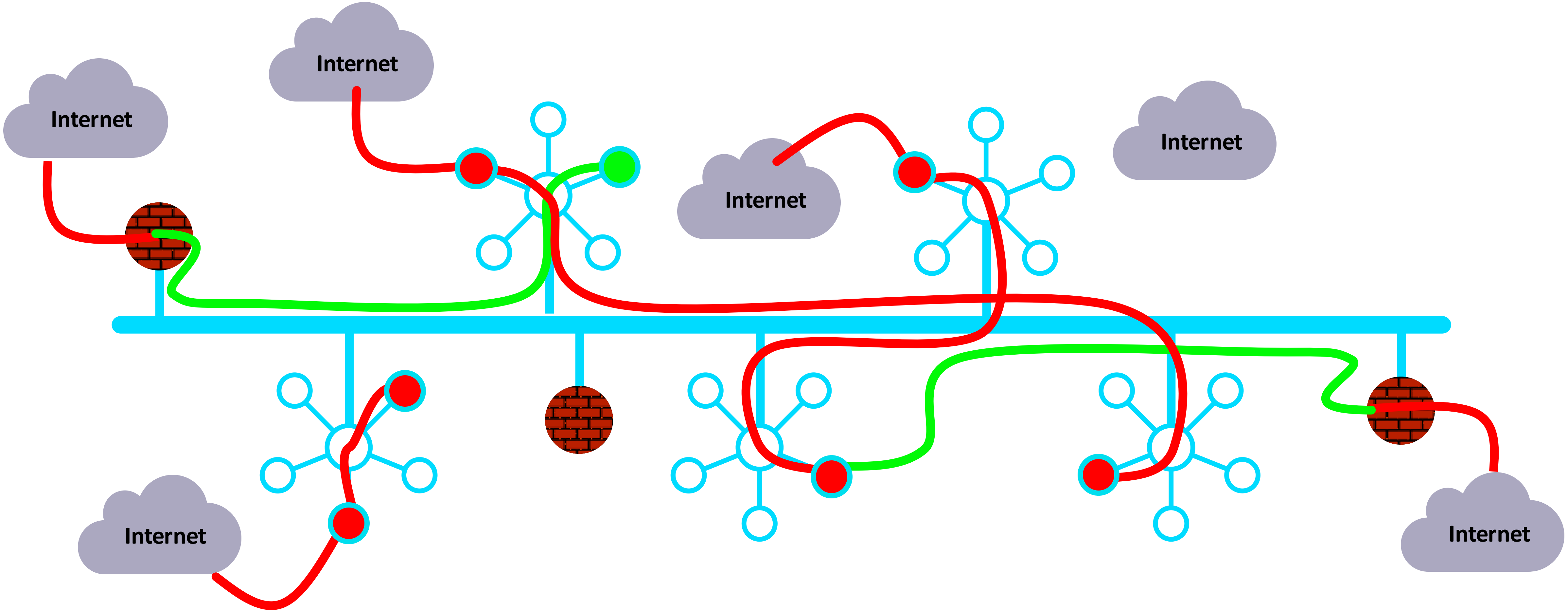
ACE Team

As Architected with Lift-and-Shift, Bolt-on, Data Center Era Products…



“Last Generation Firewalls”

In Reality...


Internet
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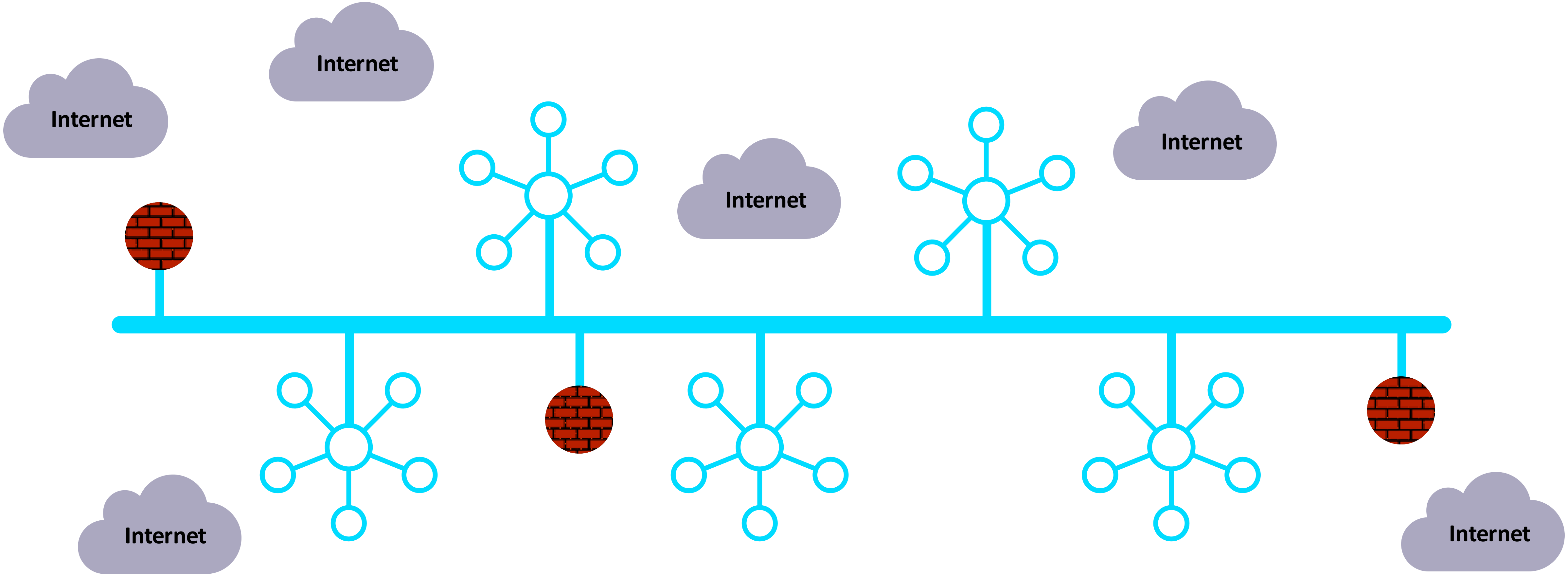
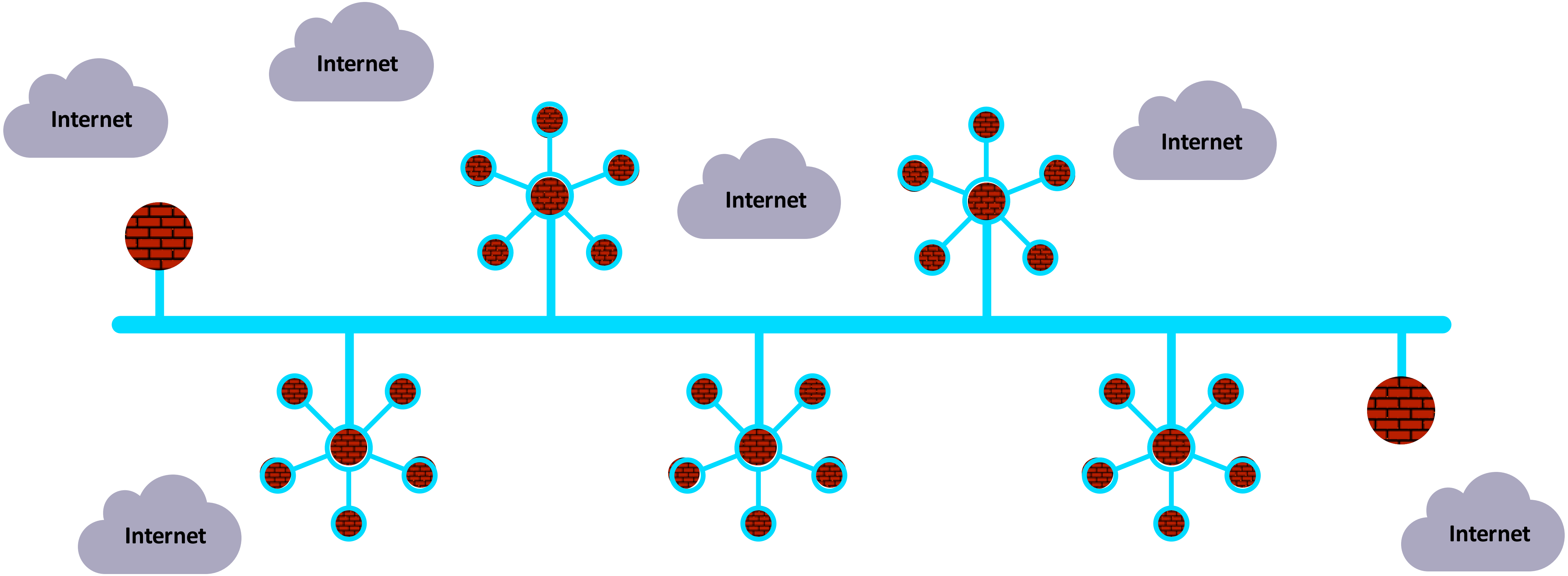
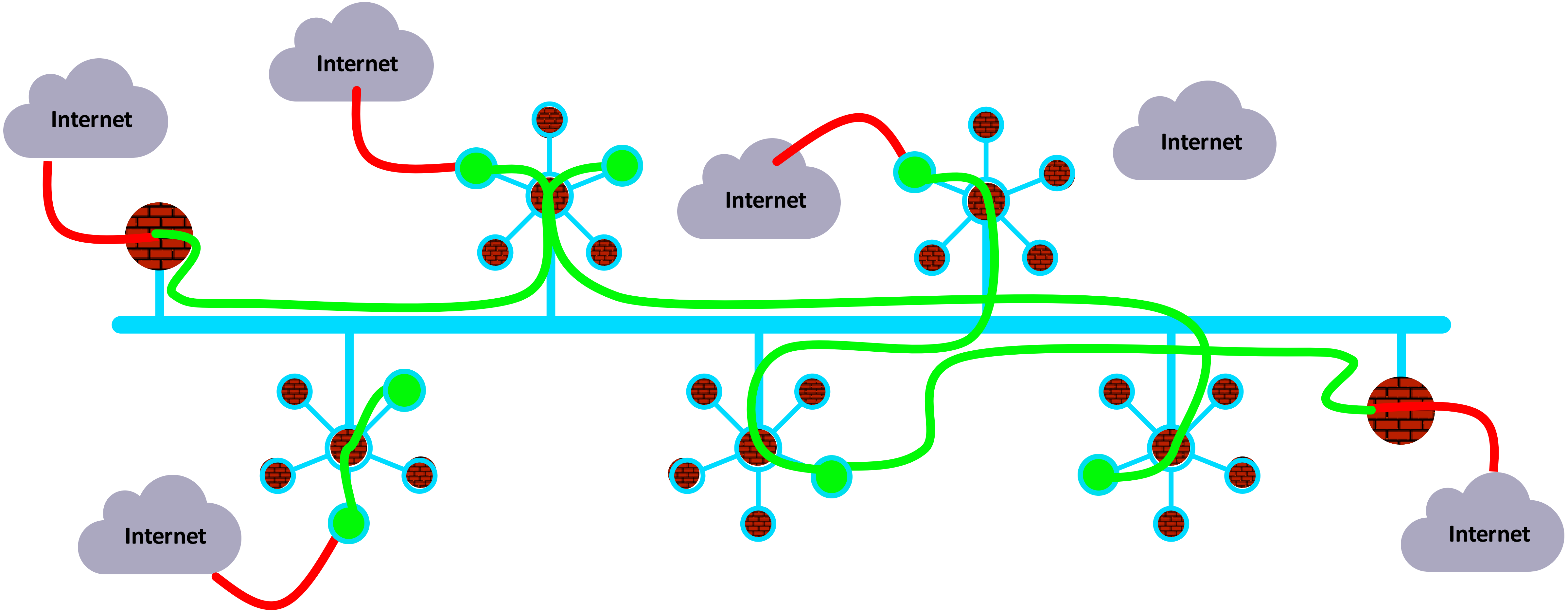
What If… the architecture was built for cloud



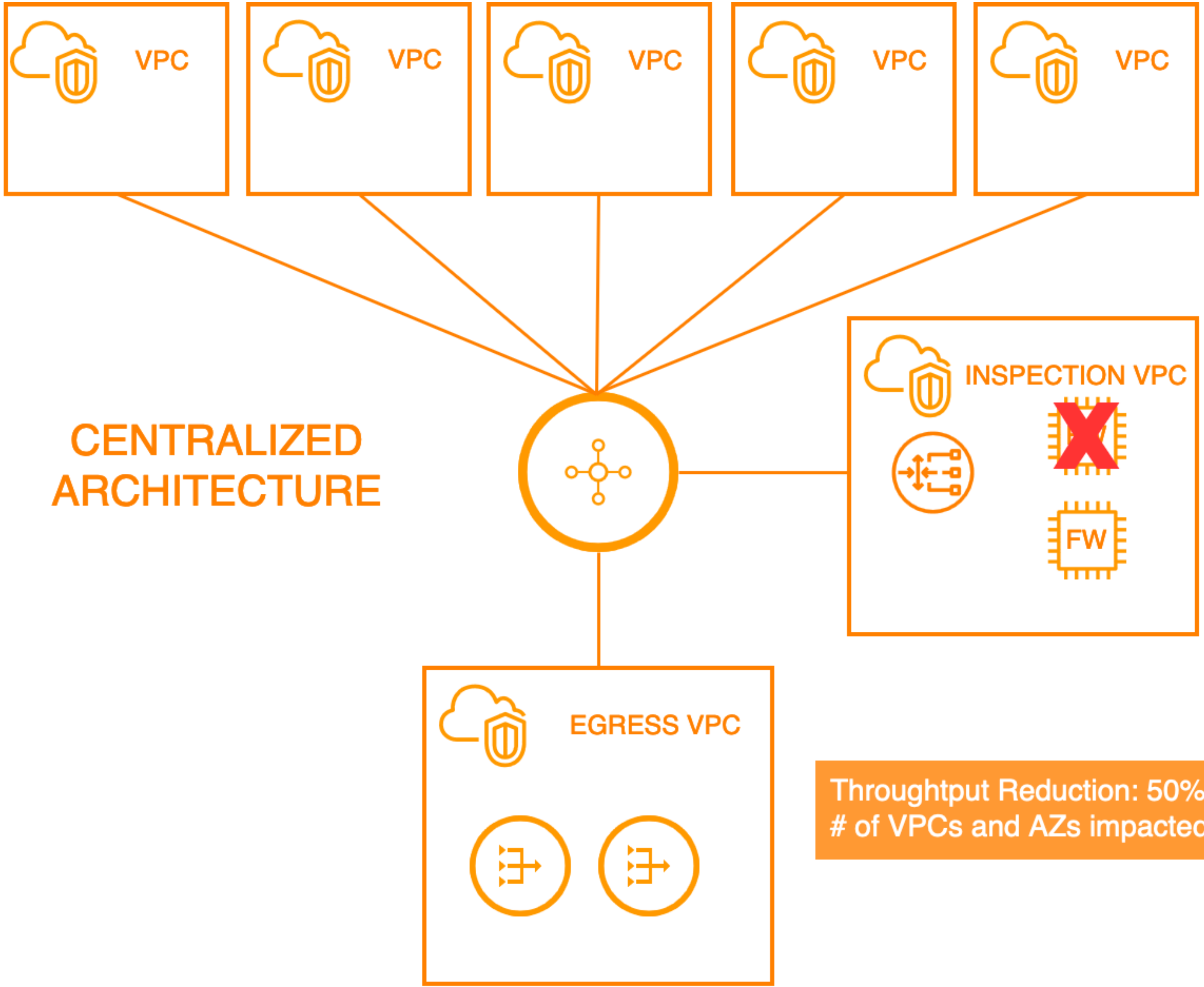
Firewalling Functions were Embedded in the Cloud Network Everywhere…



Distribution of the Security Services into the Spokes

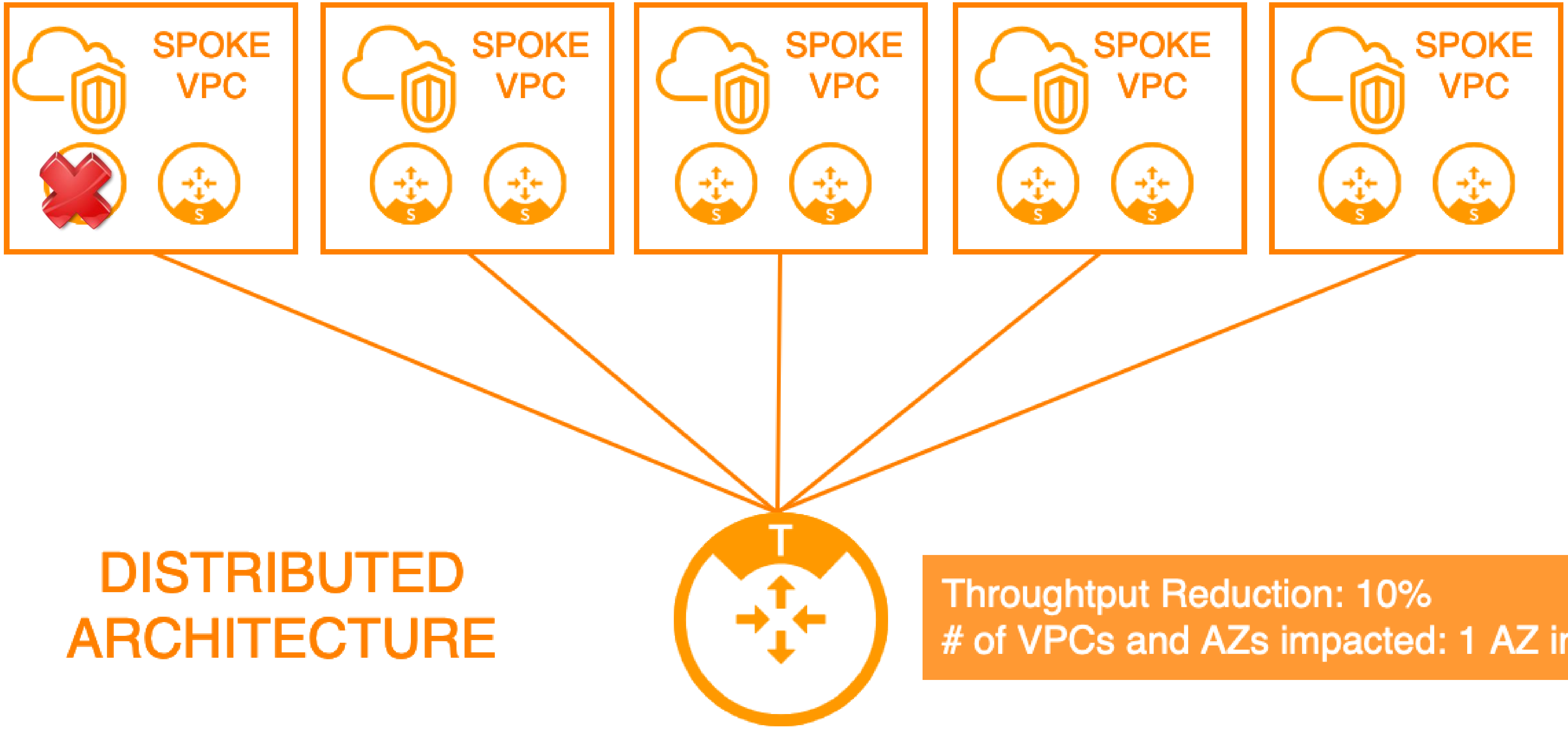


Impact of Failure – Centralized Architecture



Throughtput Reduction: 50%
# of VPCs and AZs impacted: ALL

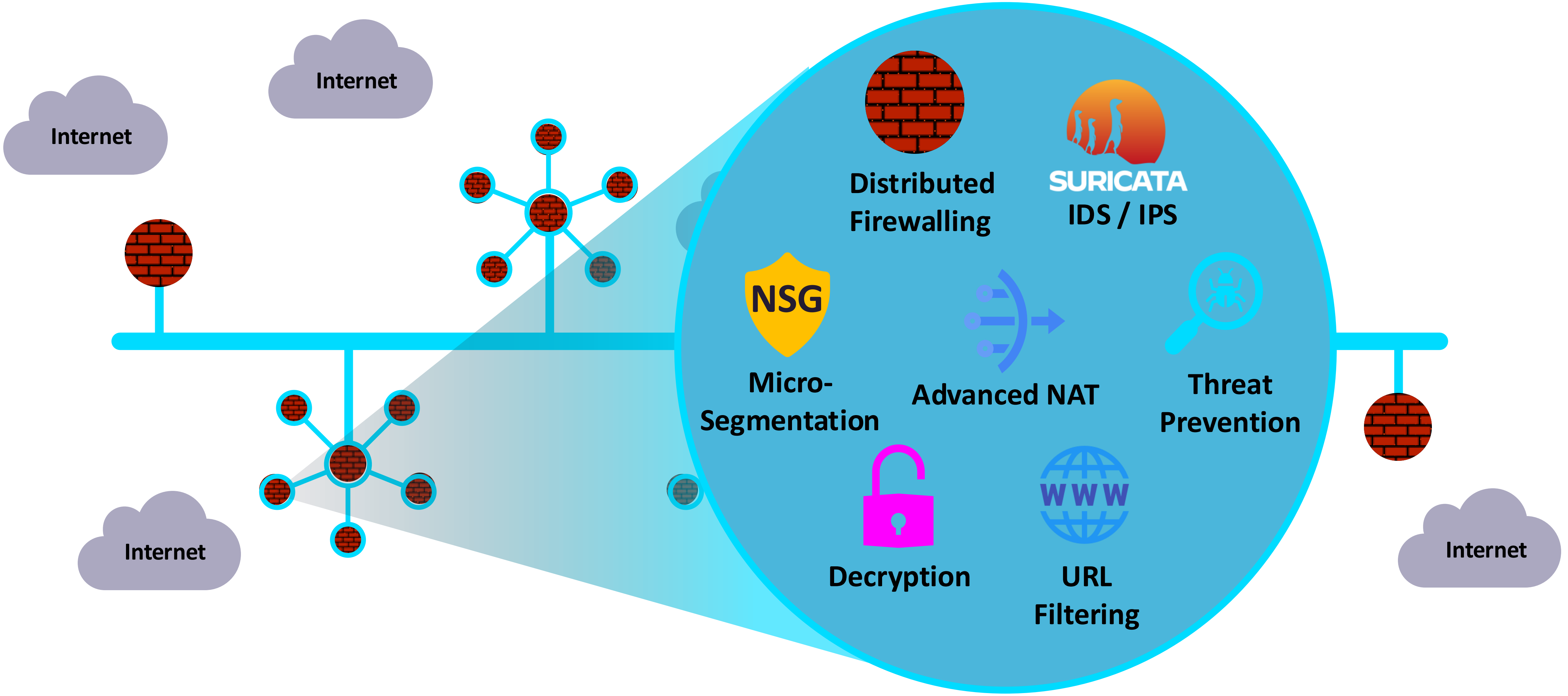
Impact of Failure – Distributed Architecture



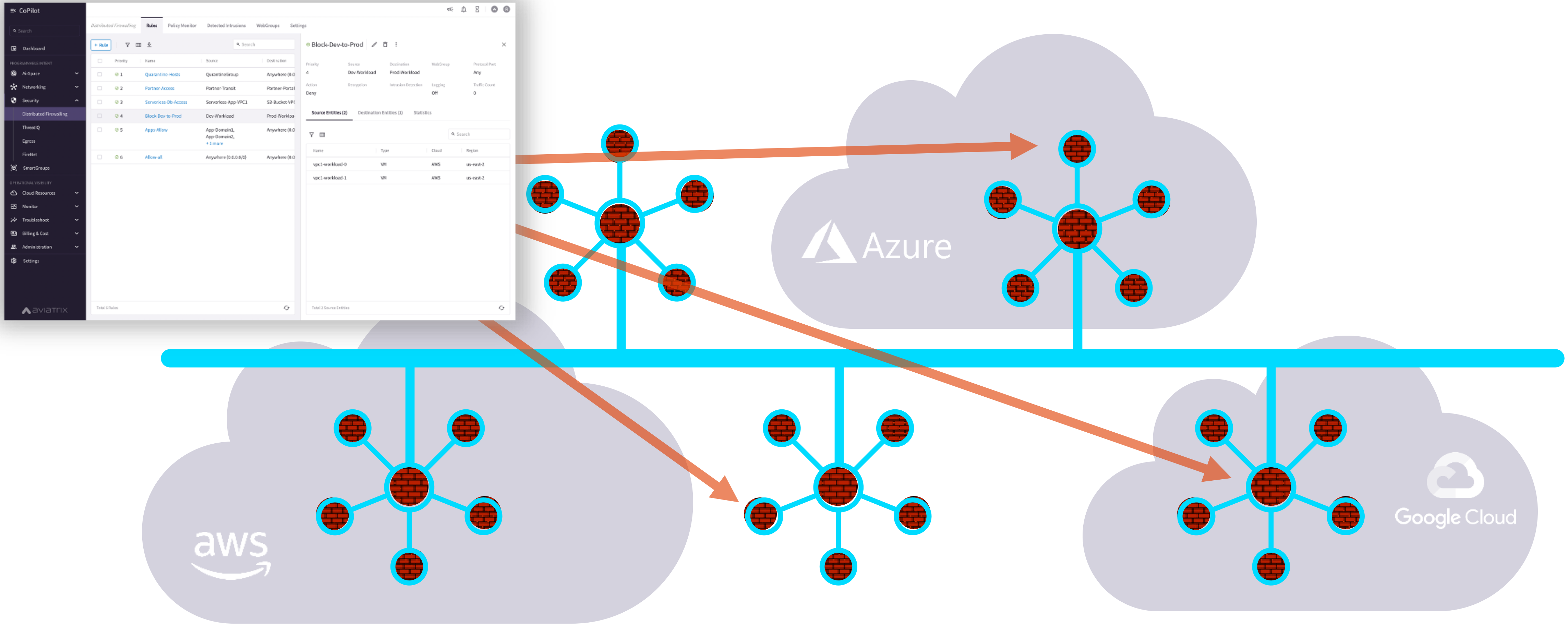
DISTRIBUTED ARCHITECTURE

Throughtput Reduction: 10%
# of VPCs and AZs impacted: 1 AZ in 1 VPC

And, What If it was more than just firewalling…



Policy Creation Looked Like One Big Firewall … A Distributed Cloud Firewall…



Priority	Name	Source	Destination
1	Quarantine-Hosts	QurantineGroup	Anywhere (0.0
2	Partner-Access	Partner-Transit	Partner-Portal
3	Serverless-Db-Access	Serverless-App-VPC1	S3-Bucket-VP
4	Block-Dev-to-Prod	Dev-Workload	Prod-Workloa
5	Apps-Allow	App-Domain1, App-Domain2, + 1 more	Anywhere (0.0
6	Allow-all	Anywhere (0.0.0.0/0)	Anywhere (0.0

Total 6 Rules

Block-Dev-to-Prod

Priority	Source	Destination	WebGroup	Protocol Port
4	Dev-Workload	Prod-Workload		Any

Action	Decryption	Intrusion Detection	Logging	Traffic Count
Deny			Off	0

Source Entities (2) | Destination Entities (1) | Statistics

Name	Type	Cloud	Region
vpc1-workload-0	VM	AWS	us-east-2
vpc1-workload-1	VM	AWS	us-east-2

Total 2 Source Entities

Where and How Policies Are Enforced Is Abstracted…

SmartGroups: Definition

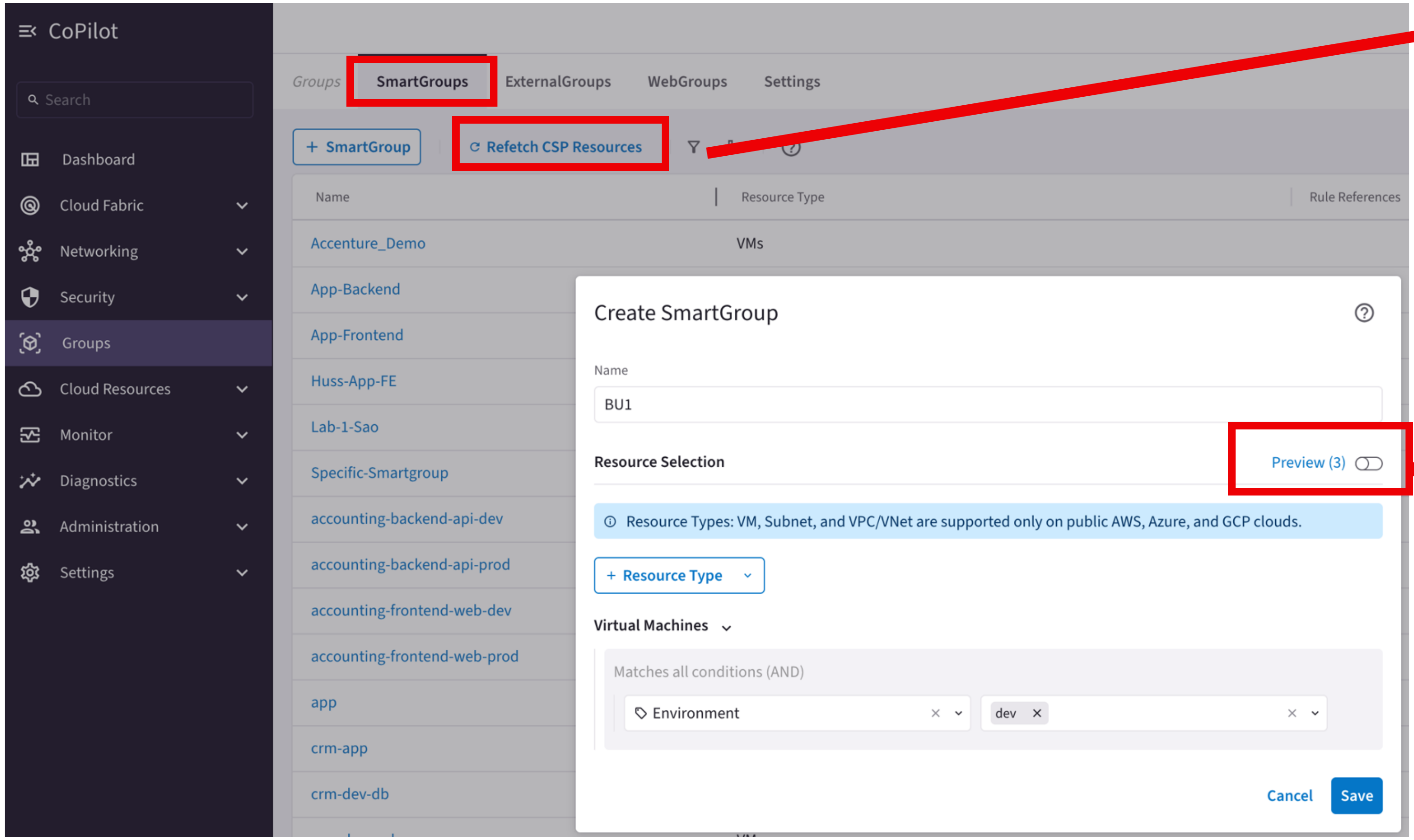
- A firewall rule consists of two important initial elements (i.e. *L3 info*):
  - **Source**
  - **Destination**

- **What is a SmartGroup?**

A SmartGroup identifies a group of resources that have similar policy requirements and are associated to the same *logical container*.

- The members of a SmartGroup can be classified using *different* methods:
  - CSP Tag
  - Subnets
  - VPC/Vnets
  - Kubernetes
  - Hostnames
  - External Connections (S2C)

Smart Groups Creation



Name	Resource Type	Rule References
Accenture_Demo	VMs	
App-Backend		
App-Frontend		
Huss-App-FE		
Lab-1-Sao		
Specific-Smartgroup		
accounting-backend-api-dev		
accounting-backend-api-prod		
accounting-frontend-web-dev		
accounting-frontend-web-prod		
app		
crm-app		
crm-dev-db		

Create SmartGroup

Name: BU1

Resource Selection — Preview (3)

ⓘ Resource Types: VM, Subnet, and VPC/VNet are supported only on public AWS, Azure, and GCP clouds.

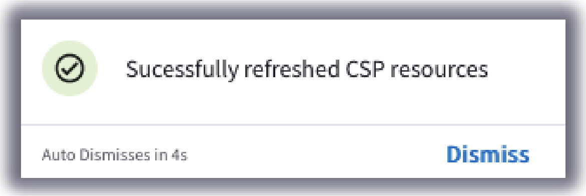
+ Resource Type

Virtual Machines

Matches all conditions (AND)

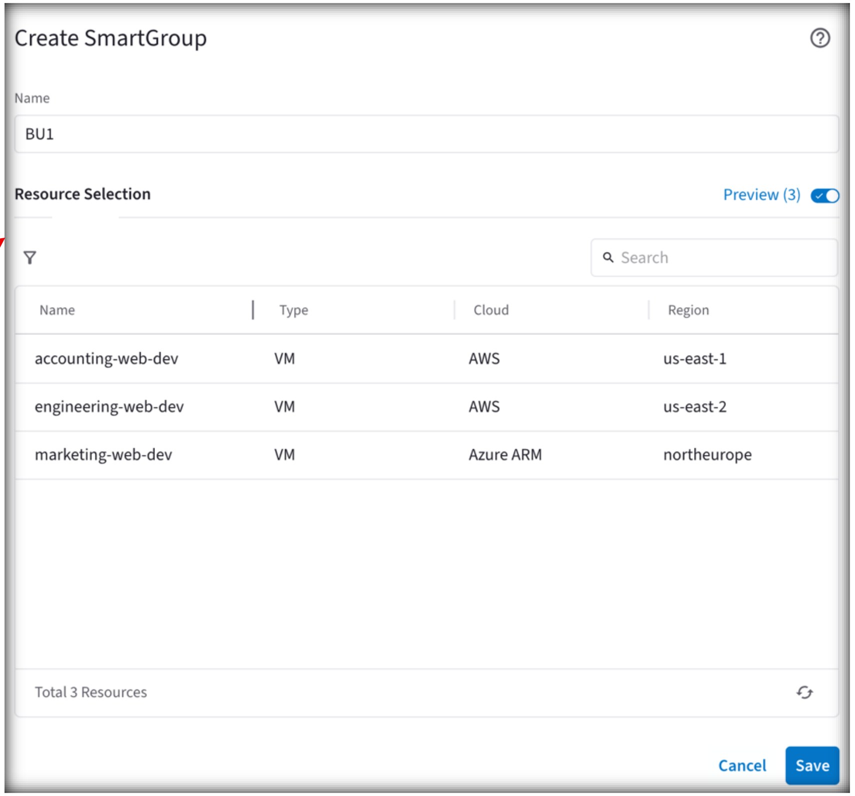
Environment — dev

Cancel Save



Sucessfully refreshed CSP resources

Auto Dismisses in 4s



Create SmartGroup

Name: BU1

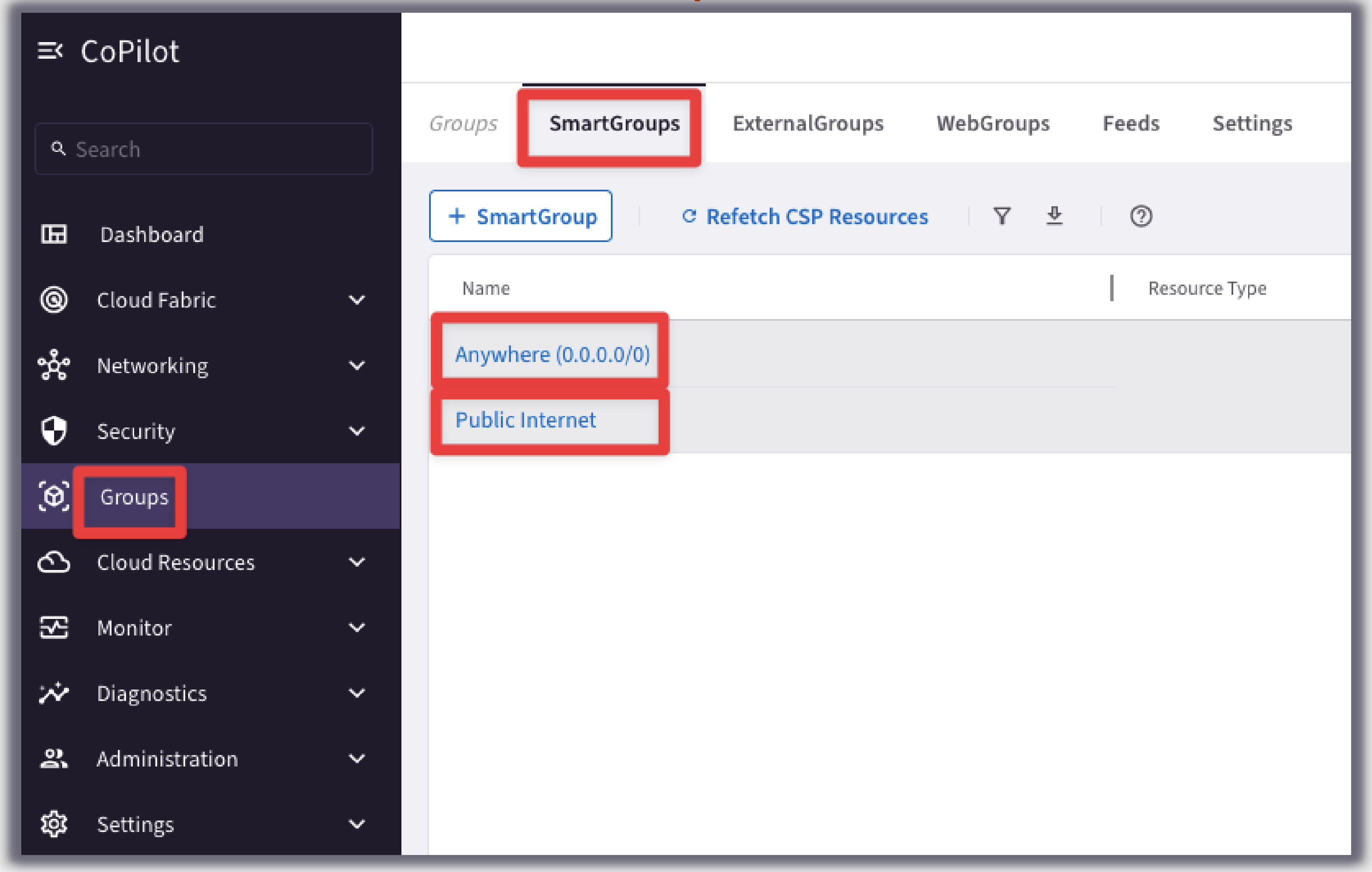
Resource Selection — Preview (3)

Name	Type	Cloud	Region
accounting-web-dev	VM	AWS	us-east-1
engineering-web-dev	VM	AWS	us-east-2
marketing-web-dev	VM	Azure ARM	northeurope

Total 3 Resources

- Controller polls the CSPs to retrieve inventory (about VPCs, instances etc.) every **15 minutes** (can be modified)
- CoPilot queries Controller every **1 hour** (can be modified)
- On-demand refresh of tags is available

Pre-defined Smart Groups

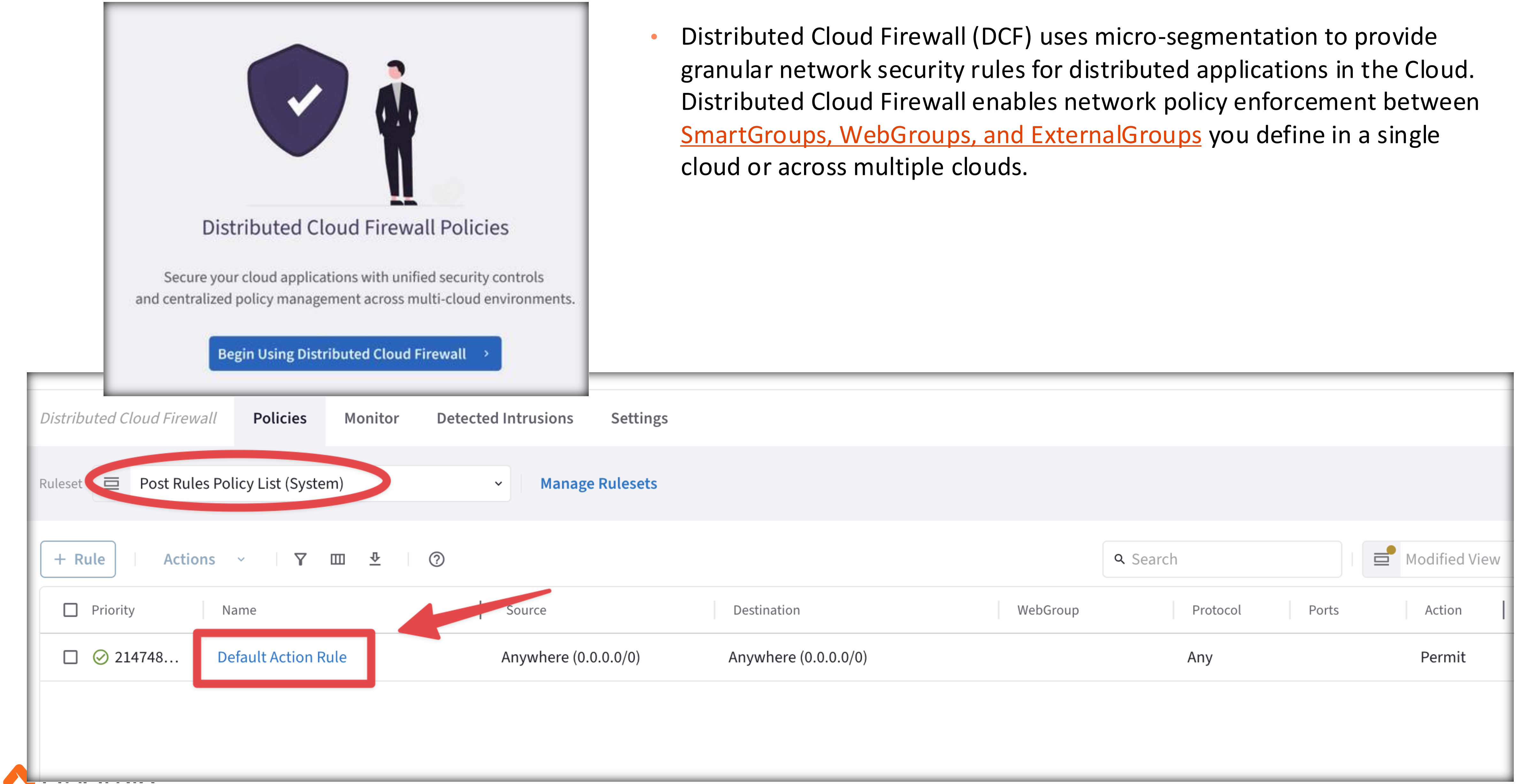


Name	Resource Type
Anywhere (0.0.0.0/0)	
Public Internet	

- **Anywhere (0.0.0.0/0)** → RFC1918 routes + Default Route (IGW)
- **Public Internet** → Default Route (IGW)

Enabling Distributed Cloud Firewall

- Distributed Cloud Firewall (DCF) uses micro-segmentation to provide granular network security rules for distributed applications in the Cloud. Distributed Cloud Firewall enables network policy enforcement between SmartGroups, WebGroups, and ExternalGroups you define in a single cloud or across multiple clouds.



Distributed Cloud Firewall Policies

Secure your cloud applications with unified security controls and centralized policy management across multi-cloud environments.

Begin Using Distributed Cloud Firewall ›
Distributed Cloud Firewall
Policies
Monitor
Detected Intrusions
Settings

Ruleset: Post Rules Policy List (System)

□	Priority	Name	Source	Destination	WebGroup	Protocol	Ports	Action
□	✓ 214748…	Default Action Rule	Anywhere (0.0.0.0/0)	Anywhere (0.0.0.0/0)		Any		Permit

Supported Cloud Providers and Gateways

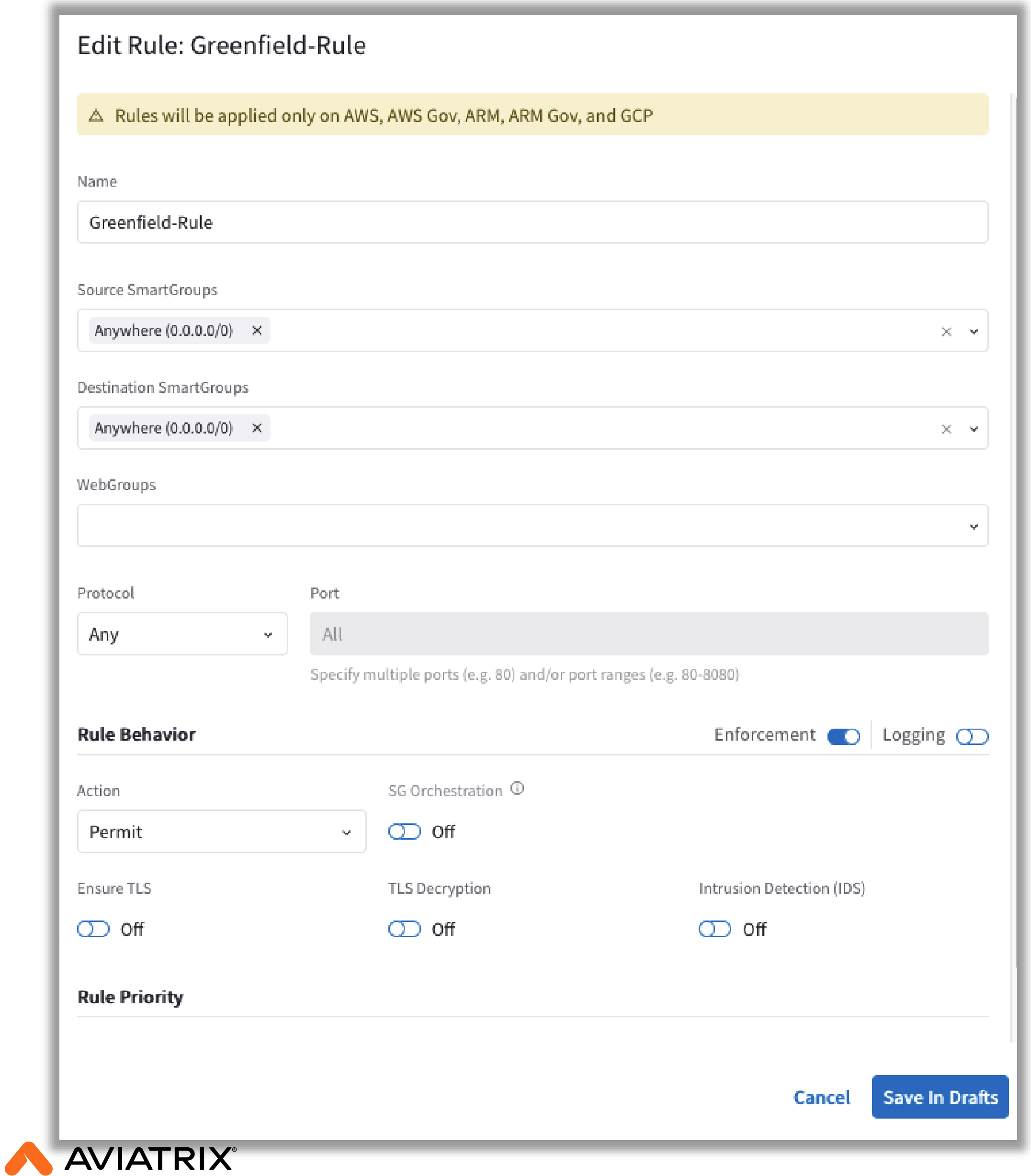
Distributed Cloud Firewall is supported for the following clouds:

- AWS, AWS GovCloud, AWS China
- Azure, Azure Government, Azure in China
- GCP, Google for Government

The following gateway types are supported:

- Spokes attached to a Transit Gateway
- Spokes detached from a Transit Gateway
- Public Subnet Filtering Gateways (enable PSF Gateways with DCF here)
- External connections (Site2Cloud) (enable External Connections with DCF here):
- Terminating on a Spoke Gateway
- Terminating on a Transit Gateway (L4 only)
- Edge as Spoke Gateway (L4 only; non-CSP tag)

How to create a Greenfield-Rule



Edit Rule: Greenfield-Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GCP

Name: Greenfield-Rule

Source SmartGroups: Anywhere (0.0.0.0/0) ×

Destination SmartGroups: Anywhere (0.0.0.0/0) ×

WebGroups:

Protocol: Any

Port: All

Specify multiple ports (e.g. 80) and/or port ranges (e.g. 80-8080)

Rule Behavior

Enforcement ● Logging ○

Action: Permit

SG Orchestration: Off

Ensure TLS: Off

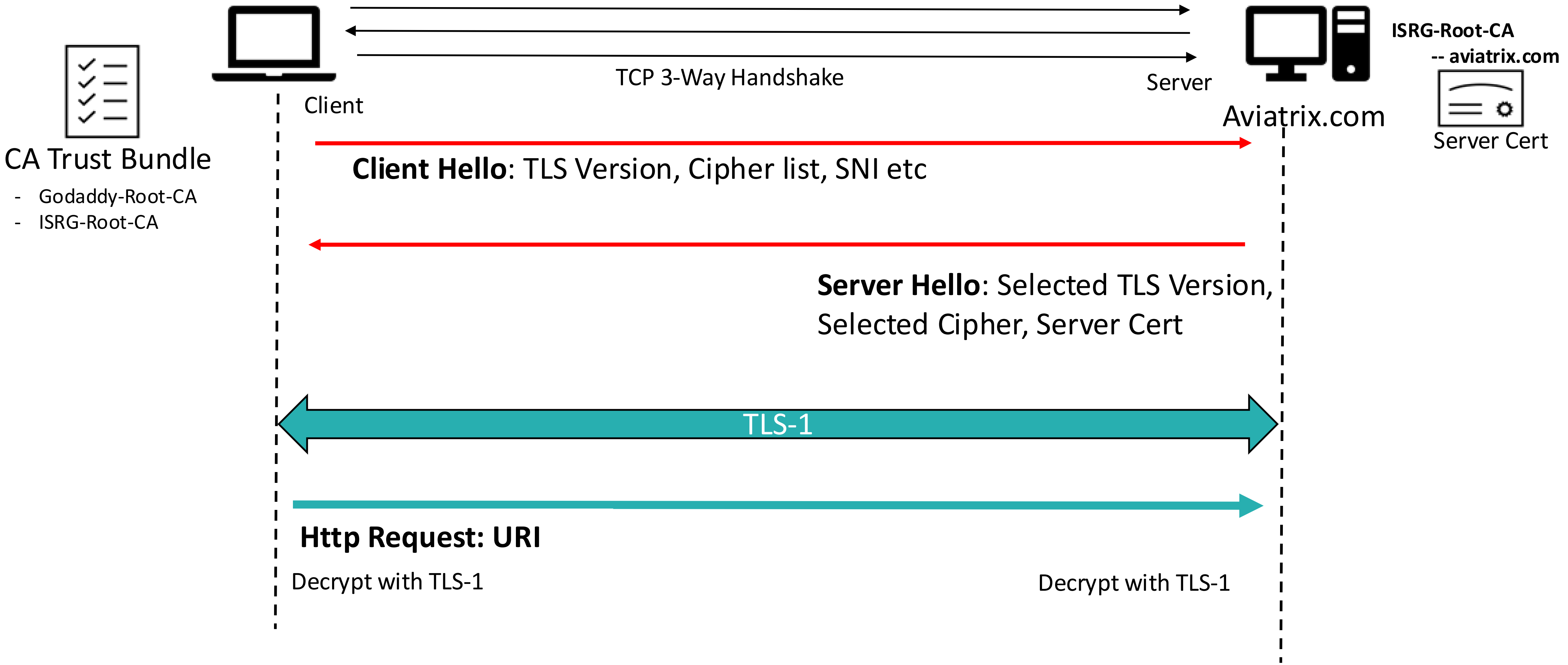
TLS Decryption: Off

Intrusion Detection (IDS): Off

Rule Priority

- **Source SmartGroups:** Anywhere(0.0.0.0/0)
- **Destination SmartGroups:** Anywhere(0.0.0.0/0)
- **Protocol:** Any
- **Action:** Permit

TLS Decryption: Basic TLS Connection



TCP 3-Way Handshake

Client

Server

Aviatrix.com

ISRG-Root-CA
-- aviatrix.com

Server Cert

CA Trust Bundle

- Godaddy-Root-CA
- ISRG-Root-CA

Client Hello: TLS Version, Cipher list, SNI etc

Server Hello: Selected TLS Version, Selected Cipher, Server Cert

TLS-1

Http Request: URI

Decrypt with TLS-1

Decrypt with TLS-1

TLS Decryption: PKI/ KMS and Trust Bundle

Certificate Hierarchy

- Root
  - Intermediate
    - Server Cert (Leaf Cert)

Certificate Fields

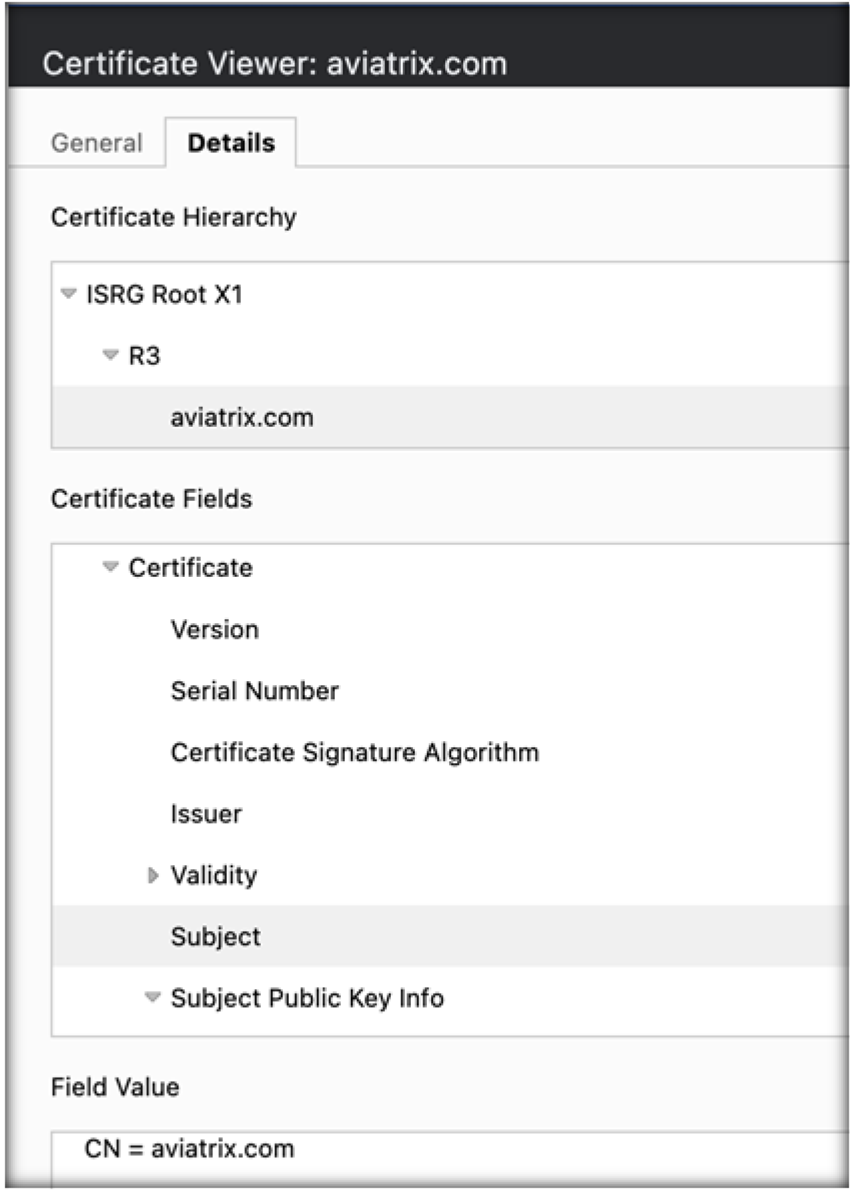
- Issuer
- Validity
- Subject

Trusted Root CA Bundle

Used by the Client and/or Proxy Gateway to Identify/ Trust the Original Server Cert

Decryption CA Cert

Used by the Decryption/Proxy gateway to generate a new Proxy-Server Cert and Sign it with the Decryption CA Cert



Certificate Viewer: aviatrix.com

Certificate Hierarchy

- ISRG Root X1
  - R3
    - aviatrix.com

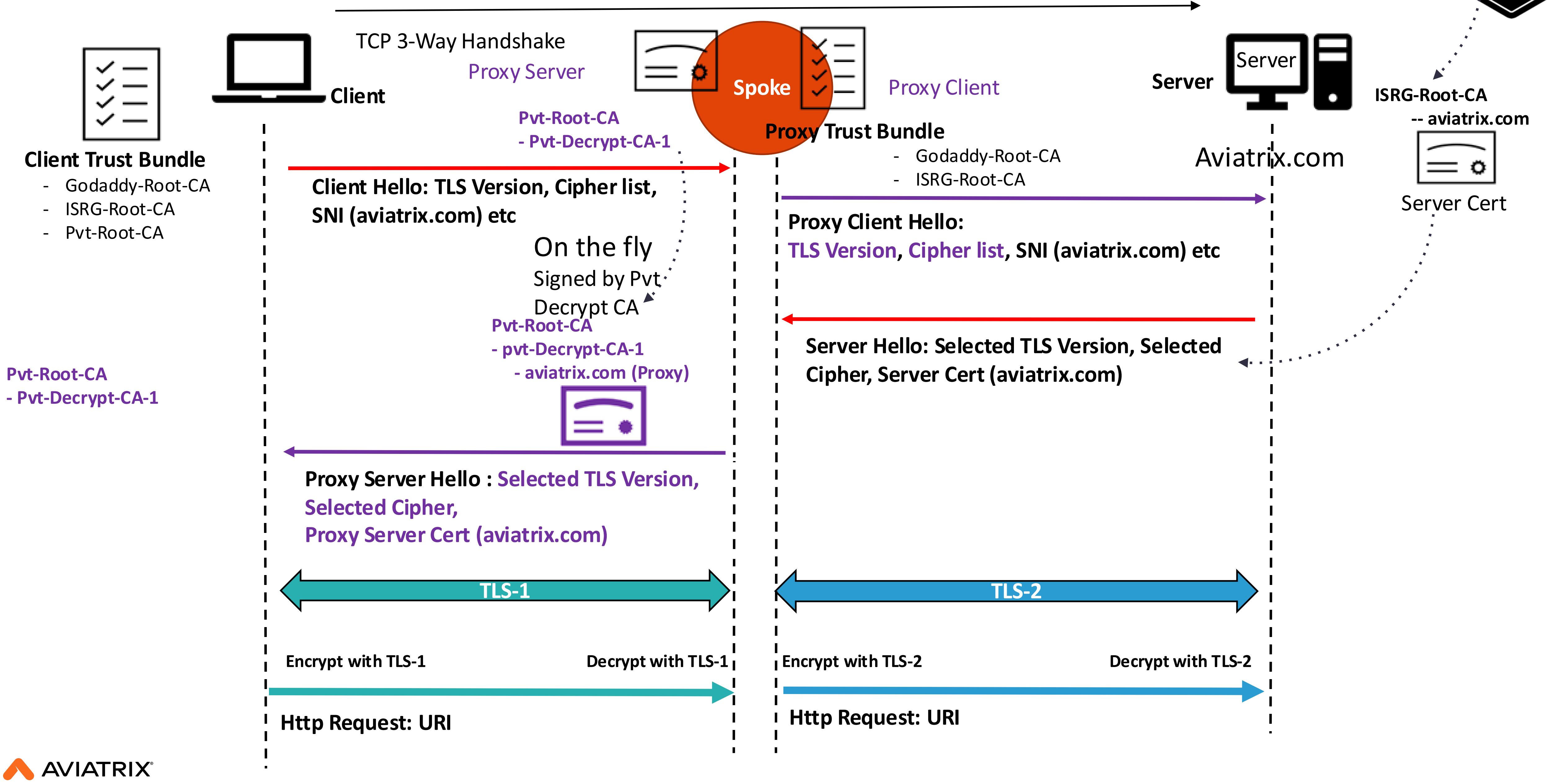
Certificate Fields

- Certificate
  - Version
  - Serial Number
  - Certificate Signature Algorithm
  - Issuer
  - Validity
  - Subject
  - Subject Public Key Info

Field Value

CN = aviatrix.com

TLS Decryption: Basic TLS Decryption



Signed by Public CA

TCP 3-Way Handshake

Client

Proxy Server

Spoke

Proxy Client

Server

Server

Client Trust Bundle
- Godaddy-Root-CA
- ISRG-Root-CA
- Pvt-Root-CA

Pvt-Root-CA
- Pvt-Decrypt-CA-1

Proxy Trust Bundle
- Godaddy-Root-CA
- ISRG-Root-CA

Aviatrix.com

ISRG-Root-CA
-- aviatrix.com

Server Cert

Client Hello: TLS Version, Cipher list, SNI (aviatrix.com) etc

Proxy Client Hello:
TLS Version, Cipher list, SNI (aviatrix.com) etc

On the fly
Signed by Pvt
Decrypt CA

Pvt-Root-CA
- pvt-Decrypt-CA-1
- aviatrix.com (Proxy)

Server Hello: Selected TLS Version, Selected Cipher, Server Cert (aviatrix.com)

Pvt-Root-CA
- Pvt-Decrypt-CA-1

Proxy Server Hello : Selected TLS Version, Selected Cipher, Proxy Server Cert (aviatrix.com)

TLS-1

TLS-2

Encrypt with TLS-1

Decrypt with TLS-1

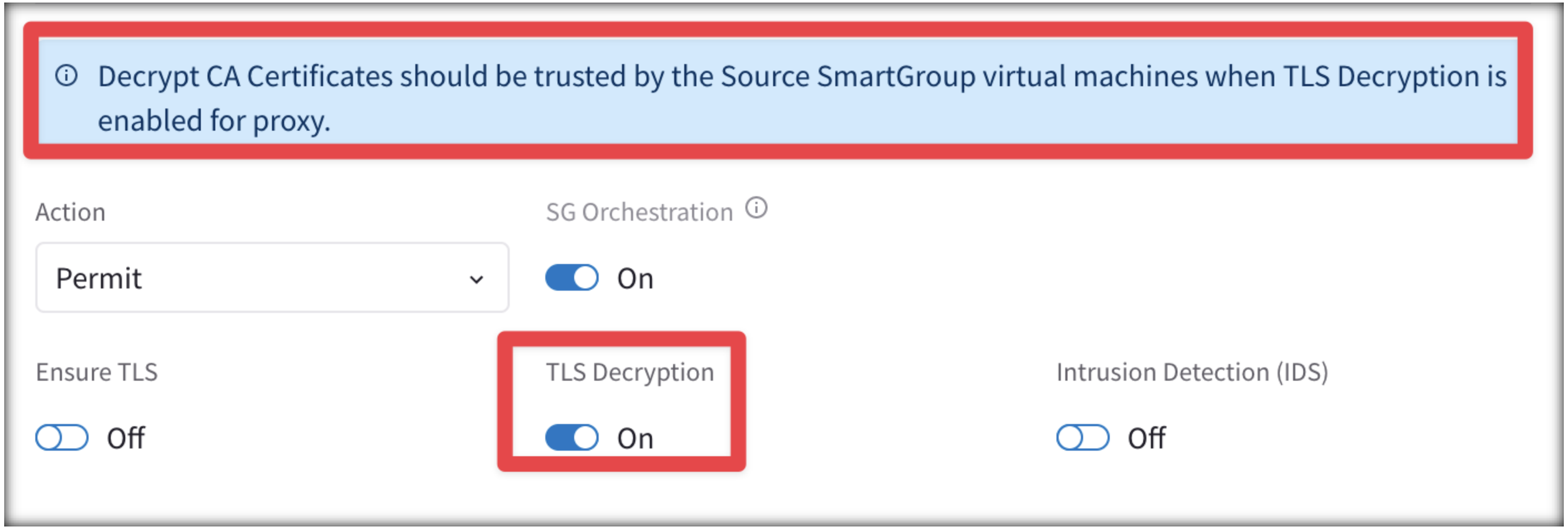
Encrypt with TLS-2

Decrypt with TLS-2

Http Request: URI

Http Request: URI

TLS Decryption: Decryption CA Cert



ⓘ Decrypt CA Certificates should be trusted by the Source SmartGroup virtual machines when TLS Decryption is enabled for proxy.

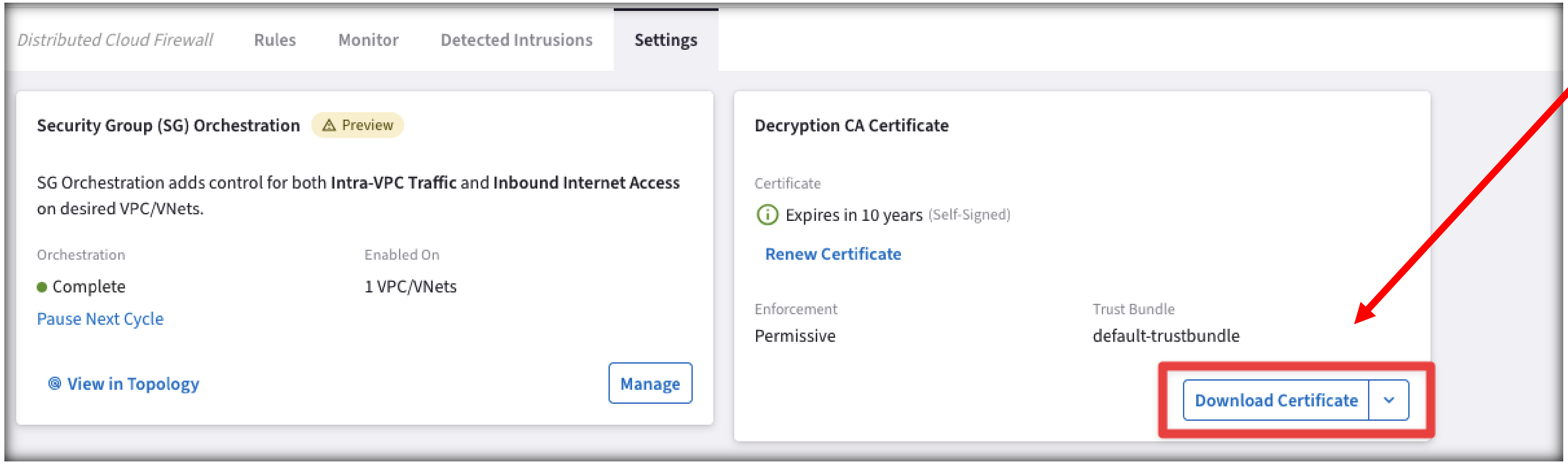
Action: Permit

SG Orchestration ⓘ: On

Ensure TLS: Off

TLS Decryption: On

Intrusion Detection (IDS): Off



Security Group (SG) Orchestration ⚠ Preview

SG Orchestration adds control for both **Intra-VPC Traffic** and **Inbound Internet Access** on desired VPC/VNets.

Orchestration: ● Complete

Enabled On: 1 VPC/VNets

Decryption CA Certificate

Certificate: ⓘ Expires in 10 years (Self-Signed)

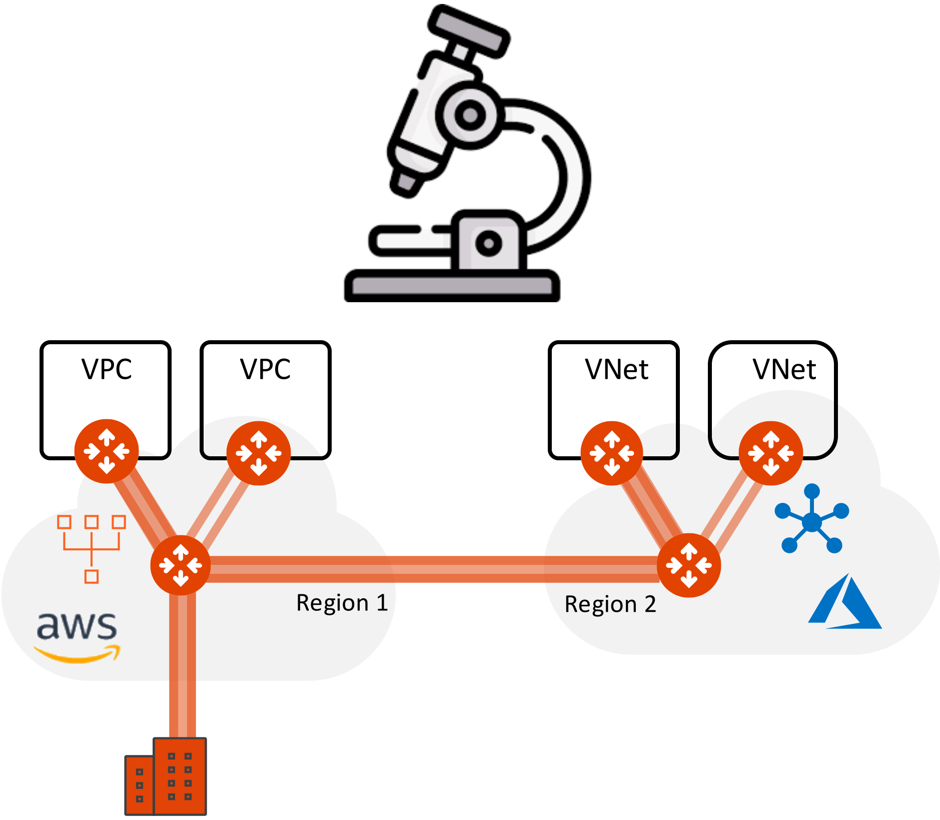
Enforcement: Permissive

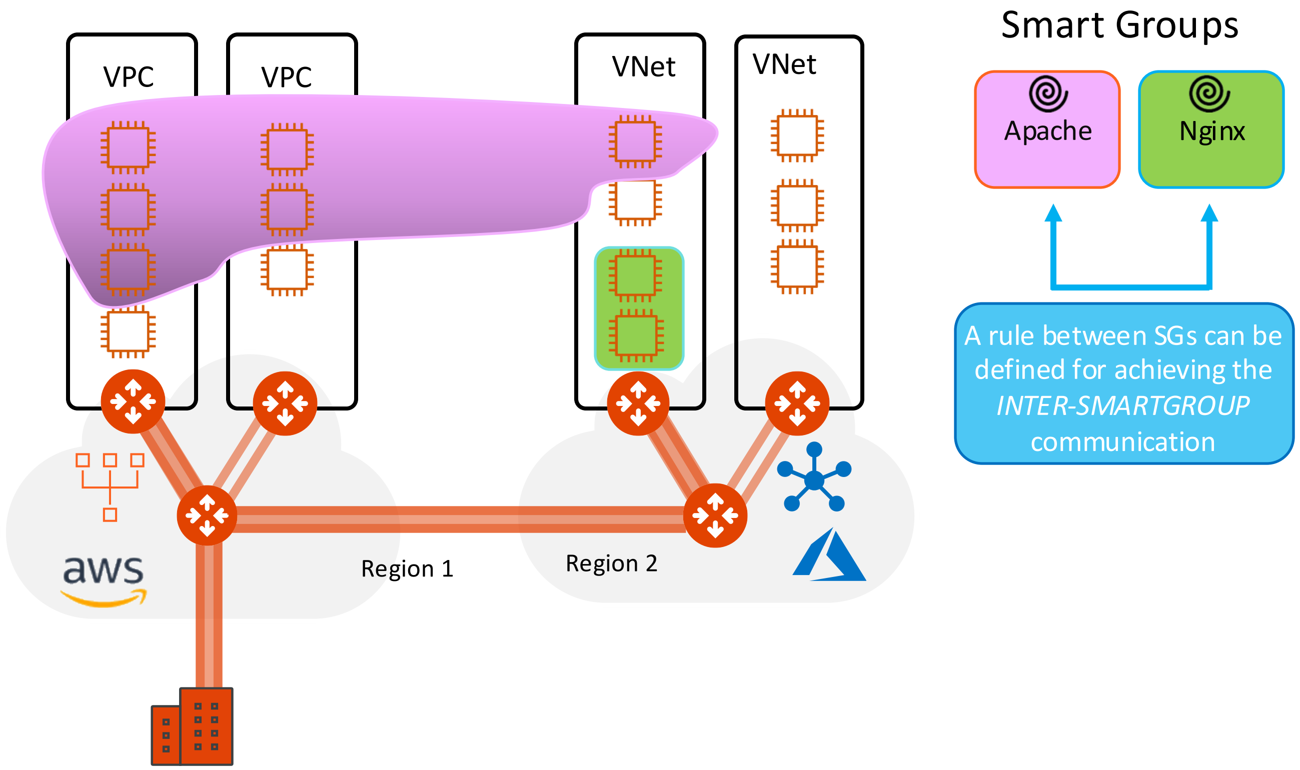
Trust Bundle: default-trustbundle

1. Download the Decryption CA Bundle.
2. Distribute the bundle across all the workloads.

Decrypt CA Certificates should be trusted by the **Source SmartGroup** virtual machines when TLS Decryption is enabled for proxy.

Distributed Cloud Firewall Rule Types: Intra-rule vs. Inter-rule



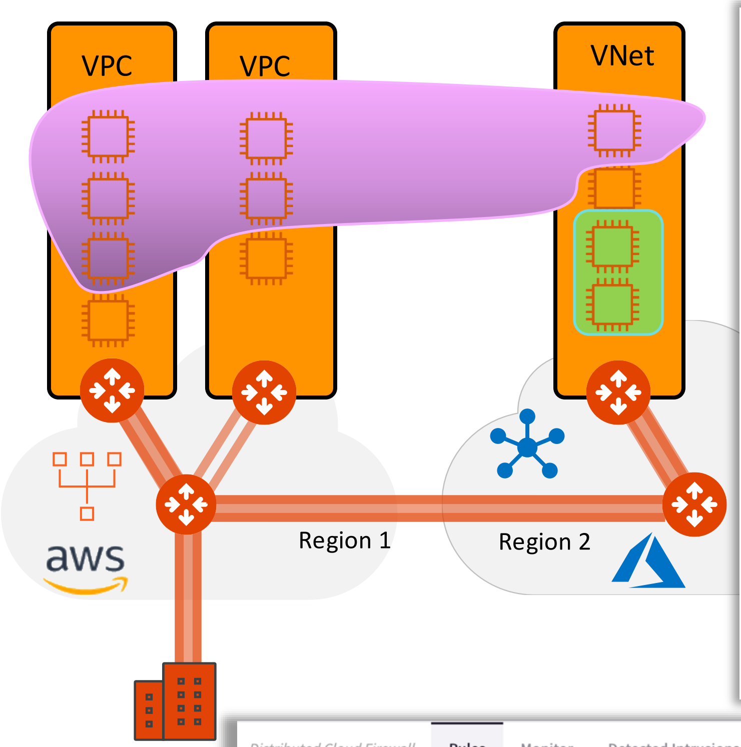


A rule between SGs can be defined for achieving the *INTER-SMARTGROUP* communication

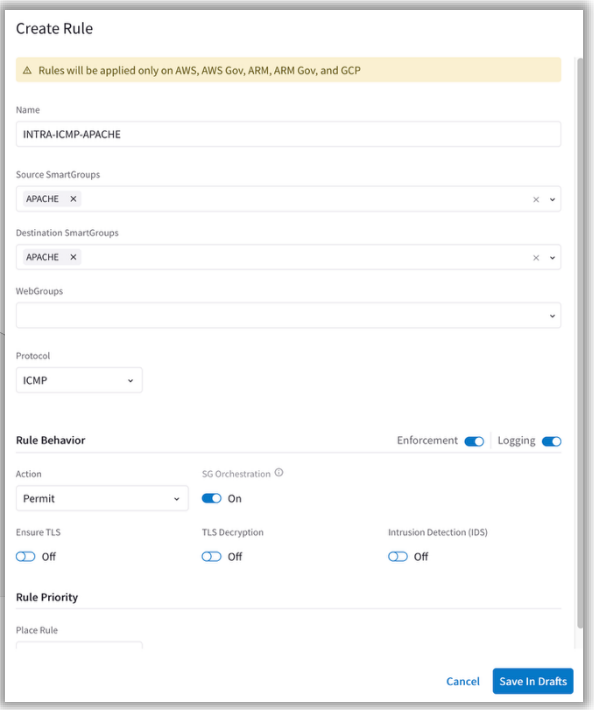
- **INTRA-RULE**: is defined within a Smart Group, for dictating what kind of traffic is allowed/prohibited among all the instances that belong to that Smart Group

- **INTER-RULE:** is defined among Smart Groups, for dictating what kind of traffic is allowed/prohibited among two or more Smart Groups.

Micro-Segmention: SmartGroups, Intra-Rules and Inter-Rules



SmartGroup Apache → intra



Create Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GCP

Name: INTRA-ICMP-APACHE

Source SmartGroups: APACHE ×

Destination SmartGroups: APACHE ×

WebGroups:

Protocol: ICMP

Rule Behavior — Enforcement: On | Logging: On

Action: Permit

SG Orchestration: On

Ensure TLS: Off

TLS Decryption: Off

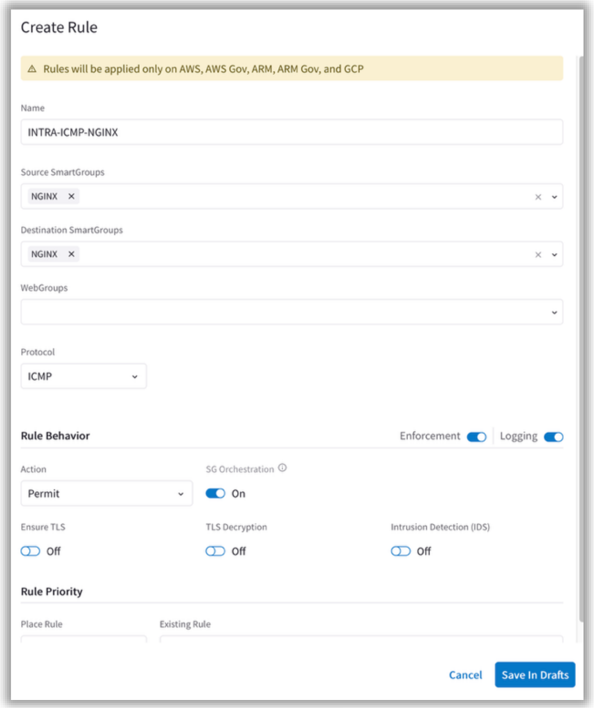
Intrusion Detection (IDS): Off

Rule Priority

Place Rule

Cancel | Save In Drafts

SmartGroup Nginx → intra



Create Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GCP

Name: INTRA-ICMP-NGINX

Source SmartGroups: NGINX ×

Destination SmartGroups: NGINX ×

WebGroups:

Protocol: ICMP

Rule Behavior — Enforcement: On | Logging: On

Action: Permit

SG Orchestration: On

Ensure TLS: Off

TLS Decryption: Off

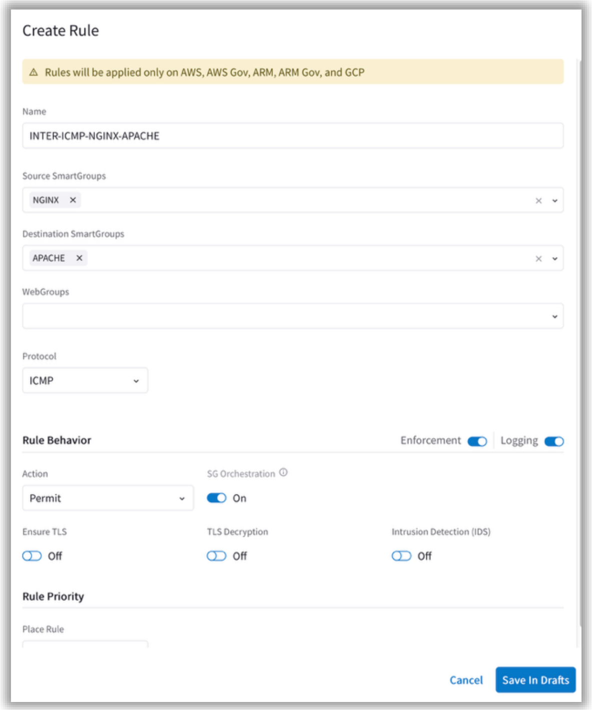
Intrusion Detection (IDS): Off

Rule Priority

Place Rule | Existing Rule

Cancel | Save In Drafts

SmartGroup Nginx → inter → SmartGroup Apache



Create Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GCP

Name: INTER-ICMP-NGINX-APACHE

Source SmartGroups: NGINX ×

Destination SmartGroups: APACHE ×

WebGroups:

Protocol: ICMP

Rule Behavior — Enforcement: On | Logging: On

Action: Permit

SG Orchestration: On

Ensure TLS: Off

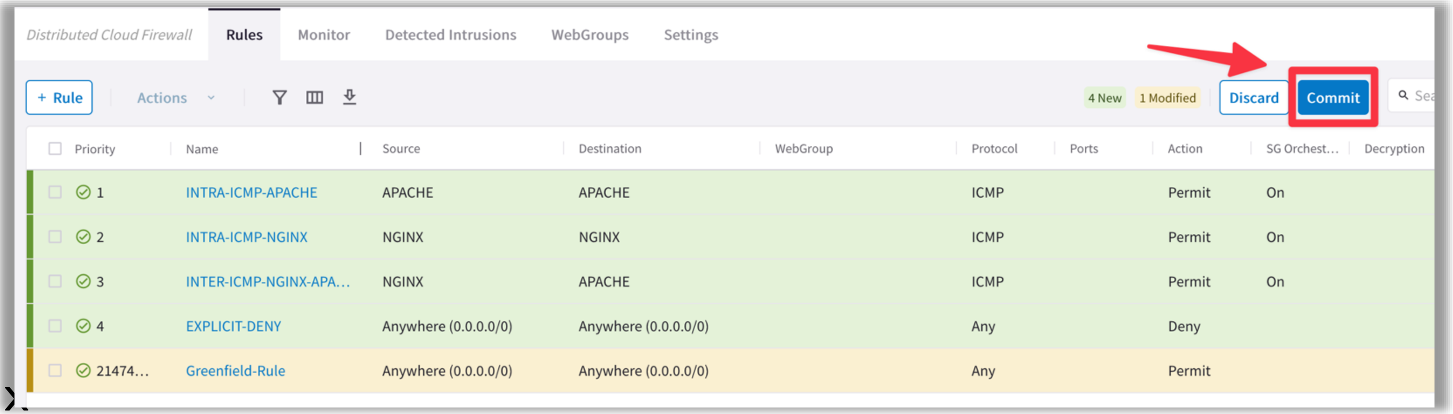
TLS Decryption: Off

Intrusion Detection (IDS): Off

Rule Priority

Place Rule

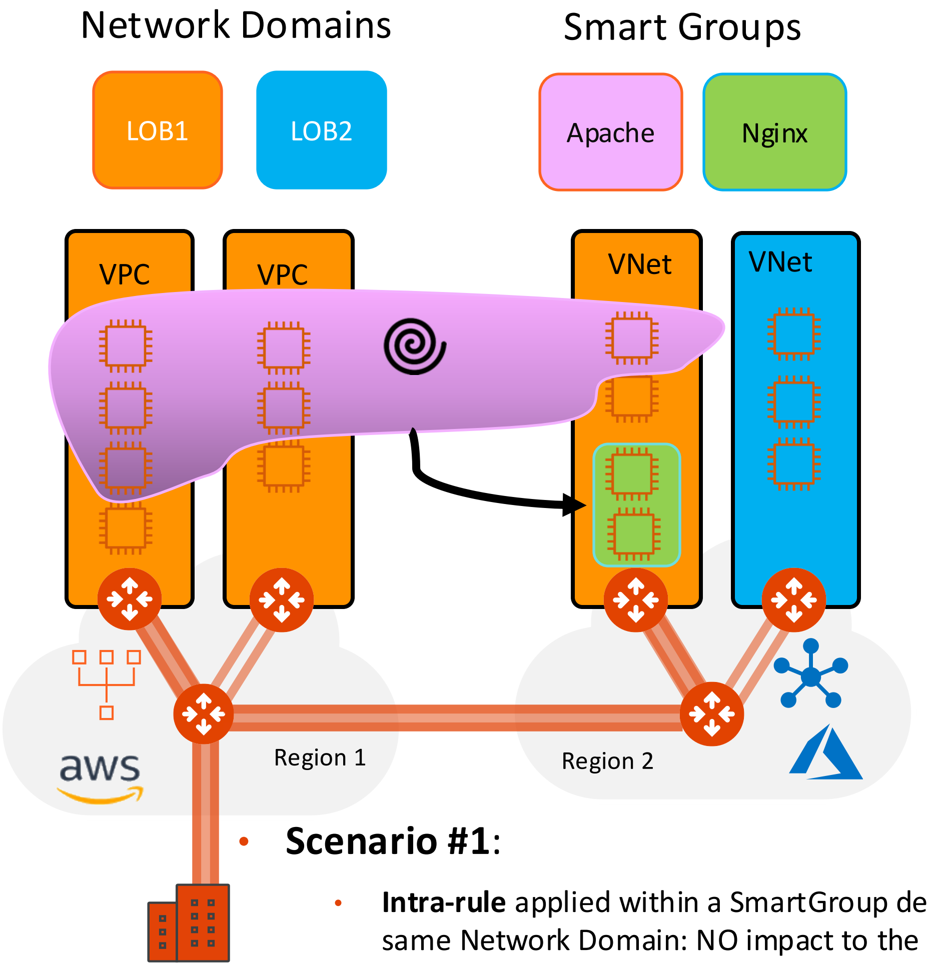
Cancel | Save In Drafts



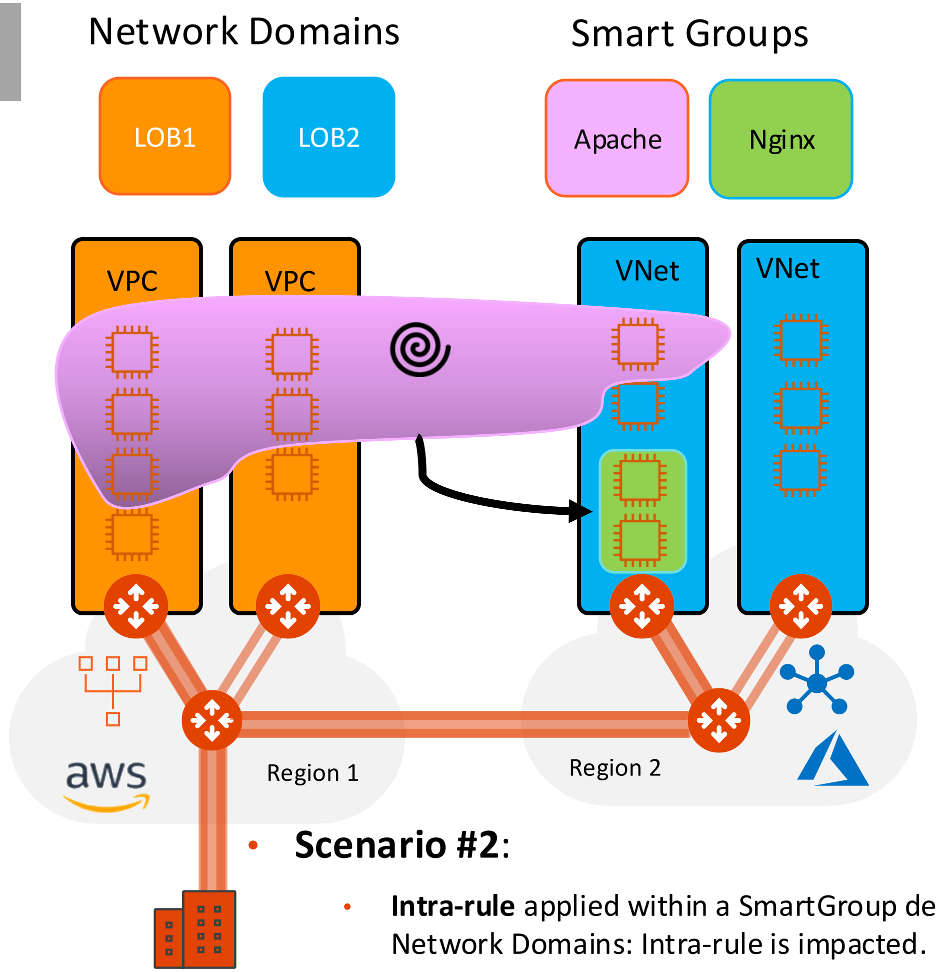
Priority	Name	Source	Destination	WebGroup	Protocol	Ports	Action	SG Orchest...	Decryption
✓ 1	INTRA-ICMP-APACHE	APACHE	APACHE		ICMP		Permit	On	
✓ 2	INTRA-ICMP-NGINX	NGINX	NGINX		ICMP		Permit	On	
✓ 3	INTER-ICMP-NGINX-APA...	NGINX	APACHE		ICMP		Permit	On	
✓ 4	EXPLICIT-DENY	Anywhere (0.0.0.0/0)	Anywhere (0.0.0.0/0)		Any		Deny		
✓ 21474...	Greenfield-Rule	Anywhere (0.0.0.0/0)	Anywhere (0.0.0.0/0)		Any		Permit		

- **Micro-Segmentation**: Combination of SmartGroups and DCF Rules
- Rule changes are saved in **Draft** state.
- When you apply a rule to a SmartGroup, please keep in mind that there is an **Invisible Hidden Deny** at the very bottom.
- To save the changes click on "**Commit**"
- **Discard** will trash the changes
- Rule is **stateful**, this means that the return traffic is allowed automatically

Network Segmentation & Distributed Cloud Firewall Rule together



NO connection policy is applied



- **Scenario #1**:
  - **Intra-rule** applied within a SmartGroup defined within the same Network Domain: NO impact to the rule
  - **Inter-rule** applied between SmartGroups defined within the same Network Domains: NO impact to the rule

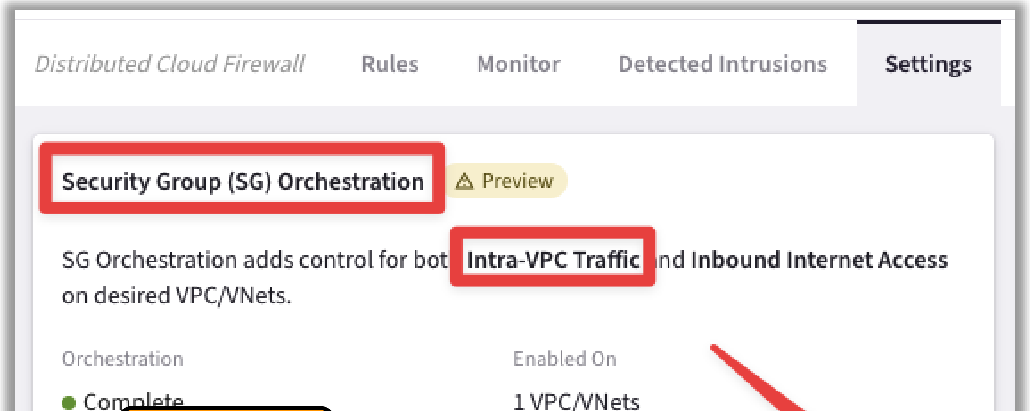
- **Scenario #2**:
  - **Intra-rule** applied within a SmartGroup defined across two Network Domains: Intra-rule is impacted.
  - **Inter-rule** is applied between SmartGroups defined across two different Network Domains: Inter-rule is impacted

Caveat:

- Network Segmentation and Distributed Firewalling are **NOT** mutually exclusive!
- Network Segmentation takes **precedence** over the extent of a SmartGroup

Security Group (SG) Orchestration: Intra VPC/VNET Traffic Control

❑ Enable the feature on the relevant VPC/VNet

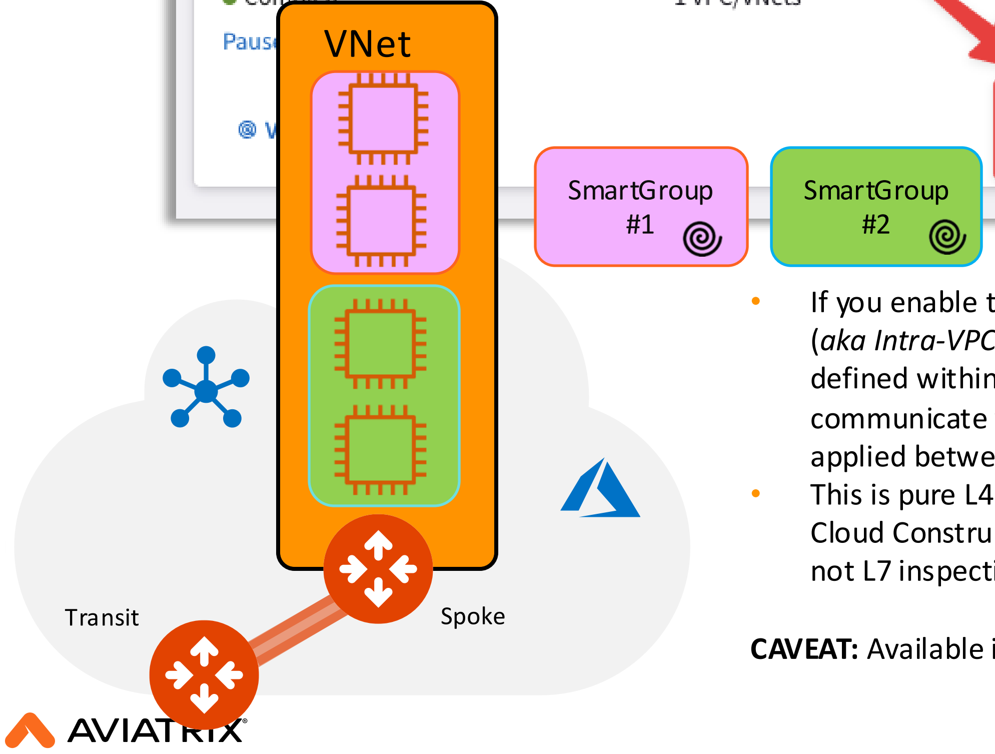


Security Group (SG) Orchestration ⚠ Preview

SG Orchestration adds control for bot **Intra-VPC Traffic** nd **Inbound Internet Access** on desired VPC/VNets.

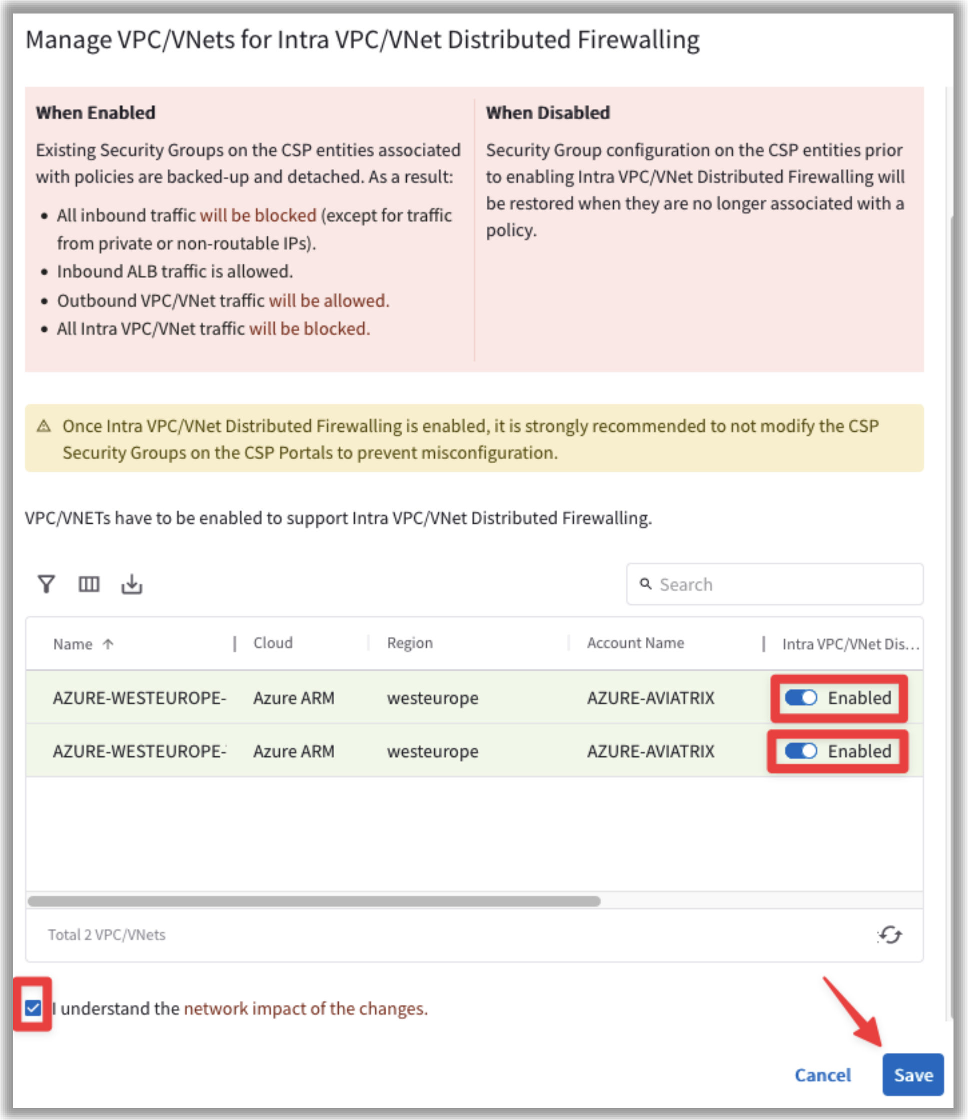
Orchestration	Enabled On
● Complete	1 VPC/VNets

Paus



- If you enable the **Security Group (SG) Orchestration** (*aka Intra-VPC Traffic Control*), the SmartGroups defined within the same VPC/VNet will not be able to communicate with each other, unless an inter rule is applied between them.
- This is pure L4 separation, leveraging the Native Cloud Constructs (such as SG, NSG and ASG). This is not L7 inspection.

CAVEAT: Available in AWS/Azure



Manage VPC/VNets for Intra VPC/VNet Distributed Firewalling

When Enabled

Existing Security Groups on the CSP entities associated with policies are backed-up and detached. As a result:

- All inbound traffic will be blocked (except for traffic from private or non-routable IPs).
- Inbound ALB traffic is allowed.
- Outbound VPC/VNet traffic will be allowed.
- All Intra VPC/VNet traffic will be blocked.

When Disabled

Security Group configuration on the CSP entities prior to enabling Intra VPC/VNet Distributed Firewalling will be restored when they are no longer associated with a policy.

⚠ Once Intra VPC/VNet Distributed Firewalling is enabled, it is strongly recommended to not modify the CSP Security Groups on the CSP Portals to prevent misconfiguration.

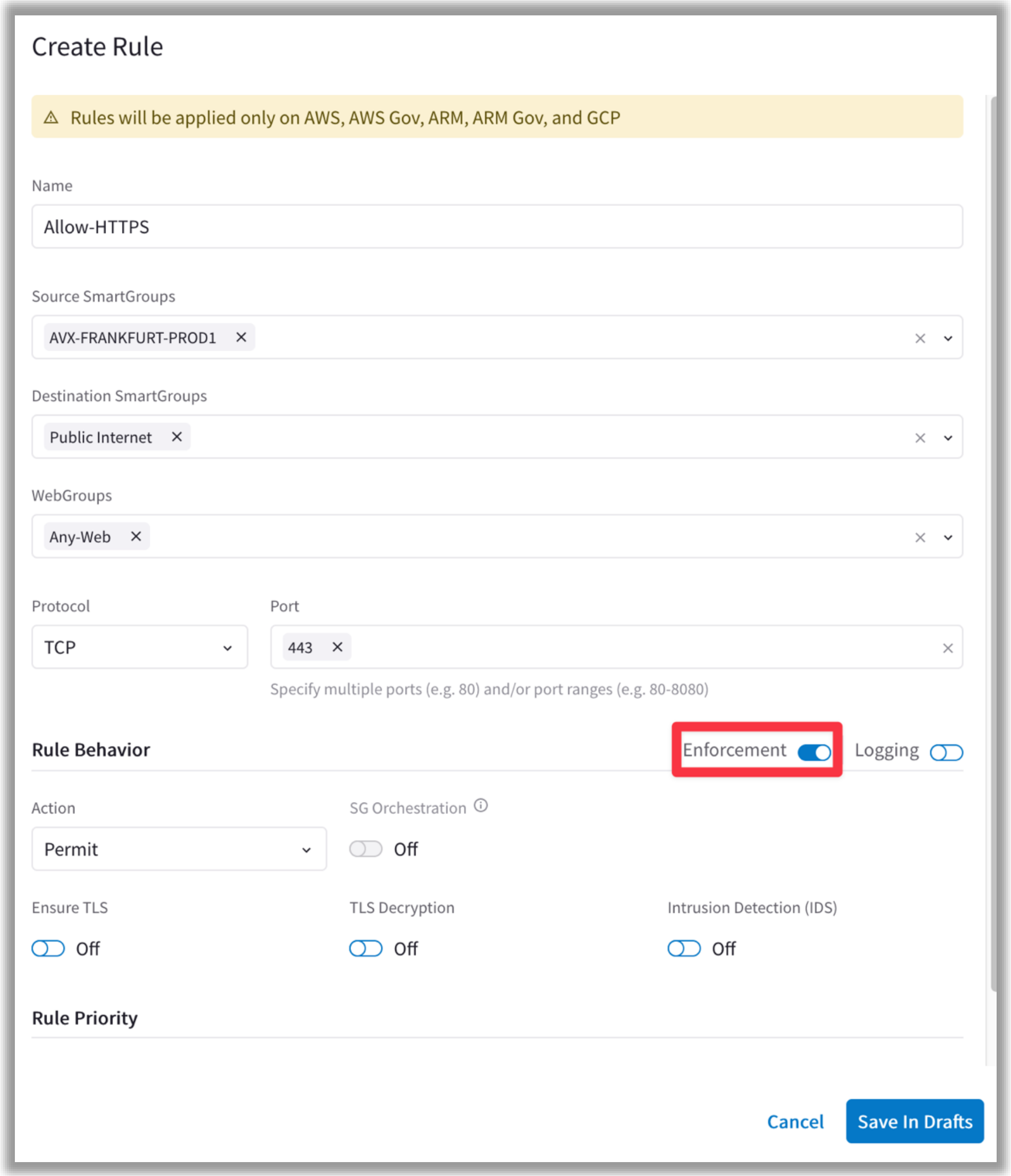
VPC/VNETs have to be enabled to support Intra VPC/VNet Distributed Firewalling.

Name ↑	Cloud	Region	Account Name	Intra VPC/VNet Dis...
AZURE-WESTEUROPE-	Azure ARM	westeurope	AZURE-AVIATRIX	Enabled
AZURE-WESTEUROPE-	Azure ARM	westeurope	AZURE-AVIATRIX	Enabled

Total 2 VPC/VNets

☑ I understand the network impact of the changes.

Rule Enforcement



Create Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GCP

Name: Allow-HTTPS

Source SmartGroups: AVX-FRANKFURT-PROD1 ✕

Destination SmartGroups: Public Internet ✕

WebGroups: Any-Web ✕

Protocol: TCP

Port: 443 ✕

Specify multiple ports (e.g. 80) and/or port ranges (e.g. 80-8080)

Rule Behavior — Enforcement: On — Logging: Off

Action: Permit

SG Orchestration: Off

Ensure TLS: Off

TLS Decryption: Off

Intrusion Detection (IDS): Off

Rule Priority

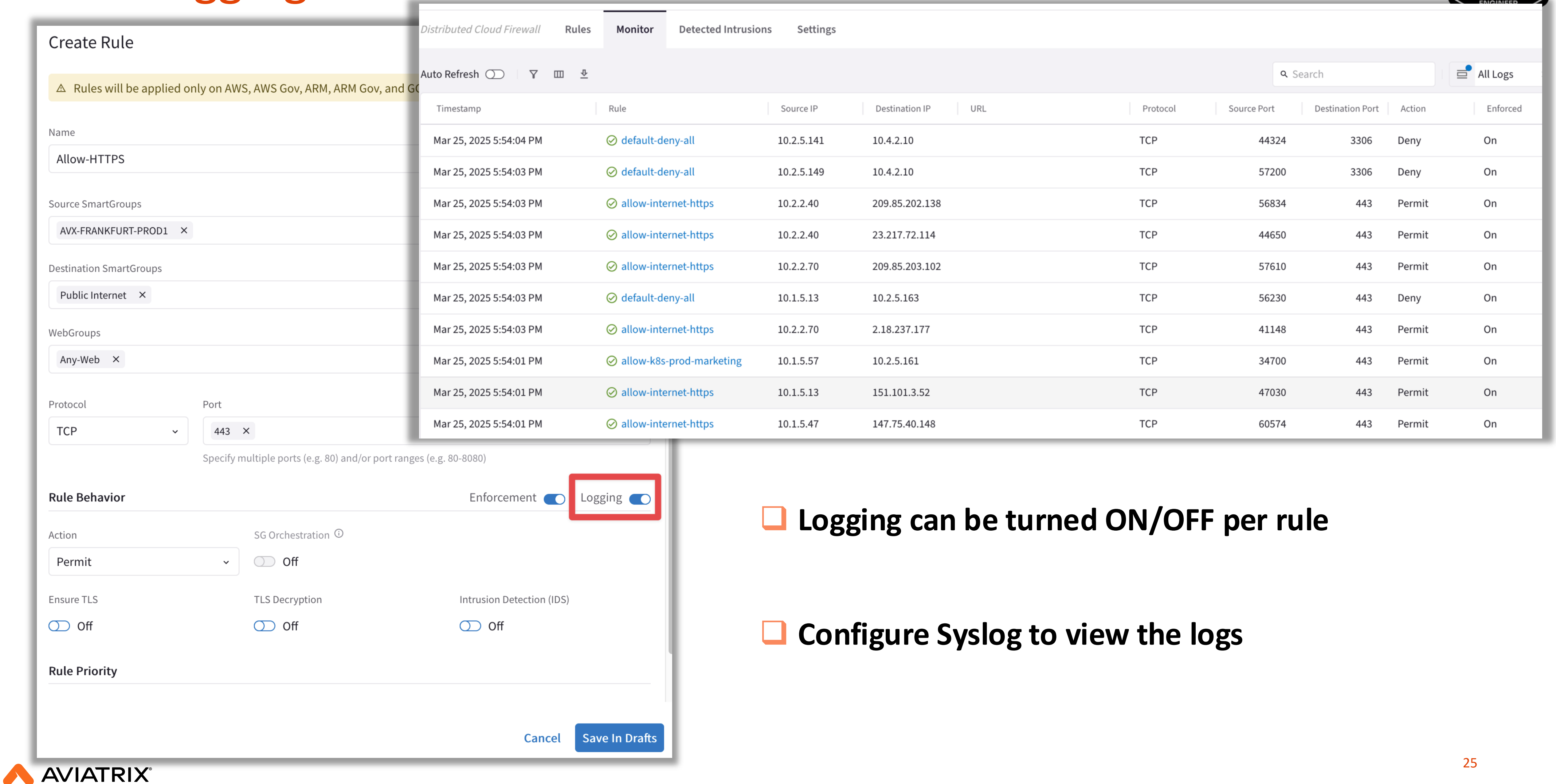
❑ Enforcement ON

- Policy is enforced in the Data Plane

❑ Enforcement OFF

- Policy is NOT enforced in the Data Plane
- The option provides a *Watch/Test* mode
- Common use case is with deny rule
- Watch what traffic hits the deny rule before enforcing the rule in the Data Plane.

Rule Logging



Create Rule

⚠ Rules will be applied only on AWS, AWS Gov, ARM, ARM Gov, and GC

Name: Allow-HTTPS

Source SmartGroups: AVX-FRANKFURT-PROD1 ✕

Destination SmartGroups: Public Internet ✕

WebGroups: Any-Web ✕

Protocol: TCP

Port: 443 ✕

Specify multiple ports (e.g. 80) and/or port ranges (e.g. 80-8080)

Rule Behavior

Enforcement ●

Logging ●

Action: Permit

SG Orchestration ⓘ: Off

Ensure TLS: Off

TLS Decryption: Off

Intrusion Detection (IDS): Off

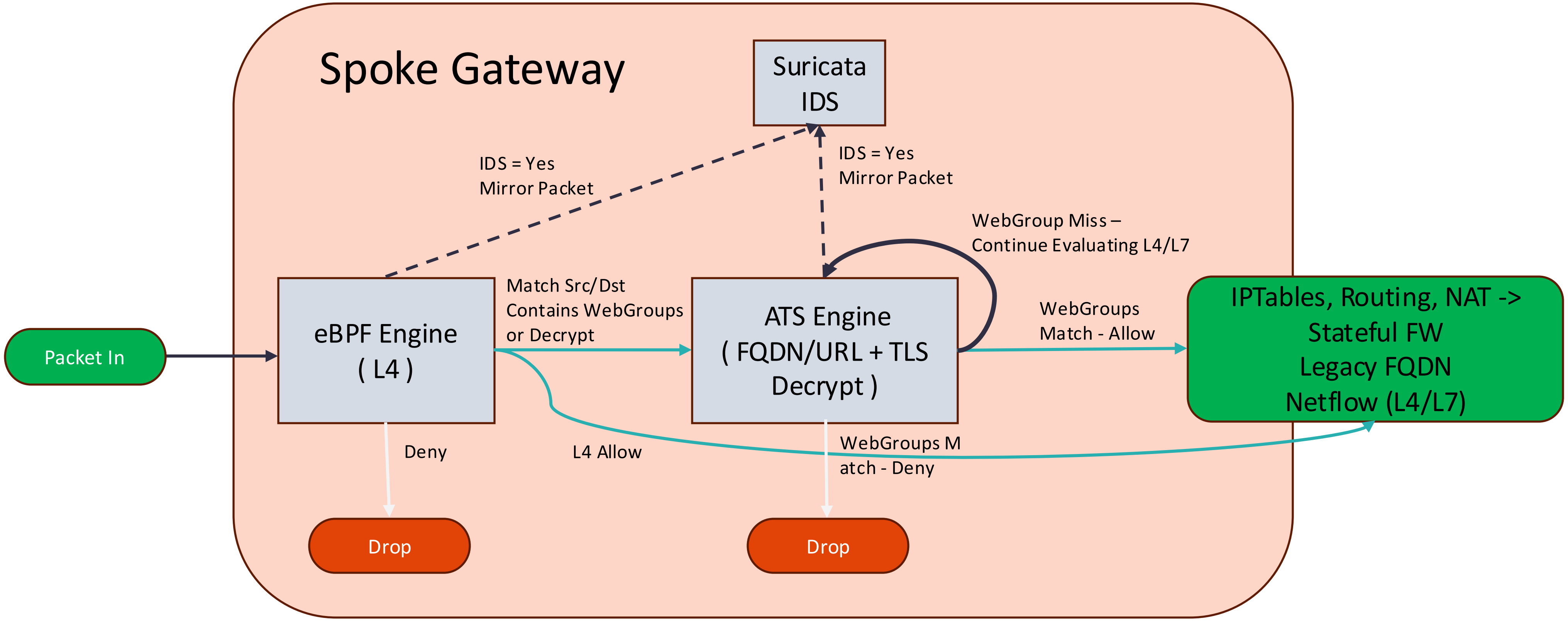
Rule Priority

Timestamp	Rule	Source IP	Destination IP	URL	Protocol	Source Port	Destination Port	Action	Enforced
Mar 25, 2025 5:54:04 PM	✓ default-deny-all	10.2.5.141	10.4.2.10		TCP	44324	3306	Deny	On
Mar 25, 2025 5:54:03 PM	✓ default-deny-all	10.2.5.149	10.4.2.10		TCP	57200	3306	Deny	On
Mar 25, 2025 5:54:03 PM	✓ allow-internet-https	10.2.2.40	209.85.202.138		TCP	56834	443	Permit	On
Mar 25, 2025 5:54:03 PM	✓ allow-internet-https	10.2.2.40	23.217.72.114		TCP	44650	443	Permit	On
Mar 25, 2025 5:54:03 PM	✓ allow-internet-https	10.2.2.70	209.85.203.102		TCP	57610	443	Permit	On
Mar 25, 2025 5:54:03 PM	✓ default-deny-all	10.1.5.13	10.2.5.163		TCP	56230	443	Deny	On
Mar 25, 2025 5:54:03 PM	✓ allow-internet-https	10.2.2.70	2.18.237.177		TCP	41148	443	Permit	On
Mar 25, 2025 5:54:01 PM	✓ allow-k8s-prod-marketing	10.1.5.57	10.2.5.161		TCP	34700	443	Permit	On
Mar 25, 2025 5:54:01 PM	✓ allow-internet-https	10.1.5.13	151.101.3.52		TCP	47030	443	Permit	On
Mar 25, 2025 5:54:01 PM	✓ allow-internet-https	10.1.5.47	147.75.40.148		TCP	60574	443	Permit	On

- **Logging can be turned ON/OFF per rule**
- **Configure Syslog to view the logs**

DFW Engines At-a-Glance

- **eBPF** (extended Berkeley Packet Filter) Engine (L4) → Stateful Firewall Rule (forwarding path)
- WebProxy **ATS** (Apache Traffic Server) Engine (L7) → it is triggered whether WebGroups or TLS Decryption are required
- **Suricata** Engine (DPI) → Signature of the payload (<u>only in IDS mode at the moment</u>)



AVIATRIX

ACE

★★★★

PROFESSIONAL

Next: Lab 11 – Distributed Cloud Firewall